SCATSAT Data Quality and Initial Results

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Outline of Talk

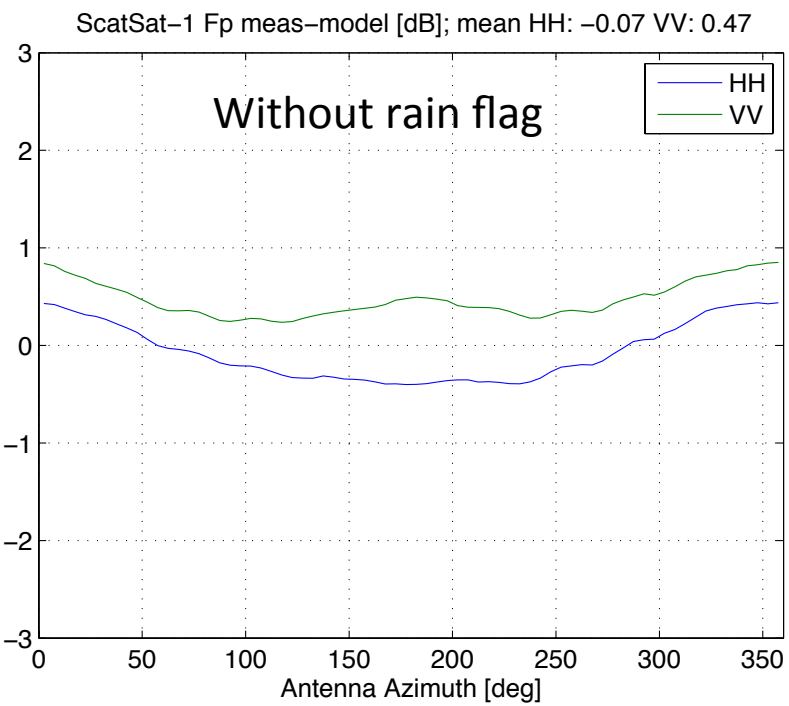
- SCATSAT-1 data quality and calibration
  - Slice balancing
  - Overall calibration
- SCATSAT-1 wind retrieval performance
  - JPL has implemented same OCSAT algorithms for SCATSAT-1
  - Comparison of ISRO and JPL OVW performance
- Joint SCATSAT-1 / ASCAT-A/B winds

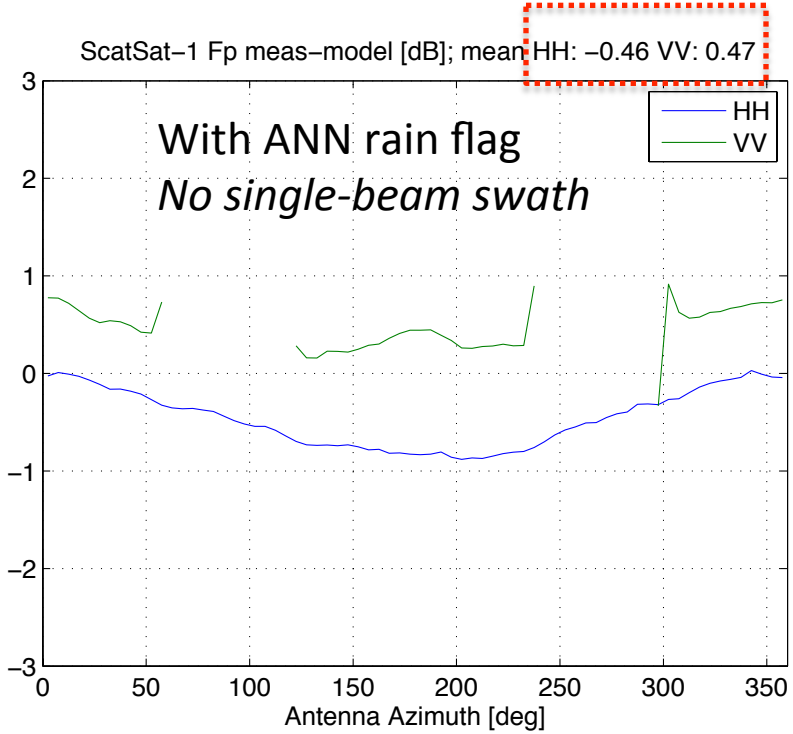
SCATSAT-1 Data Quality

- Echo centering is good.
- Percentage of negative σ_0 are correct.
- Slice balancing shows large mis-balance between slices.
- Overall calibration is very close:
  - Applied a +0.47 dB adjustment to HH.
  - Applied a -0.47 dB adjustment to VV.
  - *QuikSCAT based calibration is not complete yet.*
- All results are for version 1.1.1 data; we haven't assessed 1.1.2 yet.

SCATSAT-1 Footprint Calibration

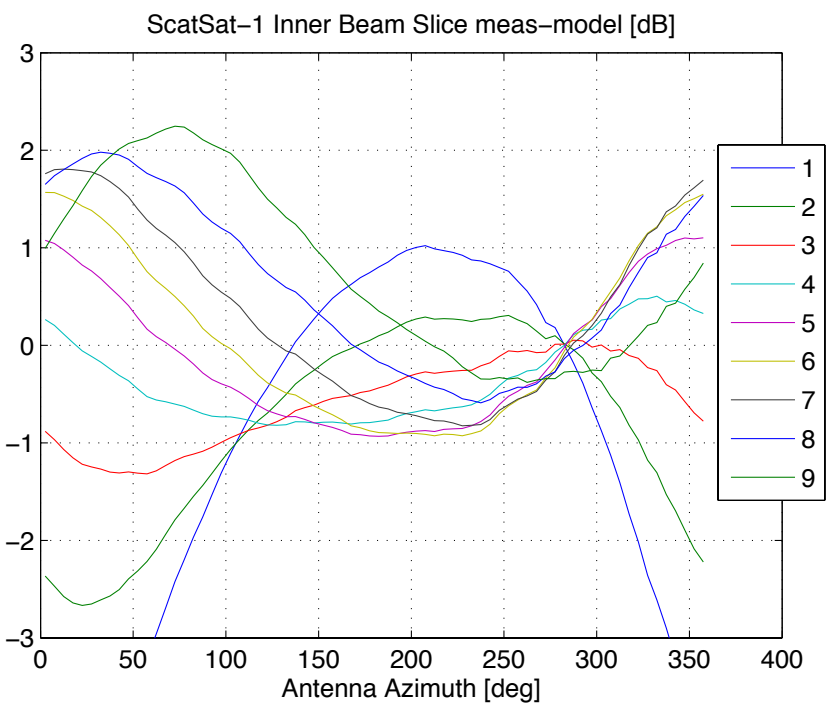
- Use OSCAT GMF and ECMWF to compute model σ_0 for every pulse.
- HH biased low by 0.46 dB; VV high by 0.47 dB.
  - Corrected for in initial processing.

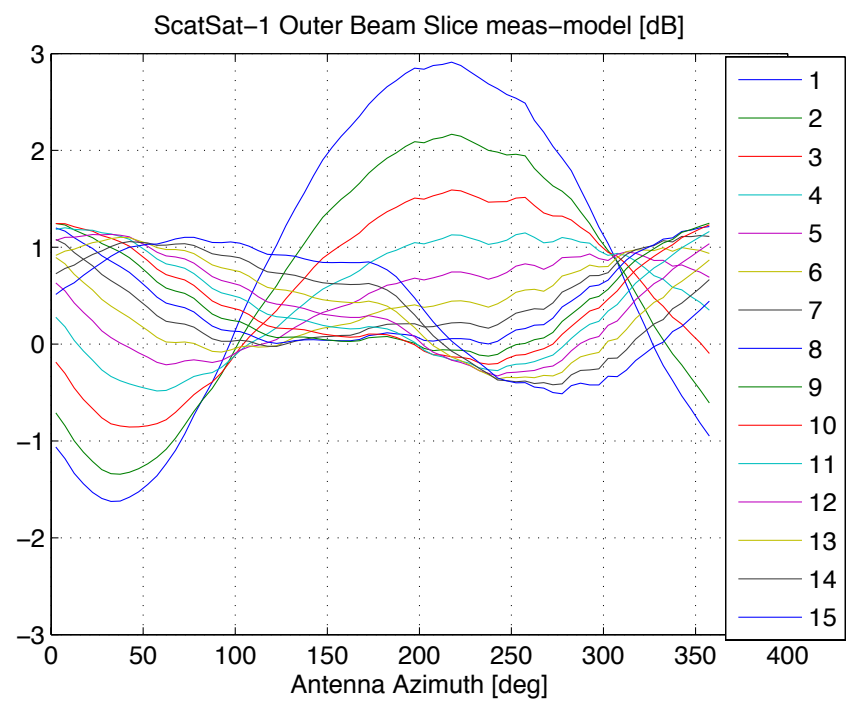




SCATSAT-1 Slice Balance

- Use ECMWF and OSCAT GMF to compute model σ_0 for slice.
- *Slice misbalancing corrected for in JPL processing.*

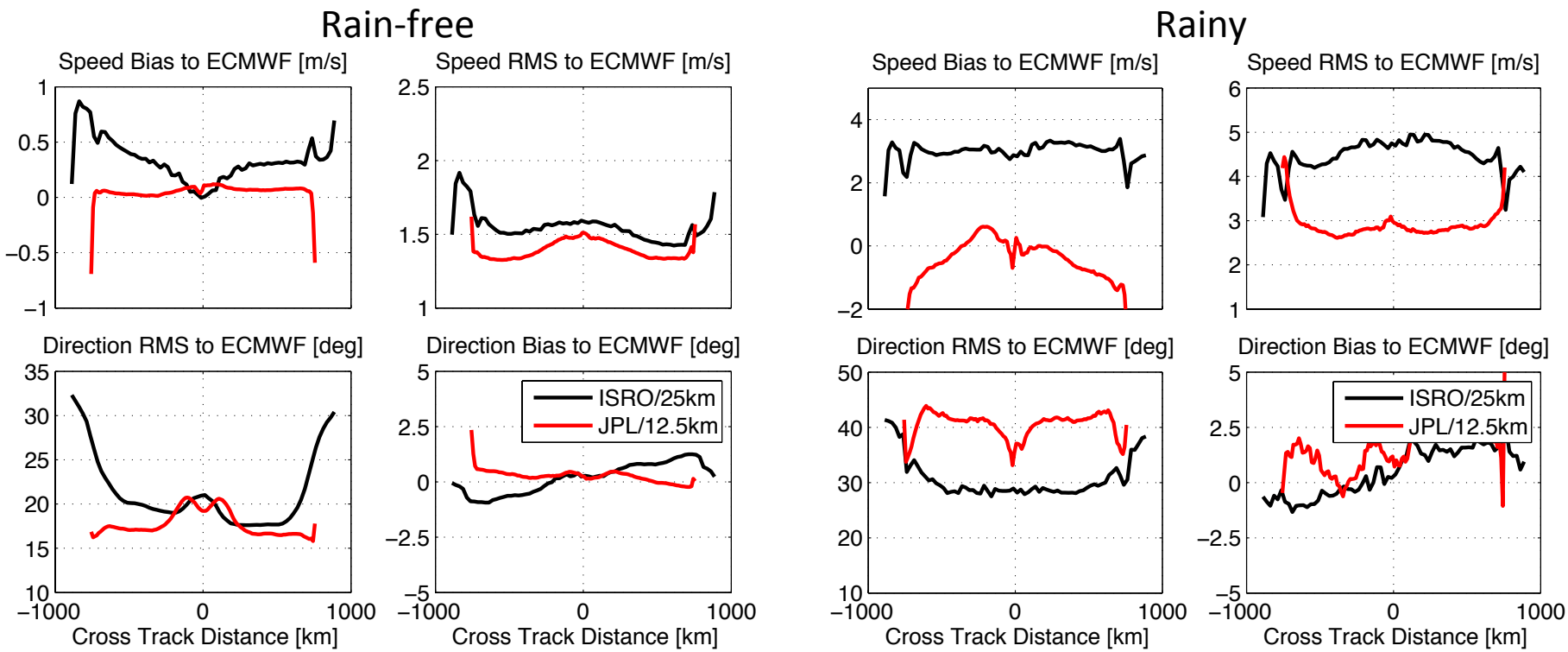


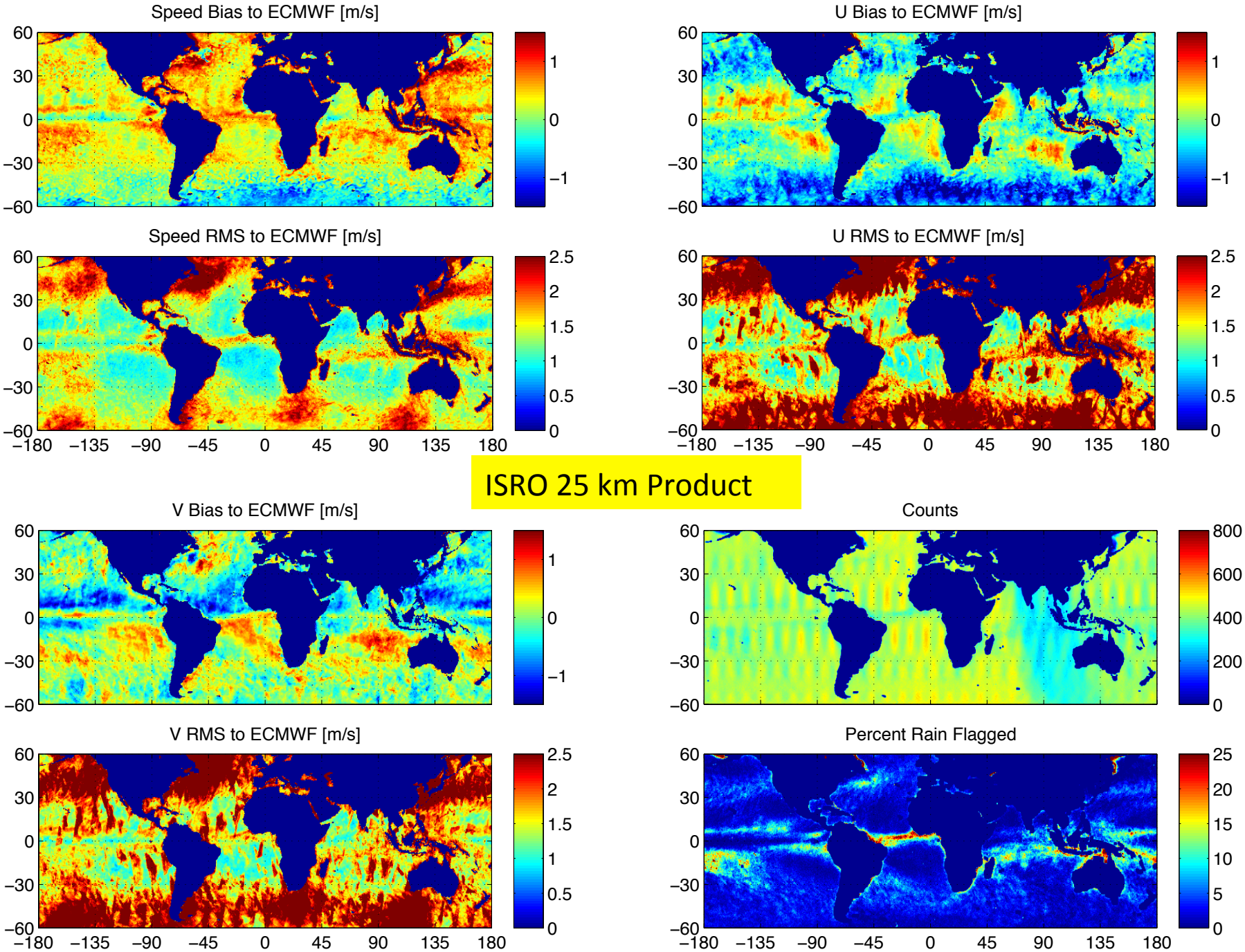


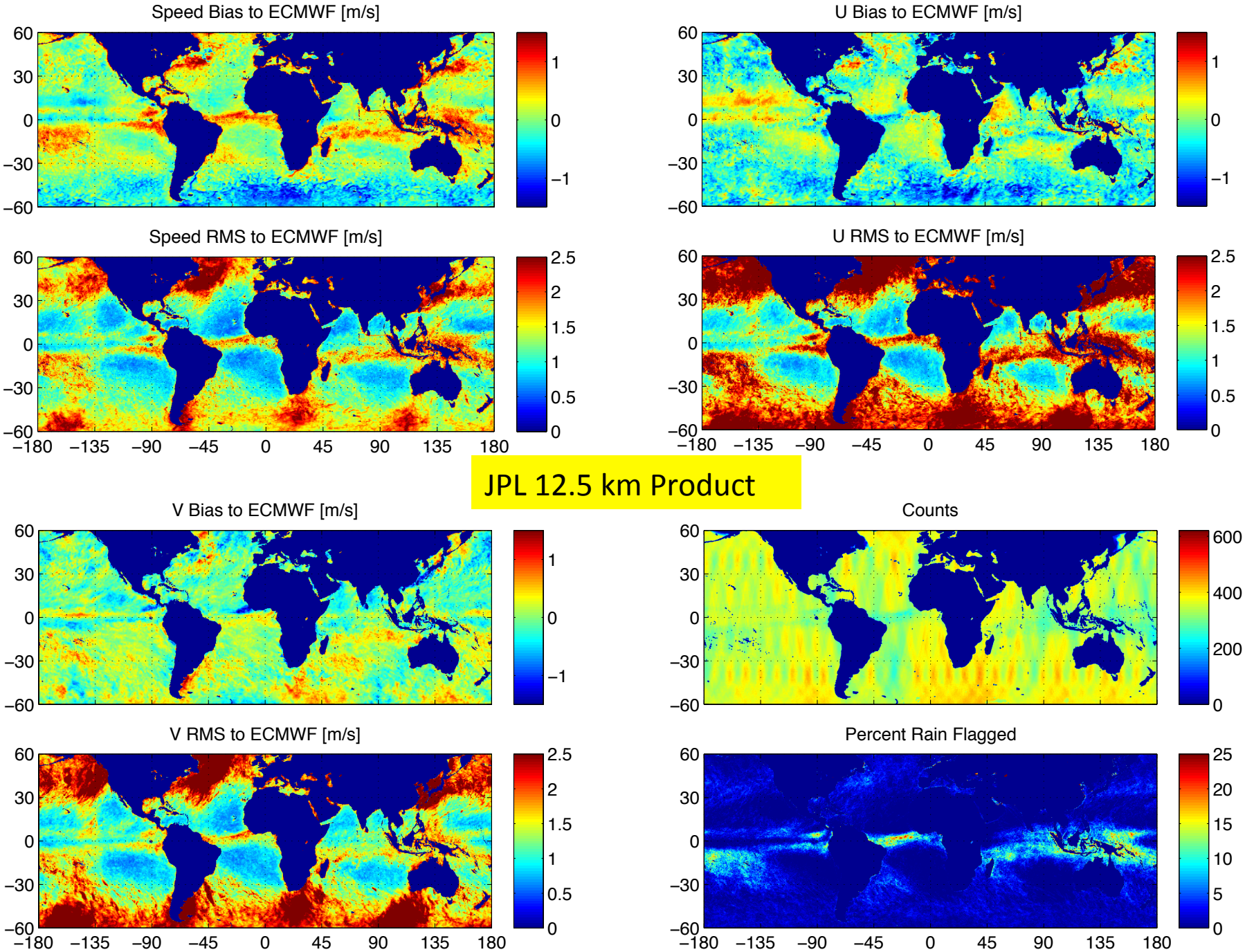
SCATSAT-1 OVW Performance

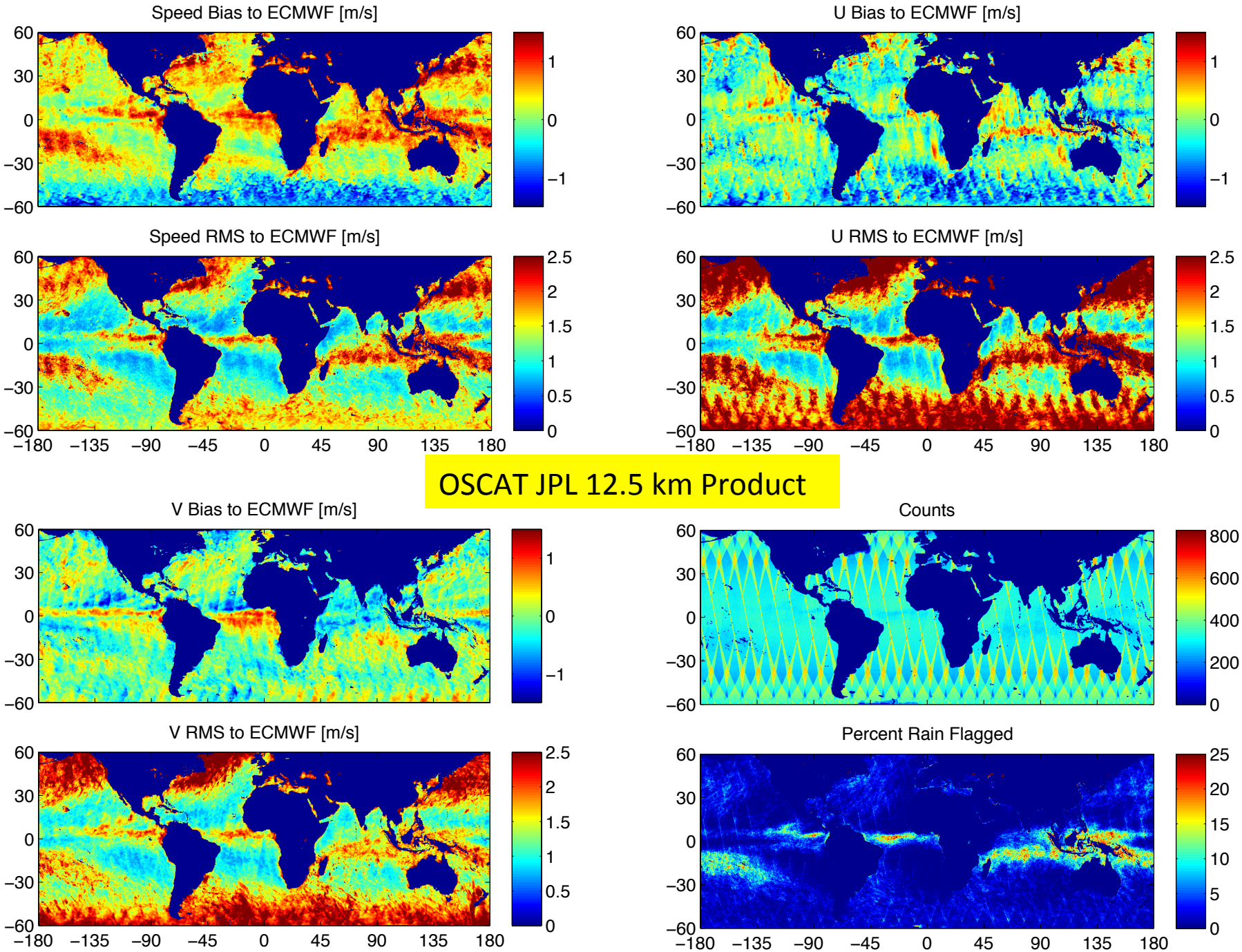
- Use same algorithms developed for OCSAT
  - Neural network based rain flag and correction.
  - Possibility to improve high winds as in the RapidScat High SNR neural network rain correction.
- Performance is very good
  - Improved compared to OSCAT, in particular lack of swath artifacts in averaged wind maps of bias compared to ECMWF.

SCATSAT-1 Performance vs ECMWF




Speed Bias to ECMWF [m/s]
U Bias to ECMWF [m/s]
Speed RMS to ECMWF [m/s]
U RMS to ECMWF [m/s]
ISRO 25 km Product
V Bias to ECMWF [m/s]
Counts
V RMS to ECMWF [m/s]
Percent Rain Flagged
60
30
0
−30
−60
−180
−135
−90
−45
0
45
90
135
180
1
0
−1
2.5
2
1.5
1
0.5
0
800
600
400
200
0
25
20
15
10
5
0

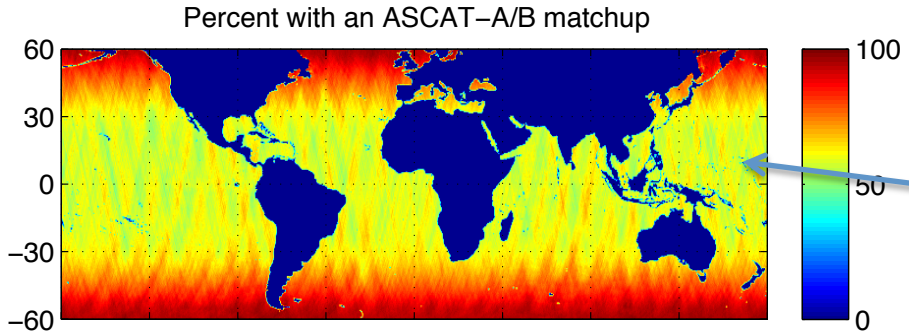

Speed Bias to ECMWF [m/s]
U Bias to ECMWF [m/s]
Speed RMS to ECMWF [m/s]
U RMS to ECMWF [m/s]
JPL 12.5 km Product
V Bias to ECMWF [m/s]
Counts
V RMS to ECMWF [m/s]
Percent Rain Flagged
60
30
0
−30
−60
−180
−135
−90
−45
0
45
90
135
180
1
0
−1
2.5
2
1.5
1
0.5
0
600
400
200
0
25
20
15
10
5
0



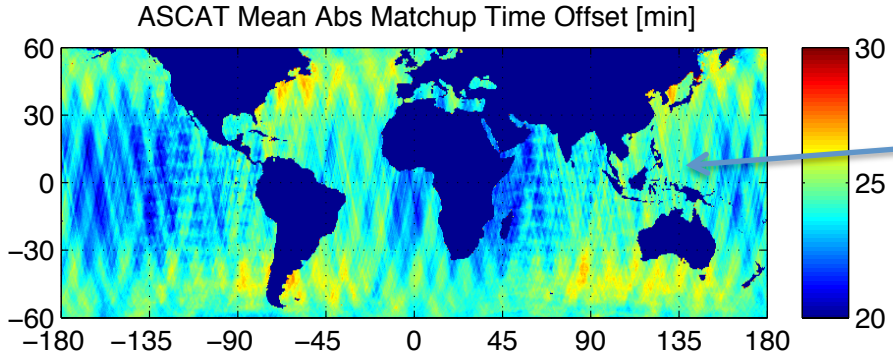
OSCAT JPL 12.5 km Product

SCATSAT-1 and ASCAT-A/B

- SCATSAT-1 was launched with LTAN about 21:15
  - Has drifted to 20:58 so far…
  - ASCAT-A/B are both in 20:40 LTAN orbits with opposite phase in orbit plane. (50 minutes apart)
- SCATSAT-1 collocates extremely well with the two of them.
  - More than 60% of SCATSAT-1 have a matchup with either ASCAT-A /B
  - All within 50 minutes.
  - Have to use both ASCAT-A and B to get best collocations.
- Orbit period difference between SCATSAT-1 and ASCAT of two minutes
  - Makes matchup time offsets and swath locations non-stationary in time.
  - Cycling of matchup times and swath locations every 50 orbits or so (100 minutes / 2 minutes)

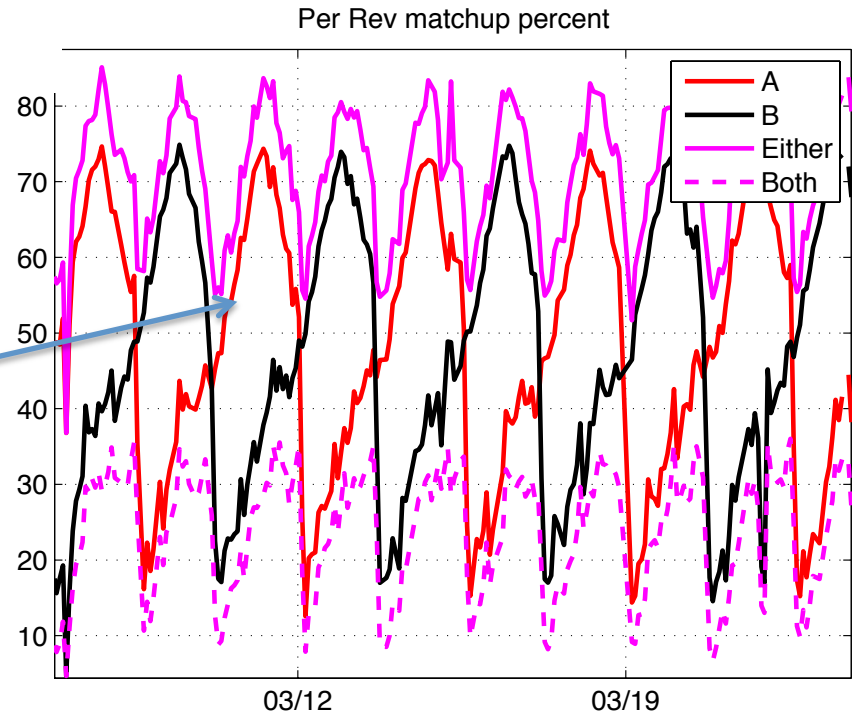


Matchup percent varies from 60 at equator to nearly 100 at high latitudes

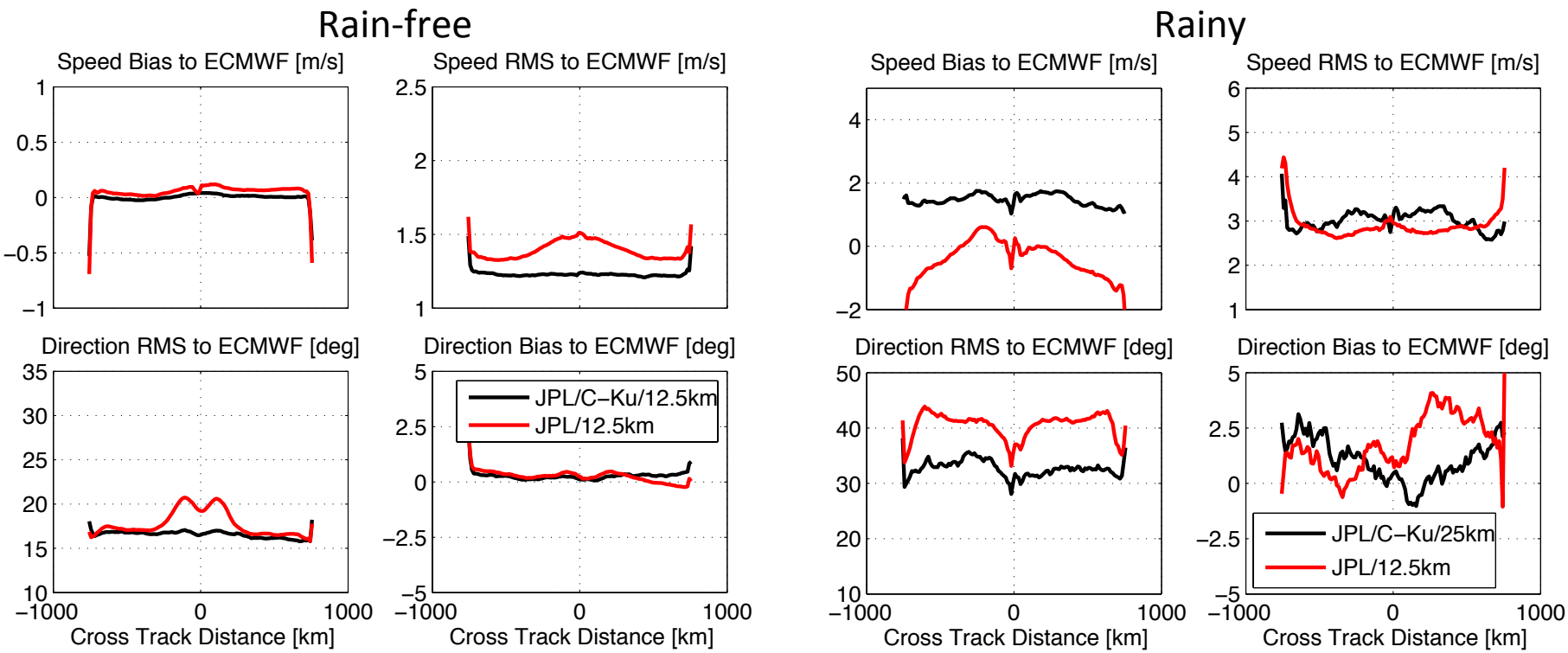


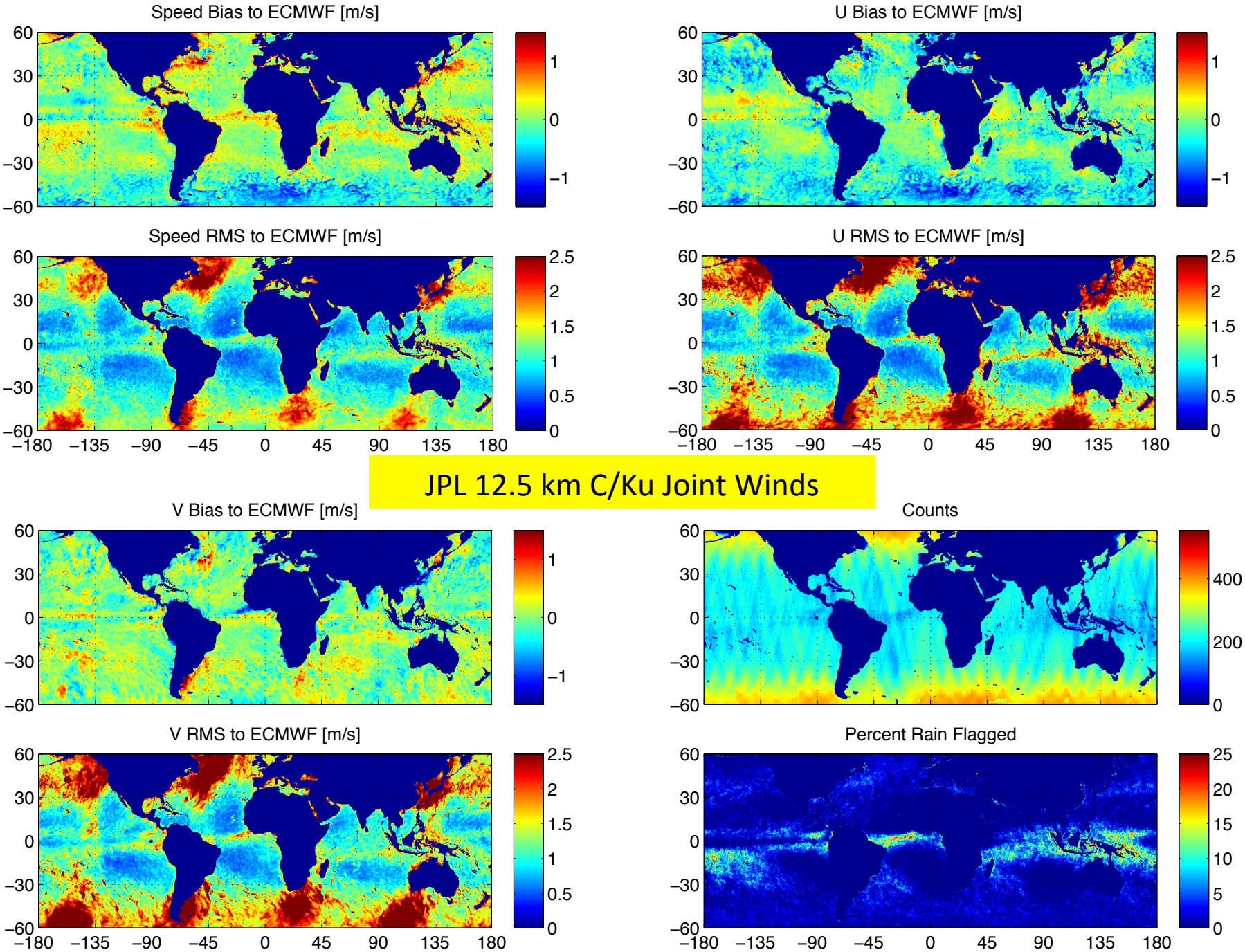
Average abs(matchup) time offset is 25 minutes, but it is distributed between [-50, +50] minutes.

Cycling of matchup percent with ASCAT-A/B in time

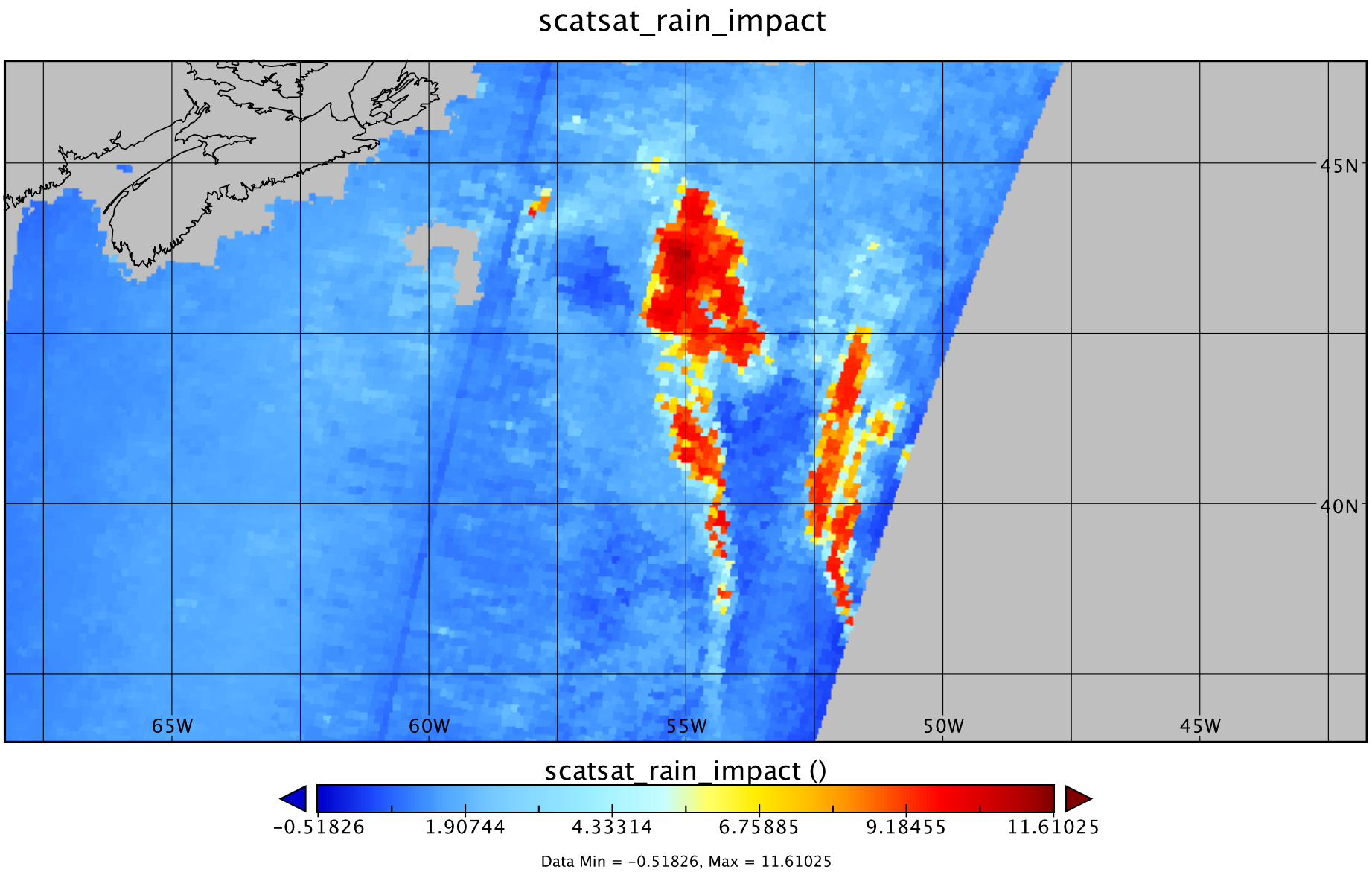


Joint C/Ku Performance vs ECMWF



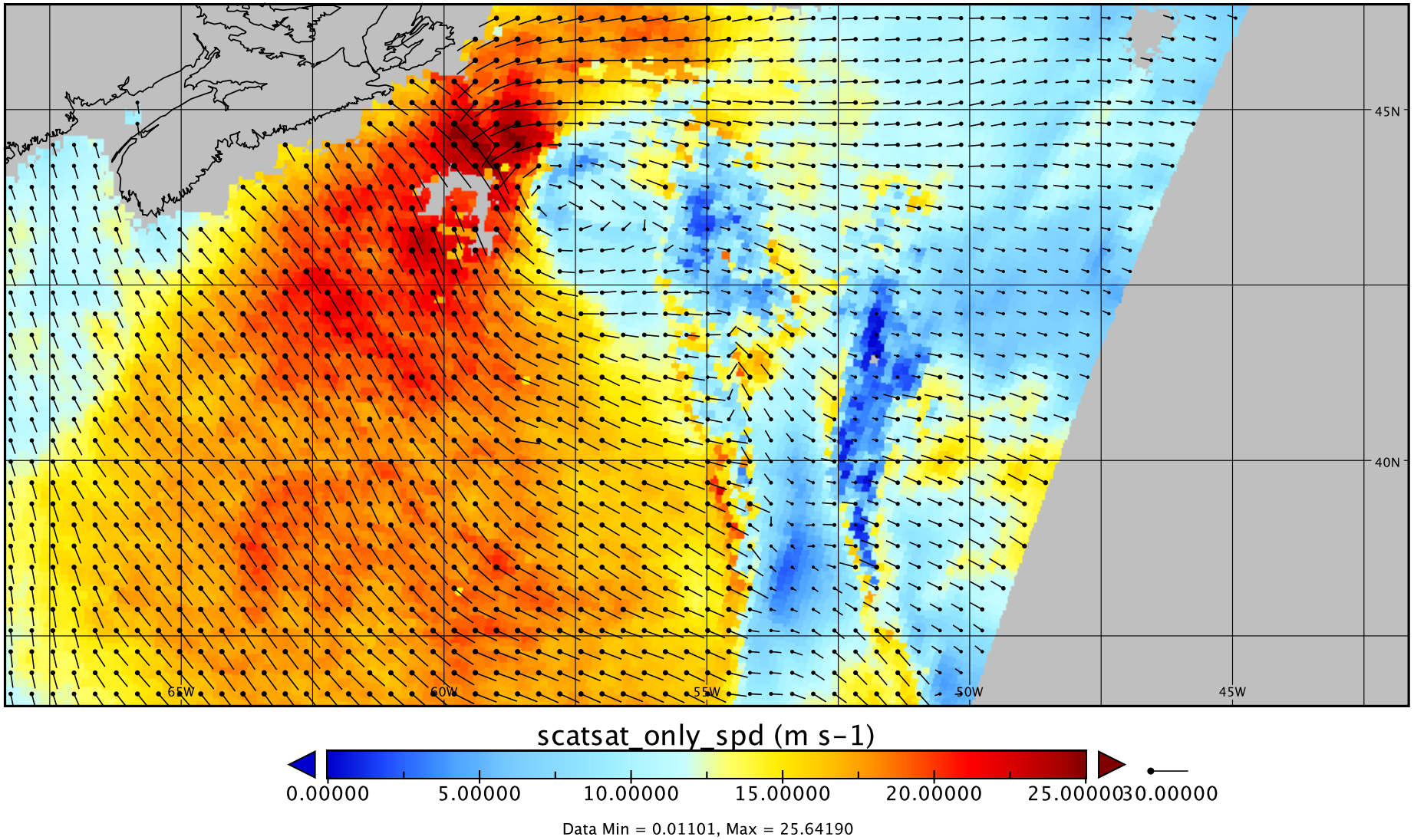


JPL 12.5 km C/Ku Joint Winds


scatsat_rain_impact
45N
40N
65W
60W
55W
50W
45W
scatsat_rain_impact ()
-0.51826
1.90744
4.33314
6.75885
9.18455
11.61025
Data Min = -0.51826, Max = 11.61025

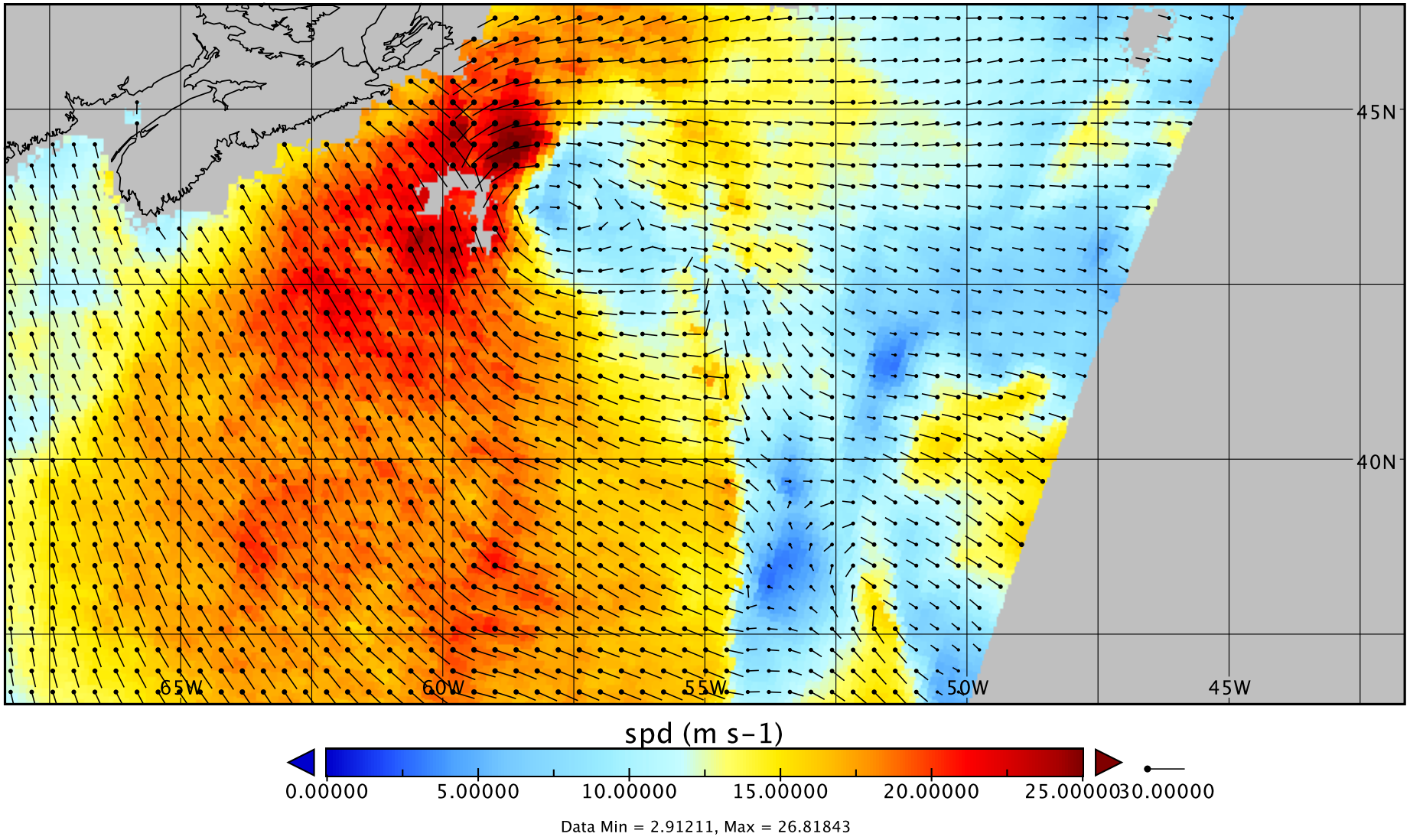
SCATSAT-1 Only Wind Speed with Rain Correction

scatsat_only_spd



C/Ku Joint Wind Vectors

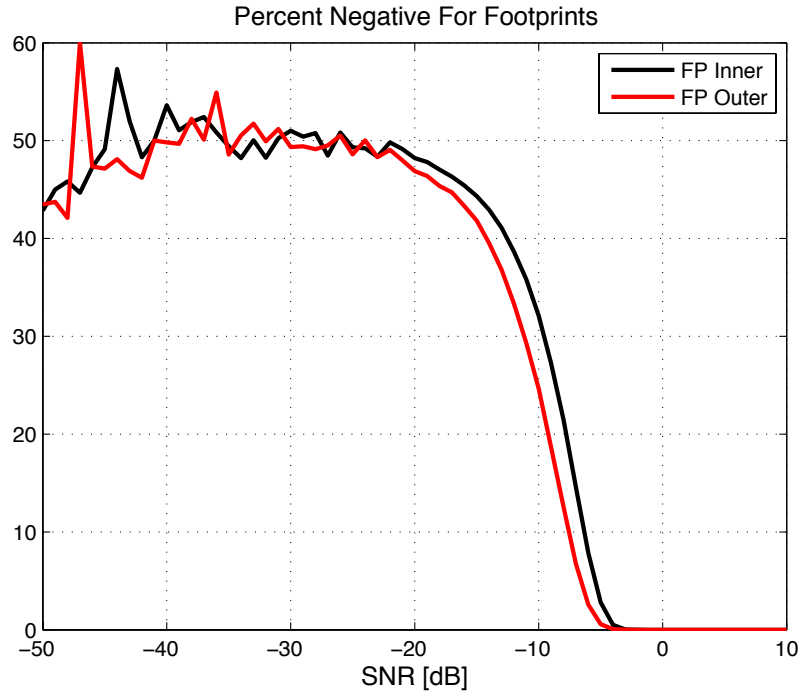
spd

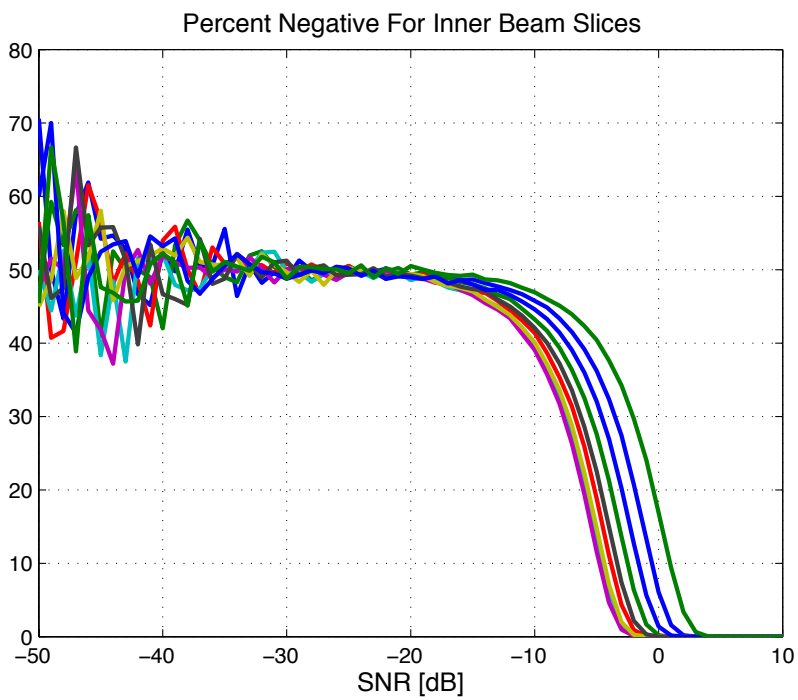


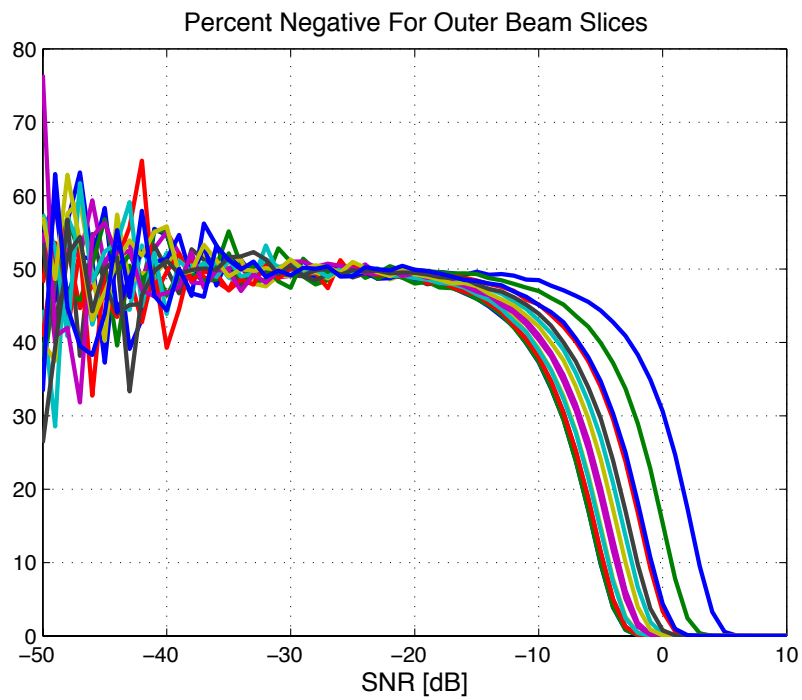
Summary

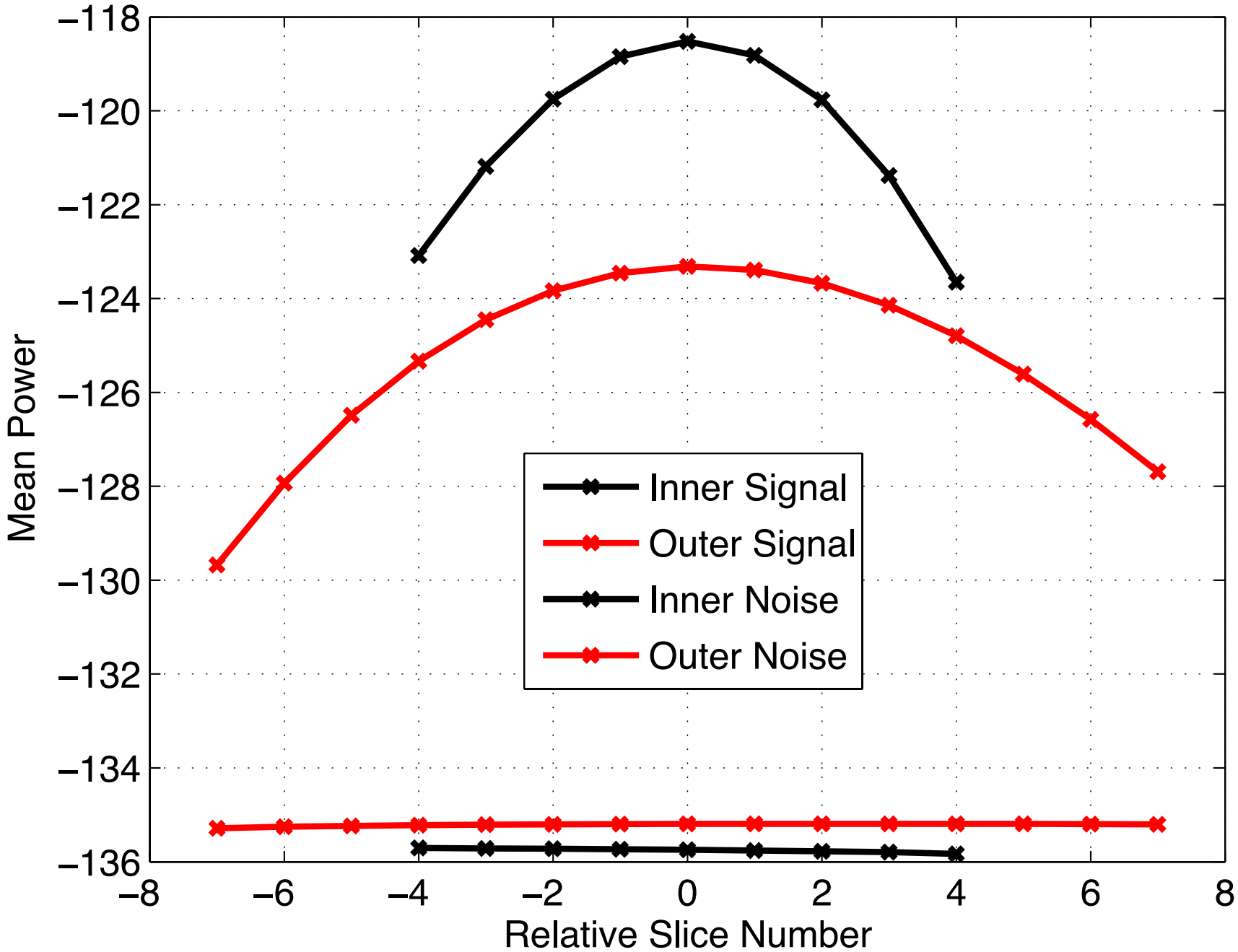
- SCATSAT-1 provides quality ocean vector winds.
  - Data are well calibrated to 0.5 dB level.
  - Some slice misbalancing; it is repeatable and correctable.
- Ocean vector winds processing yields improved winds as compared to OSCAT.
- Collocations with ASCAT-A/B will provide ability to do new things:
  - Improved winds in rain.
  - Improved extreme winds.
  - Wind and rain estimation.
  - Land applications (soil moisture, biomass).

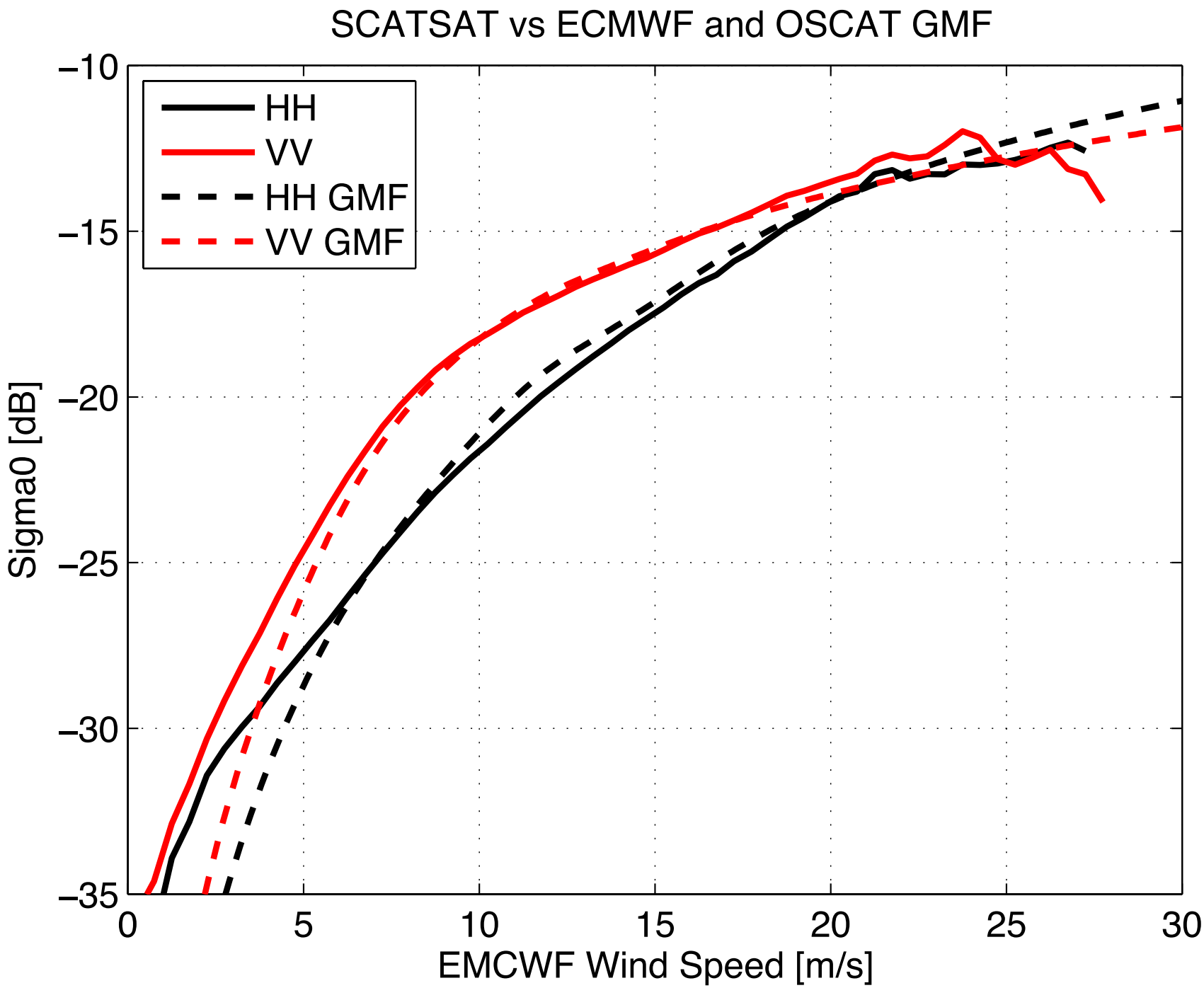
Negative sigma0 seems good
No indication of noise subtraction issues at this point.





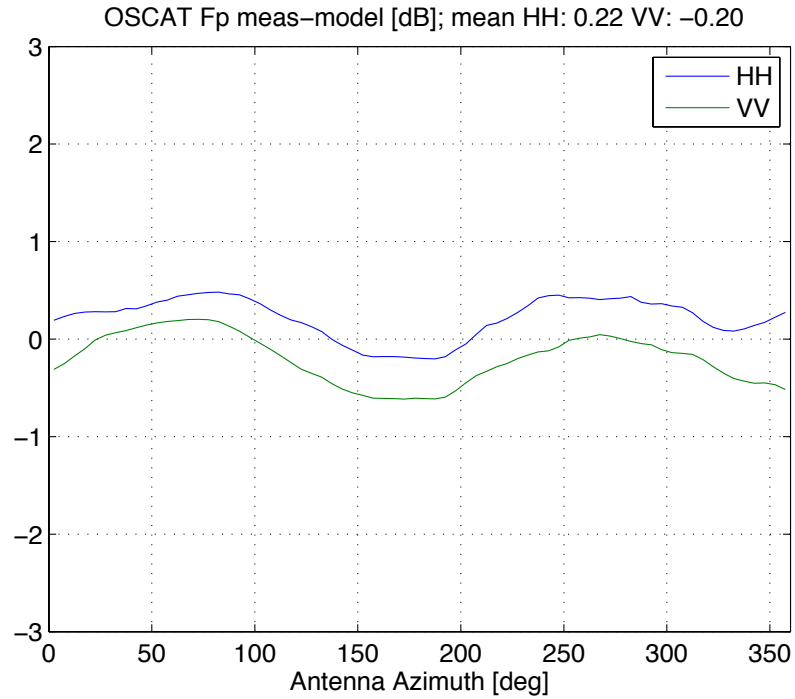


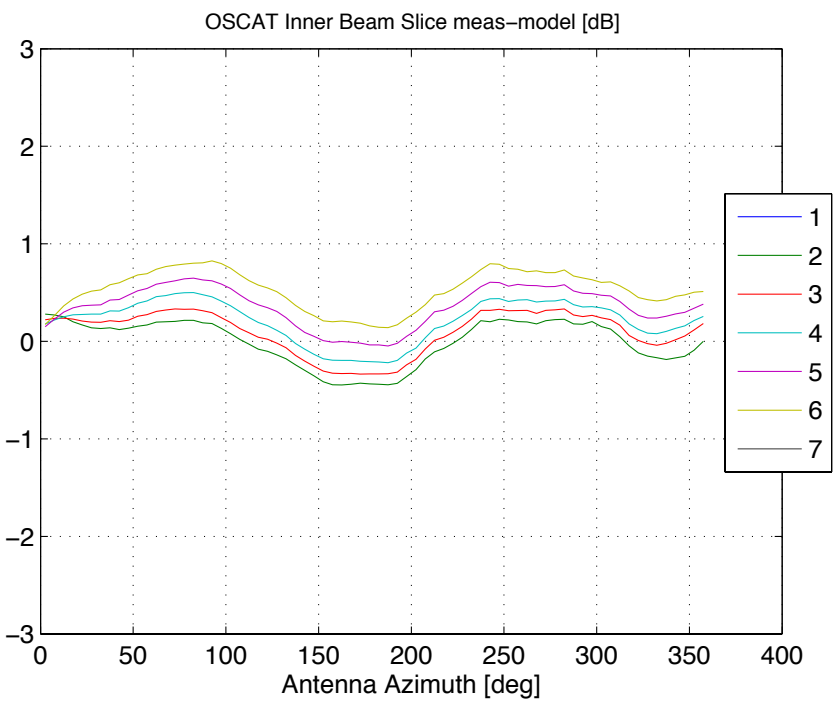

−118
−120
−122
−124
−126
−128
−130
−132
−134
−136
Mean Power
−8
−6
−4
−2
0
2
4
6
8
Relative Slice Number
Inner Signal
Outer Signal
Inner Noise
Outer Noise

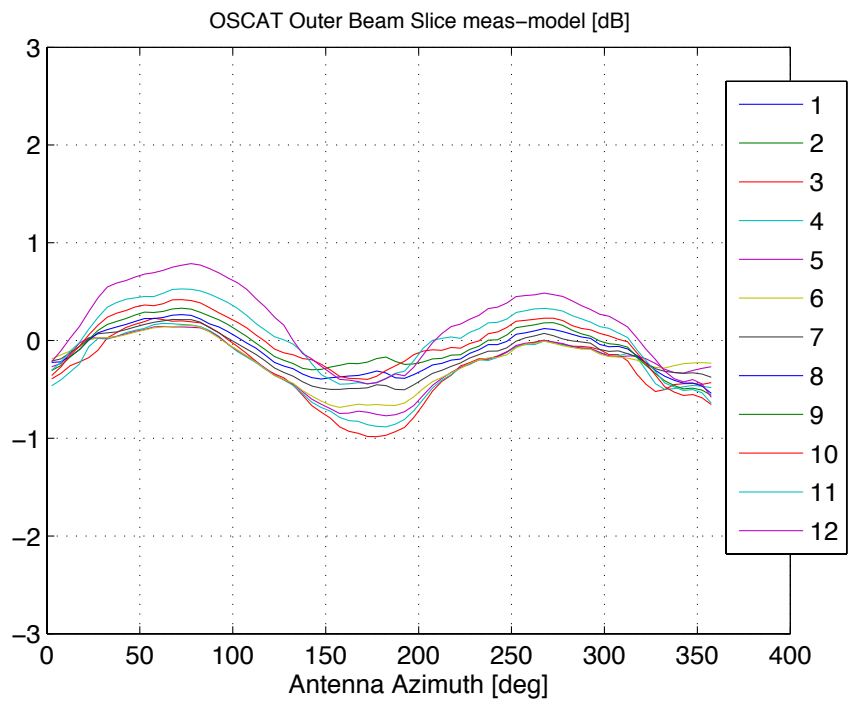

SCATSAT vs ECMWF and OSCAT GMF
HH
VV
HH GMF
VV GMF
Sigma0 [dB]
EMCWF Wind Speed [m/s]
−10
−15
−20
−25
−30
−35
0
5
10
15
20
25
30

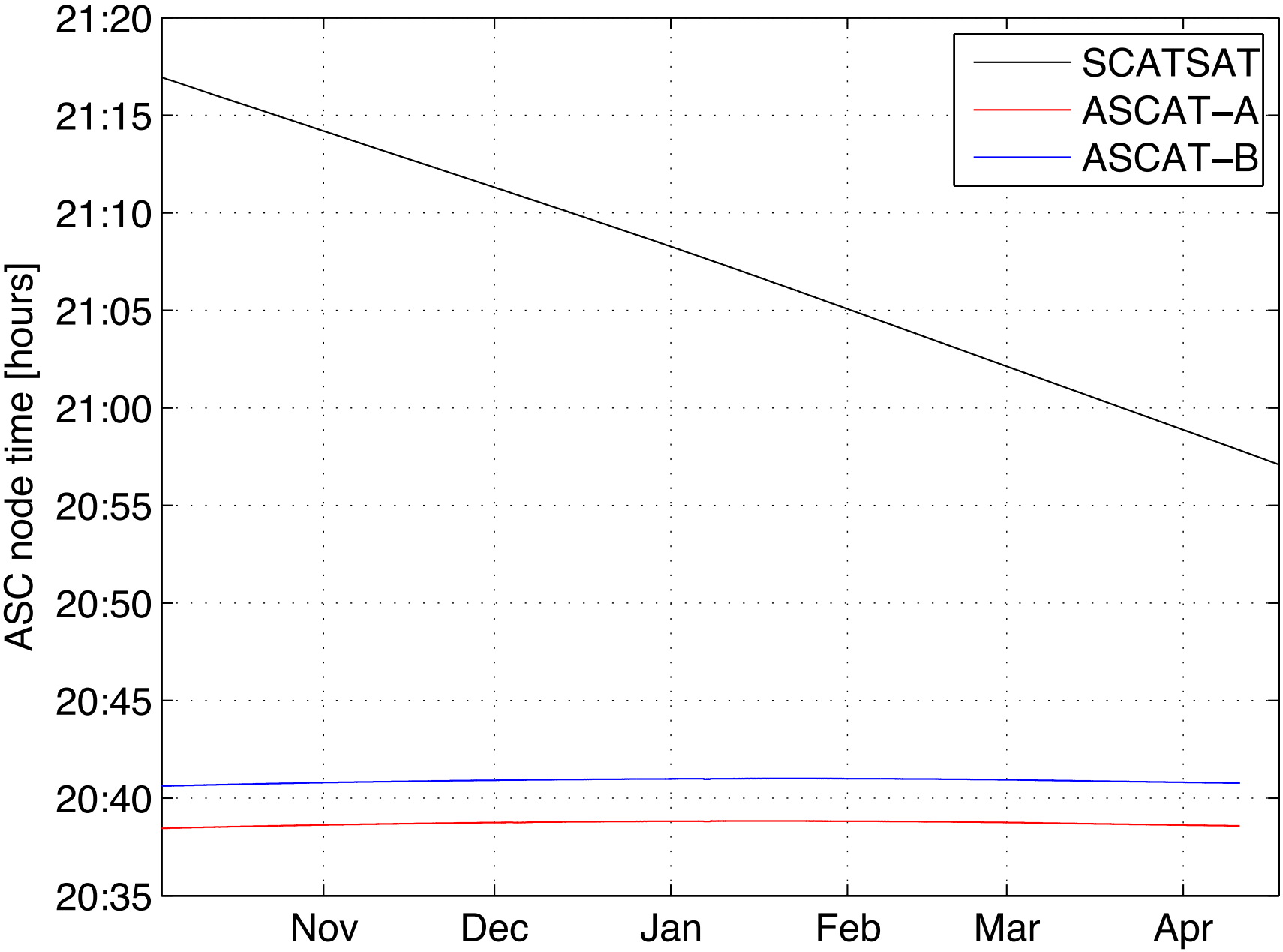
OSCAT Slice balancing

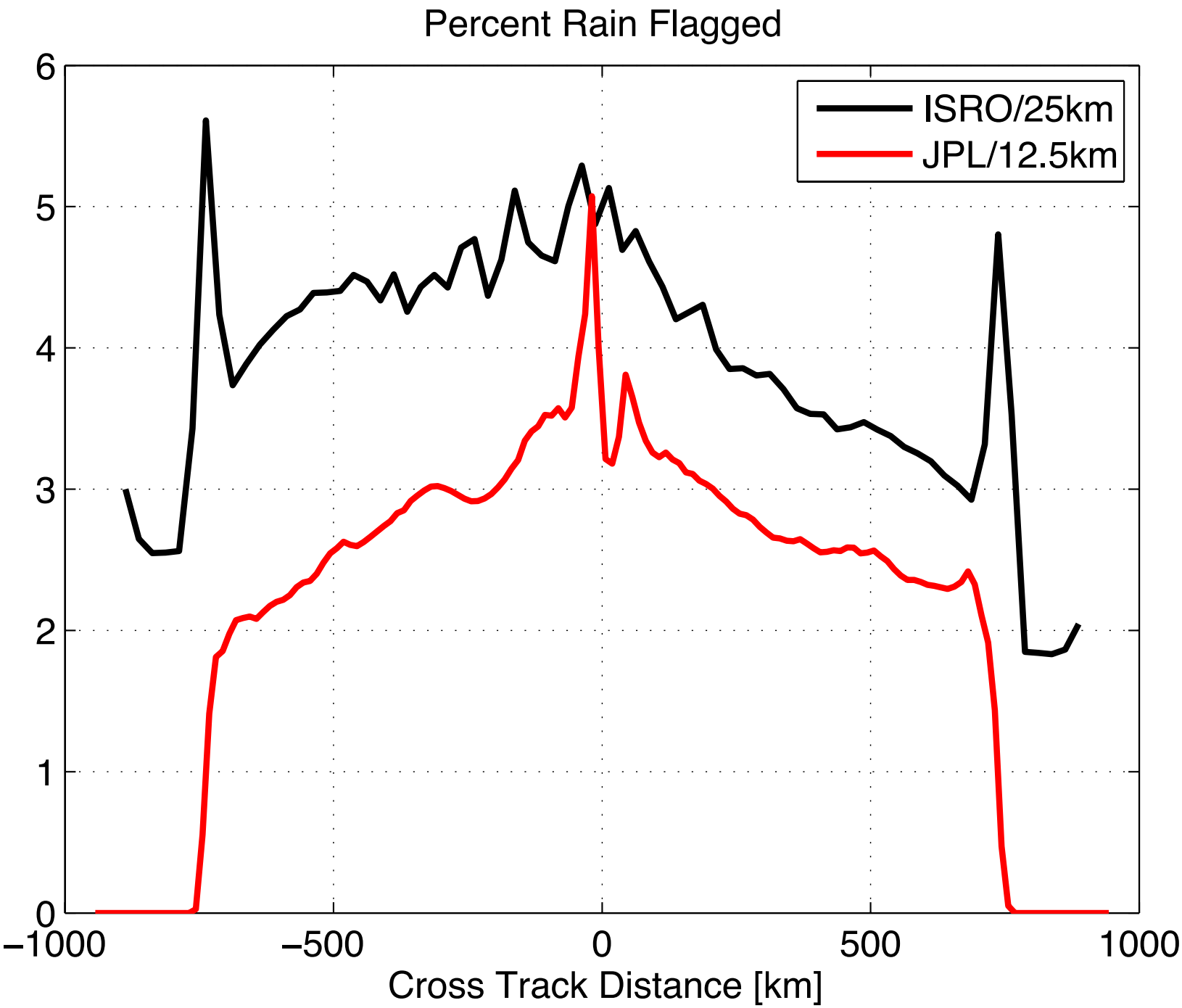
- Use ECMWF and OSCAT GMF to computed model sigma0 for each pulse and slice.

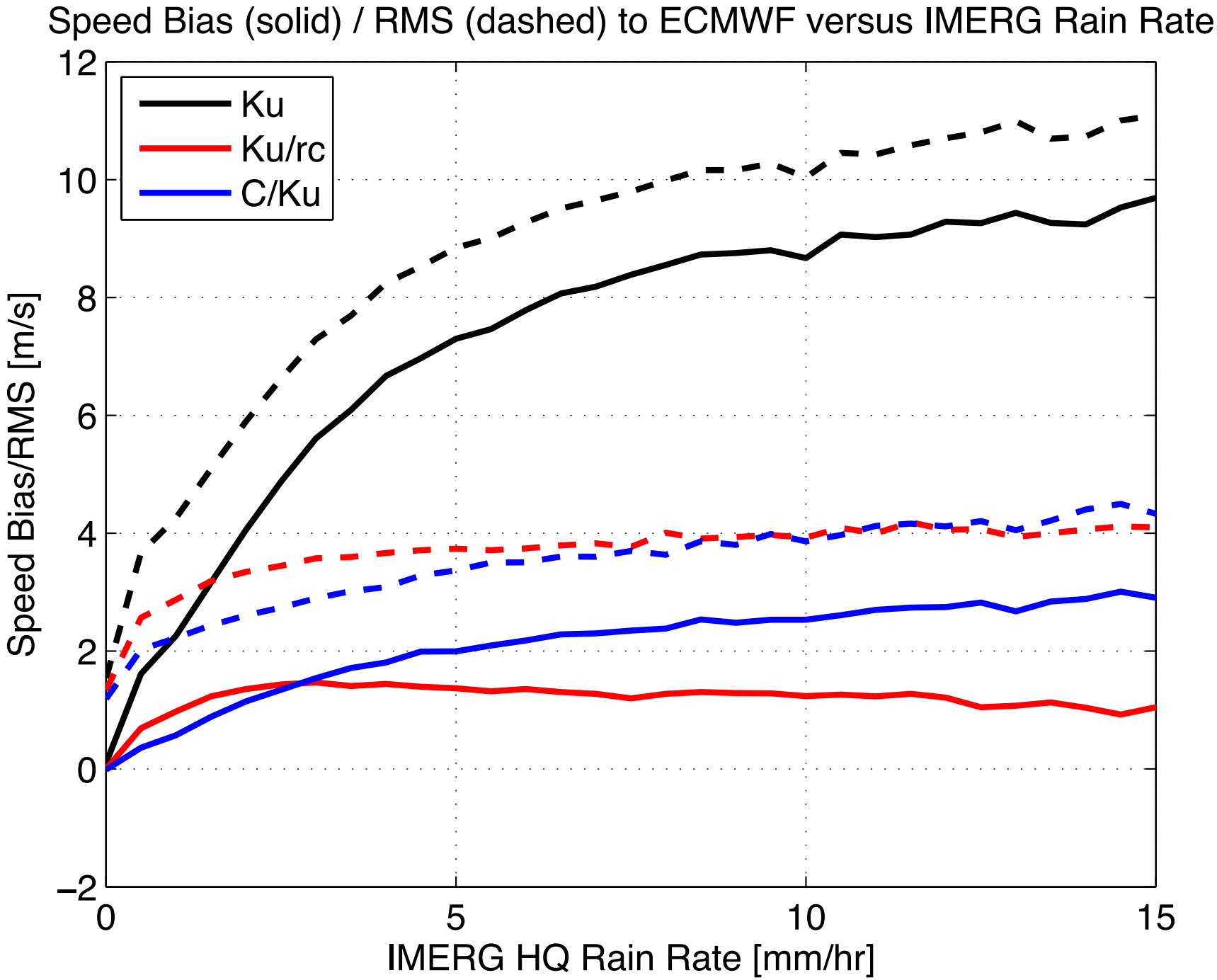


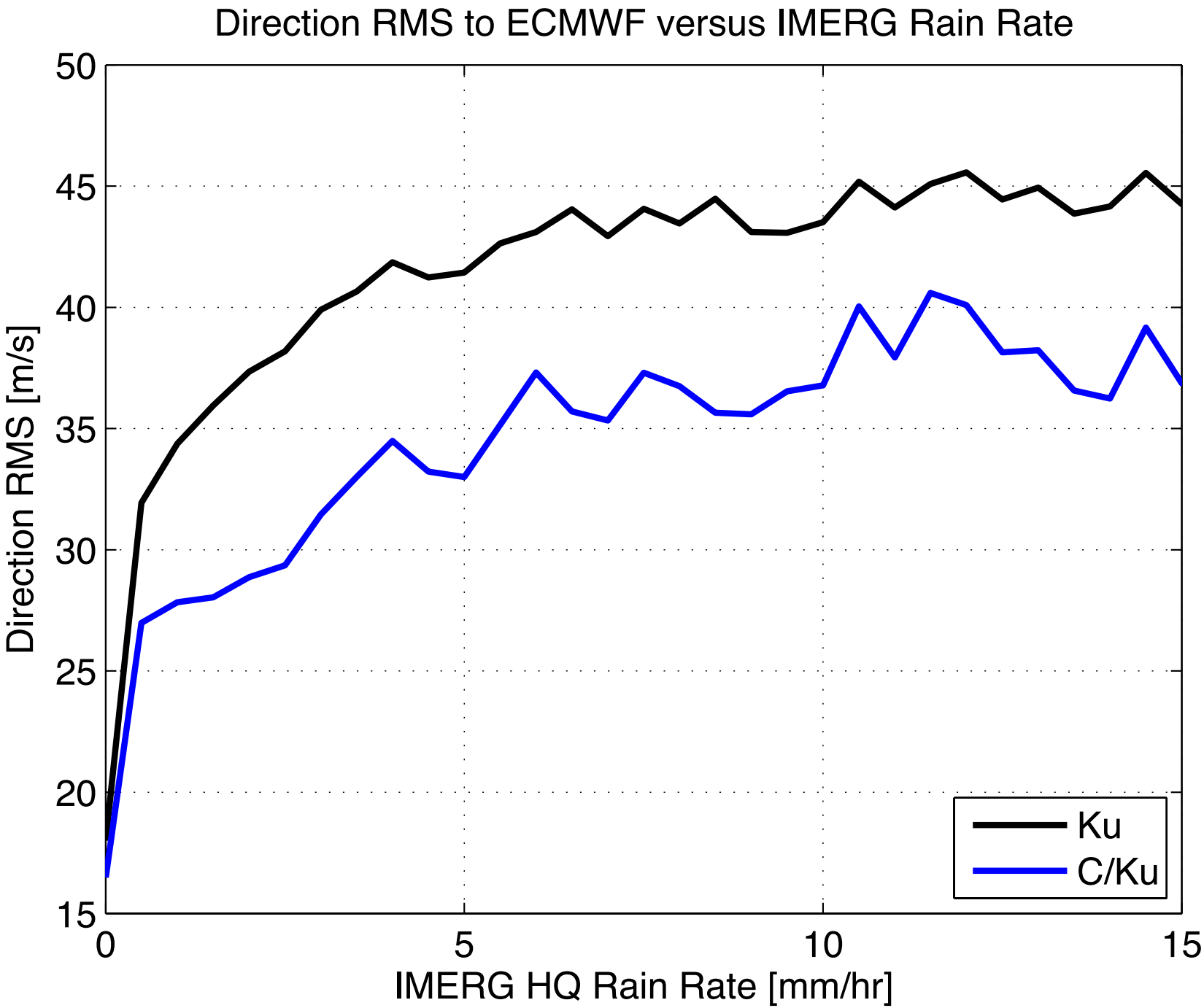


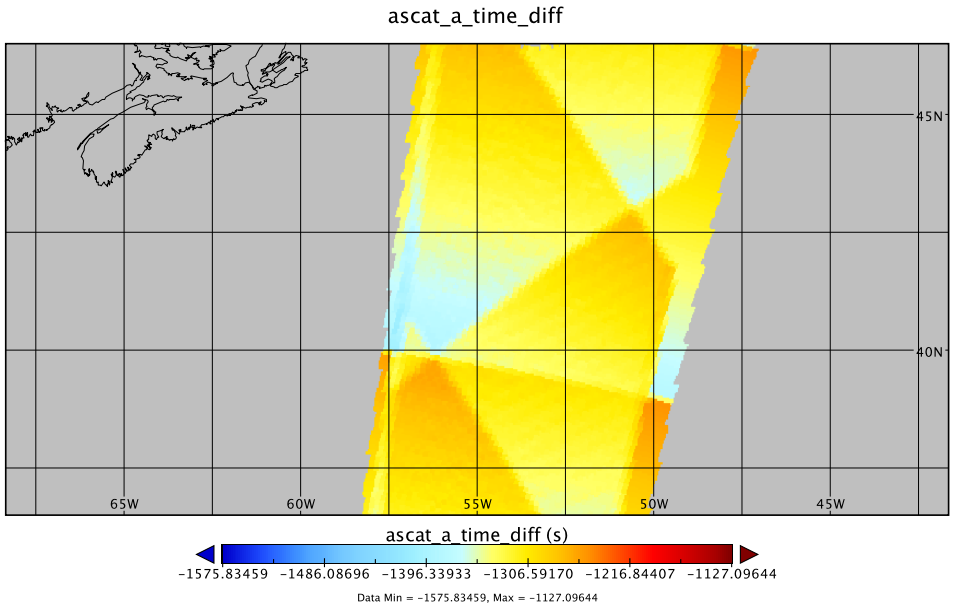


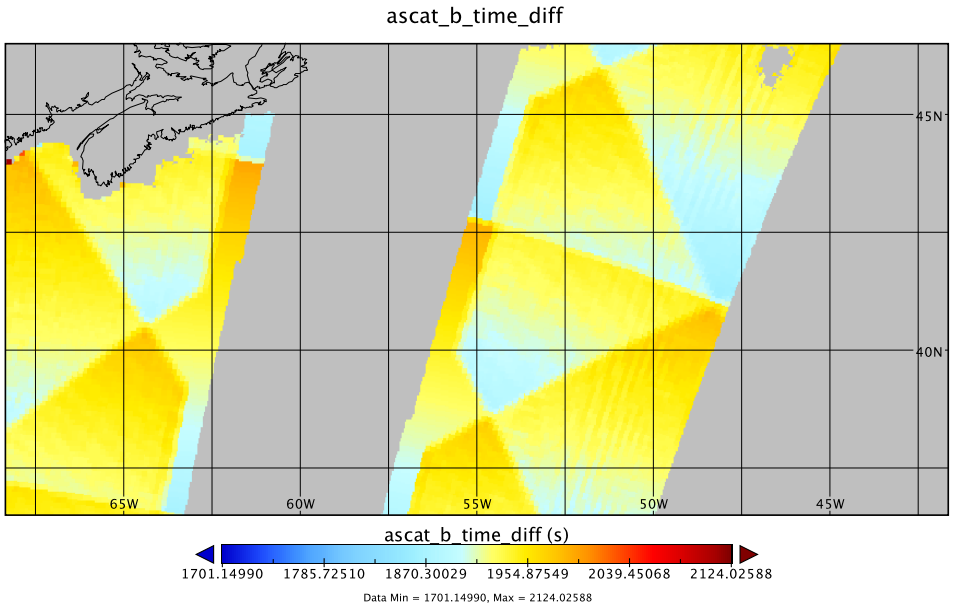

SCATSAT
ASCAT−A
ASCAT−B
ASC node time [hours]
21:20
21:15
21:10
21:05
21:00
20:55
20:50
20:45
20:40
20:35
Nov
Dec
Jan
Feb
Mar
Apr


Percent Rain Flagged
ISRO/25km
JPL/12.5km
6
5
4
3
2
1
0
−1000
−500
0
500
1000
Cross Track Distance [km]


Speed Bias (solid) / RMS (dashed) to ECMWF versus IMERG Rain Rate
Ku
Ku/rc
C/Ku
Speed Bias/RMS [m/s]
IMERG HQ Rain Rate [mm/hr]
12
10
8
6
4
2
0
−2
0
5
10
15

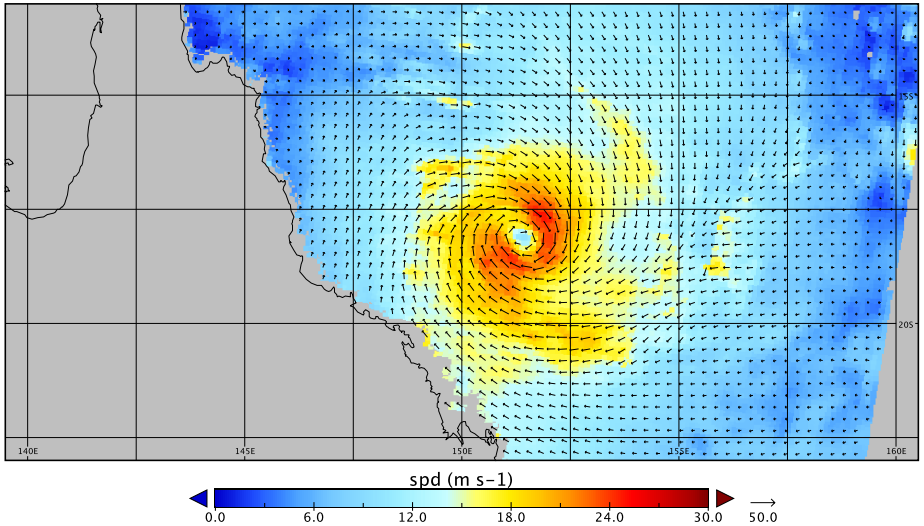

Direction RMS to ECMWF versus IMERG Rain Rate
Direction RMS [m/s]
IMERG HQ Rain Rate [mm/hr]
50
45
40
35
30
25
20
15
0
5
10
15
Ku
C/Ku


ascat_a_time_diff
45N
40N
65W
60W
55W
50W
45W
ascat_a_time_diff (s)
-1575.83459 -1486.08696 -1396.33933 -1306.59170 -1216.84407 -1127.09644
Data Min = -1575.83459, Max = -1127.09644

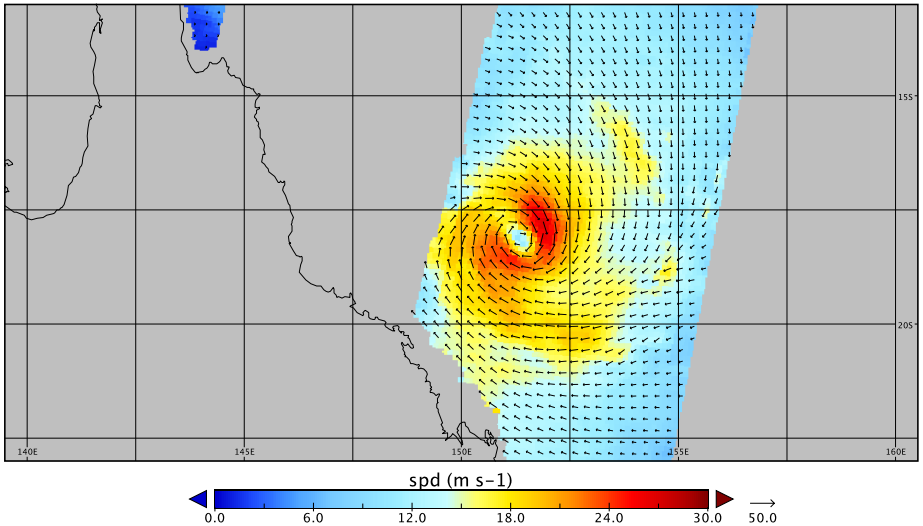
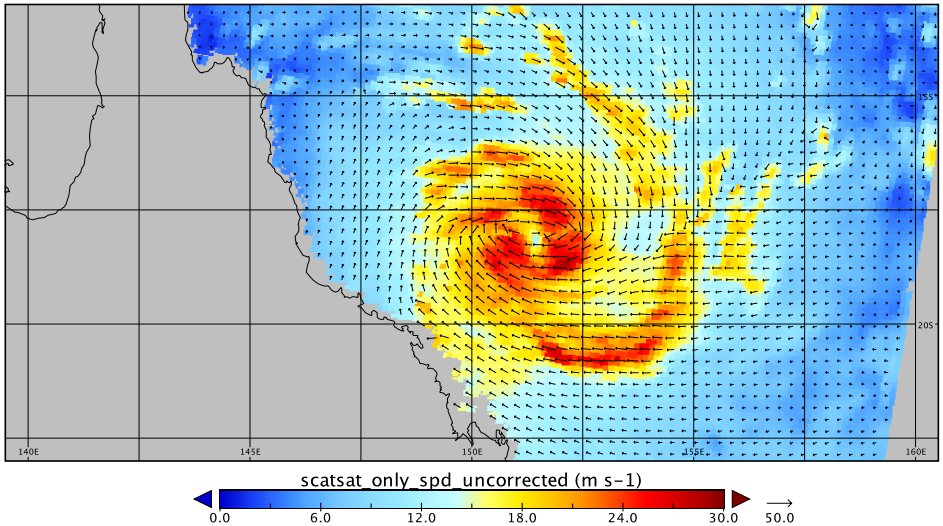

ascat_b_time_diff
45N
40N
65W
60W
55W
50W
45W
ascat_b_time_diff (s)
1701.14990 1785.72510 1870.30029 1954.87549 2039.45068 2124.02588
Data Min = 1701.14990, Max = 2124.02588

TC Debbie 3/25/2017

Joint C/Ku



ASCAT Only



SCATSAT Only – no rain correction