

Supplementary Material

The influence of a mantle plume head on subduction zone dynamics

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Table DR1: Dimensional parameters common to all models (after Mason et al. 2010, Table 1; Stegman et al. 2006, Table 1).

Parameter	Material	Symbol	Value	Units
Height or thickness (y)	Domain	H_{box}	1000	km
	Upper Mantle	H_{um}	650	
	Lower Mantle	H_{lm}	350	
	Slab	H_{slab}	100	
	Plume Head	H_{plume}	100	
Length (x, normal to trench)	Domain	L_{box}	4000	km
	Slab	L_{slab}	2200	
Width (z, parallel to trench)	Domain	W_{box}	4000	km
	Slab	W_{slab}	2750	
Gravitational acceleration	Domain	g	10	m/s ²
Density	Upper Mantle	ρ_{um}	3300	kg/m ³
	Lower Mantle	ρ_{lm}	3300	
	Slab	ρ_{slab}	3380	
	Contrast	$\Delta\rho = \rho_{slab} - \rho_{um}$	80	
Viscosity	Upper Mantle	η_{um}	7.17×10^{19} *	Pa s
	Lower Mantle	η_{lm}	100 η_{um}	
	Slab	η_{slab}	200 η_{um}	
	Plume Head	η_{plume}	0.01 η_{um}	
Reference Stress	Domain	$\tau_{ref} = \Delta\rho g H_{box}$	800	MPa
Velocity	Domain	v	$v = v' \tau_{ref} H_{slab} / \eta_{um}$	m/s

* based on a timeframe of 45 Myrs after the slab tip velocity reaches maximum.

Table DR2: Dimensional model parameter variations.

Slab strength	Slab cohesion μ_0 (MPa)	Slab depth coefficient μ_1 (MPa/km)	Plume head length L_{plume} and mirrored width $2 \times W_{plume}$ (km)	Plume head density ρ_{plume} (kg/m ³)
Weak	32	0.2	N/A	N/A
			400	3200
				3250
			600	3200
				3250
			700	3200
				3250
Strong	64	0.4	N/A	N/A
			400	3200
				3250
			600	3200
				3250
			700	3200
				3250
			3200	
			3250	