



Supplement of

Topographic control of tides in the Ross Sea: eddy-like structures, bottom-trapped waves, and energetics

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Introduction

In this document, Table S1 summarizes the Model-Observation Comparison, including the mooring stations chosen, as well as the validation depths and time periods selected.

Figures S1-S16 show the comparison of the simulated and observed tidal currents at different mooring stations shown in Table S1.

Figure S17 compares the PRISM cross-slope temperature sections with the corresponding model monthly mean.

Figure S18 shows tide-induced sea level changes and surface- and topographic-mode volume transports at mid-flood and mid-ebb.

Figure S19 shows the spatial distribution of depth-averaged, period-averaged sea water temperature.

Figure S20 shows the spatial distribution of time-mean magnitude of baroclinic sea level and tidal SSH.

Figure S21 shows the depth-integrated energy flux (W/m) components, including the time-averaged values along with snapshots taken at high tide and low tide.

Figure S22 shows a snapshot of the vertical profile of baroclinic tidal energy flux (pressure work components) at the model grid cell matched to mooring CC1.

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Table S1. Model-Observation Comparison Summary

Figure Number	Mooring Station	Validation Depth (m)	Validation Period
S1	adp1	864 m	2003-03-06 21:00–2003-04-06 20:00
S2	adp2	504 m	2004-03-09 01:00–2004-04-09 00:00
S3	ca1	484 m	2003-03-02 07:00–2003-04-02 06:00
S4	cb1	524 m	2003-03-03 07:00–2003-03-15 19:00
S5	cb2	381 m	2003-04-01 00:00–2003-05-01 00:00
3	cc1	630 m	2003-03-03 02:00–2003-04-03 01:00
S6	cd1	716 m	2003-03-02 21:00–2003-04-02 20:00
S7	ce1	1387 m	2003-03-03 20:00–2003-03-22 14:00
S8	ce2	1751 m	2003-04-01 00:00–2003-05-01 00:00
S9	eb1	961 m	2003-03-01 20:00–2003-04-01 19:00
S10	m1	478 m	2004-03-08 22:00–2004-04-08 21:00
S11	m3	491 m	2004-03-07 00:00–2004-04-06 23:00
S12	m4	964 m	2004-03-10 07:00–2004-04-10 06:00
S13	m5	1729 m	2004-03-09 07:00–2004-04-09 06:00
S14	wa1	587 m	2003-03-06 06:00–2003-04-06 05:00
S15	wb1	1004 m	2003-03-06 02:00–2003-04-06 01:00
S16	wc1	1238 m	2003-03-04 02:00–2003-04-04 01:00

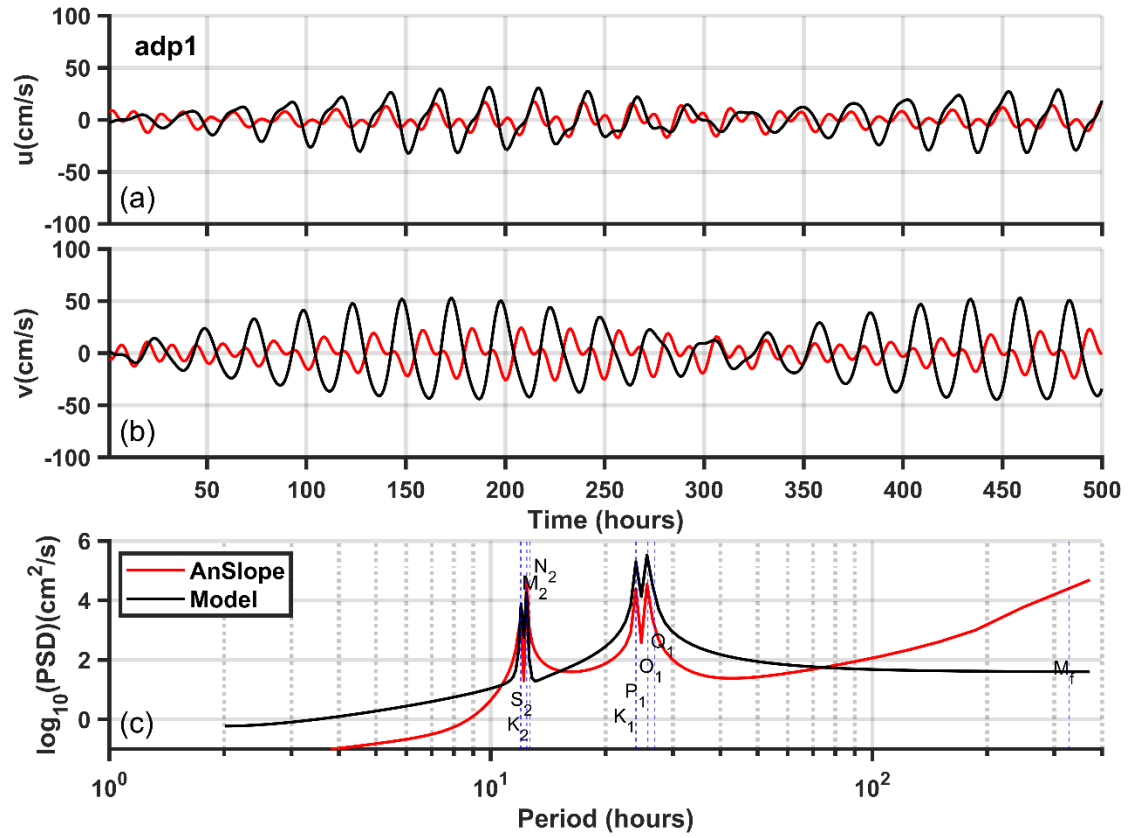


Figure S1. Comparison of the simulated tidal currents and observation from mooring adp1, showing the filtered time series (semi-diurnal and diurnal constituents) of the (a) meridional and (b) zonal tidal velocities, and (c) the corresponding power spectral density (PSD).

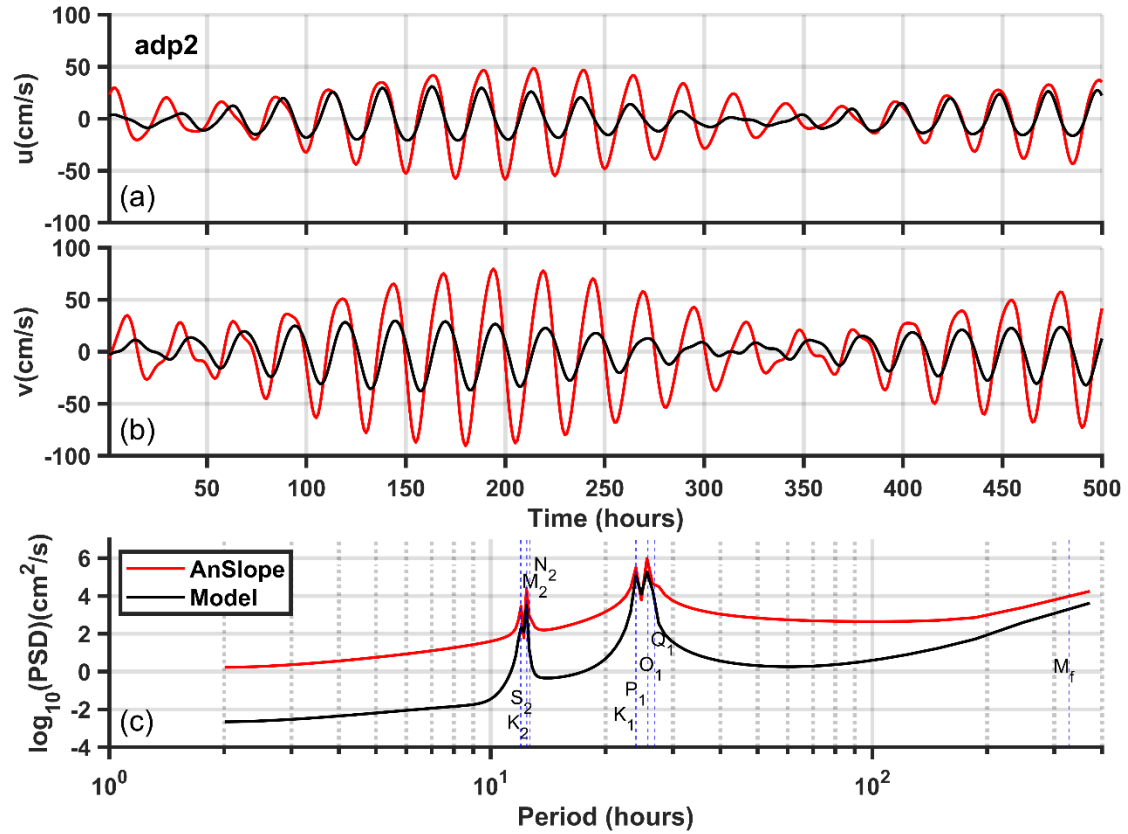


Figure S2. Comparison for mooring adp2, as in Figure S1.

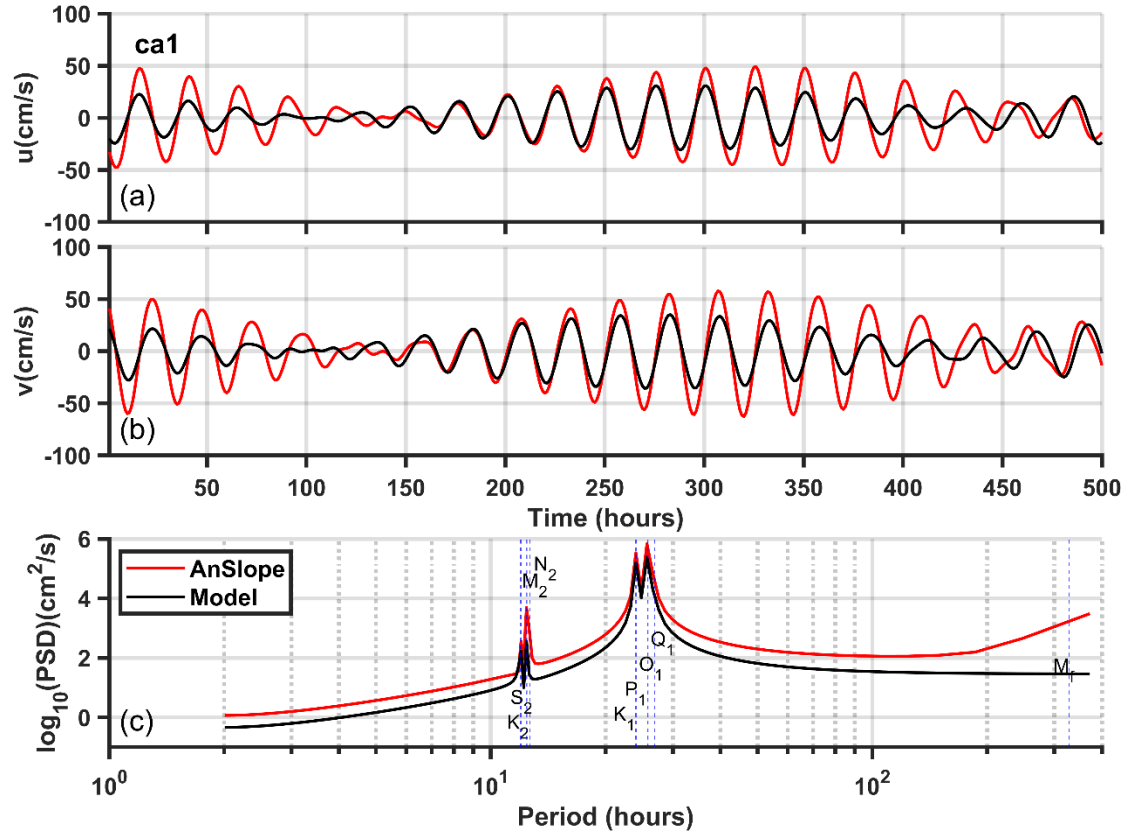


Figure S3. Comparison for mooring ca1, otherwise as in Figure S1.

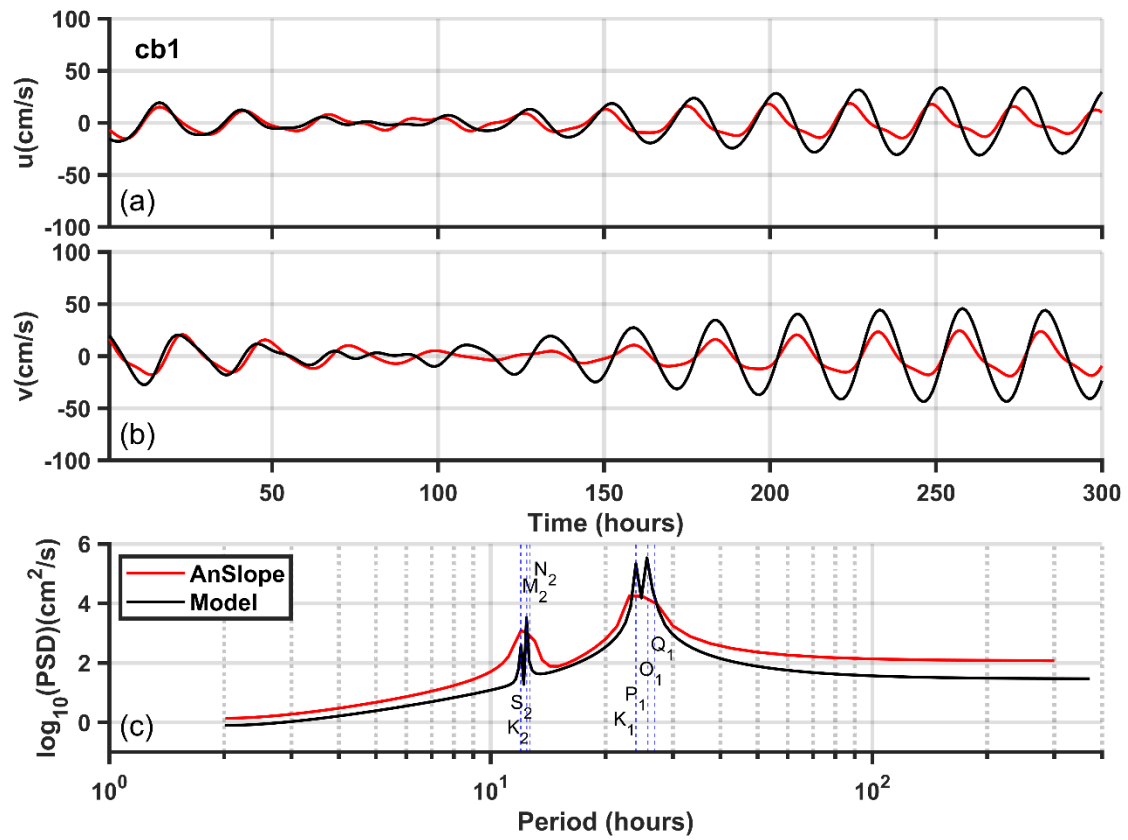


Figure S4. Comparison for mooring cb1, as in Figure S1.

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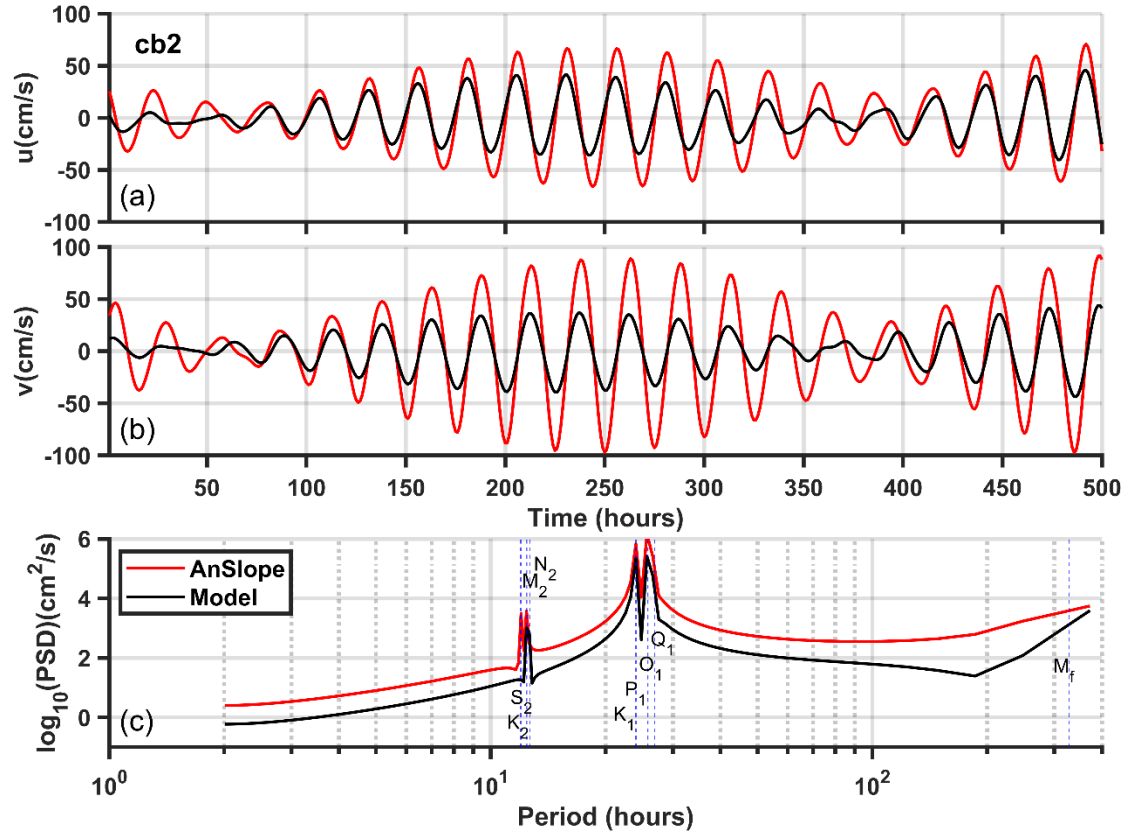


Figure S5. Comparison for mooring cb2, as in Figure S1.

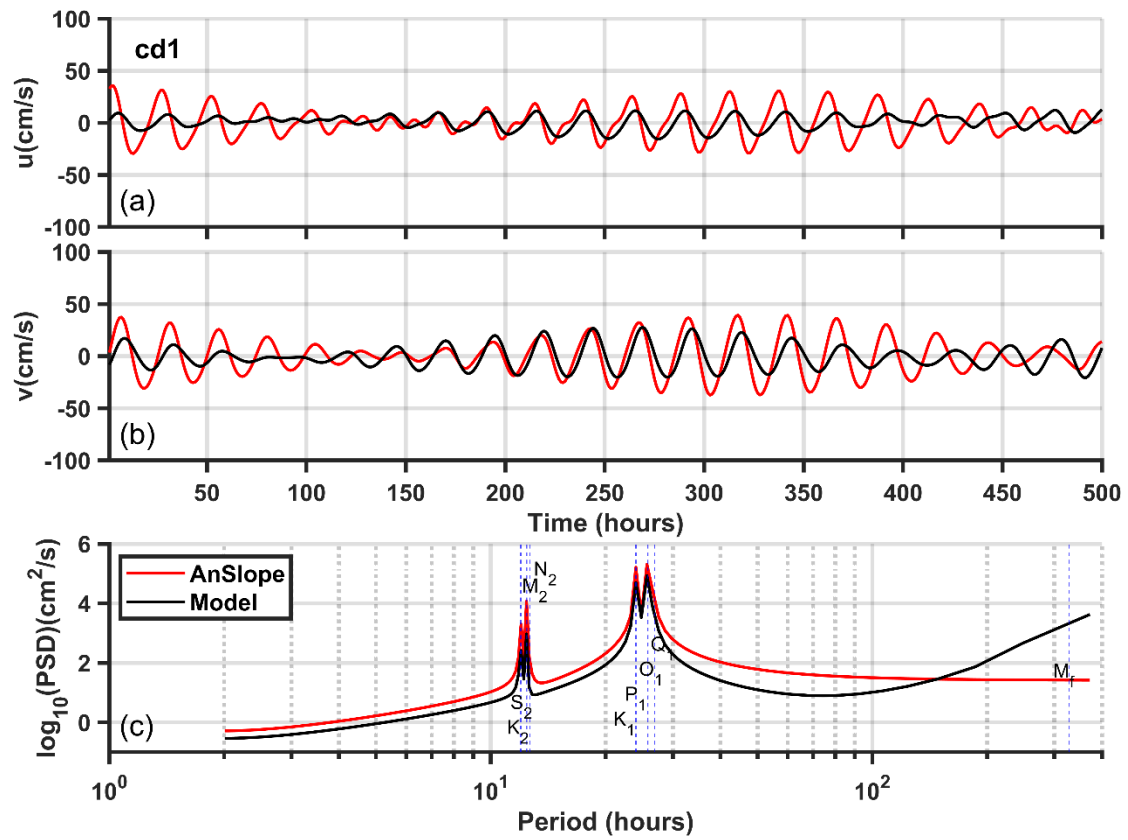


Figure S6. Comparison for mooring cd1, otherwise as in Figure S1.

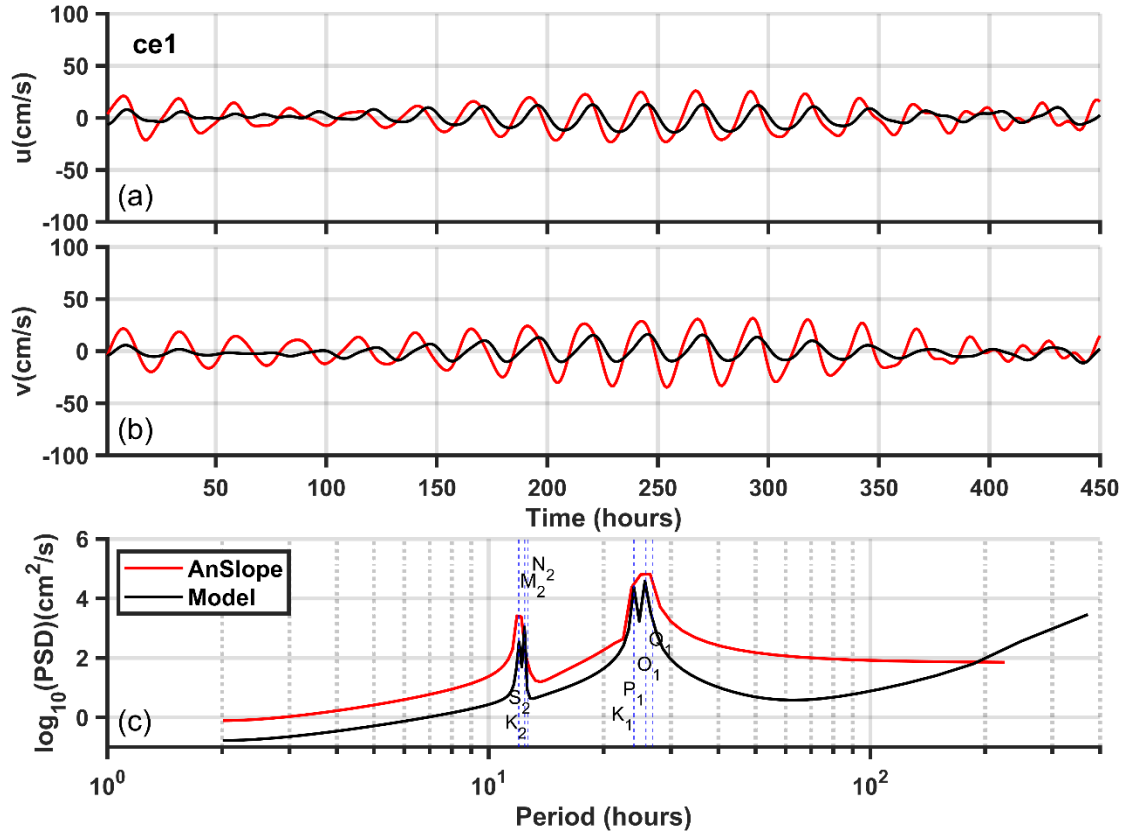


Figure S7. Comparison for mooring ce1, otherwise as in Figure S1.

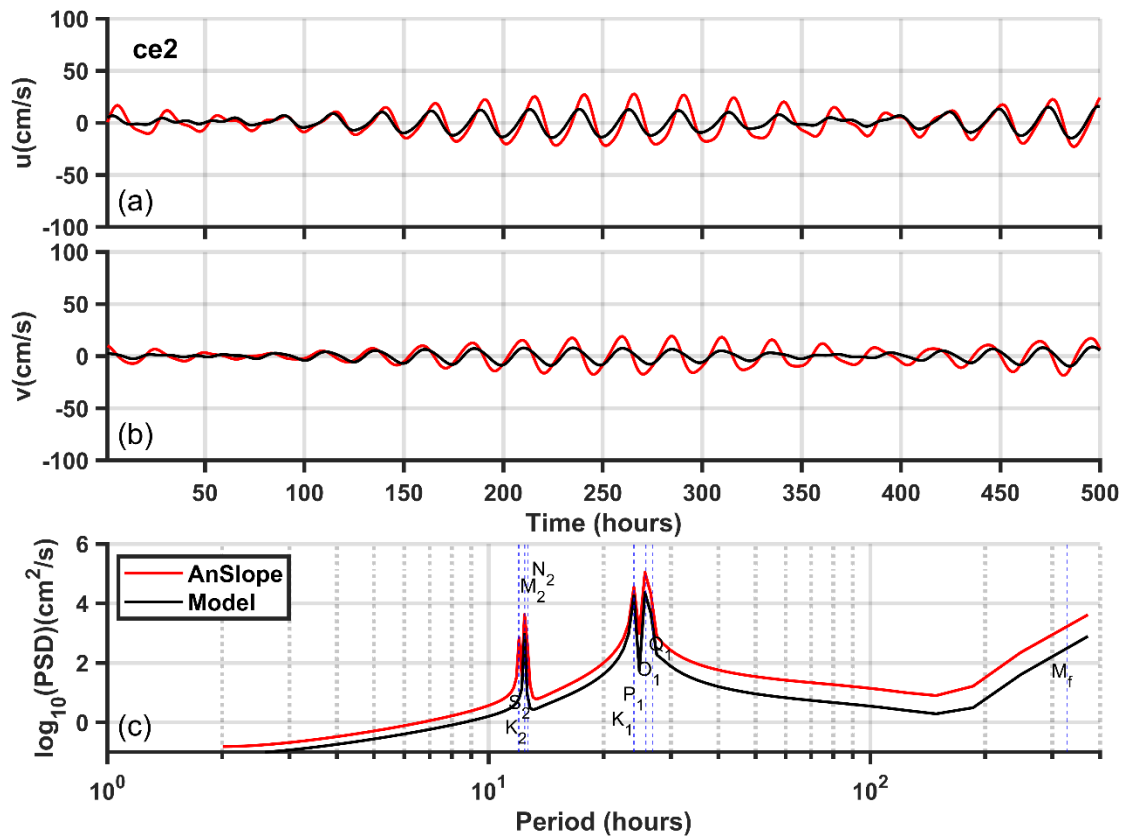


Figure S8. Comparison for mooring ce2, otherwise as in Figure S1.

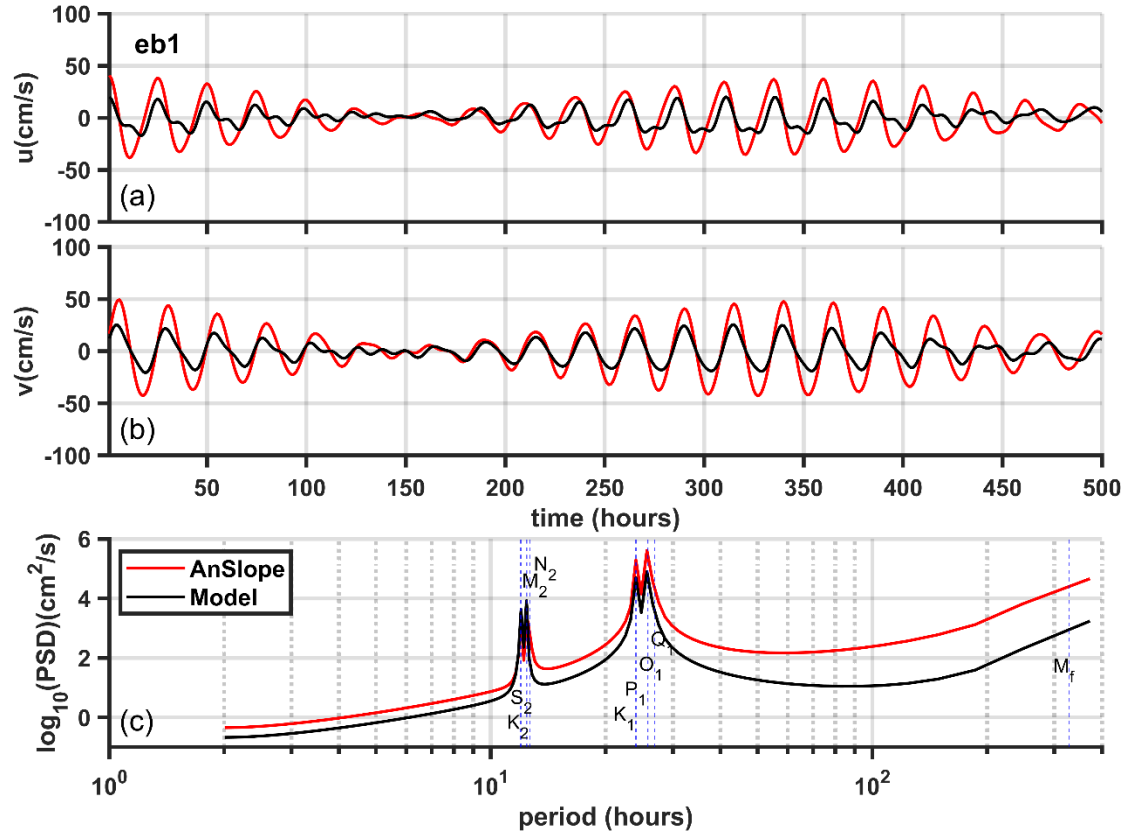


Figure S9. Comparison for mooring eb1, otherwise as in Figure S1.

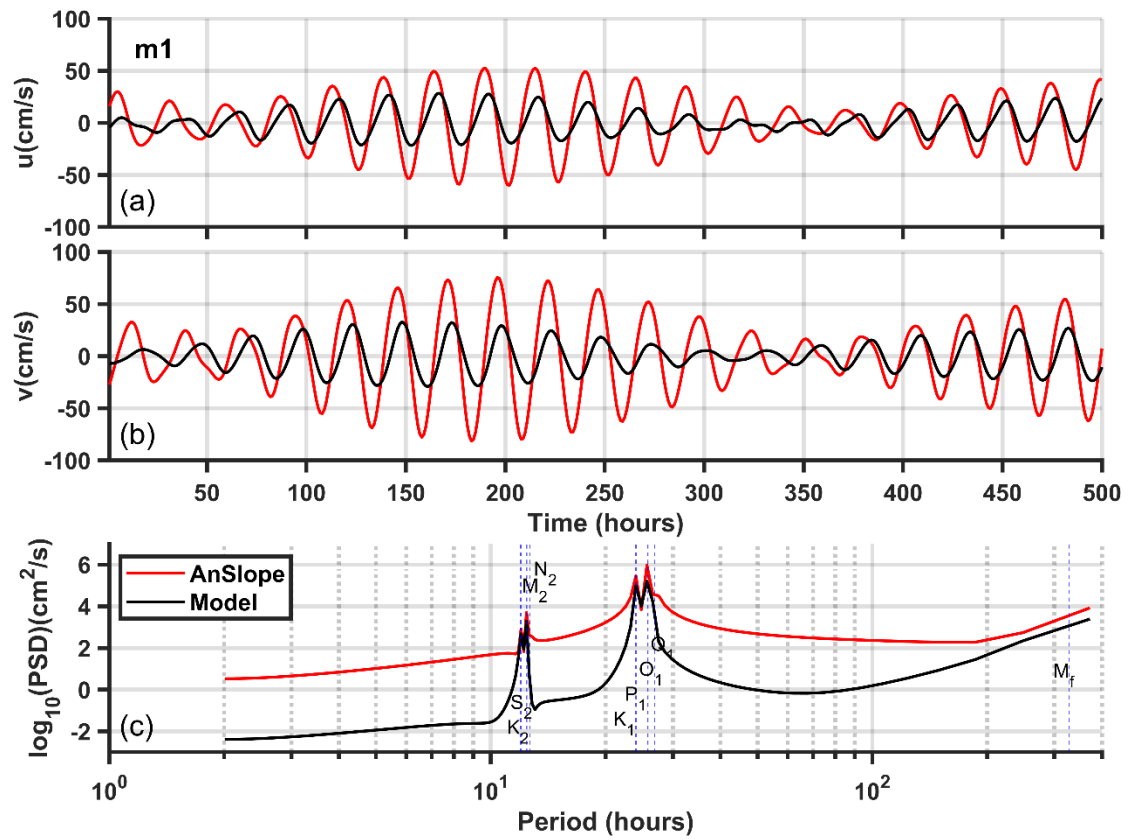


Figure S10. Comparison for mooring m1, otherwise as in Figure S1.

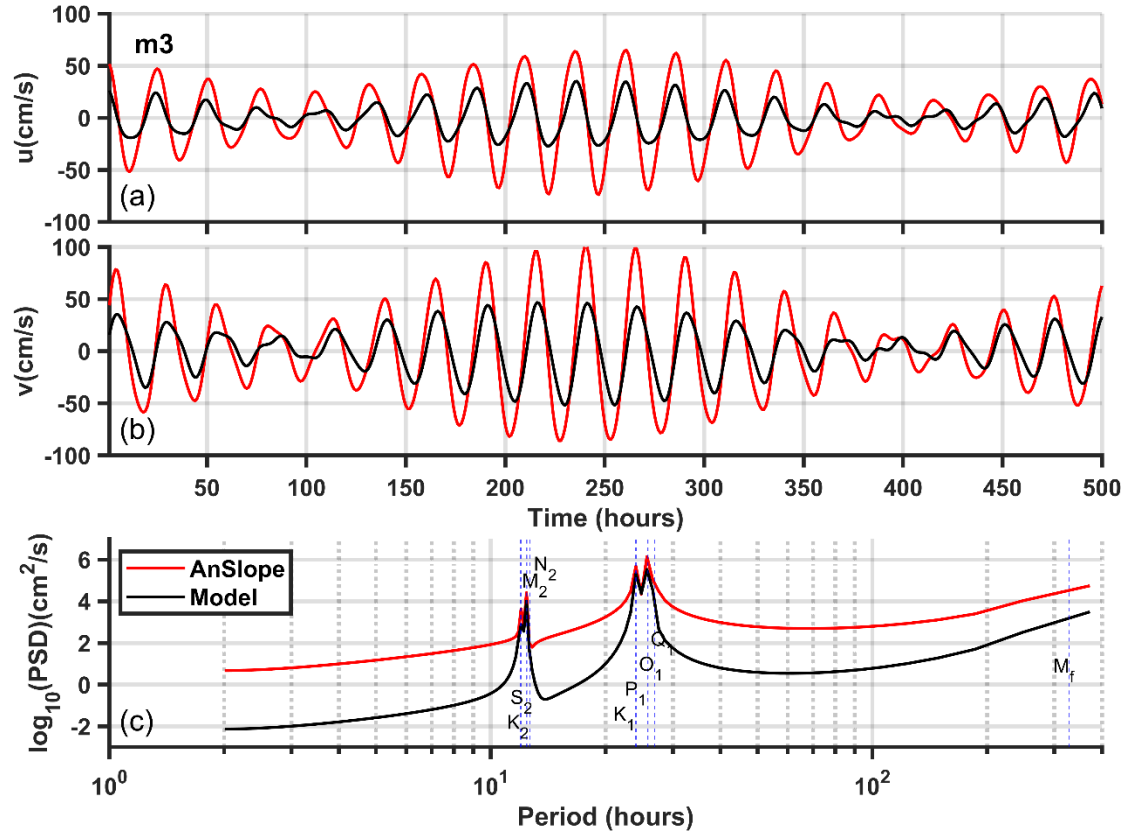


Figure S11. Comparison for mooring m3, otherwise as in Figure S1.

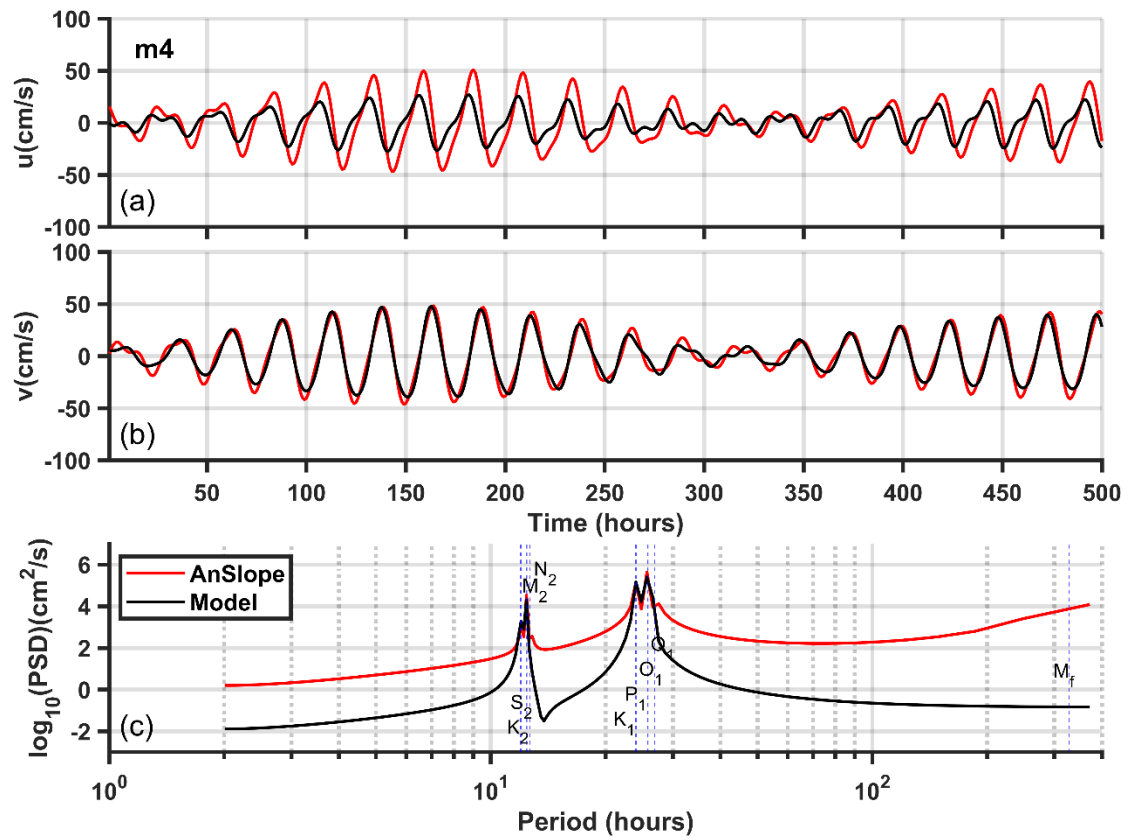


Figure S12. Comparison for mooring m4, otherwise as in Figure S1.

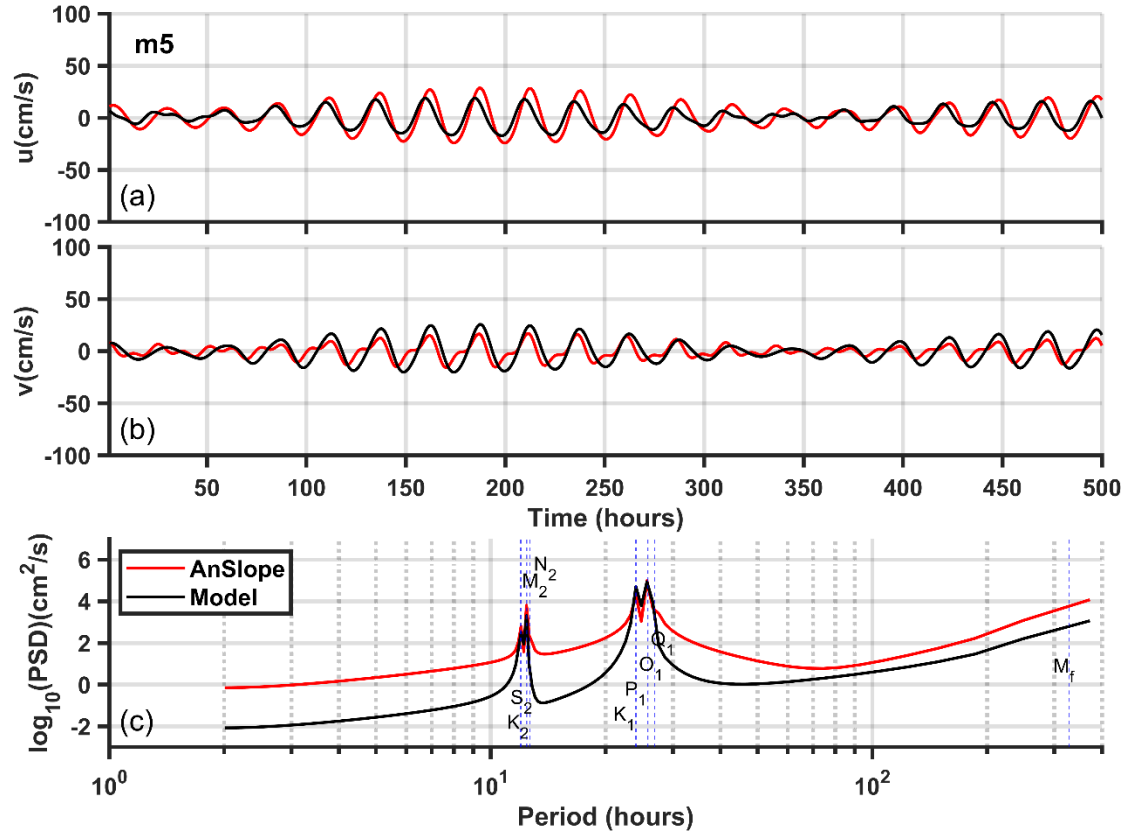


Figure S13. Comparison for mooring m5, otherwise as in Figure S1.

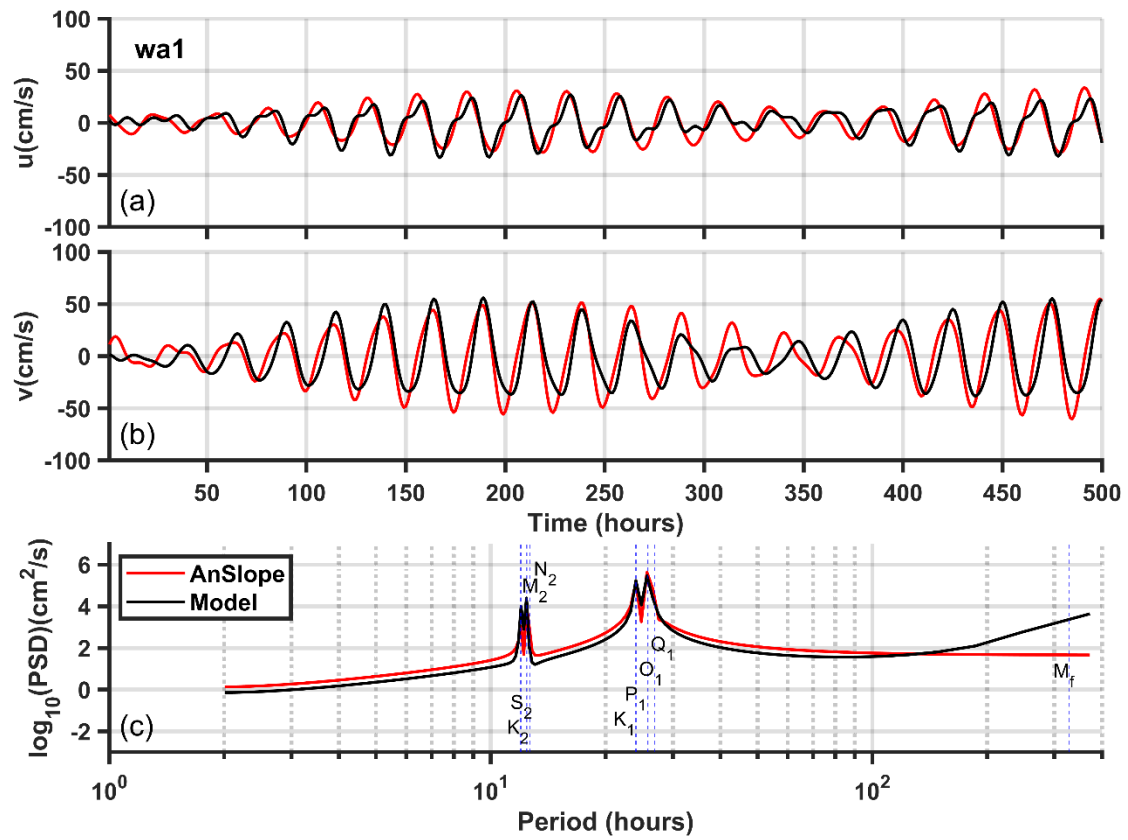


Figure S14. Comparison for mooring wa1, otherwise as in Figure S1.

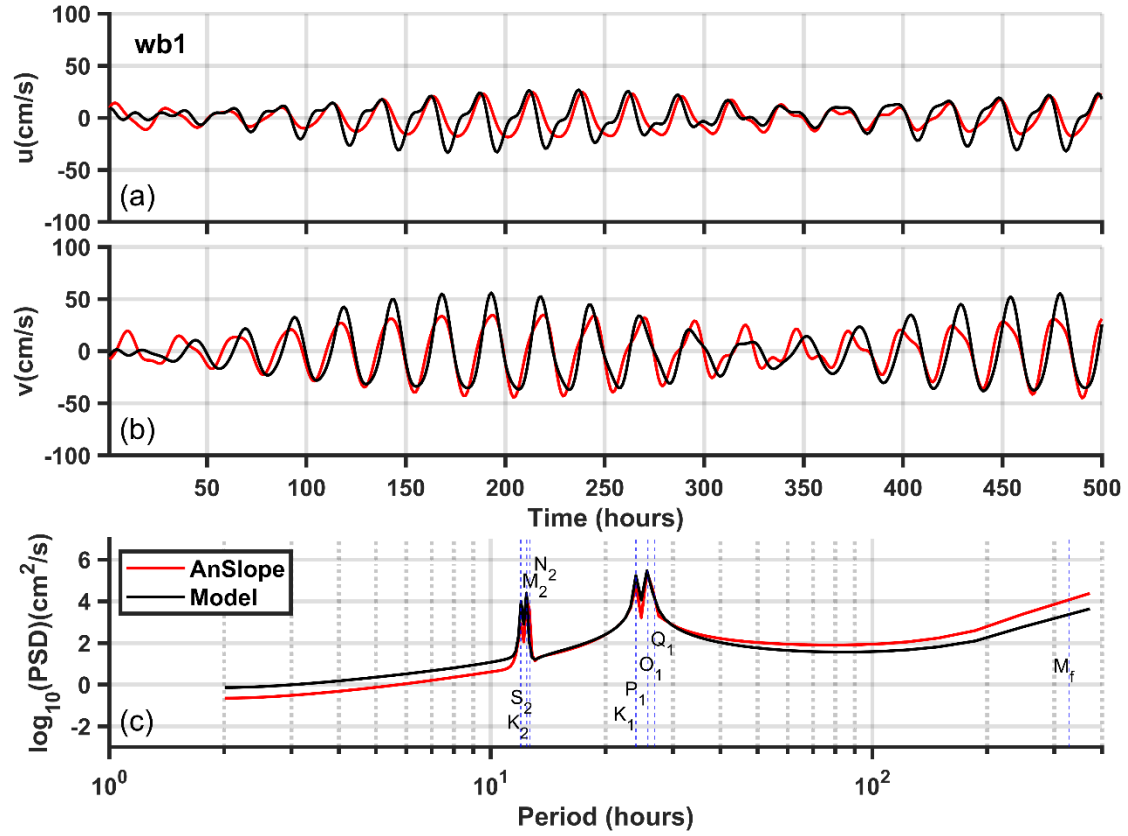


Figure S15. Comparison for mooring wb1, otherwise as in Figure S1.

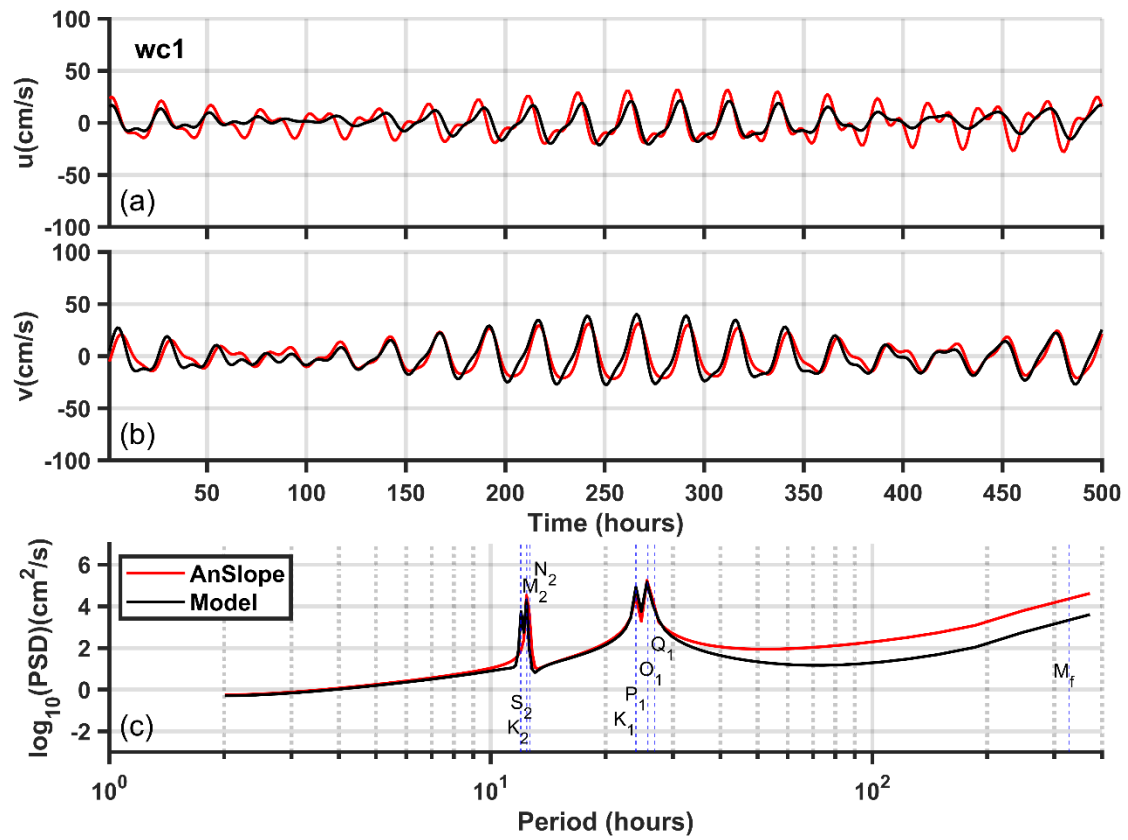


Figure S16. Comparison for mooring wc1, otherwise as in Figure S1.

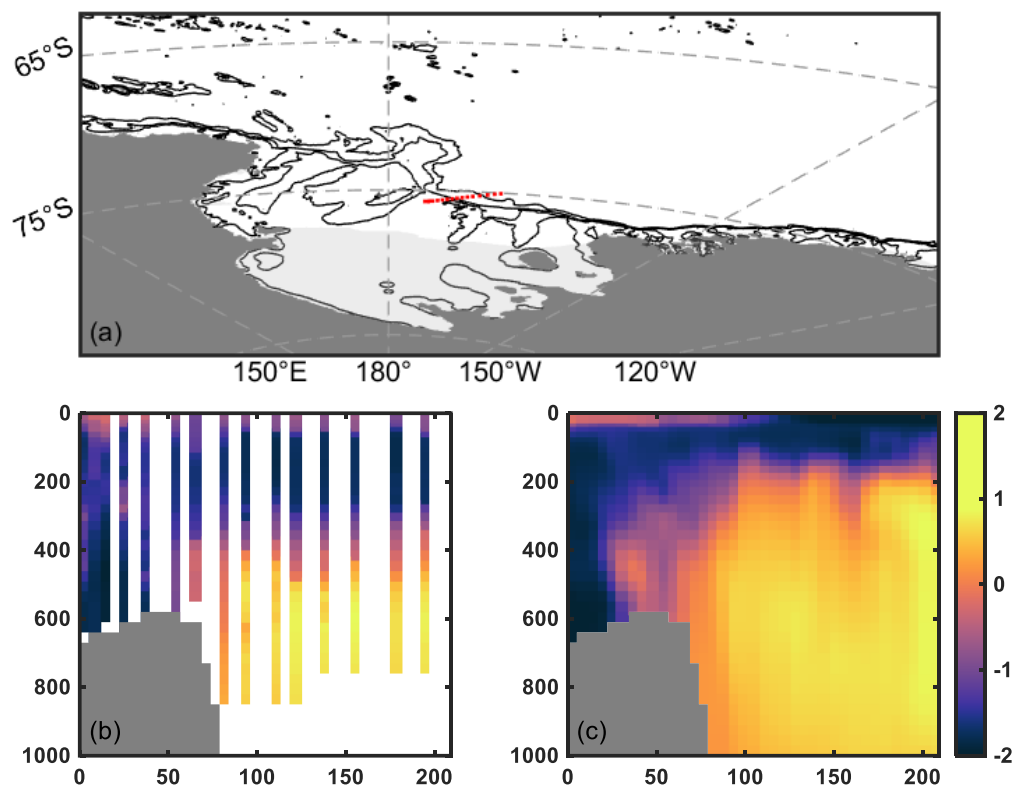


Figure S17. (a) XBT transect across the Ross Sea continental slope in the PRISM project (red dots). (b) Observed and (c) simulated temperature sections along the transect.

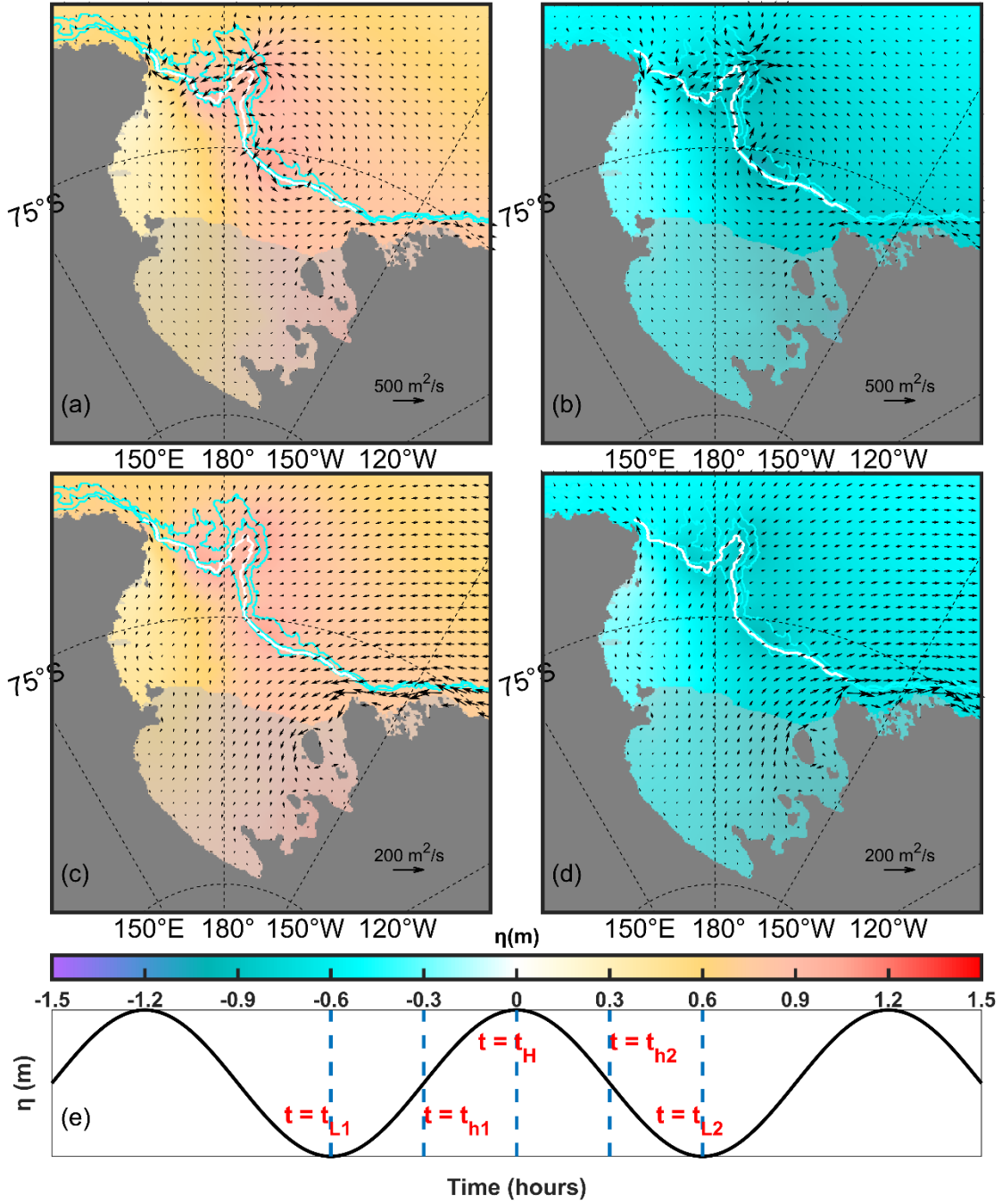


Figure S18. (a) Tide-induced sea level change (color shading) during half flood period (from t_{L1} to t_{h1}), overlain by volume transport vectors of the topographic mode at t_{h1} . (b) Tide-induced sea level change (color shading) during half ebb period (from t_H to t_{h2}), overlain by volume transport vectors of the topographic mode at t_{h2} . (c, d) Corresponding volume divergence due to the surface mode (color shading) during flood and ebb periods, overlain by volume transport vectors of the surface mode at t_{h1} and t_{h2} , respectively. The 500, 1000, and 2000-m isobaths (cyan) and the 700-m isobath (white) are shown along the continental slope. (e) Schematic for illustrating the flood and ebb periods for integration.

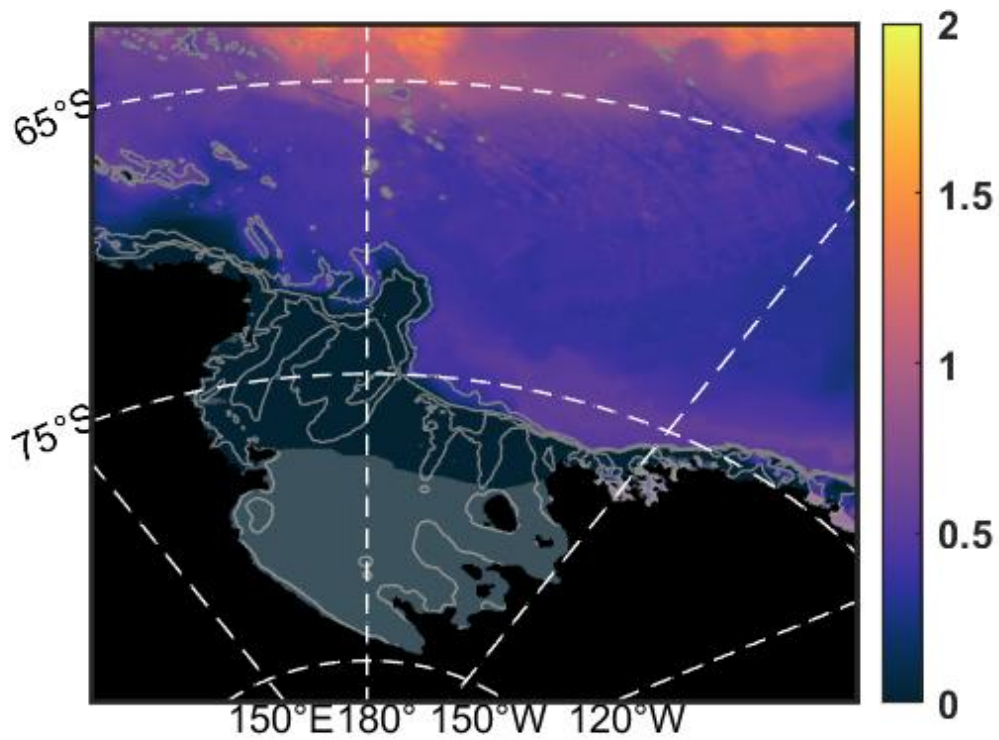


Figure S19. Spatial distribution of depth-averaged, period-averaged sea water temperature (°C). Bathymetry contours are spaced at 500, 1000, and 2000 m.

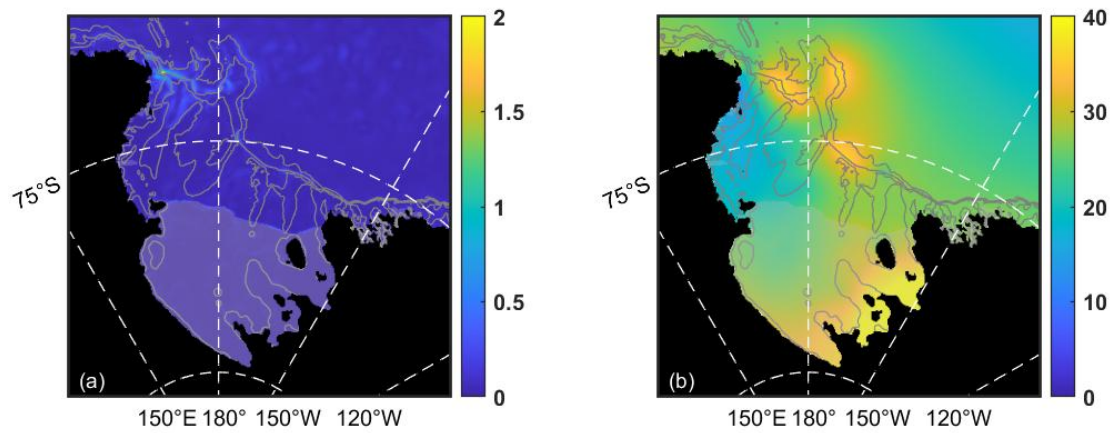


Figure S20. Spatial distribution of (a) the time-mean magnitude of baroclinic pseudo sea level (cm), and (b) the time-mean magnitude of total tidal SSH (cm). Bathymetry contours are spaced at 500, 1000, and 2000 m.

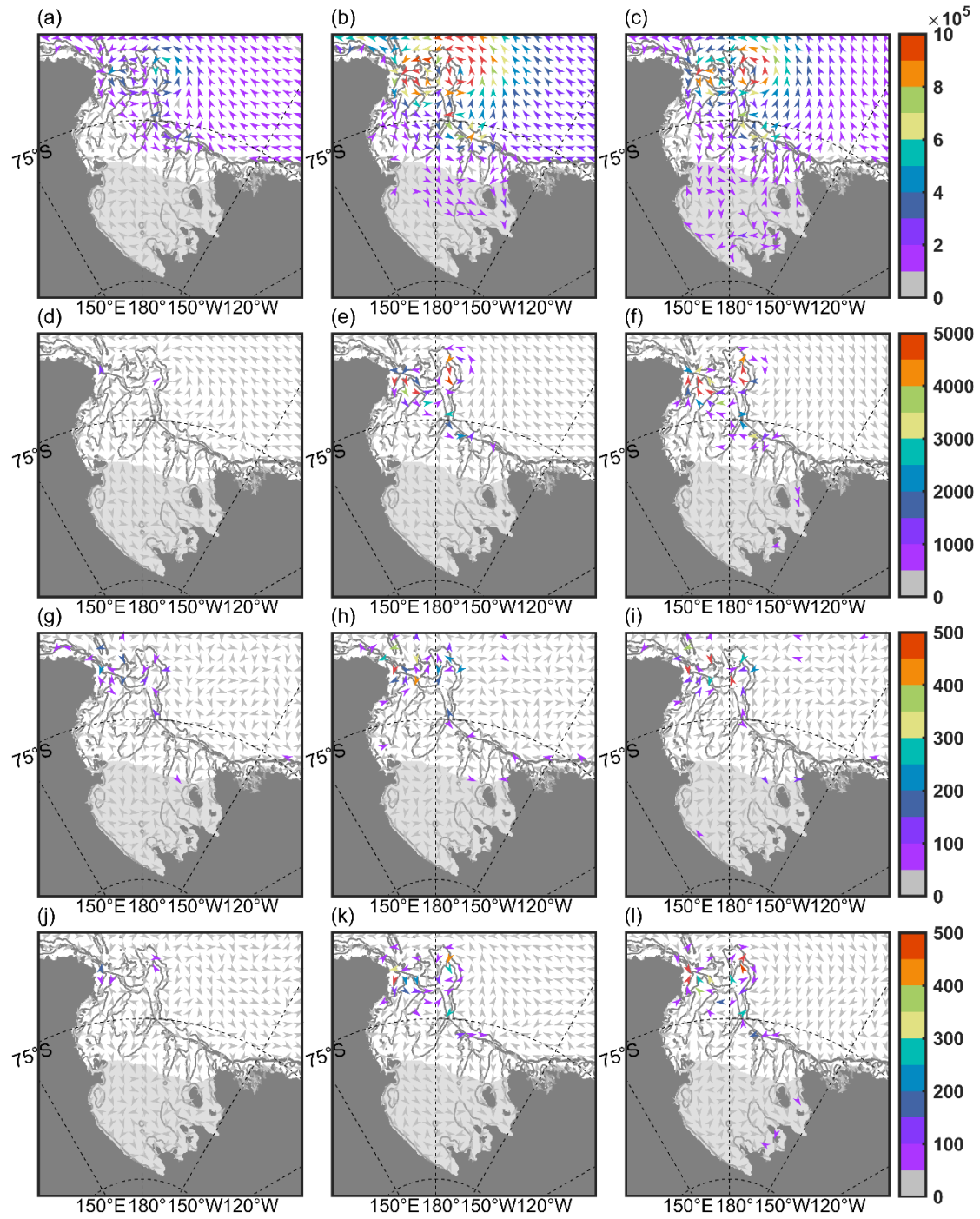


Figure S21. Depth-integrated energy flux (W/m) components: (a–c) barotropic pressure work, (d–f) barotropic advective work, (g–i) baroclinic pressure work, and (j–l) baroclinic advective work. From left to right, the columns correspond to the time-averaged values, snapshots at high tide, and snapshots at low tide, respectively.

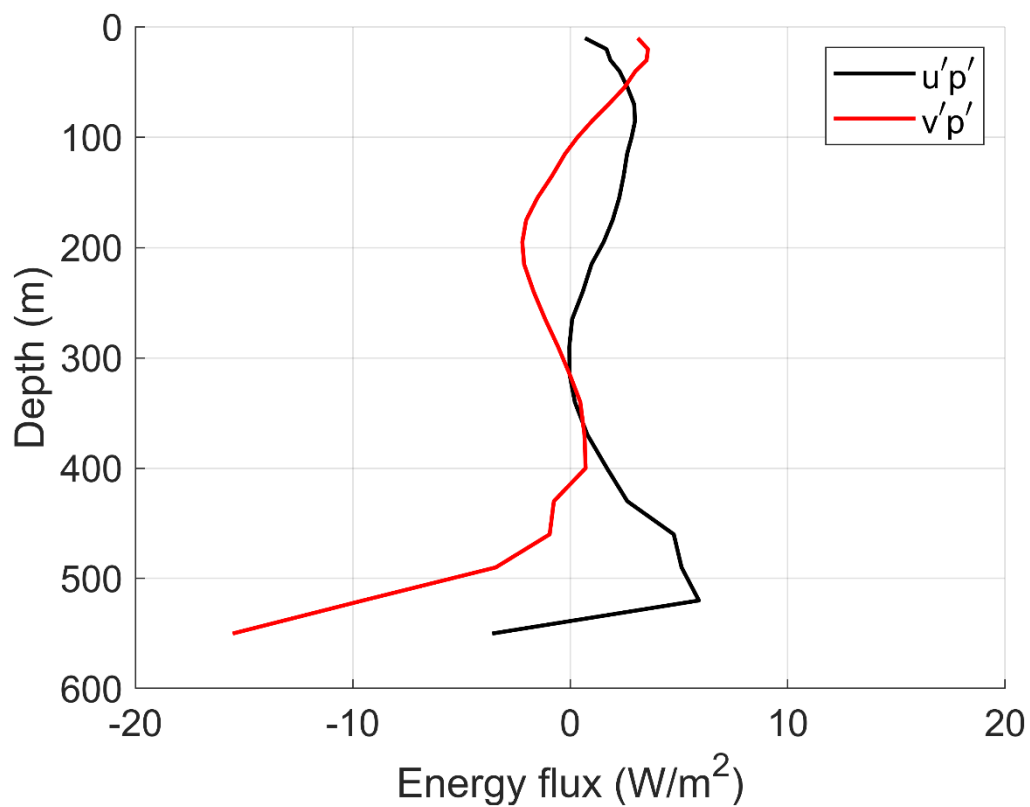


Figure S22. Snapshot of the vertical profile of baroclinic tidal energy flux (pressure work components) at the model grid cell matched to mooring CC1 (same location as in Fig. 9a), illustrating the partial cancellation of fluxes in the overlying water column and the strong, coherent near-bottom signal.