Supporting information for
Gas Migration and Slope Instability in the Danube Fan: Insights from Integrated OBS–MCS Seismic Analysis

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S1. Forward model assessment

A first order assessment of the forward model is typically obtained by a comparison between the observed and synthetic traveltimes derived from ray tracing and the ray coverage. In combination with statistical model parameters, such as the root-mean-square (RMS) misfit, this gives an estimation of the model quality. Figs. S1 and S2 display the observed and modelled traveltime picks and ray coverage of profile X for the P- and S-wave model, respectively. Similarly. Figs. S3 and S4 show the resulting comparison and ray coverage for the P- and S-wave model of profile Y, respectively. In addition, the tables S1 and S2 provide the modelled seismic P- and S-wave velocities, corresponding Vp/Vs-ratios, and pick uncertainties for each layer of both profiles.

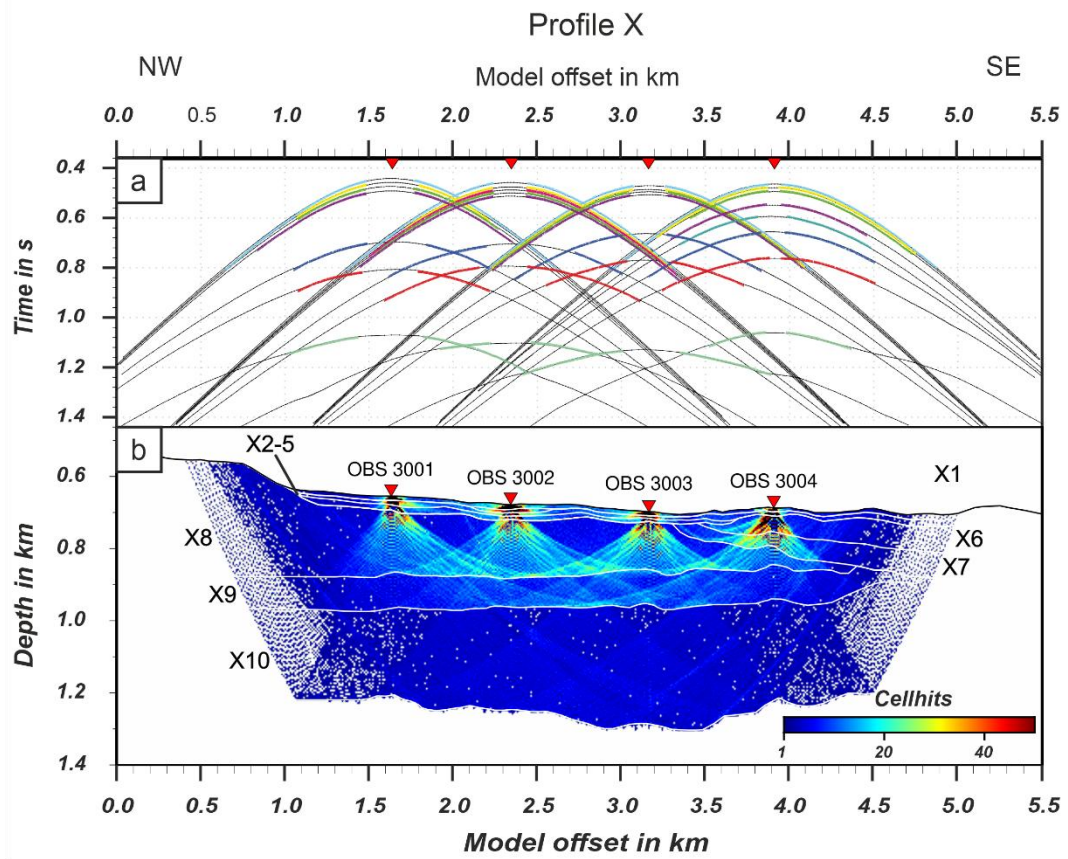**Fig. S 1:** *Forward model assessment for the P-wave velocity model of profile X. (a) Comparison between the observed (coloured lines) and synthetic traveltime picks (black lines). (b) Ray coverage based on the ray density within the model cells.*
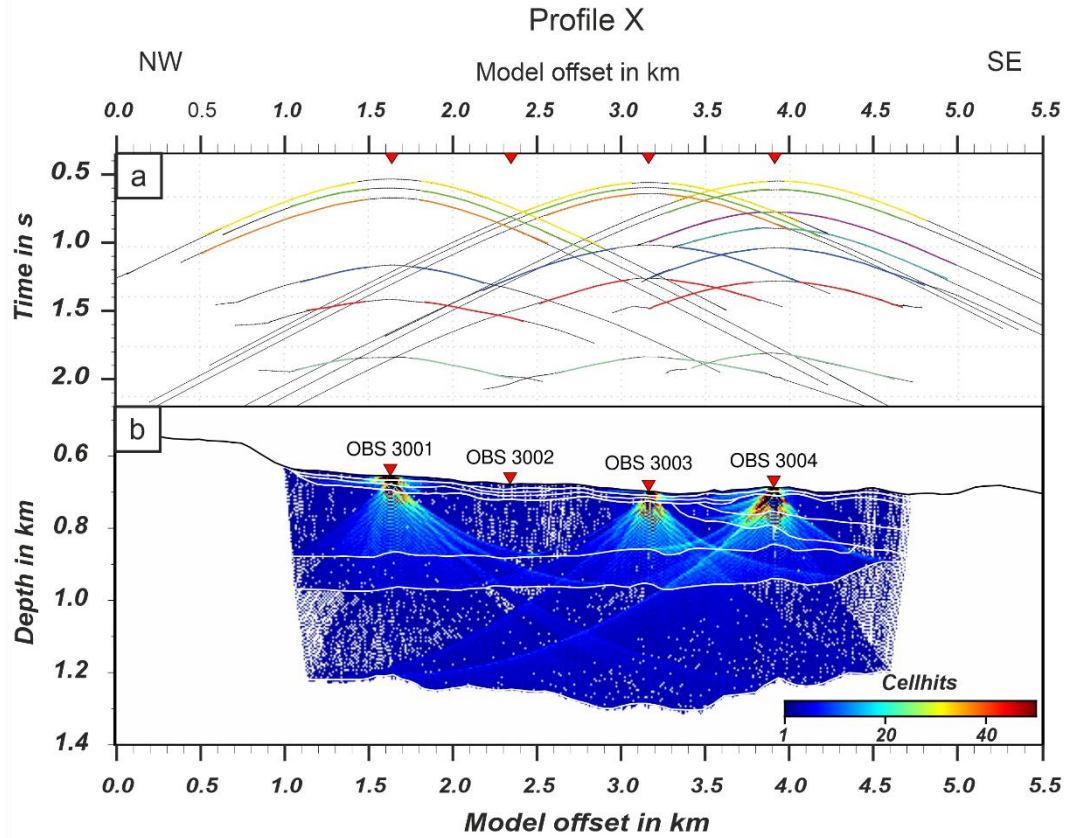

Fig. S 2: *Forward model assessment for the S-wave velocity model of profile X. (a) Comparison between the observed (coloured lines) and synthetic traveltime picks (black lines). (b) Ray coverage based on the ray density within the model cells.*

Fig. S 3: *Forward model assessment for the P-wave velocity model of profile Y. (a) Comparison between the observed (coloured lines) and synthetic traveltime picks (black lines). (b) Ray coverage based on the ray density within the model cells.*
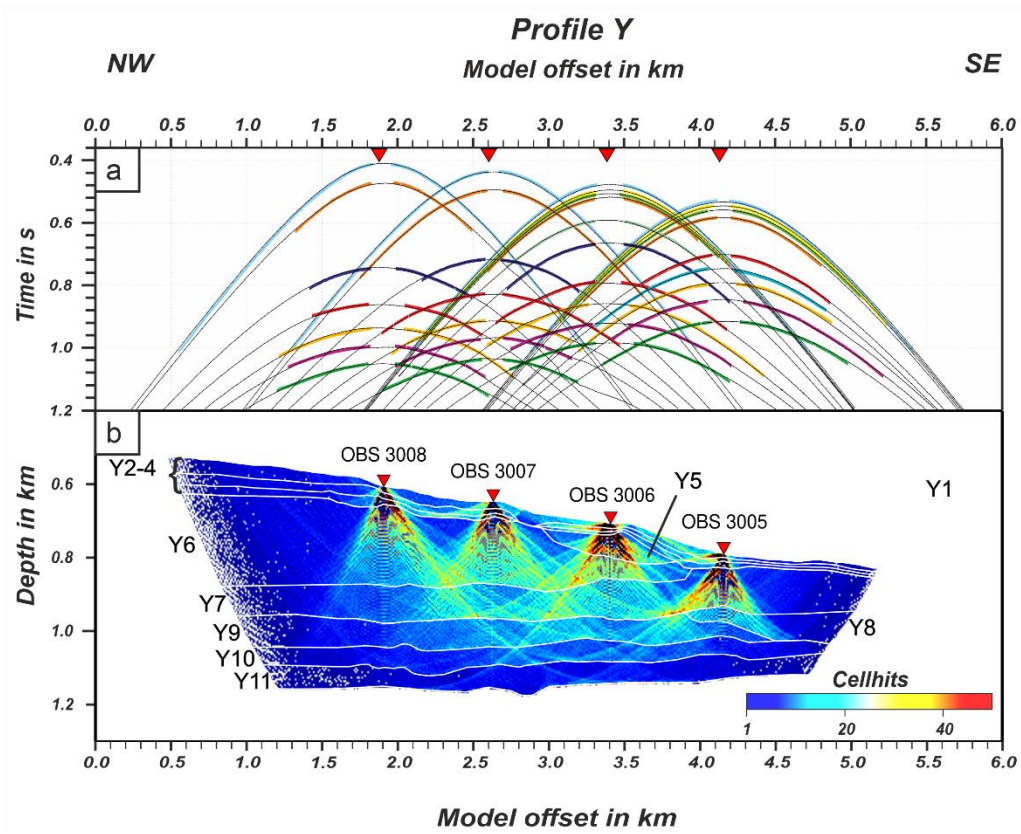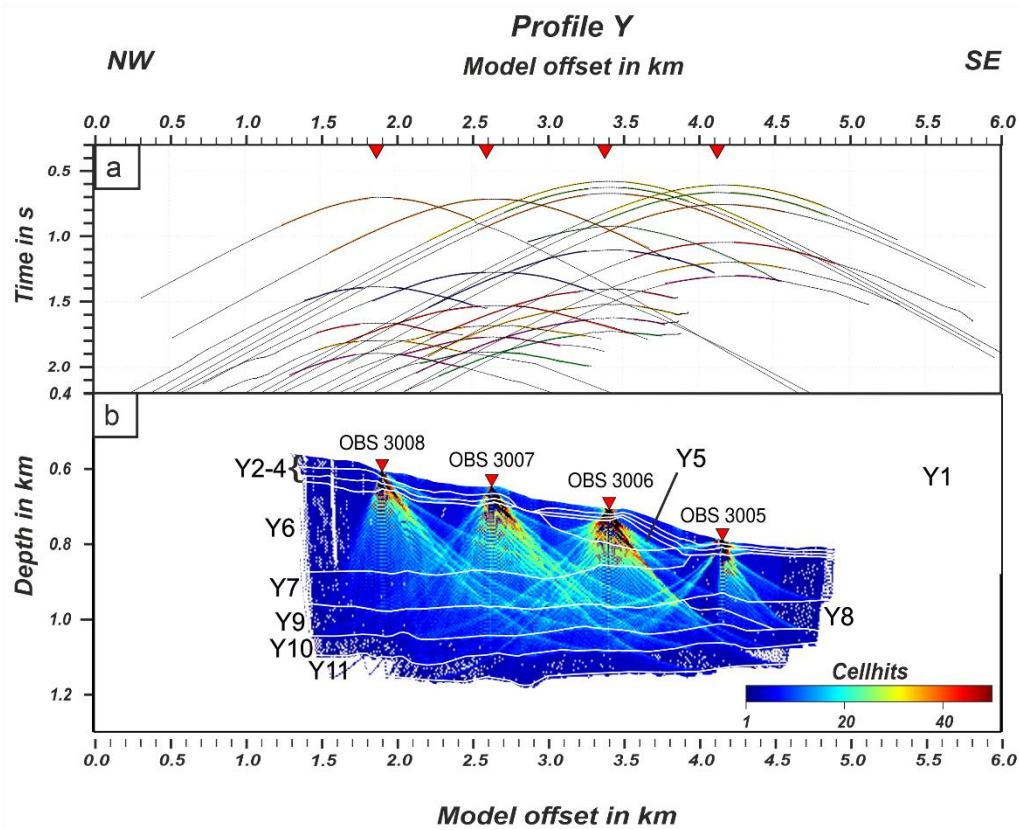

Fig. S 4: *Forward model assessment for the S-wave velocity model of profile Y. (a) Comparison between the observed (coloured lines) and synthetic traveltime picks (black lines). (b) Ray coverage based on the ray density within the model cells.*

Table S 1: *Modelled seismic velocities, Vp/Vs-ratios, and the corresponding pick uncertainties for each layer (top to bottom) for profile X.*

Layer	Vp (m/s)	Vs (m/s)	Vp/Vs-ratio	Pick uncertainty (P-/ S-wave model)	
X1	1483			5 ms / 5 ms	Water layer
X2	1510	140	10.6	5 ms / 7 ms	Unit 1
X3	1510	150	10	6 ms / -	
X4	1520	210	7.2	7 ms / 11 ms	
X5	1530	230	6.8	7 ms / 12 ms	
X6	1580-1620	320	5	7 ms / 16 ms	Unit 2
X7	1680-1720	420-430	4	10 ms / 18 ms	
X8	1640-1760	430-460	3.8	15 ms /20 ms	
X9	1760-1800	500-510	3.6	16 ms / 20 ms	Unit 3
X10	1800-1900	820-860	2.2	18 ms / 24 ms	

Table S 2: *Modelled seismic velocities, Vp/Vs-ratios, and the corresponding pick uncertainties for each layer (top to bottom) for profile Y.*

Layer	Vp (m/s)	Vs (m/s)	Vp/Vs-ratio	Pick uncertainty (P-/ S-wave model)	
Y1	1483			5 ms / 5 ms	Water layer
Y2	1510	140	10.6	5 ms / 7 ms	Unit 1
Y3	1520	210	7.2	6 ms / 10 ms	
Y4	1530	230	6.8	7 ms / 12 ms	
Y5	1600-1640	280-285	5.8	10 ms / 12 ms	Unit 2
Y6	1640-1660	410-420	4	9 ms / 16 ms	
Y7	1670-1780	450-480	3.7	10 ms / 18 ms	
Y8	1800-1970	490-530	3.7	12 ms / no picks*	Unit 3
Y9	1780-1820	710-730	2.5	12 ms / 20 ms	
Y10	1820-1850	780-790	2.4	15 ms / 21 ms	
Y11	1850-1900	790-810	2.4	17 ms / 21 ms	
* Vs estimated for model continuity					