

Status of DWD contribution to EMiR

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- MWR TCWV retrieval
- Processing and very first results
- Validation plan
- G-VAP: GNSS analysis and MWR data upload

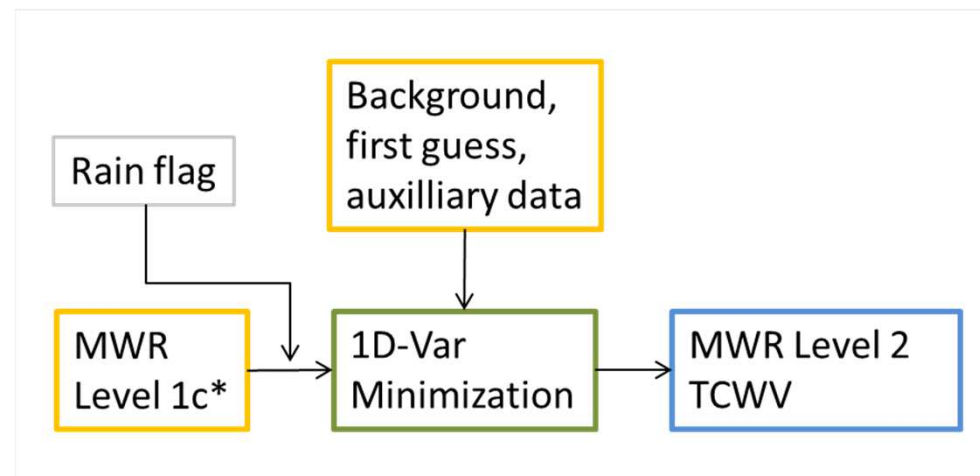
Achieved

- Technical Note on 1D-Var
- Prototype processing and processing of entire time series
- Strong involvement in homogeneity/bias correction analysis (Level 1)
- 1D-Var MWR retrieval
- Drafting and submission of ATBD on MWR 1D-Var, with support from Ralf and Frank

Starting point: ESA DUE GlobVapour MWR 1D-Var

(based on NWP SAF software, ENVISAT only)

- ➔ Finds optimal fit between background profiles (ERA-Interim or climatology) and satellite data
- ➔ Changes state estimate x iteratively towards most likely solution
- ➔ Weights background and obs according to input error covariances
- ➔ Forward model: RTTOV6.7, calculates T_b from background profiles



Flowchart of MWR processor

$$J(x) = \frac{1}{2} (x - x^b)^T B^{-1} (x - x^b) + \frac{1}{2} [y^o - H(x)]^T (E + F)^{-1} [y^o - H(x)] + J_s$$

The cost function to be minimized.

Source: ATBD L2 MWR (April 2015)



EMiR-specific code changes

- Implementation of ERS-1/2 RTTOV coefficient files
- FORTRAN I/O interface modifications to read ERS data
- RTTOV-simulated and MWR-observed Tb's included in NetCDF 1D-Var output files
- Implementation of land/sea-ice flag: all pixels < 100 km distance to land/sea-ice are masked (ACE-2, GTOPO30, in coop. with Ralf)
- Changes in collocation routine, with special focus on correct vertical interpolation of ERA-Interim profiles on RTTOV levels whilst conserving ERA-Interim column totals*
- Numerous code changes and development for output data postprocessing in IDL and R

More:

- Implementation of bias correction based on channel and instrument specific values, estimated in cooperation with Ralf (see deliverable on calibration):

| | 23.8 GHz | 36.5 GHz |
|----------|----------|----------|
| ENVISAT: | -0.3 | 3.43 |
| ERS2: | -0.85 | 3.0 |
| ERS1: | 1.55 | 5.65 |

- Error covariances
 - Background error covariance (B) matrix: tests planned with changing the background error for T
 - Observation error covariance (R) matrix: noise estimates for MWR (pre-launch)

Processing of entire time series

implementation done, transfer done, processing done
but...

based on:

- MWR data from Bruno:
- bias correction from Ralf:

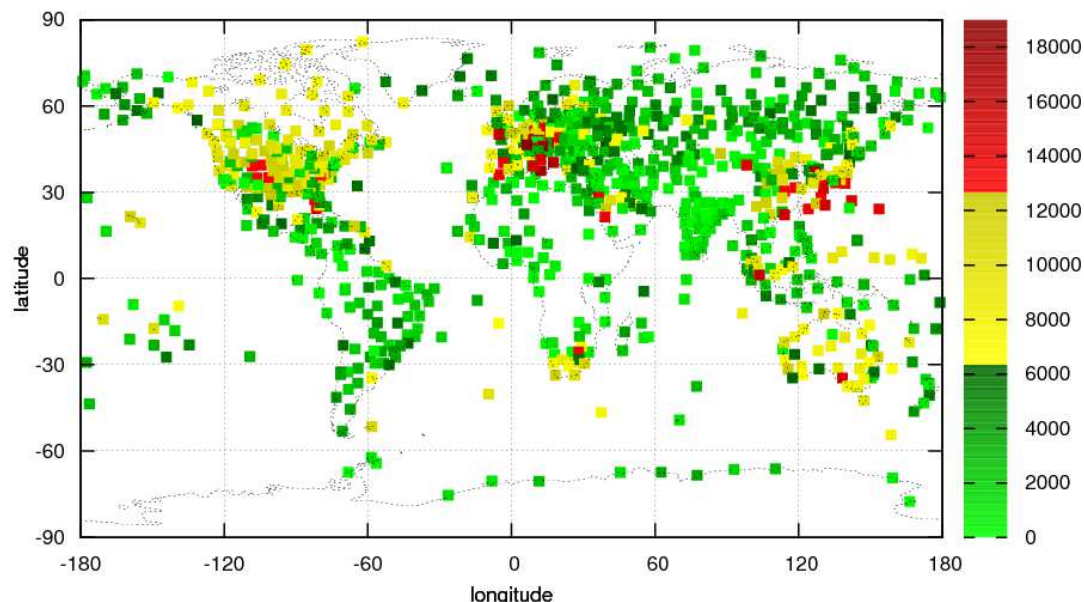
version 3.0, 07 Jan 2015
08 May 2015

- Utilise NCAR GNSS data and GUAN radiosondes as reference.
- Define collocation criteria and develop collocation software considering Level 2 data
- Analyze comparison results in terms of global accuracy (bias) and precision (RMSE)
- Assess accuracy relative to operational MWR product
(how to get access?)

- Utilise NCAR GNSS data and ARSA instead of GUAN radiosondes as reference (more stations including GUAN and bias corrected relative to IASI).
GNSS and ARSA have been downloaded.
- Define collocation criteria and develop collocation software considering Level 2 data.
Existing collocation software adapted to utilise GNSS and ARSA, current setting: 30 min, 100 km (can be easily changed).

Analysed Radiosoundings Archive (ARSA)

(ARSA, available from ARA/ABC(t)/LMD)

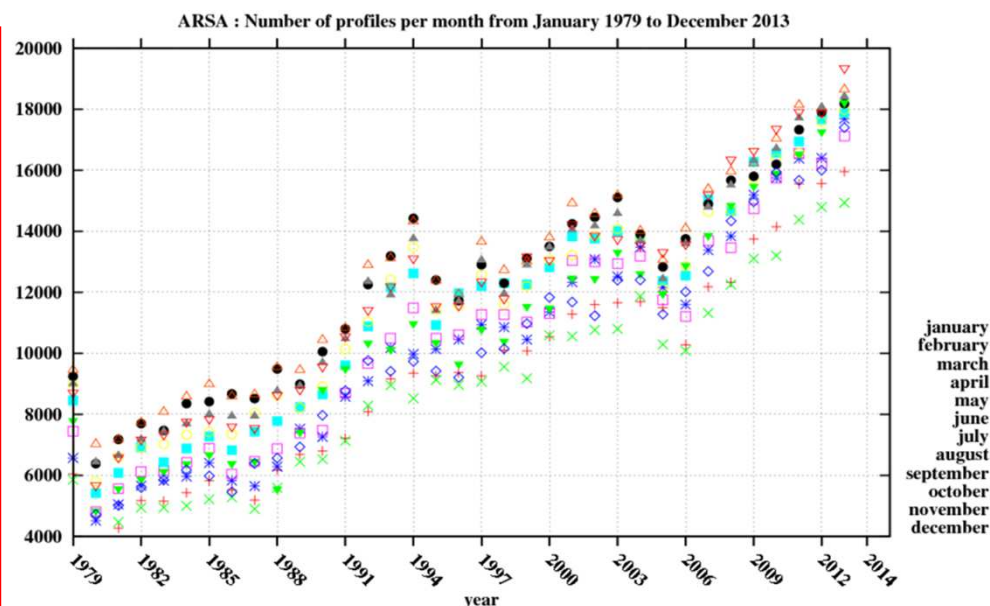


Courtesy: N. Scott, LMD

Number of profiles available within 25 years (1979-2013), typically increasing with time and with large spatial variability.

- Format problems, redundant RS and levels, **unrealistic jumps**
- Physically implausible values,
- Internal inconsistencies among variables,
- Climatological outliers,
- Temporal and vertical inconsistencies in temperature, dew point temperatures.
- Empirical correction in UT to achieve consistency with IASI.

Intense quality control needed and applied!

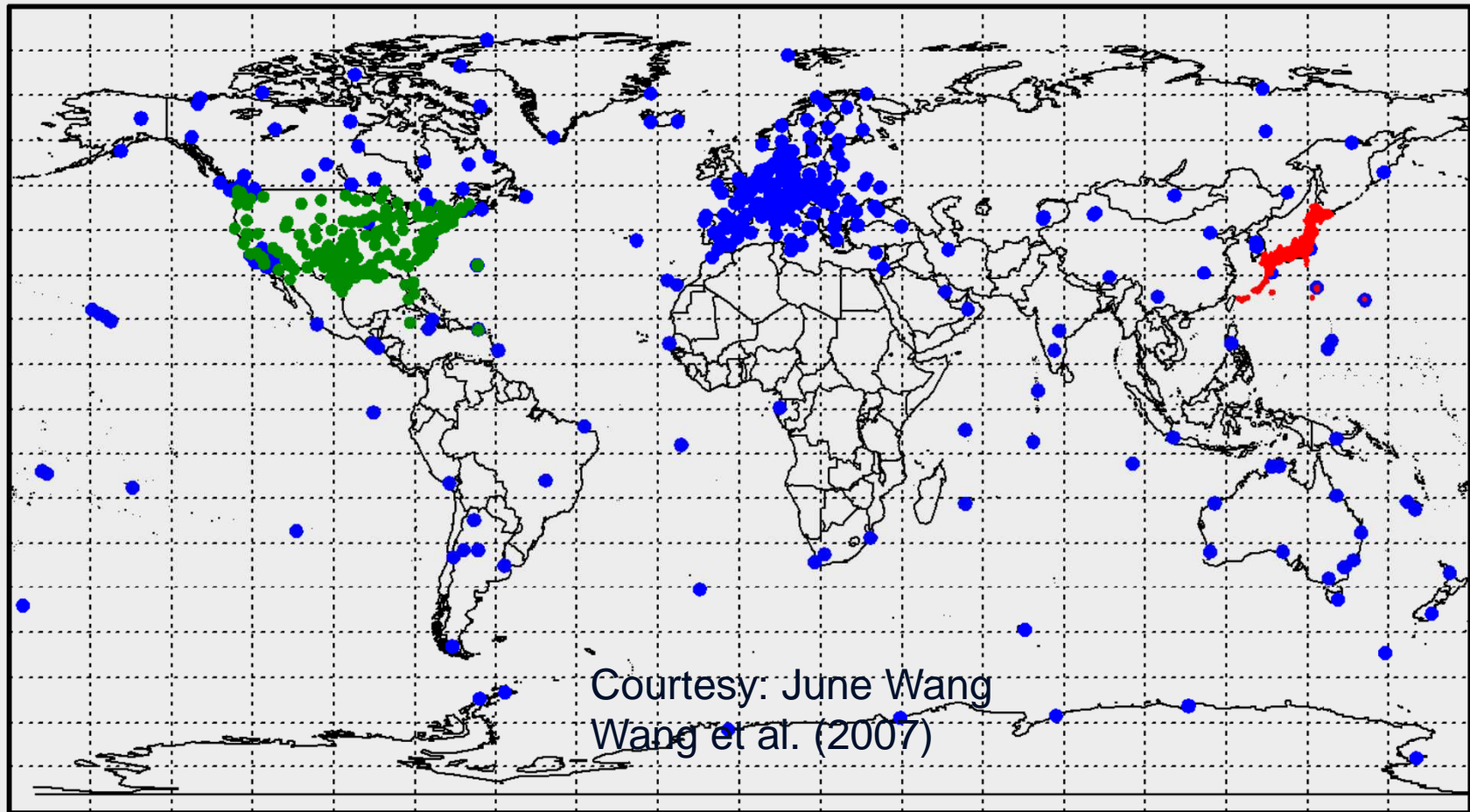


GEWEX water vapor assessment

Analysis of the diurnal sampling bias: Interim results

NCAR global, 2-hourly GNSS-PW data (1995-present)

- Jan. 1995 to Dec. 2012
- 2 hourly (0100, 0300, ..., 2300 UTC)
- 380 IGS, 169 SuomiNet, 1223 GEONET
- Accuracy: < 3 mm
- Ps, Tm, ZHD and ZWD also available
- <http://dss.ucar.edu/datasets/ds721.1/>

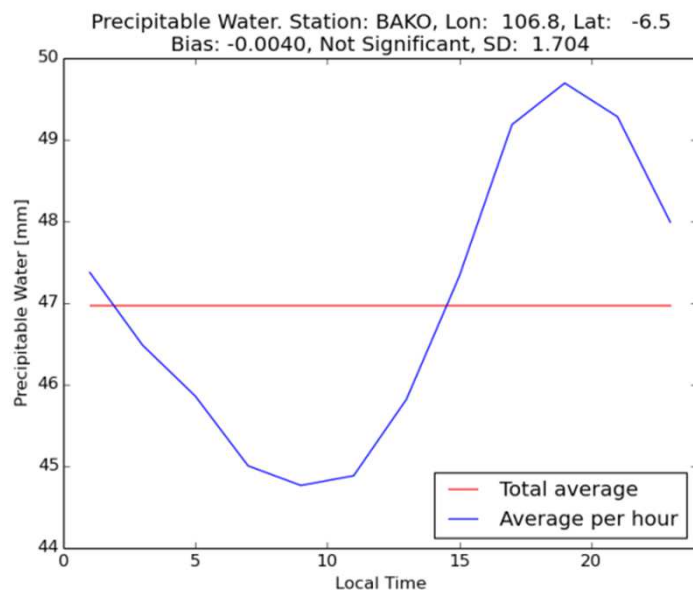


Method:

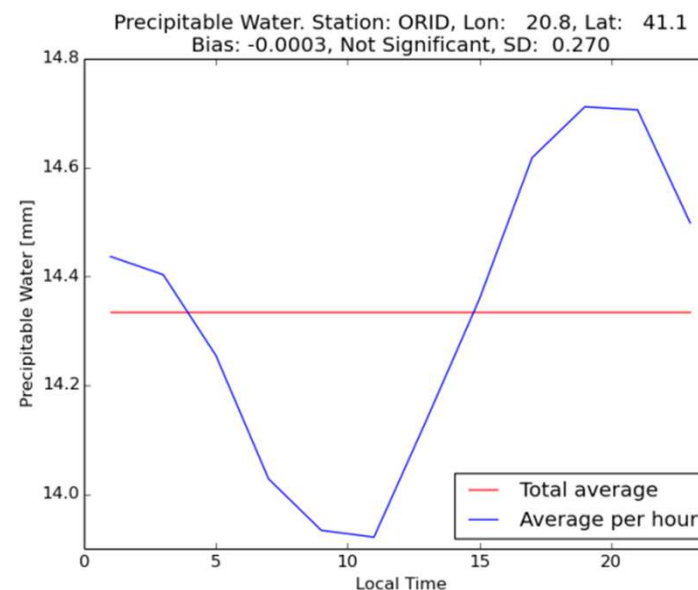
- Full climatology for period 2004-2008
- Data averaged according to overpass times (e.g., 04-06 and 16-18 LT)
- Difference between binned data and climatology



Indonesia

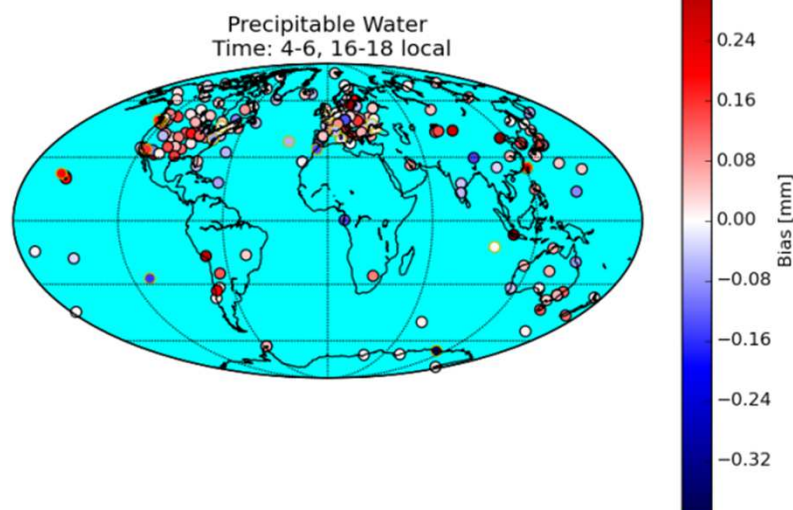


Macedonia

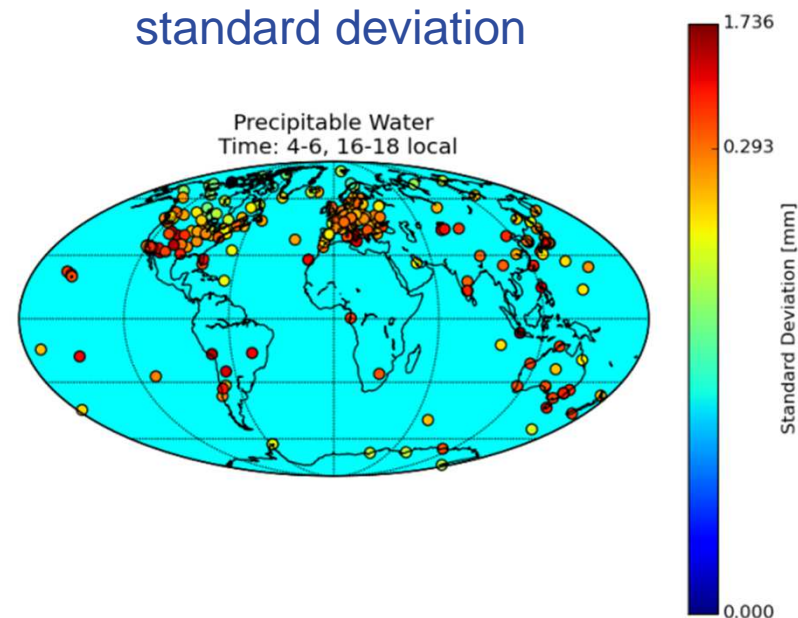


4-6, 16-18 LT

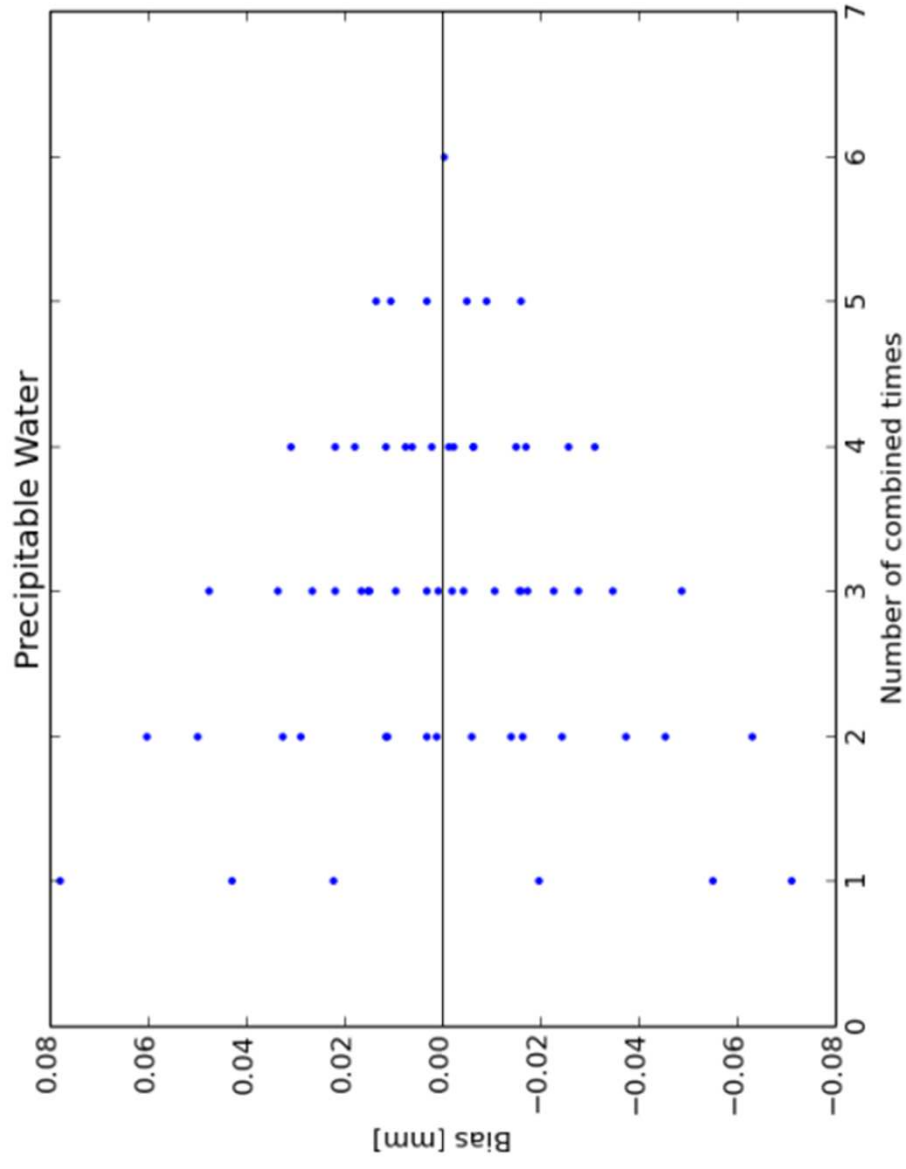
bias



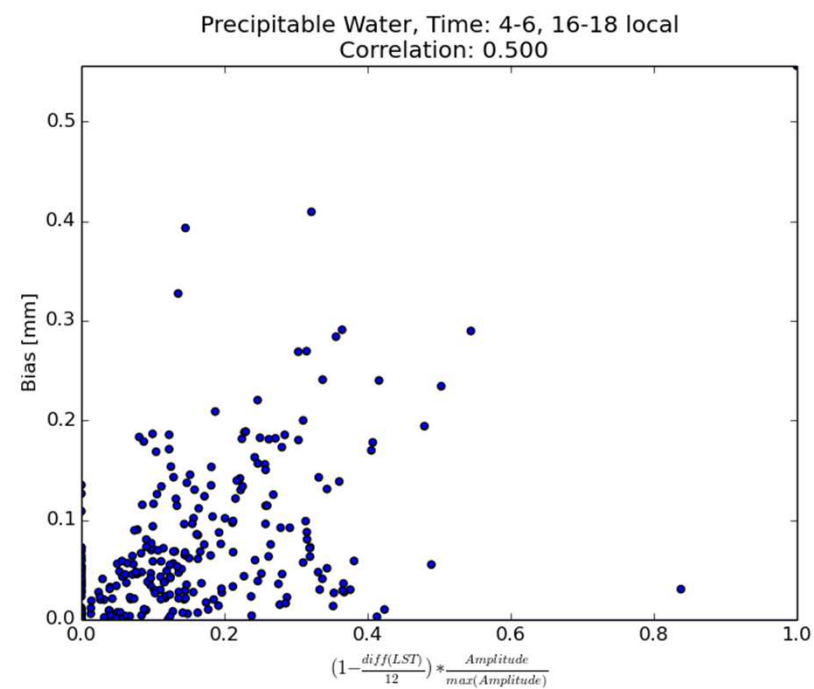
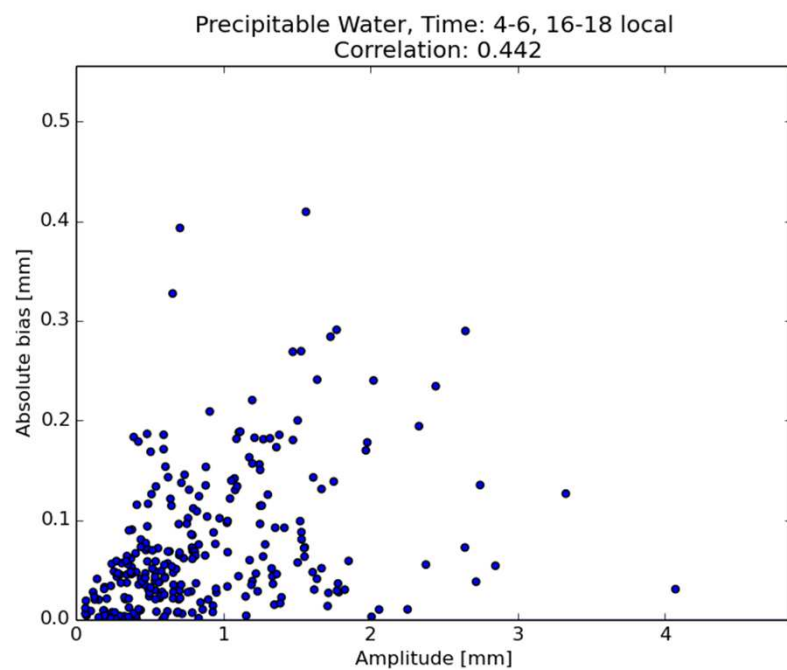
standard deviation



Available per month and LT.



Absolute bias



Next...

- Potentially minor retrieval adaptations
- Reprocessing
- Validation
- Consideration of MWR record in G-VAP (?)!