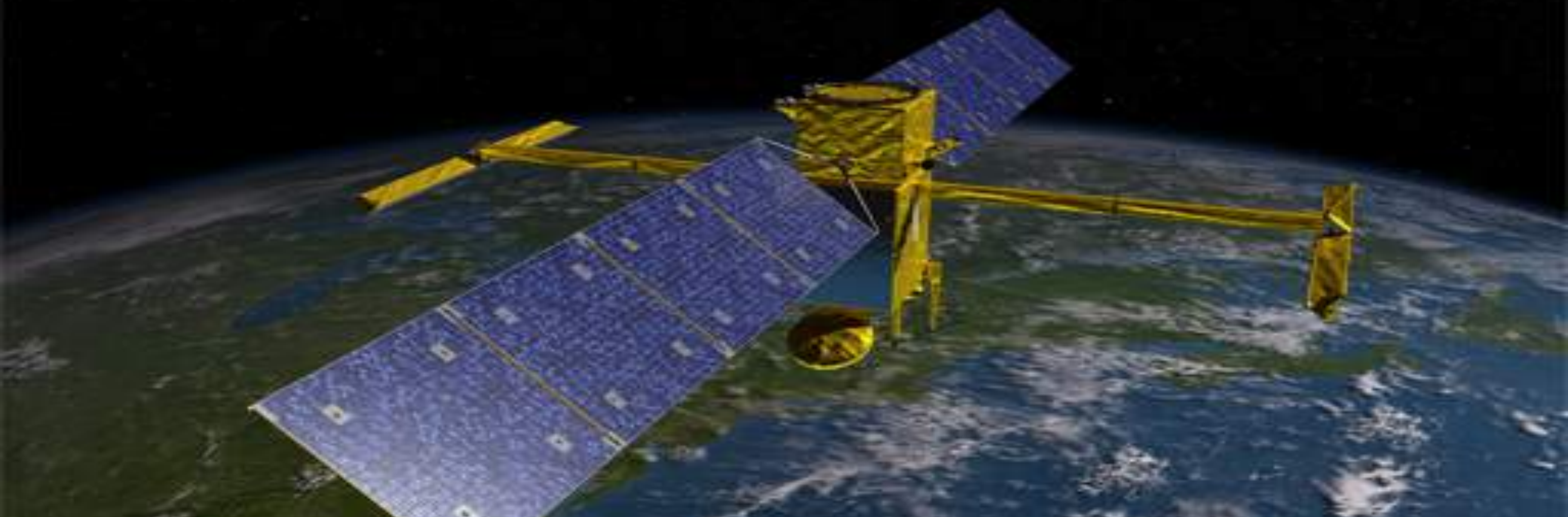
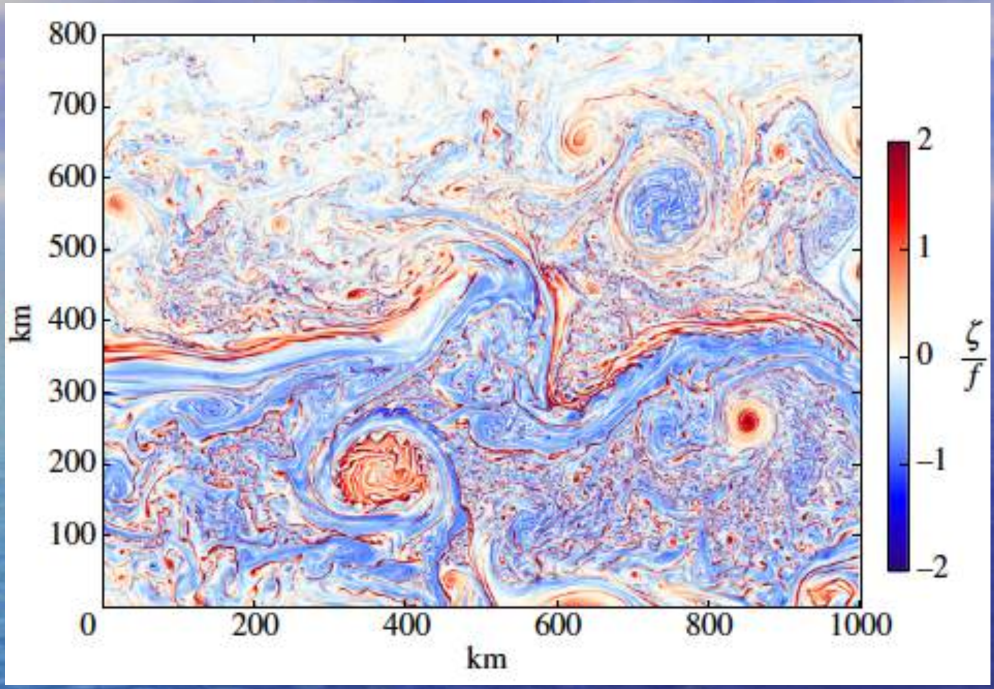
The SWOT Mission: SSH at small scales validation and understanding



Lee-Lueng Fu
Jet Propulsion Laboratory, Pasadena, CA, USA

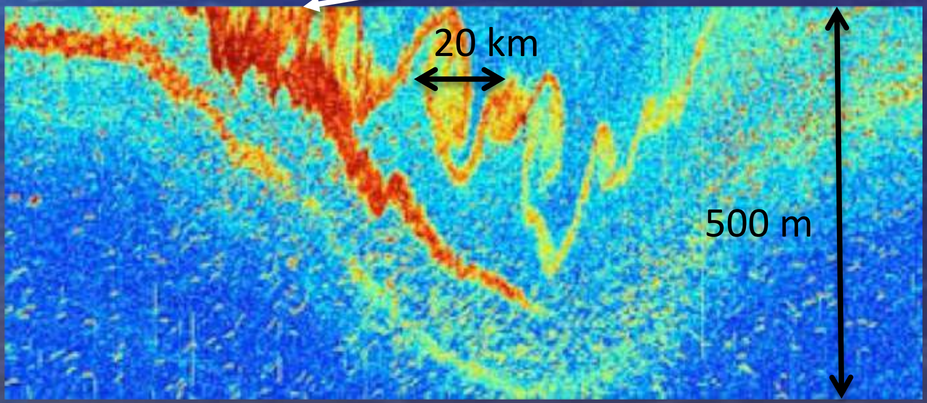
ECCO Meeting
October 29-31,2018
Austin, Texas USA

Vertical transport of heat and water properties in the ocean



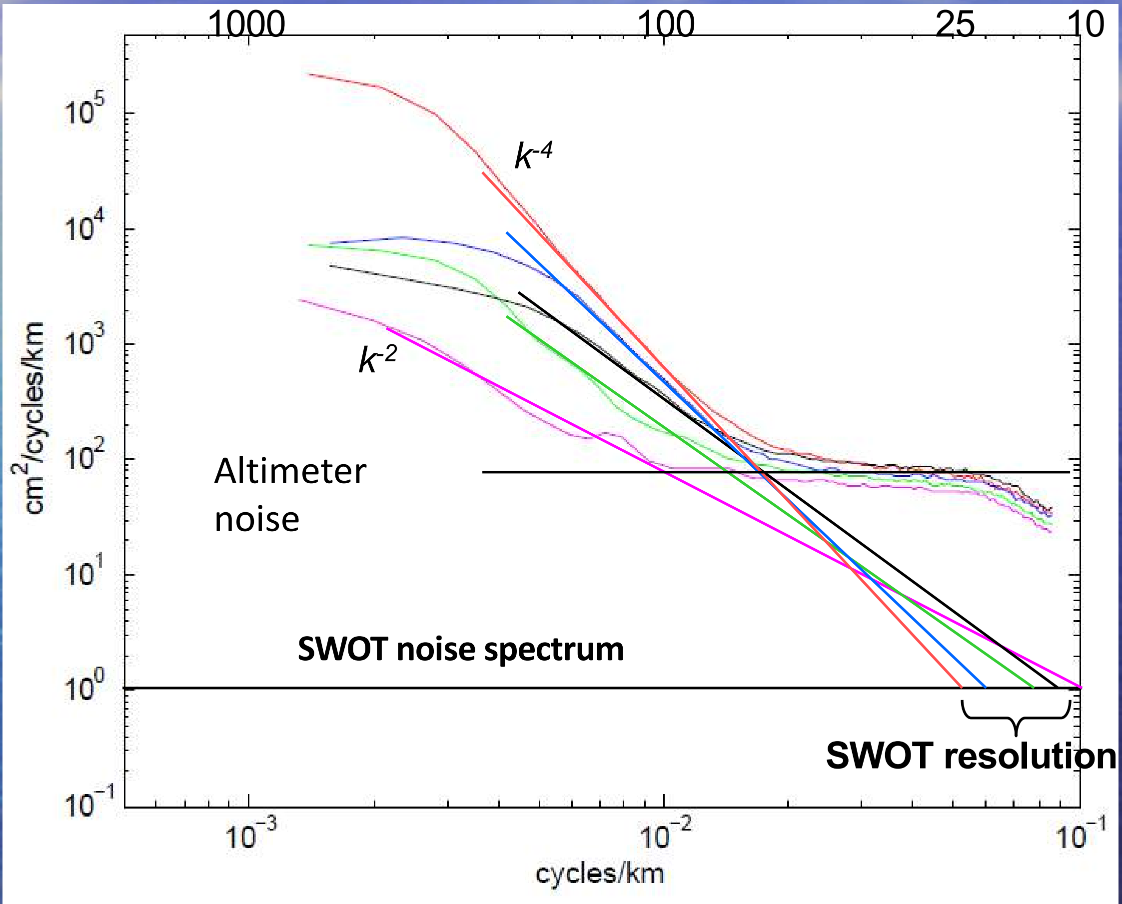
Vertical vorticity at the surface in the Gulf Stream (McWilliams, 2016)

Sea surface height variations to be observed by SWOT

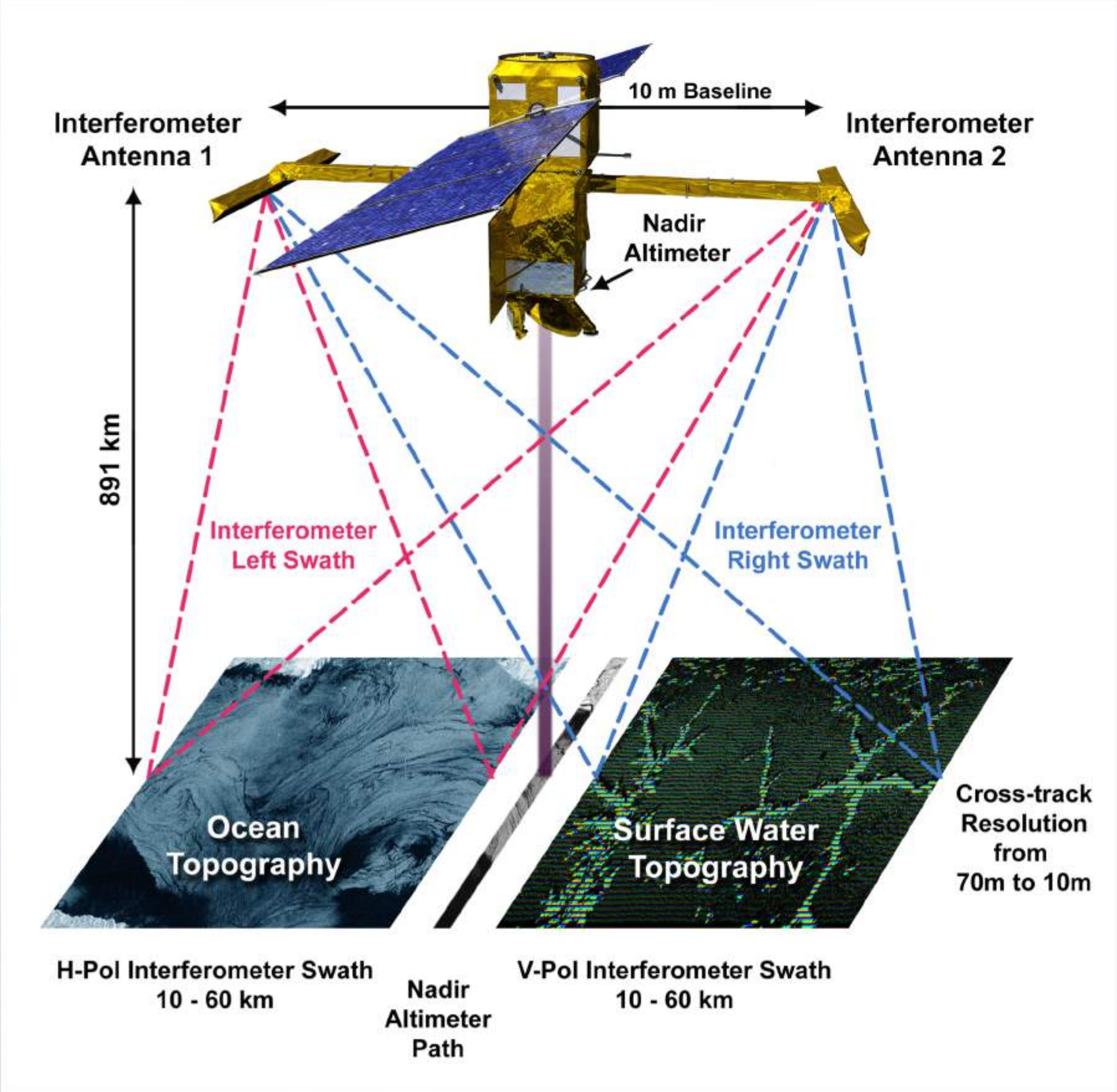


NOAA/GFDL

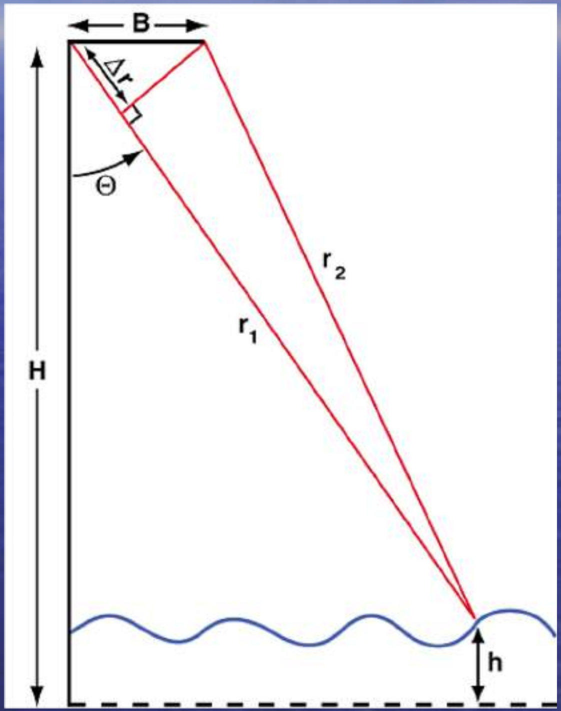
SSH wavenumber spectra



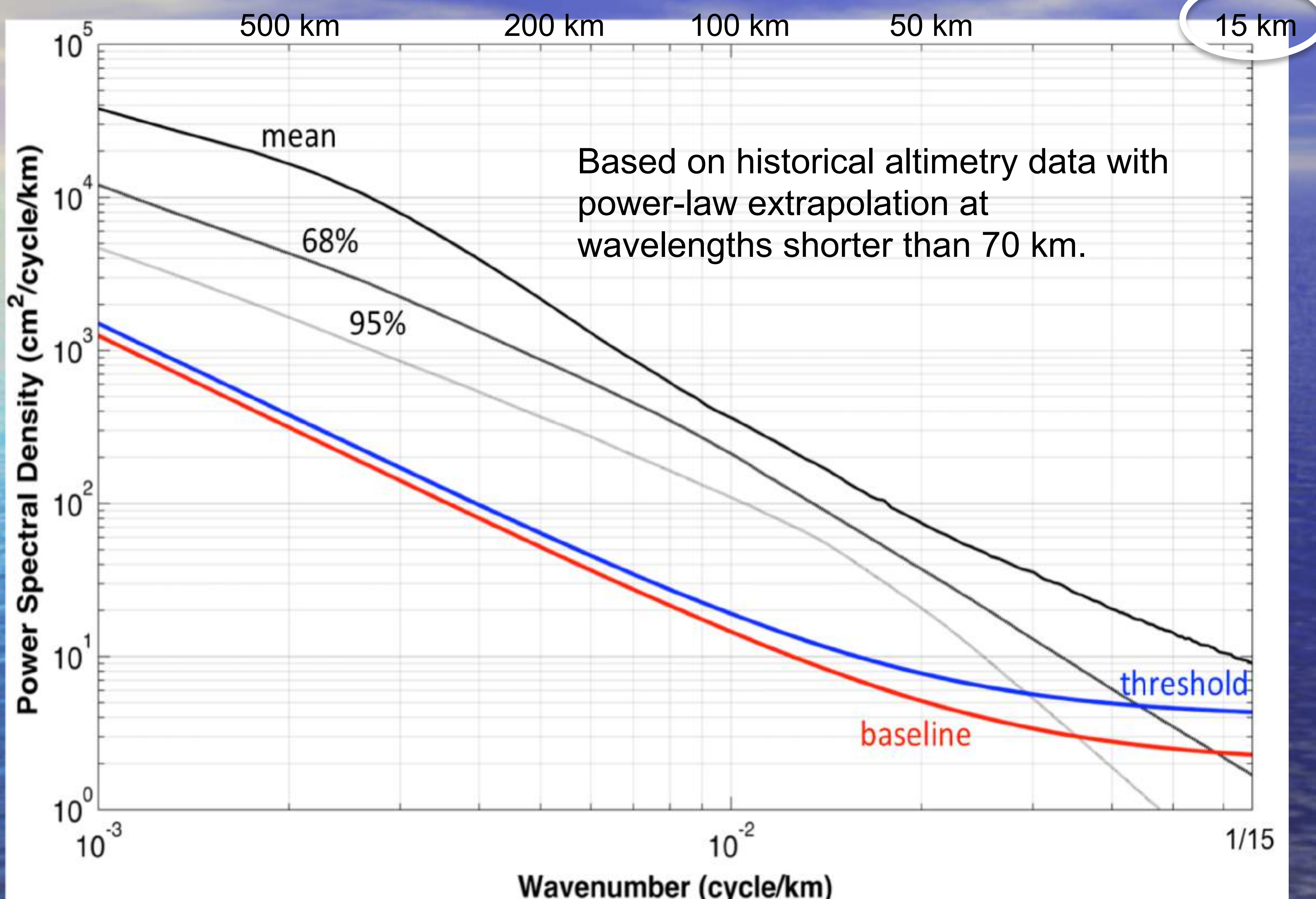
SWOT measurement system



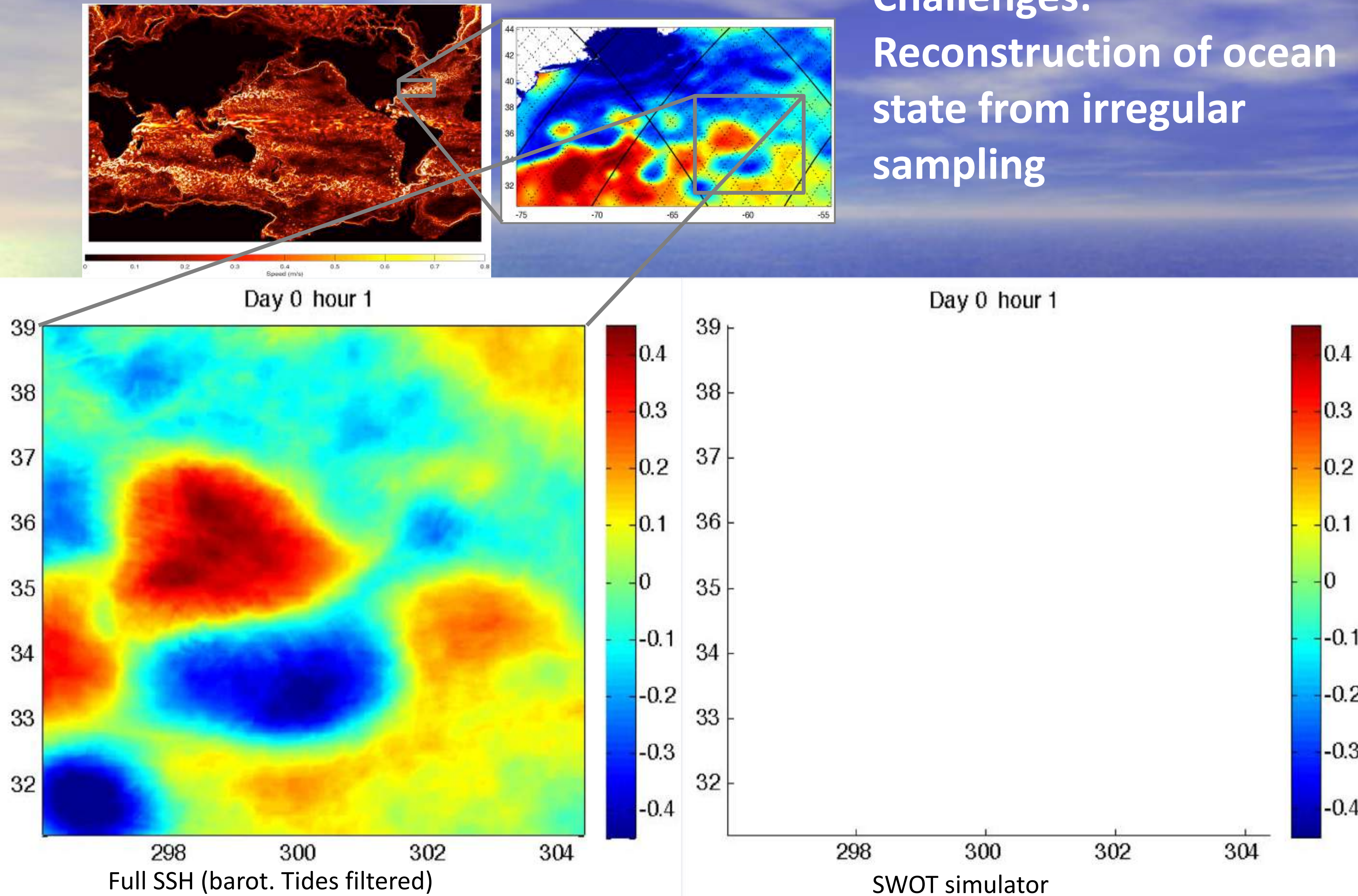
Interferometric Altimetry Measurement



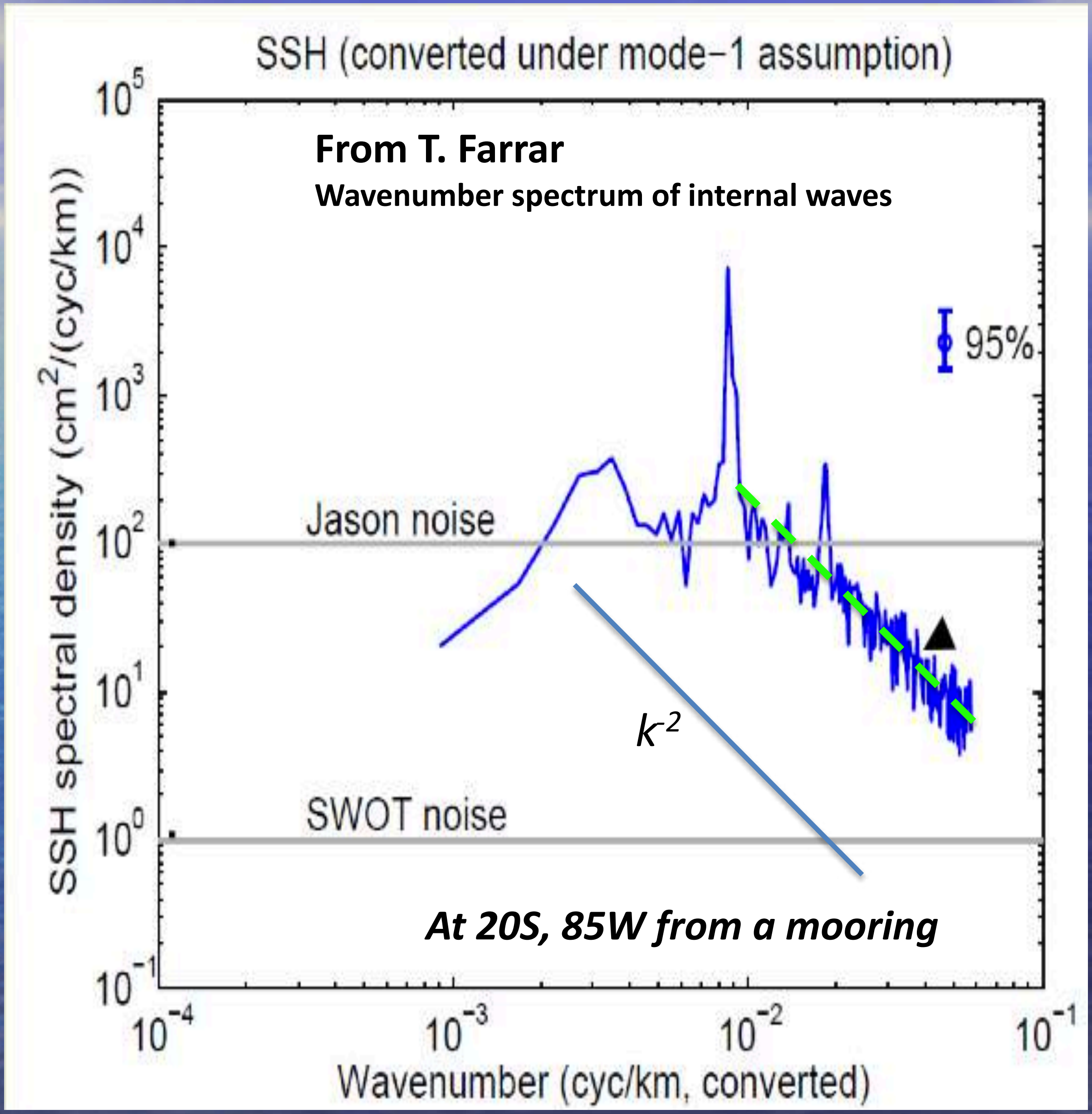
Sea Surface Height Requirement



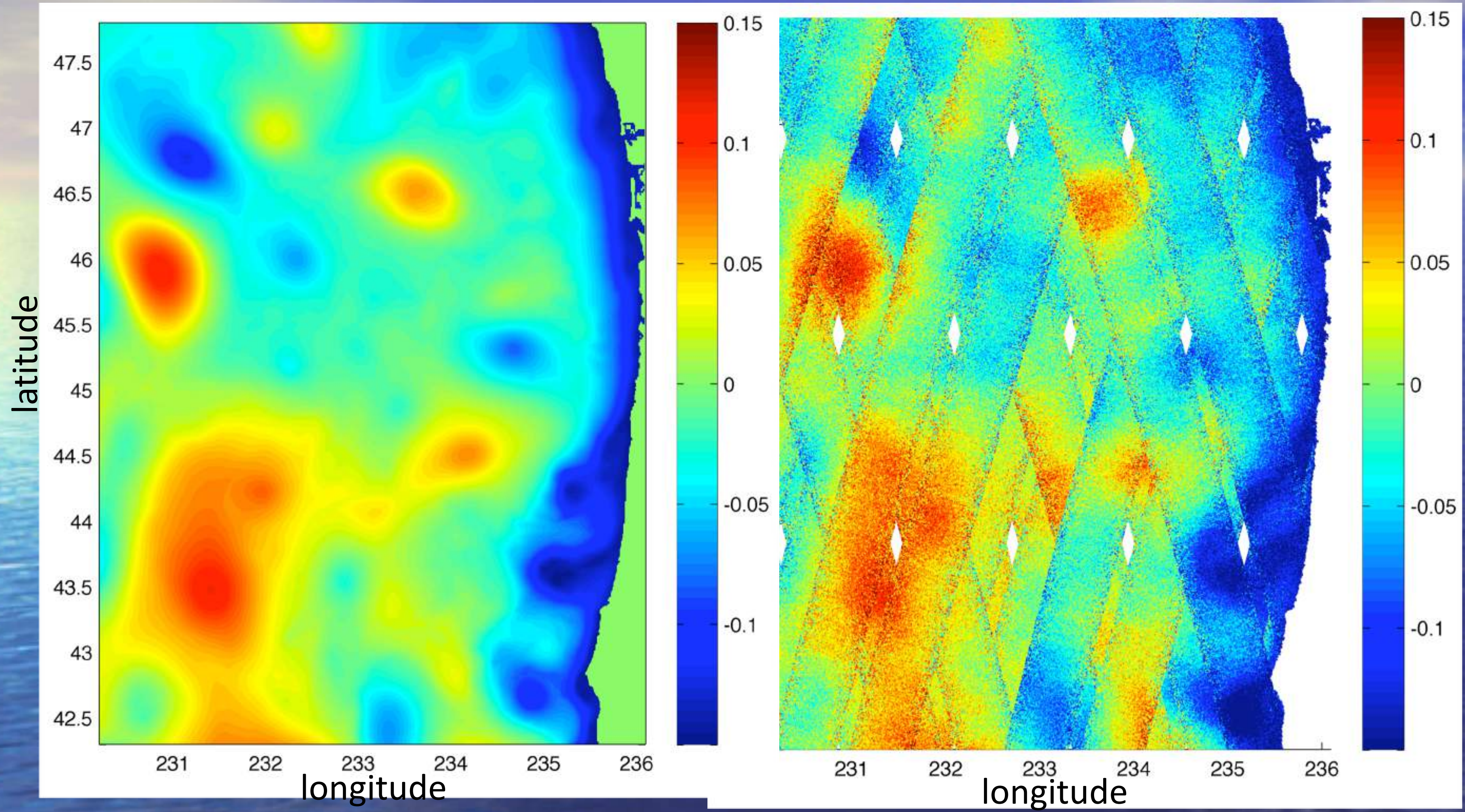
Challenges: Reconstruction of ocean state from irregular sampling



Challenges: Dealing with Internal tides and internal waves



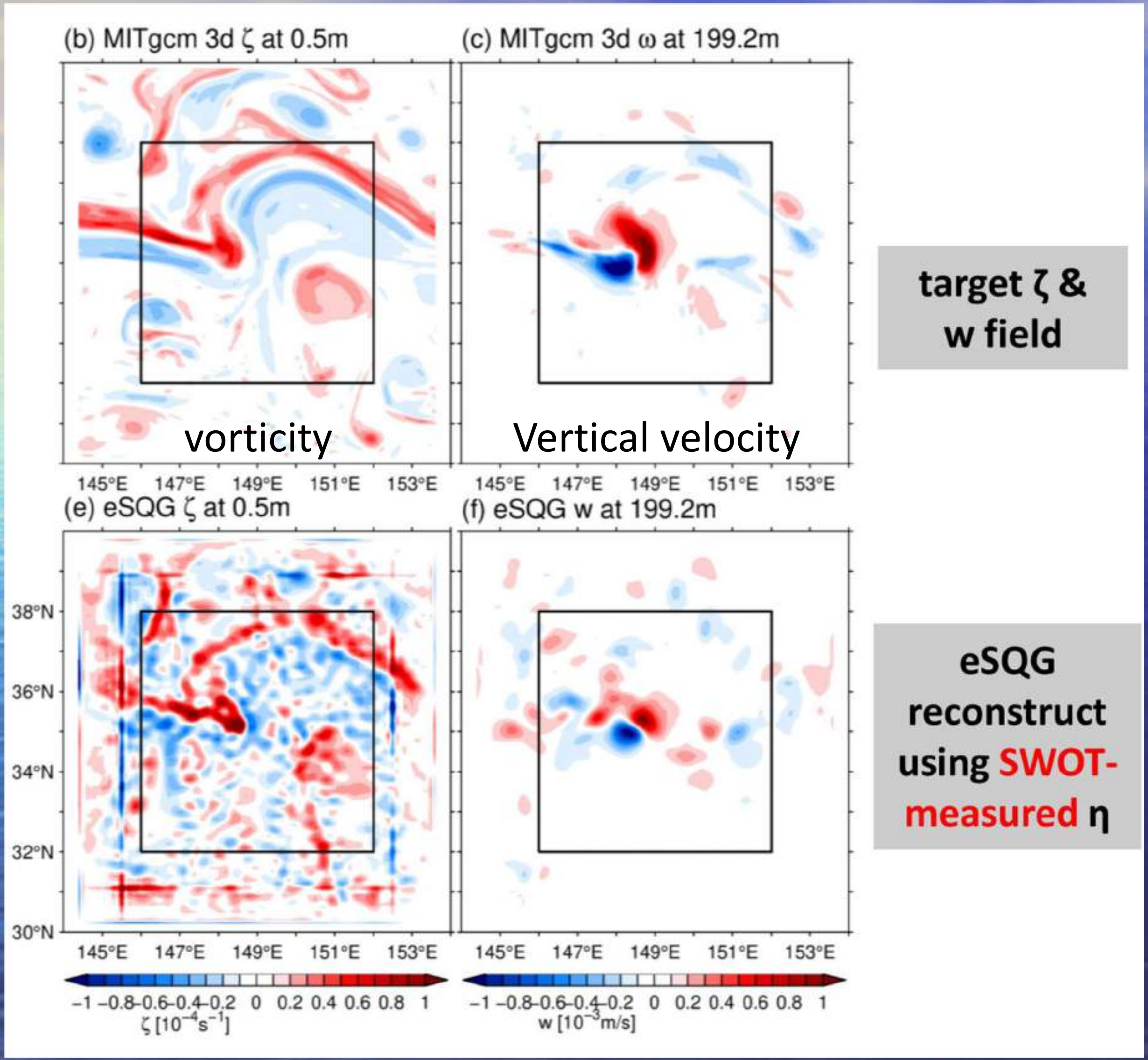
Challenges: Reconstruction of ocean state from irregular sampling

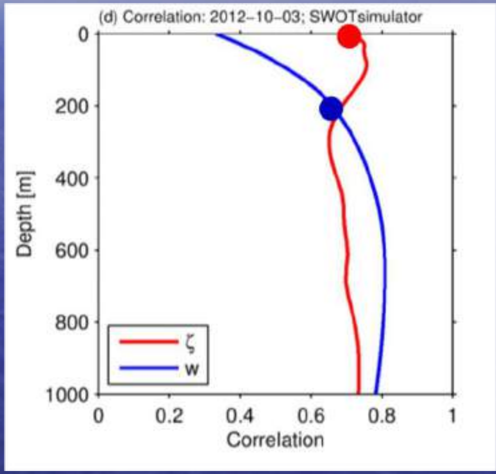


A software tool available for simulating SWOT-like observations for studying reconstruction methodology

Surface Vorticty and Vertical Velocity

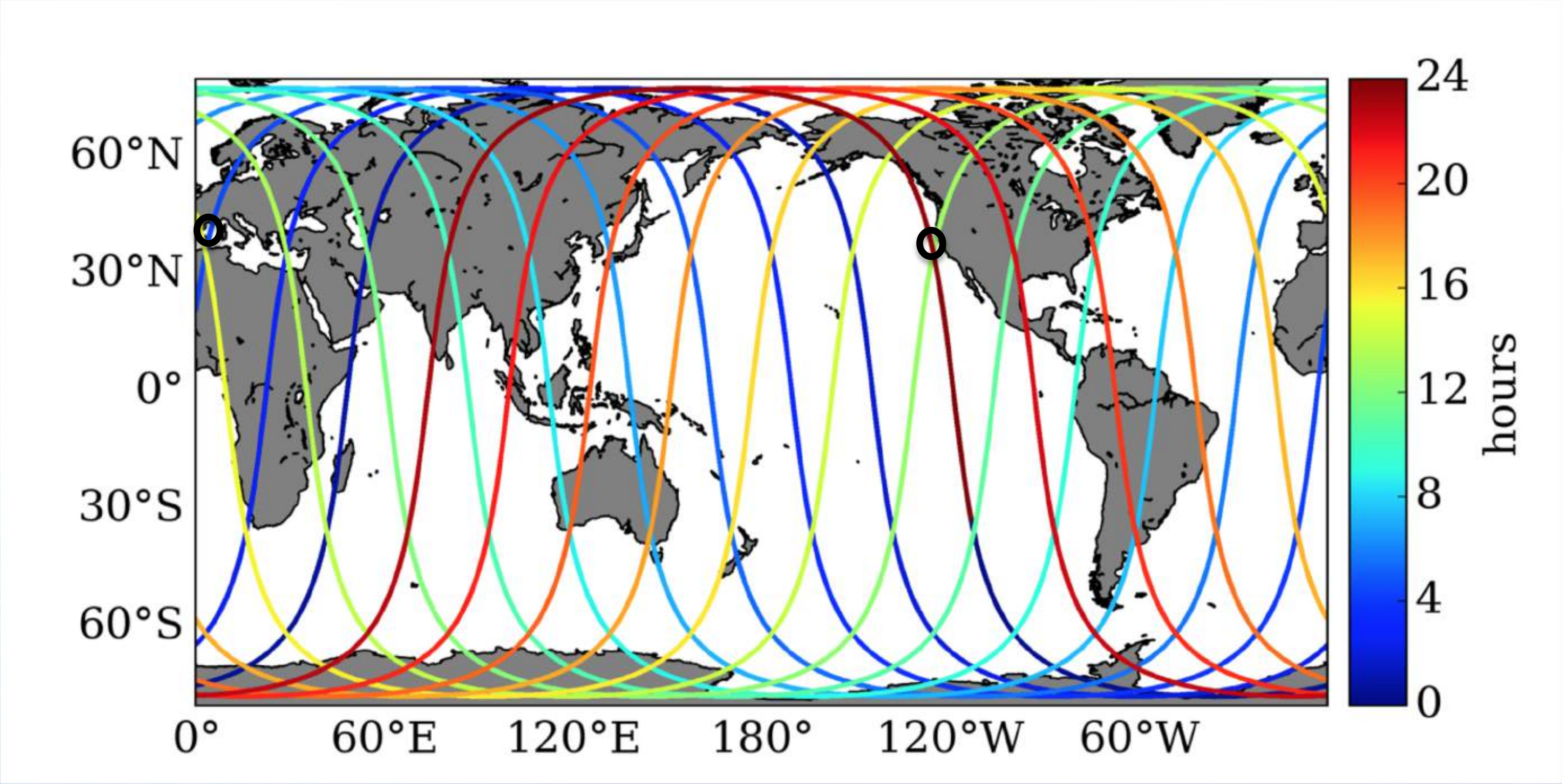
A Grand Challenge for Ocean Remote Sensing





(Qiu et al, 2018)

One-day repeat phase for initial Cal/Val



SWOT ocean calval objectives

- Geodetic validation - validate the measurement of SSH to meet the wavenumber spectrum requirement
    - GPS buoys and airborne lidar

- Oceanographic validation – validate the utility of the SSH measurement to meet the science objectives
    - Moorings of temperature and salinity sensors
    - Station-keeping gliders
    - Upper ocean profilers (Prawler, wire-walker)

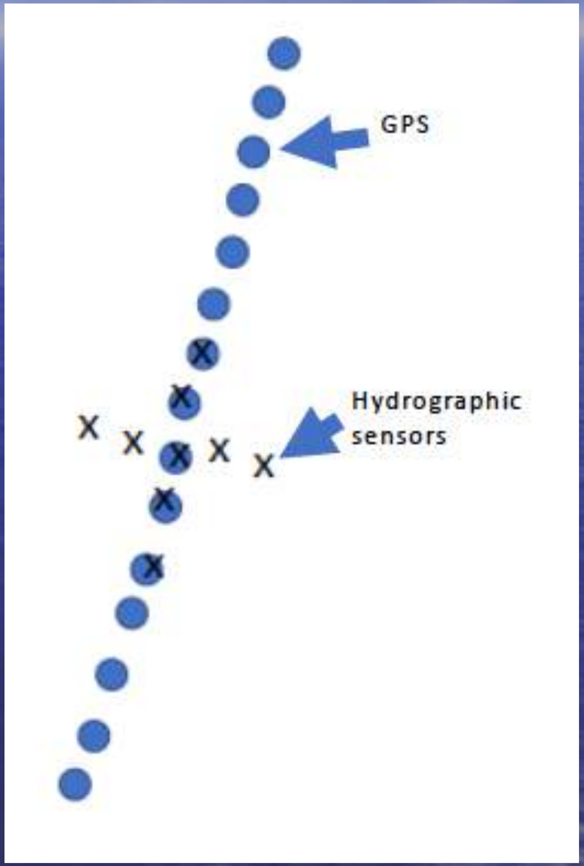
Meeting the challenge of CalVal with an in-situ observing system

A strawman design:

An along-track array of GPS buoys for SSH validation

A two-dimensional array of hydrographic sensors (gliders, prawlers, possibly some deep CTDs, or combination of them) for the oceanographic understanding. Such deployment will link the mission's calval plan to the development of the post-launch science campaign.

The minimum length of the GPS array needs to be ~ 110 km, according to a modeling study of the long-wavelength calval by the SWOT nadir altimeter.

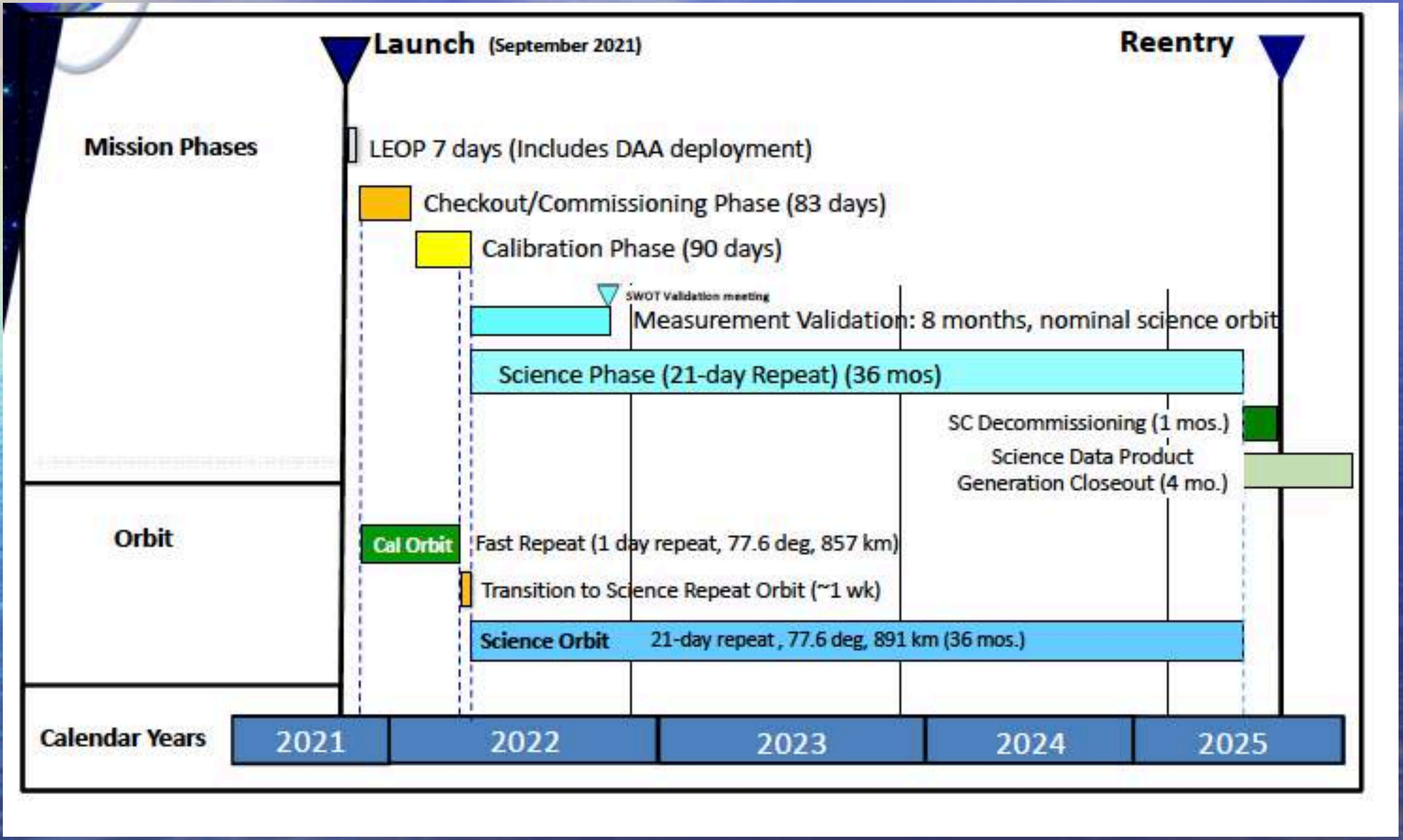


Objectives of the Oceanographic Validation

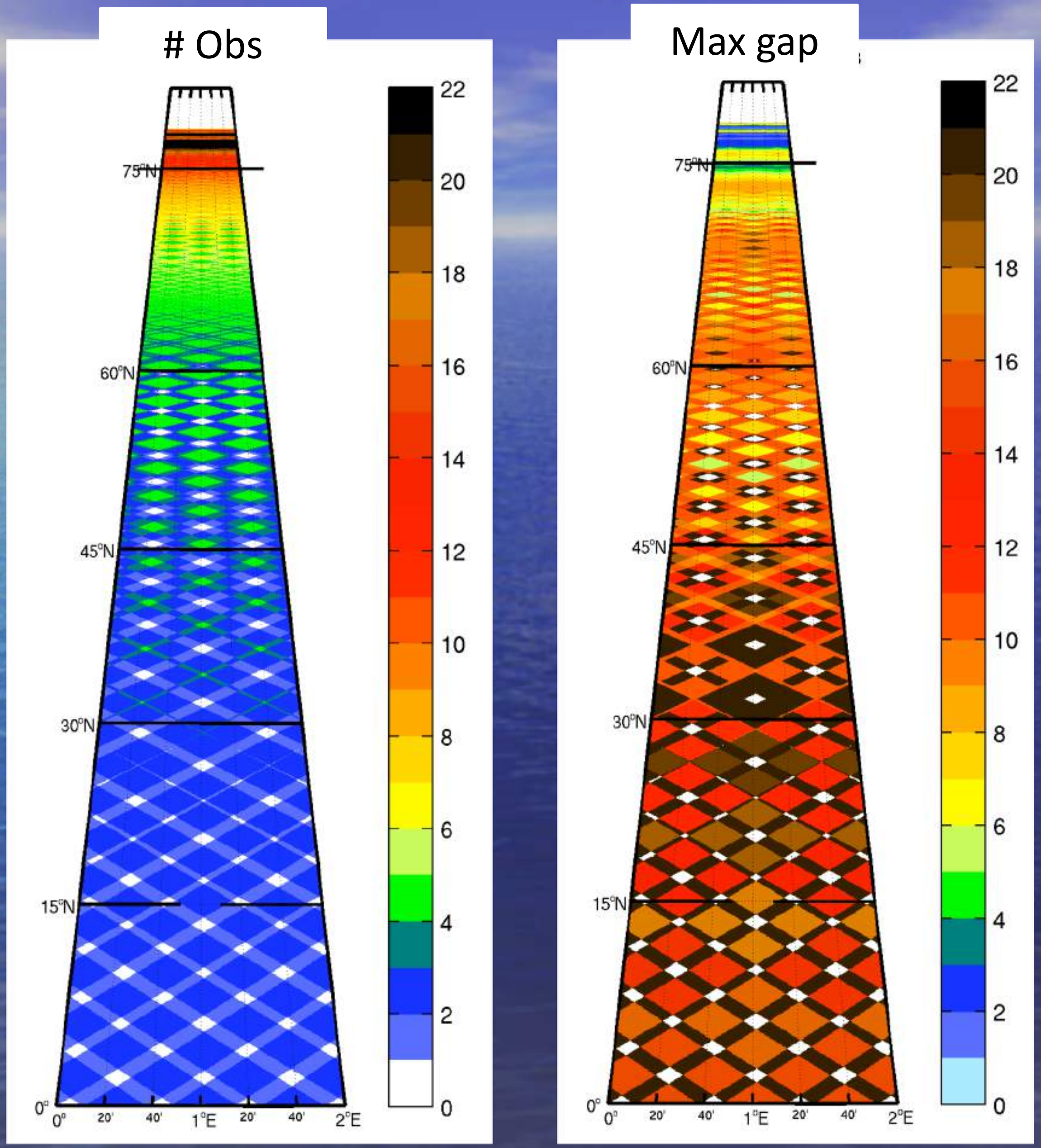
- Vorticity dynamics and vertical velocity/transport
- Modeling/data assimilation is a tool to address the objectives.
  - Before launch: design an in-situ observing system to provide estimate of vorticity and vertical velocity
  - After launch: test the performance of SWOT for vorticity and vertical velocity

Back-Up

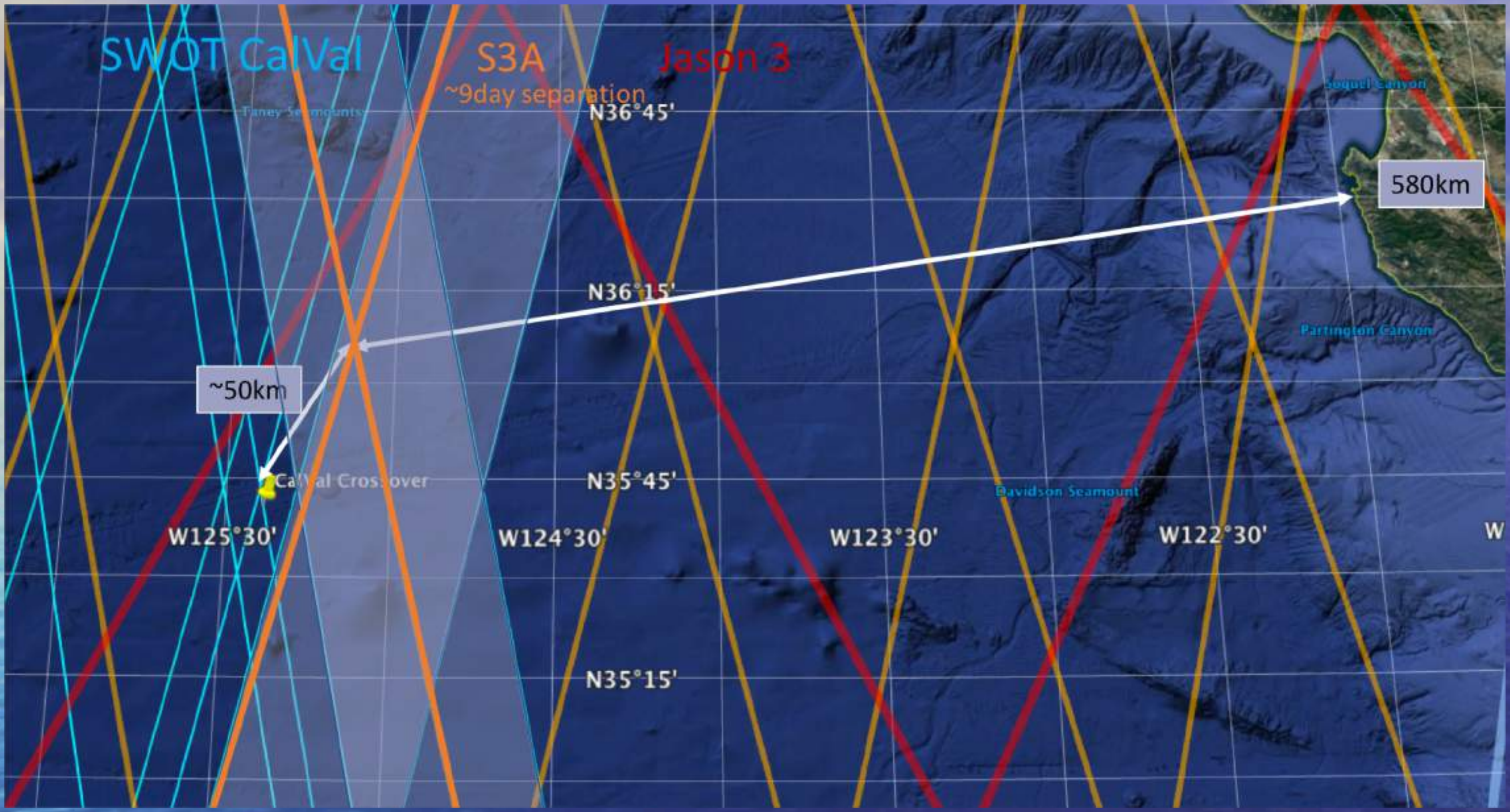
Mission Phases/Timeline



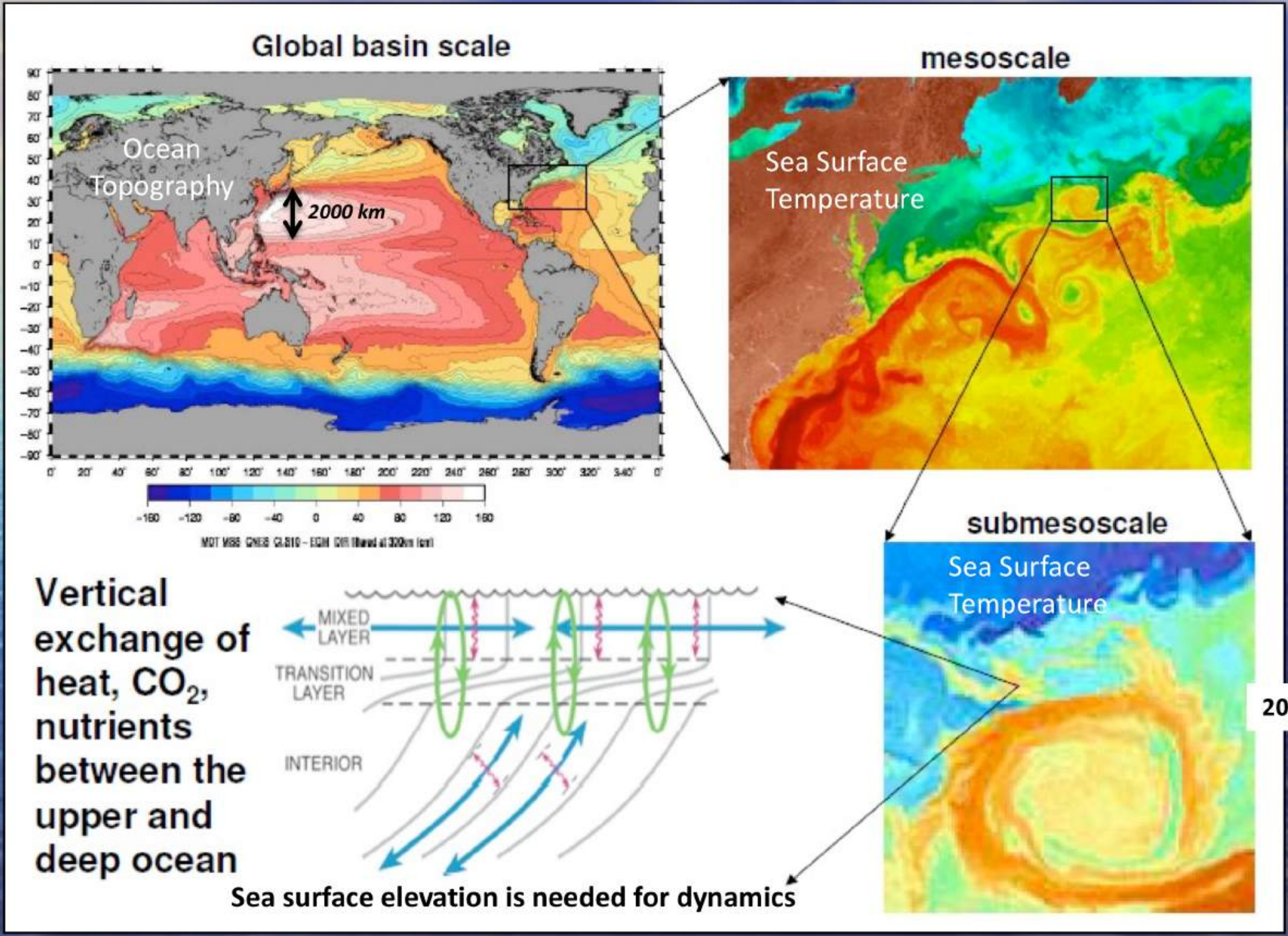
Sampling pattern of the 21-day orbit for the Science Phase



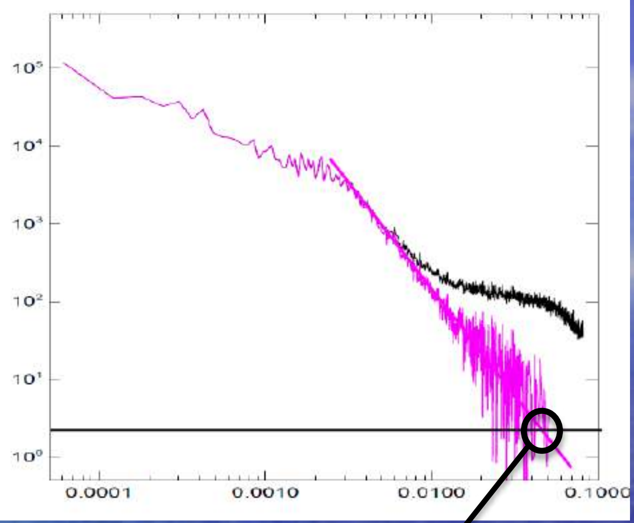
Pre-launch ocean in-situ calval experiment



Targeting the dynamics of the smallest scales of ocean currents



SWOT SSH resolution in the global ocean



Fu and Ubelmann (2013)