



Status and Plans for Finalization of SRT's Contribution to AIRS Version-7 and Version-7 AO

Joel Susskind¹, John Blaisdell², Lena Iredell²,
Louis Kouvaris²

NASA GSFC Sounder Research Team (SRT)
AIRS Science Team Meeting
Greenbelt, MD
October 27, 2017

¹NASA GSFC Laboratory for Atmospheres

²SAIC

Background and Status

- A previous AIRS operational Version at JPL was Version-6.28, which was presented at the March 2016 AIRS Science Team Meeting.
- Version-6.28 performed much better than Version-6 especially with regard to water vapor profiles and total precipitable water.
- We call our current SRT system Version-6.46. Version-6.46 is significantly better than Version-6.28 for $T(p)$, $q(p)$, $O_3(p)$. Version-6.46 AO performs about as well as Version-6.46.
- SRT Version-6.46 is now installed at JPL and is called Version-6.4.6. Version-6.4.6 AIRS/AMSU and Version-6.4.6 AIRS Only (AO) have been run at JPL for January 2015 and July 2015.
- A scientifically equivalent Version-6.46 CrIS/ATMS retrieval system is now installed at the Sounder SIPS. Monthly retrievals have not been run yet.

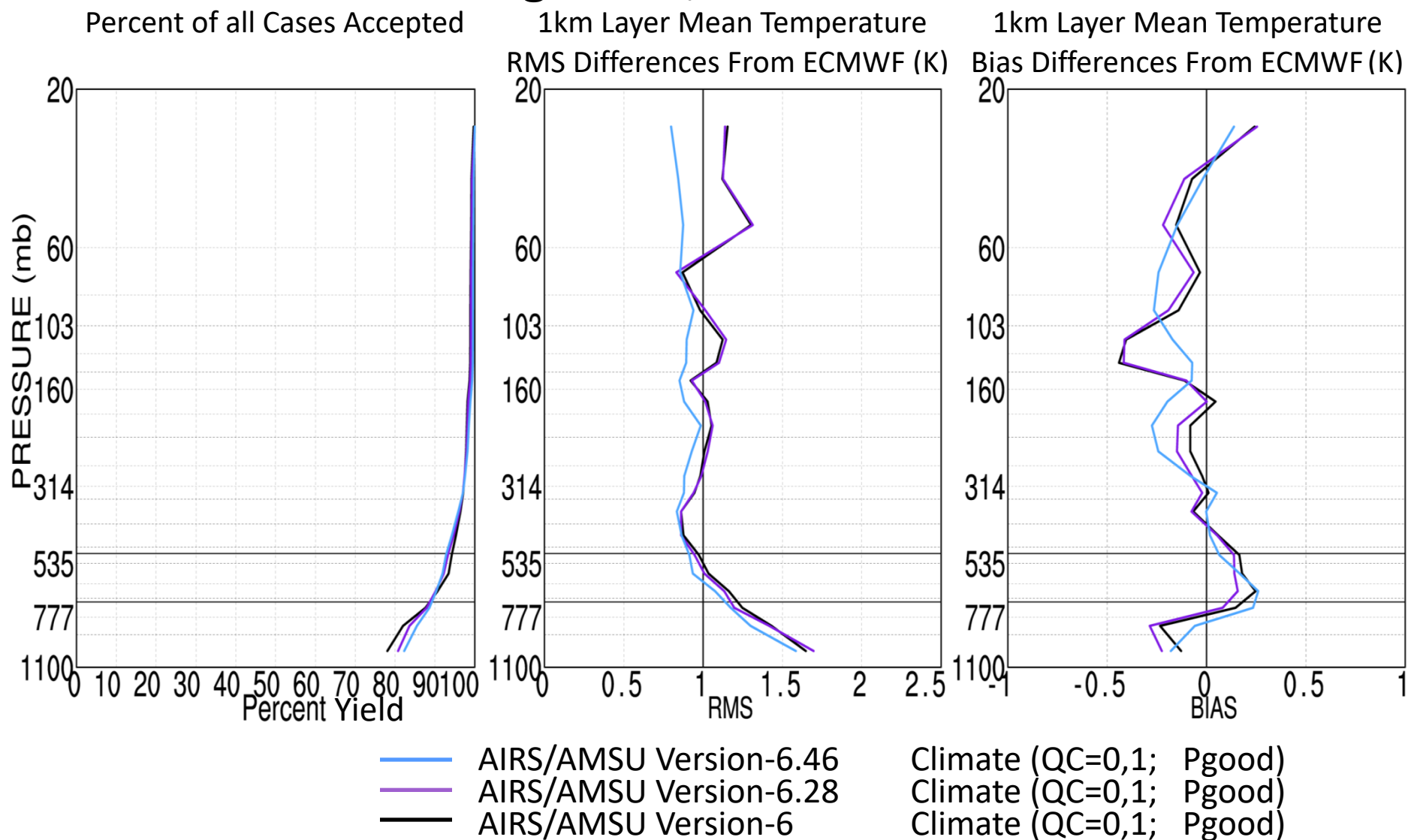
Success Criteria

The SRT objective is to generate accurate AIRS and CrIS monthly mean level-3 climate data sets that are consistent with each other.

- AIRS Version-7 and Version-7 AO monthly mean level-3 products, and their interannual differences, should be more accurate than AIRS Version-6.28 or AIRS Version-6.
- AIRS Version-7 AO products should at worst be only slightly poorer than those of AIRS Version-7.
- CrIS/ATMS monthly mean products, and especially their interannual differences, should match those of AIRS Version-7, and Version-7 AO, as best as possible.

We will address each of these in turn.

August 15, 2013 Global



Version-6.46 $T(p)$ products passing climate QC are significantly more accurate than those of Version-6.28 or Version-6, with higher yields.

August 15, 2013 Global

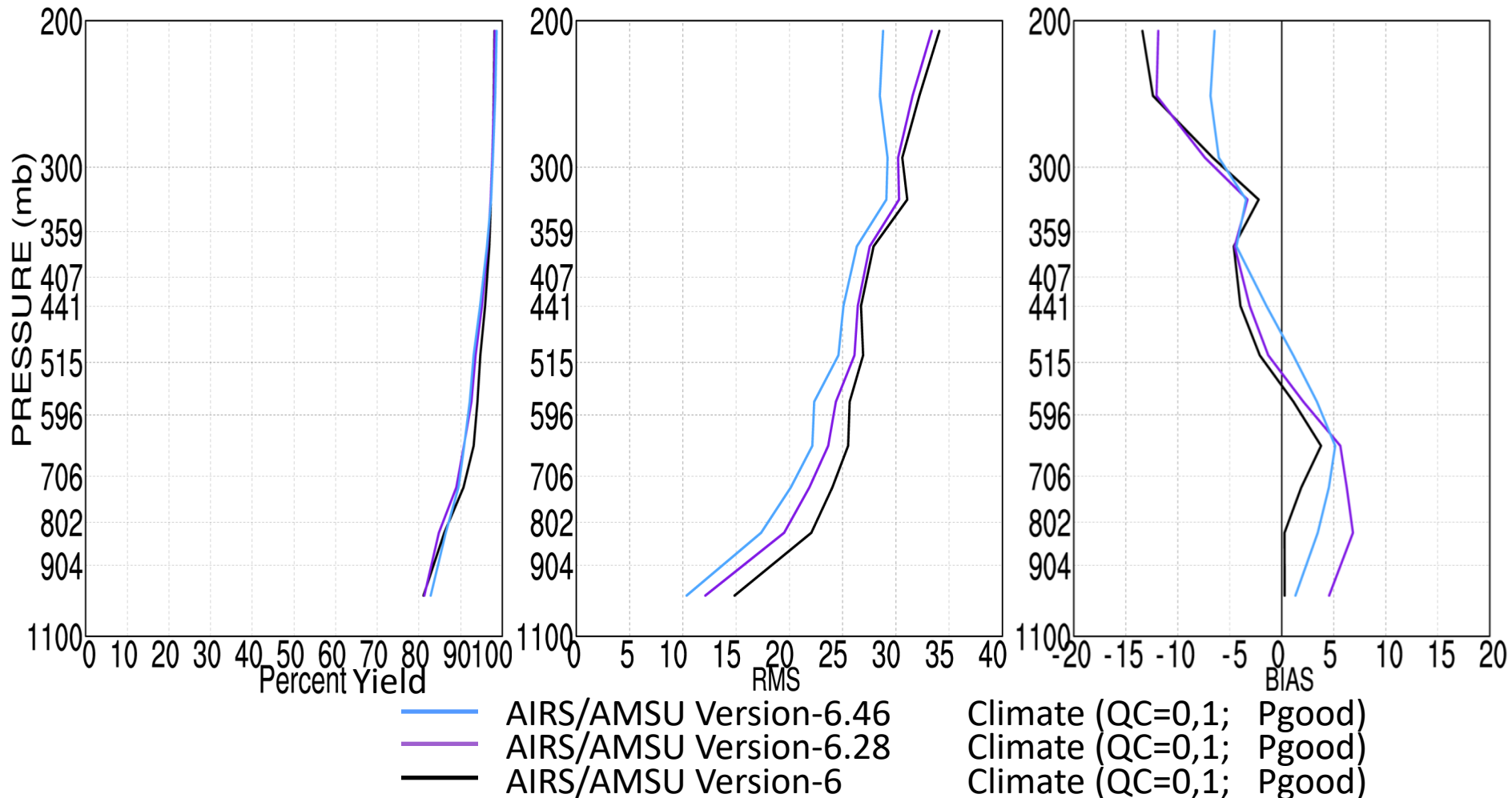
Percent of all Cases Accepted

1km Layer Precipitable Water

1km Layer Precipitable Water

RMS % Differences From ECMWF

Bias % Differences From ECMWF



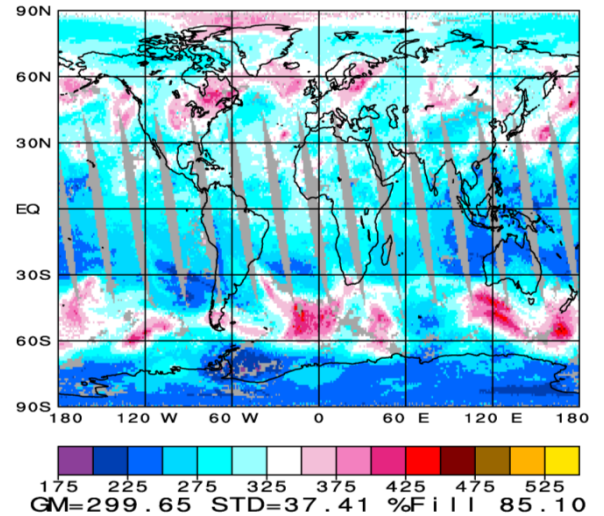
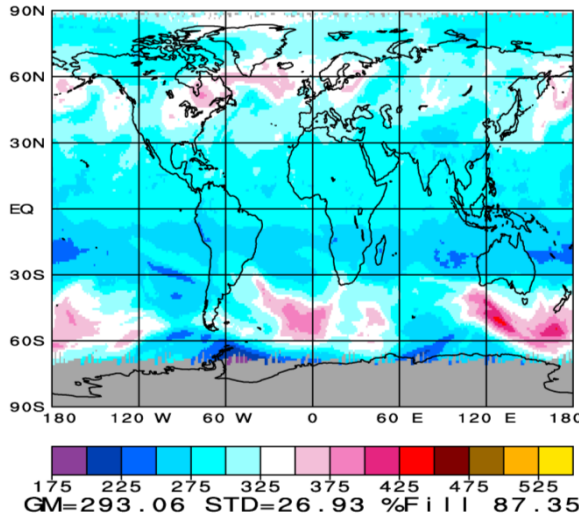
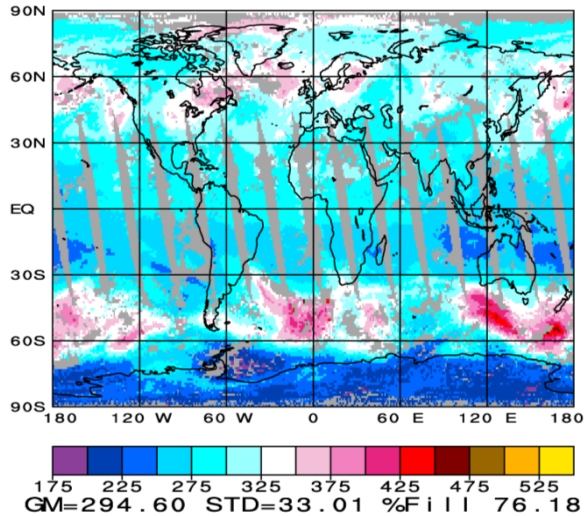
AIRS Version-6.46 water vapor profiles are significantly more accurate than those of Version-6.28 or Version-6. AIRS Version-6.46 water vapor profiles are still biased dry in the upper troposphere, but by a lesser amount than previous Versions.

Ozone (DU)
August 15, 2013 1:30 PM

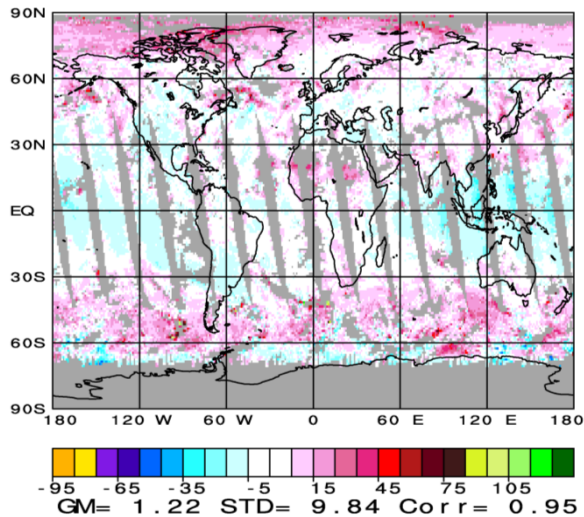
AIRS/AMSU Version-6.46

OMPS

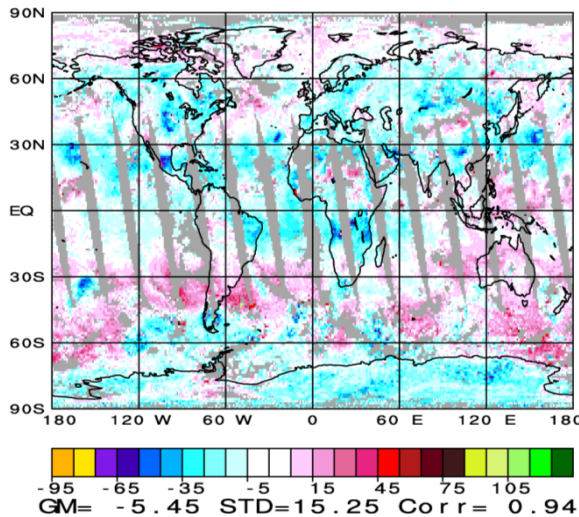
AIRS/AMSU Version-6



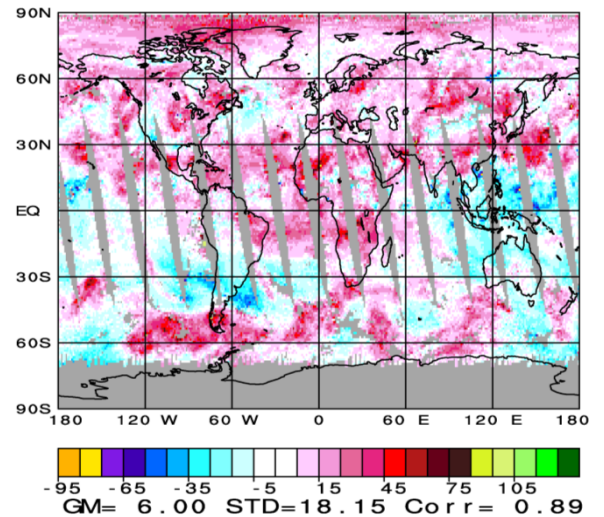
V6.46 minus OMPS



V6.46 minus V6



V6 minus OMPS

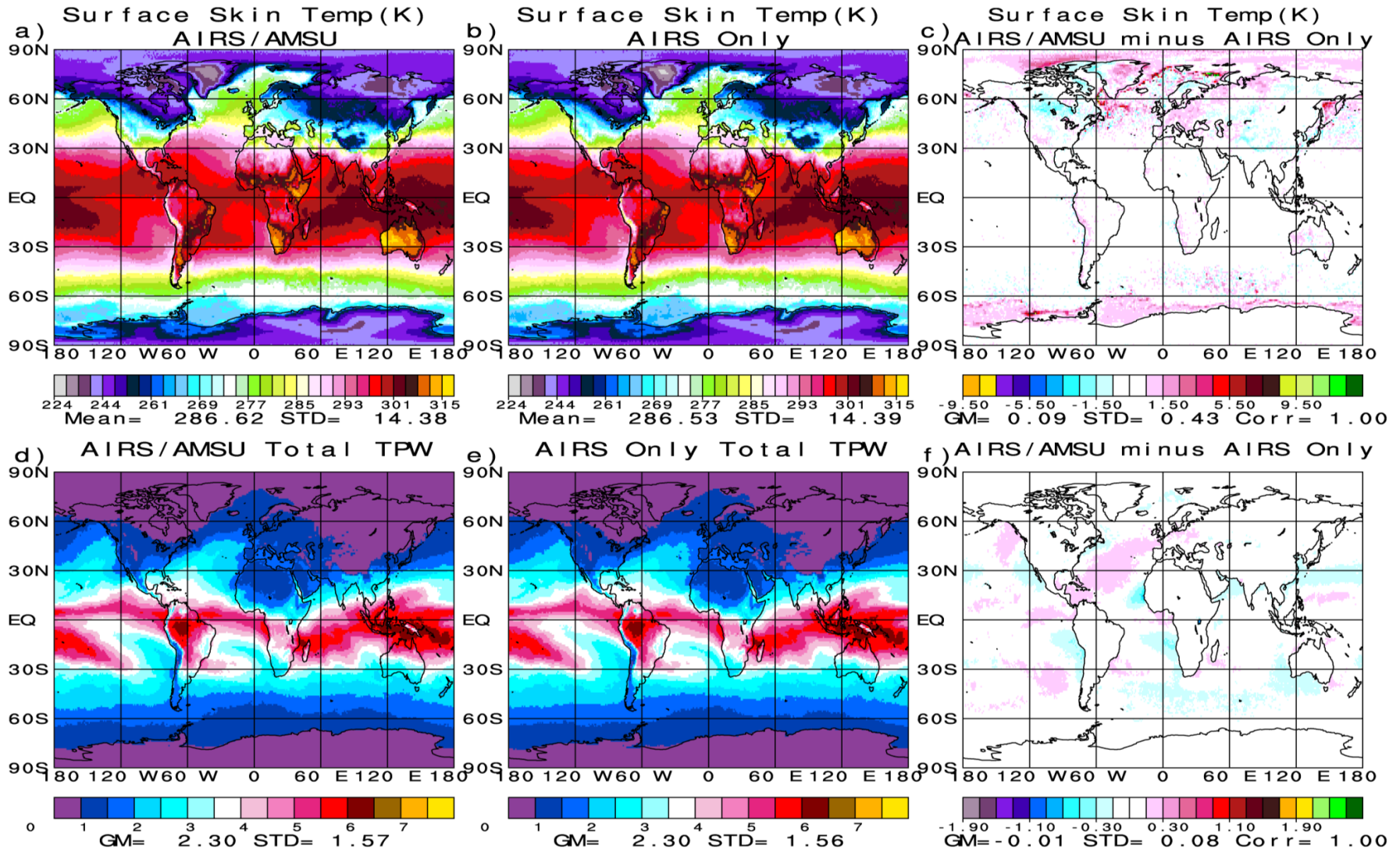


AIRS Version-6.46 total O_3 is in excellent agreement with OMPS and is much better than Version-6 total O_3 . Note also that the ozone hole over Antarctica is much deeper in Version-6.46 than it was in Version-6. AIRS Version-6.46 total O_3 is also better than Version-6. 28.

Joel Susskind, John Blaisdell, Lena Iredell, Louis Kouvaris

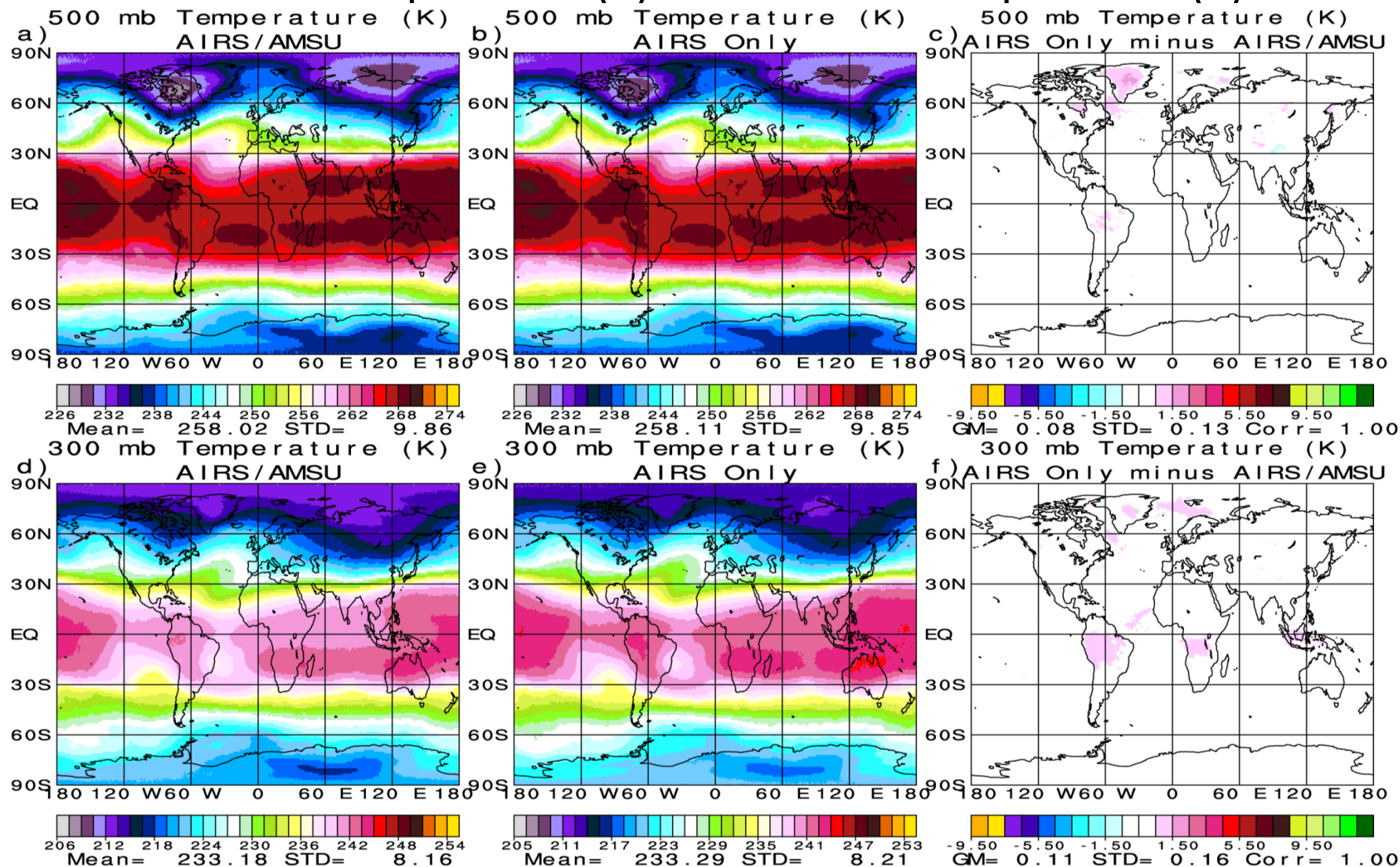
January 2015 Monthly Mean Version-6.4.6 run at JPL

Surface Skin Temperature (K) and Total Precipitable Water (cm)



Version-6.4.6 AIRS/AMSU and AIRS Only monthly mean surface skin temperatures and total precipitable water agree well with each other. This is a requirement for Verion-7.

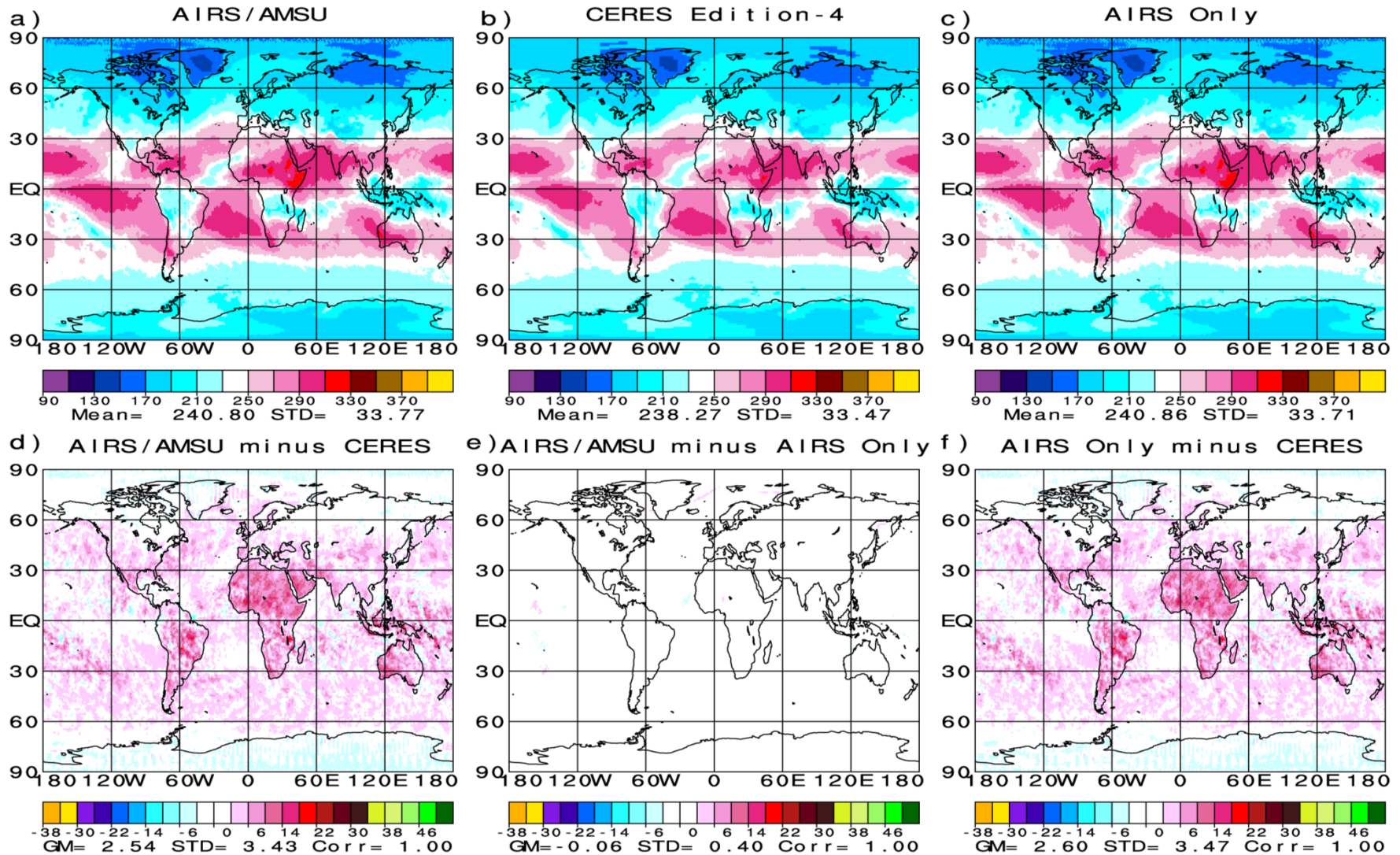
January 2015 Monthly Mean Version-6.4.6 run at JPL 500 mb Temperature (K) and 300 mb Temperature (K)



Monthly mean Version-6.4.6 AIRS/AMSU and AIRS Only 500 mb and 300 mb temperatures agree extremely well with each other.

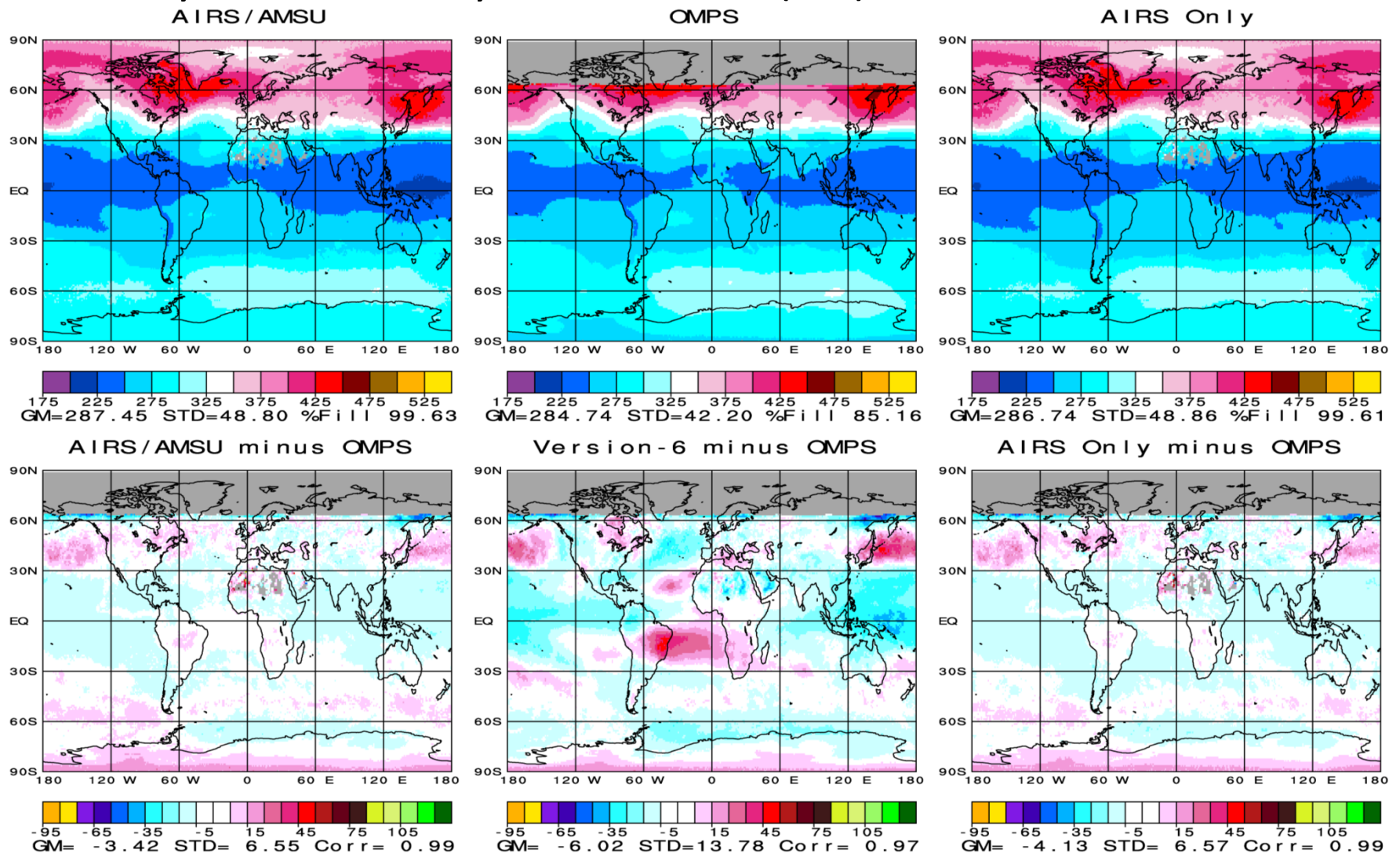
January 2015 Monthly Mean Version-6.4.6 run at JPL

OLR (Watts/m²)



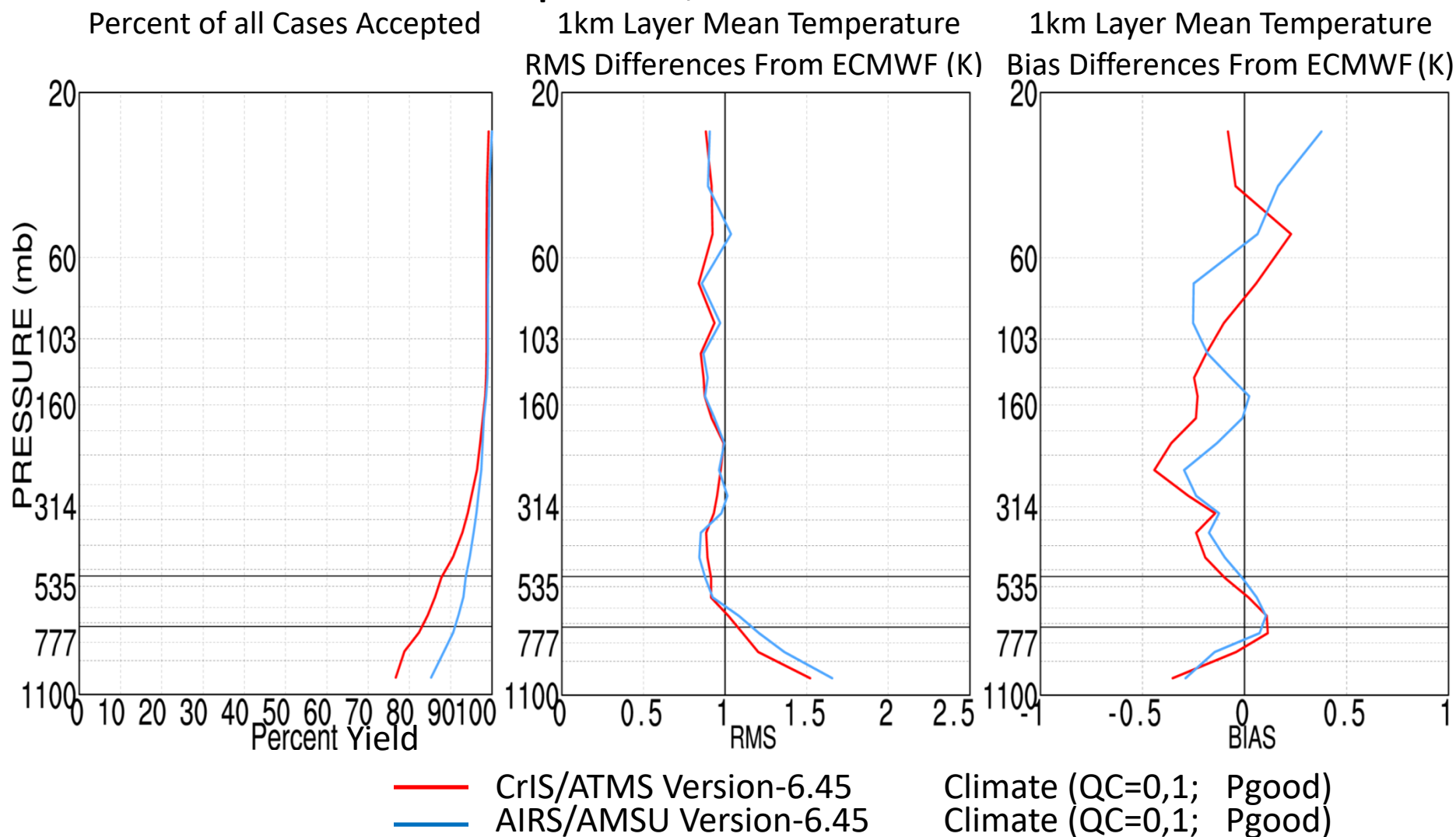
Version-6.4.6 AIRS/AMSU and Version-6.4.6 AIRS Only OLR agree extremely well with each other and, like Version-6, agree well with CERES.

January 2015 Monthly Mean Ozone (DU) Version-6.4.6 run at JPL



Version-6.4.6 AIRS/AMSU and Version-6.4.6. AIRS Only total ozone agree extremely well with each other and with OMPS. Version-6.4.6 AO total O_3 is significantly better than Version-6. This major improvement in total O_3 is the biggest reason to start production of Version-7 in the near future.

April 15, 2016 Global



CrIS/ATMS Version-6.45 temperature profiles passing climate QC are of comparable accuracy to those of AIRS. We don't have this result yet for Version-6.46. The differences between versions 6.46 and 6.45 would not affect $T(p)$ accuracies.

April 15, 2016 Global

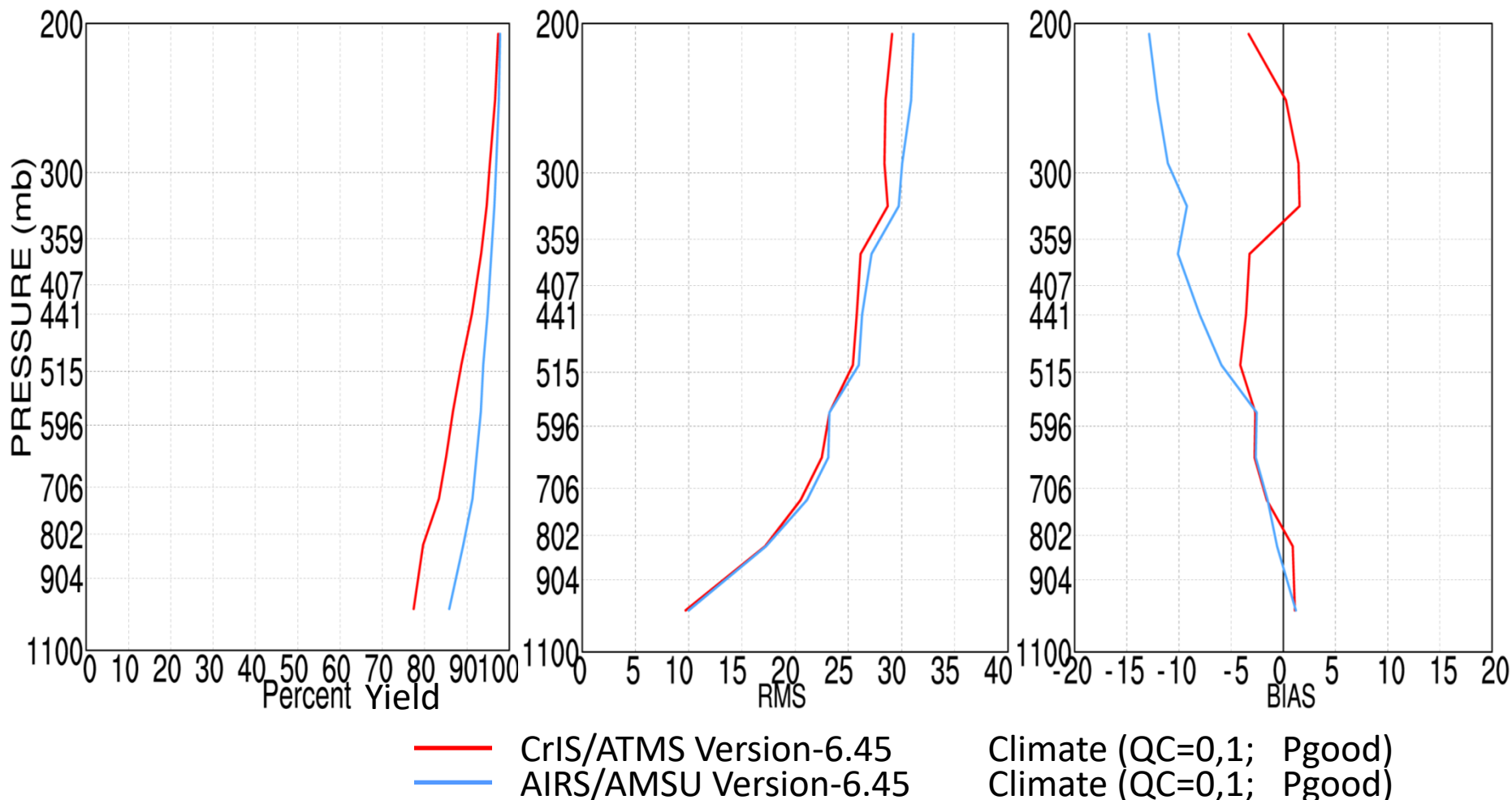
Percent of all Cases Accepted

1km Layer Precipitable Water

1km Layer Precipitable Water

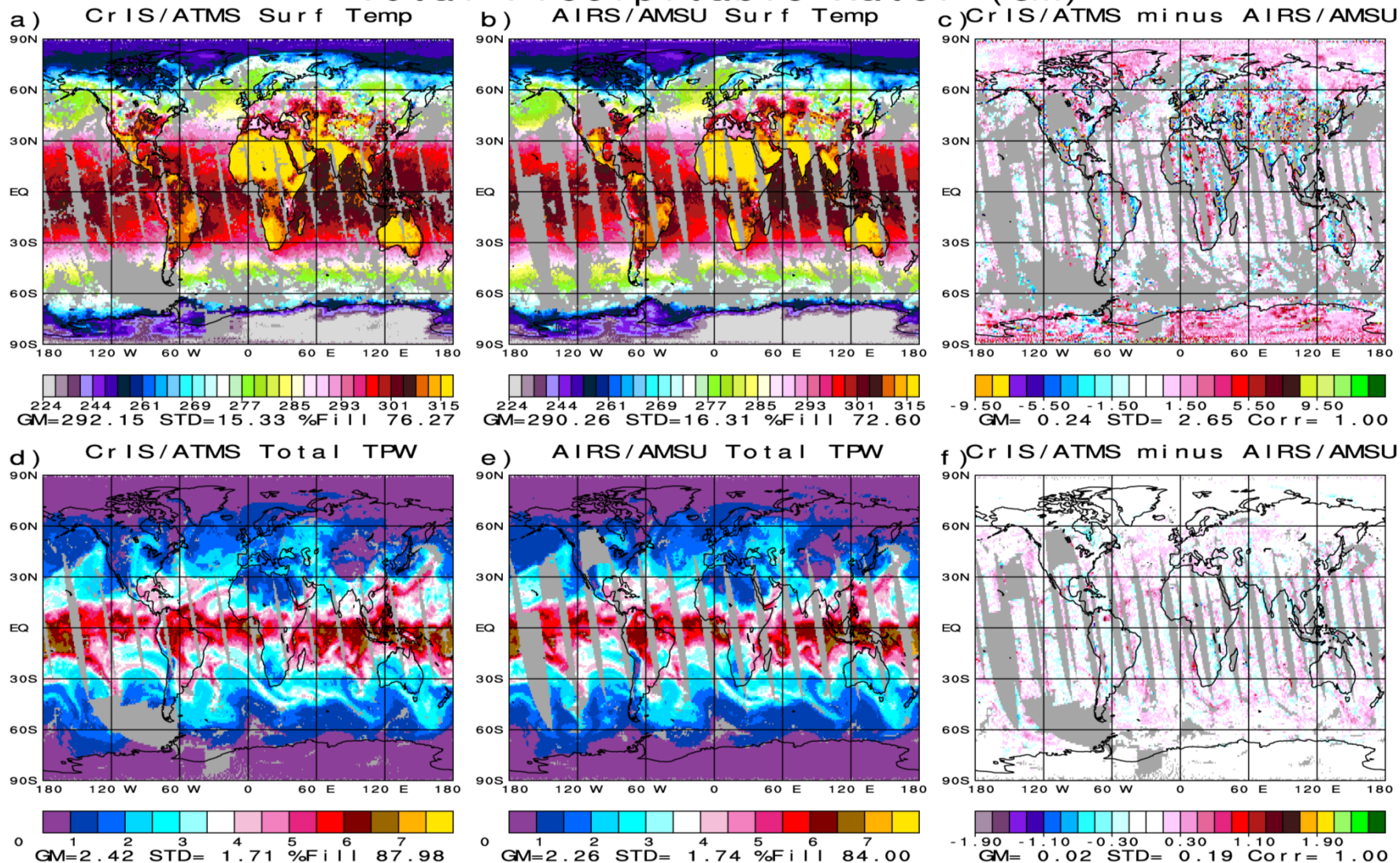
RMS % Differences From ECMWF

Bias % Differences From ECMWF



Version-6.45 CrIS/ATMS water vapor profiles are actually somewhat more accurate than those of AIRS/AMSU, and do not show the dry upper tropospheric bias found in AIRS/AMSU.

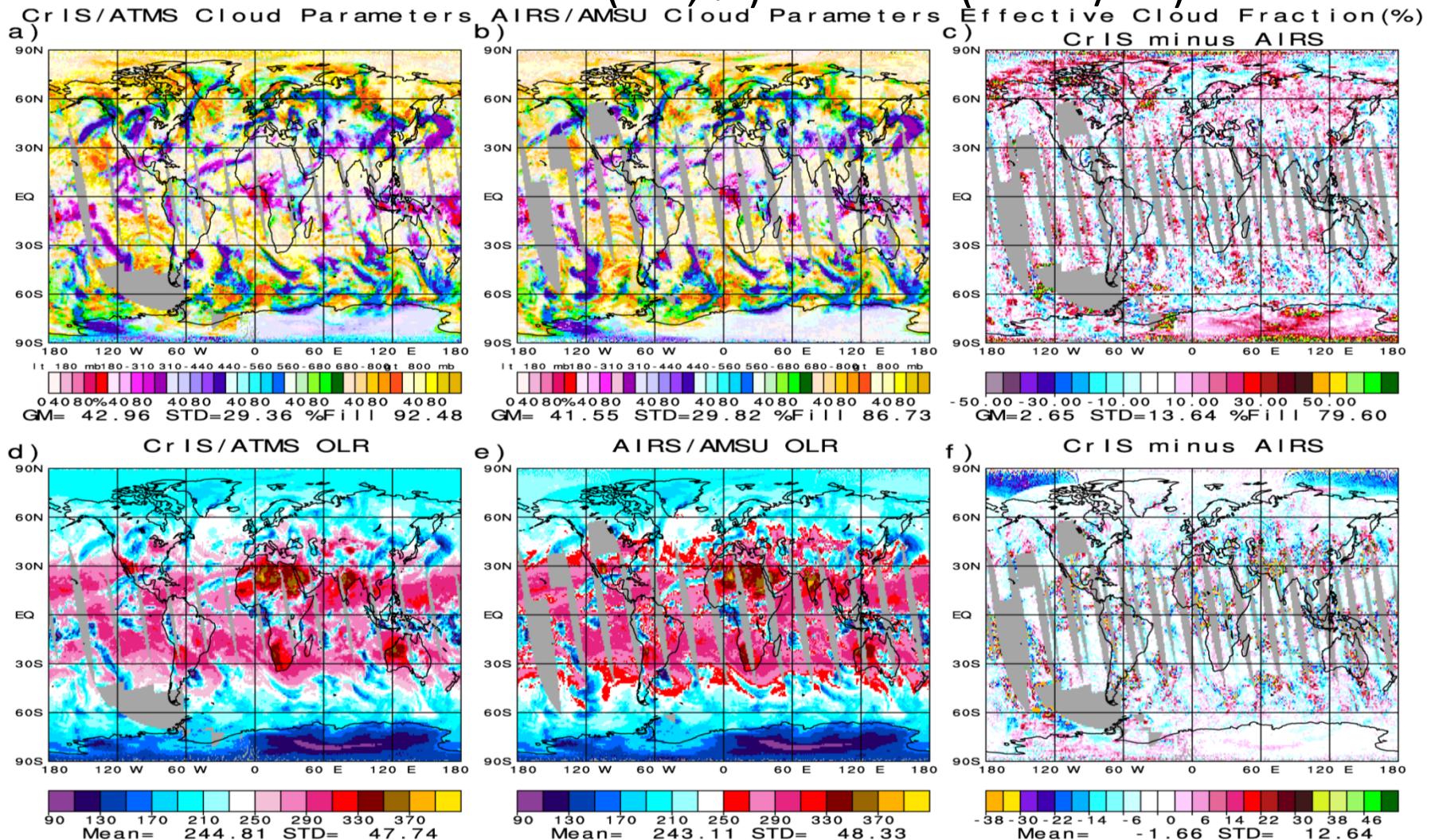
April 15, 2016 1:30 PM
Surface Skin Temperature (K) and
Total Precipitable Water (cm)



CrIS/ATMS surface skin temperatures agree very well with AIRS/AMSU over ocean, but have some differences with AIRS/AMSU over land, especially over the poles. Measurement times in a given location are not the same, nor are the satellite zenith angles.

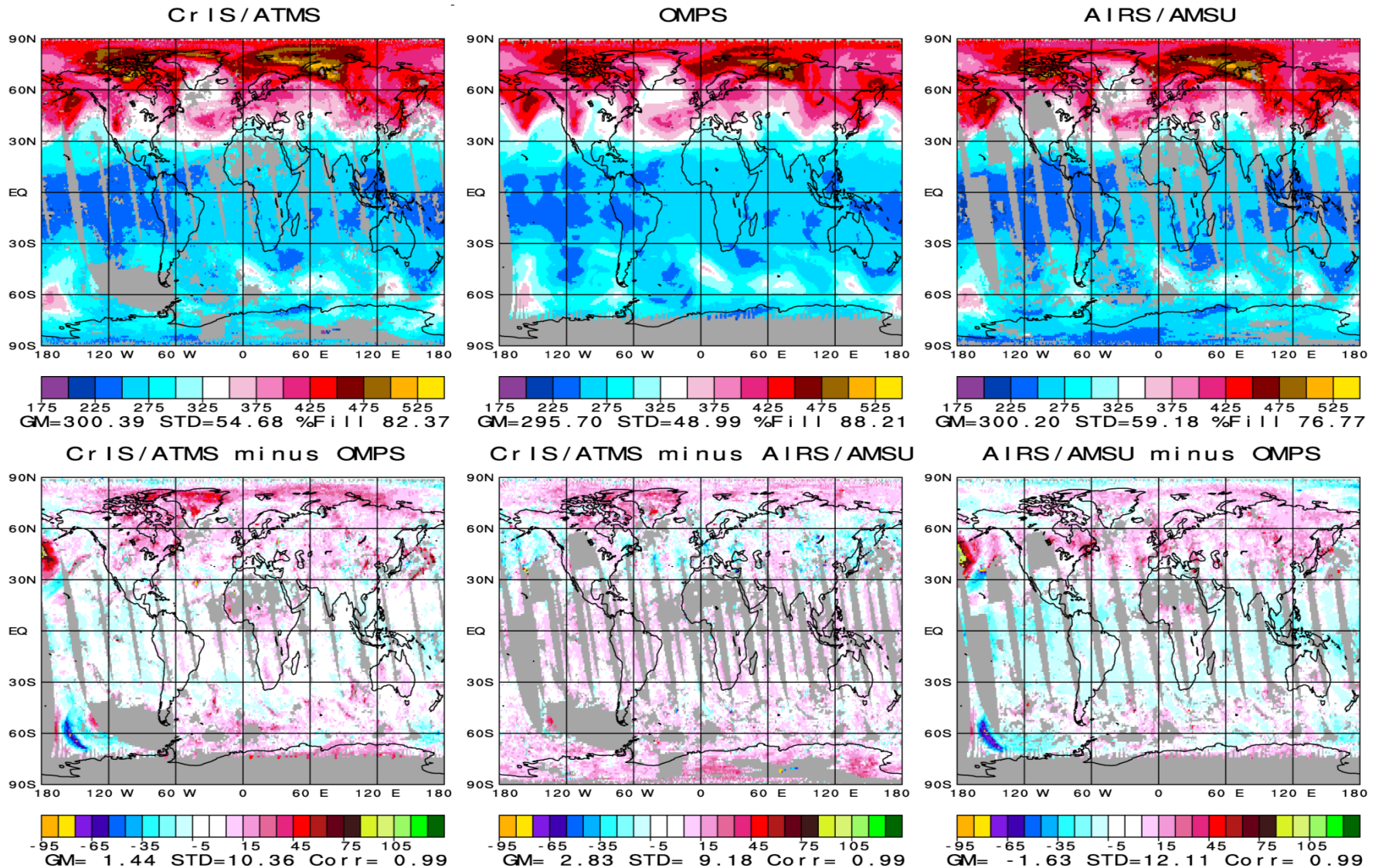
April 15, 2016 1:30 PM

Cloud Parameters (mb, %) and OLR (Watts/m²)



CrIS/ATMS and AIRS/AMSU cloud parameters and OLR agree well with each other, especially given the fact that measurement times and zenith angles are not the same as each other. Differences poleward of 75N on either side of the dateline are a result of different samples being included in the two data sets for the "same day".

April 15, 2016 1:30 PM Total Ozone (DU)



CrIS/ATMS total ozone products match OMPS even better than do AIRS/AMSU, which is already extremely good.

Scientific Findings and Recommendations

- Version-6.46 temperature profiles, water vapor profiles, and especially total O_3 , are very much improved compared to Version-6. With minor tweaking, Version-6.46 is a good candidate for use in Version-7.
- JPL Version-6.4.6 and JPL Version-6.4.6 AO monthly mean products agree extremely well with each other. Version-6.4.6 AO is accurate enough that there is not necessarily a need to process both Version-7 and Version-7 AO data sets.
- Single day comparisons show Version-6.46 CrIS/ATMS and Version-6.46 AIRS/AMSU products agree extremely well with each other. We need to demonstrate agreement of Version-6.46 CrIS/ATMS and Version-6.46 AO products on a monthly mean basis for different months and years. CrIS/ATMS and AIRS/AMSU monthly mean comparisons showed excellent agreement with each other using a previous version.