Electronic Supplement 4

Notes on application of emissivity, atmospheric and surface reflection corrections

Pixel integrated radiances input into all dual-band Equations given in Chapter 4 need to be corrected for emissivity, atmospheric and surface reflection effects. These effects, their variation by waveband and the general form of the correction procedures are covered in Section 2.3 of Chapter 2. In this Appendix we review correction procedures typically used in thermal remote sensing of volcanic hot spots in the NIR, SWIR and MIR, and tabulate values for use in each correction. In addition, we review an alternative atmospheric correction routine for the TIR, as well as reflection correction routines proposed for correction of data collected in the NIR, SWIR and MIR.

General form of the brightness temperature correction equation by waveband

While emissivity will vary by surface type, both emissivity, atmospheric and reflection effects will vary by wavelength (see Chapter 2). Following Chapter 2, the form of our correction for emissivity, atmospheric and reflection effects will thus also vary by waveband.

(1) TIR

In the TIR spectral emissivity (ε_λ), atmospheric transmissivity (τ_λ) and atmospheric upwelling radiance [$L_U(\lambda)$] will be the main issues. This means that, for a simple two component model where we have two surfaces at temperatures T_1 and T_2, we will need to make the following corrections:

$$M(\lambda, T_{int}) = [\tau_\lambda \varepsilon_{\lambda 1}\, pM(\lambda, T_1) + (1-p)\tau_\lambda \varepsilon_{\lambda 2} M(\lambda, T_2)] + L_U(\lambda)$$

so that

$$[M(\lambda, T_{int}) - L_U(\lambda)]\, /\tau_\lambda = \varepsilon_{\lambda 1}\, pM(\lambda, T_1) + (1-p)\varepsilon_{\lambda 2} M(\lambda, T_2)$$

Here $L_U(\lambda)$ is the atmospheric up-welling radiation at wavelength λ, τ_λ is atmospheric transmissivity at wavelength λ, and $\varepsilon_{\lambda 1}$ and $\varepsilon_{\lambda 2}$ are the emissivities for the surfaces radiating at temperatures T_1 and T_2, respectively. If $\varepsilon_{\lambda 1} = \varepsilon_{\lambda 2}$ we can simplify to:

$$[M(\lambda, T_{int}) - L_U(\lambda)]\, /\tau_\lambda \varepsilon_\lambda = pM(\lambda, T_1) + (1-p)M(\lambda, T_2)$$

In other words we have to remove the upwelling contribution from the integrated radiance and correct for the transmissivity and emissivity effects.

(2) SWIR

In the SWIR, reflection (rather than upwelling radiance) is the problem, so that we need to write:

$$M(\lambda, T_{int}) = [\tau_\lambda \varepsilon_{\lambda 1}\, pM(\lambda, T_1) + (1-p)\tau_\lambda \varepsilon_{\lambda 2} M(\lambda, T_2)] \; + \; L_R(\lambda)$$

$L_R(\lambda)$ being the surface reflected radiance. Now we need to correct the integrated radiance for reflection and transmissivity, so that:

$$[M(\lambda, T_{int}) - \; L_R(\lambda)] \,/\tau_\lambda \; = \varepsilon_{\lambda 1}\, pM(\lambda, T_1) + (1-p)\tau_\lambda \varepsilon_{\lambda 2} M(\lambda, T_2)$$

Again, if $\varepsilon_{\lambda 1} = \varepsilon_{\lambda 2}$ we can simplify to

$$[M(\lambda, T_{int}) - L_r(\lambda)] \,/\tau_\lambda \varepsilon_\lambda \; = pM(\lambda, T_1) + (1-p)M(\lambda, T_2)$$

The integrated radiance is now suitably corrected for emissivity, atmospheric transmissivity and surface reflection.

(3) MIR

The MIR is the worst case, where both atmospheric up-welling radiation and surface reflected radiation have to be taken into account, so that:

$$M(\lambda, T_{int}) = [\tau_\lambda \varepsilon_{\lambda 1}\, pM(\lambda, T_1) + (1-p)\tau_\lambda \varepsilon_{\lambda 2} M(\lambda, T_2)] \; + \; L_U(\lambda) \; + \; L_R(\lambda)$$

Now we need to correct the integrated radiance for both atmospheric upwelling and surface reflected radiance, as well as emissivity and atmospheric transmission effects, so that:

$$[M(\lambda, T_{int}) - \; L_U(\lambda) - \; L_R(\lambda)] \,/\tau_\lambda = \varepsilon_{\lambda 1}\, pM(\lambda, T_1) + (1-p)\tau_\lambda \varepsilon_{\lambda 2} M(\lambda, T_2)$$

In the case where $\varepsilon_{\lambda 1} = \varepsilon_{\lambda 2}$ we can simplify to

$$[M(\lambda, T_{int}) - \; L_U(\lambda) - \; L_R(\lambda)] \,/\tau_\lambda \varepsilon_\lambda = \varepsilon_{\lambda 1}\, pM(\lambda, T_1) + (1-p)\tau_\lambda \varepsilon_{\lambda 2} M(\lambda, T_2)$$

Again, the corrected integrated radiance can now be used to extract true, kinetic temperature for surfaces in the pixel.

Values for input into the correction equations

In short, atmospheric, emissivity and surface reflection correction can be split into three cases:

Case 1: *Pixel-integrated temperature in the NIR or SWIR:*
Correct for emissivity, transmissivity, and surface reflection, so that surface temperature (T_{int}) is obtained from brightness temperature (= T_{int}*) following:

Case 1a (by day):

$$M(\lambda_{SWIR}, T_{int}) = [M(\lambda_{SWIR}, T_{int}{}^{*}) - L_R(\lambda_{SWIR})] / \tau_{\lambda SWIR}\, \varepsilon_{\lambda SWIR}$$

Case 1b (by night):

$$M(\lambda_{SWIR}, T_{int}) = M(\lambda_{SWIR}, T_{int}{}^{*}) / \tau_{\lambda SWIR}\, \varepsilon_{\lambda SWIR}$$

Case 2: *Pixel-integrated temperature in the MIR:*
Correct for emissivity, transmissivity, atmospheric upwelling radiance and surface reflection, so that surface temperature (T_{int}) is obtained from brightness temperature (= T_{int}*) following:

Case 2a (by day):

$$M(\lambda_{MIR}, T_{int}) = [M(\lambda_{MIR}, T_{int}{}^{*}) - L_R(\lambda_{MIR}) - L_U(\lambda_{MIR})] / \tau_{\lambda MIR}\, \varepsilon_{\lambda MIR}$$

Case 2b (by night):

$$M(\lambda_{MIR}, T_{int}) = [M(\lambda_{MIR}, T_{int}{}^{*}) - L_U(\lambda_{MIR})] / \tau_{\lambda MIR}\, \varepsilon_{\lambda MIR}$$

Case 3: *Pixel-integrated temperature in the MIR:*
Correct for emissivity, transmissivity and atmospheric upwelling radiance, so that surface temperature (T_{int}) is obtained from brightness temperature (= T_{int}*) following:

Case 3 (by day and night):

$$M(\lambda_{TIR}, T_{int}) = [M(\lambda_{TIR}, T_{int}{}^{*}) - L_U(\lambda_{TIR})] / \tau_{\lambda TIR}\, \varepsilon_{\lambda TIR}$$

Next, we consider setting values for emissivity (ε_λ), and the two atmospheric properties [τ_λ and $L_U(\lambda)$]. We consider surface reflection correction in the final section of this supplement.

Emissivity

As discussed in Chapter 2, emissivity, as defined by Krichoff's Law, can be obtained from:

$$\varepsilon(\lambda) = 1 - \rho(\lambda)$$

$\rho(\lambda)$ being reflection. Emissivity for a surface can thus be defined, at any given wavelength, using a measurement of reflection made at the same wavelength. We thus need to make a reflection measurement of the surface in question at the required wavelength. Some samples of volcanic surfaces are listed in Table S4.1, and their reflection spectra are given in Figure S4.1. Emissivity can now be assessed using such spectra and taking the average value over the required wavelength range. The spectra were those used to create the spectral emissivity plots of Figure 2.7, and are reflection spectra obtained for each surface between 2.08 μm and 14 μm using a Nicolet system FTIR spectrometer by Jack Salisbury (Johns Hopkins University, USA) during December 1995. We have already used these spectra to obtain appropriate emissivity correction values for the typical wavebands in which most commercial radiometers, as well as thermal cameras, operate as given in Table 8.1 of

Table S4.1. *Samples collected for volcanic surfaces and used to obtain the reflectance spectra of Figure S4.1.*

Sample	Location	Type	Emplaced	Collected	Description
MU1	Kilauea	Basalt: pahoehoe	1974	10/95	Pahoehoe with glassy surface from 1969–74 Mauna Ulu flow field
MU2	Kilauea	Basalt: 'A'a	1969	10/95	'A'a from 1969–1974 Mauna Ulu flow field
Haw83	Kilauea	Basalt: pahoehoe	10/95	10/95	Glassy pahoehoe ropes from 1983–95 Pu'u 'O'o flow field
Haw83a	Kilauea	Basalt: pahoehoe	10/95	10/95	Pahoehoe with smooth, glassy surface from 1983–95 Pu'u 'O'o flow field
Haw83b	Kilauea	Basalt: pahoehoe	10/95	10/95	Pahoehoe with vesicular surface from 1983–95 Pu'u 'O'o flow field
Etna1	Etna	Basalt: pahoehoe	05/92	09/95	Slaby (spiny) pahoehoe from toe of 1991–93 flow
Etna2	Etna	Basalt: 'A'a	05/92	09/95	'A'a clasts from toe of 1991–93 flow just above Zafferana Etnea
Etna3	Etna	Basalt: Scoria	1990	09/95	Scoria from 1990 air-fall field W of summit craters
Strom	Stromboli	Basalt: Spatter	09/95	09/95	Spatter collected within 50 m of active vent
StromA	Stromboli	Basalt: Scoria	09/95	09/95	Scoria collected within 50 m of active vent
StromB	Stromboli	Basalt: 'A'a	1986	10/94	'A'a clasts from 1985–86 flow field on the Sciara del Fuoco
Vulc1	Vulcano	Trachite/Rhyolite	1888–90	09/95	Trachytic-Rhyolitic block erupted during 1888–90 eruption
Vulc2fsh	Vulcano	Sulphur 1	–	09/95	Yellow sulphur from fumarole within Fossa fumarole field: Fresh surface
Vulc2wth	Vulcano	Sulphur 2	–	09/95	Yellow sulphur from fumarole within Fossa fumarole field: Weathered surface

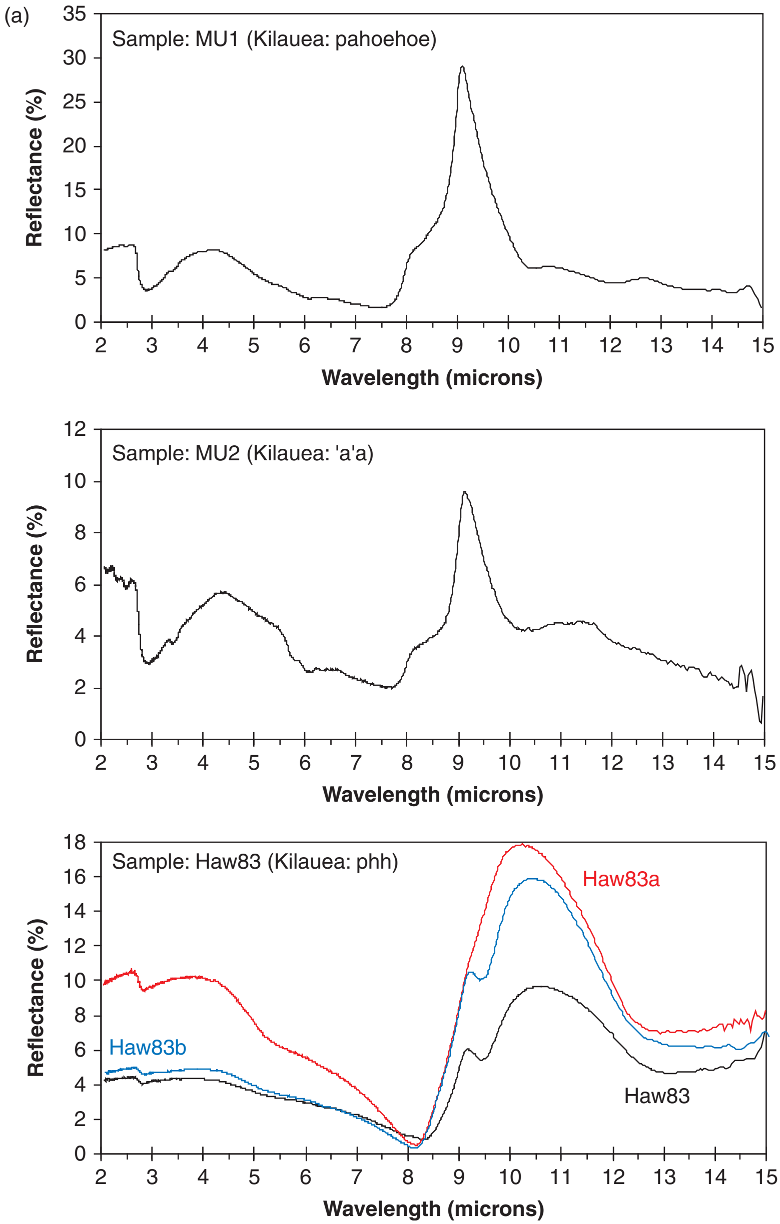

Figure S4.1. Sample reflectance spectra for the samples collated in Table S4.1. (a) Pahoehoe and 'a'a surfaces from Kilauea, (b) Pahoehoe, 'a'a and scoria surfaces from Etna, (c) spatter, scoria and 'a'a surfaces from Stromboli, and (d) blocks and fumarolic surfaces from Vulcano. See Table S4.1 for description of surface character and composition.

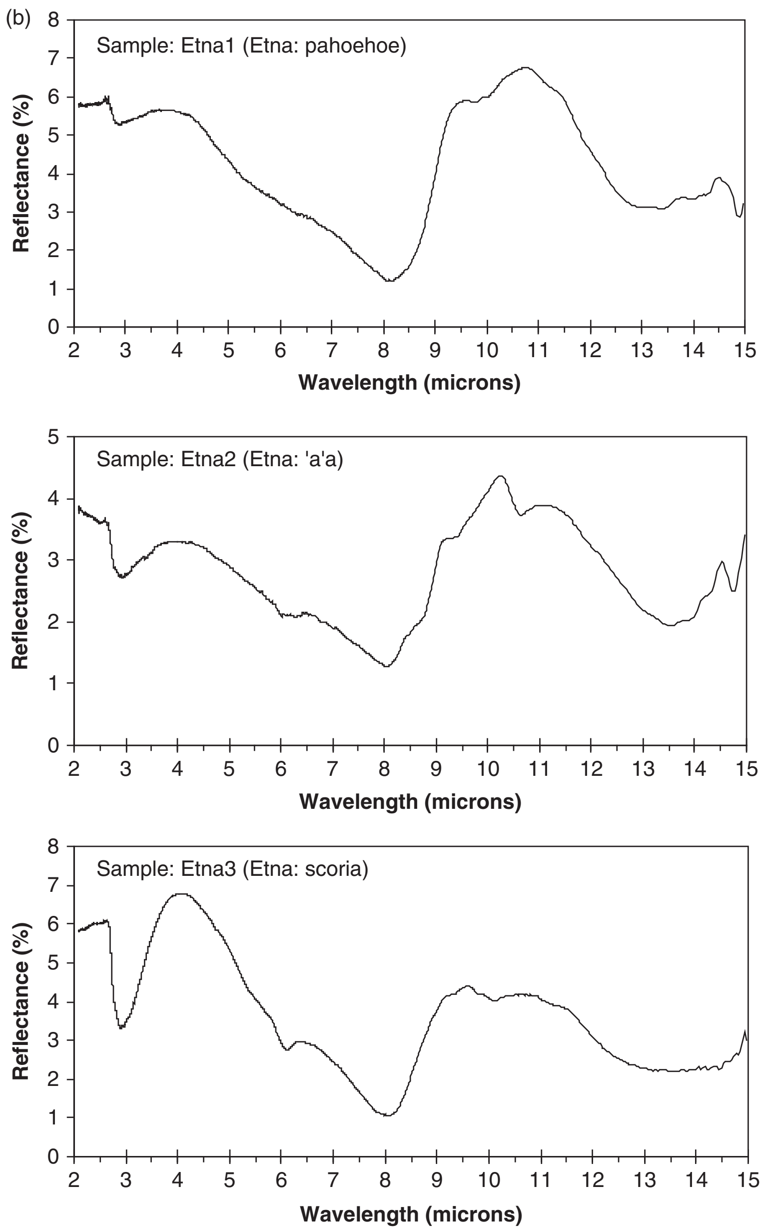

Figure S4.1. (*cont.*)

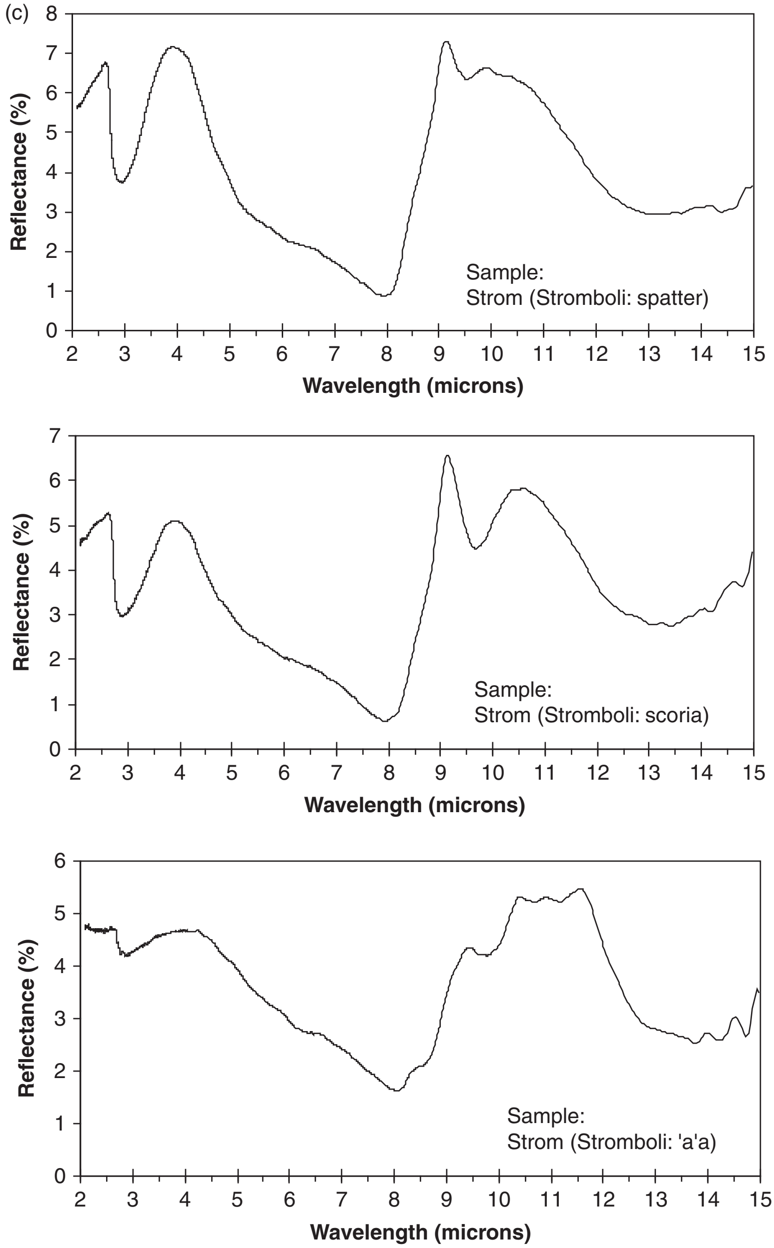

Figure S4.1. (*cont.*)

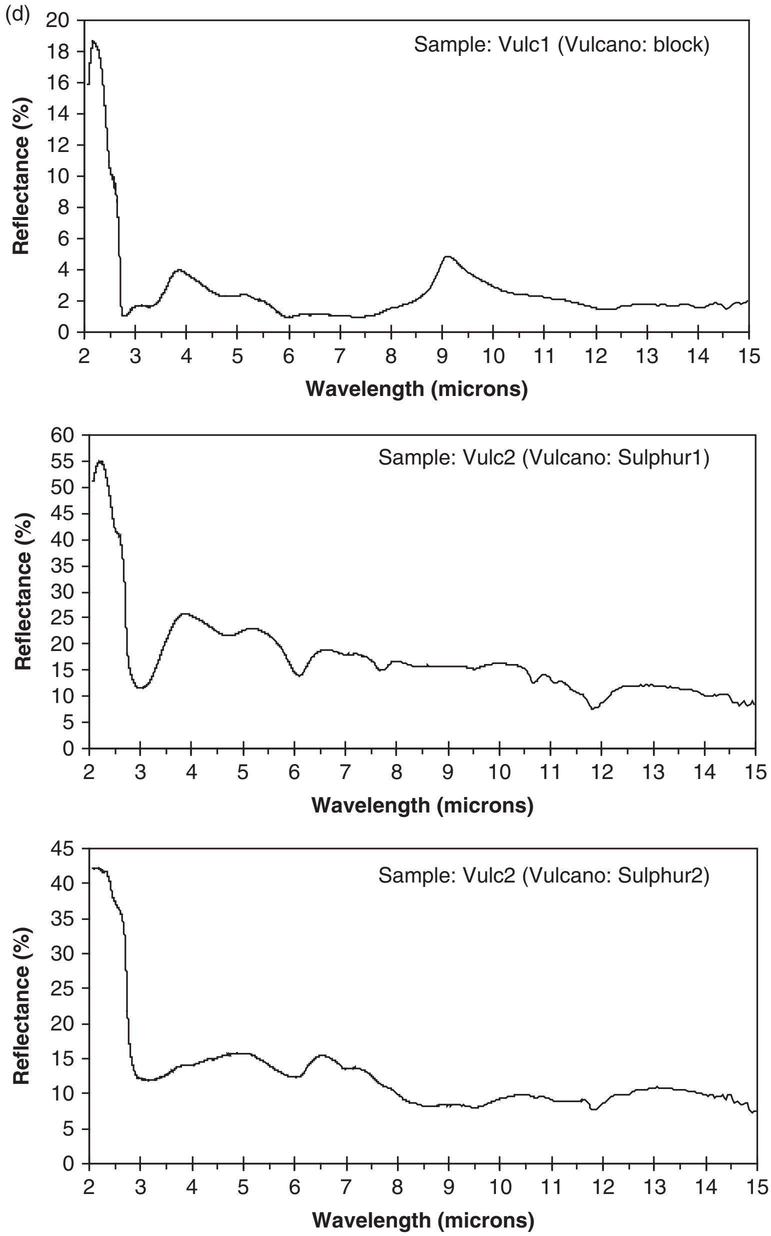

Figure S4.1. (*cont.*)

Table S4.2a. *Emissivities averaged over the sensor wavebands of TM-, AVHRR- and GOES-class sensors for the Kilauea and Etna samples of Table S4.1.*

				EMISSIVITY							
SENSOR	BAND	SPECTRAL REGION	WAVEBAND	MU1	MU2	Haw83	Haw83a	Haw83b	Etna1	Etna2	Etna3
TM	7	SWIR	2.08–2.35	0.916	0.935	0.957	0.900	0.951	0.942	0.962	0.941
MODIS	7	SWIR	2.105–2.155	0.917	0.935	0.957	0.901	0.951	0.942	0.962	0.942
ASTER	5	SWIR	2.145–2.185	0.916	0.934	0.957	0.901	0.951	0.942	0.962	0.942
ASTER	6	SWIR	2.185–2.225	0.916	0.934	0.957	0.900	0.951	0.942	0.962	0.941
ASTER	7	SWIR	2.235–2.285	0.915	0.936	0.957	0.899	0.951	0.942	0.963	0.941
ASTER	8	SWIR	2.295–2.365	0.914	0.938	0.957	0.898	0.950	0.942	0.963	0.940
ASTER	9	SWIR	2.360–2.430	0.913	0.938	0.956	0.898	0.950	0.942	0.963	0.940
SEVIRI	IR3.9	MIR	3.48–4.36	0.921	0.943	0.959	0.904	0.952	0.947	0.968	0.935
AVHRR	3	MIR	3.55–3.93	0.925	0.953	0.957	0.899	0.950	0.944	0.967	0.936
ATSR		MIR	3.7	0.924	0.953	0.957	0.899	0.949	0.944	0.967	0.935
GOES	2	MIR	3.80–4.00	0.921	0.950	0.957	0.899	0.949	0.944	0.967	0.933
MODIS	21	MIR	3.929–3.989	0.920	0.949	0.957	0.899	0.949	0.944	0.967	0.932
MODIS	22	MIR	3.929–3.989	0.920	0.949	0.957	0.899	0.949	0.944	0.967	0.932
ASTER	10	TIR	8.125–8.475	0.909	0.963	0.991	0.989	0.986	0.987	0.984	0.986
SEVIRI	IR8.7	TIR	8.30–9.10	0.865	0.953	0.977	0.957	0.952	0.978	0.979	0.974
ASTER	11	TIR	8.475–8.825	0.878	0.957	0.980	0.959	0.953	0.980	0.980	0.974
ASTER	12	TIR	8.925–9.275	0.739	0.914	0.945	0.902	0.901	0.954	0.969	0.960
SEVIRI	IR9.7	TIR	9.38–9.94	0.844	0.939	0.935	0.846	0.877	0.941	0.963	0.957
SEVIRI	IR10.8	TIR	9.80–11.80	0.931	0.956	0.911	0.841	0.857	0.938	0.961	0.960
GOES	4	TIR	10.2–11.2	0.937	0.956	0.905	0.833	0.847	0.934	0.960	0.959
ASTER	13	TIR	10.25–10.95	0.937	0.957	0.904	0.829	0.844	0.934	0.960	0.958
AVHRR	4	TIR	10.3–11.3	0.938	0.956	0.905	0.836	0.849	0.934	0.961	0.959
TM	6	TIR	10.4–12.5	0.946	0.958	0.917	0.867	0.878	0.943	0.964	0.963

Table S4.2a. (*cont.*)

				EMISSIVITY							
SENSOR	BAND	SPECTRAL REGION	WAVEBAND	MU1	MU2	Haw83	Haw83a	Haw83b	Etna1	Etna2	Etna3
ATSR		TIR	10.8	0.937	0.956	0.904	0.835	0.847	0.933	0.962	0.958
ASTER	14	TIR	10.95–11.65	0.943	0.955	0.912	0.858	0.870	0.939	0.962	0.961
SEVIRI	IR12.0	TIR	11.00–13.00	0.950	0.960	0.930	0.893	0.902	0.952	0.968	0.968
AVHRR	5	TIR	11.5–12.5	0.953	0.961	0.931	0.899	0.908	0.953	0.967	0.968
GOES	5	TIR	11.5–12.5	0.953	0.961	0.931	0.899	0.908	0.953	0.967	0.968
MODIS	32	TIR	11.770–12.270	0.955	0.961	0.932	0.902	0.911	0.954	0.968	0.969
ATSR		TIR	12	0.956	0.962	0.931	0.902	0.911	0.954	0.968	0.969

Table S4.2b. *Emissivities averaged over the sensor wavebands of TM-, AVHRR- and GOES-class sensors for the Stromboli and Vulcano samples of Table S4.1.*

				EMISSIVITY					
SENSOR	BAND	SPECTRAL REGION	WAVEBAND	Strom	StromA	StromB	Vulc1	Vulc2fsh	Vulc2wth
TM	7	SWIR	2.08–2.35	0.942	0.952	0.953	0.822	0.464	0.581
MODIS	7	SWIR	2.105–2.155	0.943	0.953	0.953	0.823	0.466	0.578
ASTER	5	SWIR	2.145–2.185	0.943	0.953	0.953	0.815	0.457	0.578
ASTER	6	SWIR	2.185–2.225	0.942	0.953	0.953	0.815	0.452	0.580
ASTER	7	SWIR	2.235–2.285	0.941	0.952	0.953	0.818	0.454	0.583
ASTER	8	SWIR	2.295–2.365	0.939	0.950	0.953	0.830	0.478	0.584
ASTER	9	SWIR	2.360–2.430	0.937	0.950	0.953	0.852	0.514	0.596
SEVIRI	IR3.9	MIR	3.48–4.36	0.940	0.958	0.954	0.972	0.771	0.851
AVHRR	3	MIR	3.55–3.93	0.931	0.951	0.954	0.965	0.754	0.863
ATSR		MIR	3.7	0.930	0.950	0.953	0.961	0.746	0.861
GOES	2	MIR	3.80–4.00	0.929	0.949	0.953	0.961	0.743	0.860
MODIS	21	MIR	3.929–3.989	0.929	0.949	0.953	0.962	0.744	0.860
MODIS	22	MIR	3.929–3.989	0.929	0.949	0.953	0.962	0.744	0.860
ASTER	10	TIR	8.125–8.475	0.980	0.987	0.981	0.982	0.841	0.913
SEVIRI	IR8.7	TIR	8.30–9.10	0.958	0.968	0.976	0.973	0.842	0.917
ASTER	11	TIR	8.475–8.825	0.959	0.970	0.977	0.975	0.842	0.918
ASTER	12	TIR	8.925–9.275	0.931	0.940	0.963	0.954	0.843	0.916
SEVIRI	IR9.7	TIR	9.38–9.94	0.935	0.952	0.957	0.964	0.843	0.916
SEVIRI	IR10.8	TIR	9.80–11.80	0.942	0.948	0.949	0.976	0.863	0.908
GOES	4	TIR	10.2–11.2	0.939	0.944	0.948	0.976	0.858	0.905
ASTER	13	TIR	10.25–10.95	0.938	0.943	0.948	0.976	0.855	0.903
AVHRR	4	TIR	10.3–11.3	0.940	0.944	0.947	0.977	0.862	0.906
TM	6	TIR	10.4–12.5	0.950	0.953	0.951	0.980	0.882	0.908
ATSR		TIR	10.8	0.940	0.943	0.947	0.977	0.863	0.905

Table S4.2b. (*cont.*)

				EMISSIVITY					
SENSOR	BAND	SPECTRAL REGION	WAVEBAND	Strom	StromA	StromB	Vulc1	Vulc2fsh	Vulc2wth
ASTER	14	TIR	10.95–11.65	0.948	0.950	0.947	0.979	0.881	0.910
SEVIRI	IR12.0	TIR	11.00–13.00	0.959	0.961	0.956	0.982	0.890	0.907
AVHRR	5	TIR	11.5–12.5	0.961	0.962	0.955	0.984	0.902	0.910
GOES	5	TIR	11.5–12.5	0.961	0.962	0.955	0.984	0.902	0.910
MODIS	32	TIR	11.770–12.270	0.962	0.964	0.956	0.984	0.911	0.914
ATSR		TIR	12	0.962	0.964	0.956	0.985	0.913	0.914

Chapter 8 and Table 9.5 of Chapter 9, respectively. We here use these spectra to obtain appropriate emissivity correction values for the wavebands currently flown on the main satellite-based sensors used for volcano radiometry, as reviewed in Appendices C, D and E (i.e., TM-, AVHRR- and GOES-class sensors). These band- and surface-specific emissivity corrections are given in Tables S4.2a and S4.2b and can be used in the above Equations to obtain an appropriate correction value for emissivity.

Types of correction

Cracknell and Hayes (1991) and Cracknell (1997) list a number of options for atmospheric correction, including:

1. Ignore atmospheric effects (i.e., carry out no atmospheric correction);
2. Calibration with *in situ* measurements;
3. Use of a model atmosphere loaded with default parameters;
4. Use of a model atmosphere loaded with parameters determined from simultaneous meteorological data, such as that available from satellite-based sounders or radiosonde;
5. Correction of atmospheric effects on a pixel-by-pixel basis using the split-window methodology.

Over active volcanic targets, option 1 may be viable. If we use a model loaded with default parameters set from global, historic meteorological parameters, we could argue that the uncertainty in our exact knowledge of the atmospheric properties over the target, including the unaccounted for effects of volcanic gases, mean the correction may introduce more error than had we completed no correction at all. We may also argue that, to an extent, option 2 is that used with the conversion to time-average discharge rate (TADR) or lava volume from thermal data. As discussed in Section 5 of Chapter 4, this conversion can boil down to a best-fit relation where we have the relation,

$$\mathrm{TADR} = a\ \mathrm{A}_{\mathrm{lava}}$$

In which $\mathrm{A}_{\mathrm{lava}}$ is the lava area extracted from mixture modeling of the TIR pixel, and a is a coefficient with defines a linear relation between TADR and $\mathrm{A}_{\mathrm{lava}}$. It is possible that, due to errors in our assumptions when setting in the mixture model (see Section 3 of Chapter 4) or in application of atmospheric correction to the pixel radiance prior to mixture modeling, $\mathrm{A}_{\mathrm{lava}}$ is in error. However, we can adjust parameter a until the output TADR matches our ground-based measurement, in this case a field-based measurement of TADR or lava flow volume (see Section 4.5.5 of Chapter 4).

However, option 3 has tended to be the most commonly used methodology applied to volcano hot spot data acquired in the SWIR, MIR and TIR, where values for upwelling radiance and transmissivity have typically been set using the LOWTRAN or MODTRAN atmospheric code. This code allows values to be calculated, over any wavelength range, for specified altitude, scan angle and path length type (from vertical to horizontal) combinations. The latter option allows the correction to be applied for a vertical satellite-based view, or a horizontal line of site for a thermal camera view. This code has thus been the basis for our assessments of atmospheric effects in satellite data (in Chapter 2), as well as radiometer and thermal camera data (in Chapters 7 and 9). We thus start by detailing this type of correction, before considering option 5: the split-window methodology.

LOWTRAN and MODTRAN

One of the most common ways to correct for transmissivity and upwelling radiance in volcanology is to used the LOWTRAN or MODTRAN atmospheric modeling software. LOWTRAN was initially designed to calculate atmospheric transmittance and radiance averaged over 20 cm^{-1} in steps of 5 cm^{-1} from 350 to 40 000 cm^{-1} (Kneizys *et al.*, 1983), and eventually between 0 and 50 000 cm^{-1}, or 0.2 μm to infinity (Kneizys *et al.*, 1988). For our purposes, the software allows estimation of atmospheric upwelling radiance and transmissivity, as well as surface reflection, for any waveband between 0.2 and 28.5 μm. Developed at the Air Force Geophysics Laboratory (Hanscom Air Force Base, Massachusetts, USA), and made available through the National Climatic Center (Asheville, NC, USA), it was originally written in FORTRAN 77 and the user initialized the software through entry of tab-delimited input cards. Upgraded to MODTRAN (MODerate resolution TRANsmission) in 1994, the model treated the atmosphere as a stack of up to 33 atmospheric layers between 0 and 100 km. MODTRAN could also be run using the PcModWin software, an easy-to-use program driven by a series of model set up menus and distributed by the Ontar corporation (Ontar Corporation, 1996).

The program

PcModWin 4.0 ran MODTRAN 4.0 and allowed the user to edit 20 input cards through the manipulation of a series of model set-up options. Of most importance to us were:

1. Model atmosphere card
   This card allows selection of the model atmosphere, six options being available:
   - 1976 US Standard
   - SubArctic Winter
   - SubArctic Summer
   - MidLatitude Winter
   - MidLatitude Summer
   - Tropical Model

   Plus an option allowing entry of meteorological data or new model. Also on this card was the option to select the path type, options being:
   - Slant path to space or ground:
     for use with satellite geometries that look downwards through the entire atmosphere, or
   - Slant and horizontal path
     For use with ground-based geometries that look from one point to another on the Earth's surface.

2. Surface parameters card
   This card allows entry of surface albedo for calculation of surface reflection. For a surface with emissivity of 0.95, for example, entry of 0.05 will provide an estimate for the reflection from that surface. This option requires selection of the "Direct Solar Irradiance" option from the "Model Atmosphere" card, and entry of day number and solar zenith angle in the "Solar/Lunar irradiance" card. Output are identical to those calculated using the procedure of Appendix B.
3. Aerosols screen
   This screen allows selection of the aerosol model, 12 options being available, including:
   - Rural, VIS = 23 km
   - Rural, VIS = 5 km
   - Navy maritime, and
   - Maritime, VIS = 23 km

   Season (spring-summer or fall-winter) can also be specified, as well as the altitude of the imaged surface.
4. Geometry and spectral band card
   This card allows entry of the observer height, this being 100 km, i.e., at the top of the atmosphere, for a satellite view, and zenith angle (180 ° for a view that looks straight down, i.e., at nadir; 130 ° for a scan angle of 50 °). For a horizontal path from a radiometer or thermal camera to a targeted surface, we will need to enter the height of the observer (i.e., the height at which the instrument was deployed) and the path length (i.e., the distance to the target). This card also allows the all important entry of waveband initial and final wavelength.

The output

Once model set-up cards are completed, the model runs to output three space delimited ASCII files, examples of which are given in the Appendix to this Electronic Supplement (Appendix S4A):

MODOUT1: This file describes all the model input parameters, atmospheric profiles used, and viewing geometry, and gives model output as a function of wave number (cm^{-1}) and wavelength (in μm).

MODOUT2: This file contains the model outputs only, as a function of wave number (cm^{-1}).

MODOUT3: This file contains the model set-up parameters, and any additional model results if these have been requested.

Making the correction

In the model output section of MODOUT1 we find, listed by wavelength, transmissivity, path thermal radiance (in W/cm^2-sr-μm) and surface reflected radiance (also in W/cm^2-sr-μm). These columns can be used to estimate the waveband-averaged values for τ_λ, $L_U(\lambda)$, and $L_R(\lambda)$, as done in Appendix S4A. These values can now be used in the atmospheric correction equations listed above. In the case of the Appendix S4A example, we have a correction, for our thermal camera measurement made between 7.5 and 13 μm at sea level over a path length of 500 m,

$$M(\lambda_{TIR}, T_{int}) = [M(\lambda_{TIR}, T_{int}^{*}) - L_U(\lambda_{TIR})] / \tau_{\lambda TIR}\, \varepsilon_{\lambda TIR}$$

so that

$$M(\lambda_{TIR}, T_{int}) = [M(\lambda_{TIR}, T_{int}^{*}) - (1.06 \times 10^{-4}\ \text{W/cm}^2\text{-sr-}\mu\text{m})] / [(0.85)\ (0.95)]$$

Selecting a model atmosphere

As listed above, there are six models that can be selected within MODTRAN. The 1976 U.S. Standard Atmosphere is from a standard atmospheric model. The model is an idealized, steady-state representation of the earth's atmosphere to 1000 km, depicting middle-latitude year-round mean conditions, and is based upon averages from atmospheric data (NOAA, 1976). The other five models are seasonal models built using data from a wide variety of sources to represent average seasonal and latitude variations in atmospheric properties, as follows:

SubArctic Winter	=	Set for 60 N latitude, January
SubArctic Summer	=	Set for 60 N latitude, July
MidLatitude Winter	=	Set for 45 N latitude, January
MidLatitude Summer	=	Set for 45 N latitude, July
Tropical Model	=	Set for 15 N latitude

The selection of the aerosol model (e.g., Visibility of 5 km versus visibility of 23 km) will also affect the output τ_λ and $L_U(\lambda)$ values. Application of each model combination will give a slightly different correction. In Table S4.3 I give the MODTRAN-derived corrections for a TM band 6 (10.4 – 12.5 μm) pixel at sea-level for each model. This shows the range of corrections that can be obtained from each combination of atmosphere and aerosol model, and the range of corrected temperatures we can obtain.

We next apply these atmospheric corrections, with a sea surface emissivity of 0.98 (Singh, 1984), to a TM band 6 pixel located just off-shore of Kilauea's ocean entry (a zone where lava is entering the water) in a 23 July 1991 TM image. The atmosphere and emissivity corrected temperatures are given in the final two columns of Table 4.3 and yield results (T_{corr}) in the range 20.5 °C to 23.6 °C, compared with a brightness temperature of 17.3 °C. Given that this measurement was made just off-shore of Kilauea's ocean entry, the water may have contained particles of volcanic glass. If we assume that particles of volcanic glass suspended in the water decrease the emissvity to 0.95, then the range of T_{corr} increases to 22.3 °C to 25.7 °C, with a mean of 24.1 °C and a standard deviation of 0.9 °C. This compares with typical in-situ surface temperatures measured offshore of Kilauea's ocean entry of 24.2 °C to 25.7 °C, with a mean of 25.2 °C (Sansone and Resing, 1995).

The question remains, though, which atmospheric model do we use? Inspection of Table S4.3 shows that the 1976 US Standard Atmosphere and the MidLatitude Summer (or Winter) atmospheres (all using the Rural, VIS = 5 km aerosol model) give temperatures closest to those expected, for this case. However, in the absence of in-situ temperatures with which we can validate our model selection, or in-situ atmospheric profiles, all we can say is that:

Table S4.3. *MODTRAN-derived atmospheric corrections, listed by model, for a satellite-based measurement in the 10.4 to 12.5 µm waveband (correction is for a vertical path length from the top of the atmosphere to sea level). Upwelling and transmissivity values obtained for each model are used to correct the mean brightness temperature of 17.3±0.5 °C for pixels off-shore of Kilauea's ocean entry (Hawaii) in a 23 July 1991 TM band 6 image, giving an atmospherically corrected temperature (T_{corr}). Two corrections are completed, one corrected for a surface emissivity of 0.98, and the second using an emissivity of 0.95. Results need to be compared with typical in-situ sea surface temperature measurements of 25.2 °C. Values closest to the expected value are highlighted in bold. Note that the tropical model seems to consistently under-correct.*

Atmospheric Model	Aerosol Model	Transmissivity	Upwelling (W/cm^2-sr-µm)	T_{corr} (°C) $\varepsilon = 0.98$	T_{corr} (°C) $\varepsilon = 0.95$
1976 U.S. Standard Atmosphere	Rural, VIS = 23 km	0.82	1.09E-04	22.2	24.4
	Rural, VIS = 5 km	**0.78**	**1.35E-04**	**23.1**	**25.2**
	Navy maritime	0.83	1.05E-04	21.8	23.9
	Maritime, VIS = 23 km	0.82	1.09E-04	22.2	24.4
	Urban, VIS = 5 km	0.77	1.45E-04	22.9	25.1
	Tropospheric, VIS = 50 km	0.84	1.02E-04	21.3	23.4
Tropical	Rural, VIS = 23 km	0.44	4.45E-04	20.2	22.3
	Rural, VIS = 5 km	0.41	4.64E-04	21.3	23.5
	Navy maritime	0.44	4.43E-04	20.5	22.7
	Maritime, VIS = 23 km	0.43	4.49E-04	21.0	23.1
MidLatitude Summer	Rural, VIS = 23 km	0.6	2.95E-04	22.5	24.7
	Rural, VIS = 5 km	**0.57**	**3.18E-04**	**22.9**	**25.0**
	Navy maritime	0.61	2.92E-04	21.8	23.9
	Maritime, VIS = 23 km	0.6	2.97E-04	22.2	24.4
MidLatitude Winter	Rural, VIS = 23 km	0.89	5.52E-05	21.7	23.8
	Rural, VIS = 5 km	**0.84**	**7.80E-05**	**23.6**	**25.7**
	Navy maritime	0.88	6.00E-05	22.0	24.2
	Maritime, VIS = 23 km	0.88	5.86E-05	22.2	24.3

- All models move the temperature closer to the true surface value, so it is better to apply a correction than none at all;
- Using a 1976 US Standard Atmosphere will likely give a temperature within 2 to 3 °C of the true (expected) surface value;
- The Rural, VIS = 5 km aerosol model seems the most appropriate for this case, use of the VIS = 23 km model may make a difference of 0.4 °C to 1.9 °C depending on the model used.
- Differences across the models result in T_{corr} that range over 3.4 °C, so that this is our uncertainty due to model variation.

We return to the performance of the US Standard Atmosphere in correcting land surface temperatures in a later section of this supplement.

Corrections for use with thermal camera and satellite data

In Chapter 9, MODTRAN runs of the type given in Appendix S4C were used to estimate atmospheric effects [τ_λ and $L_U(\lambda)$] in thermal camera data, collected between 7.5 and 13 μm, for horizontal path lengths out to 10 km and for altitudes of between 0 and 5 km. These results are given in Table 9.4 of Chapter 9, and plotted in Figures 9.16 and 9.17. Such MODTRAN-generated output can be used as atmospheric correction lookup tables, so that the lookup tables for thermal camera correction are given in Chapter 9. I here provide lookup tables for use with satellite data.

In Table S4.4, I give τ_λ and $L_U(\lambda)$ as a function of surface altitude and scan angle, for the SWIR, MIR and TIR wavebands of the main TM-, AVHRR- and GOES-class sensors currently used for volcano radiometry. In Figure S4.2 we use the values given in Table S4.4 for MODIS band 32 to plot τ_λ and $L_U(\lambda)$ as a function of scan angle and surface altitude. We see that the variation of τ_λ and $L_U(\lambda)$ with scan angle (α) can be described using a fourth order polynomial, i.e.,

$$\tau_\lambda = a_0(\alpha^4) - a_1(\alpha^3) + a_2(\alpha^2) - a_3(\alpha) + a_4$$

and

$$L_U(\lambda) = b_0(\alpha^4) - b_1(\alpha^3) + b_2(\alpha^2) - b_3(\alpha) + b_4$$

For the case plotted in Figure S4.2, we have

$$\tau_\lambda = 2.08\text{E-}08(\alpha^4) - 2.18\text{E-}06(\alpha^3) + 2.99\text{E-}05(\alpha^2) - 2.69\text{E-}04(\alpha) + 8.30\text{E-}01$$

and

$$L_U(\lambda) = -2.08\text{E-}12(\alpha^4) + 4.95\text{E-}10(\alpha^3) - 3.82\text{E-}09(\alpha^2) + 1.93\text{E-}07(\alpha) + 1.07\text{E-}04$$

Note that this relation is just for a pixel at an altitude of 2000 m imaged in MODIS Band 32. For any other band – altitude combination the appropriate values from Table S4.4 will have to be plotted and used to derive the appropriate coefficients for use in the polynomial.

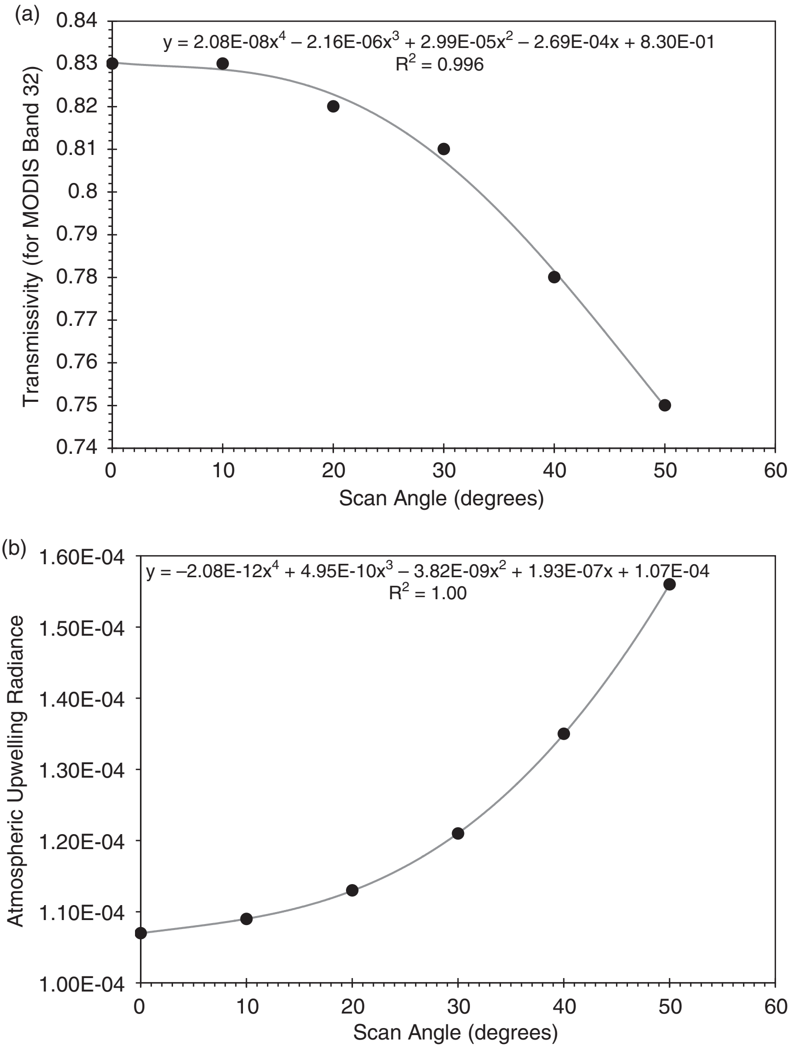

Figure S4.2. (a) Transmissivity and (b) atmospheric upwelling data points of Table S4.4 plotted, for MODIS band 32 and a surface altitude of 2000 m, as a function of scan angle. The polynomial best-fit to the six data points is given in gray. Atmospheric upwelling radiance are in units of WATTS/CM^2-STER-MICRON.

Similarly, at any scan angle, the variation of τ_λ and $L_U(\lambda)$ with altitude (h) can be described using a fourth order polynomial. Using the values from Table S4.4 for a nadir pixel in ETM+ band 6 we have, as plotted in Figure S4.3,

$$\tau_\lambda = -4.17\text{E-}04(h^4) + 4.17\text{E-}03(h^3) - 1.96\text{E-}02(h^2) + 7.58\text{E-}02(h) + 8.30\text{E-}01$$

and

$$L_U(\lambda) = -1.24\text{E-}06(h^3) + 1.33\text{E-}05(h^2) - 5.72\text{E-}05(h) + 1.04\text{E-}04$$

Again, note that this relation is just for a nadir pixel imaged in ETM+ Band 6. For any other band – scan angle combination the appropriate values from Table S4.4 will have to be

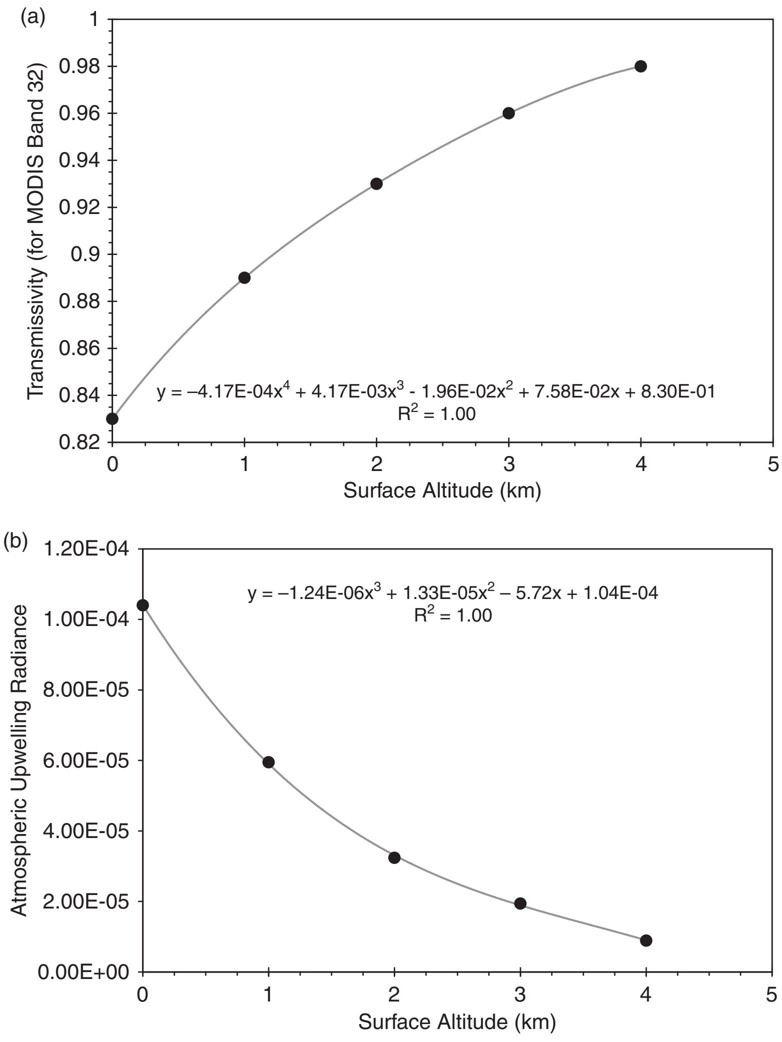

Figure S4.3. (a) Transmissivity and (b) atmospheric upwelling data points of Table S4.4 plotted, for a nadir pixel in TM/ETM+ band 6, as a function of surface altitude. The polynomial best-fit to the five data points is given in gray. Note that, in (b), a third order polynomial gives the best fit, as opposed to a fourth order polynomial in (a). Atmospheric upwelling radiance are in units of watts/cm^2-ster-micron.

Table S4.4. *Transmissivity (τ_λ) and atmospheric upwelling radiamce [$L_U(\lambda)$] as a function of scan angle and surface altitude, for the SWIR, MIR and TIR wavebands of the primary TM-, AVHRR- and GOES-class sensors currently used for volcano radiometry. Five tables are given, one for each surface altitude of 0, 1, 2, 3 and 4 km. In each table, τ_λ and $L_U(\lambda)$ are given every 10 ° from a scan angle of 0 ° out to 50 °. Values have been obtained from multiple runs of MODTRAN, using the input card given in Appendix S4A but for a slant path to space or ground between 0.6 and 14 μm. Given in parentheses below each scan angle is the zenith angle used in MODTRAN, where Zenith = 180 ° minus scan angle. Units for $L_U(\lambda)$ are in watts/cm^2-ster-micron.*

US Standard Atmosphere, Rural Vis 23 km (Alt = 0 km)														
			0 ° (Nadir, 180 °)		10 ° (170 °)		20 ° (160 °)		30 ° (150 °)		40 ° (140 °)		50 ° (130 °)	
Sensor Waveband	Spectral Region	Waveband (μm)	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$
TM 3	NIR	0.63–0.69	0.71	4.95E-29	0.71	5.01E-29	0.70	5.21E-29	0.67	5.57E-29	0.64	6.14E-29	0.58	7.04E-29
TM 4	NIR	0.76–0.90	0.76	1.46E-22	0.76	1.48E-22	0.75	1.54E-22	0.73	1.65E-22	0.71	1.83E-22	0.66	2.12E-22
SEVIRI NIR1.6	SWIR	1.50–1.78	0.89	5.28E-12	0.89	5.34E-12	0.88	5.52E-12	0.87	5.86E-12	0.86	6.42E-12	0.84	7.30E-12
TM 5	SWIR	1.55–1.75	0.91	3.74E-12	0.91	3.79E-12	0.90	3.94E-12	0.90	4.22E-12	0.88	4.68E-12	0.86	5.43E-12
ATSR 1.6μm	SWIR	1.6	0.88	1.16E-12	0.88	1.18E-12	0.88	1.23E-12	0.87	1.32E-12	0.85	1.48E-12	0.82	1.74E-12
ASTER 4	SWIR	1.600–1.700	0.92	2.40E-12	0.92	2.44E-12	0.91	2.55E-12	0.91	2.76E-12	0.90	3.11E-12	0.88	3.68E-12
MODIS 6	SWIR	1.628–1.652	0.92	1.86E-12	0.92	1.89E-12	0.92	1.97E-12	0.91	2.14E-12	0.90	2.41E-12	0.88	2.86E-12
TM 7	SWIR	2.08–2.35	0.91	1.49E-09	0.91	1.51E-09	0.90	1.57E-09	0.89	1.69E-09	0.88	1.87E-09	0.86	2.16E-09
MODIS 7	SWIR	2.105–2.155	0.94	4.82E-10	0.94	4.89E-10	0.94	5.11E-10	0.93	5.53E-10	0.92	6.22E-10	0.91	7.35E-10
ASTER 5	SWIR	2.145–2.185	0.92	8.06E-10	0.92	8.17E-10	0.92	8.52E-10	0.91	9.15E-10	0.90	1.02E-09	0.89	1.19E-09
ASTER 6	SWIR	2.185–2.225	0.92	1.11E-09	0.92	1.12E-09	0.91	1.17E-09	0.91	1.26E-09	0.90	1.40E-09	0.88	1.63E-09
ASTER 7	SWIR	2.235–2.285	0.91	1.42E-09	0.91	1.44E-09	0.90	1.50E-09	0.90	1.62E-09	0.88	1.81E-09	0.86	2.13E-09
ASTER 8	SWIR	2.295–2.365	0.83	4.79E-09	0.83	4.85E-09	0.82	5.01E-09	0.81	5.31E-09	0.79	5.79E-09	0.76	6.53E-09
ASTER 9	SWIR	2.360–2.430	0.68	1.59E-08	0.68	1.60E-08	0.67	1.64E-08	0.65	1.71E-08	0.63	1.81E-08	0.59	1.96E-08
SEVIRI IR3.9	MIR	3.48–4.36	0.66	3.37E-06	0.66	3.40E-06	0.66	3.49E-06	0.64	3.66E-06	0.62	3.91E-06	0.59	4.31E-06
AVHRR 3	MIR	3.55–3.93	0.84	1.85E-06	0.84	1.87E-06	0.83	1.94E-06	0.82	2.07E-06	0.80	2.27E-06	0.77	2.60E-06
ATSR 3.7 μm	MIR	3.7	0.94	6.53E-07	0.94	6.63E-07	0.94	6.95E-07	0.94	7.54E-07	0.93	8.52E-07	0.91	1.02E-06
GOES 2	MIR	3.80–4.00	0.85	2.19E-06	0.85	2.22E-06	0.84	2.31E-06	0.83	2.48E-06	0.81	2.75E-06	0.78	3.19E-06
MODIS 21	MIR	3.929–3.989	0.87	2.18E-06	0.86	2.22E-06	0.86	2.31E-06	0.85	2.49E-06	0.83	2.79E-06	0.80	3.26E-06

Table S4.4. (*cont.*)

US standard atmosphere, rural vis 23 km (alt = 0 km)														
			0 ° (Nadir, 180 °)		10 ° (170 °)		20 ° (160 °)		30 ° (150 °)		40 ° (140 °)		50 ° (130 °)	
Sensor Waveband	Spectral Region	Waveband (μm)	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$
MODIS 22	MIR	3.929–3.989	0.87	2.18E-06	0.86	2.22E-06	0.86	2.31E-06	0.85	2.49E-06	0.83	2.79E-06	0.80	3.26E-06
ASTER 10	TIR	8.125–8.475	0.68	1.59E-04	0.68	1.60E-04	0.67	1.64E-04	0.65	1.72E-04	0.63	1.83E-04	0.59	2.01E-04
SEVIRI IR8.7	TIR	8.30–9.10	0.77	1.16E-04	0.77	1.17E-04	0.76	1.21E-04	0.75	1.27E-04	0.73	1.37E-04	0.69	1.53E-04
ASTER 11	TIR	8.475–8.825	0.75	1.26E-04	0.75	1.28E-04	0.74	1.31E-04	0.73	1.38E-04	0.70	1.48E-04	0.67	1.64E-04
ASTER 12	TIR	8.925–9.275	0.83	9.06E-05	0.82	9.16E-05	0.82	9.49E-05	0.80	1.01E-04	0.78	1.11E-04	0.75	1.27E-04
SEVIRI IR9.7	TIR	9.38–9.94	0.38	1.59E-04	0.37	1.60E-04	0.36	1.63E-04	0.34	1.68E-04	0.31	1.76E-04	0.27	1.87E-04
SEVIRI IR10.8	TIR	9.80–11.80	0.81	9.60E-05	0.81	9.72E-05	0.81	1.01E-04	0.79	1.08E-04	0.77	1.19E-04	0.74	1.37E-04
GOES 4	TIR	10.2–11.2	0.87	8.48E-05	0.86	8.60E-05	0.86	8.97E-05	0.85	9.65E-05	0.83	1.08E-04	0.80	1.26E-04
ASTER 13	TIR	10.25–10.95	0.86	8.54E-05	0.86	8.66E-05	0.86	9.03E-05	0.85	9.72E-05	0.83	1.08E-04	0.80	1.27E-04
AVHRR 4	TIR	10.3–11.3	0.87	8.48E-05	0.86	8.60E-05	0.86	8.96E-05	0.85	9.64E-05	0.83	1.07E-04	0.80	1.25E-04
TM 6	TIR	10.4–12.5	0.83	1.04E-04	0.83	1.05E-04	0.82	1.09E-04	0.81	1.17E-04	0.79	1.29E-04	0.76	1.49E-04
ATSR 10.8 μm	TIR	10.8	0.89	6.89E-05	0.89	6.99E-05	0.89	7.31E-05	0.88	7.91E-05	0.86	8.90E-05	0.83	1.06E-04
ASTER 14	TIR	10.95–11.65	0.86	9.11E-05	0.85	9.24E-05	0.85	9.61E-05	0.84	1.03E-04	0.82	1.15E-04	0.79	1.33E-04
SEVIRI IR12.0	TIR	11.00–13.00	0.78	1.32E-04	0.78	1.34E-04	0.77	1.39E-04	0.75	1.47E-04	0.73	1.61E-04	0.69	1.82E-04
AVHRR 5	TIR	11.5–12.5	0.80	1.24E-04	0.80	1.26E-04	0.79	1.30E-04	0.78	1.39E-04	0.75	1.52E-04	0.72	1.74E-04
GOES 5	TIR	11.5–12.5	0.80	1.24E-04	0.80	1.26E-04	0.79	1.30E-04	0.78	1.39E-04	0.75	1.52E-04	0.72	1.74E-04
MODIS 32	TIR	11.77–12.27	0.83	1.07E-04	0.83	1.09E-04	0.82	1.13E-04	0.81	1.21E-04	0.78	1.35E-04	0.75	1.56E-04
ATSR 12 μm	TIR	12	0.87	8.01E-05	0.87	8.13E-05	0.87	8.50E-05	0.86	9.19E-05	0.84	1.03E-04	0.81	1.22E-04

US Standard Atmosphere, Rural Vis 23 km (Alt = 1 km)														
			0 ° (Nadir, 180 °)		10 ° (170 °)		20 ° (160 °)		30 ° (150 °)		40 ° (140 °)		50 ° (130 °)	
Sensor Waveband	Spectral Region	Waveband (μm)	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$
TM 3	NIR	0.63–0.69	0.75	8.03E-30	0.74	8.13E-30	0.73	8.46E-30	0.71	9.06E-30	0.68	1.00E-29	0.63	1.16E-29
TM 4	NIR	0.76–0.90	0.80	3.47E-23	0.79	3.52E-23	0.79	3.67E-23	0.77	3.94E-23	0.75	4.38E-23	0.71	5.09E-23
SEVIRI NIR1.6	SWIR	1.50–1.78	0.91	2.19E-12	0.91	2.22E-12	0.91	2.30E-12	0.90	2.45E-12	0.89	2.70E-12	0.87	3.10E-12

TM 5	SWIR	1.55–1.75	0.92	1.57E-12	0.92	1.59E-12	0.92	1.65E-12	0.91	1.78E-12	0.90	1.98E-12	0.89	2.31E-12
ATSR 1.6μm	SWIR	1.6	0.90	4.89E-13	0.90	4.97E-13	0.89	5.19E-13	0.88	5.60E-13	0.87	6.27E-13	0.85	7.38E-13
ASTER 4	SWIR	1.600–1.700	0.93	1.01E-12	0.93	1.03E-12	0.93	1.08E-12	0.92	1.16E-12	0.91	1.31E-12	0.89	1.56E-12
MODIS 6	SWIR	1.628–1.652	0.93	7.88E-13	0.93	8.00E-13	0.93	8.38E-13	0.92	9.08E-13	0.91	1.02E-12	0.90	1.22E-12
TM 7	SWIR	2.08–2.35	0.92	7.32E-10	0.92	7.41E-10	0.92	7.73E-10	0.91	8.30E-10	0.90	9.24E-10	0.88	1.08E-09
MODIS 7	SWIR	2.105–2.155	0.95	2.27E-10	0.95	2.30E-10	0.95	2.41E-10	0.94	2.61E-10	0.94	2.94E-10	0.92	3.50E-10
ASTER 5	SWIR	2.145–2.185	0.94	3.78E-10	0.94	3.83E-10	0.94	4.00E-10	0.93	4.31E-10	0.92	4.82E-10	0.91	5.66E-10
ASTER 6	SWIR	2.185–2.225	0.94	5.21E-10	0.94	5.28E-10	0.93	5.52E-10	0.93	5.95E-10	0.92	6.66E-10	0.90	7.83E-10
ASTER 7	SWIR	2.235–2.285	0.92	7.28E-10	0.92	7.39E-10	0.92	7.72E-10	0.91	8.33E-10	0.90	9.34E-10	0.88	1.10E-09
ASTER 8	SWIR	2.295–2.365	0.86	2.35E-09	0.86	2.38E-09	0.85	2.46E-09	0.84	2.62E-09	0.83	2.88E-09	0.80	3.28E-09
ASTER 9	SWIR	2.360–2.430	0.75	7.94E-09	0.75	8.01E-09	0.74	8.21E-09	0.73	8.58E-09	0.70	9.16E-09	0.67	1.01E-08
SEVIRI IR3.9	MIR	3.48–4.36	0.70	2.40E-06	0.69	2.42E-06	0.69	2.48E-06	0.68	2.60E-06	0.66	2.78E-06	0.64	3.07E-06
AVHRR 3	MIR	3.55–3.93	0.88	1.06E-06	0.87	1.07E-06	0.87	1.11E-06	0.86	1.19E-06	0.84	1.32E-06	0.82	1.52E-06
ATSR 3.7 μm	MIR	3.7	0.96	3.59E-07	0.96	3.64E-07	0.95	3.82E-07	0.95	4.14E-07	0.94	4.69E-07	0.93	5.62E-07
GOES 2	MIR	3.80–4.00	0.88	1.32E-06	0.87	1.34E-06	0.87	1.40E-06	0.86	1.50E-06	0.84	1.67E-06	0.81	1.95E-06
MODIS 21	MIR	3.929–3.989	0.89	1.35E-06	0.89	1.36E-06	0.88	1.43E-06	0.87	1.54E-06	0.86	1.72E-06	0.83	2.03E-06
MODIS 22	MIR	3.929–3.989	0.89	1.35E-06	0.89	1.36E-06	0.88	1.43E-06	0.87	1.54E-06	0.86	1.72E-06	0.83	2.03E-06
ASTER 10	TIR	8.125–8.475	0.76	1.05E-04	0.76	1.06E-04	0.75	1.09E-04	0.74	1.14E-04	0.72	1.23E-04	0.68	1.36E-04
SEVIRI IR8.7	TIR	8.30–9.10	0.83	7.59E-05	0.83	7.66E-05	0.82	7.91E-05	0.81	8.35E-05	0.79	9.06E-05	0.76	1.02E-04
ASTER 11	TIR	8.475–8.825	0.81	8.41E-05	0.81	8.49E-05	0.80	8.75E-05	0.79	9.22E-05	0.77	9.96E-05	0.74	1.11E-04
ASTER 12	TIR	8.925–9.275	0.87	5.82E-05	0.87	5.89E-05	0.86	6.12E-05	0.85	6.53E-05	0.84	7.20E-05	0.81	8.29E-05
SEVIRI IR9.7	TIR	9.38–9.94	0.40	1.41E-04	0.40	1.42E-04	0.38	1.45E-04	0.36	1.50E-04	0.34	1.57E-04	0.29	1.68E-04
SEVIRI IR10.8	TIR	9.80–11.80	0.86	5.95E-05	0.86	6.02E-05	0.86	6.26E-05	0.85	6.68E-05	0.83	7.39E-05	0.81	8.53E-05
GOES 4	TIR	10.2–11.2	0.91	4.82E-05	0.91	4.89E-05	0.91	5.11E-05	0.90	5.51E-05	0.89	6.17E-05	0.87	7.26E-05
ASTER 13	TIR	10.25–10.95	0.91	4.88E-05	0.91	4.95E-05	0.91	5.17E-05	0.90	5.58E-05	0.89	6.25E-05	0.87	7.36E-05
AVHRR 4	TIR	10.3–11.3	0.91	4.79E-05	0.91	4.86E-05	0.91	5.08E-05	0.90	5.47E-05	0.89	6.12E-05	0.87	7.19E-05
TM 6	TIR	10.4–12.5	0.89	5.94E-05	0.89	6.02E-05	0.89	6.27E-05	0.88	6.72E-05	0.87	7.47E-05	0.84	8.68E-05
ATSR 10.8 μm	TIR	10.8	0.93	3.72E-05	0.93	3.78E-05	0.93	3.96E-05	0.92	4.30E-05	0.91	4.86E-05	0.90	5.79E-05
ASTER 14	TIR	10.95–11.65	0.91	5.06E-05	0.91	5.14E-05	0.90	5.35E-05	0.90	5.76E-05	0.88	6.43E-05	0.86	7.52E-05
SEVIRI IR12.0	TIR	11.00–13.00	0.85	7.96E-05	0.85	8.05E-05	0.85	8.35E-05	0.84	8.88E-05	0.82	9.75E-05	0.79	1.11E-04
AVHRR 5	TIR	11.5–12.5	0.87	7.19E-05	0.87	7.28E-05	0.86	7.56E-05	0.86	8.08E-05	0.84	8.93E-05	0.81	1.03E-04
GOES 5	TIR	11.5–12.5	0.87	7.19E-05	0.87	7.28E-05	0.86	7.56E-05	0.86	8.08E-05	0.84	8.93E-05	0.81	1.03E-04
MODIS 32	TIR	11.77–12.27	0.89	5.98E-05	0.89	6.06E-05	0.89	6.32E-05	0.88	6.80E-05	0.87	7.58E-05	0.84	8.87E-05
ATSR 12 μm	TIR	12	0.93	4.17E-05	0.93	4.24E-05	0.92	4.44E-05	0.92	4.81E-05	0.91	5.43E-05	0.89	6.48E-05

Table S4.4. (*cont.*)

			US STANDARD ATMOSPHERE, RURAL VIS 23 KM (ALT = 2 KM)											
			0 ° (Nadir, 180 °)		10 ° (170 °)		20 ° (160 °)		30 ° (150 °)		40 ° (140 °)		50 ° (130 °)	
Sensor Waveband	Spectral Region	Waveband (μm)	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$
TM 3	NIR	0.63–0.69	0.78	1.16E-30	0.78	1.17E-30	0.77	1.22E-30	0.75	1.31E-30	0.72	1.46E-30	0.68	1.69E-30
TM 4	NIR	0.76–0.90	0.83	7.49E-24	0.83	7.59E-24	0.82	7.92E-24	0.81	8.52E-24	0.79	9.51E-24	0.75	1.11E-23
SEVIRI NIR1.6	SWIR	1.50–1.78	0.93	8.51E-13	0.93	8.62E-13	0.93	8.96E-13	0.92	9.57E-13	0.91	1.06E-12	0.90	1.22E-12
TM 5	SWIR	1.55–1.75	0.94	6.13E-13	0.94	6.22E-13	0.94	6.48E-13	0.93	6.98E-13	0.92	7.81E-13	0.91	9.17E-13
ATSR 1.6μm	SWIR	1.6	0.91	1.94E-13	0.91	1.97E-13	0.91	2.06E-13	0.90	2.22E-13	0.89	2.50E-13	0.87	2.95E-13
ASTER 4	SWIR	1.600–1.700	0.94	4.01E-13	0.94	4.07E-13	0.94	4.26E-13	0.93	4.62E-13	0.93	5.22E-13	0.91	6.23E-13
MODIS 6	SWIR	1.628–1.652	0.95	3.14E-13	0.94	3.19E-13	0.94	3.34E-13	0.94	3.62E-13	0.93	4.09E-13	0.92	4.88E-13
TM 7	SWIR	2.08–2.35	0.94	3.43E-10	0.94	3.47E-10	0.93	3.63E-10	0.93	3.90E-10	0.92	4.36E-10	0.91	5.11E-10
MODIS 7	SWIR	2.105–2.155	0.96	1.01E-10	0.96	1.02E-10	0.96	1.07E-10	0.96	1.16E-10	0.95	1.31E-10	0.94	1.57E-10
ASTER 5	SWIR	2.145–2.185	0.95	1.66E-10	0.95	1.68E-10	0.95	1.76E-10	0.95	1.90E-10	0.94	2.14E-10	0.93	2.53E-10
ASTER 6	SWIR	2.185–2.225	0.95	2.31E-10	0.95	2.34E-10	0.95	2.45E-10	0.94	2.65E-10	0.94	2.98E-10	0.93	3.53E-10
ASTER 7	SWIR	2.235–2.285	0.93	3.59E-10	0.93	3.64E-10	0.93	3.80E-10	0.92	4.11E-10	0.91	4.61E-10	0.90	5.44E-10
ASTER 8	SWIR	2.295–2.365	0.89	1.10E-09	0.89	1.11E-09	0.88	1.15E-09	0.87	1.23E-09	0.86	1.36E-09	0.84	1.56E-09
ASTER 9	SWIR	2.360–2.430	0.81	3.72E-09	0.81	3.75E-09	0.80	3.86E-09	0.79	4.05E-09	0.77	4.34E-09	0.74	4.81E-09
SEVIRI IR3.9	MIR	3.48–4.36	0.72	1.76E-06	0.72	1.78E-06	0.72	1.82E-06	0.71	1.90E-06	0.69	2.03E-06	0.67	2.23E-06
AVHRR 3	MIR	3.55–3.93	0.90	5.78E-07	0.90	5.86E-07	0.90	6.11E-07	0.89	6.57E-07	0.88	7.31E-07	0.86	8.51E-07
ATSR 3.7 μm	MIR	3.7	0.97	1.90E-07	0.97	1.93E-07	0.97	2.03E-07	0.96	2.20E-07	0.96	2.50E-07	0.95	3.00E-07
GOES 2	MIR	3.80–4.00	0.90	7.76E-07	0.90	7.87E-07	0.89	8.22E-07	0.88	8.85E-07	0.87	9.89E-07	0.85	1.16E-06
MODIS 21	MIR	3.929–3.989	0.91	8.09E-07	0.91	8.21E-07	0.90	8.59E-07	0.89	9.28E-07	0.88	1.04E-06	0.86	1.23E-06
MODIS 22	MIR	3.929–3.989	0.91	8.09E-07	0.91	8.21E-07	0.90	8.59E-07	0.89	9.28E-07	0.88	1.04E-06	0.86	1.23E-06
ASTER 10	TIR	8.125–8.475	0.82	6.69E-05	0.82	6.75E-05	0.82	6.95E-05	0.81	7.30E-05	0.79	7.88E-05	0.76	8.78E-05
SEVIRI IR8.7	TIR	8.30–9.10	0.87	4.84E-05	0.87	4.89E-05	0.86	5.06E-05	0.86	5.36E-05	0.84	5.85E-05	0.82	6.63E-05
ASTER 11	TIR	8.475–8.825	0.86	5.43E-05	0.85	5.48E-05	0.85	5.66E-05	0.84	5.99E-05	0.82	6.52E-05	0.80	7.35E-05
ASTER 12	TIR	8.925–9.275	0.90	3.71E-05	0.90	3.75E-05	0.89	3.91E-05	0.89	4.19E-05	0.87	4.64E-05	0.85	5.39E-05
SEVIRI IR9.7	TIR	9.38–9.94	0.42	1.30E-04	0.41	1.30E-04	0.40	1.33E-04	0.38	1.38E-04	0.35	1.44E-04	0.31	1.54E-04

SEVIRI IR10.8	TIR	9.80–11.80	0.89	3.75E-05	0.89	3.80E-05	0.89	3.94E-05	0.88	4.21E-05	0.87	4.66E-05	0.85	5.37E-05
GOES 4	TIR	10.2–11.2	0.94	2.66E-05	0.94	2.70E-05	0.94	2.82E-05	0.94	3.05E-05	0.93	3.43E-05	0.92	4.05E-05
ASTER 13	TIR	10.25–10.95	0.94	2.71E-05	0.94	2.75E-05	0.94	2.88E-05	0.94	3.11E-05	0.93	3.50E-05	0.91	4.14E-05
AVHRR 4	TIR	10.3–11.3	0.95	2.63E-05	0.94	2.66E-05	0.94	2.78E-05	0.94	3.01E-05	0.93	3.37E-05	0.92	3.98E-05
TM 6	TIR	10.4–12.5	0.93	3.24E-05	0.93	3.29E-05	0.93	3.43E-05	0.93	3.69E-05	0.92	4.11E-05	0.90	4.81E-05
ATSR 10.8 μm	TIR	10.8	0.96	1.95E-05	0.96	1.98E-05	0.96	2.08E-05	0.95	2.25E-05	0.95	2.55E-05	0.94	3.06E-05
ASTER 14	TIR	10.95–11.65	0.94	2.69E-05	0.94	2.73E-05	0.94	2.85E-05	0.94	3.07E-05	0.93	3.43E-05	0.92	4.04E-05
SEVIRI IR12.0	TIR	11.00–13.00	0.91	4.57E-05	0.90	4.62E-05	0.90	4.80E-05	0.89	5.12E-05	0.88	5.65E-05	0.86	6.50E-05
AVHRR 5	TIR	11.5–12.5	0.92	3.92E-05	0.92	3.97E-05	0.92	4.14E-05	0.91	4.44E-05	0.90	4.94E-05	0.88	5.74E-05
GOES 5	TIR	11.5–12.5	0.92	3.92E-05	0.92	3.97E-05	0.92	4.14E-05	0.91	4.44E-05	0.90	4.94E-05	0.88	5.74E-05
MODIS 32	TIR	11.77–12.27	0.94	3.12E-05	0.94	3.16E-05	0.93	3.31E-05	0.93	3.57E-05	0.92	4.00E-05	0.91	4.72E-05
ATSR 12 μm	TIR	12	0.96	2.03E-05	0.96	2.06E-05	0.96	2.16E-05	0.95	2.35E-05	0.95	2.66E-05	0.94	3.18E-05

US STANDARD ATMOSPHERE, RURAL VIS 23 KM (ALT = 3 KM)

Sensor Waveband	Spectral Region	Waveband (μm)	0 ° (Nadir, 180 °)		10 ° (170 °)		20 ° (160 °)		30 ° (150 °)		40 ° (140 °)		50 ° (130 °)	
			τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$
TM 3	NIR	0.63–0.69	0.82	2.05E-31	0.82	1.43E-31	0.81	1.50E-31	0.79	1.61E-31	0.77	1.79E-31	0.73	2.09E-31
TM 4	NIR	0.76–0.90	0.86	2.26E-24	0.86	1.46E-24	0.85	1.52E-24	0.84	1.64E-24	0.83	1.84E-24	0.80	2.17E-24
SEVIRI NIR1.6	SWIR	1.50–1.78	0.95	4.23E-13	0.95	3.07E-13	0.94	3.20E-13	0.94	3.43E-13	0.93	3.81E-13	0.92	4.43E-13
TM 5	SWIR	1.55–1.75	0.95	3.14E-13	0.95	2.23E-13	0.95	2.33E-13	0.95	2.52E-13	0.94	2.83E-13	0.93	3.34E-13
ATSR 1.6μm	SWIR	1.6	0.93	1.03E-13	0.93	7.26E-14	0.92	7.59E-14	0.92	8.21E-14	0.91	9.23E-14	0.89	1.09E-13
ASTER 4	SWIR	1.600–1.700	0.88	3.70E-18	0.95	1.49E-13	0.95	1.56E-13	0.95	1.69E-13	0.94	1.91E-13	0.93	2.29E-13
MODIS 6	SWIR	1.628–1.652	0.96	1.78E-13	0.96	1.17E-13	0.95	1.23E-13	0.95	1.33E-13	0.94	1.51E-13	0.93	1.80E-13
TM 7	SWIR	2.08–2.35	0.95	1.96E-10	0.95	1.54E-10	0.95	1.61E-10	0.94	1.74E-10	0.94	1.95E-10	0.92	2.29E-10
MODIS 7	SWIR	2.105–2.155	0.97	6.22E-11	0.97	4.21E-11	0.97	4.41E-11	0.97	4.79E-11	0.96	5.42E-11	0.96	6.49E-11
ASTER 5	SWIR	2.145–2.185	0.97	9.25E-11	0.97	6.86E-11	0.96	7.18E-11	0.96	7.78E-11	0.96	8.78E-11	0.95	1.04E-10
ASTER 6	SWIR	2.185–2.225	0.96	1.34E-10	0.96	9.71E-11	0.96	1.02E-10	0.96	1.10E-10	0.95	1.24E-10	0.94	1.48E-10
ASTER 7	SWIR	2.235–2.285	0.94	2.26E-10	0.94	1.70E-10	0.94	1.77E-10	0.94	1.92E-10	0.93	2.15E-10	0.92	2.54E-10
ASTER 8	SWIR	2.295–2.365	0.91	5.79E-10	0.91	4.92E-10	0.90	5.12E-10	0.90	5.49E-10	0.88	6.09E-10	0.87	7.06E-10
ASTER 9	SWIR	2.360–2.430	0.86	1.77E-09	0.86	1.64E-09	0.85	1.68E-09	0.84	1.77E-09	0.83	1.92E-09	0.81	2.14E-09
SEVIRI IR3.9	MIR	3.48–4.36	0.76	1.21E-06	0.74	1.37E-06	0.74	1.40E-06	0.73	1.46E-06	0.72	1.55E-06	0.70	1.69E-06
AVHRR 3	MIR	3.55–3.93	0.93	3.44E-07	0.93	3.08E-07	0.92	3.22E-07	0.92	3.47E-07	0.91	3.88E-07	0.89	4.55E-07

Table S4.4. (*cont.*)

US STANDARD ATMOSPHERE, RURAL VIS 23 KM (ALT = 3 KM)														
Sensor	Spectral	Waveband	0 ° (Nadir, 180 °)		10 ° (170 °)		20 ° (160 °)		30 ° (150 °)		40 ° (140 °)		50 ° (130 °)	
Waveband	Region	(μm)	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$
ATSR 3.7 μm	MIR	3.7	0.98	1.37E-07	0.98	9.85E-08	0.97	1.03E-07	0.97	1.12E-07	0.97	1.27E-07	0.96	1.53E-07
GOES 2	MIR	3.80–4.00	0.92	5.01E-07	0.92	4.52E-07	0.91	4.73E-07	0.90	5.10E-07	0.89	5.71E-07	0.87	6.70E-07
MODIS 21	MIR	3.929–3.989	0.92	5.38E-07	0.92	4.80E-07	0.92	5.02E-07	0.91	5.43E-07	0.90	6.11E-07	0.88	7.23E-07
MODIS 22	MIR	3.929–3.989	0.92	5.38E-07	0.92	4.80E-07	0.92	5.02E-07	0.91	5.43E-07	0.90	6.11E-07	0.88	7.23E-07
ASTER 10	TIR	8.125–8.475	0.79	4.95E-05	0.87	4.15E-05	0.87	4.28E-05	0.86	4.51E-05	0.85	4.88E-05	0.83	5.48E-05
SEVIRI IR8.7	TIR	8.30–9.10	0.90	3.10E-05	0.90	3.05E-05	0.90	3.17E-05	0.89	3.37E-05	0.88	3.70E-05	0.86	4.23E-05
ASTER 11	TIR	8.475–8.825	0.89	3.51E-05	0.89	3.43E-05	0.89	3.56E-05	0.88	3.78E-05	0.87	4.15E-05	0.85	4.73E-05
ASTER 12	TIR	8.925–9.275	0.92	2.47E-05	0.92	2.39E-05	0.92	2.49E-05	0.91	2.68E-05	0.90	2.99E-05	0.88	3.50E-05
SEVIRI IR9.7	TIR	9.38–9.94	0.43	1.22E-04	0.43	1.23E-04	0.41	1.25E-04	0.40	1.29E-04	0.37	1.36E-04	0.33	1.45E-04
SEVIRI IR10.8	TIR	9.80–11.80	0.92	2.61E-05	0.91	2.53E-05	0.91	2.63E-05	0.91	2.80E-05	0.90	3.09E-05	0.88	3.55E-05
GOES 4	TIR	10.2–11.2	0.96	1.69E-05	0.96	1.47E-05	0.96	1.54E-05	0.96	1.67E-05	0.95	1.88E-05	0.95	2.23E-05
ASTER 13	TIR	10.25–10.95	0.96	1.61E-05	0.96	1.51E-05	0.96	1.58E-05	0.96	1.71E-05	0.95	1.93E-05	0.94	2.29E-05
AVHRR 4	TIR	10.3–11.3	0.97	1.53E-05	0.97	1.44E-05	0.96	1.50E-05	0.96	1.63E-05	0.96	1.83E-05	0.95	2.17E-05
TM 6	TIR	10.4–12.5	0.96	1.94E-05	0.96	1.73E-05	0.96	1.80E-05	0.95	1.95E-05	0.95	2.18E-05	0.94	2.57E-05
ATSR 10.8 μm	TIR	10.8	0.97	1.14E-05	0.97	1.04E-05	0.97	1.09E-05	0.97	1.19E-05	0.97	1.35E-05	0.96	1.61E-05
ASTER 14	TIR	10.95–11.65	0.97	1.51E-05	0.97	1.41E-05	0.96	1.47E-05	0.96	1.59E-05	0.96	1.79E-05	0.95	2.11E-05
SEVIRI IR12.0	TIR	11.00–13.00	0.94	2.62E-05	0.94	2.56E-05	0.94	2.66E-05	0.93	2.85E-05	0.93	3.15E-05	0.91	3.65E-05
AVHRR 5	TIR	11.5–12.5	0.95	2.12E-05	0.95	2.06E-05	0.95	2.15E-05	0.95	2.31E-05	0.94	2.58E-05	0.93	3.03E-05
GOES 5	TIR	11.5–12.5	0.95	2.12E-05	0.95	2.06E-05	0.95	2.15E-05	0.95	2.31E-05	0.94	2.58E-05	0.93	3.03E-05
MODIS 32	TIR	11.77–12.27	0.96	1.64E-05	0.96	1.57E-05	0.96	1.64E-05	0.96	1.78E-05	0.95	2.00E-05	0.95	2.38E-05
ATSR 12 μm	TIR	12	0.98	1.04E-05	0.98	9.64E-06	0.98	1.01E-05	0.97	1.10E-05	0.97	1.25E-05	0.97	1.50E-05

US STANDARD ATMOSPHERE, RURAL VIS 23 KM (ALT = 4 KM)														
Sensor	Spectral	Waveband	0 ° (Nadir, 180 °)		10 ° (170 °)		20 ° (160 °)		30 ° (150 °)		40 ° (140 °)		50 ° (130 °)	
Waveband	Region	(μm)	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$	τ_λ	$L_U(\lambda)$
TM 3	NIR	0.63–0.69	0.86	1.05E-32	0.86	1.07E-32	0.85	1.11E-32	0.84	1.20E-32	0.82	1.34E-32	0.78	1.56E-32
TM 4	NIR	0.76–0.90	0.89	2.39E-25	0.89	2.43E-25	0.89	2.54E-25	0.88	2.75E-25	0.87	3.09E-25	0.85	3.66E-25

SEVIRI NIR1.6	SWIR	1.50–1.78	0.96	9.76E-14	0.96	9.89E-14	0.96	1.03E-13	0.96	1.11E-13	0.95	1.24E-13	0.94	1.45E-13
TM 5	SWIR	1.55–1.75	0.97	7.10E-14	0.96	7.20E-14	0.96	7.53E-14	0.96	8.15E-14	0.96	9.17E-14	0.95	1.09E-13
ATSR 1.6μm	SWIR	1.6	0.94	2.38E-14	0.94	2.41E-14	0.94	2.53E-14	0.94	2.73E-14	0.93	3.08E-14	0.91	3.65E-14
ASTER 4	SWIR	1.600–1.700	0.97	4.78E-14	0.97	4.85E-14	0.96	5.09E-14	0.96	5.52E-14	0.96	6.25E-14	0.95	7.48E-14
MODIS 6	SWIR	1.628–1.652	0.97	3.77E-14	0.97	3.83E-14	0.97	4.01E-14	0.96	4.35E-14	0.96	4.93E-14	0.95	5.89E-14
TM 7	SWIR	2.08–2.35	0.96	6.35E-11	0.96	6.44E-11	0.96	6.73E-11	0.96	7.27E-11	0.95	8.16E-11	0.94	9.63E-11
MODIS 7	SWIR	2.105–2.155	0.98	1.54E-11	0.98	1.56E-11	0.98	1.64E-11	0.98	1.78E-11	0.97	2.02E-11	0.97	2.42E-11
ASTER 5	SWIR	2.145–2.185	0.98	2.50E-11	0.98	2.54E-11	0.98	2.66E-11	0.97	2.89E-11	0.97	3.27E-11	0.96	3.90E-11
ASTER 6	SWIR	2.185–2.225	0.97	3.62E-11	0.97	3.68E-11	0.97	3.85E-11	0.97	4.18E-11	0.97	4.73E-11	0.96	5.65E-11
ASTER 7	SWIR	2.235–2.285	0.95	7.23E-11	0.95	7.34E-11	0.95	7.67E-11	0.95	8.29E-11	0.94	9.32E-11	0.93	1.10E-10
ASTER 8	SWIR	2.295–2.365	0.93	2.04E-10	0.93	2.07E-10	0.92	2.16E-10	0.92	2.32E-10	0.91	2.59E-10	0.89	3.02E-10
ASTER 9	SWIR	2.360–2.430	0.90	6.60E-10	0.90	6.67E-10	0.89	6.89E-10	0.89	7.29E-10	0.88	7.92E-10	0.86	8.92E-10
SEVIRI IR3.9	MIR	3.48–4.36	0.77	1.11E-06	0.76	1.12E-06	0.76	1.14E-06	0.76	1.18E-06	0.75	1.25E-06	0.73	1.35E-06
AVHRR 3	MIR	3.55–3.93	0.95	1.56E-07	0.94	1.58E-07	0.94	1.65E-07	0.94	1.78E-07	0.93	2.00E-07	0.92	2.35E-07
ATSR 3.7 μm	MIR	3.7	0.98	4.64E-08	0.98	4.71E-08	0.98	4.94E-08	0.98	5.37E-08	0.98	6.09E-08	0.97	7.33E-08
GOES 2	MIR	3.80–4.00	0.93	2.50E-07	0.93	2.54E-07	0.93	2.65E-07	0.92	2.86E-07	0.91	3.21E-07	0.90	3.78E-07
MODIS 21	MIR	3.929–3.989	0.94	2.68E-07	0.94	2.72E-07	0.94	2.84E-07	0.93	3.08E-07	0.92	3.46E-07	0.91	4.11E-07
MODIS 22	MIR	3.929–3.989	0.94	2.68E-07	0.94	2.72E-07	0.94	2.84E-07	0.93	3.08E-07	0.92	3.46E-07	0.91	4.11E-07
ASTER 10	TIR	8.125–8.475	0.91	2.47E-05	0.91	2.49E-05	0.91	2.58E-05	0.90	2.73E-05	0.89	2.97E-05	0.87	3.35E-05
SEVIRI IR8.7	TIR	8.30–9.10	0.93	1.87E-05	0.93	1.90E-05	0.92	1.97E-05	0.92	2.11E-05	0.91	2.33E-05	0.90	2.70E-05
ASTER 11	TIR	8.475–8.825	0.92	2.09E-05	0.92	2.12E-05	0.92	2.20E-05	0.91	2.35E-05	0.90	2.60E-05	0.88	3.00E-05
ASTER 12	TIR	8.925–9.275	0.94	1.52E-05	0.94	1.55E-05	0.94	1.62E-05	0.93	1.75E-05	0.92	1.96E-05	0.91	2.31E-05
SEVIRI IR9.7	TIR	9.38–9.94	0.44	1.17E-04	0.43	1.18E-04	0.42	1.20E-04	0.41	1.24E-04	0.38	1.30E-04	0.34	1.40E-04
SEVIRI IR10.8	TIR	9.80–11.80	0.93	1.83E-05	0.93	1.85E-05	0.93	1.92E-05	0.92	2.04E-05	0.91	2.23E-05	0.90	2.55E-05
GOES 4	TIR	10.2–11.2	0.98	8.02E-06	0.98	8.14E-06	0.98	8.53E-06	0.97	9.25E-06	0.97	1.04E-05	0.96	1.25E-05
ASTER 13	TIR	10.25–10.95	0.98	8.23E-06	0.98	8.35E-06	0.98	8.75E-06	0.97	9.49E-06	0.97	1.07E-05	0.96	1.28E-05
AVHRR 4	TIR	10.3–11.3	0.98	7.72E-06	0.98	7.84E-06	0.98	8.21E-06	0.97	8.90E-06	0.97	1.00E-05	0.97	1.20E-05
TM 6	TIR	10.4–12.5	0.98	8.89E-06	0.98	9.02E-06	0.97	9.44E-06	0.97	1.02E-05	0.97	1.15E-05	0.96	1.37E-05
ATSR 10.8 μm	TIR	10.8	0.98	5.55E-06	0.98	5.64E-06	0.98	5.92E-06	0.98	6.43E-06	0.98	7.30E-06	0.97	8.78E-06
ASTER 14	TIR	10.95–11.65	0.98	7.29E-06	0.98	7.40E-06	0.98	7.75E-06	0.98	8.39E-06	0.97	9.46E-06	0.97	1.12E-05
SEVIRI IR12.0	TIR	11.00–13.00	0.96	1.39E-05	0.96	1.41E-05	0.96	1.47E-05	0.96	1.57E-05	0.95	1.75E-05	0.94	2.04E-05
AVHRR 5	TIR	11.5–12.5	0.97	1.03E-05	0.97	1.04E-05	0.97	1.09E-05	0.97	1.18E-05	0.97	1.33E-05	0.96	1.57E-05
GOES 5	TIR	11.5–12.5	0.97	1.03E-05	0.97	1.04E-05	0.97	1.09E-05	0.97	1.18E-05	0.97	1.33E-05	0.96	1.57E-05
MODIS 32	TIR	11.77–12.27	0.98	7.60E-06	0.98	7.72E-06	0.98	8.09E-06	0.98	8.78E-06	0.97	9.93E-06	0.97	1.19E-05
ATSR 12 μm	TIR	12	0.99	4.47E-06	0.99	4.54E-06	0.99	4.77E-06	0.99	5.18E-06	0.98	5.89E-06	0.98	7.08E-06

plotted and used to derive the appropriate polynomial coefficients. However, lookup tables such as those given in Table S4.4 can be used to set polynomial relations which allow rapid atmospheric correction as a function of scan angle and/or surface altitude. In the MODIS band 32 relation given above, for example, we find that the required corrections for a pixel at an altitude of 2000 m and at a scan angle of 35° are:

$$\begin{aligned}\tau_\lambda &= 2.08\text{E-}08(35^4) - 2.18\text{E-}06(35^3) + 2.99\text{E-}05(35^2) - 2.69\text{E-}04(35) + 8.30\text{E-}01 \\ &= 0.79\end{aligned}$$

and

$$\begin{aligned}L_U(\lambda) &= -2.08\text{E-}12(35^4) + 4.95\text{E-}10(35^3) - 3.82\text{E-}09(35^2) + 1.93\text{E-}07(35) + 1.07\text{E-}04 \\ &= 1.27 \times 10^{-4}\ \text{Wcm}^2\ \text{sr}^{-1}\ \mu\text{m}^{-1}\end{aligned}$$

In effect, this is a quick and simple method to set appropriate atmospheric correction values as a function of scan angle and surface altitude. For thermal camera data, coefficients for use in polynomials that describe variation in τ_λ and $L_U(\lambda)$ as a function of line of sight (camera-to-target) distance and altitude can be obtained from the data given in Table 9.4 of Chapter 9.

The split window atmospheric correction method

The split window method uses the differential atmospheric effects in two bands that causes a systematic difference in the temperatures between the two bands. The method relies on the temperature difference between the two bands being solely due to variations in water vapor content of the atmospheric column between the surface and the sensor. Thus, it will not work if:

(i) a sub-pixel hot spot is present to cause band-to-band pixel-integrated temperature differences, or
(ii) emissivities are different at the two wavelengths used.

Thus, the methodology has been typically applied to sea surfaces (where the emissivity can be approximated by one at all wavelengths) with two bands in the 10–14 μm window typically being used, hence the label "split window". Traditionally, the split window bands of AVHRR, bands 4 and 5, which fall at 10.3 to 11.3 μm and 10.5 to 11.5 μm, respectively, were used. The effect can be seen in Figure S4.4 where, if the atmospheric effects were the same in both wavebands, the two pixel brightness temperatures (T_4 and T_5) should be the same and fall along the 45° line. However, differential atmospheric effects cause a linear relation whereby $T_5 = 0.95(T_4) + 1.69$. The split window uses this effect to empirically derive a relation with the general form (e.g., Deschamps and Phulpin, 1980),

$$T_s = a_0 + a_1 T_b(\lambda_1) + a_2 T_b(\lambda_2)$$

in which T_s is surface temperature, $T_b(\lambda_1)$ and $T_b(\lambda_2)$ are the brightness temperature in the two split-window, bands being used, and a_0, a_1 and a_2 are determined by multivariate

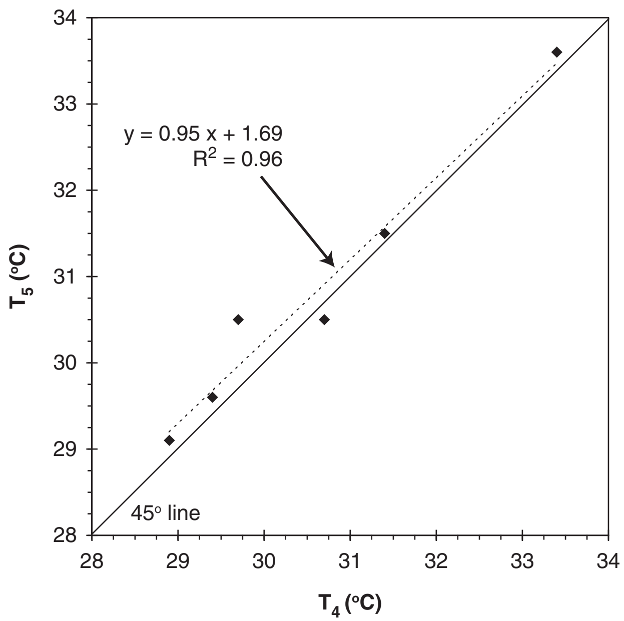

Figure S4.4. AVHRR channel 4 (T_4) and 5 (T_5) brightness temperatures for a 2×3 box of pixels located immediately to the west of Etna's summit in a NOAA-11 image acquired on 3 June 1994 at 15:06Z. If brightness temperatures are the same in both channels, they should fall on the solid 45° line. Instead, they fall off of this line and have a positive, linear relation, with the trend marked by the dashed line.

regression analysis. Cracknell and Hayes (1991) trace the approach to Anding and Kauth (1970). It was subsequently developed widely in the 1980s and 1990s to obtain sea-surface temperatures from AVHRR data. Some corrections developed during this time are given in Table S4.5, in which it should be noted that each correction should only be applied to the atmospheric, seasonal and/or latitudinal conditions for which it was derived.

For ground surfaces, Price (1984) and Vidal (1991) proposed the relation:

$$T_s = T_b(\lambda_1) + \frac{1}{R-1}[T_b(\lambda_1) - T_b(\lambda_2)]$$

in this case, R can be obtained from linear regression between $T_b(\lambda_1)$ and $T_b(\lambda_2)$, that is,

$$R = \overline{y} - b\overline{x}$$

in which $\overline{y}$ is the mean of all the y values in the series [in our case the mean of the $T_b(\lambda_1)$ values] and $\overline{x}$ is the mean of all the x values in the series [in our case the mean of the $T_b(\lambda_2)$ values]. Now,

$$b = \frac{\sum_i (x_i - \overline{x}) - (y_i - \overline{y})}{\sum_i (x_i - \overline{x})^2}$$

Table S4.5. *Some sea (and lake) surface temperature corrections [to give sea surface temperature (SST) and lake surface temperature (LST), respectively] for AVHRR data published between 1980 and 1995. Corrections use AVHRR split window channels 4 and 5, and work off of the brightness temperature recorded in channels 4 (10.3 – 11.3 μm, T_{11}) and 5 (11.5 – 12.5 μm, T_{12}).*

Study	Correction	Notes
Deschamps & Phulpin (1980)	$SST = 3.626\ T_{11} - 2.626\ T_{12} - 2.18$	Used a group of atmospheres that were assumed to be representative of atmospheric variability on a worldwide scale. Works in Kelvin.
Kidwell (1995)	Daytime: $SST = 0.9712\ T_{11} + 2.0663\ (T_{11} - T_{12}) + 1.8983\ (T_{11} - T_{12}) \times (SEC\ \theta_z - 1) - 1.9790\ (SEC\ \theta_z) - 264.79$ Nighttime: $SST = 0.9843\ T_{11} + 2.0942\ (T_{11} - T_{12}) + 2.0994\ (T_{11} - T_{12}) \times (SEC\ \theta_z - 1) - 1.1838\ (SEC\ \theta_z) - 268.74$	Split-window corrections given by NOAA for use with data from the AVHRR flown on NOAA-11. Needed to be used with data corrected for non-linearity (see Electronic Supplement 2) and used the satellite zenith angle (θ_z); SEC θ_z is the secant of the satellite zenith angle [$= 1/\cos(\theta_z)$]. Gives SST in °C when input brightness temperatures are in Kelvin.
Llewellyn-Jones *et al.* (1984)	Tropical: $SST = 3.9078\ T_{11} - 2.8524\ T_{12} - 17.1817$ N. Atlantic: $SST = 2.6710\ T_{11} - 1.6689\ T_{12} - 0.334$	From: Coefficients for 39 Tropical profiles; Coefficients for 61 North Atlantic profiles. Works in Kelvin.
Singh (1984)	$SST = 1.764\ T_{11} - 0.764\ T_{12} + 0.78$	Sea surface temperatures in the range 270 to 300 K. Works in Kelvin.
McClain *et al.* (1985)	Night: $SST = 3.6535\ T_{11} - 2.6680\ T_{12} - 268.41$ Day: $SST = 3.6569\ T_{11} - 2.6705\ T_{12} - 268.92$	Tested using global data from drifting buoys with bias (buoy minus satellite temperature) of –0.09 to –0.14 °C. Gives SST in °C when input brightness temperatures are in Kelvin.
Li & McDonnell (1988)	$SST = T_{11} - 2.68\ (T_{11} - T_{12}) - 0.45$	New Zealand Weather Service two channel (split window) atmospheric correction method. Works in Kelvin
Yokoyama & Tanba (1991)	$SST = 3.331\ T_{11} - 2.331\ T_{12} - 0.526$	Functions derived from regression analysis of Mutsu Bay (Japan) test case data sets. Works in Kelvin
Wooster *et al.* (1994)	$LST = 3.2148\ T_{11} - 2.2148\ T_{12} - 271.19$	Developed using NOAA-11 AVHRR data for lake Malawi (Tropical lake surface temperature correction). Cannot use with daytime data, as data may be contaminated (by reflection). Gives LST in °C when input brightness temperatures are in Kelvin.

Table S4.6. *Regression analysis for a 2× 3 box of AVHRR pixels located immediately to the west of Etna's summit in a NOAA-11 image acquired on 3 June 1994 at 15:06Z. Channels 4 (T_4) and 5 (T_5) brightness temperatures are given for each pixel plus all steps required to complete the analysis: (1) estimation of mean values (x_{mean} and y_{mean}), (2) estimation, for each pixel, of x_i - x_{mean} and y_i - y_{mean}, and (3) estimation, for each pixel, of (x_i - x_{mean})(y_i - y_{mean}), (4) estimation, for each pixel, of $(x_i - x_{mean})^2$. Followed by, (5) summing of the previous two calculations to obtain $\sum (x_i - \overline{x}) - (y_i - \overline{y})$ and $\sum (x_i - \overline{x})^2$, (6) estimation of b [by dividing $\sum (x_i - \overline{x}) - (y_i - \overline{y})$ by $\sum (x_i - \overline{x})^2$, and (7) calculation of R ($R = y_{mean} - bx_{mean}$). In this case, regression yields a value for R of 1.69.*

Pixel	x-value (T_4, °C)	x_i - x_{mean}	y-value (T_5, °C)	y_i - y_{mean}		(x_i - x_{mean}) multiplied by (y_i - y_{mean})	$(x_i - x_{mean})^2$
1	33.4	2.8	33.6	2.8		7.89	7.93
2	31.4	0.8	31.5	0.7		0.57	0.67
3	30.7	0.1	30.5	−0.3		-0.03	0.01
4	29.7	−0.9	30.5	−0.3		0.26	0.78
5	28.9	−1.7	29.1	−1.7		2.86	2.83
6	29.4	−1.2	29.6	−1.2		1.42	1.40
Mean:	30.6		30.8		Sum:	12.97	13.63
	b:	0.9517					
	R:	1.6940		1/(R−1):	1.4409		

This is completed for a small 2 × 3 box of AVHRR pixels located immediately to the west of Etna's summit in Table S4.6, the brightness temperatures for these pixels being plotted in Figure S4.4. Regression yields a value for R of 1.69, so that the correction for this small image area is,

$$T_s = T_b(\lambda_4) + 1.44[T_b(\lambda_4) - T_b(\lambda_5)]$$

$T_b(\lambda_4)$ and $T_b(\lambda_5)$ being the brightness temperatures in AVHRR channels 4 and 5. This method needs to be set on a case-by-case basis. Thus, while Price (1984) obtained R values of between 1.31 and 1.40 for AVHRR images of the Central United States obtained during July 1981, Vidal (1991) obtained R of 1.36±0.21 ($n = 20$, $r^2 = 0.95$) for an area of sugar-cane in Morocco during June-September 1989. We must also note that this method relies on the same assumptions as the sea-surface temperature split-window correction. Crucially that emissivities must be roughly equal in the two wavebands used, the assumption being that the brightness temperature difference between the two wavebands [$T_b(\lambda_1) - T_b(\lambda_2)$] is due only to atmospheric effects.

Differential emissivity effects

Becker (1987) pointed out that, if emissivity is different between the two split-window wavebands, then the error generated on the surface temperature obtained from the split-window method is of the order of,

$$Error = 50\frac{(1-\bar{\varepsilon})}{\bar{\varepsilon}} - 300\frac{(\varepsilon_1 - \varepsilon_2)}{\bar{\varepsilon}}$$

in which ε_1 and ε_2 are the emissivities in the two wavebands used, and $\bar{\varepsilon} = (\varepsilon_1 + \varepsilon_2) / 2$. Thus, for a basaltic scoria-covered surface at Etna's summit (with the AVHRR band 4 and 5 emissivities of sample Etna 3 in Table S4.2a) the assumption of approximately similar emissivities in the split-window waveband is approximately valid and error is minimized. However, we still have an error of,

$$Error = 50\frac{(1-0.964)}{0.964} - 300\frac{(0.959-0.968)}{0.964} = 4.7\,^{\circ}C$$

For our sample of Hawaiian pahoehoe (Haw83a) of Table S4.2a we have,

$$Error = 50\frac{(1-0.868)}{0.868} - 300\frac{(0.836-0.899)}{0.868} = 29.4\,^{\circ}C$$

Thus, for cases where we also have differential emissivity effects, a different form of the split-window correction equation has been derived, with the general form (e.g., Price 1984; Coll *et al.*, 1994):

$$T_s = T_b(\lambda_1) + A\,[T_b(\lambda_1) - T_b(\lambda_2)] + B(\varepsilon)$$

in which A is a constant related to the atmospheric effects in the two bands with the form,

$$A = a_0 - a_1[T_b(\lambda_1) - T_b(\lambda_2)]$$

and $B(\varepsilon)$ is a coefficient related to the emissivity effects with the form,

$$B = a_2(1-\varepsilon_1) - a_3\Delta\varepsilon$$

in which $\Delta\varepsilon = \varepsilon_1 + \varepsilon_2$. Some relations with each of the above forms, set to work with the AVHRR split window channels, are given in Appendix S4B.

Ground truthing of atmospheric correction

On 3 June 1994 I carried out an experiment in an attempt to understand which atmospheric correction I should apply to data acquired by the AVHRR flown on NOAA-11 (i.e., which of the corrections laid out in Table 4.5 and Appendix S4B was most appropriate?). For 15 minutes either side of the satellite overpass (which was at 13:15Z), I carried out surface temperature measurements over a 100 × 100 m area located just to the west of Etna's summit crater. The area contained a uniform cover of recent scoria, and forty-four measurements were made with a Minolta/Land Cyclops 300 radiometer. A sample of the scoria was collected, and used to obtain the reflectance spectra of Figure S4.1b. This, in turn, was used to estimate the emissivity for the scoria across the measurement wavelength of the radiometer (8–13 μm), this being 0.97, and all brightness temperatures were corrected accordingly (see Chapters 7 and 8). The mean (plus or minus one standard deviation) of all measurements (T_{scoria}) was 52.9±6.7 °C. Within the area was a 3800 m^2 snow patch at a brightness temperature of −1.6 °C, which when corrected for a snow emissivity of 0.99 (Salisbury *et al.*, 1994) gave a surface temperature (T_{snow}) of −1.0 °C. The expected pixel-integrated radiant exitance for the area (M) was then obtained from,

$$M = f_{snow}(\sigma \, T_{snow}{}^{4}) + (1 - f_{snow})\,(\sigma \, T_{scora}{}^{4})$$

This was converted to a pixel-integrated temperature (T_{int}) using,

$$T = \left(\frac{M}{\sigma}\right)^{\frac{1}{4}}$$

For f_{snow} of $\frac{3800\,m^2}{10000\,m^2} = 0.38$ I obtained an expected pixel integrated temperature of 35.6±4.9 °C.

Next, I located the pixel immediately to the west of Etna's summit in the AVHRR images. This was acquired at a scan angle of 23.24 °, so that the satellite zenith angle was 66.76 °, and had a brightness temperature, corrected for non-linearity, of 30.2 °C in channel 4 (T_4) and 29.6 °C in channel 5 (T_5). All of the atmospheric corrections designed for sea-surface temperature retrieval using the NOAA-11, as given in Table 4.5 were then applied. In addition, all of the split-window methods proposed for land surfaces with differential emissivity, as given in Appendix S4B were applied. To apply these corrections, the channel 4 and 5 emissivities obtained for the scoria sample, i.e., 0.96 and 0.97 (see Table 4.2a) were used. In addition, the split window correction,

$$T_s = T_b(\lambda_1) + \frac{1}{R-1}\left[T_b(\lambda_1) - T_b(\lambda_2)\right]$$

was applied with the R-value taken directly from the image, as done in Table S4.6. Finally, a MODTRAN-based correction was applied, using output for a 1976 US Standard (Rural, Vis = 23 km, Spring-Summer) atmosphere for a surface at an elevation of 2500 m viewed, from space, at a scan angle of 23.24°, so that the zenith angle was 156.76°. This gave τ_4 of 0.95, τ_5 of 0.92, L_U (at 10.8μm) of 7.34×10^{5} W m^{-2} m^{-1} and L_U (at 12μm) of 1.15×10^{6} W m^{-2} m^{-1}. All results are given in Table S4.7, along with the difference between the corrected pixel-integrated temperature and the expected pixel-integrated temperature using:

(i) the mean scoria temperature,
(ii) the mean scoria temperature minus one standard deviation, and
(iii) the mean scoria temperature plus one standard deviation.

Table S4.7 *Atmospheric corrections applied to a NOAA-11 AVHRR image of Etna's summit acquired on 3 June 1994 at 13:15Z. First block of corrections are obtained using a model-based approach (i.e., corrections obtained from MODTAN), the second block are obtained from the land surface temperature corrections of Appendix S4B, and the third block from the sea surface temperature corrections of Table S4.5. In all cases, correction is completed using a brightness temperature (corrected for non-linearity) of 30.2 °C in channel 4 (=* T_4*) and 29.6 °C in channel 5 (=* T_5*). These are used with* ε_4 *of 0.96 and* ε_5 *of 0.97 (from Table 4.2a). Atmosphere and emissivity corrected temperatures (*T_s*) are compared with the predicted mean surface temperature (± one standard deviation) of 35.6±4.9 °C (=* $T_{mean} \pm 1\sigma$*) based on 44 temperature measurements of the imaged surface made simultaneously with satellite overpass. Where:*

$$
\begin{aligned}
\Delta T1 &= T_s - [T_{mean} - 1\sigma] \\
\Delta T2 &= T_s - [T_{mean}] \\
\Delta T3 &= T_s - [T_{mean} + 1\sigma]
\end{aligned}
$$

- positive ΔT means expected surface temperature is less than corrected pixel temperature;
- negative ΔT means expected surface temperature is greater than corrected pixel temperature;
- zero ΔT means expected surface temperature is the same as corrected pixel temperature.

Correction Applied:	Notes	Surface Temperature (°C)	ΔT1	ΔT2	ΔT3
MODTRAN-based correction, T_4	τ_4 and L_U(10.8μm) calculated for a 1976 US Standard (Rural, Vis = 23 km, Spring-Summer) and used to correct the channel 4 brightness temperature	34.8	4.1	−0.8	−5.7
MODTRAN-based correction, T_5	τ_5 and L_U(12μm) calculated for a 1976 US Standard (Rural, Vis = 23 km, Spring-Summer) and used to correct the channel 5 brightness temperature	34.9	4.1	−0.7	−5.7
Price (1984), R=1.3	Methodology of Price (1984), as given in Appendix S4B, with R value given by Price (1984)	32.2	1.4	−3.4	−8.3
R=1.36 (Vidal, 1991)	Methodology of Price (1984), as given in Appendix S4B, with R value given by Vidal (1991)	31.9	1.1	−3.8	−8.7
R=1.7 (from image)	Methodology of Price (1984), as given in Appendix S4B, with R value calculated from the image (as given in Table S4.6)	31.1	0.3	−4.6	−9.5
R=1.3, with emissivity term	Methodology of Price (1984), as given in Appendix S4B, with R value given by Price (1984) + emissivity correction of Price (1984) (see Appendix S4B)	31.6	0.8	−4.1	−9.0

Correction Applied:	Notes	Surface Temperature (°C)	ΔT1	ΔT2	ΔT3
R=1.36, with emissivity term	Methodology of Price (1984), as given in Appendix S4B, with R value given by Vidal (1991) + emissivity correction of Price (1984) (see Appendix S4B)	31.4	0.6	−4.3	−9.2
R=1.7, with emissivity term	Methodology of Price (1984), as given in Appendix S4B, with R value calculated from the image (as given in Table S4.6) + emissivity correction of Price (1984) (see Appendix S4B)	30.9	0.1	−4.7	−9.6
Becker & Li (1990)	Correction of Becker and Li (1990): as given in Appendix S4B	33.3	2.5	−2.3	−7.2
Sobrino *et al*. (1991): I	Correction of Sobrino *et al*. (1991): as given in Appendix S4B using Tropical Atmosphere coefficients	31.9	1.1	−3.7	−8.6
Sobrino *et al*. (1991): II	Correction of Sobrino *et al*. (1991): as given in Appendix S4B using Mid-Latitude Summer coefficients	31.8	1.0	−3.8	−8.7
Sobrino *et al*. (1991): III	Correction of Sobrino *et al*. (1991): as given in Appendix S4B using 1976 US Standard Atmosphere coefficients	31.6	0.8	−4.0	−8.9
Sobrino *et al*. (1991): IV	Correction of Sobrino *et al*. (1991): as given in Appendix S4B using Mid-Latitude Winter coefficients	31.5	0.8	−4.1	−9.0
Coll *et al*. (1994)	Correction of Coll *et al*. (1994): as given in Appendix S4B	33.7	2.9	−1.9	−6.8
Deschamps & Phulpin (1980)	Correction as given in Table S4.5	29.6	−1.2	−6.0	−10.9
Llewellyn-Jones *et al*. (1984)	Correction as given in Table S4.5	31.5	0.7	−4.1	−9.0
Singh (1984)	Correction as given in Table S4.5	31.4	0.7	−4.2	−9.1
McClain *et al*. (1985)	Correction as given in Table S4.5	31.9	1.1	−3.7	−8.6
Li & McDonnell (1988)	Correction as given in Table S4.5	28.1	−2.6	−7.5	−12.4
Yokoyama & Tanba (1991)	Correction as given in Table S4.5	31.1	0.3	−4.6	−9.5
Wooster *et al*. (1994)	Correction as given in Table S4.5	33.5	2.7	−2.1	−7.1
Kidwell (1995)	Correction as given in Table S4.5	27.8	−3.0	−7.8	−12.7
No.		23	23	23	23
Min		27.8	−3.0	−7.8	−12.7
Max		34.9	4.1	−0.7	−5.7
Mean		31.7	0.9	−3.9	−8.8
Standard Deviation		1.8	1.8	1.8	1.8

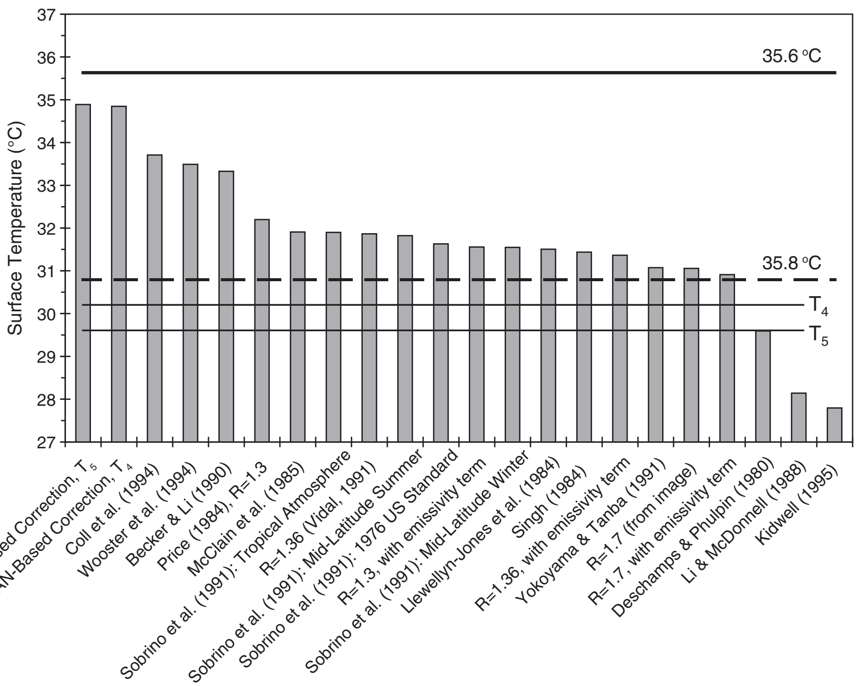

Figure S4.5. Results of applying the atmospheric corrections presented in this supplement to the case given in Table S4.7. Corrections are applied to a NOAA-11 AVHRR pixel located immediately to the west of Etna's summit on 3 June 1994 at 13:15Z. The pixel brightness temperature is 30.2 °C in channel 4 (horizontal line marked T_4) and 29.6 °C in channel 5 (horizontal line marked T_5). The pixel was known to contain a mixture of scoria and snow whose temperatures were measured at the time of image capture. The surface temperature predicted using the mean scoria temperature is given by the thick horizontal solid line, and that using the mean scoria temperature minus one standard deviation is given by the dashed line. Correction results are given in order of decreasing temperature, where Table S4.7 gives the correction description and results plotted here.

The range of results obtained from applying all 22 corrections to the same pixel are plotted in Figure S4.5, in which they are sorted from the highest estimated surface temperature to the lowest. We see that:

- Results range from 27.8 °C to 34.9 °C, and compare with an expected surface temperature of 35.6±4.9 °C.
- If we compare the range of corrected temperatures with the expected surface temperature obtained using the mean scoria temperature, the model-based (MODTRAN) correction performs the best, giving a temperature which is 0.7 °C lower than expected (see Table S4.7).
- If we compare the range of corrected temperatures with the expected surface temperature obtained using the mean scoria temperature minus one standard deviation, then the split-window correction, using the R value obtained from the image, and the emissivity

correction of Price (1984) applied, performs the best, giving a temperature which is 0.1 °C higher than expected (see Table S4.7).

- If we compare the range of corrected temperatures with the expected surface temperature obtained using the mean scoria temperature plus one standard deviation, then all corrected temperatures are too low, by up to 12.7 °C (likely indicating that this surface temperature estimate is too high).
- There are ten values within 0.5 °C of each other [staring with the value obtained using the correction of McClain *et al*. (1985), i.e., 31.9 °C, and finishing with the value of Vidal *et al*. (1991) - corrected for emissivity, i.e., 31.4 °C].

The problem is, we do not really know what the exact pixel temperature is to within a few degrees (i.e., the same range of variation as we have in the bulk of the corrected temperatures). Probably the best we can say is that,

(i) applying a correction moves the temperature closer to the actual surface temperature than if we use the uncorrected temperature, and
(ii) our uncertainty as to whether we have the correct surface temperature or not is around 4 °C, but may be as good as < 1 °C.

Correction for surface reflected radiance

Six methods are available to reduce the problems of reflection contamination of the pixel-integrated radiance or temperature.

(1) Use nighttime data

This is the most simple solution, as by night there will be no reflected component to worry about. However, it means abandoning daytime passes, which may preclude use of a great quantity of otherwise useable data.

(2) Use a thermal waveband in which reflection is not an issue

If we use daytime data acquired in the TIR, reflection will not be an issue because the reflected component will be trivial (see Chapter 2). However, there are many hot spot applications that need, or use, data in the MIR and SWIR; so again this may preclude use of a great quantity of otherwise useable data.

(3) Use a model-based assessment of the reflected component

This involves the following three steps:

(i) Determine the surface type present in the pixel, and select an appropriate spectral reflectivity. Those appropriate for volcanic surfaces across wavebands typically used for volcanic thermal applications are given in Table 4.8.

(ii) Follow the methodology of Appendix B to estimate spectral reflectivity as a function of latitude, day number and day hour.
(iii) Subtract the spectral reflectivity from the pixel radiance, and then correct for all other atmospheric effects.

The same estimate can be made using MODTRAN by inputting the appropriate reflectivity into the parameter files used to run the model. An assessment of reflectivity at every selected wavelength increment is then given in the output files (see MODOUT1.txt of Appendix S4A, although the reflection option has not been selected in this case so the "Surface Reflection" columns of the output tables are filled with zeros).

(4) Assess reflection using a thermal infrared band

This involves the following six steps:

(i) Take a measurement in both the MIR and TIR for an ambient pixel next to the hot spot.
(ii) Correct the TIR for emissivity and atmospheric effects.
(iii) Take the TIR result to be true for the actual surface temperature.
(iv) Convert the resulting surface temperature to a spectral radiance for the MIR waveband in question.
(v) Compare the resulting MIR spectral radiance with that measured in the MIR, and assume the difference is due to the combined effects of emissivity, atmosphere and surface reflection.
(vi) Use this difference value as a correction for the hot spot pixel, i.e., subtract it from the spectral radiance measurement for the hot spot pixel.

(5) Assess reflection using surrounding SWIR pixels

This works very much like method 4, but applies to SWIR (or NIR) pixels in which there is no thermal component, i.e., pixels around the hot spot. In such pixels all radiance can be assumed to be reflected in origin. It involves the following four steps:

(i) Take a reflection measurement for a pixel next to the hot spot.
(ii) Correct the measurement for atmospheric and emissivity effects.
(iii) Take the background result to be true of the actual levels of reflection in the target (hot spot) pixel.
(iv) Use this value as a reflection correction for the hot spot pixel, i.e., subtract it from the spectral radiance measurement for the hot spot pixel.

(6) Assess reflection using a non-thermally-emissive band in the NIR or VIS

The following method can work if multiple wavebands are available across the VIS, NIR and SWIR.

(i) Locate the hot spot pixel, and find the first waveband in which there is no thermal anomaly.
(ii) Correct this measurement for atmospheric and emissivity effects, and convert it to a spectral radiance appropriate to the waveband in which the hot spot measurement is being made.
(iii) Use this value as a reflection correction for the hot spot waveband, i.e., subtract it from the spectral radiance measurement for the hot spot waveband.

While Methods (1) through (4) can be used for correction of MIR data, methods (5) and (6) have tended to have been used with SWIR data for volcanic hot spots acquired by TM and ETM+, and have been explored by Oppenheimer *et al*. (1993) and Wooster and Kaneko (2001).

Oppenheimer et al. (1993)

In an Appendix to their Journal of Geophysical Research paper, *Infrared Image Analysis of Volcanic Thermal Features: Lascar Volcano, Chile, 1983–1992*, Oppenheimer *et al*. (1993) proposed method (6). The Appendix begins by stating that "previous attempts to correct for backscattered light (reflection) have involved subtracting digital counts of "cold" pixels, beyond the thermal anomaly, from those of the "hot" pixels in each of the (anomalous) SWIR bands", i.e., method (5). However, Oppenheimer *et al*. (1993) claimed that "this extrapolation can be inaccurate, especially if part of the anomaly lies in shadow". Oppenheimer *et al*. (1993) thus proposed the following method that uses non-anomalous pixels in TM band 4, and anomalous pixels in bands 5 and 7. Working in terms of DN in bands 4, 5 and 7 (DN_4, DN_5 and DN_7, respectively), the correction was applied as follows:

$$DN_{5,thermal} = DN_5 - DN_4 \left(\frac{DN_5}{DN_4}\right)_{av}$$

$$DN_{7,thermal} = DN_7 - DN_4 \left(\frac{DN_7}{DN_4}\right)_{av}$$

thus the correction has the form

$$DN_{anomaly,thermal} = DN_{anomaly} - DN_{reflective} \left(\frac{DN_{anomaly}}{DN_{reflective}}\right)_{av}$$

in which

$DN_{anomaly,thermal}$ is the anomalous DN corrected for reflection;
$DN_{anomaly}$ is the pixel DN in the thermally anomalous band;
$DN_{reflective}$ is the pixel DN in the non-thermally anomalous band, in which we have reflection only, and

$\left(\frac{DN_{anomaly}}{DN_{reflective}}\right)_{av}$ is the mean value for ratios of $DN_{anomaly}$ to $DN_{reflective}$ for non-anomalous pixels surrounding the anomaly.

In this correction, spectral radiance can also be used in place of DN.

Oppenheimer *et al*. (1993) also suggested method (5) as a potential correction for the residual signal apparent in the SWIR in nighttime data, where

$$DN_{anomaly,thermal} = DN_{anomaly} - DN_{background}$$

here, $DN_{background}$ is the average value from non-anomalous pixels surrounding the anomaly and in the same waveband.

Wooster and Kaneko (2001)

By comparing results obtained from same-day nighttime and daytime TM images acquired for hot spots at Unzen's active lava dome, Wooster and Kaneko (2001) assessed the performance of methods (5) and (6) when applied to SWIR data. Wooster and Kaneko (2001) termed method (5) the "mean approach", since it was based on "the average SWIR reflectance of the nonthermally anomalous volcanic background", and method (6) the "per-pixel" approach, since it used an estimate of the "SWIR reflectance for each pixel using a measure of their near infrared reflectance". They found the following:

- Comparison of night- and day-time data showed that application of the dual-band method to data corrected using the "mean approach" resulted in sub-pixel hot spot areas that were 81–94 % smaller than the nighttime extractions, making the mean approach "seriously inadequate".
- Underestimates in data corrected using the "per-pixel" approach were less severe, but the results were still 47–61 % smaller than the reference (nighttime) data set.

They did concede, though, that

- Although surfaces cooler than 400 °C suffered from such errors, results retrieved for surfaces greater than 400 °C corresponded "quite well" to those obtained from the reference data set;
- The test was made for a reflective dacitic and fumarolic surface, so that errors may be less for surfaces of lower reflectivity.

Wooster and Kaneko (2001) thus concluded that nighttime data should be used, i.e., method (1) is the most robust means of ensuring that there is no reflection contamination. However, if daytime data are used Wooster and Kaneko (2001) recommended use of the "per-pixel approach", but advised "caution when quantitatively interpreting the derived thermal parameters, at least at andesitic and dacitic volcanoes". The good news was that daytime corrections (and retrievals) may be more robust at basaltic volcanoes due to their higher surface temperatures and lower reflectances.

Summation

A number of emissivity, atmospheric, and reflection corrections are available. However, in cases where it is impossible to assess the "reality" of the satellite-sensor-extracted surface temperatures, difference between the actual surface temperature and the satellite-derived surface temperature may be up to 4 °C, although it may be better then 1 °C. The problem is, we do not know how close we are to reality and, as seen in Figure S4.5, 22 different "corrections" can produce 22 different results. We need more experiments along the lines of those completed here that compare in-situ and satellite-derived surface temperatures over volcanic surfaces to understand,

(i) which correction procedures perform the best, and
(ii) the precision that can be obtained when applying (the commonly used) model-based (MODTRAN-type) corrections.

For reflection corrections, following Wooster and Kaneko (2001), it is probably best to cross-check same-day daytime and nighttime results to (i) determine whether or not reflection correction introduces a systematic error into derived parameters and, (ii) if an error exists, remove that error.

Table S4.8a. *Surface reflectivity averaged over the sensor wavebands of TM-, AVHRR- and GOES-class sensors for the Kilauea and Etna samples of Table S4.1. Following Kichoff's Law, these are simply one minus the emissivity values of Table 4.2a.*

				REFLECTIVITY							
SENSOR	BAND	SPECTRAL REGION	WAVEBAND	MU1	MU2	Haw83	Haw83a	Haw83b	Etna1	Etna2	Etna3
TM	7	SWIR	2.08 – 2.35	0.084	0.065	0.043	0.100	0.049	0.058	0.038	0.059
MODIS	7	SWIR	2.105–2.155	0.083	0.065	0.043	0.099	0.049	0.058	0.038	0.058
ASTER	5	SWIR	2.145 – 2.185	0.084	0.066	0.043	0.099	0.049	0.058	0.038	0.058
ASTER	6	SWIR	2.185 – 2.225	0.084	0.066	0.043	0.100	0.049	0.058	0.038	0.059
ASTER	7	SWIR	2.235 – 2.285	0.085	0.064	0.043	0.101	0.049	0.058	0.037	0.059
ASTER	8	SWIR	2.295 – 2.365	0.086	0.062	0.043	0.102	0.050	0.058	0.037	0.060
ASTER	9	SWIR	2.360 – 2.430	0.087	0.062	0.044	0.102	0.050	0.058	0.037	0.060
SEVIRI	IR3.9	MIR	3.48 – 4.36	0.079	0.057	0.041	0.096	0.048	0.053	0.032	0.065
AVHRR	3	MIR	3.55 – 3.93	0.075	0.047	0.043	0.101	0.050	0.056	0.033	0.064
ATSR		MIR	3.7	0.076	0.047	0.043	0.101	0.051	0.056	0.033	0.065
GOES	2	MIR	3.80 – 4.00	0.079	0.050	0.043	0.101	0.051	0.056	0.033	0.067
MODIS	21	MIR	3.929–3.989	0.080	0.051	0.043	0.101	0.051	0.056	0.033	0.068
MODIS	22	MIR	3.929–3.989	0.080	0.051	0.043	0.101	0.051	0.056	0.033	0.068
ASTER	10	TIR	8.125 – 8.475	0.091	0.037	0.009	0.011	0.014	0.013	0.016	0.014
SEVIRI	IR8.7	TIR	8.30 – 9.10	0.135	0.047	0.023	0.043	0.048	0.022	0.021	0.026
ASTER	11	TIR	8.475 – 8.825	0.122	0.043	0.020	0.041	0.047	0.020	0.020	0.026
ASTER	12	TIR	8.925 – 9.275	0.261	0.086	0.055	0.098	0.099	0.046	0.031	0.040
SEVIRI	IR9.7	TIR	9.38 – 9.94	0.156	0.061	0.065	0.154	0.123	0.059	0.037	0.043
SEVIRI	IR10.8	TIR	9.80 – 11.80	0.069	0.044	0.089	0.159	0.143	0.062	0.039	0.040
GOES	4	TIR	10.2 – 11.2	0.063	0.044	0.095	0.167	0.153	0.066	0.040	0.041
ASTER	13	TIR	10.25 – 10.95	0.063	0.043	0.096	0.171	0.156	0.066	0.040	0.042
AVHRR	4	TIR	10.3 – 11.3	0.062	0.044	0.095	0.164	0.151	0.066	0.039	0.041

				REFLECTIVITY							
SENSOR	BAND	SPECTRAL REGION	WAVEBAND	MU1	MU2	Haw83	Haw83a	Haw83b	Etna1	Etna2	Etna3
TM	6	TIR	10.4 – 12.5	0.054	0.042	0.083	0.133	0.122	0.057	0.036	0.037
ATSR		TIR	10.8	0.063	0.044	0.096	0.165	0.153	0.067	0.038	0.042
ASTER	14	TIR	10.95 – 11.65	0.057	0.045	0.088	0.142	0.130	0.061	0.038	0.039
SEVIRI	IR12.0	TIR	11.00 – 13.00	0.050	0.040	0.070	0.107	0.098	0.048	0.032	0.032
AVHRR	5	TIR	11.5 – 12.5	0.047	0.039	0.069	0.101	0.092	0.047	0.033	0.032
GOES	5	TIR	11.5 – 12.5	0.047	0.039	0.069	0.101	0.092	0.047	0.033	0.032
MODIS	32	TIR	11.770–12.270	0.045	0.039	0.068	0.098	0.089	0.046	0.032	0.031
ATSR		TIR	12	0.044	0.038	0.069	0.098	0.089	0.046	0.032	0.031

Table S4.8b. *Surface reflectivity averaged over the sensor wavebands of TM-, AVHRR- and GOES-class sensors for the Stromboli and Vulcano samples of Table S4.1. Following Kichoff's Law, these are simply one minus the emissivity values of Table 4.2b.*

				REFLECTIVITY					
SENSOR	BAND	SPECTRAL REGION	WAVEBAND	Strom	StromA	StromB	Vulc1	Vulc2fsh	Vulc2wth
TM	7	SWIR	2.08 – 2.35	0.058	0.048	0.047	0.178	0.536	0.419
MODIS	7	SWIR	2.105–2.155	0.057	0.047	0.047	0.177	0.534	0.422
ASTER	5	SWIR	2.145 – 2.185	0.057	0.047	0.047	0.185	0.543	0.422
ASTER	6	SWIR	2.185 – 2.225	0.058	0.047	0.047	0.185	0.548	0.420
ASTER	7	SWIR	2.235 – 2.285	0.059	0.048	0.047	0.182	0.546	0.417
ASTER	8	SWIR	2.295 – 2.365	0.061	0.050	0.047	0.170	0.522	0.416
ASTER	9	SWIR	2.360 – 2.430	0.063	0.050	0.047	0.148	0.486	0.404
SEVIRI	IR3.9	MIR	3.48 – 4.36	0.060	0.042	0.046	0.028	0.229	0.149
AVHRR	3	MIR	3.55 – 3.93	0.069	0.049	0.046	0.035	0.246	0.137
ATSR		MIR	3.7	0.070	0.050	0.047	0.039	0.254	0.139
GOES	2	MIR	3.80 – 4.00	0.071	0.051	0.047	0.039	0.257	0.140
MODIS	21	MIR	3.929–3.989	0.071	0.051	0.047	0.038	0.256	0.140
MODIS	22	MIR	3.929–3.989	0.071	0.051	0.047	0.038	0.256	0.140
ASTER	10	TIR	8.125 – 8.475	0.020	0.013	0.019	0.018	0.159	0.087
SEVIRI	IR8.7	TIR	8.30 – 9.10	0.042	0.032	0.024	0.027	0.158	0.083
ASTER	11	TIR	8.475 – 8.825	0.041	0.030	0.023	0.025	0.158	0.082
ASTER	12	TIR	8.925 – 9.275	0.069	0.060	0.037	0.046	0.157	0.084
SEVIRI	IR9.7	TIR	9.38 – 9.94	0.065	0.048	0.043	0.036	0.157	0.084
SEVIRI	IR10.8	TIR	9.80 – 11.80	0.058	0.052	0.051	0.024	0.137	0.092
GOES	4	TIR	10.2 – 11.2	0.061	0.056	0.052	0.024	0.142	0.095
ASTER	13	TIR	10.25 – 10.95	0.062	0.057	0.052	0.024	0.145	0.097
AVHRR	4	TIR	10.3 – 11.3	0.060	0.056	0.053	0.023	0.138	0.094

				REFLECTIVITY					
SENSOR	BAND	SPECTRAL REGION	WAVEBAND	Strom	StromA	StromB	Vulc1	Vulc2fsh	Vulc2wth
TM	6	TIR	10.4 – 12.5	0.050	0.047	0.049	0.020	0.118	0.092
ATSR		TIR	10.8	0.060	0.057	0.053	0.023	0.137	0.095
ASTER	14	TIR	10.95 – 11.65	0.052	0.050	0.053	0.021	0.119	0.090
SEVIRI	IR12.0	TIR	11.00 – 13.00	0.041	0.039	0.044	0.018	0.110	0.093
AVHRR	5	TIR	11.5 – 12.5	0.039	0.038	0.045	0.016	0.098	0.090
GOES	5	TIR	11.5 – 12.5	0.039	0.038	0.045	0.016	0.098	0.090
MODIS	32	TIR	11.770–12.270	0.038	0.036	0.044	0.016	0.089	0.086
ATSR		TIR	12	0.038	0.036	0.044	0.015	0.087	0.086

Appendix S4A

MODTRAN output files

Attached to this Appendix, in text format, are the three output files produced from a MODTRAN run with the following input parameters:

Model Atmosphere:	1976 US Standard
Type of Path:	Horizontal
Mode of Execution:	Thermal Radiance
CO_2 Mixing Ratio:	380.000 ppmv
Surface Albedo:	0.05
Aerosol Model:	Rural - VIS = 23 km
Seasonal Modifications:	Determined by Model
Ground Altitude:	0 km
Observer Height:	0 km
Path Length:	0.5 km
Initial Frequency:	769 cm^{-1} (7.5 μm)
Final Frequency:	1333 cm^{-1} (13.0 μm)

This model run is set up so as to mimic the correction required for a broadband radiometer or camera operating between 7.5 and 13 μm over a 500 m-long horizontal path at sea-level.

We now have the following three output files : MODOUT1, MODOUT2 and MODOUT3. These can be viewed on the following pages.

(1) MODOUT1.txt

This output file is split into five parts:

Part 1: Header information and card entries for model set up
Part 2: Atmospheric profiles used by the model
Part 3: Total column absorber amounts
Part 4: Model output
Part 5: Model output summary

The final column of Part 3 gives total transmission for each frequency across the selected waveband. If we take the average of this we obtain τ_λ (averaged between 7.5 and 13 μm) of

0.85. This is the same as the summary value given in part 5. The fourth and fifth columns of Part 3 give the path thermal radiance in units of W/cm^2-sr-cm^{-1} and W/cm^2-sr-µm, respectively. If we take the average of column five we obtain $L_U(\lambda)$ (averaged between 7.5 and 13 µm) 1.06×10^{-4} W/cm^2-sr-µm.

(2) MODOUT2.txt

This output file is split into two parts:

Part 1: Header information and card entries for model set up
Part 2: Model output

We are interested in the second and third columns of the model output which give, as a function of frequency, total transmission [τ_λ] and path thermal radiance [$L_U(\lambda)$].

(3) MODOUT3.txt

This output file is split into two parts:

Part 1: Header information and card entries for model set up
Part 2: Model output

For this model run, no extra model output was requested, so part 2 is empty.

OUTPUT FILE 1: MODOUT 1

```
*******************************************************************************
MODTRAN4: Official Version 1.1 Apr 2000
Developed in a collaborative effort between SPECTRAL SCIENCES, INC. (www.spectral.com) and
   the AIR FORCE RESEARCH LABORATORY (www-vsbm.plh.af.mil).
*******************************************************************************


CARD 1 *****T      6    1   1    0    0    0    0    0    0    0    0    0    0       0.000   0.05
CARD 1A *****FF   0T    5 380.00000                                         0.000
MOLECULAR BAND MODEL DATA FILE:            DATA/BMP99_01.BIN
CARD 2 *****       1    0   0    0    0    0    0.00000  0.00000  0.00000  0.00000        0.00000
MODEL ATMOSPHERE NO. 6
CARD 3 *****       0.00000  10.00000  30.00000  0.50000  0.00000  0.00000  0               0.00000
   6371.23 RADIUS OF THE EARTH [KM].
CARD 4 *****       765      1335      1         1

PROGRAM WILL COMPUTE RADIANCE

ATMOSPHERIC MODEL
              TEMPERATURE    =    6         1976 U S STANDARD
              WATER VAPOR    =    6         1976 U S STANDARD
              OZONE          =    6         1976 U S STANDARD
                                            M5    =    6   M6    =    6       MDEF    =    1


AEROSOL MODEL
   REGIME                         AEROSOL TYPE          PROFILE                SEASON
   BOUNDARY LAYER (0−2 KM) RURAL                        23.0 KM METEOROLOGICAL RANGE AT
                                                           SEA LEVEL
   TROPOSPHERE (2−10KM)           TROPOSPHERIC          TROPOSPHERIC           SPRING-SUMMER
   STRATOSPHERE (10−30KM)         BACKGROUND STRATO     BACKGROUND STRATO      SPRING-SUMMER
   UPPER ATMOS (30−100KM)         METEORIC DUST         NORMAL


HORIZONTAL PATH
              ALTITUDE =       0.00000 KM
              RANGE    =       0.50000 KM
FREQUENCY RANGE
                  IV1    =     765 CM–1 ( 13.07 MICRONS)
                  IV2    =     1335 CM–1 ( 7.49 MICRONS)
                  IDV    =     1 CM–1
              IFWHM      =     1 CM–1
```

1 ATMOSPHERIC PROFILES

I	Z	P	T	N2	CNTMSLF	CNTMFRN	MOL SCAT	N−1	O3 (UV)	O2 (UV)	WAT DROP	ICE PART	RAIN RATE
	(KM)	(MB)	(K)		(MOL/CM2 KM)		(−)	(−)	(ATM CM/KM)		(GM/M3)	(GM/M3)	(MM/HR)
1	0.0000	1013.250	288.1	8.241E-01	1.569E+20	2.011E+22	9.479E-01	2.723E-04	2.522E-03	3.540E+04	0.000	0.000	0.000
2	1.0000	898.760	281.7	6.787E−01	7.941E+19	1.300E+22	8.602E−01	2.472E−04	2.521E−03	3.082E+04	0.000	0.000	0.000
3	2.0000	795.010	275.2	5.564E−01	3.788E+19	8.142E+21	7.789E−01	2.239E−04	2.521E−03	2.680E+04	0.000	0.000	0.000
4	3.0000	701.210	268.7	4.540E−01	1.460E+19	4.572E+21	7.036E−01	2.023E−04	2.335E−03	2.329E+04	0.000	0.000	0.000
5	4.0000	616.600	262.2	3.687E−01	5.451E+18	2.520E+21	6.340E−01	1.823E−04	2.147E−03	2.022E+04	0.000	0.000	0.000
6	5.0000	540.480	255.7	2.978E−01	1.845E+18	1.319E+21	5.699E−01	1.639E−04	2.147E−03	1.754E+04	0.000	0.000	0.000
7	6.0000	472.170	249.2	2.393E−01	6.506E+17	7.024E+20	5.108E−01	1.469E−04	2.100E−03	1.520E+04	0.000	0.000	0.000
8	7.0000	411.050	242.7	1.912E−01	1.986E+17	3.470E+20	4.566E−01	1.313E−04	2.287E−03	1.316E+04	0.000	0.000	0.000
9	8.0000	356.510	236.2	1.518E−01	6.481E+16	1.767E+20	4.069E−01	1.170E−04	2.427E−03	1.138E+04	0.000	0.000	0.000
10	9.0000	308.000	229.7	1.198E−01	9.531E+15	6.020E+19	3.614E−01	1.039E−04	3.313E−03	9.820E+03	0.000	0.000	0.000
11	10.0000	264.990	223.3	9.390E−02	1.459E+15	2.085E+19	3.200E−01	9.203E−05	4.201E−03	8.464E+03	0.000	0.000	0.000
12	11.0000	226.990	216.8	7.308E−02	3.029E+14	8.382E+18	2.823E−01	8.119E−05	6.066E−03	7.282E+03	0.000	0.000	0.000
13	12.0000	193.990	216.6	5.344E−02	6.163E+13	3.233E+18	2.414E−01	6.942E−05	7.471E−03	6.056E+03	0.000	0.000	0.000
14	13.0000	165.790	216.6	3.903E−02	1.459E+13	1.344E+18	2.063E−01	5.933E−05	7.934E−03	5.050E+03	0.000	0.000	0.000
15	14.0000	141.700	216.6	2.851E−02	3.180E+12	5.365E+17	1.763E−01	5.071E−05	8.869E−03	4.224E+03	0.000	0.000	0.000
16	15.0000	121.110	216.6	2.083E−02	1.653E+12	3.306E+17	1.507E−01	4.334E−05	9.803E−03	3.544E+03	0.000	0.000	0.000
17	16.0000	103.520	216.6	1.522E−02	7.538E+11	1.908E+17	1.288E−01	3.705E−05	1.121E−02	2.980E+03	0.000	0.000	0.000
18	17.0000	88.497	216.6	1.112E−02	5.233E+11	1.359E+17	1.101E−01	3.167E−05	1.307E−02	2.512E+03	0.000	0.000	0.000
19	18.0000	75.652	216.6	8.127E−03	3.775E+11	9.869E+16	9.413E−02	2.707E−05	1.494E−02	2.121E+03	0.000	0.000	0.000
20	19.0000	64.674	216.6	5.939E−03	2.795E+11	7.259E+16	8.047E−02	2.314E−05	1.634E−02	1.794E+03	0.000	0.000	0.000
21	20.0000	55.293	216.6	4.341E−03	2.096E+11	5.375E+16	6.880E−02	1.979E−05	1.774E−02	1.520E+03	0.000	0.000	0.000
22	21.0000	47.289	217.6	3.148E−03	1.579E+11	3.973E+16	5.859E−02	1.685E−05	1.774E−02	1.284E+03	0.000	0.000	0.000
23	22.0000	40.475	218.6	2.285E−03	1.199E+11	2.949E+16	4.992E−02	1.436E−05	1.821E−02	1.087E+03	0.000	0.000	0.000
24	23.0000	34.668	219.6	1.662E−03	9.305E+10	2.216E+16	4.256E−02	1.224E−05	1.774E−02	9.210E+02	0.000	0.000	0.000
25	24.0000	29.717	220.6	1.210E−03	7.102E+10	1.652E+16	3.632E−02	1.045E−05	1.681E−02	7.820E+02	0.000	0.000	0.000

26	25.0000	25.492	221.6	8.824E−04	5.485E+10	1.240E+16	3.102E−02	8.921E−06	1.587E−02	6.650E+02	0.000	0.000	0.000
27	30.0000	11.970	226.5	1.861E−04	1.319E+10	2.792E+15	1.425E−02	4.097E−06	9.335E−03	3.013E+02	0.000	0.000	0.000
28	35.0000	5.746	236.5	3.934E−05	2.999E+09	6.119E+14	6.549E−03	1.884E−06	5.133E−03	1.376E+02	0.000	0.000	0.000
29	40.0000	2.871	250.4	8.768E−06	7.029E+08	1.399E+14	3.092E−03	8.893E−07	2.257E−03	6.479E+01	0.000	0.000	0.000
30	45.0000	1.491	264.2	2.123E−06	1.840E+08	3.522E+13	1.522E−03	4.376E−07	7.988E−04	3.184E+01	0.000	0.000	0.000
31	50.0000	0.798	270.6	5.791E−07	5.019E+07	9.606E+12	7.946E−04	2.285E−07	2.463E−04	1.662E+01	0.000	0.000	0.000
32	55.0000	0.425	260.8	1.772E−07	1.464E+07	2.870E+12	4.396E−04	1.264E−07	7.913E−05	9.191E+00	0.000	0.000	0.000
33	60.0000	0.220	247.0	5.266E−08	3.772E+06	7.942E+11	2.396E−04	6.892E−08	2.636E−05	5.009E+00	0.000	0.000	0.000
34	70.0000	0.052	219.6	3.768E−09	1.465E+05	4.187E+10	6.410E−05	1.843E−08	1.923E−06	1.340E+00	0.000	0.000	0.000
35	80.0000	0.011	198.6	1.871E−10	2.496E+03	1.218E+09	1.428E−05	4.108E−09	4.285E−07	2.985E−01	0.000	0.000	0.000
36	100.0000	0.000	195.1	1.795E−13	9.116E−02	2.279E+05	4.424E−07	1.272E−10	1.769E−08	7.078E−03	0.000	0.000	0.000

1 ATMOSPHERIC PROFILES

I	Z	P	T	AEROSOL 1	AEROSOL 2	AEROSOL 3	AEROSOL 4	AER1*RH	RH (%)	RH (%)	CIRRUS	WAT DROP	ICE PART
	(KM)	(MB)	(K)	(−)	(−)	(−)	(−)	(BEFORE H2O SCALING)		(AFTER)	(−)	(550nm VIS [KM−1])	
1	0.0000	1013.250	288.1	1.580E−01	0.000E+00	0.000E+00	0.000E+00	6.302E−01	4.604E+01	4.604E+01	0.00000	0.00000	0.00000
2	1.0000	898.760	281.7	9.910E−02	0.000E+00	0.000E+00	0.000E+00	3.893E−01	4.918E+01	4.918E+01	0.00000	0.00000	0.00000
3	2.0000	795.010	275.2	6.210E−02	0.000E+00	0.000E+00	0.000E+00	2.402E−01	5.216E+01	5.216E+01	0.00000	0.00000	0.00000
4	3.0000	701.210	268.7	0.000E+00	3.460E−02	0.000E+00	0.000E+00	0.000E+00	5.091E+01	5.091E+01	0.00000	0.00000	0.00000
5	4.0000	616.600	262.2	0.000E+00	1.850E−02	0.000E+00	0.000E+00	0.000E+00	5.021E+01	5.021E+01	0.00000	0.00000	0.00000
6	5.0000	540.480	255.7	0.000E+00	9.310E−03	0.000E+00	0.000E+00	0.000E+00	4.849E+01	4.849E+01	0.00000	0.00000	0.00000
7	6.0000	472.170	249.2	0.000E+00	7.710E−03	0.000E+00	0.000E+00	0.000E+00	4.928E+01	4.928E+01	0.00000	0.00000	0.00000
8	7.0000	411.050	242.7	0.000E+00	6.230E−03	0.000E+00	0.000E+00	0.000E+00	4.817E+01	4.817E+01	0.00000	0.00000	0.00000
9	8.0000	356.510	236.2	0.000E+00	3.370E−03	0.000E+00	0.000E+00	0.000E+00	5.050E+01	5.050E+01	0.00000	0.00000	0.00000
10	9.0000	308.000	229.7	0.000E+00	1.820E−03	0.000E+00	0.000E+00	0.000E+00	3.698E+01	3.698E+01	0.00000	0.00000	0.00000
11	10.0000	264.990	223.3	0.000E+00	1.140E−03	0.000E+00	0.000E+00	0.000E+00	2.887E+01	2.887E+01	0.00000	0.00000	0.00000
12	11.0000	226.990	216.8	0.000E+00	0.000E+00	7.990E−04	0.000E+00	0.000E+00	2.754E+01	2.754E+01	0.00000	0.00000	0.00000

I	Z	P	T	AEROSOL 1	AEROSOL 2	AEROSOL 3	AEROSOL 4	AER1*RH	RH (%)	RH (%)	CIRRUS	WAT DROP	ICE PART
	(KM)	(MB)	(K)	(−)	(−)	(−)	(−)		(BEFORE H2O SCALING)	(AFTER)	(−)	(550nm VIS [KM−1])	
13	12.0000	193.990	216.6	0.000E+00	0.000E+00	6.410E−04	0.000E+00	0.000E+00	1.261E+01	1.261E+01	0.00000	0.00000	0.00000
14	13.0000	165.790	216.6	0.000E+00	0.000E+00	5.170E−04	0.000E+00	0.000E+00	6.134E+00	6.134E+00	0.00000	0.00000	0.00000
15	14.0000	141.700	216.6	0.000E+00	0.000E+00	4.420E−04	0.000E+00	0.000E+00	2.864E+00	2.864E+00	0.00000	0.00000	0.00000
16	15.0000	121.110	216.6	0.000E+00	0.000E+00	3.950E−04	0.000E+00	0.000E+00	2.065E+00	2.065E+00	0.00000	0.00000	0.00000
17	16.0000	103.520	216.6	0.000E+00	0.000E+00	3.820E−04	0.000E+00	0.000E+00	1.394E+00	1.394E+00	0.00000	0.00000	0.00000
18	17.0000	88.497	216.6	0.000E+00	0.000E+00	4.250E−04	0.000E+00	0.000E+00	1.162E+00	1.162E+00	0.00000	0.00000	0.00000
19	18.0000	75.652	216.6	0.000E+00	0.000E+00	5.200E−04	0.000E+00	0.000E+00	9.867E−01	9.867E−01	0.00000	0.00000	0.00000
20	19.0000	64.674	216.6	0.000E+00	0.000E+00	5.810E−04	0.000E+00	0.000E+00	8.490E−01	8.490E−01	0.00000	0.00000	0.00000
21	20.0000	55.293	216.6	0.000E+00	0.000E+00	5.890E−04	0.000E+00	0.000E+00	7.353E−01	7.353E−01	0.00000	0.00000	0.00000
22	21.0000	47.289	217.6	0.000E+00	0.000E+00	5.020E−04	0.000E+00	0.000E+00	5.720E−01	5.720E−01	0.00000	0.00000	0.00000
23	22.0000	40.475	218.6	0.000E+00	0.000E+00	4.200E−04	0.000E+00	0.000E+00	4.440E−01	4.440E−01	0.00000	0.00000	0.00000
24	23.0000	34.668	219.6	0.000E+00	0.000E+00	3.000E−04	0.000E+00	0.000E+00	3.489E−01	3.489E−01	0.00000	0.00000	0.00000
25	24.0000	29.717	220.6	0.000E+00	0.000E+00	1.980E−04	0.000E+00	0.000E+00	2.722E−01	2.722E−01	0.00000	0.00000	0.00000
26	25.0000	25.492	221.6	0.000E+00	0.000E+00	1.310E−04	0.000E+00	0.000E+00	2.139E−01	2.139E−01	0.00000	0.00000	0.00000
27	30.0000	11.970	226.5	0.000E+00	0.000E+00	3.320E−05	0.000E+00	0.000E+00	6.100E−02	6.100E−02	0.00000	0.00000	0.00000
28	35.0000	5.746	236.5	0.000E+00	0.000E+00	0.000E+00	1.640E−05	0.000E+00	1.056E−02	1.056E−02	0.00000	0.00000	0.00000
29	40.0000	2.871	250.4	0.000E+00	0.000E+00	0.000E+00	7.990E−06	0.000E+00	1.468E−03	1.468E−03	0.00000	0.00000	0.00000
30	45.0000	1.491	264.2	0.000E+00	0.000E+00	0.000E+00	4.010E−06	0.000E+00	2.511E−04	2.511E−04	0.00000	0.00000	0.00000
31	50.0000	0.798	270.6	0.000E+00	0.000E+00	0.000E+00	2.100E−06	0.000E+00	8.196E−05	8.196E−05	0.00000	0.00000	0.00000
32	55.0000	0.425	260.8	0.000E+00	0.000E+00	0.000E+00	1.103E−06	0.000E+00	9.152E−05	9.152E−05	0.00000	0.00000	0.00000
33	60.0000	0.220	247.0	0.000E+00	0.000E+00	0.000E+00	5.797E−07	0.000E+00	1.430E−04	1.430E−04	0.00000	0.00000	0.00000
34	70.0000	0.052	219.6	0.000E+00	0.000E+00	0.000E+00	1.600E−07	0.000E+00	4.369E−04	4.369E−04	0.00000	0.00000	0.00000
35	80.0000	0.011	198.6	0.000E+00	0.000E+00	0.000E+00	2.878E−08	0.000E+00	8.483E−04	8.483E−04	0.00000	0.00000	0.00000
36	100.0000	0.000	195.1	0.000E+00	0.000E+00	0.000E+00	9.310E−10	0.000E+00	8.684E−06	8.684E−06	0.00000	0.00000	0.00000

1 ATMOSPHERIC PROFILES (AFTER COLUMN SCALING)

I	Z	P	H2O	O3	CO2	CO	CH4	N2O	O2	NH3	NO	NO2	SO2	HNO3
	(KM)	(MB)						(ATM CM / KM)						
1	0.0000	1013.250	7.34E+02	2.52E−03	3.60E+01	1.42E−02	1.61E−01	3.03E−02	1.98E+04	4.74E−05	2.84E−05	2.18E−06	2.84E−05	4.74E−06
2	1.0000	898.760	5.22E+02	2.52E−03	3.27E+01	1.25E−02	1.46E−01	2.75E−02	1.80E+04	4.30E−05	2.58E−05	1.98E−06	2.36E−05	5.13E−06
3	2.0000	795.010	3.61E+02	2.52E−03	2.96E+01	1.09E−02	1.32E−01	2.49E−02	1.63E+04	3.61E−05	2.34E−05	1.79E−06	1.84E−05	5.40E−06
4	3.0000	701.210	2.24E+02	2.33E−03	2.67E+01	9.49E−03	1.20E−01	2.25E−02	1.47E+04	2.67E−05	2.11E−05	1.62E−06	1.34E−05	5.57E−06
5	4.0000	616.600	1.37E+02	2.15E−03	2.41E+01	8.32E−03	1.08E−01	2.03E−02	1.33E+04	1.83E−05	1.90E−05	1.46E−06	9.26E−06	5.62E−06
6	5.0000	540.480	7.96E+01	2.15E−03	2.17E+01	7.43E−03	9.69E−02	1.82E−02	1.19E+04	1.16E−05	1.71E−05	1.31E−06	6.72E−06	5.56E−06
7	6.0000	472.170	4.73E+01	2.10E−03	1.94E+01	6.58E−03	8.68E−02	1.63E−02	1.07E+04	7.46E−06	1.53E−05	1.17E−06	4.96E−06	5.67E−06
8	7.0000	411.050	2.61E+01	2.29E−03	1.73E+01	5.69E−03	7.76E−02	1.46E−02	9.54E+03	4.51E−06	1.37E−05	1.05E−06	3.79E−06	5.75E−06
9	8.0000	356.510	1.49E+01	2.43E−03	1.55E+01	4.82E−03	6.90E−02	1.30E−02	8.50E+03	2.64E−06	1.22E−05	9.36E−07	2.93E−06	5.66E−06
10	9.0000	308.000	5.72E+00	3.31E−03	1.37E+01	3.95E−03	6.12E−02	1.15E−02	7.55E+03	1.36E−06	1.08E−05	8.38E−07	2.37E−06	5.53E−06
11	10.0000	264.990	2.24E+00	4.20E−03	1.22E+01	3.19E−03	5.39E−02	1.02E−02	6.69E+03	6.50E−07	9.60E−06	7.62E−07	1.95E−06	5.57E−06
12	11.0000	226.990	1.02E+00	6.07E−03	1.07E+01	2.53E−03	4.73E−02	8.86E−03	5.90E+03	3.08E−07	8.47E−06	7.40E−07	1.63E−06	5.70E−06
13	12.0000	193.990	4.60E−01	7.47E−03	9.17E+00	1.89E−03	4.01E−02	7.47E−03	5.04E+03	1.52E−07	7.24E−06	7.60E−07	1.35E−06	5.82E−06
14	13.0000	165.790	2.24E−01	7.93E−03	7.84E+00	1.31E−03	3.39E−02	6.29E−03	4.31E+03	6.44E−08	6.17E−06	9.18E−07	1.15E−06	5.69E−06
15	14.0000	141.700	1.05E−01	8.87E−03	6.70E+00	8.86E−04	2.87E−02	5.29E−03	3.69E+03	1.96E−08	5.20E−06	1.32E−06	9.94E−07	5.87E−06
16	15.0000	121.110	7.54E−02	9.80E−03	5.73E+00	5.94E−04	2.42E−02	4.44E−03	3.15E+03	6.74E−09	4.26E−06	2.58E−06	8.67E−07	6.81E−06
17	16.0000	103.520	5.09E−02	1.12E−02	4.89E+00	3.95E−04	2.04E−02	3.71E−03	2.69E+03	2.72E−09	3.45E−06	4.11E−06	7.41E−07	9.49E−06
18	17.0000	88.497	4.24E−02	1.31E−02	4.18E+00	2.74E−04	1.71E−02	3.06E−03	2.30E+03	1.21E−09	2.77E−06	5.72E−06	5.91E−07	1.44E−05
19	18.0000	75.652	3.60E−02	1.49E−02	3.58E+00	1.85E−04	1.43E−02	2.51E−03	1.97E+03	6.31E−10	2.26E−06	7.26E−06	4.50E−07	1.99E−05
20	19.0000	64.674	3.10E−02	1.63E−02	3.06E+00	1.25E−04	1.19E−02	2.03E−03	1.68E+03	3.19E−10	1.96E−06	8.53E−06	3.19E−07	2.55E−05
21	20.0000	55.293	2.68E−02	1.77E−02	2.61E+00	9.16E−05	9.80E−03	1.63E−03	1.44E+03	1.66E−10	1.75E−06	9.56E−06	2.19E−07	2.89E−05
22	21.0000	47.289	2.33E−02	1.77E−02	2.23E+00	7.22E−05	7.94E−03	1.29E−03	1.22E+03	1.12E−10	1.62E−06	1.03E−05	1.56E−07	2.89E−05
23	22.0000	40.475	2.03E−02	1.82E−02	1.90E+00	6.15E−05	6.35E−03	1.02E−03	1.04E+03	8.59E−11	1.53E−06	1.08E−05	1.14E−07	2.73E−05
24	23.0000	34.668	1.79E−02	1.77E−02	1.62E+00	5.56E−05	5.07E−03	8.37E−04	8.90E+02	6.77E−11	1.53E−06	1.10E−05	8.81E−08	2.44E−05
25	24.0000	29.717	1.56E−02	1.68E−02	1.38E+00	5.08E−05	4.06E−03	6.81E−04	7.59E+02	5.23E−11	1.64E−06	1.11E−05	6.90E−08	2.12E−05

I	Z	P	H2O	O3	CO2	CO	CH4	N2O	O2	NH3	NO	NO2	SO2	HNO3
	(KM)	(MB)						(ATM CM / KM)						
26	25.0000	25.492	1.37E−02	1.59E−02	1.18E+00	4.65E−05	3.27E−03	5.45E−04	6.48E+02	3.82E−11	2.12E−06	1.16E−05	5.43E−08	1.74E−05
27	30.0000	11.970	6.73E−03	9.34E−03	5.41E−01	2.44E−05	1.30E−03	2.02E−04	2.98E+02	9.05E−12	3.49E−06	8.78E−06	1.91E−08	5.33E−06
28	35.0000	5.746	3.21E−03	5.13E−03	2.49E−01	1.32E−05	4.89E−04	6.07E−05	1.37E+02	1.19E−12	4.68E−06	4.77E−06	7.60E−09	1.07E−06
29	40.0000	2.871	1.55E−03	2.26E−03	1.17E−01	7.72E−06	1.74E−04	1.40E−05	6.46E+01	9.09E−14	3.46E−06	1.25E−06	4.21E−09	1.65E−07
30	45.0000	1.491	7.95E−04	7.99E−04	5.78E−02	4.93E−06	5.52E−05	2.42E−06	3.18E+01	4.53E−15	1.78E−06	1.75E−07	3.20E−09	1.84E−08
31	50.0000	0.798	4.15E−04	2.46E−04	3.02E−02	3.65E−06	1.67E−05	3.78E−07	1.66E+01	5.67E−16	8.18E−07	3.52E−08	2.83E−09	4.41E−09
32	55.0000	0.425	2.24E−04	7.91E−05	1.67E−02	2.92E−06	7.25E−06	1.32E−07	9.19E+00	2.11E−16	4.44E−07	1.49E−08	2.02E−09	1.96E−09
33	60.0000	0.220	1.14E−04	2.64E−05	9.11E−03	2.57E−06	3.59E−06	4.95E−08	5.01E+00	8.77E−17	2.42E−07	6.83E−09	1.23E−09	9.20E−10
34	70.0000	0.052	2.24E−05	1.92E−06	2.44E−03	1.96E−06	9.61E−07	7.36E−09	1.34E+00	1.65E−17	7.37E−08	1.48E−09	2.77E−10	2.10E−10
35	80.0000	0.011	2.93E−06	28E−07	5.39E−04	2.14E−06	2.14E−07	1.01E−09	2.99E−01	2.91E−18	3.83E−08	2.89E−10	1.90E−11	4.30E−11
36	100.0000	0.000	1.77E−08	77E−08	9.93E−06	7.48E−07	5.31E−09	1.47E−11	7.08E−03	6.55E−20	9.20E−08	7.52E−12	1.58E−14	1.21E-122

I	Z	CFC−11	CFC−12	CFC−13	CFC−14	CFC−22	CFC−113	CFC−114	CFC−115	CLONO2	HNO4	CHCL2F	CCL4	N2O5
	(KM)	(ATM CM/KM)												
1	0.0000	1.33E−05	2.28E−05	9.48E−14	9.48E−14	5.69E−06	1.80E−06	1.14E−06	9.48E−14	5.45E−07	4.11E−08	9.48E−14	1.23E−05	2.29E−11
2	1.0000	1.20E−05	2.06E−05	8.60E−14	8.60E−14	5.16E−06	1.63E−06	1.03E−06	8.60E−14	4.41E−07	1.84E-07	8.60E−14	1.12E−05	8.21E−11
3	2.0000	1.09E−05	1.87E−05	7.79E−14	7.79E−14	4.67E−06	1.48E−06	9.35E−07	7.79E−14	3.51E−07	2.99E−07	7.79E−14	1.01E−05	1.30E−10
4	3.0000	9.85E−06	1.69E−05	7.04E−14	7.04E−14	4.21E−06	1.34E−06	8.44E−07	7.04E−14	2.73E−07	3.90E−07	7.04E−14	9.15E−06	1.67E−10
5	4.0000	8.88E−06	1.52E−05	6.34E−14	6.34E−14	3.79E−06	1.20E−06	7.61E−07	6.34E−14	2.07E−07	4.59E−07	6.34E−14	8.24E−06	1.96E−10
6	5.0000	7.98E−06	1.37E−05	5.70E−14	5.70E−14	3.41E−06	1.08E−06	6.84E−07	5.70E−14	1.57E−07	1.03E−06	5.70E−14	7.40E−06	2.06E−10
7	6.0000	7.15E−06	1.23E−05	5.11E−14	5.11E−14	3.05E−06	9.71E−07	6.13E−07	5.11E−14	1.15E−07	1.48E−06	5.11E−14	6.61E−06	2.11E−10
8	7.0000	6.39E−06	1.10E−05	4.57E−14	4.57E−14	2.73E−06	8.67E−07	5.48E−07	4.57E−14	7.97E−08	1.83E−06	4.57E−14	5.90E−06	2.12E−10
9	8.0000	5.70E−06	9.76E−06	4.07E−14	4.07E−14	2.43E−06	7.73E−07	4.88E−07	4.07E−14	5.05E−08	2.07E−06	4.07E−14	5.25E−06	2.10E−10
10	9.0000	5.05E−06	8.67E−06	3.61E−14	3.61E−14	2.16E−06	6.86E−07	4.34E−07	3.61E−14	4.37E−08	1.77E−06	3.61E−14	4.66E−06	2.08E−10
11	10.0000	4.46E−06	7.66E−06	3.20E−14	3.20E−14	1.91E−06	6.06E−07	3.84E−07	3.20E−14	3.76E−08	1.51E−06	3.20E−14	4.13E−06	2.04E−10
12	11.0000	3.93E−06	6.76E−06	2.82E−14	2.82E−14	1.68E−06	5.34E−07	3.39E−07	2.82E−14	3.23E−08	1.28E−06	2.82E−14	3.64E−06	1.97E−10
13	12.0000	3.36E−06	5.77E−06	2.41E−14	2.41E−14	1.44E−06	4.56E−07	2.90E−07	2.41E−14	2.68E−08	1.05E−06	2.41E−14	3.11E−06	1.83E−10
14	13.0000	2.78E−06	4.86E−06	2.06E−14	2.06E−14	1.22E−06	3.83E−07	2.45E−07	2.06E−14	1.65E−07	1.17E−06	2.06E−14	2.58E−06	9.09E−09
15	14.0000	2.31E−06	4.09E−06	1.76E−14	1.76E−14	1.03E−06	3.21E−07	2.07E−07	1.76E−14	2.63E−07	1.22E−06	1.76E−14	2.13E−06	1.54E−08
16	15.0000	1.91E−06	3.44E−06	1.51E−14	1.51E−14	8.71E−07	2.69E−07	1.75E−07	1.51E−14	3.29E−07	1.24E−06	1.51E−14	1.76E−06	1.97E−08
17	16.0000	1.58E−06	2.90E−06	1.29E−14	1.29E−14	7.37E−07	2.25E−07	1.48E−07	1.29E−14	3.70E−07	1.22E−06	1.29E−14	1.46E−06	2.24E−08
18	17.0000	1.24E−06	2.37E−06	1.10E−14	1.10E−14	6.13E−07	1.82E−07	1.23E−07	1.10E−14	1.12E−06	1.57E−06	1.10E−14	1.12E−06	9.67E−08
19	18.0000	9.56E−07	1.93E−06	9.41E−15	9.41E−15	5.09E−07	1.46E−07	1.02E−07	9.41E−15	1.64E−06	1.79E−06	9.41E−15	8.53E−07	1.49E−07
20	19.0000	7.32E−07	1.56E−06	8.05E−15	8.05E−15	4.22E−07	1.17E−07	8.47E−08	8.05E−15	1.99E−06	1.91E−06	8.05E−15	6.39E−07	1.84E−07
21	20.0000	5.52E−07	1.27E−06	6.88E−15	6.88E−15	3.50E−07	9.36E−08	7.02E−08	6.88E−15	2.20E−06	1.96E−06	6.88E−15	4.69E−07	2.06E−07
22	21.0000	4.02E−07	1.00E−06	5.86E−15	5.86E−15	2.87E−07	7.25E−08	5.72E−08	5.86E−15	2.70E−06	2.06E−06	5.86E−15	3.35E−07	2.43E−07
23	22.0000	2.85E−07	7.89E−07	4.99E−15	4.99E−15	2.34E−07	5.57E−08	4.65E−08	4.99E−15	3.00E−06	2.09E−06	4.99E−15	2.30E−07	2.65E−07
24	23.0000	1.94E−07	6.17E−07	4.26E−15	4.26E−15	1.91E−07	4.23E−08	3.77E−08	4.26E−15	3.15E−06	2.07E−06	4.26E−15	1.49E−07	2.75E−07
25	24.0000	1.23E−07	4.79E−07	3.63E−15	3.63E−15	1.56E−07	3.16E−08	3.06E−08	3.63E−15	3.20E−06	2.00E−06	3.63E−15	8.72E−08	2.76E−07

I	Z	CFC−11	CFC−12	CFC−13	CFC−14	CFC−22	CFC−113	CFC−114	CFC−115	CLONO2	HNO4	CHCL2F	CCL4	N2O5
	(KM)						(ATM CM/KM)							
26	25.0000	8.46E−08	3.68E−07	3.10E−15	3.10E−15	1.27E−07	2.36E−08	2.47E−08	3.10E−15	3.02E−06	1.80E−06	3.10E−15	5.84E−08	2.39E−07
27	30.0000	5.56E−09	8.38E−08	1.42E−15	1.42E−15	4.31E−08	4.15E−09	8.03E−09	1.42E−15	1.62E−06	7.27E−07	1.42E−15	2.50E−09	7.86E−08
28	35.0000	1.30E−10	1.40E−08	6.55E−16	6.55E−16	1.36E−08	4.69E−10	2.39E−09	6.55E−16	3.43E−07	9.62E−08	6.55E−16	2.59E−11	7.09E−09
29	40.0000	5.72E−13	1.88E−09	3.09E−16	3.09E−16	4.30E−09	3.80E−11	7.17E−10	3.09E−16	1.32E−08	3.08E−09	3.09E−16	1.22E−14	6.59E−11
30	45.0000	1.40E−14	3.25E−10	1.52E−16	1.52E−16	1.58E−09	4.89E−12	2.46E−10	1.52E−16	2.56E−10	1.33E−10	1.52E−16	8.48E−17	5.99E−13
31	50.0000	4.74E−16	6.77E−11	7.95E−17	7.95E−17	6.98E−10	7.87E−13	9.93E−11	7.95E−17	3.71E−12	6.06E−12	7.95E−17	8.69E−19	5.00E−15
32	55.0000	2.69E−17	1.83E−11	4.40E−17	4.40E−17	3.57E−10	1.72E−13	4.57E−11	4.40E−17	5.25E−14	2.99E−13	4.40E−17	1.66E−20	4.59E−17
33	60.0000	1.02E−18	4.65E−12	2.40E−17	2.40E−17	1.85E−10	3.40E−14	2.08E−11	2.40E−17	4.10E−16	1.15E−14	2.40E−17	1.26E−22	1.23E−19
34	70.0000	3.26E−21	2.50E−13	6.41E−18	6.41E−18	4.61E−11	1.13E−15	3.75E−12	6.41E−18	4.64E−19	2.06E−16	6.41E−18	6.33E−26	5.26E−23
35	80.0000	2.83E−24	7.41E−15	1.43E−18	1.43E−18	9.31E−12	1.76E−17	5.07E−13	1.43E−18	5.77E−23	1.20E−18	1.43E−18	4.18E−30	7.27E−27
36	100.0000	1.38E−30	1.10E−18	4.42E−20	4.42E−20	7.92E−14	5.79E−22	9.42E−16	4.42E−20	3.57E−35	1.47E−31	4.42E−20	2.26E−38	0.00E+00

HORIZONTAL PATH AT ALTITUDE = 0.000 KM WITH RANGE = 0.500 KM, MODEL = 6

TOTAL COLUMN ABSORBER AMOUNTS FOR THE LINE-OF-SIGHT PATH:

HNO3 (ATM CM)	O3 UV (ATM CM)	CNTMSLF1 (MOL CM-2)	CNTMSLF2 (MOL CM-2)	CNTMFRN (MOL CM-2)	N2 CONT	MOL SCAT (550 NM EXT)
2.3699E−06	1.2608E−03	7.8474E+19	1.7112E+19	1.0053E+22	4.1207E−01	5.7436E−03

AER 1	AER 2	AER 3	AER 4	CIRRUS	WAT DROP (KM GM/M3)	ICE PART (KM GM/M3)	MEAN AER RH (PRCNT)
0.079000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	46.04

H2O	O3	CO2	CO	CH4	N2O
		(ATM CM)			
3.6710E+02	1.2608E-03	1.8011E+01	7.1096E-03	8.0575E−02	1.5167E−02

O2	NH3	NO	NO2	SO2
		(ATM CM)		
9.9060E+03	2.3699E−05	1.4219E−05	1.0901E−06	1.4219E-05

CFC−11	CFC−12	CFC−13	CFC−14	CFC−22	CFC−113	CFC−114
			(ATM CM)			
6.6356E−06	1.1375E−05	4.7397E−14	4.7397E−14	2.8438E−06	9.0055E−07	5.6877E−07

CFC−115	CLONO2	HNO4	CHCL2F	CCL4	N2O5
			(ATM CM)		
4.7397E−14	2.7253E−07	2.0570E−08	4.7397E−14	6.1616E−06	1.1470E−11

1 RADIANCE(WATTS/CM2−STER−XXX)

0 FREQ (CM−1)	WAVLEN (MICRN)	DIREC EMIS	PATH THERMAL (CM−1)	PATH THERMAL (MICRN)	SCAT PART (CM−1)	SURFACE EMISSION (CM−1)	SURFACE EMISSION (MICRN)	SURFACE REFLECTED (CM−1)	SURFACE REFLECTED (MICRN)	TOTAL RADIANCE (CM−1)	TOTAL RADIANCE (MICRN)	INTEGRAL	TOTAL TRANS
765.	13.072	0.950	1.14E-06	6.66E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-06	6.66E-05	5.69E-07	0.90476
766.	13.055	0.950	1.02E−06	6.01E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E−06	6.01E−05	1.59E−06	0.91424
767.	13.038	0.950	1.22E−06	7.15E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.22E−06	7.15E−05	2.81E−06	0.89808
768.	13.021	0.950	1.03E−06	6.06E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E−06	6.06E−05	3.84E−06	0.91375
769.	13.004	0.950	2.31E−06	1.36E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.31E−06	1.36E−04	6.14E−06	0.80621
770.	12.987	0.950	2.44E−06	1.44E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.44E−06	1.44E−04	8.58E−06	0.79511
771.	12.970	0.950	8.92E−07	5.30E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.92E−07	5.30E−05	9.47E−06	0.92489
772.	12.953	0.950	7.53E−07	4.49E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.53E−07	4.49E−05	1.02E−05	0.93651
773.	12.937	0.950	7.91E−07	4.73E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.91E−07	4.73E−05	1.10E−05	0.93319
774.	12.920	0.950	8.22E−07	4.93E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.22E−07	4.93E−05	1.18E−05	0.93047
775.	12.903	0.950	1.02E−06	6.12E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E−06	6.12E−05	1.29E−05	0.91368
776.	12.887	0.950	3.23E−06	1.94E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.23E−06	1.94E−04	1.61E−05	0.72658
777.	12.870	0.950	4.25E−06	2.57E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.25E−06	2.57E−04	2.03E−05	0.63922
778.	12.853	0.950	8.73E−07	5.28E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.73E−07	5.28E−05	2.12E−05	0.92582
779.	12.837	0.950	2.41E−06	1.46E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E−06	1.46E−04	2.36E−05	0.79491
780.	12.821	0.950	8.43E−07	5.13E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.43E−07	5.13E−05	2.45E−05	0.92822
781.	12.804	0.950	7.08E−07	4.32E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.08E−07	4.32E−05	2.52E−05	0.93962
782.	12.788	0.950	7.23E−07	4.42E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.23E−07	4.42E−05	2.59E−05	0.93829
783.	12.771	0.950	8.10E−07	4.96E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.10E−07	4.96E−05	2.67E−05	0.93078
784.	12.755	0.950	5.07E−06	3.11E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.07E−06	3.11E−04	3.18E−05	0.56615
785.	12.739	0.950	1.62E−06	9.97E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E−06	9.97E−05	3.34E−05	0.86132
786.	12.723	0.950	7.00E−07	4.33E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.00E−07	4.33E−05	3.41E−05	0.93990
787.	12.706	0.950	6.53E−07	4.04E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E−07	4.04E−05	3.47E−05	0.94391
788.	12.690	0.950	6.53E−07	4.05E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E−07	4.05E−05	3.54E−05	0.94382

789.	12.674	0.950	6.01E−07	3.74E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.01E−07	3.74E−05	3.60E−05	0.94824
790.	12.658	0.950	6.23E−07	3.89E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.23E−07	3.89E−05	3.66E−05	0.94623
791.	12.642	0.950	8.36E−07	5.23E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.36E−07	5.23E−05	3.75E−05	0.92779
792.	12.626	0.950	1.88E−06	1.18E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.88E−06	1.18E−04	3.93E−05	0.83749
793.	12.610	0.950	9.27E−07	5.83E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.27E−07	5.83E−05	4.03E−05	0.91972
794.	12.594	0.950	3.29E−06	2.08E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.29E−06	2.08E−04	4.35E−05	0.71455
795.	12.579	0.950	1.10E−06	6.94E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E−06	6.94E−05	4.46E−05	0.90472
796.	12.563	0.950	5.24E−06	3.32E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.24E−06	3.32E−04	4.99E−05	0.54396
797.	12.547	0.950	1.06E−06	6.74E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E−06	6.74E−05	5.10E−05	0.90769
798.	12.531	0.950	2.59E−06	1.65E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.59E−06	1.65E−04	5.35E−05	0.77386
799.	12.516	0.950	6.75E−06	4.31E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.75E−06	4.31E−04	6.03E−05	0.41086
800.	12.500	0.950	8.08E−07	5.17E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.08E−07	5.17E−05	6.11E−05	0.92934
801.	12.484	0.950	6.30E−07	4.04E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.30E−07	4.04E−05	6.17E−05	0.94489
802.	12.469	0.950	6.86E−07	4.41E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.86E−07	4.41E−05	6.24E−05	0.93985
803.	12.453	0.950	2.41E−06	1.56E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E−06	1.56E−04	6.48E−05	0.78834
804.	12.438	0.950	2.96E−06	1.91E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.96E−06	1.91E−04	6.78E−05	0.73987
805.	12.422	0.950	6.50E−07	4.21E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.50E−07	4.21E−05	6.84E−05	0.94278
806.	12.407	0.950	9.26E−07	6.02E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.26E−07	6.02E−05	6.94E−05	0.91838
807.	12.392	0.950	6.86E−07	4.46E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.86E−07	4.46E−05	7.01E−05	0.93950
808.	12.376	0.950	2.66E−06	1.74E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.66E−06	1.74E−04	7.27E−05	0.76496
809.	12.361	0.950	7.38E−07	4.83E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.38E−07	4.83E−05	7.34E−05	0.93473
810.	12.346	0.950	5.32E−07	3.49E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.32E−07	3.49E−05	7.40E−05	0.95288
811.	12.330	0.950	5.63E−07	3.70E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.63E−07	3.70E−05	7.45E−05	0.95003
812.	12.315	0.950	5.55E−07	3.66E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.55E−07	3.66E−05	7.51E−05	0.95070
813.	12.300	0.950	5.62E−07	3.71E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.62E−07	3.71E−05	7.57E−05	0.95001
814.	12.285	0.950	1.97E−06	1.31E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E−06	1.31E−04	7.76E−05	0.82408
815.	12.270	0.950	2.00E−06	1.33E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E−06	1.33E−04	7.96E−05	0.82195
816.	12.255	0.950	5.88E−07	3.91E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.88E−07	3.91E−05	8.02E−05	0.94749
817.	12.240	0.950	5.19E−07	3.46E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.19E−07	3.46E−05	8.07E−05	0.95356

818.	12.225	0.950	4.84E−07	3.24E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.84E−07	3.24E−05	8.12E−05	0.95659
819.	12.210	0.950	4.98E−07	3.34E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.98E−07	3.34E−05	8.17E−05	0.95530
820.	12.195	0.950	4.91E−07	3.30E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.91E−07	3.30E−05	8.22E−05	0.95590
821.	12.180	0.950	4.72E−07	3.18E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.72E−07	3.18E−05	8.27E−05	0.95755
822.	12.165	0.950	4.83E−07	3.26E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.83E−07	3.26E−05	8.32E−05	0.95648
823.	12.151	0.950	4.98E−07	3.38E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.98E−07	3.38E−05	8.37E−05	0.95503
824.	12.136	0.950	4.72E−07	3.21E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.72E−07	3.21E−05	8.41E−05	0.95730
825.	12.121	0.950	1.10E−06	7.50E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E−06	7.50E−05	8.52E−05	0.90023
826.	12.107	0.950	4.97E−07	3.39E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.97E−07	3.39E−05	8.57E−05	0.95499
827.	12.092	0.950	8.41E−07	5.75E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.41E−07	5.75E−05	8.66E−05	0.92368
828.	12.077	0.950	1.87E−06	1.28E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.87E−06	1.28E−04	8.84E−05	0.83038
829.	12.063	0.950	4.82E−07	3.31E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.82E−07	3.31E−05	8.89E−05	0.95616
830.	12.048	0.950	4.58E−07	3.16E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.58E−07	3.16E−05	8.94E−05	0.95821
831.	12.034	0.950	4.56E−07	3.15E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.56E−07	3.15E−05	8.98E−05	0.95840
832.	12.019	0.950	4.41E−07	3.05E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.41E−07	3.05E−05	9.03E−05	0.95966
833.	12.005	0.950	4.42E−07	3.07E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.42E−07	3.07E−05	9.07E−05	0.95955
834.	11.990	0.950	4.38E−07	3.04E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.38E−07	3.04E−05	9.12E−05	0.95988
835.	11.976	0.950	4.54E−07	3.17E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.54E−07	3.17E−05	9.16E−05	0.95829
836.	11.962	0.950	6.53E−07	4.56E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E−07	4.56E−05	9.23E−05	0.93994
837.	11.947	0.950	4.34E−07	3.04E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.34E−07	3.04E−05	9.27E−05	0.96004
838.	11.933	0.950	4.63E−07	3.25E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.63E−07	3.25E−05	9.32E−05	0.95731
839.	11.919	0.950	4.72E−07	3.32E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.72E−07	3.32E−05	9.36E−05	0.95641
840.	11.905	0.950	2.10E−06	1.48E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E−06	1.48E−04	9.57E−05	0.80561
841.	11.891	0.950	4.93E−07	3.49E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.93E−07	3.49E−05	9.62E−05	0.95434
842.	11.876	0.950	6.69E−07	4.74E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.69E−07	4.74E−05	9.69E−05	0.93796
843.	11.862	0.950	4.28E−07	3.04E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.28E−07	3.04E−05	9.73E−05	0.96025
844.	11.848	0.950	4.20E−07	2.99E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.20E−07	2.99E−05	9.77E−05	0.96095
845.	11.834	0.950	4.18E−07	2.99E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.18E−07	2.99E−05	9.82E−05	0.96099
846.	11.820	0.950	4.38E−07	3.13E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.38E−07	3.13E−05	9.86E−05	0.95914
847.	11.806	0.950	4.21E−07	3.02E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.21E−07	3.02E−05	9.90E−05	0.96064

848.	11.792	0.950	4.25E−07	3.06E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.25E−07	3.06E−05	9.94E−05	0.96018
849.	11.779	0.950	5.45E−07	3.93E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.45E−07	3.93E−05	1.00E−04	0.94884
850.	11.765	0.950	1.97E−06	1.42E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E−06	1.42E−04	1.02E−04	0.81480
851.	11.751	0.950	5.01E−07	3.63E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.01E−07	3.63E−05	1.02E−04	0.95290
852.	11.737	0.950	3.14E−06	2.28E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.14E−06	2.28E−04	1.06E−04	0.70458
853.	11.723	0.950	2.17E−06	1.58E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.17E−06	1.58E−04	1.08E−04	0.79566
854.	11.710	0.950	6.33E−07	4.62E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.33E−07	4.62E−05	1.08E−04	0.94014
855.	11.696	0.950	1.93E−06	1.41E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.93E−06	1.41E−04	1.10E−04	0.81767
856.	11.682	0.950	4.25E−07	3.12E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.25E−07	3.12E−05	1.11E−04	0.95967
857.	11.669	0.950	3.96E−07	2.91E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.96E−07	2.91E−05	1.11E−04	0.96243
858.	11.655	0.950	3.90E−07	2.87E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.90E−07	2.87E−05	1.12E−04	0.96290
859.	11.641	0.950	5.70E−07	4.20E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.70E−07	4.20E−05	1.12E−04	0.94574
860.	11.628	0.950	4.56E−07	3.37E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.56E−07	3.37E−05	1.13E−04	0.95648
861.	11.614	0.950	3.79E−07	2.81E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.79E−07	2.81E−05	1.13E−04	0.96382
862.	11.601	0.950	3.78E−07	2.81E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E−07	2.81E−05	1.13E−04	0.96387
863.	11.587	0.950	3.75E−07	2.79E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.75E−07	2.79E−05	1.14E−04	0.96410
864.	11.574	0.950	3.88E−07	2.90E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.88E−07	2.90E−05	1.14E−04	0.96273
865.	11.561	0.950	1.36E−06	1.01E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E−06	1.01E−04	1.15E−04	0.86966
866.	11.547	0.950	4.40E−07	3.30E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.40E−07	3.30E−05	1.16E−04	0.95758
867.	11.534	0.950	3.72E−07	2.80E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.72E−07	2.80E−05	1.16E−04	0.96408
868.	11.521	0.950	3.68E−07	2.77E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.68E−07	2.77E−05	1.17E−04	0.96448
869.	11.507	0.950	3.64E−07	2.75E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.64E−07	2.75E−05	1.17E−04	0.96475
870.	11.494	0.950	3.73E−07	2.83E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.73E−07	2.83E−05	1.17E−04	0.96380
871.	11.481	0.950	1.51E−06	1.15E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E−06	1.15E−04	1.19E−04	0.85300
872.	11.468	0.950	4.21E−07	3.20E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.21E−07	3.20E−05	1.19E−04	0.95901
873.	11.455	0.950	3.61E−07	2.75E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.61E−07	2.75E−05	1.20E−04	0.96482
874.	11.442	0.950	3.55E−07	2.71E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.55E−07	2.71E−05	1.20E−04	0.96541
875.	11.429	0.950	3.52E−07	2.70E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.52E−07	2.70E−05	1.20E−04	0.96559
876.	11.416	0.950	3.73E−07	2.86E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.73E−07	2.86E−05	1.21E−04	0.96353

877.	11.403	0.950	3.52E−07	2.71E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.52E−07	2.71E−05	1.21E−04	0.96544
878.	11.390	0.950	4.13E−07	3.19E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.13E−07	3.19E−05	1.21E−04	0.95941
879.	11.377	0.950	9.90E−07	7.65E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.90E−07	7.65E−05	1.22E−04	0.90257
880.	11.364	0.950	3.60E−07	2.78E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.60E−07	2.78E−05	1.23E−04	0.96457
881.	11.351	0.950	5.43E−07	4.22E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.43E−07	4.22E−05	1.23E−04	0.94640
882.	11.338	0.950	3.53E−07	2.75E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.53E−07	2.75E−05	1.24E−04	0.96508
883.	11.325	0.950	5.11E−07	3.98E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.11E−07	3.98E−05	1.24E−04	0.94941
884.	11.312	0.950	1.04E−06	8.16E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E−06	8.16E−05	1.25E−04	0.89642
885.	11.299	0.950	3.56E−07	2.79E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.56E−07	2.79E−05	1.26E−04	0.96464
886.	11.287	0.950	3.59E−07	2.82E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.59E−07	2.82E−05	1.26E−04	0.96430
887.	11.274	0.950	1.52E−06	1.20E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E−06	1.20E−04	1.28E−04	0.84809
888.	11.261	0.950	4.27E−07	3.36E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.27E−07	3.36E−05	1.28E−04	0.95742
889.	11.249	0.950	7.18E−07	5.68E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.18E−07	5.68E−05	1.29E−04	0.92818
890.	11.236	0.950	4.87E−07	3.86E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.87E−07	3.86E−05	1.29E−04	0.95119
891.	11.223	0.950	5.13E−07	4.07E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.13E−07	4.07E−05	1.30E−04	0.94850
892.	11.211	0.950	3.36E−07	2.67E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.36E−07	2.67E−05	1.30E−04	0.96621
893.	11.198	0.950	3.24E−07	2.59E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.24E−07	2.59E−05	1.30E−04	0.96733
894.	11.186	0.950	3.20E−07	2.55E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E−07	2.55E−05	1.31E−04	0.96778
895.	11.173	0.950	3.20E−07	2.57E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E−07	2.57E−05	1.31E−04	0.96763
896.	11.161	0.950	3.29E−07	2.64E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.29E−07	2.64E−05	1.31E−04	0.96670
897.	11.148	0.950	3.51E−07	2.82E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.51E−07	2.82E−05	1.32E−04	0.96443
898.	11.136	0.950	4.07E−07	3.28E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.07E−07	3.28E−05	1.32E−04	0.95871
899.	11.123	0.950	3.17E−07	2.56E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.17E−07	2.56E−05	1.32E−04	0.96778
900.	11.111	0.950	3.13E−07	2.54E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.13E−07	2.54E−05	1.33E−04	0.96808
901.	11.099	0.950	3.11E−07	2.52E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.11E−07	2.52E−05	1.33E−04	0.96826
902.	11.086	0.950	3.16E−07	2.57E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.16E−07	2.57E−05	1.33E−04	0.96765
903.	11.074	0.950	3.18E−07	2.59E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.18E−07	2.59E−05	1.34E−04	0.96747
904.	11.062	0.950	3.09E−07	2.52E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.09E−07	2.52E−05	1.34E−04	0.96830
905.	11.050	0.950	3.40E−07	2.79E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.40E−07	2.79E−05	1.34E−04	0.96505

906.	11.038	0.950	6.34E−07	5.21E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.34E−07	5.21E−05	1.35E−04	0.93469
907.	11.025	0.950	3.75E−07	3.08E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.75E−07	3.08E−05	1.35E−04	0.96135
908.	11.013	0.950	3.78E−07	3.11E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E−07	3.11E−05	1.36E−04	0.96097
909.	11.001	0.950	1.77E−06	1.47E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E−06	1.47E−04	1.37E−04	0.81641
910.	10.989	0.950	4.14E−07	3.43E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.14E−07	3.43E−05	1.38E−04	0.95704
911.	10.977	0.950	3.51E−07	2.92E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.51E−07	2.92E−05	1.38E−04	0.96351
912.	10.965	0.950	3.13E−07	2.60E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.13E−07	2.60E−05	1.39E−04	0.96748
913.	10.953	0.950	3.07E−07	2.56E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.07E−07	2.56E−05	1.39E−04	0.96804
914.	10.941	0.950	4.68E−07	3.91E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.68E−07	3.91E−05	1.39E−04	0.95117
915.	10.929	0.950	3.10E−07	2.60E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.10E−07	2.60E−05	1.40E−04	0.96755
916.	10.917	0.950	2.99E−07	2.51E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.99E−07	2.51E−05	1.40E−04	0.96867
917.	10.905	0.950	3.04E−07	2.56E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E−07	2.56E−05	1.40E−04	0.96809
918.	10.893	0.950	4.76E−07	4.02E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.76E−07	4.02E−05	1.41E−04	0.94990
919.	10.881	0.950	3.13E−07	2.64E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.13E−07	2.64E−05	1.41E−04	0.96708
920.	10.870	0.950	3.02E−07	2.55E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.02E−07	2.55E−05	1.41E−04	0.96816
921.	10.858	0.950	4.42E−07	3.75E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.42E−07	3.75E−05	1.42E−04	0.95326
922.	10.846	0.950	1.25E−06	1.06E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E−06	1.06E−04	1.43E−04	0.86765
923.	10.834	0.950	3.44E−07	2.93E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E−07	2.93E−05	1.43E−04	0.96351
924.	10.823	0.950	3.09E−07	2.64E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.09E−07	2.64E−05	1.44E−04	0.96714
925.	10.811	0.950	9.92E−07	8.49E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.92E−07	8.49E−05	1.45E−04	0.89433
926.	10.799	0.950	3.05E−07	2.62E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.05E−07	2.62E−05	1.45E−04	0.96746
927.	10.787	0.950	3.07E−07	2.64E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.07E−07	2.64E−05	1.45E−04	0.96718
928.	10.776	0.950	2.87E−07	2.47E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.87E−07	2.47E−05	1.46E−04	0.96924
929.	10.764	0.950	3.91E−07	3.37E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.91E−07	3.37E−05	1.46E−04	0.95811
930.	10.753	0.950	2.86E−07	2.48E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.86E−07	2.48E−05	1.46E−04	0.96924
931.	10.741	0.950	3.13E−07	2.72E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.13E−07	2.72E−05	1.47E−04	0.96626
932.	10.730	0.950	2.93E−07	2.55E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.93E−07	2.55E−05	1.47E−04	0.96838
933.	10.718	0.950	3.09E−07	2.69E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.09E−07	2.69E−05	1.47E−04	0.96664
934.	10.707	0.950	2.75E−07	2.40E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.75E−07	2.40E−05	1.47E−04	0.97020
935.	10.695	0.950	3.14E−07	2.75E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.14E−07	2.75E−05	1.48E−04	0.96593

936.	10.684	0.950	2.75E−07	2.41E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.75E−07	2.41E−05	1.48E−04	0.97016
937.	10.672	0.950	3.31E−07	2.91E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.31E−07	2.91E−05	1.48E−04	0.96399
938.	10.661	0.950	2.75E−07	2.42E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.75E−07	2.42E−05	1.49E−04	0.96999
939.	10.650	0.950	3.15E−07	2.78E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.15E−07	2.78E−05	1.49E−04	0.96555
940.	10.638	0.950	2.76E−07	2.44E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.76E−07	2.44E−05	1.49E−04	0.96974
941.	10.627	0.950	4.18E−07	3.70E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.18E−07	3.70E−05	1.50E−04	0.95419
942.	10.616	0.950	3.25E−07	2.88E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.25E−07	2.88E−05	1.50E−04	0.96431
943.	10.604	0.950	2.69E−07	2.39E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.69E−07	2.39E−05	1.50E−04	0.97045
944.	10.593	0.950	3.49E−07	3.11E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.49E−07	3.11E−05	1.51E−04	0.96157
945.	10.582	0.950	3.73E−07	3.33E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.73E−07	3.33E−05	1.51E−04	0.95877
946.	10.571	0.950	3.35E−07	3.00E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.35E−07	3.00E−05	1.51E−04	0.96292
947.	10.560	0.950	3.14E−07	2.81E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.14E−07	2.81E−05	1.52E−04	0.96524
948.	10.549	0.950	1.31E−06	1.18E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E−06	1.18E−04	1.53E−04	0.85461
949.	10.537	0.950	3.67E−07	3.30E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.67E−07	3.30E−05	1.53E−04	0.95916
950.	10.526	0.950	2.61E−07	2.35E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.61E−07	2.35E−05	1.54E−04	0.97094
951.	10.515	0.950	3.15E−07	2.85E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.15E−07	2.85E−05	1.54E−04	0.96479
952.	10.504	0.950	2.56E−07	2.32E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.56E−07	2.32E−05	1.54E−04	0.97140
953.	10.493	0.950	5.87E−07	5.33E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.87E−07	5.33E−05	1.55E−04	0.93418
954.	10.482	0.950	2.96E−07	2.69E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.96E−07	2.69E−05	1.55E−04	0.96680
955.	10.471	0.950	5.50E−07	5.02E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.50E−07	5.02E−05	1.56E−04	0.93804
956.	10.460	0.950	3.95E−07	3.61E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.95E−07	3.61E−05	1.56E−04	0.95544
957.	10.449	0.950	2.44E−07	2.23E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.44E−07	2.23E−05	1.56E−04	0.97244
958.	10.438	0.950	2.65E−07	2.43E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E−07	2.43E−05	1.56E−04	0.97004
959.	10.428	0.950	3.37E−07	3.10E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.37E−07	3.10E−05	1.57E−04	0.96174
960.	10.417	0.950	3.18E−07	2.93E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.18E−07	2.93E−05	1.57E−04	0.96385
961.	10.406	0.950	2.50E−07	2.31E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E−07	2.31E−05	1.57E−04	0.97157
962.	10.395	0.950	2.60E−07	2.41E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E−07	2.41E−05	1.58E−04	0.97031
963.	10.384	0.950	2.51E−07	2.33E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.51E−07	2.33E−05	1.58E−04	0.97132
964.	10.373	0.950	2.35E−07	2.19E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.35E−07	2.19E−05	1.58E−04	0.97306
965.	10.363	0.950	2.69E−07	2.50E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.69E−07	2.50E−05	1.58E−04	0.96915

966.	10.352	0.950	3.45E−07	3.22E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.45E−07	3.22E−05	1.59E−04	0.96038
967.	10.341	0.950	3.91E−07	3.66E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.91E−07	3.66E−05	1.59E−04	0.95493
968.	10.331	0.950	2.88E−07	2.70E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.88E−07	2.70E−05	1.59E−04	0.96672
969.	10.320	0.950	2.89E−07	2.71E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.89E−07	2.71E−05	1.60E−04	0.96664
970.	10.309	0.950	2.49E−07	2.34E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.49E−07	2.34E−05	1.60E−04	0.97114
971.	10.299	0.950	5.12E−07	4.83E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.12E−07	4.83E−05	1.60E−04	0.94060
972.	10.288	0.950	4.18E−07	3.95E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.18E−07	3.95E−05	1.61E−04	0.95137
973.	10.277	0.950	5.08E−07	4.81E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.08E−07	4.81E−05	1.61E−04	0.94079
974.	10.267	0.950	4.34E−07	4.12E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.34E−07	4.12E−05	1.62E−04	0.94935
975.	10.256	0.950	3.01E−07	2.86E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.01E−07	2.86E−05	1.62E−04	0.96483
976.	10.246	0.950	6.19E−07	5.89E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.19E−07	5.89E−05	1.63E−04	0.92749
977.	10.235	0.950	4.33E−07	4.13E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.33E−07	4.13E−05	1.63E−04	0.94914
978.	10.225	0.950	2.90E−07	2.78E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.90E−07	2.78E−05	1.63E−04	0.96585
979.	10.215	0.950	2.33E−07	2.23E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.33E−07	2.23E−05	1.64E−04	0.97258
980.	10.204	0.950	2.60E−07	2.49E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E−07	2.49E−05	1.64E−04	0.96933
981.	10.194	0.950	2.77E−07	2.67E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.77E−07	2.67E−05	1.64E−04	0.96717
982.	10.183	0.950	2.63E−07	2.53E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E−07	2.53E−05	1.64E−04	0.96886
983.	10.173	0.950	2.41E−07	2.33E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E−07	2.33E−05	1.65E−04	0.97138
984.	10.163	0.950	3.05E−07	2.96E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.05E−07	2.96E−05	1.65E−04	0.96366
985.	10.152	0.950	2.31E−07	2.24E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.31E−07	2.24E−05	1.65E−04	0.97247
986.	10.142	0.950	2.09E−07	2.03E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.09E−07	2.03E−05	1.65E−04	0.97499
987.	10.132	0.950	2.21E−07	2.15E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.21E−07	2.15E−05	1.66E−04	0.97356
988.	10.121	0.950	2.15E−07	2.10E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E−07	2.10E−05	1.66E−04	0.97415
989.	10.111	0.950	2.17E−07	2.13E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.17E−07	2.13E−05	1.66E−04	0.97387
990.	10.101	0.950	2.32E−07	2.28E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.32E−07	2.28E−05	1.66E−04	0.97200
991.	10.091	0.950	2.08E−07	2.04E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E−07	2.04E−05	1.67E−04	0.97488
992.	10.081	0.950	2.12E−07	2.08E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.12E−07	2.08E−05	1.67E−04	0.97441
993.	10.070	0.950	2.07E−07	2.04E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.07E−07	2.04E−05	1.67E−04	0.97491
994.	10.060	0.950	2.16E−07	2.13E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E−07	2.13E−05	1.67E−04	0.97380
995.	10.050	0.950	2.11E−07	2.09E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.11E−07	2.09E−05	1.67E−04	0.97433

996.	10.040	0.950	2.05E−07	2.03E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E−07	2.03E−05	1.68E−04	0.97500
997.	10.030	0.950	2.07E−07	2.05E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.07E−07	2.05E−05	1.68E−04	0.97474
998.	10.020	0.950	2.17E−07	2.16E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.17E−07	2.16E−05	1.68E−04	0.97348
999.	10.010	0.950	3.38E−07	3.38E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.38E−07	3.38E−05	1.68E−04	0.95850
1000.	10.000	0.950	3.65E−07	3.65E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.65E−07	3.65E−05	1.69E−04	0.95512
1001.	9.990	0.950	2.35E−07	2.36E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.35E−07	2.36E−05	1.69E−04	0.97105
1002.	9.980	0.950	2.09E−07	2.10E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.09E−07	2.10E−05	1.69E−04	0.97422
1003.	9.970	0.950	2.13E−07	2.15E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.13E−07	2.15E−05	1.69E−04	0.97361
1004.	9.960	0.950	3.51E−07	3.54E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.51E−07	3.54E−05	1.70E−04	0.95646
1005.	9.950	0.950	2.13E−07	2.15E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.13E−07	2.15E−05	1.70E−04	0.97359
1006.	9.940	0.950	2.10E−07	2.13E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E−07	2.13E−05	1.70E−04	0.97383
1007.	9.930	0.950	2.47E−07	2.51E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E−07	2.51E−05	1.70E−04	0.96915
1008.	9.921	0.950	2.18E−07	2.21E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.18E−07	2.21E−05	1.71E−04	0.97277
1009.	9.911	0.950	2.14E−07	2.18E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.14E−07	2.18E−05	1.71E−04	0.97323
1010.	9.901	0.950	5.48E−07	5.59E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.48E−07	5.59E−05	1.71E−04	0.93126
1011.	9.891	0.950	5.30E−07	5.41E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.30E−07	5.41E−05	1.72E−04	0.93340
1012.	9.881	0.950	2.43E−07	2.49E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.43E−07	2.49E−05	1.72E−04	0.96935
1013.	9.872	0.950	2.29E−07	2.35E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E−07	2.35E−05	1.72E−04	0.97103
1014.	9.862	0.950	1.03E−06	1.06E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E−06	1.06E−04	1.73E−04	0.87009
1015.	9.852	0.950	2.96E−07	3.05E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.96E−07	3.05E−05	1.74E−04	0.96251
1016.	9.843	0.950	2.32E−07	2.40E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.32E−07	2.40E−05	1.74E−04	0.97048
1017.	9.833	0.950	3.75E−07	3.88E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.75E−07	3.88E−05	1.74E−04	0.95228
1018.	9.823	0.950	5.93E−07	6.15E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.93E−07	6.15E−05	1.75E−04	0.92431
1019.	9.814	0.950	2.57E−07	2.67E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.57E−07	2.67E−05	1.75E−04	0.96714
1020.	9.804	0.950	2.53E−07	2.63E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.53E−07	2.63E−05	1.75E−04	0.96765
1021.	9.794	0.950	2.48E−07	2.59E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.48E−07	2.59E−05	1.76E−04	0.96815
1022.	9.785	0.950	2.67E−07	2.79E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.67E−07	2.79E−05	1.76E−04	0.96569
1023.	9.775	0.950	2.53E−07	2.64E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.53E−07	2.64E−05	1.76E−04	0.96744
1024.	9.766	0.950	2.33E−07	2.44E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.33E−07	2.44E−05	1.76E−04	0.96989
1025.	9.756	0.950	2.56E−07	2.69E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.56E−07	2.69E−05	1.77E−04	0.96691

1026.	9.747	0.950	2.32E−07	2.44E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.32E−07	2.44E−05	1.77E−04	0.96992
1027.	9.737	0.950	2.63E−07	2.78E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E−07	2.78E−05	1.77E−04	0.96578
1028.	9.728	0.950	5.98E−07	6.32E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.98E−07	6.32E−05	1.78E−04	0.92215
1029.	9.718	0.950	6.90E−07	7.31E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.90E−07	7.31E−05	1.78E−04	0.90992
1030.	9.709	0.950	3.85E−07	4.08E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.85E−07	4.08E−05	1.79E−04	0.94969
1031.	9.699	0.950	3.78E−07	4.02E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E−07	4.02E−05	1.79E−04	0.95047
1032.	9.690	0.950	2.72E−07	2.90E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.72E−07	2.90E−05	1.79E−04	0.96426
1033.	9.681	0.950	3.03E−07	3.23E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.03E−07	3.23E−05	1.80E−04	0.96014
1034.	9.671	0.950	2.24E−07	2.39E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.24E−07	2.39E−05	1.80E−04	0.97050
1035.	9.662	0.950	2.77E−07	2.97E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.77E−07	2.97E−05	1.80E−04	0.96338
1036.	9.653	0.950	2.28E−07	2.45E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.28E−07	2.45E−05	1.81E−04	0.96974
1037.	9.643	0.950	2.77E−07	2.97E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.77E−07	2.97E−05	1.81E−04	0.96329
1038.	9.634	0.950	2.74E−07	2.96E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E−07	2.96E−05	1.81E−04	0.96349
1039.	9.625	0.950	4.75E−07	5.13E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.75E−07	5.13E−05	1.82E−04	0.93661
1040.	9.615	0.950	3.08E−07	3.33E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.08E−07	3.33E−05	1.82E−04	0.95882
1041.	9.606	0.950	2.93E−07	3.17E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.93E−07	3.17E−05	1.82E−04	0.96083
1042.	9.597	0.950	2.08E−07	2.26E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E−07	2.26E−05	1.82E−04	0.97206
1043.	9.588	0.950	3.91E−07	4.26E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.91E−07	4.26E−05	1.83E−04	0.94738
1044.	9.579	0.950	1.83E−07	1.99E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E−07	1.99E−05	1.83E−04	0.97535
1045.	9.569	0.950	2.65E−07	2.89E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E−07	2.89E−05	1.83E−04	0.96420
1046.	9.560	0.950	2.12E−07	2.32E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.12E−07	2.32E−05	1.83E−04	0.97126
1047.	9.551	0.950	2.94E−07	3.22E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.94E−07	3.22E−05	1.84E−04	0.96015
1048.	9.542	0.950	2.46E−07	2.71E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.46E−07	2.71E−05	1.84E−04	0.96650
1049.	9.533	0.950	5.18E−07	5.70E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.18E−07	5.70E−05	1.84E−04	0.92941
1050.	9.524	0.950	3.87E−07	4.26E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.87E−07	4.26E−05	1.85E−04	0.94719
1051.	9.515	0.950	4.73E−07	5.22E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.73E−07	5.22E−05	1.85E−04	0.93532
1052.	9.506	0.950	3.84E−07	4.25E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.84E−07	4.25E−05	1.86E−04	0.94736
1053.	9.497	0.950	2.65E−07	2.94E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E−07	2.94E−05	1.86E−04	0.96358
1054.	9.488	0.950	3.56E−07	3.95E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.56E−07	3.95E−05	1.86E−04	0.95101
1055.	9.479	0.950	3.07E−07	3.42E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.07E−07	3.42E−05	1.87E−04	0.95759

1056.	9.470	0.950	5.24E−07	5.84E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.24E−07	5.84E−05	1.87E−04	0.92757
1057.	9.461	0.950	3.21E−07	3.58E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.21E−07	3.58E−05	1.87E−04	0.95553
1058.	9.452	0.950	2.72E−07	3.05E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.72E−07	3.05E−05	1.88E−04	0.96215
1059.	9.443	0.950	3.82E−07	4.29E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.82E−07	4.29E−05	1.88E−04	0.94677
1060.	9.434	0.950	5.66E−07	6.36E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.66E−07	6.36E−05	1.89E−04	0.92106
1061.	9.425	0.950	2.69E−07	3.03E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.69E−07	3.03E−05	1.89E−04	0.96234
1062.	9.416	0.950	2.72E−07	3.07E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.72E−07	3.07E−05	1.89E−04	0.96188
1063.	9.407	0.950	4.49E−07	5.07E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.49E−07	5.07E−05	1.90E−04	0.93696
1064.	9.398	0.950	2.13E−07	2.41E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.13E−07	2.41E−05	1.90E−04	0.97007
1065.	9.390	0.950	2.41E−07	2.73E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E−07	2.73E−05	1.90E−04	0.96603
1066.	9.381	0.950	2.01E−06	2.28E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.01E−06	2.28E−04	1.92E−04	0.71575
1067.	9.372	0.950	3.04E−07	3.46E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E−07	3.46E−05	1.92E−04	0.95691
1068.	9.363	0.950	2.25E−07	2.57E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.25E−07	2.57E−05	1.93E−04	0.96804
1069.	9.355	0.950	2.31E−07	2.63E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.31E−07	2.63E−05	1.93E−04	0.96720
1070.	9.346	0.950	2.32E−07	2.65E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.32E−07	2.65E−05	1.93E−04	0.96696
1071.	9.337	0.950	1.75E−07	2.00E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E−07	2.00E−05	1.93E−04	0.97503
1072.	9.328	0.950	2.58E−07	2.96E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.58E−07	2.96E−05	1.94E−04	0.96310
1073.	9.320	0.950	4.19E−07	4.82E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.19E−07	4.82E−05	1.94E−04	0.93989
1074.	9.311	0.950	1.02E−06	1.18E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E−06	1.18E−04	1.95E−04	0.85333
1075.	9.302	0.950	3.41E−07	3.94E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.41E−07	3.94E−05	1.95E−04	0.95084
1076.	9.294	0.950	3.52E−07	4.07E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.52E−07	4.07E−05	1.96E−04	0.94918
1077.	9.285	0.950	2.56E−07	2.97E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.56E−07	2.97E−05	1.96E−04	0.96291
1078.	9.276	0.950	1.79E−07	2.08E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E−07	2.08E−05	1.96E−04	0.97407
1079.	9.268	0.950	2.42E−07	2.82E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E−07	2.82E−05	1.96E−04	0.96474
1080.	9.259	0.950	2.43E−07	2.83E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.43E−07	2.83E−05	1.97E−04	0.96463
1081.	9.251	0.950	2.70E−07	3.15E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.70E−07	3.15E−05	1.97E−04	0.96054
1082.	9.242	0.950	2.29E−07	2.68E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E−07	2.68E−05	1.97E−04	0.96647
1083.	9.234	0.950	2.16E−07	2.54E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E−07	2.54E−05	1.97E−04	0.96823
1084.	9.225	0.950	1.74E−07	2.05E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.74E−07	2.05E−05	1.98E−04	0.97438
1085.	9.217	0.950	3.30E−07	3.89E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.30E−07	3.89E−05	1.98E−04	0.95126

1086.	9.208	0.950	2.14E−07	2.52E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.14E−07	2.52E−05	1.98E−04	0.96843
1087.	9.200	0.950	1.92E−07	2.27E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.92E−07	2.27E−05	1.98E−04	0.97150
1088.	9.191	0.950	2.32E−07	2.75E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.32E−07	2.75E−05	1.98E−04	0.96557
1089.	9.183	0.950	1.82E−07	2.16E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.82E−07	2.16E−05	1.99E−04	0.97290
1090.	9.174	0.950	1.98E−07	2.35E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E−07	2.35E−05	1.99E−04	0.97052
1091.	9.166	0.950	1.21E−06	1.44E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E−06	1.44E−04	2.00E−04	0.81867
1092.	9.158	0.950	2.42E−07	2.89E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E−07	2.89E−05	2.00E−04	0.96369
1093.	9.149	0.950	1.69E−07	2.02E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E−07	2.02E−05	2.00E−04	0.97465
1094.	9.141	0.950	1.62E−07	1.94E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E−07	1.94E−05	2.01E−04	0.97560
1095.	9.132	0.950	1.57E−07	1.88E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E−07	1.88E−05	2.01E−04	0.97635
1096.	9.124	0.950	1.54E−07	1.85E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E−07	1.85E−05	2.01E−04	0.97668
1097.	9.116	0.950	1.57E−07	1.88E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E−07	1.88E−05	2.01E−04	0.97627
1098.	9.107	0.950	1.61E−07	1.95E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E−07	1.95E−05	2.01E−04	0.97549
1099.	9.099	0.950	2.68E−07	3.24E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.68E−07	3.24E−05	2.02E−04	0.95915
1100.	9.091	0.950	9.85E−07	1.19E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.85E−07	1.19E−04	2.03E−04	0.84973
1101.	9.083	0.950	1.05E−06	1.28E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.05E−06	1.28E−04	2.04E−04	0.83879
1102.	9.074	0.950	2.77E−07	3.36E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.77E−07	3.36E−05	2.04E−04	0.95759
1103.	9.066	0.950	1.85E−07	2.25E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E−07	2.25E−05	2.04E−04	0.97156
1104.	9.058	0.950	1.58E−07	1.92E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E−07	1.92E−05	2.04E−04	0.97571
1105.	9.050	0.950	1.70E−07	2.08E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E−07	2.08E−05	2.04E−04	0.97372
1106.	9.042	0.950	3.54E−07	4.33E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.54E−07	4.33E−05	2.05E−04	0.94518
1107.	9.033	0.950	1.85E−06	2.27E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E−06	2.27E−04	2.07E−04	0.71335
1108.	9.025	0.950	2.10E−07	2.58E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E−07	2.58E−05	2.07E−04	0.96739
1109.	9.017	0.950	1.64E−07	2.02E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.64E−07	2.02E−05	2.07E−04	0.97443
1110.	9.009	0.950	1.93E−07	2.38E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.93E−07	2.38E−05	2.07E−04	0.96985
1111.	9.001	0.950	3.22E−07	3.97E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.22E−07	3.97E−05	2.07E−04	0.94962
1112.	8.993	0.950	1.45E−06	1.79E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.45E−06	1.79E−04	2.09E−04	0.77331
1113.	8.985	0.950	1.68E−07	2.08E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E−07	2.08E−05	2.09E−04	0.97365
1114.	8.977	0.950	1.51E−07	1.88E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E−07	1.88E−05	2.09E−04	0.97617
1115.	8.969	0.950	1.67E−07	2.07E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E−07	2.07E−05	2.09E−04	0.97367

1116.	8.961	0.950	1.45E−07	1.80E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.45E−07	1.80E−05	2.10E−04	0.97711
1117.	8.953	0.950	1.62E−07	2.02E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E−07	2.02E−05	2.10E−04	0.97435
1118.	8.945	0.950	2.92E−07	3.65E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.92E−07	3.65E−05	2.10E−04	0.95361
1119.	8.937	0.950	1.61E−07	2.01E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E−07	2.01E−05	2.10E−04	0.97440
1120.	8.929	0.950	2.22E−07	2.79E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.22E−07	2.79E−05	2.10E−04	0.96446
1121.	8.921	0.950	2.24E−06	2.81E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.24E−06	2.81E−04	2.13E−04	0.64174
1122.	8.913	0.950	3.10E−07	3.90E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.10E−07	3.90E−05	2.13E−04	0.95029
1123.	8.905	0.950	1.59E−07	2.00E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E−07	2.00E−05	2.13E−04	0.97447
1124.	8.897	0.950	1.74E−07	2.19E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.74E−07	2.19E−05	2.13E−04	0.97201
1125.	8.889	0.950	1.39E−07	1.76E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E−07	1.76E−05	2.13E−04	0.97746
1126.	8.881	0.950	1.48E−07	1.87E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E−07	1.87E−05	2.14E−04	0.97608
1127.	8.873	0.950	1.41E−07	1.79E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E−07	1.79E−05	2.14E−04	0.97713
1128.	8.865	0.950	1.36E−07	1.72E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E−07	1.72E−05	2.14E−04	0.97794
1129.	8.857	0.950	1.41E−07	1.80E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E−07	1.80E−05	2.14E−04	0.97694
1130.	8.850	0.950	1.63E−07	2.09E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.63E−07	2.09E−05	2.14E−04	0.97328
1131.	8.842	0.950	1.47E−07	1.88E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E−07	1.88E−05	2.14E−04	0.97593
1132.	8.834	0.950	1.61E−07	2.07E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E−07	2.07E−05	2.14E−04	0.97351
1133.	8.826	0.950	1.90E−07	2.44E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E−07	2.44E−05	2.15E−04	0.96863
1134.	8.818	0.950	2.74E−07	3.53E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E−07	3.53E−05	2.15E−04	0.95468
1135.	8.811	0.950	8.83E−07	1.14E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.83E−07	1.14E−04	2.16E−04	0.85380
1136.	8.803	0.950	3.36E−06	4.34E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.36E−06	4.34E−04	2.19E−04	0.44259
1137.	8.795	0.950	1.71E−06	2.21E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.71E−06	2.21E−04	2.21E−04	0.71557
1138.	8.787	0.950	4.97E−07	6.44E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.97E−07	6.44E−05	2.21E−04	0.91713
1139.	8.780	0.950	1.84E−07	2.39E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.84E−07	2.39E−05	2.22E−04	0.96919
1140.	8.772	0.950	1.70E−07	2.20E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E−07	2.20E−05	2.22E−04	0.97159
1141.	8.764	0.950	1.62E−07	2.10E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E−07	2.10E−05	2.22E−04	0.97285
1142.	8.757	0.950	2.43E−07	3.17E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.43E−07	3.17E−05	2.22E−04	0.95904
1143.	8.749	0.950	1.44E−07	1.88E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E−07	1.88E−05	2.22E−04	0.97576
1144.	8.741	0.950	1.50E−07	1.96E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.50E−07	1.96E−05	2.22E−04	0.97470

1145.	8.734	0.950	1.52E−07	1.99E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E−07	1.99E−05	2.23E−04	0.97424
1146.	8.726	0.950	1.49E−07	1.96E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.49E−07	1.96E−05	2.23E−04	0.97462
1147.	8.718	0.950	1.59E−07	2.09E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E−07	2.09E−05	2.23E−04	0.97296
1148.	8.711	0.950	1.95E−07	2.57E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.95E−07	2.57E−05	2.23E−04	0.96672
1149.	8.703	0.950	1.70E−06	2.24E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E−06	2.24E−04	2.25E−04	0.70927
1150.	8.696	0.950	4.01E−07	5.30E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.01E−07	5.30E−05	2.25E−04	0.93124
1151.	8.688	0.950	2.92E−07	3.87E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.92E−07	3.87E−05	2.25E−04	0.94973
1152.	8.681	0.950	1.76E−06	2.33E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E−06	2.33E−04	2.27E−04	0.69677
1153.	8.673	0.950	4.07E−07	5.41E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.07E−07	5.41E−05	2.28E−04	0.92973
1154.	8.666	0.950	1.63E−07	2.16E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.63E−07	2.16E−05	2.28E−04	0.97184
1155.	8.658	0.950	1.91E−07	2.55E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.91E−07	2.55E−05	2.28E−04	0.96684
1156.	8.651	0.950	1.36E−07	1.82E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E−07	1.82E−05	2.28E−04	0.97626
1157.	8.643	0.950	1.41E−07	1.89E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E−07	1.89E−05	2.28E−04	0.97541
1158.	8.636	0.950	1.39E−07	1.87E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E−07	1.87E−05	2.28E−04	0.97564
1159.	8.628	0.950	1.47E−07	1.97E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E−07	1.97E−05	2.29E−04	0.97428
1160.	8.621	0.950	1.40E−07	1.88E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.40E−07	1.88E−05	2.29E−04	0.97539
1161.	8.613	0.950	1.43E−07	1.93E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E−07	1.93E−05	2.29E−04	0.97481
1162.	8.606	0.950	1.49E−07	2.01E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.49E−07	2.01E−05	2.29E−04	0.97369
1163.	8.598	0.950	1.62E−07	2.19E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E−07	2.19E−05	2.29E−04	0.97139
1164.	8.591	0.950	2.53E−07	3.42E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.53E−07	3.42E−05	2.29E−04	0.95515
1165.	8.584	0.950	1.92E−06	2.60E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.92E−06	2.60E−04	2.31E−04	0.65903
1166.	8.576	0.950	8.88E−07	1.21E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.88E−07	1.21E−04	2.32E−04	0.84173
1167.	8.569	0.950	2.05E−07	2.80E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E−07	2.80E−05	2.32E−04	0.96331
1168.	8.562	0.950	1.33E−07	1.82E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E−07	1.82E−05	2.33E−04	0.97608
1169.	8.554	0.950	1.80E−07	2.46E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.80E−07	2.46E−05	2.33E−04	0.96760
1170.	8.547	0.950	1.83E−07	2.50E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E−07	2.50E−05	2.33E−04	0.96712
1171.	8.540	0.950	2.05E−07	2.81E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E−07	2.81E−05	2.33E−04	0.96304
1172.	8.532	0.950	2.17E−07	2.98E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.17E−07	2.98E−05	2.33E−04	0.96071
1173.	8.525	0.950	5.23E−07	7.20E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.23E−07	7.20E−05	2.34E−04	0.90511

1174.	8.518	0.950	2.47E−06	3.41E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E−06	3.41E−04	2.36E−04	0.55033
1175.	8.511	0.950	3.44E−06	4.75E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E−06	4.75E−04	2.40E−04	0.37258
1176.	8.503	0.950	4.79E−07	6.63E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.79E−07	6.63E−05	2.40E−04	0.91243
1177.	8.496	0.950	2.73E−07	3.79E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.73E−07	3.79E−05	2.40E−04	0.94994
1178.	8.489	0.950	1.89E−07	2.62E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.89E−07	2.62E−05	2.41E−04	0.96533
1179.	8.482	0.950	2.50E−07	3.47E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E−07	3.47E−05	2.41E−04	0.95403
1180.	8.475	0.950	1.60E−07	2.23E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E−07	2.23E−05	2.41E−04	0.97041
1181.	8.467	0.950	3.60E−07	5.03E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.60E−07	5.03E−05	2.41E−04	0.93331
1182.	8.460	0.950	1.46E−07	2.04E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E−07	2.04E−05	2.42E−04	0.97286
1183.	8.453	0.950	1.49E−07	2.08E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.49E−07	2.08E−05	2.42E−04	0.97231
1184.	8.446	0.950	3.07E−07	4.30E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.07E−07	4.30E−05	2.42E−04	0.94280
1185.	8.439	0.950	2.55E−07	3.59E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.55E−07	3.59E−05	2.42E−04	0.95227
1186.	8.432	0.950	6.76E−07	9.52E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.76E−07	9.52E−05	2.43E−04	0.87329
1187.	8.425	0.950	3.78E−06	5.32E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E−06	5.32E−04	2.47E−04	0.29062
1188.	8.418	0.950	6.76E−07	9.54E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.76E−07	9.54E−05	2.47E−04	0.87276
1189.	8.410	0.950	2.30E−07	3.25E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.30E−07	3.25E−05	2.48E−04	0.95660
1190.	8.403	0.950	2.13E−07	3.01E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.13E−07	3.01E−05	2.48E−04	0.95973
1191.	8.396	0.950	3.43E−07	4.87E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.43E−07	4.87E−05	2.48E−04	0.93487
1192.	8.389	0.950	1.58E−07	2.25E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E−07	2.25E−05	2.48E−04	0.96991
1193.	8.382	0.950	1.61E−07	2.29E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E−07	2.29E−05	2.49E−04	0.96931
1194.	8.375	0.950	2.70E−07	3.86E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.70E−07	3.86E−05	2.49E−04	0.94832
1195.	8.368	0.950	2.03E−07	2.90E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E−07	2.90E−05	2.49E−04	0.96115
1196.	8.361	0.950	2.19E−07	3.13E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E−07	3.13E−05	2.49E−04	0.95792
1197.	8.354	0.950	3.26E−07	4.66E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.26E−07	4.66E−05	2.50E−04	0.93734
1198.	8.347	0.950	2.89E−06	4.15E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.89E−06	4.15E−04	2.52E−04	0.44166
1199.	8.340	0.950	6.95E−07	9.99E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.95E−07	9.99E−05	2.53E−04	0.86557
1200.	8.333	0.950	1.90E−07	2.74E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E−07	2.74E−05	2.53E−04	0.96315
1201.	8.326	0.950	1.91E−07	2.75E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.91E−07	2.75E−05	2.54E−04	0.96289
1202.	8.319	0.950	1.41E−07	2.03E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E−07	2.03E−05	2.54E−04	0.97255

1203.	8.313	0.950	1.22E−07	1.77E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.22E−07	1.77E−05	2.54E−04	0.97608
1204.	8.306	0.950	1.19E−07	1.72E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E−07	1.72E−05	2.54E−04	0.97678
1205.	8.299	0.950	1.47E−07	2.14E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E−07	2.14E−05	2.54E−04	0.97103
1206.	8.292	0.950	4.39E−07	6.38E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.39E−07	6.38E−05	2.54E−04	0.91362
1207.	8.285	0.950	1.85E−07	2.69E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E−07	2.69E−05	2.55E−04	0.96349
1208.	8.278	0.950	1.60E−07	2.33E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E−07	2.33E−05	2.55E−04	0.96837
1209.	8.271	0.950	3.17E−07	4.63E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.17E−07	4.63E−05	2.55E−04	0.93717
1210.	8.264	0.950	3.44E−07	5.04E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E−07	5.04E−05	2.56E−04	0.93156
1211.	8.258	0.950	2.16E−06	3.16E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E−06	3.16E−04	2.58E−04	0.56995
1212.	8.251	0.950	3.59E−06	5.27E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.59E−06	5.27E−04	2.61E−04	0.28293
1213.	8.244	0.950	1.62E−06	2.38E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E−06	2.38E−04	2.63E−04	0.67577
1214.	8.237	0.950	3.35E−07	4.94E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.35E−07	4.94E−05	2.63E−04	0.93270
1215.	8.230	0.950	5.41E−07	7.99E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.41E−07	7.99E−05	2.64E−04	0.89105
1216.	8.224	0.950	2.76E−07	4.08E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.76E−07	4.08E−05	2.64E−04	0.94432
1217.	8.217	0.950	2.15E−07	3.19E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E−07	3.19E−05	2.64E−04	0.95641
1218.	8.210	0.950	8.30E−07	1.23E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E−07	1.23E−04	2.65E−04	0.83159
1219.	8.203	0.950	2.65E−06	3.93E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E−06	3.93E−04	2.68E−04	0.46139
1220.	8.197	0.950	6.11E−07	9.09E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.11E−07	9.09E−05	2.68E−04	0.87541
1221.	8.190	0.950	6.12E−07	9.13E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.12E−07	9.13E−05	2.69E−04	0.87481
1222.	8.183	0.950	4.05E−07	6.05E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.05E−07	6.05E−05	2.69E−04	0.91697
1223.	8.177	0.950	4.61E−07	6.89E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.61E−07	6.89E−05	2.70E−04	0.90533
1224.	8.170	0.950	6.30E−07	9.44E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.30E−07	9.44E−05	2.70E−04	0.87021
1225.	8.163	0.950	3.91E−06	5.87E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.91E−06	5.87E−04	2.74E−04	0.19193
1226.	8.157	0.950	2.32E−06	3.49E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.32E−06	3.49E−04	2.77E−04	0.51955
1227.	8.150	0.950	4.23E−07	6.37E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.23E−07	6.37E−05	2.77E−04	0.91217
1228.	8.143	0.950	1.81E−07	2.73E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E−07	2.73E−05	2.77E−04	0.96229
1229.	8.137	0.950	5.00E−07	7.56E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E−07	7.56E−05	2.78E−04	0.89556
1230.	8.130	0.950	2.80E−07	4.24E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.80E−07	4.24E−05	2.78E−04	0.94136
1231.	8.123	0.950	1.18E−07	1.78E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E−07	1.78E−05	2.78E−04	0.97532

1232.	8.117	0.950	1.14E−07	1.73E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E−07	1.73E−05	2.78E−04	0.97603
1233.	8.110	0.950	2.79E−07	4.25E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.79E−07	4.25E−05	2.79E−04	0.94111
1234.	8.104	0.950	1.18E−07	1.80E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E−07	1.80E−05	2.79E−04	0.97503
1235.	8.097	0.950	1.37E−07	2.09E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.37E−07	2.09E−05	2.79E−04	0.97089
1236.	8.091	0.950	4.64E−07	7.09E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.64E−07	7.09E−05	2.79E−04	0.90141
1237.	8.084	0.950	8.02E−07	1.23E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.02E−07	1.23E−04	2.80E−04	0.82907
1238.	8.078	0.950	2.84E−07	4.36E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.84E−07	4.36E−05	2.80E−04	0.93923
1239.	8.071	0.950	1.48E−06	2.28E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E−06	2.28E−04	2.82E−04	0.68218
1240.	8.065	0.950	5.99E−07	9.21E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.99E−07	9.21E−05	2.82E−04	0.87137
1241.	8.058	0.950	4.79E−07	7.38E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.79E−07	7.38E−05	2.83E−04	0.89680
1242.	8.052	0.950	4.81E−07	7.41E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.81E−07	7.41E−05	2.83E−04	0.89627
1243.	8.045	0.950	1.81E−06	2.80E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E−06	2.80E−04	2.85E−04	0.60802
1244.	8.039	0.950	3.52E−06	5.44E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.52E−06	5.44E−04	2.89E−04	0.23689
1245.	8.032	0.950	1.69E−06	2.62E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E−06	2.62E−04	2.90E−04	0.63252
1246.	8.026	0.950	5.81E−07	9.02E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.81E−07	9.02E−05	2.91E−04	0.87333
1247.	8.019	0.950	3.39E−07	5.27E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.39E−07	5.27E−05	2.91E−04	0.92589
1248.	8.013	0.950	1.21E−06	1.88E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E−06	1.88E−04	2.93E−04	0.73525
1249.	8.006	0.950	4.25E−07	6.63E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.25E−07	6.63E−05	2.93E−04	0.90664
1250.	8.000	0.950	4.35E−07	6.79E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.35E−07	6.79E−05	2.93E−04	0.90419
1251.	7.994	0.950	7.24E−07	1.13E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.24E−07	1.13E−04	2.94E−04	0.83994
1252.	7.987	0.950	8.89E−07	1.39E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.89E−07	1.39E−04	2.95E−04	0.80311
1253.	7.981	0.950	7.42E−07	1.16E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.42E−07	1.16E−04	2.96E−04	0.83522
1254.	7.974	0.950	9.85E−07	1.55E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.85E−07	1.55E−04	2.97E−04	0.78060
1255.	7.968	0.950	7.08E−07	1.12E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.08E−07	1.12E−04	2.97E−04	0.84187
1256.	7.962	0.950	4.91E−07	7.74E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.91E−07	7.74E−05	2.98E−04	0.89012
1257.	7.955	0.950	1.02E−06	1.61E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E−06	1.61E−04	2.99E−04	0.77171
1258.	7.949	0.950	9.74E−07	1.54E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.74E−07	1.54E−04	3.00E−04	0.78078
1259.	7.943	0.950	2.67E−06	4.24E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.67E−06	4.24E−04	3.03E−04	0.39652
1260.	7.937	0.950	4.11E−06	6.52E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.11E−06	6.52E−04	3.07E−04	0.07102

1261.	7.930	0.950	3.02E−06	4.80E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.02E−06	4.80E−04	3.10E−04	0.31490
1262.	7.924	0.950	1.38E−06	2.20E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.38E−06	2.20E−04	3.11E−04	0.68606
1263.	7.918	0.950	1.07E−06	1.70E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E−06	1.70E−04	3.12E−04	0.75707
1264.	7.911	0.950	2.04E−06	3.26E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.04E−06	3.26E−04	3.14E−04	0.53374
1265.	7.905	0.950	2.48E−06	3.97E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.48E−06	3.97E−04	3.17E−04	0.43193
1266.	7.899	0.950	3.16E−06	5.07E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.16E−06	5.07E−04	3.20E−04	0.27352
1267.	7.893	0.950	3.09E−06	4.97E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.09E−06	4.97E−04	3.23E−04	0.28695
1268.	7.886	0.950	3.94E−06	6.34E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.94E−06	6.34E−04	3.27E−04	0.08960
1269.	7.880	0.950	3.09E−06	4.97E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.09E−06	4.97E−04	3.30E−04	0.28451
1270.	7.874	0.950	3.98E−06	6.42E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.98E−06	6.42E−04	3.34E−04	0.07595
1271.	7.868	0.950	3.40E−06	5.49E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.40E−06	5.49E−04	3.37E−04	0.20849
1272.	7.862	0.950	4.15E−06	6.72E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.15E−06	6.72E−04	3.42E−04	0.03084
1273.	7.855	0.950	2.19E−06	3.54E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E−06	3.54E−04	3.44E−04	0.48802
1274.	7.849	0.950	1.23E−06	1.99E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E−06	1.99E−04	3.45E−04	0.71235
1275.	7.843	0.950	1.21E−06	1.96E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E−06	1.96E−04	3.46E−04	0.71580
1276.	7.837	0.950	6.60E−07	1.07E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.60E−07	1.07E−04	3.47E−04	0.84433
1277.	7.831	0.950	1.23E−06	2.00E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E−06	2.00E−04	3.48E−04	0.70937
1278.	7.825	0.950	5.82E−07	9.50E−05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.82E−07	9.50E−05	3.49E−04	0.86206
1279.	7.819	0.950	8.10E−07	1.32E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.10E−07	1.32E−04	3.49E−04	0.80743
1280.	7.812	0.950	3.10E−06	5.09E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.10E−06	5.09E−04	3.53E−04	0.25973
1281.	7.806	0.950	1.93E−06	3.17E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.93E−06	3.17E−04	3.54E−04	0.53816
1282.	7.800	0.950	9.94E−07	1.63E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.94E−07	1.63E−04	3.55E−04	0.76162
1283.	7.794	0.950	1.34E−06	2.21E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E−06	2.21E−04	3.57E−04	0.67798
1284.	7.788	0.950	2.36E−06	3.89E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E−06	3.89E−04	3.59E−04	0.43070
1285.	7.782	0.950	1.11E−06	1.83E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E−06	1.83E−04	3.60E−04	0.73213
1286.	7.776	0.950	1.76E−06	2.91E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E−06	2.91E−04	3.62E−04	0.57326
1287.	7.770	0.950	3.68E−06	6.10E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.68E−06	6.10E−04	3.66E−04	0.10590
1288.	7.764	0.950	3.89E−06	6.45E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.89E−06	6.45E−04	3.70E−04	0.05260
1289.	7.758	0.950	3.18E−06	5.29E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.18E−06	5.29E−04	3.73E−04	0.22230
1290.	7.752	0.950	1.69E−06	2.81E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E−06	2.81E−04	3.74E−04	0.58639

1291.	7.746	0.950	3.23E−06	5.38E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.23E−06	5.38E−04	3.78E−04	0.20670
1292.	7.740	0.950	1.21E−06	2.01E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E−06	2.01E−04	3.79E−04	0.70323
1293.	7.734	0.950	1.33E−06	2.22E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E−06	2.22E−04	3.80E−04	0.67273
1294.	7.728	0.950	1.06E−06	1.78E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E−06	1.78E−04	3.81E−04	0.73664
1295.	7.722	0.950	1.34E−06	2.25E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E−06	2.25E−04	3.83E−04	0.66692
1296.	7.716	0.950	3.12E−06	5.24E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.12E−06	5.24E−04	3.86E−04	0.22385
1297.	7.710	0.950	3.41E−06	5.73E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.41E−06	5.73E−04	3.89E−04	0.15007
1298.	7.704	0.950	1.30E−06	2.19E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E−06	2.19E−04	3.90E−04	0.67528
1299.	7.698	0.950	9.11E−07	1.54E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.11E−07	1.54E−04	3.91E−04	0.77147
1300.	7.692	0.950	1.26E−06	2.13E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E−06	2.13E−04	3.93E−04	0.68248
1301.	7.686	0.950	1.03E−06	1.74E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E−06	1.74E−04	3.94E−04	0.74034
1302.	7.680	0.950	1.53E−06	2.59E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E−06	2.59E−04	3.95E−04	0.61297
1303.	7.675	0.950	1.64E−06	2.78E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.64E−06	2.78E−04	3.97E−04	0.58514
1304.	7.669	0.950	1.97E−06	3.36E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E−06	3.36E−04	3.99E−04	0.49794
1305.	7.663	0.950	2.76E−06	4.71E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.76E−06	4.71E−04	4.02E−04	0.29506
1306.	7.657	0.950	3.09E−06	5.26E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.09E−06	5.26E−04	4.05E−04	0.21107
1307.	7.651	0.950	1.90E−06	3.25E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E−06	3.25E−04	4.07E−04	0.51192
1308.	7.645	0.950	3.66E−06	6.26E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.66E−06	6.26E−04	4.10E−04	0.06010
1309.	7.639	0.950	2.36E−06	4.05E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E−06	4.05E−04	4.13E−04	0.39094
1310.	7.634	0.950	1.58E−06	2.70E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E−06	2.70E−04	4.14E−04	0.59266
1311.	7.628	0.950	2.03E−06	3.50E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E−06	3.50E−04	4.16E−04	0.47284
1312.	7.622	0.950	3.60E−06	6.19E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.60E−06	6.19E−04	4.20E−04	0.06565
1313.	7.616	0.950	3.82E−06	6.59E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.82E−06	6.59E−04	4.24E−04	0.00326
1314.	7.610	0.950	3.73E−06	6.43E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.73E−06	6.43E−04	4.27E−04	0.02658
1315.	7.605	0.950	3.66E−06	6.32E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.66E−06	6.32E−04	4.31E−04	0.04199
1316.	7.599	0.950	3.38E−06	5.86E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.38E−06	5.86E−04	4.34E−04	0.11090
1317.	7.593	0.950	3.79E−06	6.57E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.79E−06	6.57E−04	4.38E−04	0.00177
1318.	7.587	0.950	3.70E−06	6.43E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.70E−06	6.43E−04	4.42E−04	0.02281
1319.	7.582	0.950	3.77E−06	6.57E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E−06	6.57E−04	4.46E−04	0.00009
1320.	7.576	0.950	3.74E−06	6.52E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.74E−06	6.52E−04	4.49E−04	0.00565

1321.	7.570	0.950	3.43E−06	5.99E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.43E−06	5.99E−04	4.53E−04	0.08544
1322.	7.564	0.950	2.21E−06	3.87E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.21E−06	3.87E−04	4.55E−04	0.40847
1323.	7.559	0.950	2.95E−06	5.16E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.95E−06	5.16E−04	4.58E−04	0.21099
1324.	7.553	0.950	2.19E−06	3.83E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E−06	3.83E−04	4.60E−04	0.41291
1325.	7.547	0.950	1.26E−06	2.22E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E−06	2.22E−04	4.61E−04	0.65946
1326.	7.541	0.950	1.85E−06	3.26E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E−06	3.26E−04	4.63E−04	0.49997
1327.	7.536	0.950	1.87E−06	3.29E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.87E−06	3.29E−04	4.65E−04	0.49453
1328.	7.530	0.950	2.41E−06	4.24E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E−06	4.24E−04	4.68E−04	0.34684
1329.	7.524	0.950	1.66E−06	2.94E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E−06	2.94E−04	4.69E−04	0.54715
1330.	7.519	0.950	3.16E−06	5.59E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.16E−06	5.59E−04	4.72E−04	0.13811
1331.	7.513	0.950	1.25E−06	2.21E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E−06	2.21E−04	4.74E−04	0.65863
1332.	7.508	0.950	1.98E−06	3.51E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E−06	3.51E−04	4.76E−04	0.45772
1333.	7.502	0.950	2.68E−06	4.75E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.68E−06	4.75E−04	4.78E−04	0.26365
1334.	7.496	0.950	2.03E−06	3.62E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E−06	3.62E−04	4.80E−04	0.43917
1335.	7.491	0.950	2.42E−06	4.32E−04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E−06	4.32E−04	4.82E−04	0.32894

INTEGRATED ABSORPTION FROM 765 TO 1335 CM-1 = 84.6328 CM-1
AVERAGE TRANSMITTANCE = 0.8515

INTEGRATED TOTAL RADIANCE = 4.815013E-04 WATTS CM-2 STER-1 (FROM 765 TO 1335 CM-1)
MINIMUM SPECTRAL RADIANCE = 1.139295E-07 WATTS CM-2 STER-1 / CM-1 AT 1232 CM-1
MAXIMUM SPECTRAL RADIANCE = 6.748774E-06 WATTS CM-2 STER-1 / CM-1 AT 799 CM-1

TARGET-PIXEL (H2) SURFACE TEMPERATURE [K] = 0.000
AREA-AVERAGED GROUND TEMPERATURE [K] = 288.150
TARGET-PIXEL (H2) DIRECTIONAL EMISSIVITY = 0.950
AREA-AVERAGED GROUND EMISSIVITY = 0.950

SPECTRUM WILL BE CONVOLVED USING A TRIANGULAR SLIT
CONVOLVED SPECTRA ARE IN FILES PLTOUT.SCN AND TAPE7.SCN
BANDPASS FOR CONVOLVING = 769. TO 1333. CM-1.
UNCONVOLVED INTEGRATED RADIANCE: 4.71929E-04 WATTS CM-2 STER-1
CONVOLVED INTEGRATED RADIANCE: 4.71929E-04 WATTS CM-2 STER-1

CARD 5 ***** 0

OUTPUT FILE 2: MODOUT 2

```
T     6    1    1     0    6    6     6    6     6    6     1    0     0   0.0000.05
      1    1    1     0    0    0  23.00000   0.00000   0.00000   0.00000   0.00000
  −99.000  −99.000  −99.000  −99
  −99.00000 −99.00000 −99.00000
    361976 U S STANDARD
    0.00000   10.00000   30.00000    0.50000   0.00000   0.00000    0
   −99  −99   −99 −99
  −99.00000  −99.00000 −99.00000  −99.00000  −99.00000  −99.00000  −99.00000 −99.00000
        765       1335         1          1
```

0 FREQ	TOT TRANS	PTH THRML	THRML SCT	SURF EMIS	SOL SCAT	SING SCAT	GRND RFLT	DRCT RFLT	TOTAL RAD	REF SOL	SOL@OBS	DEPTH
765.	0.90476280	1.1387E-06	0.0000E+00	0.0000E+00			0.0000E+00		1.1387E−06			0.100
766.	0.91424292	1.0241E−06	0.0000E+00	0.0000E+00			0.0000E+00		1.0241E−06			0.090
767.	0.89808452	1.2156E−06	0.0000E+00	0.0000E+00			0.0000E+00		1.2156E−06			0.107
768.	0.91375434	1.0275E−06	0.0000E+00	0.0000E+00			0.0000E+00		1.0275E−06			0.090
769.	0.80621219	2.3059E−06	0.0000E+00	0.0000E+00			0.0000E+00		2.3059E−06			0.215
770.	0.79510736	2.4352E−06	0.0000E+00	0.0000E+00			0.0000E+00		2.4352E−06			0.229
771.	0.92488819	8.9163E−07	0.0000E+00	0.0000E+00			0.0000E+00		8.9163E−07			0.078
772.	0.93650973	7.5276E−07	0.0000E+00	0.0000E+00			0.0000E+00		7.5276E−07			0.066
773.	0.93319088	7.9114E−07	0.0000E+00	0.0000E+00			0.0000E+00		7.9114E−07			0.069
774.	0.93047410	8.2231E−07	0.0000E+00	0.0000E+00			0.0000E+00		8.2231E−07			0.072

775.	0.91367936	1.0197E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.0197E−06	0.090
776.	0.72658074	3.2259E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.2259E−06	0.319
777.	0.63921529	4.2514E−06	0.0000E+00	0.0000E+00	0.0000E+00	4.2514E−06	0.448
778.	0.92581826	8.7306E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.7306E−07	0.077
779.	0.79491407	2.4107E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.4107E−06	0.230
780.	0.92822343	8.4265E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.4265E−07	0.074
781.	0.93961978	7.0797E−07	0.0000E+00	0.0000E+00	0.0000E+00	7.0797E−07	0.062
782.	0.93829030	7.2265E−07	0.0000E+00	0.0000E+00	0.0000E+00	7.2265E−07	0.064
783.	0.93077743	8.0961E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.0961E−07	0.072
784.	0.56615084	5.0677E−06	0.0000E+00	0.0000E+00	0.0000E+00	5.0677E−06	0.569
785.	0.86131871	1.6179E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.6179E−06	0.149
786.	0.93990391	7.0019E−07	0.0000E+00	0.0000E+00	0.0000E+00	7.0019E−07	0.062
787.	0.94390815	6.5270E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.5270E−07	0.058
788.	0.94381803	6.5291E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.5291E−07	0.058
789.	0.94824284	6.0072E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.0072E−07	0.053
790.	0.94623458	6.2322E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.2322E−07	0.055
791.	0.92779124	8.3592E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.3592E−07	0.075
792.	0.83748633	1.8789E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.8789E−06	0.177
793.	0.91972429	9.2689E−07	0.0000E+00	0.0000E+00	0.0000E+00	9.2689E−07	0.084
794.	0.71454716	3.2916E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.2916E−06	0.336
795.	0.90471727	1.0973E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.0973E−06	0.100
796.	0.54396427	5.2448E−06	0.0000E+00	0.0000E+00	0.0000E+00	5.2448E−06	0.609
797.	0.90768617	1.0603E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.0603E−06	0.097
798.	0.77385968	2.5939E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.5939E−06	0.256
799.	0.41085541	6.7488E−06	0.0000E+00	0.0000E+00	0.0000E+00	6.7488E−06	0.890
800.	0.92934269	8.0831E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.0831E−07	0.073
801.	0.94489133	6.2960E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.2960E−07	0.057
802.	0.93984908	6.8628E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.8628E−07	0.062
803.	0.78834200	2.4116E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.4116E−06	0.238
804.	0.73987079	2.9599E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.9599E−06	0.301

805.	0.94277763	6.5022E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.5022E−07	0.059
806.	0.91837752	9.2623E−07	0.0000E+00	0.0000E+00	0.0000E+00	9.2623E−07	0.085
807.	0.93950415	6.8555E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.8555E−07	0.062
808.	0.76495844	2.6599E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.6599E−06	0.268
809.	0.93472850	7.3765E−07	0.0000E+00	0.0000E+00	0.0000E+00	7.3765E−07	0.067
810.	0.95287830	5.3180E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.3180E−07	0.048
811.	0.95002770	5.6319E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.6319E−07	0.051
812.	0.95070404	5.5480E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.5480E−07	0.051
813.	0.95000798	5.6185E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.6185E−07	0.051
814.	0.82407719	1.9744E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.9744E−06	0.193
815.	0.82194674	1.9955E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.9955E−06	0.196
816.	0.94748825	5.8770E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.8770E−07	0.054
817.	0.95356077	5.1901E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.1901E−07	0.048
818.	0.95658863	4.8449E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.8449E−07	0.044
819.	0.95529735	4.9820E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.9820E−07	0.046
820.	0.95590258	4.9075E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.9075E−07	0.045
821.	0.95755345	4.7171E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.7171E−07	0.043
822.	0.95647860	4.8297E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.8297E−07	0.044
823.	0.95502651	4.9837E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.9837E−07	0.046
824.	0.95730346	4.7246E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.7246E−07	0.044
825.	0.90022832	1.1024E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.1024E−06	0.105
826.	0.95499110	4.9661E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.9661E−07	0.046
827.	0.92367870	8.4089E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.4089E−07	0.079
828.	0.83038485	1.8661E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.8661E−06	0.186
829.	0.95616335	4.8158E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.8158E−07	0.045
830.	0.95821351	4.5839E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.5839E−07	0.043
831.	0.95839560	4.5573E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.5573E−07	0.042
832.	0.95966268	4.4120E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.4120E−07	0.041
833.	0.95955348	4.4175E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.4175E−07	0.041
834.	0.95987940	4.3754E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.3754E−07	0.041

835.	0.95829064	4.5420E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.5420E−07	0.043
836.	0.93994397	6.5302E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.5302E−07	0.062
837.	0.96003890	4.3387E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.3387E−07	0.041
838.	0.95731205	4.6279E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.6279E−07	0.044
839.	0.95641363	4.7182E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.7182E−07	0.045
840.	0.80560786	2.1011E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.1011E−06	0.216
841.	0.95434391	4.9275E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.9275E−07	0.047
842.	0.93795502	6.6862E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.6862E−07	0.064
843.	0.96024919	4.2772E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.2772E−07	0.041
844.	0.96094847	4.1957E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.1957E−07	0.040
845.	0.96099281	4.1845E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.1845E−07	0.040
846.	0.95914435	4.3762E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.3762E−07	0.042
847.	0.96064323	4.2092E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.2092E−07	0.040
848.	0.96017957	4.2523E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.2523E−07	0.041
849.	0.94884342	5.4545E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.4545E−07	0.053
850.	0.81480080	1.9716E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.9716E−06	0.205
851.	0.95290250	5.0063E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.0063E−07	0.048
852.	0.70458090	3.1354E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.1354E−06	0.350
853.	0.79565871	2.1654E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.1654E−06	0.229
854.	0.94014376	6.3331E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.3331E−07	0.062
855.	0.81766653	1.9262E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.9262E−06	0.201
856.	0.95967388	4.2534E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.2534E−07	0.041
857.	0.96242899	3.9567E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.9567E−07	0.038
858.	0.96289533	3.9014E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.9014E−07	0.038
859.	0.94574261	5.6961E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.6961E−07	0.056
860.	0.95647776	4.5619E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.5619E−07	0.044
861.	0.96382362	3.7859E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.7859E−07	0.037
862.	0.96387023	3.7751E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.7751E−07	0.037
863.	0.96409893	3.7453E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.7453E−07	0.037
864.	0.96273339	3.8816E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.8816E−07	0.038

865.	0.86965775	1.3554E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.3554E−06	0.140
866.	0.95757884	4.4044E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.4044E−07	0.043
867.	0.96407521	3.7239E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.7239E−07	0.037
868.	0.96448267	3.6758E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.6758E−07	0.036
869.	0.96475053	3.6422E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.6422E−07	0.036
870.	0.96380293	3.7341E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.7341E−07	0.037
871.	0.85299742	1.5141E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.5141E−06	0.159
872.	0.95901436	4.2145E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.2145E−07	0.042
873.	0.96481806	3.6119E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.6119E−07	0.036
874.	0.96540749	3.5456E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5456E−07	0.035
875.	0.96559322	3.5208E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5208E−07	0.035
876.	0.96352512	3.7264E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.7264E−07	0.037
877.	0.96544325	3.5247E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5247E−07	0.035
878.	0.95941287	4.1330E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.1330E−07	0.041
879.	0.90257269	9.9047E−07	0.0000E+00	0.0000E+00	0.0000E+00	9.9047E−07	0.103
880.	0.96457040	3.5959E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5959E−07	0.036
881.	0.94639558	5.4316E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.4316E−07	0.055
882.	0.96507788	3.5327E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5327E−07	0.036
883.	0.94941276	5.1090E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.1090E−07	0.052
884.	0.89642191	1.0443E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.0443E−06	0.109
885.	0.96463805	3.5595E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5595E−07	0.036
886.	0.96429610	3.5879E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5879E−07	0.036
887.	0.84808862	1.5240E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.5240E−06	0.165
888.	0.95741588	4.2650E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.2650E−07	0.044
889.	0.92817771	7.1814E−07	0.0000E+00	0.0000E+00	0.0000E+00	7.1814E−07	0.075
890.	0.95118862	4.8723E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.8723E−07	0.050
891.	0.94850498	5.1316E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.1316E−07	0.053
892.	0.96621329	3.3612E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.3612E−07	0.034
893.	0.96732920	3.2447E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.2447E−07	0.033
894.	0.96777534	3.1950E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1950E−07	0.033

895.	0.96763319	3.2037E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.2037E−07	0.033
896.	0.96670288	3.2901E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.2901E−07	0.034
897.	0.96443087	3.5087E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5087E−07	0.036
898.	0.95870519	4.0665E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.0665E−07	0.042
899.	0.96777993	3.1674E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1674E−07	0.033
900.	0.96808356	3.1322E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1322E−07	0.032
901.	0.96825701	3.1099E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1099E−07	0.032
902.	0.96765006	3.1639E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1639E−07	0.033
903.	0.96746755	3.1762E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1762E−07	0.033
904.	0.96830261	3.0894E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0894E−07	0.032
905.	0.96504998	3.4005E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.4005E−07	0.036
906.	0.93468910	6.3434E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.3434E−07	0.068
907.	0.96135026	3.7474E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.7474E−07	0.039
908.	0.96096581	3.7781E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.7781E−07	0.040
909.	0.81640750	1.7739E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.7739E−06	0.203
910.	0.95704061	4.1435E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.1435E−07	0.044
911.	0.96351314	3.5131E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5131E−07	0.037
912.	0.96748036	3.1256E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1256E−07	0.033
913.	0.96803766	3.0666E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0666E−07	0.032
914.	0.95117474	4.6763E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.6763E−07	0.050
915.	0.96755081	3.1024E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1024E−07	0.033
916.	0.96867377	2.9897E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.9897E−07	0.032
917.	0.96808732	3.0403E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0403E−07	0.032
918.	0.94989592	4.7649E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.7649E−07	0.051
919.	0.96707875	3.1253E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1253E−07	0.033
920.	0.96815640	3.0176E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0176E−07	0.032
921.	0.95326465	4.4209E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.4209E−07	0.048
922.	0.86764878	1.2497E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.2497E−06	0.142
923.	0.96350914	3.4395E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.4395E−07	0.037
924.	0.96714455	3.0913E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0913E−07	0.033

925.	0.89432532	9.9247E−07	0.0000E+00	0.0000E+00	0.0000E+00	9.9247E−07	0.112
926.	0.96745527	3.0510E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0510E−07	0.033
927.	0.96717966	3.0713E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0713E−07	0.033
928.	0.96924245	2.8731E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.8731E−07	0.031
929.	0.95811224	3.9057E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.9057E−07	0.043
930.	0.96923667	2.8632E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.8632E−07	0.031
931.	0.96625811	3.1347E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1347E−07	0.034
932.	0.96838307	2.9320E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.9320E−07	0.032
933.	0.96663618	3.0883E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0883E−07	0.034
934.	0.97019559	2.7538E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7538E−07	0.030
935.	0.96593320	3.1419E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1419E−07	0.035
936.	0.97016382	2.7467E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7467E−07	0.030
937.	0.96399134	3.3088E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.3088E−07	0.037
938.	0.96998632	2.7529E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7529E−07	0.030
939.	0.96554685	3.1543E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1543E−07	0.035
940.	0.96974301	2.7650E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7650E−07	0.031
941.	0.95419240	4.1783E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.1783E−07	0.047
942.	0.96430969	3.2494E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.2494E−07	0.036
943.	0.97045231	2.6852E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6852E−07	0.030
944.	0.96157366	3.4856E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.4856E−07	0.039
945.	0.95877421	3.7325E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.7325E−07	0.042
946.	0.96292400	3.3506E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.3506E−07	0.038
947.	0.96524334	3.1351E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1351E−07	0.035
948.	0.85461175	1.3090E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.3090E−06	0.157
949.	0.95916325	3.6698E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.6698E−07	0.042
950.	0.97094101	2.6065E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6065E−07	0.029
951.	0.96478695	3.1525E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1525E−07	0.036
952.	0.97139794	2.5558E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.5558E−07	0.029
953.	0.93418020	5.8705E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.8705E−07	0.068
954.	0.96679616	2.9559E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.9559E−07	0.034

955.	0.93804443	5.5050E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.5050E−07	0.064
956.	0.95543694	3.9521E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.9521E−07	0.046
957.	0.97243875	2.4396E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4396E−07	0.028
958.	0.97003531	2.6473E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6473E−07	0.030
959.	0.96174246	3.3736E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.3736E−07	0.039
960.	0.96385181	3.1815E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1815E−07	0.037
961.	0.97157371	2.4971E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4971E−07	0.029
962.	0.97031099	2.6030E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6030E−07	0.030
963.	0.97132206	2.5096E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.5096E−07	0.029
964.	0.97305983	2.3530E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.3530E−07	0.027
965.	0.96915281	2.6890E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6890E−07	0.031
966.	0.96037757	3.4473E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.4473E−07	0.040
967.	0.95493025	3.9137E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.9137E−07	0.046
968.	0.96671867	2.8845E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.8845E−07	0.034
969.	0.96663529	2.8861E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.8861E−07	0.034
970.	0.97114074	2.4915E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4915E−07	0.029
971.	0.94060075	5.1183E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.1183E−07	0.061
972.	0.95136654	4.1825E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.1825E−07	0.050
973.	0.94079375	5.0818E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.0818E−07	0.061
974.	0.94935316	4.3387E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.3387E−07	0.052
975.	0.96483094	3.0069E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0069E−07	0.036
976.	0.92748642	6.1876E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.1876E−07	0.075
977.	0.94913584	4.3318E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.3318E−07	0.052
978.	0.96584964	2.9027E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.9027E−07	0.035
979.	0.97258186	2.3259E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.3259E−07	0.028
980.	0.96933210	2.5964E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.5964E−07	0.031
981.	0.96717393	2.7737E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7737E−07	0.033
982.	0.96886331	2.6257E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6257E−07	0.032
983.	0.97137570	2.4091E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4091E−07	0.029
984.	0.96365714	3.0527E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0527E−07	0.037

985.	0.97246933	2.3079E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.3079E−07	0.028
986.	0.97499084	2.0924E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.0924E−07	0.025
987.	0.97356105	2.2076E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.2076E−07	0.027
988.	0.97415012	2.1541E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1541E−07	0.026
989.	0.97387332	2.1728E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1728E−07	0.026
990.	0.97200269	2.3238E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.3238E−07	0.028
991.	0.97488189	2.0806E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.0806E−07	0.025
992.	0.97440839	2.1156E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1156E−07	0.026
993.	0.97491354	2.0697E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.0697E−07	0.025
994.	0.97380179	2.1571E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1571E−07	0.027
995.	0.97432745	2.1095E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1095E−07	0.026
996.	0.97499686	2.0504E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.0504E−07	0.025
997.	0.97474486	2.0669E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.0669E−07	0.026
998.	0.97347927	2.1661E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1661E−07	0.027
999.	0.95850152	3.3826E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.3826E−07	0.042
1000.	0.95511520	3.6512E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.6512E−07	0.046
1001.	0.97104722	2.3504E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.3504E−07	0.029
1002.	0.97421598	2.0889E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.0889E−07	0.026
1003.	0.97361356	2.1334E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1334E−07	0.027
1004.	0.95645696	3.5133E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5133E−07	0.045
1005.	0.97359425	2.1263E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1263E−07	0.027
1006.	0.97382963	2.1030E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1030E−07	0.027
1007.	0.96914870	2.4741E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4741E−07	0.031
1008.	0.97276634	2.1795E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1795E−07	0.028
1009.	0.97322798	2.1382E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1382E−07	0.027
1010.	0.93126404	5.4784E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.4784E−07	0.071
1011.	0.93340486	5.2968E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.2968E−07	0.069
1012.	0.96934509	2.4332E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4332E−07	0.031
1013.	0.97103083	2.2947E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.2947E−07	0.029
1014.	0.87009060	1.0269E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.0269E−06	0.139

1015.	0.96250969	2.9574E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.9574E−07	0.038
1016.	0.97047716	2.3241E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.3241E−07	0.030
1017.	0.95228446	3.7484E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.7484E−07	0.049
1018.	0.92430991	5.9337E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.9337E−07	0.079
1019.	0.96714443	2.5704E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.5704E−07	0.033
1020.	0.96764898	2.5256E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.5256E−07	0.033
1021.	0.96815187	2.4812E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4812E−07	0.032
1022.	0.96568763	2.6676E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6676E−07	0.035
1023.	0.96744144	2.5260E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.5260E−07	0.033
1024.	0.96989250	2.3309E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.3309E−07	0.031
1025.	0.96690786	2.5566E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.5566E−07	0.034
1026.	0.96992087	2.3190E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.3190E−07	0.031
1027.	0.96577710	2.6329E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6329E−07	0.035
1028.	0.92215490	5.9764E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.9764E−07	0.081
1029.	0.90992093	6.9011E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.9011E−07	0.094
1030.	0.94969237	3.8460E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.8460E−07	0.052
1031.	0.95047343	3.7783E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.7783E−07	0.051
1032.	0.96425647	2.7211E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7211E−07	0.036
1033.	0.96013713	3.0283E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0283E−07	0.041
1034.	0.97050464	2.2359E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.2359E−07	0.030
1035.	0.96338159	2.7700E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7700E−07	0.037
1036.	0.96973723	2.2844E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.2844E−07	0.031
1037.	0.96328527	2.7655E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7655E−07	0.037
1038.	0.96349114	2.7442E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7442E−07	0.037
1039.	0.93660927	4.7545E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.7545E−07	0.065
1040.	0.95881695	3.0823E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0823E−07	0.042
1041.	0.96082598	2.9257E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.9257E−07	0.040
1042.	0.97206426	2.0819E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.0819E−07	0.028
1043.	0.94737625	3.9134E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.9134E−07	0.054
1044.	0.97535485	1.8288E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.8288E−07	0.025

1045.	0.96420252	2.6507E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6507E−07	0.036
1046.	0.97125983	2.1235E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1235E−07	0.029
1047.	0.96014673	2.9383E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.9383E−07	0.041
1048.	0.96649784	2.4647E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4647E−07	0.034
1049.	0.92941248	5.1819E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.1819E−07	0.073
1050.	0.94719088	3.8684E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.8684E−07	0.054
1051.	0.93532205	4.7276E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.7276E−07	0.067
1052.	0.94735909	3.8394E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.8394E−07	0.054
1053.	0.96357864	2.6507E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6507E−07	0.037
1054.	0.95100731	3.5578E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5578E−07	0.050
1055.	0.95759374	3.0728E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0728E−07	0.043
1056.	0.92757398	5.2367E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.2367E−07	0.075
1057.	0.95553160	3.2083E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.2083E−07	0.045
1058.	0.96215171	2.7247E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7247E−07	0.039
1059.	0.94676542	3.8240E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.8240E−07	0.055
1060.	0.92105877	5.6582E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.6582E−07	0.082
1061.	0.96233952	2.6934E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6934E−07	0.038
1062.	0.96187603	2.7206E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7206E−07	0.039
1063.	0.93696147	4.4887E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.4887E−07	0.065
1064.	0.97007114	2.1264E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1264E−07	0.030
1065.	0.96603227	2.4081E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4081E−07	0.035
1066.	0.71575117	2.0107E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.0107E−06	0.334
1067.	0.95691174	3.0413E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0413E−07	0.044
1068.	0.96804142	2.2507E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.2507E−07	0.032
1069.	0.96719646	2.3051E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.3051E−07	0.033
1070.	0.96695608	2.3169E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.3169E−07	0.034
1071.	0.97503459	1.7466E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.7466E−07	0.025
1072.	0.96309608	2.5761E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.5761E−07	0.038
1073.	0.93988693	4.1869E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.1869E−07	0.062
1074.	0.85333174	1.0193E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.0193E−06	0.159

1075.	0.95084268	3.4087E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.4087E−07	0.050
1076.	0.94918358	3.5159E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5159E−07	0.052
1077.	0.96291471	2.5601E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.5601E−07	0.038
1078.	0.97406971	1.7861E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.7861E−07	0.026
1079.	0.96474040	2.4232E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4232E−07	0.036
1080.	0.96462935	2.4254E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4254E−07	0.036
1081.	0.96054304	2.6996E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6996E−07	0.040
1082.	0.96647370	2.2887E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.2887E−07	0.034
1083.	0.96822870	2.1640E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1640E−07	0.032
1084.	0.97438055	1.7411E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.7411E−07	0.026
1085.	0.95126426	3.3046E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.3046E−07	0.050
1086.	0.96842939	2.1359E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1359E−07	0.032
1087.	0.97150427	1.9235E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.9235E−07	0.029
1088.	0.96556586	2.3191E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.3191E−07	0.035
1089.	0.97290105	1.8210E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.8210E−07	0.027
1090.	0.97052425	1.9762E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.9762E−07	0.030
1091.	0.81867182	1.2130E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.2130E−06	0.200
1092.	0.96369016	2.4234E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4234E−07	0.037
1093.	0.97465414	1.6878E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6878E−07	0.026
1094.	0.97559702	1.6214E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6214E−07	0.025
1095.	0.97634751	1.5679E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.5679E−07	0.024
1096.	0.97668368	1.5421E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.5421E−07	0.024
1097.	0.97626722	1.5661E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.5661E−07	0.024
1098.	0.97548670	1.6139E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6139E−07	0.025
1099.	0.95915365	2.6831E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.6831E−07	0.042
1100.	0.84973294	9.8483E−07	0.0000E+00	0.0000E+00	0.0000E+00	9.8483E−07	0.163
1101.	0.83878535	1.0542E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.0542E−06	0.176
1102.	0.95759332	2.7666E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7666E−07	0.043
1103.	0.97155970	1.8512E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.8512E−07	0.029
1104.	0.97570968	1.5774E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.5774E−07	0.025
1105.	0.97372282	1.7025E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.7025E−07	0.027

1106.	0.94518310	3.5435E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.5435E−07	0.056
1107.	0.71334916	1.8487E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.8487E−06	0.338
1108.	0.96739167	2.0982E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.0982E−07	0.033
1109.	0.97443032	1.6415E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6415E−07	0.026
1110.	0.96985126	1.9310E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.9310E−07	0.031
1111.	0.94962287	3.2192E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.2192E−07	0.052
1112.	0.77331406	1.4452E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.4452E−06	0.257
1113.	0.97364575	1.6763E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6763E−07	0.027
1114.	0.97616917	1.5123E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.5123E−07	0.024
1115.	0.97367203	1.6669E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6669E−07	0.027
1116.	0.97711217	1.4457E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4457E−07	0.023
1117.	0.97435331	1.6162E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6162E−07	0.026
1118.	0.95361102	2.9166E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.9166E−07	0.047
1119.	0.97439522	1.6061E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6061E−07	0.026
1120.	0.96446192	2.2239E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.2239E−07	0.036
1121.	0.64174074	2.2367E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.2367E−06	0.444
1122.	0.95028830	3.0964E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0964E−07	0.051
1123.	0.97447377	1.5863E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.5863E−07	0.026
1124.	0.97200817	1.7354E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.7354E−07	0.028
1125.	0.97745663	1.3943E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.3943E−07	0.023
1126.	0.97607929	1.4761E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4761E−07	0.024
1127.	0.97712541	1.4082E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4082E−07	0.023
1128.	0.97793746	1.3550E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.3550E−07	0.022
1129.	0.97694194	1.4128E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4128E−07	0.023
1130.	0.97327685	1.6336E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6336E−07	0.027
1131.	0.97592914	1.4680E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4680E−07	0.024
1132.	0.97350532	1.6120E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6120E−07	0.027
1133.	0.96863294	1.9039E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.9039E−07	0.032
1134.	0.95468056	2.7443E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7443E−07	0.046
1135.	0.85380125	8.8321E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.8321E−07	0.158
1136.	0.44259334	3.3594E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.3594E−06	0.815

1137.	0.71556544	1.7102E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.7102E−06	0.335
1138.	0.91713059	4.9708E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.9708E−07	0.087
1139.	0.96919018	1.8437E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.8437E−07	0.031
1140.	0.97159135	1.6960E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6960E−07	0.029
1141.	0.97285306	1.6168E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6168E−07	0.028
1142.	0.95903695	2.4338E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4338E−07	0.042
1143.	0.97576272	1.4366E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4366E−07	0.025
1144.	0.97469729	1.4962E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4962E−07	0.026
1145.	0.97424489	1.5193E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.5193E−07	0.026
1146.	0.97462302	1.4935E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4935E−07	0.026
1147.	0.97296071	1.5875E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.5875E−07	0.027
1148.	0.96672320	1.9490E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.9490E−07	0.034
1149.	0.70926964	1.6987E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.6987E−06	0.344
1150.	0.93124044	4.0079E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.0079E−07	0.071
1151.	0.94972563	2.9234E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.9234E−07	0.052
1152.	0.69677472	1.7590E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.7590E−06	0.361
1153.	0.92973089	4.0665E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.0665E−07	0.073
1154.	0.97184378	1.6255E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6255E−07	0.029
1155.	0.96683556	1.9100E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.9100E−07	0.034
1156.	0.97625571	1.3642E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.3642E−07	0.024
1157.	0.97540772	1.4095E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4095E−07	0.025
1158.	0.97564489	1.3925E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.3925E−07	0.025
1159.	0.97427803	1.4671E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4671E−07	0.026
1160.	0.97538686	1.4005E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4005E−07	0.025
1161.	0.97481221	1.4297E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4297E−07	0.026
1162.	0.97369438	1.4896E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4896E−07	0.027
1163.	0.97138590	1.6164E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6164E−07	0.029
1164.	0.95515281	2.5272E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.5272E−07	0.046
1165.	0.65903312	1.9167E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.9167E−06	0.417
1166.	0.84173328	8.8752E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.8752E−07	0.172
1167.	0.96331167	2.0524E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.0524E−07	0.037

1168.	0.97607988	1.3349E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.3349E−07	0.024
1169.	0.96760225	1.8035E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.8035E−07	0.033
1170.	0.96712464	1.8257E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.8257E−07	0.033
1171.	0.96304291	2.0473E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.0473E−07	0.038
1172.	0.96070516	2.1715E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1715E−07	0.040
1173.	0.90511048	5.2309E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.2309E−07	0.100
1174.	0.55032945	2.4728E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.4728E−06	0.597
1175.	0.37257746	3.4418E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.4418E−06	0.987
1176.	0.91242820	4.7921E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.7921E−07	0.092
1177.	0.94993991	2.7327E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7327E−07	0.051
1178.	0.96533006	1.8879E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.8879E−07	0.035
1179.	0.95402819	2.4972E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.4972E−07	0.047
1180.	0.97040915	1.6034E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6034E−07	0.030
1181.	0.93330991	3.6048E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.6048E−07	0.069
1182.	0.97286451	1.4631E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4631E−07	0.028
1183.	0.97231430	1.4891E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4891E−07	0.028
1184.	0.94280010	3.0690E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.0690E−07	0.059
1185.	0.95227444	2.5543E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.5543E−07	0.049
1186.	0.87329239	6.7648E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.7648E−07	0.135
1187.	0.29062012	3.7779E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.7779E−06	1.236
1188.	0.87275869	6.7597E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.7597E−07	0.136
1189.	0.95660281	2.2998E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.2998E−07	0.044
1190.	0.95972645	2.1289E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1289E−07	0.041
1191.	0.93487024	3.4343E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.4343E−07	0.067
1192.	0.96991330	1.5825E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.5825E−07	0.031
1193.	0.96931499	1.6100E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.6100E−07	0.031
1194.	0.94832081	2.7048E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7048E−07	0.053
1195.	0.96114910	2.0283E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.0283E−07	0.040
1196.	0.95792037	2.1914E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1914E−07	0.043
1197.	0.93734032	3.2550E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.2550E−07	0.065

1198.	0.44165692	2.8932E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.8932E−06	0.817
1199.	0.86557227	6.9483E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.9483E−07	0.144
1200.	0.96315134	1.8999E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.8999E−07	0.038
1201.	0.96289027	1.9085E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.9085E−07	0.038
1202.	0.97254556	1.4084E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4084E−07	0.028
1203.	0.97607929	1.2241E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.2241E−07	0.024
1204.	0.97678220	1.1851E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.1851E−07	0.023
1205.	0.97103208	1.4749E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.4749E−07	0.029
1206.	0.91361833	4.3871E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.3871E−07	0.090
1207.	0.96349227	1.8495E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.8495E−07	0.037
1208.	0.96836501	1.5986E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.5986E−07	0.032
1209.	0.93716884	3.1670E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.1670E−07	0.065
1210.	0.93156427	3.4408E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.4408E−07	0.071
1211.	0.56994921	2.1568E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.1568E−06	0.562
1212.	0.28292927	3.5871E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.5871E−06	1.263
1213.	0.67576981	1.6178E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.6178E−06	0.392
1214.	0.93270248	3.3495E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.3495E−07	0.070
1215.	0.89104664	5.4091E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.4091E−07	0.115
1216.	0.94431680	2.7574E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7574E−07	0.057
1217.	0.95640653	2.1533E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.1533E−07	0.045
1218.	0.83159155	8.2973E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.2973E−07	0.184
1219.	0.46139163	2.6469E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.6469E−06	0.774
1220.	0.87540543	6.1075E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.1075E−07	0.133
1221.	0.87481415	6.1209E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.1209E−07	0.134
1222.	0.91697317	4.0492E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.0492E−07	0.087
1223.	0.90533382	4.6051E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.6051E−07	0.099
1224.	0.87020820	6.2977E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.2977E−07	0.139
1225.	0.19193259	3.9109E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.9109E−06	1.651
1226.	0.51954716	2.3194E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.3194E−06	0.655
1227.	0.91217124	4.2291E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.2291E−07	0.092
1228.	0.96228945	1.8112E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.8112E−07	0.038

1229.	0.89556056	5.0032E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.0032E−07	0.110
1230.	0.94136047	2.8019E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.8019E−07	0.060
1231.	0.97531706	1.1764E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.1764E−07	0.025
1232.	0.97603393	1.1393E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.1393E−07	0.024
1233.	0.94110650	2.7925E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.7925E−07	0.061
1234.	0.97503448	1.1807E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.1807E−07	0.025
1235.	0.97089243	1.3731E−07	0.0000E+00	0.0000E+00	0.0000E+00	1.3731E−07	0.030
1236.	0.90141034	4.6388E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.6388E−07	0.104
1237.	0.82906997	8.0218E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.0218E−07	0.187
1238.	0.93922687	2.8447E−07	0.0000E+00	0.0000E+00	0.0000E+00	2.8447E−07	0.063
1239.	0.68218499	1.4838E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.4838E−06	0.382
1240.	0.87137479	5.9898E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.9898E−07	0.138
1241.	0.89679623	4.7936E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.7936E−07	0.109
1242.	0.89626801	4.8057E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.8057E−07	0.110
1243.	0.60802132	1.8113E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.8113E−06	0.498
1244.	0.23689121	3.5171E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.5171E−06	1.440
1245.	0.63252455	1.6893E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.6893E−06	0.458
1246.	0.87332797	5.8079E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.8079E−07	0.135
1247.	0.92589384	3.3890E−07	0.0000E+00	0.0000E+00	0.0000E+00	3.3890E−07	0.077
1248.	0.73524791	1.2076E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.2076E−06	0.308
1249.	0.90663975	4.2473E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.2473E−07	0.098
1250.	0.90419191	4.3474E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.3474E−07	0.101
1251.	0.83993626	7.2441E−07	0.0000E+00	0.0000E+00	0.0000E+00	7.2441E−07	0.174
1252.	0.80311394	8.8874E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.8874E−07	0.219
1253.	0.83522302	7.4187E−07	0.0000E+00	0.0000E+00	0.0000E+00	7.4187E−07	0.180
1254.	0.78060460	9.8520E−07	0.0000E+00	0.0000E+00	0.0000E+00	9.8520E−07	0.248
1255.	0.84186941	7.0824E−07	0.0000E+00	0.0000E+00	0.0000E+00	7.0824E−07	0.172
1256.	0.89012277	4.9083E−07	0.0000E+00	0.0000E+00	0.0000E+00	4.9083E−07	0.116
1257.	0.77170962	1.0171E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.0171E−06	0.259
1258.	0.78078341	9.7416E−07	0.0000E+00	0.0000E+00	0.0000E+00	9.7416E−07	0.247

1259.	0.39651540	2.6748E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.6748E−06	0.925
1260.	0.07101616	4.1066E−06	0.0000E+00	0.0000E+00	0.0000E+00	4.1066E−06	2.645
1261.	0.31490174	3.0206E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.0206E−06	1.155
1262.	0.68606120	1.3805E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.3805E−06	0.377
1263.	0.75707072	1.0655E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.0655E−06	0.278
1264.	0.53374177	2.0396E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.0396E−06	0.628
1265.	0.43192580	2.4785E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.4785E−06	0.840
1266.	0.27351847	3.1612E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.1612E−06	1.296
1267.	0.28694850	3.0946E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.0946E−06	1.248
1268.	0.08959821	3.9407E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.9407E−06	2.412
1269.	0.28450674	3.0889E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.0889E−06	1.257
1270.	0.07594769	3.9788E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.9788E−06	2.578
1271.	0.20848572	3.3991E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.3991E−06	1.568
1272.	0.03084225	4.1510E−06	0.0000E+00	0.0000E+00	0.0000E+00	4.1510E−06	3.479
1273.	0.48802453	2.1871E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.1871E−06	0.717
1274.	0.71235120	1.2255E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.2255E−06	0.339
1275.	0.71579570	1.2077E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.2077E−06	0.334
1276.	0.84432900	6.5973E−07	0.0000E+00	0.0000E+00	0.0000E+00	6.5973E−07	0.169
1277.	0.70936573	1.2284E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.2284E−06	0.343
1278.	0.86205715	5.8151E−07	0.0000E+00	0.0000E+00	0.0000E+00	5.8151E−07	0.148
1279.	0.80743450	8.0962E−07	0.0000E+00	0.0000E+00	0.0000E+00	8.0962E−07	0.214
1280.	0.25972721	3.1041E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.1041E−06	1.348
1281.	0.53816211	1.9315E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.9315E−06	0.620
1282.	0.76161742	9.9429E−07	0.0000E+00	0.0000E+00	0.0000E+00	9.9429E−07	0.272
1283.	0.67797863	1.3396E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.3396E−06	0.389
1284.	0.43069652	2.3620E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.3620E−06	0.842
1285.	0.73212808	1.1084E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.1084E−06	0.312
1286.	0.57326496	1.7610E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.7610E−06	0.556
1287.	0.10590266	3.6799E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.6799E−06	2.245
1288.	0.05259758	3.8889E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.8889E−06	2.945
1289.	0.22229569	3.1838E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.1838E−06	1.504

1290.	0.58638686	1.6887E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.6887E−06	0.534
1291.	0.20669784	3.2303E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.2303E−06	1.576
1292.	0.70322943	1.2052E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.2052E−06	0.352
1293.	0.67272902	1.3255E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.3255E−06	0.396
1294.	0.73663932	1.0638E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.0638E−06	0.306
1295.	0.66691679	1.3418E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.3418E−06	0.405
1296.	0.22385198	3.1184E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.1184E−06	1.497
1297.	0.15007085	3.4056E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.4056E−06	1.897
1298.	0.67527956	1.2977E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.2977E−06	0.393
1299.	0.77147233	9.1079E−07	0.0000E+00	0.0000E+00	0.0000E+00	9.1079E−07	0.259
1300.	0.68247569	1.2621E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.2621E−06	0.382
1301.	0.74033916	1.0293E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.0293E−06	0.301
1302.	0.61297393	1.5301E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.5301E−06	0.489
1303.	0.58514005	1.6357E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.6357E−06	0.536
1304.	0.49794421	1.9741E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.9741E−06	0.697
1305.	0.29505962	2.7644E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.7644E−06	1.221
1306.	0.21106614	3.0855E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.0855E−06	1.556
1307.	0.51191980	1.9037E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.9037E−06	0.670
1308.	0.06009932	3.6561E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.6561E−06	2.812
1309.	0.39094335	2.3627E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.3627E−06	0.939
1310.	0.59265667	1.5759E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.5759E−06	0.523
1311.	0.47284055	2.0340E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.0340E−06	0.749
1312.	0.06564826	3.5953E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.5953E−06	2.723
1313.	0.00325878	3.8249E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.8249E−06	5.726
1314.	0.02658387	3.7253E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.7253E−06	3.627
1315.	0.04198838	3.6564E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.6564E−06	3.170
1316.	0.11089729	3.3842E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.3842E−06	2.199
1317.	0.00177421	3.7892E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.7892E−06	6.334
1318.	0.02281472	3.6993E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.6993E−06	3.780
1319.	0.00008696	3.7750E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.7750E−06	9.350

1320.	0.00564779	3.7438E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.7438E−06	5.176
1321.	0.08543665	3.4340E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.4340E−06	2.460
1322.	0.40847340	2.2150E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.2150E−06	0.895
1323.	0.21099117	2.9464E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.9464E−06	1.556
1324.	0.41291186	2.1864E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.1864E−06	0.885
1325.	0.65945607	1.2648E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.2648E−06	0.416
1326.	0.49996865	1.8520E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.8520E−06	0.693
1327.	0.49453482	1.8670E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.8670E−06	0.704
1328.	0.34683636	2.4060E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.4060E−06	1.059
1329.	0.54714847	1.6636E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.6636E−06	0.603
1330.	0.13810816	3.1575E−06	0.0000E+00	0.0000E+00	0.0000E+00	3.1575E−06	1.980
1331.	0.65862596	1.2472E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.2472E−06	0.418
1332.	0.45772499	1.9757E−06	0.0000E+00	0.0000E+00	0.0000E+00	1.9757E−06	0.781
1333.	0.26364818	2.6754E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.6754E−06	1.333
1334.	0.43917128	2.0321E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.0321E−06	0.823
1335.	0.32894191	2.4248E−06	0.0000E+00	0.0000E+00	0.0000E+00	2.4248E−06	1.112
−9999.							

OUTPUT FILE 3: MODOUT 3

```
T        6      1      1       0      6      6       6      6       6      6       1      0       0    0.0000.05
         1      1      1       0      0      0    23.00000      0.00000      0.00000      0.00000    0.00000
   −99.000  −99.000  −99.000  −99
   −99.00000  −99.00000  −99.00000
     361976 U  S  STANDARD
     0.00000    10.00000    30.00000     0.50000      0.00000      0.00000       0
    −99   −99    −99  −99
   −99.00000   −99.00000  −99.00000   −99.00000  −99.00000  −99.00000   −99.00000 −99.00000
         765         1335            1             1
     0
   −9999.
```

Appendix S4B

Some atmospheric and emissivity corrections recommended for land surfaces where emissivities in the two split-window bands are different

In this Appendix, some relations proposed for atmospheric and emissivity correction, for use with AVHRR data collected over land surfaces where emissivities in the two split-window bands (channels 4 and 5) are different, are detailed. They provide examples of the following three approaches:

- A model-based approach
  One example, i.e., that of Labed and Stoll (1991)].
- A split-window-based correction with the form,

$$T_s = T_b(\lambda_1) + \frac{1}{R-1}\left[T_b(\lambda_1) - T_b(\lambda_2)\right]$$

  Two examples, i.e., those of Price (1984) and Vidal (1991).
- Three split-window-based corrections with the form,

$$\mathrm{T_s} = \mathrm{T_b}(\lambda_1) + \mathrm{A}\,[\mathrm{T_b}(\lambda_1) - \mathrm{T_b}(\lambda_2)] + \mathrm{B}(\varepsilon)$$

  Three examples, i.e., those of Becker and Li (1990), Sobrino *et al*. (1991) and Coll *et al*. (1994).

In all of the Equations that follow, I use the following notation:

T_s	=	True surface temperature;
T_4	=	Brightness temperature measured in AVHRR channel 4;
T_5	=	Brightness temperature measured in AVHRR channel 5;
ε_4	=	Emissivtiy in AVHRR channel 4;
ε_5	=	Emissivtiy in AVHRR channel 5;
$\Delta\varepsilon$	=	$\varepsilon_4 - \varepsilon_5$.

It must be stressed that all coefficients given here work for the wavelengths of the AVHRR wavebands for which they were derived.

Labed and Stoll (1991)

Labed and Stoll (1991) took the model atmosphere-based approach to derive an atmospheric correction for AVHRR data acquired over land surfaces. That is, they used LOWTRAN-derived atmospheric correction values and coincidental field-measurements of emissivity to complete the corrections laid out in the first part of this Supplement.

Labed and Stoll (1991) used a NOAA-11 AVHRR scene acquired at 02:35Z in the morning, made coincidental measurements of ε_3, ε_4 and ε_5, and used LOWTRAN-6 with a US Standard atmosphere to obtain τ_3, τ_4 and τ_5. Results given as Table 5 of Labed and Stoll (1991) were as follows:

$$\varepsilon_4 = 0.957, \qquad T_4 = 19.6 \pm 0.25\ °C;$$
$$\varepsilon_5 = 0.976, \qquad T_5 = 18.93 \pm 0.31\ °C.$$

This compared with an in-situ surface temperature, measured in the field coincident with satellite overpass, of 19.8±0.7 °C. Summing up, Labed and Stoll (1991) thus stated, "in channel 4, the root-mean-square value is within 0.2 K of the experimental one. The difference is larger in channel 5, although the mean satellite-derived surface temperature is within 0.5 K of the field value".

Price (1984)

The correction of Price (1984) was a split-window-based method with the form

$$T_s = T_4 + \frac{1}{R-1}[T_4 - T_5]$$

For R, Price (1984) derived a value of 1.3, so that

$$T_s = T_4 + \frac{1}{1.3-1}[T_4 - T_5] = T_4 + 3.33[T_4 - T_5]$$

For full correction of differential emissivity effects, Price (1984) gave (with a sign error in the original version corrected):

$$T_s = T_4 + 3.33[T_4 - T_5]\left(\frac{3.5 - \varepsilon_4}{4.5}\right) - 0.75T_4(\varepsilon_4 - \varepsilon_5)$$

i.e., a conversion with the form,

$$T_s = T_4(\lambda_1) + A\,[T_4 - T_5]\,B(\varepsilon)$$

Vidal (1991)

Likewise, Vidal (1991) gave a split-window-based correction with the form

$$T_s = T_4 + \frac{1}{R-1}[T_4 - T_5]$$

Vidal (1991), though, gave a value for R of 1.36±0.21. As explained in this Supplement, R was obtained by linear regression between T_4 and T_5. Regression was achieved using 20 data points, with a relation with an r^2 of 0.95. Thus,

$$T_s = T_4 + \frac{1}{1.36 - 1}[T_4 - T_5] = T_4 + 2.78[T_4 - T_5]$$

Becker and Li (1990)

Becker and Li (1990) gave a correction that was also subsequently used by Sobrino and Caselles (1991). It involved the following split-window correction modified for differential emissivity effects:

$$T_s = a_0 + P\frac{T_4 + T_5}{2} + M\frac{T_4 - T_5}{2}$$

in which,

$$\begin{aligned} a_0 &= 1.274 \\ P &= 1 + 0.15616\tfrac{(1-\varepsilon)}{\varepsilon} - 0.482\tfrac{\Delta\varepsilon}{\varepsilon^2} \\ M &= 6.26 + 3.98\tfrac{(1-\varepsilon)}{\varepsilon} + 38.33\tfrac{\Delta\varepsilon}{\varepsilon^2} \\ \varepsilon &= (\varepsilon_4 + \varepsilon_5)/\,2 \end{aligned}$$

The correction of Becker and Li (1990) came with the caveat that the numerical values given for the corrections "are only valid for NOAA-9, since we used the spectral response of this radiometer to compute these coefficients".

Sobrino **et al.** *(1991)*

Sobrino *et al*. (1991) gave a split-window correction, modified for differential emissivity effects, with the form,

$$\mathrm{T_s} = \mathrm{T_4} + \mathrm{A}\,(\mathrm{T_4} - \mathrm{T_5}) + \mathrm{B}$$

in which,

A & B = Coefficients which depend on surface emissivity, atmospheric absorption and total water vapor amount.

Coefficient A had the form,

$$\mathrm{A} = \mathrm{a_0} + \mathrm{a_1}(1-\varepsilon_4) + \mathrm{a_2}\Delta\varepsilon$$

In which values for the constants were set, for four atmospheric models, as follows:

Tropical Atmosphere:	$a_0 = 2.49$	$a_1 = 4.33$	$a_2 = -5.16$
Mid- Latitude Summer:	$a_0 = 2.13$	$a_1 = 3.18$	$a_2 = -7.48$
1976 US Standard:	$a_0 = 1.71$	$a_1 = 1.30$	$a_2 = -9.10$
Mid-Latitude Winter:	$a_0 = 1.57$	$a_1 = 0.76$	$a_2 = -9.08$

Coefficient B had the form,

$$B = \frac{1-\varepsilon_4}{\varepsilon_4} B_{04} T_4 - \frac{1-\varepsilon_5}{\varepsilon_5} B_{05} T_5$$

in which,

$$\mathrm{B}_{04} = \mathrm{b}_{04} + \mathrm{b}_{14}\,\Delta\varepsilon$$

and

$$\mathrm{B}_{05} = \mathrm{b}_{05} + \mathrm{b}_{15}\,\Delta\varepsilon$$

Again, values for the constants were set for four atmospheric models. For channel 4, they were set as follows:

Tropical Atmosphere:	$b_{04} = 0.075$	$b_{14} = -0.114$
Mid-Latitude Summer:	$b_{04} = 0.217$	$b_{14} = -0.513$
1976 US Standard:	$b_{04} = 0.407$	$b_{14} = -1.338$
Mid-Latitude Winter:	$b_{04} = 0.452$	$b_{14} = -1.586$

and for channel 5,

Tropical Atmosphere:	$b_{05} = 0.027$	$b_{15} = -0.089$
Mid-Latitude Summer:	$b_{05} = 0.059$	$b_{15} = -0.260$
1976 US Standard:	$b_{05} = 0.219$	$b_{15} = -1.252$
Mid-Latitude Winter:	$b_{05} = 0.263$	$b_{15} = -1.586$

Coll **et al.** *(1994)*

Coll *et al*. (1994) also recommended a correction with form,

$$\mathrm{T_s} = \mathrm{T_4} + \mathrm{A}\,(\mathrm{T_4} - \mathrm{T_5}) + \mathrm{B}(\varepsilon)$$

in which,

A = coefficient related to the atmospheric transmittances in channels 4 & 5,
B(ε) = coefficient related to differential emissivity effects.

Coefficient A had the form:

$$\mathrm{A} = \mathrm{a_0} + \mathrm{a_1}(\mathrm{T_4} - \mathrm{T_5})$$

i.e., the standard split-window atmospheric correction, where Coll *et al*. (1991) gave values of

$$\mathrm{a_0} = 1.0,\ \text{and}$$
$$\mathrm{a_1} = 0.58\ \mathrm{K^{-1}}.$$

Coefficient B had the form:

$$B(\varepsilon) = a_3 (1 - \varepsilon_4) - b\Delta\varepsilon$$

in which,

a_3 = a constant with a value around 50 K;

b = a constant that decreases as the atmospheric moisture content increases, with Coll *et al*. (1994) giving, as reference values,

b = 70 K (global mean value)
b = 150 K (mid-latitude in winter)
b = 75 K (mid-latitude in summer)
b = 50 K (tropical atmosphere)

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