Evaluation of the CYGNSS GNSS-R Signal Sensitivity to Ocean Parameters

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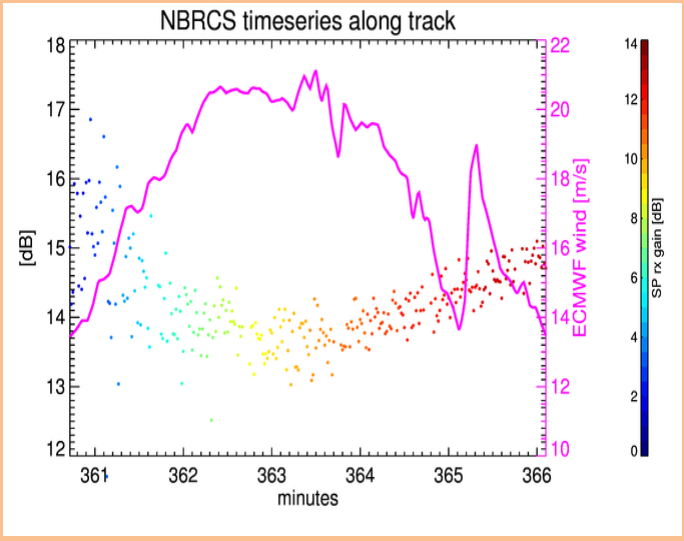
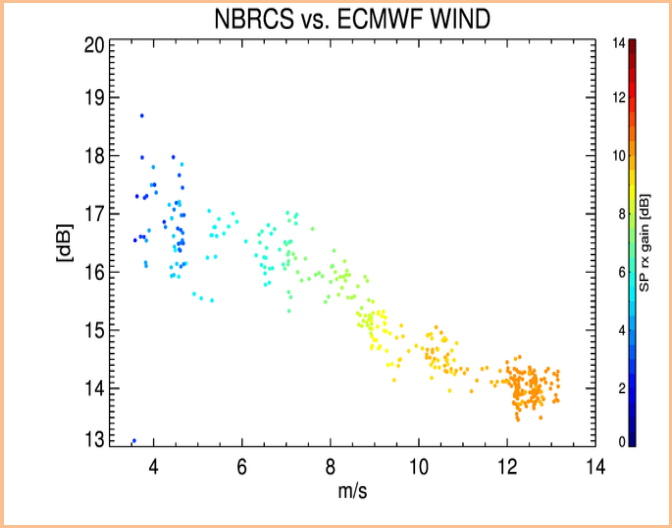
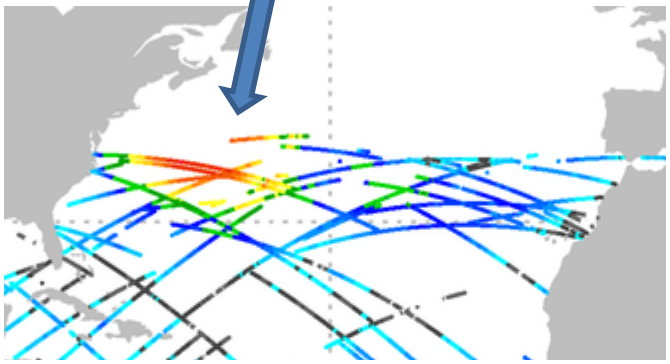
NOAA/NESDIS/STAR

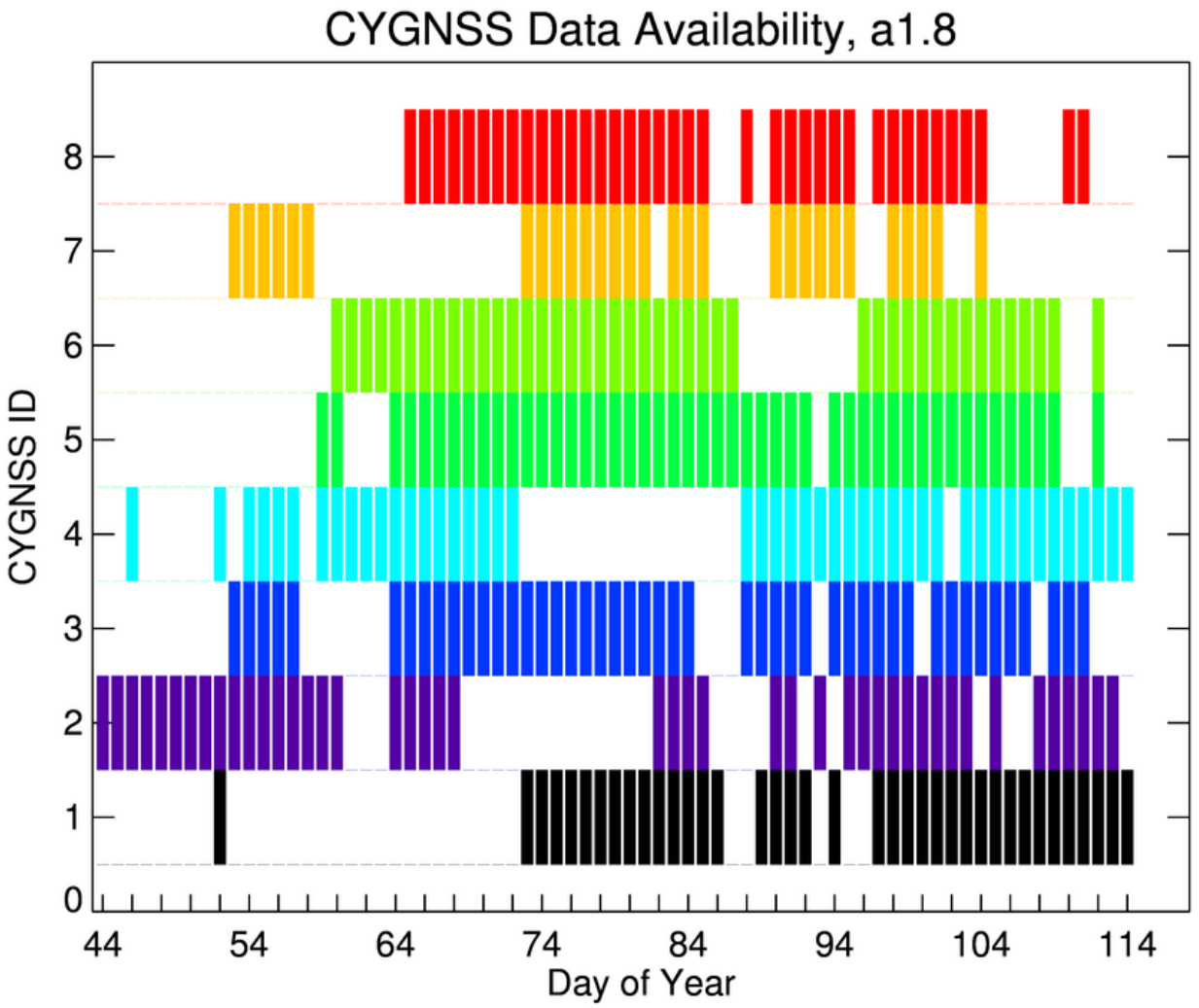
Very First look at the NBRCS from a Selected Track Feb 14th, 2017



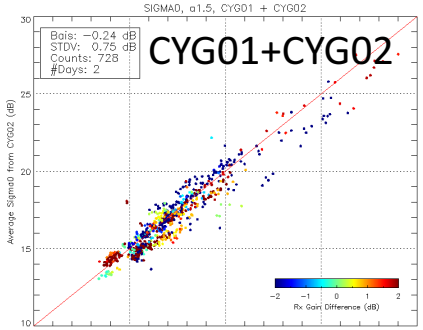


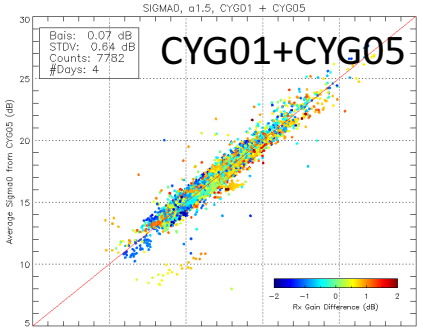


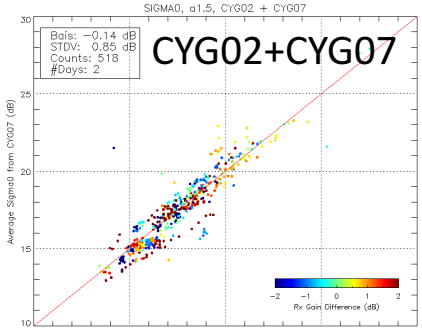
CYGNSS Data Inventory

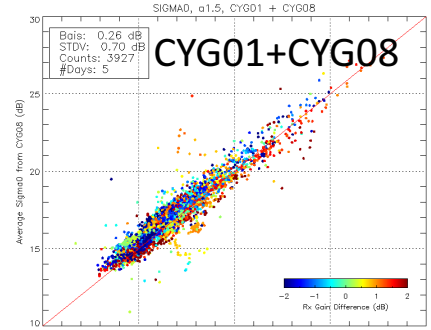


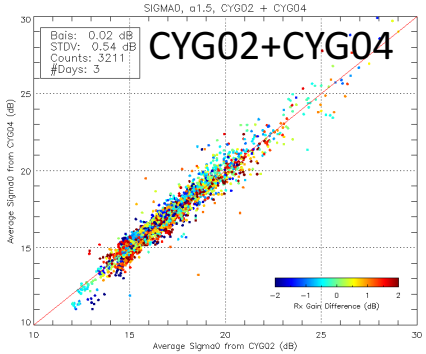
Consistency of Measurements Achieved

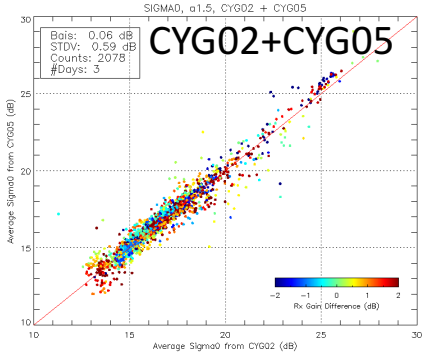


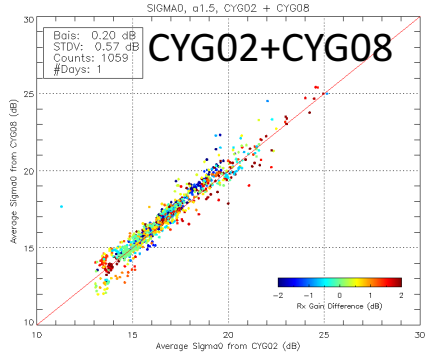


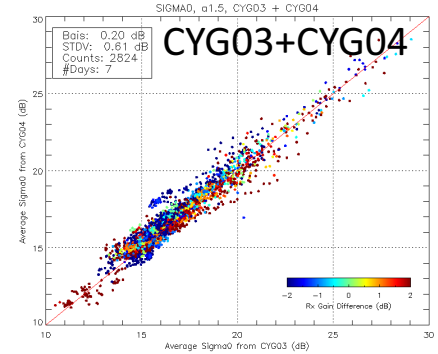


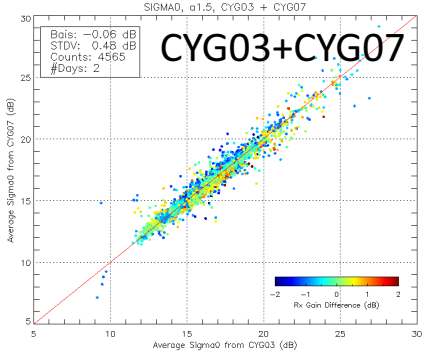


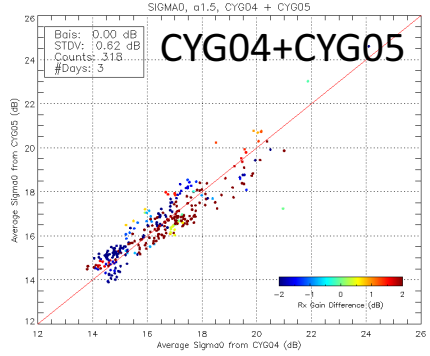


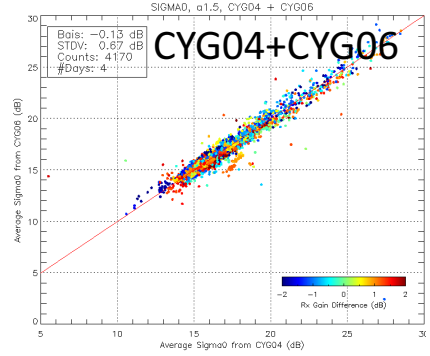


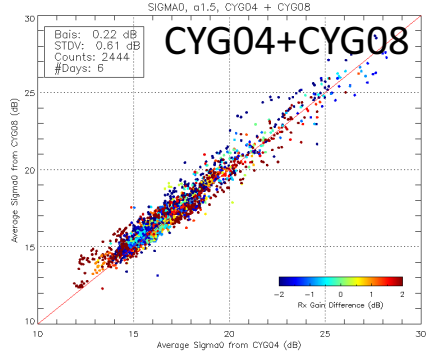




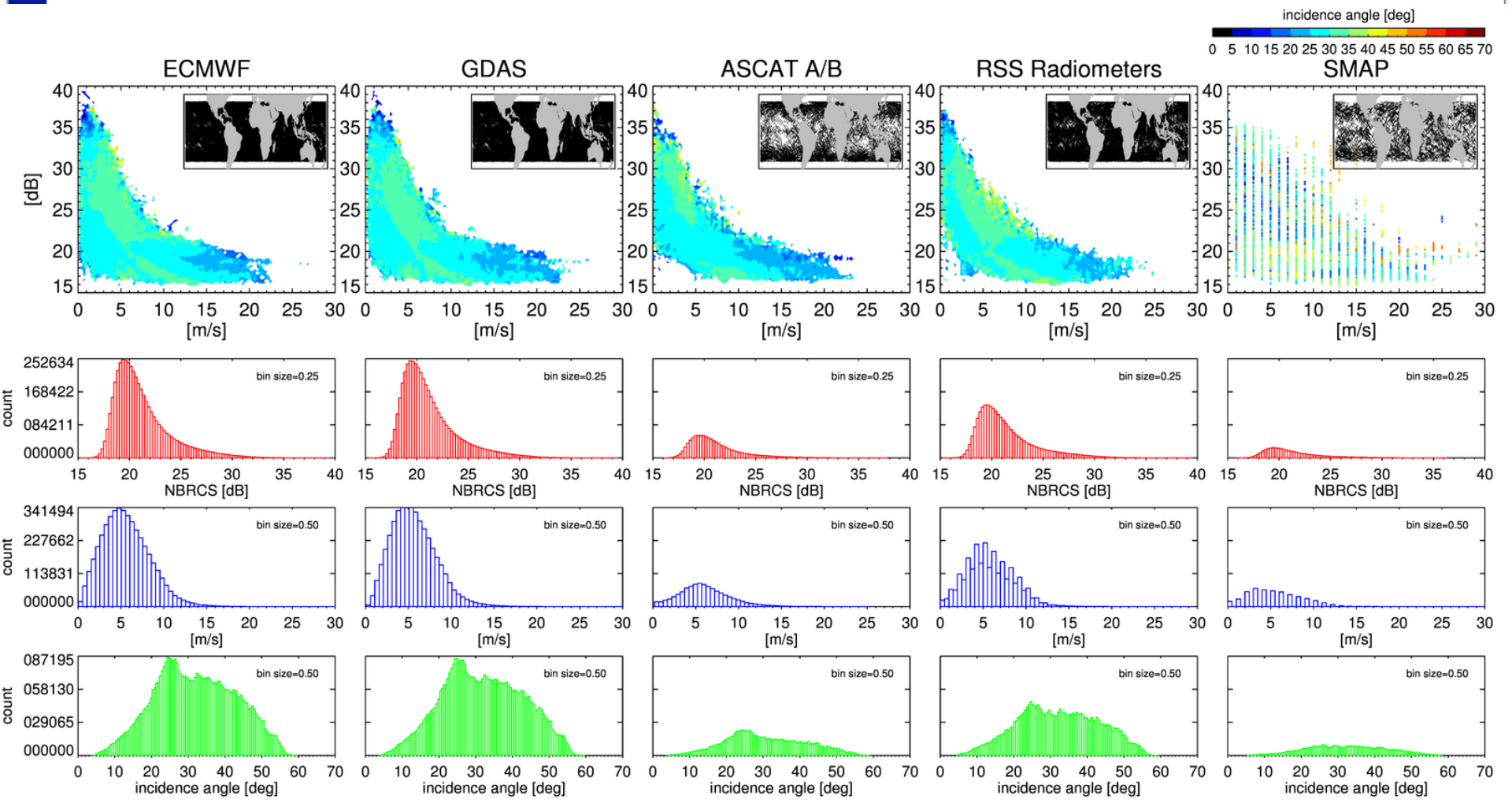




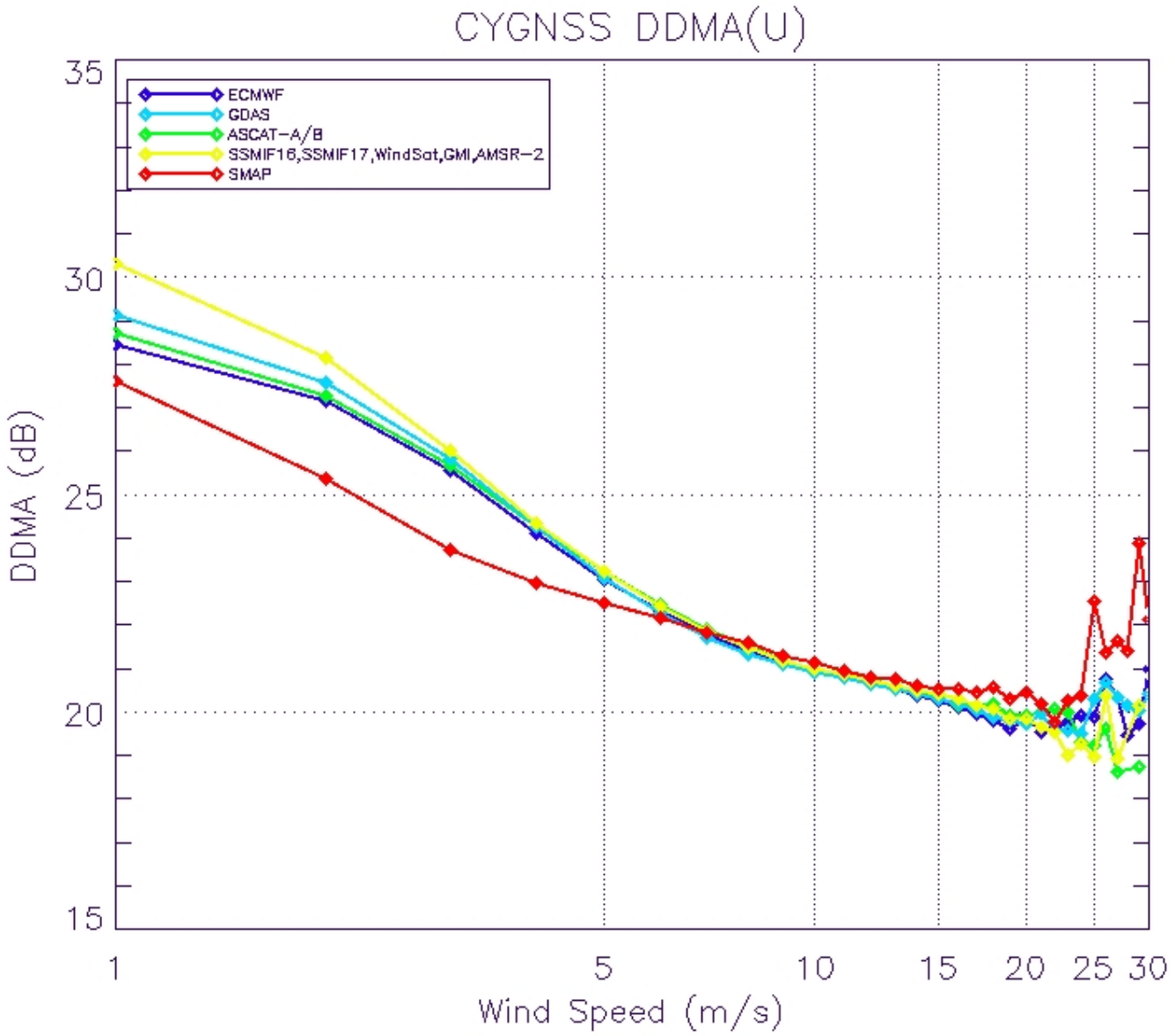


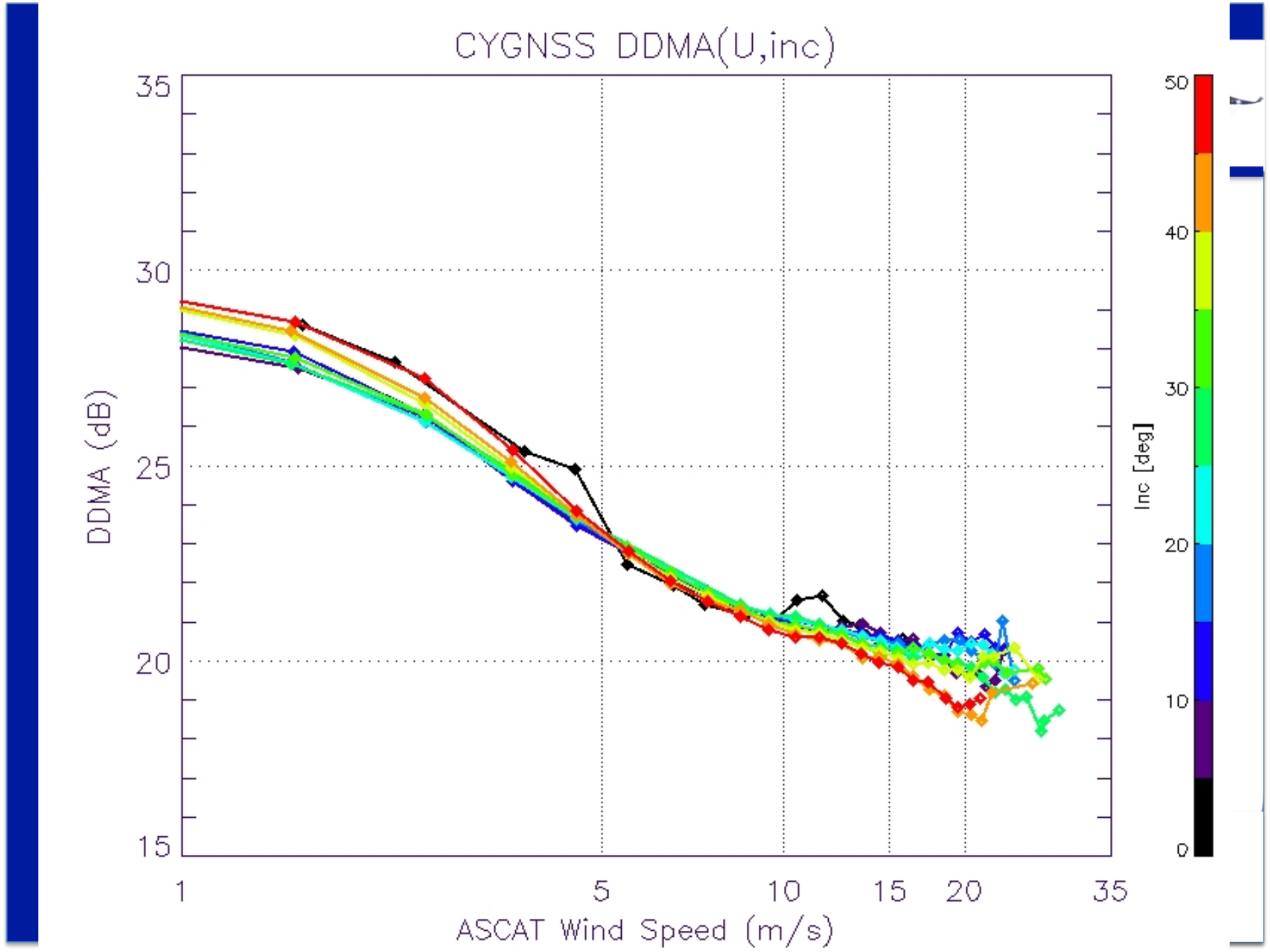


Colocation Database

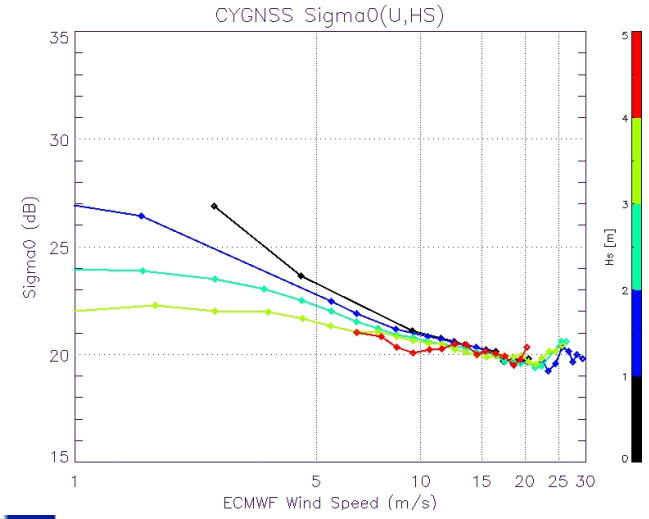


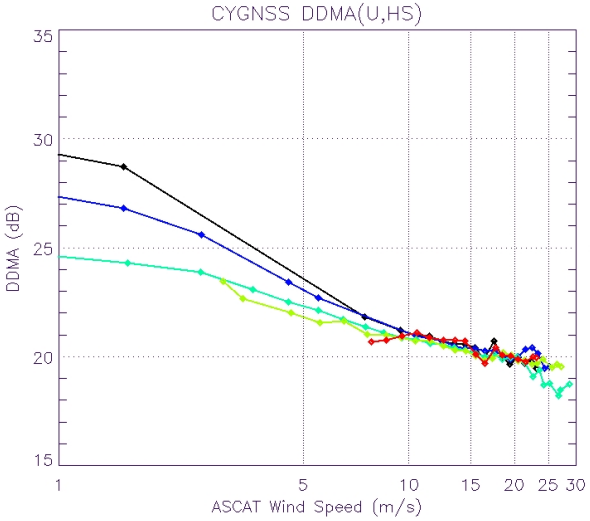
CYGNSS DDMA vs Different Surface Truth

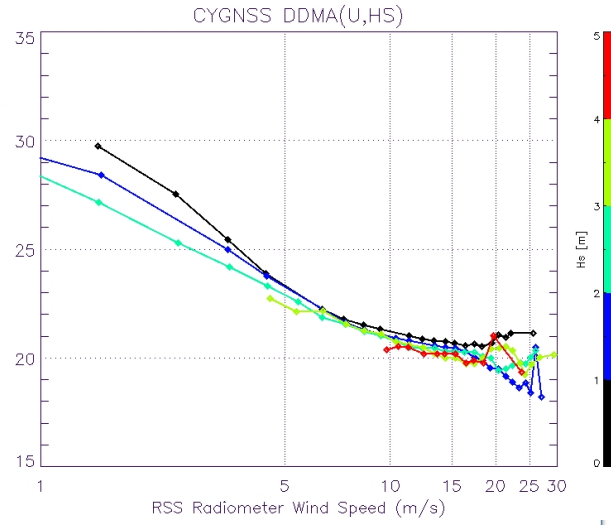


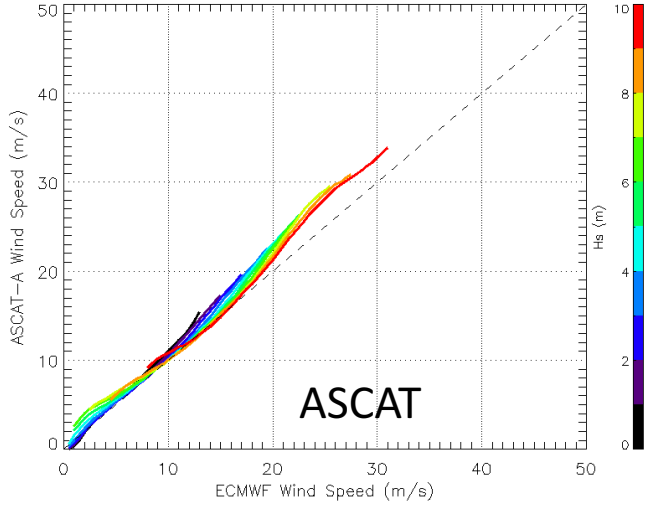

CYGNSS DDMA(U,inc)
DDMA (dB)
35
30
25
20
15
1
5
10
15
20
35
ASCAT Wind Speed (m/s)
Inc [deg]
50
40
30
20
10
0

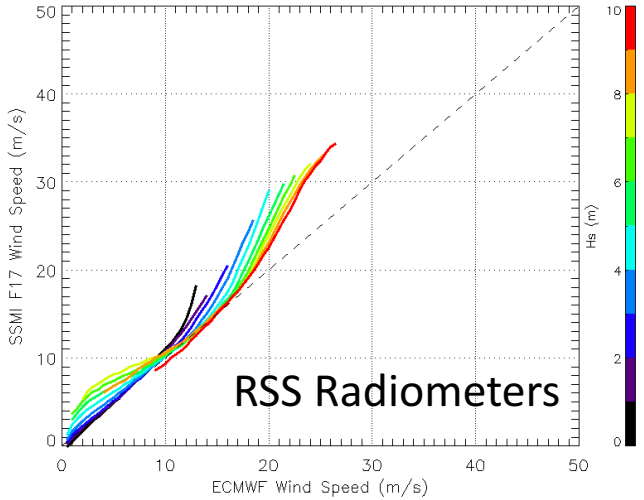
DDMA and Significant Wave Height





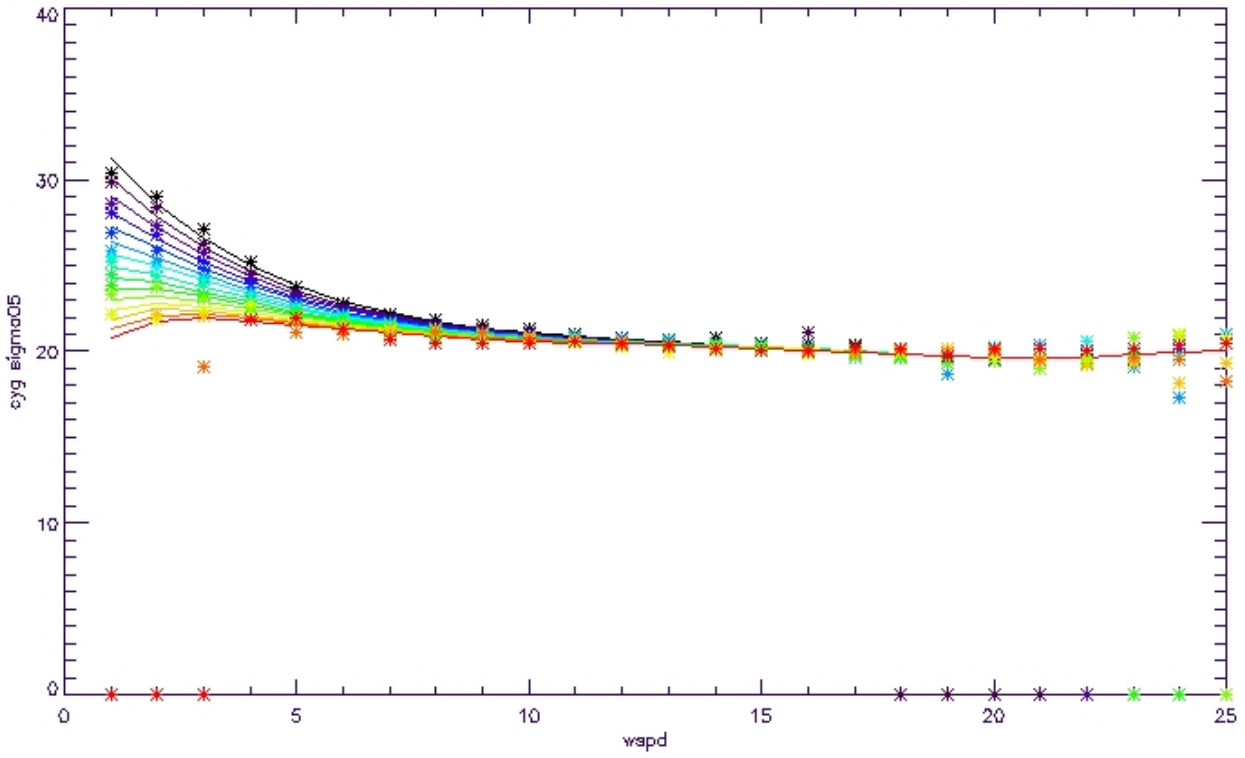






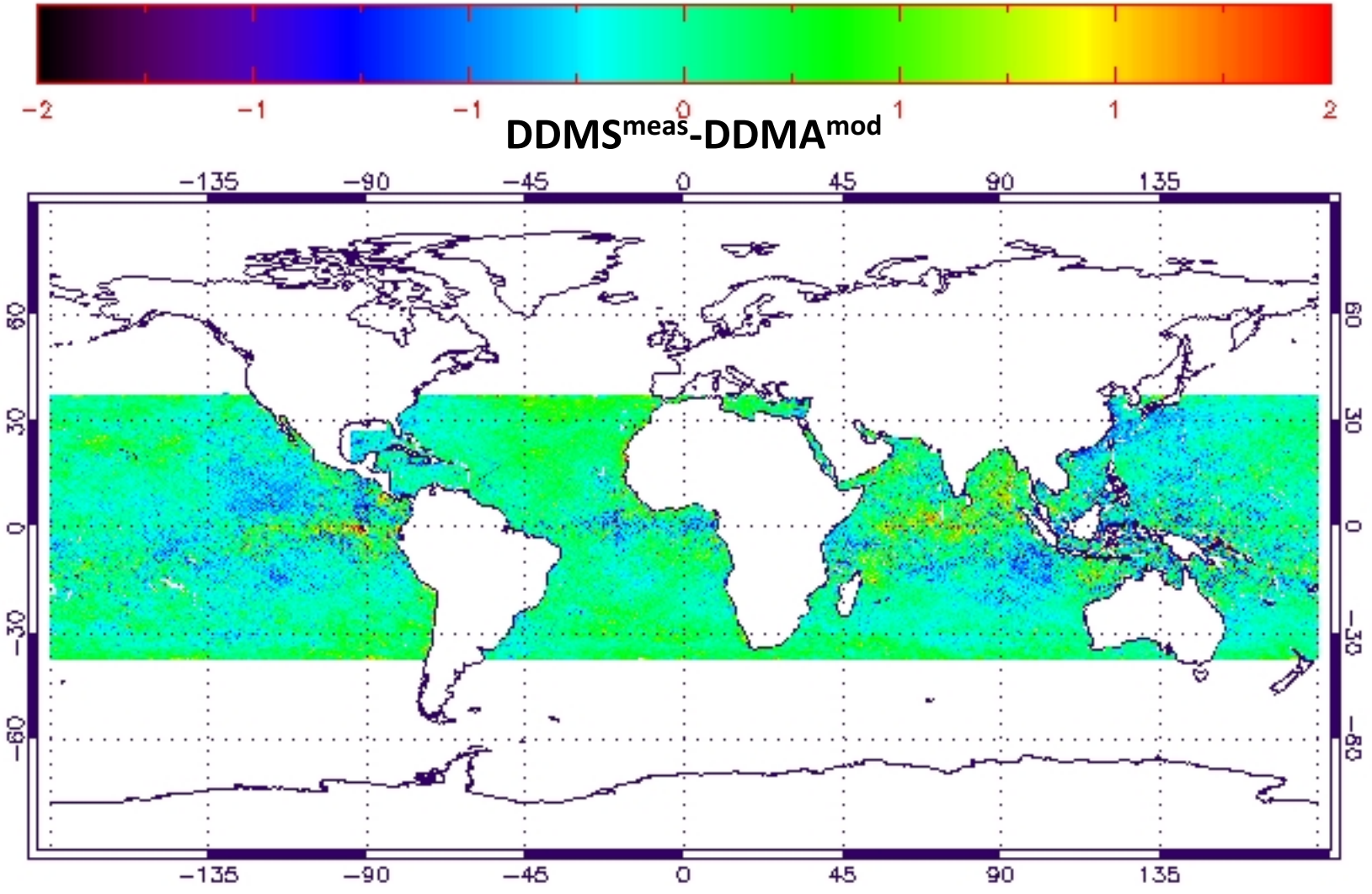
CYGNSS GMF Ver0

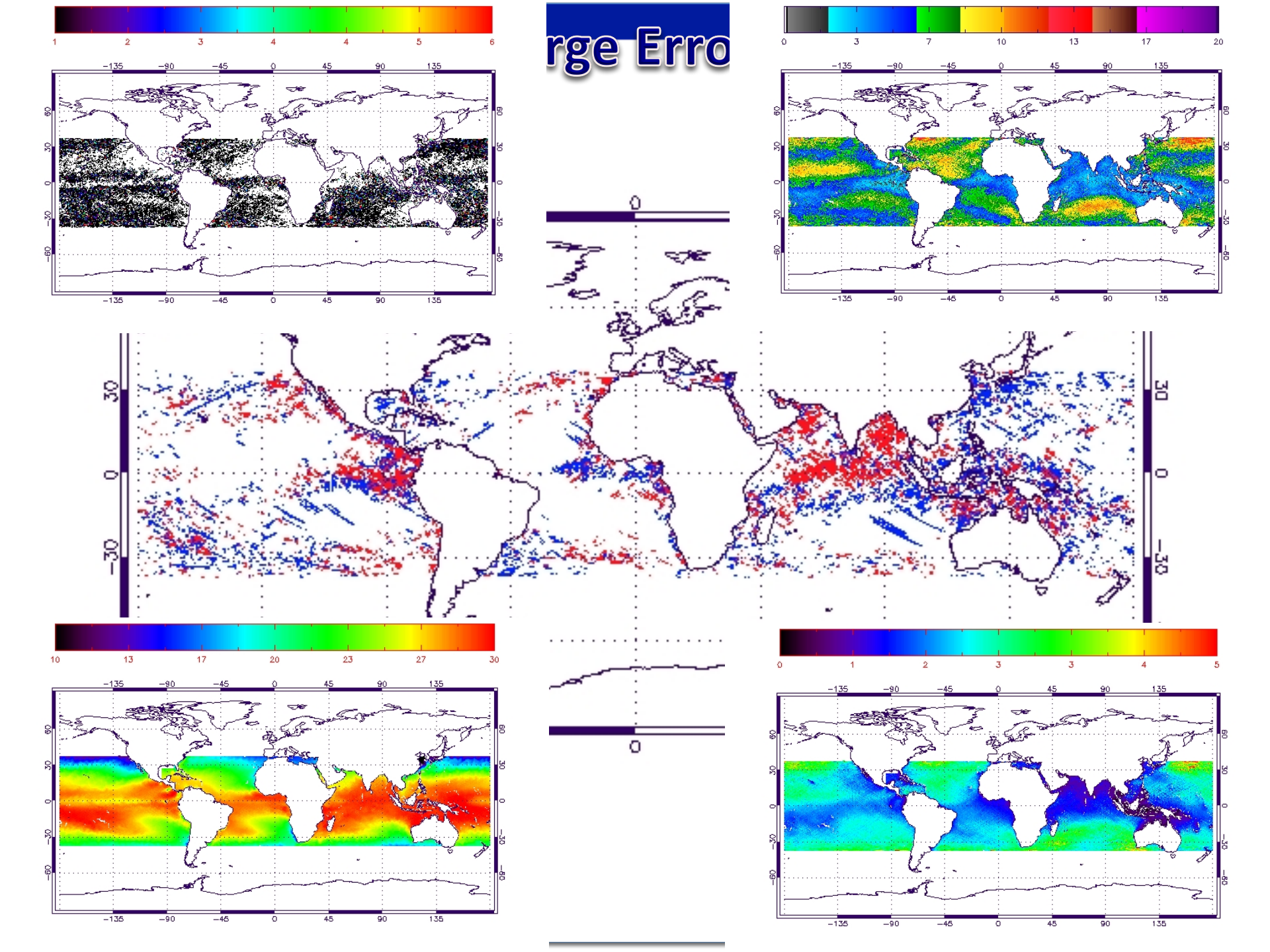
$$DDMA = a + b * \exp(-HS / c) * \exp(-U / d)$$



CYGNSS DDMA Bias

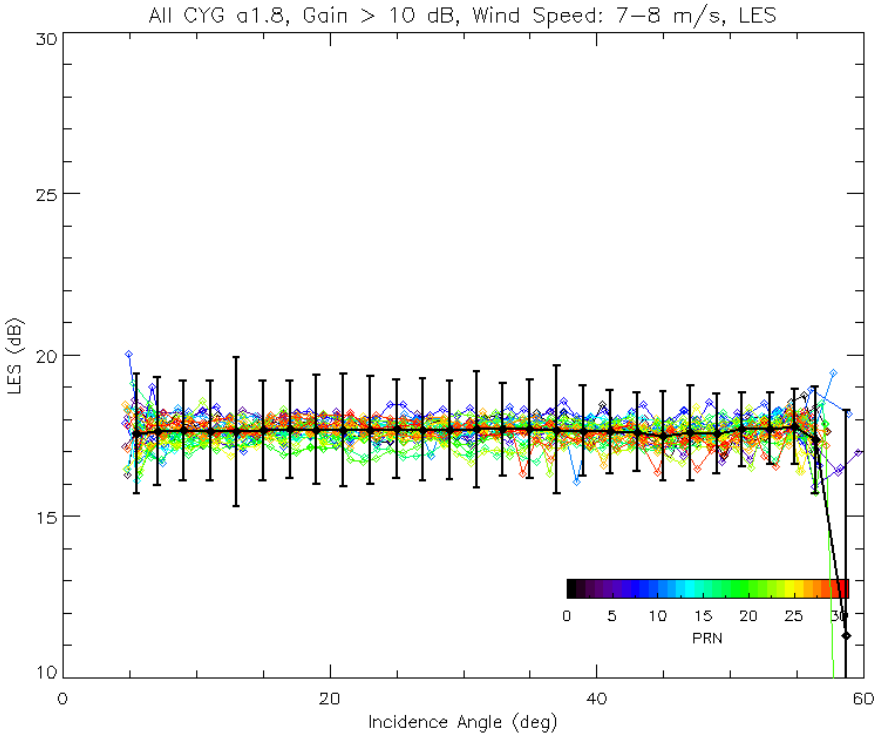
ECMWF Wind IFREMER HS

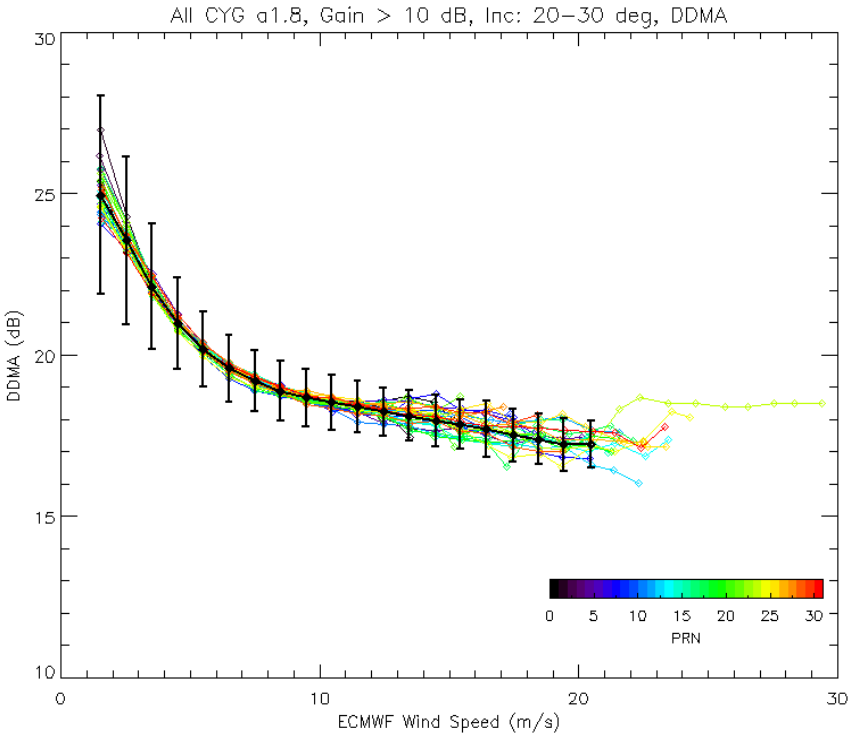


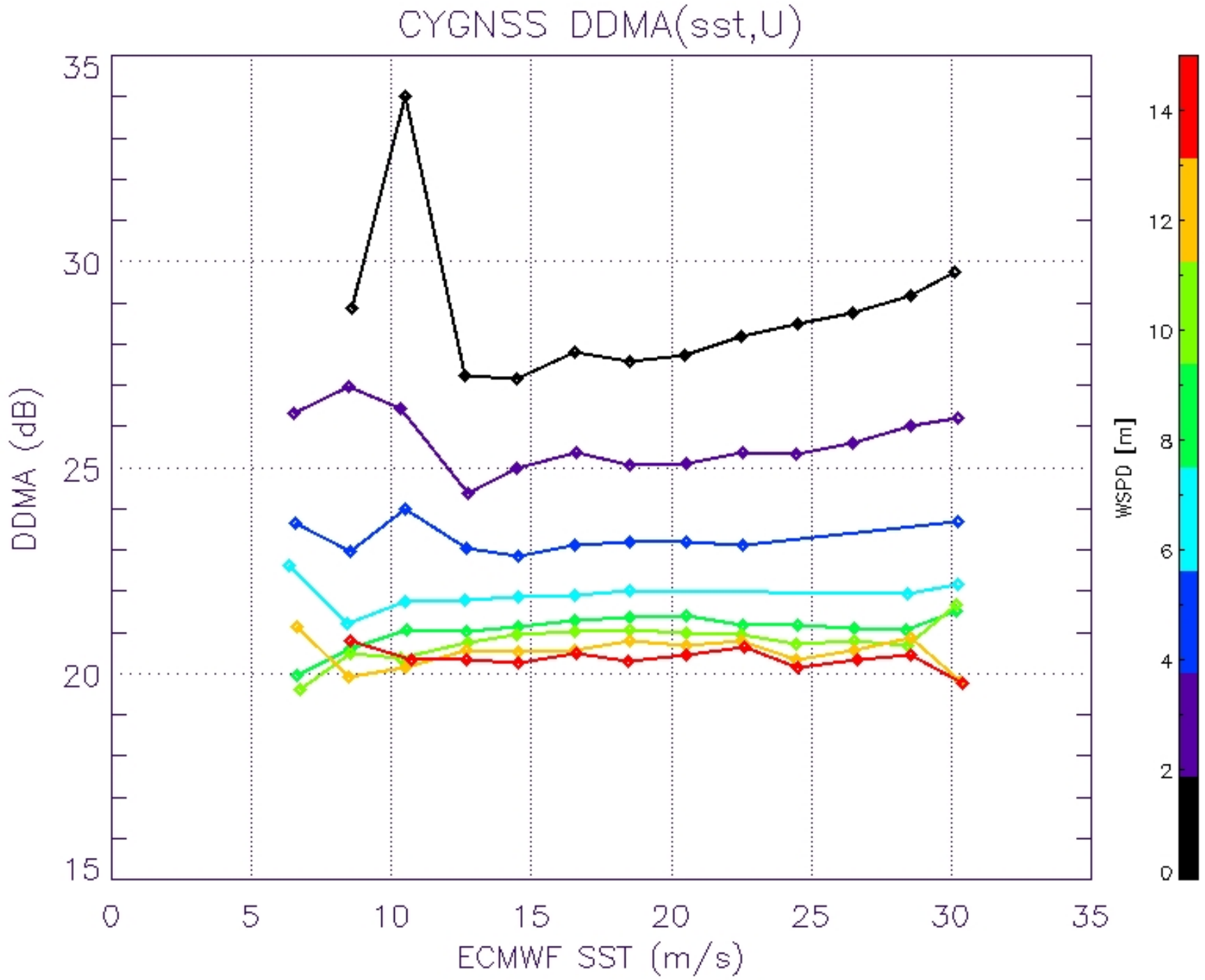

rge Erro
1 2 3 4 4 5 6
0 3 7 10 13 17 20
10 13 17 20 23 27 30
0 1 2 3 3 4 5
−135 −90 −45 0 45 90 135
60 30 0 −30 −60
30 0 −30

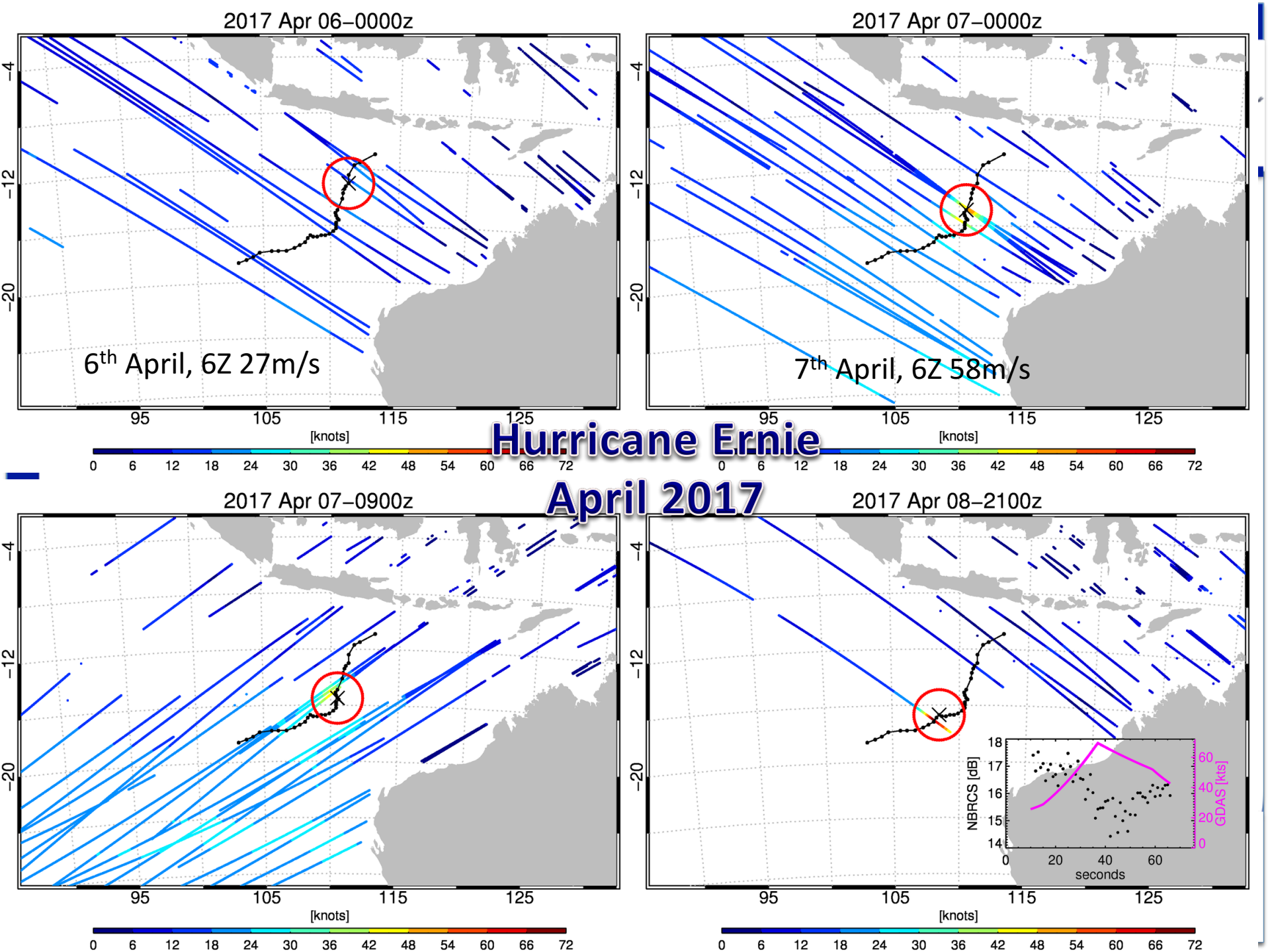
CYGNSS DDMA vs Incidence Angle and Wind Speed

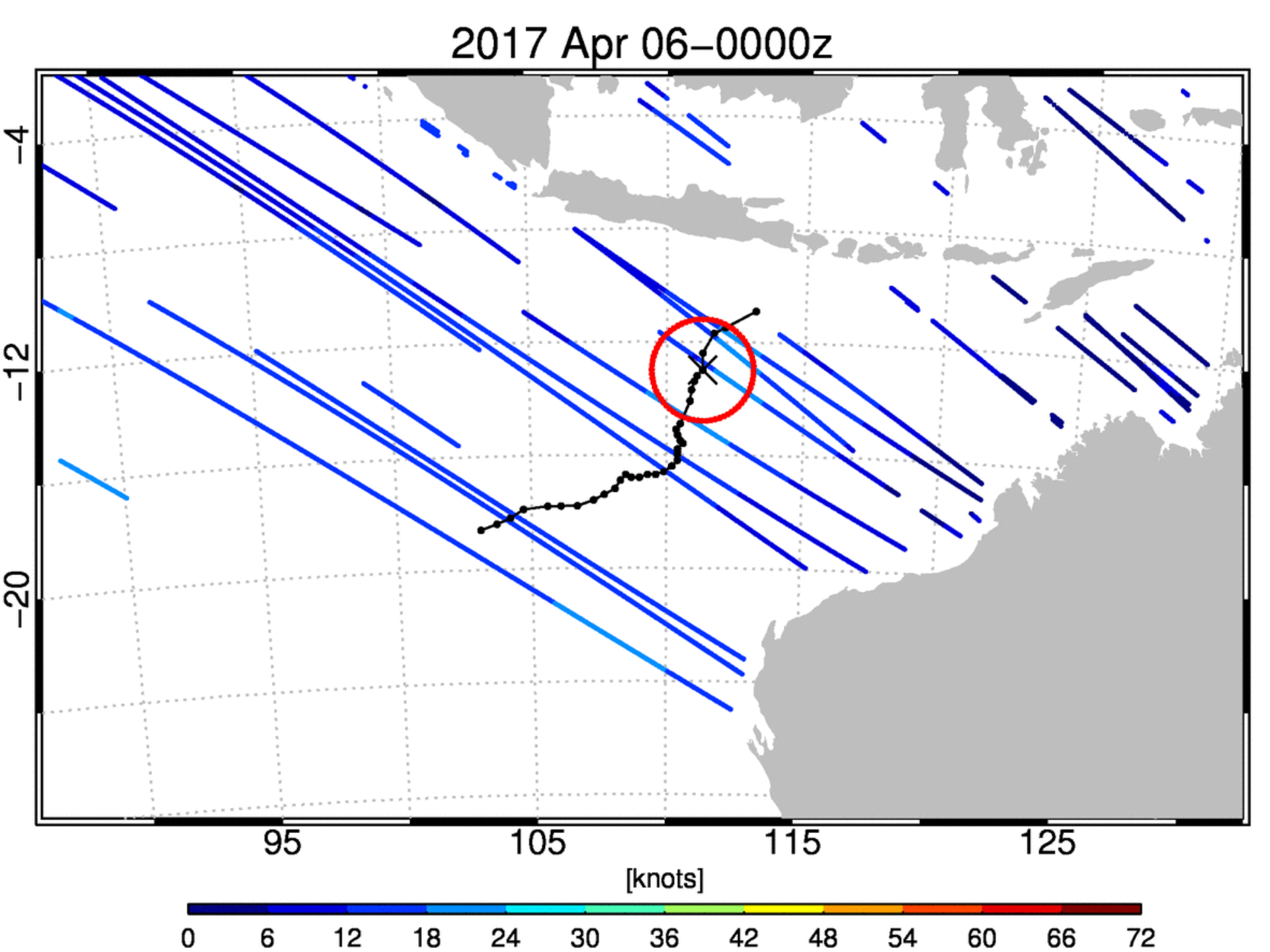
Different PRN






CYGNSS DDMA(sst,U)
DDMA (dB)
35
30
25
20
15
0
5
10
15
20
25
30
35
ECMWF SST (m/s)
WSPD [m]
14
12
10
8
6
4
2
0

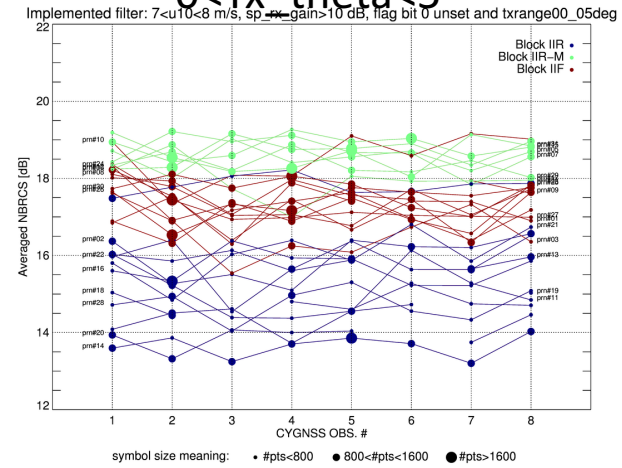

2017 Apr 06–0000z
2017 Apr 07–0000z
2017 Apr 07–0900z
2017 Apr 08–2100z
6th April, 6Z 27m/s
7th April, 6Z 58m/s
Hurricane Ernie
April 2017
-4
-12
-20
95
105
115
125
[knots]
0 6 12 18 24 30 36 42 48 54 60 66 72
NBRCS [dB]
GDAS [kts]
seconds


2017 Apr 06–0000z
-4
-12
-20
95
105
115
125
[knots]
0
6
12
18
24
30
36
42
48
54
60
66
72

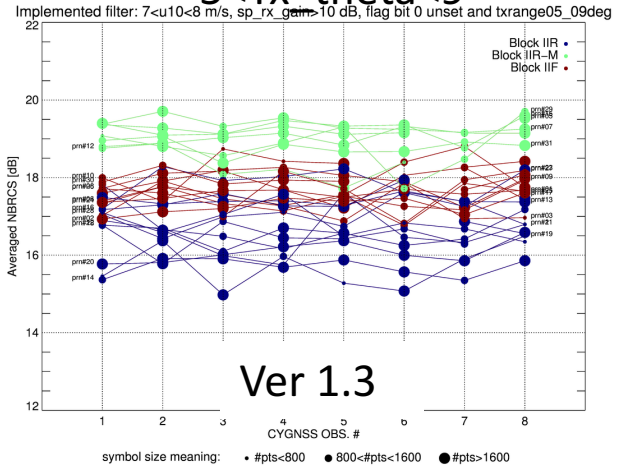
Summary

- All CYGNSS satellites are showing consistent measurements between each other
- CYGNSS measurement sensitivities comparable to TDS
  - Measured signal shows strongest sensitivity to wind
  - At wind speeds waves <7m/s significantly has very strong impact on measurements and need to be taken into account
  - At wind speeds <5m/s there is an apparent SST dependence
  - High wind speed sensitivity 2dB between 10-30m/s more

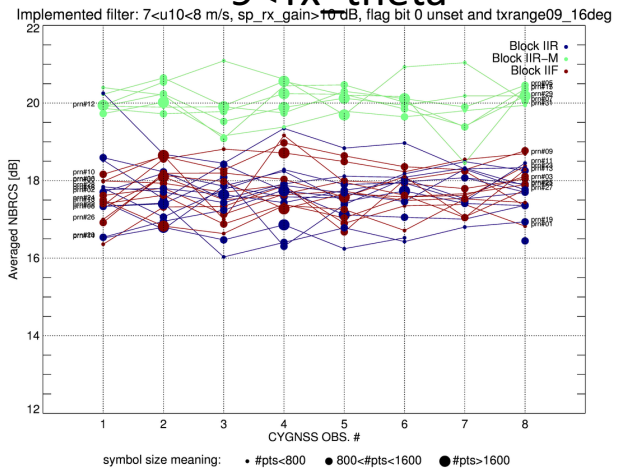
0<Tx_theta<5



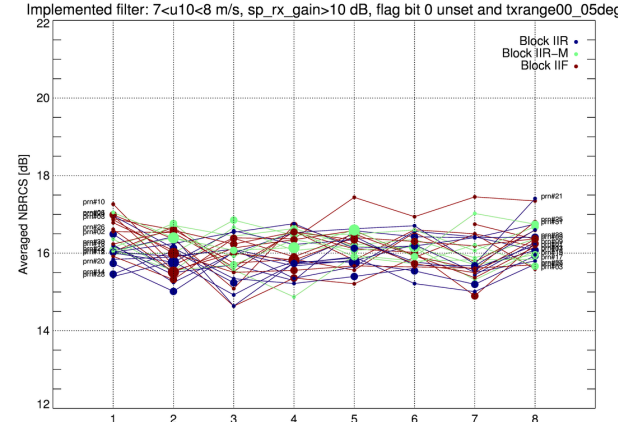
5<Tx_theta<9

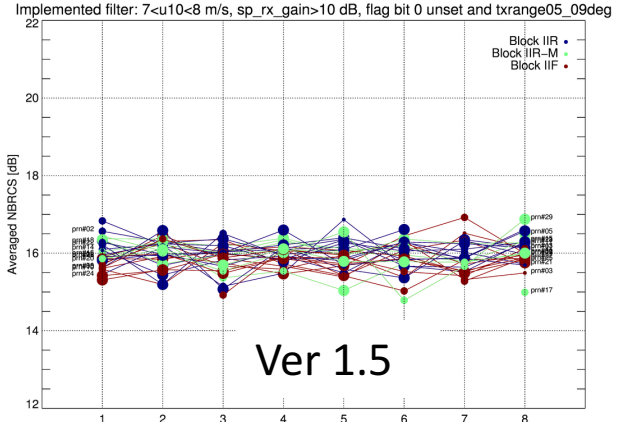


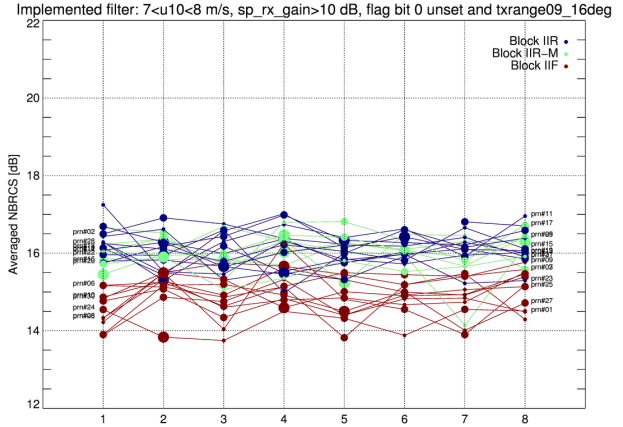
9<Tx_theta



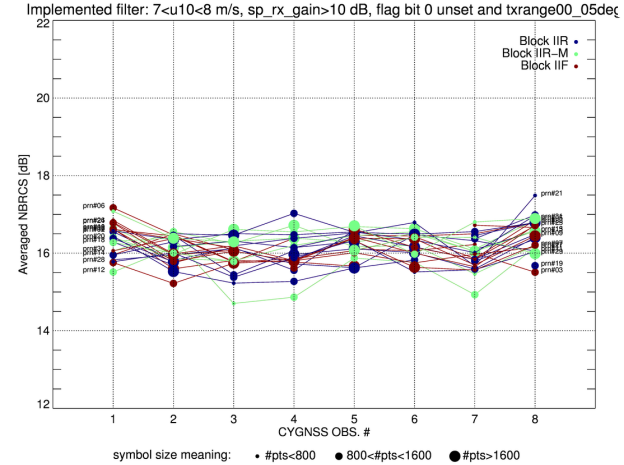
Ver 1.3

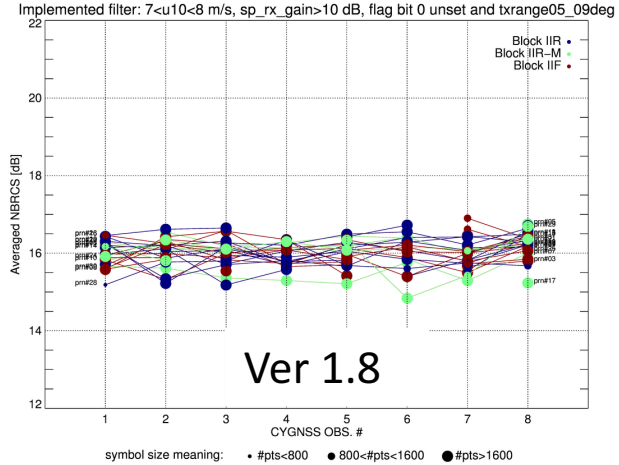


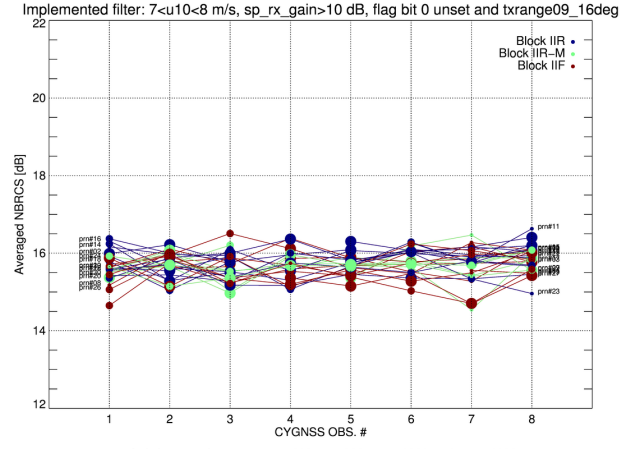




Ver 1.5







Ver 1.8