The JPL Ku-Band Scatterometer Data Product

Alexander Fore, Bryan Stiles, Brent Williams, Alexandra Chau, Sermsak Jaruwatanadilok, R. Scott Dunbar and Ernesto Rodridguez

Jet Propulsion Laboratory, California Institute of Technology

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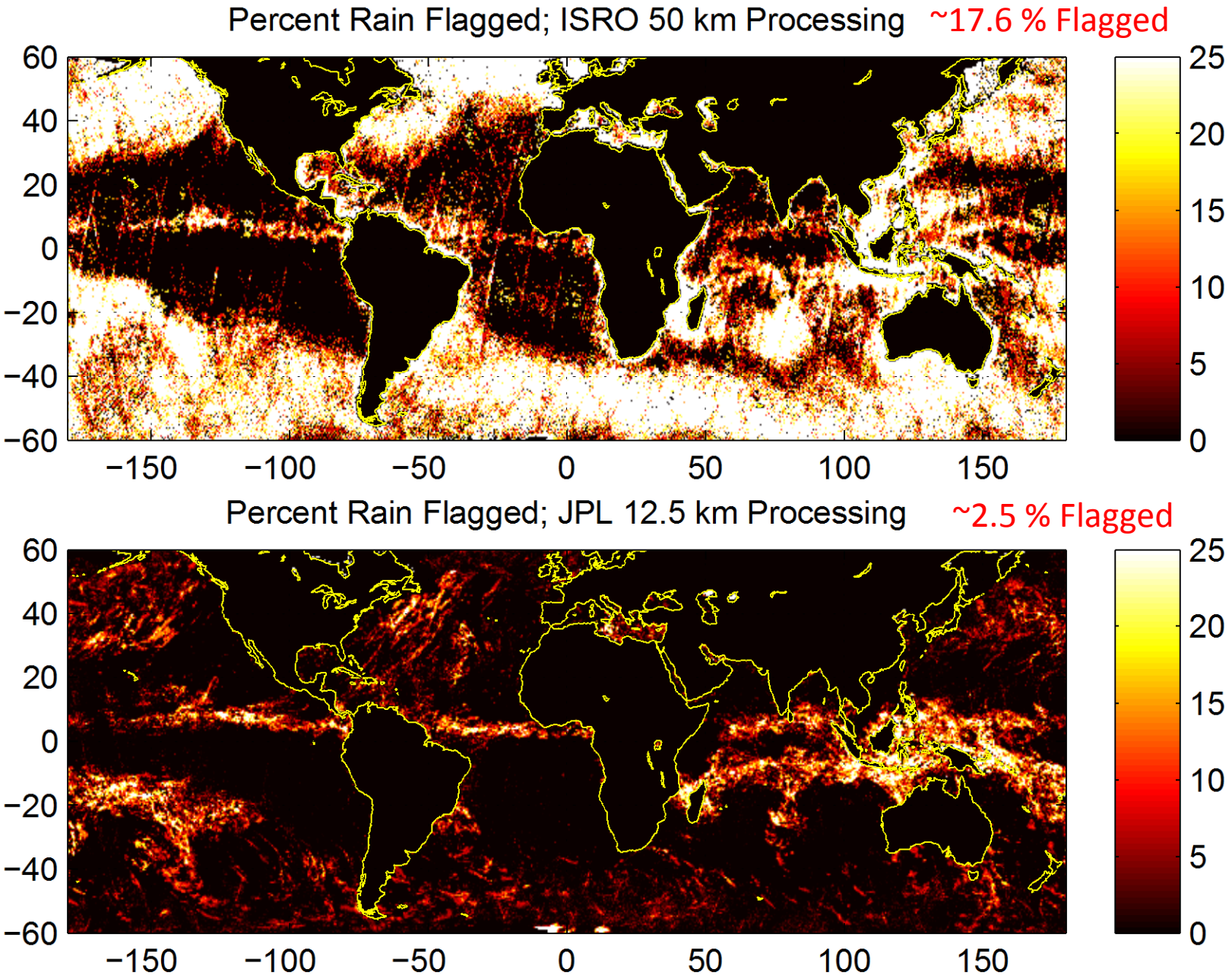
Outline of Talk

- Overview of JPL improvements to OSCAT processing.
  - Model function, calibration drift correction *(discussed in other talks).*
  - Rain flagging and rain speed correction
  - Cross-track bias adjustment
  - High resolution wind retrievals
- Discussion of validation performed on JPL OSCAT L2B and QuikSCAT L2B and L2C products.
  - Buoy comparisons.
  - Comparisons to ECMWF.
  - Spectral comparisons.

JPL Improvements to OceanSat-II Processing

- We use an identical file format as used for QuikSCAT V3 L2B data.
- High resolution 12.5 km processing.
  - Overlap processing is used, as in the QuikSCAT V3 L2B product.
- Improved rain flagging; we leverage QuikSCAT rain flagging and rain correction methods.
- Cross-Track bias adjustment
- Model function developed using the QuikSCAT instrument. *(Chau, et al presentation)*
  - Ensures continuity of inter-calibrated Ku-Band Ocean Vector Winds (OVW).
- Adjustment made for observed OceanSat-II calibration drift *(Jaruwatanadilok, et al presentation)*.
  - The continued operation of QuikSCAT has given an independent source of Ku-band σ_0.
  - Our understanding is that the OSCAT loopback is not being used, and QuikSCAT is the only way we can do this.



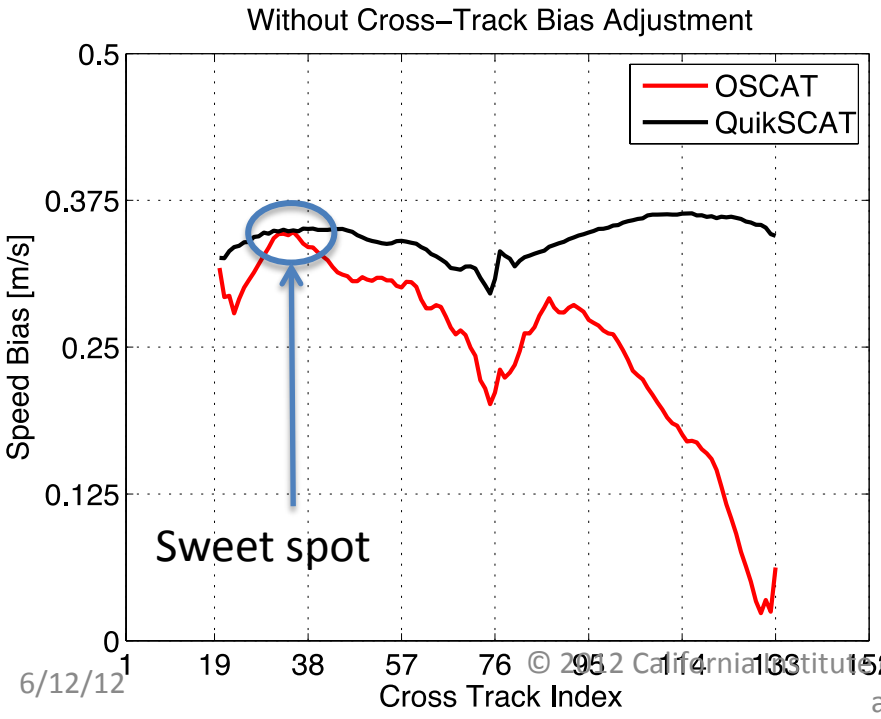
Note: the top map has values much greater than 25%

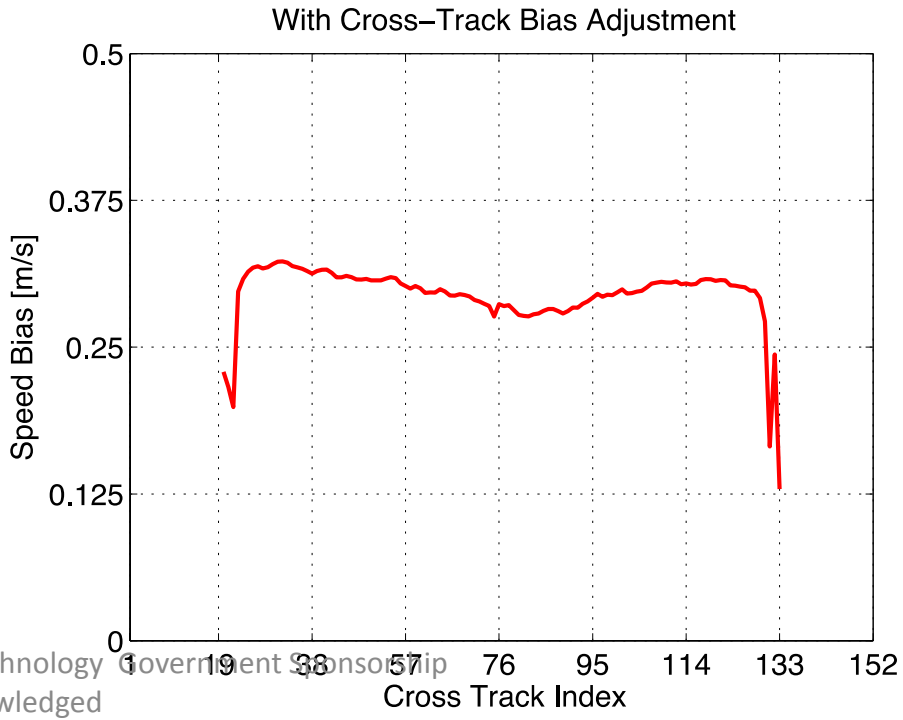
JPL Rain Flag and Speed Correction for OceanSat-II

- Leverage similarity of OceanSat-II and QuikSCAT to develop rain flag.
  - Use existing QuikSCAT neural-network based rain impact estimation methods. (from V3 L2B12 product)
  - Develop a cumulative distribution function (CDF) matching of the neural-network inputs [(fore, aft) x (HH, VV) σ_0 combinations]
- Flag all data with rain impact above a fixed threshold as rain.
  - Set thresholds for rain flagging so we flag same % of data as QuikSCAT.
- Apply rain speed correction neural-network as well.

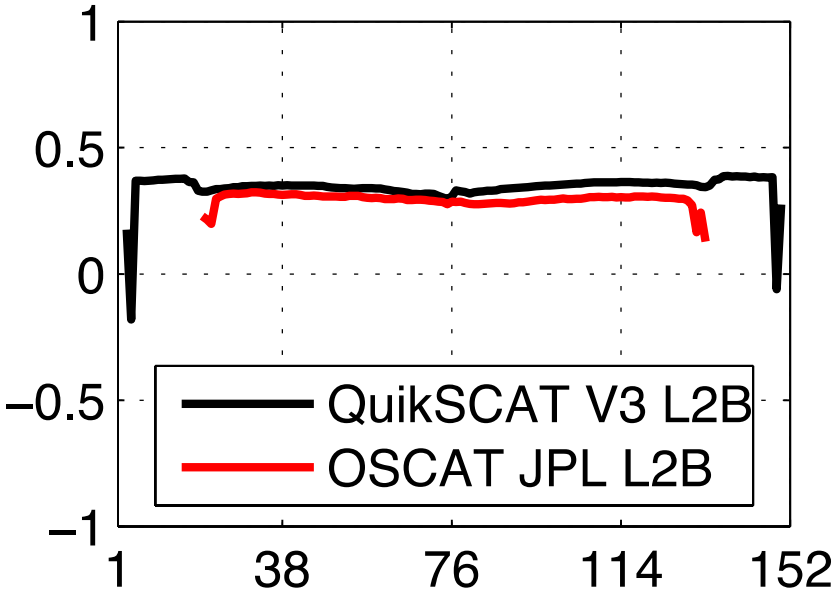
Cross-Track Bias Adjustment

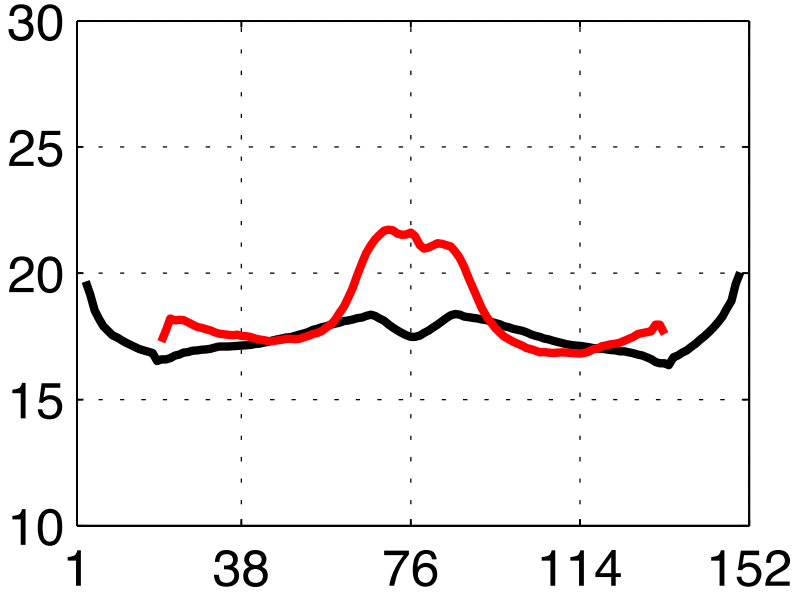
- The OSCAT data has a cross-track bias due to instrument issues.
  - If uncorrected, this leads to systematic slopes in the retrieved wind speeds.
- We remove a speed bias as compared to ECMWF with respect to the "sweet spot" cross-track locations, as a function of retrieved wind speed.
  - Sweet spot is region where OSCAT speed bias is most similar to QuikSCAT speed bias.
  - The resulting bias adjustment across the swath is then referenced to the speed bias of these sweet spot locations. We do not remove the overall bias.



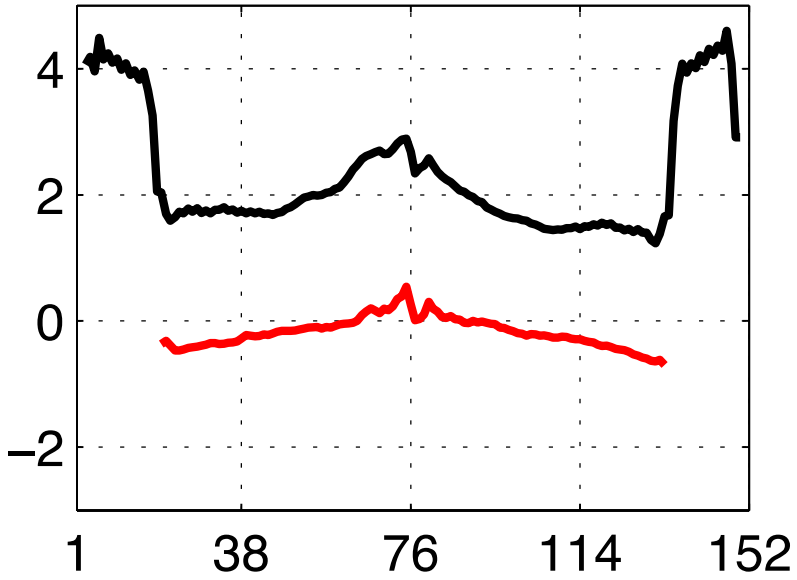


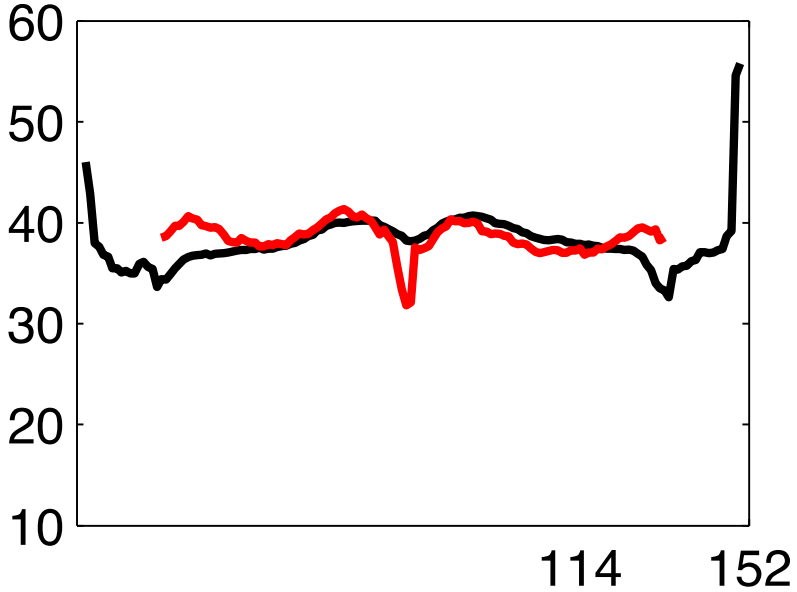
Data Flagged as Rain-Free; ECMWF in 3 to 30 m/s





Data Flagged as Rainy; ECMWF in 3 to 30 m/s





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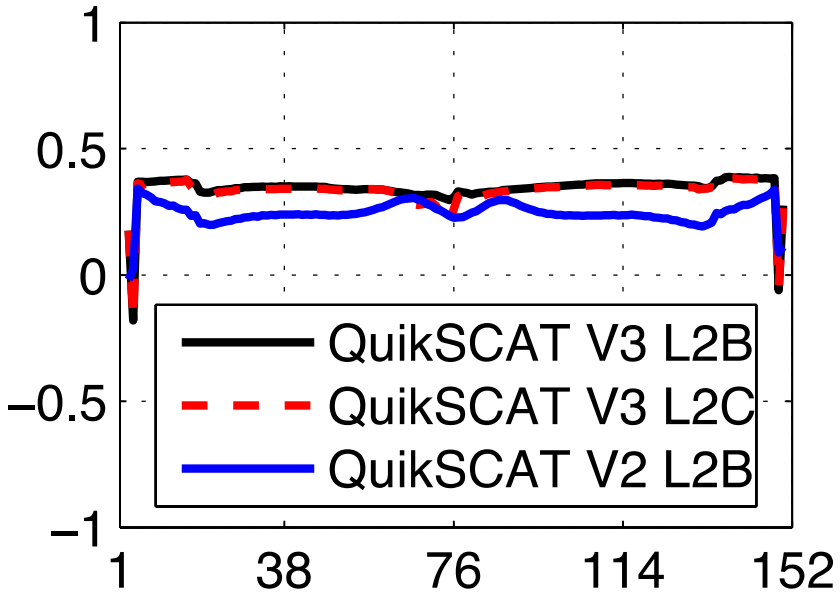

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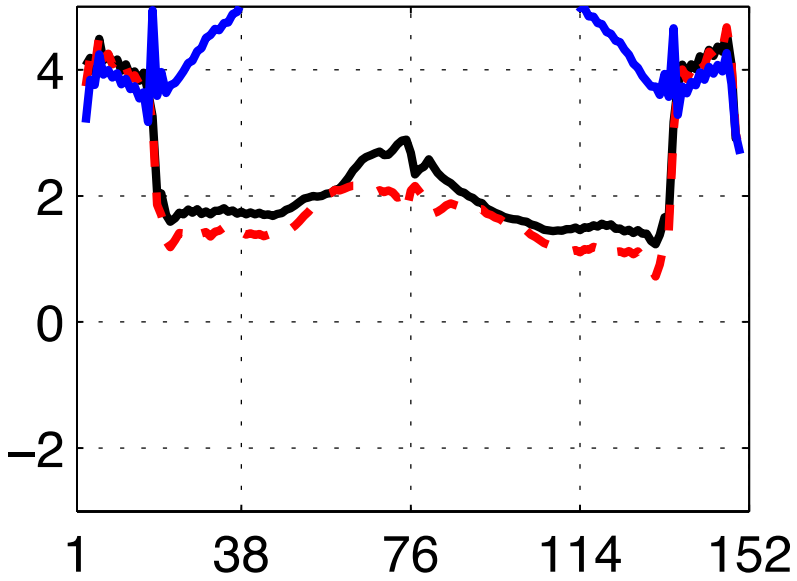
Data Flagged as Rainy; ECMWF in 3 to 30 m/s

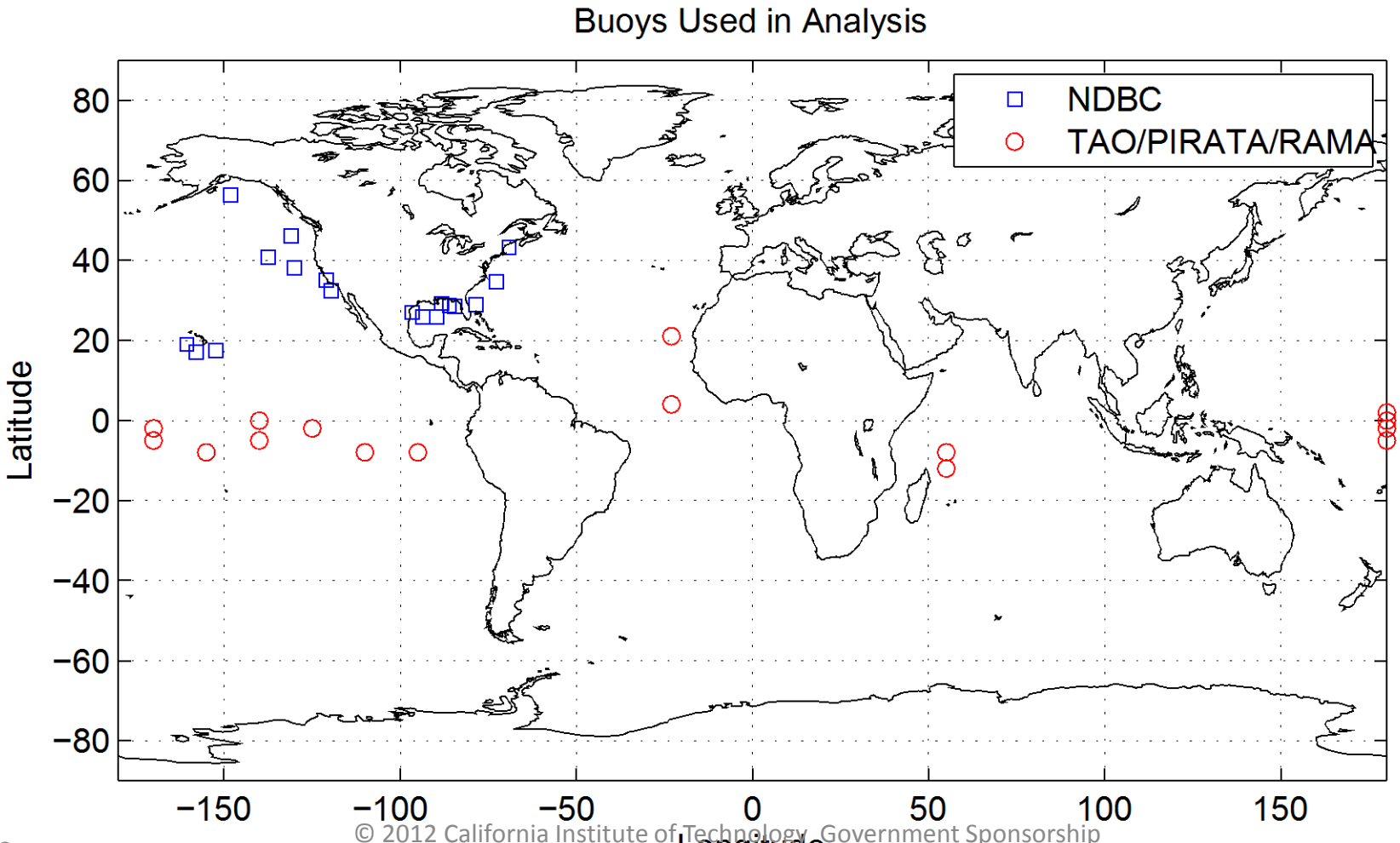


SCAT V2 L2B

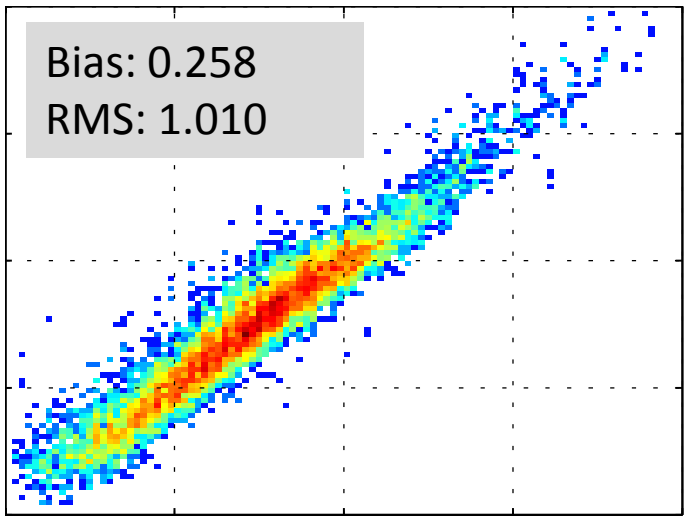
Buoy Validation

Criteria for JPL 12.5 km data:
Buoy speed > 3 & < 30
Within 12.5km
Within 30 minutes
Rain impact >0 & < 2.5 (2.44 for OSCAT)

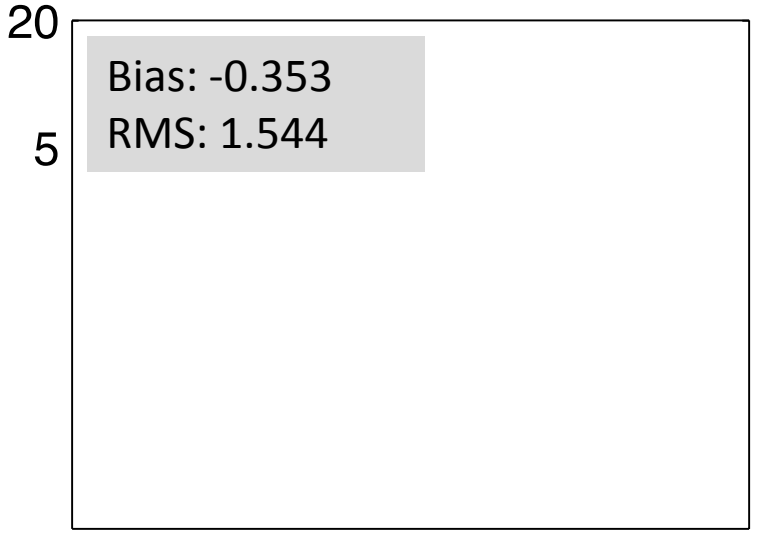
Criteria for ISRO 50 km data:
Buoy speed > 3 & < 30
Within 50km
Within 30 minutes
Flagged as rain flag valid and not rain.

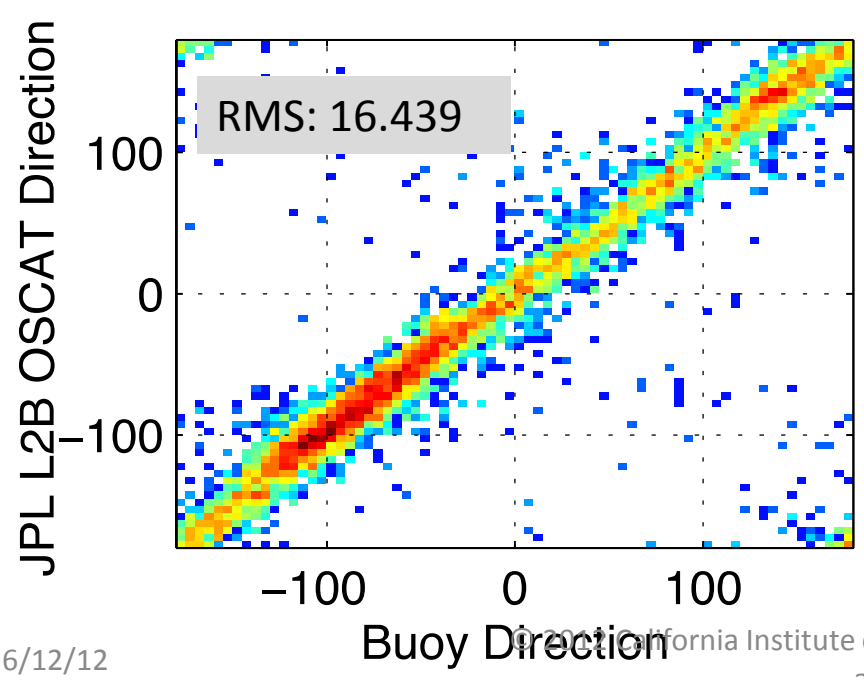


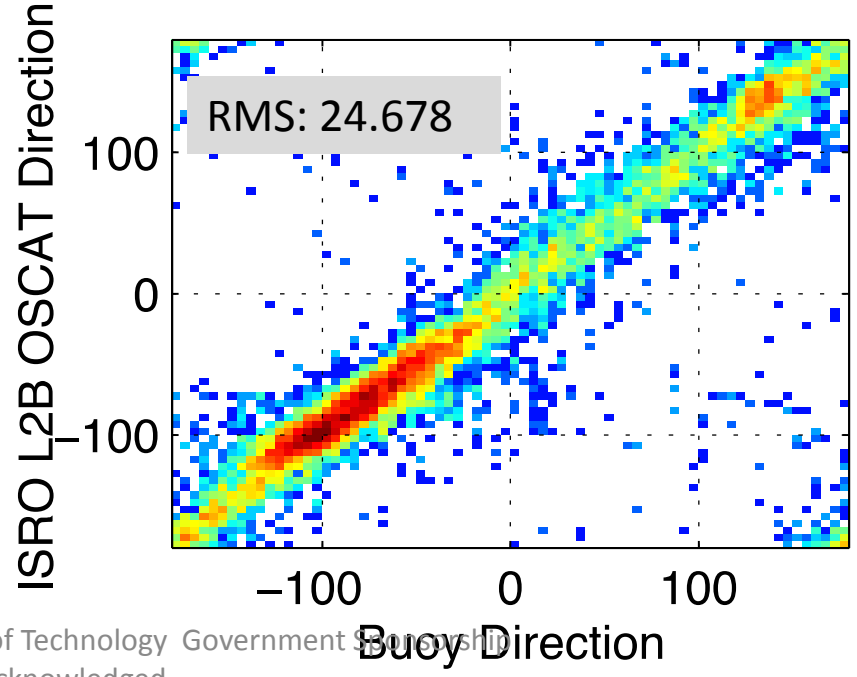
OSCAT Buoy Validation (JPL V3 L2B)



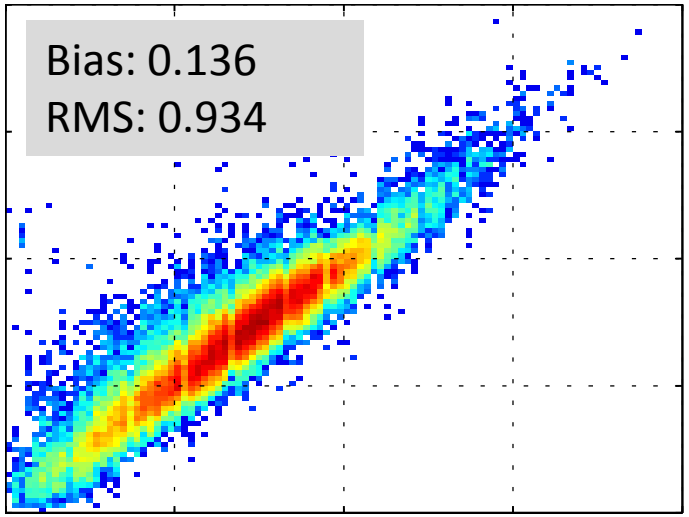
OSCAT Buoy Validation (ISRO L2B)

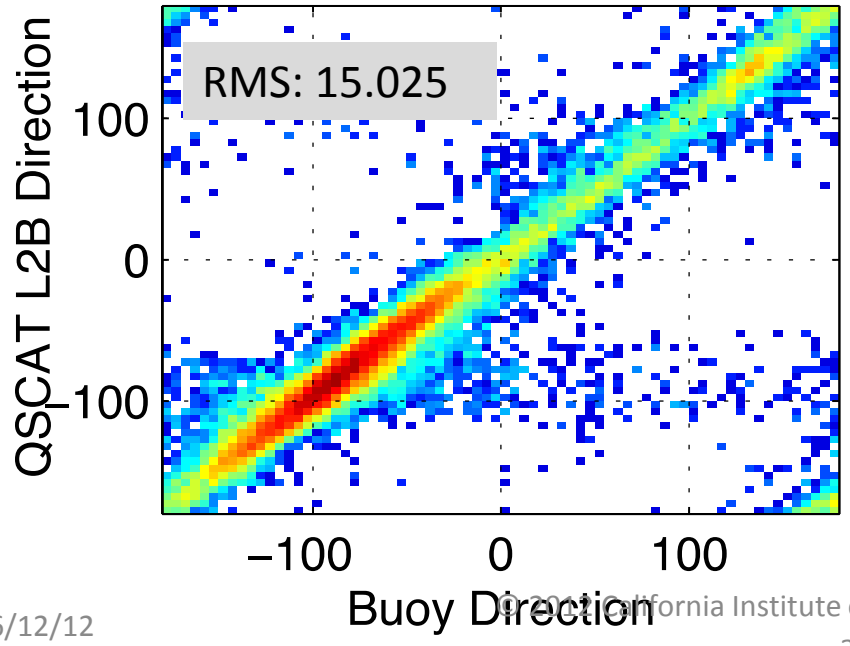




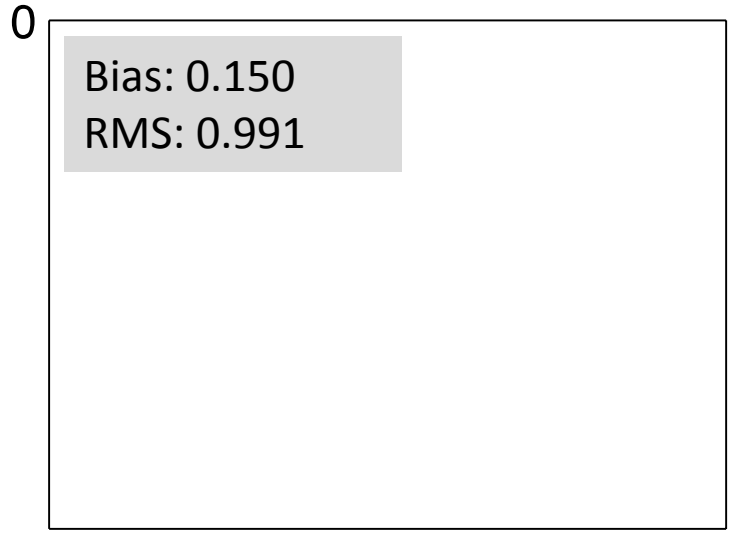


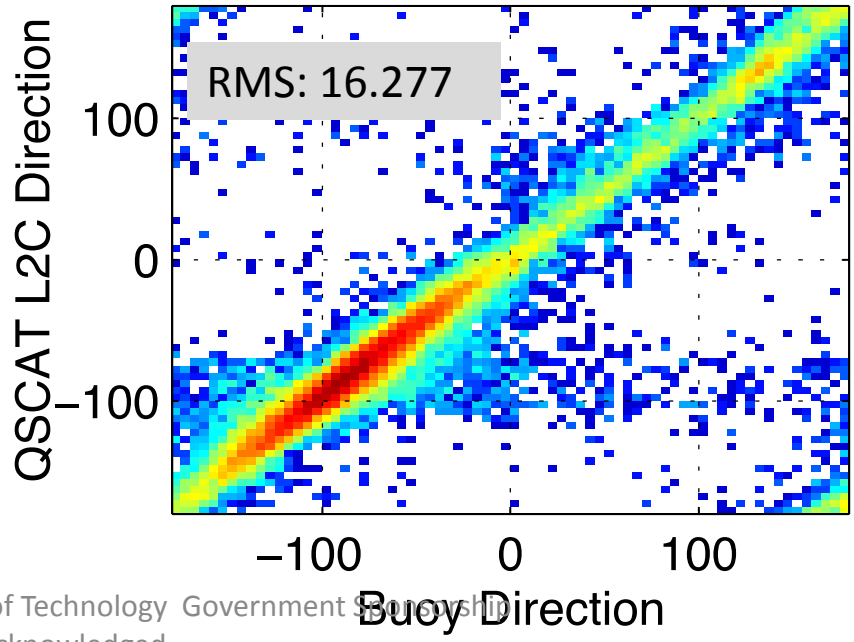
QuikSCAT Buoy Validation (V3 L2B)

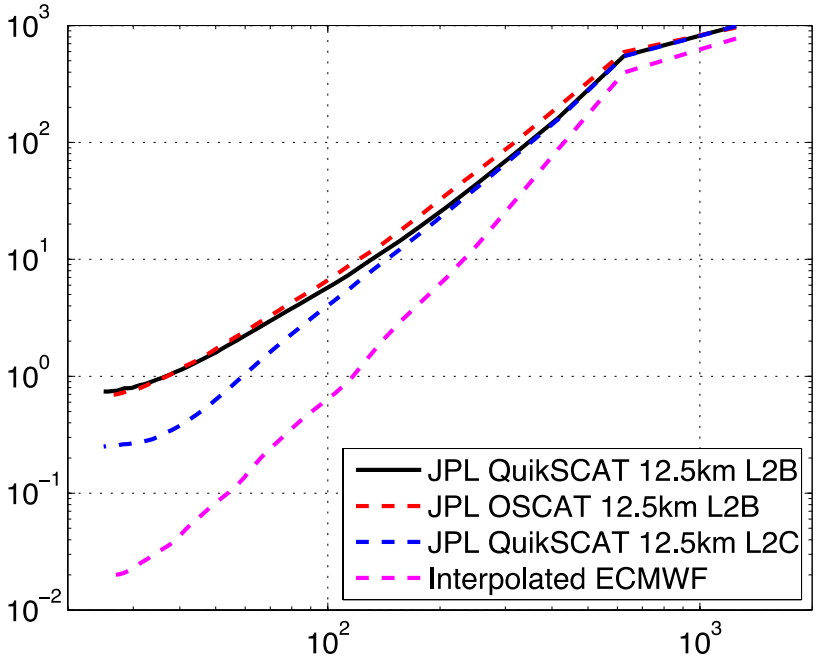


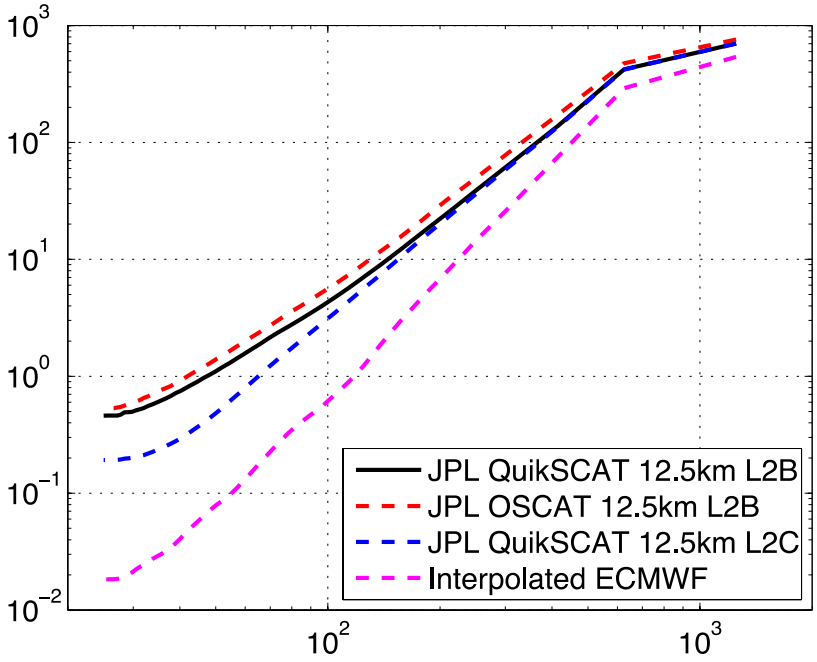


QuikSCAT Buoy Validation (V3 L2C)

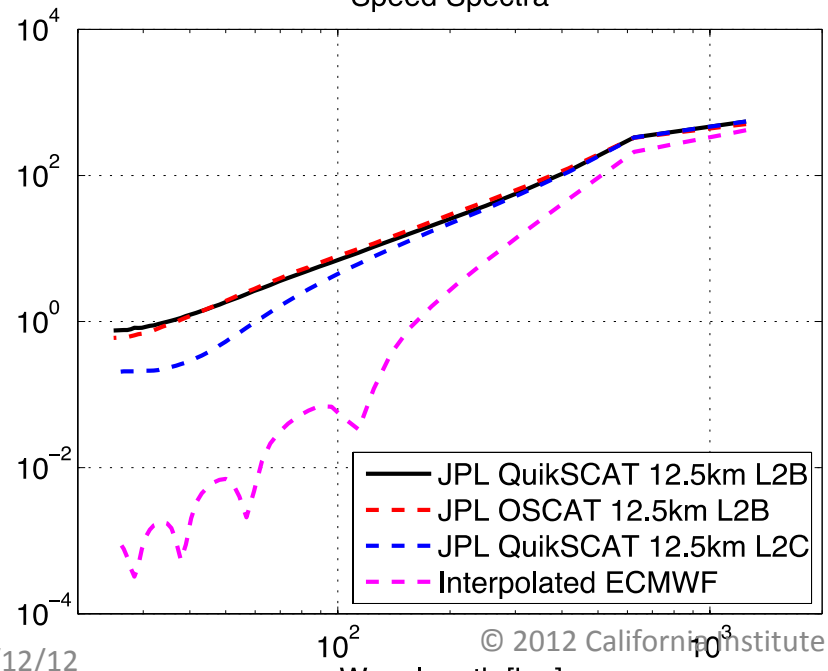




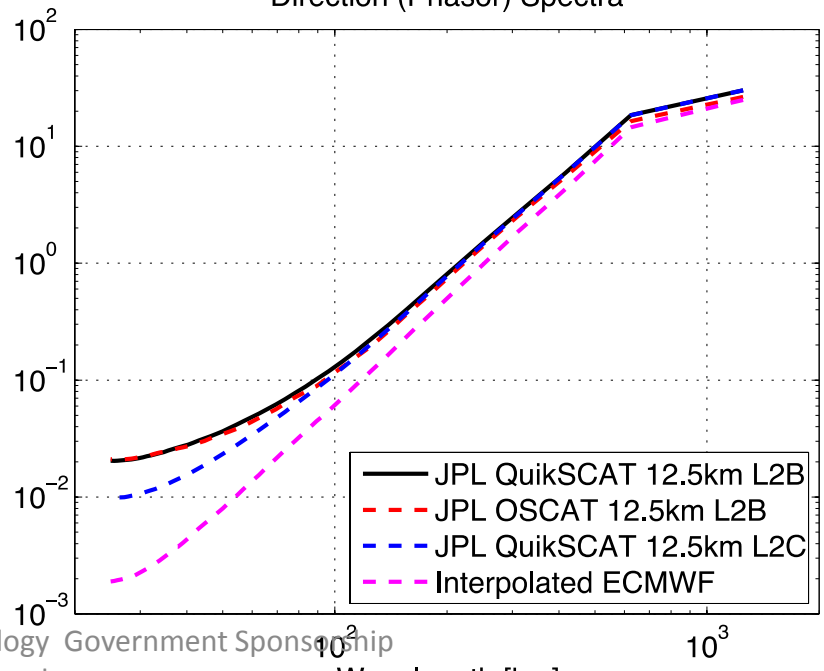




Speed Spectra



Direction (Phasor) Spectra

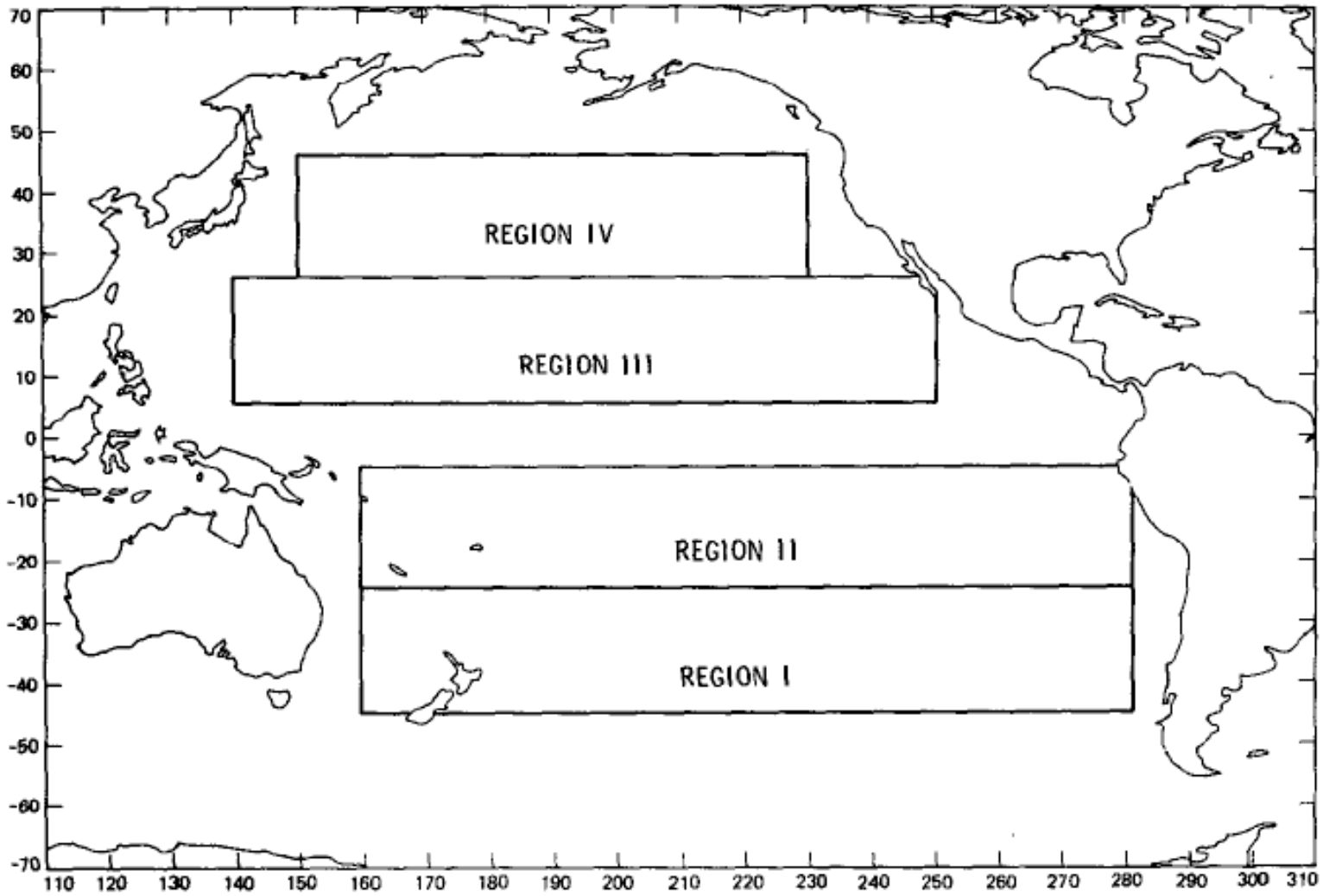


Summary and Future Work

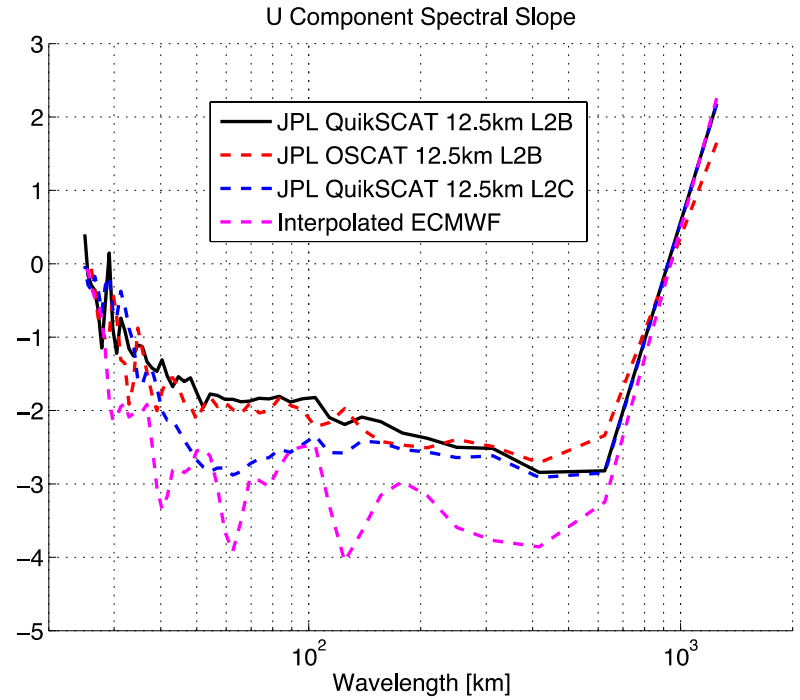
- Summary:
  - Modified QuikSCAT rain impact and rain correction neural networks for use with OSCAT data.
    - The JPL 12.5m OSCAT product flags about 2.5 % of the data as rainy whereas the ISRO L2B product flags about 17.6% of the data as rainy.
  - Developed cross-track bias adjustment to remove speed biases due to instrument issues.
  - Showed that OSCAT and QuikSCAT have comparable performance as compared to ECMWF and buoys.
    - The JPL 12.5km OSCAT product is significantly better than the ISRO 50km L2B product.
  - Showed that the QuikSCAT L2B and L2C products have similar performance, both as compared to ECMWF and as compared to buoys.
  - The spectra computed from QuikSCAT L2B and JPL OSCAT L2B products have very similar slopes and shapes indicating similar levels of noise.
  - QuikSCAT V3 12.5km L2B is much improved from V2 12.5km product.
- Future Work
  - Adapt QuikSCAT IMUD rain flag to OSCAT data.

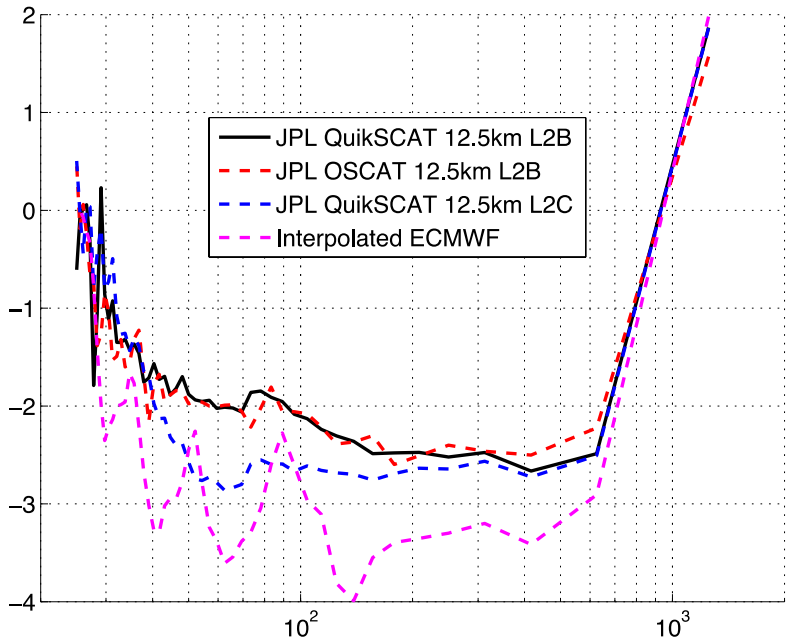
BACK UP SLIDES

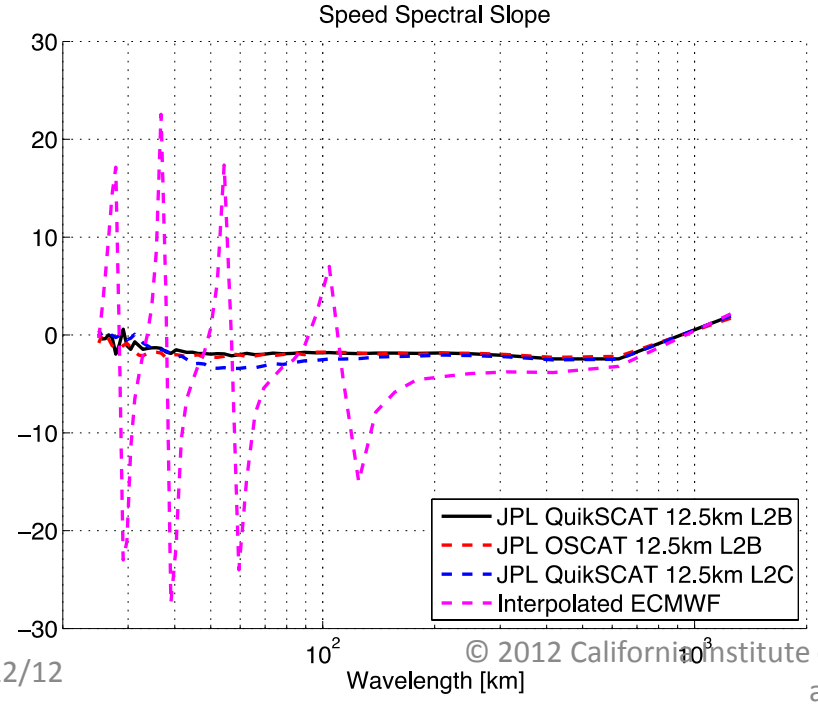
Regions for Computing Spectra

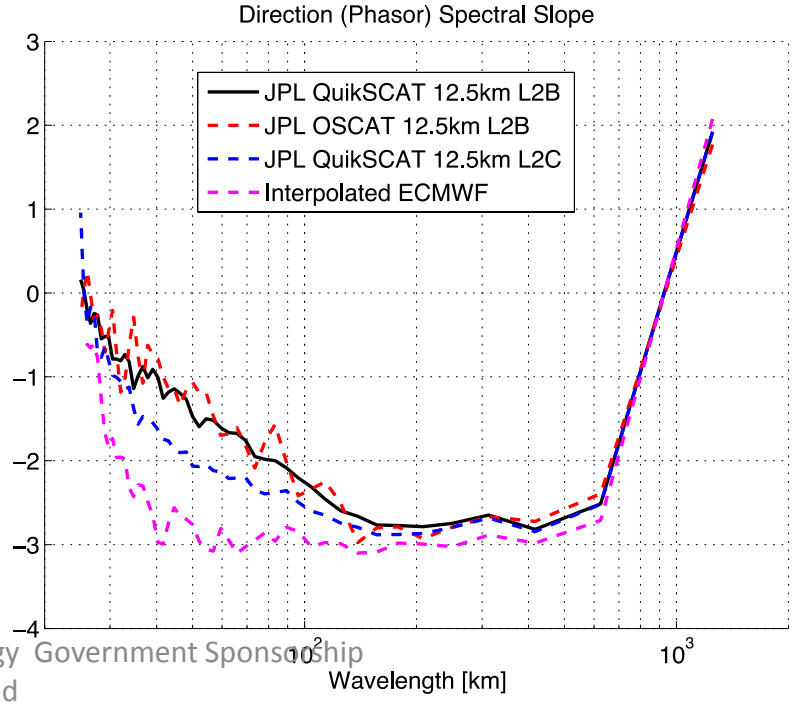


Freilich and Chelton, Journal of Physical Oceanography, 1986









Buoy (backup info)

Time: 30 min; Dist: 12.5 km; abs(lat)<50
rain Impact >= 0 & less than rain correct threshold
Buoy speed > 3 & < 30 m/s; only my trusted buoys

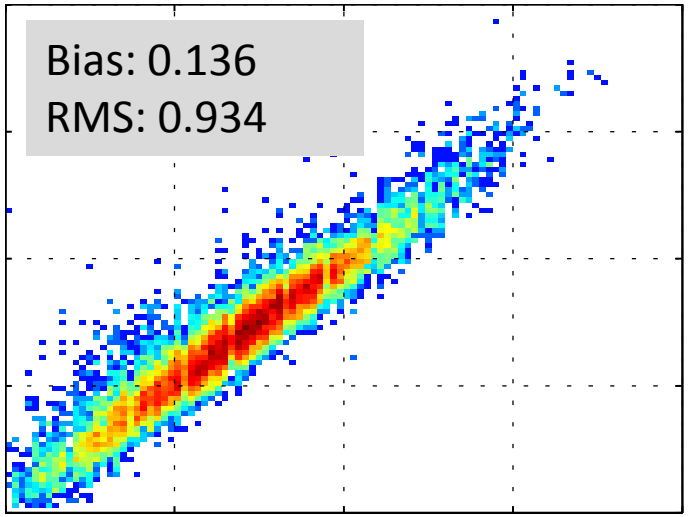
OSCAT
SCAT-BUOY: SPD bias, SPD std, DIR std: 0.258 1.010 16.439
SCAT-ECMWF; SPD bias, SPD std, DIR std: 0.445 1.212 14.619
BUOY-ECMWF; SPD bias, SPD std, DIR std: 0.187 1.209 15.346

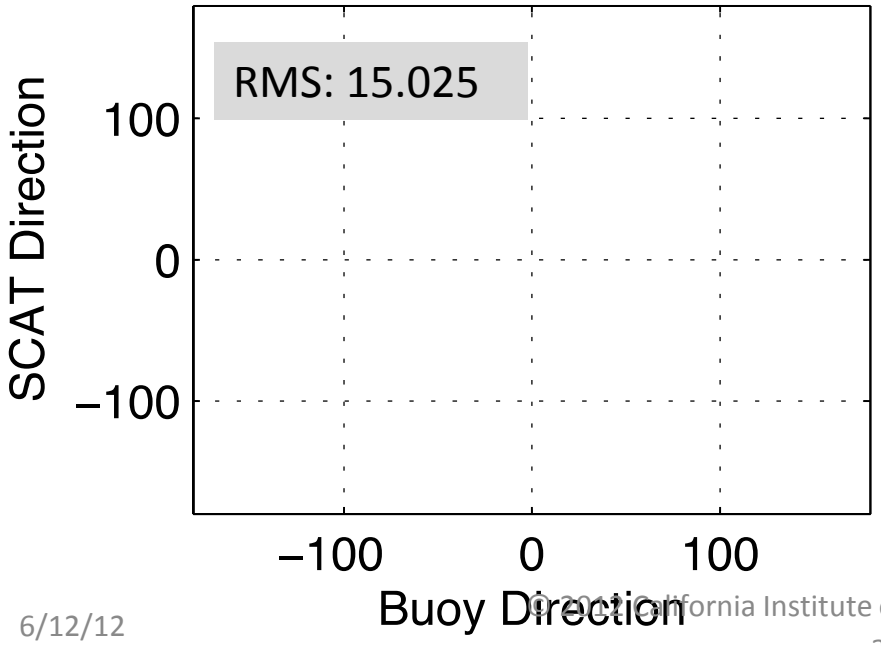
QuikSCAT
SCAT-BUOY: SPD bias, SPD std, DIR std: 0.136 0.934 15.025
SCAT-ECMWF; SPD bias, SPD std, DIR std: 0.499 1.216 16.352
BUOY-ECMWF; SPD bias, SPD std, DIR std: 0.363 1.216 17.734

Dist 50 km
OSCAT:
SCAT-BUOY: SPD bias, SPD std, DIR std: 0.241 1.196 17.586
SCAT-ECMWF; SPD bias, SPD std, DIR std: 0.437 1.238 15.344
BUOY-ECMWF; SPD bias, SPD std, DIR std: 0.197 1.250 16.307

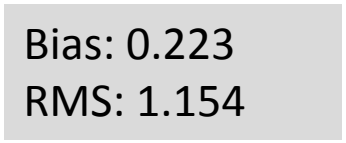
QuikSCAT
SCAT-BUOY: SPD bias, SPD std, DIR std: 0.127 1.112 16.100
SCAT-ECMWF; SPD bias, SPD std, DIR std: 0.495 1.228 16.397
BUOY-ECMWF; SPD bias, SPD std, DIR std: 0.368 1.243 18.198

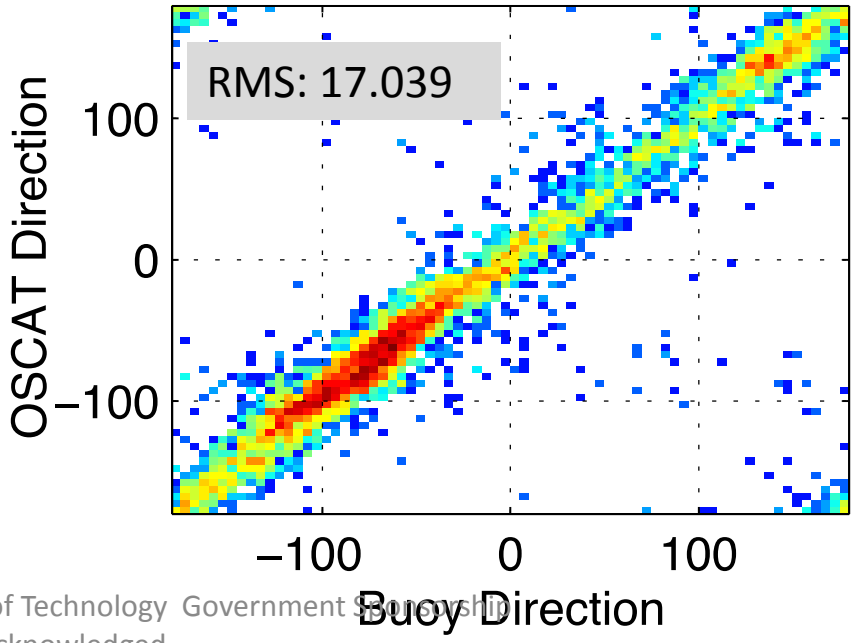
QuikSCAT Buoy Validation (V3 L2B)

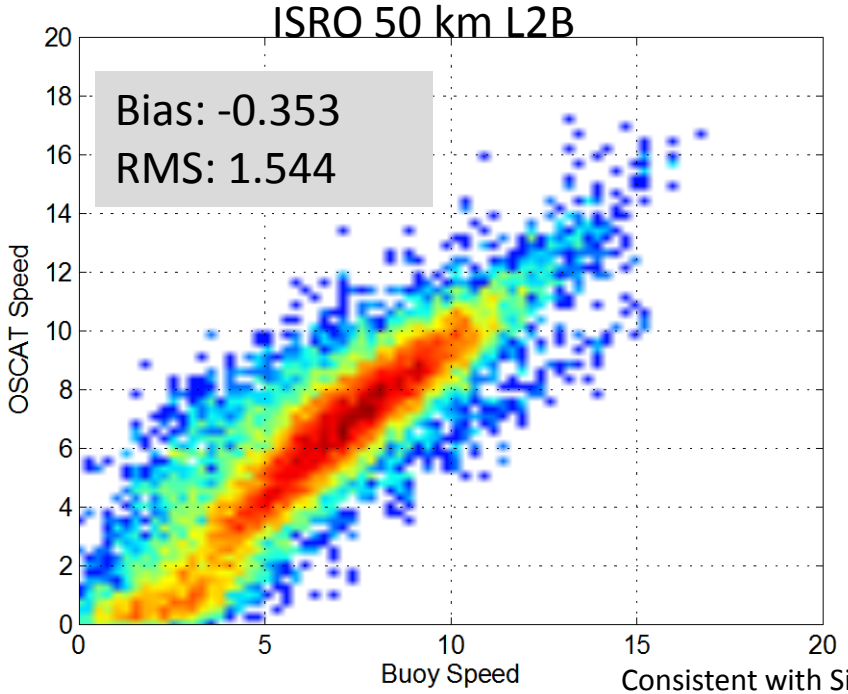


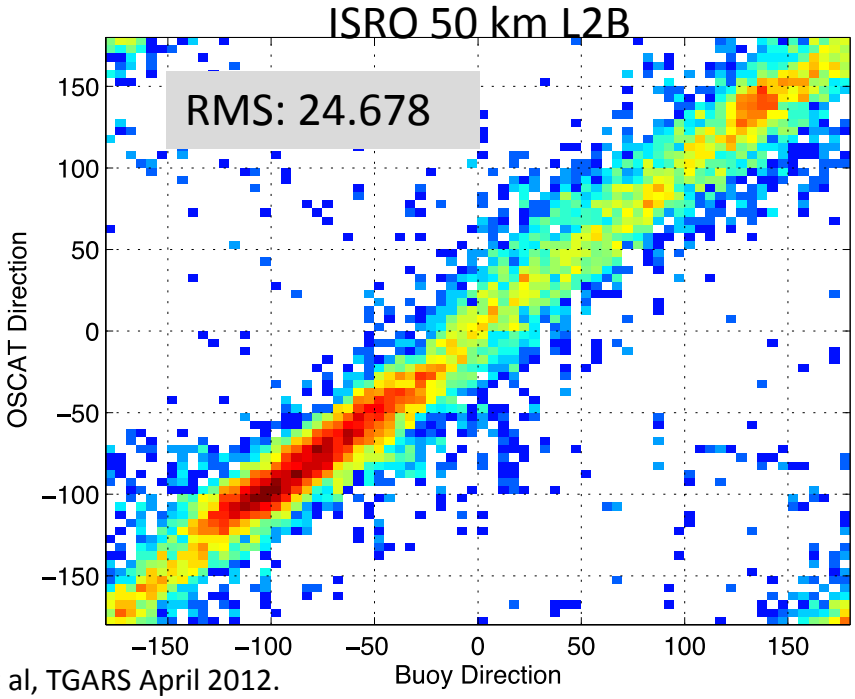


OSCAT Buoy Validation (JPL L2B)









Consistent with Singh et al, TGARS April 2012.

QuikSCAT vs OceanSat-II Rain Flagging

- OceanSat-II ISRO/L2B product has much more data flagged as rainy than QuikSCAT. (17% vs 2.5%)
  - The majority of this data is not rain contaminated but high-winds.
- We see somewhat larger errors w.r.t. ECMWF, but not nearly the same scale as with QuikSCAT.

OceanSat-II (ISRO L2B)

QuikSCAT (V2 L2B12)