

Tidal decomposition of steric height and bottom pressure from a triangle mooring array

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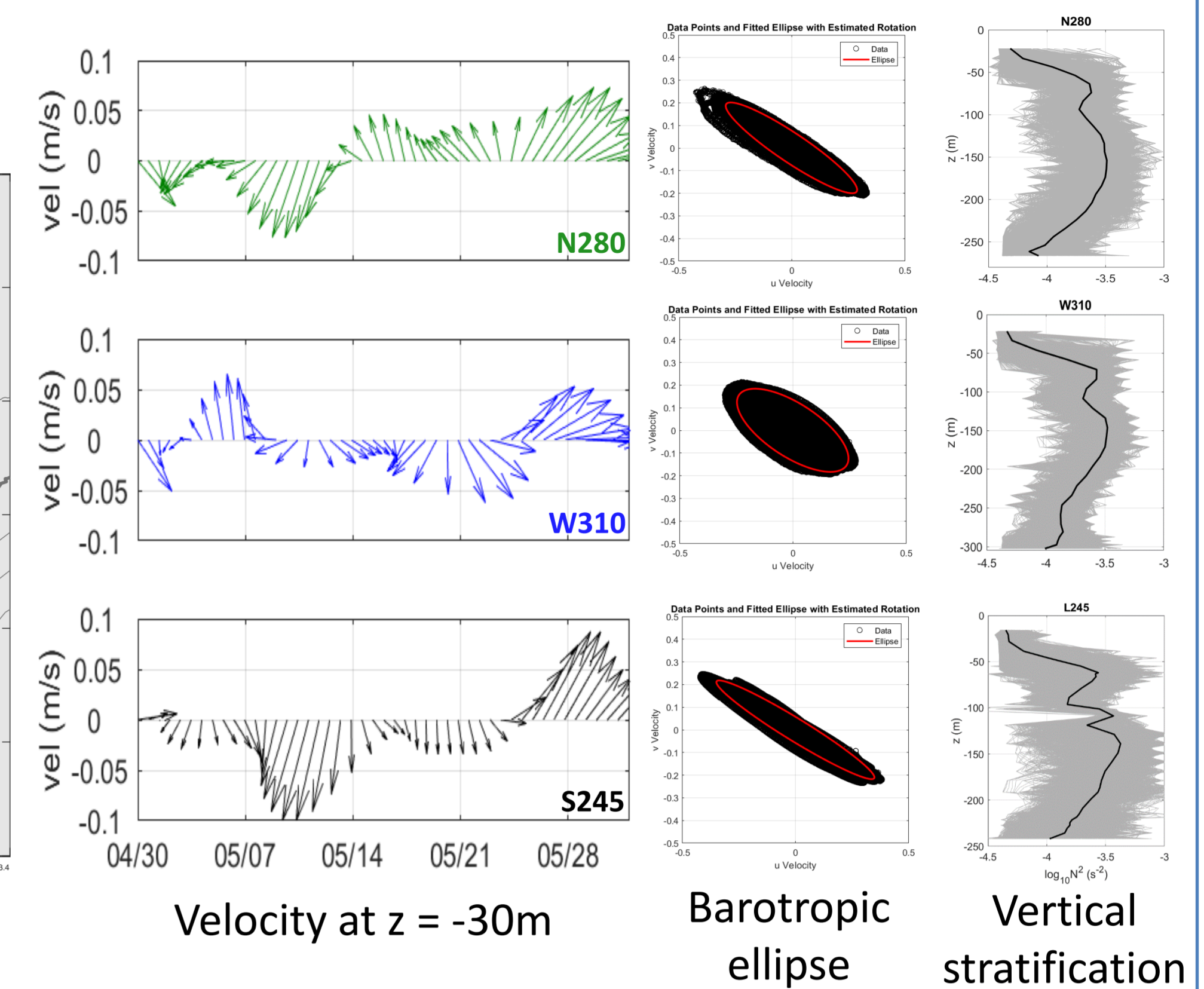
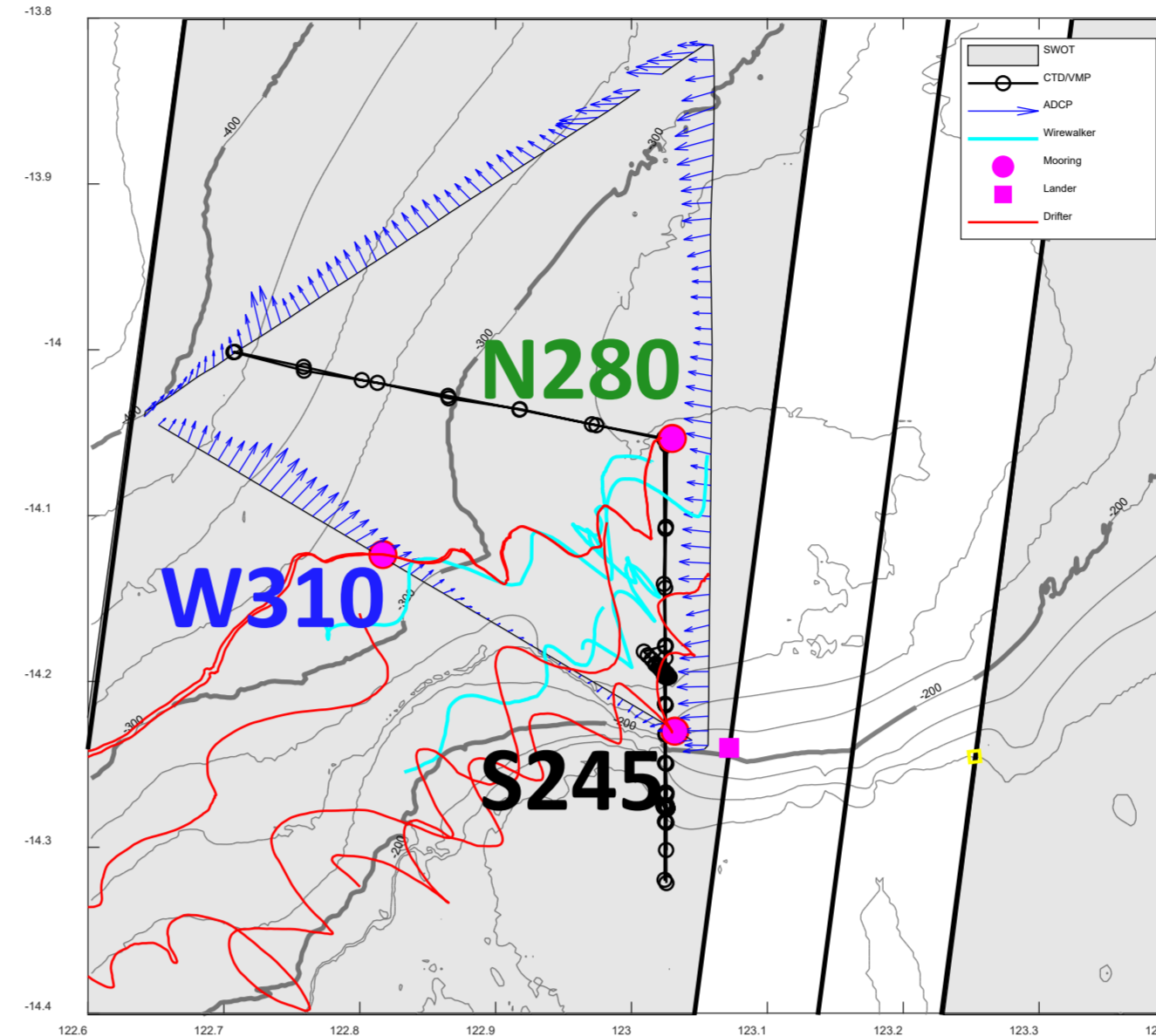
SWOT campaign on the Australian Northwest shelf

Complex Australian Northwest shelf:

- Mean flows
- Semidiurnal and diurnal tides
- internal tides and nonlinear internal waves

Objectives:

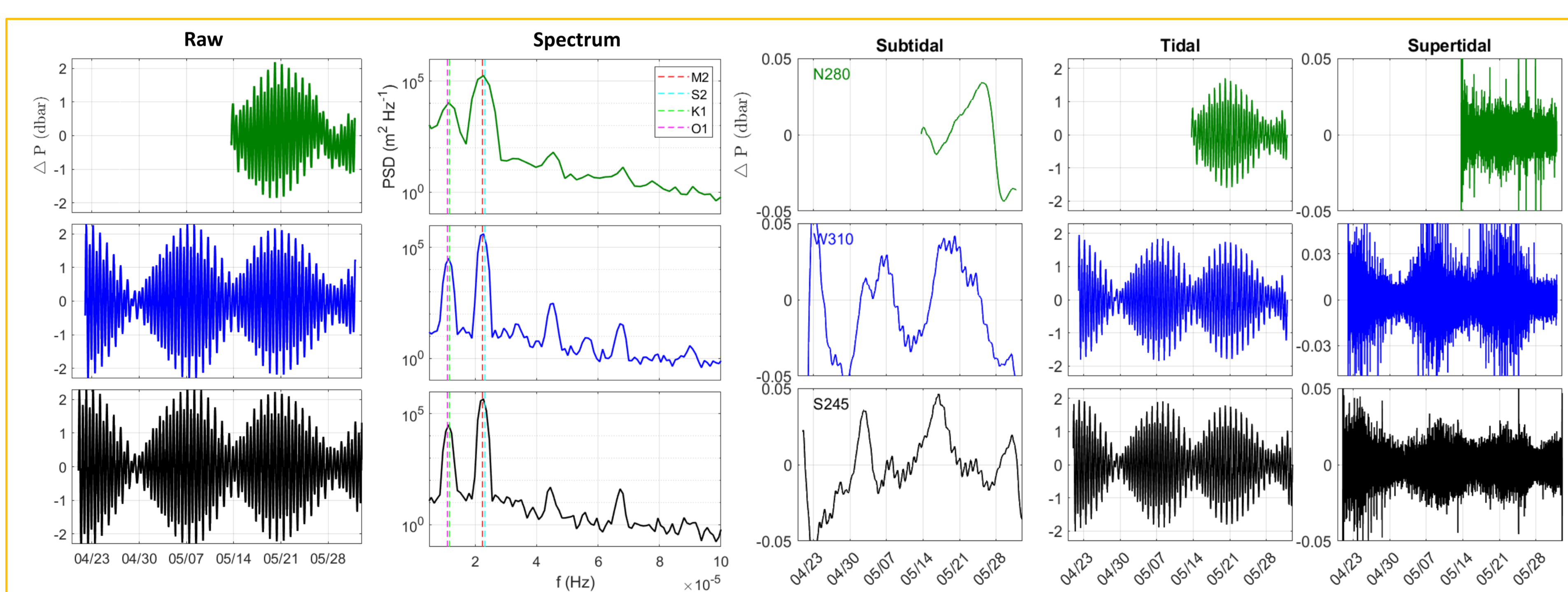
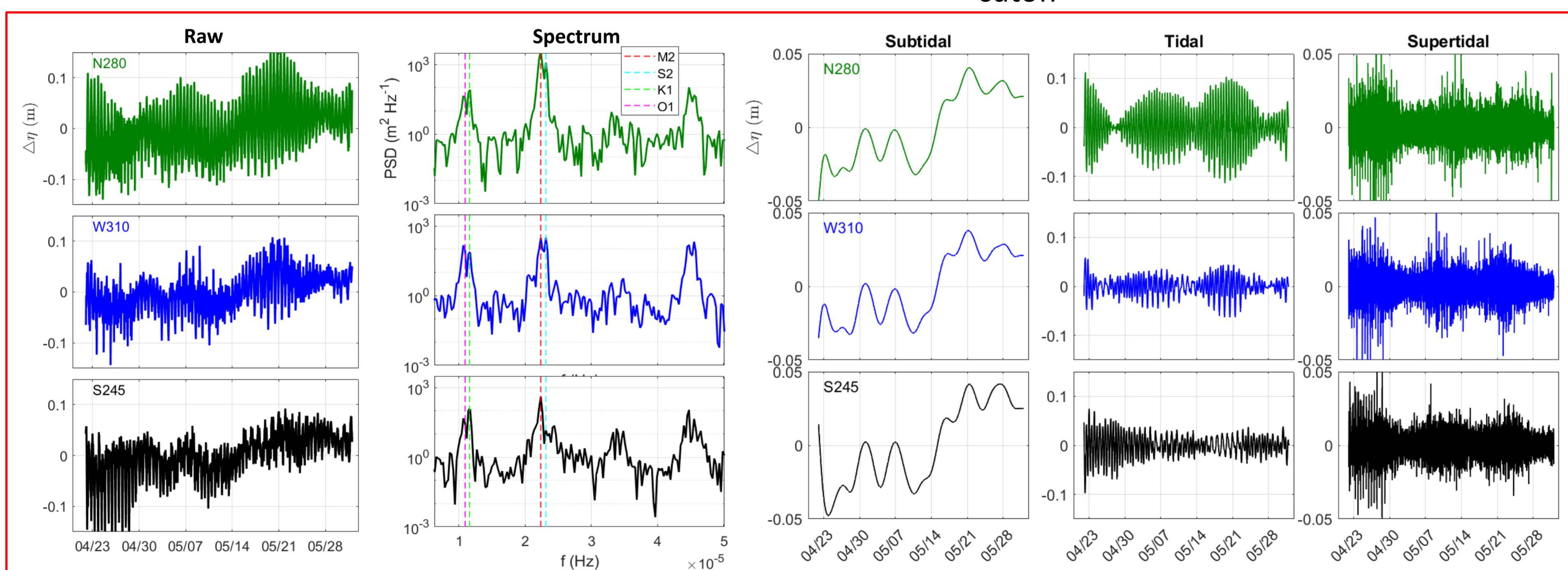
- Detangle tidal and non-tidal components from data
- Reconstruct SSH for comparison with SWOT data
- Identify what processes that SWOT can't resolve



Raw data, spectrum analysis, and tidal decomposition

Steric height and bottom pressure

- Subtidal (mean flow): lowpass filter, $T_{\text{cutoff}} = 40$ hr
- Tidal: bandpass filter, $T_{\text{cutoff}} = 4-40$ hr
- Supertidal (internal waves): highpass filter, $T_{\text{cutoff}} = 4$ hr

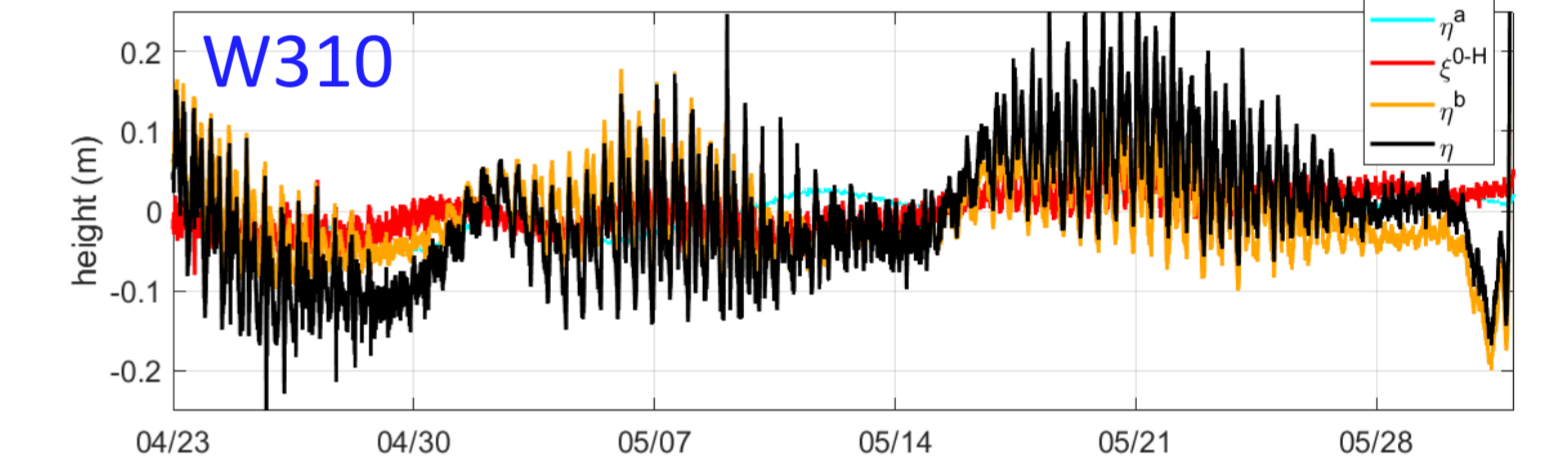


SSH budget

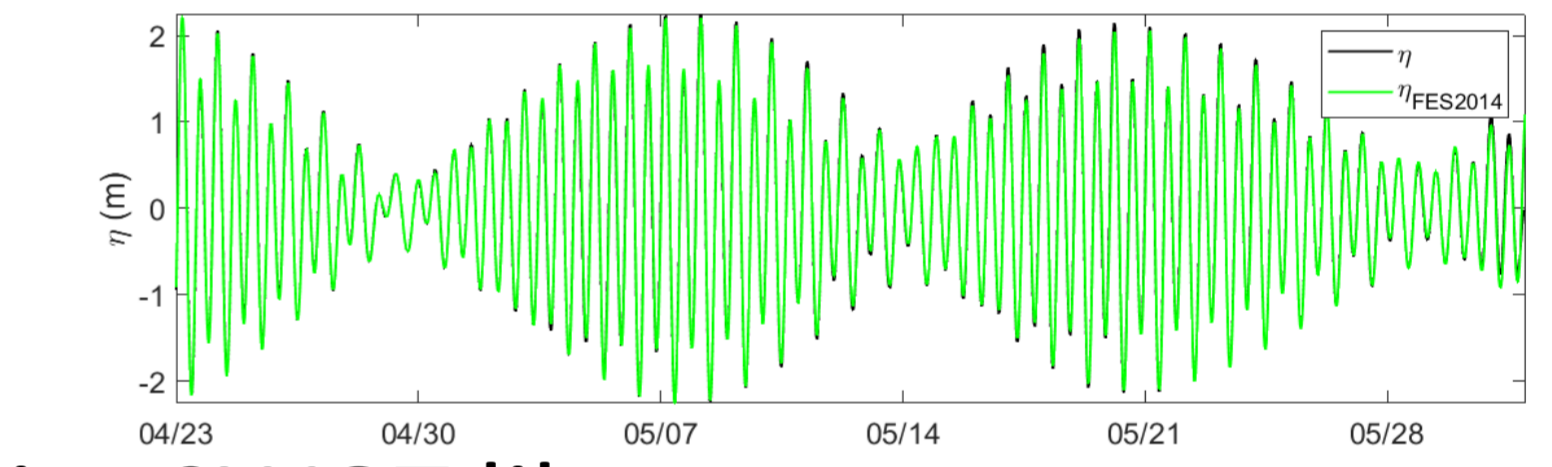
$$\eta = -\frac{P_a}{\rho_0 g} - \int_{-H}^0 \frac{\rho'}{\rho_0} dz + \frac{P'_b}{\rho_0 g}$$

Air pressure (ECMWF) Steric height Bottom pressure

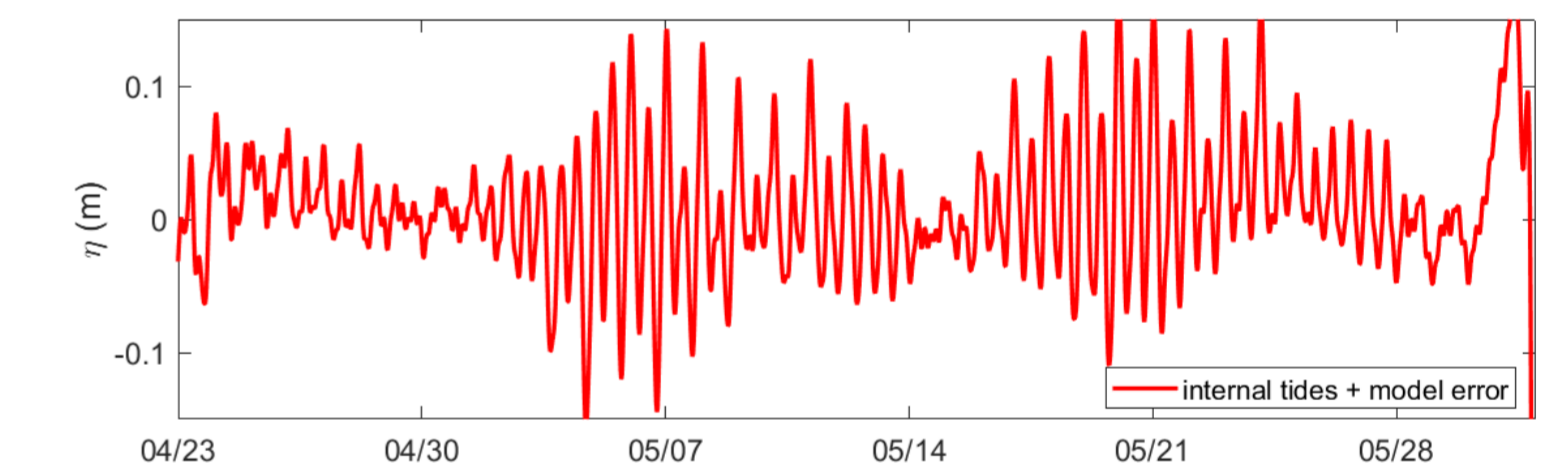
De-tided data



Tidal correction

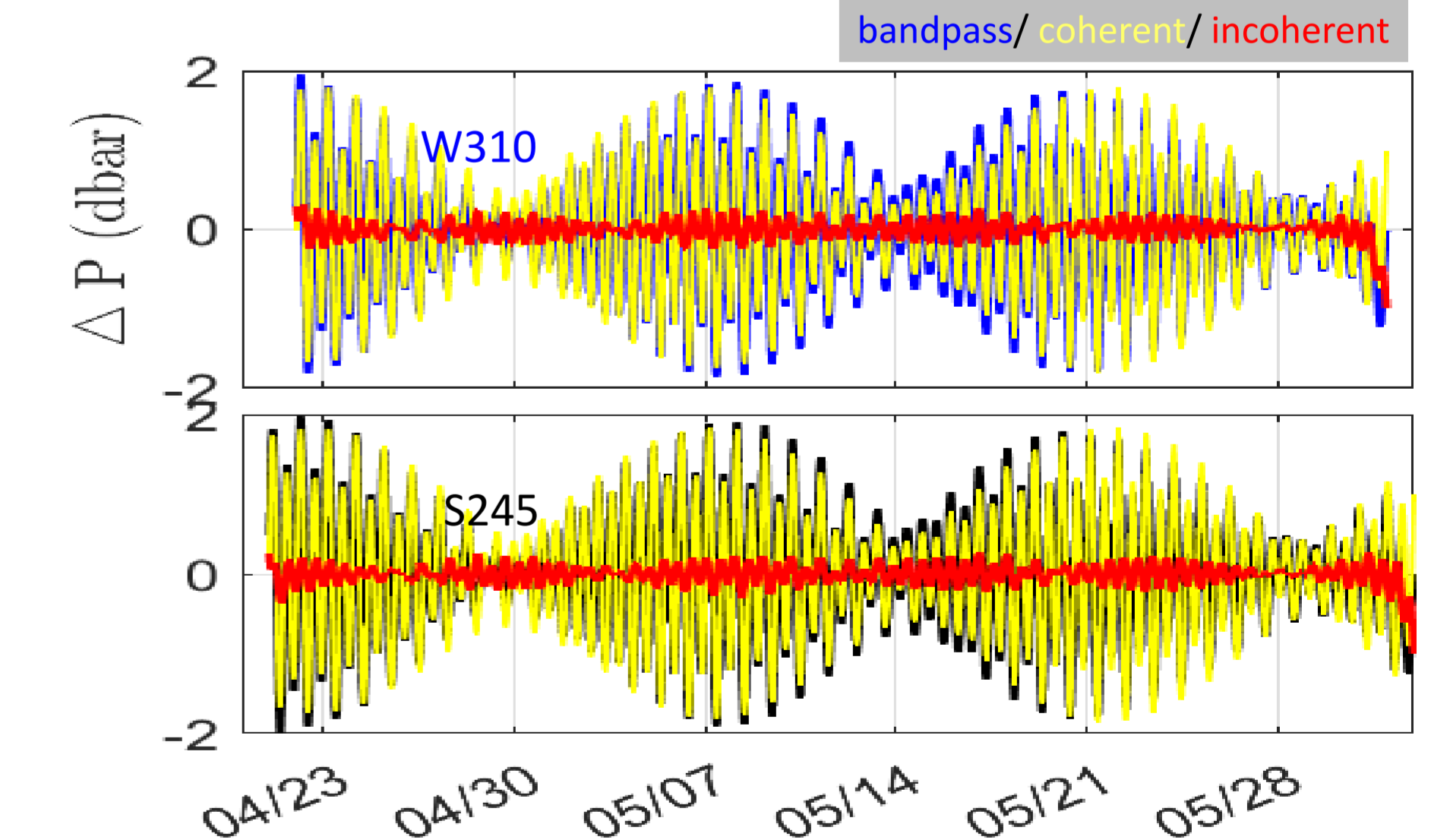


In-situ SWOT like measurements

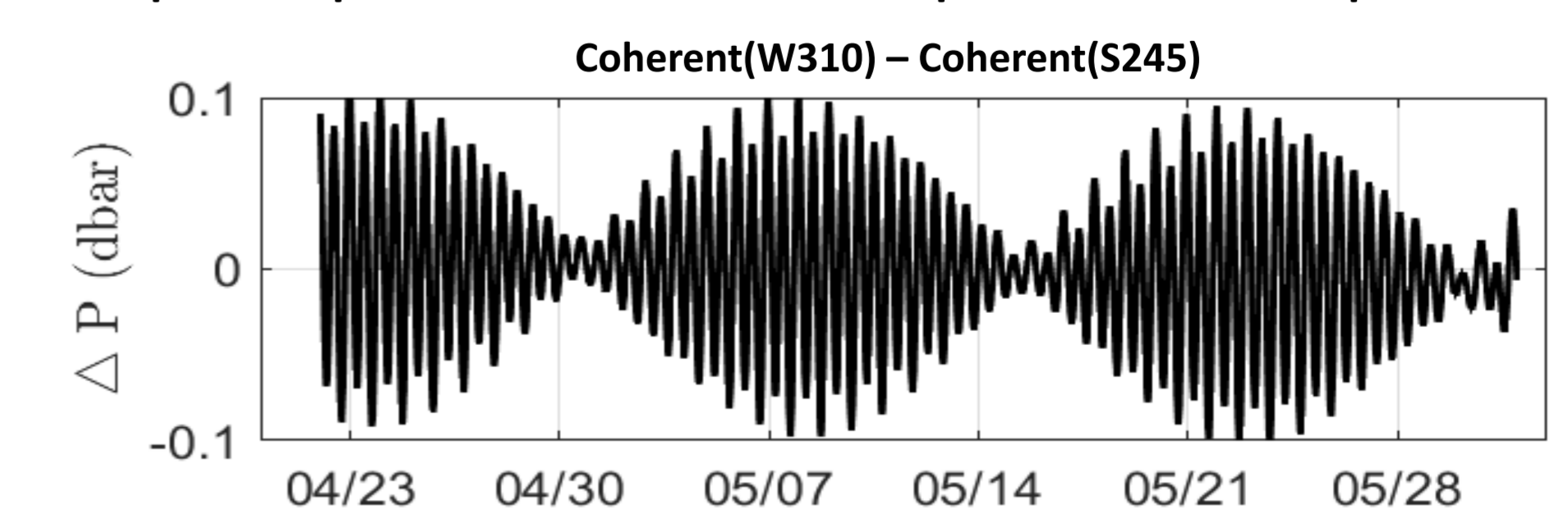


$$\eta(\text{obs}) - \eta(\text{model}) = \eta(\text{internal tides}) + \text{error} = \eta(\text{SWOT})$$

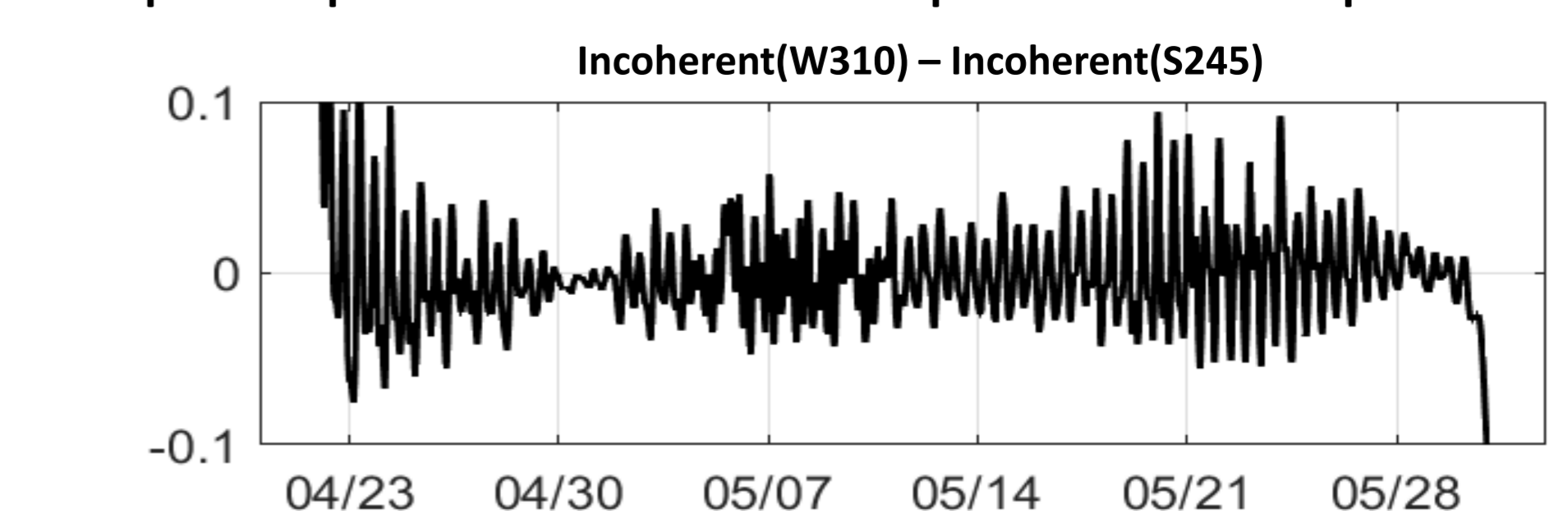
Internal tides



Coherent internal tides: a **regular** spatial and temporal pattern in their amplitudes and phases



Incoherent internal tides: an **irregular** spatial and temporal pattern in their amplitudes and phases



Early findings

- **Significant SSH Variation:** SSH exhibits substantial fluctuations (> 4m) in the Australian Northwest Shelf, primarily attributed to tidal excursions.
- **Steric Heights and Spring-Neap Cycles:** Tidal decomposition analysis has revealed that the steric heights in the region do not follow the typical spring-neap tidal cycles, indicating other dynamics (i.e., internal tides).
- **Incoherent Internal Tides:** Similar amplitudes to coherent internal tides, but neither predictable by traditional harmonic analysis nor observable by SWOT.

Acknowledgements

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