EDR Retrievals from CrIS and ATMS using CrIMSS operational algorithm

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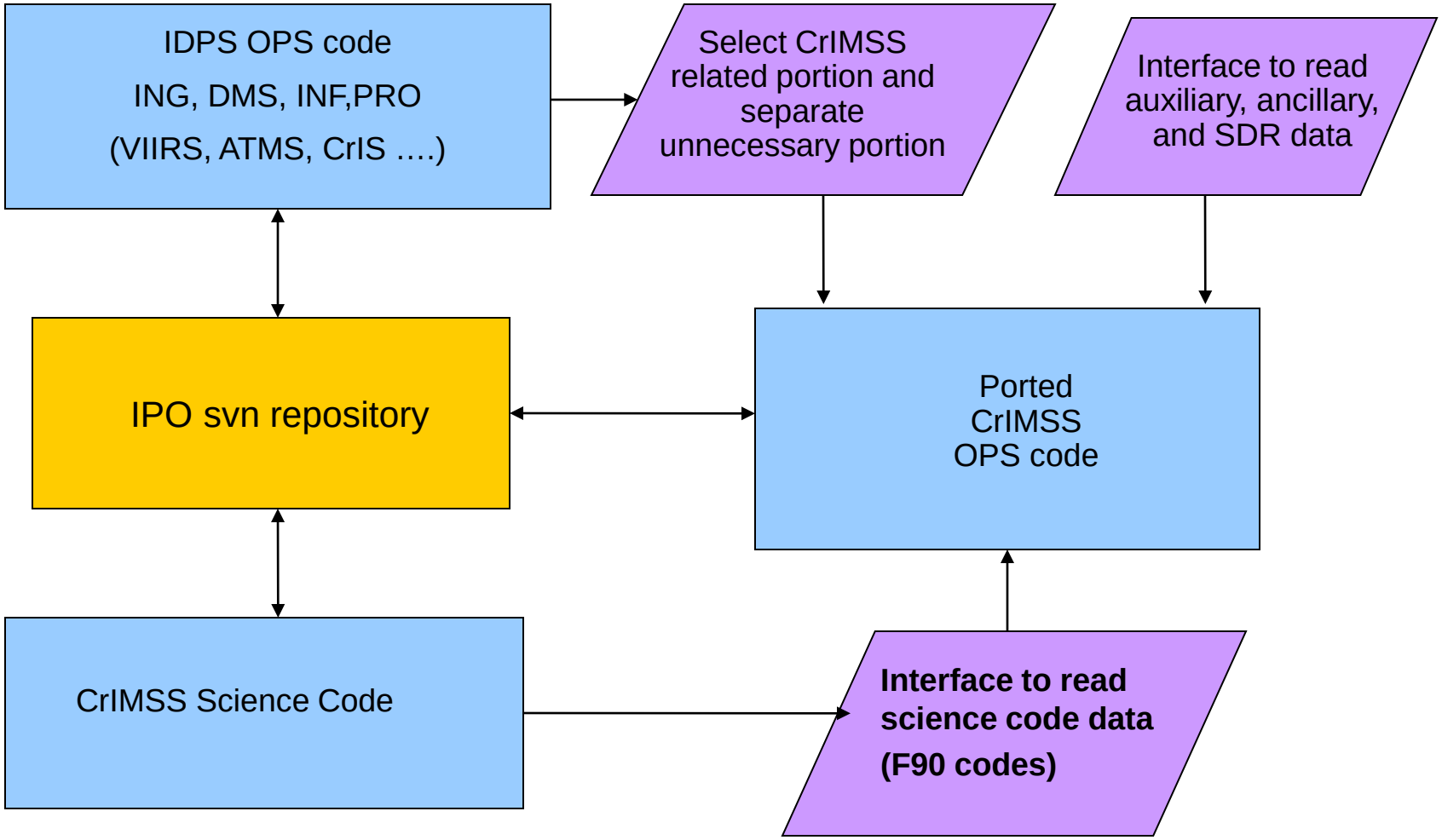
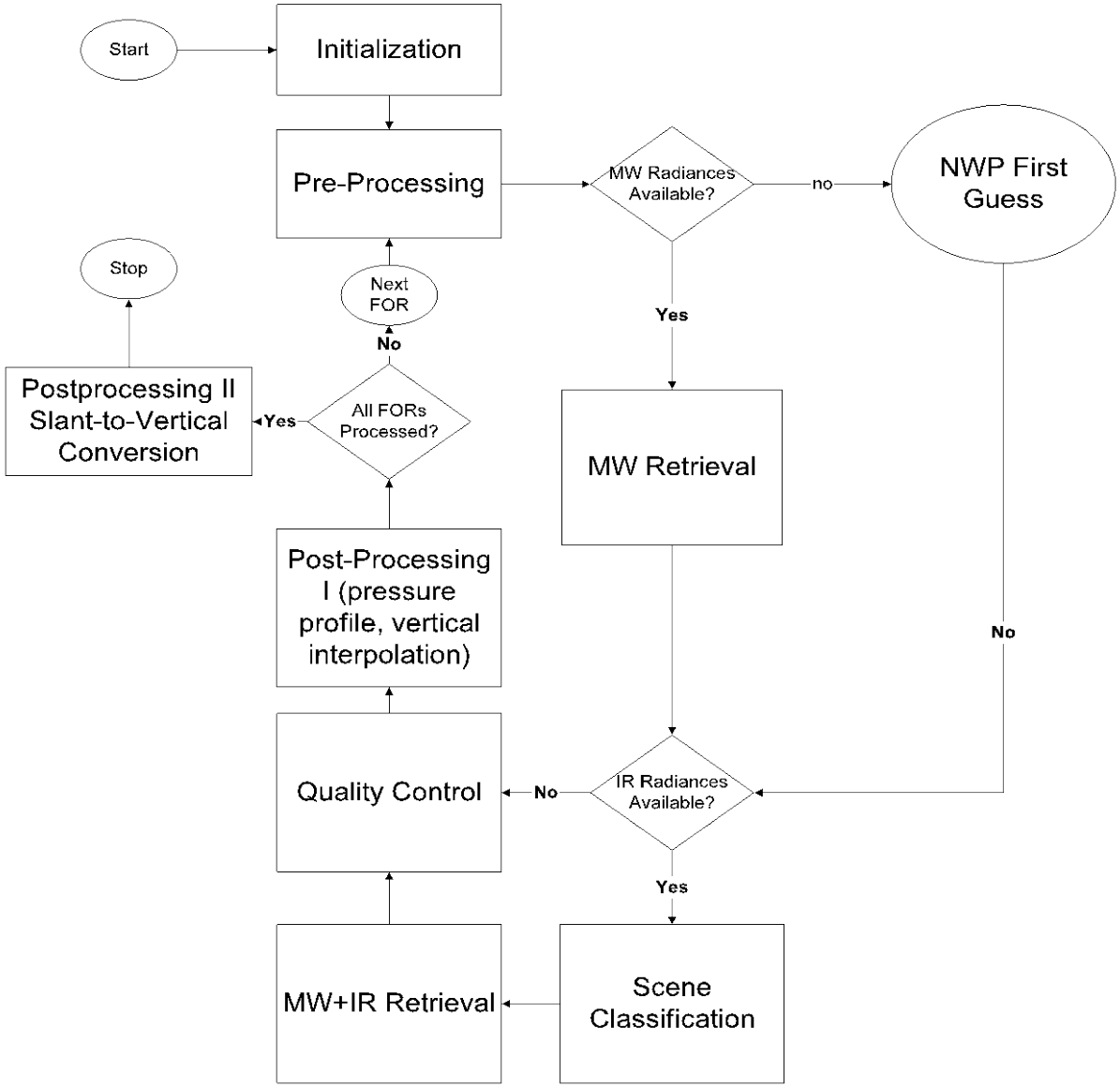
Presentation Outline

1. Introduction to CrIMSS EDR OPS code and algorithm
2. Validating and tuning CrIMSS OPS algorithm using Metop-A proxy data
3. Retrieval results for 11-11-2011 Suomi NPP ATMS data
4. Retrieval results for 2-24-2012 (golden day) ATMS/CrIS data
5. Summaries and conclusions

Introduction the ported CrIMSS OPS code

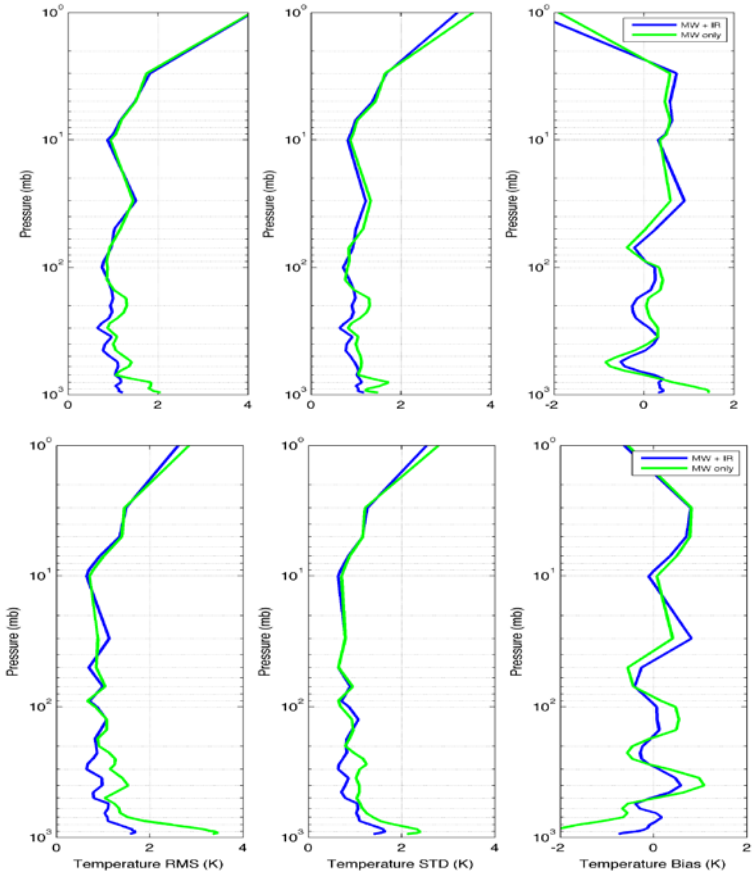


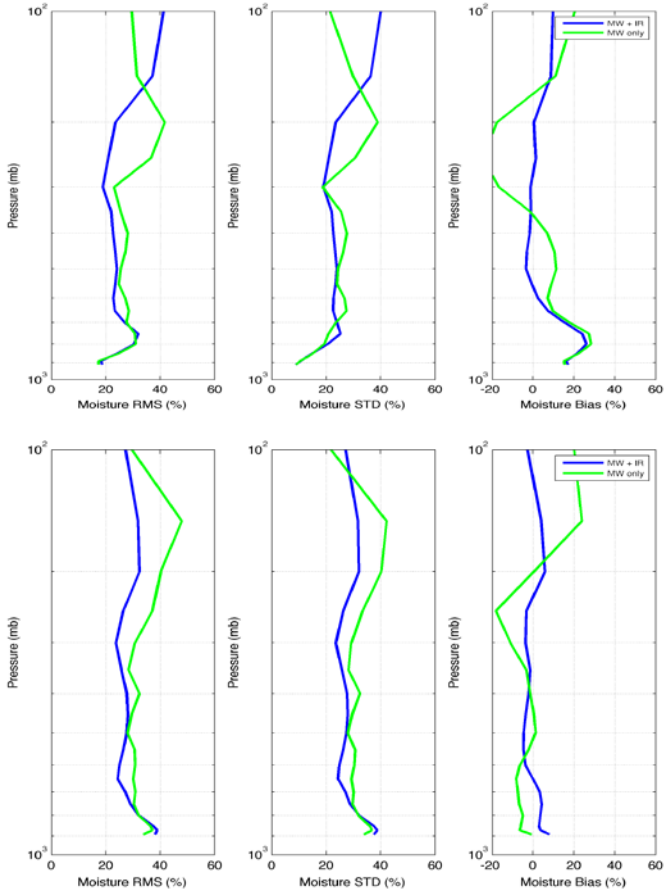
A brief description of the CrIMSS EDR algorithm



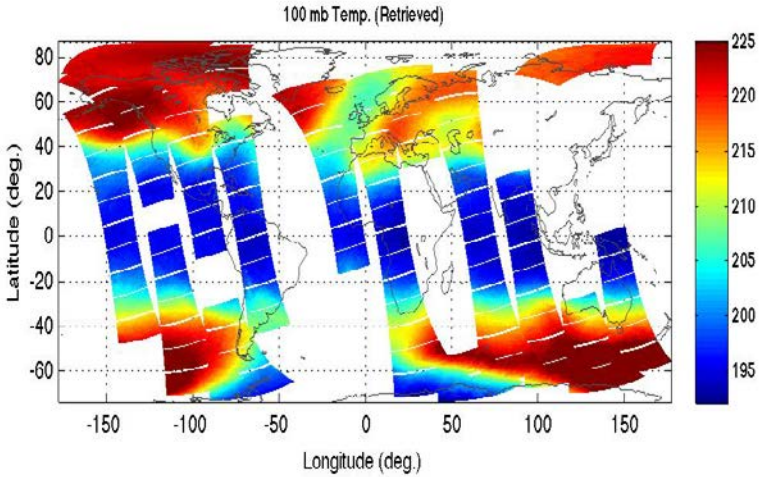
Algorithm tuning and validation performed using proxy data from IASI and AMSU/MHS

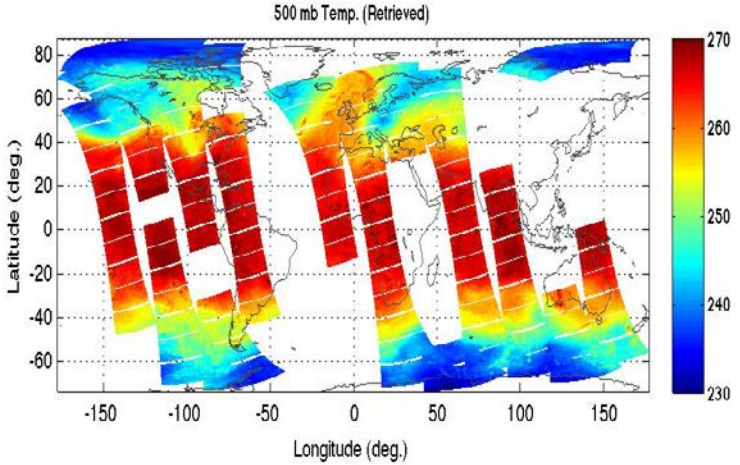
- Rigorous transformation of IASI spectra to CrIS proxy data
  - Results shown are for
- Great for algorithm tuning before the NPP launch this year
  - ➢ Bias, convergence, stability, quality control, parameter tuning …..

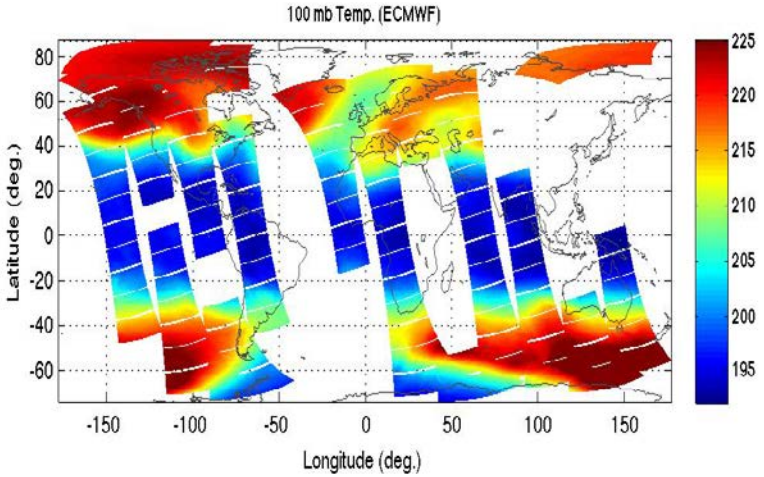


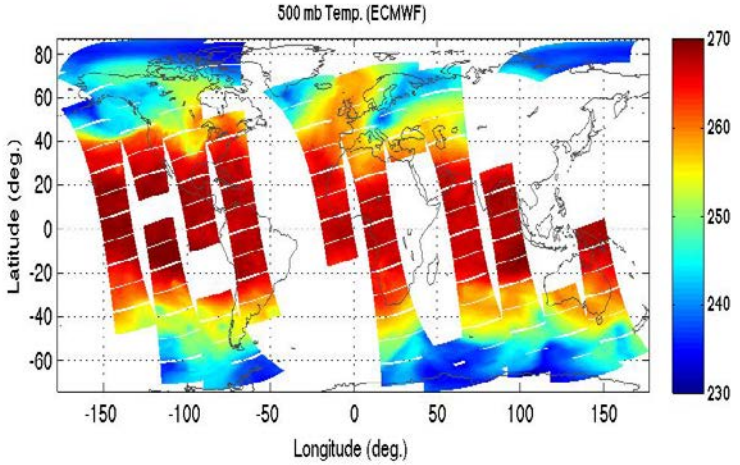


100 and 300 mb temperature retrieved from the CrIMSS EDR algorithm and comparison with ECMWF

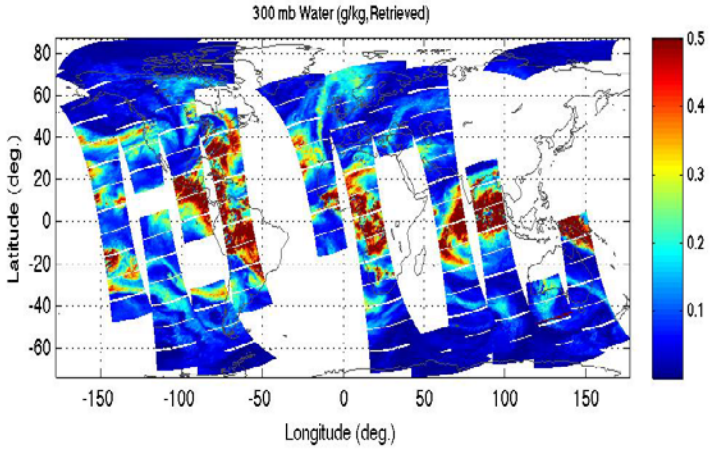


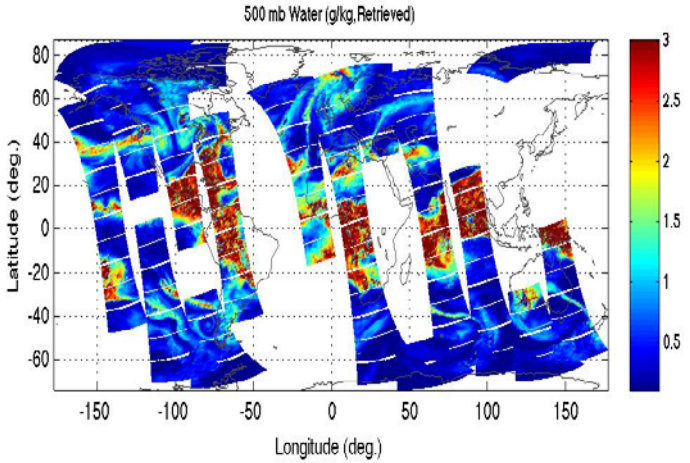


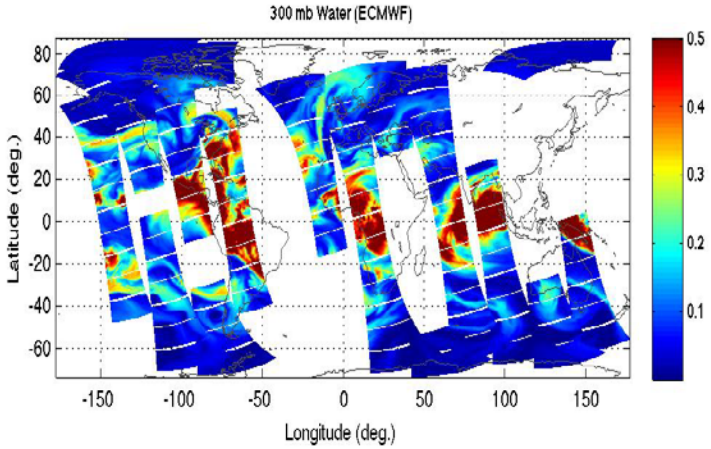


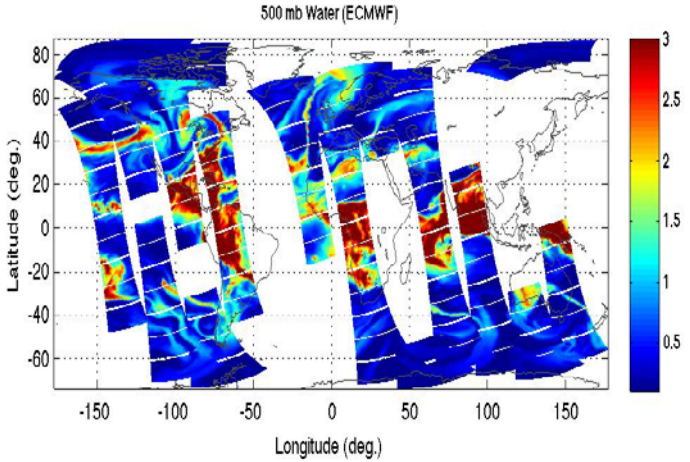


300 and 500 mb water retrieved from the CrIMSS EDR algorithm and comparison with ECMWF

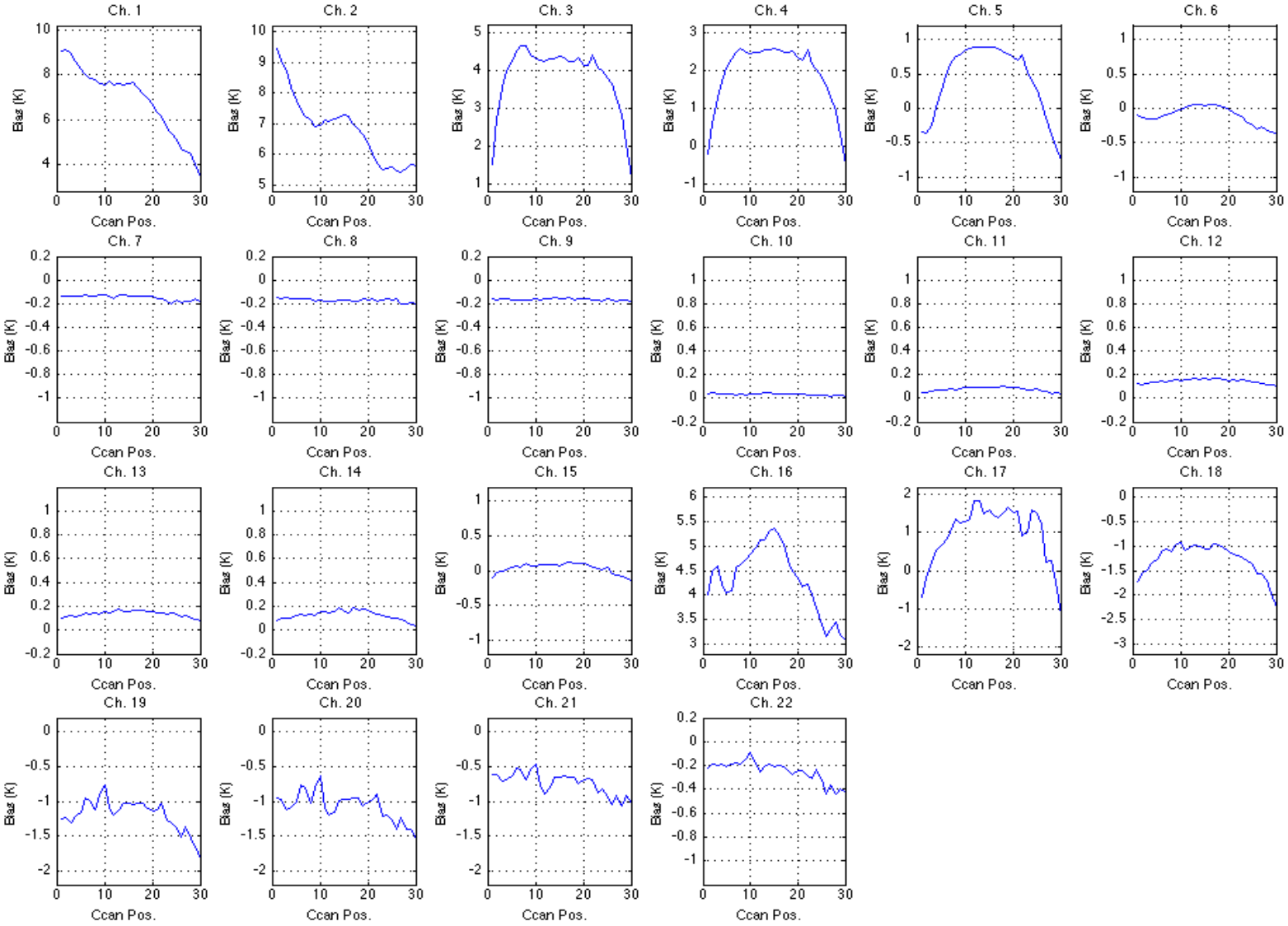






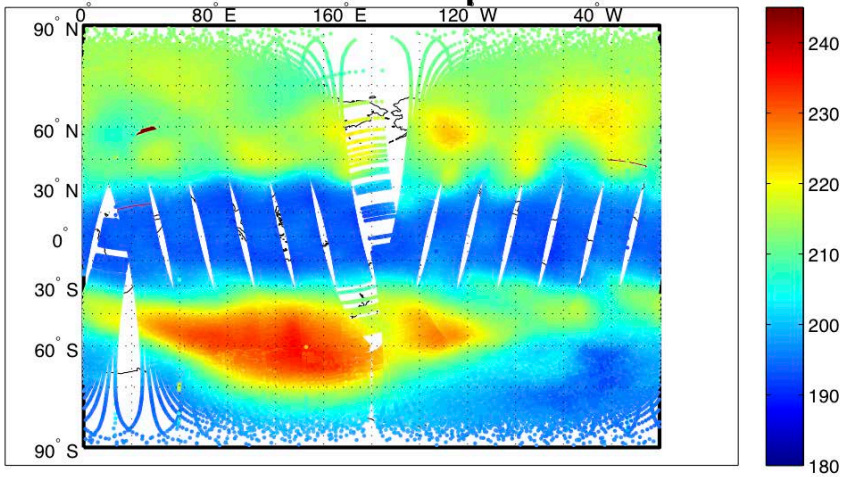


Bias Derived from ECMWF and Suomi NPP ATMS data

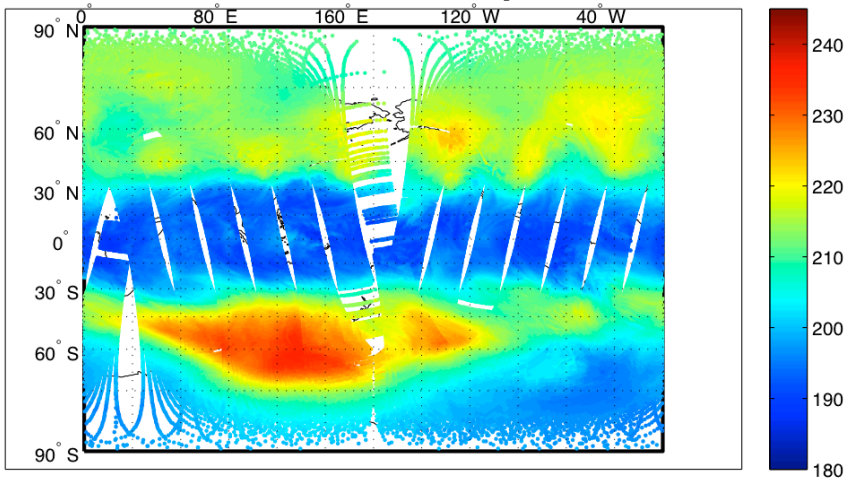


Example of Retrieved Temperatures EDR from the ported operational code using ATMS only for Nov. 11, 2011

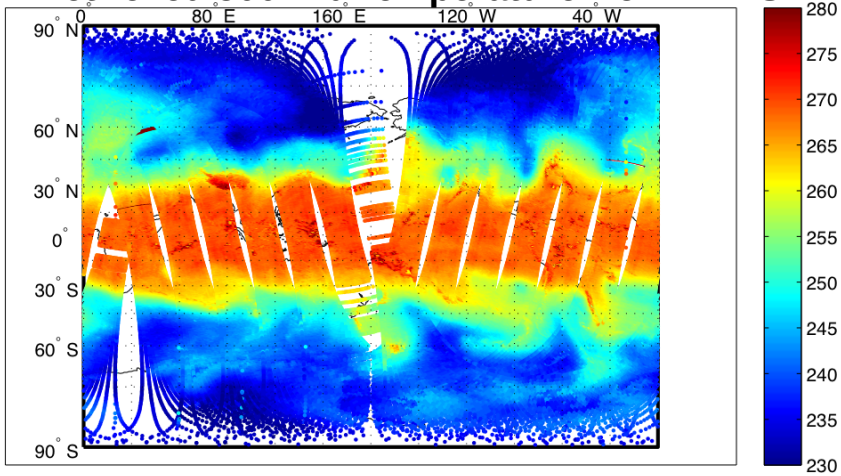
•Retrieved 100 mb Temperature from ATMS



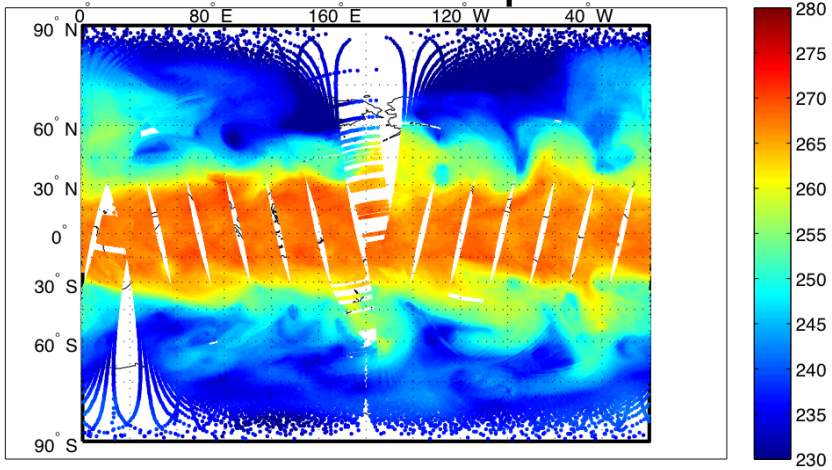
•ECMWF 100 mb Temperature



•Retrieved 500 mb Temperature from ATMS

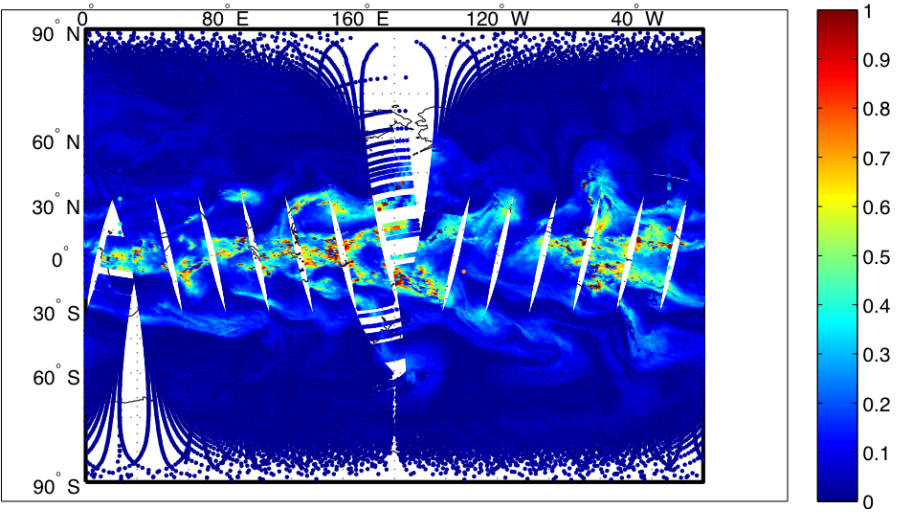


•ECMWF 500 mb Temperature

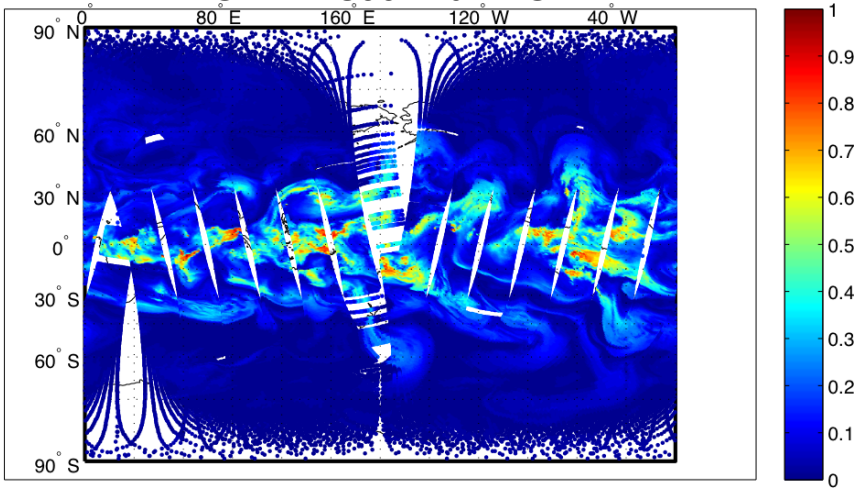


Example of Retrieved H2O EDR from the ported operational code using ATMS only for Nov. 11, 2011

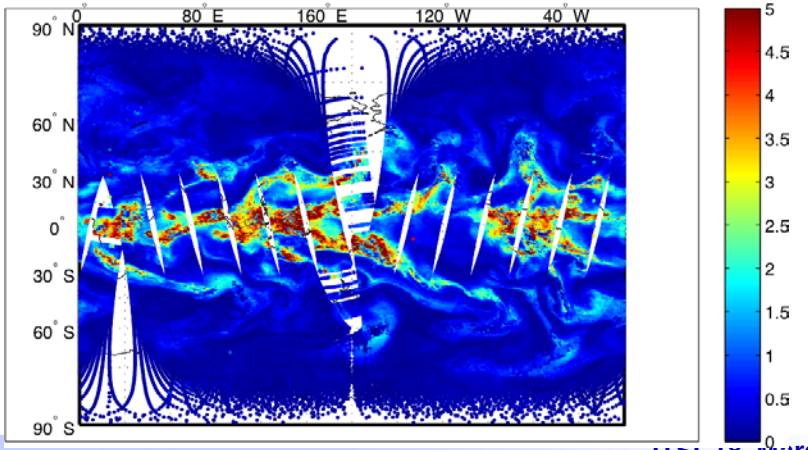
•Retrieved 300 mb H2O from ATMS



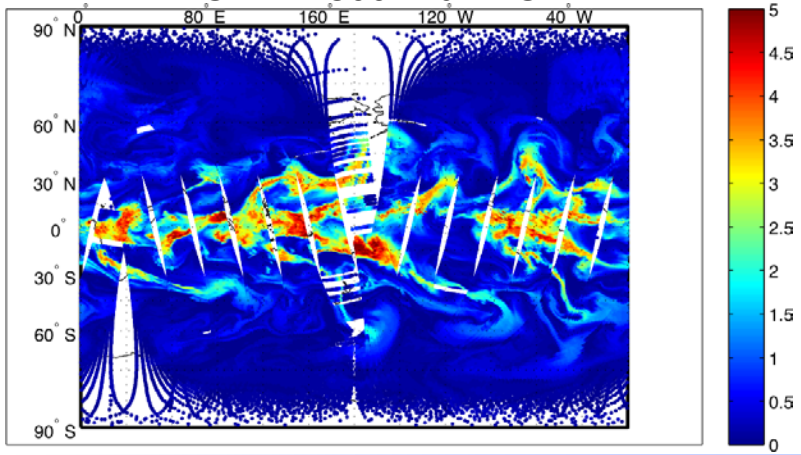
•ECMWF 300 mb H2O



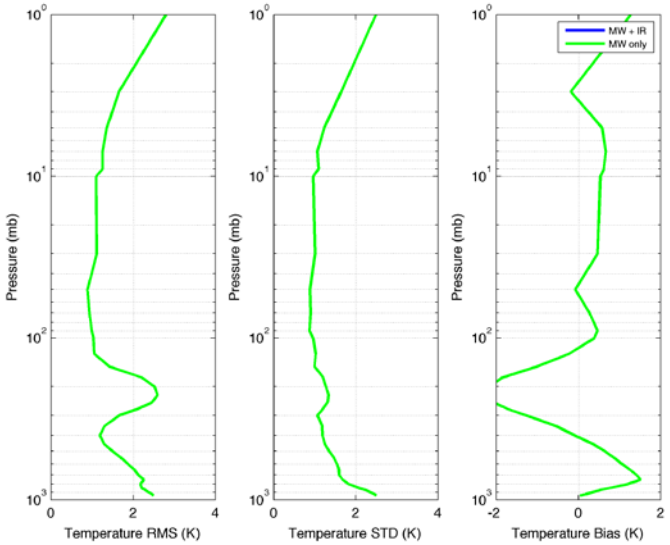
•Retrieved 500 mb H2O from ATMS



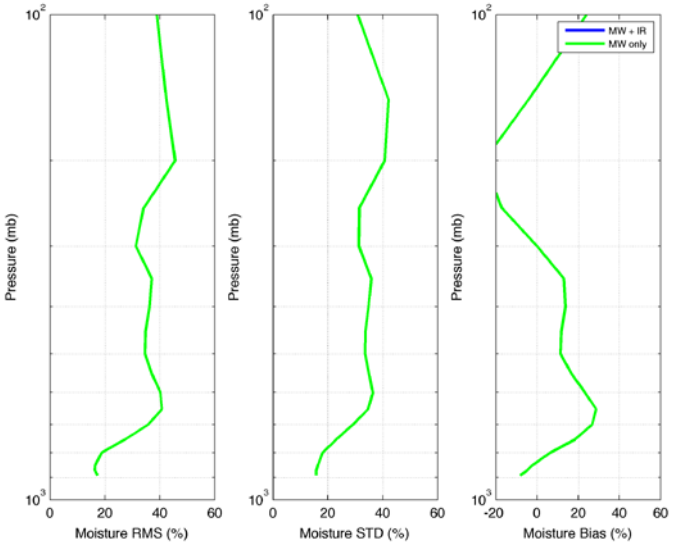
•ECMWF 500 mb H2O



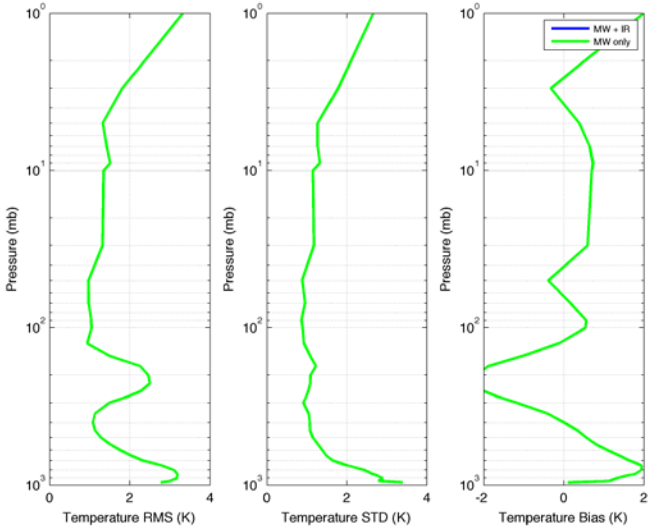
EDR statistics from the ported operational code using ATMS only data for Nov. 11, 2011



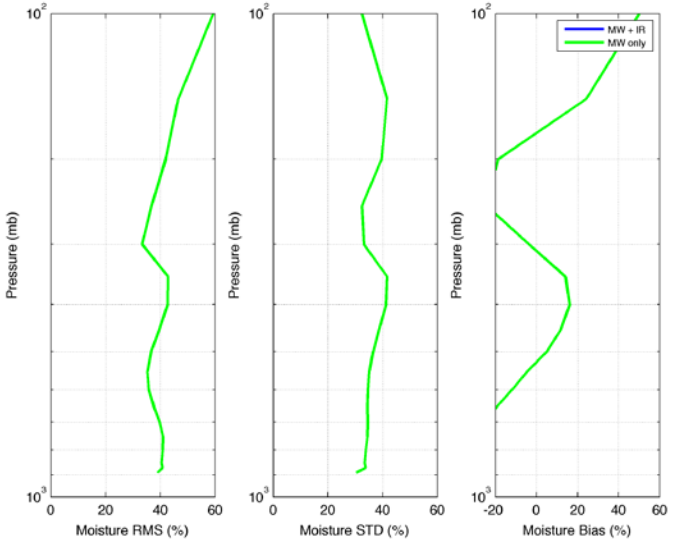
Ocean temperature



Ocean H_2O

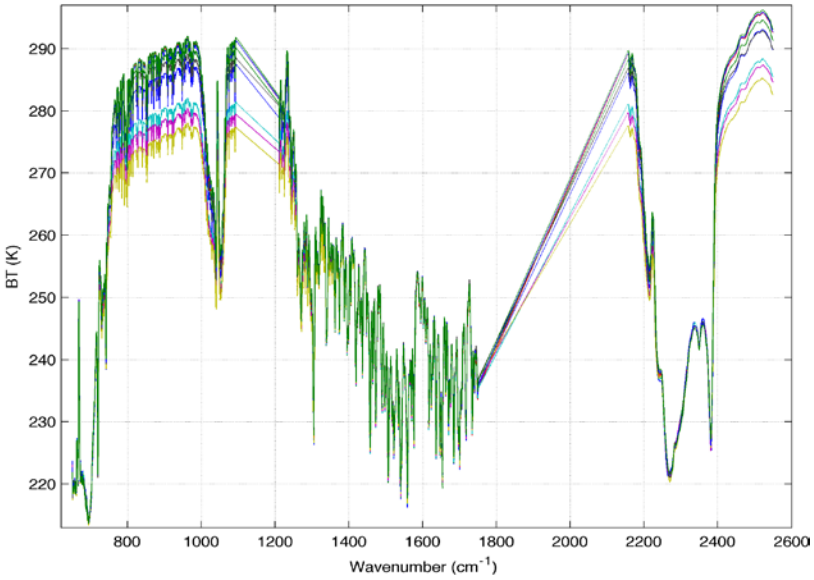


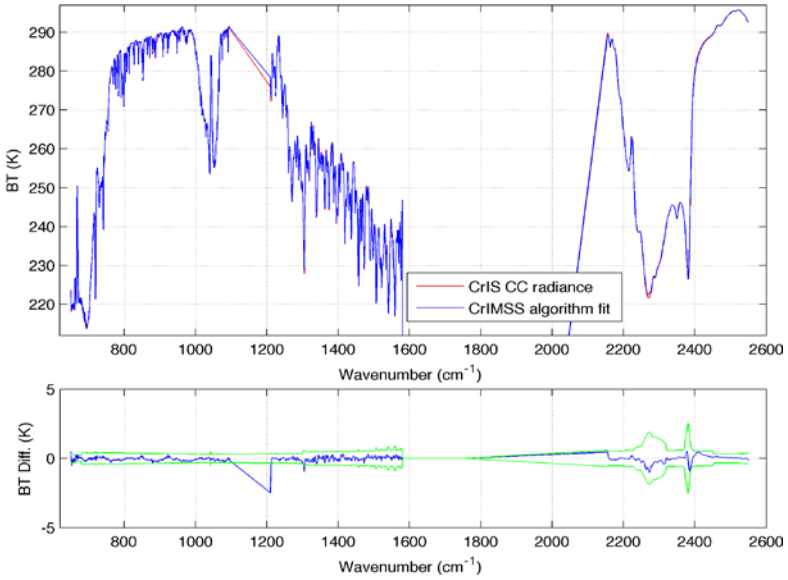
Land temperature



Land H_2O

Apply CrIMSS algorithm to focus day (2-24-2012) ATMS/CrIS data

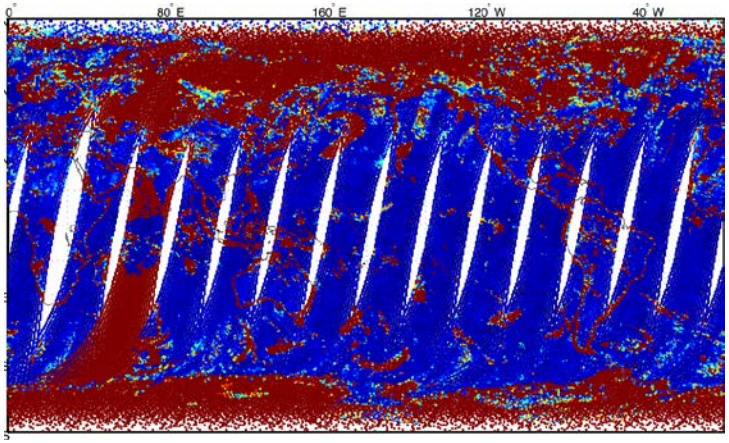


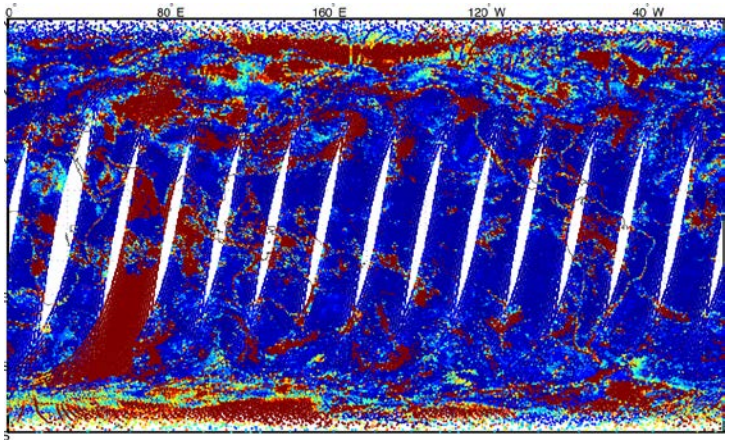


MW retrieval $\chi 2$

$$\chi^2 = \frac{1}{Nchan}\sqrt{\sum_{i=1}^{Nchan}\left(\frac{R_{obs} - R_{calc}}{R_{noise}}\right)^2}$$

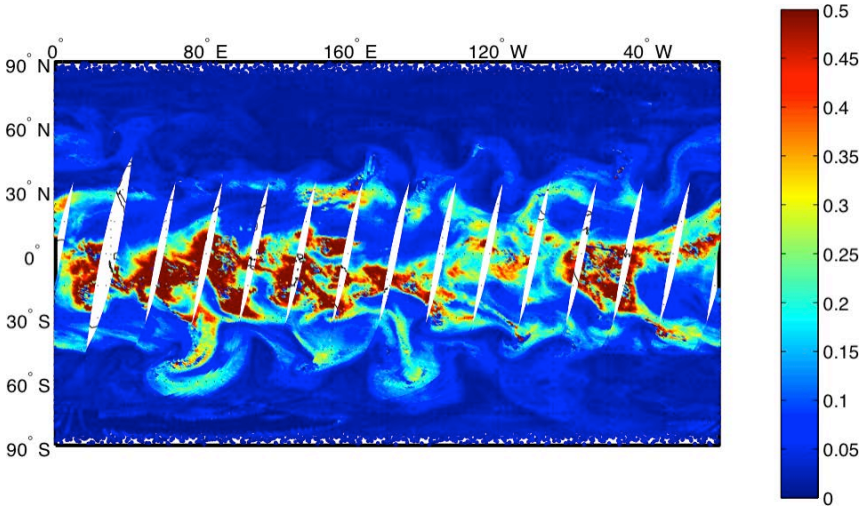
MW+IR retrieval $\chi 2$



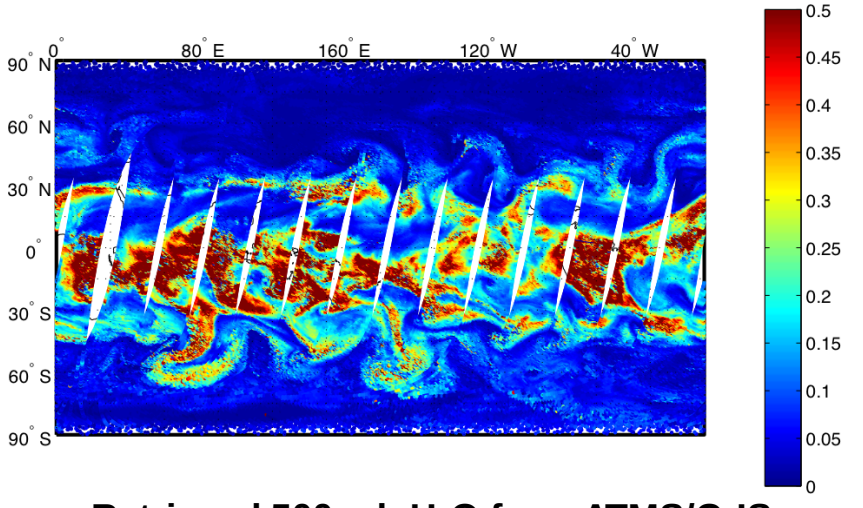


Focus day H_2O EDR Product from ATMS only and from combined ATMS/CrIS retrievals

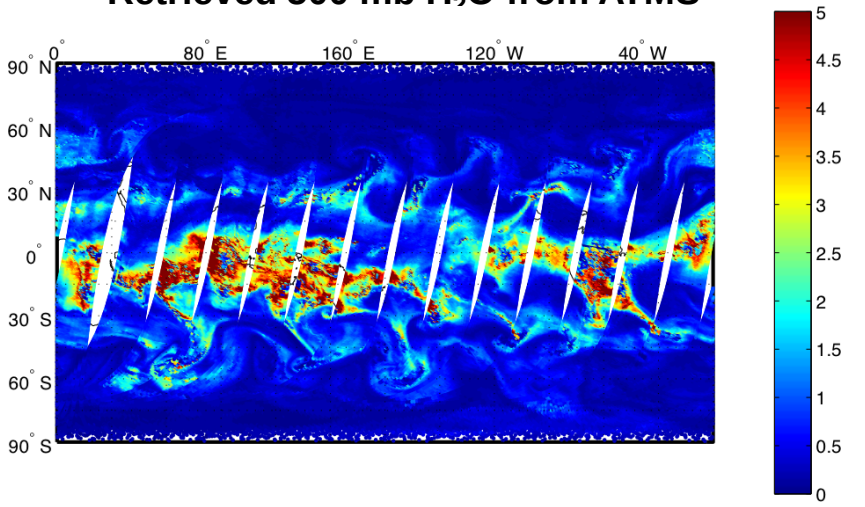
Retrieved 300 mb H_2O from ATMS



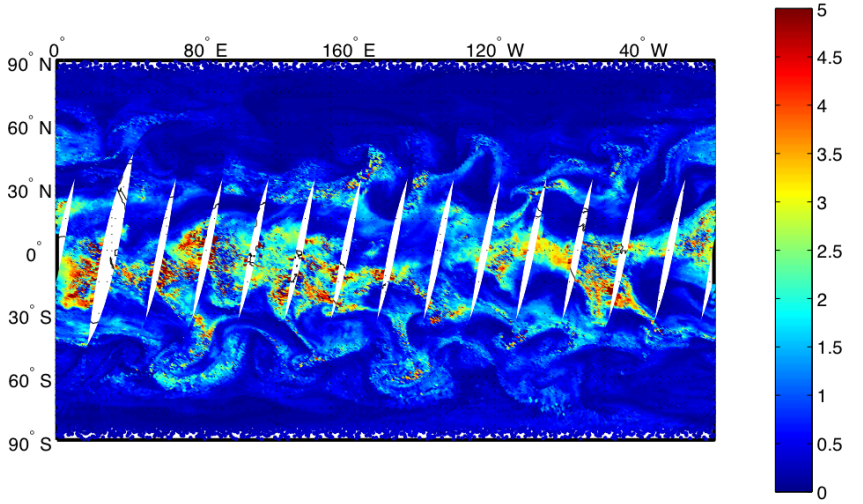
Retrieved 300 mb H_2O from ATMS/CrIS



Retrieved 500 mb H_2O from ATMS

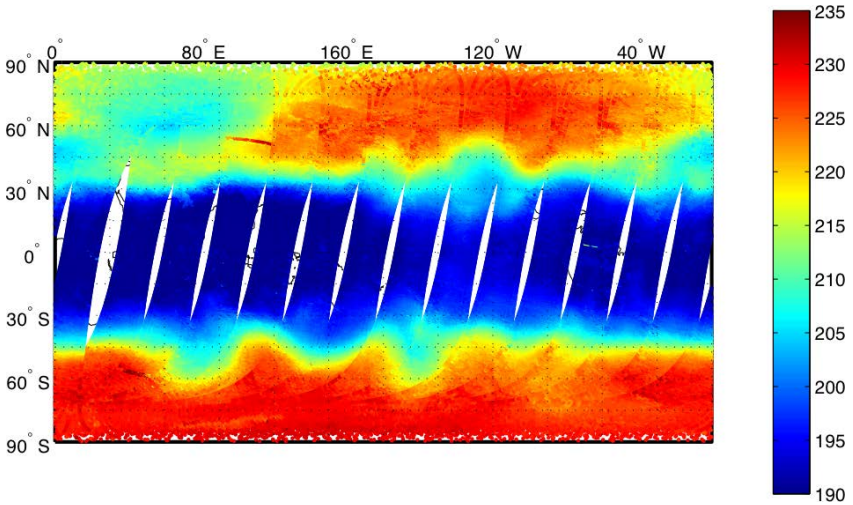


Retrieved 500 mb H_2O from ATMS/CrIS

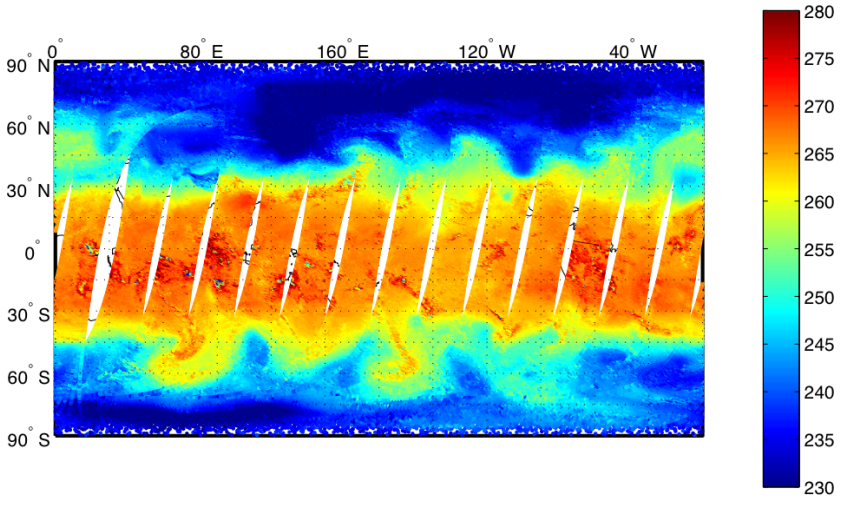


Focus day Temperature EDR Product from the combined ATMS/CrIS retrievals

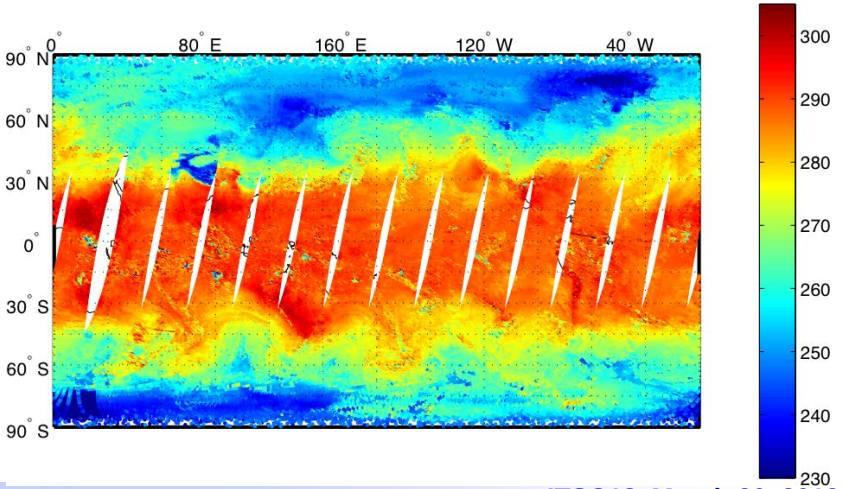
ATMS/CrIS retrieved T ant 100 mb



ATMS/CrIS retrieved T ant 500 mb



ATMS/CrIS retrieved T ant 850 mb



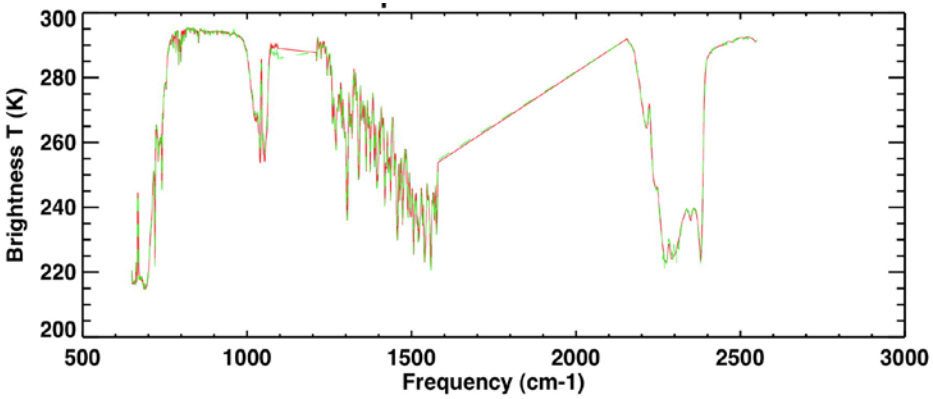
Summary and conclusions

- CrIMSS EDR operational code has been ported to run on Linux/unix system
  - Provide flexible link to science code
  - Can be easily adapted to perform different functions
    - Reading different data sources
    - Perform forward radiance simulations for bias correction
    - Perform part of the functions such as post processing, database comparison etc
- Data from IASI/AMSU/MHS provide good SDR proxy data
  - Very useful for algorithm tuning and testing
  - Good EDR performance achieved
- The ported CrIMSS OPS code has been applied to
  - Suomi NPP ATMS only data for 11-11-2011
  - Suomi NPP ATMS/CrIS Golden day data (2-24-2012)
- Future work
  - Looking into details
  - Improve convergence
  - Further tuning

Overview of ATMS and CrIS sounders

CHANNEL	CENTER FREQUENCY (GHz)	MAXIMUM BANDWIDTH (GHz)	CENTER FREQUENCY STABILITY (MHz)	STATIC BEAMWIDTH B (degrees)	QUASI-POLARIZATION	CHARACTERIZATION AT NADIR (REFERENCE ONLY)
1	23.8	0.27	10	5.2	QV	water vapor
2	31.4	0.18	10	5.2	QV	window
3	50.3	0.18	10	2.2	QH	window
4	51.76	0.40	5	2.2	QH	window
5	52.8	0.40	5	2.2	QH	surface air
6	53.596 ± 0.115	0.17	5	2.2	QH	4km ~700mb
7	54.40	0.40	5	2.2	QH	9km ~400mb
8	54.94	0.40	10	2.2	QH	11km ~250mb
9	55.50	0.33	10	2.2	QH	13km ~180mb
10	57.290334	0.33	0.5	2.2	QH	17km ~90mb
11	57.290334 ± 0.217	0.078	0.5	2.2	QH	19km ~50mb
12	57.290334 ± 0.3222 ± 0.048	0.036	1.2	2.2	QH	25km ~25mb
13	57.290334 ± 0.3222 ± 0.022	0.016	1.6	2.2	QH	29km ~10mb
14	57.290334 ± 0.3222 ± 0.010	0.008	0.5	2.2	QH	32km ~6mb
15	57.290334 ± 0.3222 ± 0.0045	0.003	0.5	2.2	QH	37km ~3mb
16	88.2	2.0	200	2.2	QV	H_2O 150mm
17	165.5	3.0	200	1.1	QH	H_2O 18mm
18	183.31 ± 7	2.0	30	1.1	QH	H_2O 8mm
19	183.31 ± 4.5	2.0	30	1.1	QH	H_2O 4.5mm
20	183.31 ± 3	1.0	30	1.1	QH	H_2O 2.5mm
21	183.31 ± 1.8	1.0	30	1.1	QH	H_2O 1.2mm
22	183.31 ± 1	0.5	30	1.1	QH	H_2O 0.5mm

	IASI	CrIS (LW)	CrIS (MW)	CrIS (SW)
MOPD	~2.0 cm	0.8 cm	0.4 cm	0.2 cm
Spectral spacing	0.25 cm^{-1}	0.625 cm^{-1}	1.25 cm^{-1}	2.5 cm^{-1}
Apodized spectral resolution	0.5 cm^{-1} Guassian	0.88 cm^{-1} Hamming	1.76 cm^{-1} Hamming	3.53 cm^{-1} Hamming



CrIS has 1317 spectral channel (unapodized)
CrIS has 1305 spectral channel (apodized)
9 Field of View (FOV) per Field of Regard (FOR)