



National Aeronautics and
Space Administration



Mapping coastal sea level at high resolution with radar interferometry: the SWOT Mission

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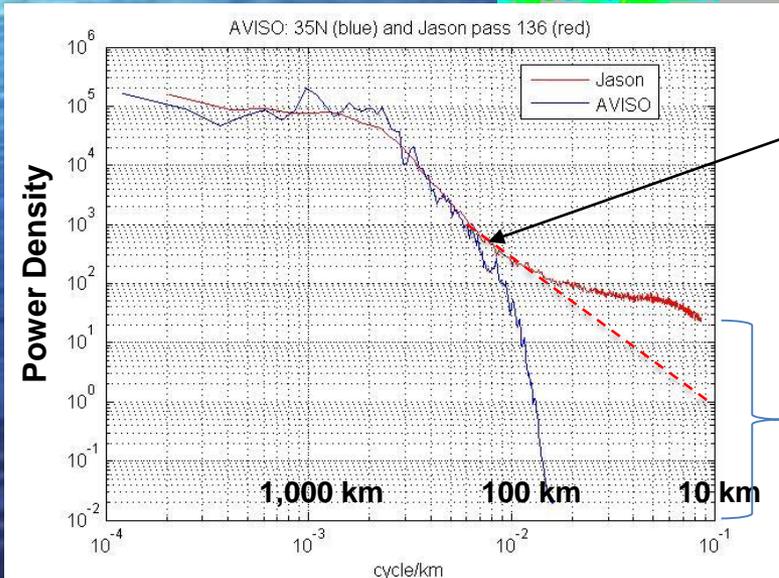
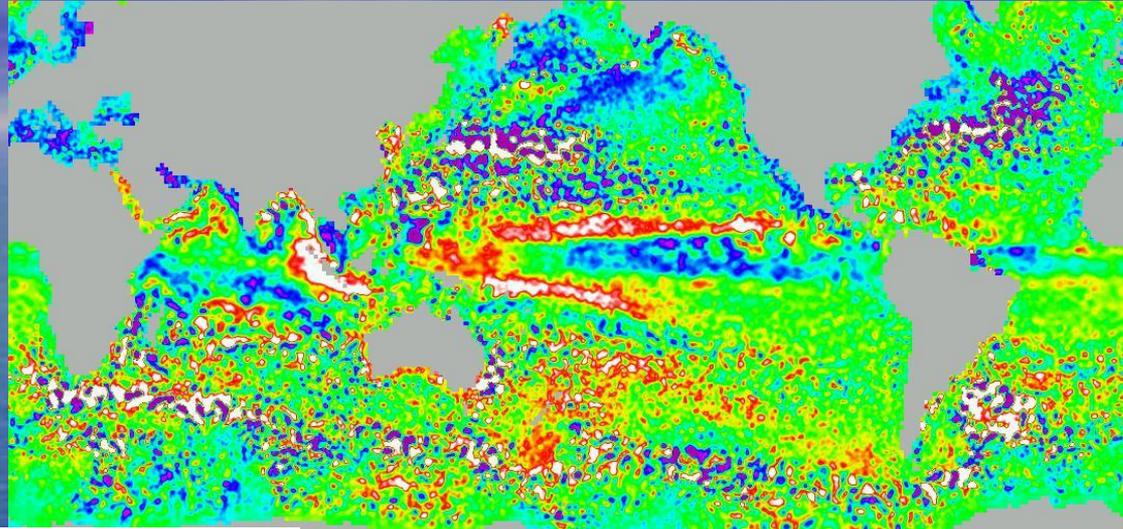
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SWOT Improves Jason Resolution by 10 times

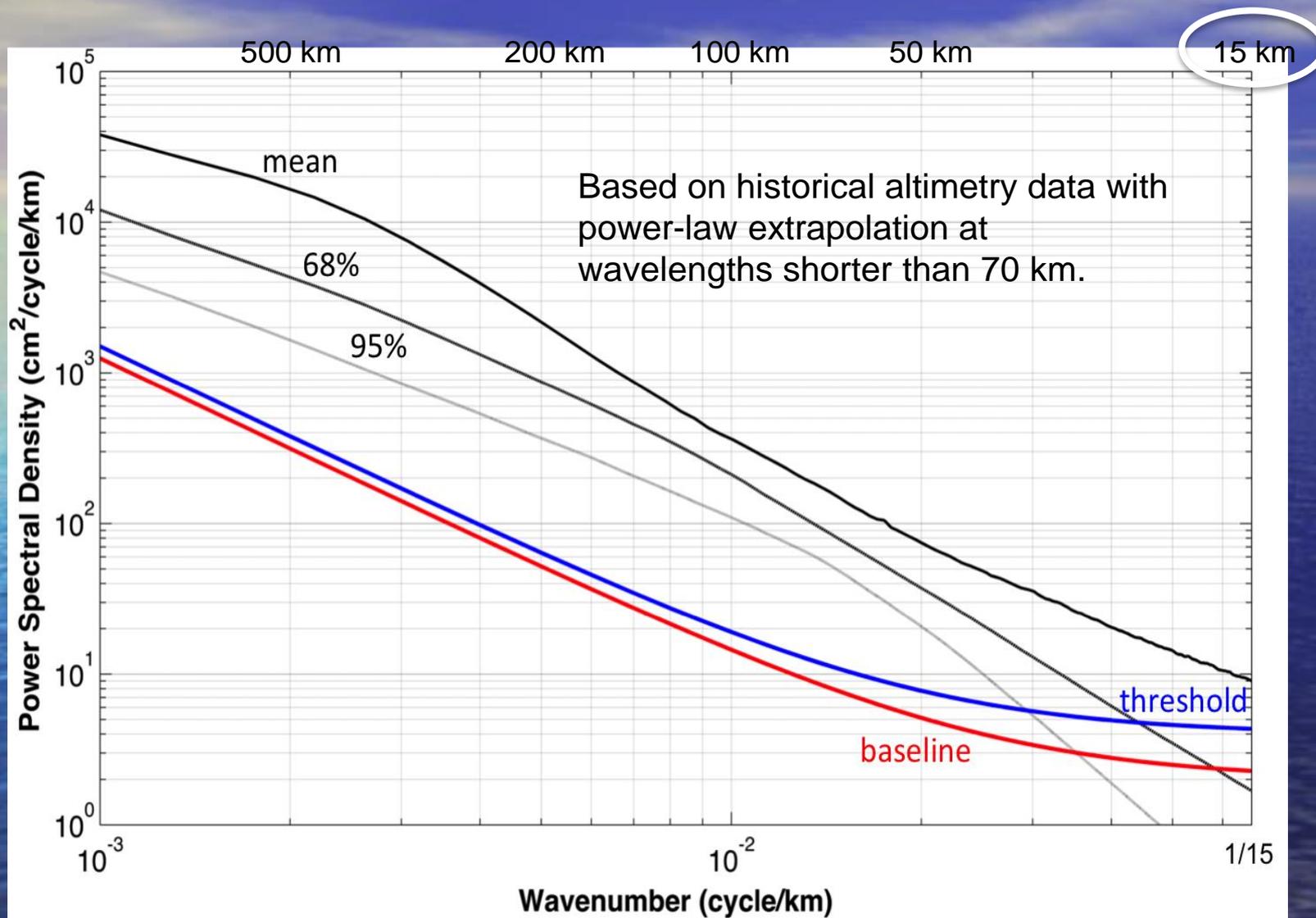
Snapshot of sea-surface height (SSH) from Jason-1/2



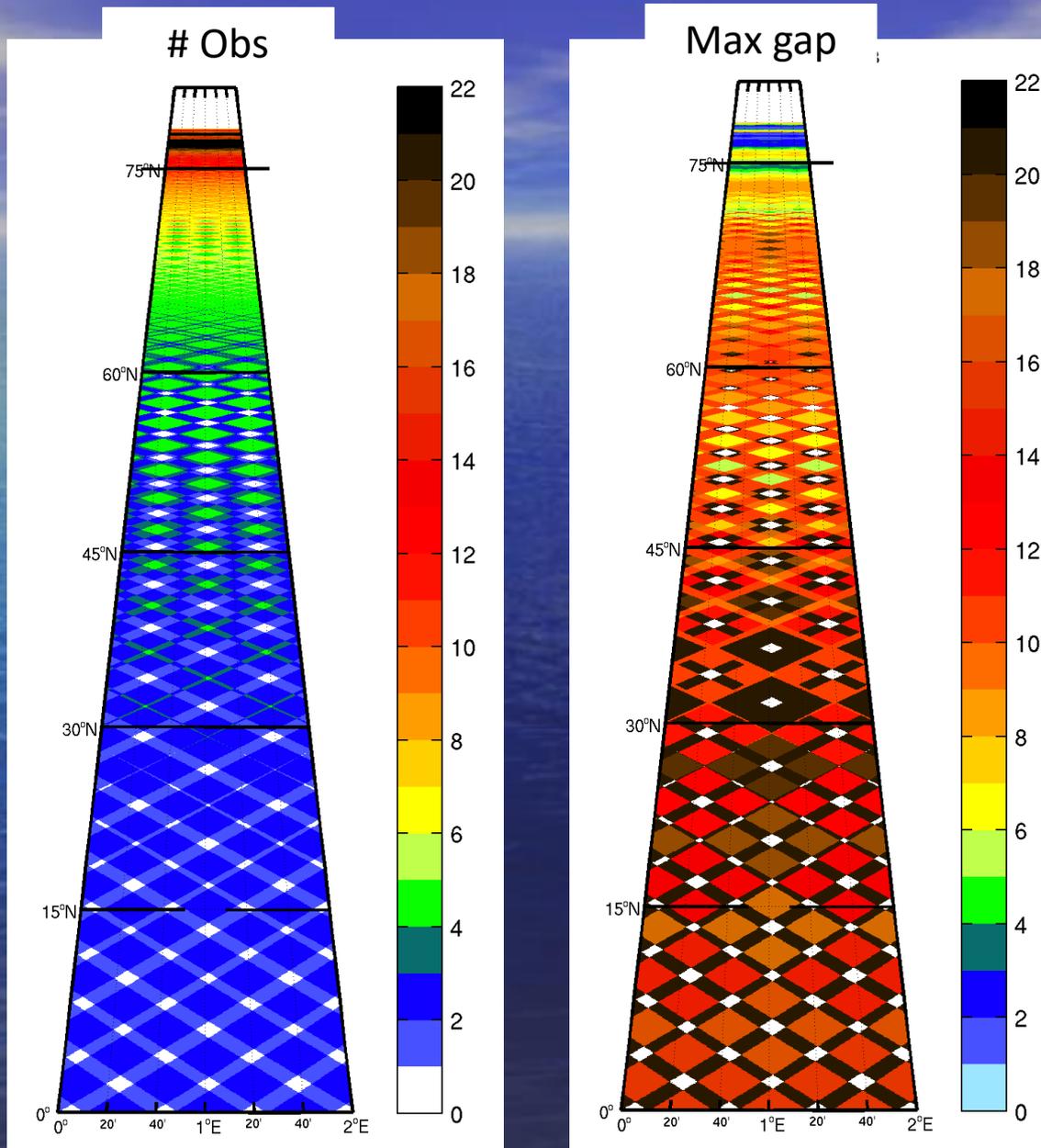
Drop in energy of 2-D gridded SSH spectrum (blue) vs alongtrack spectrum (red) at 200 km indicates the mapping resolution with nadir altimeter constellations.

SWOT will extend the measurement down to 15 km.

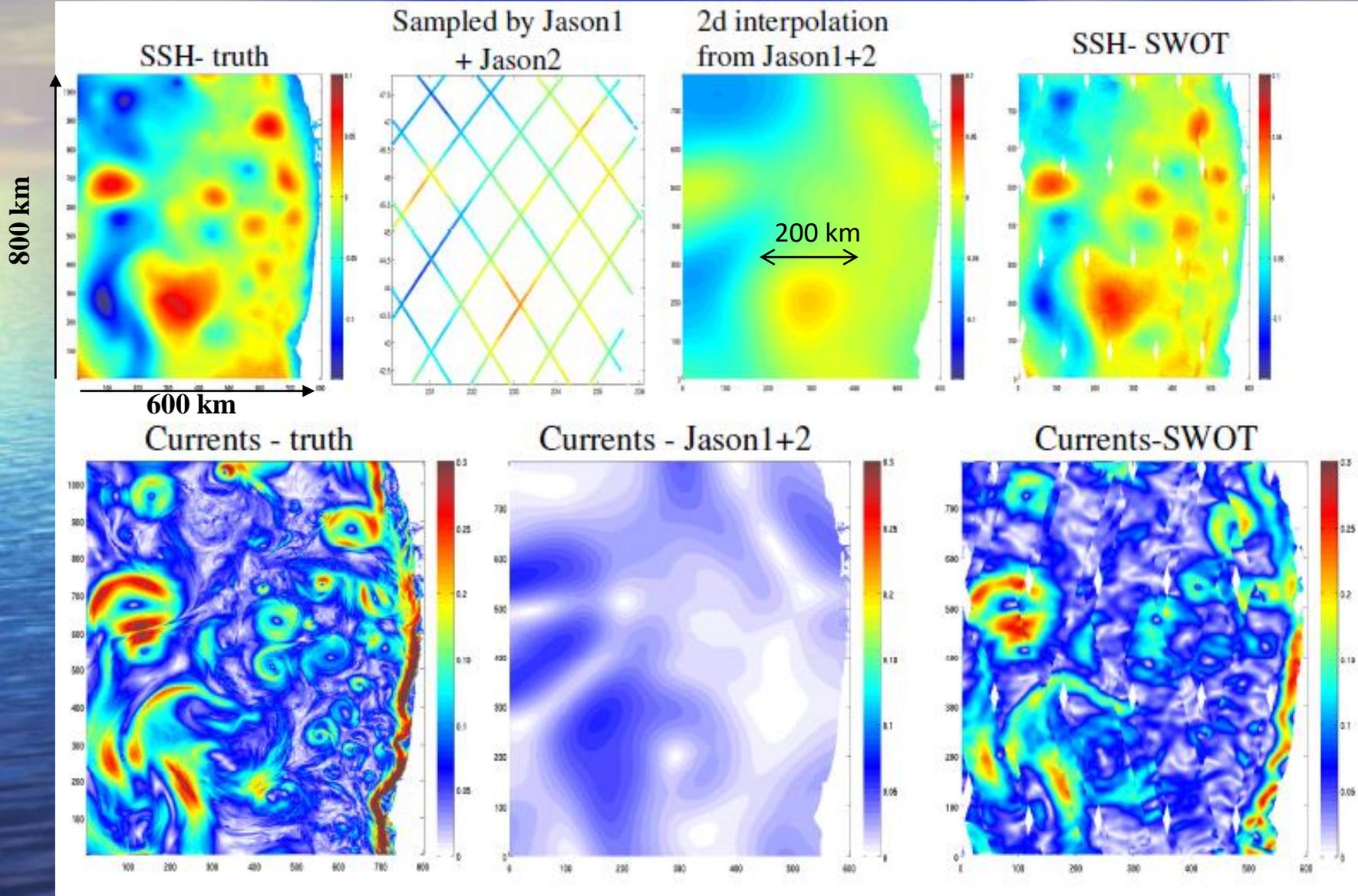
Sea Surface Height Requirement



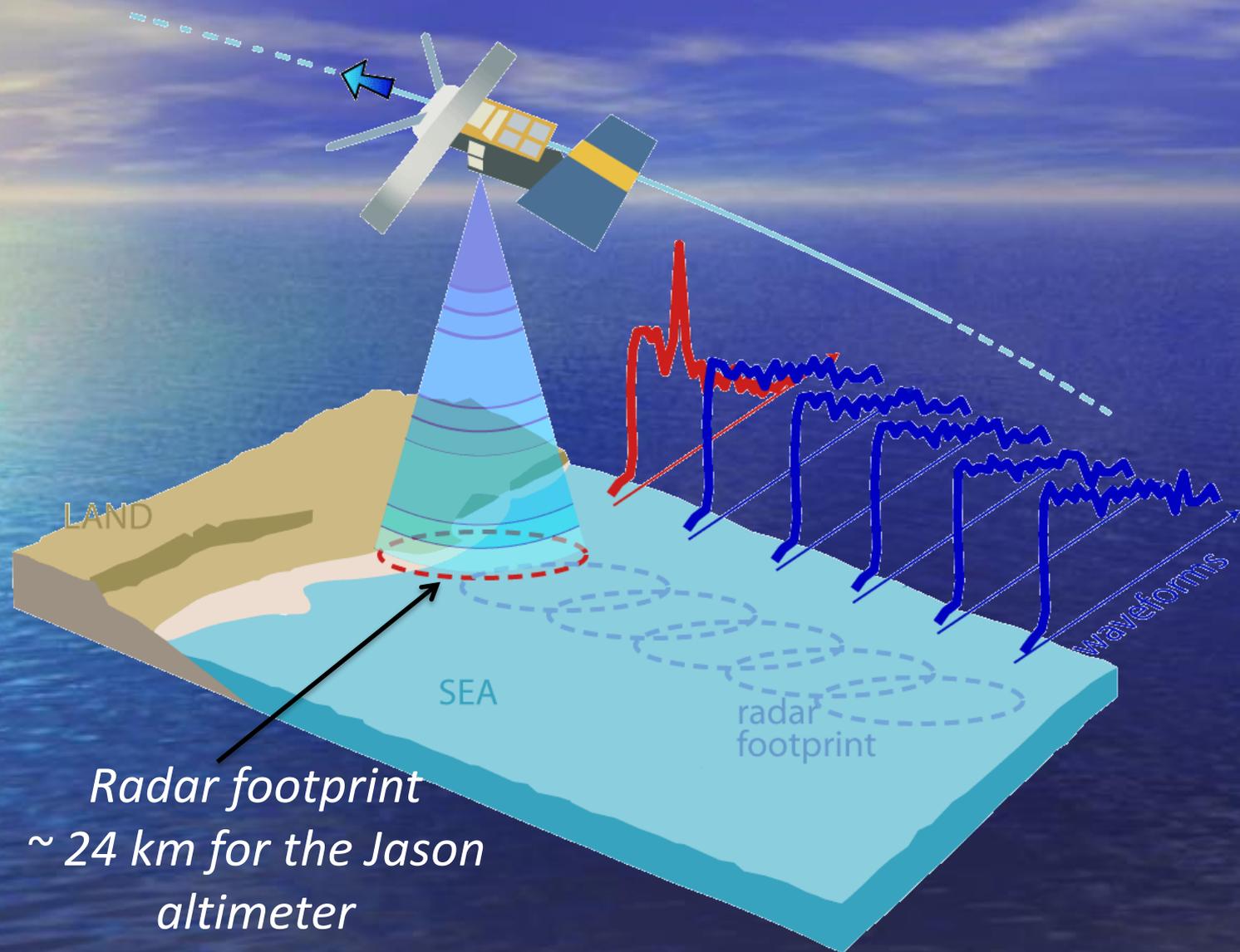
Sampling pattern of the 21-day orbit for the Science Phase



Simulated SWOT Ocean Observations

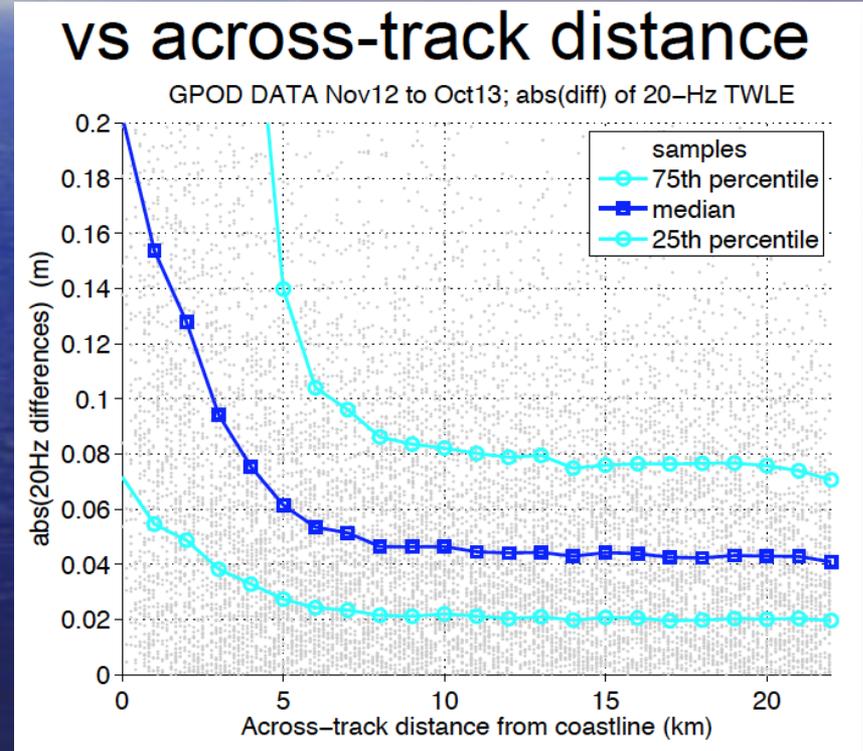
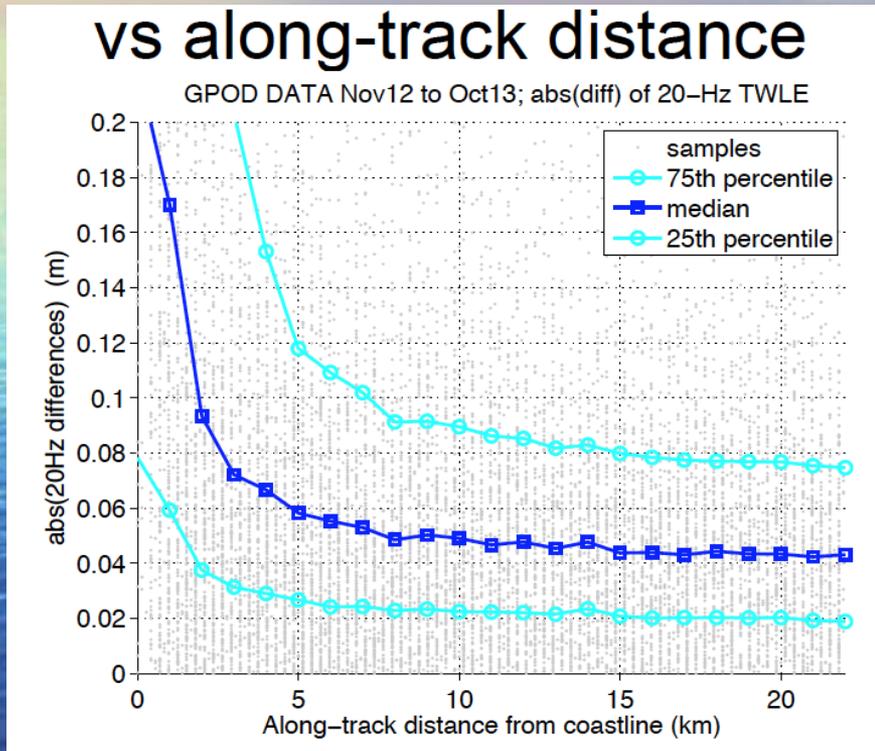


Land Contamination of Radar Waveforms



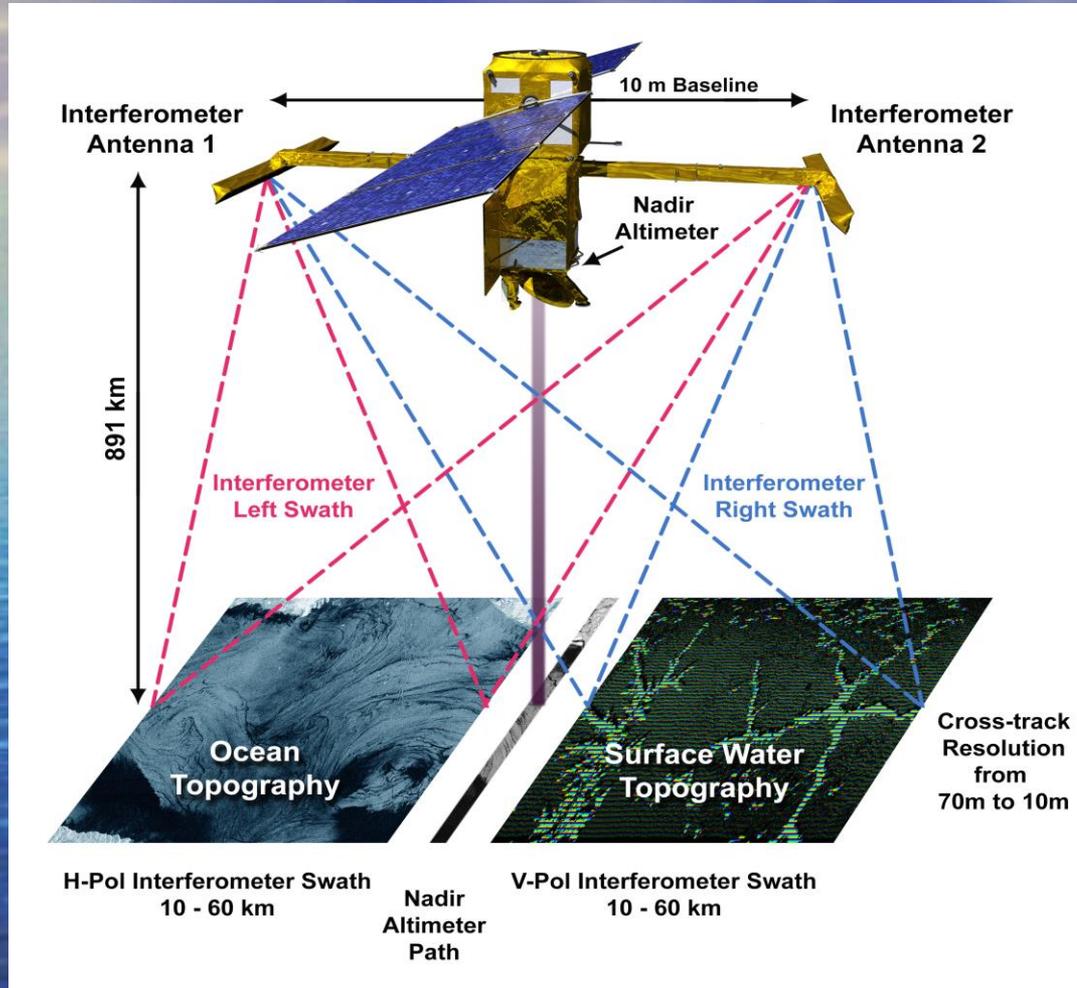
Performance of SAR altimetry (Cryosat-2 and Sentinel 3)

Measurement Noise of Cryosat-2 Altimeter





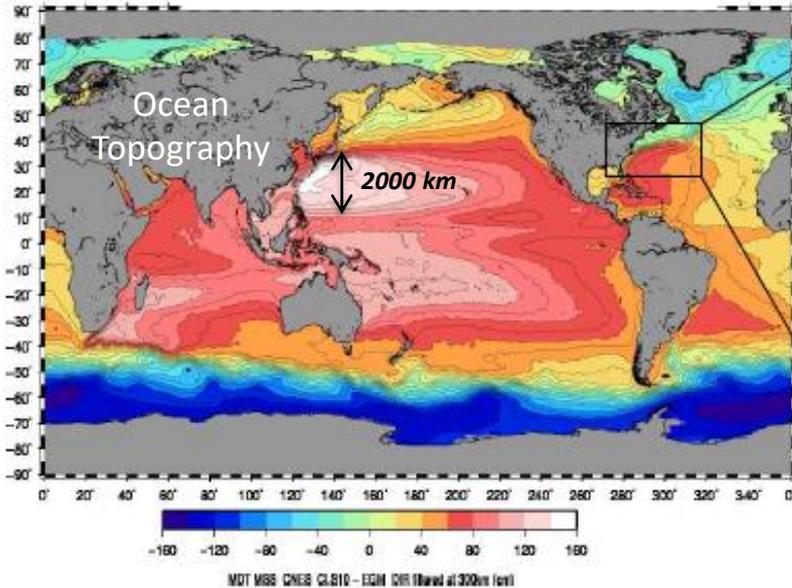
SWOT Measurement Principle



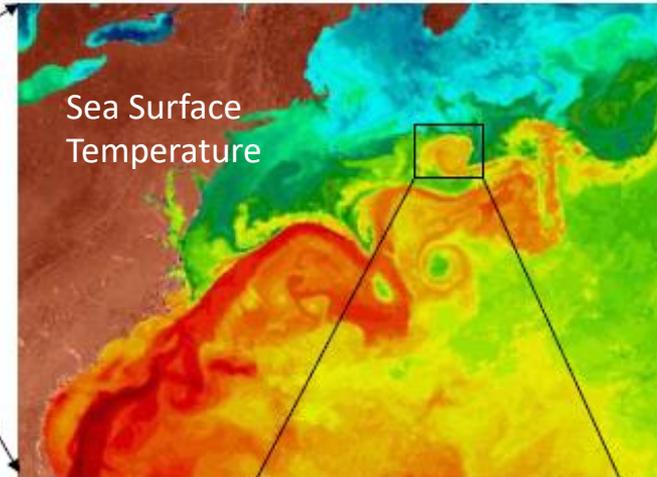
- *Mapping land surface water and ocean currents*
- *Radar interferometry*
- *International partnership*
- *In Phase C development*
- *Launch in 2021*
- *Science Team formed in 2016, to be renewed in 2019.*

Targeting the dynamics of the smallest scales of ocean currents

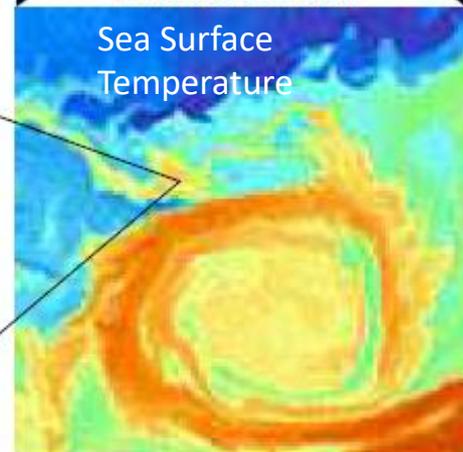
Global basin scale



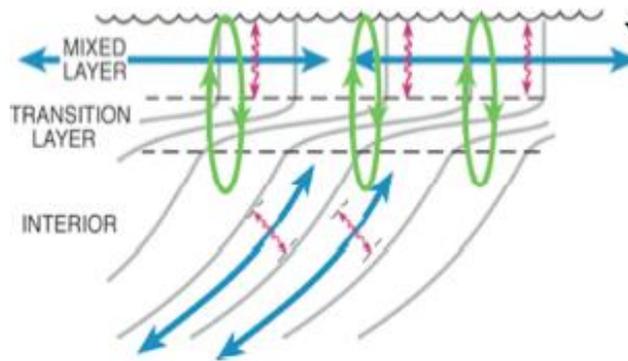
mesoscale



submesoscale



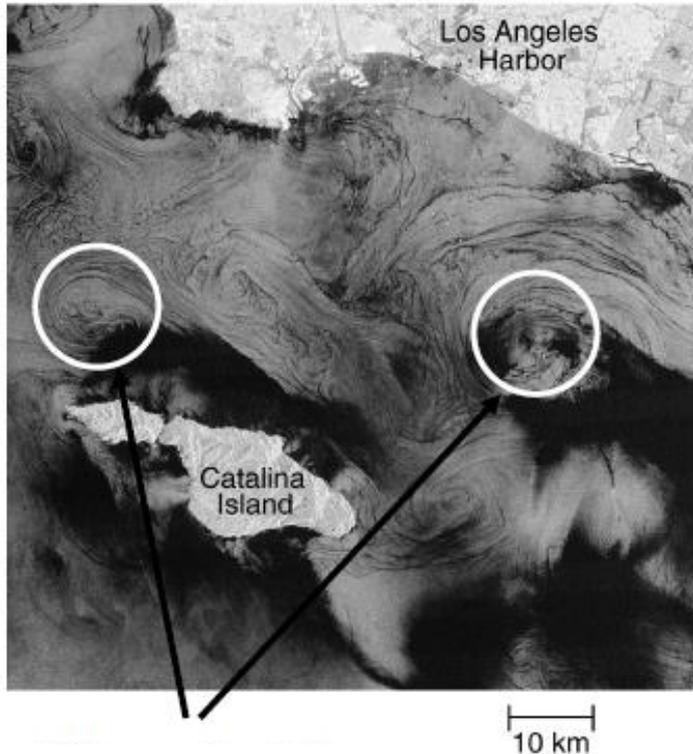
Vertical exchange of heat, CO₂, nutrients between the upper and deep ocean



Sea surface elevation is needed for dynamics

Submesoscale Ocean Processes

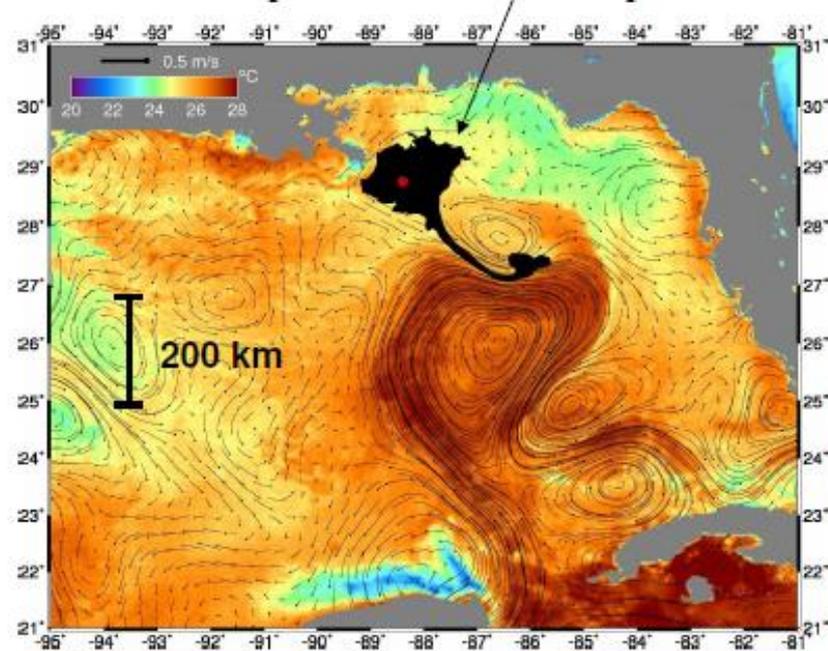
RADARSAT - December 26, 1998



15 km eddies

(B. Holt, 2004)

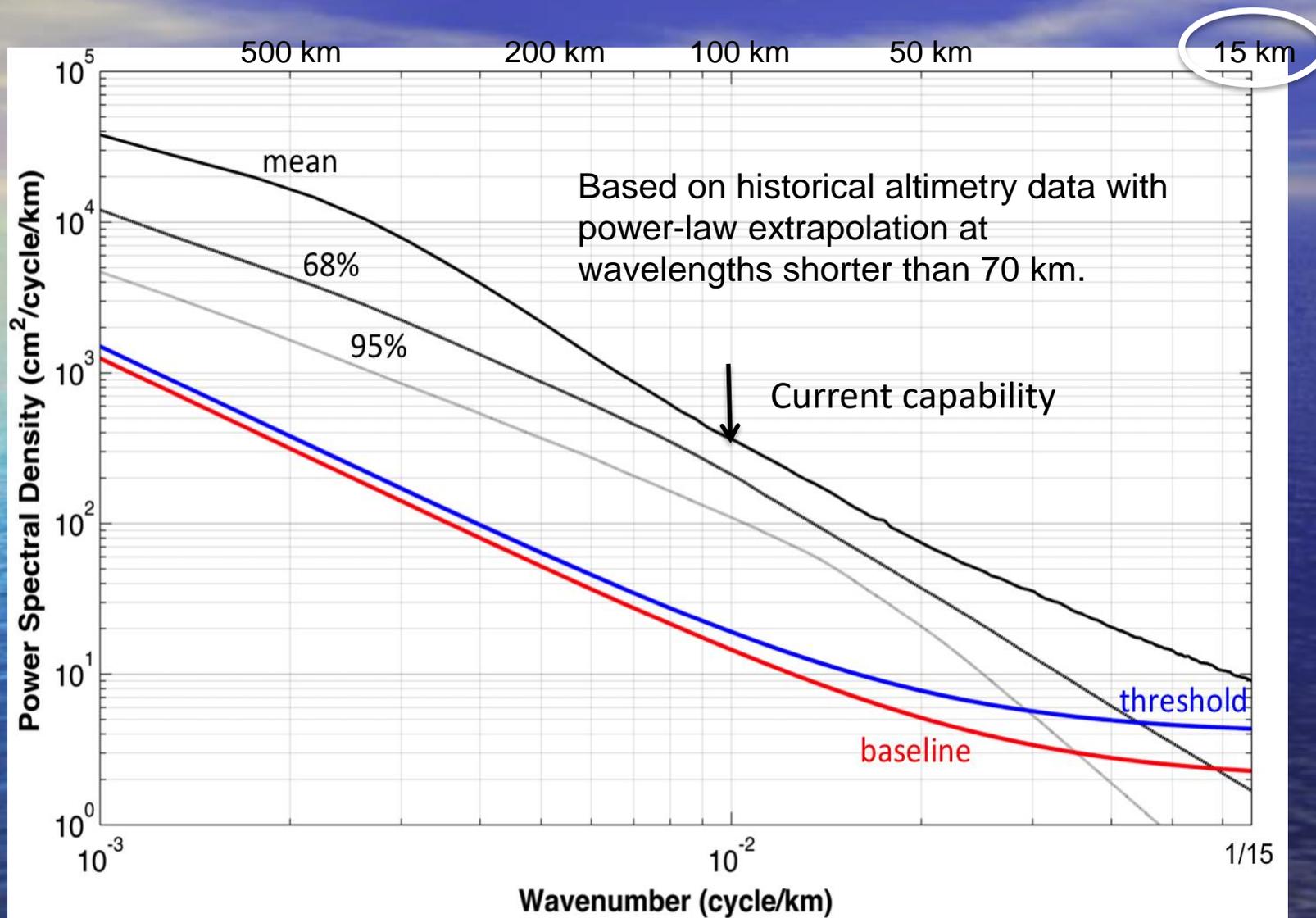
Deepwater Horizon oil spill



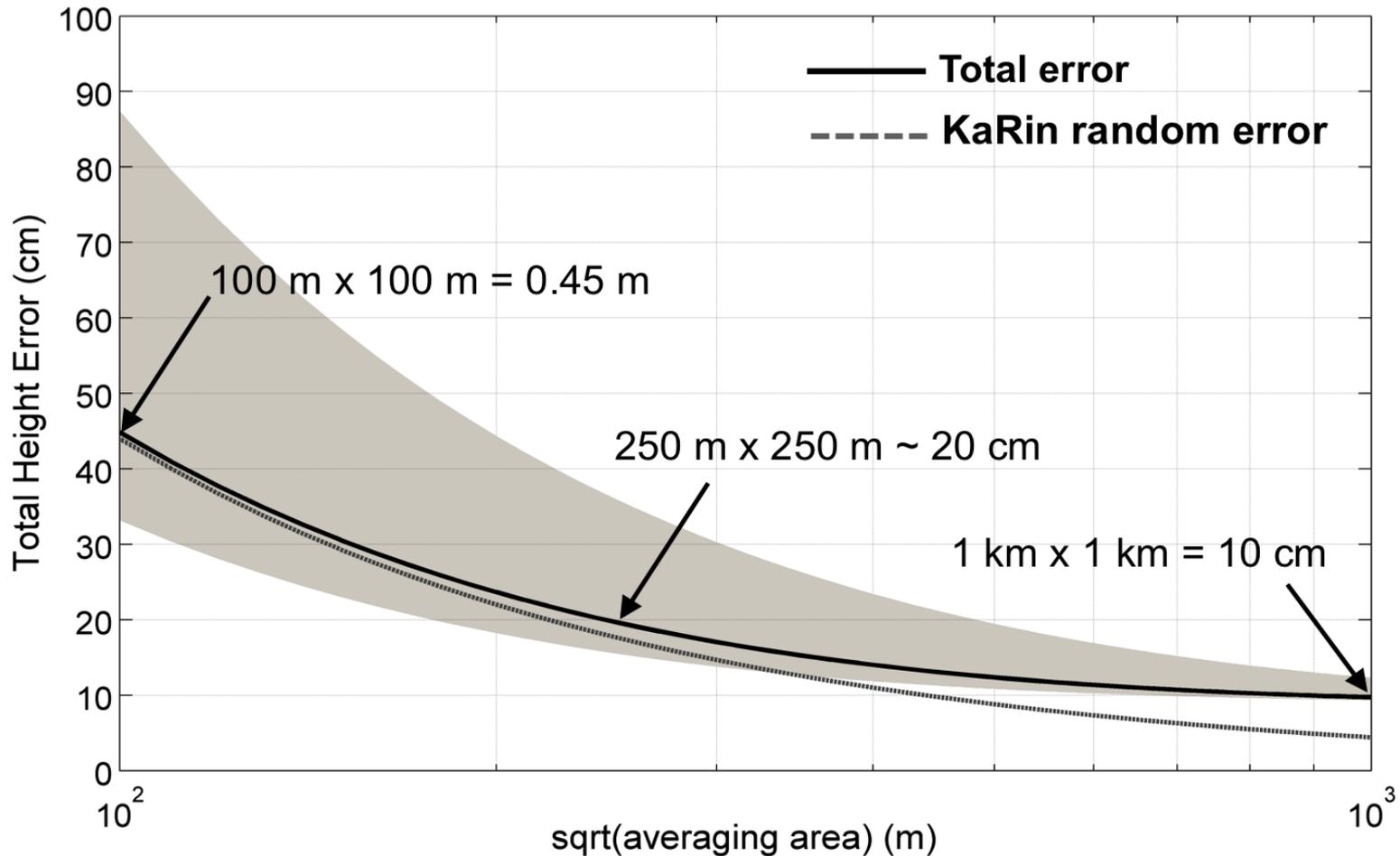
The missing information at the submesoscale is important for predicting the dispersal of pollutants in the ocean.

(G. Jacobs, 2010)

Sea Surface Height Requirement

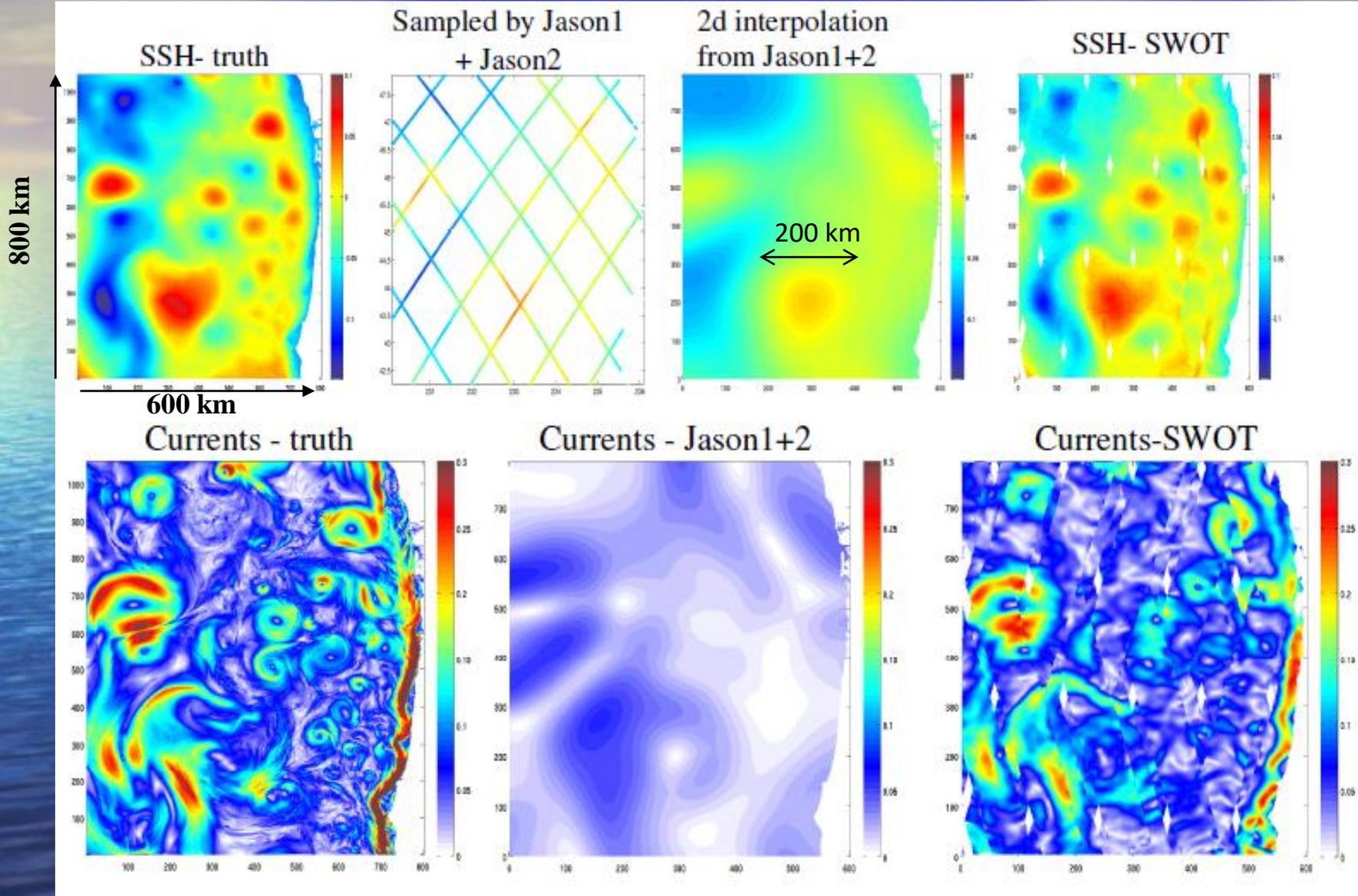


Land surface water height error as function of scale

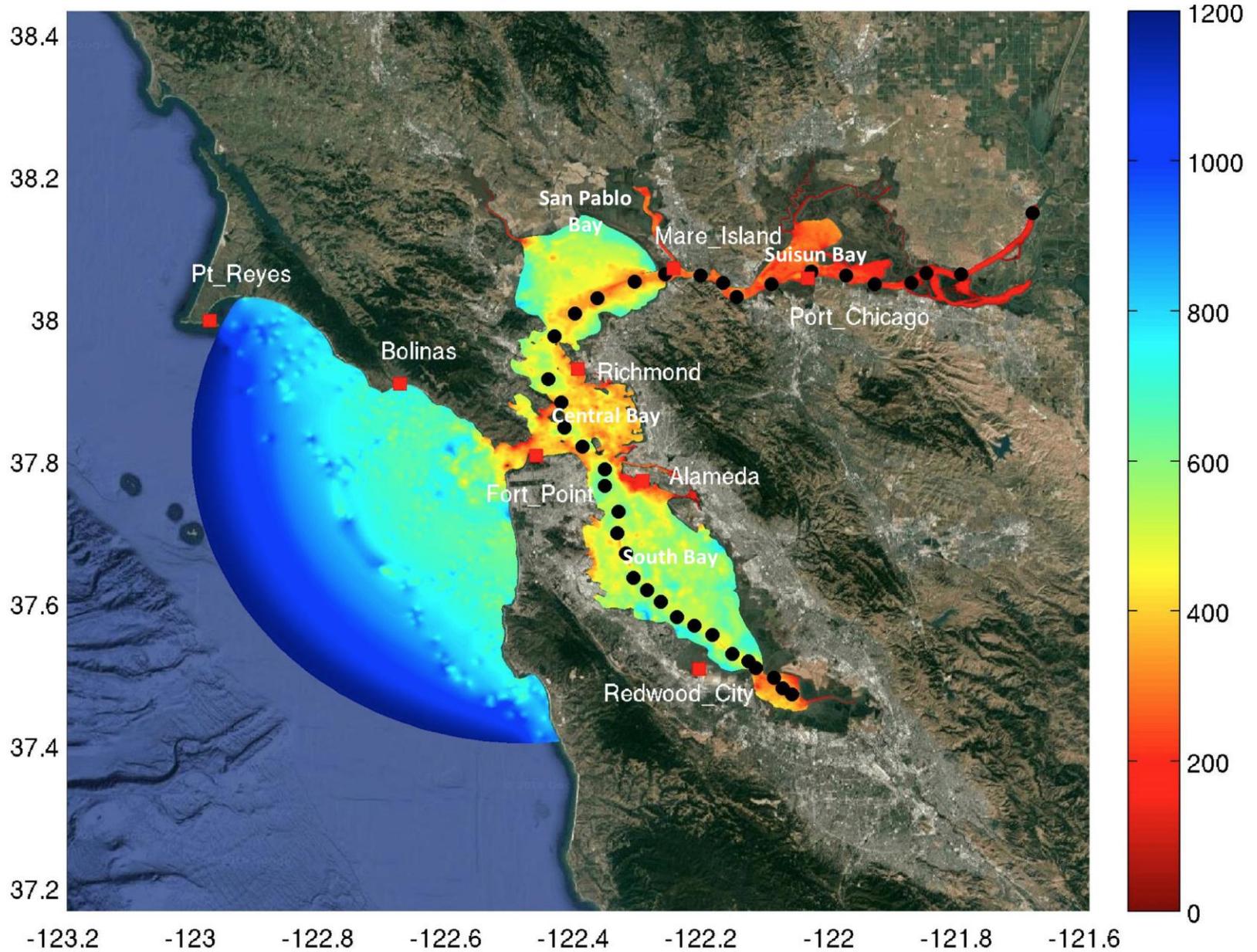


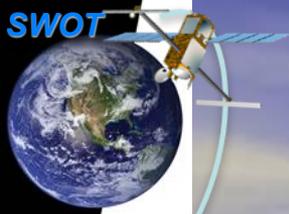
The height of storm surge during Hurricane Sandy was ~ 4 m at the Battery Park in lower Manhattan.

Simulated SWOT Ocean Observations

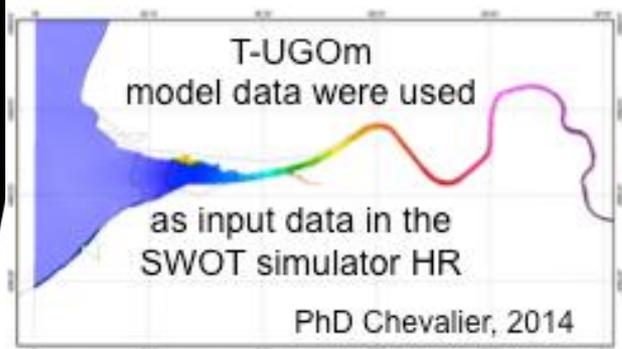


Illustrations in the San Francisco Bay

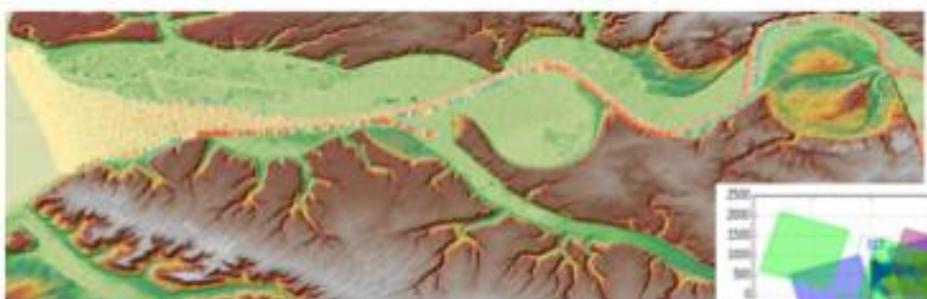




Illustrations in the Seine Estuary

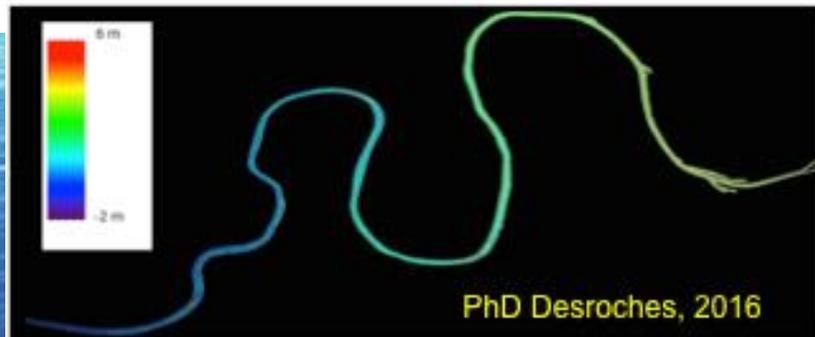
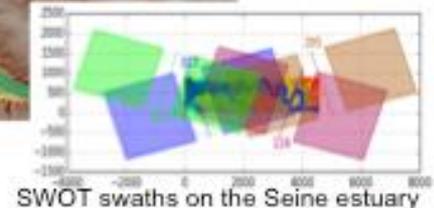


First result of the HR Simulator in the Seine estuary (swath n°17 left) - medium conditions of discharges and tide



Total error

- -3.58 -- -1.77
- -0.91 -- -0.37
- 1.91 - 3.80



The improved geolocation method of the HR simulator reproduces well the spatial variability of water level along the Seine estuary



Majority of the SWOT measurement points in the channel, with low water level error (centimetric), but some are outside & the error can be plurimetric for points outside or on the edge of the channel = Layover in relation with the cliffs along the Seine estuary & thermal noise

Summary

- **SWOT will deliver data of water elevation at a posting of 250 m over land water, ocean, sea ice, and land ice between +/-78 deg latitudes**
- **The orbit has a 21 day repeat cycle with the number of overflights increasing from 2 at the equator to more than 6 at higher than 65 degs.**
- **Within 3 km from the coast, raw data of resolution of 10-70 m will be processed for possible applications.**
- **The high resolution data will provide opportunities to study a variety of coastal and estuarine processes and their interactions with the open ocean.**