

Chapter 9 Supplement 9B

Table 9.2. Parameters used in the simulations. See online supplement 9A for details of the methods used to derive parameters.

	Run 1	Run 2	Run 3	Run 4	Run 5
Model	Strong Plume ⁽¹⁾	TEPHRA2 (inversion) ⁽²⁾	TEPHRA2 (inversion) ⁽²⁾	TEPHRA2 (forward) ⁽³⁾	FALL3D (forward) ⁽⁴⁾
Grainsize distribution	GS Etna 1998 ⁽⁵⁾	Md ϕ ⁽⁶⁾ (-3-3) STDV ⁽⁶⁾ (1-3)	Md ϕ ⁽⁶⁾ (-3-3) STDV ⁽⁶⁾ (1-3)	Md ϕ ⁽⁶⁾ (-0.6) STDV ⁽⁶⁾ (2.2)	GS Etna 1998 ⁽⁵⁾
Plume height H (km a.s.l.)	12	4–20	10–15	13	Calculated within model
Wind speed w (m s ⁻¹)	3 ⁽⁷⁾ (mean below base current)	1–20	1–20	6 (mean below plume height)	Wind Etna 1998 ⁽⁷⁾
Wind direction (° from N)	-	90–200	90–200	110–184	Wind Etna 1998 ⁽⁷⁾
Erupted mass M ($\times 10^9$ kg)	2	0.0001–100	0.5–50	1.7	Calculated within model (1.7)
Mass eruption rate \dot{M} ($\times 10^6$ kg s ⁻¹)	-	-	-	-	2.4
Particle density (kg m ⁻³)	900–2600 ⁽⁸⁾	900–2600 ⁽⁸⁾	900–2600 ⁽⁸⁾	900–2600 ⁽⁸⁾	900–2600 ⁽⁸⁾
K_H (m ² s ⁻¹)	-	0.1–8000	0.1–8000	0.5	5000 ⁽⁹⁾
Fall time threshold ⁽¹⁰⁾ (s)	-	1–5000	1–5000	278	-

⁽¹⁾Strong Plume model of Bonadonna and Phillips (2003), modified to account for Etna topography. Erupted volume was calculated for this work. Plume height and particle density are from observations (D. Andronico, unpublished data). Wind speed is averaged between the base of the current and the ground.

⁽²⁾Inversion technique used is described in Connor and Connor (2006). Runs 2 and 3 show the range of values used in the inversion technique.

⁽³⁾The forward model TEPHRA2 is described in Bonadonna *et al.* (2005b) and Connor and Connor (2006). Input data for this simulation are the best-fit results from inversion simulations (Run2)

⁽⁴⁾The forward model FALL3D is described in Folch *et al.* (2009). Column height is determined within the code using Bursik (2001). The erupted mass is calculated within the code based on column height and duration. Turbulent diffusion coefficients are also determined within the code and vary with wind, height and time.

⁽⁵⁾Total grainsize distribution was averaged using the Voronoi technique (Md ϕ = 0.8 ϕ ; STDV = 1.8; S. Scollo, unpublished data).

⁽⁶⁾Grainsize distributions are defined as median (Md ϕ) and standard deviation (STDV) of the associated best-fit

Gaussian distribution

- ⁽⁷⁾A wind profile was obtained at 37.5°N 15°E at 18:00 LT was obtained using the WRF model (Skamarock *et al.*, 2005) and used as a pseudo-sounding profile for initializing the meteorological processor CALMET.
- ⁽⁸⁾Particle density model is from Bonadonna and Phillips (2003).
- ⁽⁹⁾A horizontal diffusion coefficient $K_H=5000 \text{ m s}^{-2}$ was used instead of the K_H obtained using LES (Table 9.1) because it gave better agreement with observations (OAT analysis)
- ⁽¹⁰⁾Fall time threshold FTT indicates the fall time value above which particles are controlled by a power-law diffusion (Eq. (8) in Bonadonna *et al.* (2005b)), as supposed to Fickian diffusion described using the diffusion coefficient (Eq. (6) in Bonadonna *et al.* (2005b)).