



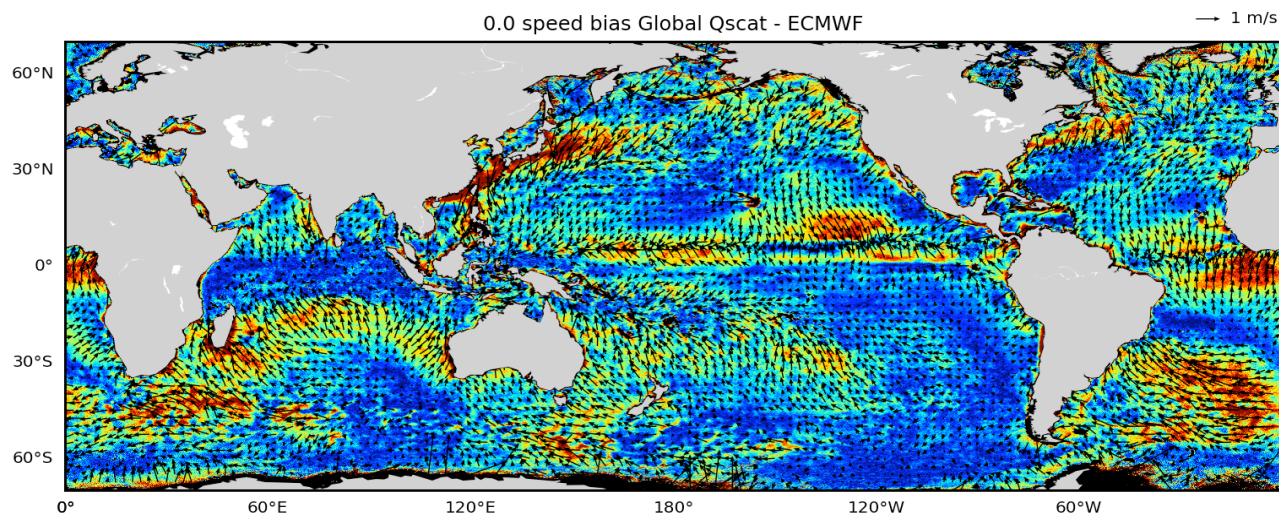
# **Systematic Geographic Differences between ASCAT, QuikSCAT and ECMWF revisited: Impact of biases and rain contamination**

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**Jet Propulsion Laboratory  
California Institute of Technology  
OVWST meeting - May 2009**



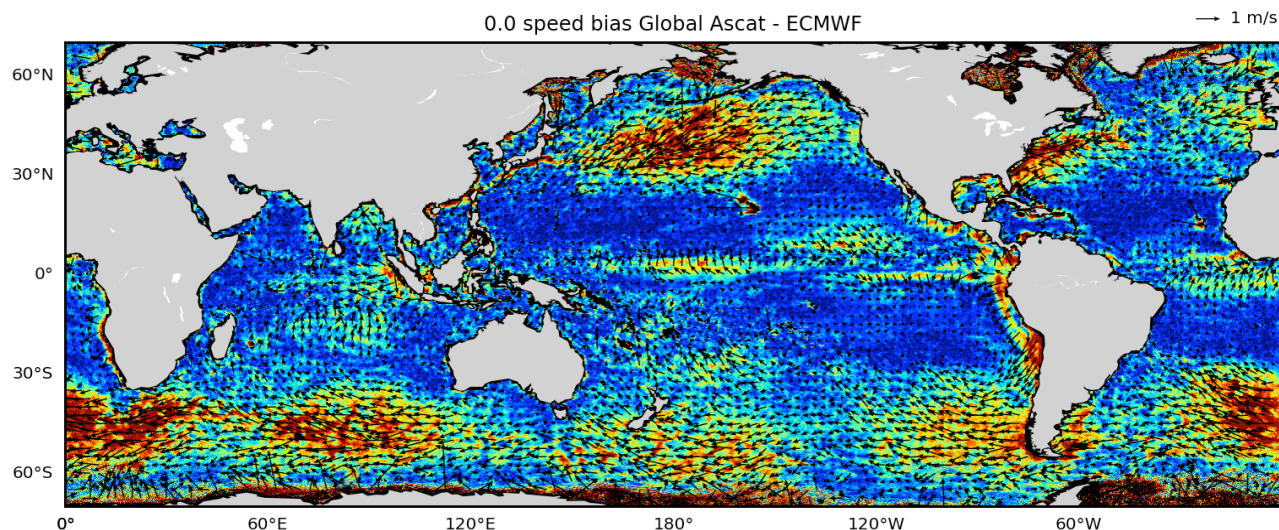
# JPL In the previous investigation ...



Climatologies based on 7 month average:

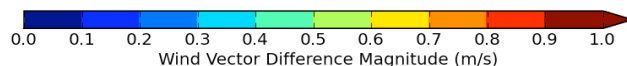
October '07 to May '08

Stresses calculated from L2 wind products and the same drag coefficient



The overall pattern is similar, but differences exist.

However, most of these differences are due to diurnal variability, since they are also present in ECMWF

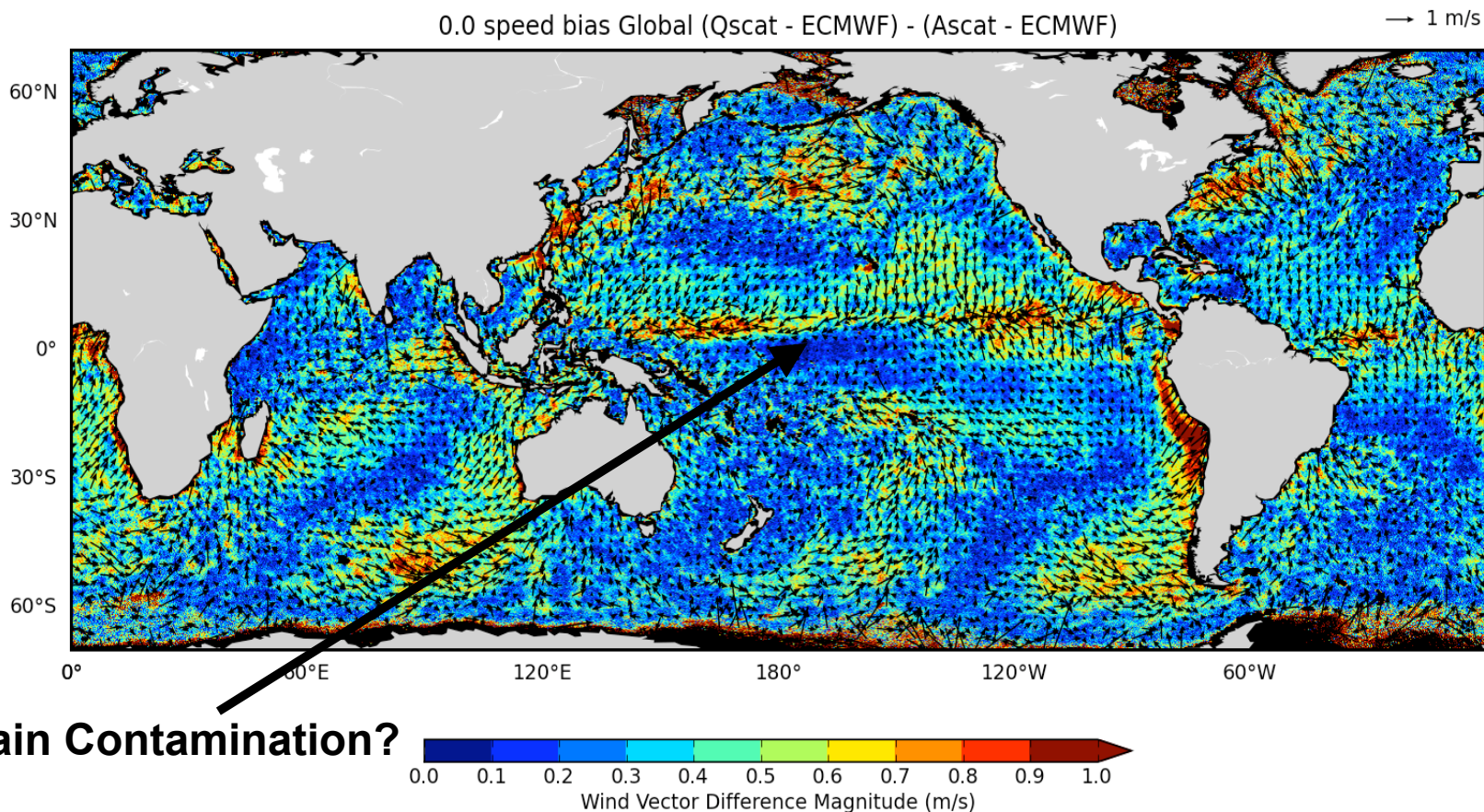




# Direct comparison ....

Removing ECMWF field at the time of collection removes diurnal variability captured by ECMWF

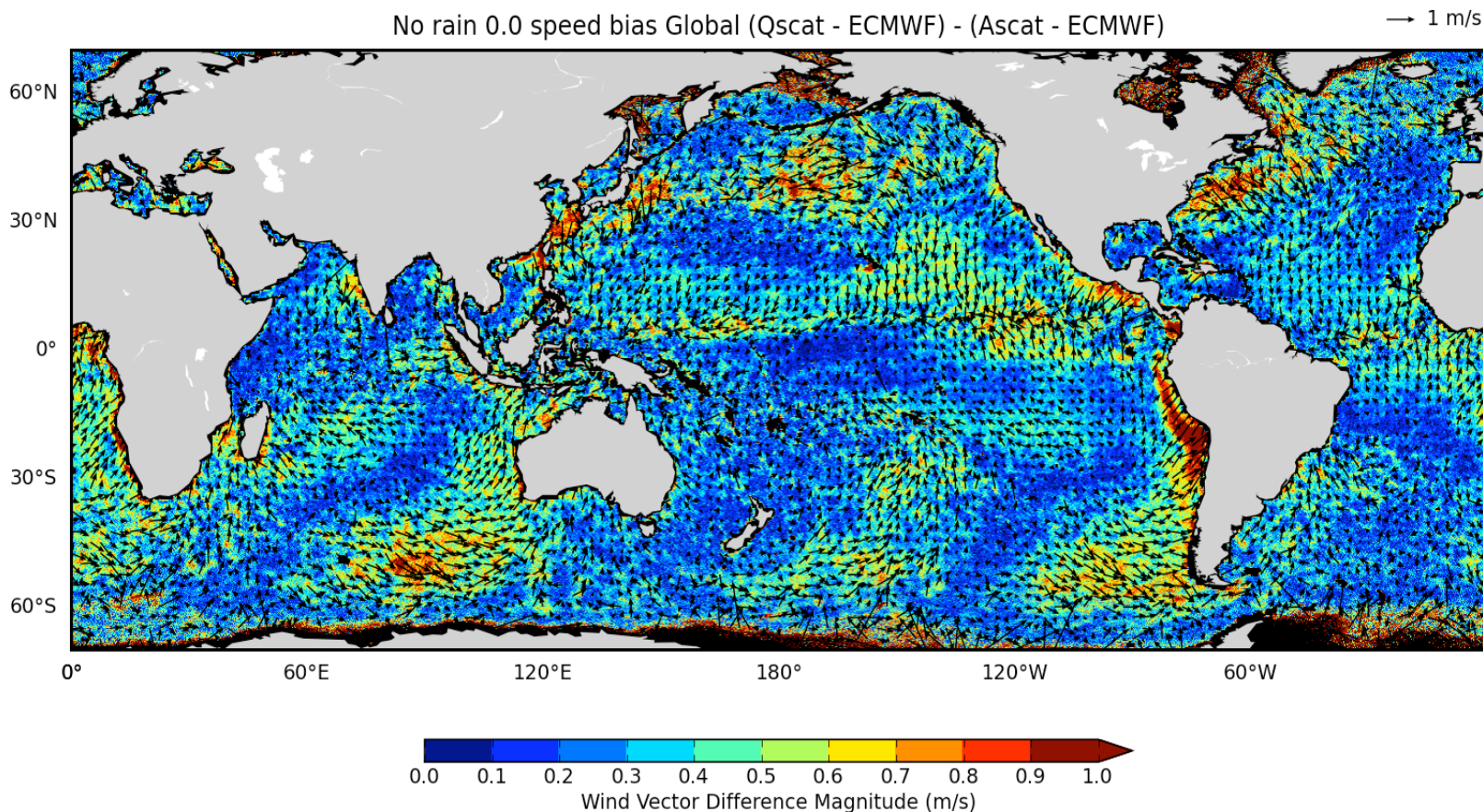
Some unmodeled diurnal variability may remain!



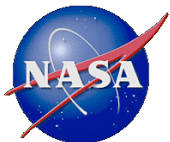


## After Removing more rain-contaminated QuikSCAT data; Remaining differences

- Portabella and Stoffelen (2009) indicates that additional biases need to be added to the ASCAT winds to obtain the equivalent 10m neutral winds estimated by QuikSCAT.
- Considering this, we revisited our comparisons applying a number of different biases in the range suggested by Portabella and Stoffelen (2009)

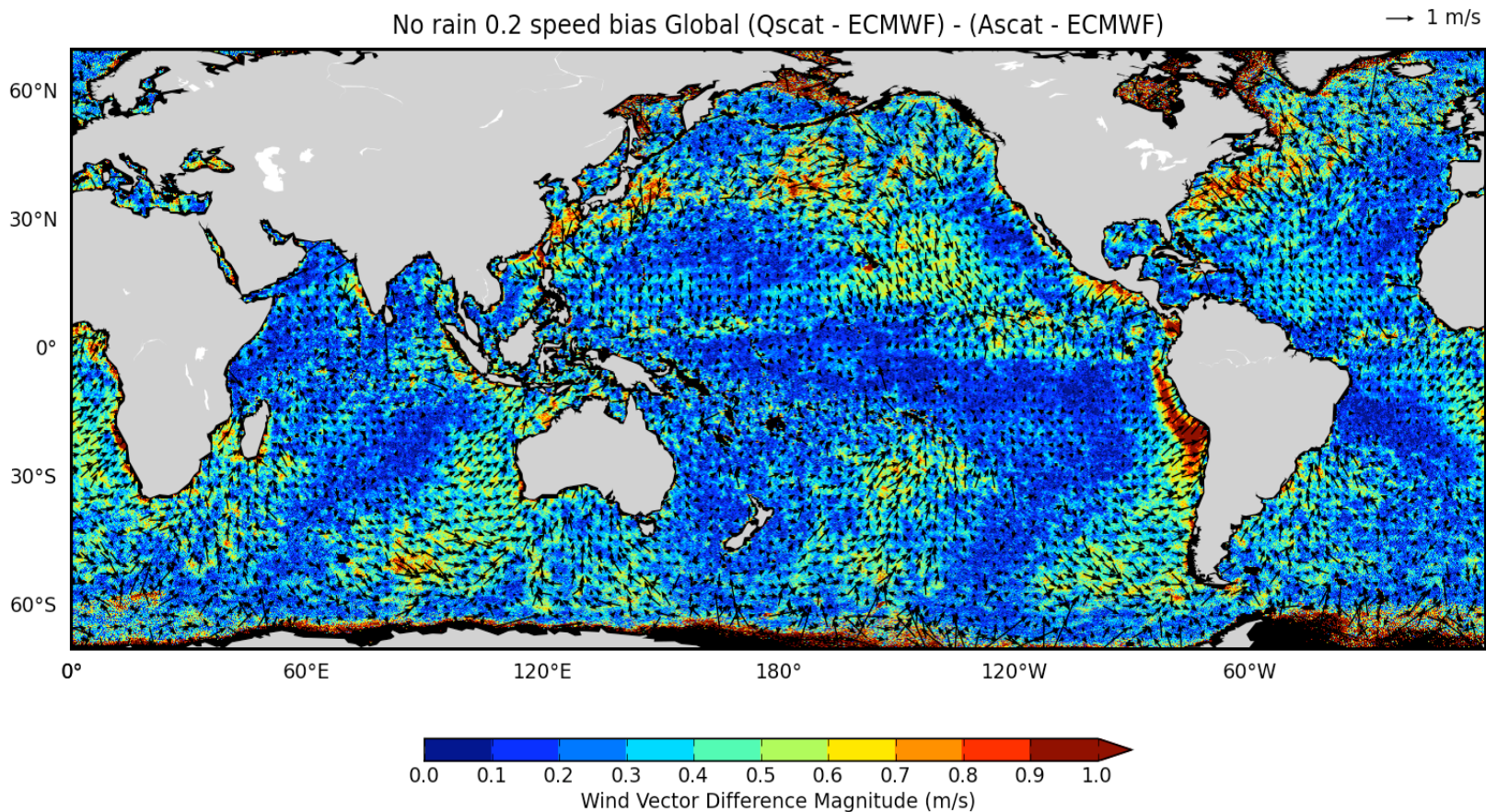






## Converting ASCAT to neutral winds ...

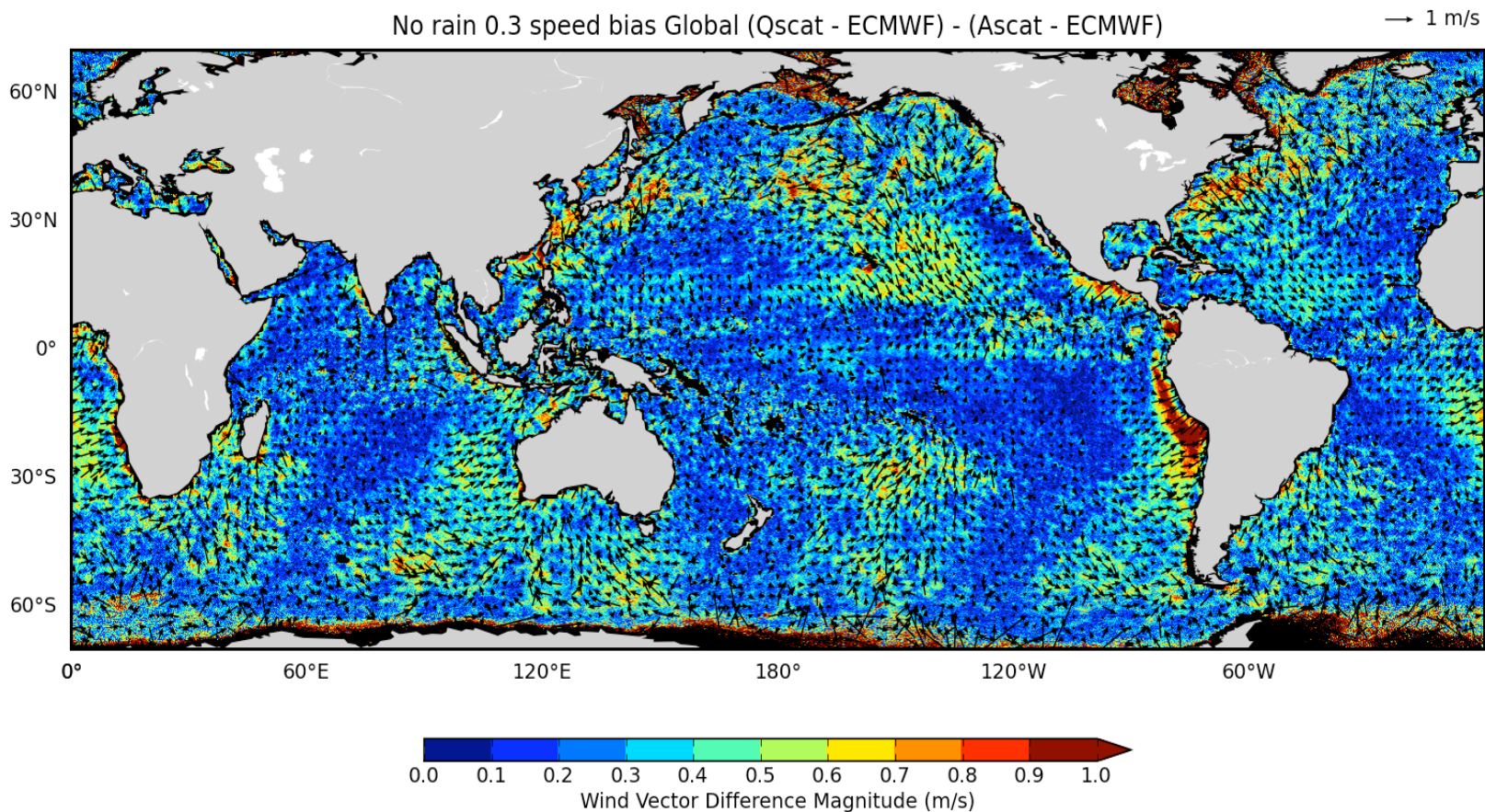
- After adding a 0.2 m/s to ASCAT winds
- Is this the right bias?



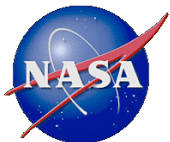


## Converting ASCAT to neutral winds ...

- After adding a 0.3 m/s to ASCAT winds
- Is this the right bias?

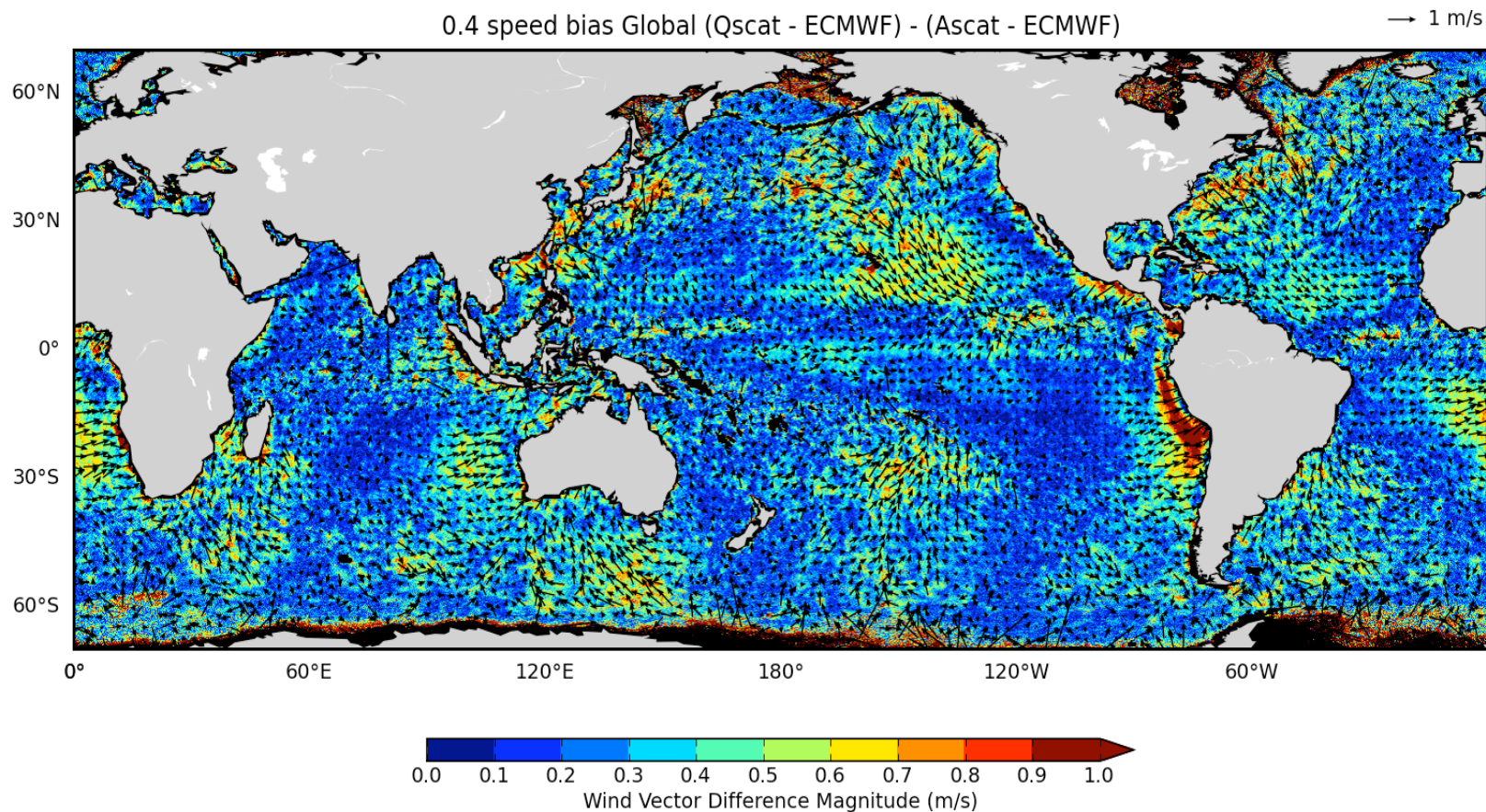






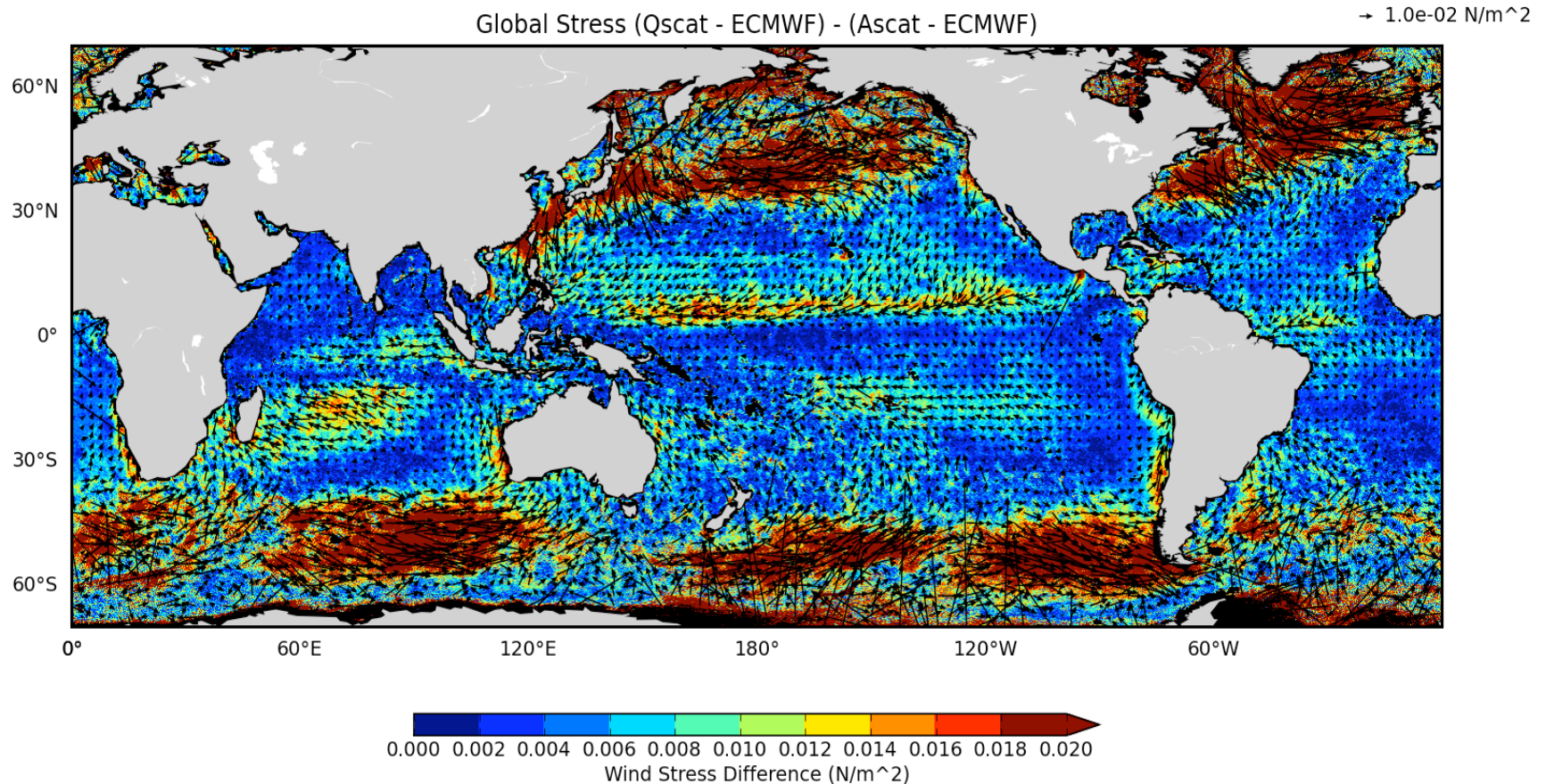
## Converting ASCAT to neutral winds ...

- After adding a 0.4 m/s to ASCAT winds
- Is this the right bias?
- Maybe it should be latitudinally dependent ?



# What about the stress ?

- We performed similar type of comparisons of the stress fields

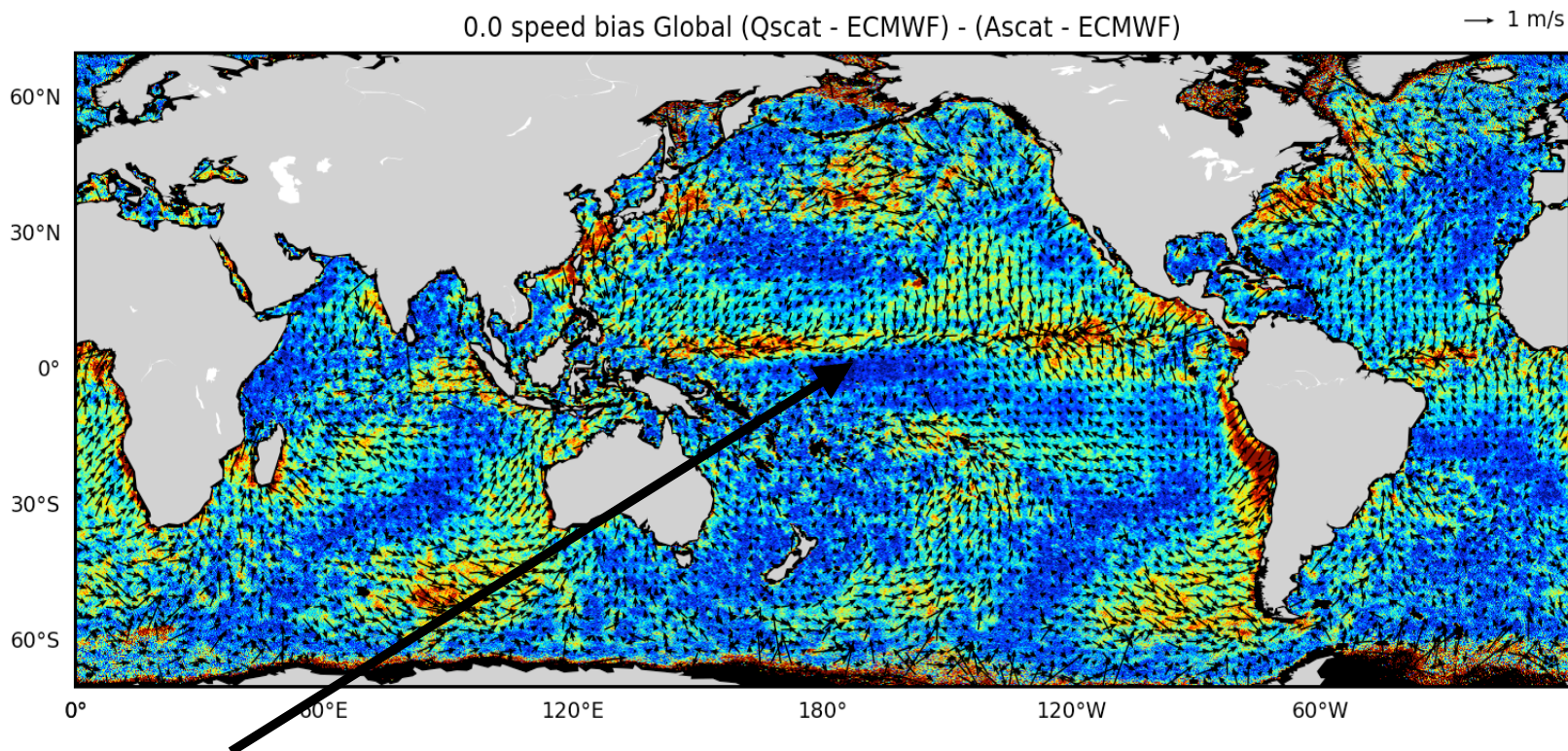




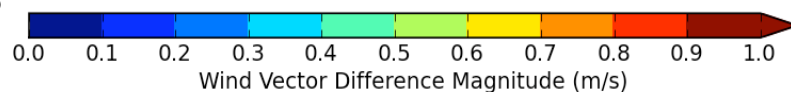
# Direct comparison ....

Removing ECMWF field at the time of collection removes diurnal variability captured by ECMWF

Some unmodeled diurnal variability may remain!



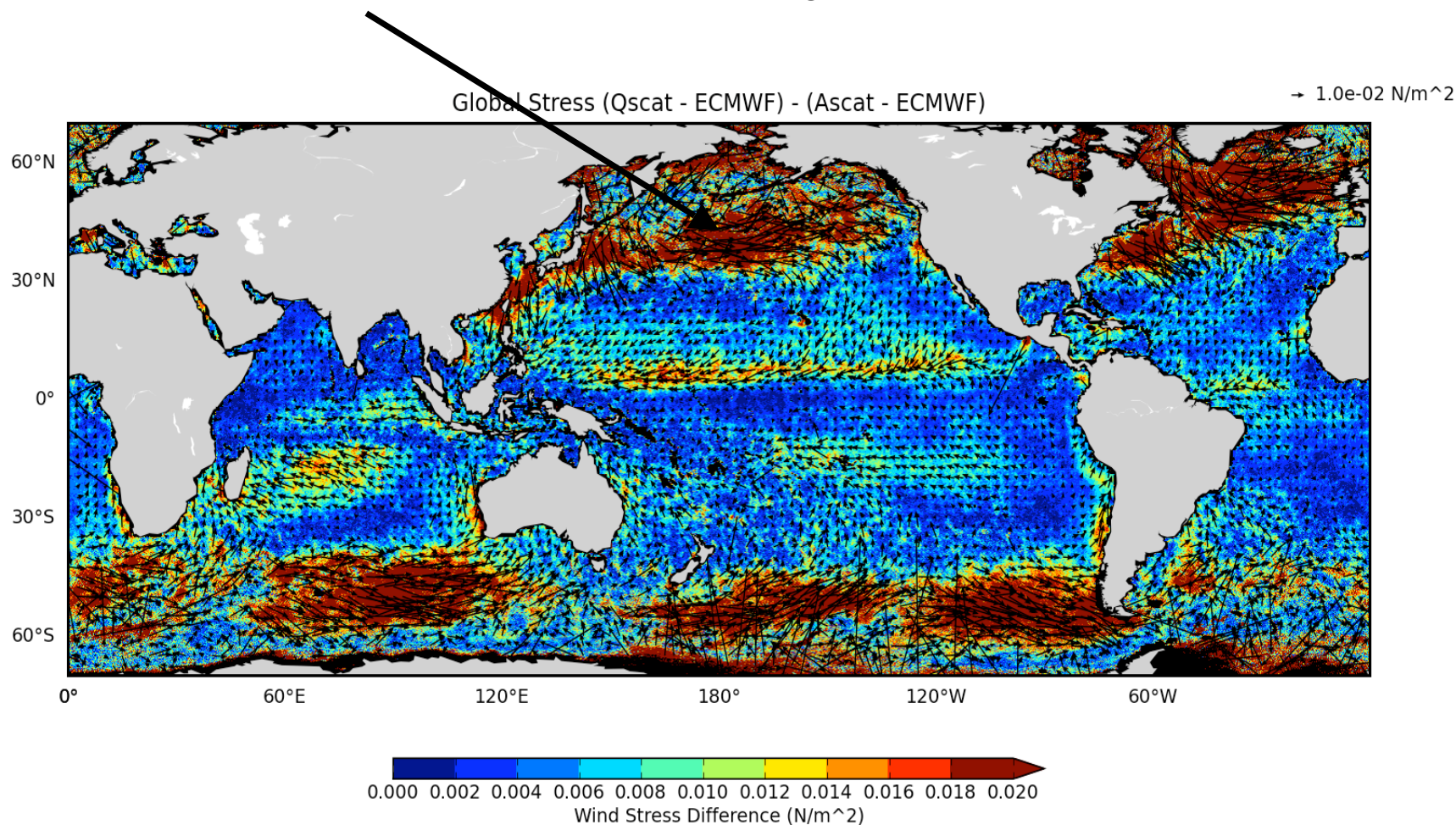
**Rain Contamination?**



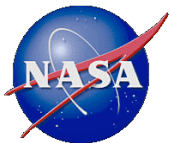
# What about the stress ?

- We performed similar type of comparisons of the stress fields

Differences in the Extratropics are much stronger than those in the Tropics

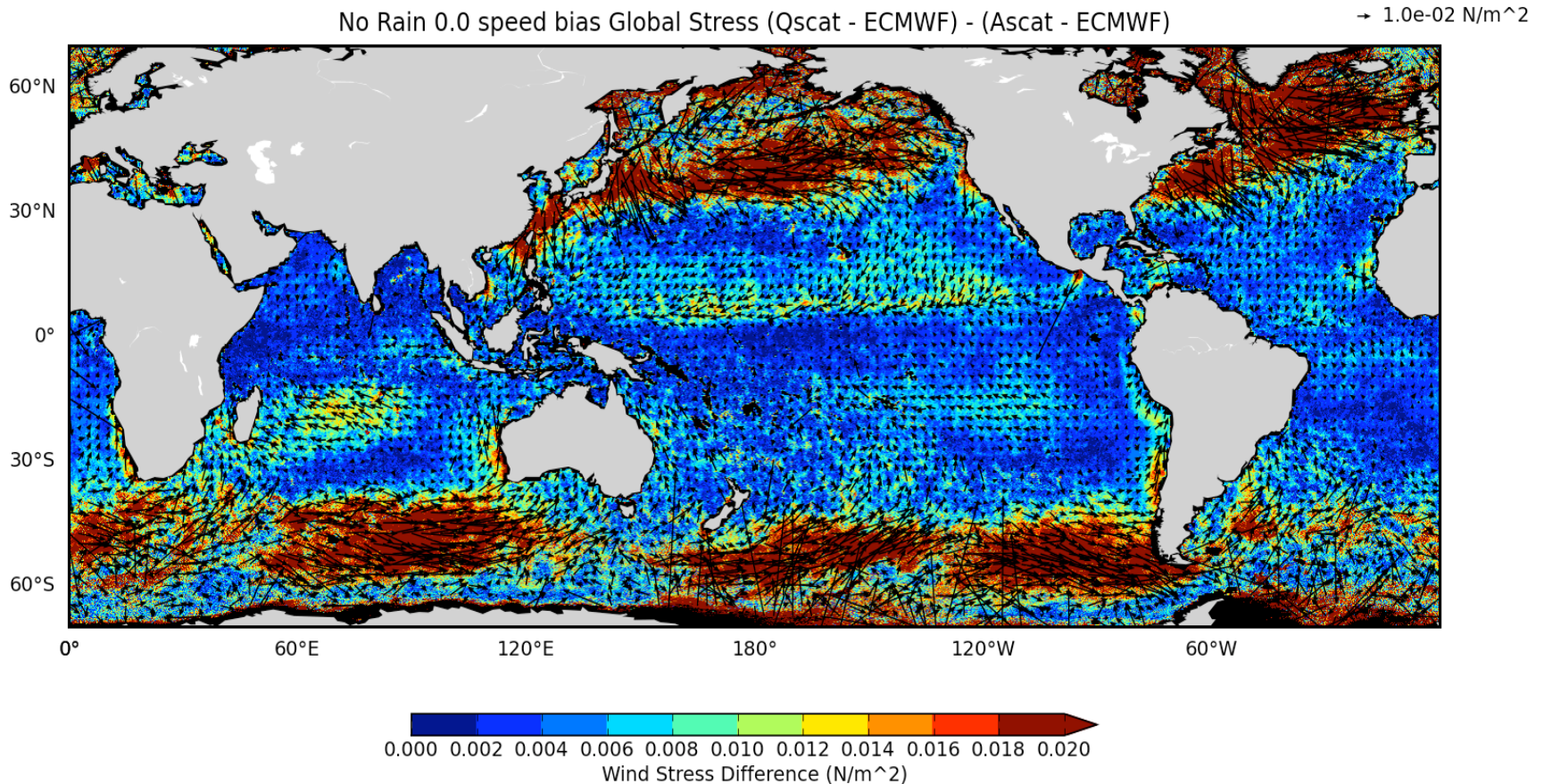


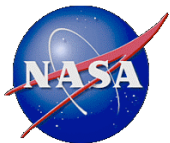




# What about the stress ?

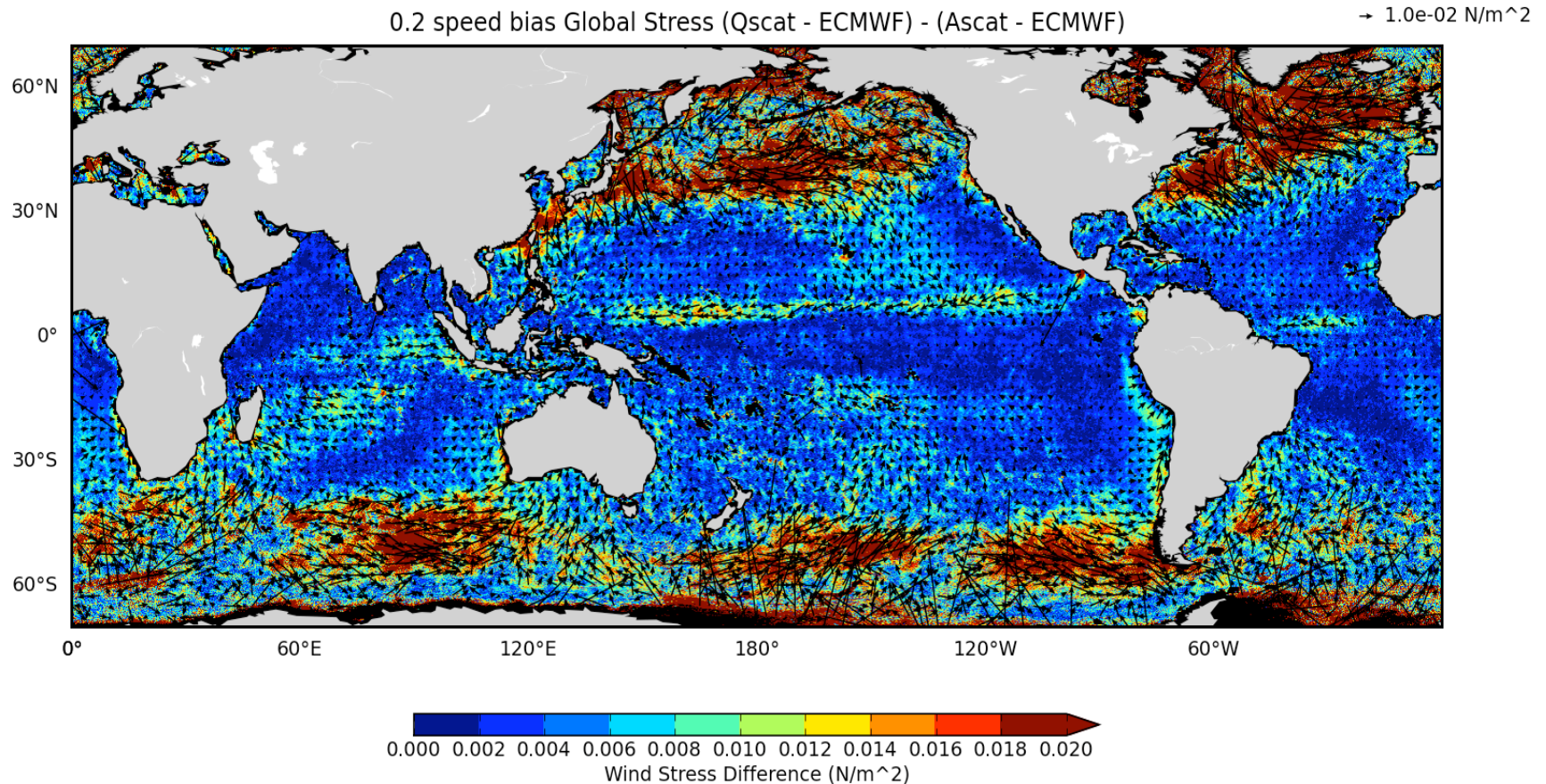
- After removing more of the QuikSCAT Rain-contaminated winds
  - Improved are only the comparisons in the Tropics
  - Still remaining are big differences in the Tropics



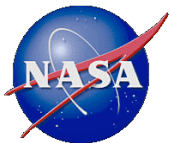


# What about the stress ?

- Adding a bias of 0.2 m/s to ASCAT winds to convert them to neutral does not solve the problem

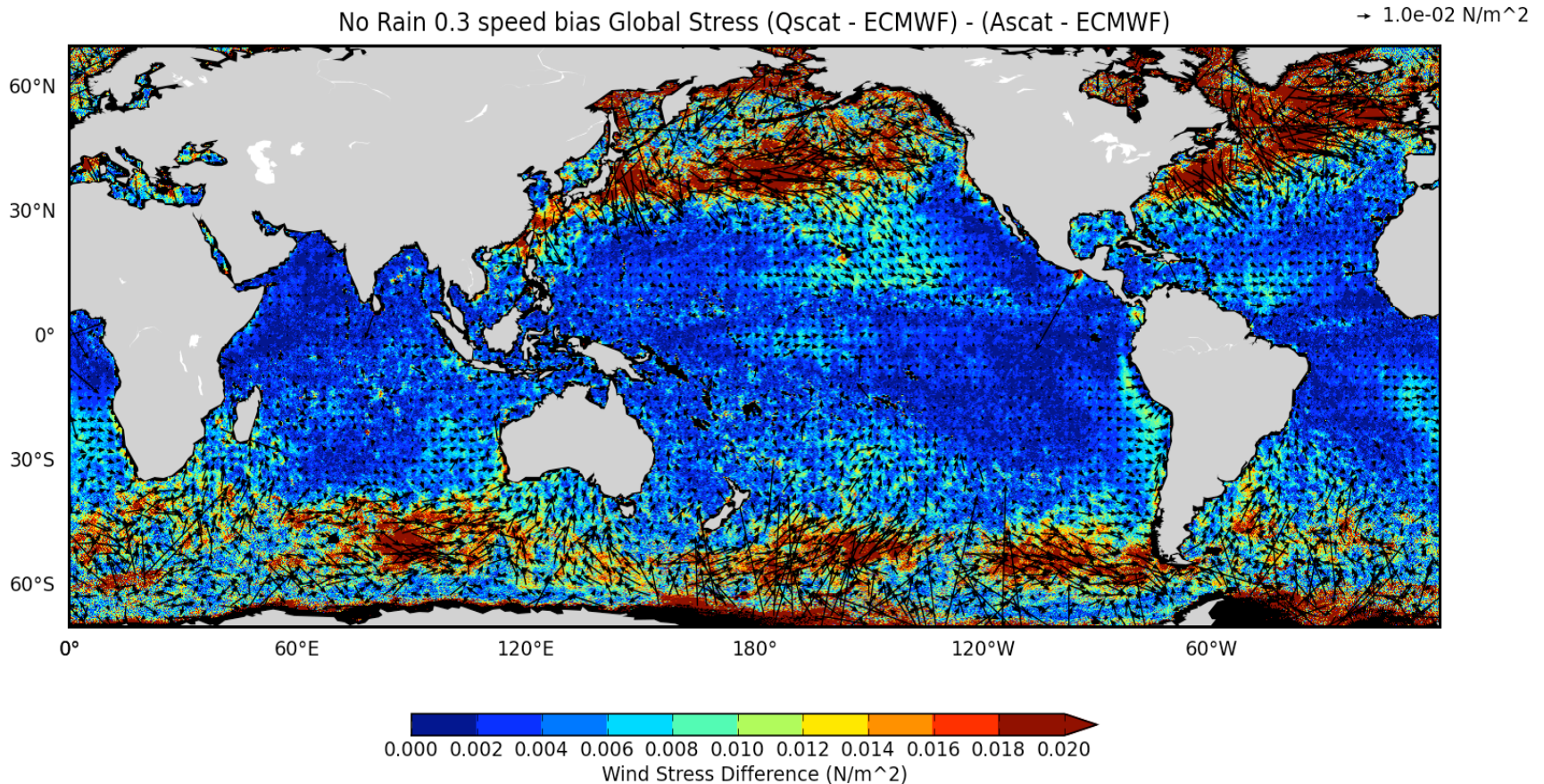


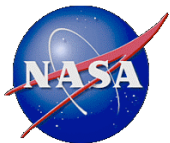




# What about the stress ?

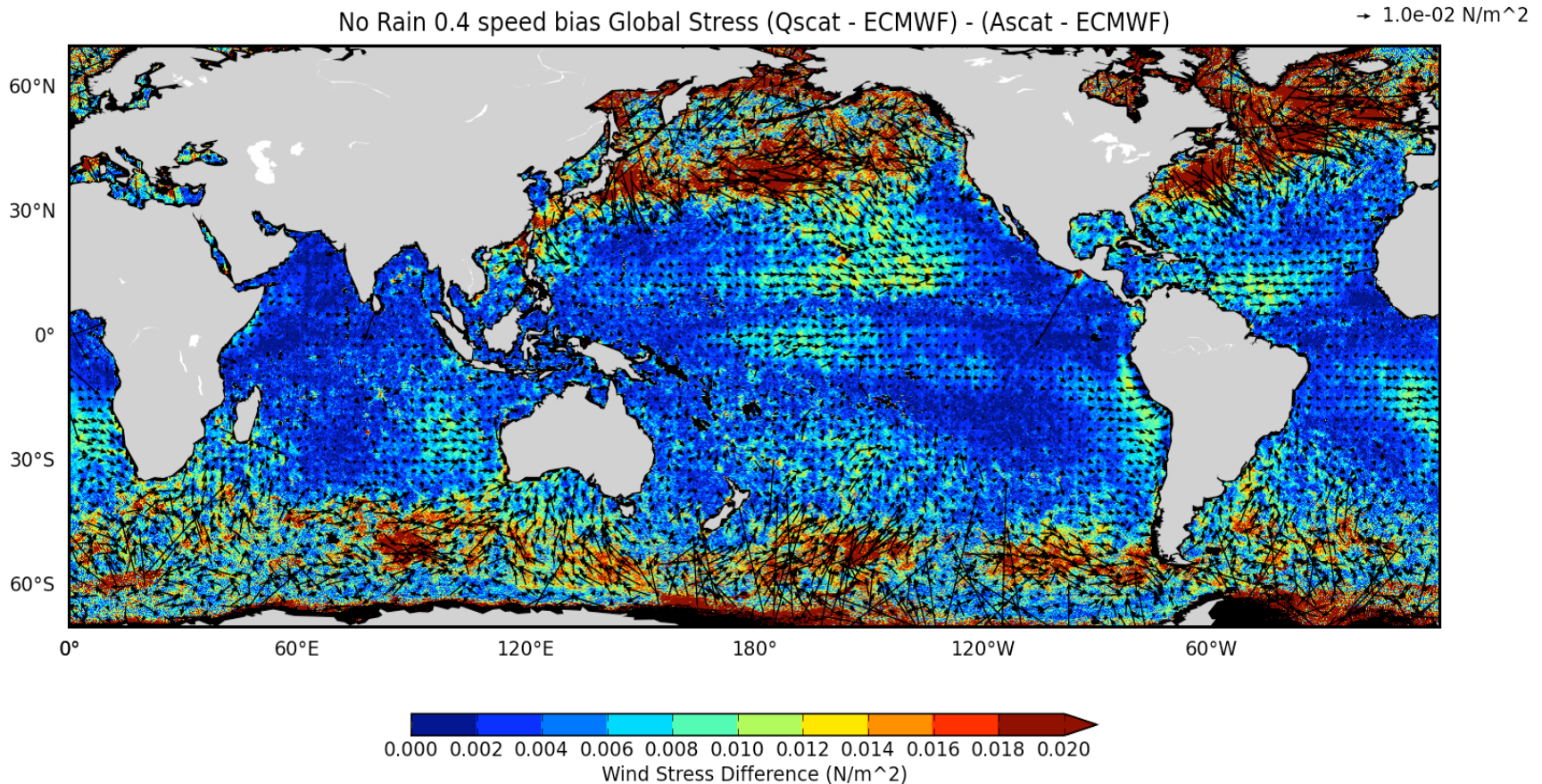
- Adding a bias of 0.3 m/s to ASCAT
  - Very good agreement in the Tropics
  - Still not enough in the Extratropics





# What about the stress ?

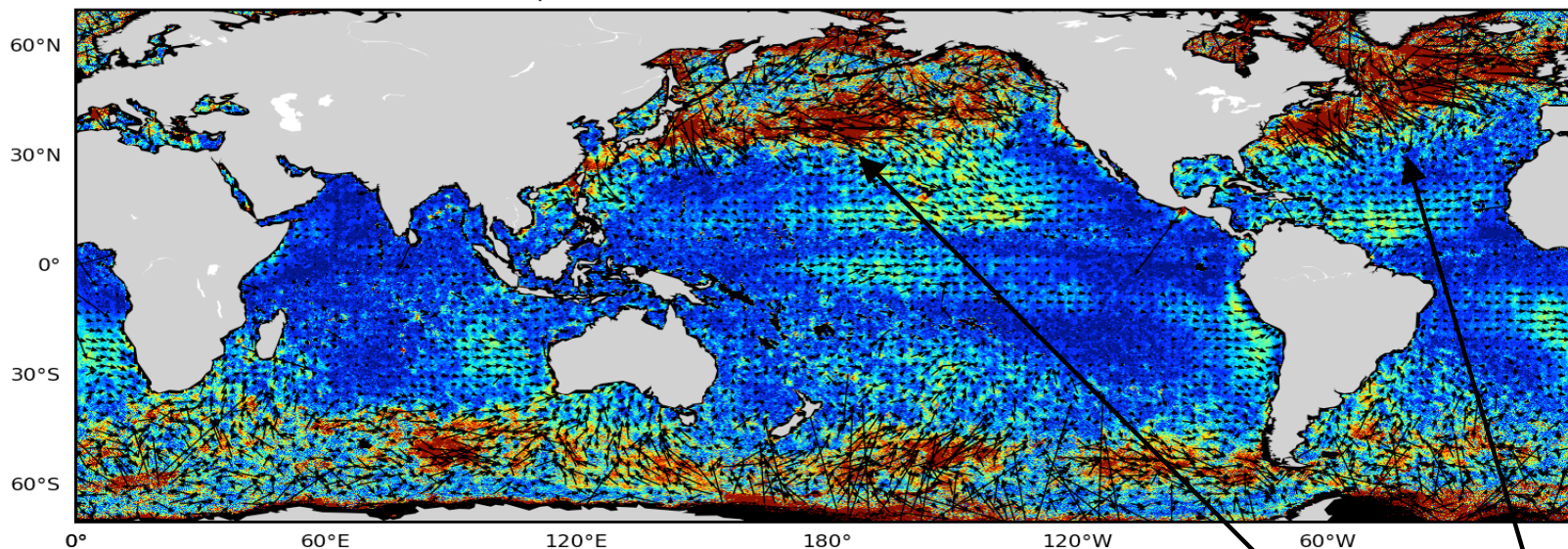
- Adding 0.4 m/s to ASCAT winds improves further the comparison in the Extratropics but impacts negatively the comparison in the Tropics.
- Do we need a latitudinally-dependent bias that is lower in the Tropics and Higher in the Extratropics?





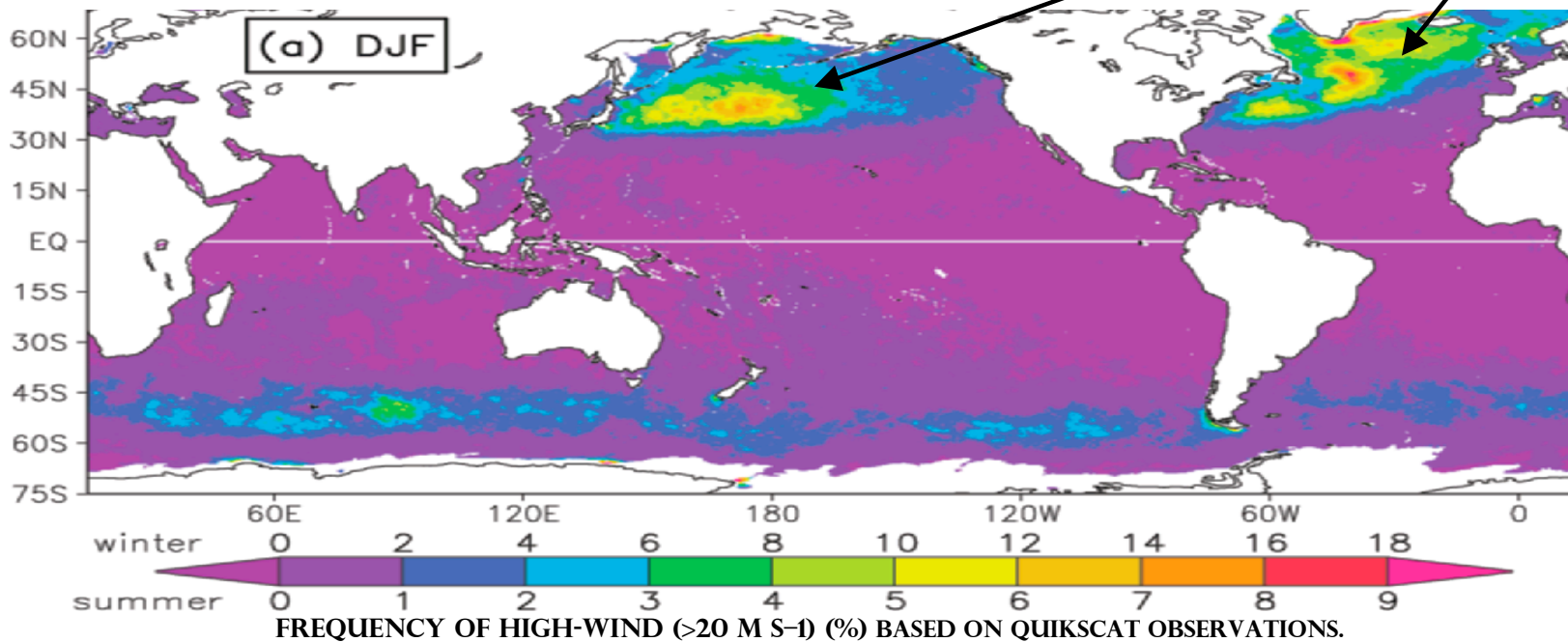
No Rain 0.4 speed bias Global Stress (Qscat - ECMWF) - (Ascat - ECMWF)

→ 1.0e-02 N/m<sup>2</sup>



From Sampe & Xie  
2007

0.000 0.002 0.004 0.006 0.008 0.010 0.012 0.014 0.016 0.018 0.020  
Wind Stress Difference (N/m<sup>2</sup>)





# Dynamical Significance of the differences

- Coupling between SST gradients and near-surface wind response - investigating the correlation between the high-frequency wind stress curl and divergence fields, and the cross-wind and down-wind SST gradients.

From O'NEILL, CHELTON, AND ESBENSEN, 2003

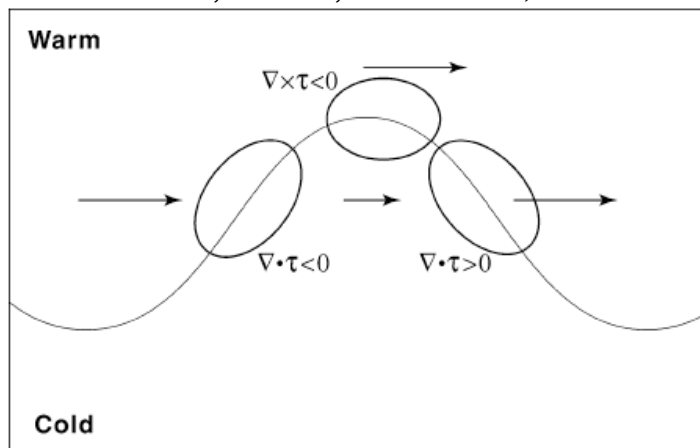


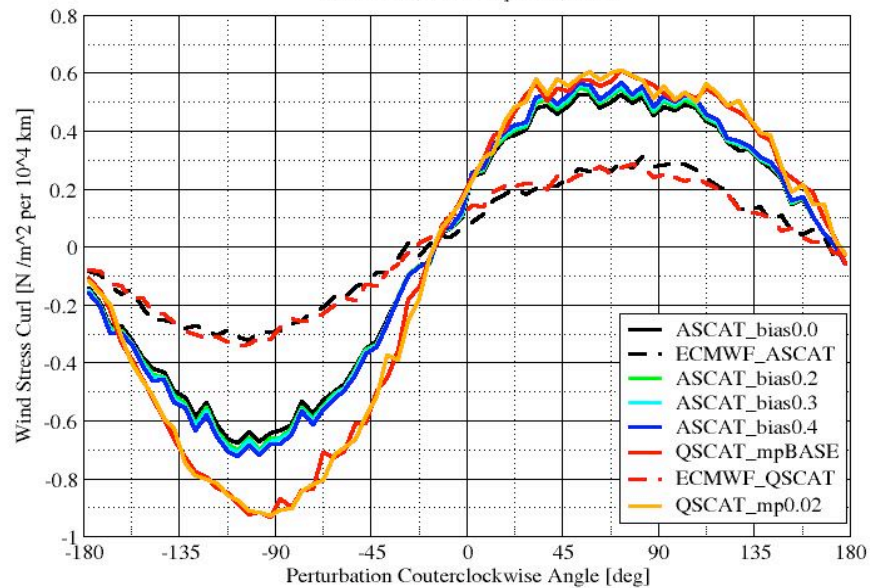
FIG. 3. Schematic of the hypothesized interaction between wind stress and SST for wind blowing obliquely across a meandering SST front. The SST front is delineated as the black sinusoidal curve, separating warm and cold water. The lengths of the arrows schematically represent the hypothesized relative magnitudes of the surface wind stress. Regions of nonzero wind stress curl and divergence are indicated.

- ASCAT/QuikSCAT comparison revisited
  - Using the set of bias-corrected data
  - Using a new approach to computing the wind stress curl/divergence (Chelton et al, 2007) from orbital instead of gridded (averaged) wind stress components to preserve the signals of each meteorological event and to avoid introducing artifacts from computing gradients of averaged quantities over a number of different events.



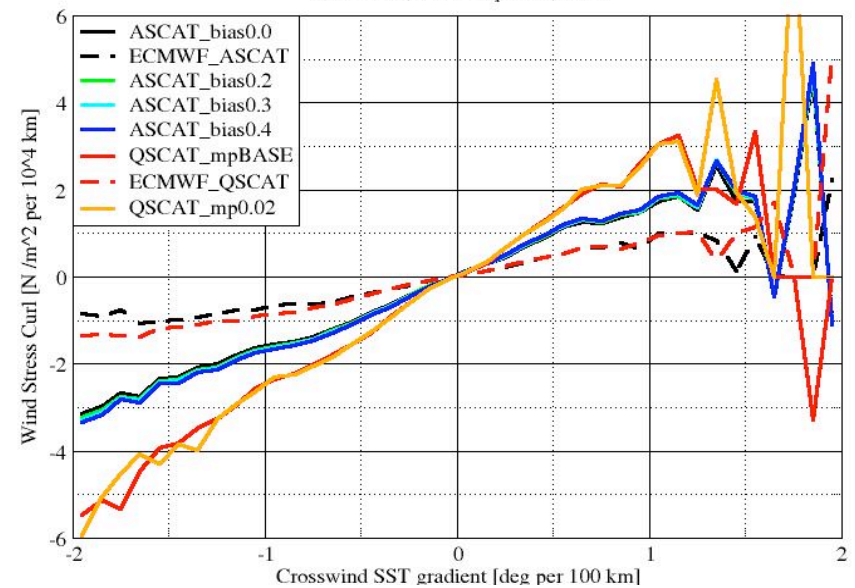
### Agulhas

October 16, 2007 - April 23, 2008



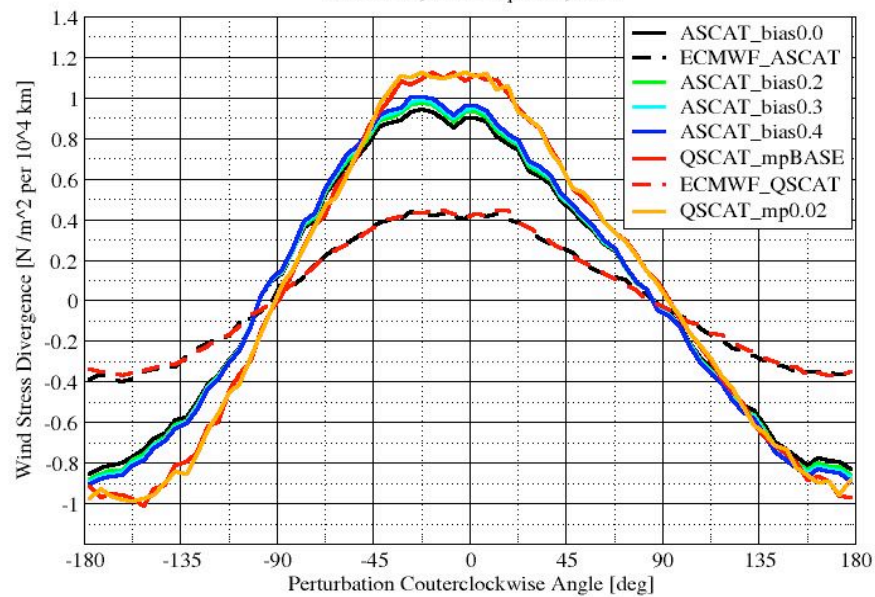
### Agulhas

October 16, 2007 - April 23, 2008



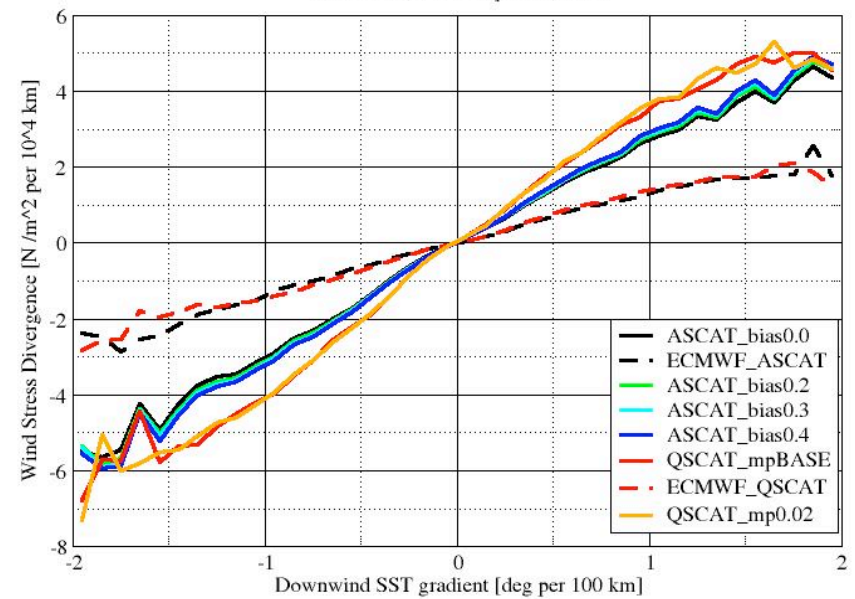
### Agulhas

October 16, 2007 - April 23, 2008



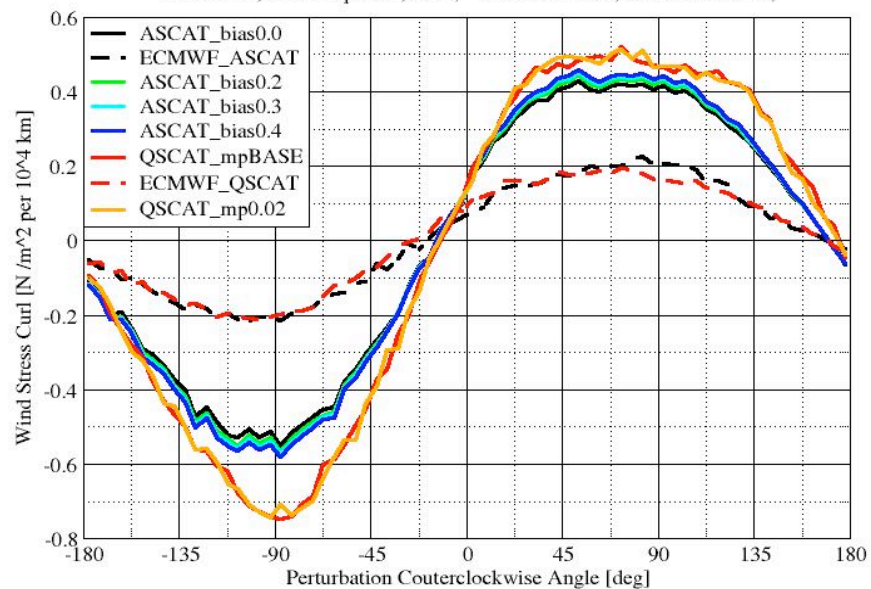
### Agulhas

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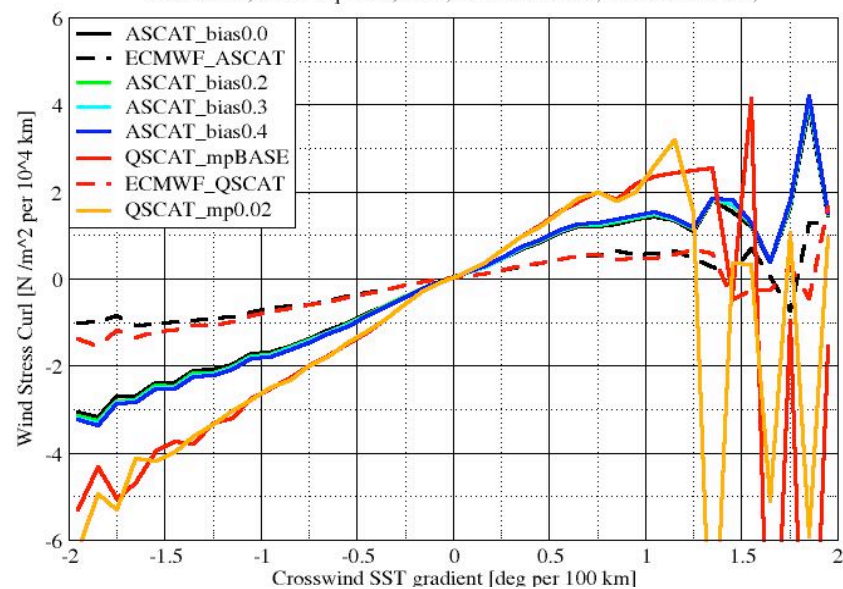
### Southern Ocean

October 16, 2007 - April 23, 2008;  $0 < \text{LON} < 359$ ;  $-55 < \text{LAT} < -32$ ;



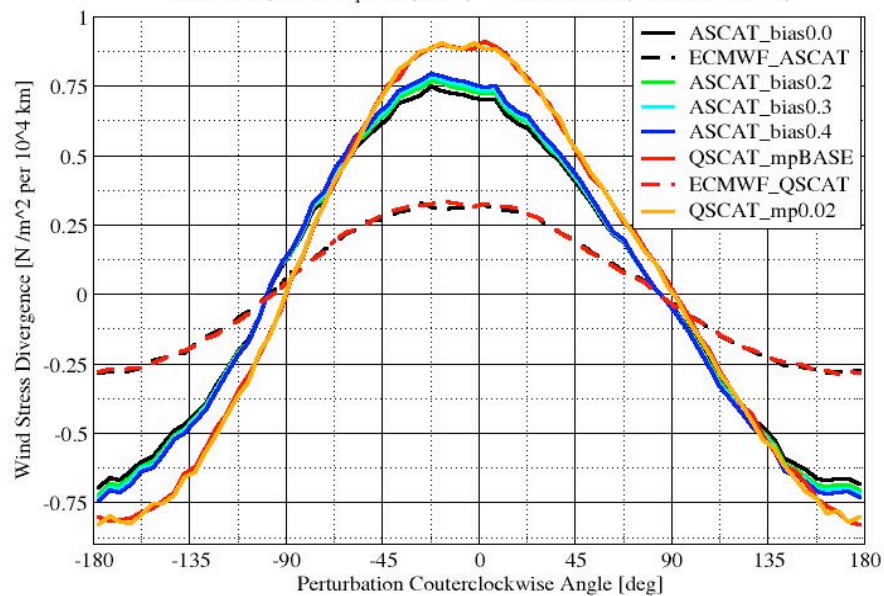
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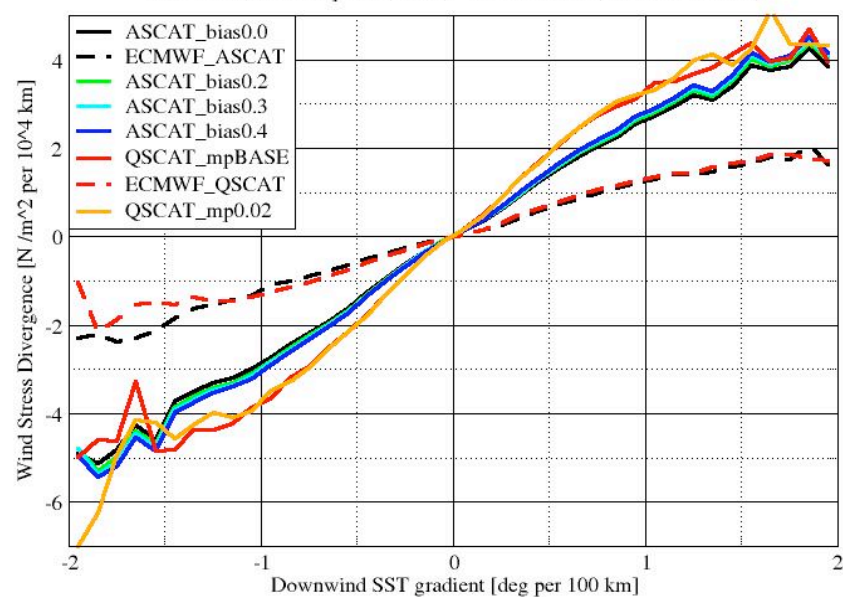
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### Southern Ocean

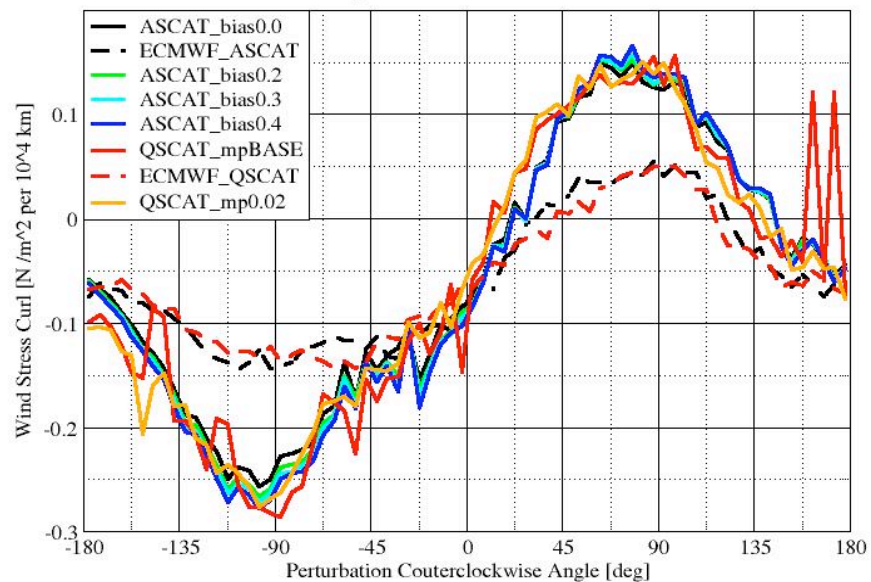
October 16, 2007 - April 23, 2008;  $0 < \text{LON} < 359$ ;  $-55 < \text{LAT} < -32$ ;





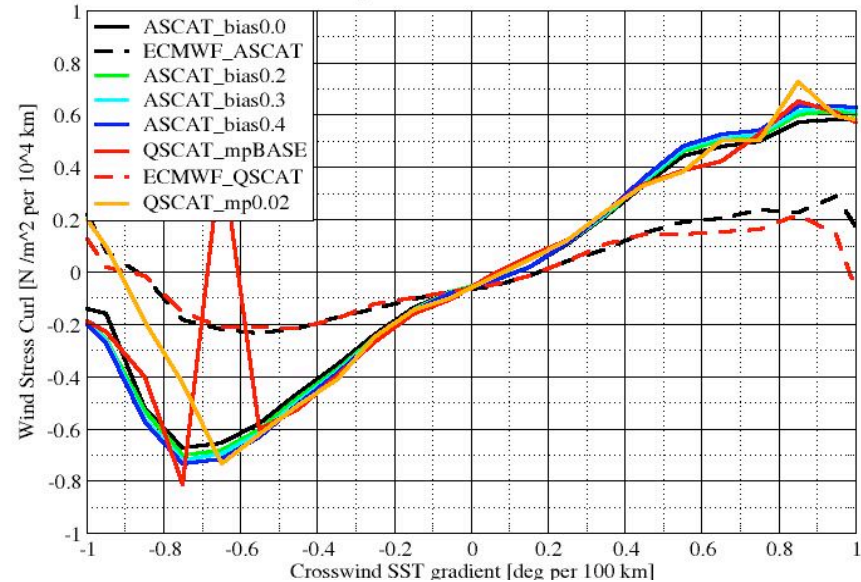
### Tropical Pacific

October 16, 2007 - April 23, 2008;  $210 < \text{LON} < 280$ ;  $-6 < \text{LAT} < 5$



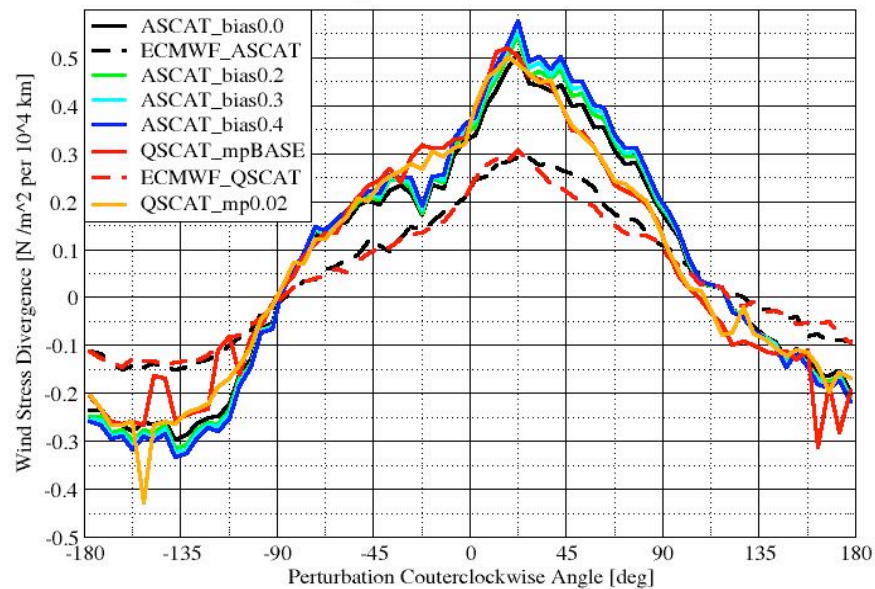
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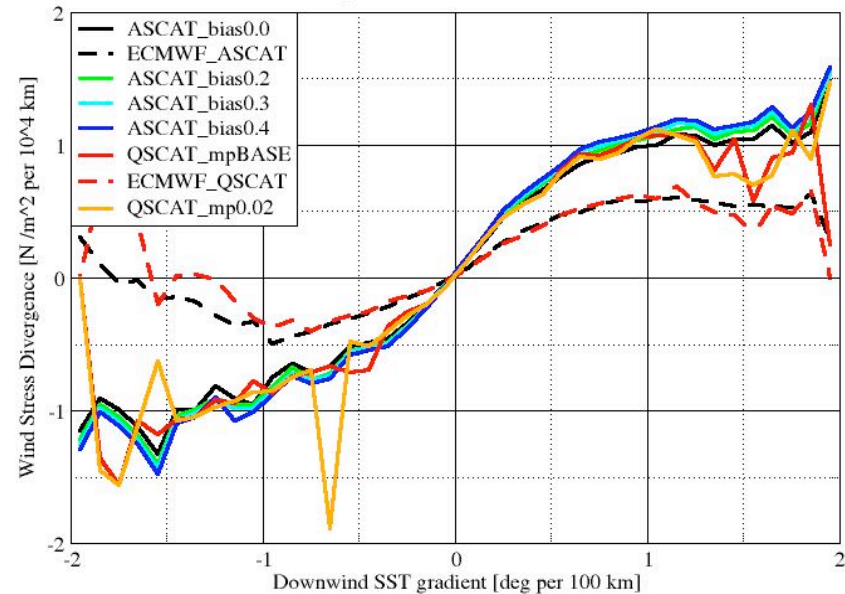
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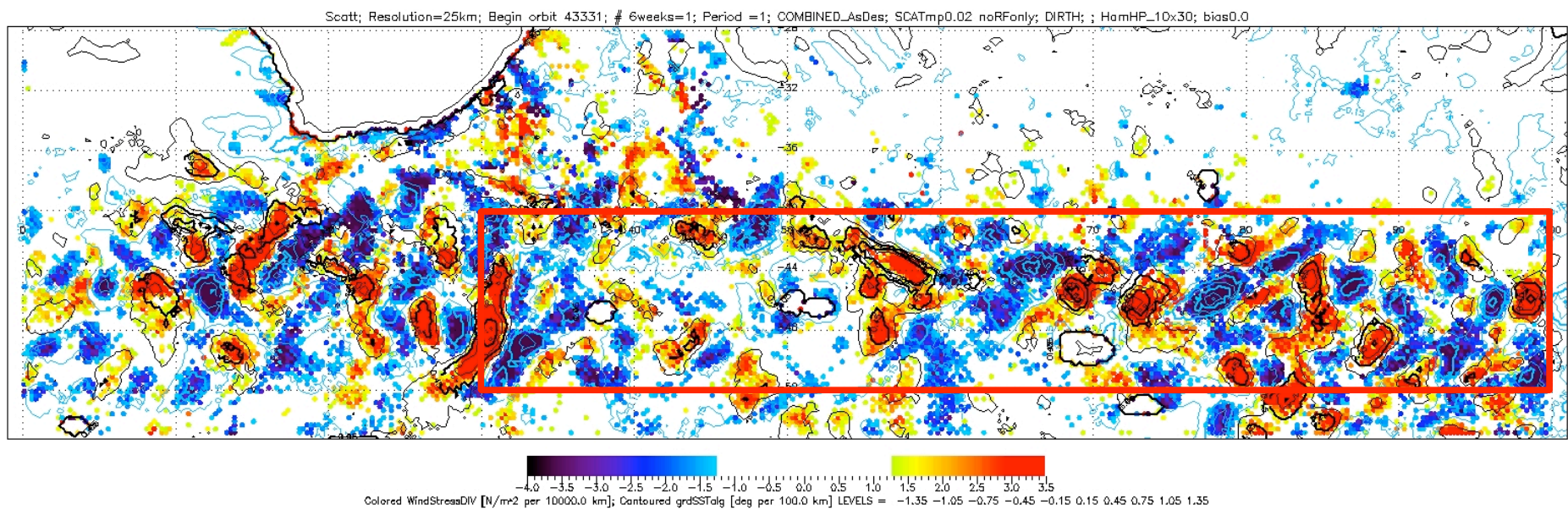
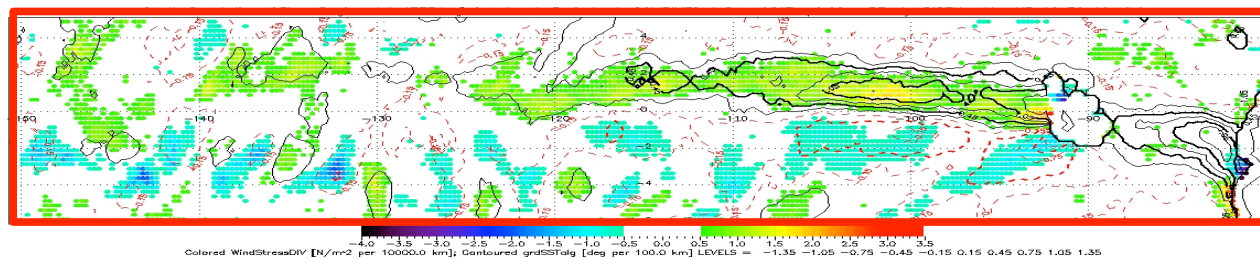
October 16, 2007 - April 23, 2008;  $210 < \text{LON} < 280$ ;  $-6 < \text{LAT} < 5$



### Tropical Pacific

October 16, 2007 - April 23, 2008;  $210 < \text{LON} < 280$ ;  $-6 < \text{LAT} < 5$









# Summary

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- QSCAT and ASCAT can be brought much closer together by:
  - Converting ASCAT winds to neutral 10 m winds by adding a bias
    - Portabella and Stoffelen\* suggest adding a bias to the ASCAT winds
    - We find best agreement by adding a latitudinally-dependent bias that is 0.2 m/s in the tropics and ~0.4 m/s in the extratropics - in good agreement with Portabella and Stoffelen\* suggested value of 0.2 m/s
  - Removing more of the rain-contaminated QuikSCAT winds
- Wind and Wind Stress fields respond differently to the the introduced speed-bias corrections in ASCAT
- The two scatterometer estimates of wind and stress are in a closer agreement with each other than they are with ECMWF estimates
- The Wind stress estimates from the two scatterometers come very close together except in the extratropical storm-track regions - are the high winds in the extratropical storms the source of disagreement?



## Summary (cont.)

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- Dynamical significance of the ASCAT/QuikSCAT differences: investigating the coupling between SST gradients and near-surface wind response
- Found that QuikSCAT shows a much **stronger correlation between the short-scale perturbations in the wind stress curl and divergence and the cross-wind and down-wind components of the SST gradients.**
- This has implications for :
  - The sensible heat and momentum fluxes
  - The modification in the MABL and the cloud thickness
  - The magnitude of the upwelling associated with the SST-induced wind stress curl perturbations that will have impact back on the ocean, altering the SST (O'Neill, Chelton and Esbensen, 2005)
- **The above is true for the Southern Ocean and the Gulf Stream BUT does not hold in the Tropical Eastern Pacific where the two scatterometers have the same response.**
- **WHY???? Is it a resolution issue??**