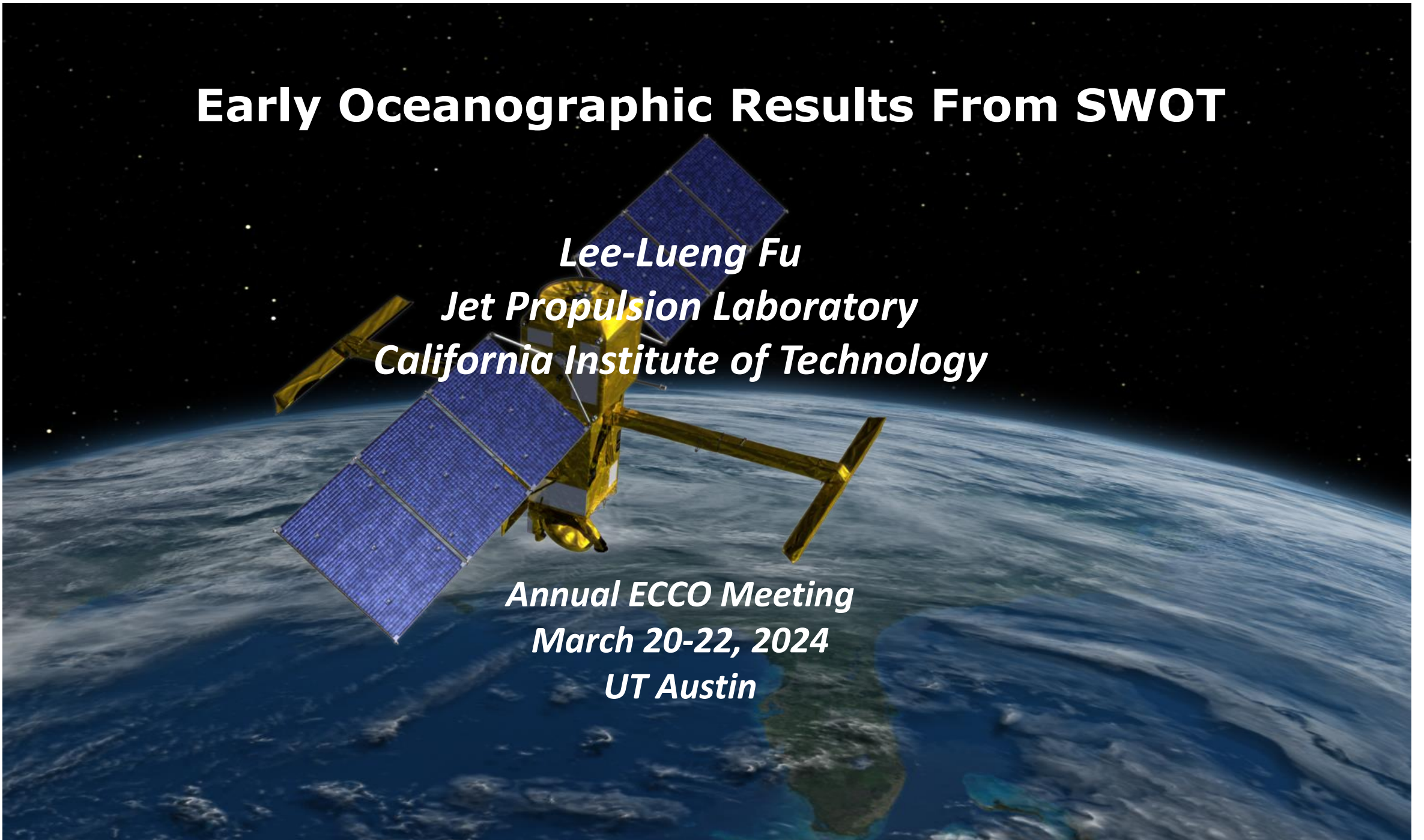


Early Oceanographic Results From SWOT

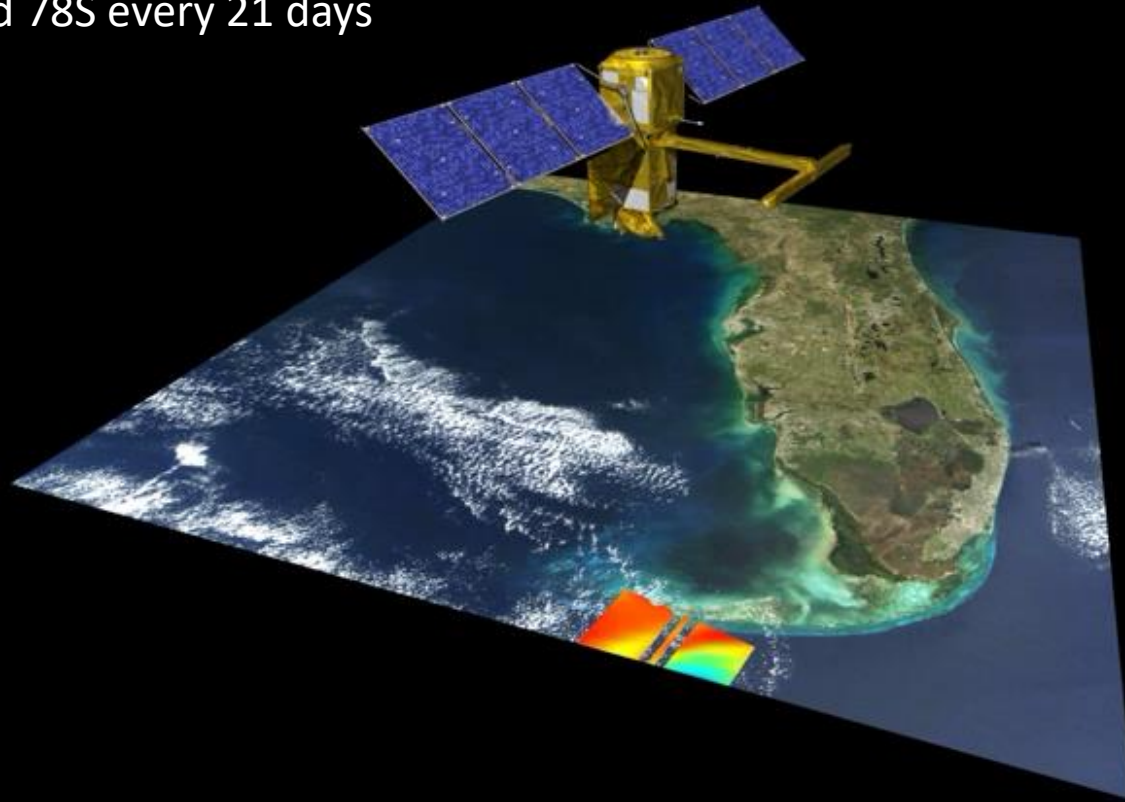
*Lee-Lueng Fu
Jet Propulsion Laboratory
California Institute of Technology*

*Annual ECCO Meeting
March 20-22, 2024
UT Austin*

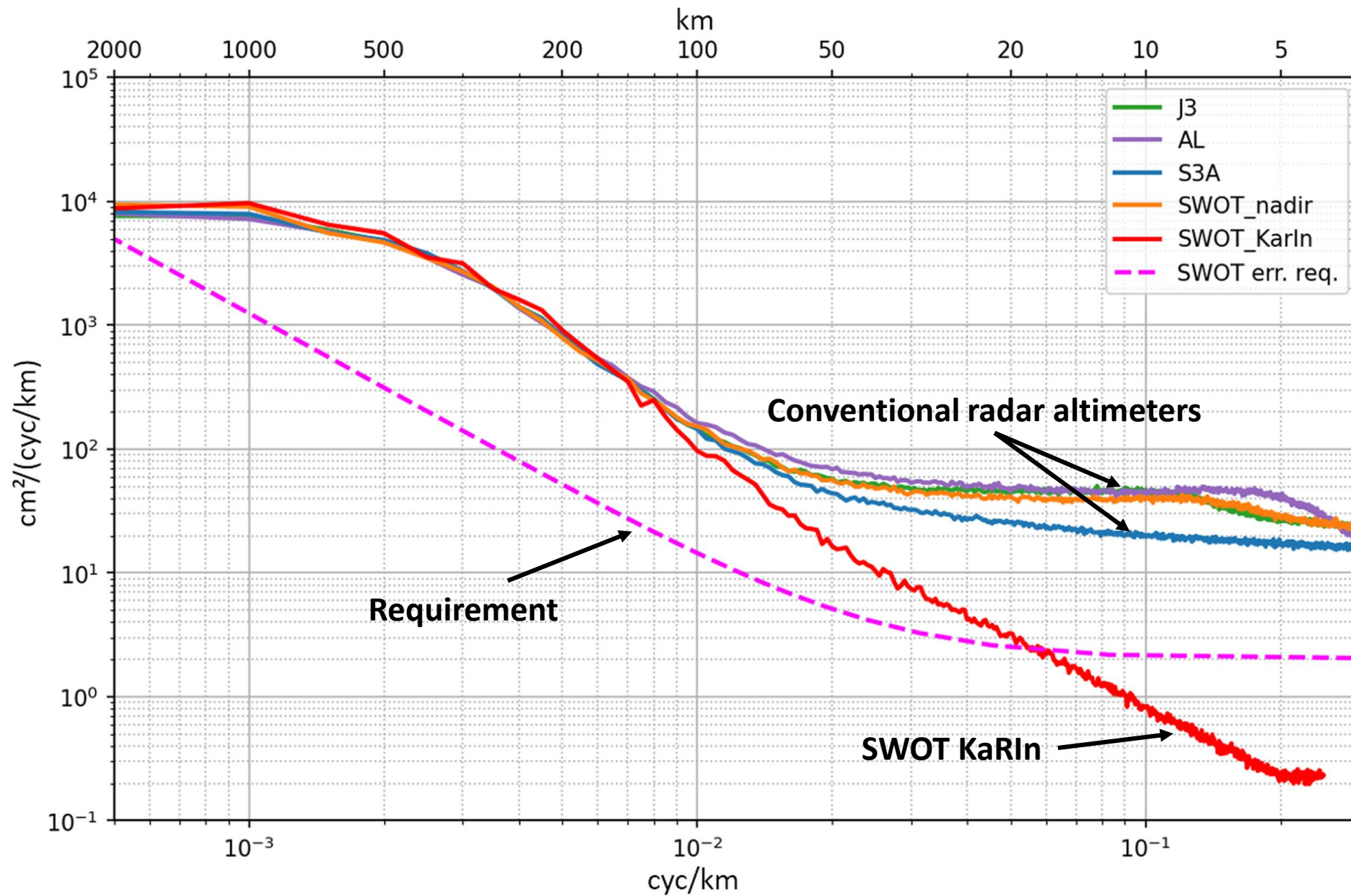


SWOT is a pathfinder mission addressing transformative questions on water and energy of the Earth System, with radar interferometry measuring the elevation of water surface of the world.

SWOT will cover the world between
78N and 78S every 21 days

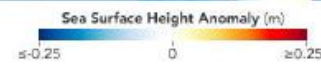
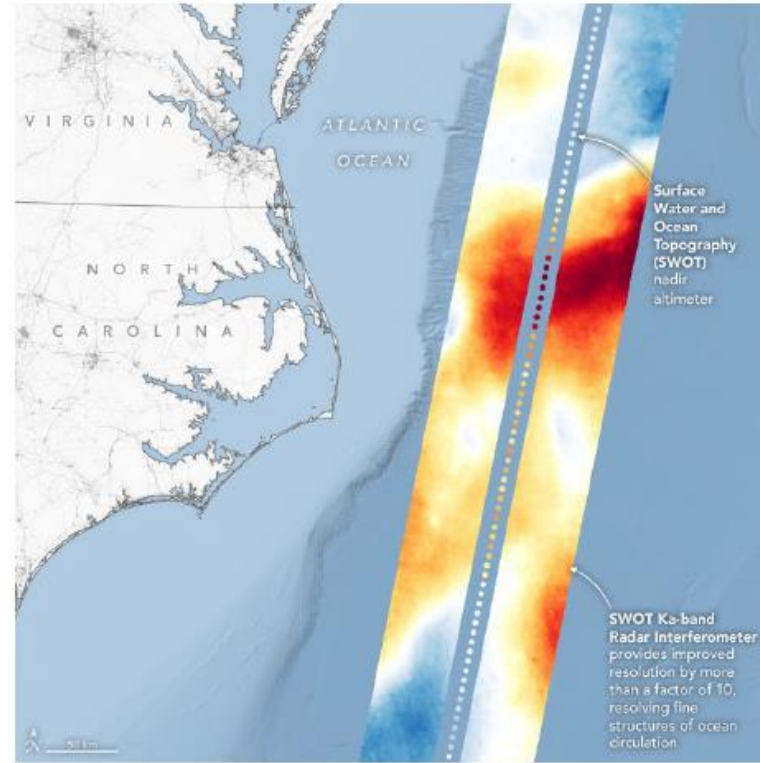
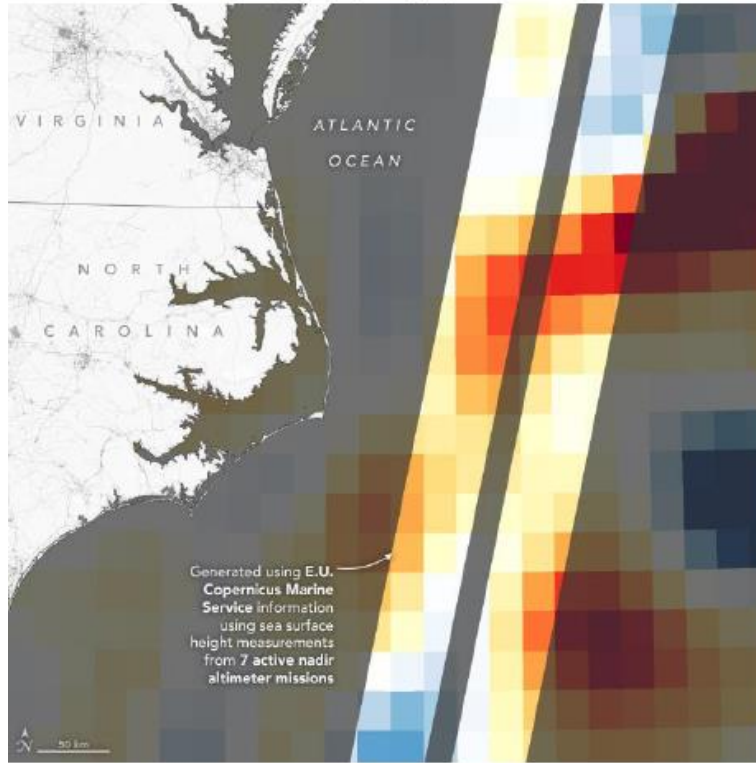


Wavenumber spectra of radar altimetry

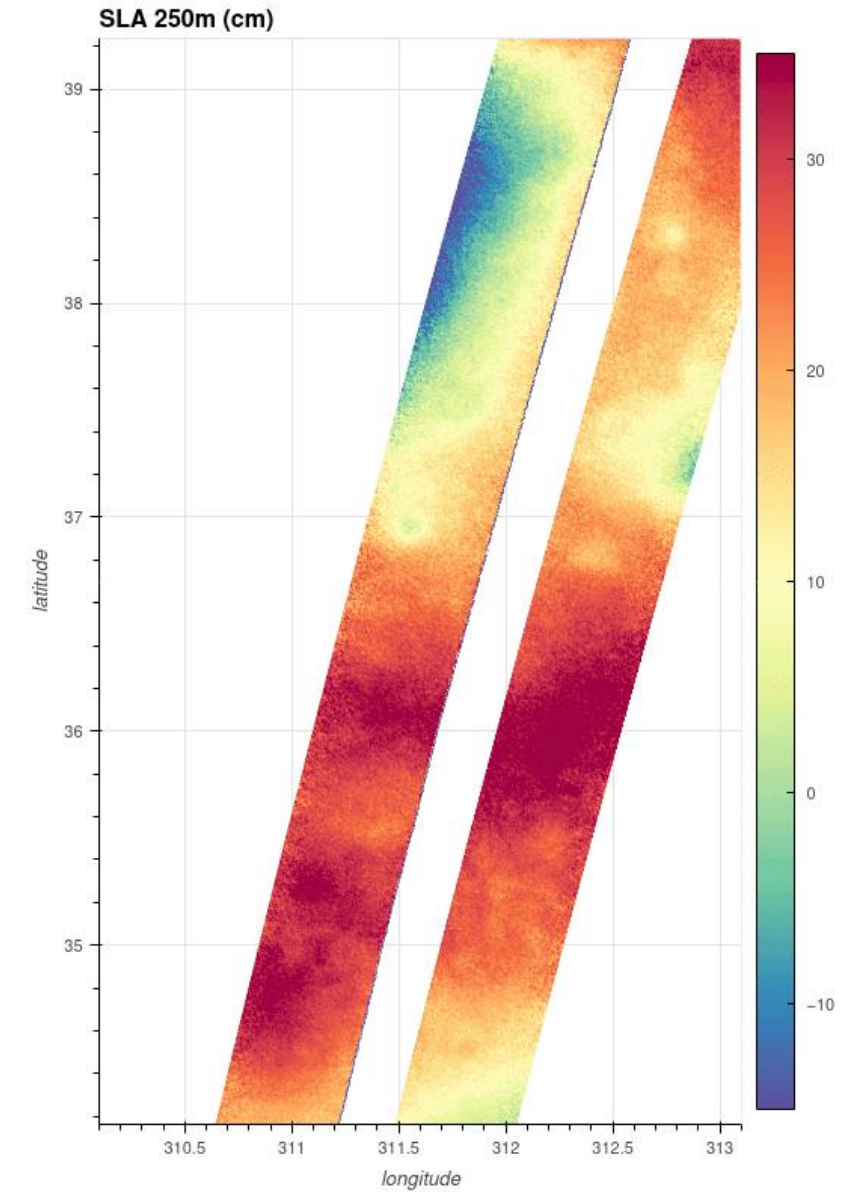


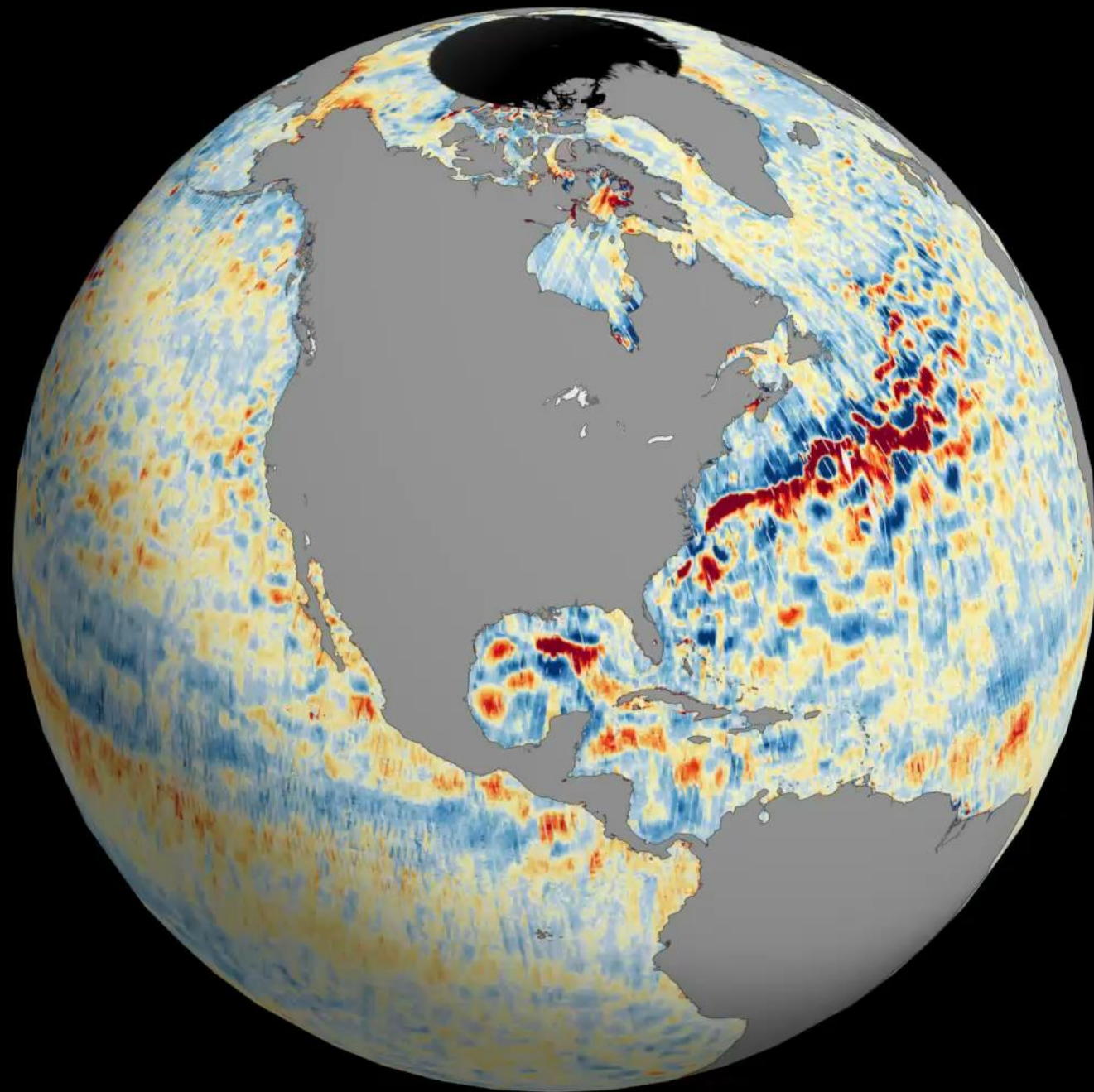
Comparison of SSH from AVISO altimetry data product (left) with SSH from SWOT KaRIN and nadir altimeter (right)

Ocean topography (1D constellation VS KaRIN 2D)

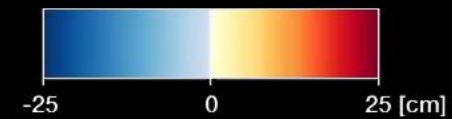


Tracking a cold eddy





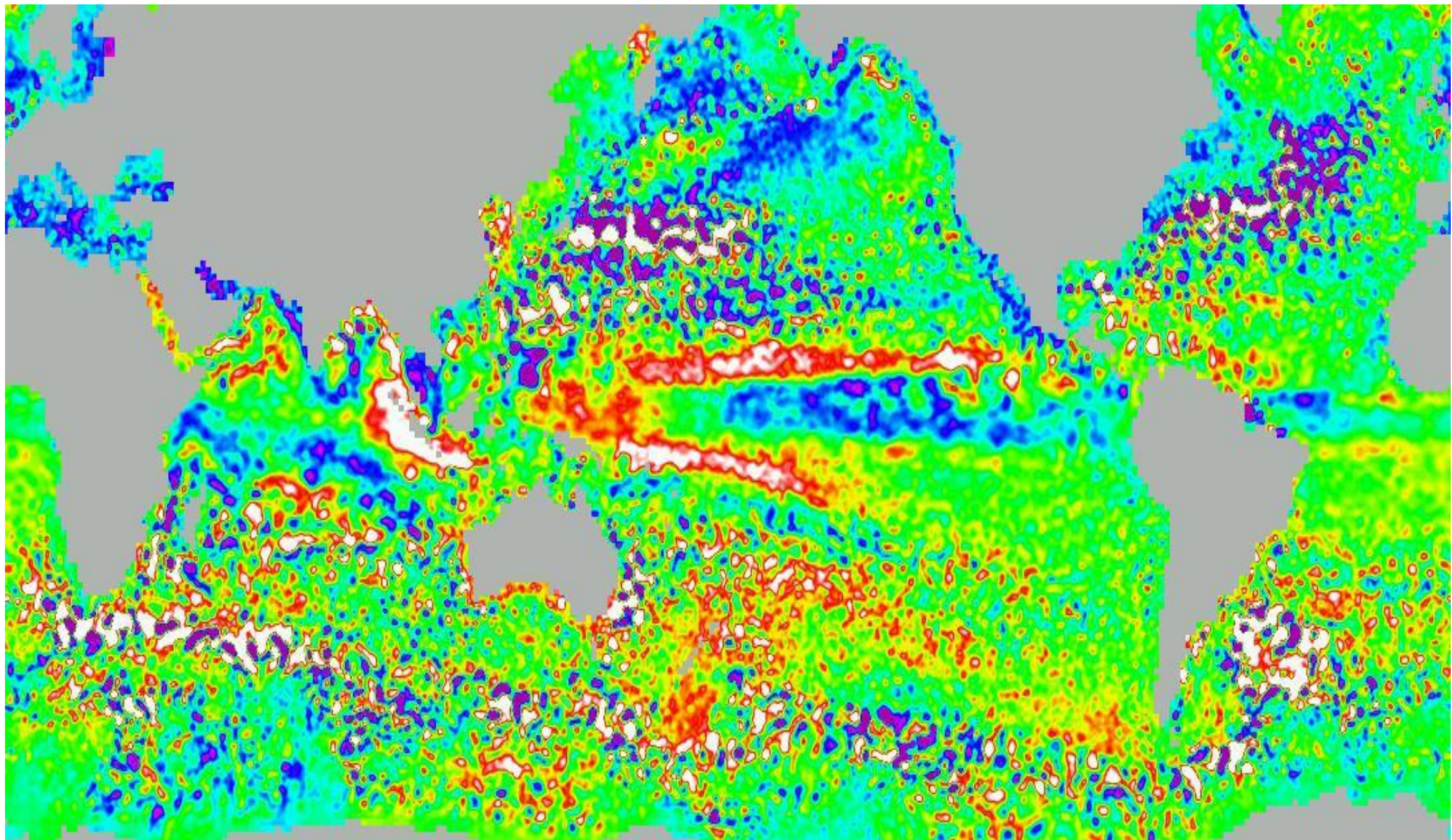
Sea Surface Height Anomaly (SSHA)



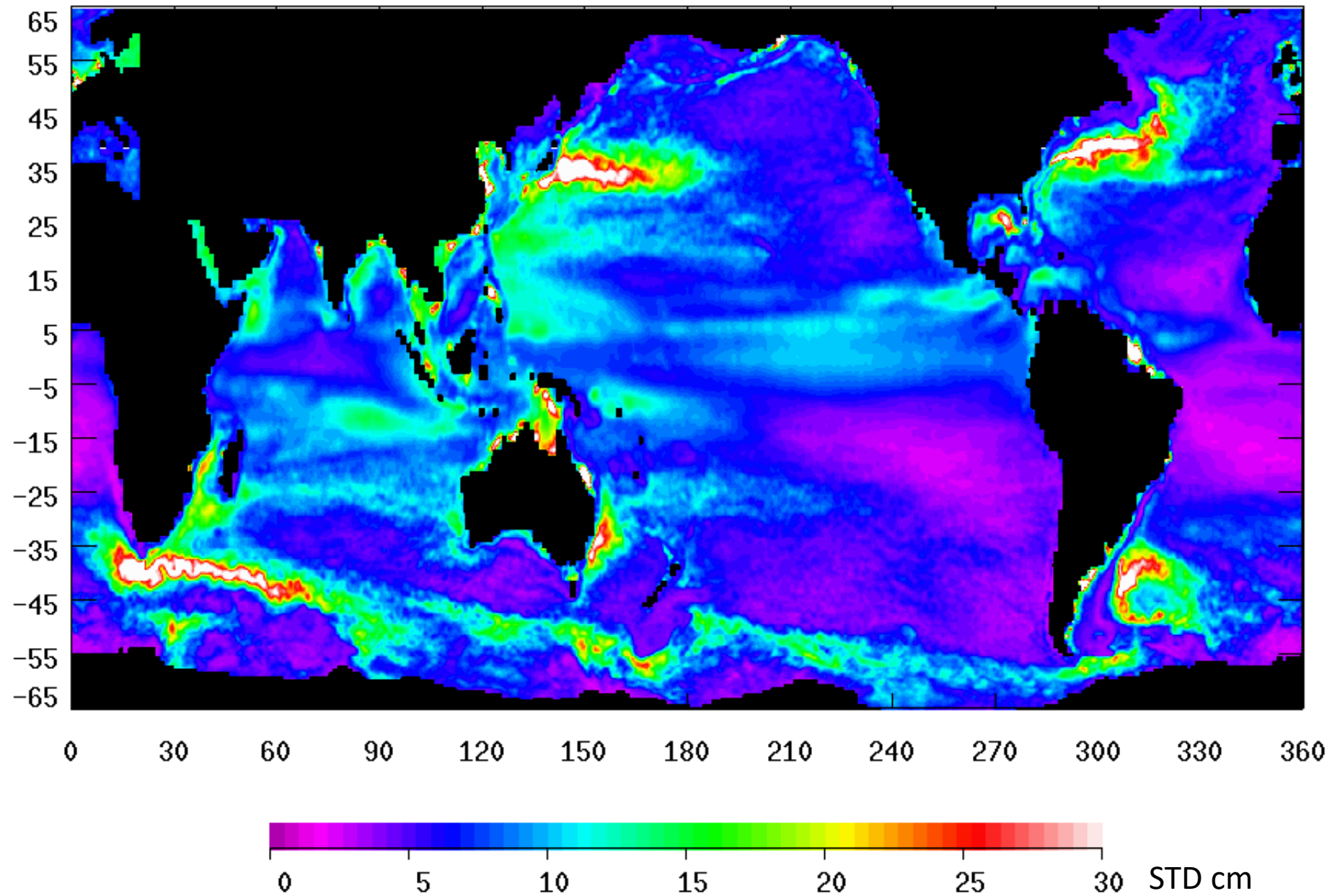
-25

0

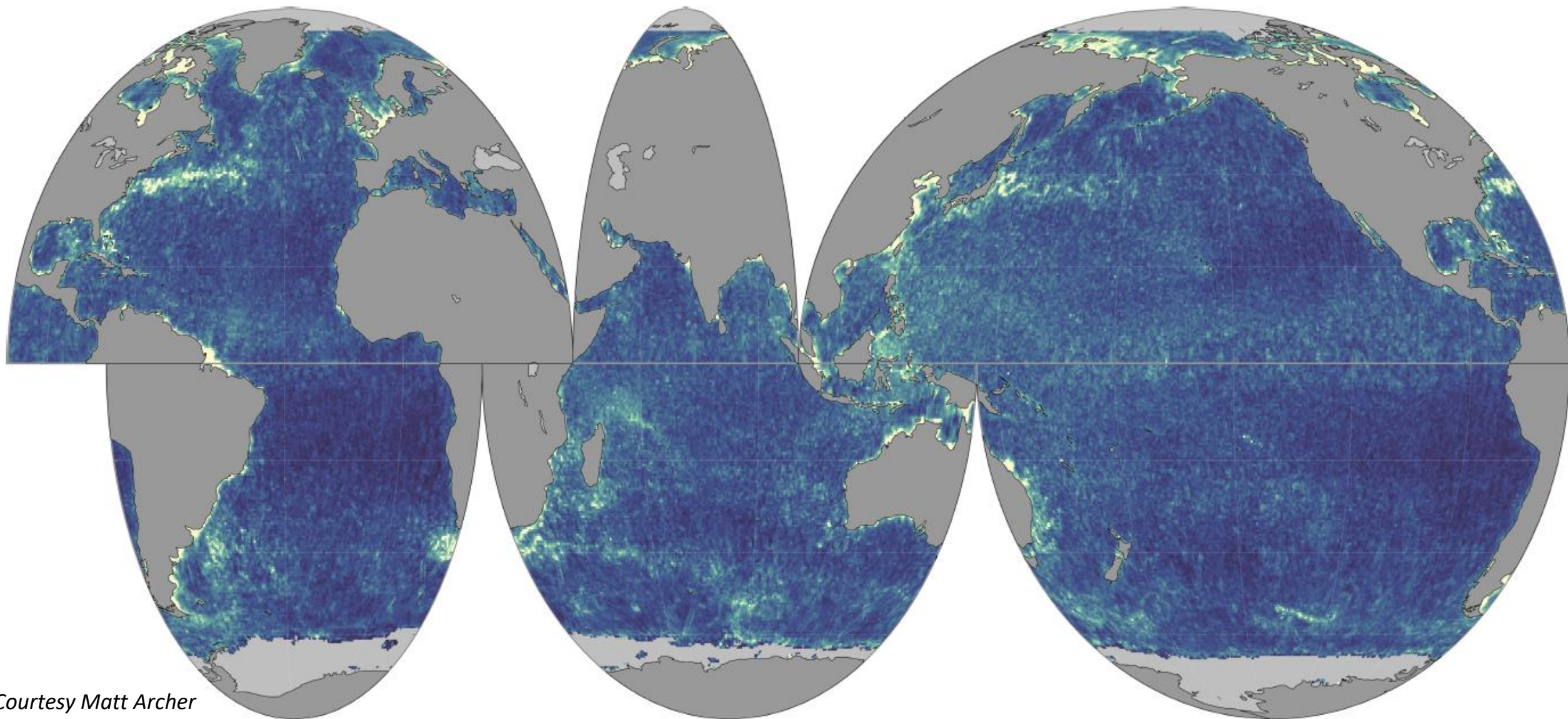
25 [cm]



Global Sea Surface Height Variability from Conventional Altimetry



Ocean variability measured by SWOT after AVISO signal removed*

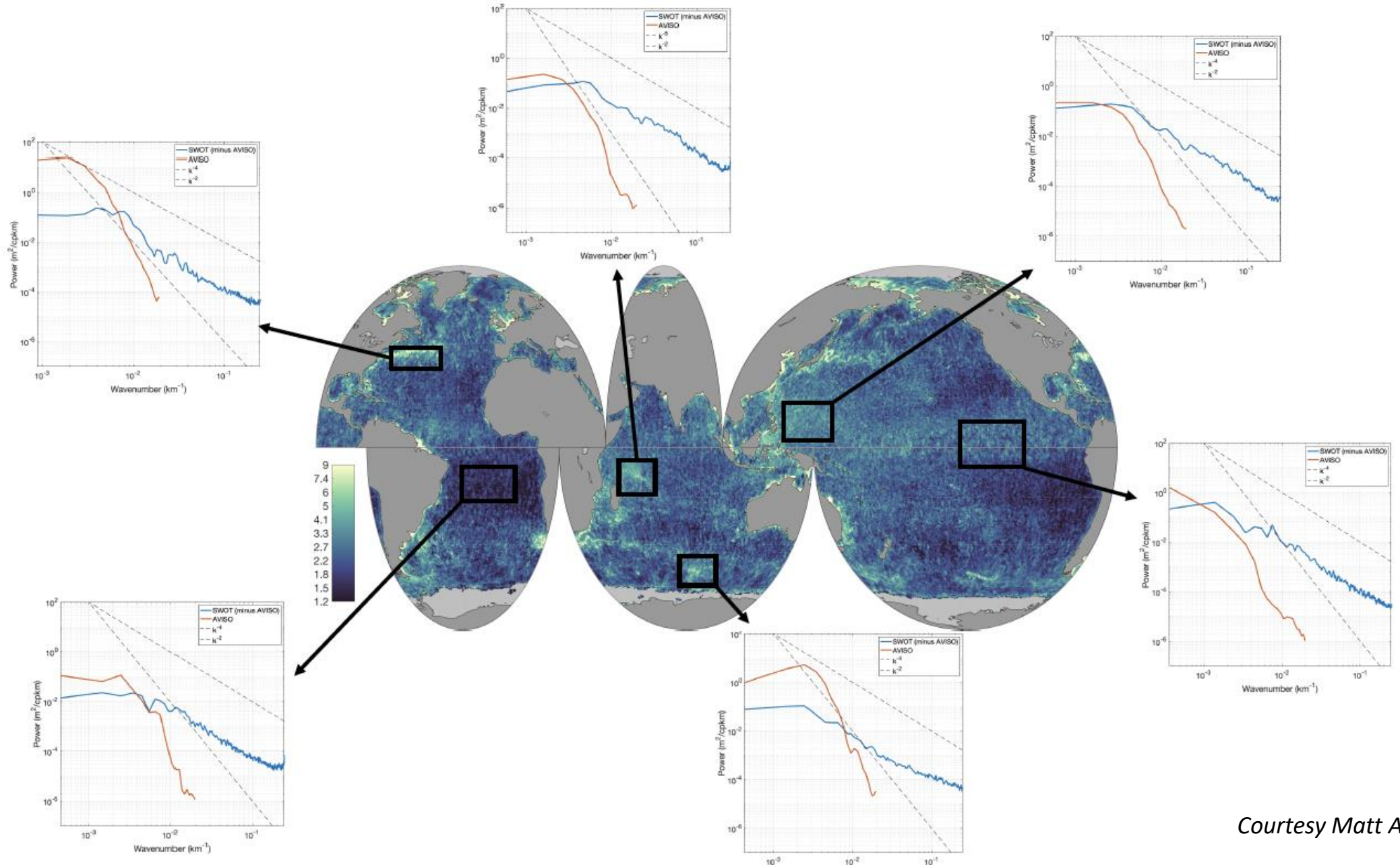


Courtesy Matt Archer

*AVISO SSH was interpolated onto each SWOT science orbit swath over 4 cycles (~3 months). Difference between SWOT and AVISO SSH was taken and STD was computed over 0.5° bins globally (space and time). See next slide for data density per bin.

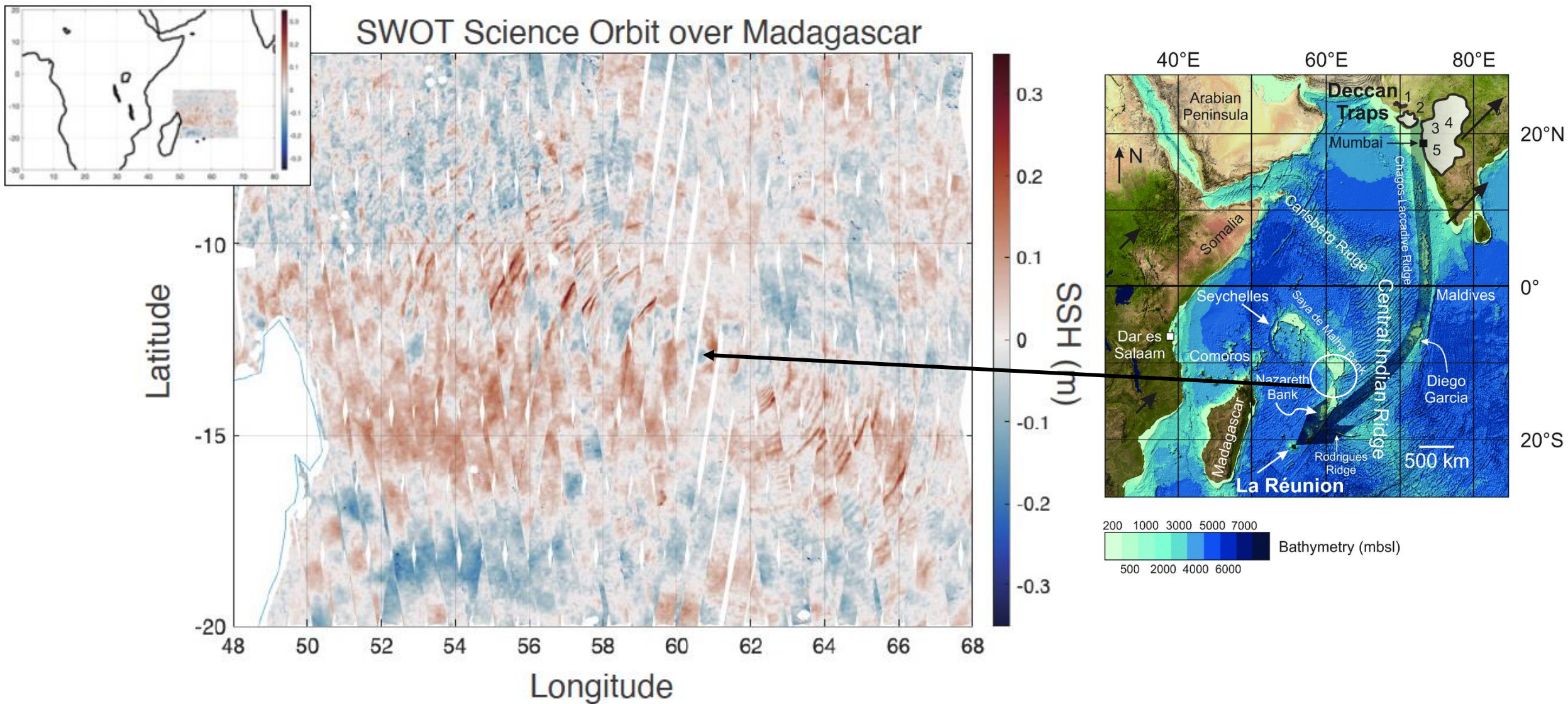


Wavenumber spectra of small-scale SSH variability



Courtesy Matt Archer

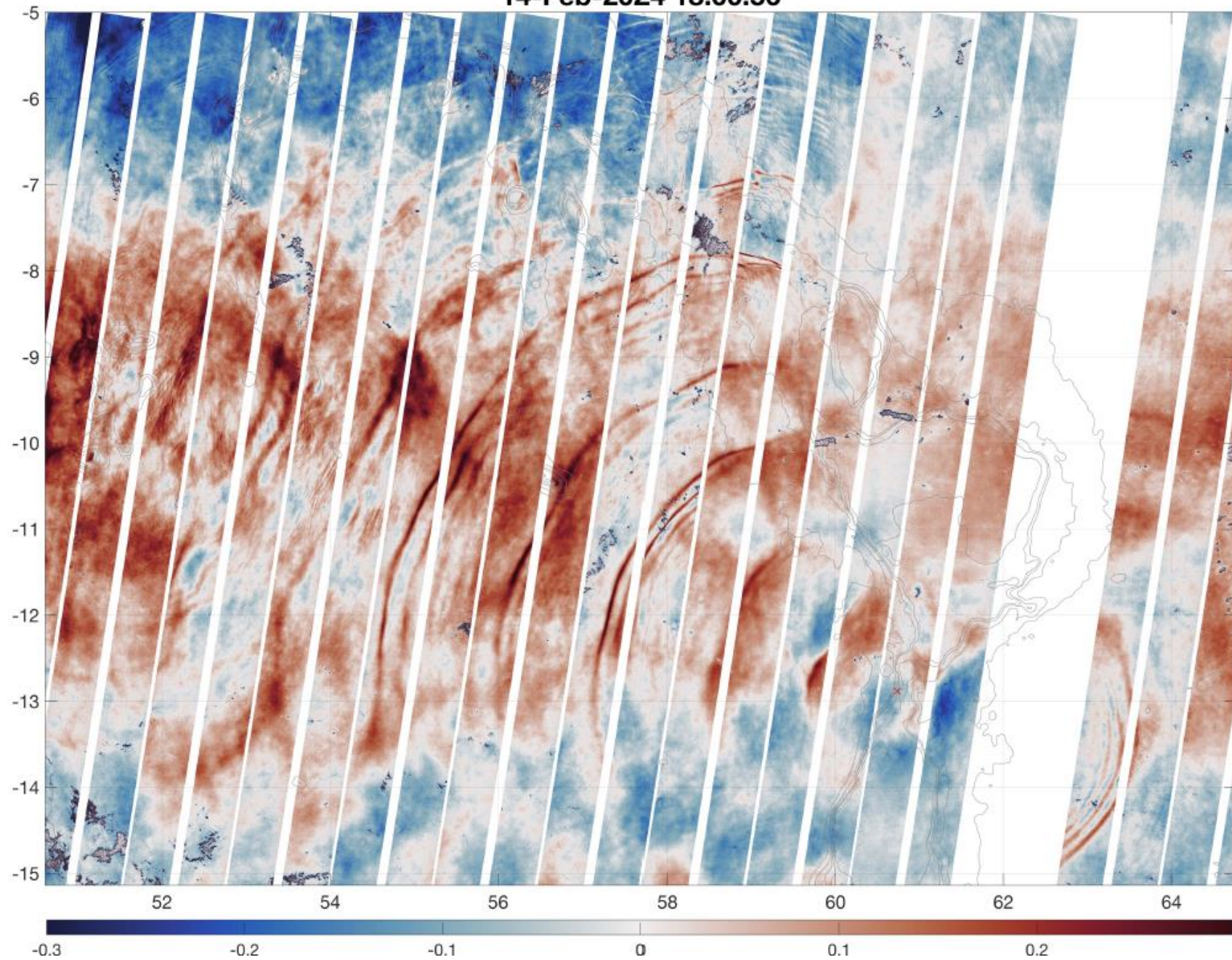
Internal tides and solitary waves radiating from bathymetric features



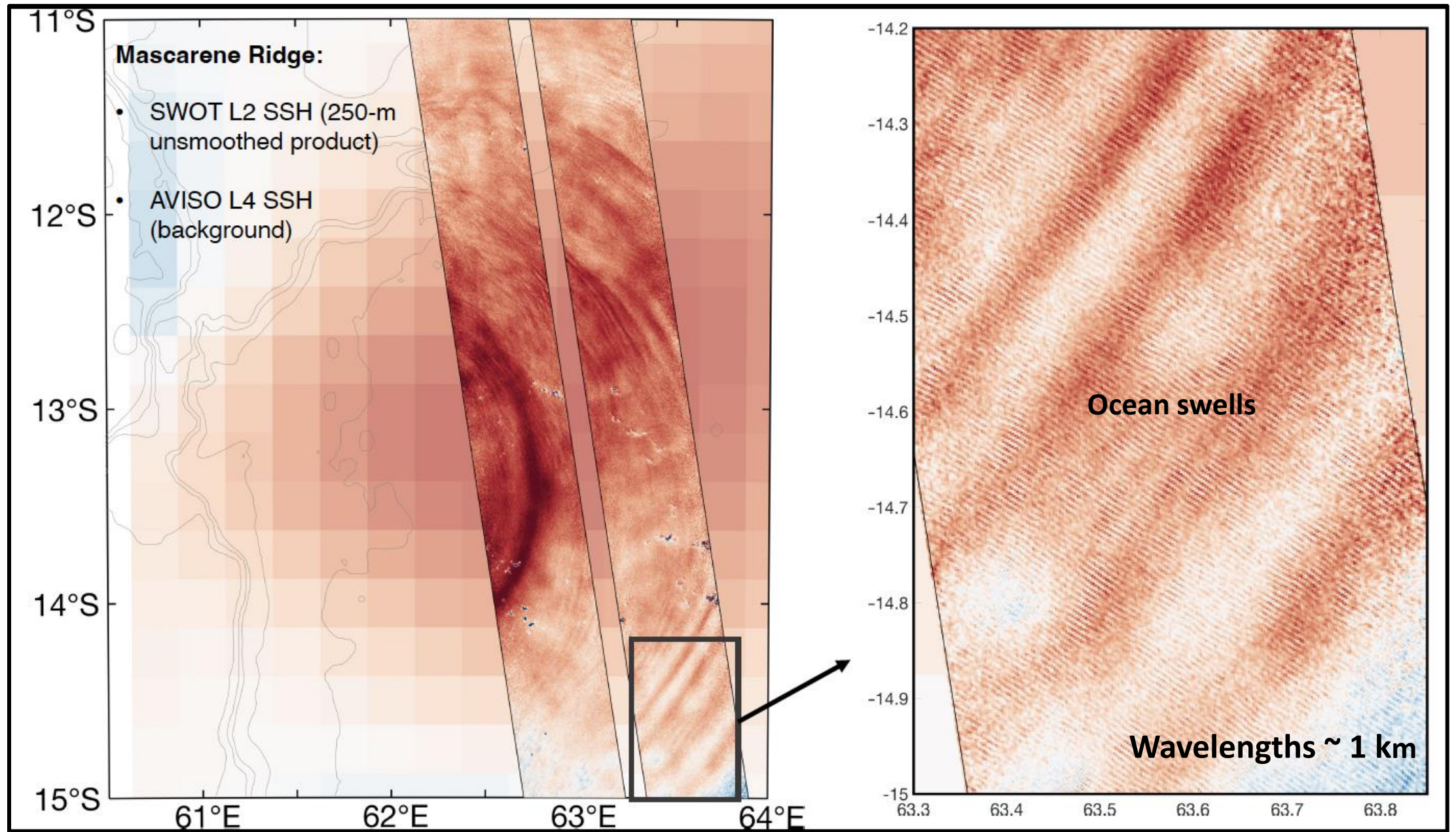
Courtesy Matt Archer

14-Feb-2024 18:00:56

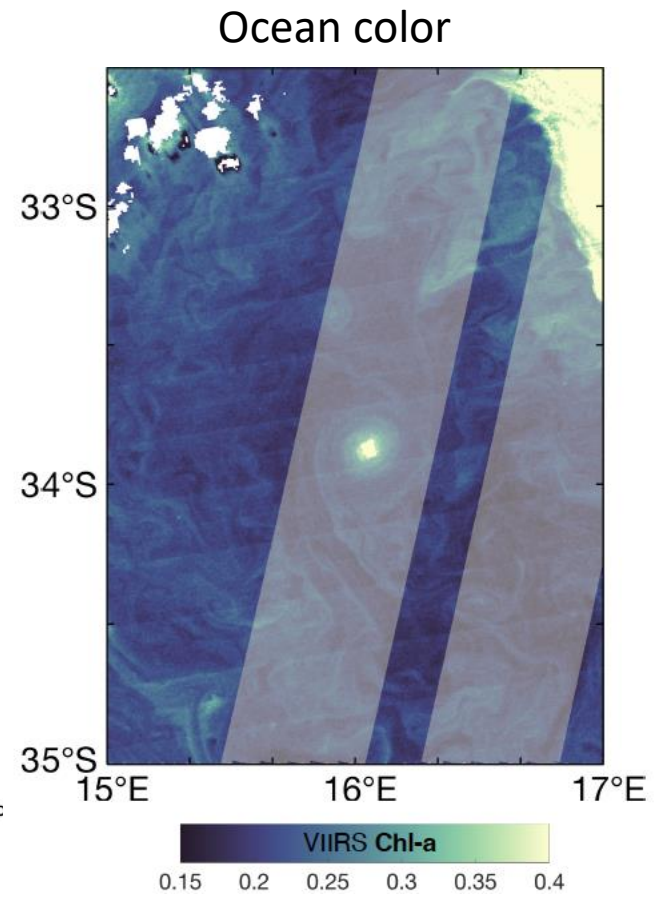
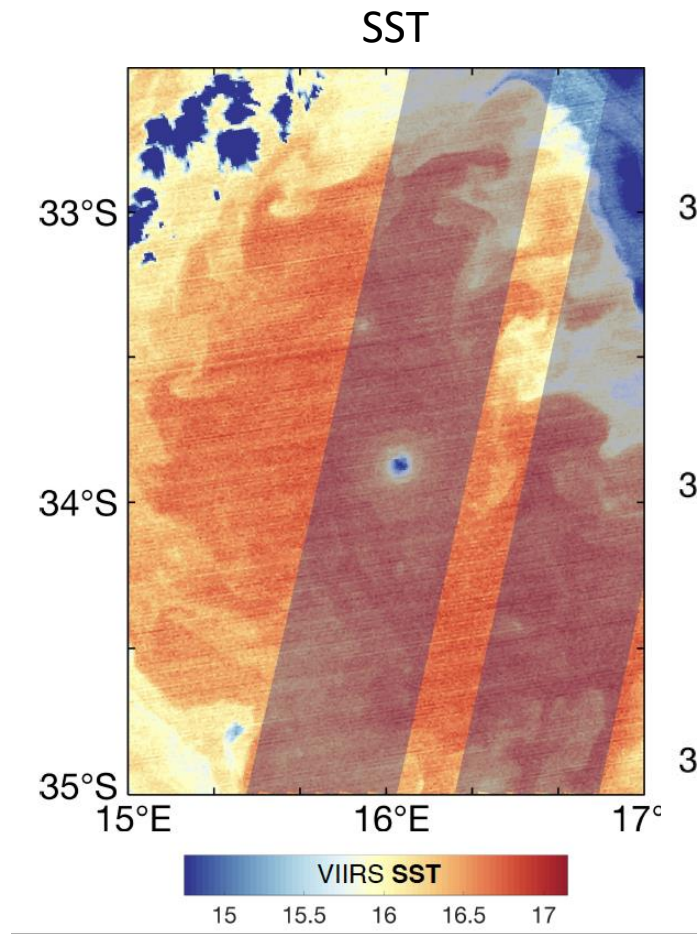
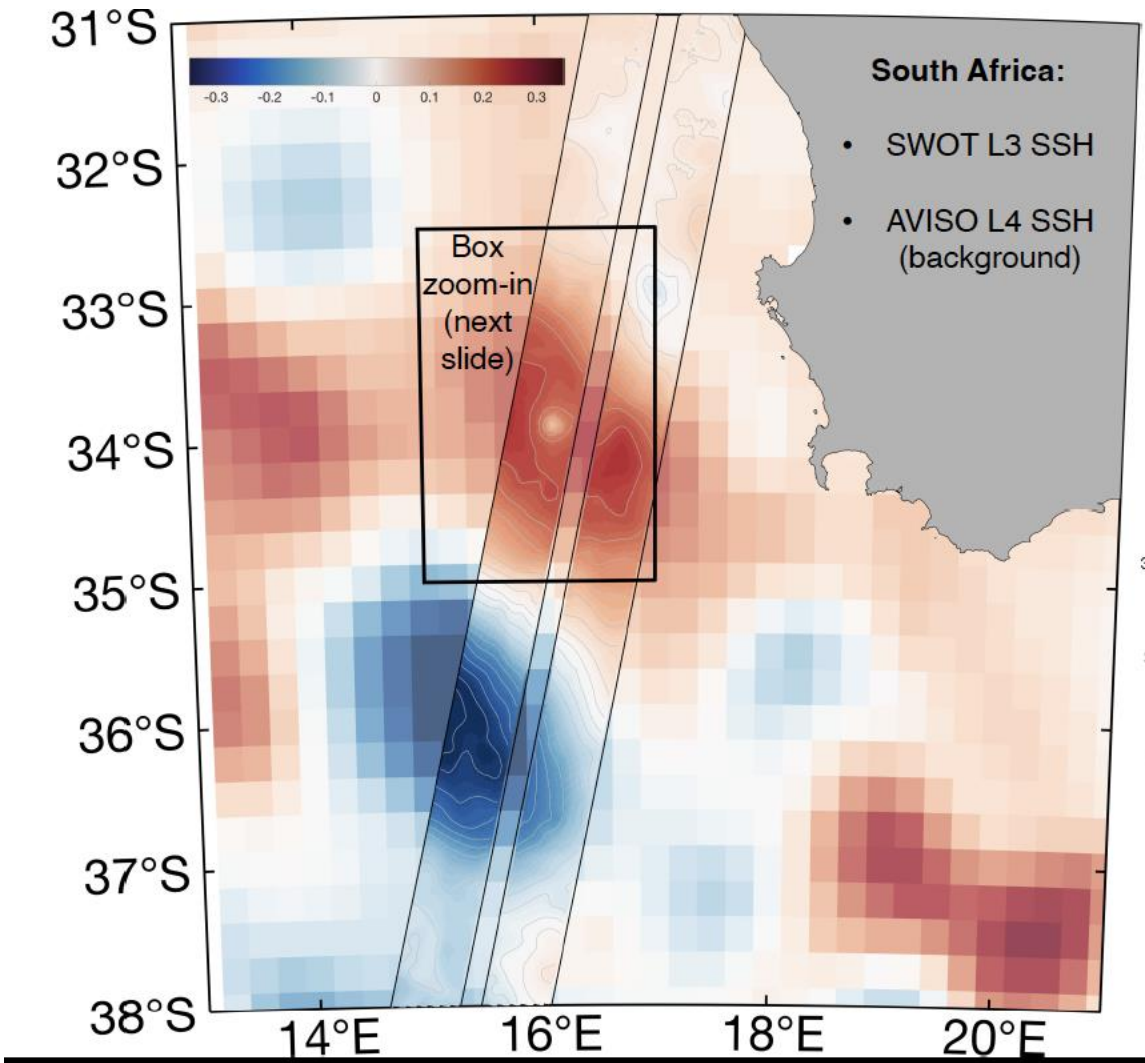
Cycle 10
Ascending
Zoomed in



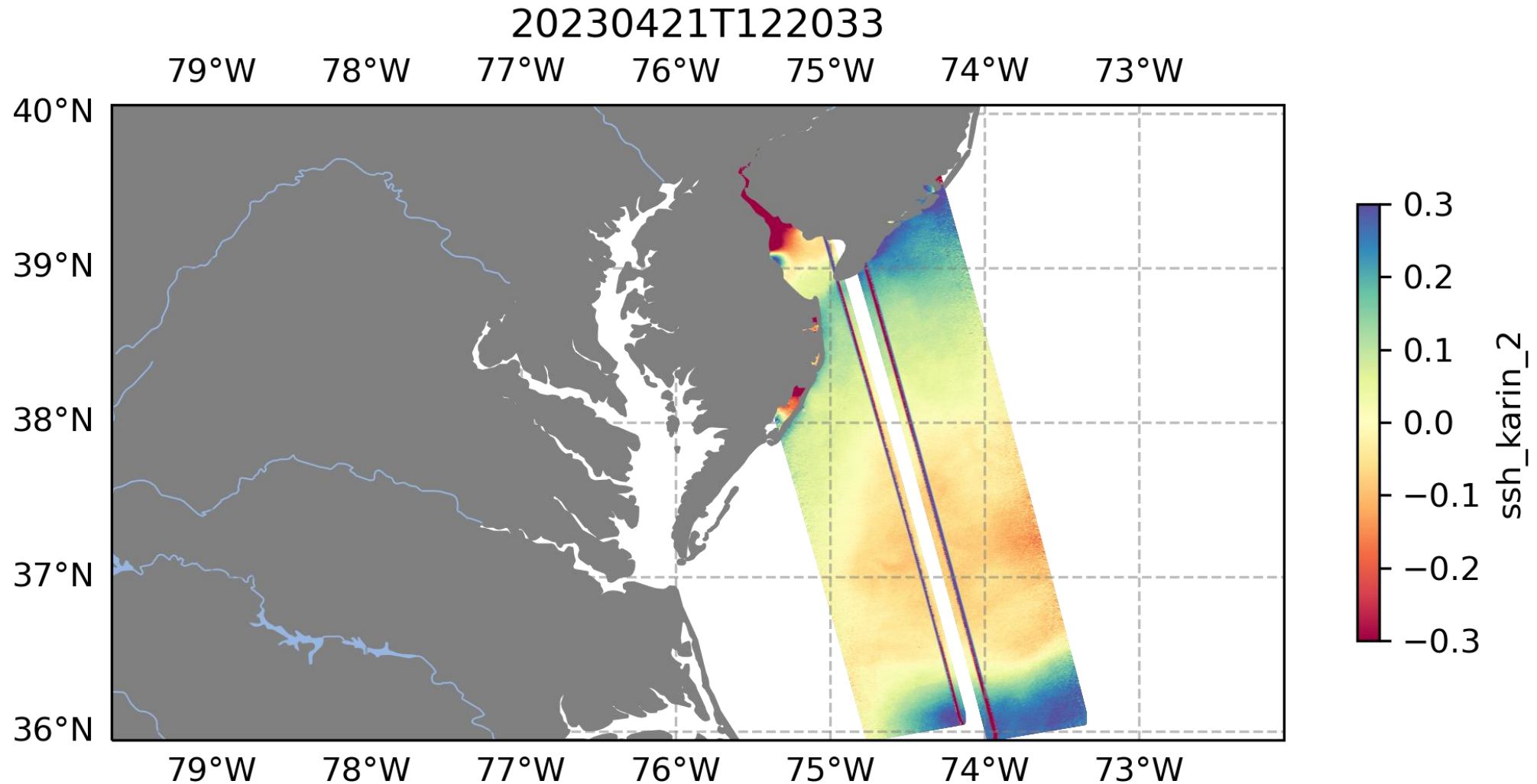
The richness of scales resolved by SWOT



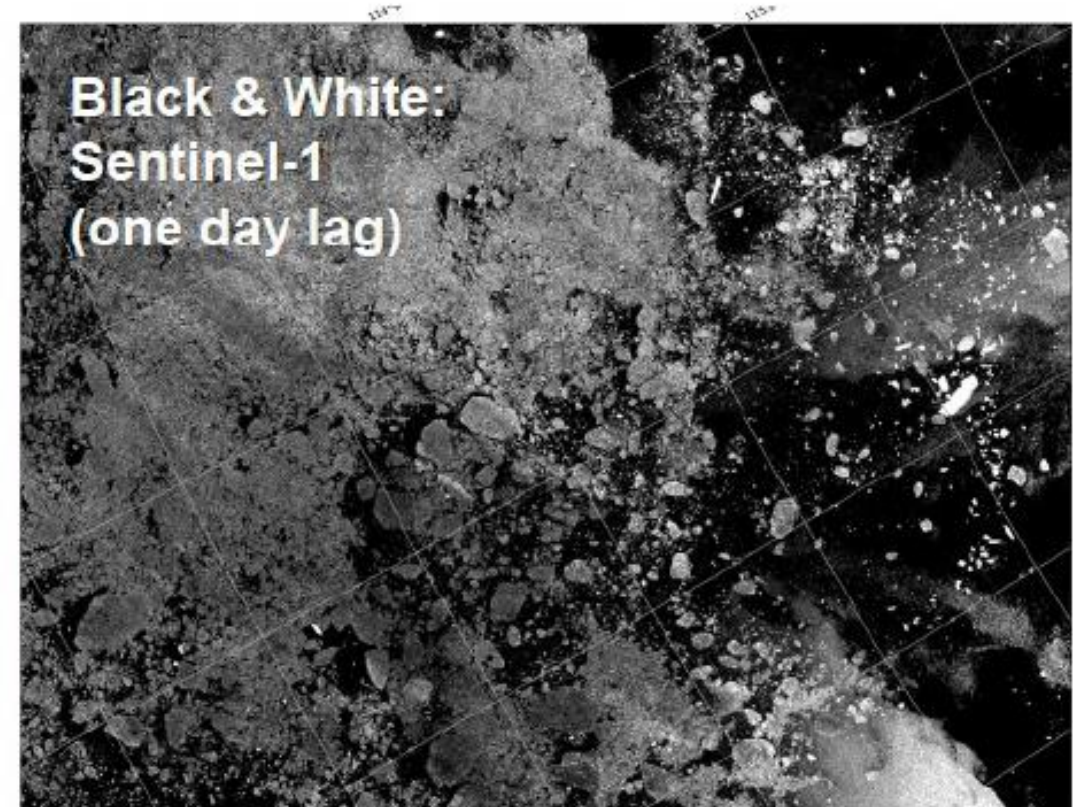
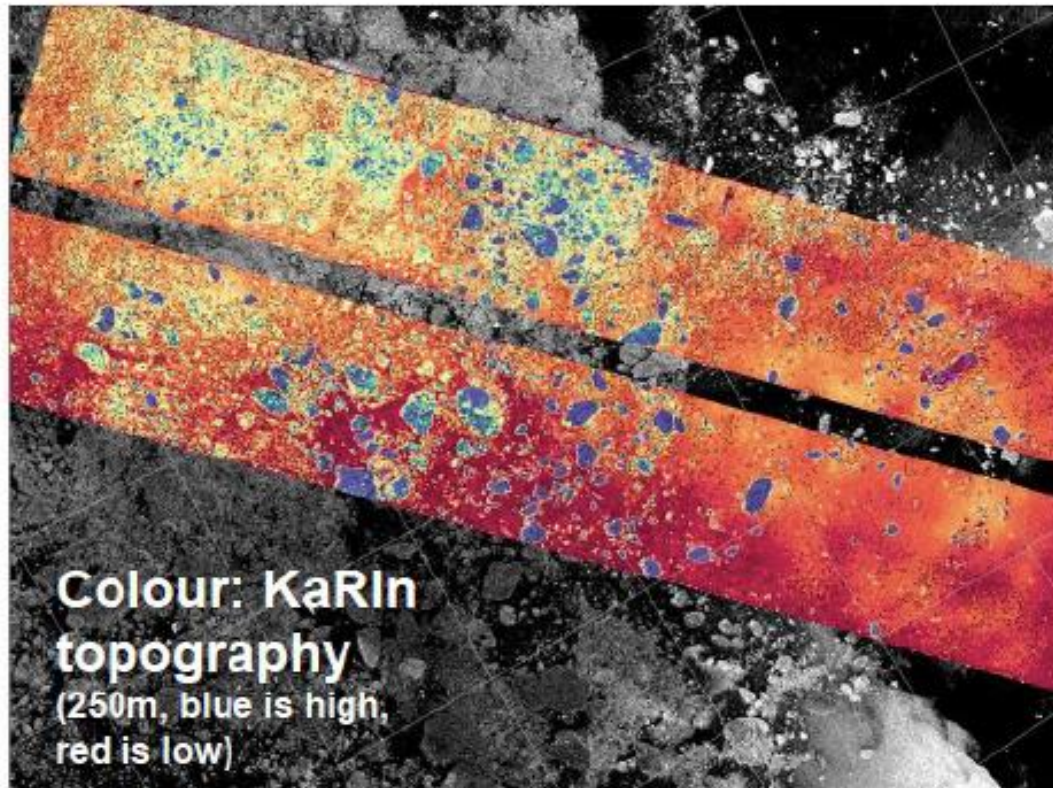
10 km submescale eddy



Applications to coastal oceans, estuaries, river deltas to study the impact of climate change and extreme weather



SWOT observations of sea ice



SWOT measures ocean topography with high resolutions in the presence of sea ice for the study of polar ocean circulation and its effects on sea ice dynamics.

Courtesy G. Dibarboure

Summary

- The random noise of SWOT Ka-band Radar Interferometer (KaRIN) measurements over the ocean is significantly less than the requirement, making the spatial resolution of ocean features less than 10 km in 2 dimensions, an order of magnitude improvement over conventional altimeters.
- SWOT is thus a breakthrough of radar remote sensing of the ocean, measuring sea surface height at the resolution of an imaging radar. See this GRL paper just published this week: <https://doi.org/10.1029/2023GL107652>
- The 1-day repeat phase has provided observations to understand the rapid change of small-scale ocean processes, but at the expense of limited spatial coverage.
- The strength of the 21-day orbit is its global coverage. Its weakness is the missing information from the temporal gaps. How to make use of a gappy time series presents a challenge to maximize the utility of SWOT in its global mapping phase.