

## Initial (Model 1) input parameters for the 1974 Mauna Ulu flow

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### Channel Dimensions

Width ( $w$ )	1.9 m
Depth ( $h$ )	1.9 m
Distance increment ( $\Delta x$ )	200 m
Total distance ( $\Sigma(\Delta x)$ )	6000 m
Slope ( $\alpha$ )	given

### Velocity constants

Gravitational acceleration ( $g$ )	9.8 m s <sup>-2</sup>
Constant $B$ (Eq. 1a and b)	3

### Viscosity and yield strength

Eruption temperature ( $T_{erupt}$ )	1170°C (1443.15 K)
Viscosity at eruption ( $\eta_0^{melt}$ )	use Giordano et al. (2008)
Constant $a$ (Eq. 6)	0.04 K <sup>-1</sup>
Yield strength at liquidus ( $\tau_0^{liq}$ )	0.01 Pa
Constant $b$ (Eq. 4)	0.08 K <sup>-1</sup>

### Density and vesicularity

Solid/DRE density ( $\rho_{DRE}$ )	use Bottinga and Weill (1970)
Vesicularity ( $\phi_b$ )	0.4
Bulk density ( $\rho_{bulk}$ )	$(1 - \phi_b) \times \rho_{DRE}$

### Thermal parameters

Core temperature ( $T_{core}$ )	Initially $T_{erupt}$
Buffer temperature ( $T_{buffer}$ )	140°C (140 K)
Hot component ( $T_{hot}$ )	$T_{hot} = T_{core} - T_{buffer}$
Crust/surface temperature ( $T_{surf}$ )	Hon et al. (1994), in K
Crust growth constant $g_1$	0.9
Crust growth constant $g_2$	-0.16

### Radiation parameters

Stefan-Boltzmann cst. ( $\sigma$ )	5.67×10 <sup>-8</sup> W m <sup>-2</sup> K <sup>-4</sup>
Emissivity ( $\varepsilon$ )	0.95

### Conduction parameters

Thermal conductivity ( $k$ )	$(1.929 - 1.554\phi_b)^2$ W m <sup>-1</sup> K <sup>-1</sup>
Basal temperature ( $T_{base}$ )	500°C (773.15 K)
Fraction of basal crust	0.19
Height of basal crust ( $h_{base}$ )	0.19× $h$ in m

### Convection parameters

Wind speed ( $U$ )	5 m s <sup>-1</sup>
C <sub>H</sub> ratio	0.0036
Air temperature ( $T_{amb}$ )	20°C (293.15 K)
Boundary air layer temperature ( $T_{mean}$ )	$0.5 \times (T_{amb} + T_{surf})$ in K
Air density ( $\rho_{air}$ )	$352.6 / T_{mean}$ kg m <sup>-3</sup>
Air specific heat capacity ( $C_p^{air}$ )	$947 + 0.191 \times T_{mean}$ J kg <sup>-1</sup> K <sup>-1</sup>

### Crystal parameters

Initial crystal content $\phi_c^{erupt}$ (phenocrysts)	0.1
Rate of crystallization $\delta\phi_c/\delta T$ (for $T_{core} > 1160^\circ\text{C}$ )	0.00083 K <sup>-1</sup>
Rate of crystallization $\delta\phi_c/\delta T$ (for $T_{core} \leq 1160^\circ\text{C}$ )	0.002 K <sup>-1</sup>
Latent heat of crystallization ( $C_L$ )	3.5×10 <sup>5</sup> J kg <sup>-1</sup>

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In blue: parameters that typically change during the model.

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