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Supplementary Materials for

Stress inversions to forecast magma pathways and eruptive vent location

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This PDF file includes:

Supplementary Materials

Supplementary materials include figs. S1 to S6 Tables S1 to S2 and references.

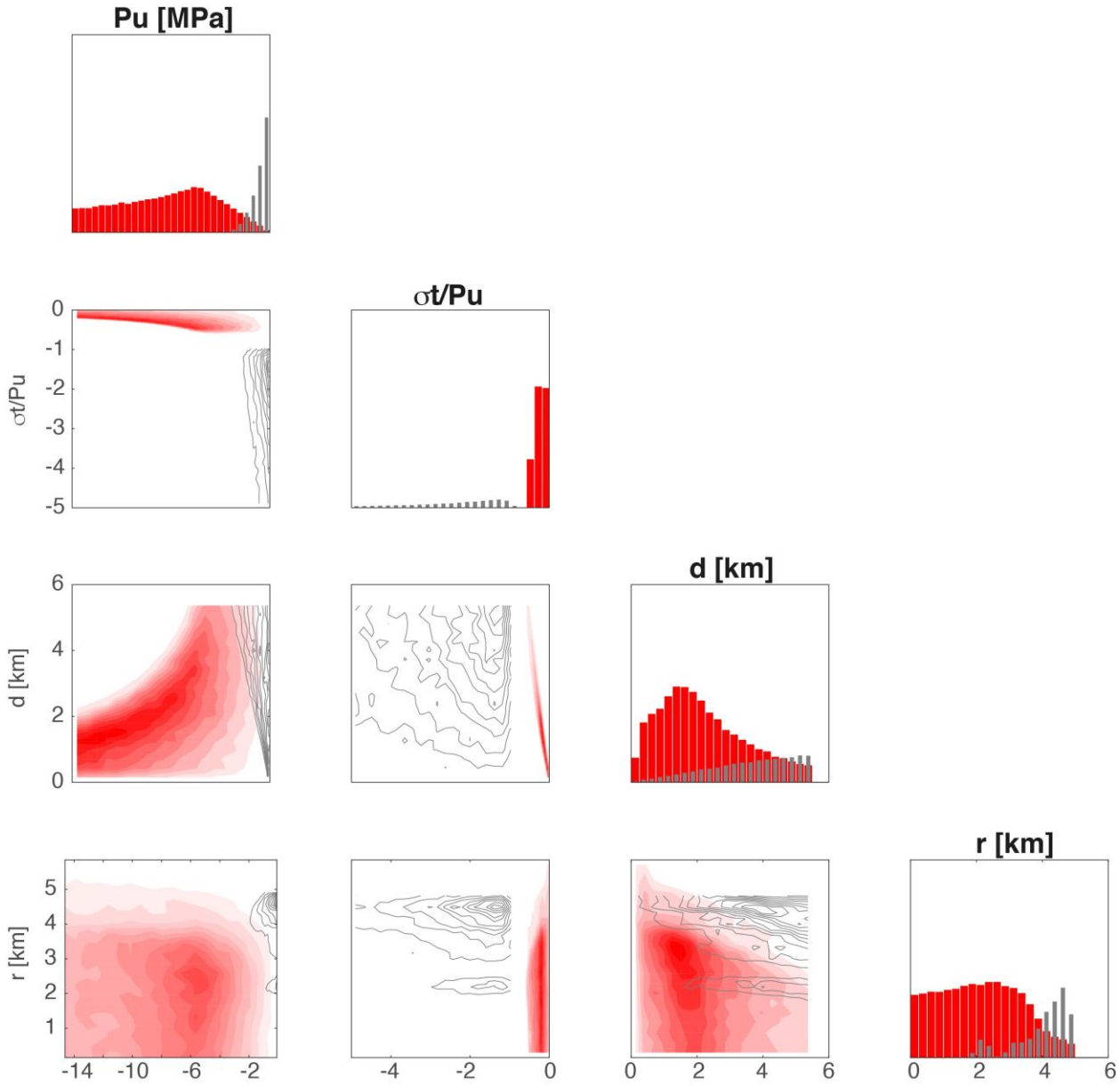

Fig. S1. Probability distributions for model parameters of epoch 1. The histograms show the distributions for individual parameters. The contour plots show covariance distributions. Bars and contours colored in gray and red refer to simulations where σ^T is larger and smaller than $2P^U/\pi$, respectively.

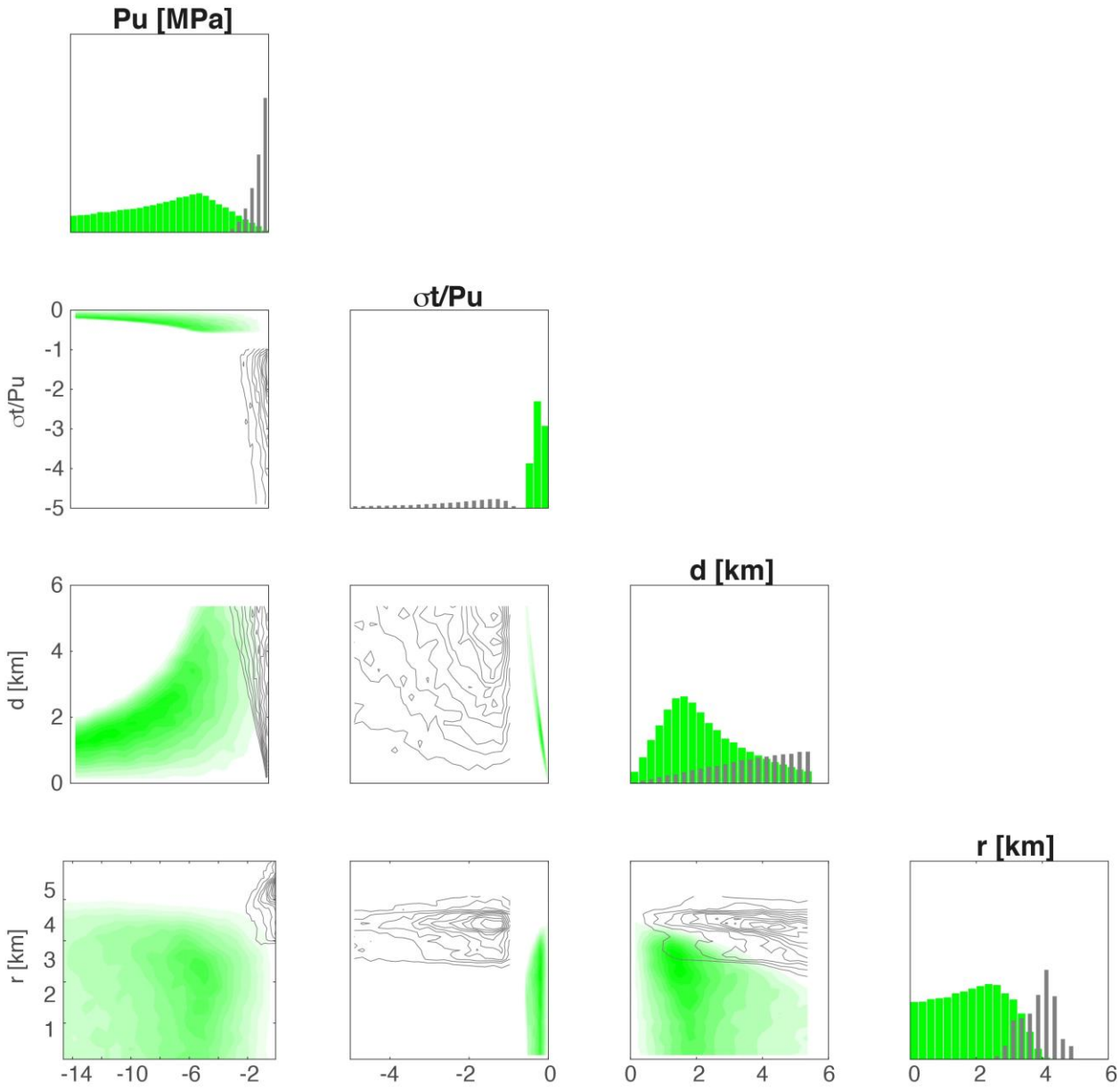

Fig. S2. Probability distributions for model parameters of epoch 2.

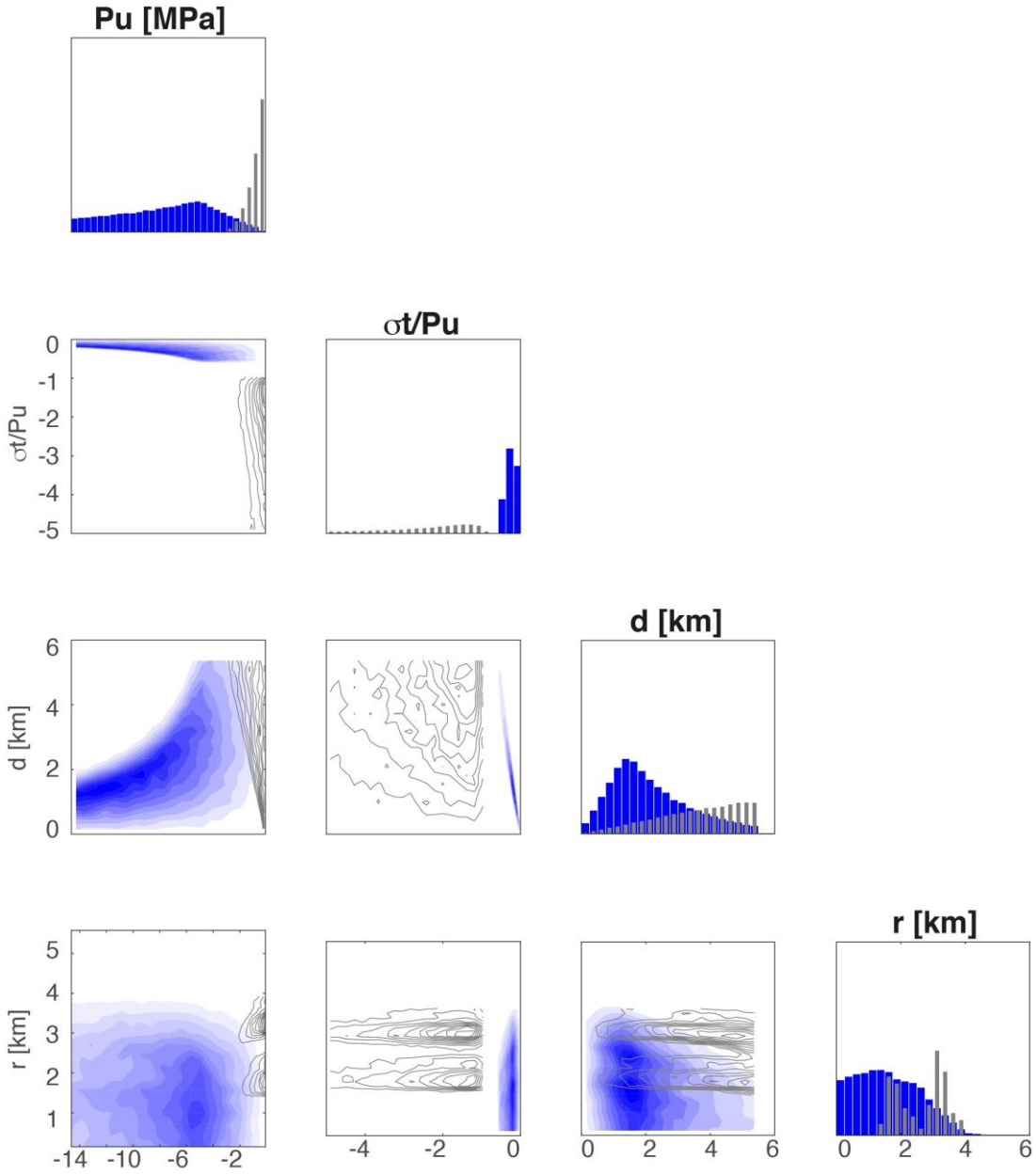

Fig. S3. Probability distributions for model parameters of epoch 3.

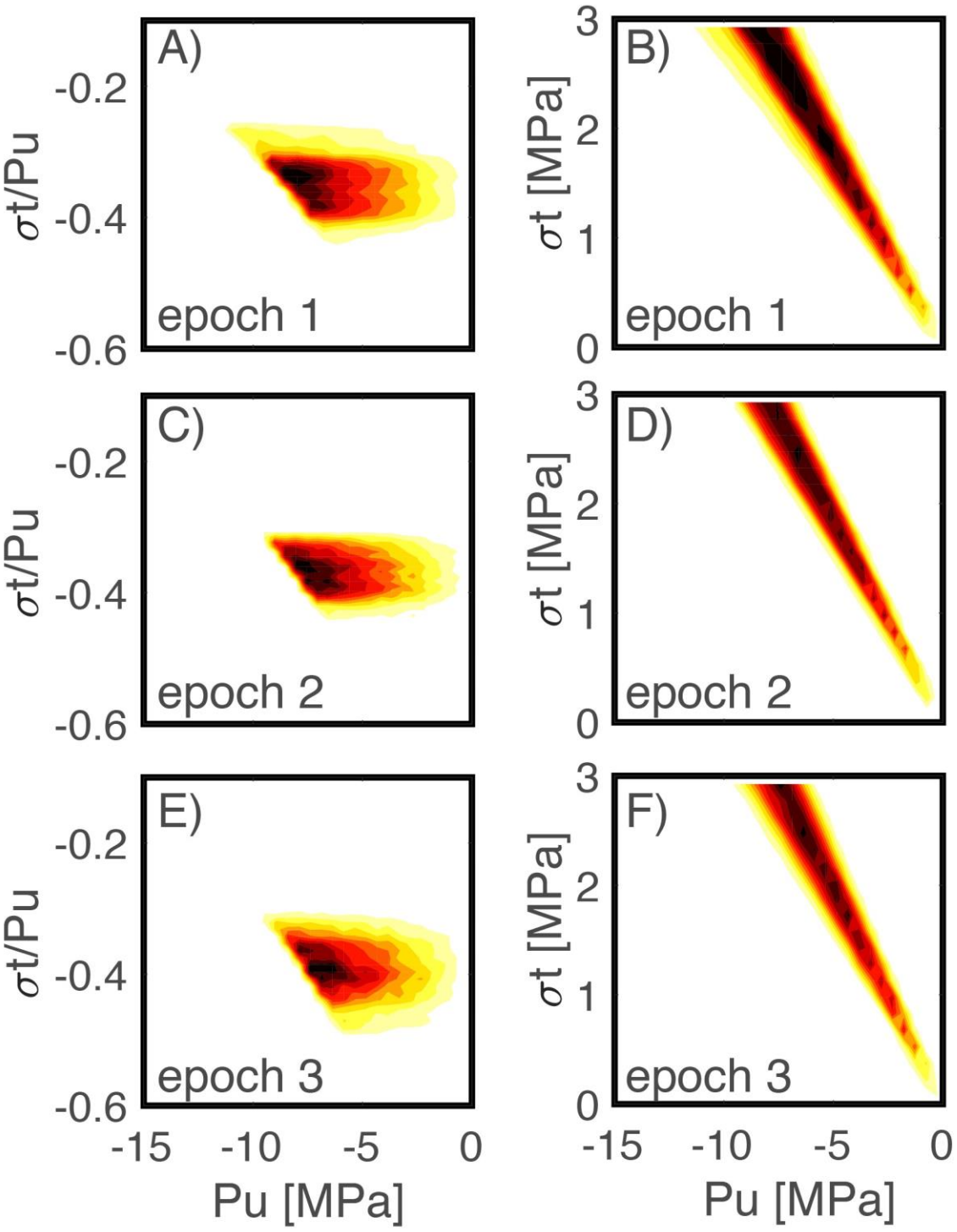

Fig. S4. Covariance distributions of σ_t/P_U versus P_U and σ_t versus P_U for a set of simulations with starting depth homogeneously distributed between 3 and 4 km and radius equal to 0 km.

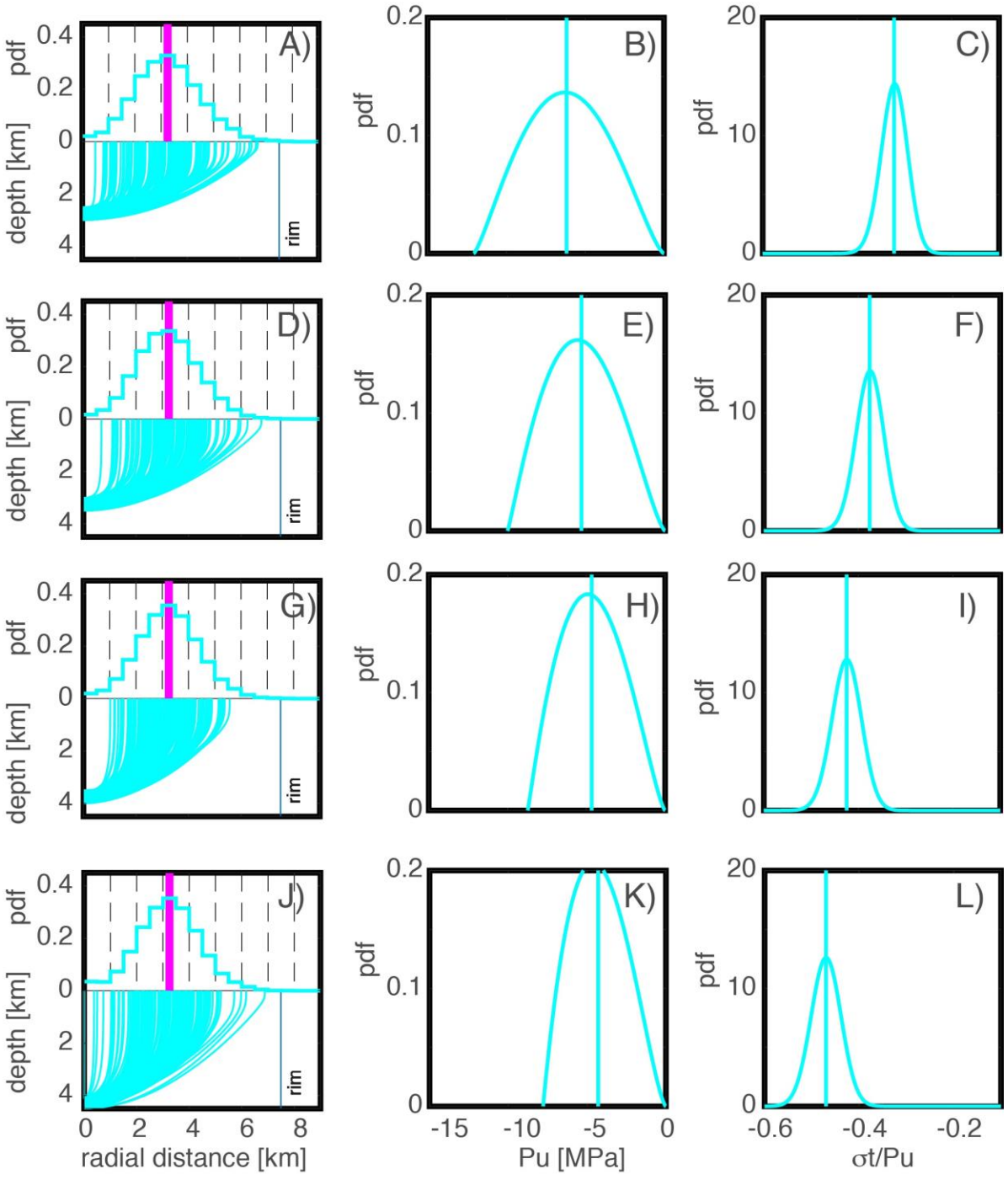

Fig. S5. Impact of variability of starting depth. Effect on P_U and σ_t/P_U distributions (panels B, E, H, K, and C, F, I, L, respectively) and forecasted arrival radii (cyan stairs of panels A, D, G, J). The thin cyan lines of panels A, D, G, J highlight forecasted magma trajectories while the magenta bar highlights the distance of Monte Nuovo from the caldera center. Each row represent simulations with a depth interval of 0.5 km from 2.5 to 4.5 km.

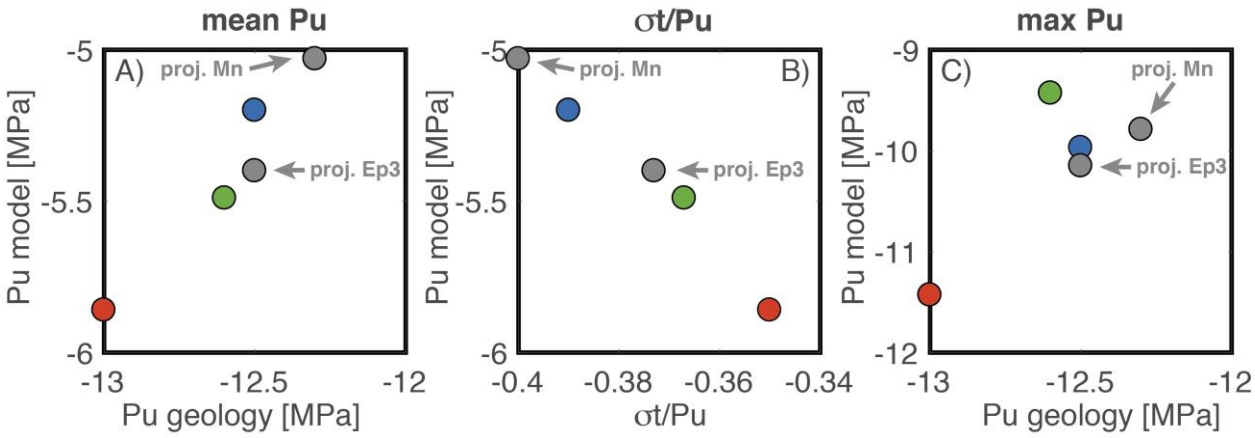

Fig. S6. Parameters projection for the time-varying stress forecast. Plot of model derived mean unloading versus geology derived unloading (panel A), model derived unloading versus σ_t/P_U (panel B) and model derived maximum unloading versus geology derived unloading (panel C). The colorcoding red, green and blue is for Epochs 1, 2 and 3, respectively. The gray dots represent the projections for Epoch3 and MN.

Table S1. Thicknesses and densities of deposits filling Campi Flegrei caldera with associated loads.

	layer thickness	density	loads	cumulative unloading
	[m]	[kg m^{-3}]	[MPa]	[MPa]
epoch 3	19 (80 - 5)	2000 - 1500	0.3	10.3
epoch 2	12 (25 - 3)	2000 - 1500	0.2	10.7
epoch 1	120 (300 - 25)	2000 - 1500	2.1	10.9
Neapolitan Yellow Tuff	350	2000	6.9	12.9
37 - 12 ka deposits	900	2200	19.4	19.8
campanian ignimbrite	500	2400	11.8	39.2
caldera floor depth	2000	2600	51.0	51.0

Thicknesses and densities of deposits filling Campi Flegrei caldera with associated loads. Data from refs. 24, 28, 38 and unpublished drilling data. For epochs 1, 2 and 3 we report the average values and their range in parenthesi

Table S2. Properties of notable worldwide calderas.

Caldera		radius	depth	submerged	min. chamber depth	max. chamber depth	P_U	σt min	σt max	vents outside the caldera	vents on the caldera rim	vents inside the caldera	references
		[m]	[m]	[m]	[m]	[m]	[Mpa]	[Mpa]	[Mpa]	[%]	[%]	[%]	
fernandina	FE	2700	1100	-	1000	2000	21.6	0.2	0.5	65	32	3	43; 44; 45
wolf	WO	2650	660	-	1800	2800	12.9	0.2	0.5	79.9	20	0.1	45; 46
darwin	DA	2700	200	-	1500	3500	3.9	0.2	0.5	62.9	37	0.1	45; 47
sierra negra	SiN	4200	110	-	2500	3500	2.2	0.2	0.5	66.9	33	0.1	45; 47
alcedo	AL	3750	300	-	2000	4000	5.9	0.2	0.5	65.9	34	0.1	45; 48
cerro azul	CeA	3500	480	-	4500	6500	9.4	0.2	0.5	82.9	17	0.1	44; 45
rano kau	RaK	700	160	-	2000	6000	3.1	0.2	0.5	64.9	35	0.1	49
campi flegrei	CaF	7500	200	-	3000	4000	3.9	1.0	3.0	0.1	23	76.9	24; 37
aso	AS	8500	250	-	3500	5500	4.9	1.0	3.0	0.1	0.1	99.8	50; 51
crater lake	CrL	4500	750	350	4000	6000	11.3	2.0	3.0	0.1	0.1	99.8	52; 53
rotorua	RO	8500	250	20	4000	8000	4.7	1.0	3.0	0.1	0.1	99.8	54; 55
santorini	SA	4700	400	200	3500	5500	5.9	1.0	3.0	0.1	0.1	99.8	56; 57
bolsena	BO	7500	450	150	2500	5500	7.4	1.0	3.0	18	75	7	58
rabaul	RA	3600	400	150	2000	4000	6.4	1.0	3.0	0.1	99.8	0.1	59
aira	AI	8500	500	200	5000	8000	7.8	1.0	3.0	0.1	99.8	0.1	60; 61
valles	VA	11000	550	-	5000	7000	10.8	2.0	3.0	40	46	16	62
dolomieu	DO	4000	100	-	1500	2500	2.0	0.2	0.5	86	13.9	0.1	L. Michon, pers. comm.