Platform and Across Swath Comparison of Vorticity Spectra from QuikSCAT, ASCAT, and OSCAT Scatterometers

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Funding Source: NASA OVWST

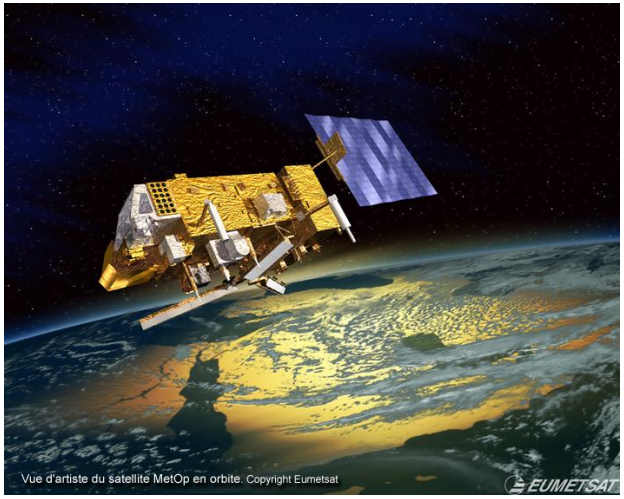
Goal

- To investigate the consistency of vorticity spectra between 3 scatterometers

QuikSCAT (QSCAT)

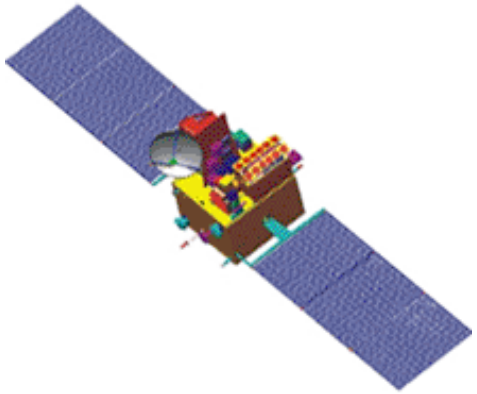
Source: Jet Propulsion Laboratory (JPL)

Advanced Scatterometer (ASCAT-A)



Source: European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)

OceanSAT-2 (OSCAT)



Source: Indian Space Research Organization (ISRO)

Motivation

- Curl of surface wind stress is very important for ocean forcing
  - Oceanographic upwelling and downwelling
  - Coastal upwelling
  - Deep ocean transport
- Surface vector winds (proxy for wind stress) have been shown to have extremely good intercalibration for Ku-band scatterometers
  - C-band differences have been greatly reduced
  - Curl is sensitive to small changes in wind
- Consistency of curl of the winds has not been investigated

Data Products

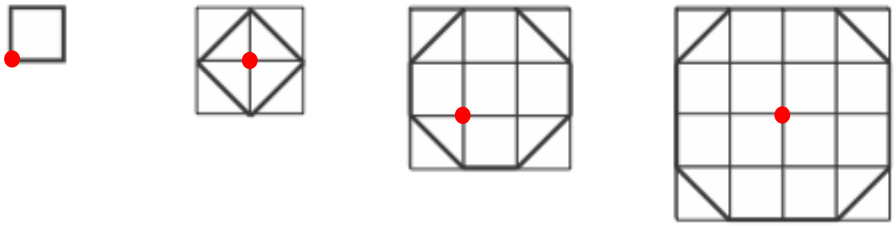
- 12.5 km Level 2b
  - QSCAT (JPL versions 2 and 3)
  - ASCAT-A (Royal Netherlands Meteorological Institute (KNMI))
  - OSCAT (JPL)

Area-averaged Surface Relative Vorticity

$$z = \frac{C}{A} \qquad C = \oint \vec{v} \cdot d\vec{l}$$

ζ: Relative Vorticity
C: Circulation
A: Area
$\vec{v}$: velocity along closed contour
$\vec{l}$: length tangent to contour

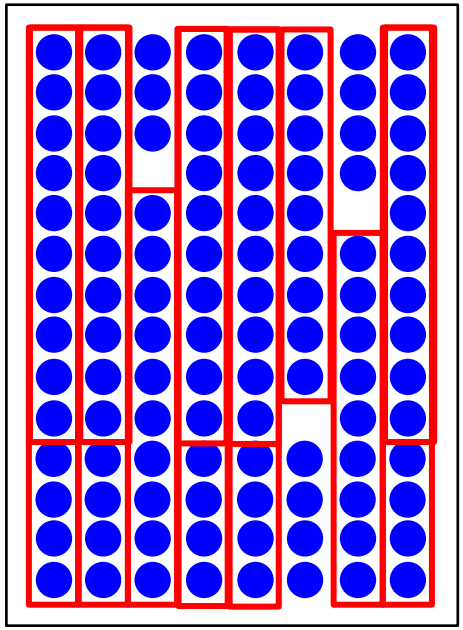
12.5 km 25 km 37.5 km 50 km



- Calculation adapted from *Bourassa and McBeth-Ford* (2010)
  - Added spline fit for interpolation between wind measurements
- Averaging over larger area reduces random error in calculation

Computing Spectra

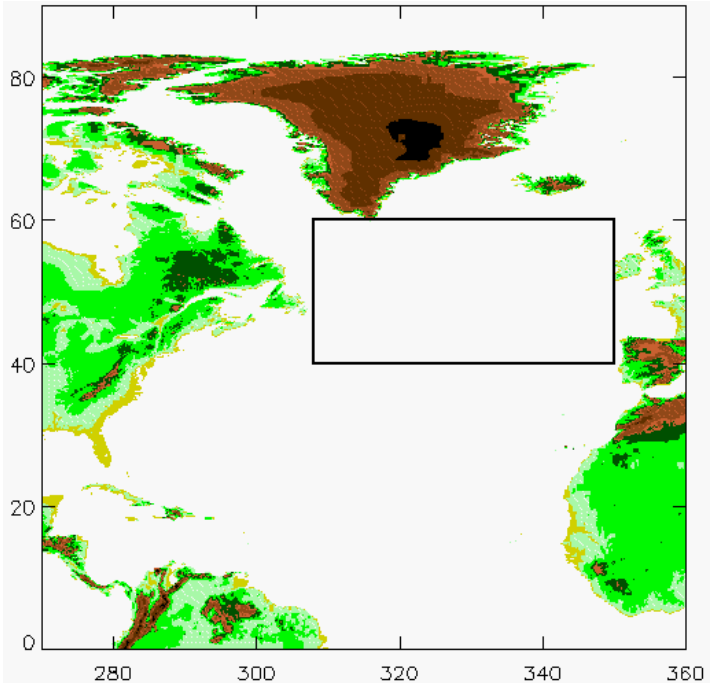
- Compute vorticity for entire swath
- Find the longest “string” for each along-swath column meeting a minimum length
  - Within regional bounds of interest
- Trim all of the strings to the same length
- Use fast Fourier transform (FFT) to compute spectra for each string
- Sum all of the spectrum for each string over period of interest and compute average spectra



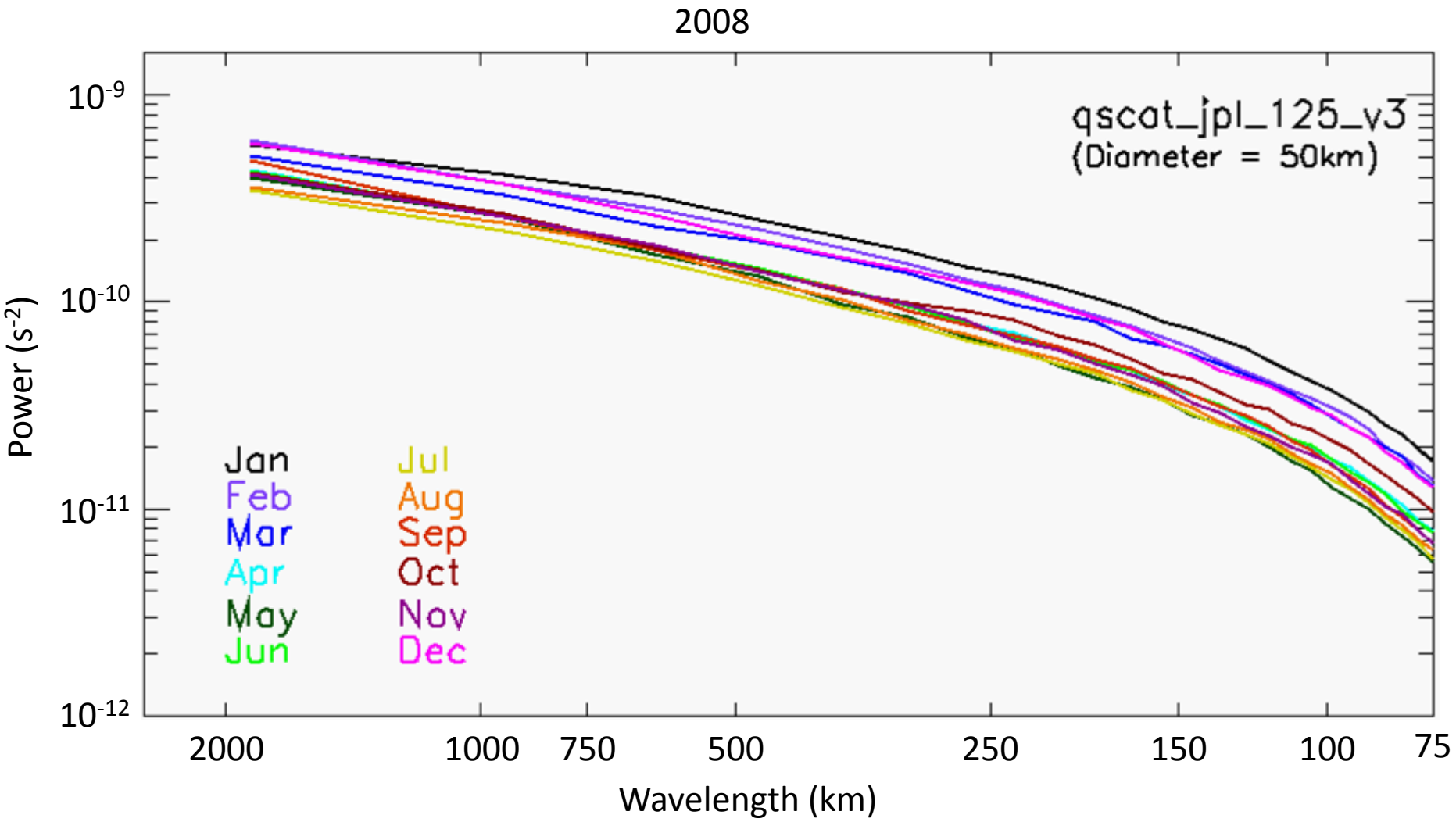
Results

1. Monthly Average Spectra
2. Across swath differences
3. Platform to platform comparisons
   - QSCAT vs. ASCAT
   - ASCAT vs. OSCAT
   - QSCAT v2 vs. v3

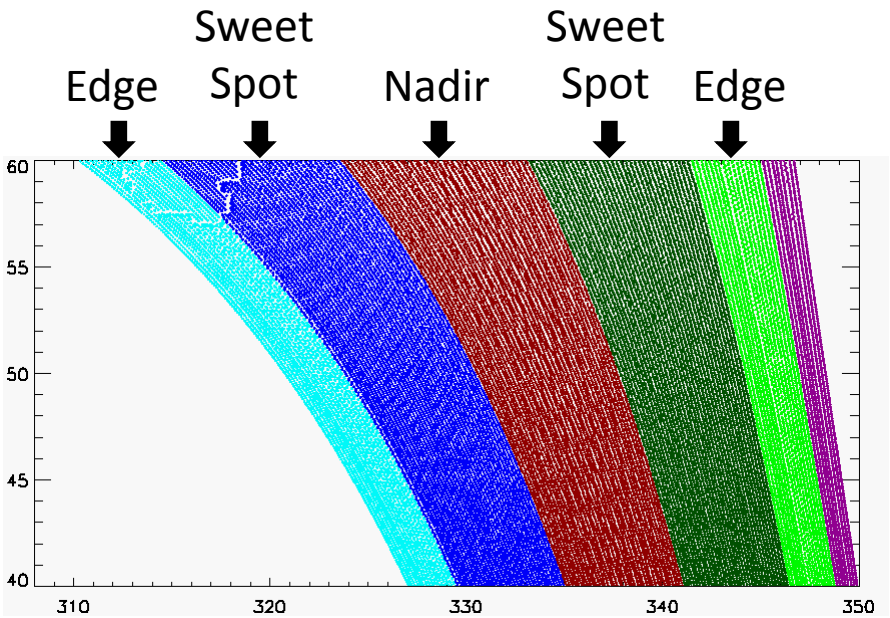
- North Atlantic
  - 40° to 60° N
  - 10° to 52° W

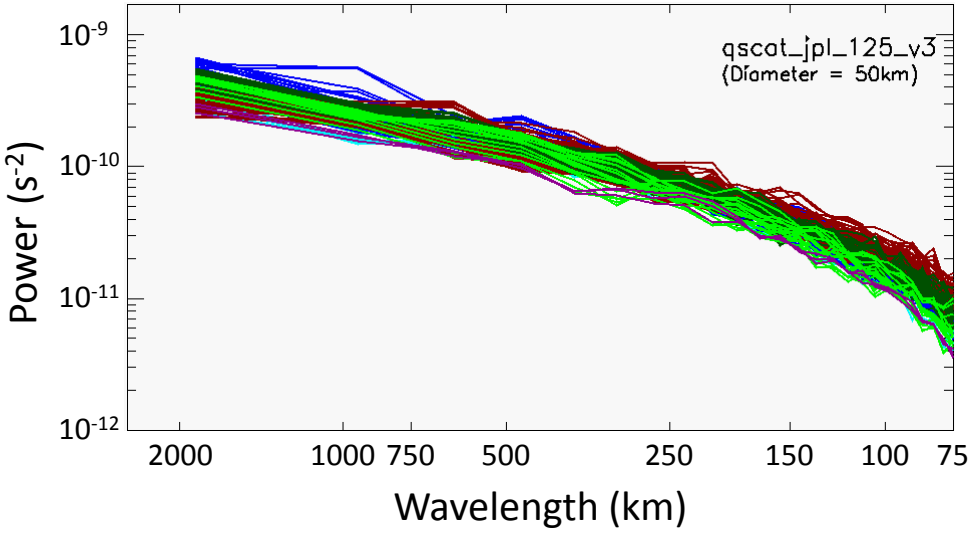


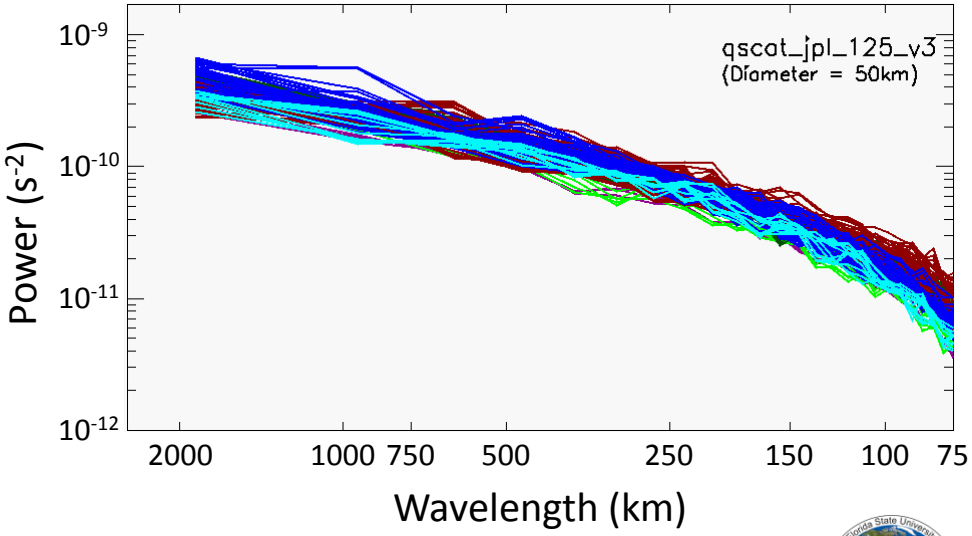
Monthly Averages (QSCAT v3)



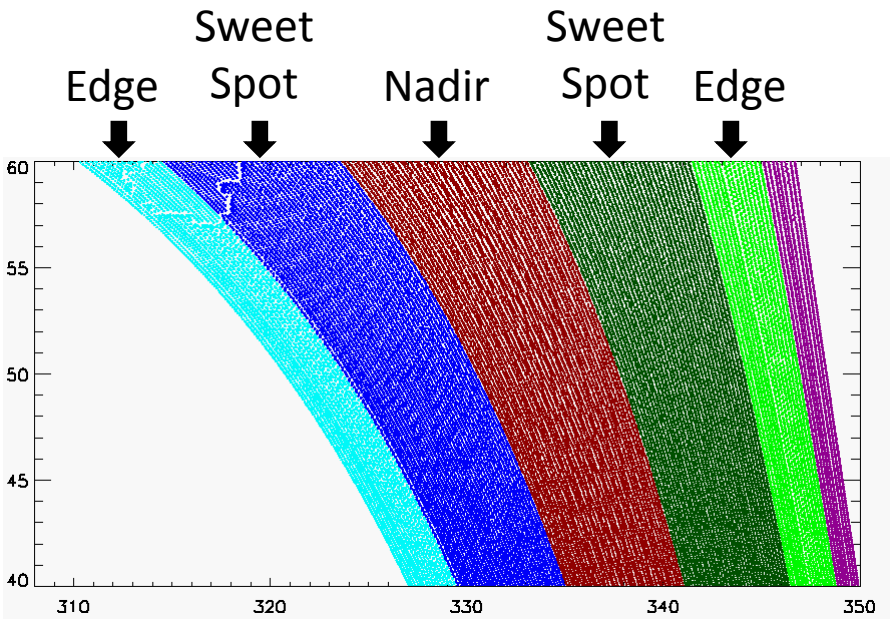
Across Swath (QSCAT v3)

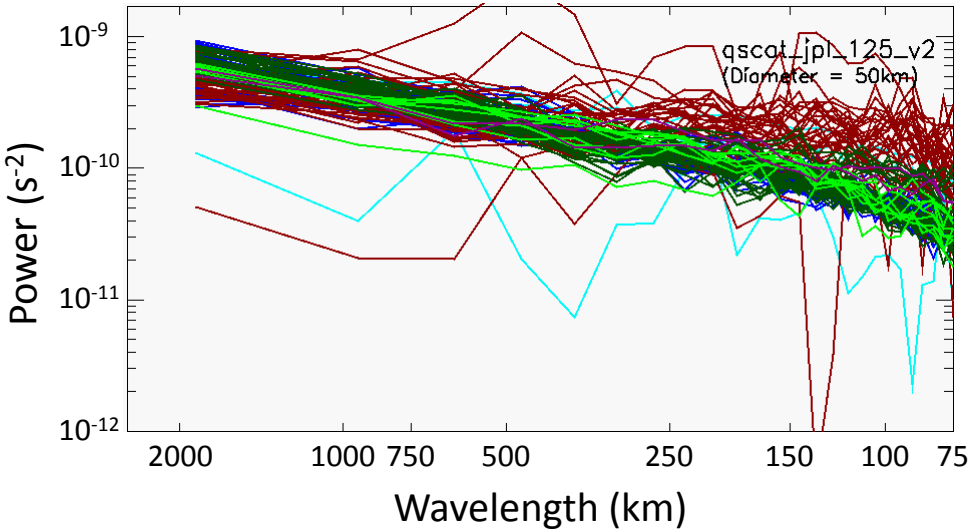


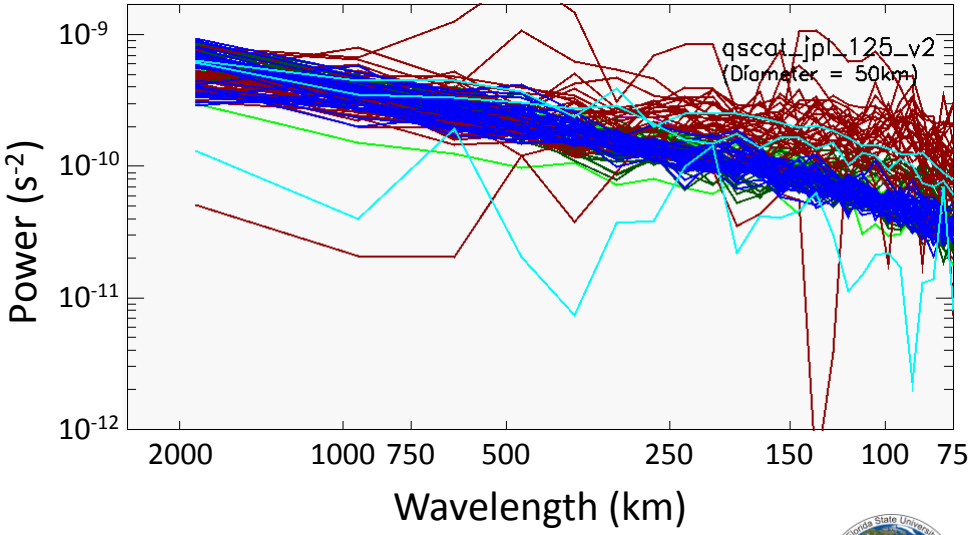




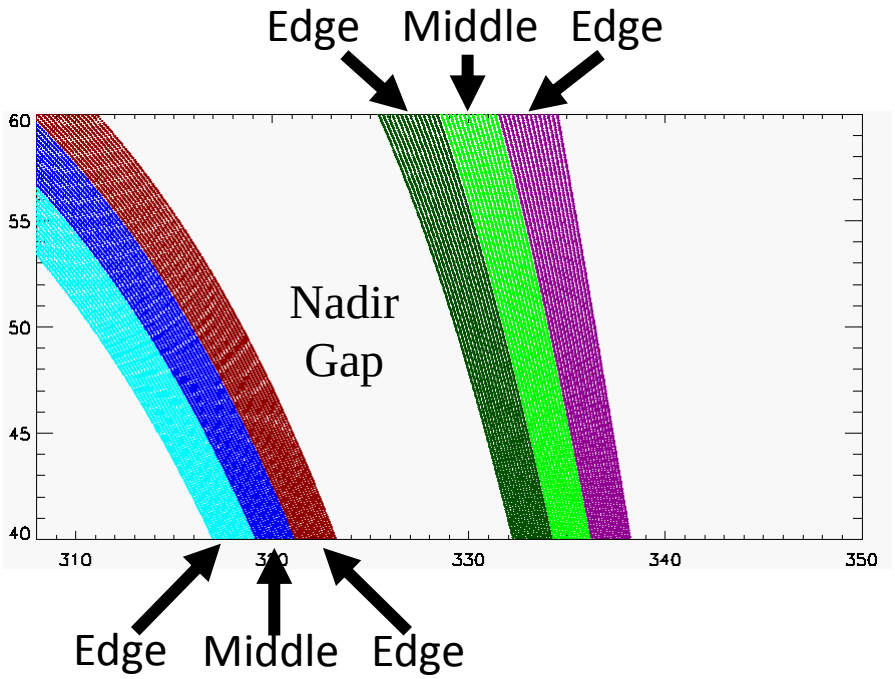
Across Swath (QSCAT v2)

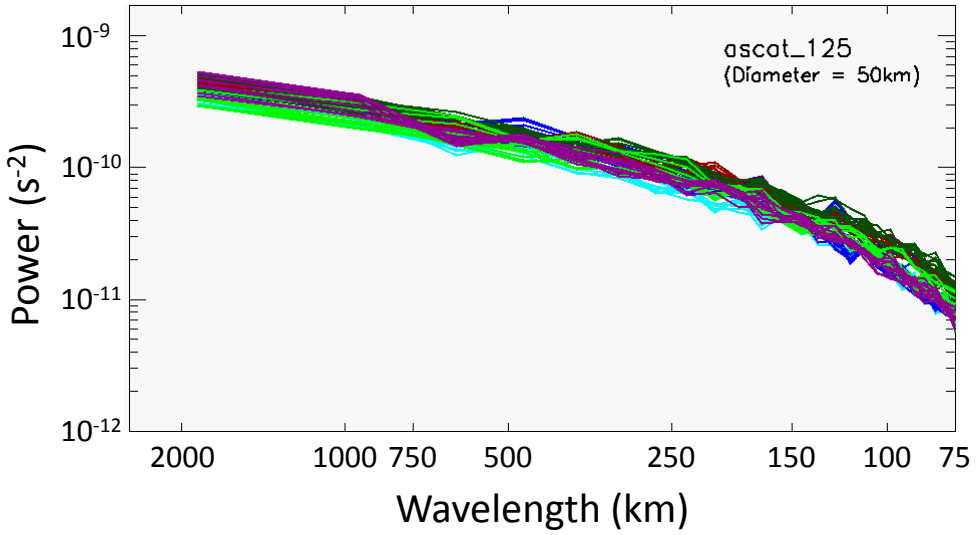


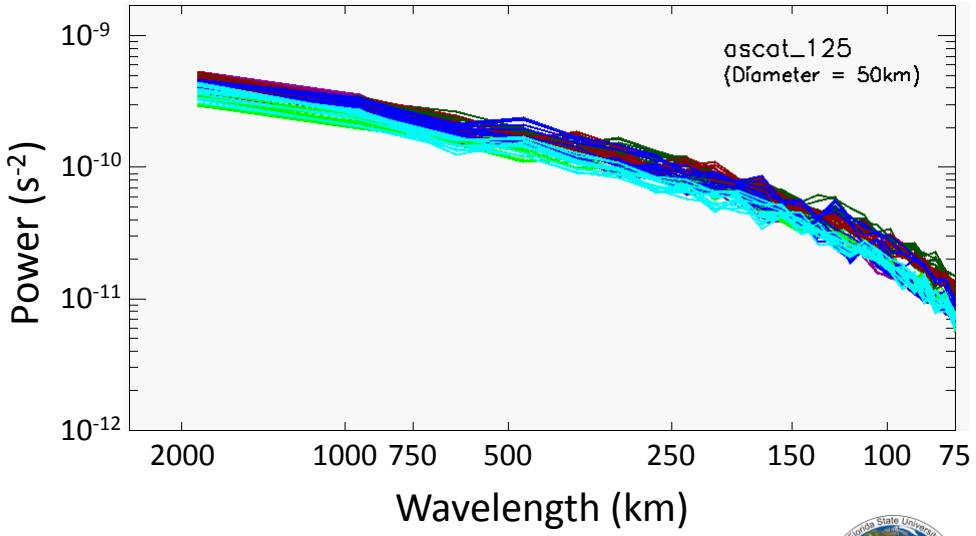




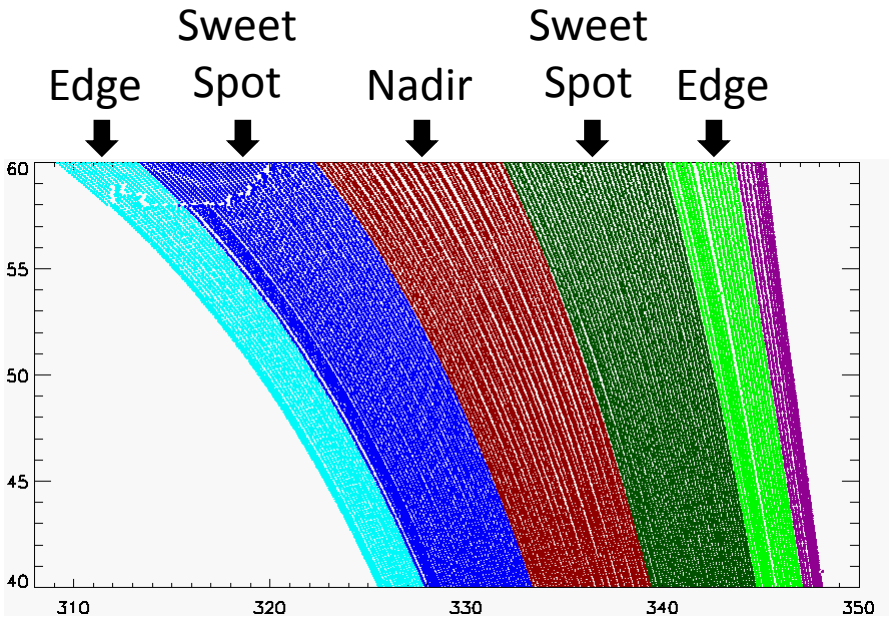
Across Swath (ASCAT)

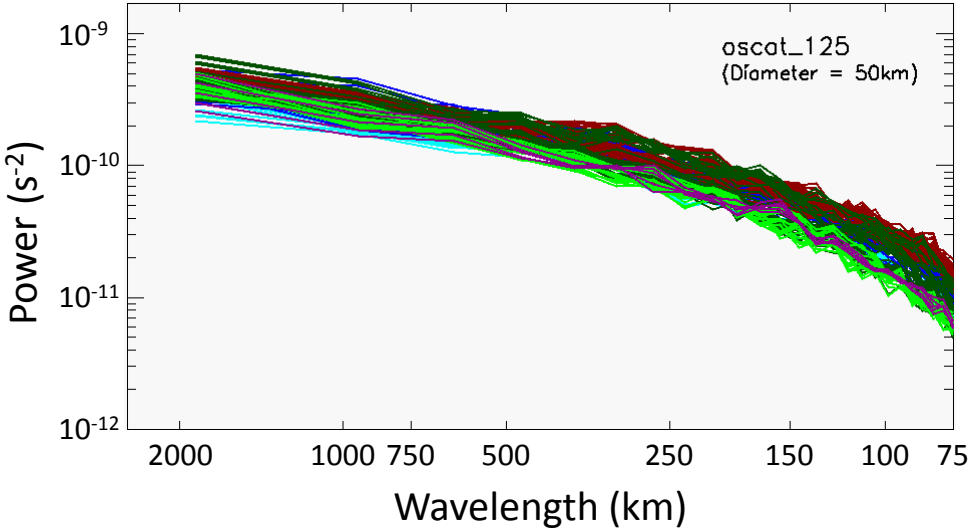


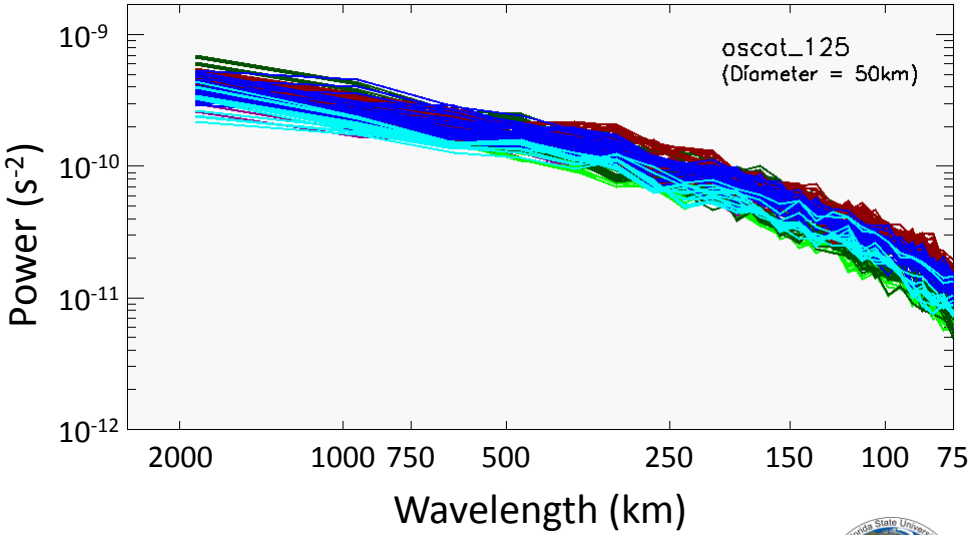




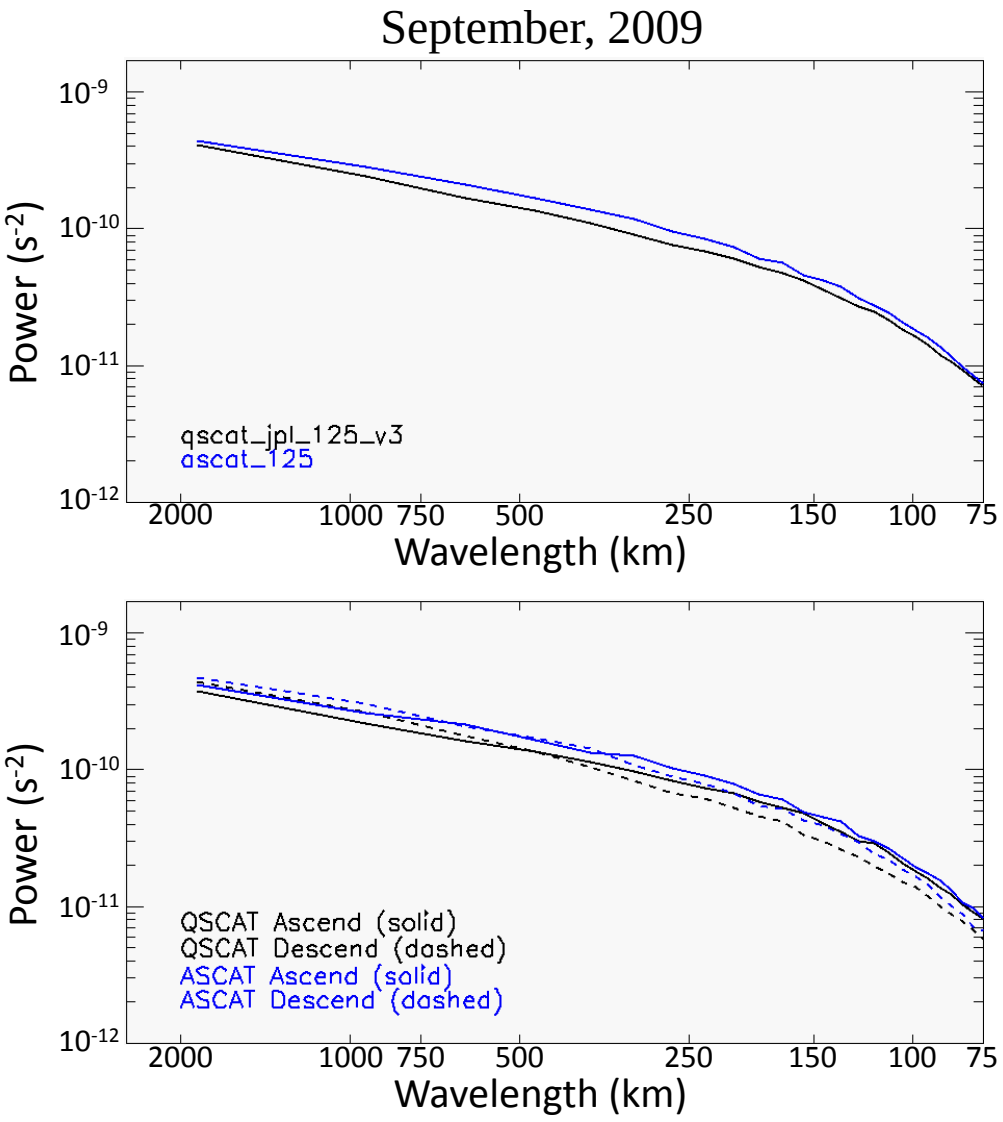
Across Swath (OSCAT)



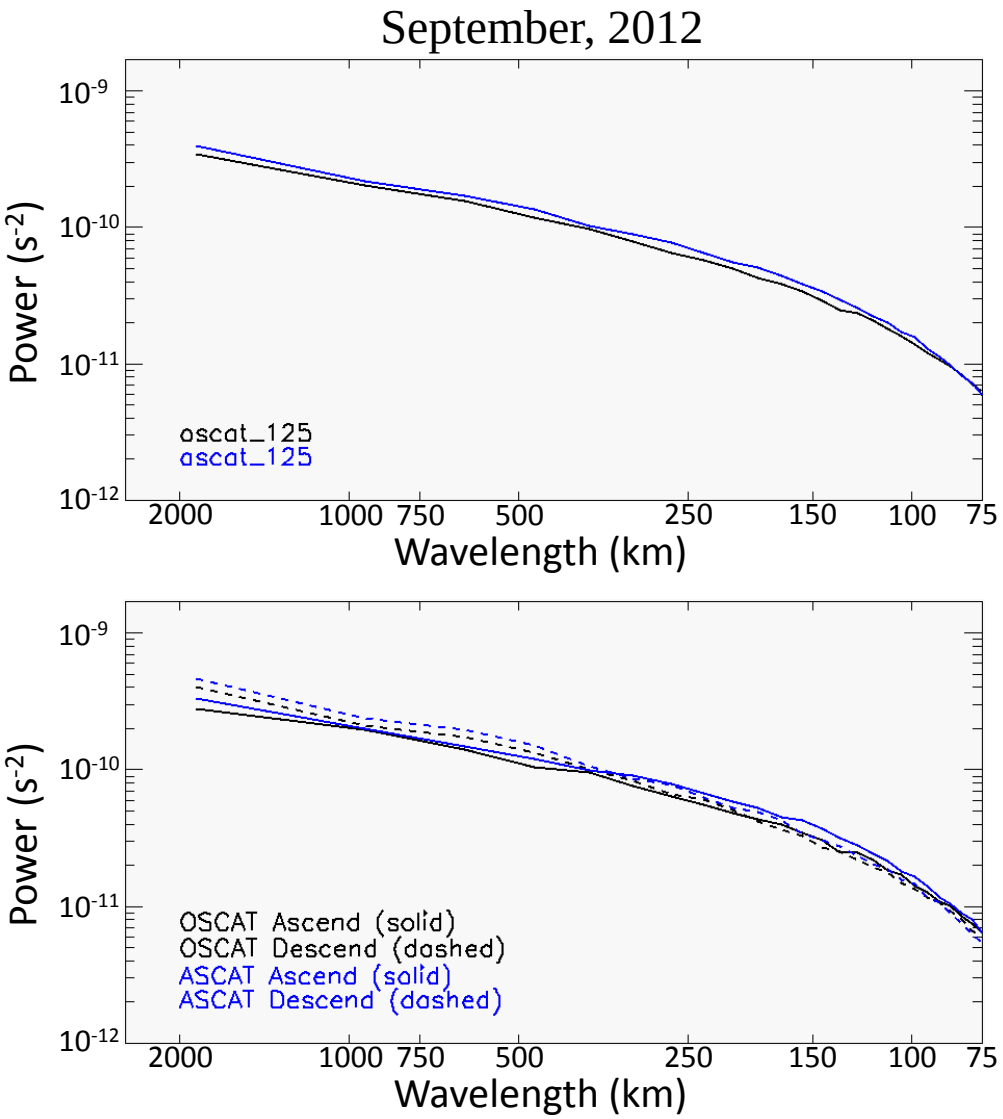




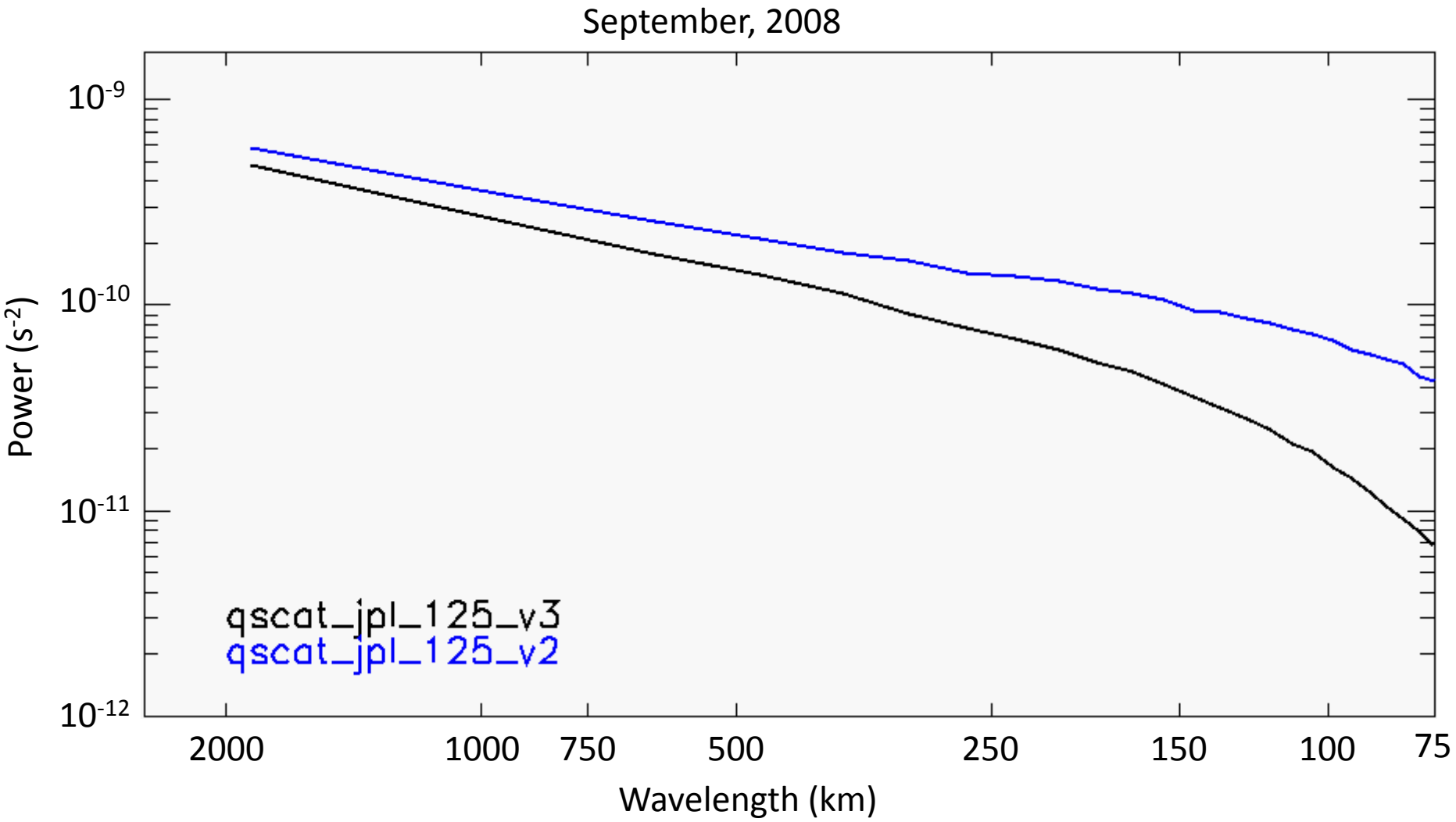
QSCAT v3 and ASCAT



ASCAT and OSCAT



QSCAT v2 and v3



Conclusion

- JPL's QSCAT 12.5 km version 3 product is a great improvement over the version 2 product
  - Spectra are more consistent
- Less variability in ASCAT spectra compared to both QSCAT and OSCAT
- QSCAT and OSCAT spectra appear to be quite comparable
- Ascending and descending swaths are similar

Questions

Backups