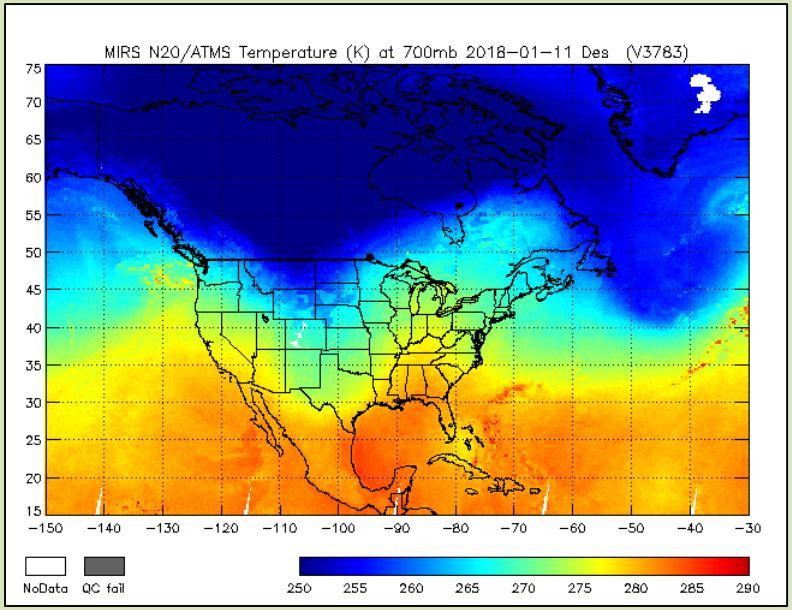
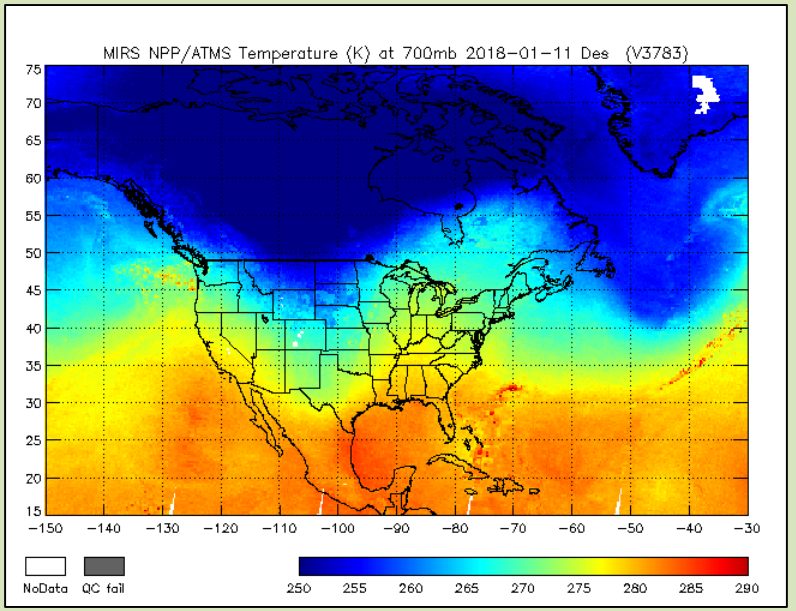
Microwave Integrated Retrieval System (MiRS): Initial Results from NOAA-20/ATMS





- Cold Air Outbreak: 11-21 January 2018
- Both N20 (left) and SNPP (right) capture event

Chris Grassotti (NOAA/STAR and U. Md. ESSIC/CICS)
Quanhua (Mark) Liu (NOAA/STAR)
Shuyan Liu (NOAA/STAR and CSU/CIRA)
also
Pan Liang (AER)

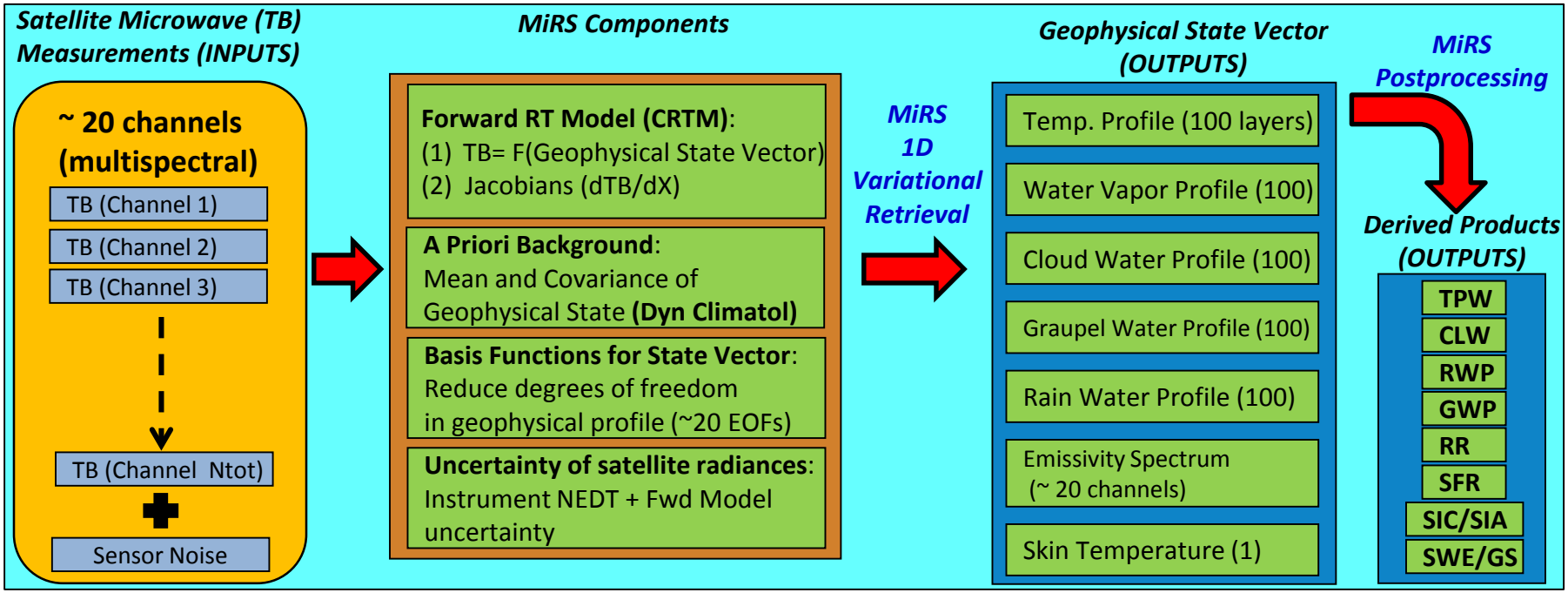
Virtual Review Comments/Actions

- Generally positive
- Updates/corrections to Readme: **Complete**
- Minor corrections to slides: **Complete**
  - Include origin of TDR data, and version of MiRS used for processing
  - N20 data not yet at CLASS
- Suggestion to accelerate to provisional maturity (final DAP).
  - Depends in part on status of additional validation efforts (e.g. rain rate), and updating radiometric bias corrections.

Outline

- Reviewer comments/actions
- Algorithm Overview
- Initial Results from NOAA-20/ATMS
  - Radiometric biases (Obs-Sim)
  - Retrieval diagnostics
  - Temperature
  - Water Vapor
  - TPW
  - **Cryosphere**
  - **Rain rate, RWP, GWP, CLW**
- Summary and Path Forward

Algorithm Overview

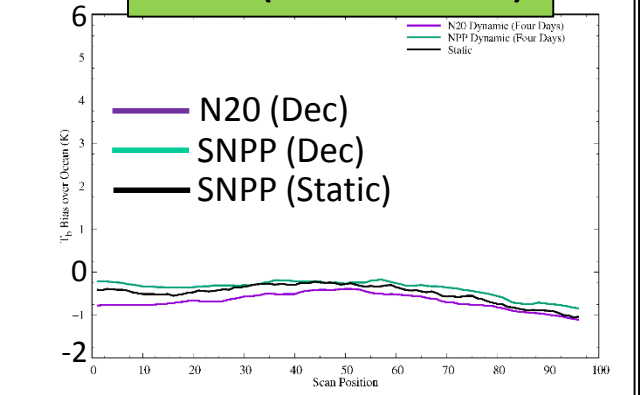


- MW Only, Variational Approach: Find the "most likely" atm/sfc state that: (1) best matches the satellite measurements, and (2) is still close to an a priori estimate of the atm/sfc conditions.
- **"Enterprise" Algorithm: Same core software runs on all satellites/sensors; facilitates science improvements and extension to new sensors.**
- Initial capability delivered in 2007. Running v11.2 since Jan 2017 on SNPP/ATMS, N18, N19, MetopA, MetopB, F17, F18, GPM/GMI, Megha-Tropiques/SAPHIR. (eventually MetopC…)
- Planned Delivery of NOAA-20/ATMS (v11.3) preliminary capability in Spring 2018.
- External Users/Applications: TC Analysis/Forecasting at NHC, **Blended Total/Layer PW** at NHC and WPC, MIMIC TPW Animations (U. Wisconsin), CSPP Direct Broadcast (U. Wisconsin), NFLUX model (NRL, Stennis), Global blended precipitation analysis at NOAA/CPC (CMPORPH),…
- **All results here are generated with MiRS v11.3 (offline processing in STAR), and TDR data generated in IDPS (Block 2 processing).**

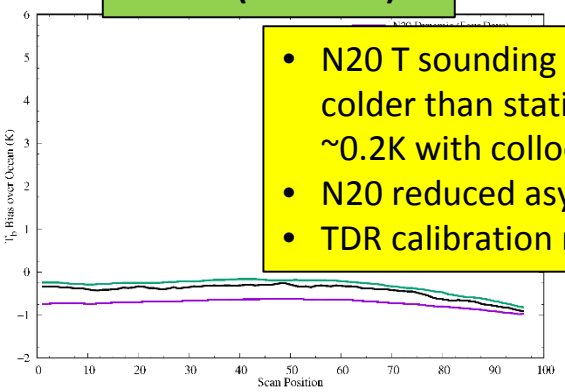
Radiometric Biases (Observed-Simulated)

- N20 and NPP Biases based on 4 days: Dec 10, 13, 16, 18
- Static Bias (oper) based on 4 days NPP 2015 Block 2 calibrated data
- ECMWF + CRTM, clear ocean

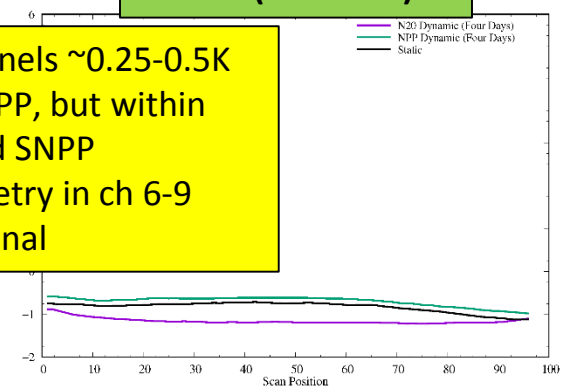
Chan 6 (53.6 ± 0.12 GHz)



Chan 7 (54.4 GHz)

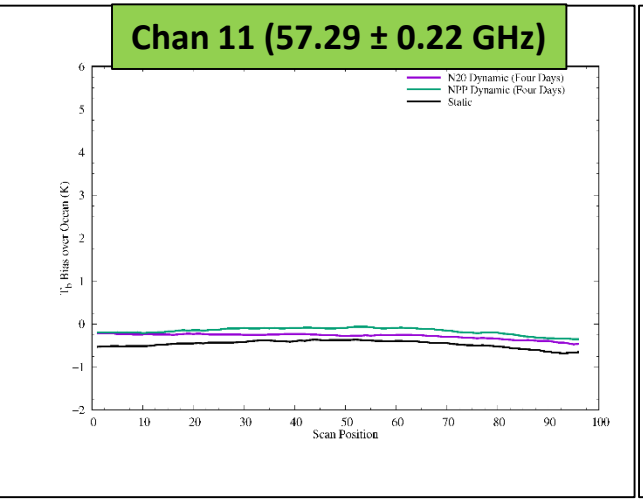


Chan 9 (55.5 GHz)

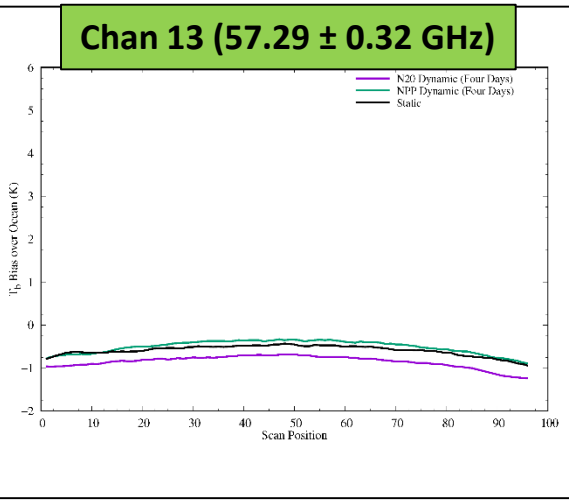


- N20 T sounding channels ~0.25-0.5K colder than static SNPP, but within ~0.2K with collocated SNPP
- N20 reduced asymmetry in ch 6-9
- TDR calibration not final

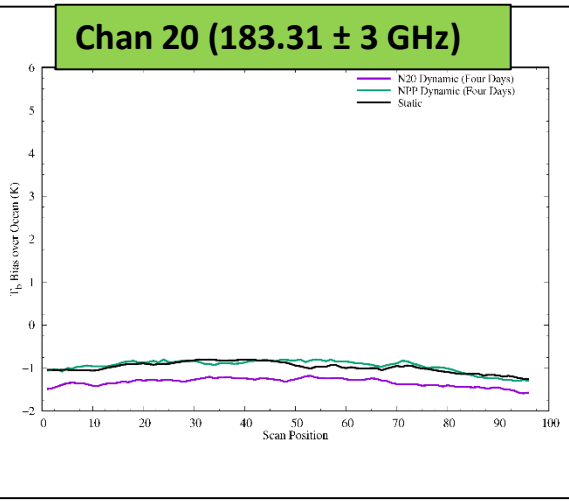
Chan 11 (57.29 ± 0.22 GHz)



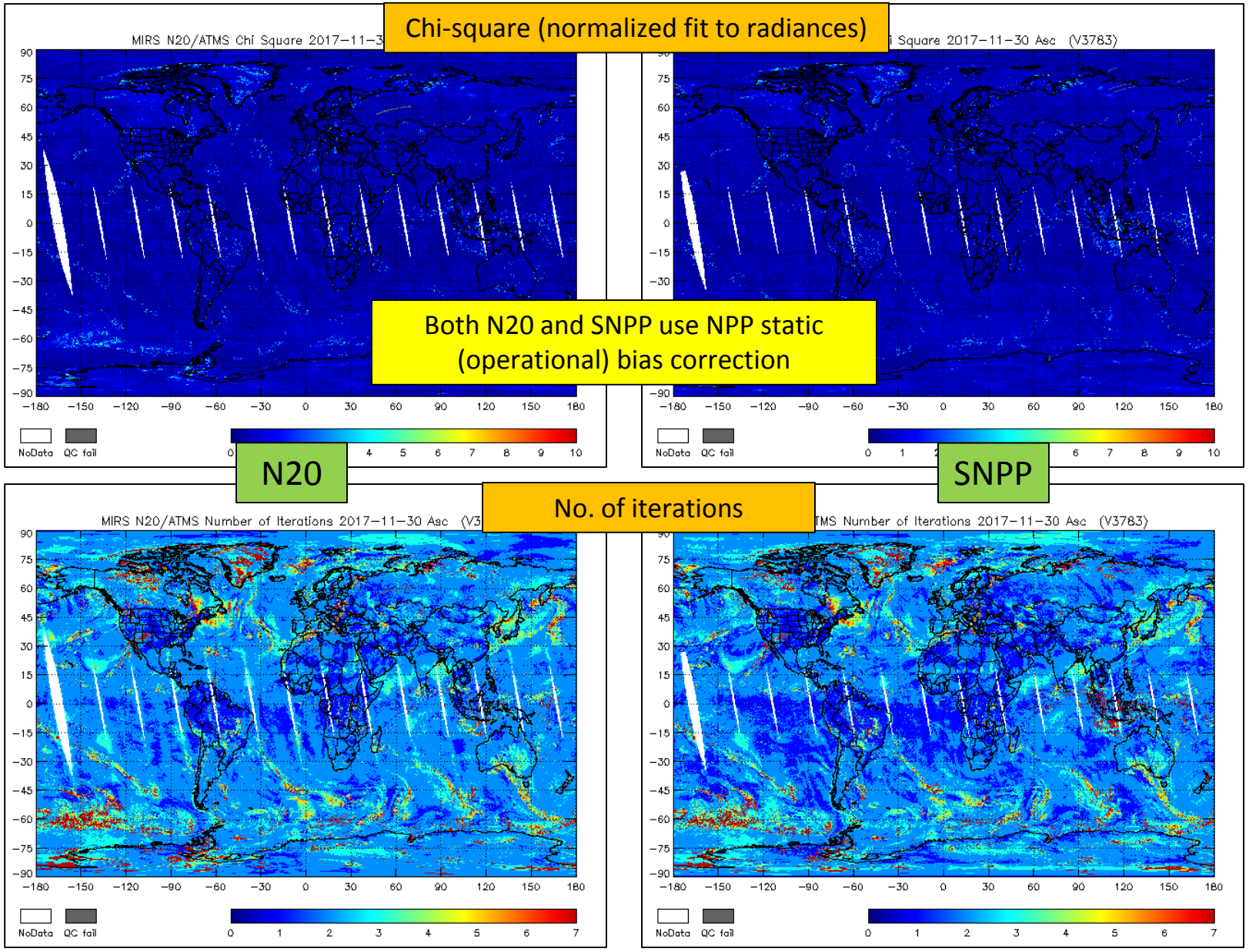
Chan 13 (57.29 ± 0.32 GHz)



Chan 20 (183.31 ± 3 GHz)

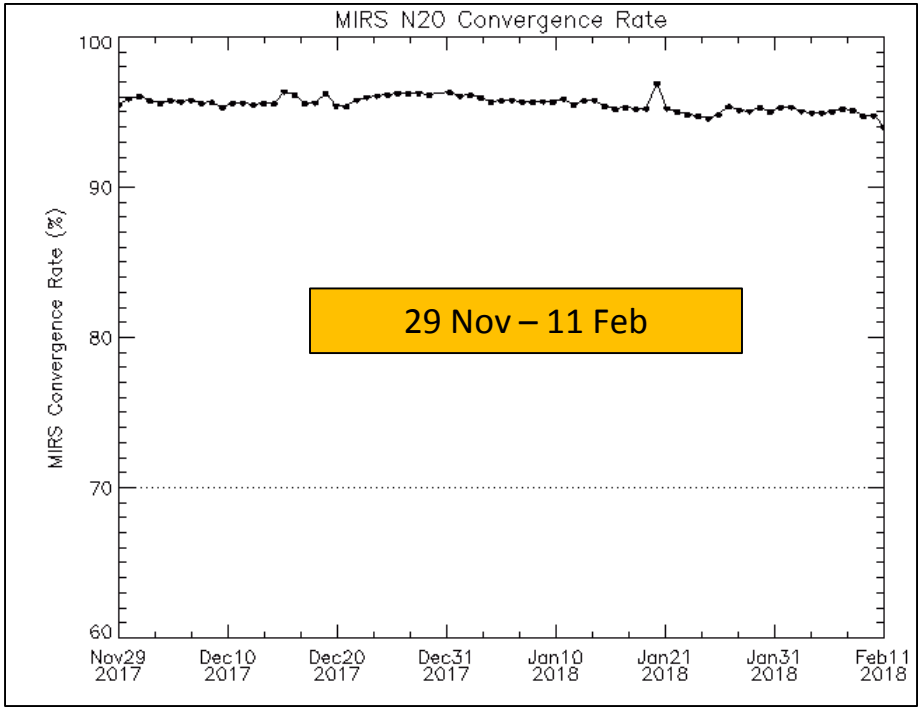


Retrieval Diagnostics (2017-11-30)

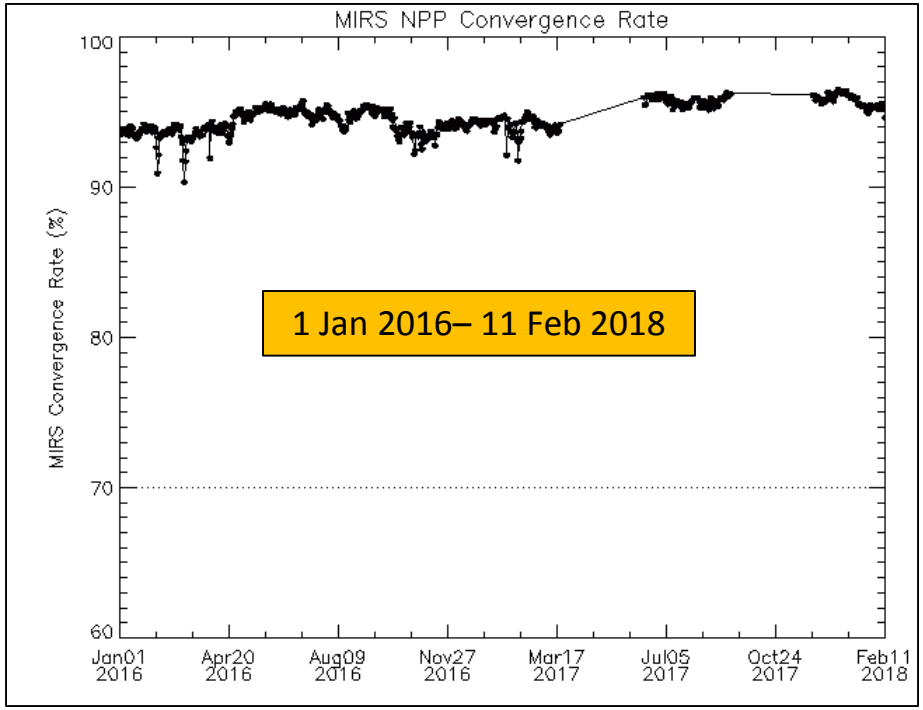


Retrieval Convergence Rate

N20

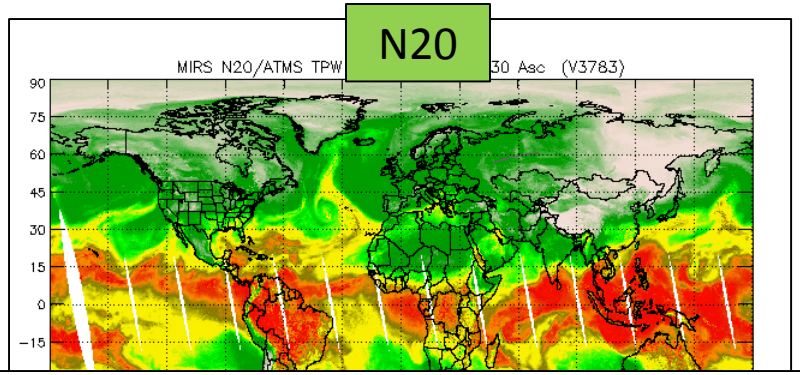


SNPP

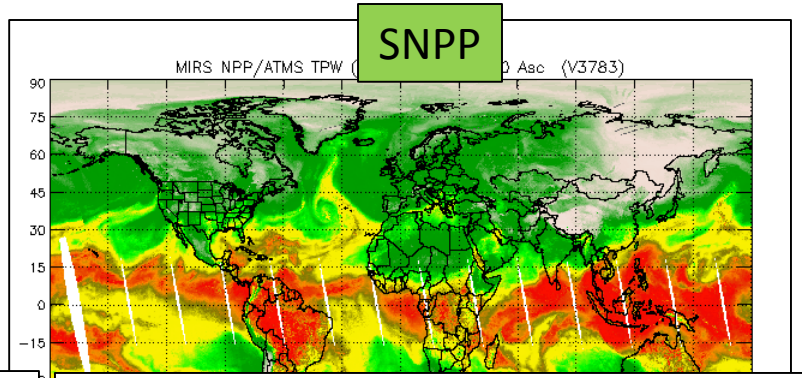


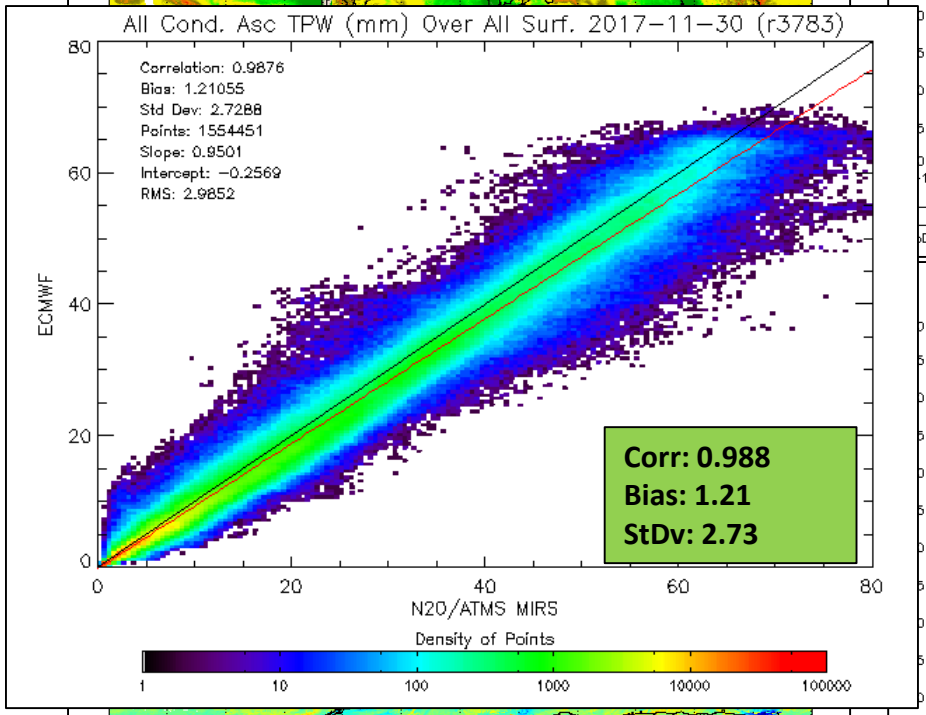
Total Precipitable Water (2017-11-30)

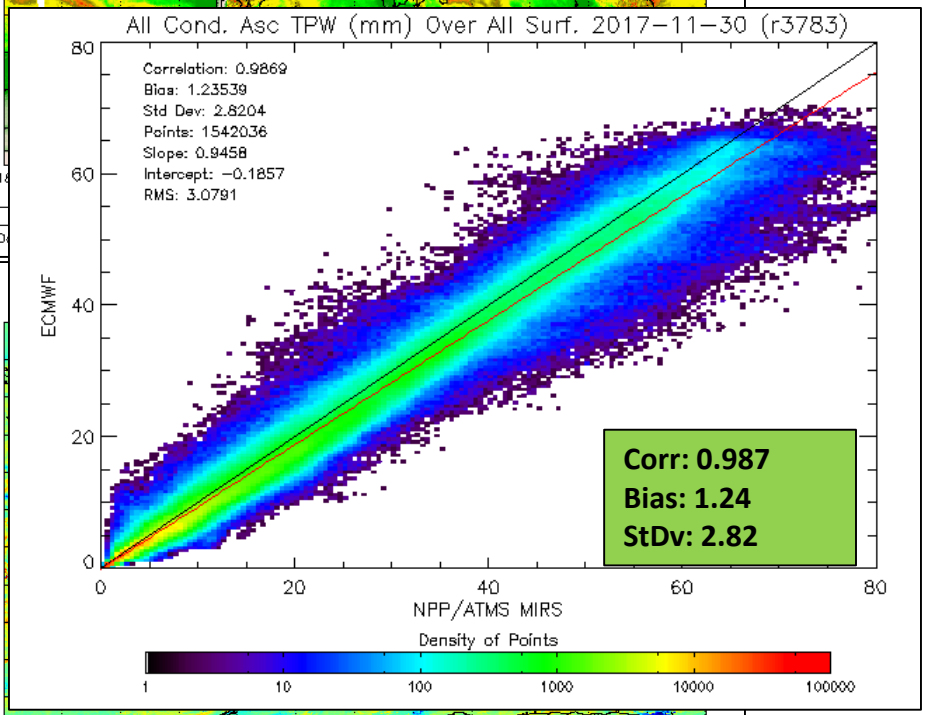
N20

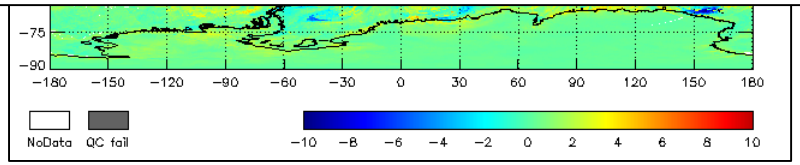


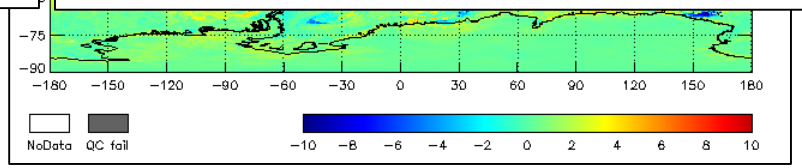
SNPP



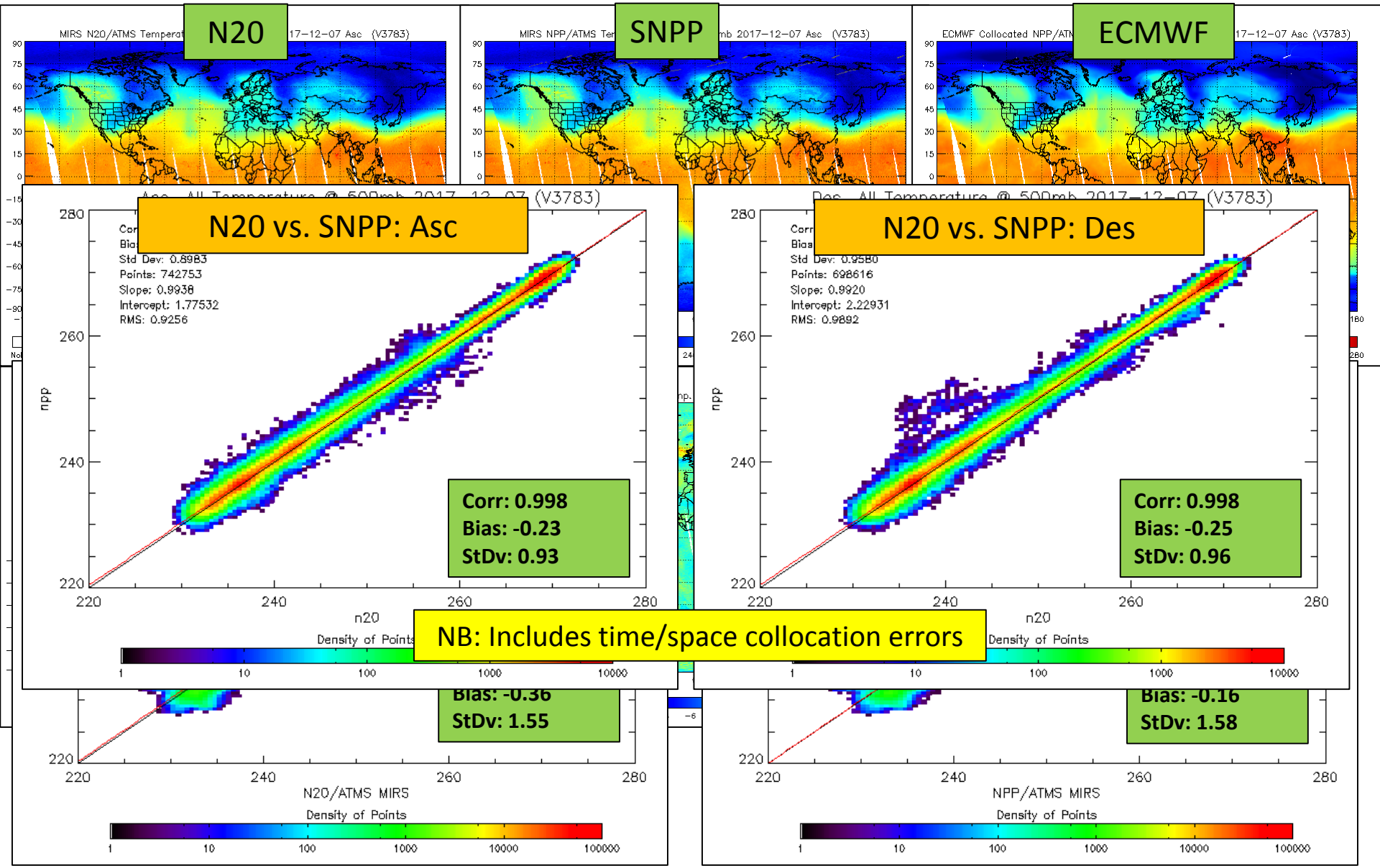








500 hPaTemperature (2017-12-07)



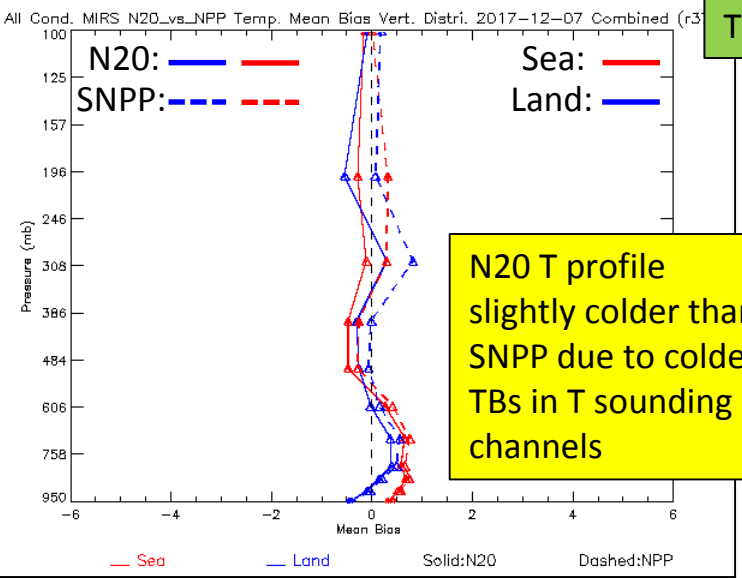
Temperature and Water Vapor Profile (2017-12-07)

Global collocation w/ECMWF

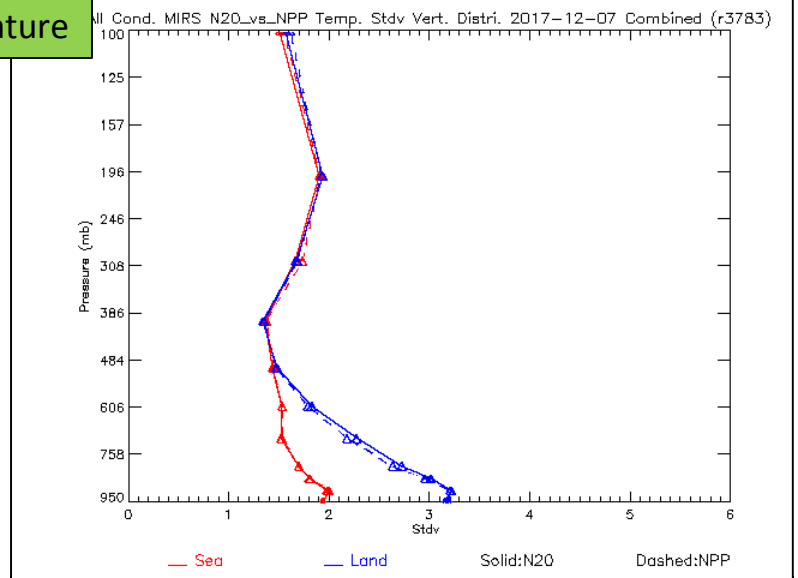
Bias

StDv

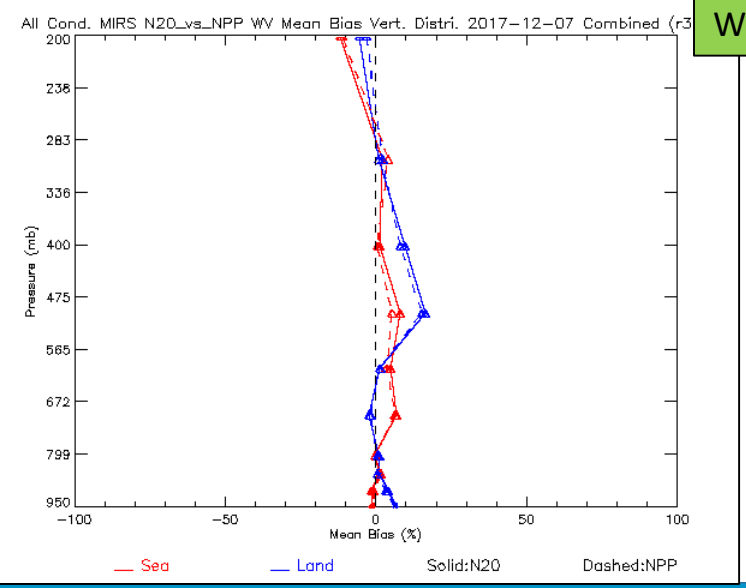
Temperature

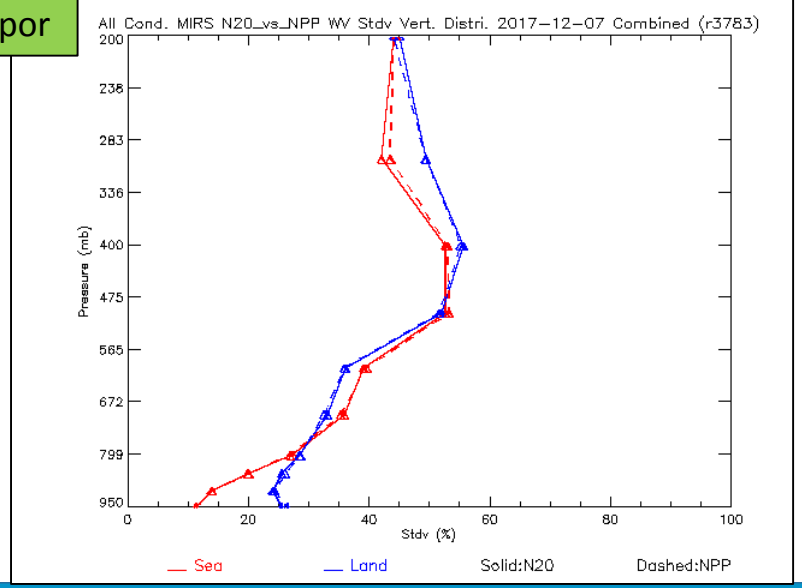


N20 T profile slightly colder than SNPP due to colder TBs in T sounding channels



Water Vapor





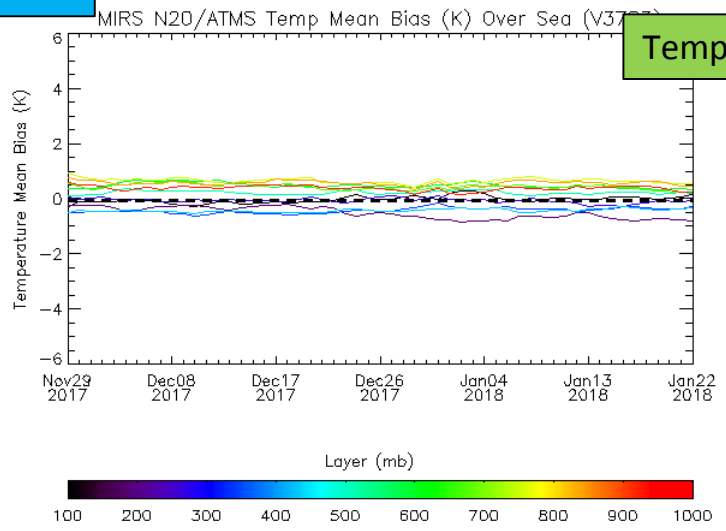
Temperature and Water Vapor Profile Performance Time Dependence (29 Nov – 22 Jan)

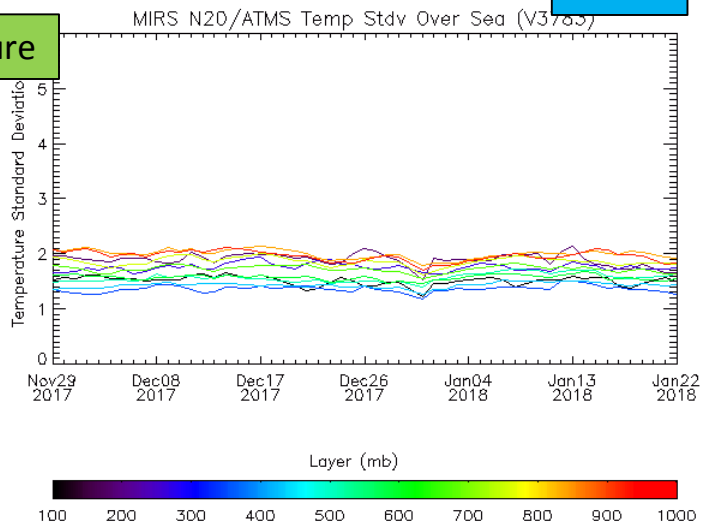
Global ocean collocation w/ECMWF

Bias

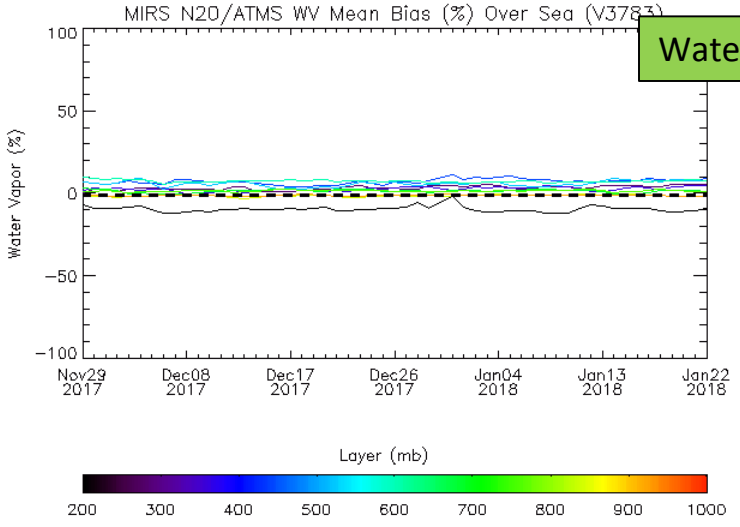
StDv

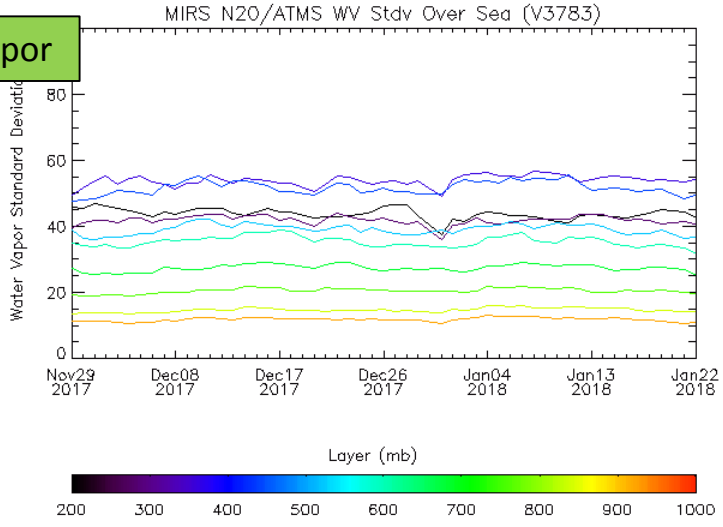
Temperature





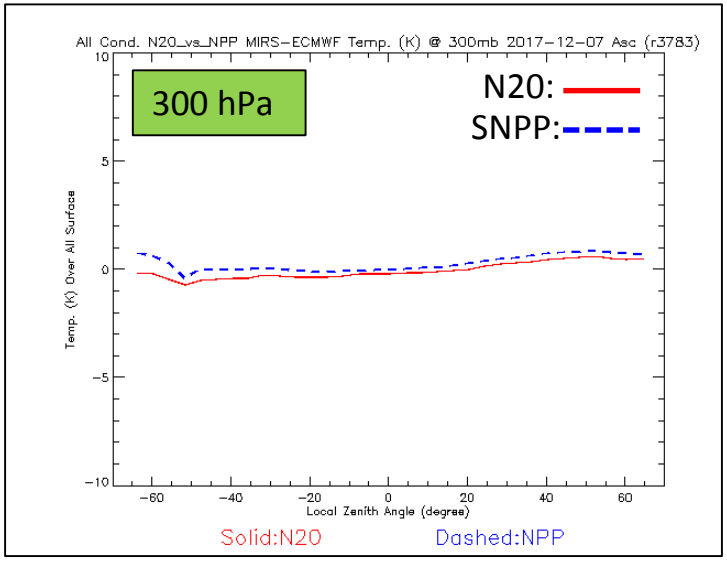
Water Vapor

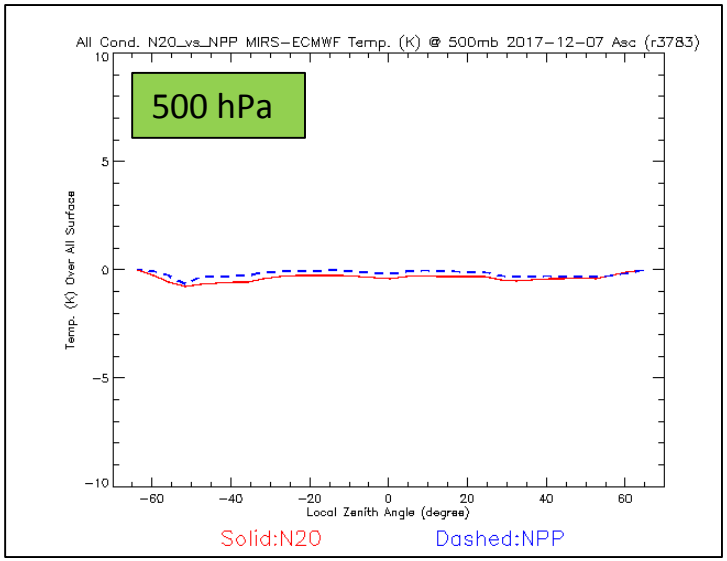


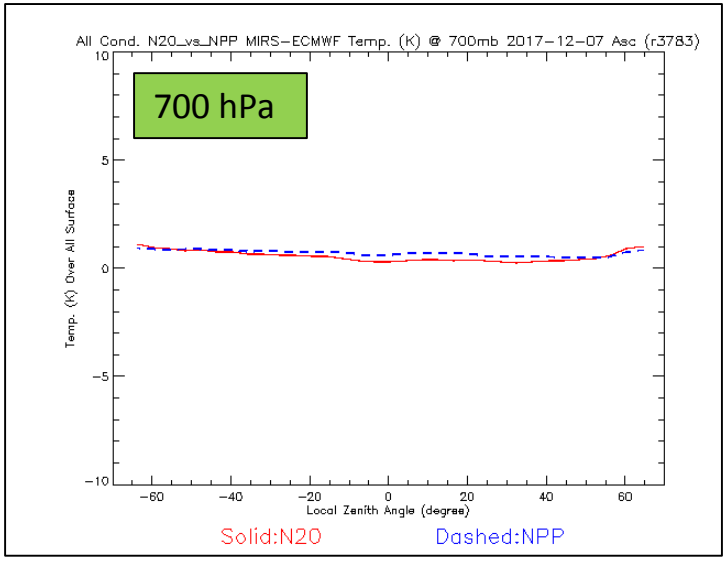


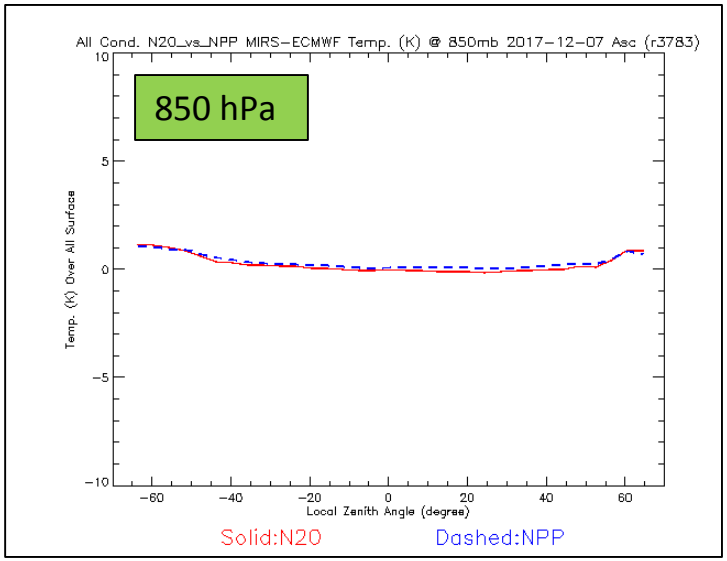
Temperature Scan Dependence (2017-12-07)

Global collocation w/ECMWF



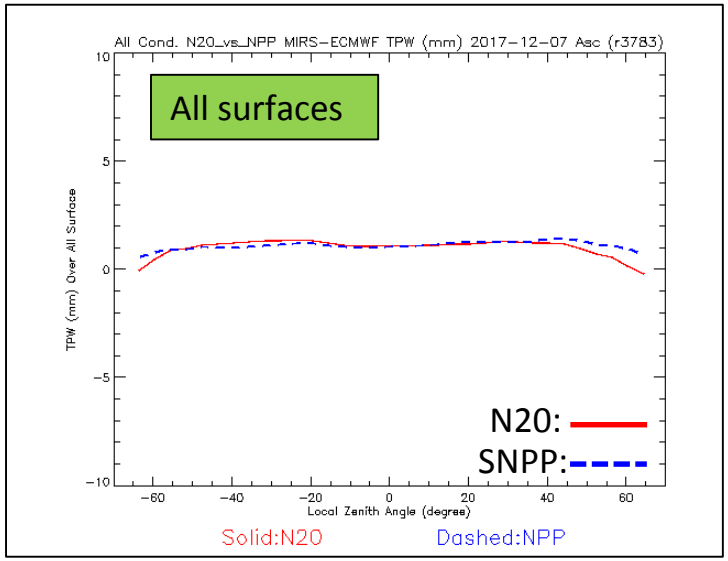


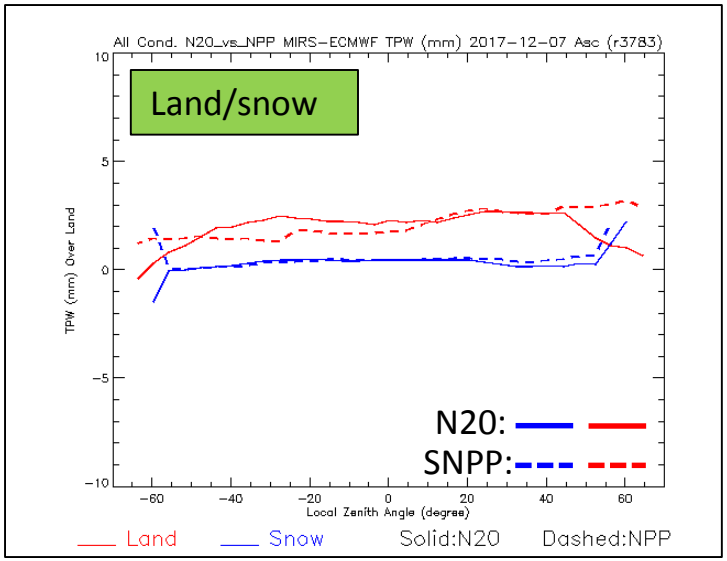


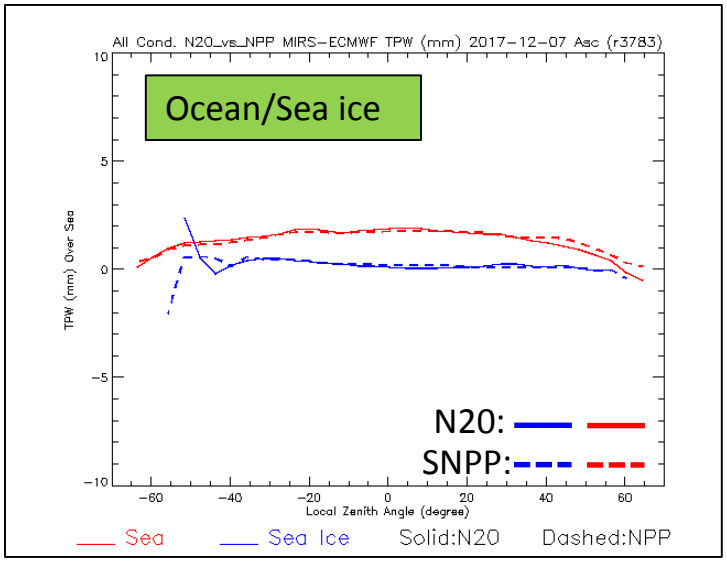


TPW Scan Dependence (2017-12-07)

Global collocation w/ECMWF







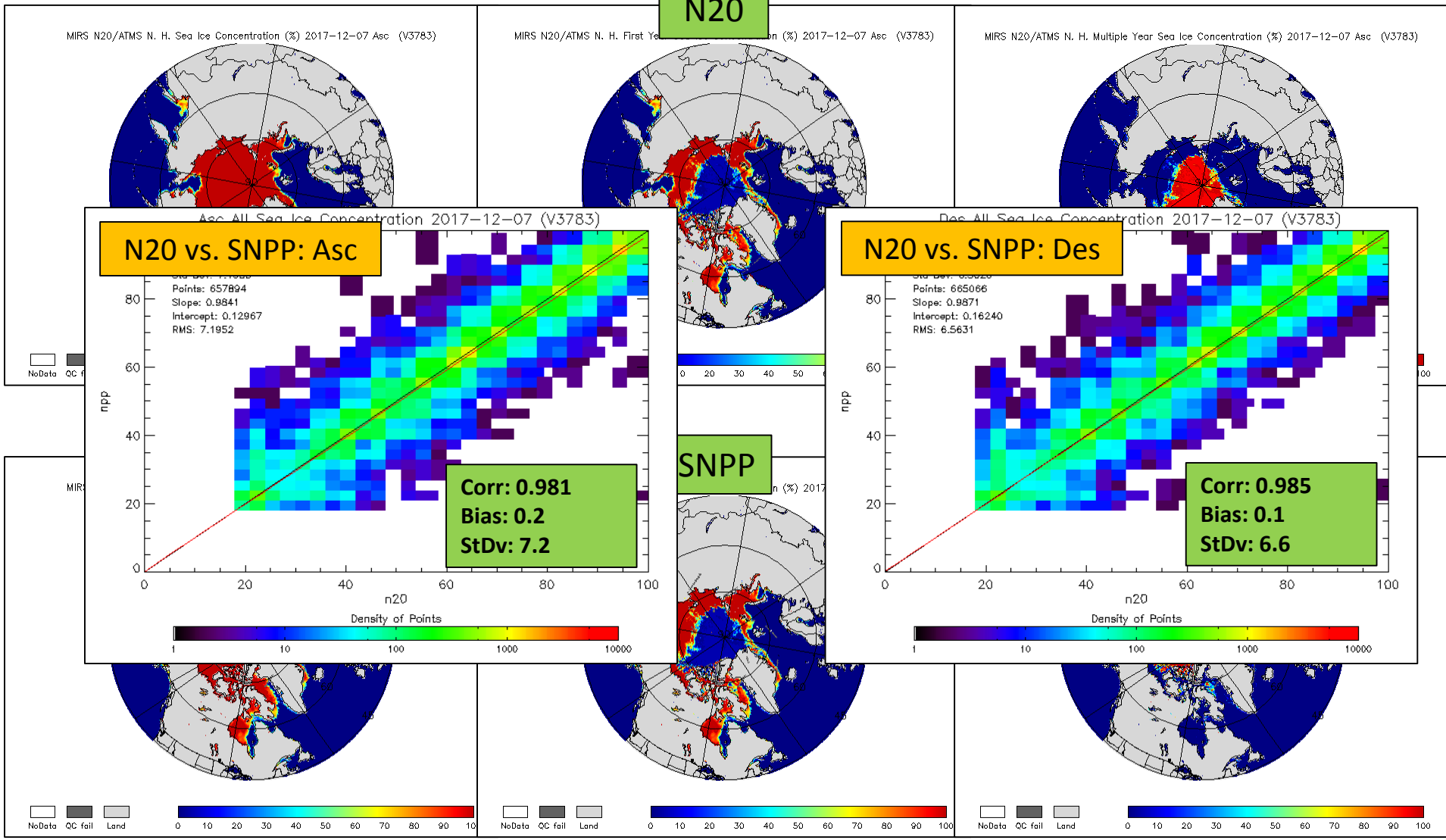
Sea Ice Concentration/Age (2017-12-07)

Total SIC

First-Year SIC

Multi-Year SIC

N20



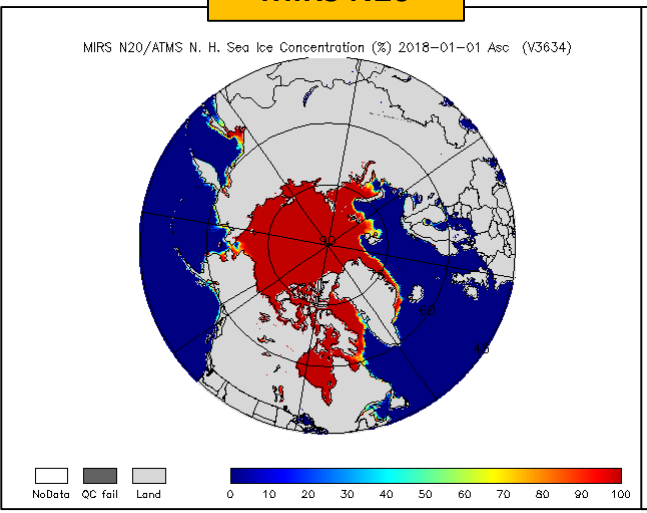
N20 vs. SNPP: Asc

N20 vs. SNPP: Des

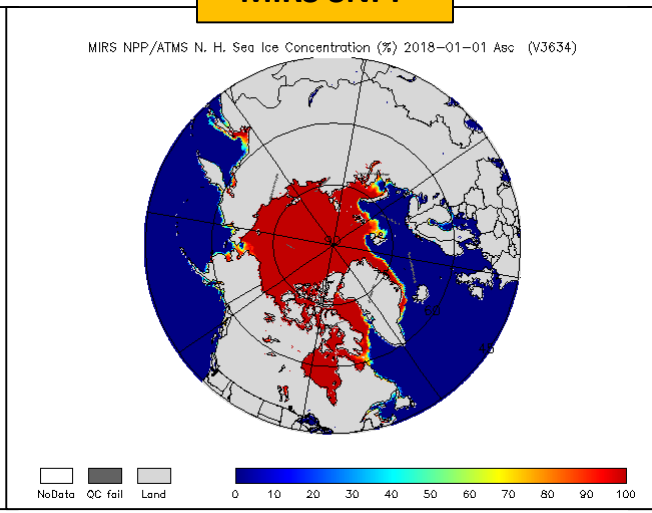
SNPP

Sea Ice Concentration: 2018-01-01

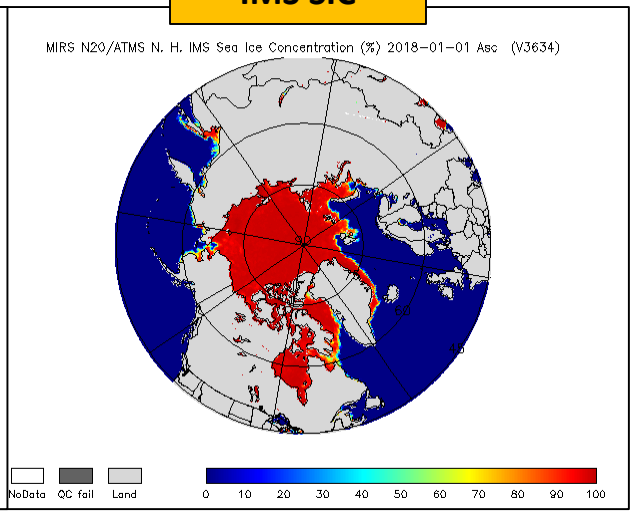
MiRS N20



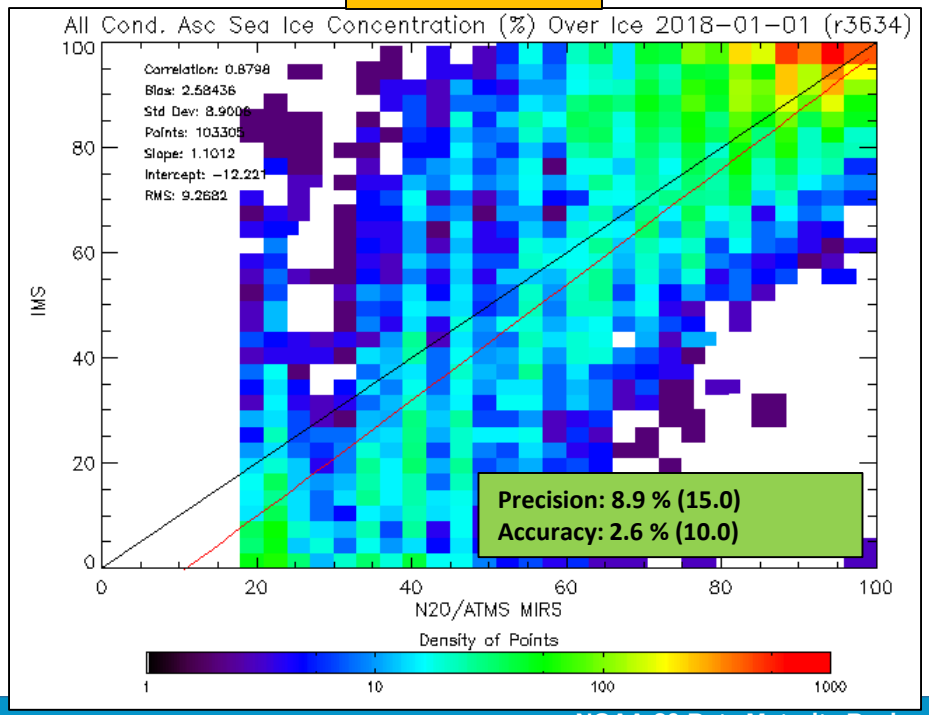
MiRS SNPP



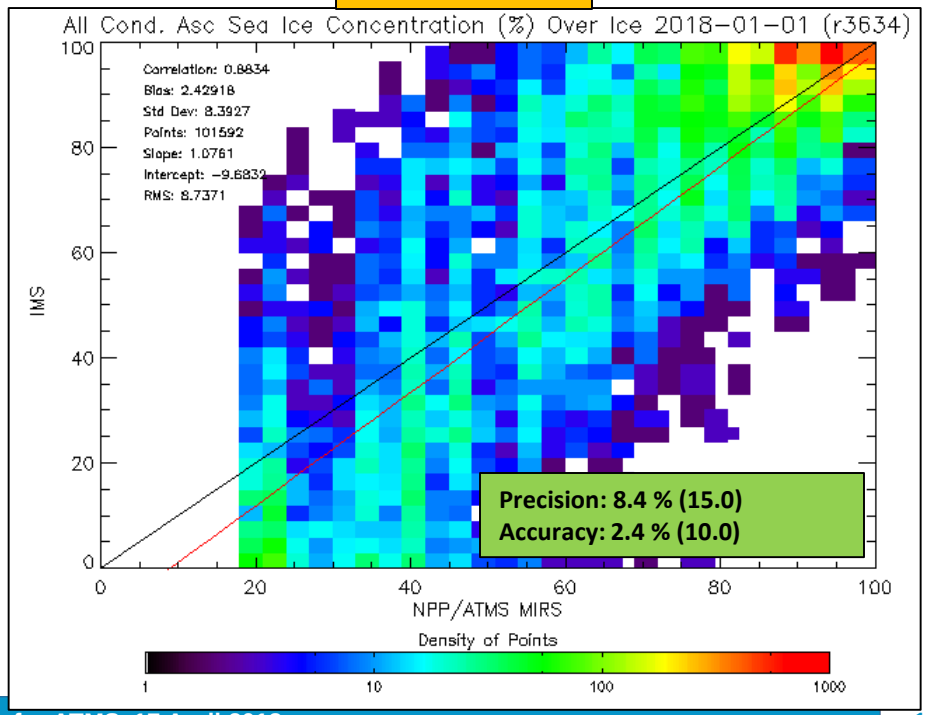
IMS SIC



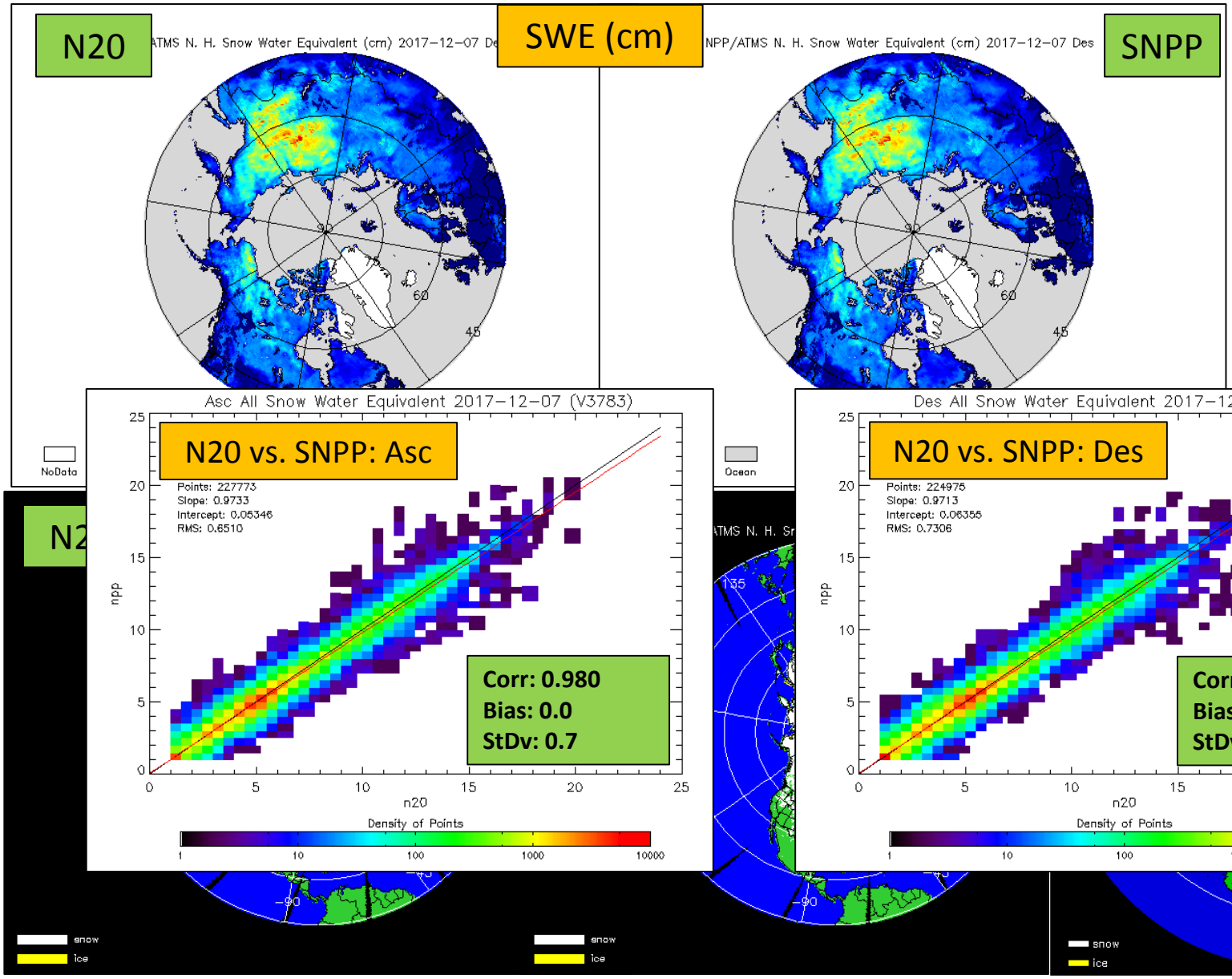
MiRS N20



MiRS SNPP

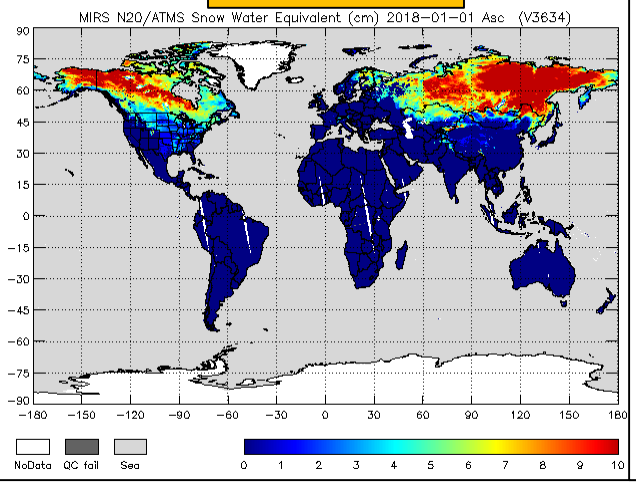


Snow Water Equiv/Cover (2017-12-07)

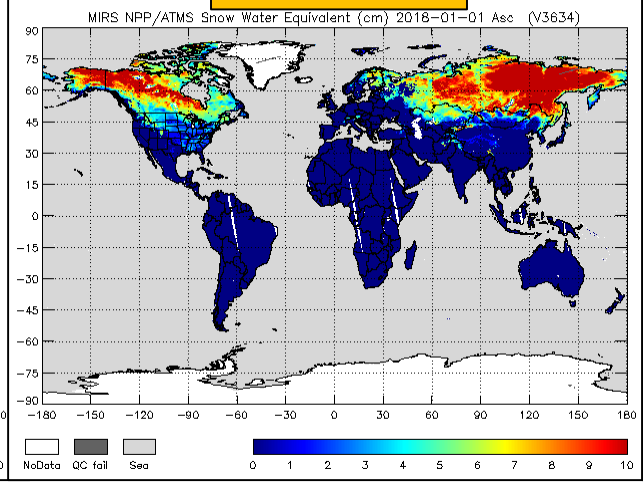


Snow Water Equivalent: 2018-01-01

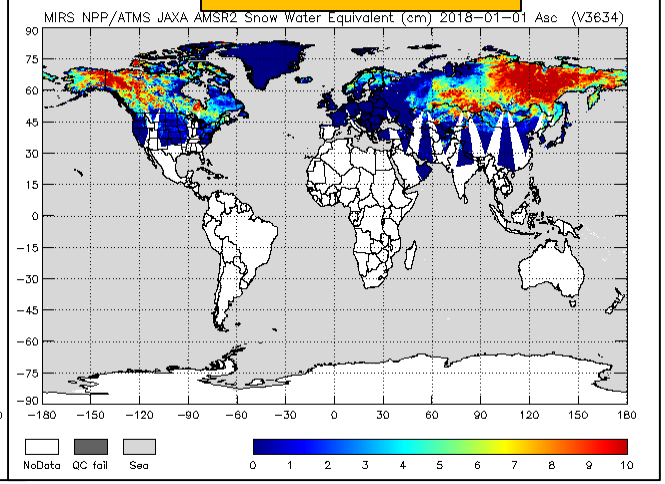
MiRS N20



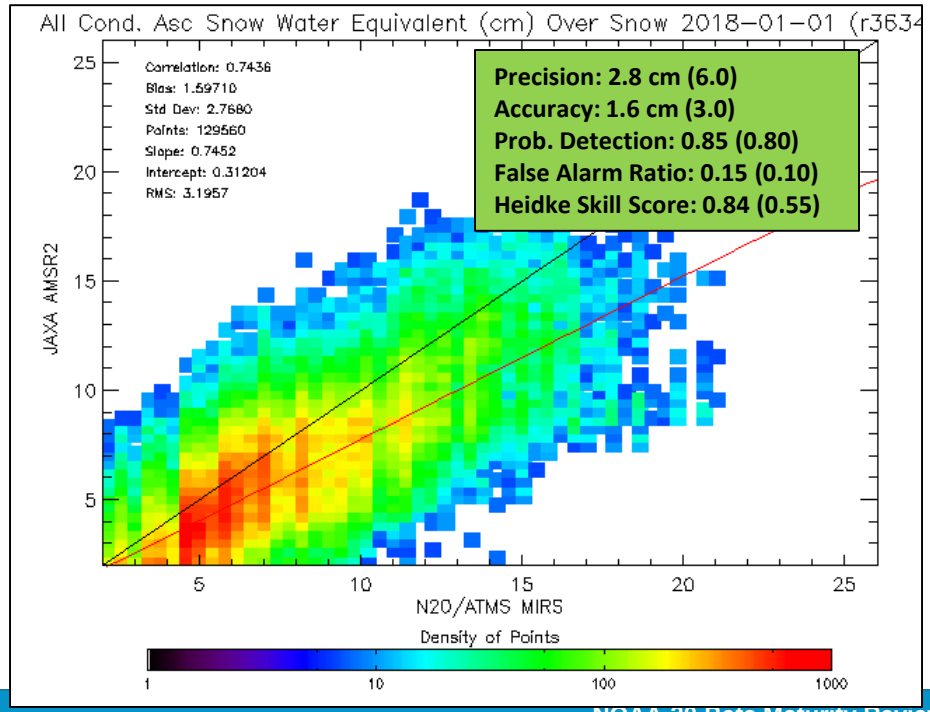
MiRS SNPP



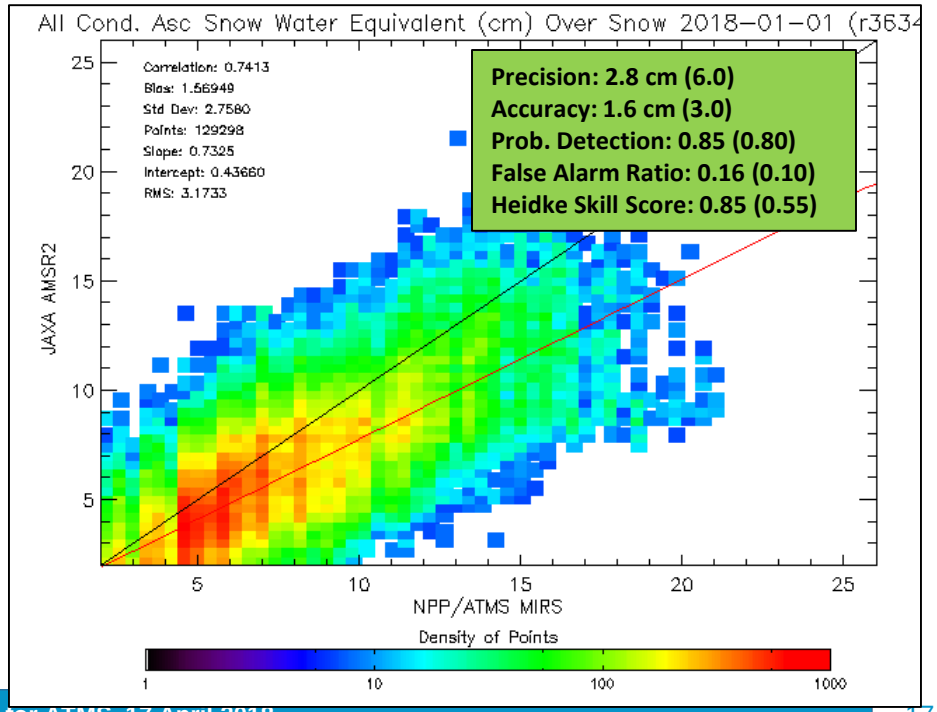
JAXA AMSR2 SWE



MiRS N20



MiRS SNPP

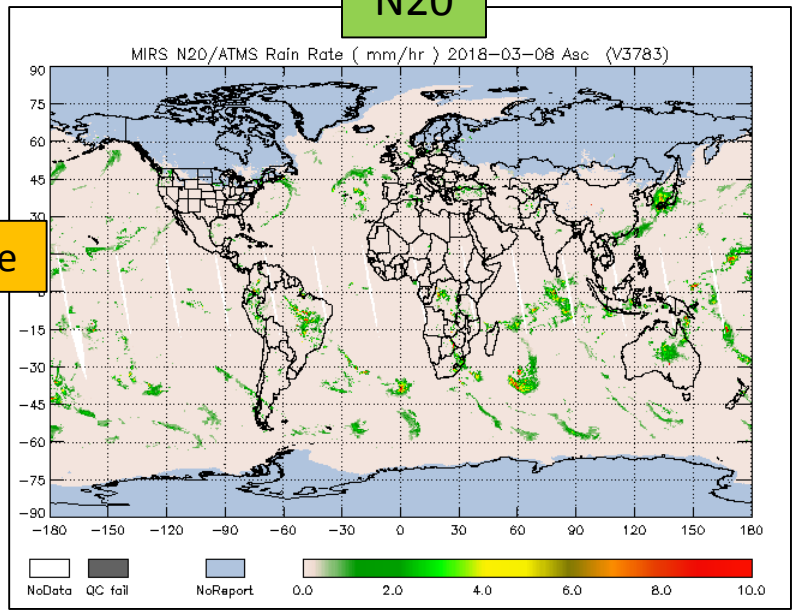


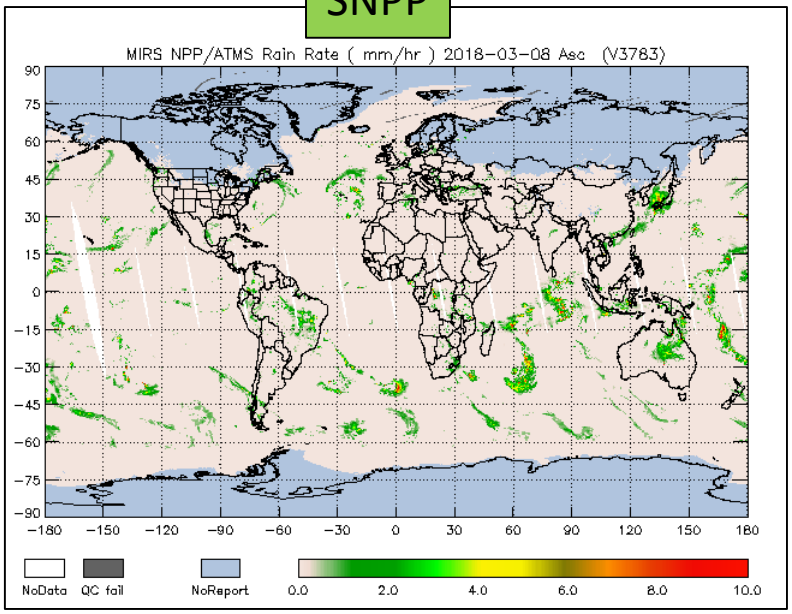
Rain Rate and Cloud Liquid Water (2018-03-08)

N20

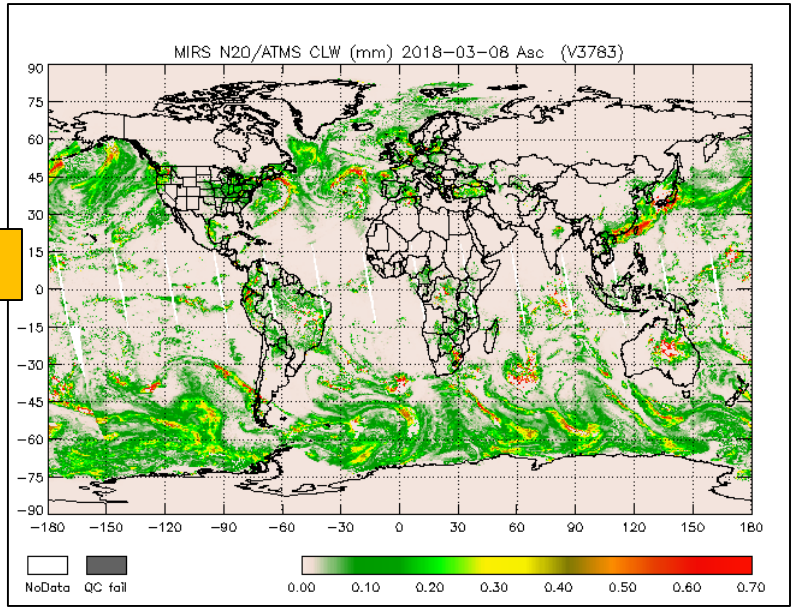
SNPP

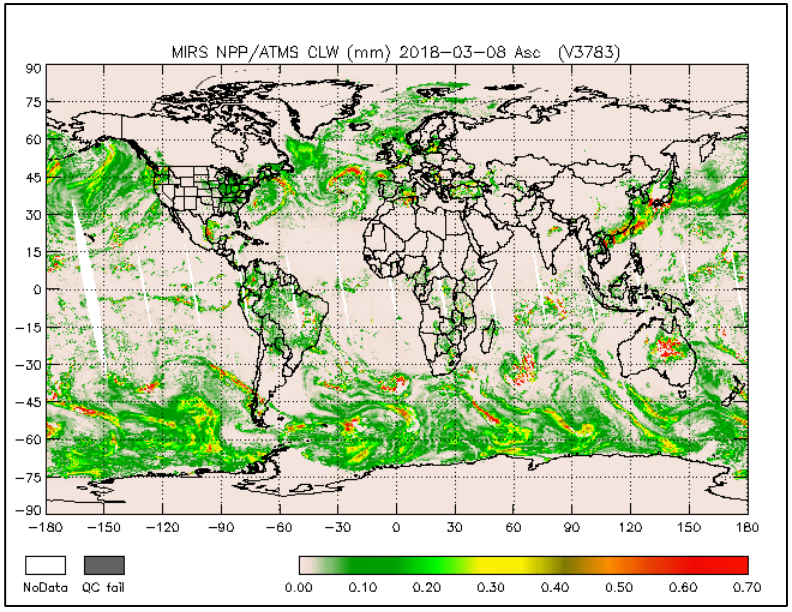
Rain rate





CLW



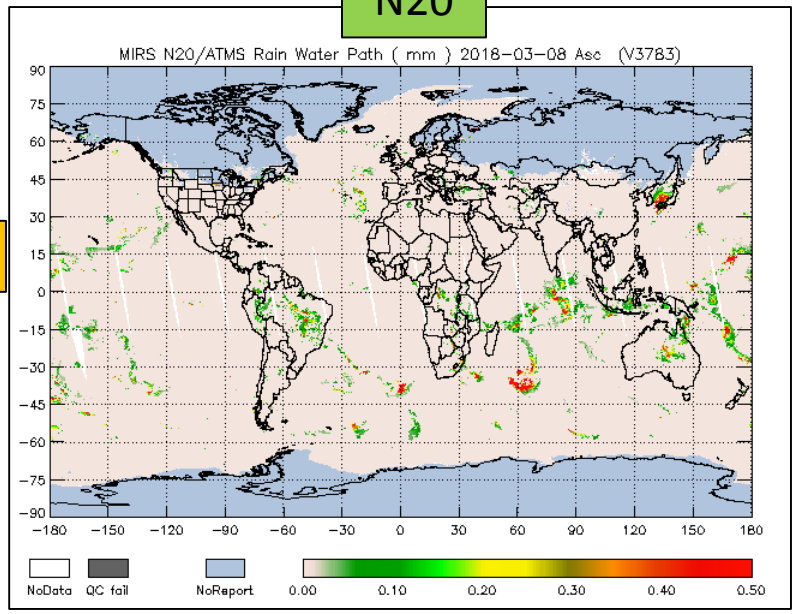


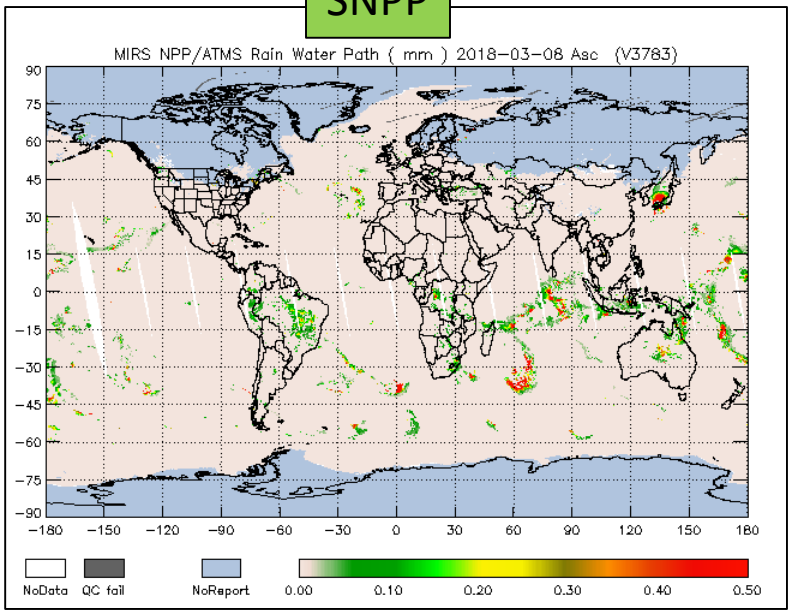
Rain Water Path and Graupel Water Path (2018-03-08)

N20

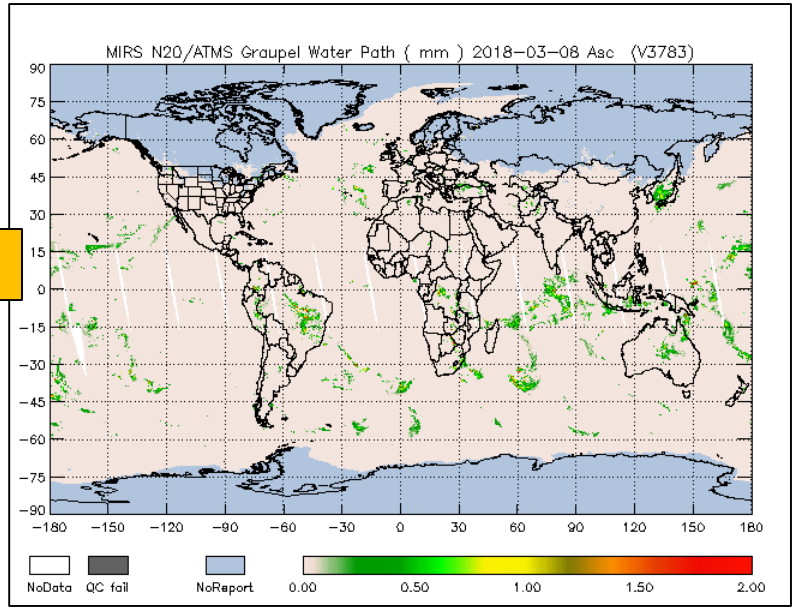
SNPP

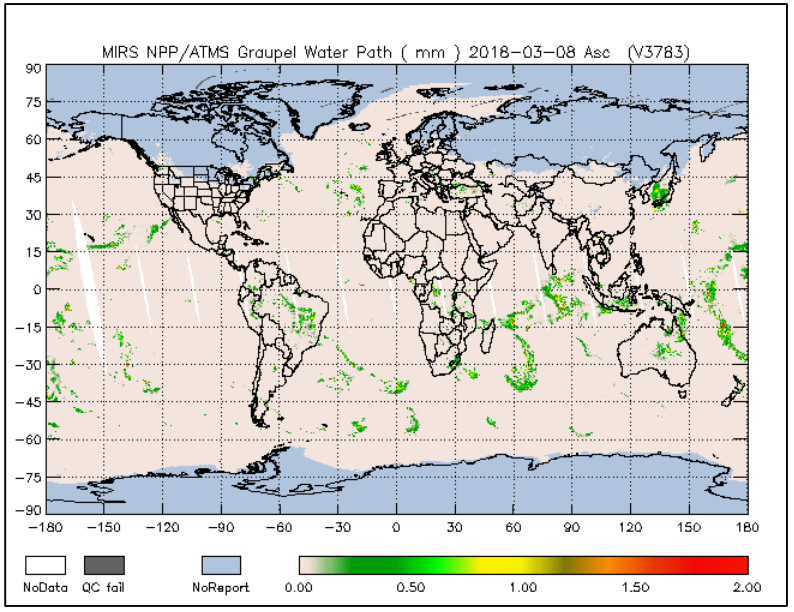
RWP





GWP





Summary

- Initial N20 validation indicates extremely good agreement with SNPP
- Next version (v11.3): Will include extension to N20 ATMS processing
- Path Forward
  - FY18 Milestones: (1) preDAP delivery in April/May 2018 (initial cal/val), (2) official DAP ~L+12 months. Continue radiometric bias characterization, validation. N20 rain rate validation (Stage IV) being implemented currently.
  - Future Improvements:
    - **CLW over land to improve light rain detection, included in v11.3**
    - **ATMS Snowfall Rate, included in v11.3**
    - **Snow water (vegetation correction to emissivity), included in v11.3**
    - Stakeholders/user needs; increase collaboration with applications developers and users…
- MiRS data available at CLASS (all satellites, except N20), and STAR ftp (S-NPP/ATMS, GPM/GMI, eventually NOAA-20/ATMS); N20 available on password-protected site
- Software package available for download **http://star.nesdis.noaa.gov/mirs**

Backup

First Look at NOAA-20 ATMS

- JPSS-1 Launch: 18 Nov 2017, 0147 PT
- First ATMS data received: 29 Nov
- MiRS processing in NOAA/STAR began immediately
- TDR/SDR Beta Maturity: 8 Dec
- TDR/SDR Provisional Maturity: 23 Jan
- Preliminary Results
  - Radiometric characterization
  - Retrieval diagnostics (chi-square, convergence, QC flags, etc.)
  - Retrieval products
  - Comparisons with SNPP and NWP (ECMWF, GDAS)
- All N20 results preliminary, non-operational
- MiRS data for N20 is not yet in CLASS
- Bottom Line: Things Look Good!