

# The CM SAF ATOVS tropospheric water vapour and temperature data record

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# Overview

- Technical specifications
- Methodology
- Exemplary results
- Evaluation

All products and documents available at:

[www.cmsaf.eu/wui](http://www.cmsaf.eu/wui)

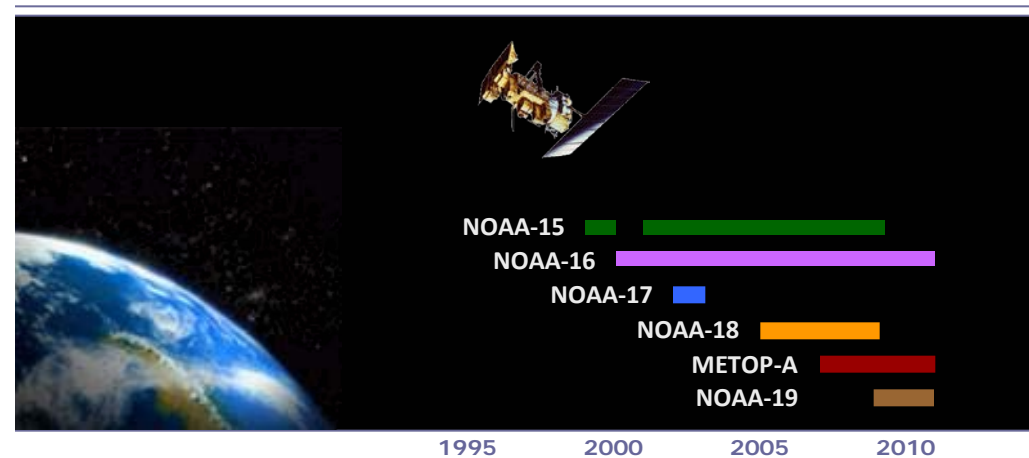
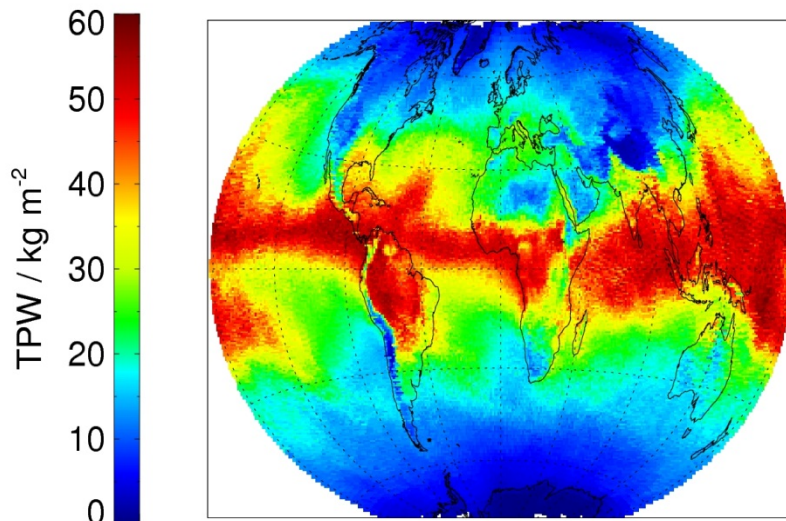
[www.cmsaf.eu/docs](http://www.cmsaf.eu/docs)

[www.cmsaf.eu/doi](http://www.cmsaf.eu/doi)

Global water vapour and temperature profiles (total columns, 5 layer integrals and averages, 6 level values, absolute and as relative humidity) with  $(90\text{km})^2$  spatial resolution as daily and monthly averages, available in netCDF CF1.5.

doi: [10.5676/EUM\\_SAF\\_CM/WVT\\_ATOVS/V001](https://doi.org/10.5676/EUM_SAF_CM/WVT_ATOVS/V001)

- **Basic input:** Advanced TIROS Operational Vertical Sounder.
- **Operational products:** January 2004 – present (continued).
- **Data record:** January 1999 – December 2011.



- **“Inter-calibration”**:  
Simultaneous nadir overpasses (SNO) coefficients for AMSU-B and MHS from V. John (UKMO, personal communication).
- **Pre-processing**:  
ATOVS and AVHRR Pre-processing Package (AAPP) software from NWP SAF to convert I1c ATOVS data (from MARS archive) to level 1d data (BUFR decoding, reordering, mapping).
- **Retrieval**:  
Optimal estimation scheme - International ATOVS Processing Package (IAPP; Li et al., 2000) using ERA-Interim (Dee et al., 2011) as background. This includes cloud detection and removal and bias adjustment.

In principle, kriging can be regarded as a prediction of a value  $x$  at a location  $p_0$  by using information at surrounding positions  $p_i$ :

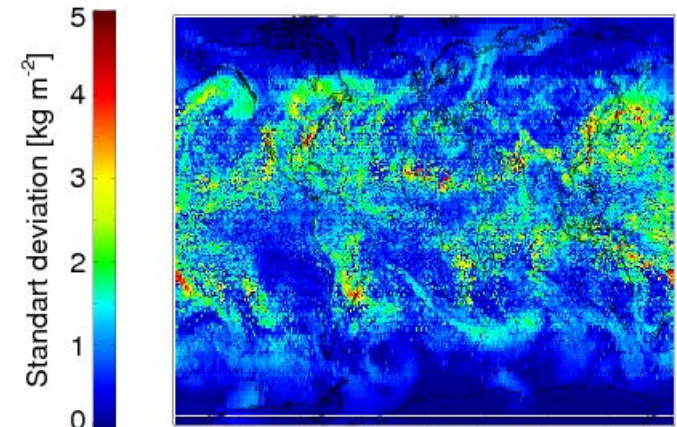
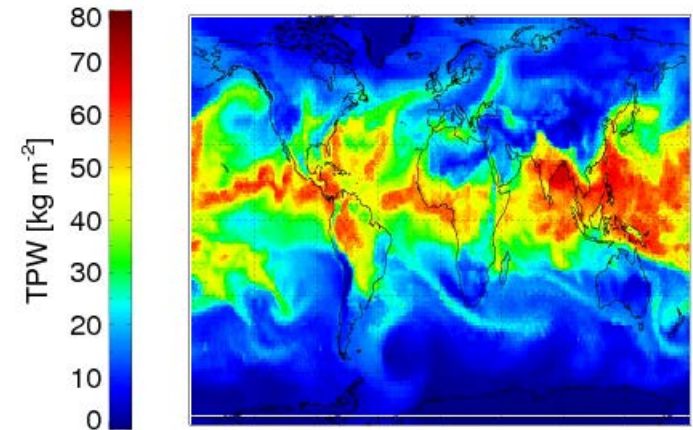
$$x_0 = \sum_{i=1}^n \lambda_i (x_i + \Delta x_i)$$

Using a month of data we get the following (more details in Schröder et al., 2013):

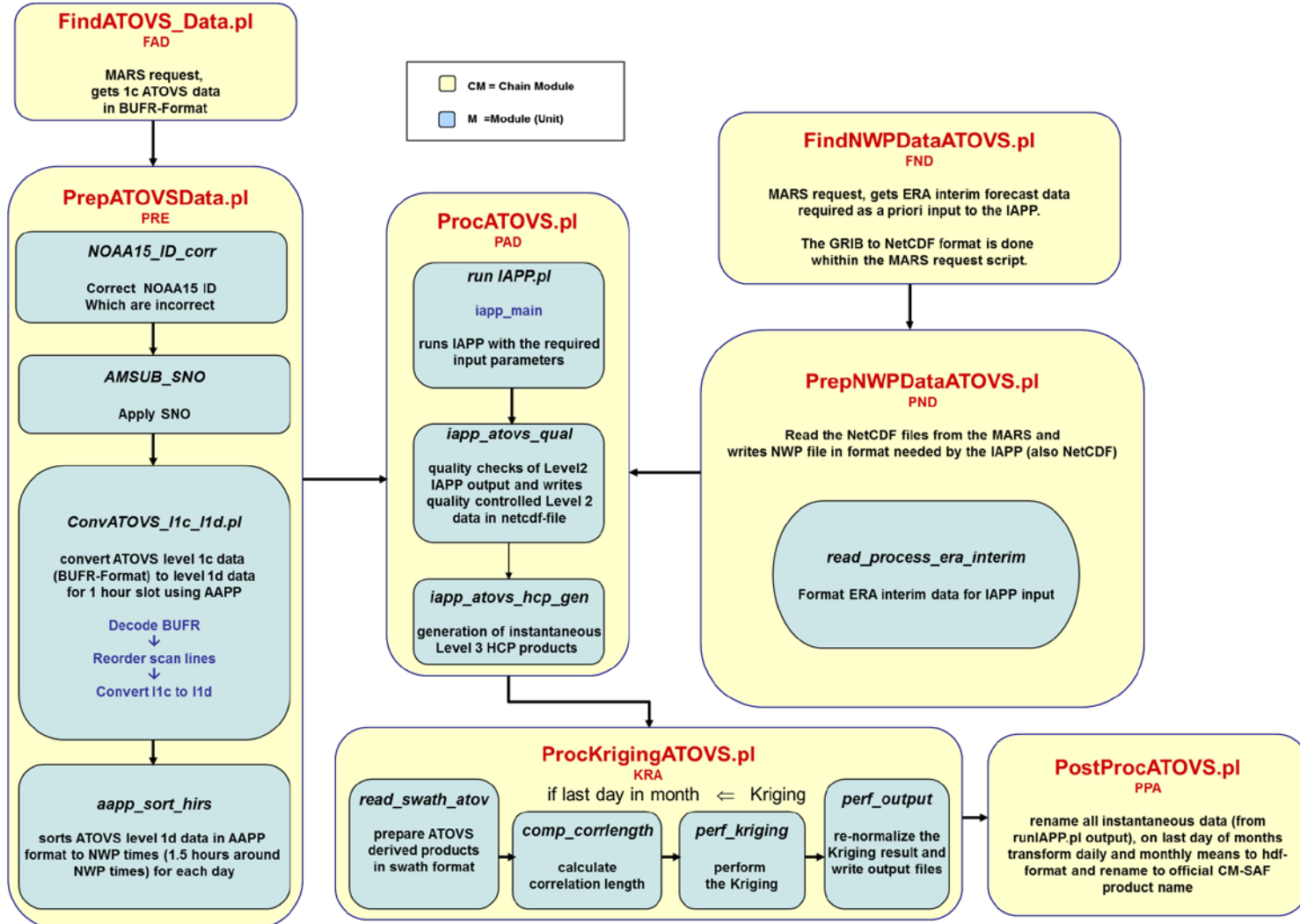
$$\sum_{t=1}^M \left( x_0 - \sum_{i=1}^n \lambda_i (x_i - \Delta x_i) \right)^2 = \min$$

## Advantages:

- Gap filling,
- Kriging uncertainty estimate per grid.

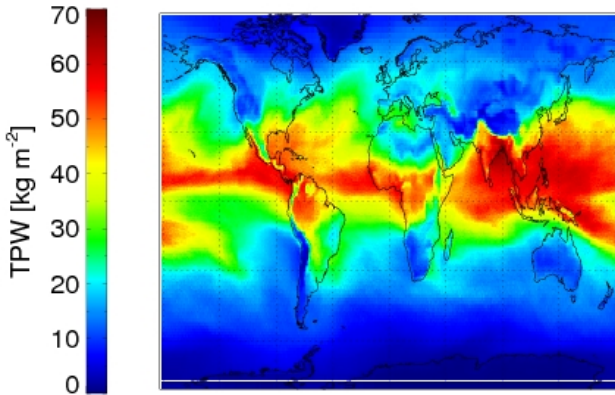


# Flow chart

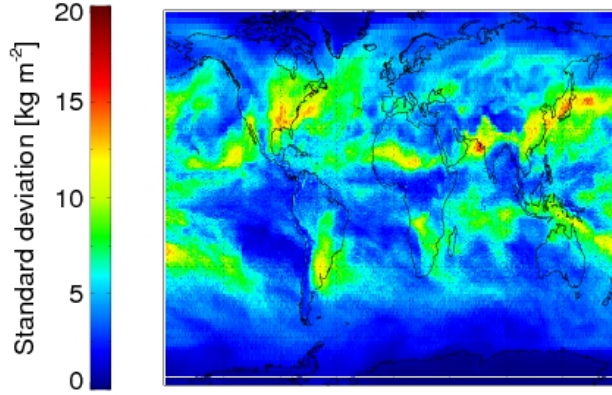


## TPW for September 2007

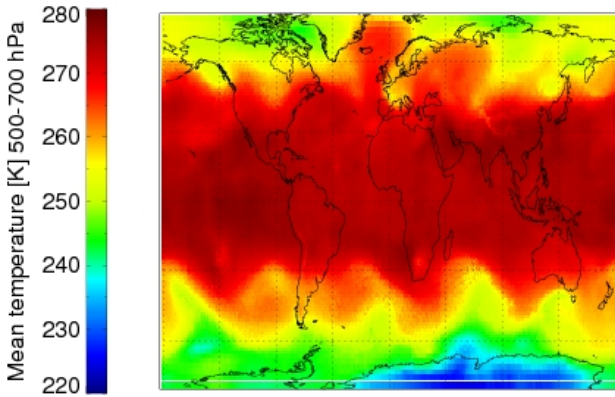
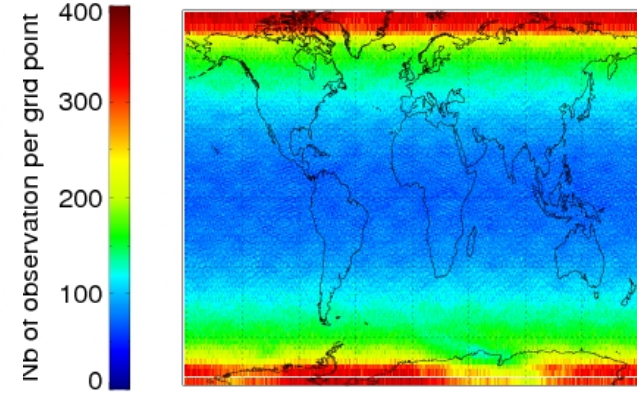
Mean



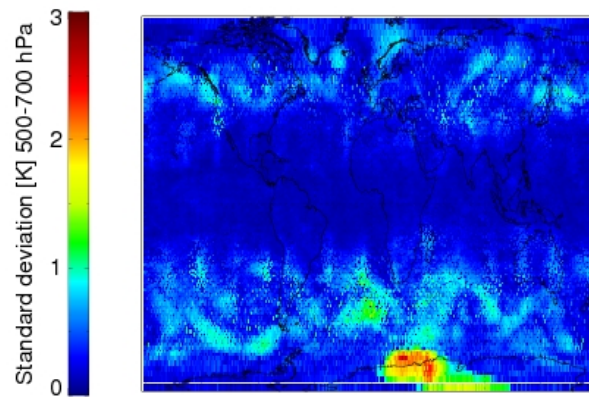
Standard deviation



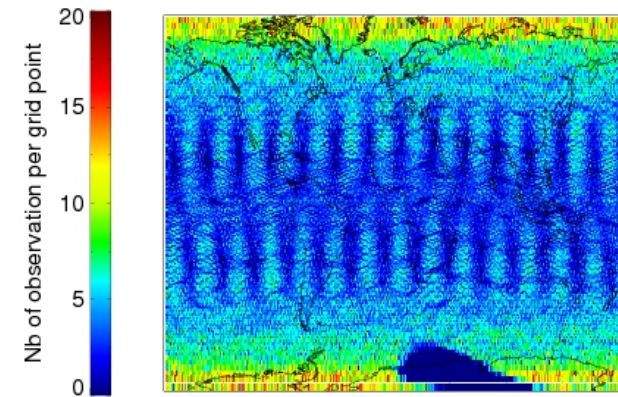
Number of valid obs.



Mean



Kriging error



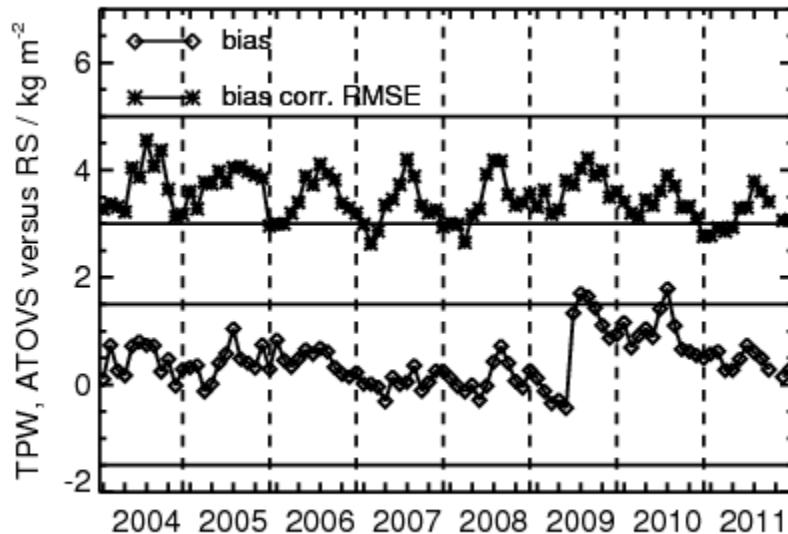
Number of valid obs.

T at 500-700 hPa on 27<sup>th</sup> September 2007

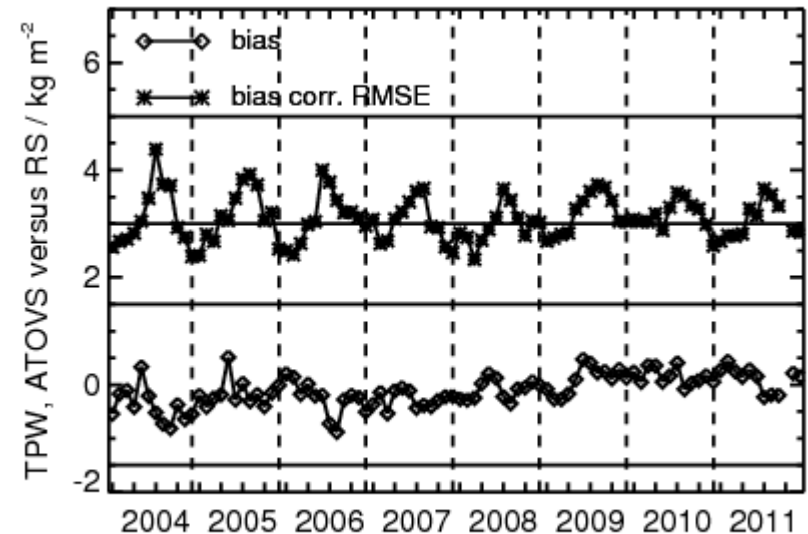
# Evaluation GUAN

- GCOS Upper-Air Network radiosonde observations.
- Operational data vs interim climate data record.
- TPW: total precipitable water.

operational product



ICDR



Consistent processing leads to improved stability.



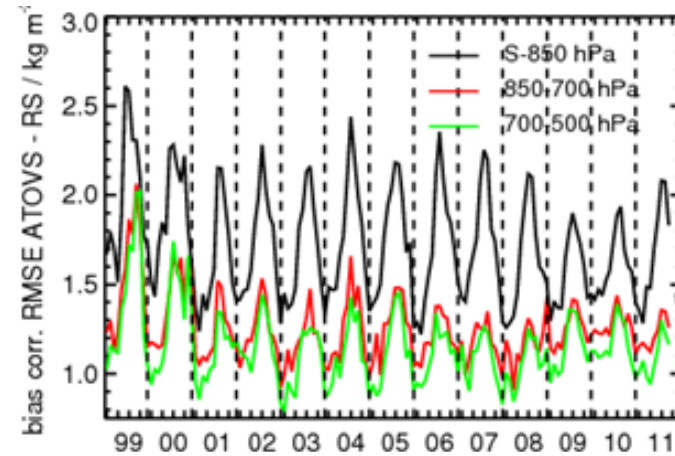
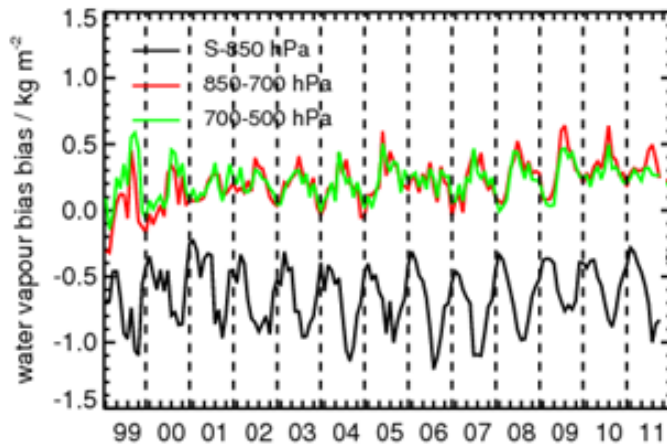


## Water vapour, layer integrals

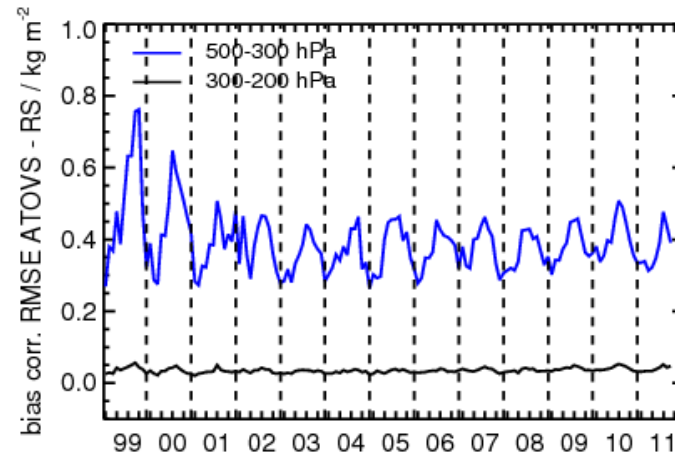
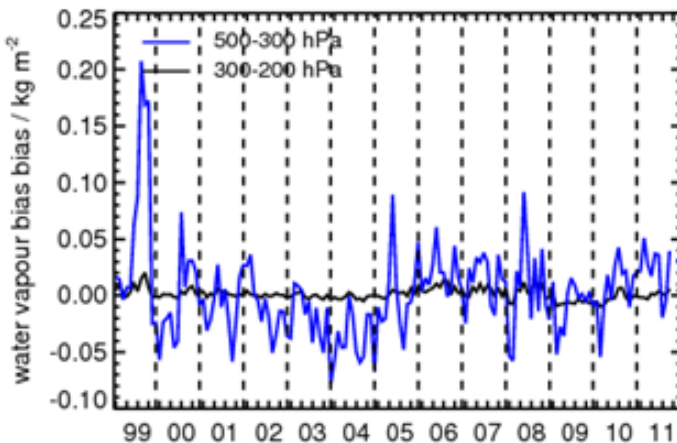
Bias

RMSD

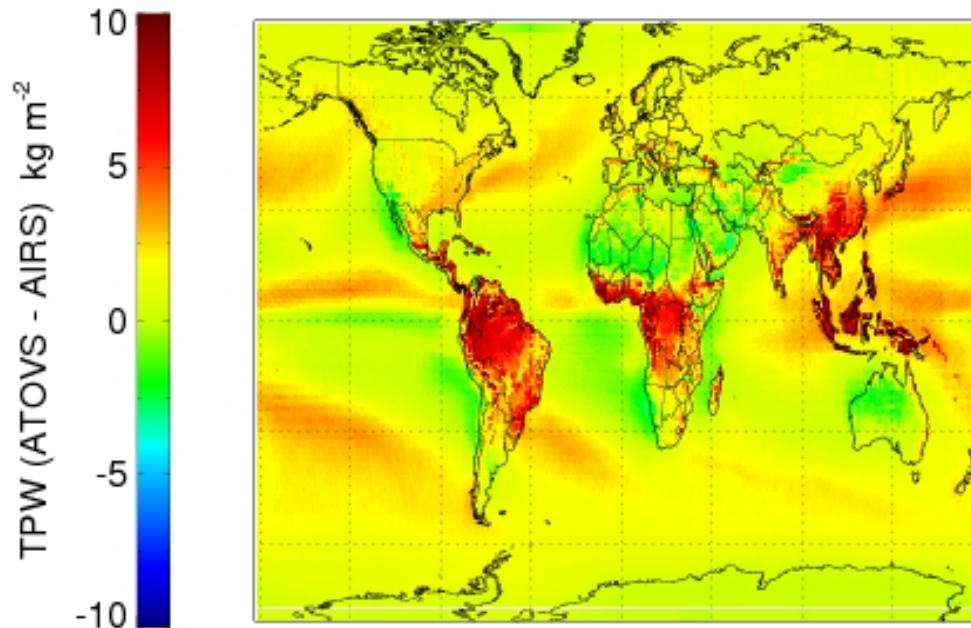
lower levels



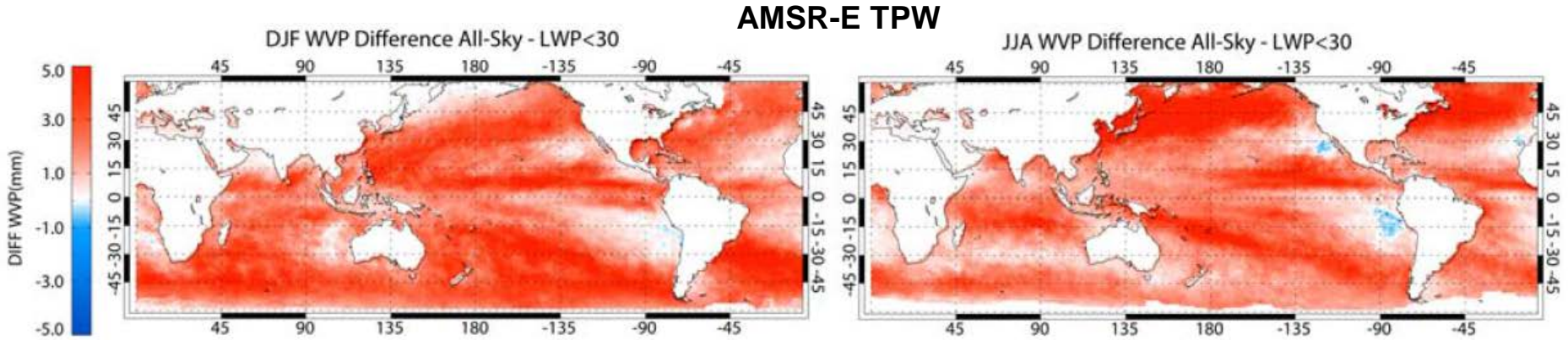
upper layers



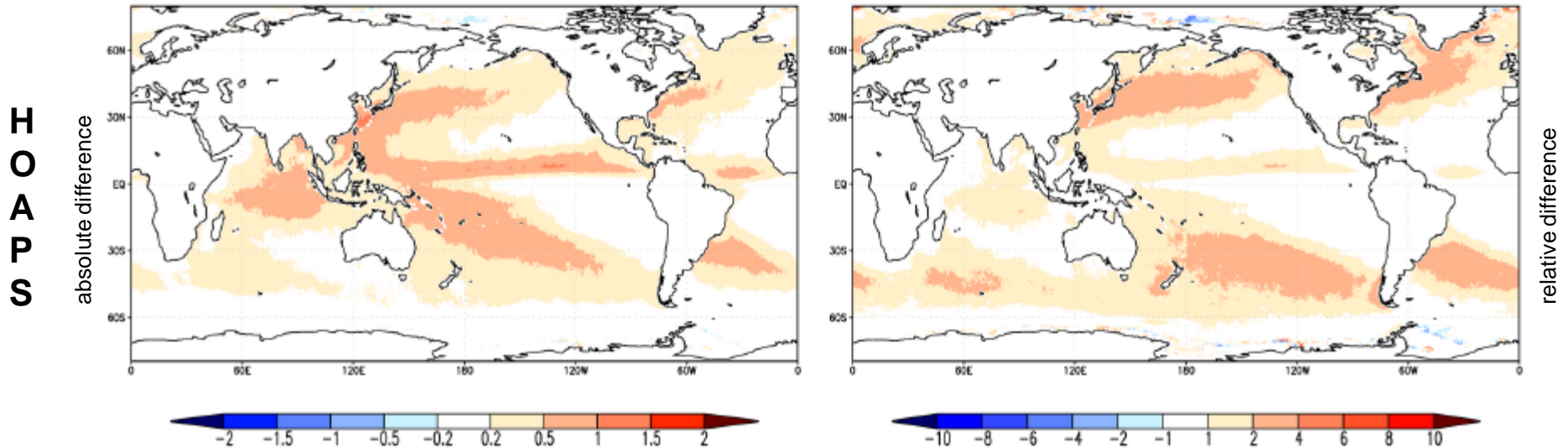
## Atmospheric InfraRed Sounder (AIRS), AIRX2RET product (version 5)



- Positive bias coincides with precipitation (ITCZ, extra-tropics, see next slide for an explanation).
- Maxima in bias over tropical land areas.

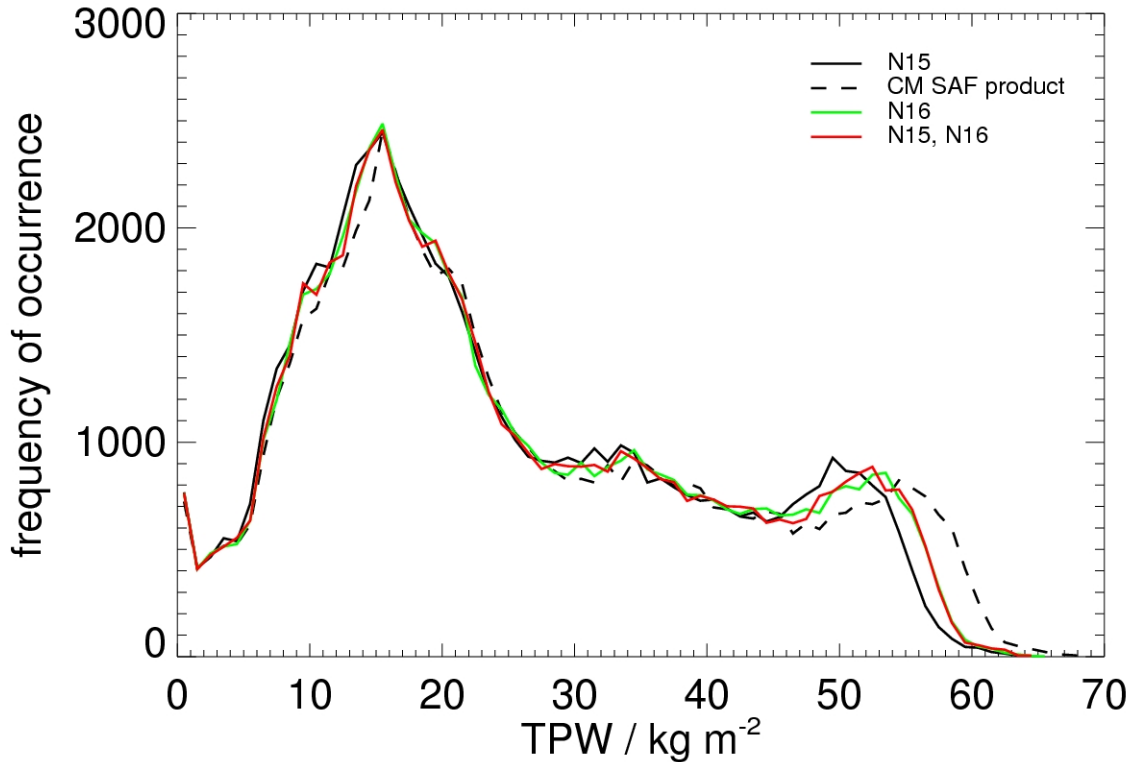


- Clear sky bias between clear sky and “all sky” observations.



- Bias induced by gap-filling.

*Schröder et al., 2013*



June 2002

CM SAF: Kriging

others: classical averaging

**Kriging dominates over diurnal sampling.**

- CM SAF ATOVS product reveals reasonable quality.
- NOAA-15 has smallest difference to AIRS, removal of NOAA15 introduces breakpoint (not shown).
- Breakpoints more evident in comparison to AIRS than in comparisons to GUAN → multiple + global data records needed for stability assessment.
- Inter-calibrated FCDRs, a reconsideration of the gridding procedure will improve the quality of the ATOVS record.
- Potential future enhancement:  
Extend to joint hyperspectral and microwave retrieval products.

## Thanks for your attention!



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