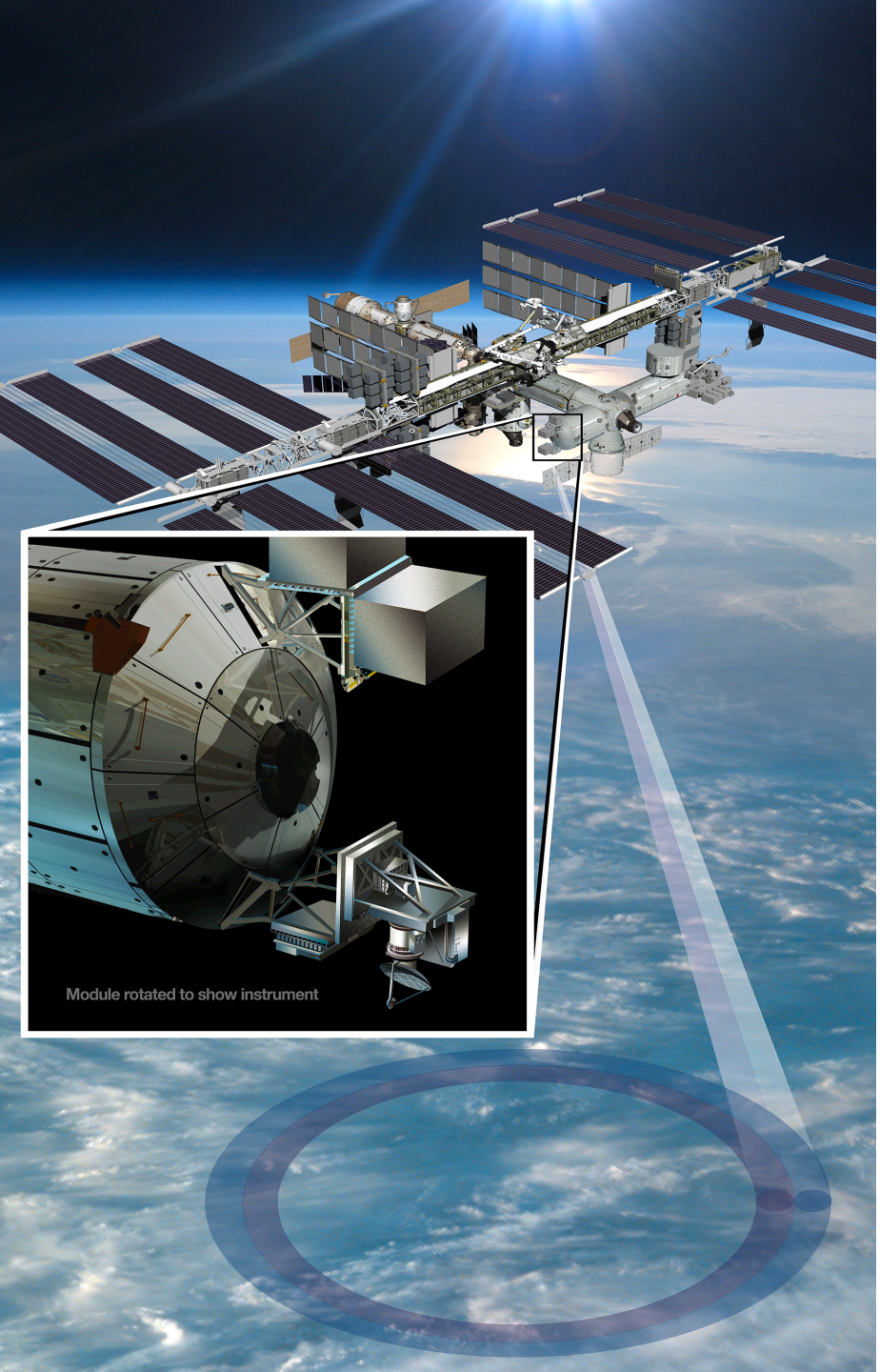
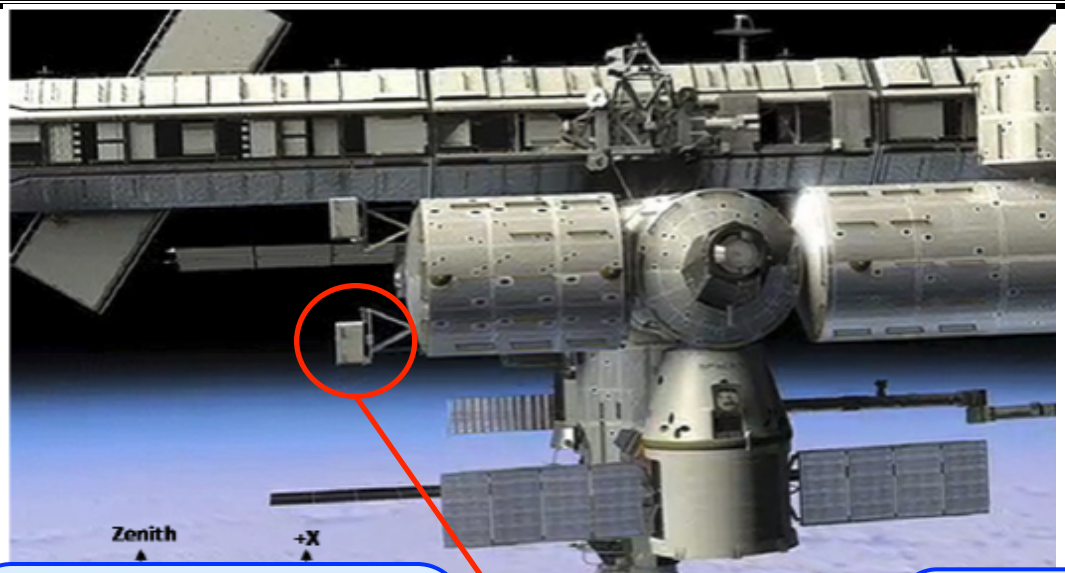
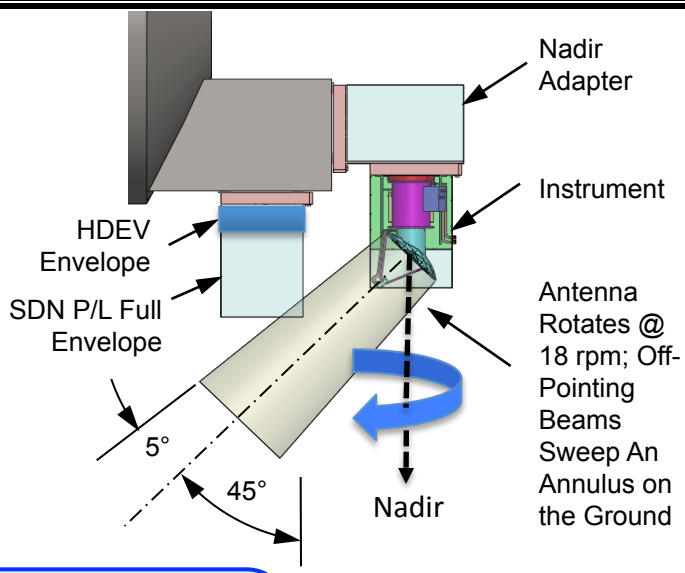


The Scientific Goals of the RapidScat Mission

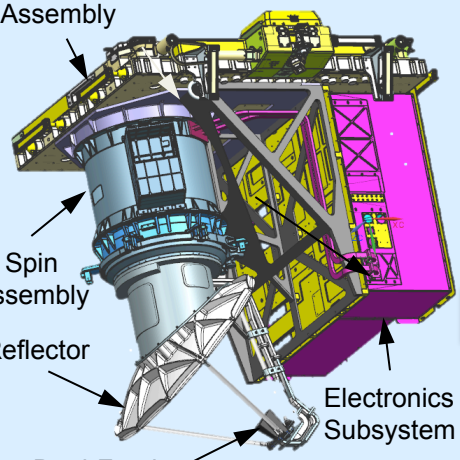
E. Rodríguez
Jet Propulsion Laboratory
California Institute of Technology

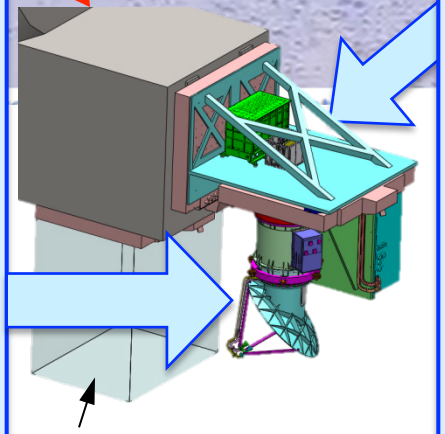
Flight System Overview



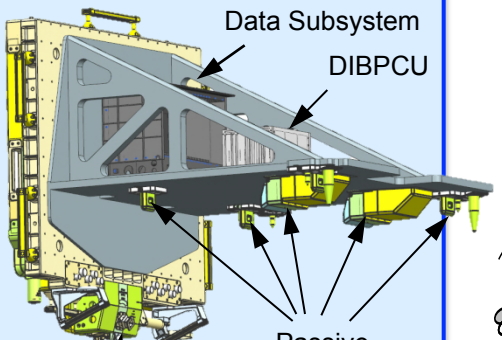


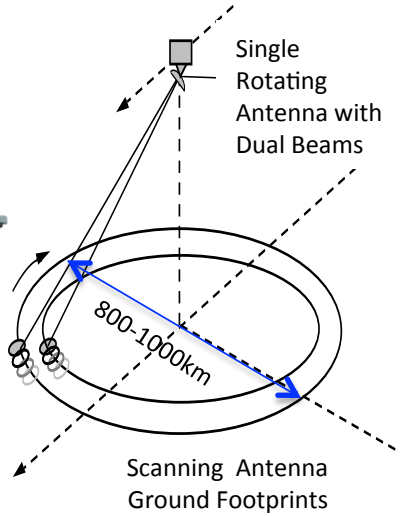
Instrument





Nadir Adapter

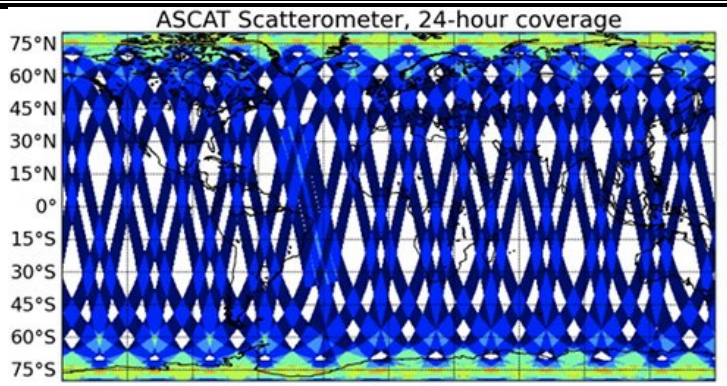


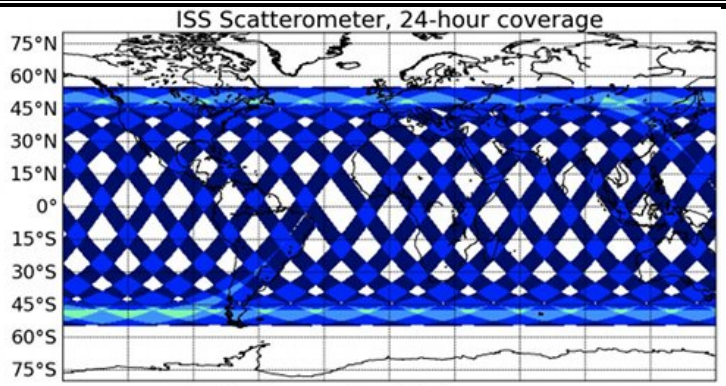


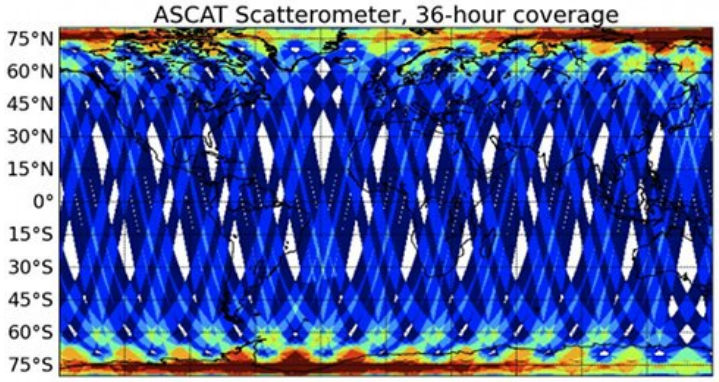
ISS-RapidScat Science Objectives

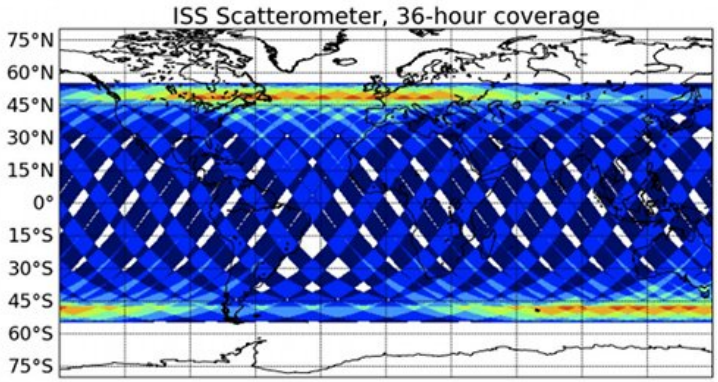
- **Provide direct wind cross-calibration for the international ocean vector winds constellation.**
  - *The ISS orbit will enable coincident measurements in space and time with each of the satellites in the constellation (ASCAT, OSCAT, QuikSCAT, and, potentially, OSCAT 2)*
- **Improve estimates of the global diurnal ocean vector wind cycle and determine the semi-diurnal cycle.**
  - *Variation of wind across different times of the day may be the cause of major discrepancies between measurements and models.*
- **Provide ocean vector winds to improve weather forecasting and complement data collected by the international ocean vector winds constellation.**
  - *The tropical coverage of the ISS will provide additional observations of storms that may develop into hurricanes or other tropical cyclones (typhoons, etc.)*

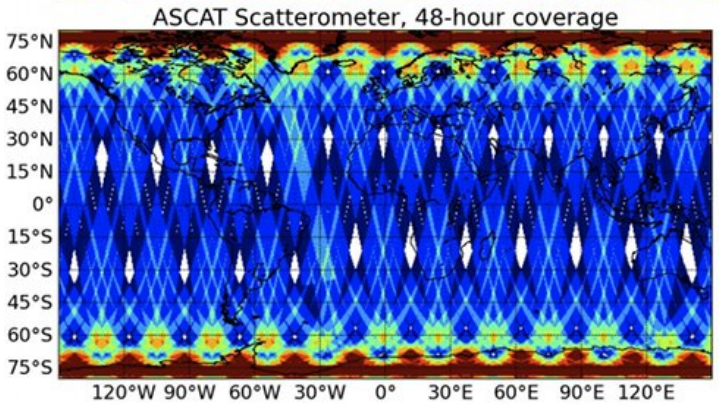
ISS Scat vs ASCAT

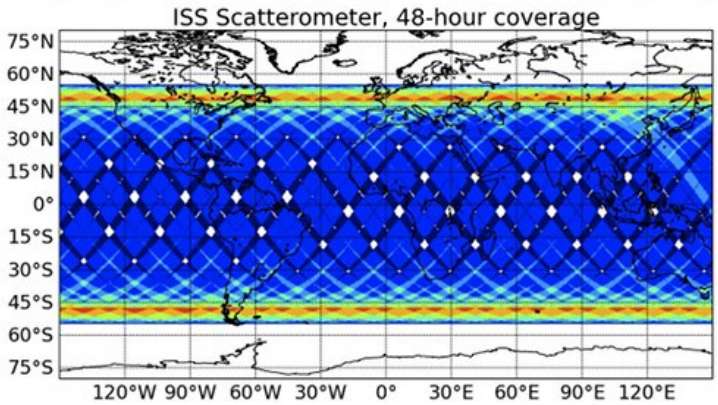




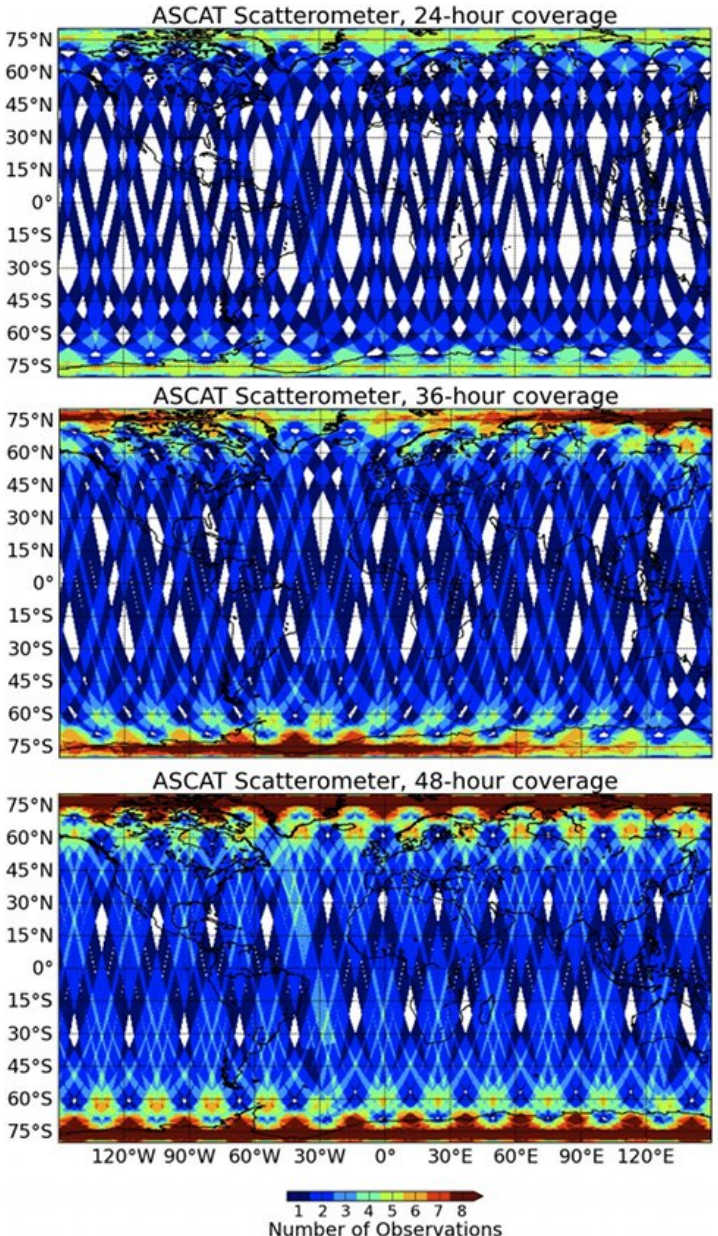


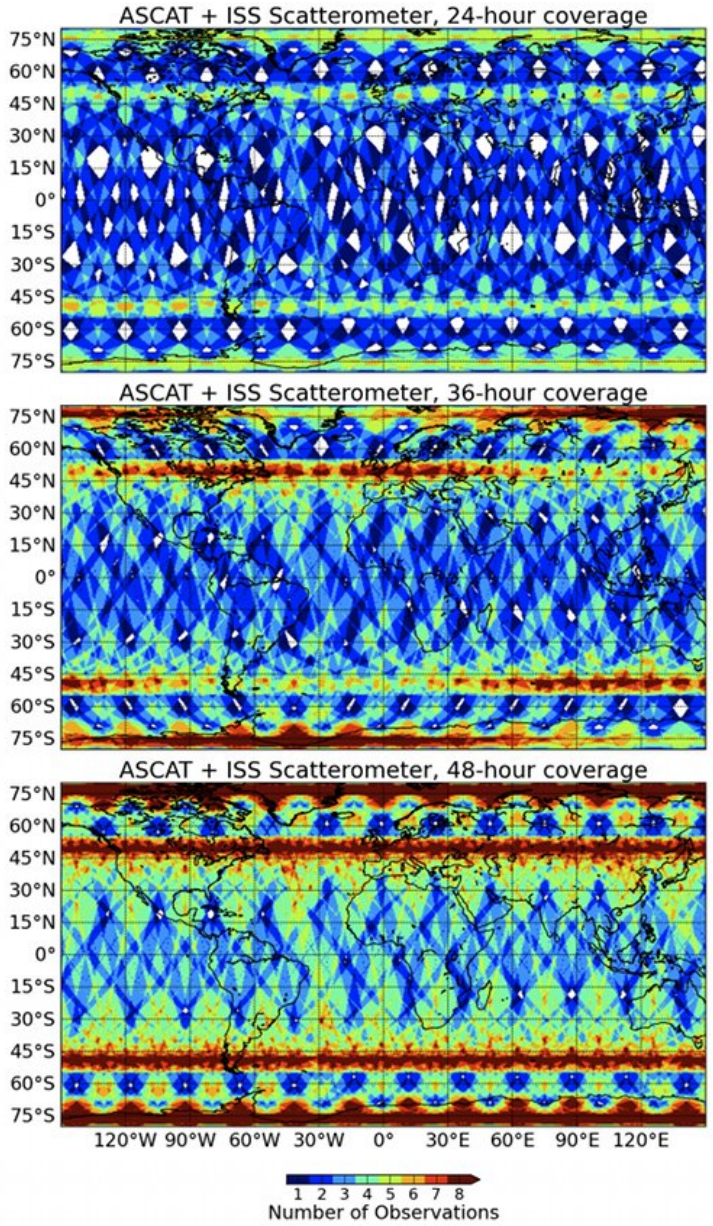




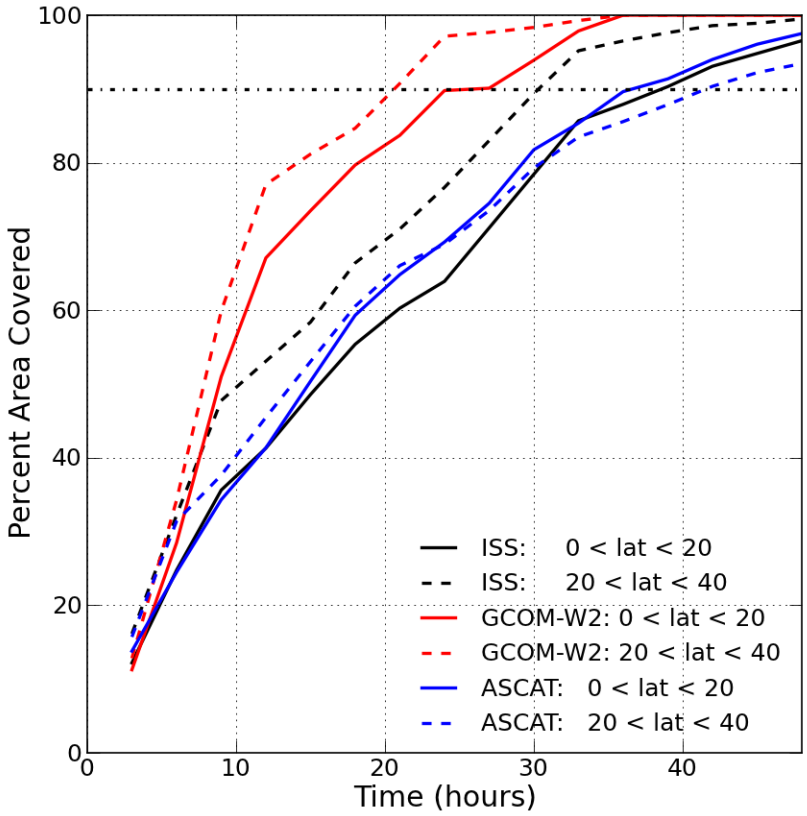


ASCAT Enhanced Coverage

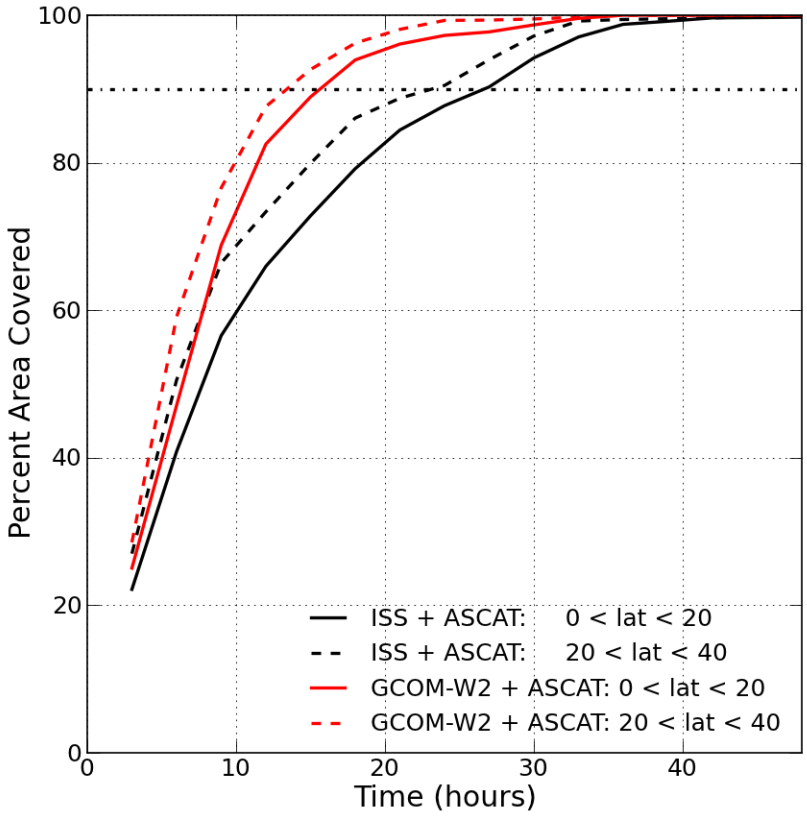




Time to Achieve Full Coverage

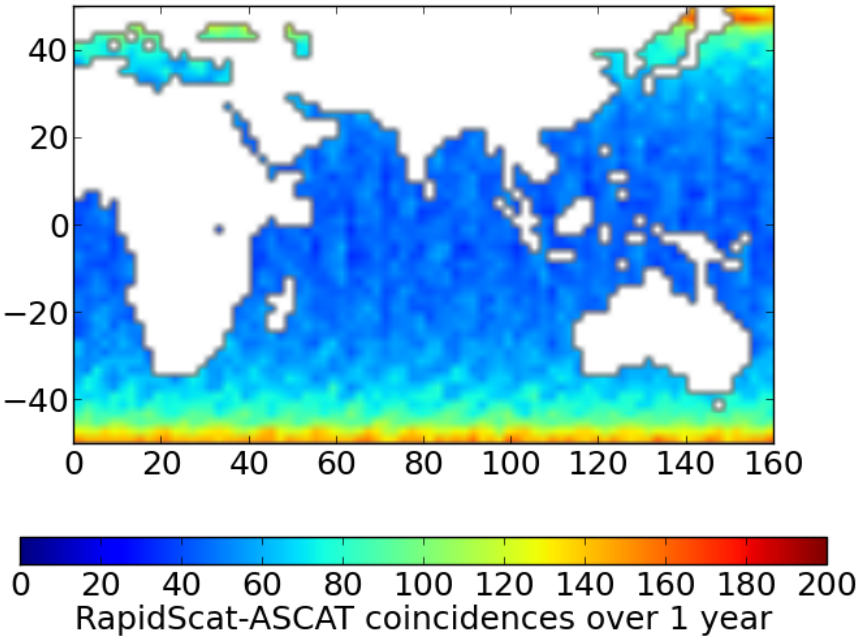


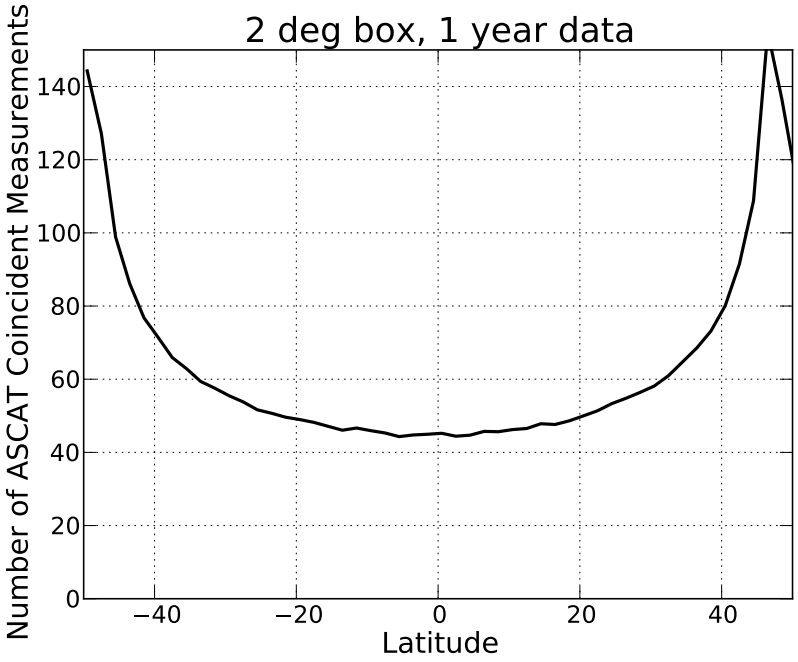
Percent coverage for latitude 10-20 deg latitude (solid) and 20-40 deg latitude (dashed) for 3 scatterometers: ASCAT (blue), ERM ISS option (black), ERM GCOM-W2 option (red).



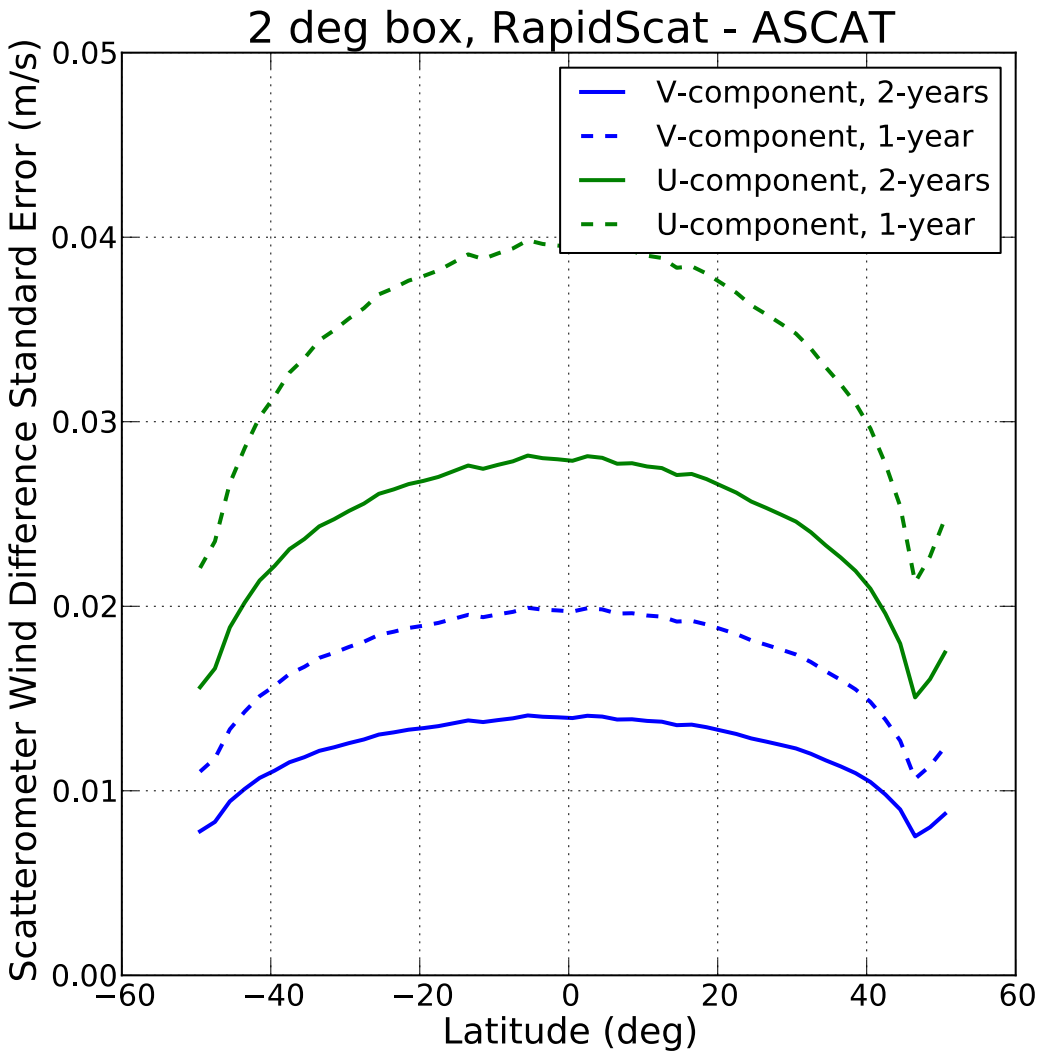
Percent coverage for latitude 10-20 deg latitude (solid) and 20-40 deg latitude (dashed) for the ISS (black) and GCOM-W2 (red) options when considered as part of a constellation with ASCAT.

RapidScat-ASCAT Collocations
1 year of data collection



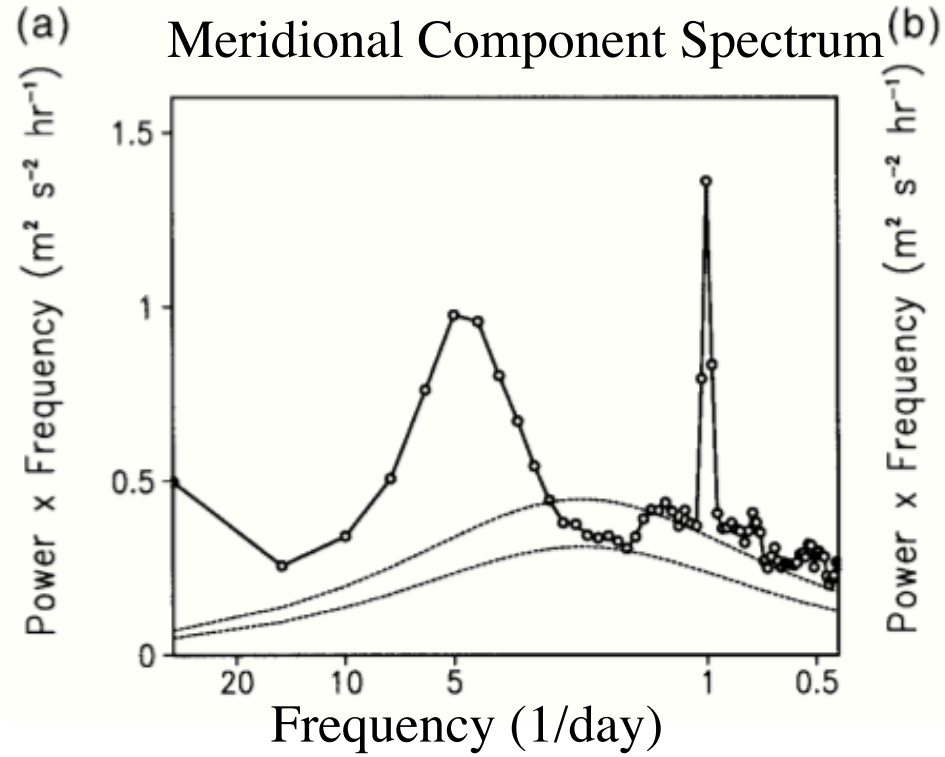


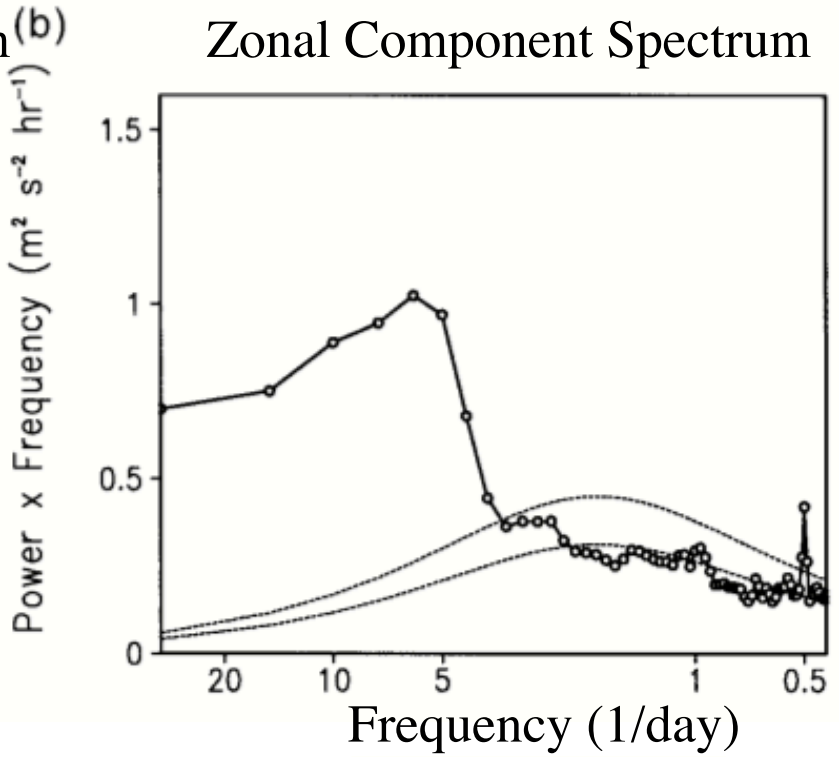
Expected Standard Errors



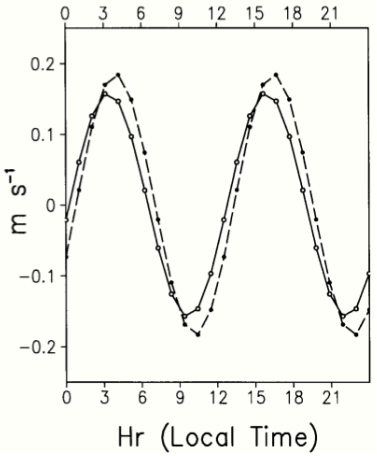
Assumption: noise measurements are uncorrelated every 25 km.

Buoy Diurnal and Semi-Diurnal Cycles

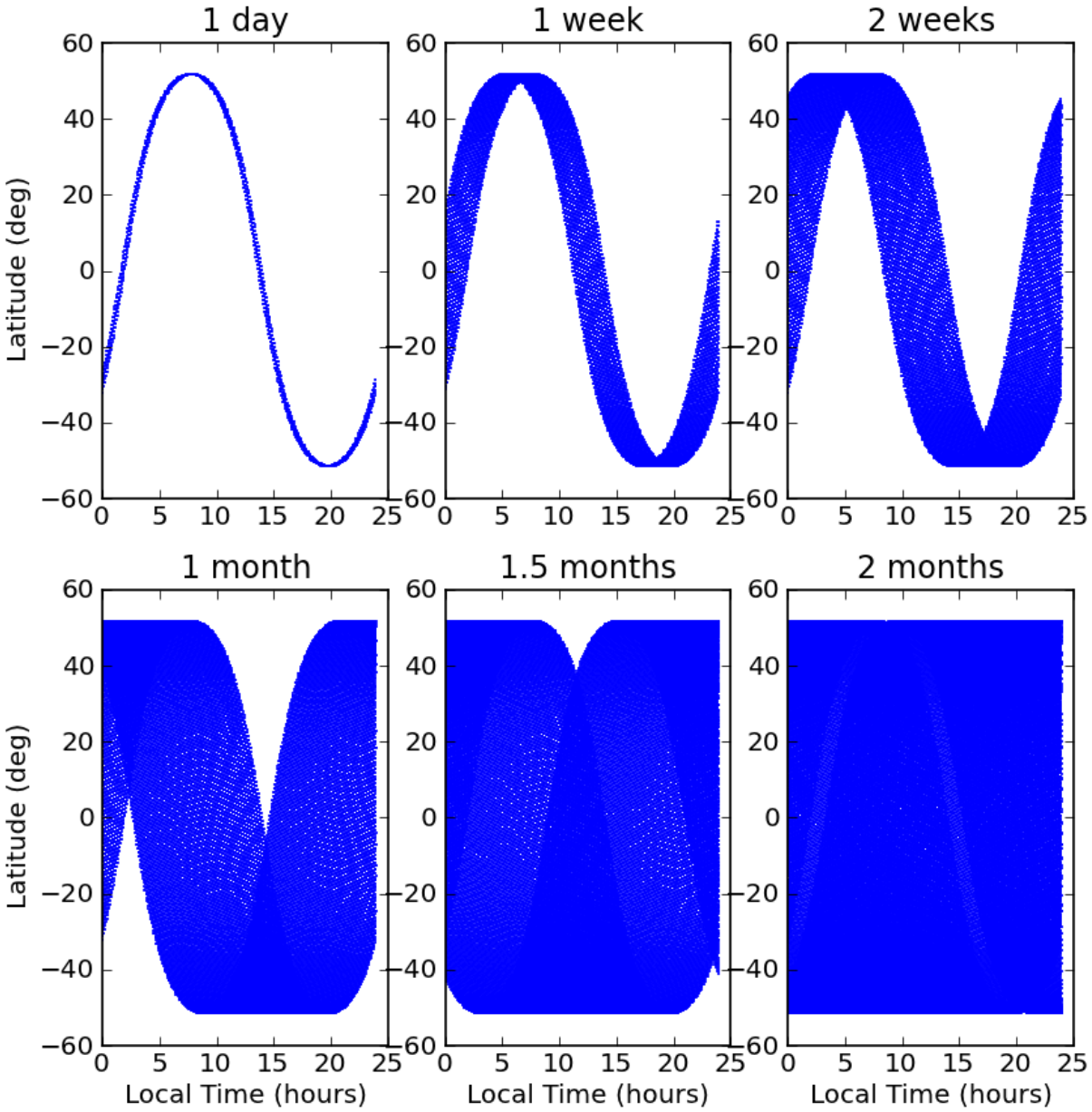




C. Deser and C. Smith, "Diurnal and semidiurnal variations of the surface wind field over the tropical pacific ocean," *Journal of Climate*, vol. 11, no. 7, pp. 1730–1748, 1998.

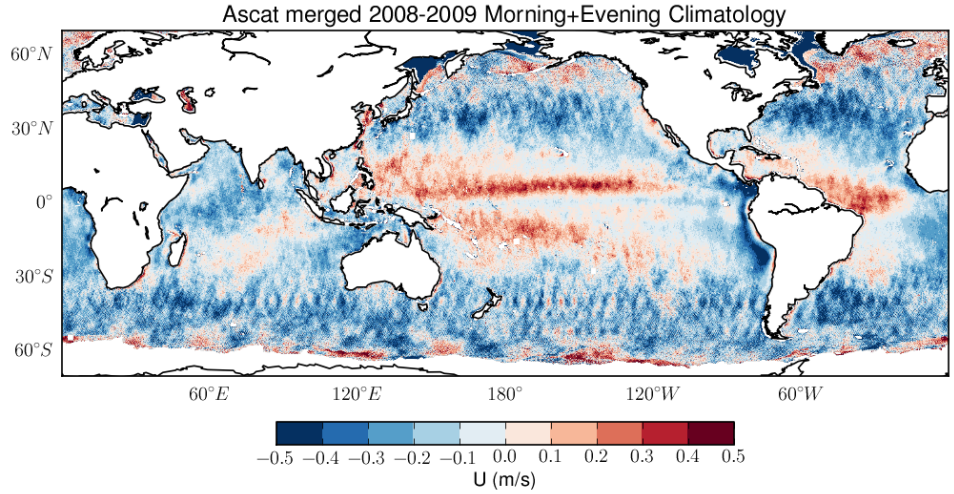


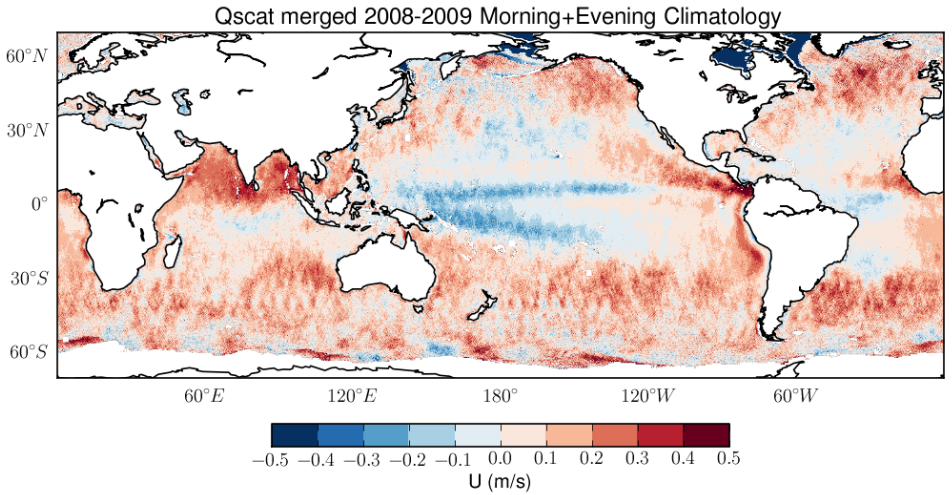
Mapping of the Diurnal Cycle

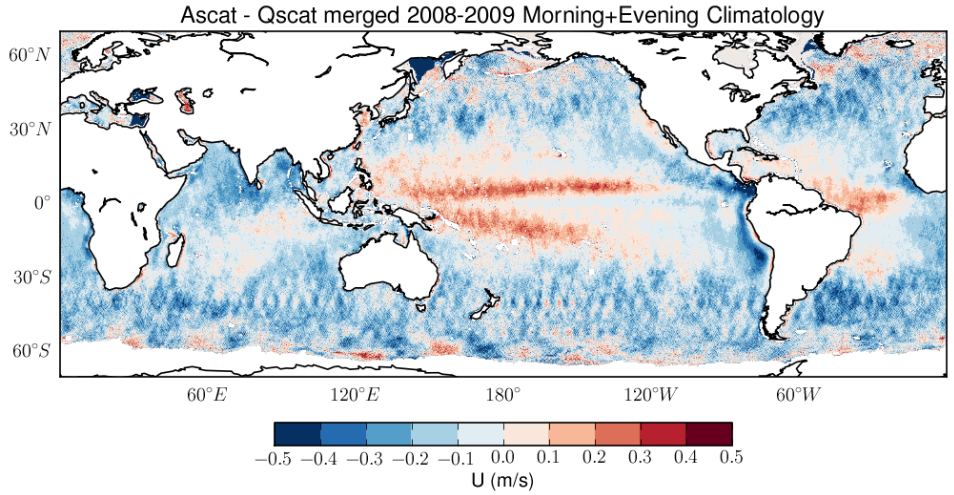


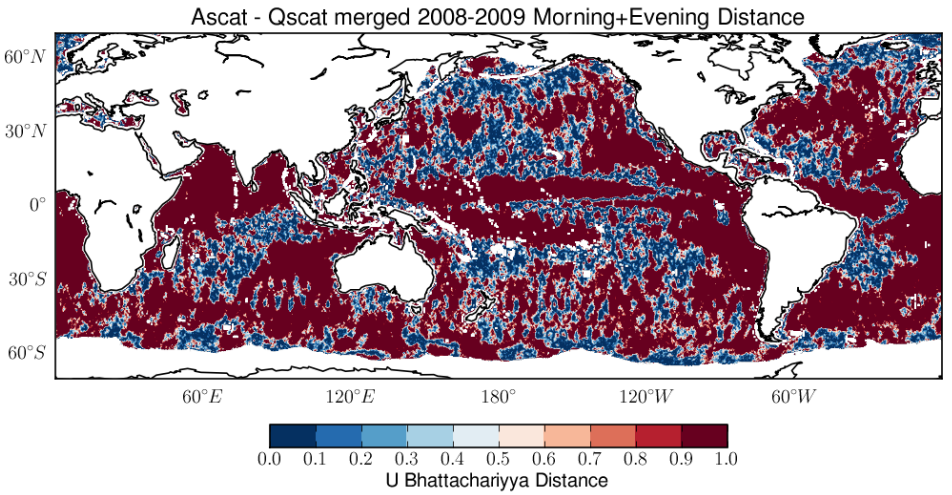
- Mapping the diurnal and semi-diurnal cycles requires, at a minimum, sampling every 6 hours in local time.
- The local time sampling characteristics of the ISS are to revisit the same latitude at slightly different local times each orbit.
- To fully sample the diurnal and semi-diurnal cycles once globally requires at least 2 months of data.
- To estimate diurnal and semi-diurnal cycles accurately, on the order of 10 sets of observations (~2 years) will be required.

QuikSCAT vs ASCAT
U component

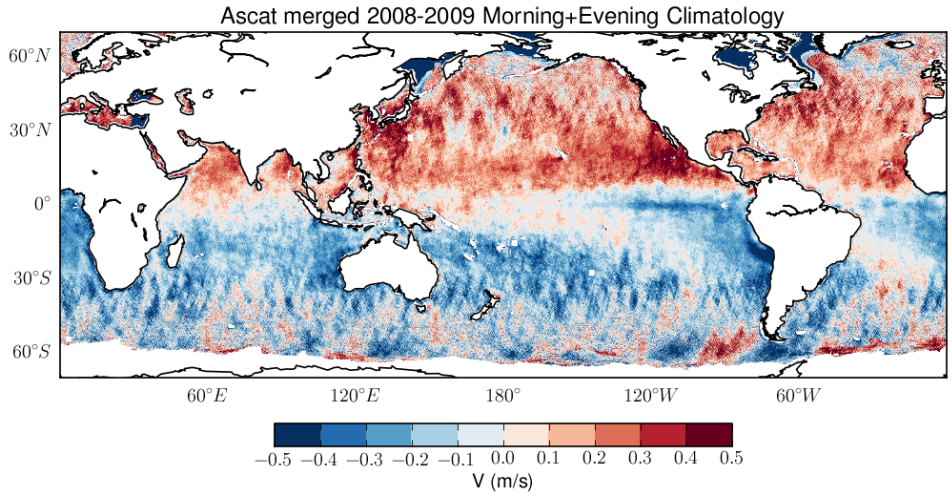


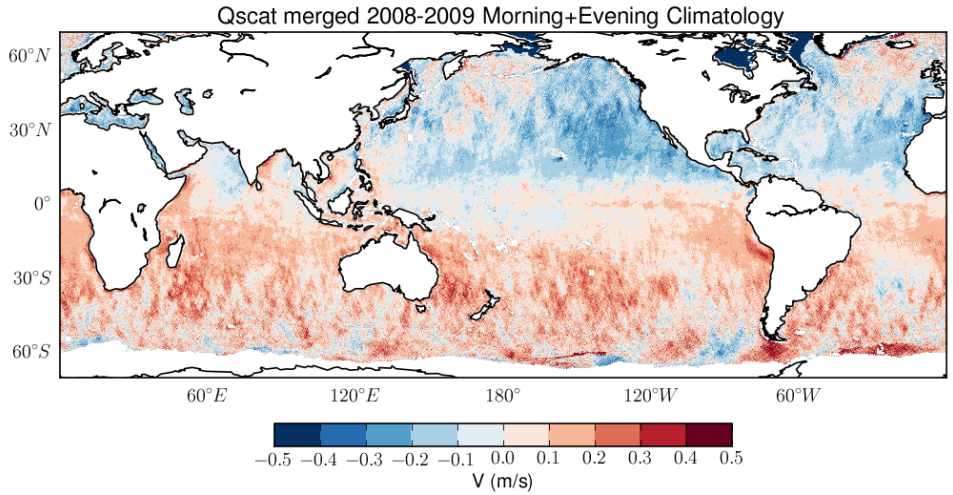


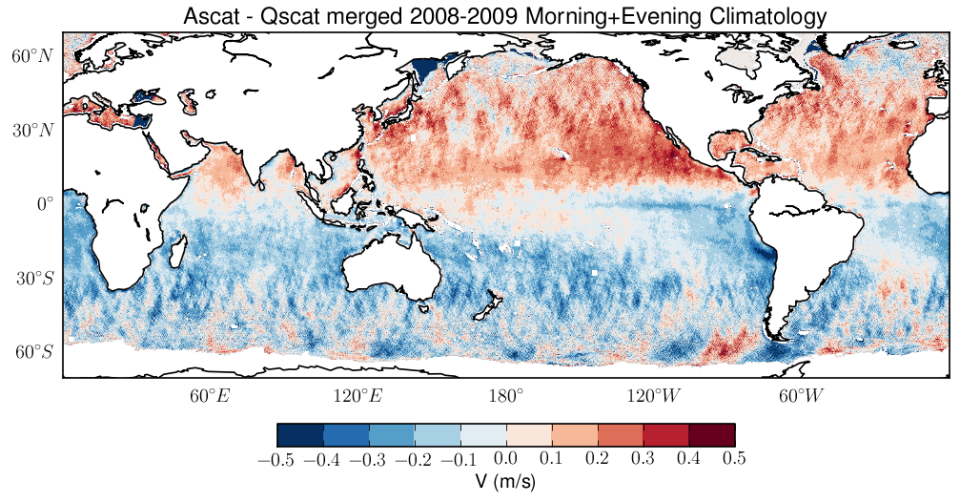


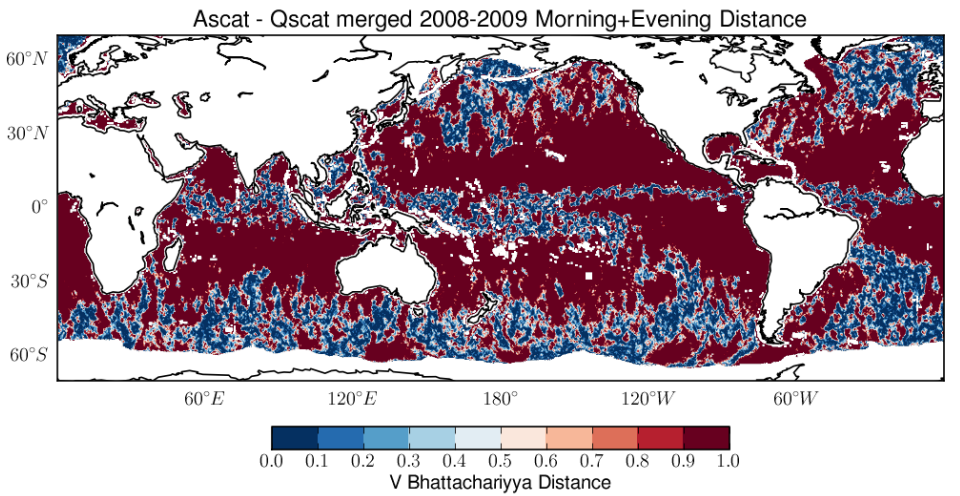


QuikSCAT vs ASCAT
V component

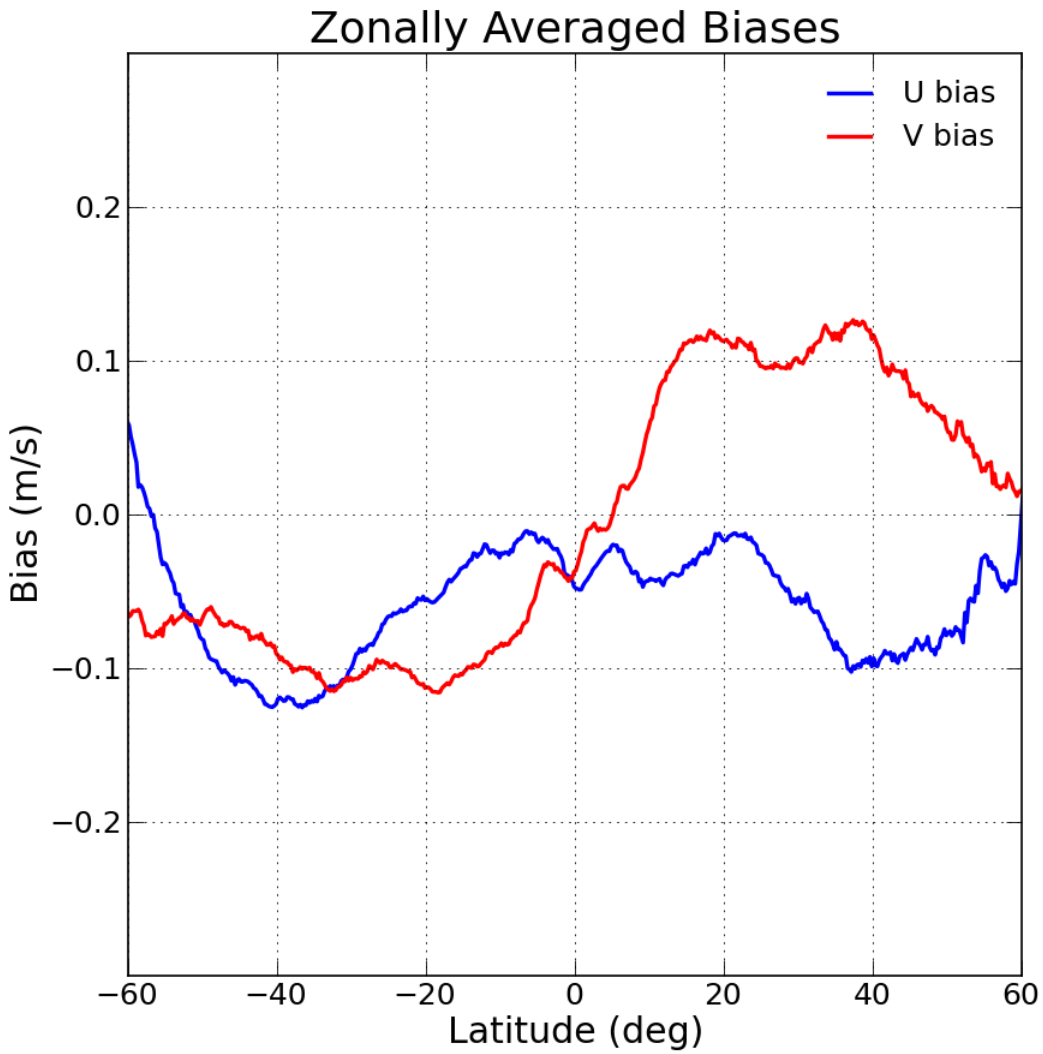








Zonally Averaged Differences



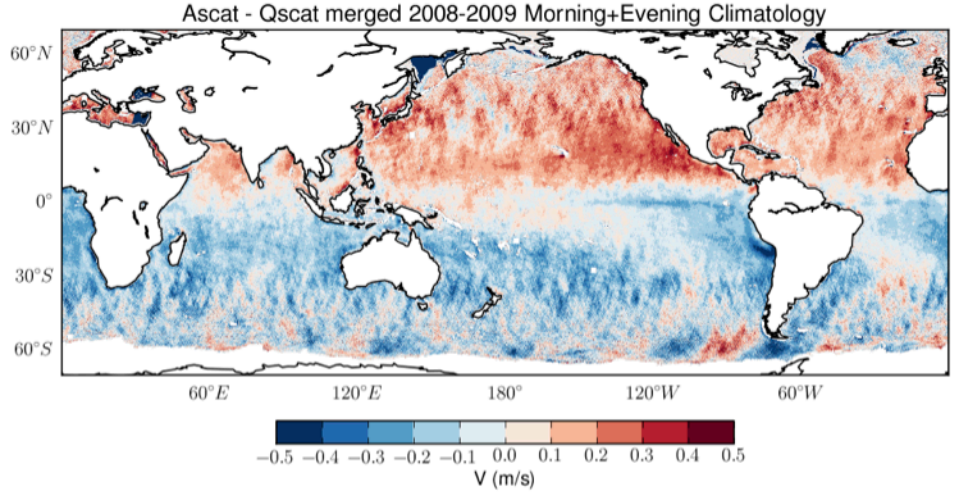
ISS Offers Platform for Evaluating Diurnal Variability and Climatology

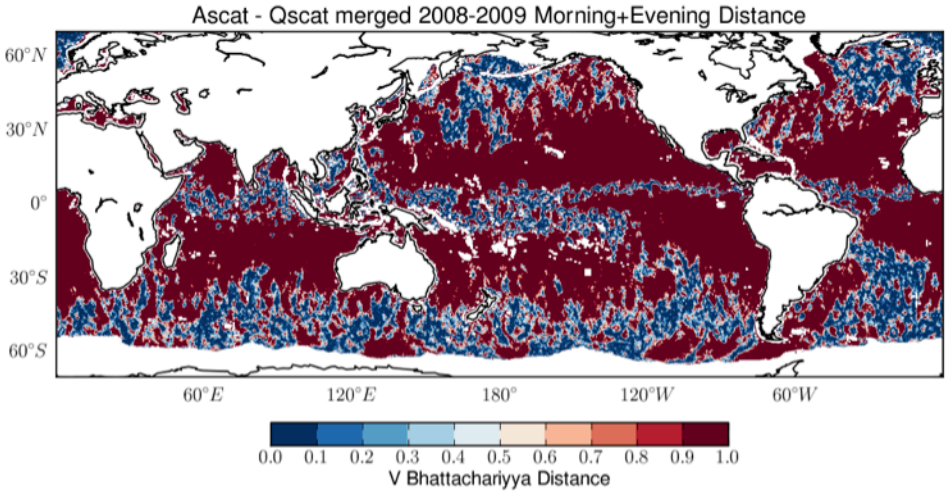
Question:

- Different sun synchronous scatterometers yield very different yearly average wind signatures. Is it due to calibration differences or systematic sampling differences?
- Can significant differences in the QuikSCAT and ASCAT climatologies be explained as contributions due to diurnal or semi-diurnal variability?
- What is the geographical distribution of diurnal and semi-diurnal winds and tropical forest backscatter and how does it influence important climate mechanisms?

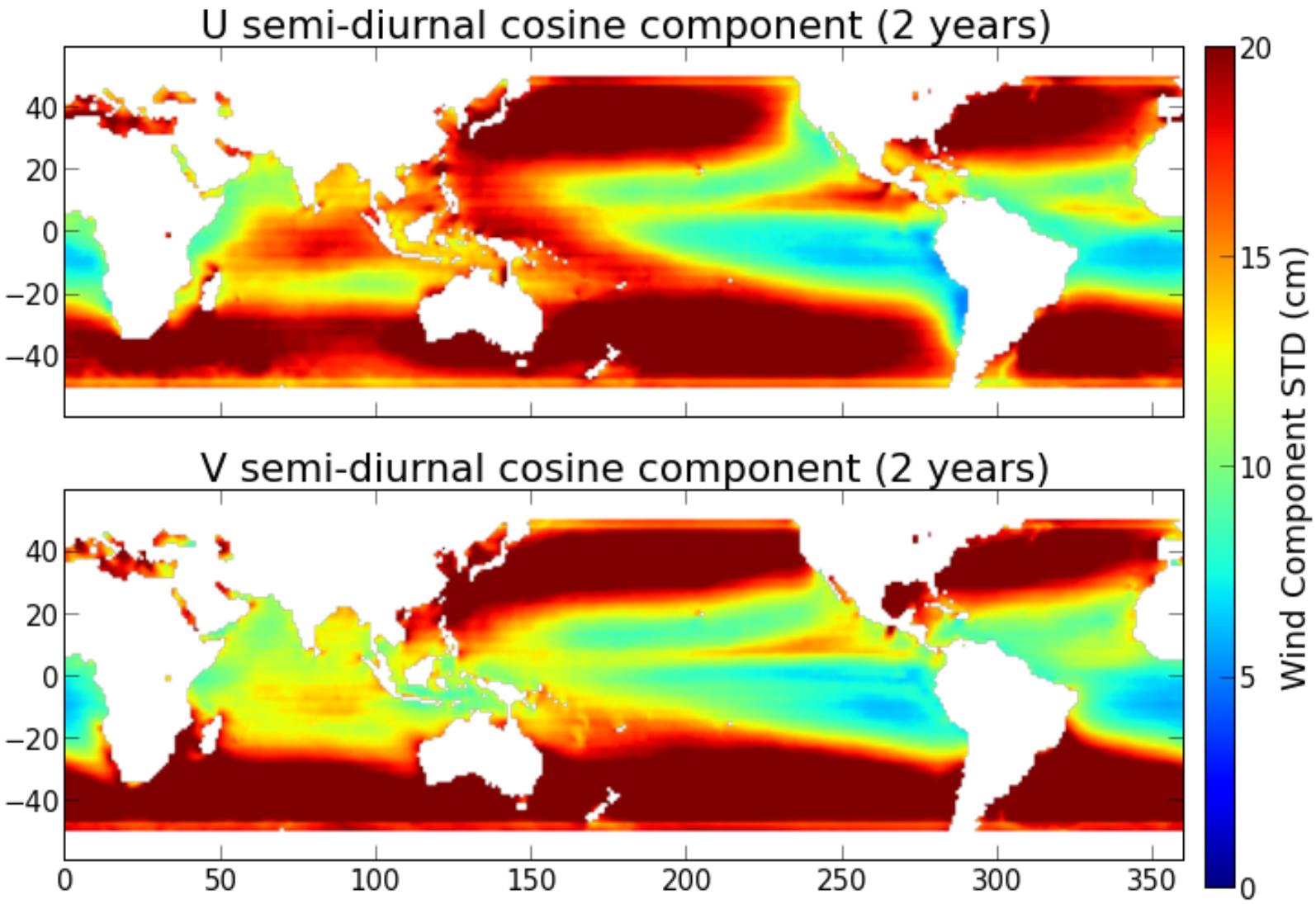
ISS Contribution:

- Resolving systematic subdiurnal variability requires multiple scatterometers in synchronized sun-synchronous orbits or a single scatterometer on a non-sun-synchronous platform such as ISS
- ISS provides an excellent platform for diurnal and semi-diurnal observations:
  - *Semi-diurnal variability estimates requires on the order of 3-4 sun-synchronous scatterometers*
  - *The ISS orbit oversamples the diurnal and semi-diurnal cycles allowing unambigous retrievals*
- The ISS orbit samples the tropics better than sun-sync scatterometers.



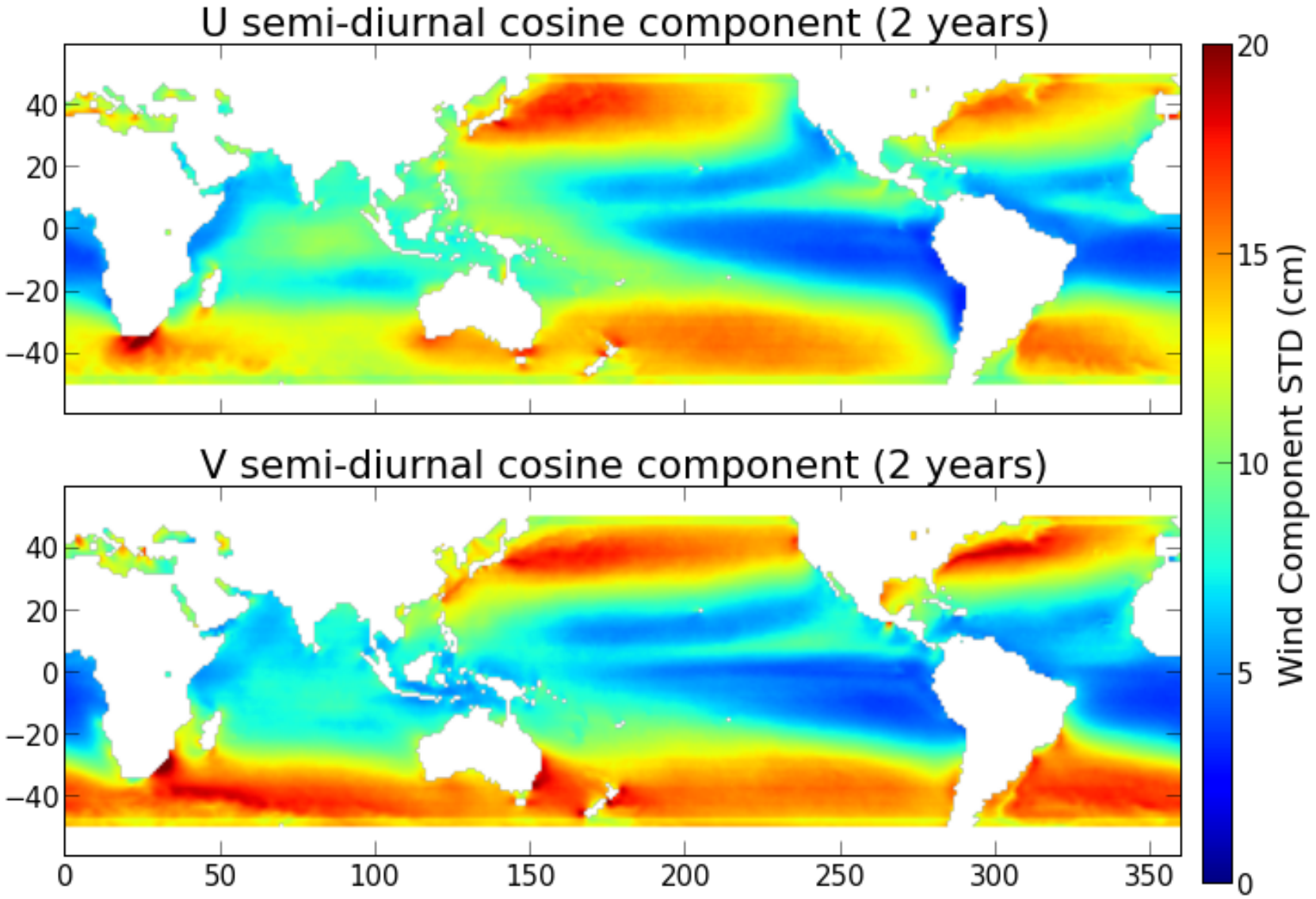


Semi-Diurnal Errors (RapidScat only)



Diurnal and sine errors are similar

Semi-Diurnal Errors (RapidScat/ASCAT/OSCAT Combined)



Diurnal and sine errors are similar