LLC4320 and SWOT

1. An OSSE study for designing an in-situ CalVal field campaign
2. On the spatial resolution of the SWOT SSH
3. At what wavelength can we use the on-board Nadir altimeter for the long-wavelength CalVal?
4. Using llc4320 as the nature run for an regional data assimilation OSSE.

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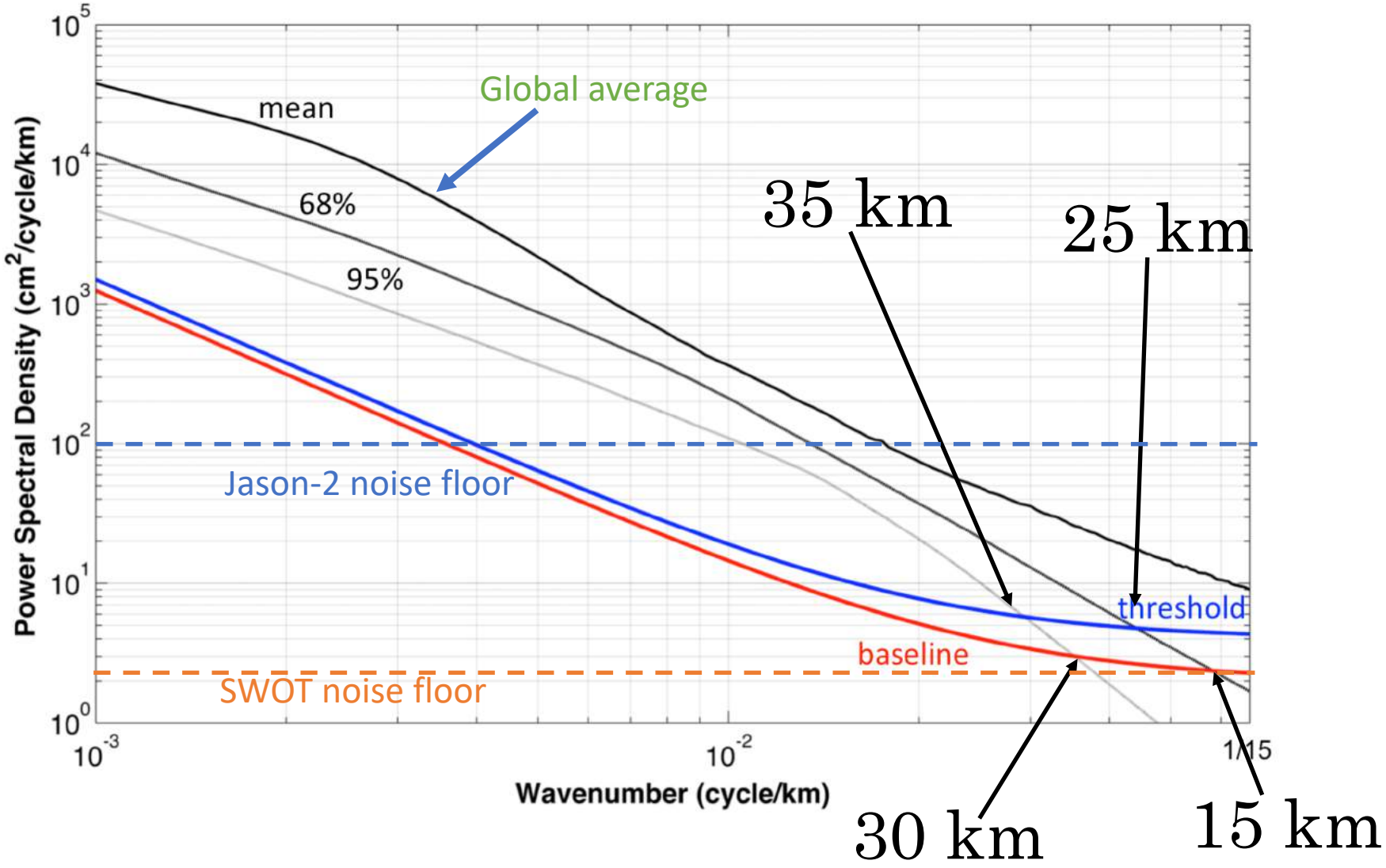
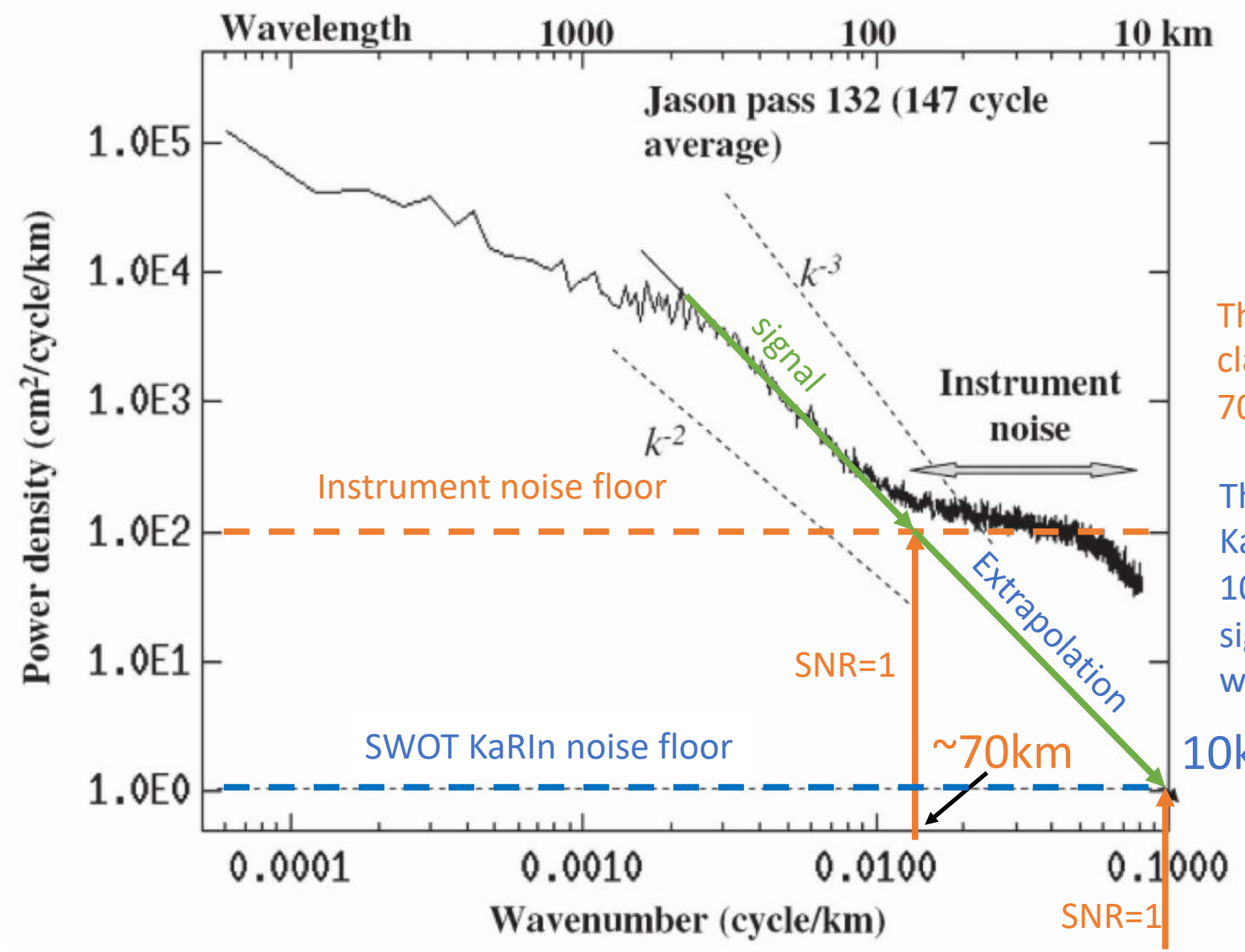
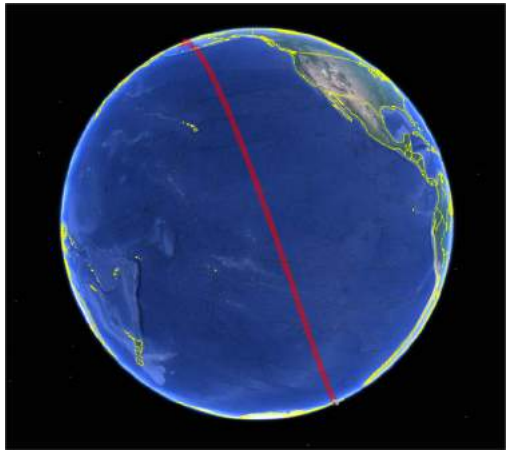
Understand the SWOT science requirement



Rodríguez, E., 2016

Extrapolation from Nadir altimeter



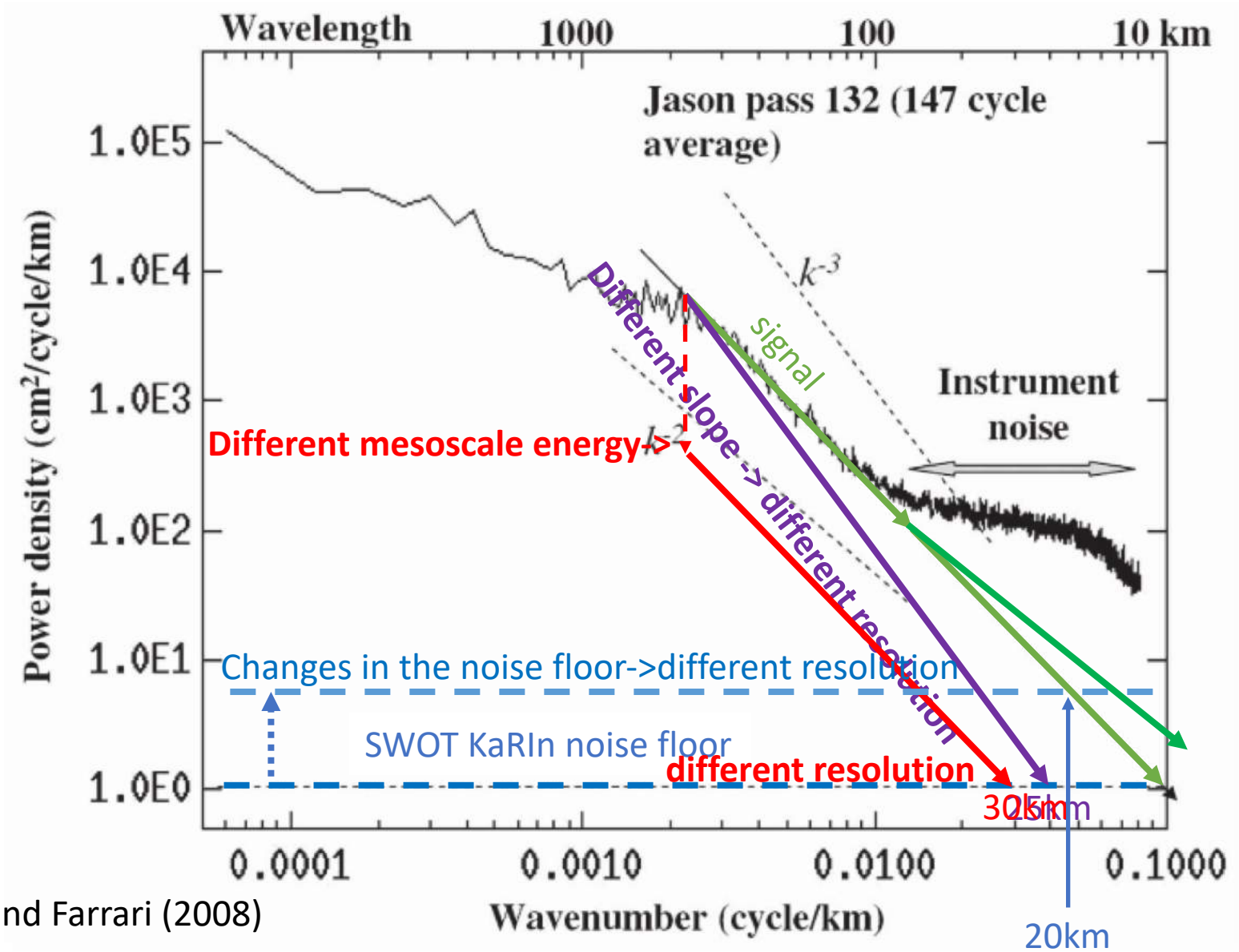


The resolution of the Jason-class nadir altimeter is about 70km. (Dufau et al., 2016)

The resolution of SWOT KaRin can be as small as 10km by extrapolating the signal from the long wavelength.

Fu and Farrari (2008)

Factors affecting the SWOT resolution



Fu and Farrari (2008)

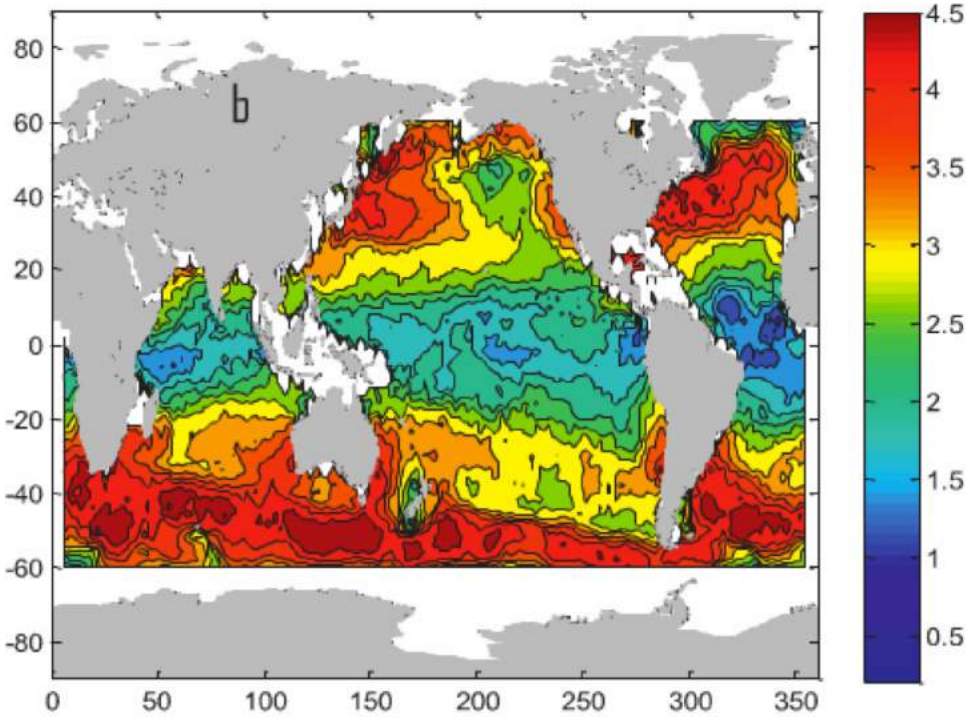
1. the spectral slope

2. the energy level at mesoscale (300-500km)

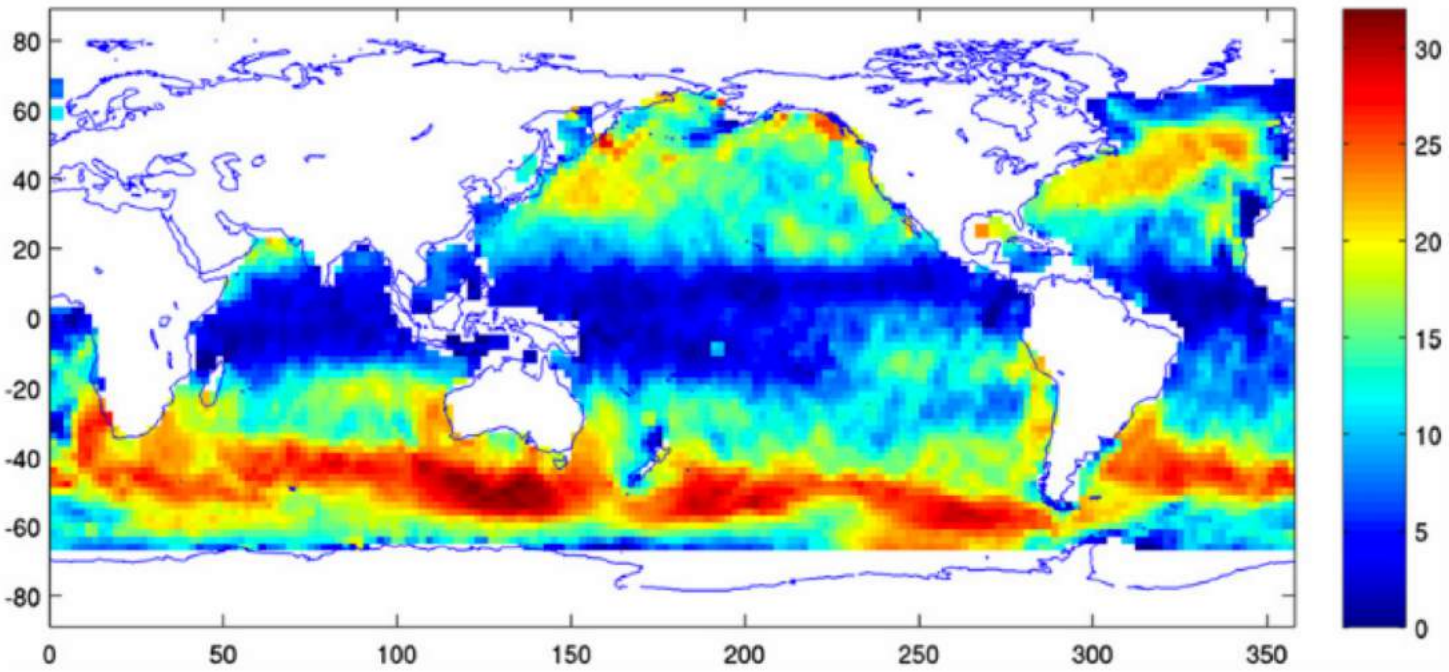
3. the noise floor (depends on the sea state, surface waves)

4. Non-constant spectral slope (due to high frequency internal gravity waves)

Variations due to the ocean signal



Xu and Fu, (2012)

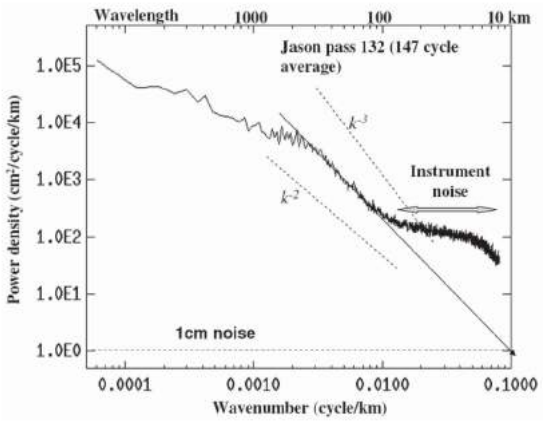


Fu and Ubelmann, 2014

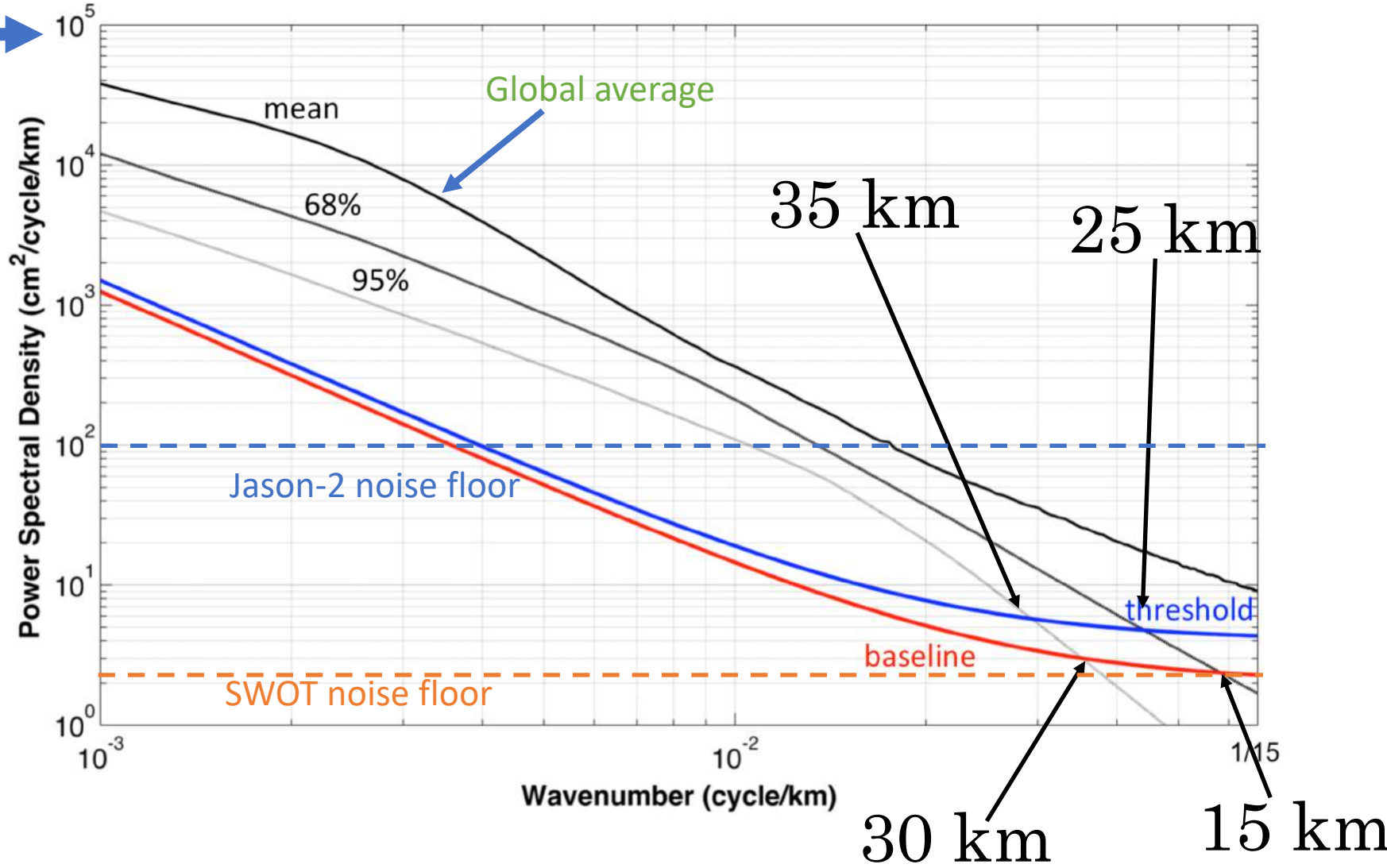
The wavenumber spectra slope shows a large geographic variation.

SWOT scale is geographically dependent (with a uniform 2m significant wave height). Mid-latitude: ~15-25km; Southern Ocean: ~25-35km.

SWOT science requirement



1. The ocean signal is based on the Jason-2 altimeter averaged globally.
2. The KaRIn noise is based on a fixed 2-meter significant wave height, which can vary seasonally and geographically.
3. Our objective: a closer look at the distribution of the SWOT resolution both in space and in time considering a varying SWH-induced noise.



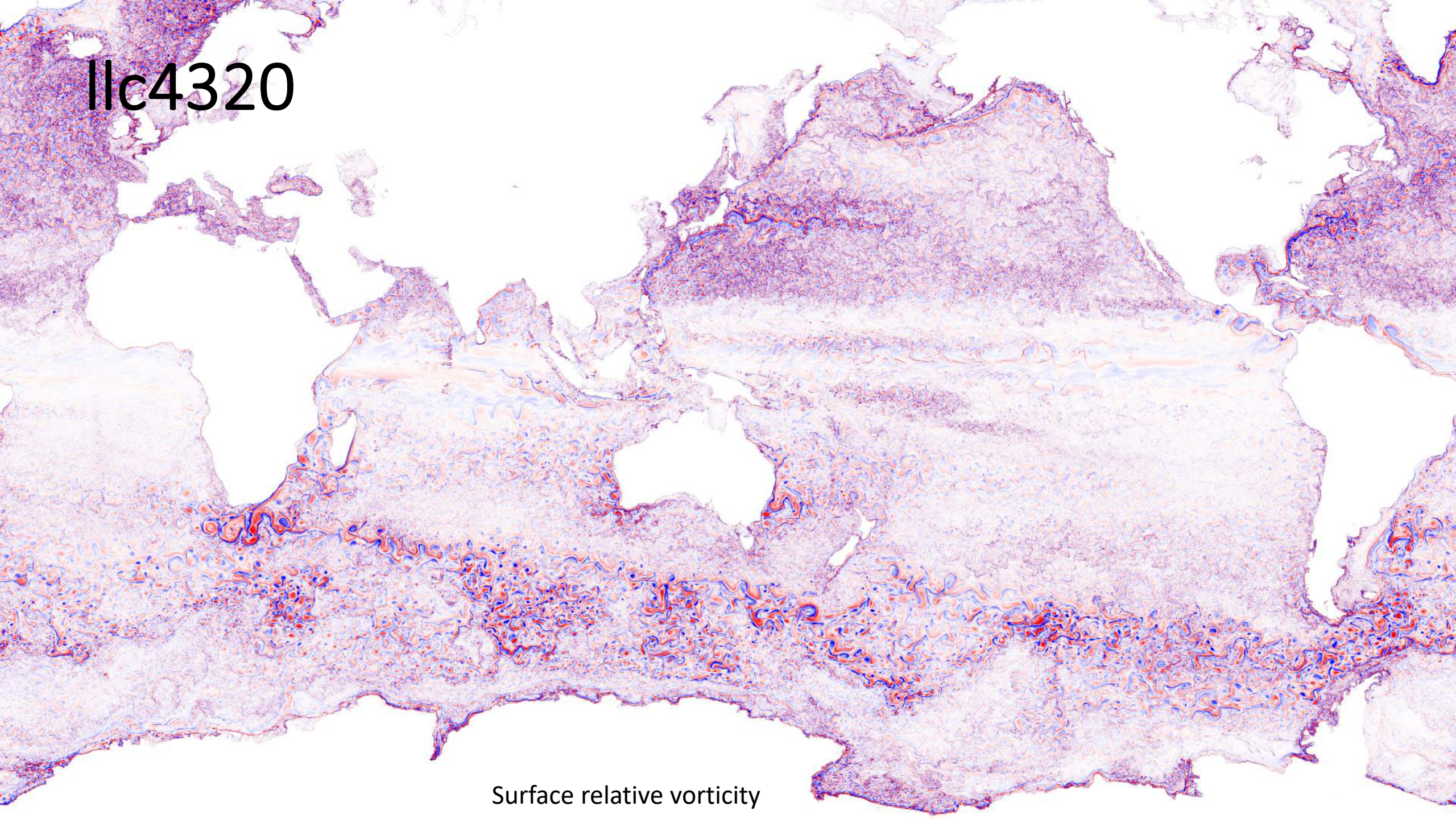
Rodríguez, E., 2016

A closer look at the distribution of the SWOT resolution

1. KaRIn noise (season, longitude, latitude)
   - KaRIn noise is a function of significant wave height.. Altimetry product will be used.
2. SSH (season, longitude, latitude)
   - Use a global simulation

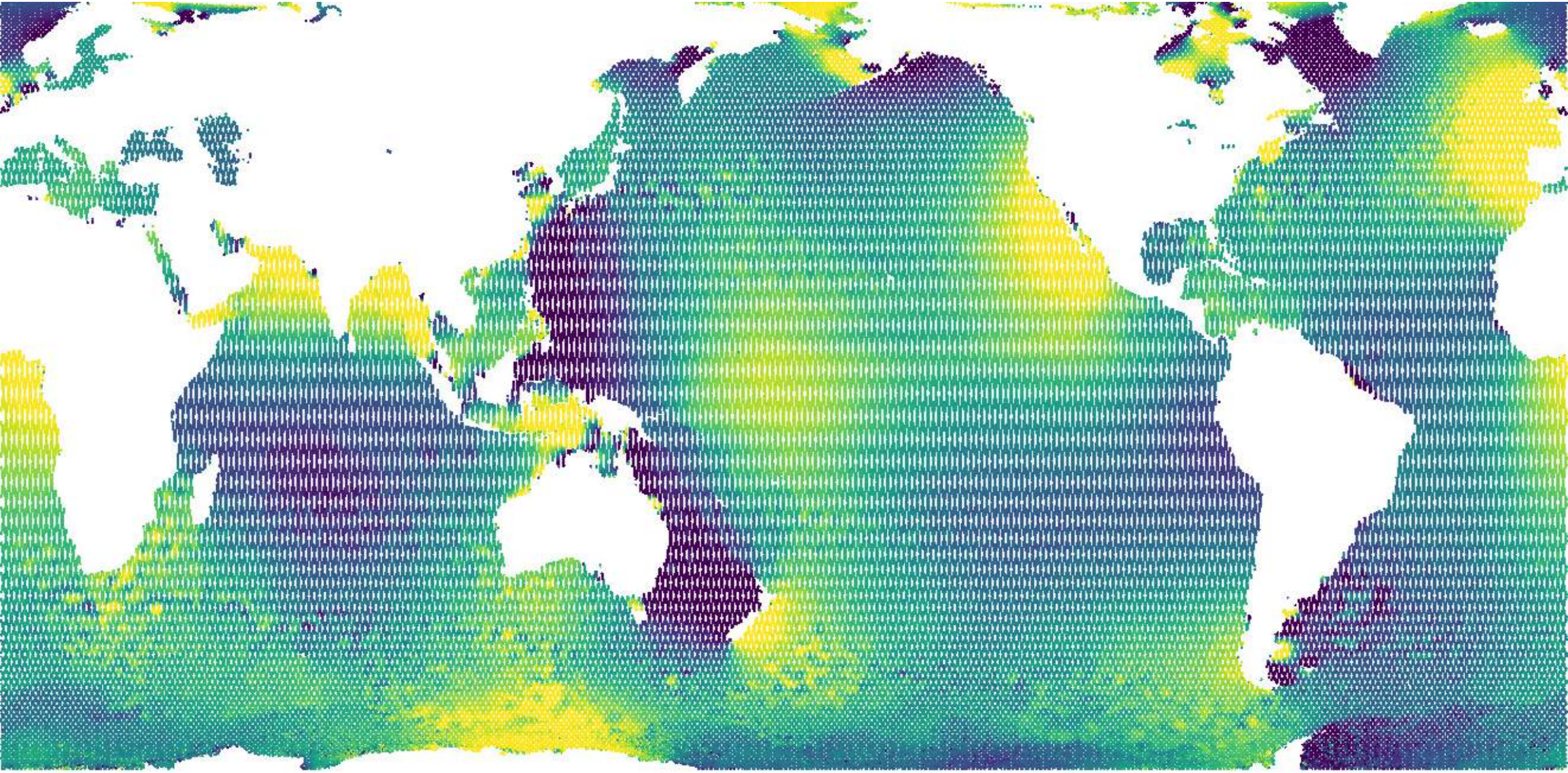
A closer look at the distribution of the SWOT resolution

1. KaRIn noise (season, longitude, latitude)
   - KaRIn noise is a function of SWH and cross-swath position
2. SSH (season, longitude, latitude)
   - Use a global simulation

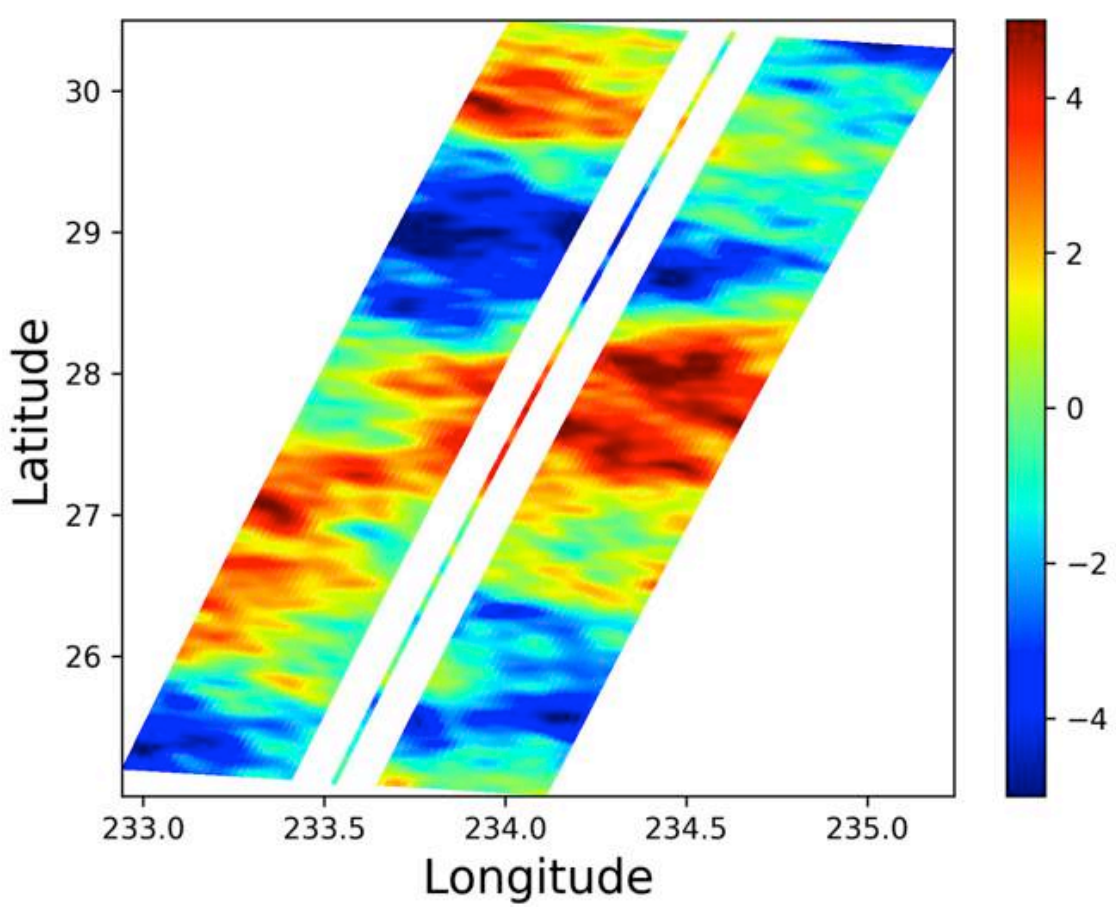


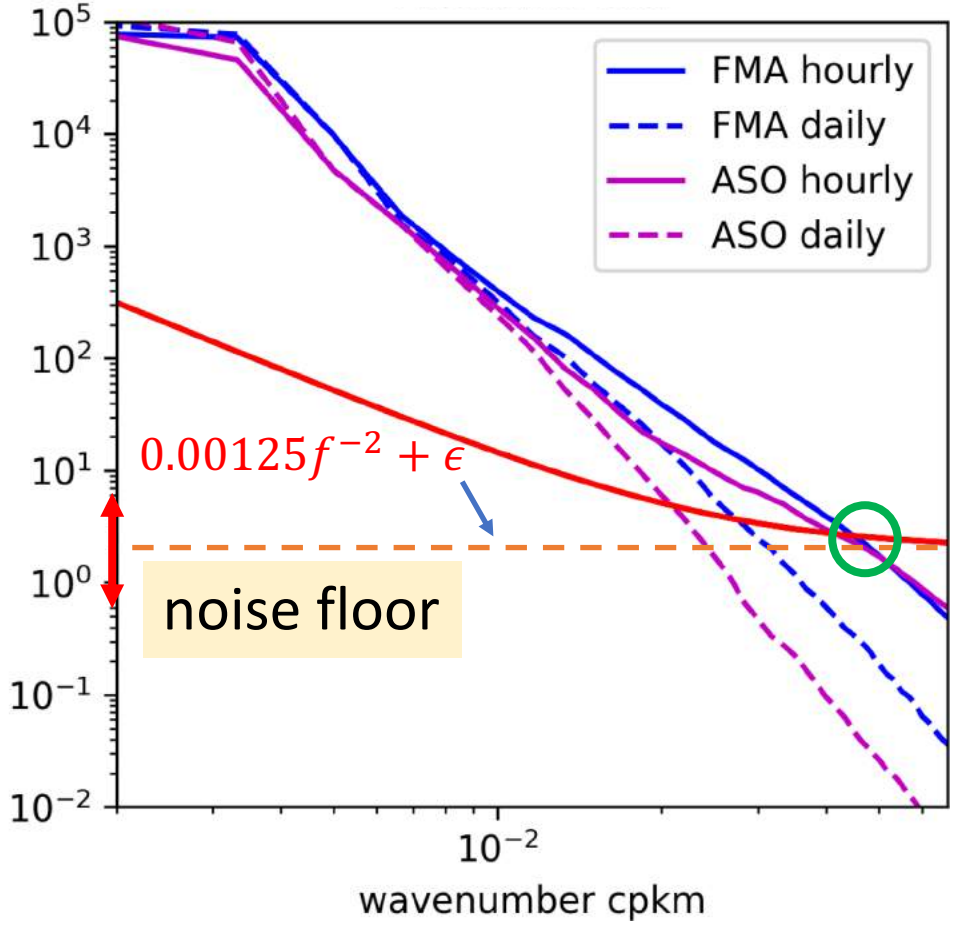
Surface relative vorticity

Interpolate the model SSH onto SWOT swaths (only the Nadir tracks are shown in this figure)

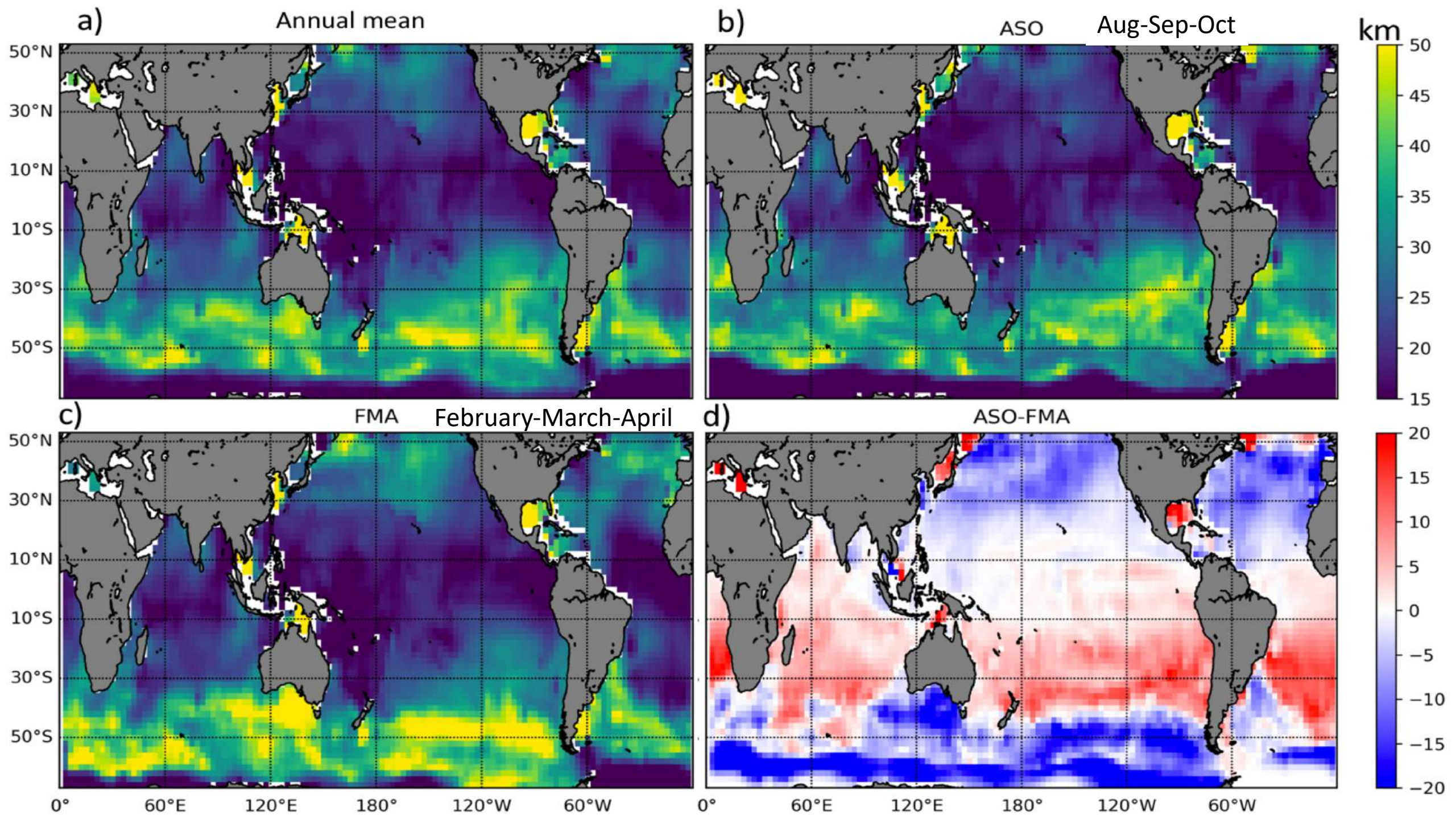


An example





1. Divide the whole swath into segments for the wavenumber spectrum calculation (left panel)
2. The spectrum slope changes seasonally and is non-uniform for different wavenumber range (right panel, blue and purple solid lines)
3. The non-uniform spectrum slope is due to high frequency baroclinic waves (right panel, compare solid and dash lines of the same color)


a)
Annual mean
b)
ASO
Aug-Sep-Oct
km
50
45
40
35
30
25
20
15
c)
FMA
February-March-April
d)
ASO-FMA
20
15
10
5
0
−5
−10
−15
−20
50°N
30°N
10°N
10°S
30°S
50°S
0°
60°E
120°E
180°
120°W
60°W

Summary

- SWOT will resolve the SSH with a spatial scale increasing from ≤15km in the tropics to ~30-50km in the high latitudes with larger values in the Southern Ocean.
- We have not considered the SWOT resolution of eddies (balanced) and waves (unbalanced) separately.
- The results are based on llc4320.