Chapter 9
Supplement 9A

Table 9.1. Comparison of eruption parameters obtained using different methods, with supplementary explanation of methods used.

Parameter	**Method**								
	Observed Data[1]	**Exponent-ial Method**[2]	**Power Law Method**[3]	**Carey and Sparks (1986)**[4]	**Sparks (1986)**	**Wilson and Walker (1987)**	**Inversion: TEPHRA2**	**OAT: PUFF**[5]	**Numerical solution: FALL3D**
Erupted Mass M ($\times 10^9$ kg)	–	0.9(1seg) 1.1(2seg) 1.8(3seg)	2.0	–	–	–	1.7	–	1.7[6]
Column height H (km a.s.l.)	12	–	–	11	–	–	13	13	12[7]
Mass eruption rate $\dot{M}$ ($\times 10^6$ kg s^{-1})	–	0.6 (1seg)[8] 0.7 (2seg) 1.2 (3seg)	1.3[8]	–	0.6[9]	1.8[10]	1.1[8]	–	2.4[7]
Grainsize distribution[11]	Mdϕ (0.8) STDV (1.8)	–	–	–	–	–	Mdϕ (-0.6) STDV (2.2)	Mdϕ (0) STDV (1.5)	–
Duration of sustained phase (min)	25 (total duration)	–	–	–	24 (1seg)[12] 30 (2seg) 51 (3seg) 56 (PL) 47 TEPHRA2	8 (1seg)[12] 10 (2seg) 17 (3seg) 19 (PL) 16 TEPHRA2	–	20–40	12[6]
[13]Maximum/ average wind speed (m s^{-1})	11 / 6	–	–	10–30	–	–	6 / 6	–	–
[14]K_H / K_V (m^2 s^{-1})	–	–	–	–	–	–	0.5	5000 / 10	5000 / 0.004–600 (mean: 50)

(1) Observed Data: Plume height was calculated from photographs, using a vent height of 3 km (D. Andronico, unpub. data). Total grainsize distribution was averaged using the Voronoi technique (S. Scollo, unpublished data). Duration is observed from seismic record (Coltelli *et al.*, 2006). Pseudo-sounding wind data were calculated for 37.5˚N 15˚E at 18:00 LT (see Table 9.2 for details).

(2) Exponential Method: Total erupted mass was calculated using the exponential method with one, two and three segments to describe the thinning trend (Eqs. 9.2 and 9.4). The 1-segment calculation was done neglecting the very proximal data.

(3) Power-Law Method: Total erupted mass calculated using the power-law method (Eq. 9.6) with $\sqrt{A_0}$ = 1.1 km and $\sqrt{A_{\mathrm{dist}}}$ = 500 km. By varying $\sqrt{A_{\mathrm{dist}}}$ between -80% (100 km) and +300% (2000 km), we obtain a difference in the resulting mass between -11% (1.8×10^9 kg) and +6% (2.1×10^9 kg), respectively. In contrast, $\sqrt{A_0}$ was taken as the intercept of the proximal exponential segments with the power-law fit . However, if we empirically vary $\sqrt{A_0}$ between -50% (0.5 km) and +50% (1.6 km) of its value we get a difference of +33% (2.7×10^9 kg) and -13% (1.8×10^9 kg) respectively.

(4) Carey and Sparks (1986): results from D. Andronico (unpublished data).

(5) OAT: Best fit obtained from sensitivity tests carried out changing each parameter "One At a Time" (from Aloisi *et al.,* 2002).

(6) The erupted mass in FALL3D is determined by multiplying $\dot{M}$ by the eruption duration, which in this case was taken as 12 minutes from the FALL3D OAT analyses.

(7) Plume height H and mass eruption rate $\dot{M}$ are determined in FALL3D using a buoyant plume model derived from Bursik (2001) with a plume temperature at the vent of 1000 °C, a plume exit velocity of 100 m s^{-1}, and entrainment coefficients $\alpha = 0.1$, $\beta = 0.34$.

(8) Mass eruption rate was calculated by dividing the erupted mass (derived from the application of both empirical and analytical models) by the observed duration (25 minutes).

(9) Mass eruption rate was calculated using the method of Sparks (1986) for a plume height of 9 km, a plume temperature of 1000 °C and for a temperate atmosphere.

(10) Mass eruption rate was calculated using the method of Wilson and Walker (1987) for a plume height of 9 km and $C = 245$ m $kg^{-1/4}$ $s^{1/4}$

(11) Grainsize distributions are defined as the median (Mdϕ) and standard deviation (STDV) of the associated best-fit Gaussian distribution.

(12) Duration ($M/\dot{M}$) was calculated based on the $\dot{M}$ determined from the methods of Sparks (1986) and Wilson and Walker (1987), together with the erupted mass M derived from inversion of TEPHRA2, the integration of the power-law best fit (PL) and the integration of one, two and three exponential segments (1seg, 2seg, 3seg)

(13) Maximum wind speed is at and altitude of 11 km and average wind speed is calculated below 12 km.

(14) Horizontal and vertical diffusion coefficients. In FALL3D the vertical diffusion is derived from similarity theory, the horizontal diffusion was set to 5000 m^2 s^{-1}, because this value gave better agreement with observations, than did the horizontal diffusion derived from the LES model (2250 m^2 s^{-1}; see text for details).