

Frequency of Volume and Freshwater Events Leaving the Arctic Ocean: A Numerical Study

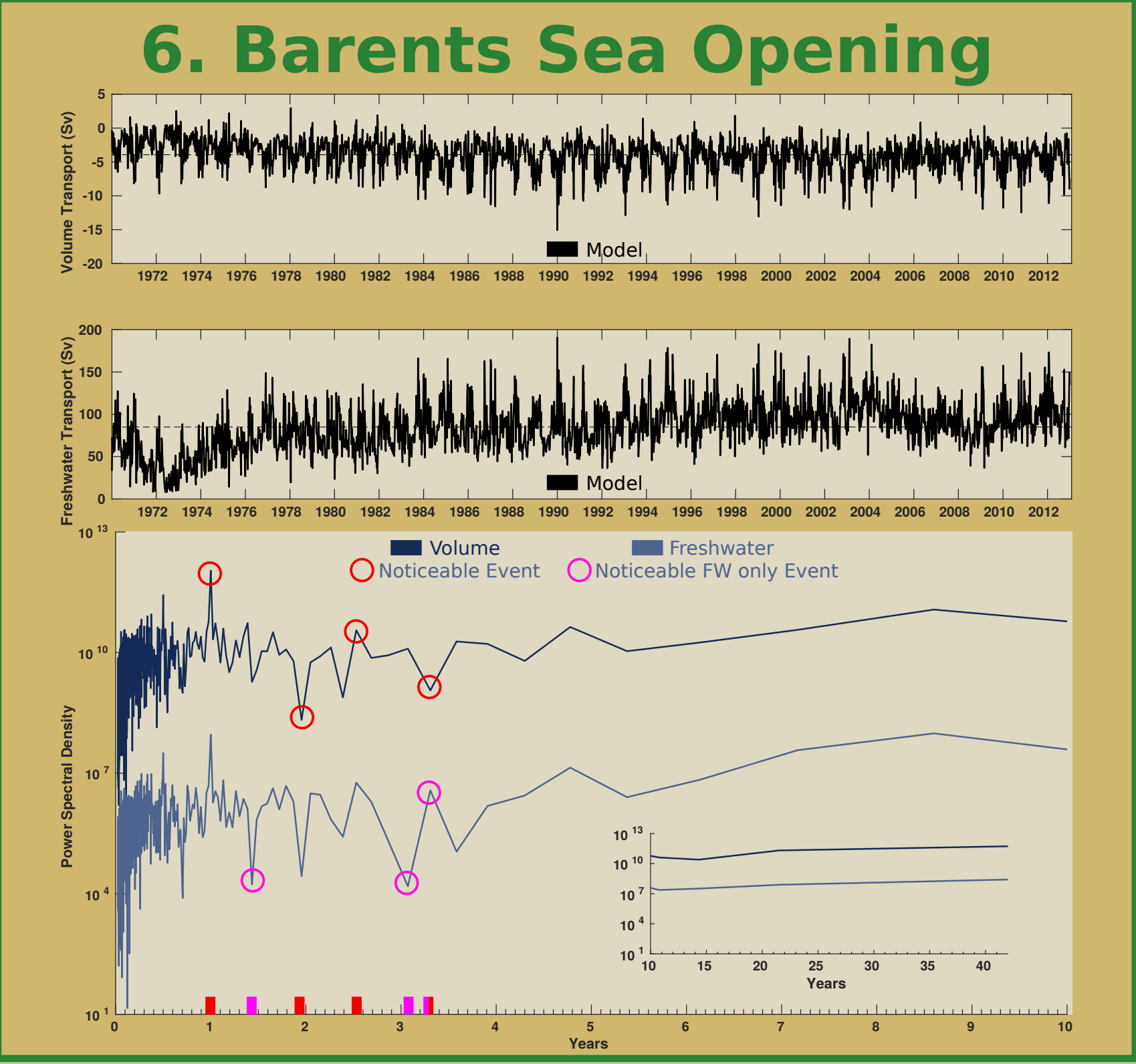
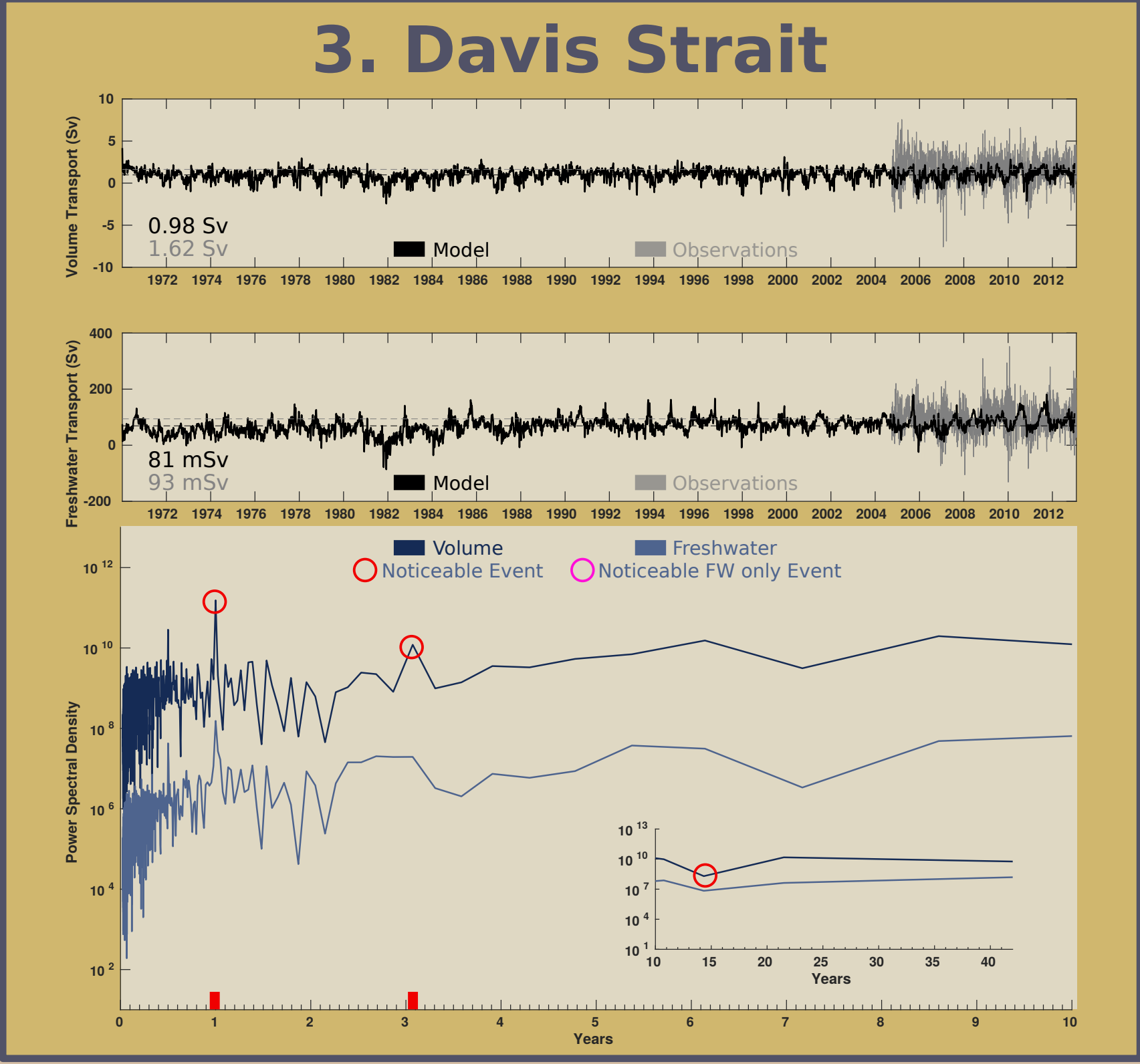
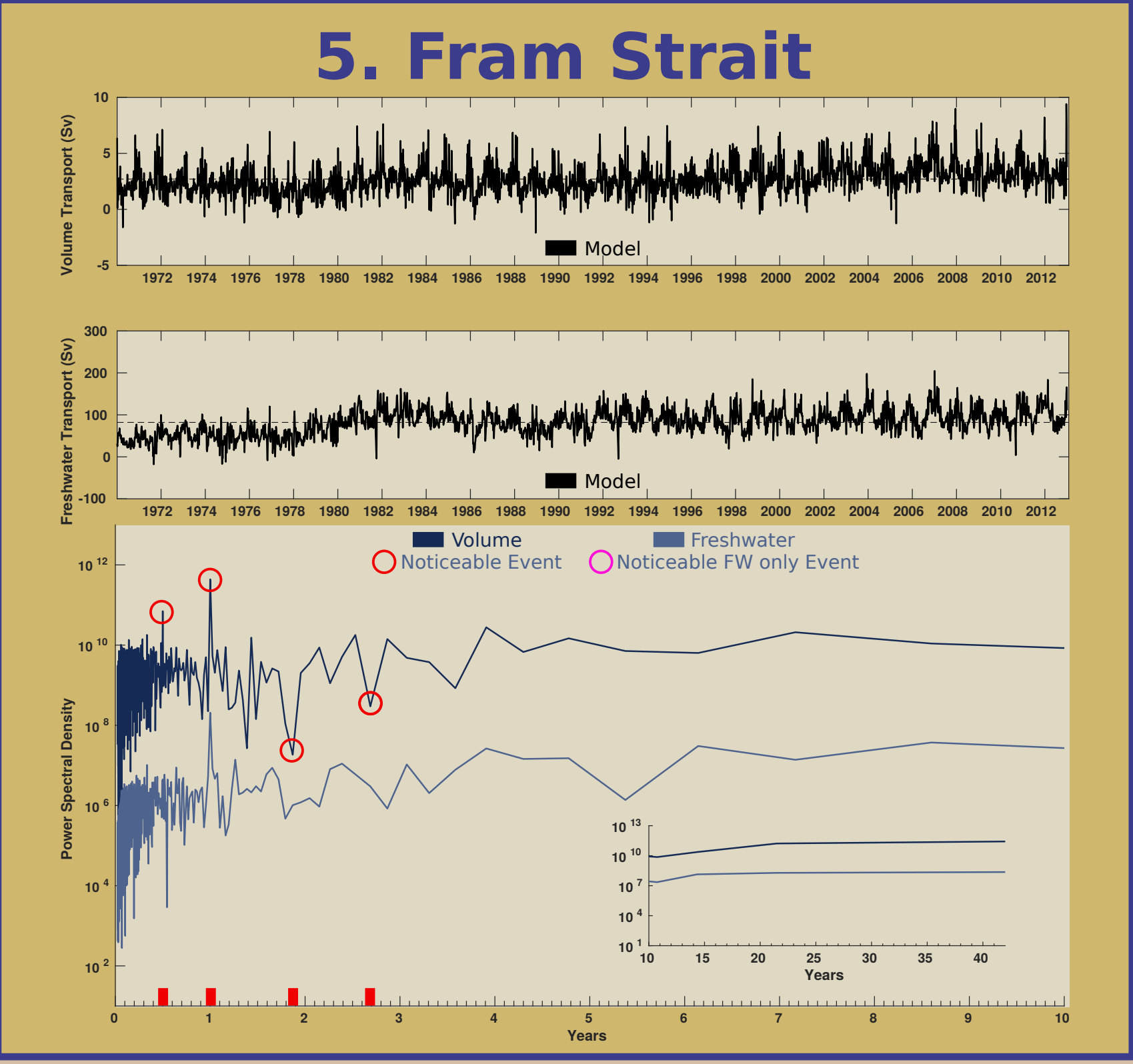
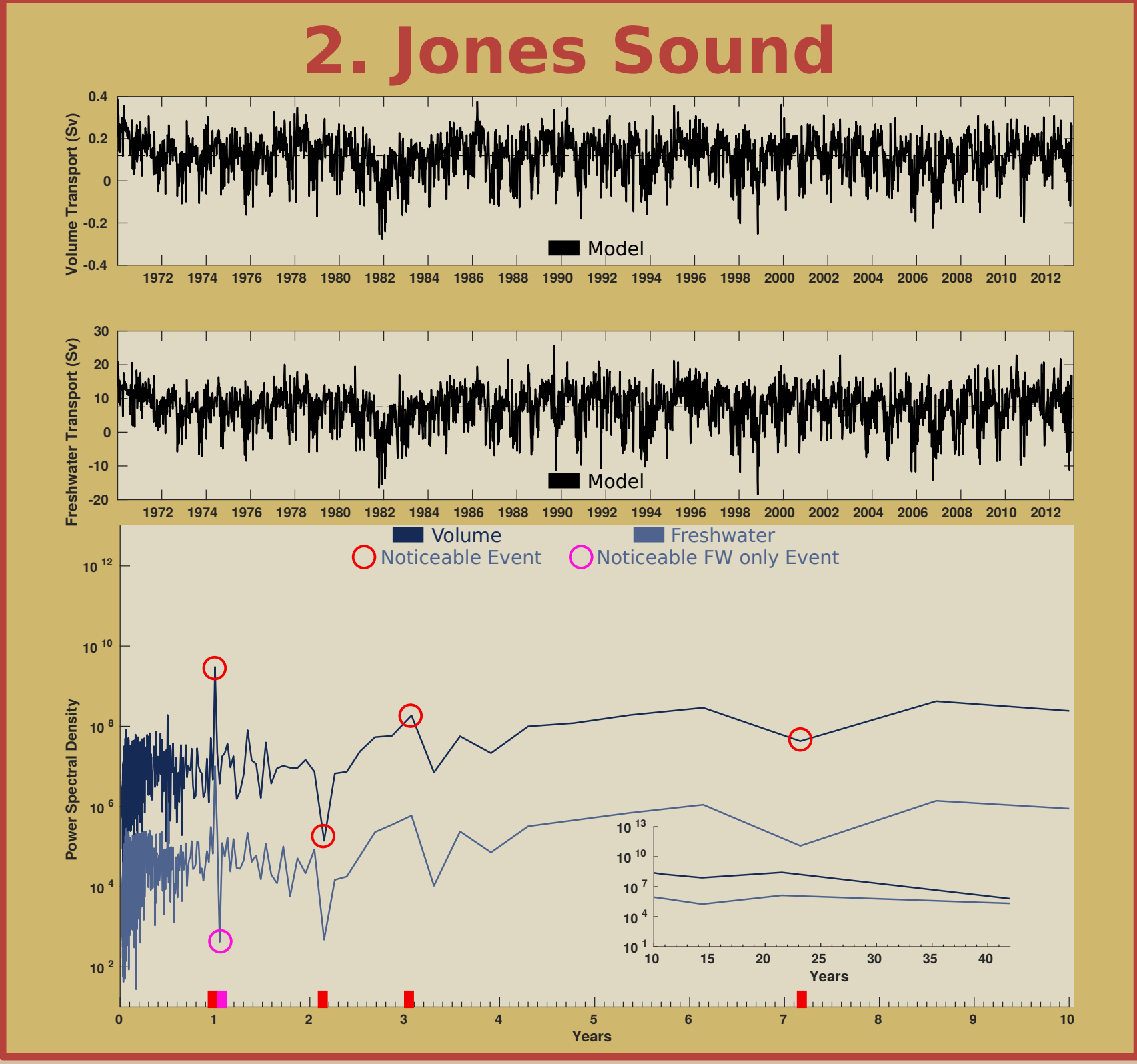
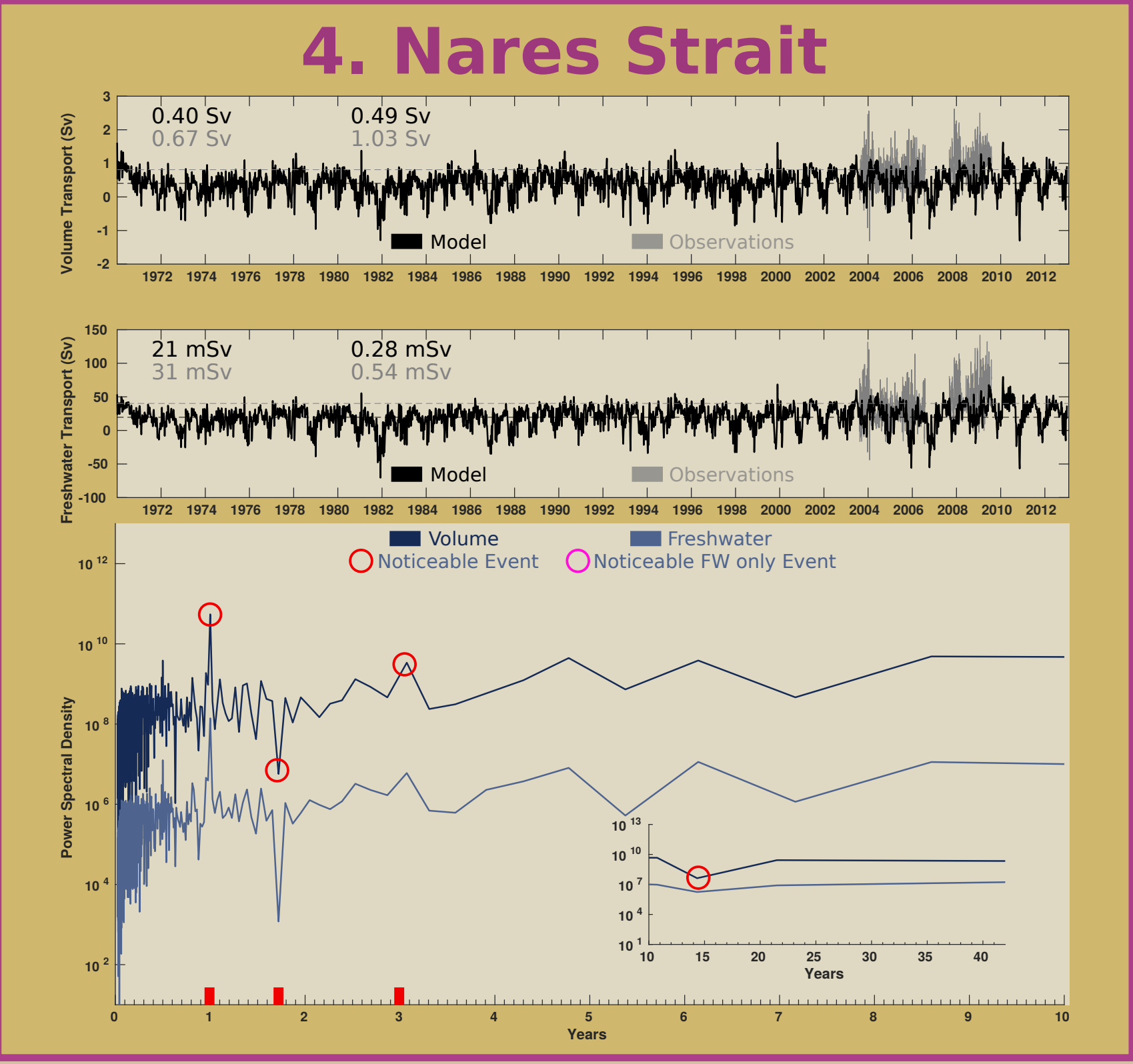
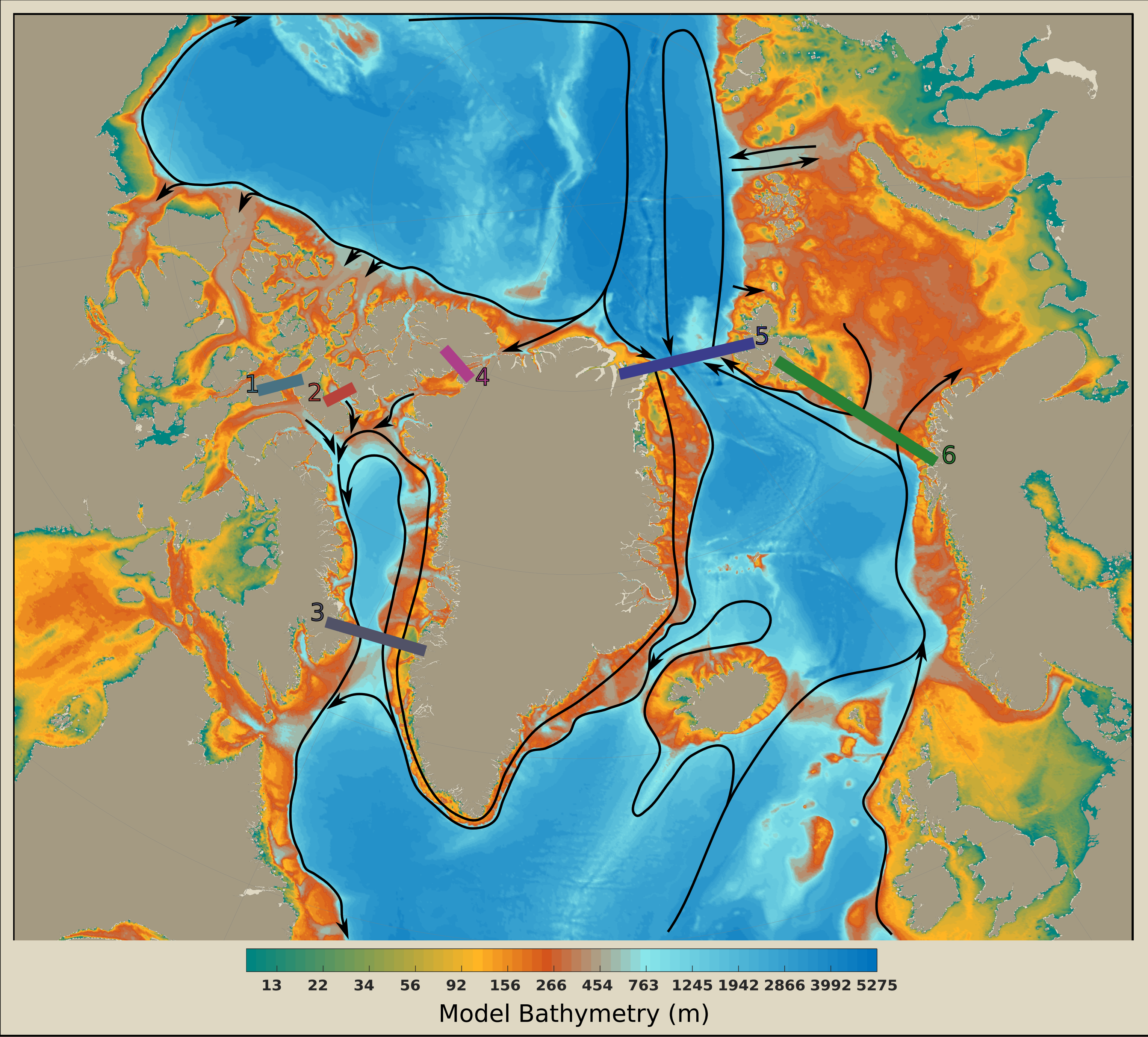
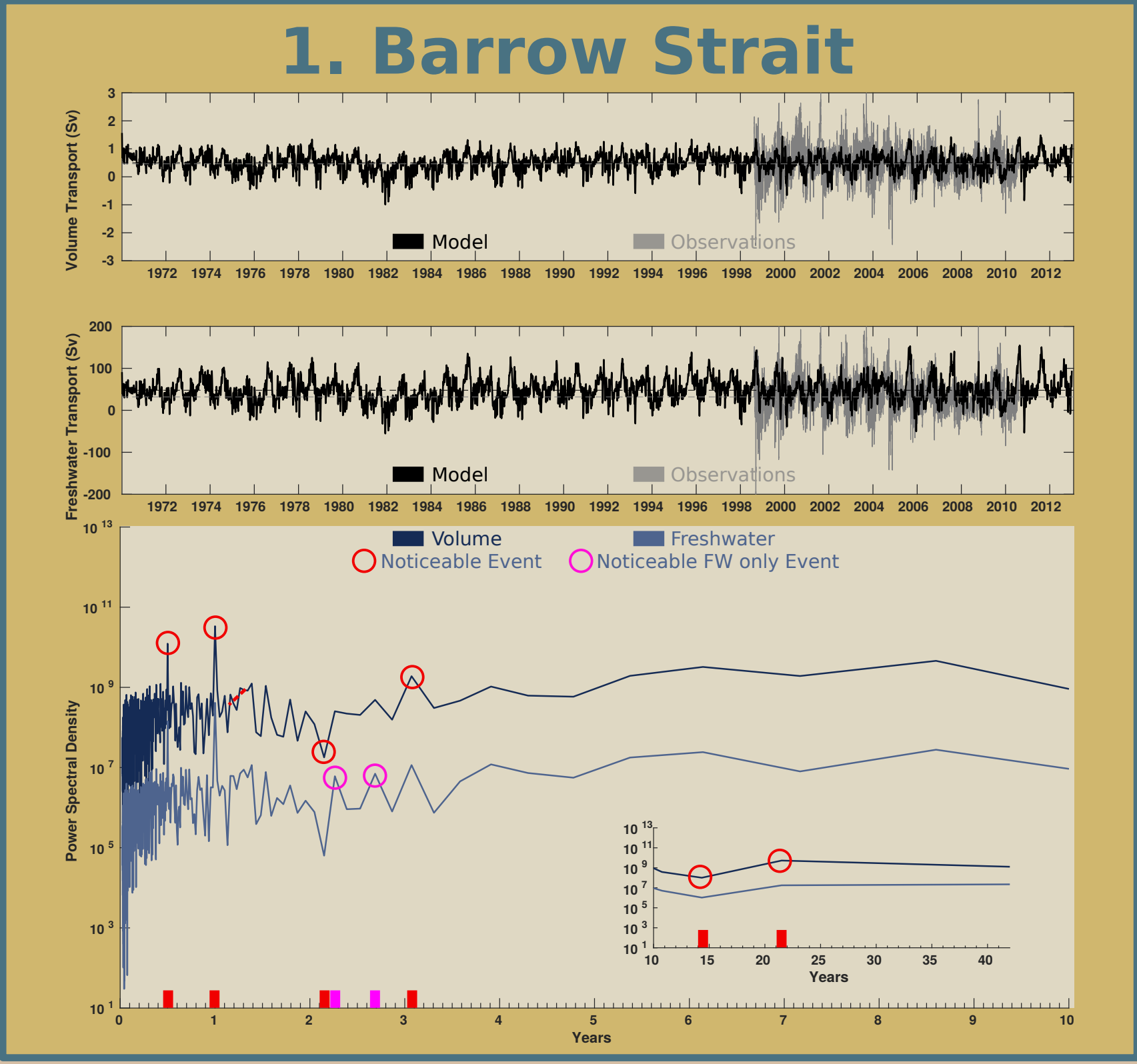
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Introduction

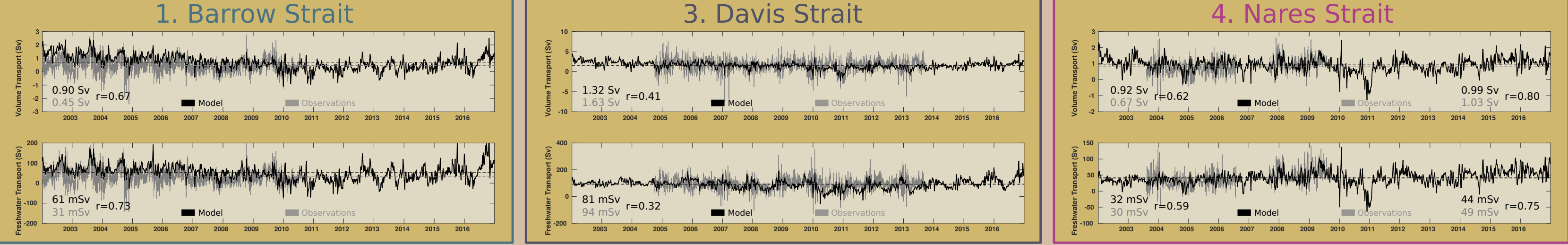
- The Arctic Ocean's upper layer contains more than 70 000 km³ of freshwater.
- Studies suggest that the residence time of freshwater storage is associated with decadal scale atmospheric patterns (e.g., Arctic Oscillation / North Atlantic Oscillation) as well as small scale features (e.g., eddies in the Beaufort Gyre).
- The export of freshwater from the Arctic has the power to change the Atlantic Meridional Overturning Circulation and thus impact the global climate.
- In this study we use a numerical model to analyze the frequency of volume and freshwater events out of the Arctic.
- By identifying the timescales of major events over the last 40 years we provide information as to how long observational measurements should be in place in order to capture all important features driving the variability of fluxes out of the Arctic.

Key points

- The model represents the large scale transports well.
- Small scale events contain an increasing amount of energy, with a maximum at ~ 3 months at Nares Strait, Davis Strait, and the Barents Sea Opening, while the maximum is at ~ 6 months at Barrow Strait, Jones Sound, and Fram Strait.
- A maxima of energy is contained at the 7-9 year frequency. This maxima occurs at a different frequency based on the strait.
- A local minima of energy is present at each strait at the 15 year frequency, with the exception of Fram Strait. At this frequency volume events do not correspond to freshwater events, and vice versa.
- Moorings should be installed for at least 5 years and preferably for ~ 20 years to capture the full spectrum of events.

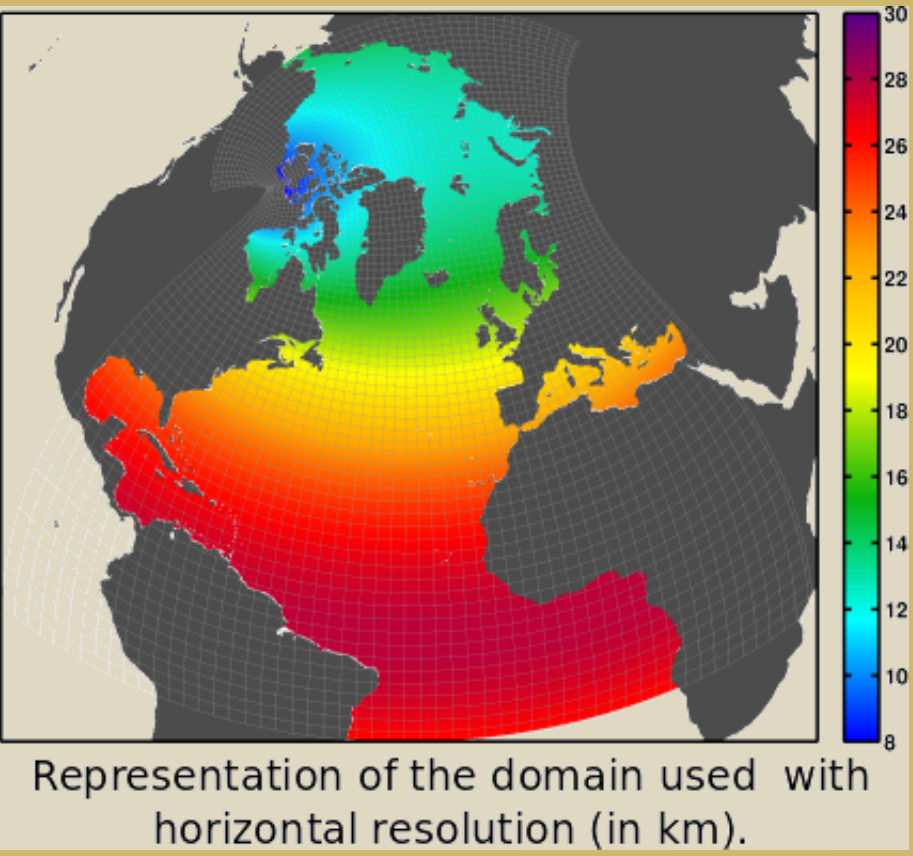


Model Evaluation with a High Resolution Experiment



Method

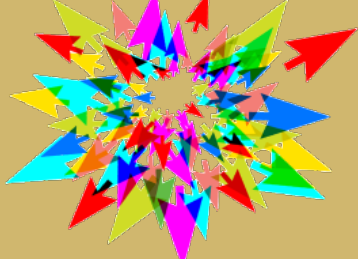
- We use the ANHA regional configuration with the coupled ice-ocean numerical model NEMO. Our horizontal resolution is 1/4° and the sea-ice module is LIM2.
- We use a remapped inter-annual monthly runoff with Greenland melt to ensure all runoff enters the ocean.
- We use a hindcast experiment using the atmospheric forcing MIROC5 (horizontal resolution: 30 km).
- We also use ANHA at 1/12° coupled with the high resolution atmospheric forcing CGRF to evaluate our numerical model with moorings.



Integration Period	Radiative Fluxes	Turbulent Fluxes	Precipitation	Restoring	Data Assimilation
1970-2012	MIROC5	MIROC5	MIROC5	No	No
2002-2016	CGRF	CGRF	CGRF	No	No

Acknowledgments

Barrow Strait observations from Prinsenberget et al. (2009) and Peterson et al. (2012)
Nares Strait observations from Münchow (2016)
Davis Strait observation from Curry et al. (2011, 2014)



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