Summary of Science Thoughts for Possible Future NASA Mission 2

- Decadal and longer climate variability
- Diurnal and sub-diurnal variability and constellation cross-calibration
- Synergy with other measurements

Importance of OVW for Climate Studies

- Ocean Vector Winds (OVW) are recognized by the Global Climate Observing System (GCOS) as an essential climate variable, and monitoring decadal trends will yield important information about the mechanisms underlying climate change.
- In order to meet the GCOS requirements and to be able to identify trends, consistent, cross-calibrated time series of Ocean Vector Winds are required than can capture the observed and expected trends in Ocean Vector Winds

The Challenge of Climate Observations

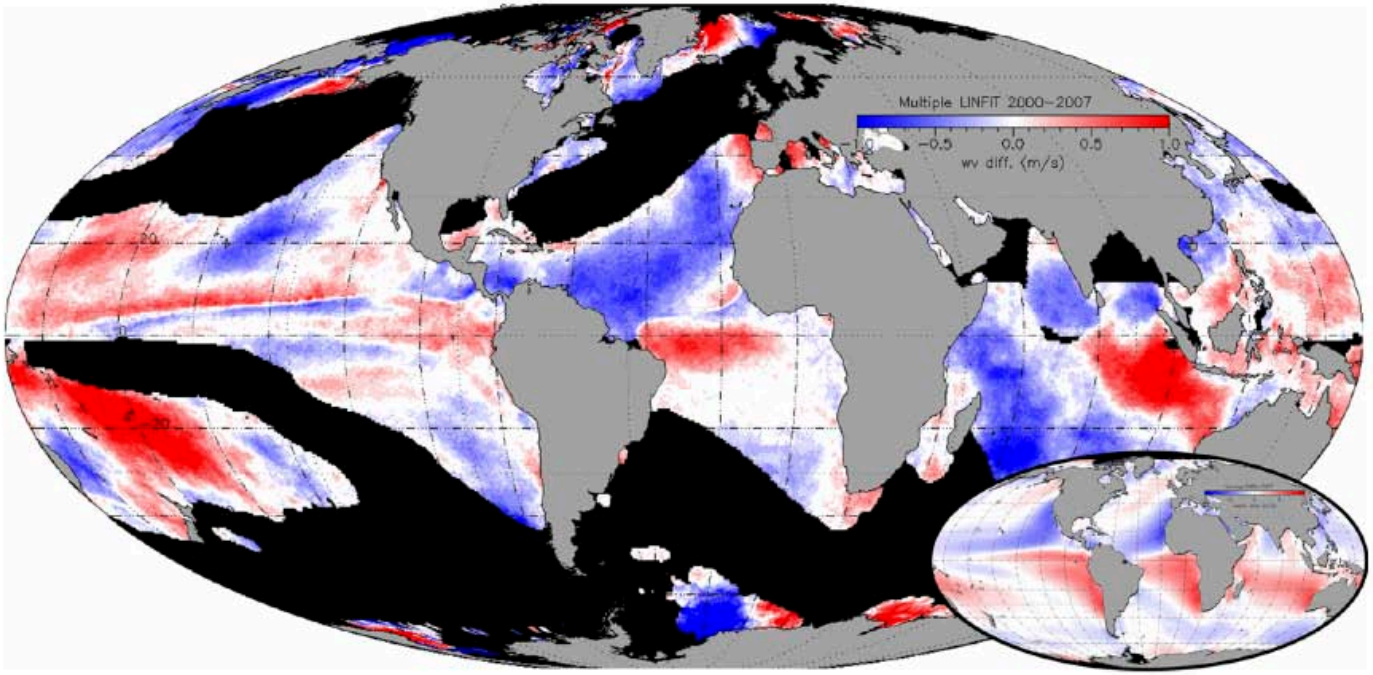
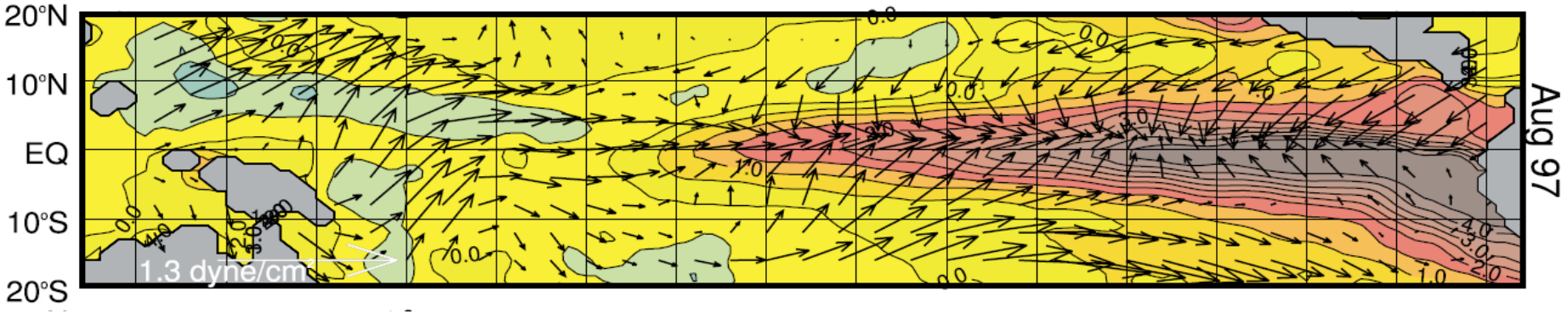


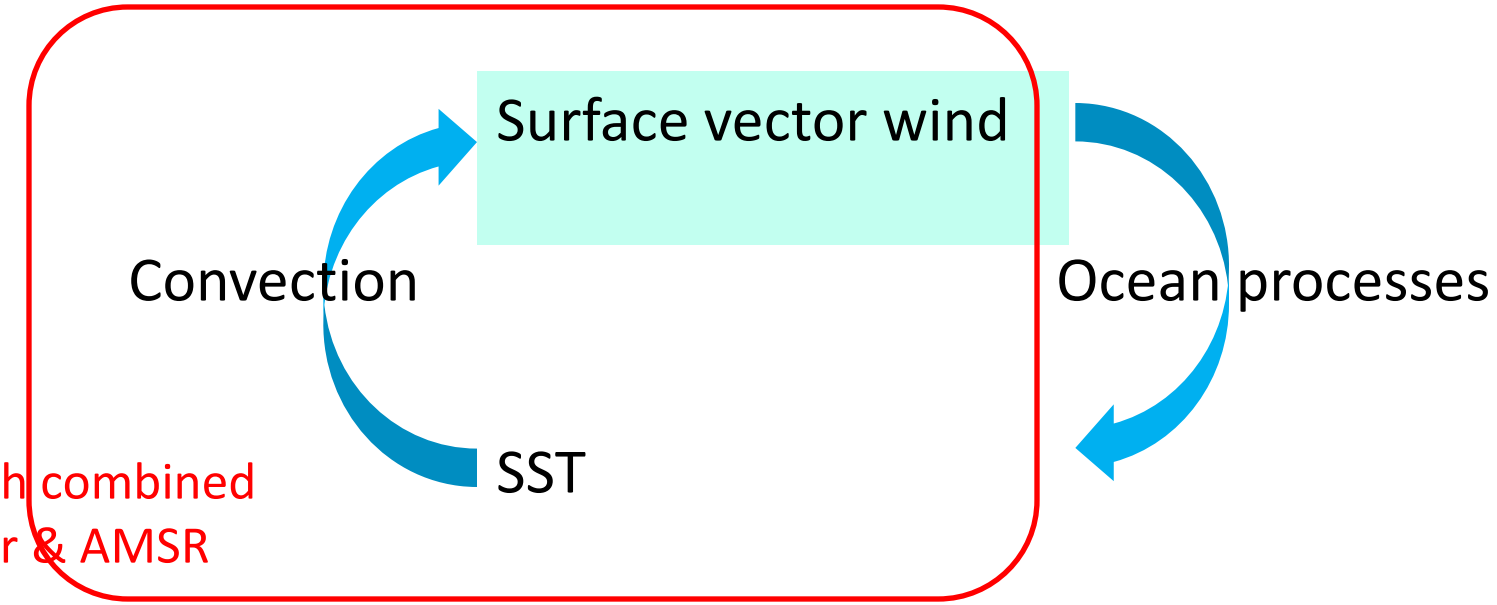
Fig. 2. Trends in the equatorward component of the wind speed at the sea surface from QuikSCAT data from 2000 to 2007 and average meridional wind component (insert). Areas with average poleward component are shown in black.

The challenge of climate observations resides in having consistent observations without global drifts over periods of decades. Observations show regional variations < 1m/s/decade.

Wind-SST interactions over warm ocean

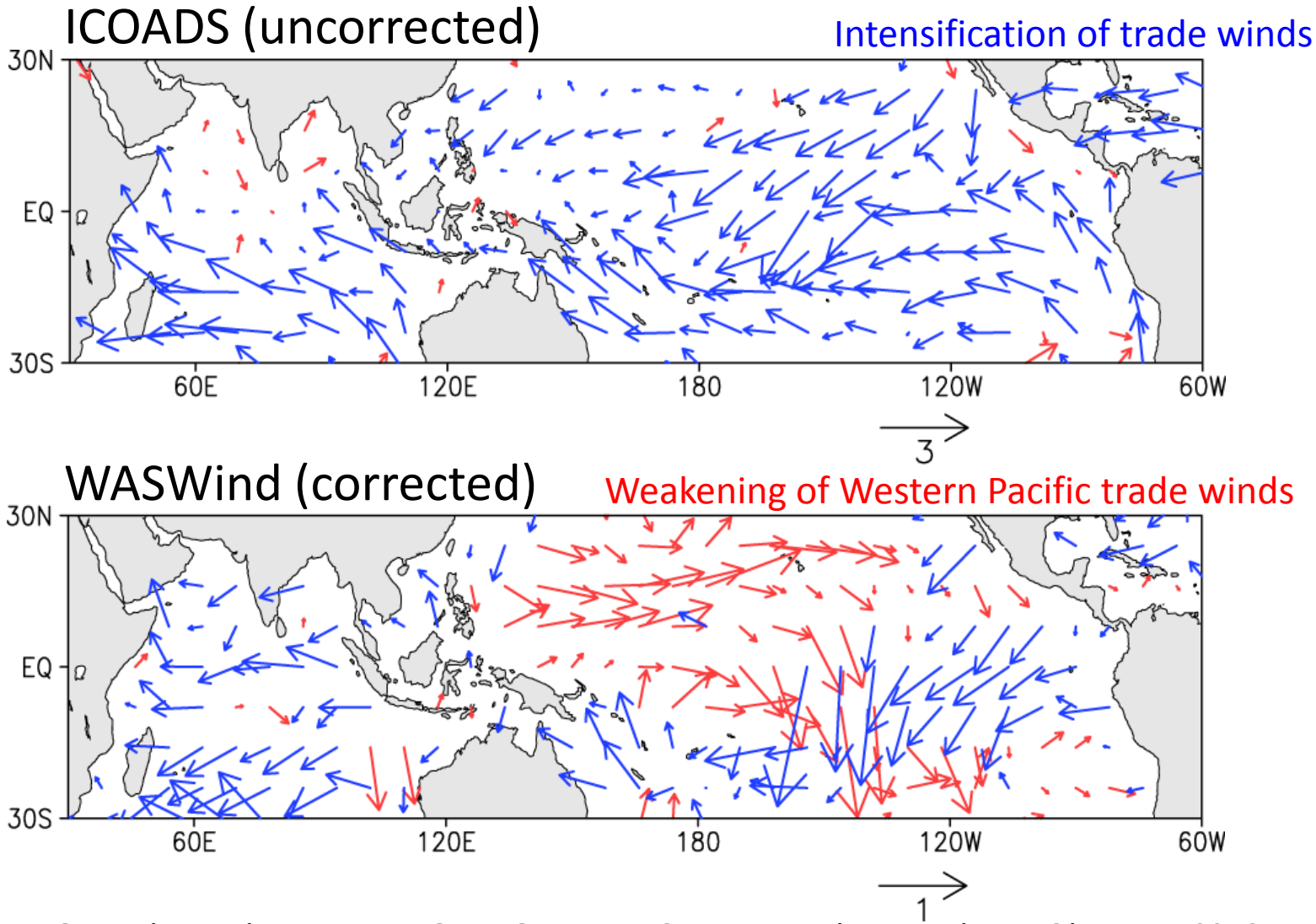


SST anomaly (colors) and SSM/I wind stress anomalies (vectors) for August 1997. Picaut et al. (2002, JGR)



Observed with combined scatterometer & AMSR

Climate Change: Surface wind (1950-2008)



Tokinaga, H., S.-P. Xie, A. Timmermann, S. McGregor, T. Ogata, H. Kubota, and Y.M. Okumura, 2012: Regional patterns of tropical Indo-Pacific climate change: Evidence of the Walker Circulation weakening. *J. Climate*, in press.

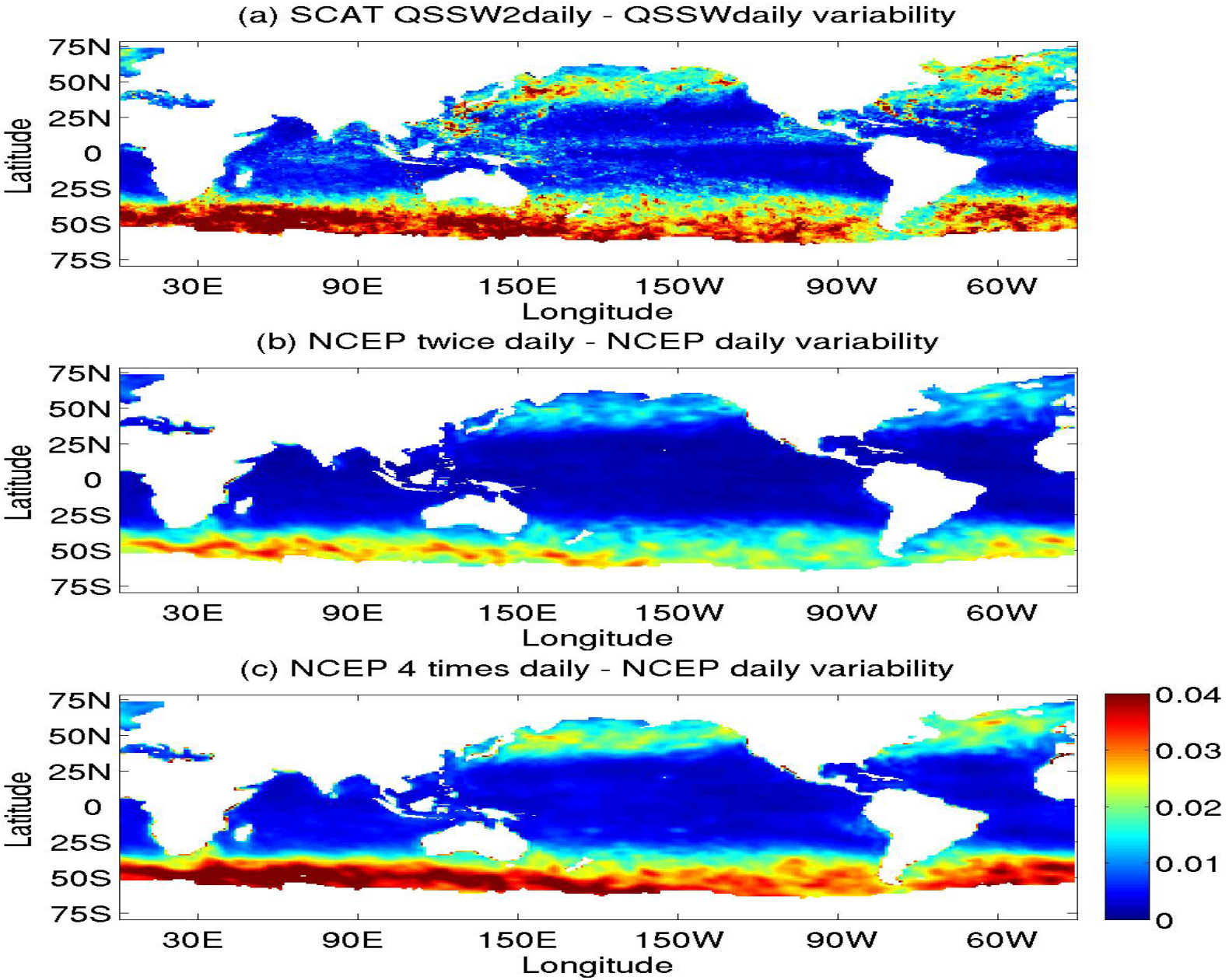
Importance of diurnal ocean-atmosphere coupling to tropical climate

- Various coupled model studies contrasting daily coupling and diurnal coupling (every 1-3 hours) suggest that diurnal air-sea interaction affects
  - mean state,
  - seasonal cycle,
  - interannual variability,
  - intraseasonal variability.
- Diurnal measurements are sparse, esp. coincident measurements of atmospheric and oceanic variables. Coincident satellite measurement of OVW and SST would improve the understanding and prediction of tropical climate variability and change, e.g., by evaluating, constraining, and improving climate models.

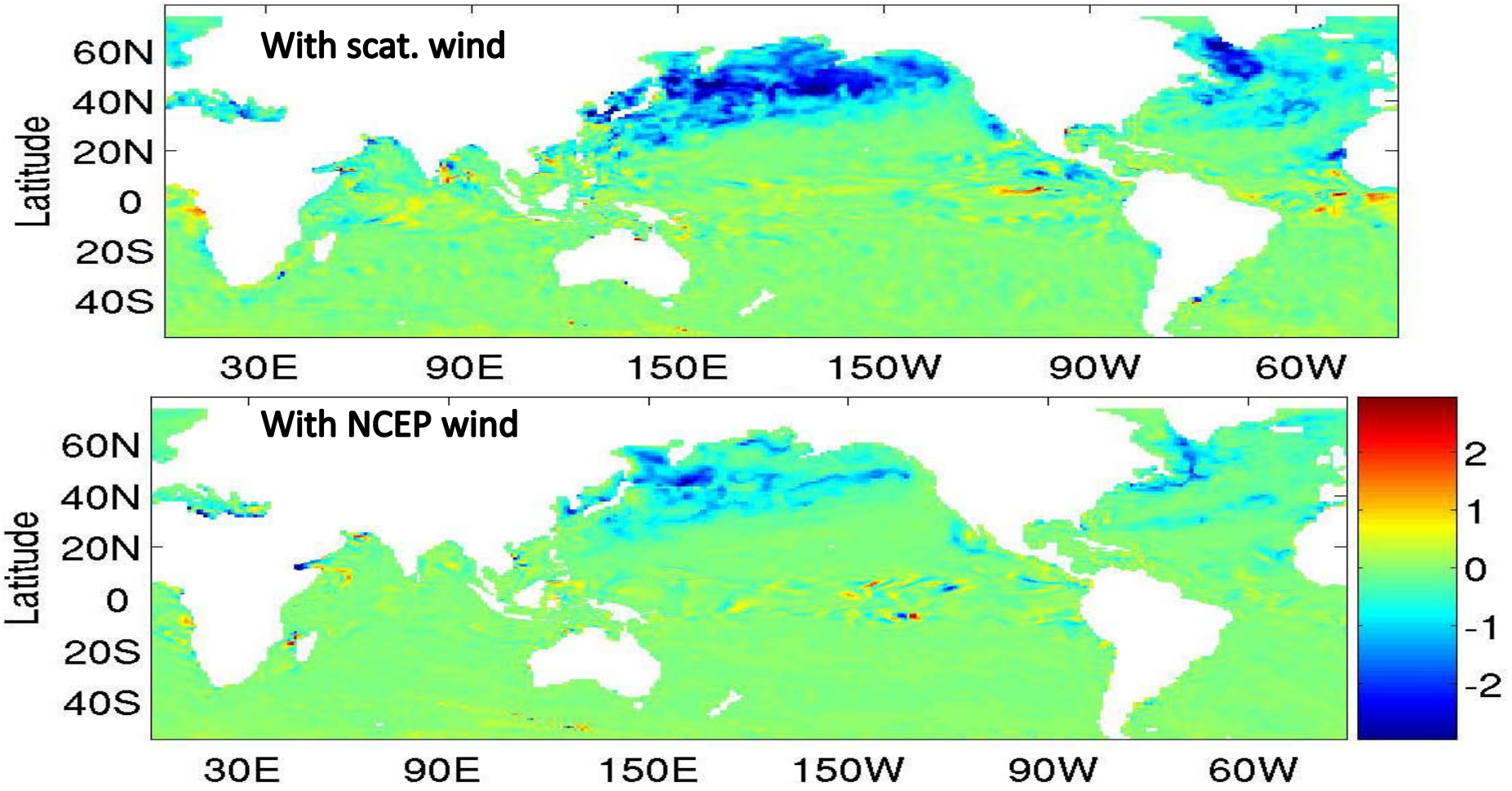
Importance of the sub-daily forcing for mid-latitude oceans

- Mid-latitude inertial oscillation in the ocean have sub-daily/diurnal frequencies.
- These oscillations provide a major mechanism of upper-layer mixing.
- Diurnal forcing is thus important to mid-latitude ocean.

Enhancement of variability due to increased (sub-daily) sampling



SST difference with twice-daily & daily winds (08/2003)



- Impact on SST is significantly larger than SST error.
- Impact with scat. wind is substantially larger than that with NCEP wind.
- Consistent with larger increase of scat. wind variability due to twice-daily sampling (previous slide).

TropSat Observatory

The TropSat Mission:

An Observatory for Mesoscale Convective System Processes in the Global Tropics

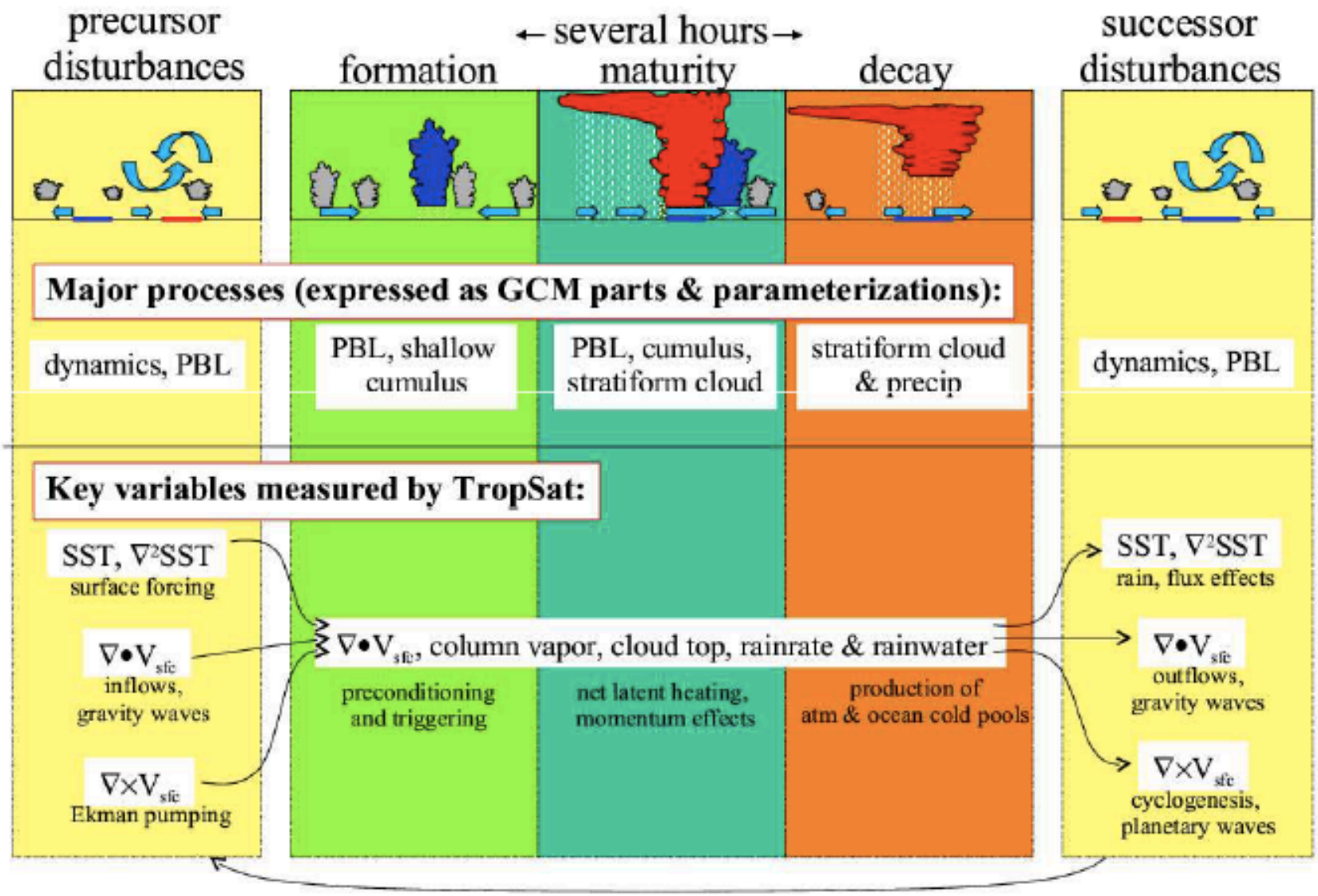
Ernesto Rodriguez
David G. Long
Ralph Milliff

19 Nov. 2008

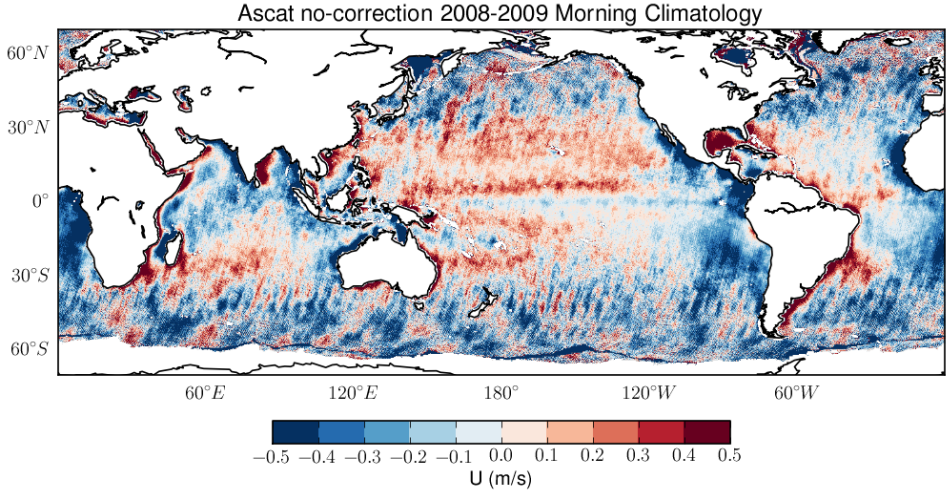
One possible TropSat configuration

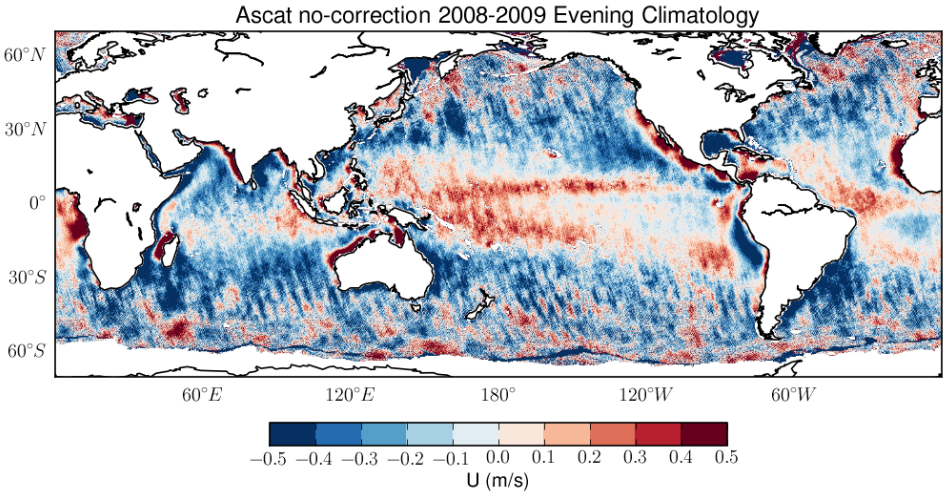
TropSat Observatory

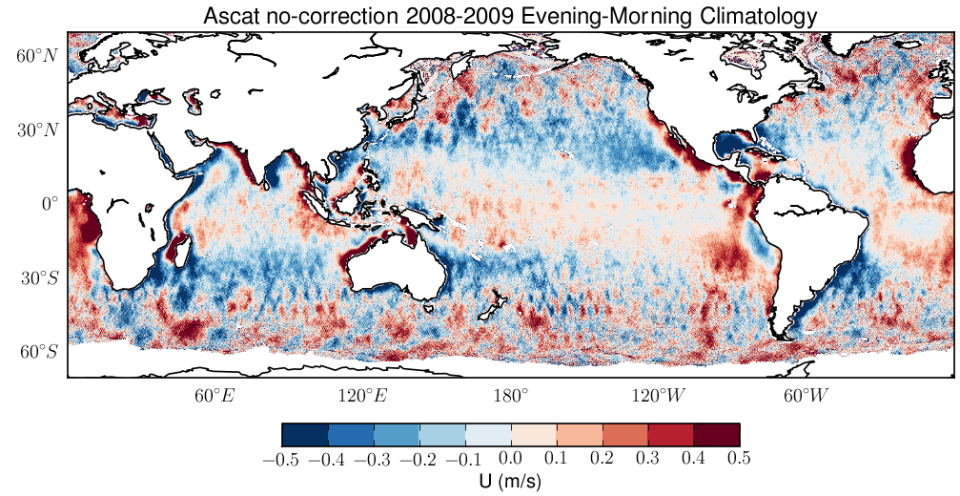
The Mesoscale Convective System (MCS) life cycle

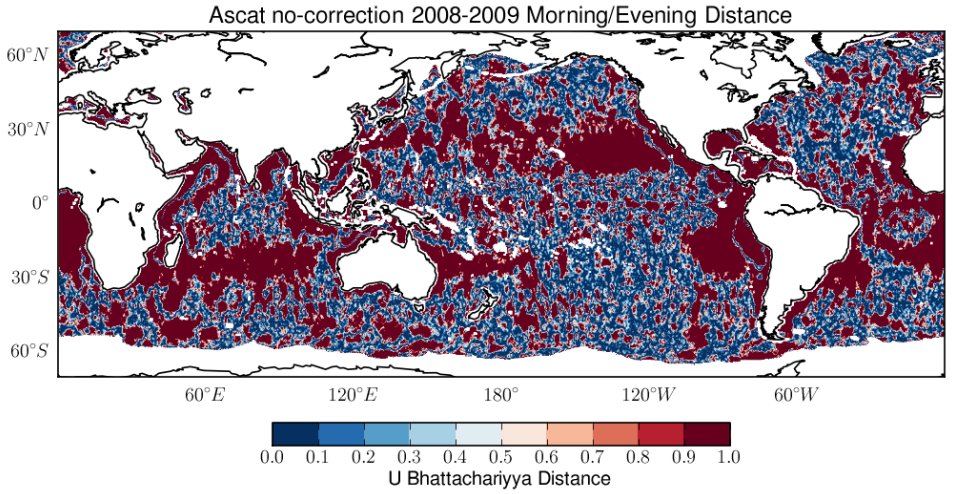


Ascat U component
Morning Evening Differences

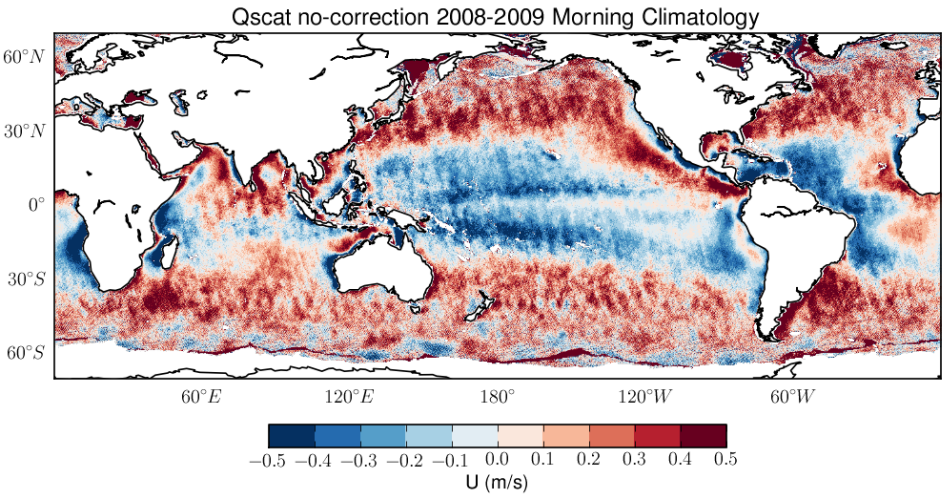


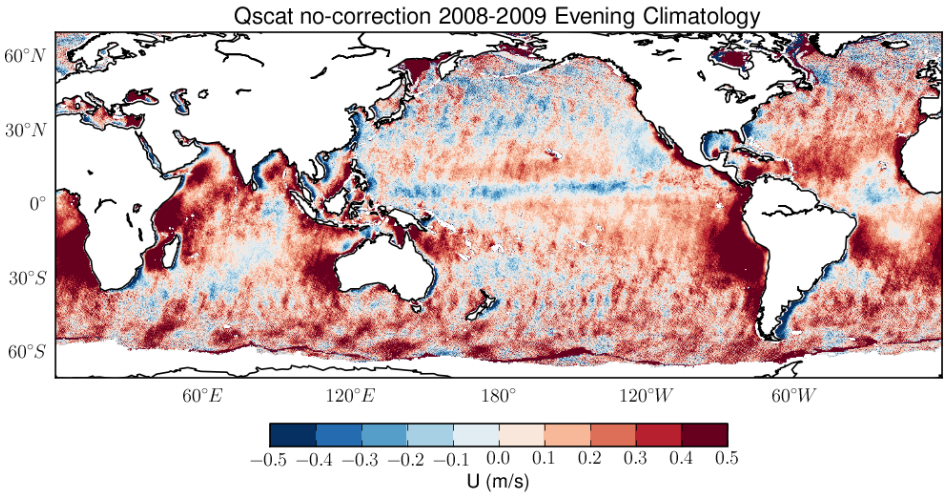


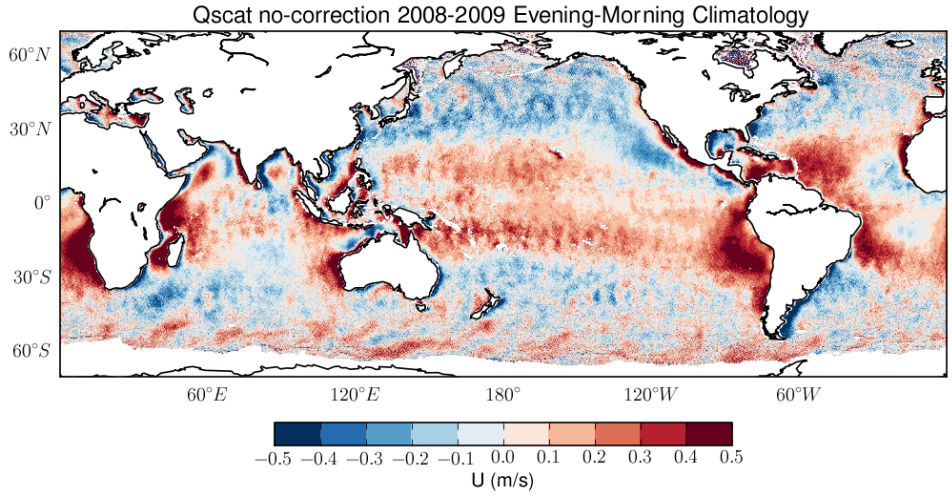


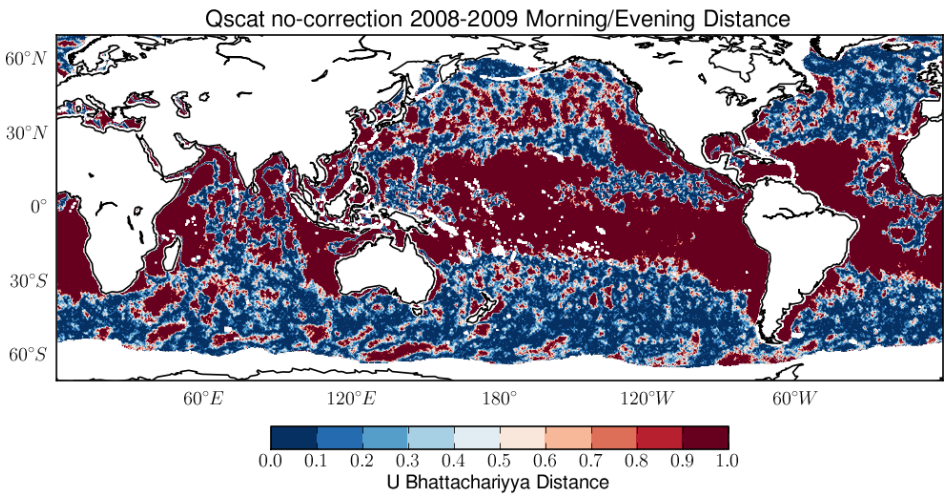


QuikSCAT U Component Morning Evening Differences

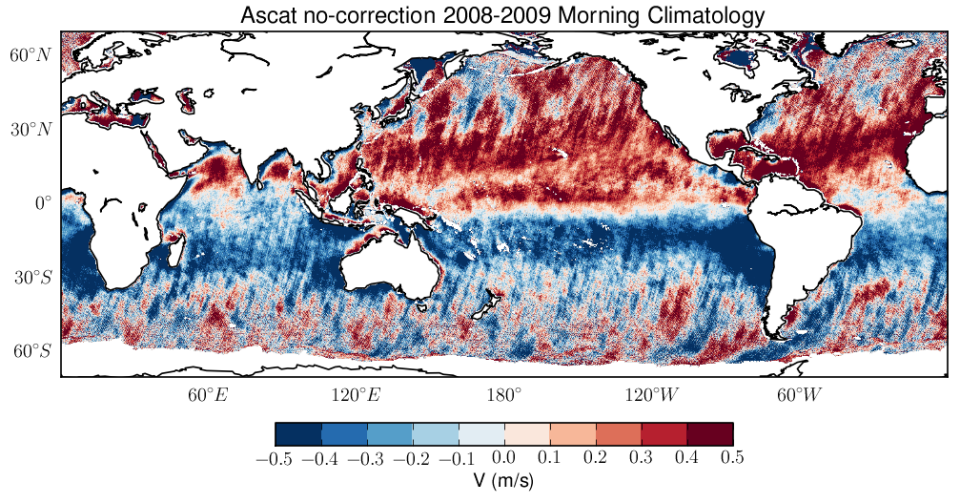


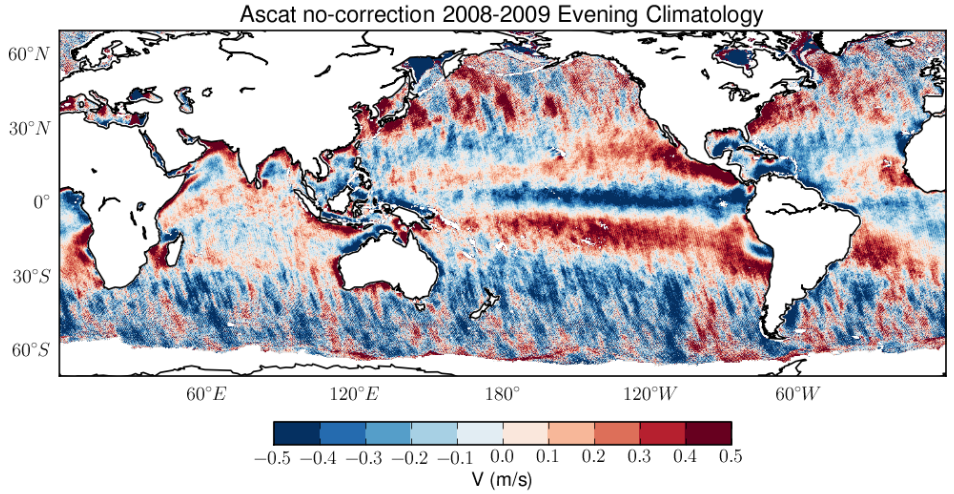


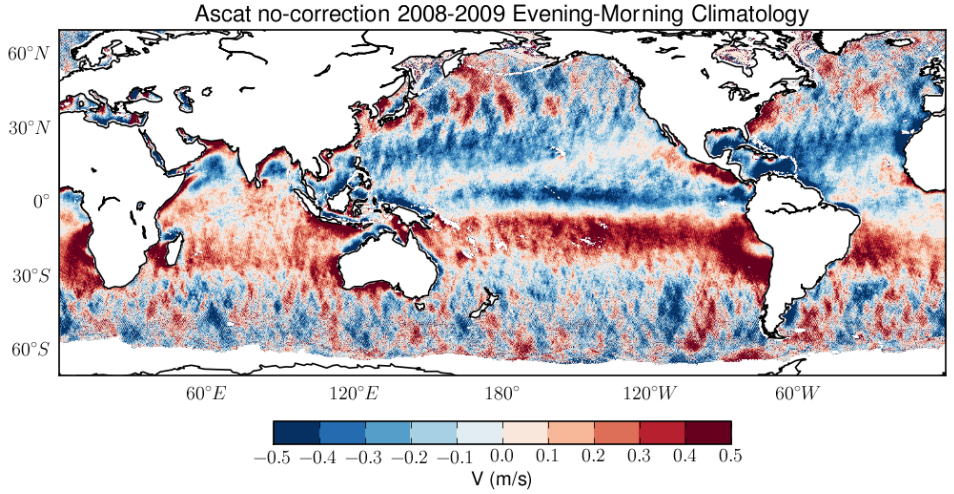


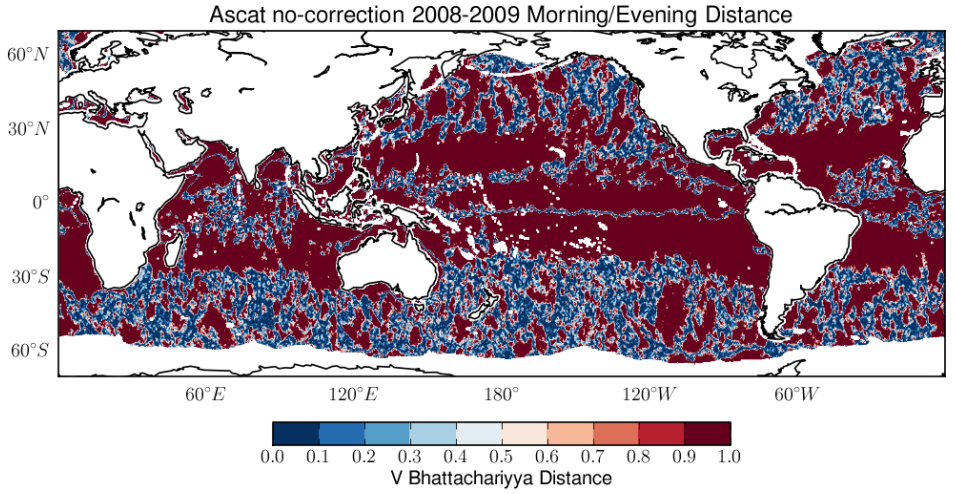


Ascat V Component
Morning-Evening Differences

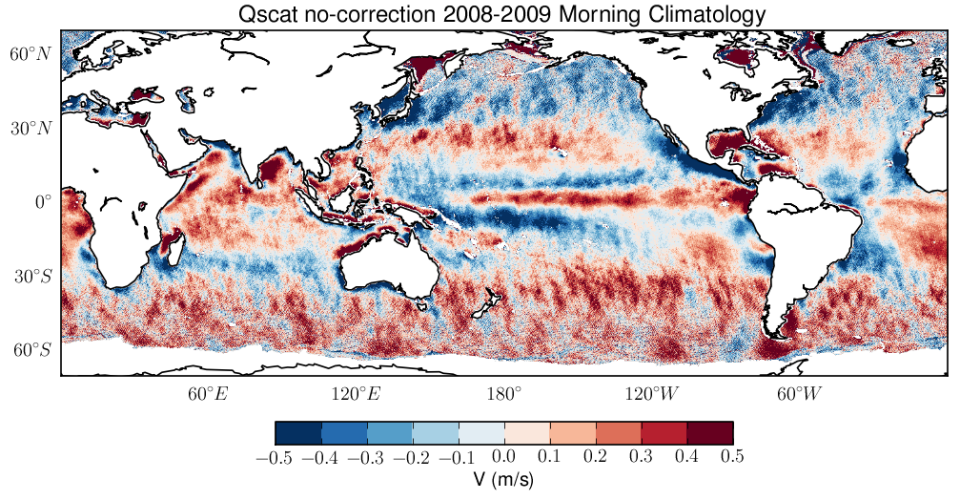


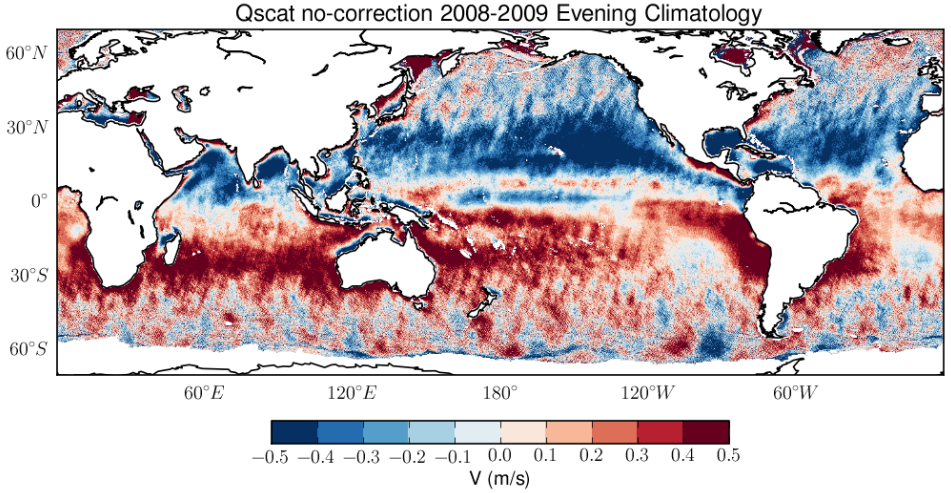


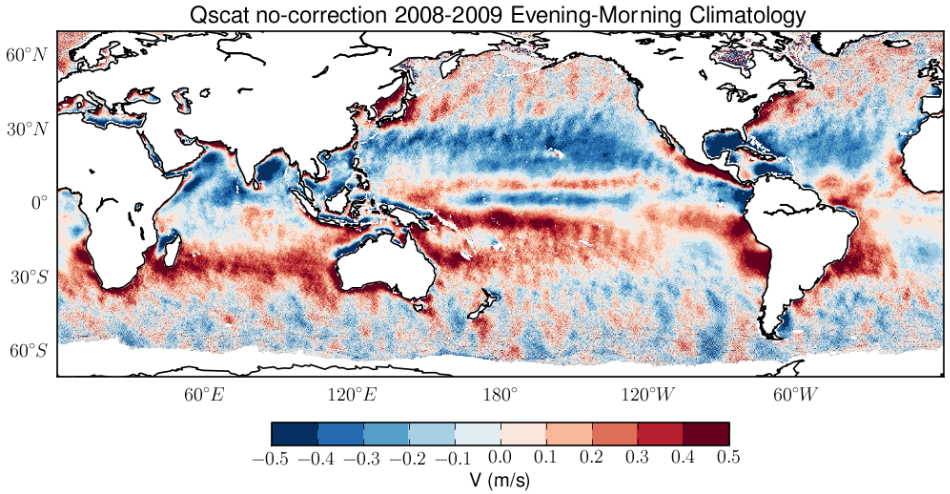


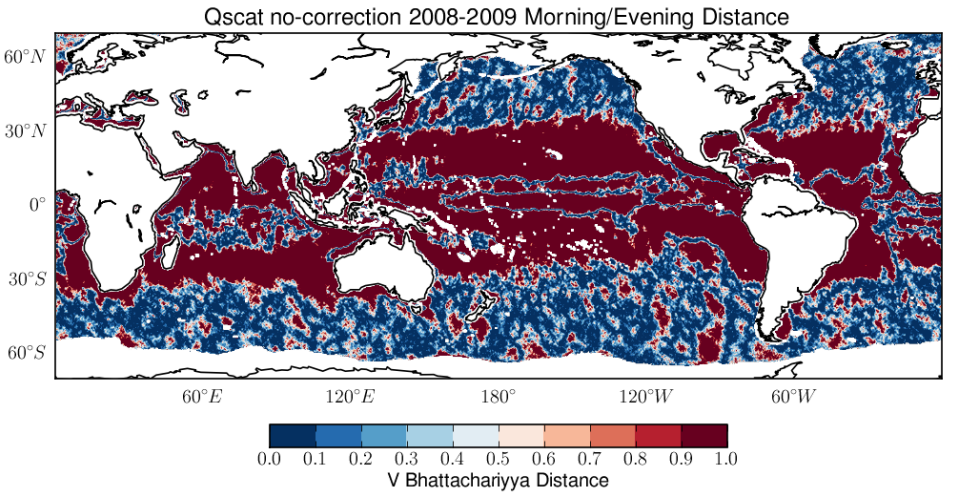


QuikSCAT V Component Morning-Evening Differences

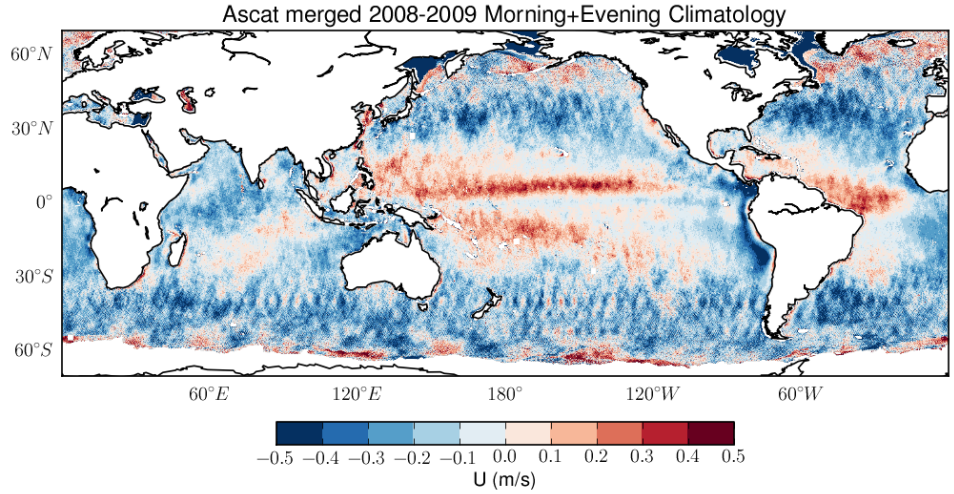


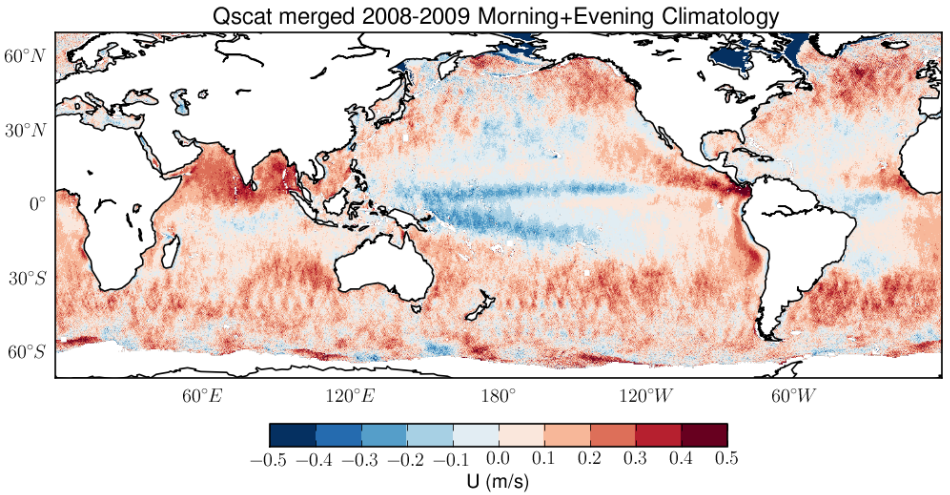


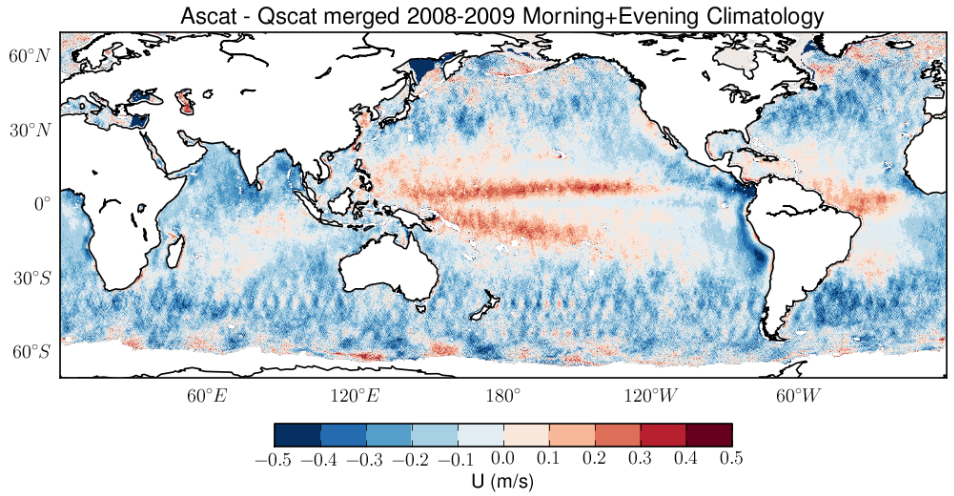


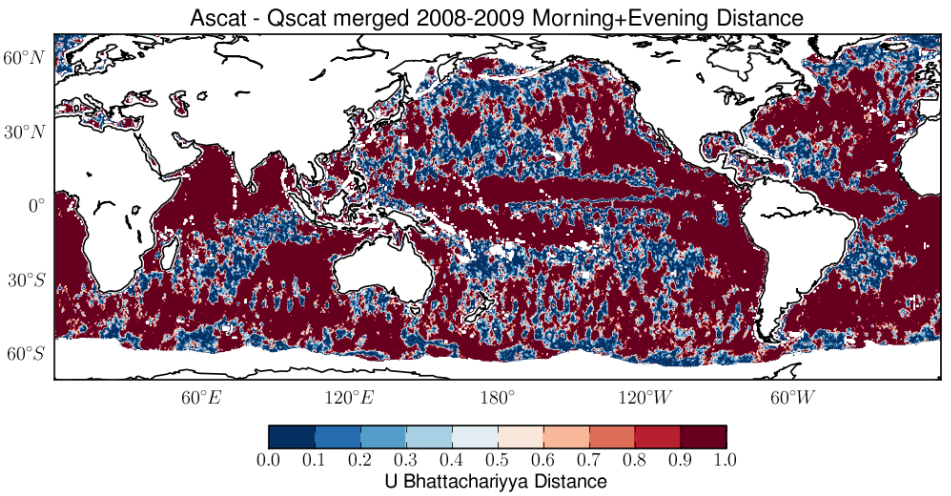


QuikSCAT vs ASCAT
U component

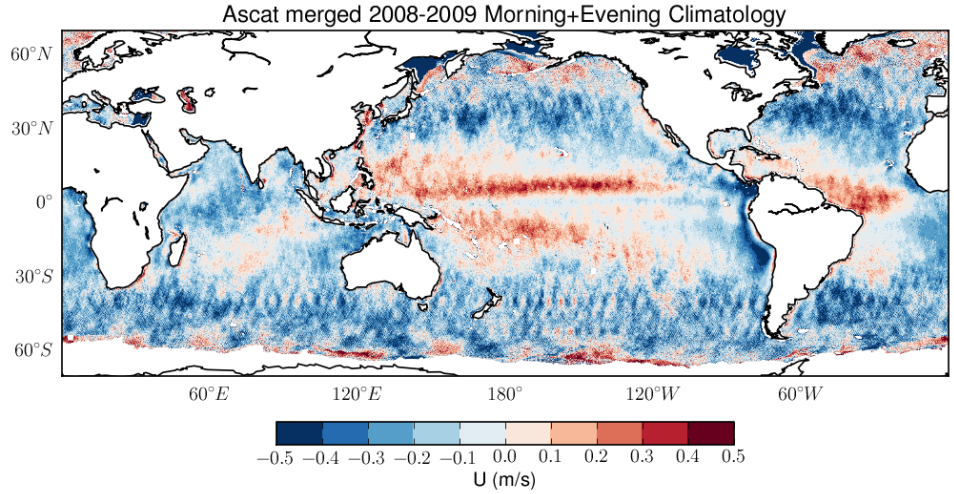


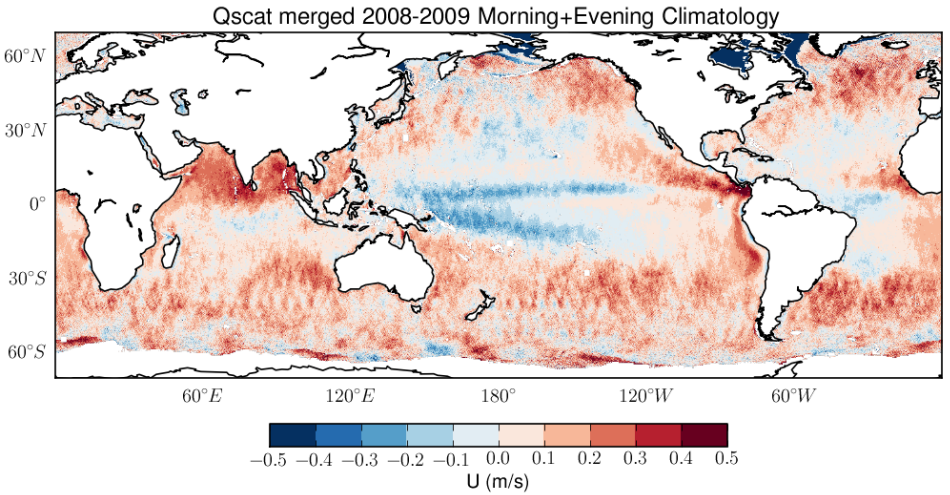


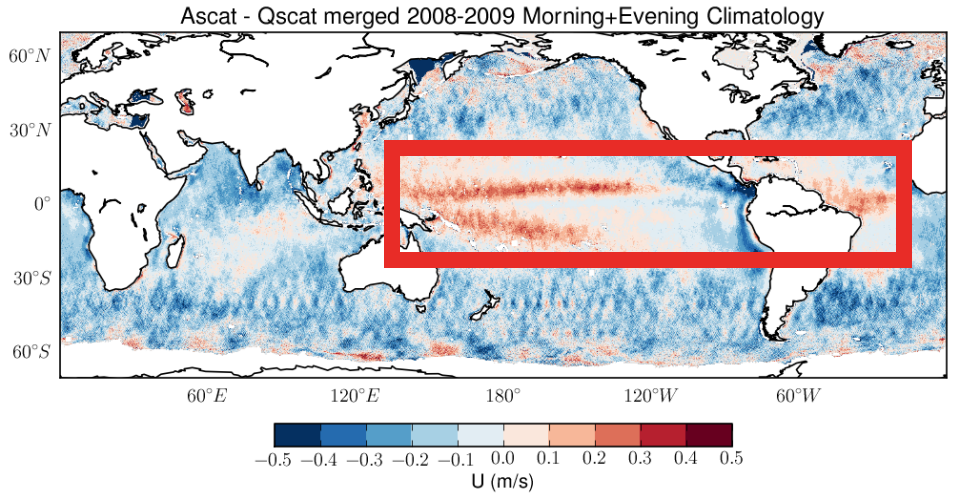


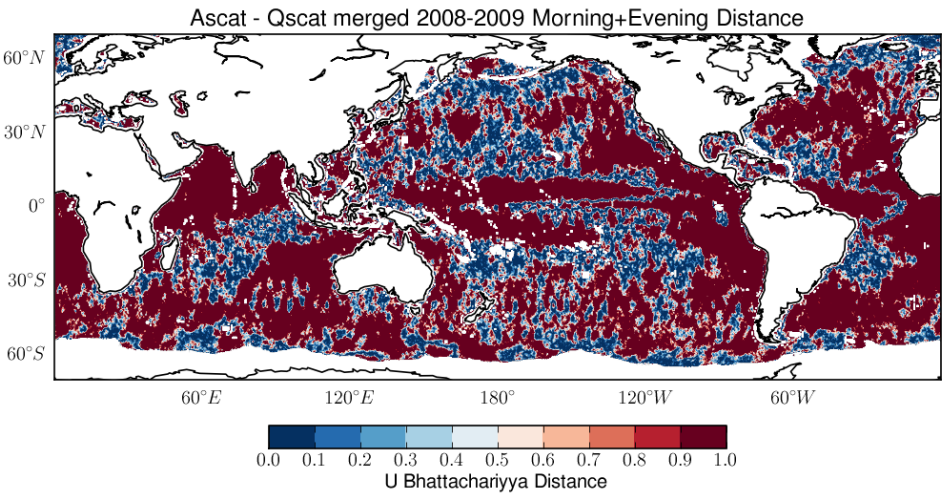


Rain effects in QuikSCAT?
Rain impacts U components more strongly

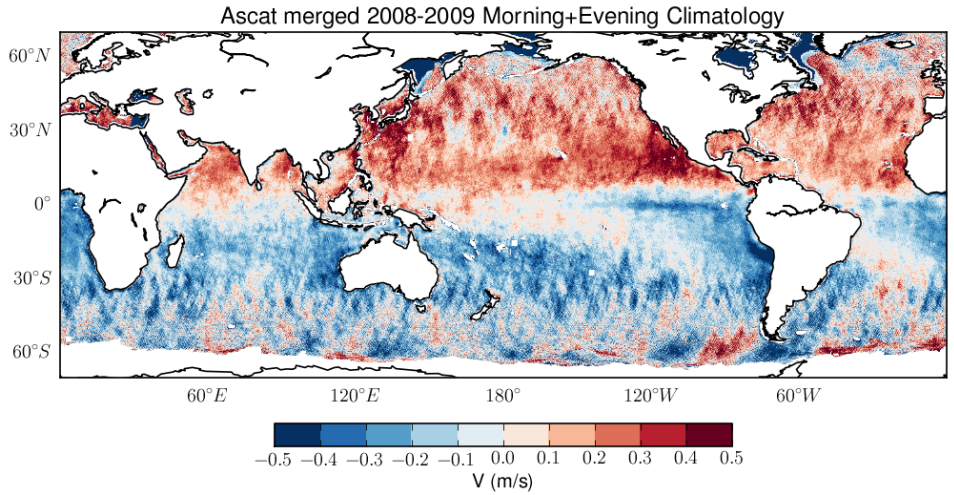


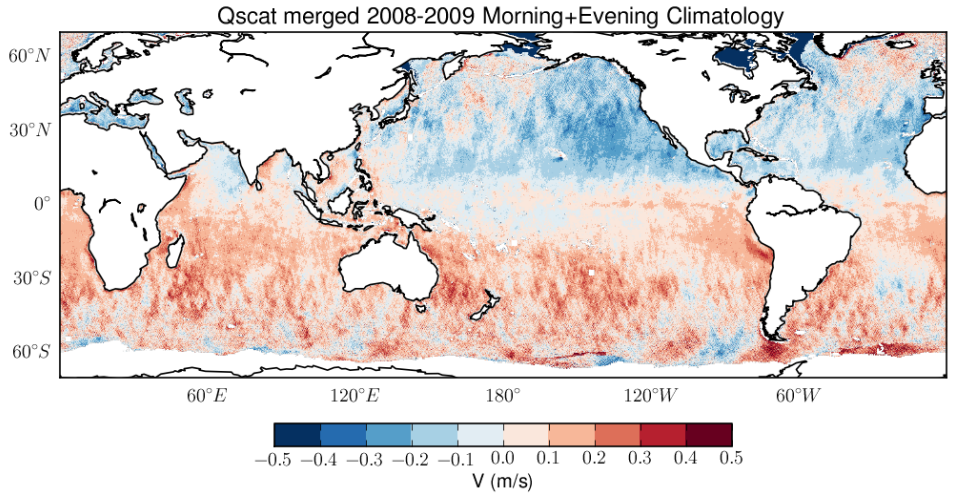


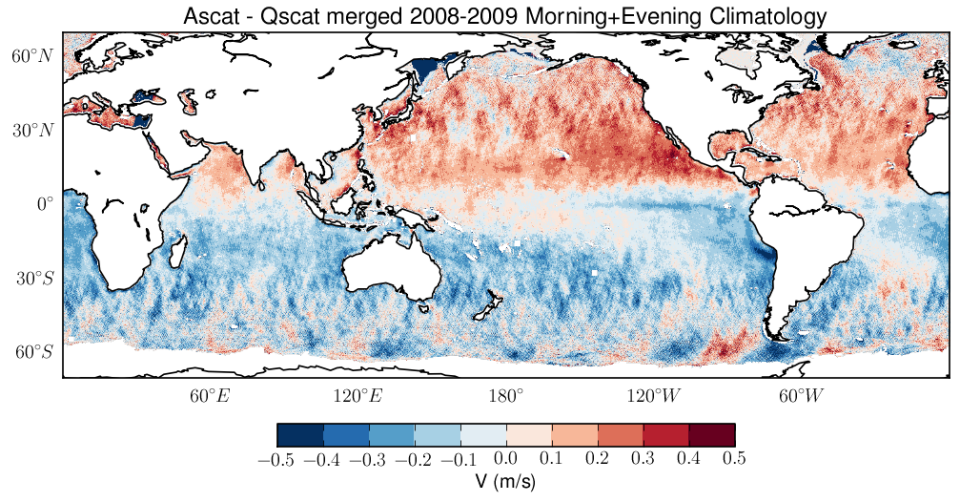


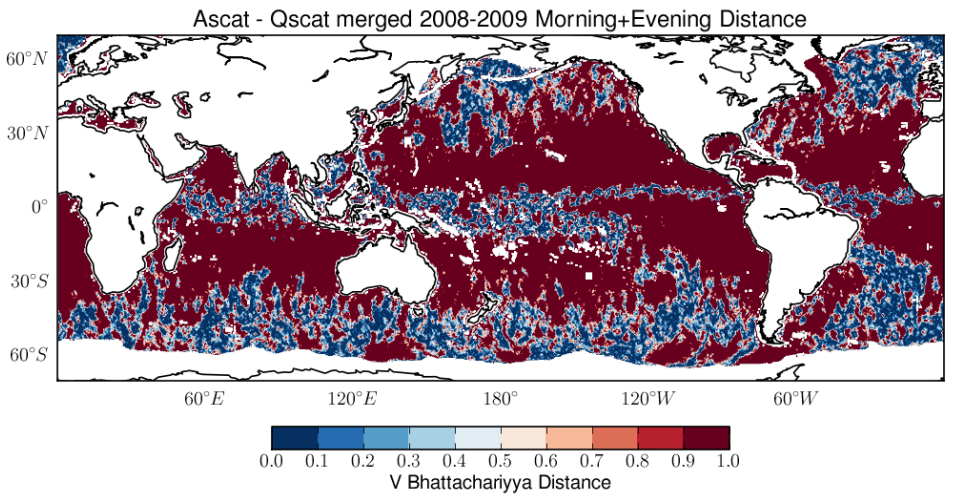


QuikSCAT vs ASCAT
V component

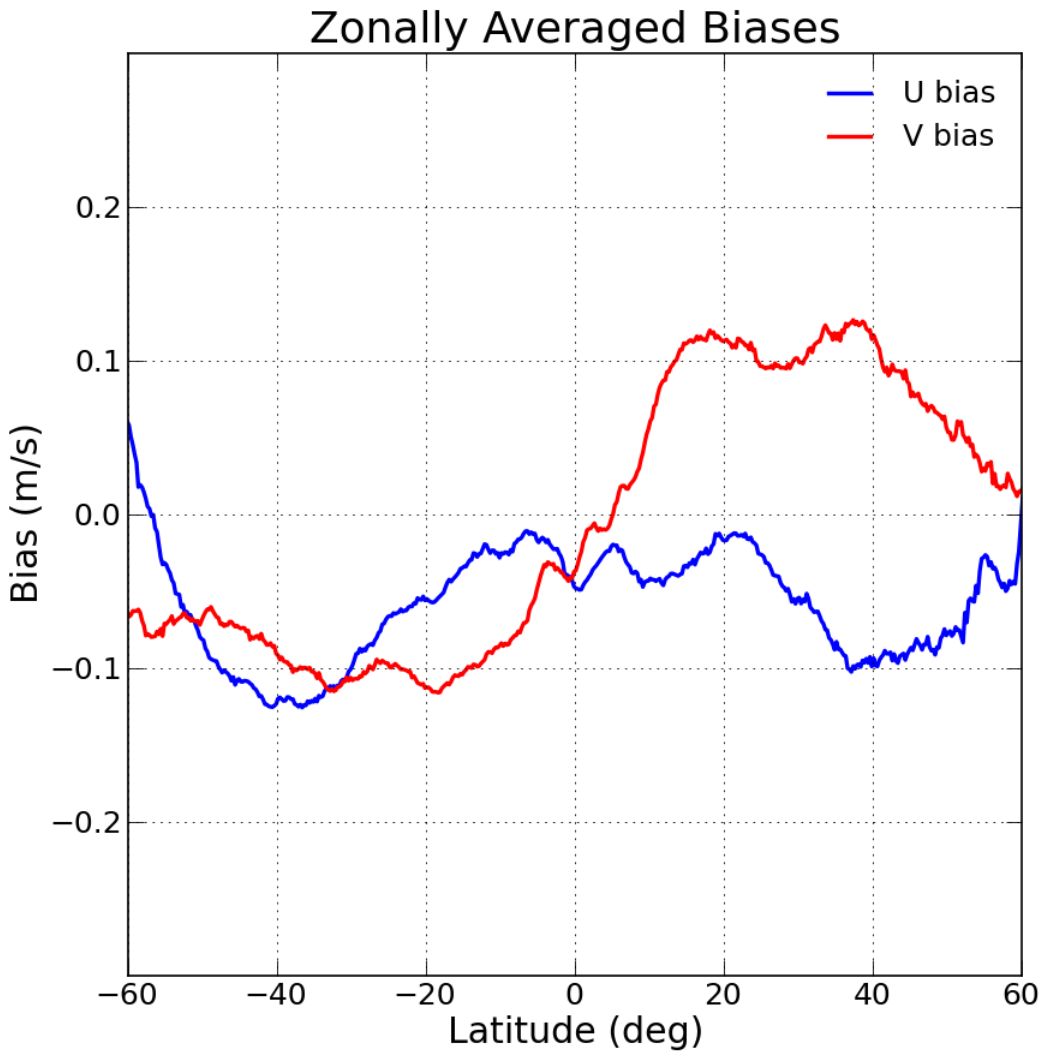








Zonally Averaged Differences



Why is this important?
Stress multiplies the biases