Biases Related to Stress and Rain

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Users Make Assumptions When Using Data

- Examples of assumptions common to winds products:
  - The data are temporally homogeneous for inter-annual variability
  - The data qualities (error characteristics) are spatially homogeneous
  - The spatial and temporal resolution is equal to the grid spacing
  - Features evolve smoothly in time
  - Noise is small at the grid resolution provided
  - Derivative fields (usually spatial derivations: e.g., curl or divergences) have homogeneous error characteristics
    - Note: this is a very big deal for oceanographers
  - Data product producers have <u>adequately</u> considered the error characteristics of the data.
  - The statistics of regularly gridded data (at any resolution) should match the statistics of swath data
  - The mean 'speed squared' equals the 'mean speed' squared
  - The data set is good enough for my application

Typical Consequences of Failure

- If the science results are obviously wrong
  - Any data associated satellite are seriously wrong
    - Amazingly, this is the most frequent response
  - The specific data set used is unsuitable for any application
    - Regardless of how obviously unsuitable it was in the first place

- The PO.DAAC has agreed to post appropriate information
  - Provided that we provide it, and
  - Develop the comparison tools/techniques, and
  - The interpretation.
  - Ideally with words and graphics

What If A Scatterometer Responds to Stress?

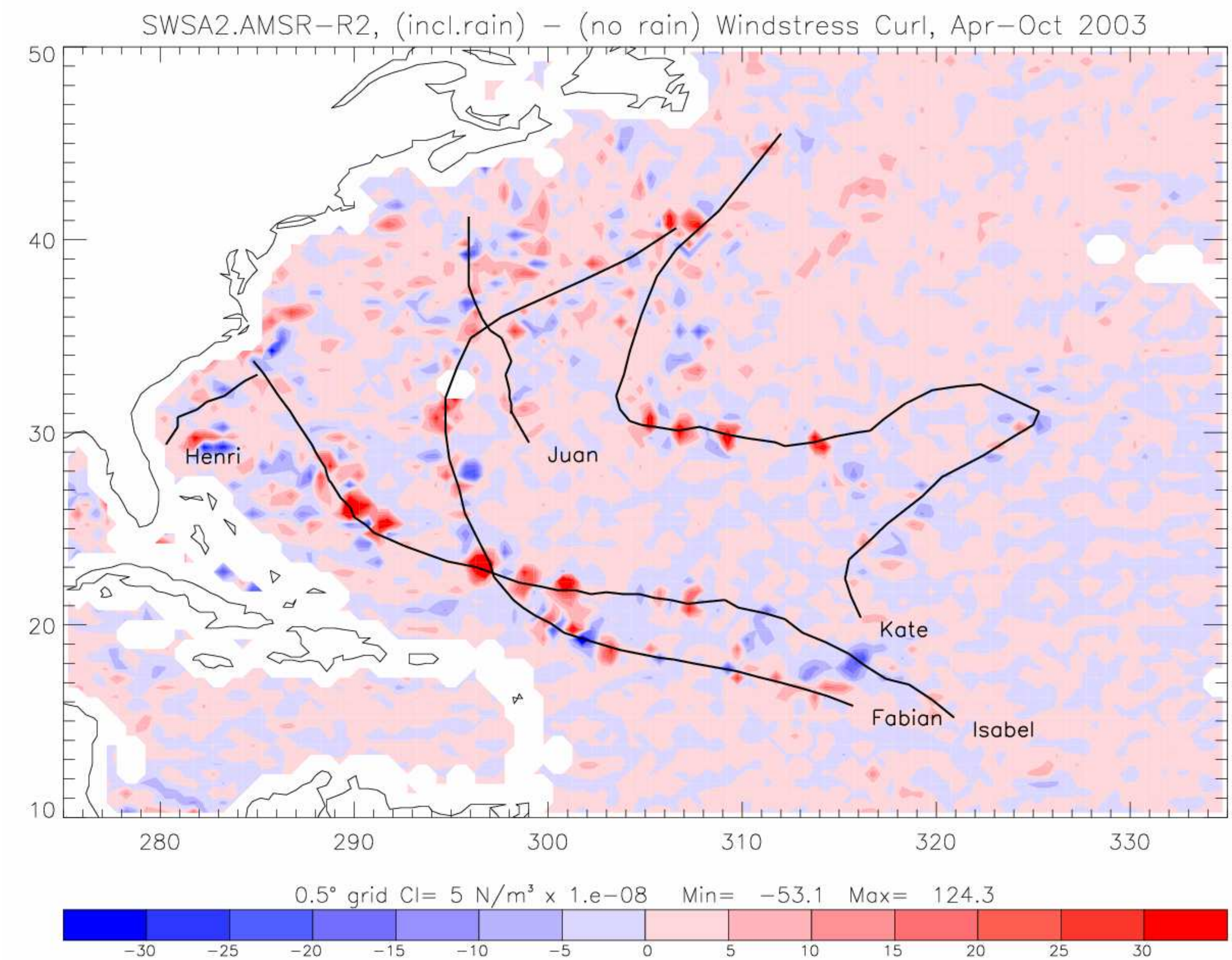
- Equivalent Neutral Winds are defined as follows:

$$U_{10EN} = \frac{u_*}{k} \ln\left(\frac{10}{z_o}\right)$$

- Stress, is a function of air density and friction velocity
  - $\tau = \rho_{air}\, u_*^{\,2}$
- Equivalent neutral winds are equivalent to kinematic stress, but NOT to stress.
- If scatterometers respond to stress, then calibrations to this form of equivalent neutral winds will be off by a factor of $\rho^{0.5}$,
  - Or more accurately, in proportion to (actual density / mean calibration density $)^{0.5}$

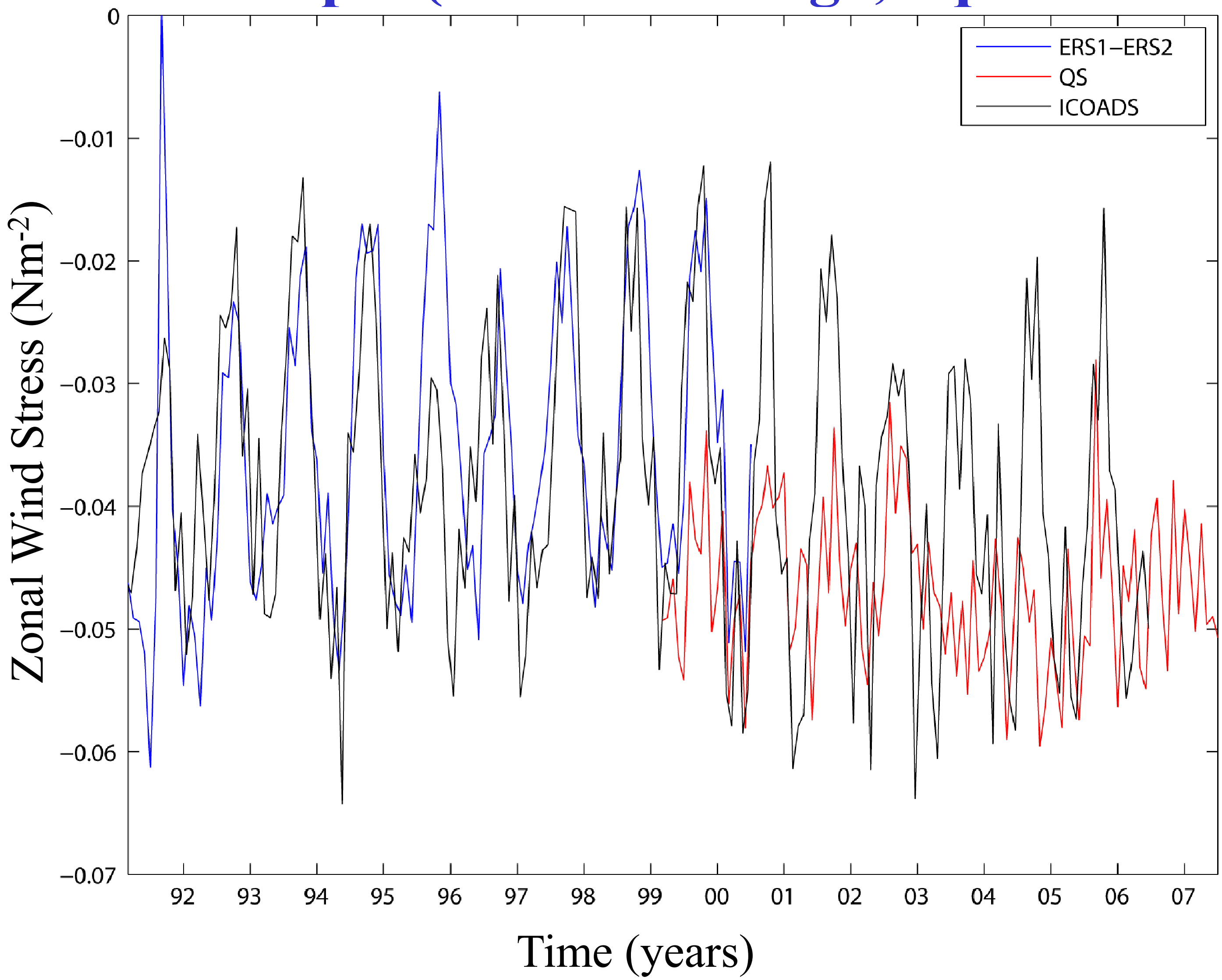
$$U_{10EN} = \frac{(\tau / \rho)^{0.5}}{k} \ln(10 / z_o)$$

Wind Stress Curl Difference



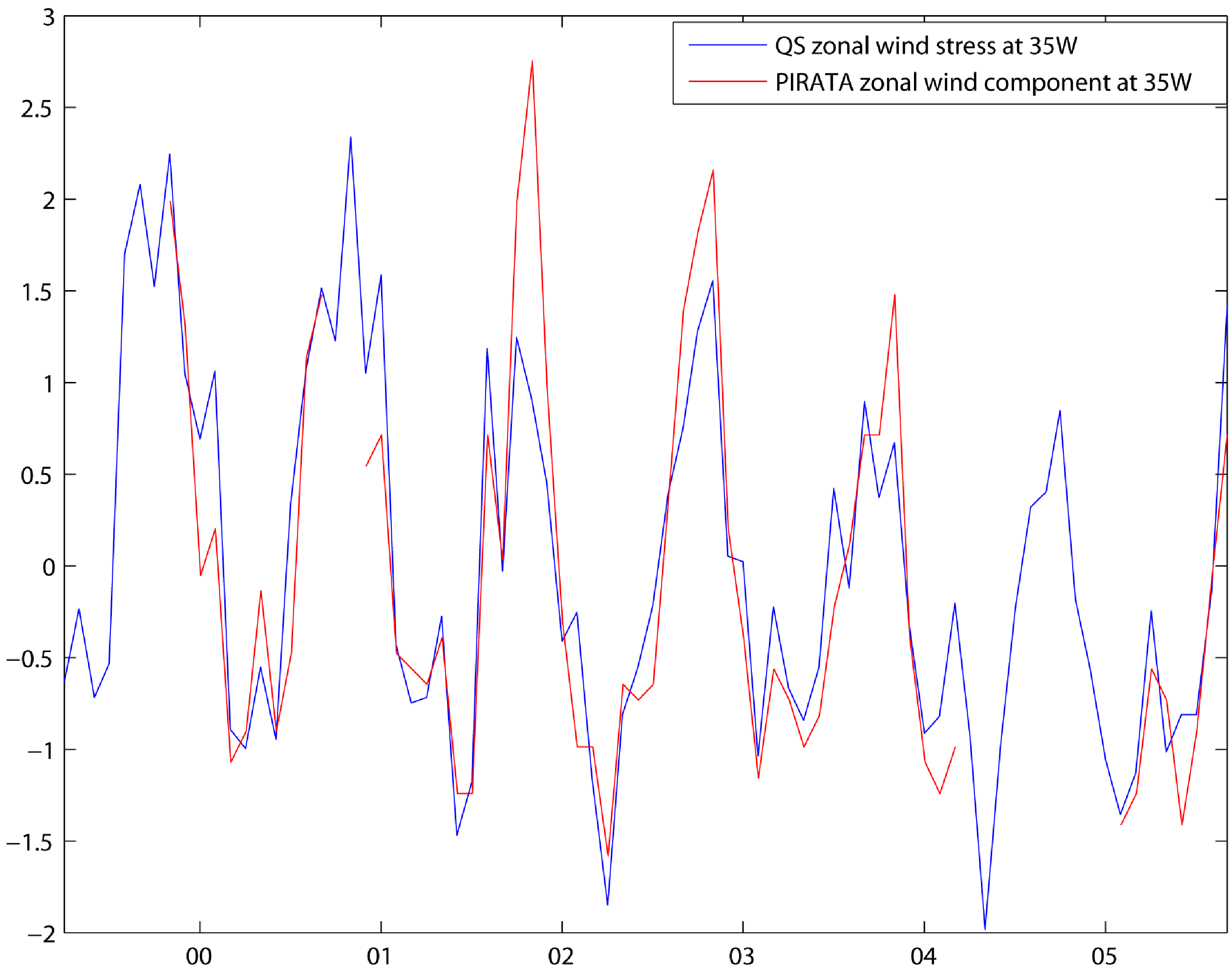
- Wind retrievals using the AMSR corrections on SeaWinds ADEOS-2 minus the same winds using the standard rain flag.
- Provided by Ralph Milliff

Example (binned average; equatorial Atlantic)



- Zonal wind stress.
- Data characteristics for the QSCAT period is far different from the ERS period.
- ICOADS data are consistent with ERS, not with QSCAT

Example



- Comparison to a different scatterometer product.
- Talking to the producer of the more questionable product I found that QSCAT data associated with rain were not considered
- All products are not equal!

Conclusions

- Biases in L3 and L4 fields associated with rain, and the use or non-use of rain flags, are a serious problem.
- Biases associated with stress are probably smaller, but could be important in areas with strong temperature gradients and for long term forcing.
- The information on current L3 and L4 products is dangerously insufficient for most users of these products.

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