Global Cross Calibration and Validation of the Jason-1 and Jason-2/OSTM Data Products

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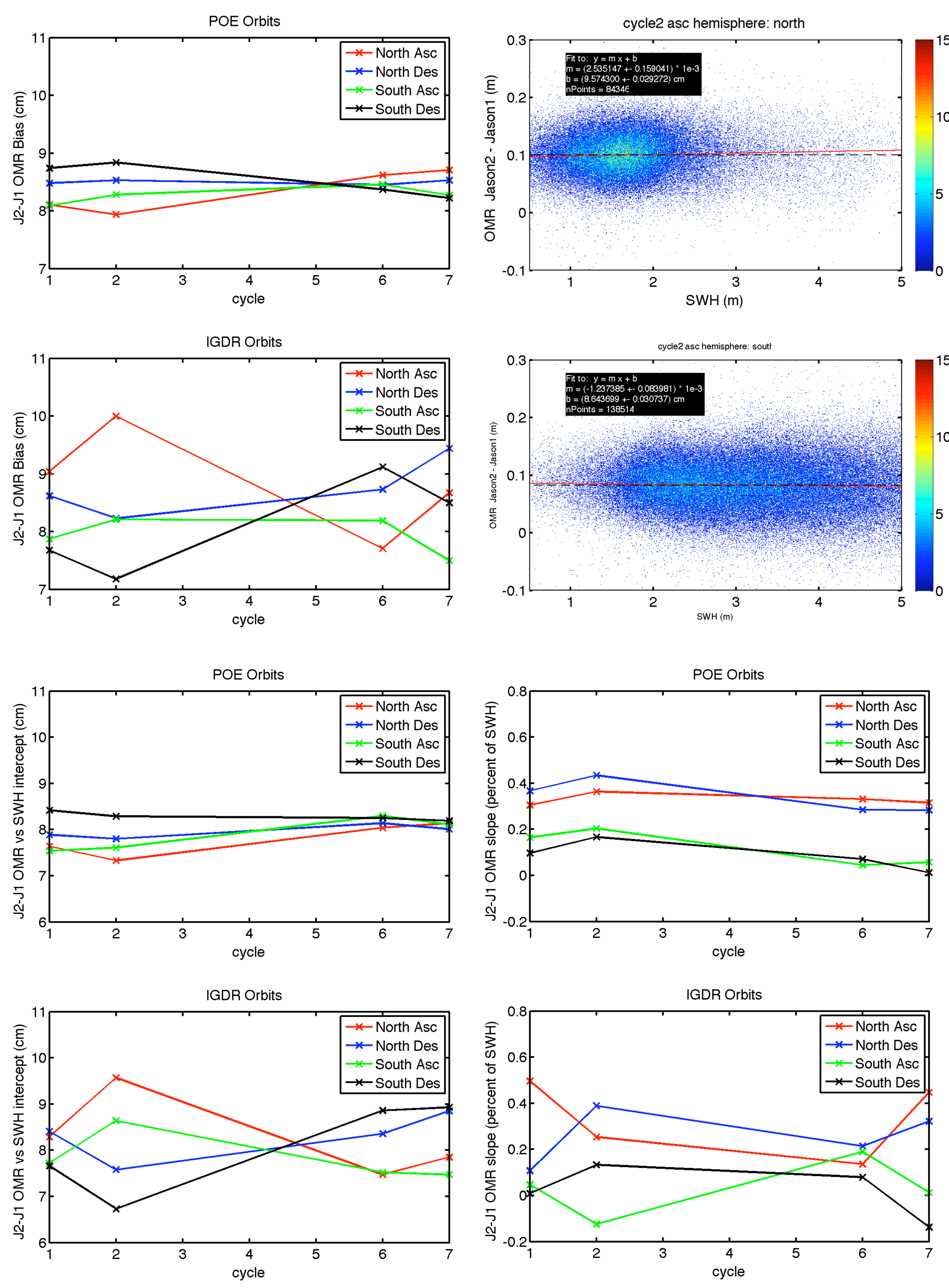
Abstract

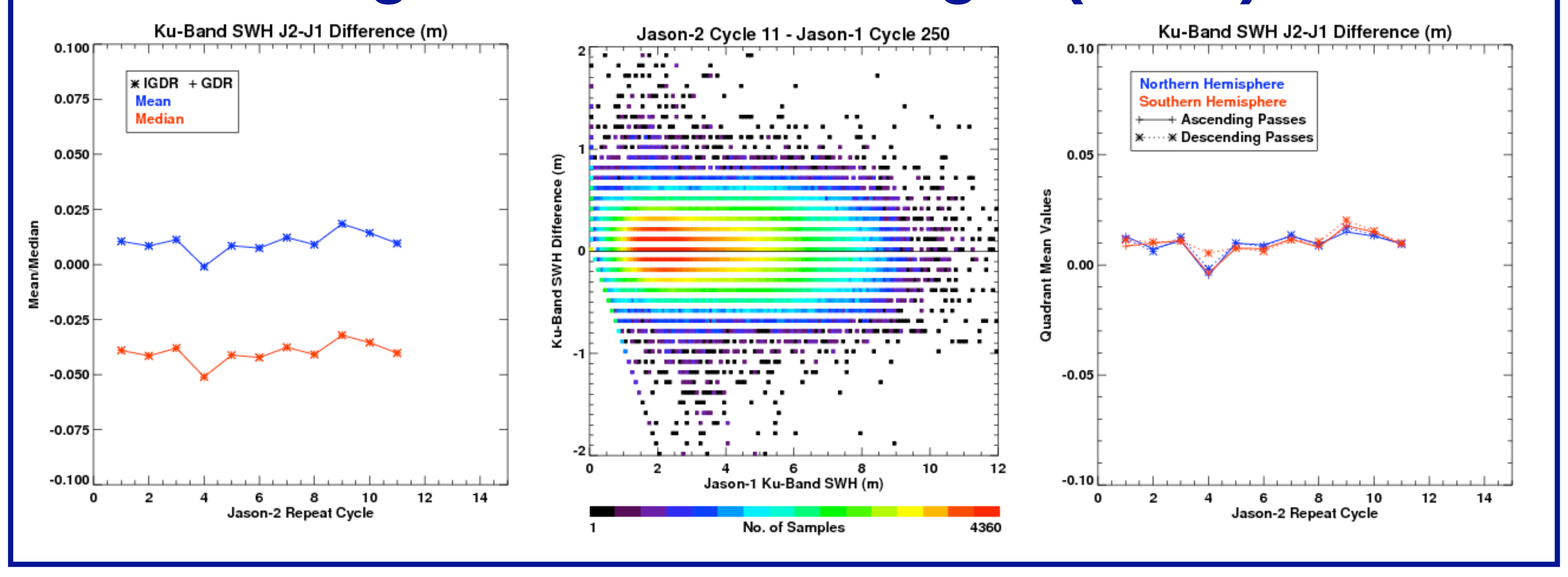
We present results from a statistical analysis of the differences between the Jason-1 (J1) and Jason-2/OSTM (J2) sea surface height and component environmental measurements during their formation-flying phase. Our analysis leverages off the fact that identical oceanographic and environmental conditions are effectively being observed by the two missions during this phase, since they are flying approximately 54 seconds apart on the same ground track. Our goal is to characterize both geographically correlated and systematic differences between the measurements from the two missions. For example, a statistical analysis of inter-mission differences segregated by quadrant, namely ascending and descending ground tracks in the northern and southern hemisphere, is used as one metric for geographically correlated errors. Meanwhile, systematic differences in the altimeter measurements are characterized as a function of significant wave height (SWH) and wind speed. For example, any relative sea-state bias difference is quantified from differences of uncorrected sea surface height, namely orbit-range-mean sea surface, as a function of SWH.

Range (Orbit-Range-Mean Sea Surface)

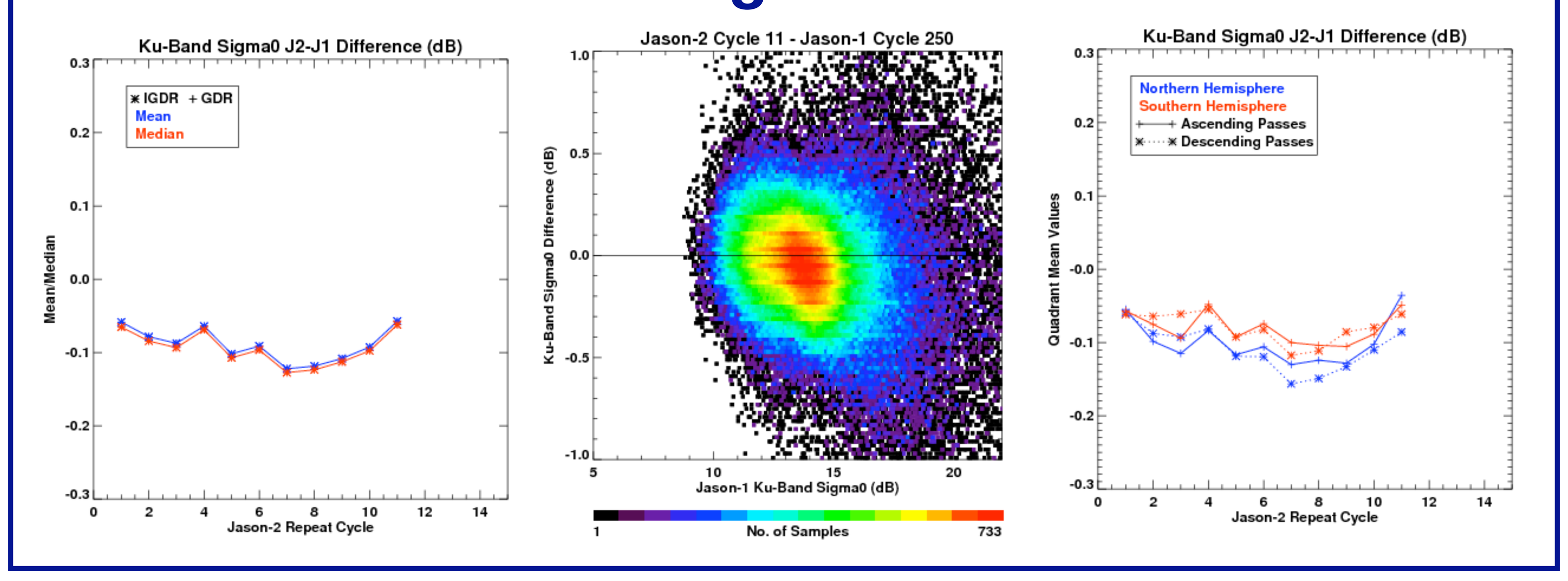
- Differences of Orbit-Range-Mean Sea Surface (OMR) determined from:
  - Orbits from available IGDRs.
  - SLR/DORIS POEs from GSFC.
- Consider temporal and spatial variations using:
  - Cycle averages
  - Separation by quadrant:
    1) North/South Hemisphere
    2) Ascending/Descending
- POEs provide significant reduction in temporal and spatial scatter.
  - Temporally
  - Spatially (North/South hemisphere).
- Also consider OMR differences as function of:
  - Sigma0
  - SWH
- No apparent dependence on Sigma0.
- Small apparent dependence on SWH that becomes increasingly repeatable from cycle to cycle when using POEs.
  - 0.25% of SWH discrepancy between northern hemisphere and southern hemisphere.
  - Bias changes from 84.1 to 81.5 mm when SWH dependence considered.
  - Cannot rule out residual orbit error at this level (4 mm at typical SWHs of 2 meters).



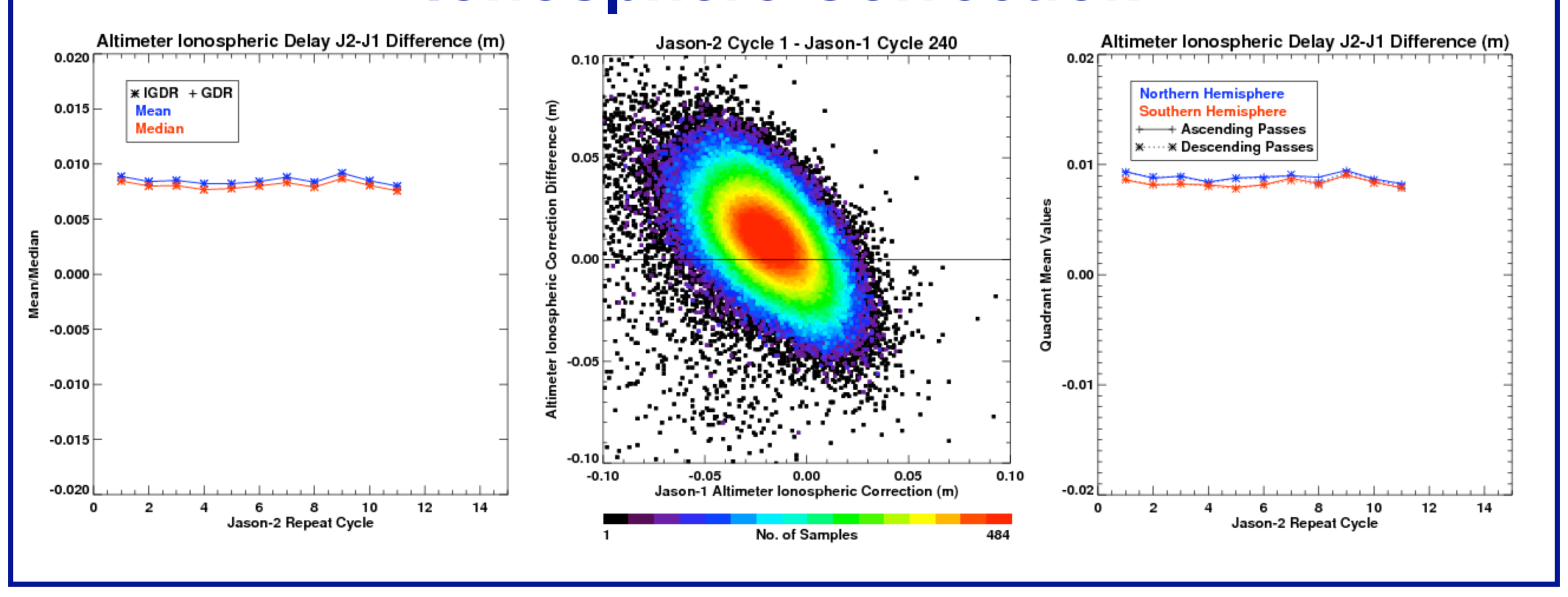
Significant Waveheight (SWH)



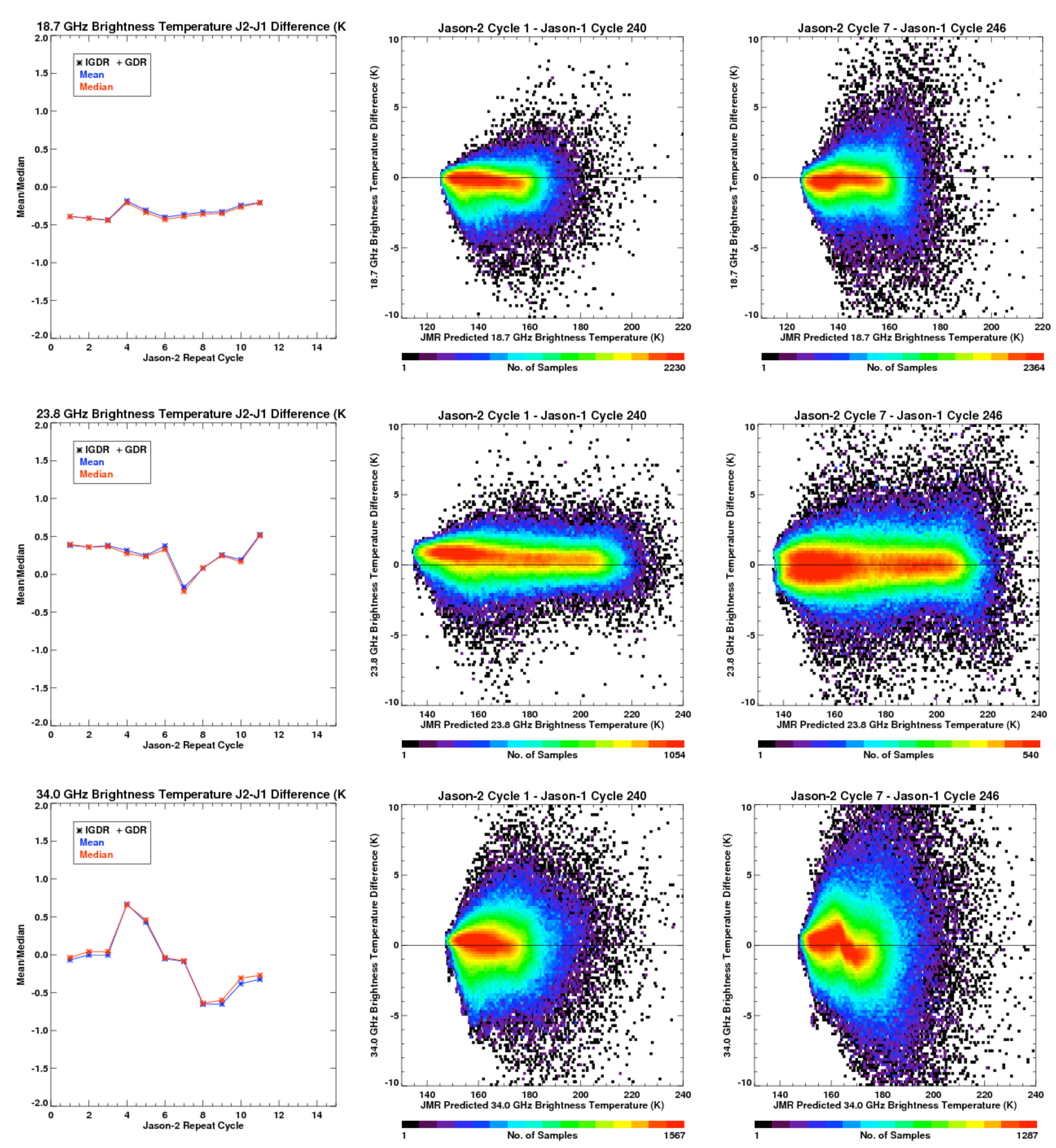
Sigma0



Ionosphere Correction

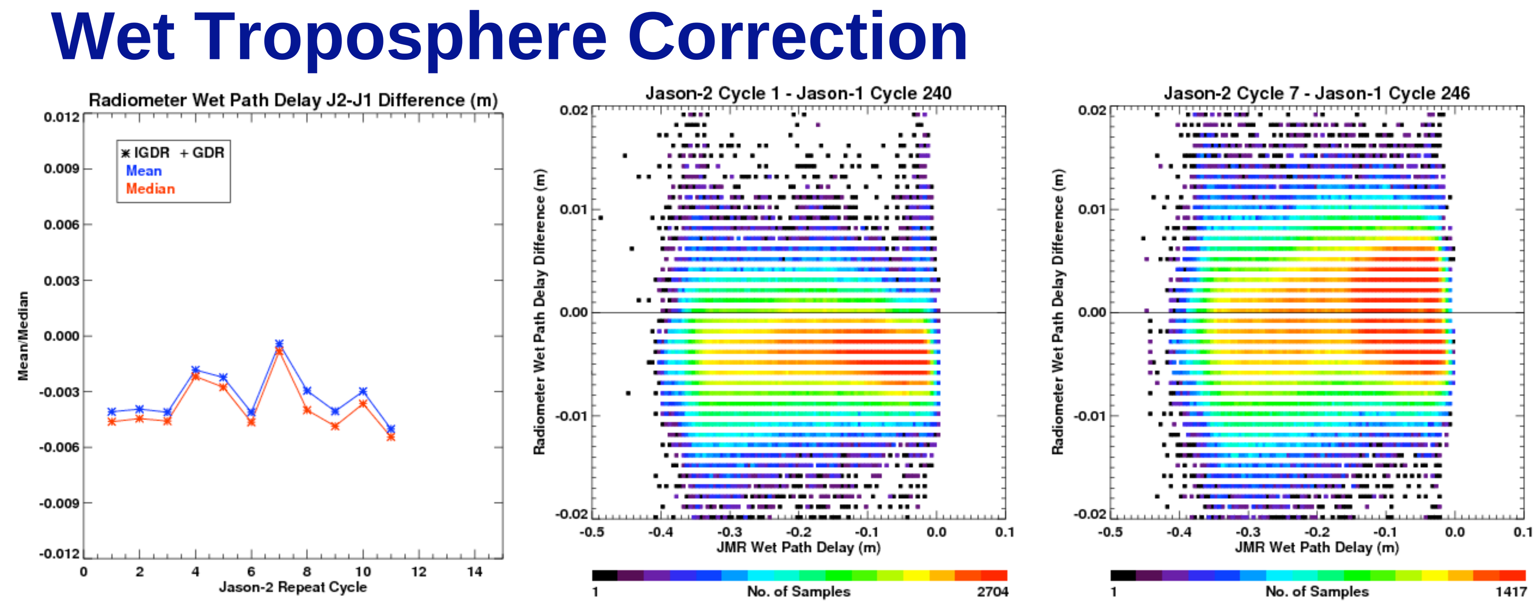


Radiometer Brightness Temperatures



Wet Troposphere Correction

- Instability in JMR measurements occurred after cycle 242/243 safehold event.
  - Especially 34GHz.
- Larger scatter in radiometer measurements of brightness temperature and wet path delay.



Summary of Jason-2/OSTM - Jason-1 Statistics (Cycles 1-11)

	Mean	Standard Deviation	Scale Difference	Hemispherical Difference
Orbit - Range - MSS (mm)	84.1 +/-2.2	41.1	None	~0.25% of SWH
SWH (cm)	1.0 +/- 0.5	19.2	None	None
Sigma0 (dB)	-0.09 +/- 0.02	0.16	None	None
Ionosphere Correction (mm)	8.5 +/- 0.3	14.7	??	None
Wet Troposphere Correction (mm)	-3.2 +/- 1.3	3.2	None	None
18.7 GHz TB (K)	-0.3 +/- 0.1	0.5	None	None
23.8 GHz TB (K)	0.3 +/- 0.2	0.8	None	None
34.0 GHz TB (K)	-0.1 +/- 0.4	1.1	None	None