Evaluation of v3.0 L1 data, including preliminary results on NOAA CyGNSS winds using the v3.0 NBRCS

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Outline

- v2.1 vs. v3.0 NBRCS timeseries
  - per fm
  - per block type
- similar analysis using preliminary NOAA wind
- a closer look at the high roll angle data

v2.1 daily averaged NBRCS per observatory

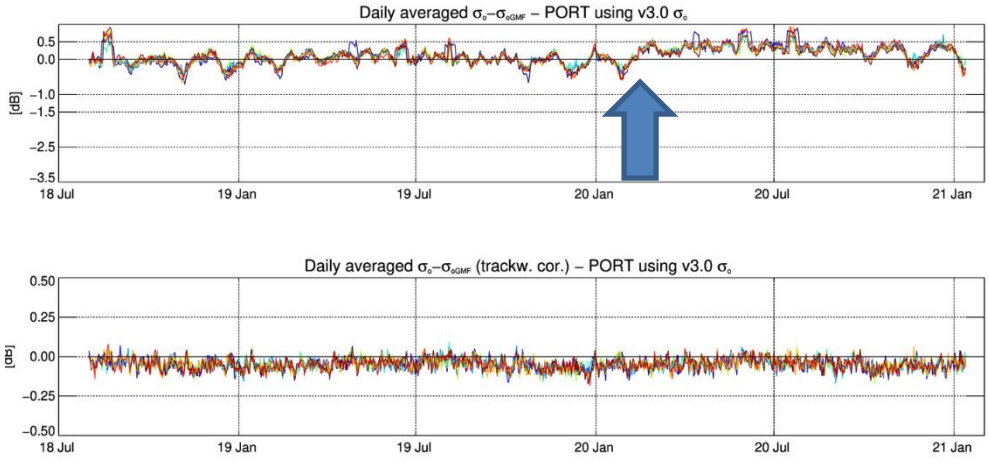
PORT

STARBOARD

→decreasing NBRCS trend, although appears stable after mid-Feb 2020
→intersatellite biases
→sudden decrease in mid-Feb 2020
→trackwise corrected NBRCS mostly immune from above mentioned issues

v3.0 daily averaged NBRCS per observatory

PORT



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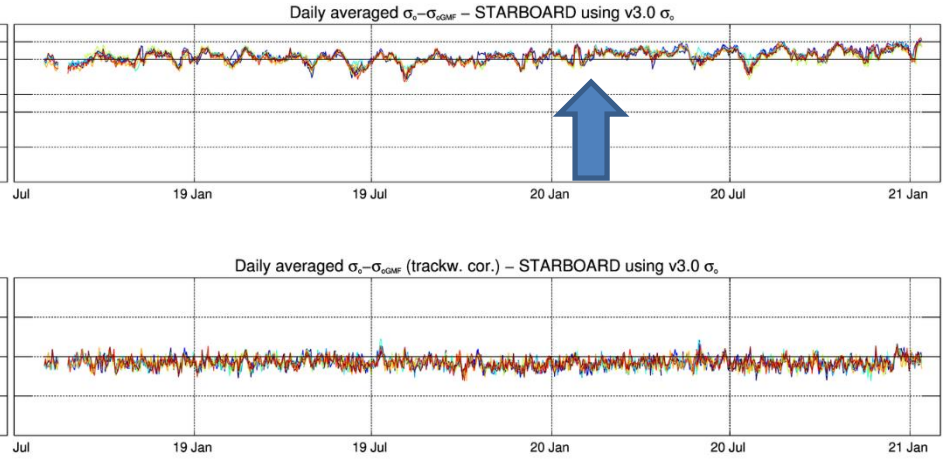
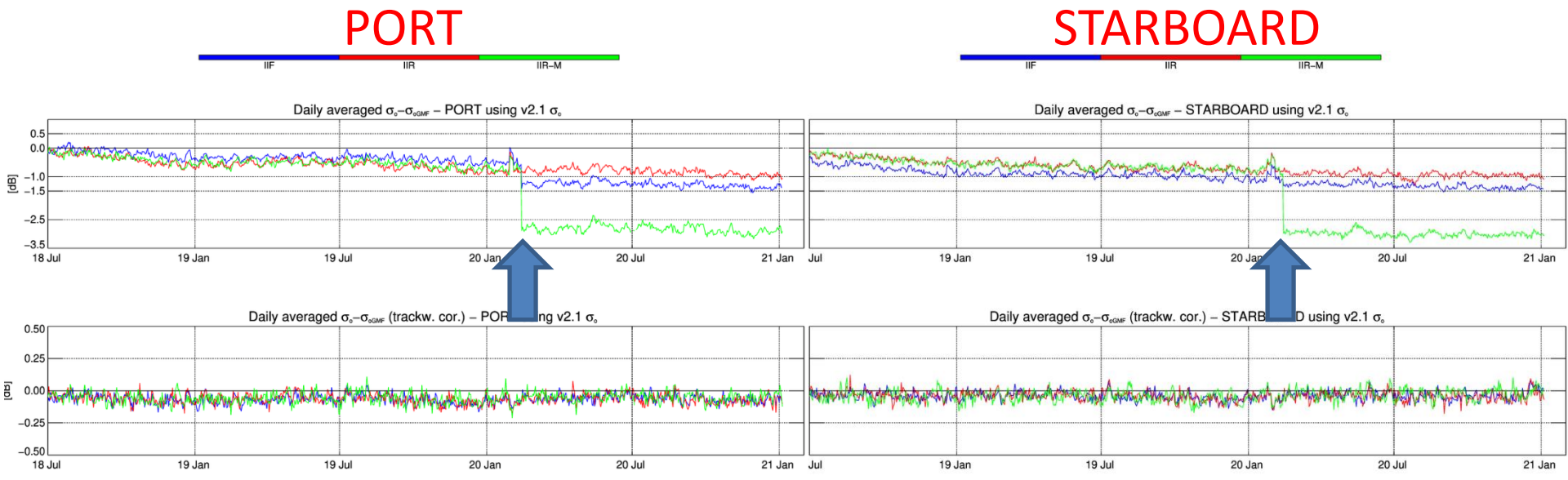


→no notable decreasing NBRCS trend!

→no noticeable intersatellite biases!

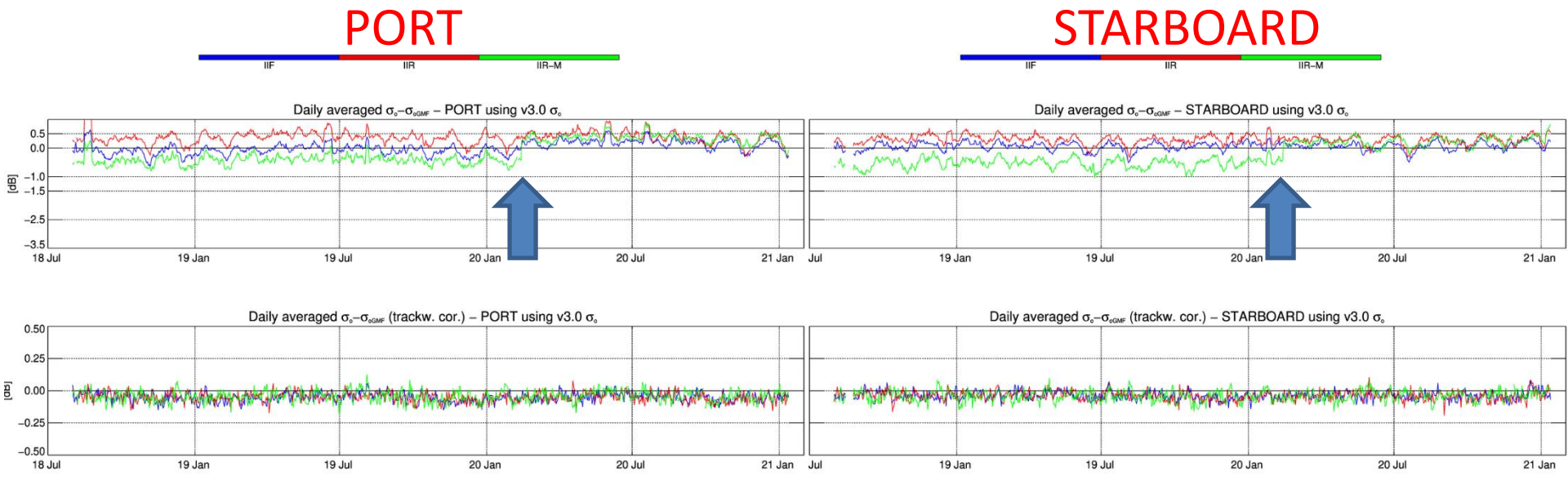
→subtle overall increase in mid-Feb 2020? (see next slides..)

v2.1 daily averaged NBRCS per GPS block type



→same decreasing NBRCS trend
→GPS block type biases
→sudden decrease for IIF/IIR-M in mid-Feb 2020 (new flex power event)
→trackwise corrected NBRCS mostly immune from above mentioned issues

v3.0 daily averaged NBRCS per GPS block type



→again, no decreasing trend in the NBRCS

→GPS block type biases still present and particularly higher prior to Feb 2020 flex power event (*and larger than v2.1*)

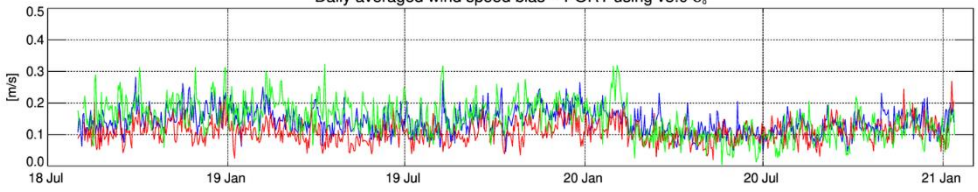
→trackwise corrected NBRCS mostly immune from above mentioned issues

NOAA Winds using v3.0 NBRCS

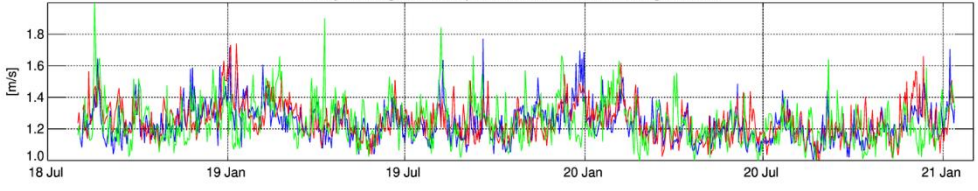
PORT

IIF IIR IIR-M

Daily averaged wind speed bias – PORT using v3.0 σ_o



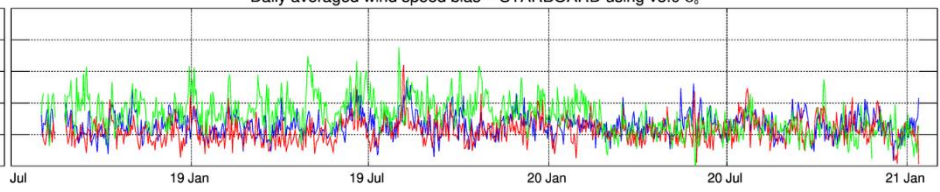
Daily averaged wind speed std diff – PORT using v3.0 σ_o



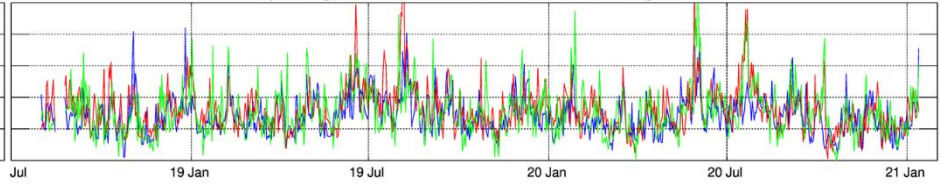
STARBOARD

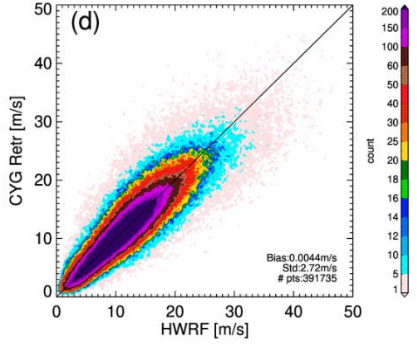
IIF IIR IIR-M

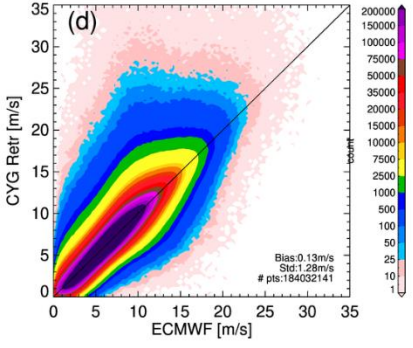
Daily averaged wind speed bias – STARBOARD using v3.0 σ_o



Daily averaged wind speed std diff – STARBOARD using v3.0 σ_o



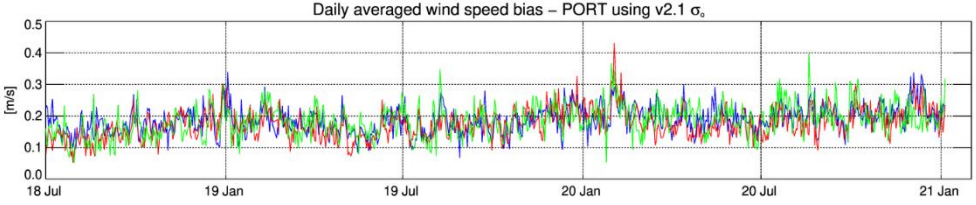


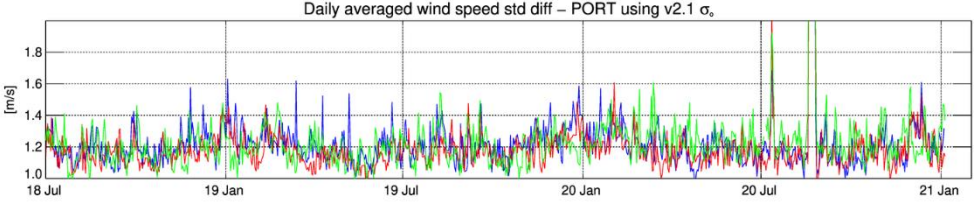


NOAA Winds using v2.1 NBRCS

PORT

IIF IIR IIR-M





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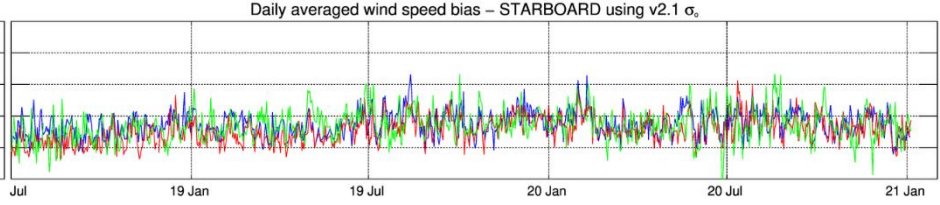
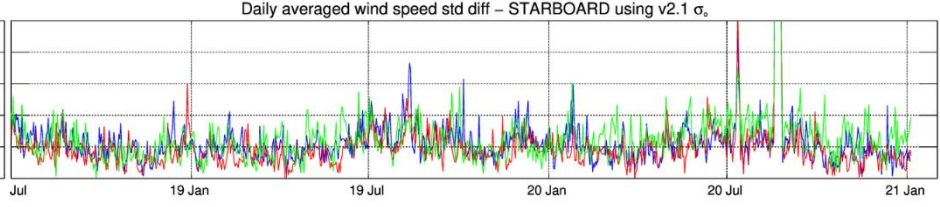
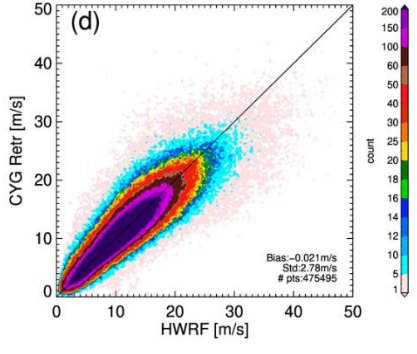
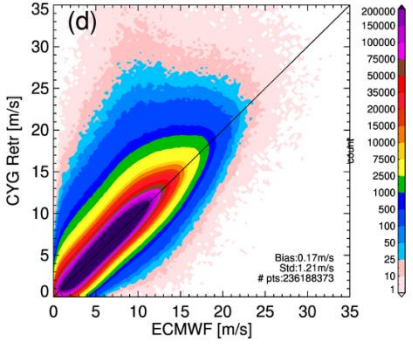
IIF IIR IIR-M

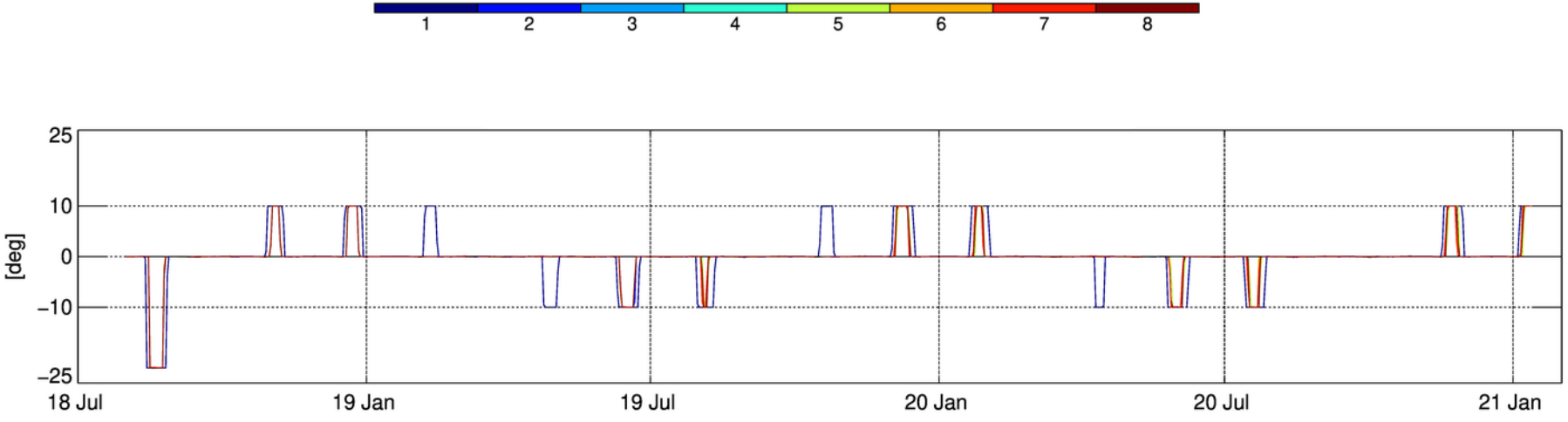








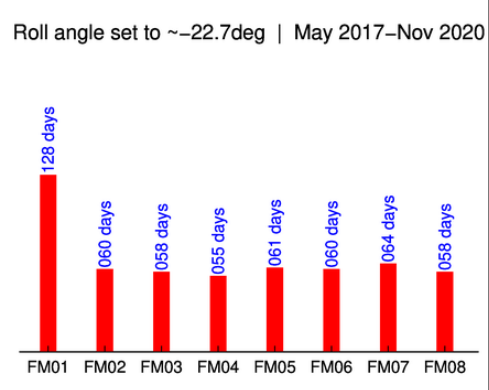
High roll data



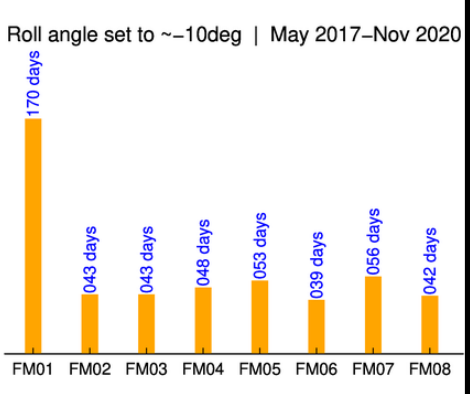
days per observatory with high roll angle

Period: May 2017 – Nov 2020

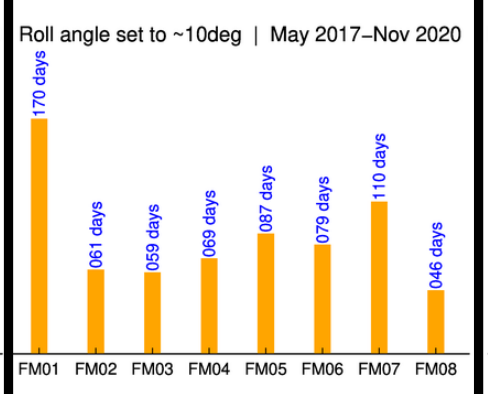
-22.7 deg



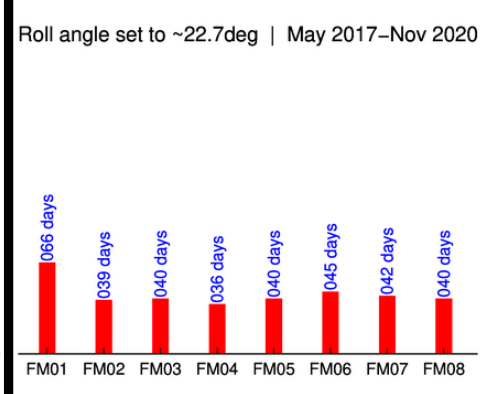
-10 deg



+10 deg

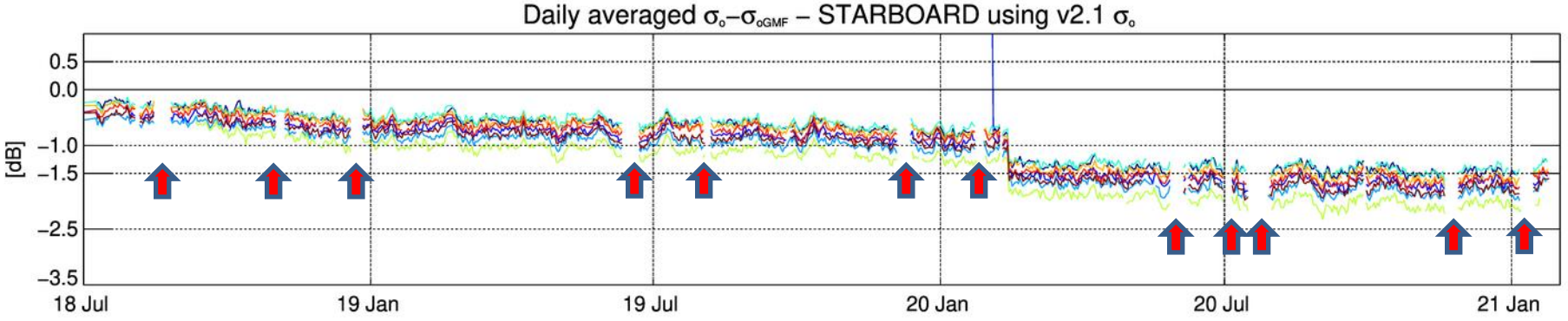


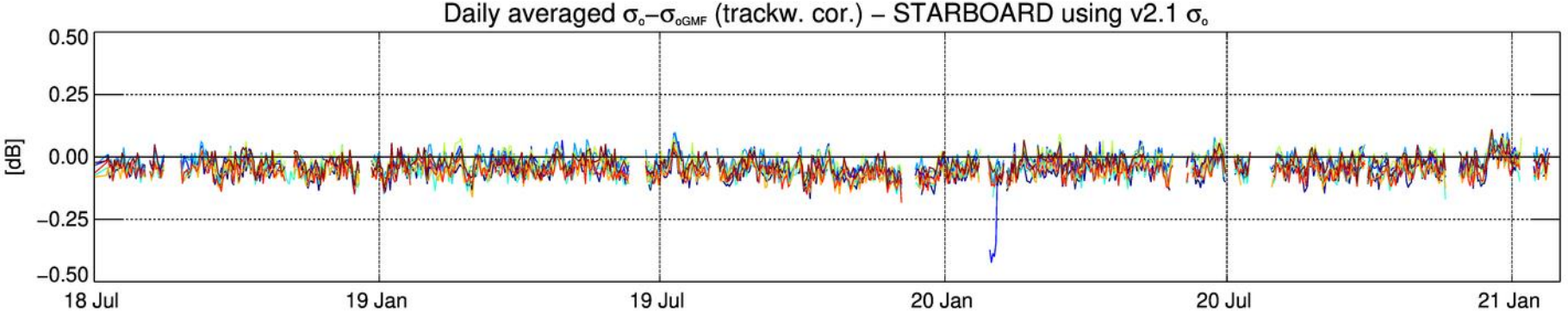
+22.7 deg



v2.1 NBRCS TIMESERIES WITHOUT 'HIGH ROLL DATA'

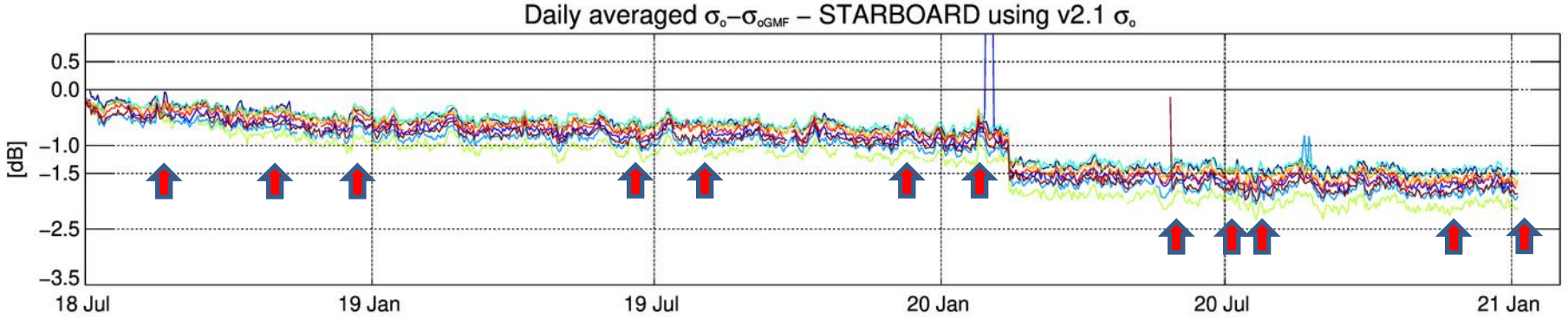
STAR

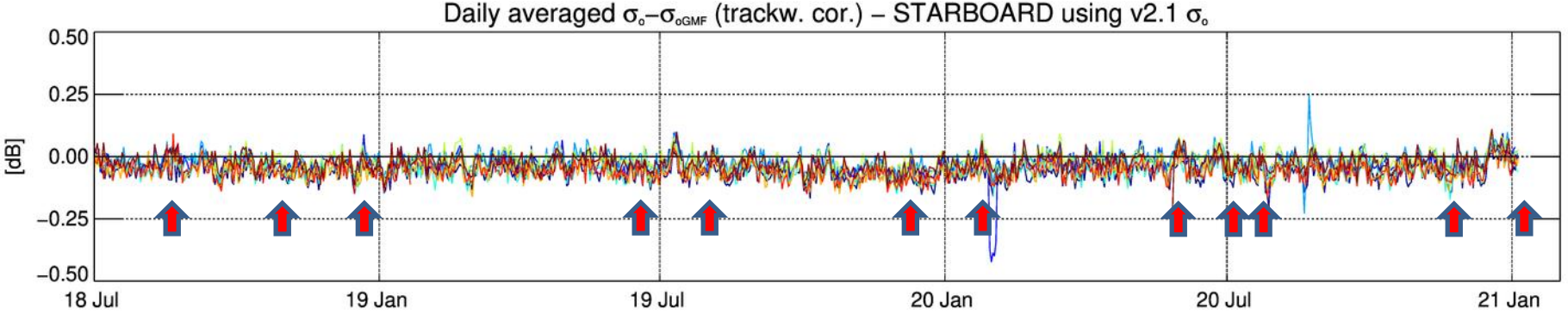




v2.1 NBRCS TIMESERIES WITH ‘HIGH ROLL DATA’

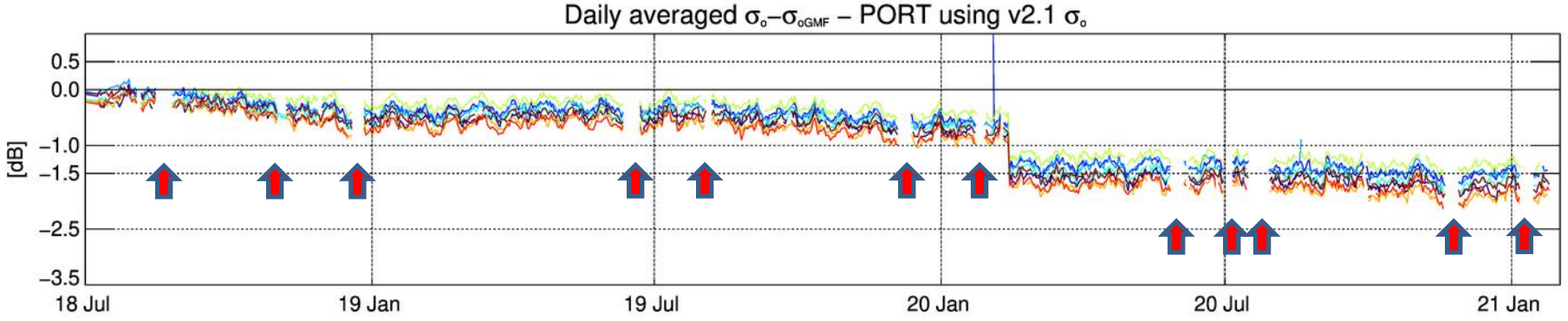
STAR

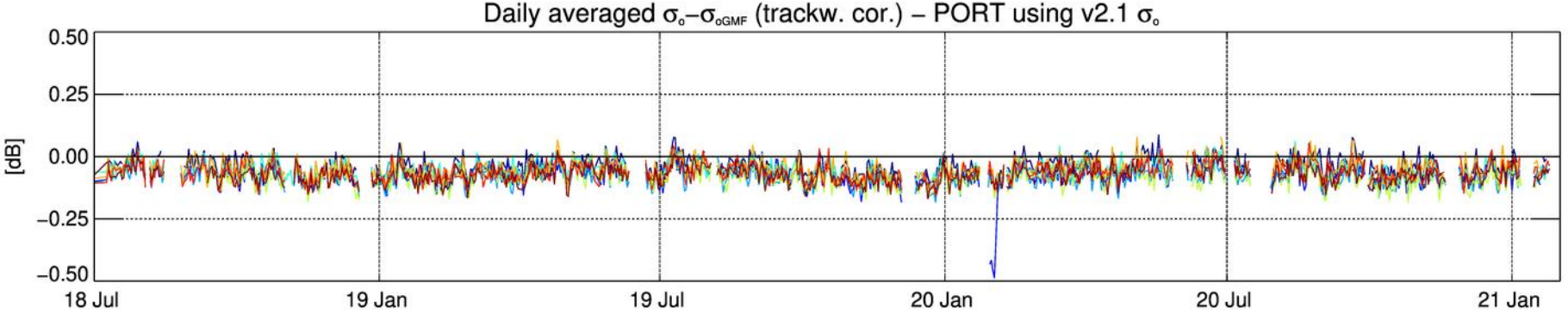




v2.1 NBRCS TIMESERIES WITHOUT 'HIGH ROLL DATA'

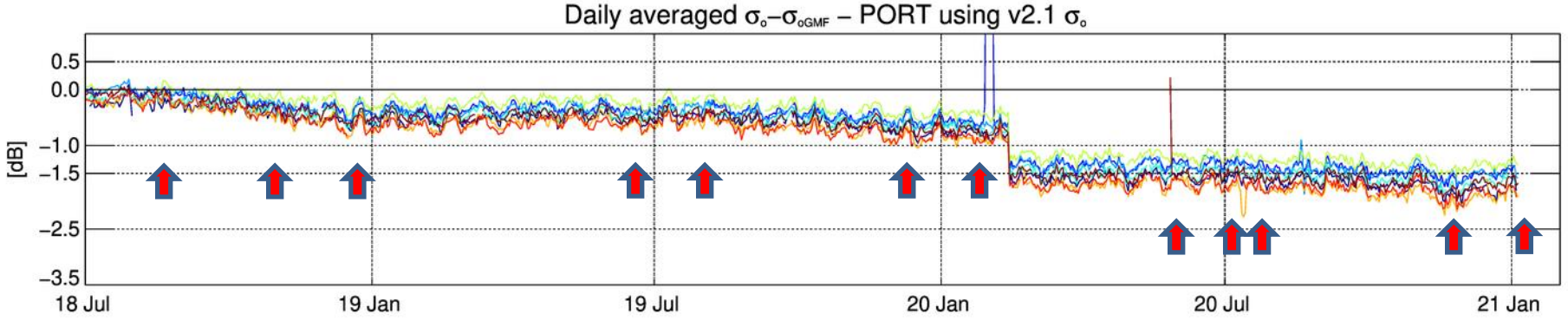
PORT



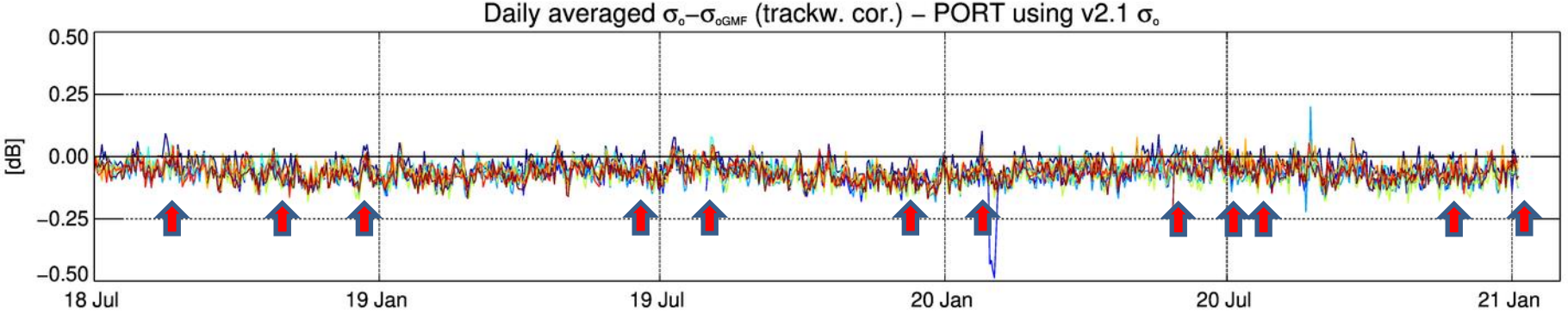


v2.1 NBRCS TIMESERIES WITH ‘HIGH ROLL DATA’

PORT

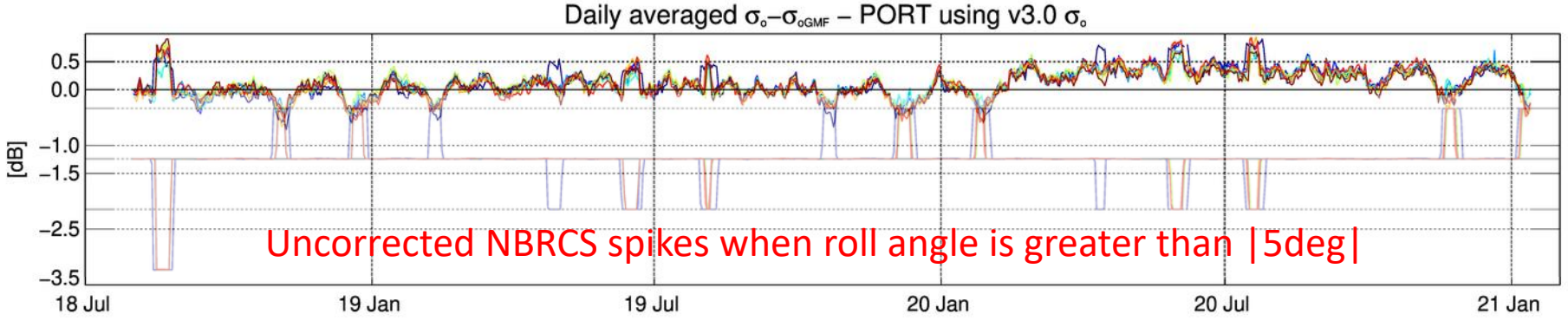


Performance appears OK at first glance (i.e. no noticeable spikes)

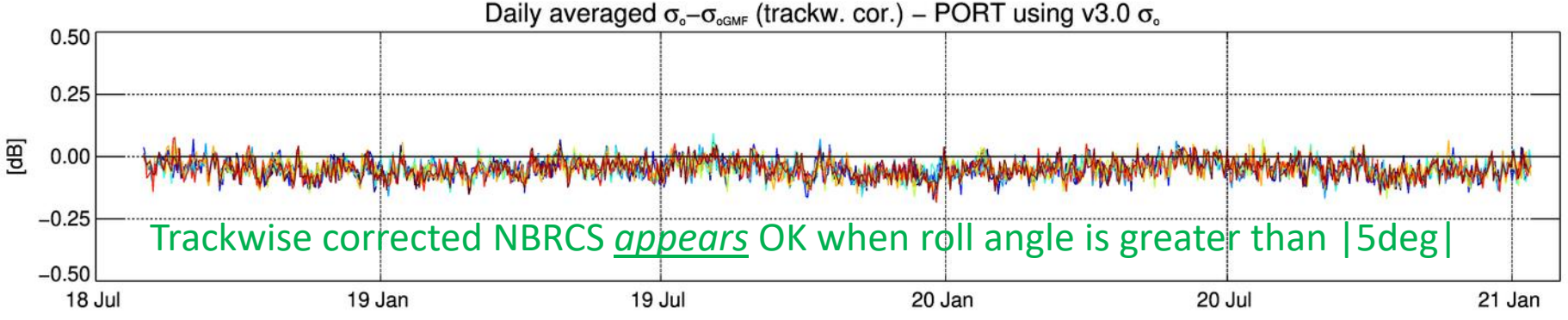


V3.0 NBRCS TIMESERIES WITHOUT 'HIGH ROLL DATA'

PORT



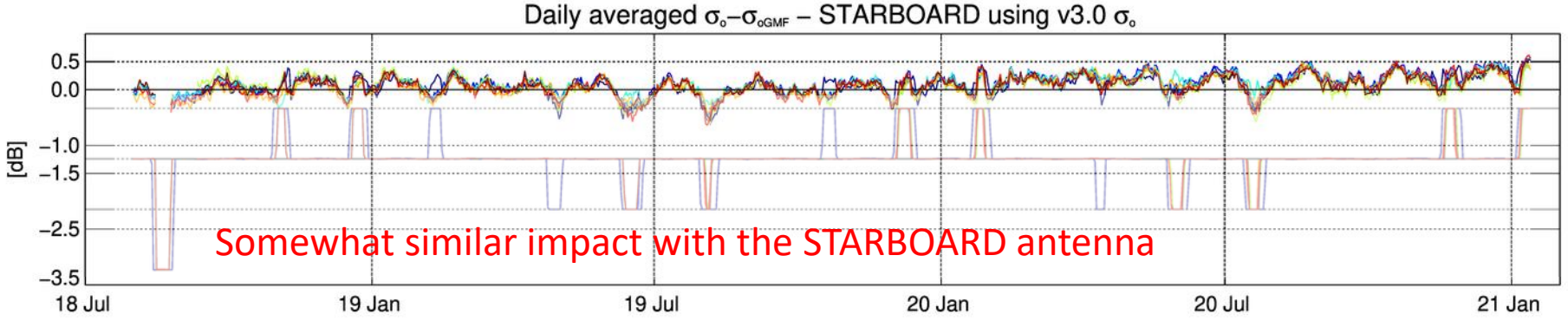
Uncorrected NBRCS spikes when roll angle is greater than |5deg|



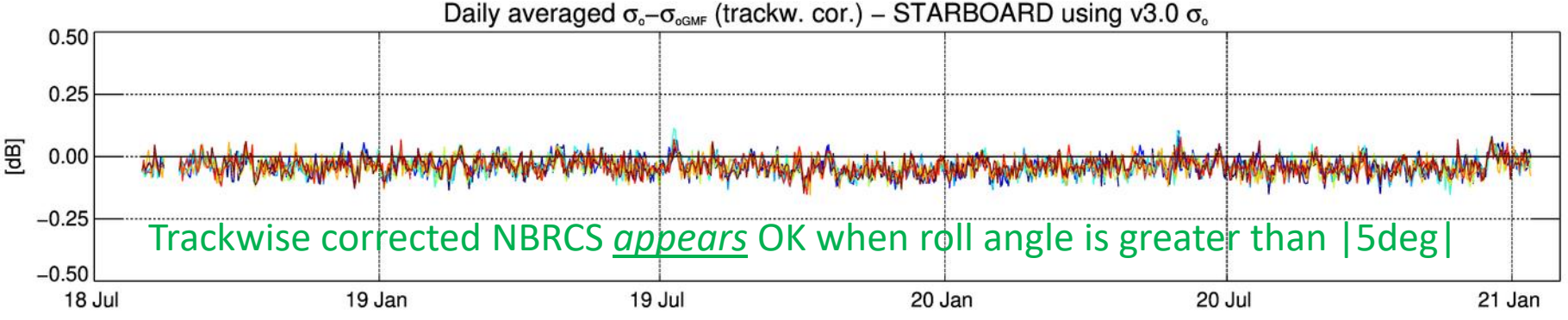
Trackwise corrected NBRCS *appears* OK when roll angle is greater than |5deg|

V3.0 NBRCS TIMESERIES WITH ‘HIGH ROLL DATA’

STAR

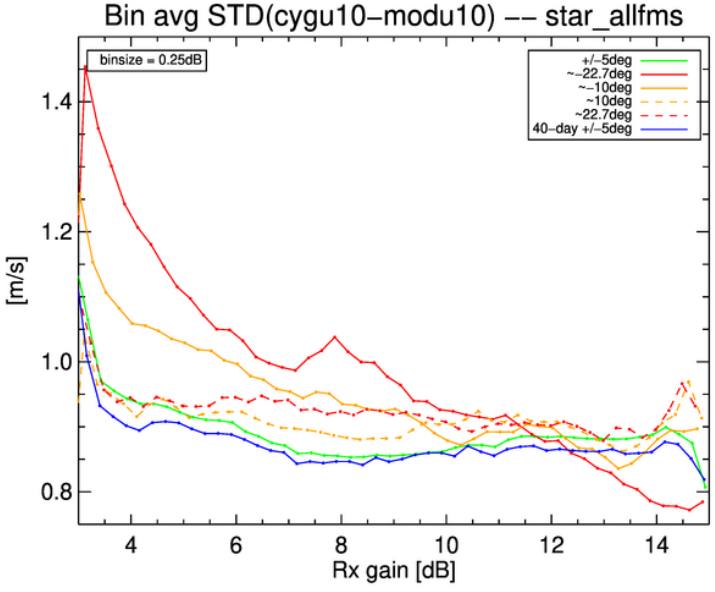


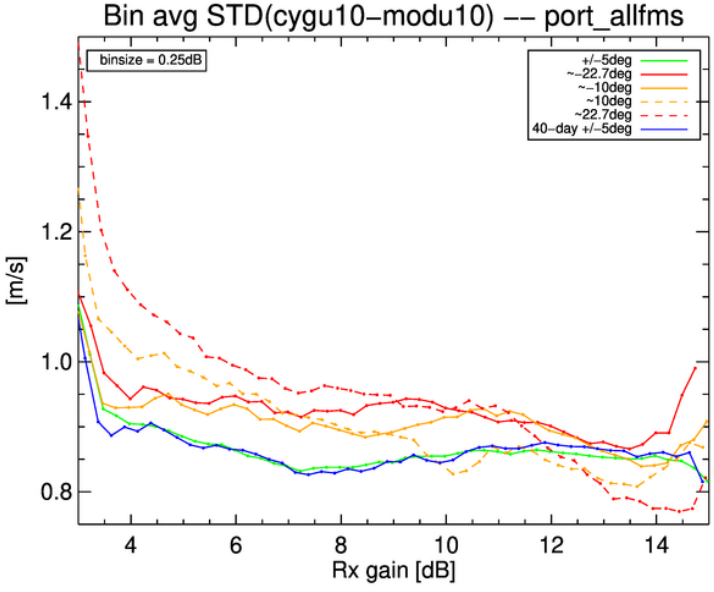
Somewhat similar impact with the STARBOARD antenna

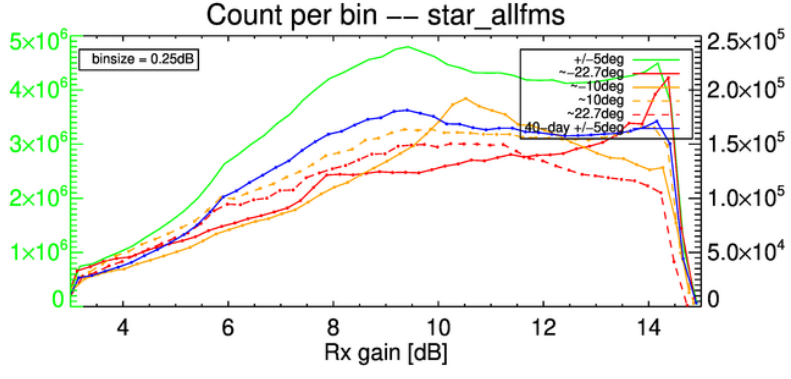


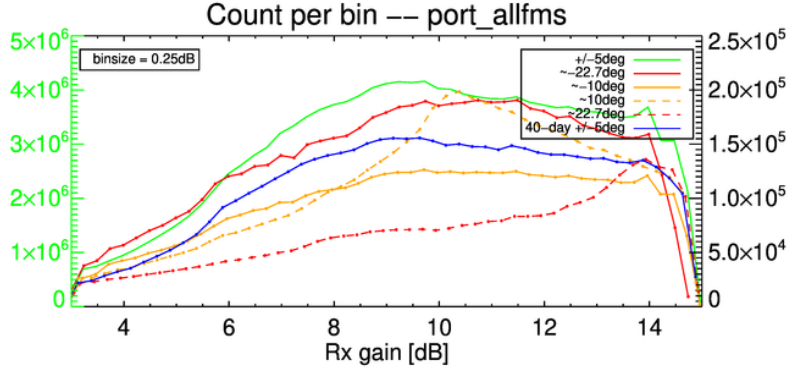
Trackwise corrected NBRCS *appears* OK when roll angle is greater than |5deg|

V2.1 STD($U10_{CYG}$-$U10_{MODEL}$) vs. Rx gain per antenna/roll angle

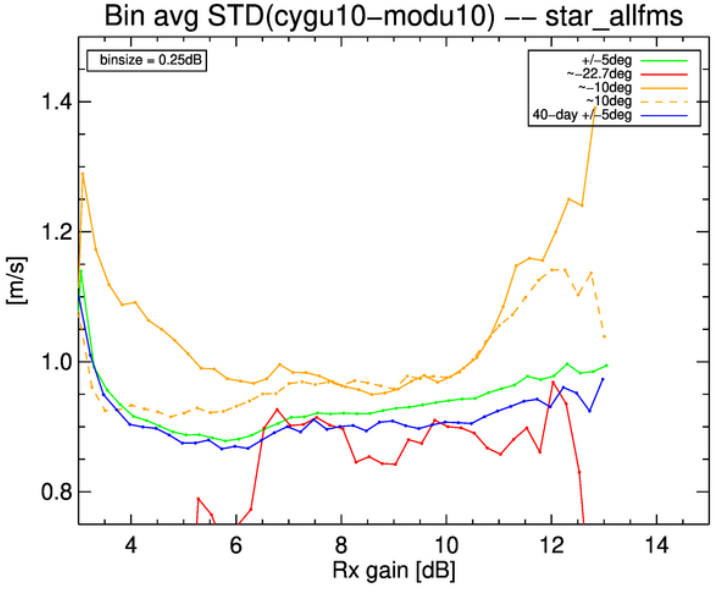


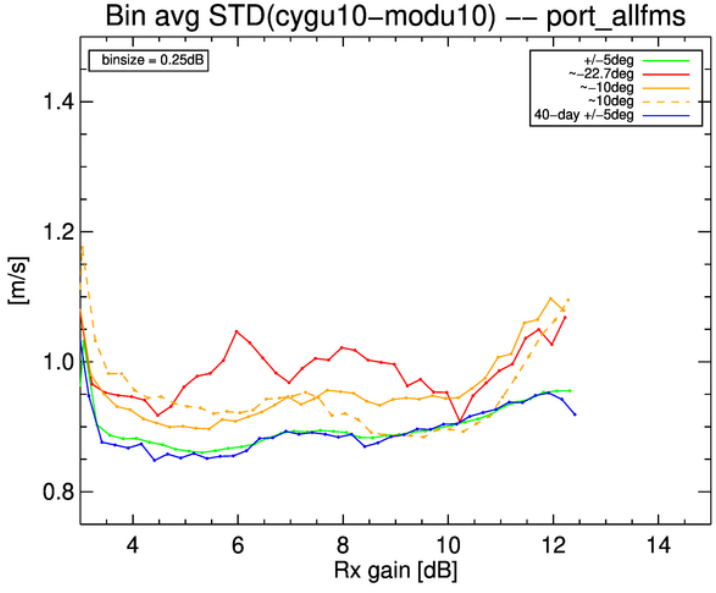


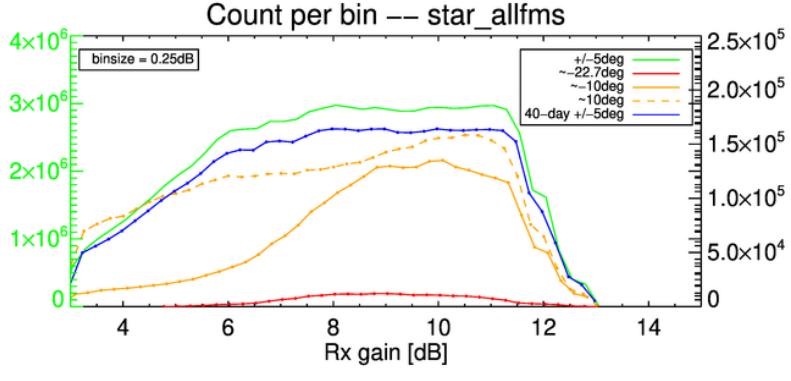


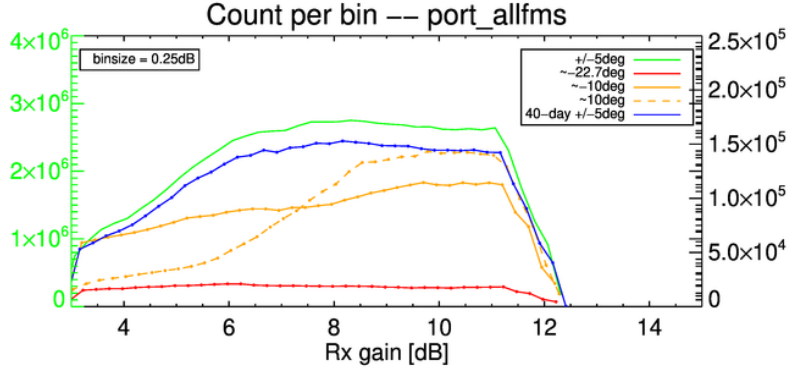


V3.0 STD($U10_{CYG}$-$U10_{MODEL}$) vs. Rx gain per antenna/roll angle

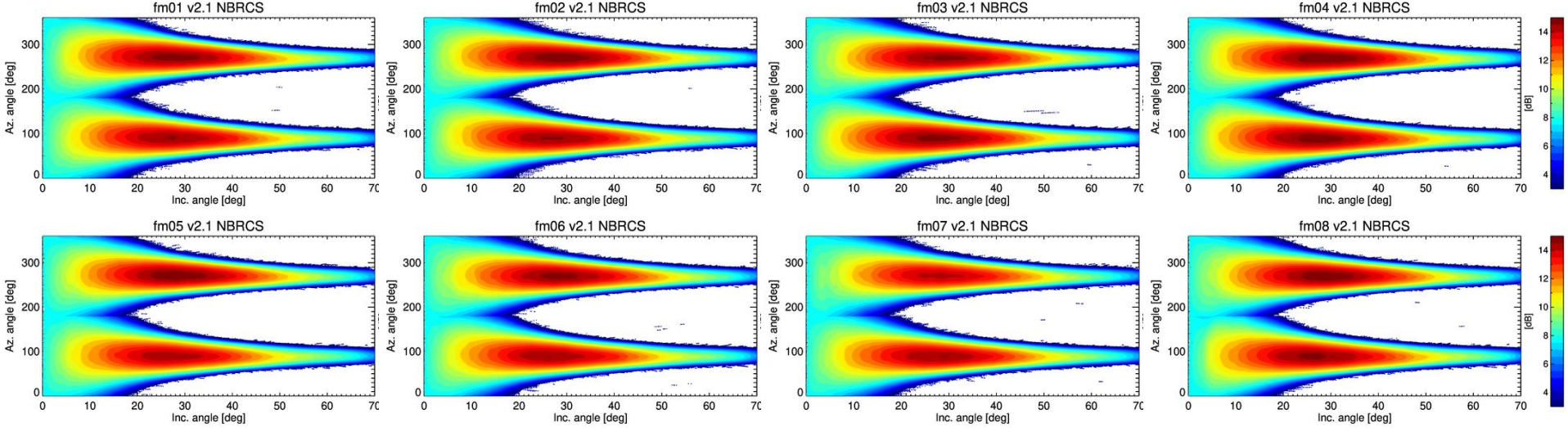


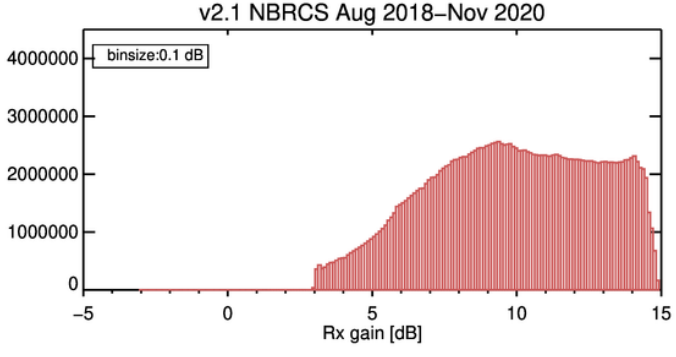




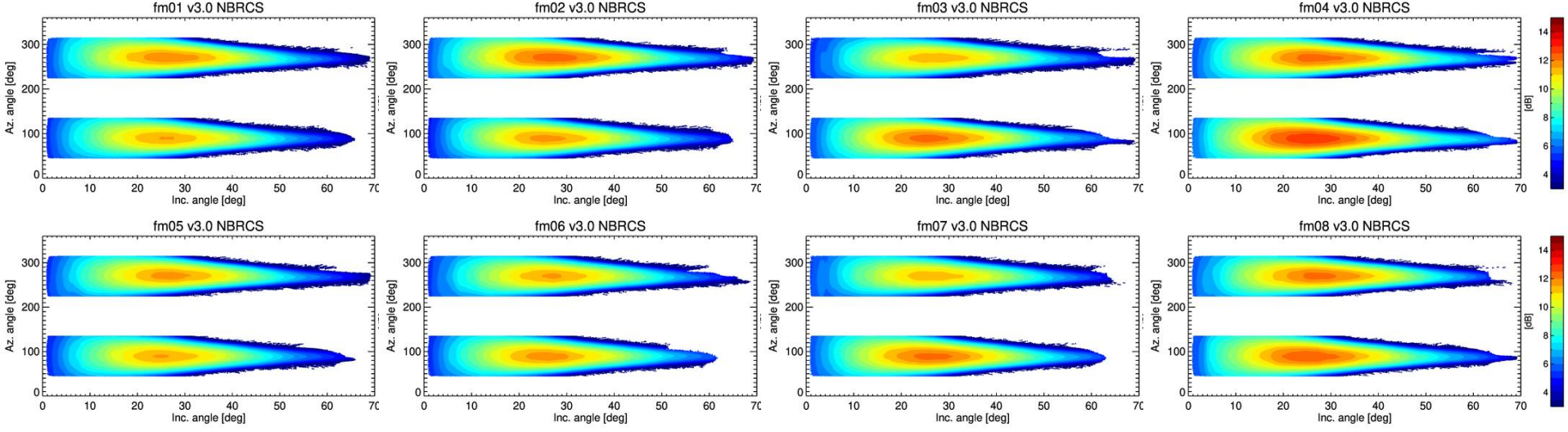


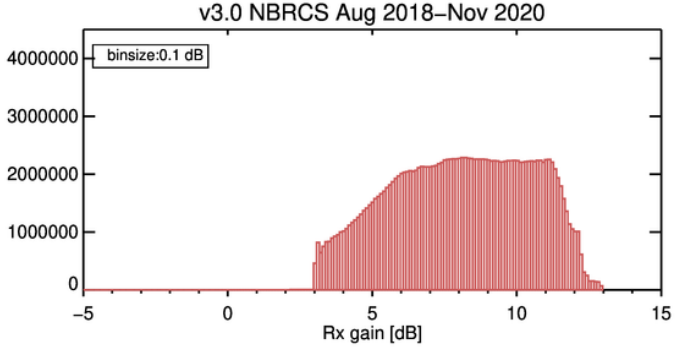
v2.1


fm01 v2.1 NBRCS
fm02 v2.1 NBRCS
fm03 v2.1 NBRCS
fm04 v2.1 NBRCS
fm05 v2.1 NBRCS
fm06 v2.1 NBRCS
fm07 v2.1 NBRCS
fm08 v2.1 NBRCS
Az. angle [deg]
Inc. angle [deg]
[dB]

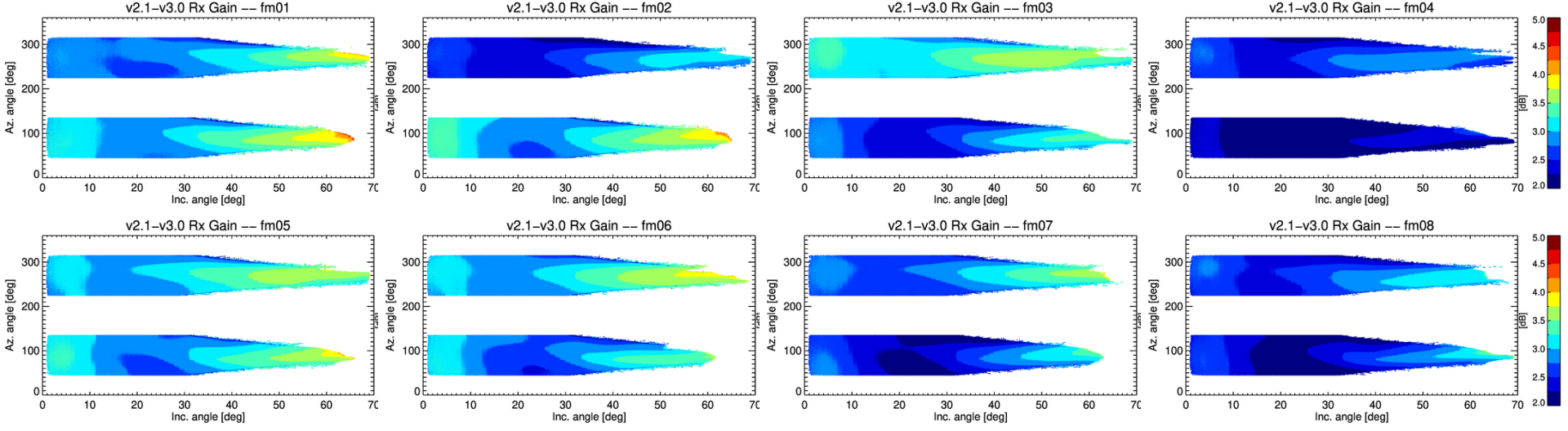

v2.1 NBRCS Aug 2018–Nov 2020
binsize:0.1 dB
Rx gain [dB]

v3.0


fm01 v3.0 NBRCS
fm02 v3.0 NBRCS
fm03 v3.0 NBRCS
fm04 v3.0 NBRCS
fm05 v3.0 NBRCS
fm06 v3.0 NBRCS
fm07 v3.0 NBRCS
fm08 v3.0 NBRCS
Az. angle [deg]
Inc. angle [deg]
[dB]


v3.0 NBRCS Aug 2018–Nov 2020
binsize:0.1 dB
Rx gain [dB]

v2.1-v3.0


v2.1–v3.0 Rx Gain –– fm01
v2.1–v3.0 Rx Gain –– fm02
v2.1–v3.0 Rx Gain –– fm03
v2.1–v3.0 Rx Gain –– fm04
v2.1–v3.0 Rx Gain –– fm05
v2.1–v3.0 Rx Gain –– fm06
v2.1–v3.0 Rx Gain –– fm07
v2.1–v3.0 Rx Gain –– fm08
Az. angle [deg]
Inc. angle [deg]
[dB]

Summary

- v3.0 NBRCS shows
  - increased stability over time
  - almost non-existent intersattelite NBRCS biases
  - increased GPS block type NBRCS biases prior to Feb 2020
  - ~|0.5| dB deviation in daily averaged NBRCS bias whenever roll angle is set greater than +/- 5deg
  - ~22% less data than v2.1 (given the same time period)
  - drastic change in the Rx gain patterns for all eight spacecraft (*should this be implemented in a v2.2 NBRCS for consistency*)?

- NOAA wind using v3.0 NBRCS shows
  - smaller overall wind speed biases so far
  - no noticeable trend
  - slightly higher std. of the wind speed error compared to v2.1
  - slightly better performance within the higher wind regime
- will contemplate the inclusion of data with high roll angle dependent on a Rx gain/roll angle relationship