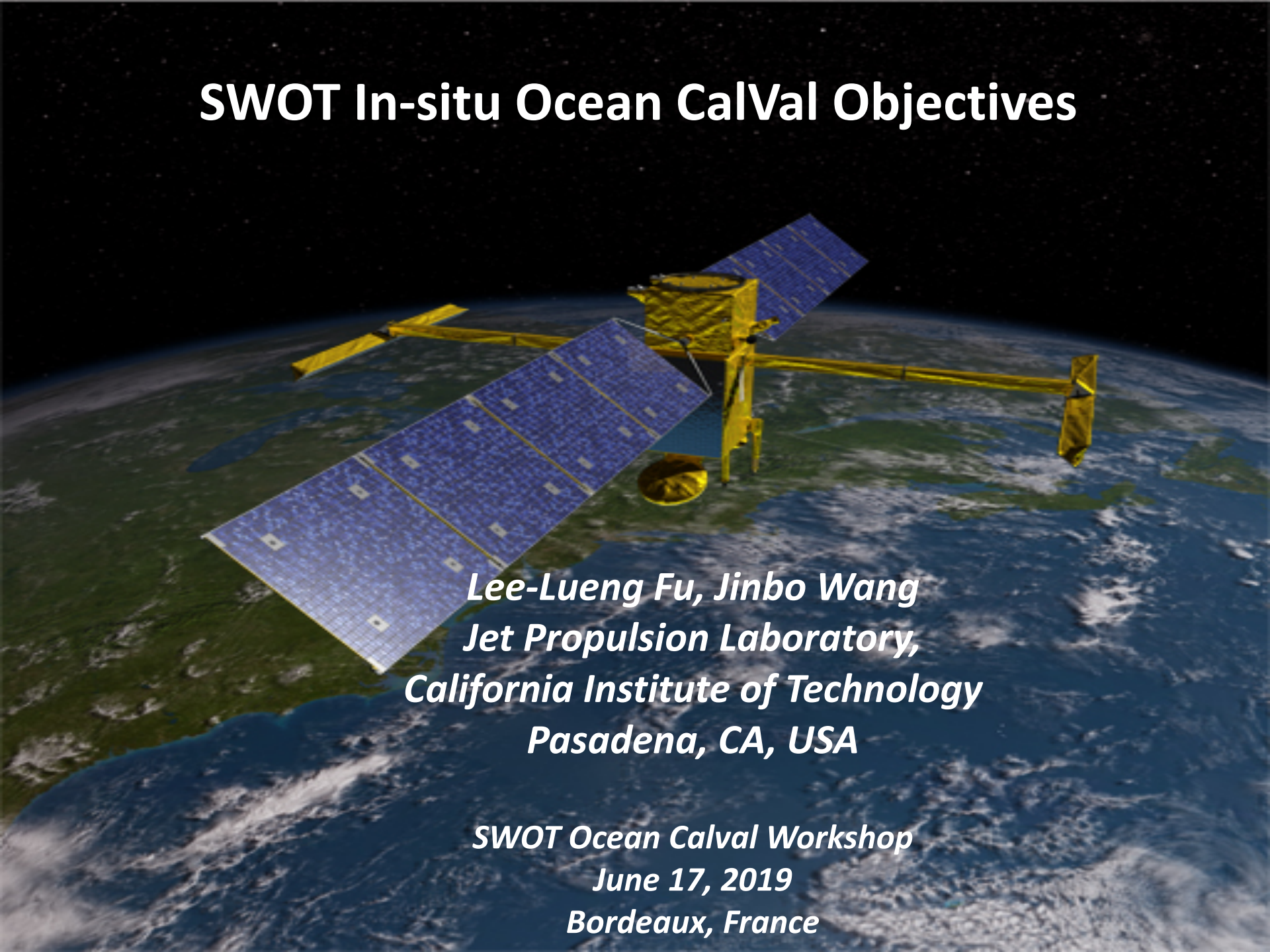
SWOT In-situ Ocean CalVal Objectives



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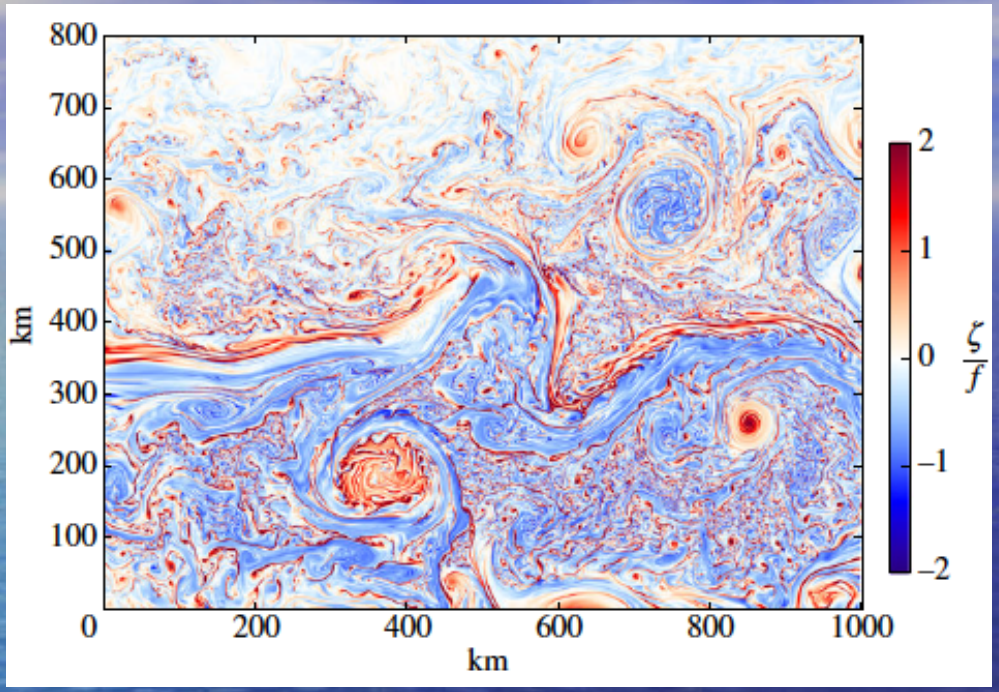
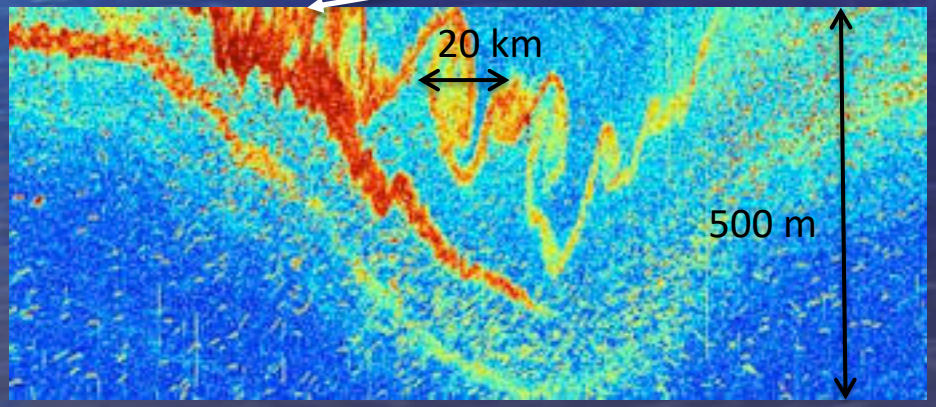
SWOT Ocean Calval Workshop
June 17, 2019
Bordeaux, France

Vertical transport of heat and water properties in the ocean



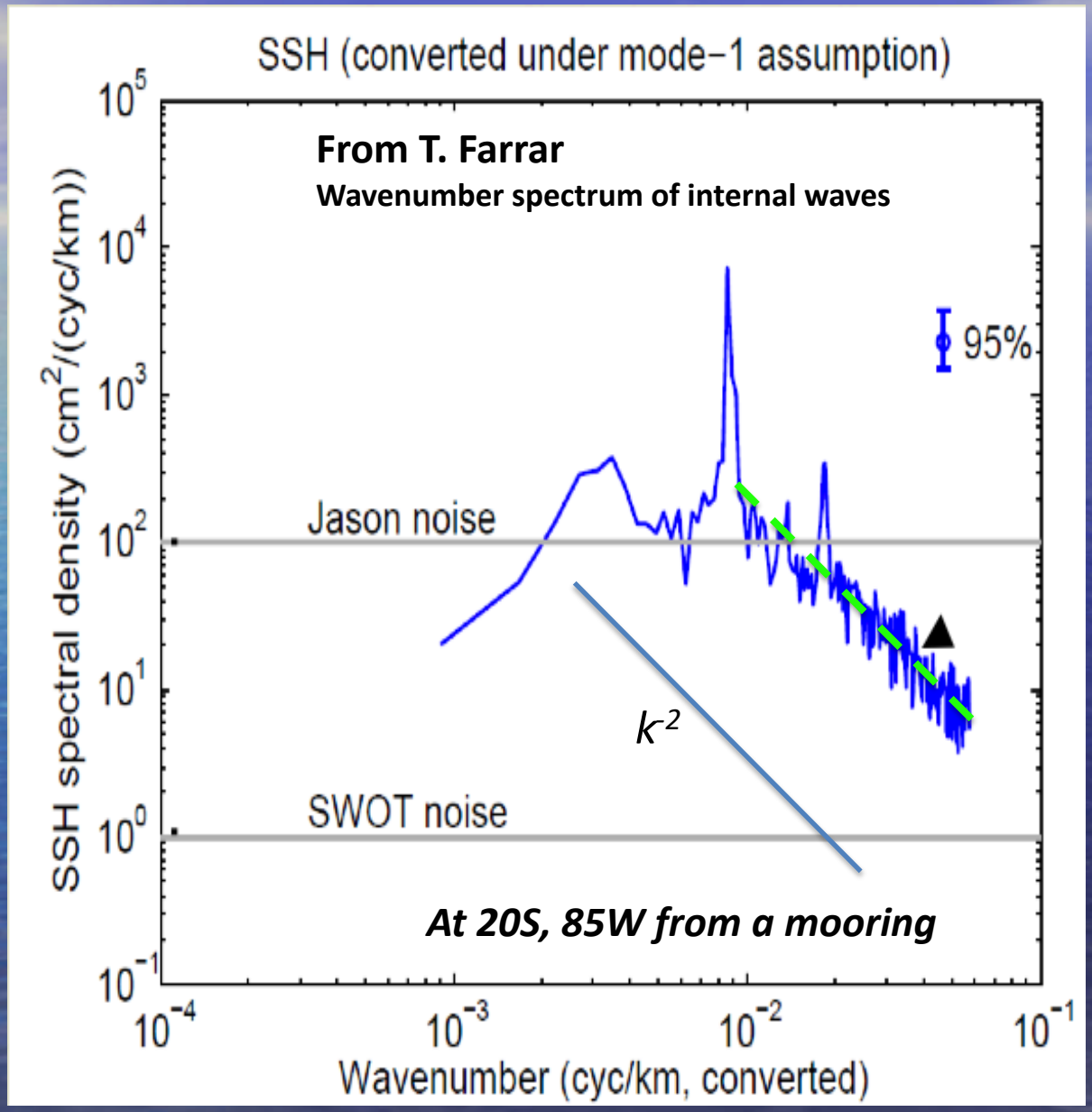
Vertical vorticity at the surface in the Gulf Stream (McWilliams, 2016)

Sea surface height variations to be observed by SWOT

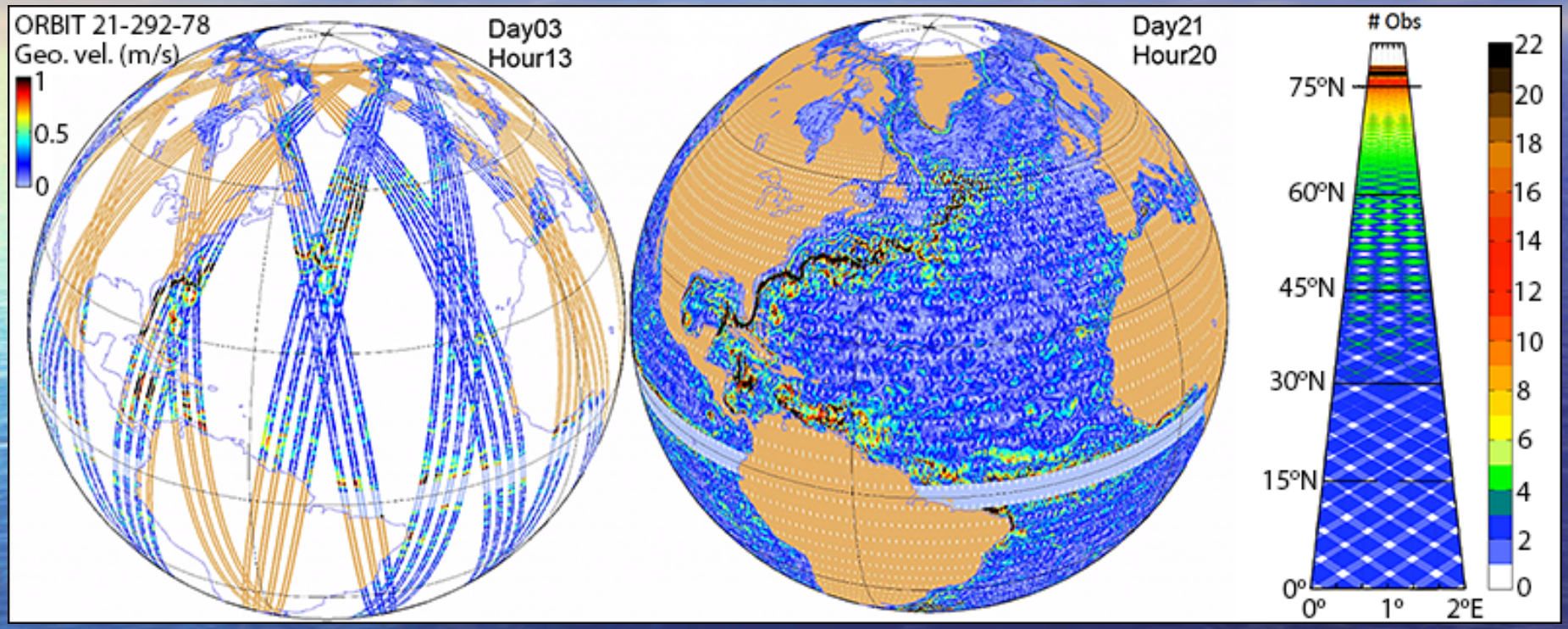


NOAA/GFDL

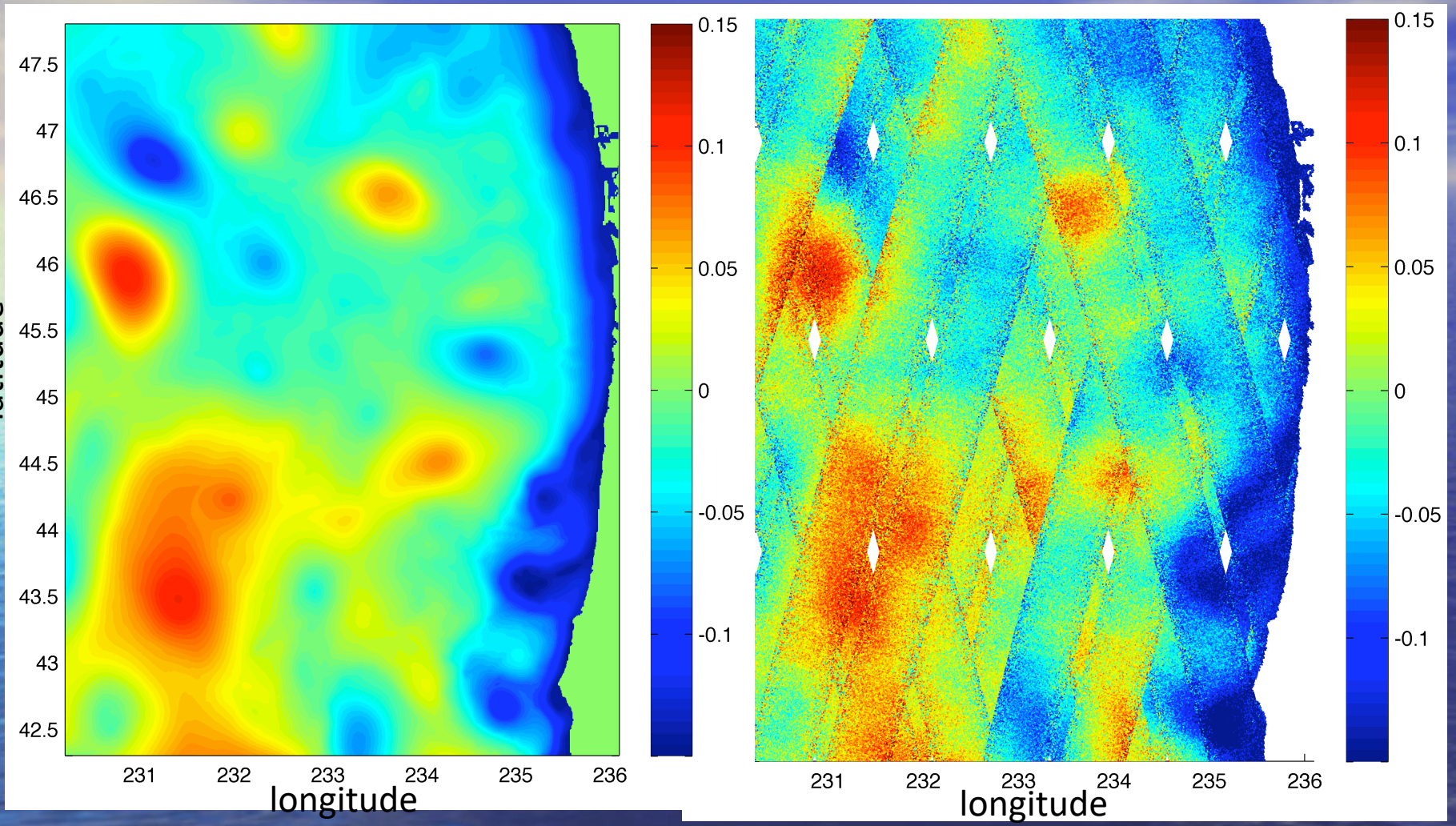
Challenges: Dealing with Internal tides and internal waves



Sampling pattern of the 21-day orbit



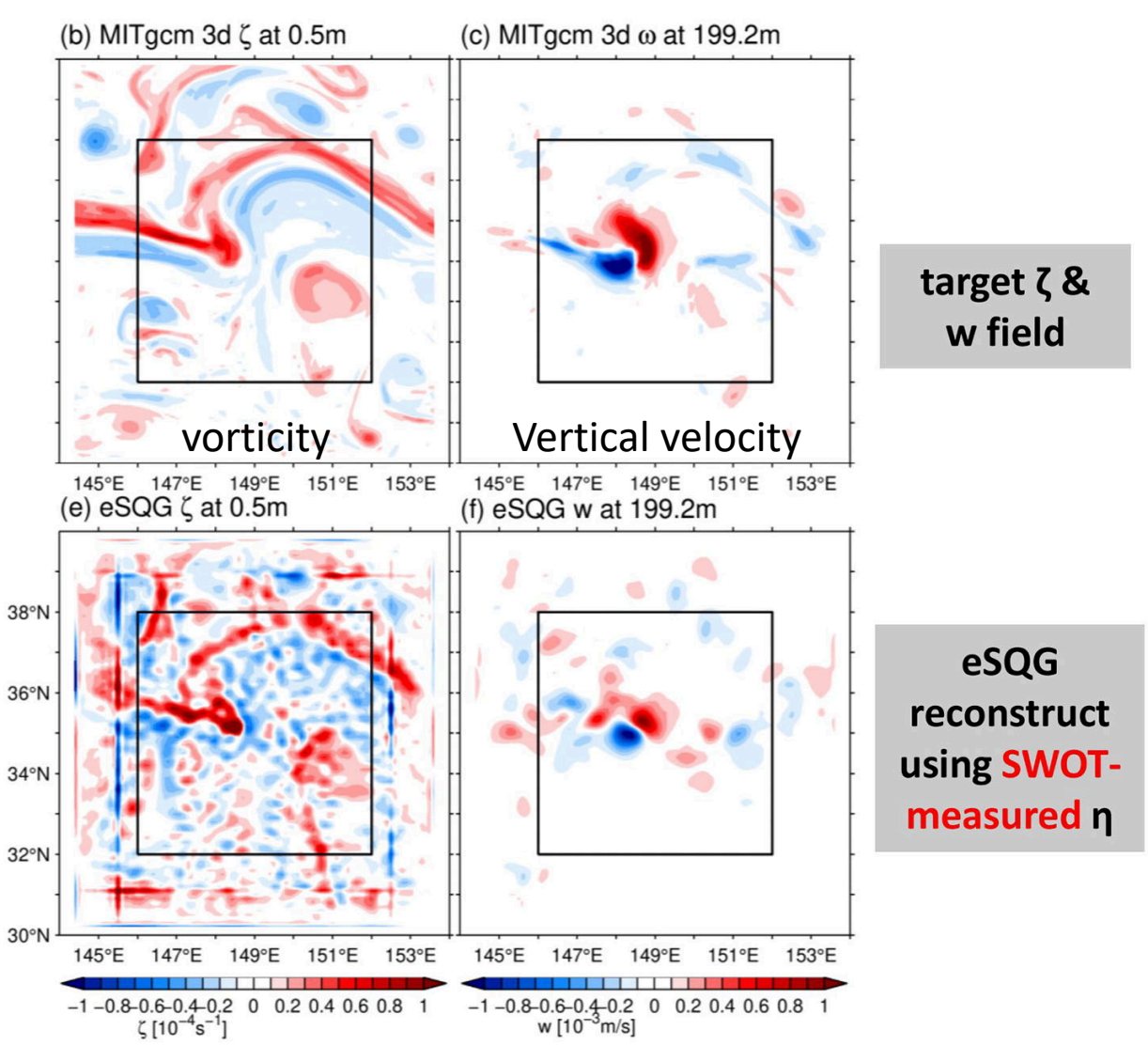
Challenges: Reconstruction of ocean state from irregular sampling



A software tool available for simulating SWOT-like observations for studying reconstruction methodology

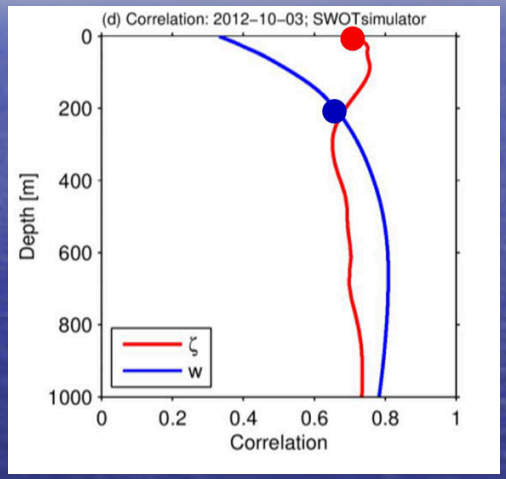
Surface Vorticty and Vertical Velocity

A Grand Challenge for Ocean Remote Sensing



target ζ & w field

eSQG reconstruct using SWOT-measured η



(Qiu et al, 2018)

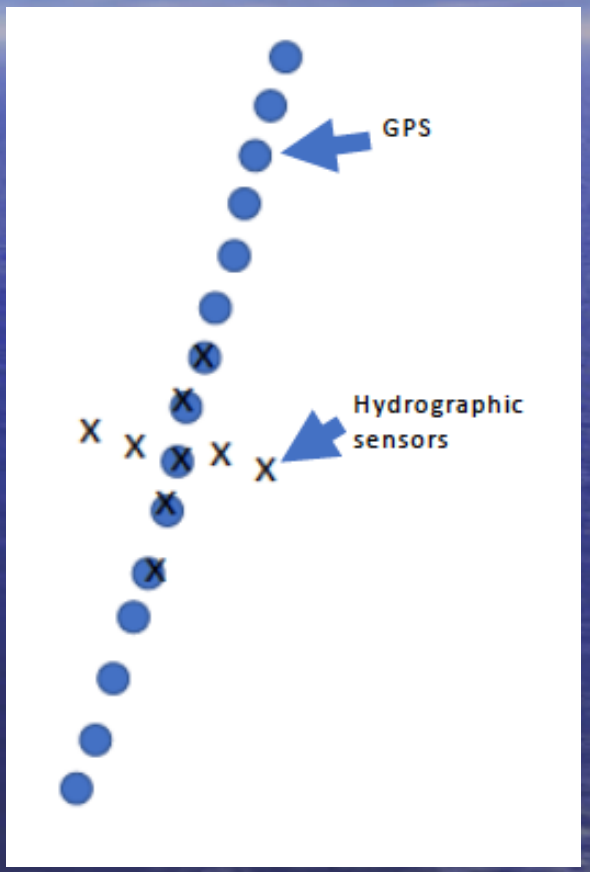
Meeting the challenge of CalVal with an in-situ observing system

A strawman design (pending on the pre-launch campaign):

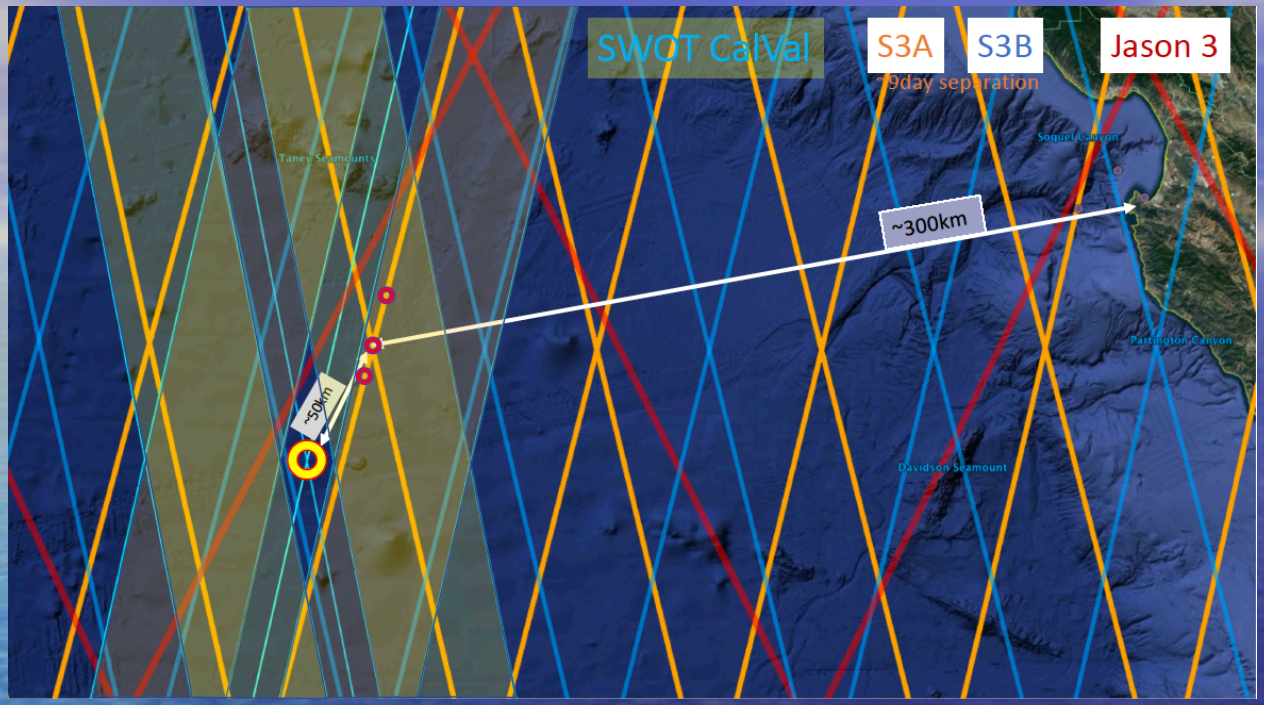
- An along-track array of GPS buoys for SSH validation

The minimum length of the GPS array needs to be ~ 120 km, according to a modeling study of the long-wavelength calval by the SWOT nadir altimeter.

- A two-dimensional array of hydrographic sensors (gliders, moored wire walkers/CTDs, etc.) for oceanographic understanding and validation.



Objectives of the pre-launch experiment

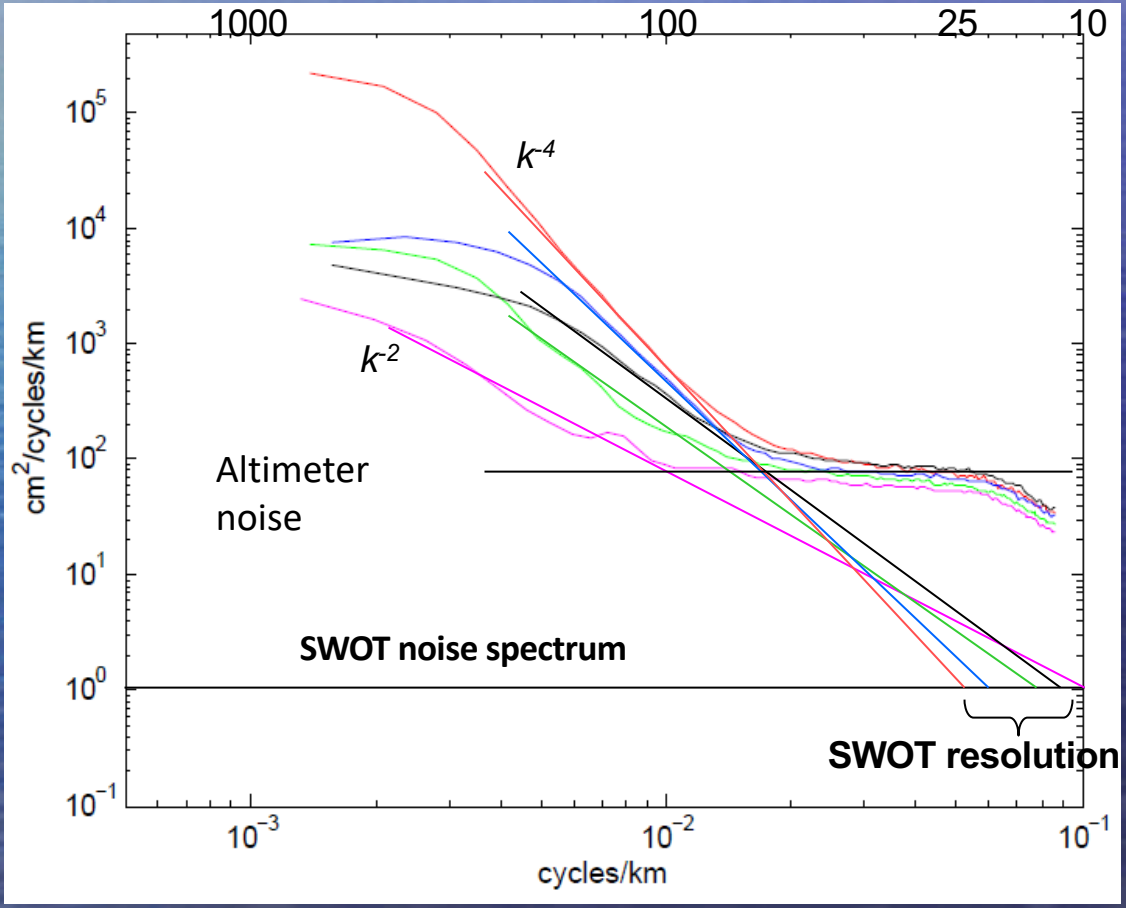


- Test the closure of determining SSH with GPS buoy, CTD mooring, and BPR.

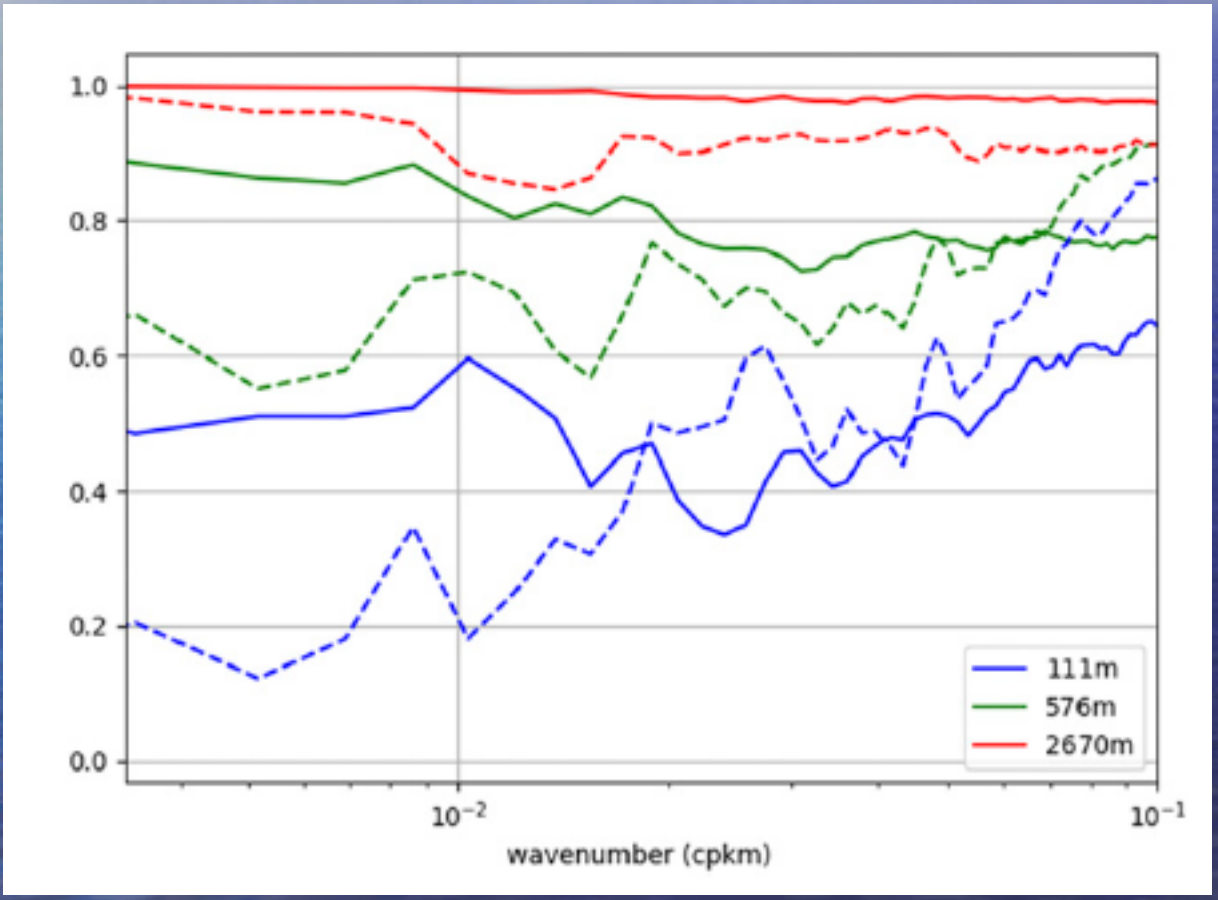
$$\eta = \frac{p_b'}{\rho_o g} - \frac{p_a}{\rho_o g} - \int_{-H}^{0} \frac{\rho'}{\rho_o} dz$$

- Test the sampling of the scales of SSH variability not resolved by conventional altimeters such as Sentinel 3A (S3A).

SSH wavenumber spectra

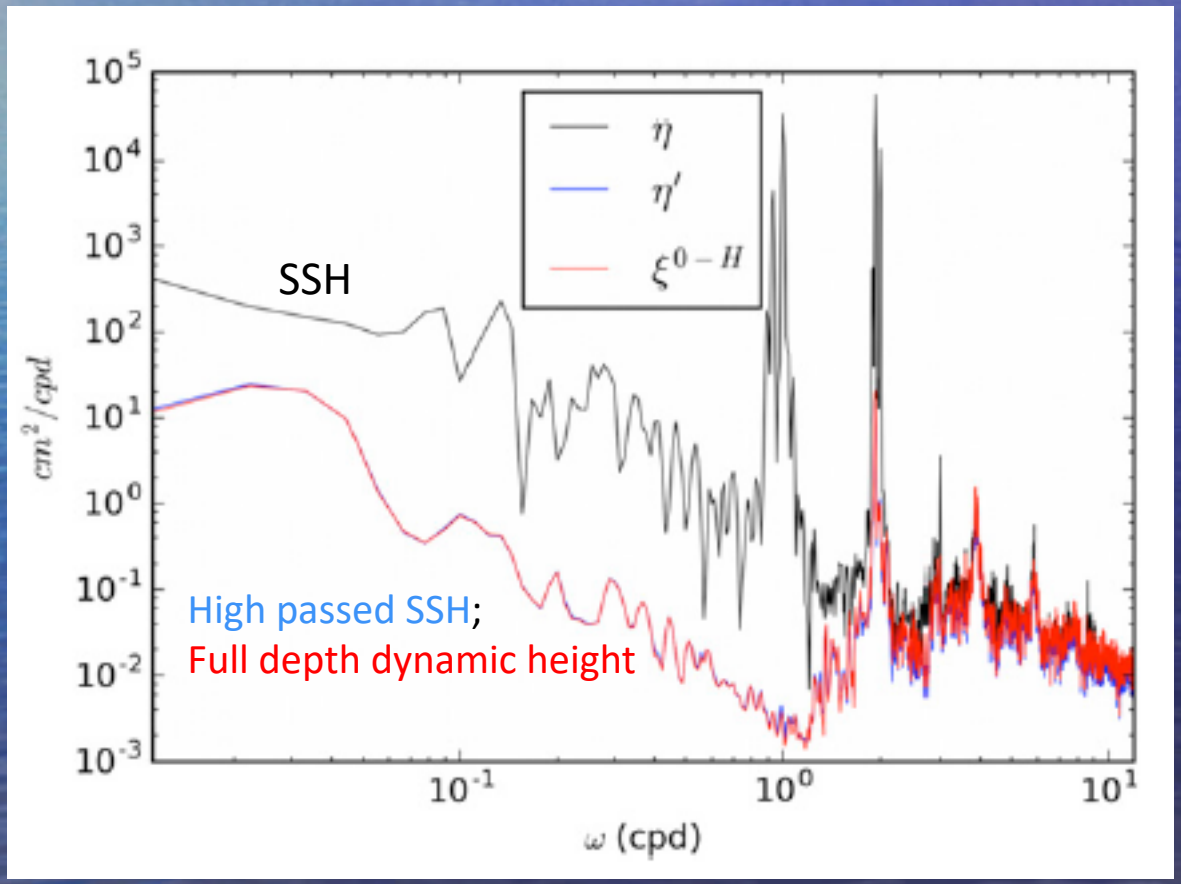


- Evaluate the vertical scale of the upper ocean circulation that can be determined by SSH at the SWOT scales for different frequency bands.
- Previous OSSE studies suggest that the upper ocean accounts for ~80% of the SSH variance.

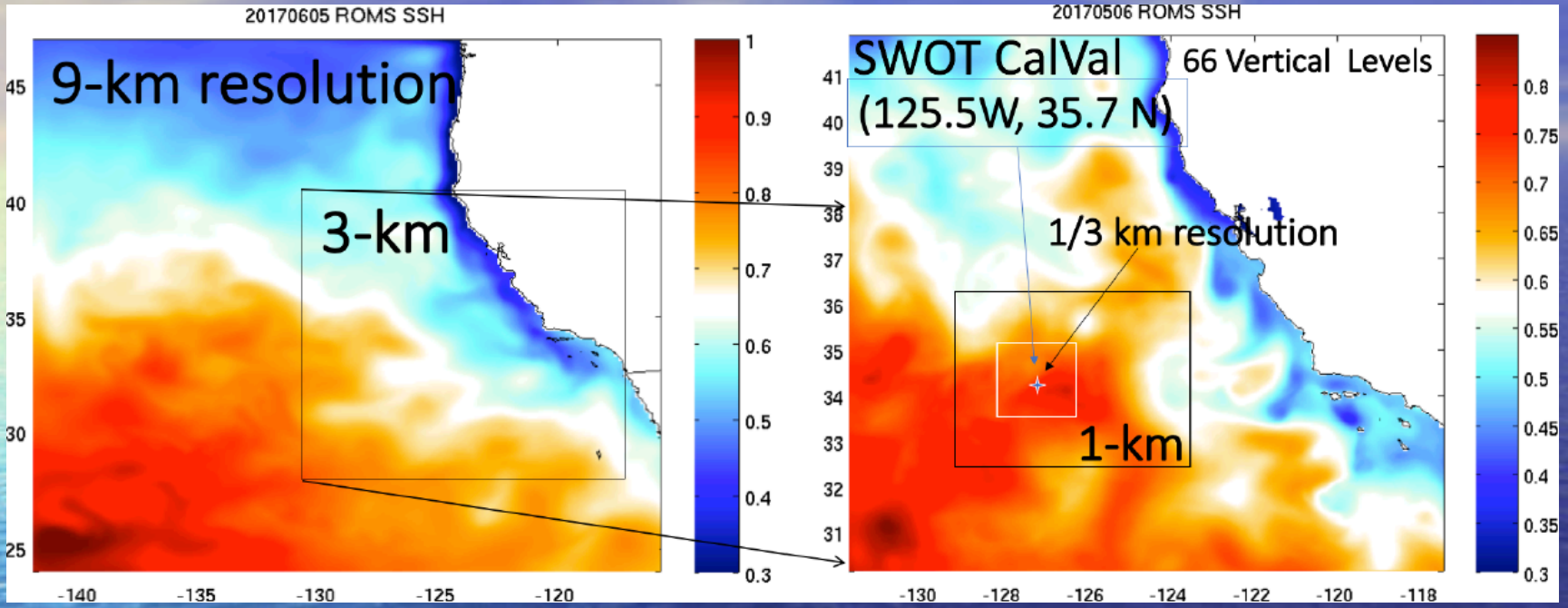


Wang et al, 2018

- Evaluate the roles of bottom pressure in SWOT SSH signals.
- The previous OSSE studies suggest that SSH at wavelengths less than 150 km is dominated by dynamic height, with little contributions from bottom pressure.
- By placing the two BPRs ~30 km will evaluate the bottom pressure signals at the SWOT scales.



- Evaluate the reconstruction of the upper ocean circulation
- Provide information for the design of the post-launch in-situ observing system.



Data assimilation

- Assimilate all SSH data from the present altimetry constellation.
- Assimilate other available routine observations (SST, SSS, and Argo).
- Evaluate the difference with and without assimilation of the in-situ observations.
- Assessment of the reconstruction of the upper ocean circulation. Comparison with the withheld glider data, and any other available high-resolution data.

Concluding Remarks

- A fundamental challenge of SWOT is insufficient temporal sampling.
- Oceanographic validation and understanding will require thoughtfully designed in-situ observing systems.
- The twice-per-day sampling at crossovers during the fast sampling phase will provide the best opportunities for oceanographic validation.
- SWOT Project will deploy an in-situ observing system at the California calval site.
- A prelaunch campaign will be conducted in September 2019 at the California site to collect data for the design of the post-launch observing system.
- Data assimilative modeling is important for the ocean calval efforts.