

Abstract

As a substantial part of the new ESA Data User Element GLOBVAPOUR project, DWD and project partners will be conducting a comprehensive IASI retrieval inter-comparison study. The focus of this effort is directed towards the identification of an optimal algorithm scheme for climate monitoring of atmospheric water vapour, considering the retrieval quality and limitations, but also the performance and applicability in re-processing frameworks. The study will include several IASI retrieval algorithms provided by the project partners and additionally participating groups. Subsequently, a comprehensive data set for atmospheric water vapour will be constructed in conjunction with SEVIRI. This data set is expected to be of novel quality on a high vertical and temporal resolution. This presentation gives an overview on the ESA DUE GLOBVAPOUR project and highlight the aims, details, and first results of the IASI retrieval inter-comparison study.

The ESA DUE GlobVapour Project

The ESA DUE project series aims at bridging the gap between research projects and the sustainable provision of Earth Observation climate data products at an information level that fully responds to the operational needs of user communities. The ultimate objective of GlobVapour (www.globvapour.info) is to provide long-term coherent water vapour data sets exploiting the synergic capabilities of different EO (ESA and non-ESA) missions allowing for improved accuracies and enhanced temporal and spatial sampling better than those provided by the single sources. The project seeks to utilize the increasing potential of the synergic capabilities of past, existing and upcoming European missions (ERS-1 and 2, ENVISAT, METOP, MSG as well as relevant non-European missions and in-situ data) in order to meet the increasing needs for coherent long-term water vapour datasets required by the scientific community. GlobVapour will develop, validate and apply novel water vapour climate data sets derived from various sensors maximising the use of ESA data but also use other important space based data.

One of the data sets will be a merged product from water vapour retrievals from IASI and SEVIRI with the following properties:

- Temporal resolution: three hourly, monthly
- Temporal coverage: 2007 – 2008
- Vertical resolution: 3 layers (200hPa-500hPa, 500hPa-850hPa, 850hPa-surface)
- Horizontal resolution: $(0.25^\circ)^2$ grid

The advantages of this product result from both the high quality of IASI retrievals with high vertical resolution and the high temporal resolution of SEVIRI covering the diurnal cycle of the water vapour. One key scientific questions will be, if and to which extend a mid- to long-term water vapour analysis, merged from two different instruments, is superior to each of the single input data sets.

In the framework of this project a IASI retrieval assessment is performed employing various existing IASI retrieval schemes to identify the most suitable scheme for this purpose.

IASI water vapour retrievals

Potentially participating IASI retrieval algorithms:

- IASI retrieval algorithm at EUMETSAT (EUMETSAT-IASI, 2009)
- IASI retrieval algorithm at DWD
- IASI retrieval algorithm at UK MetOffice
- IASI retrieval algorithm at DLR
- IASI retrieval algorithm at NOAA

Only one retrieval product (EUMETSAT) has been included so far.

This assessment is open to other algorithms/institutions also.

Validation approach

Validation sites:

- SGP Central Facility, Lamont, Oklahoma
- NSA Atqasuk Facility, Atqasuk, Alaska

Reference instruments used:

- Radiosonde, MWR

IASI data selection:

- Total columnar and profiles of water vapour in closest clear-sky pixel with distance $< 0.25^\circ$

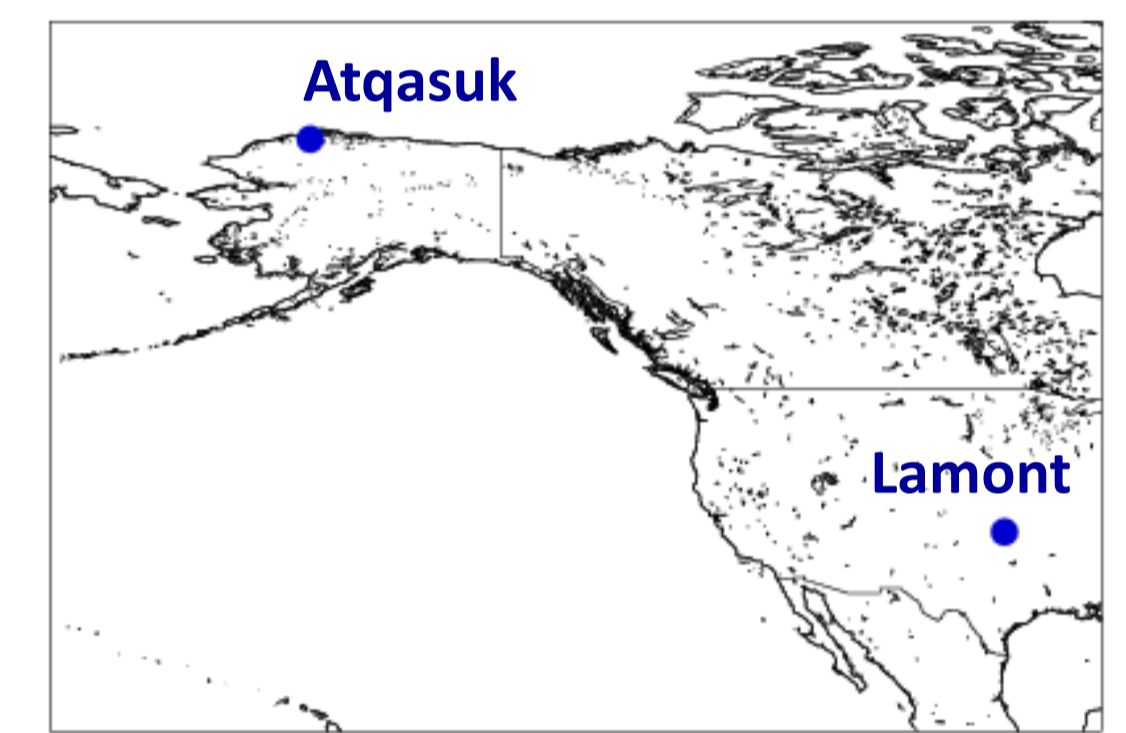


Figure 1. Location of the ARM sites used.

Validation – Lamont ARM site

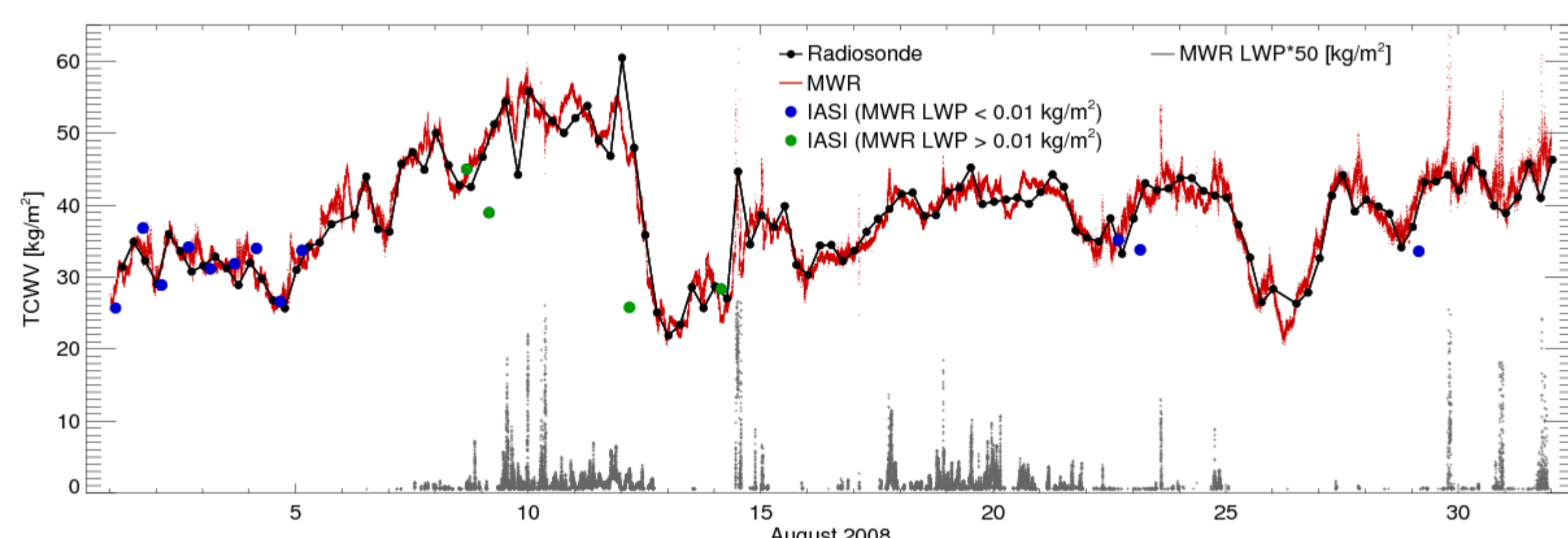


Figure 2. Time series of total columnar water vapour as derived from ground-based microwave radiometer (MWR) and radiosonde as well as from IASI measurements. MWR LWP is also shown as further indication of cloud contamination.

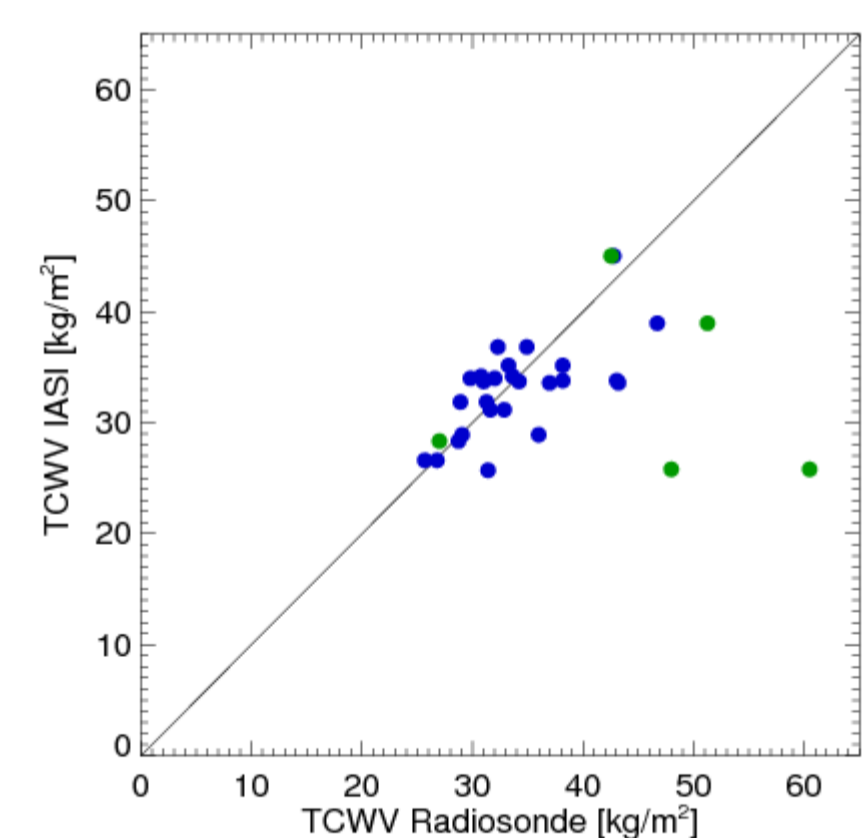


Figure 3. Scatter plot of collocated radiosonde and IASI total integrated water vapour.

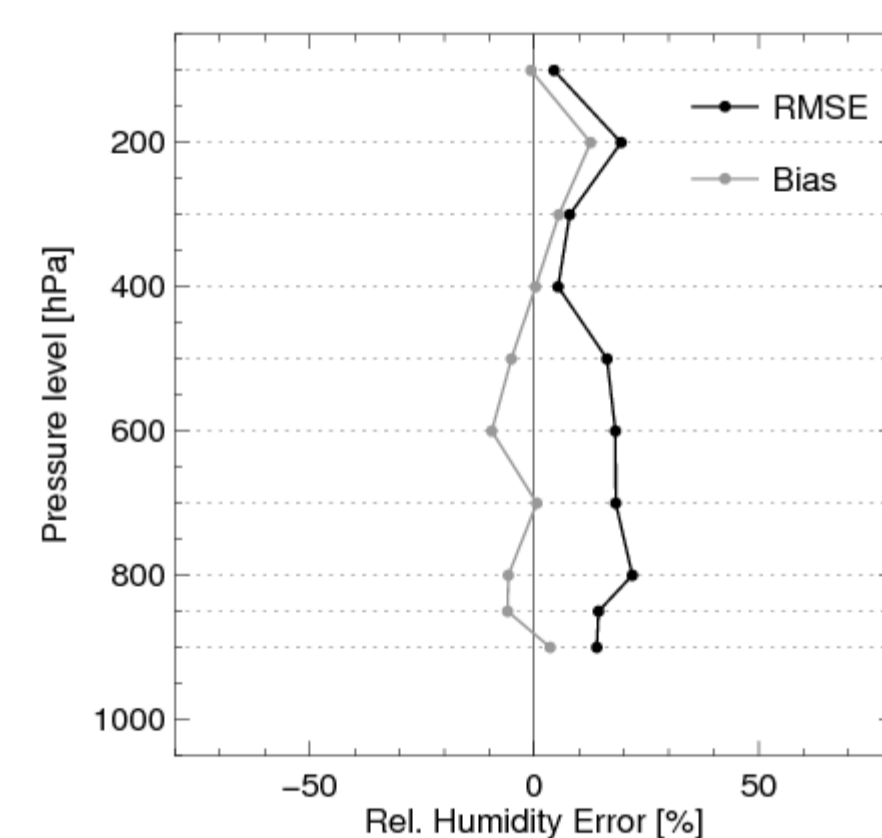


Figure 4. IASI water vapour retrieval profiles compared with radiosondes.

Validation - Atqasuk ARM site

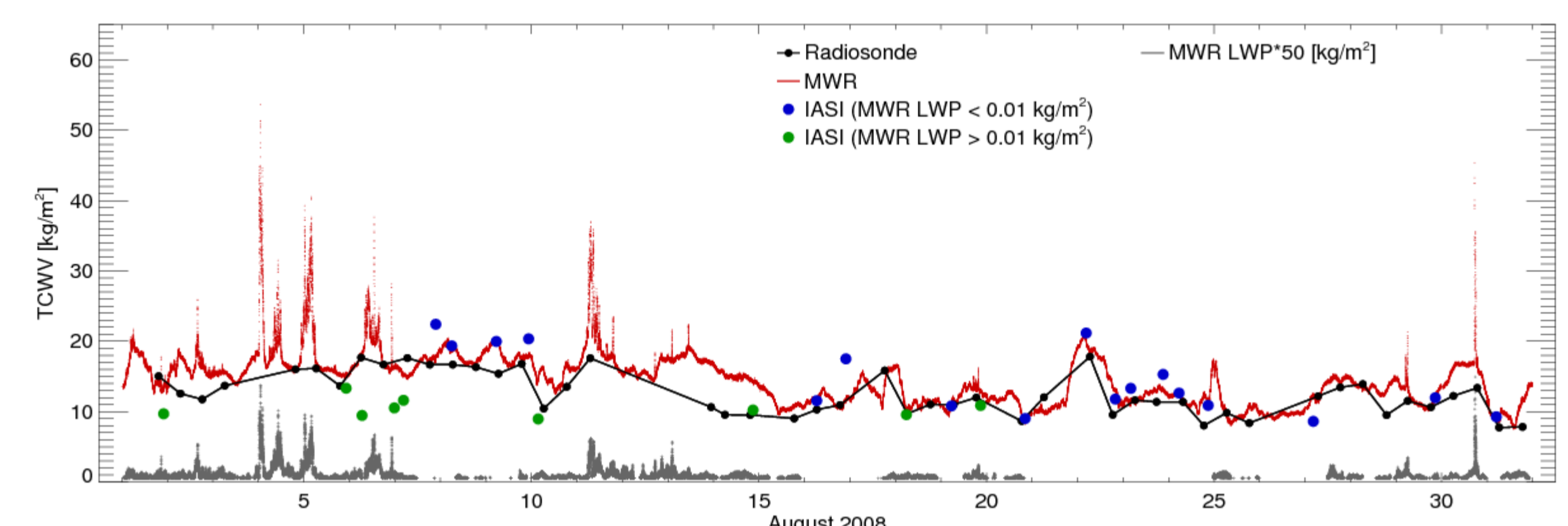


Figure 5. Time series of total columnar water vapour as derived from ground-based microwave radiometer (MWR) and radiosonde as well as from IASI measurements. MWR LWP is also shown as further indication of cloud contamination.

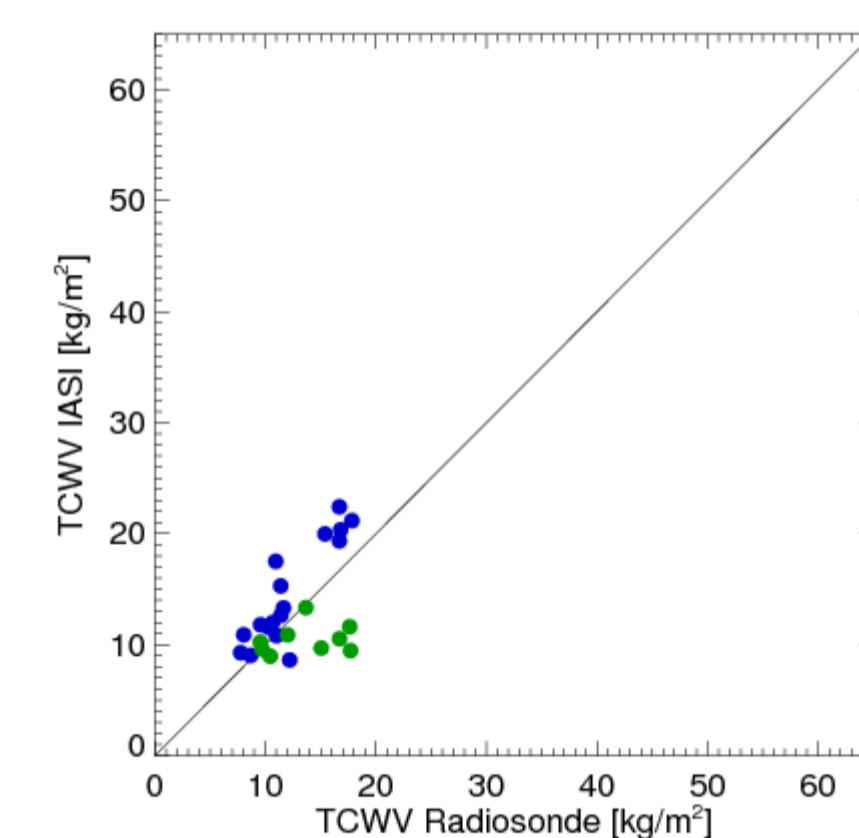


Figure 6. Scatter plot of collocated radiosonde and IASI total integrated water vapour.

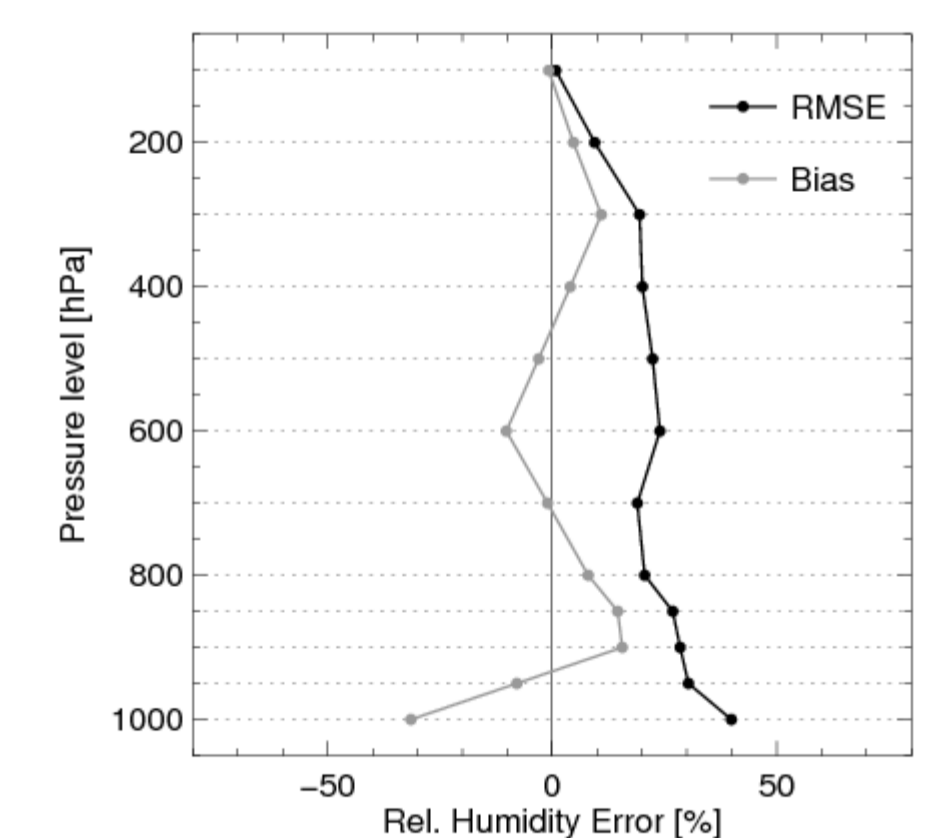


Figure 7. IASI water vapour retrieval profiles compared with radiosondes.

Summary and Outlook

Within the ESA DUE GlobVapour project an IASI assessment has been initiated aiming at the inter-comparison and validation of different existing IASI retrieval scheme. According to this assessment, the IASI retrieval scheme most suitable under climate monitoring aspects will be identified. In conjunction with a SEVIRI water vapour retrieval the selected IASI scheme will be used to derived long term water vapour data sets within the SEVIRI disc. So far only one retrieval scheme could be included which was validated against ground based water vapour measurements at two ARM sites. Preliminary validation results reveal a relative good performance of the retrieval for the total integrated water vapour values (Figures 2, 3, 5 and 6). Validation of the derived water vapour profiles show increased relative errors for low absolute water vapour values in Alaska (Atqasuk ARM site).

This validation and inter-comparison effort will be extended to all mentioned retrieval schemes; but also offering the participation of other algorithms/institutions. In a later stage, the assessment will also include further validation sites and other time periods. The computational efficiency of all algorithms in a reprocessing framework will also be investigated.

References:

- EUMETSAT-IASI, 2009: IASI Level 2 Product Guide, Ref.: EUM/OPS-EPS/MAN/04/0033, Issue: v2B, 7 Apr 2009. <http://oiswww.eumetsat.org/WEBOPS/eps-pg/IASI-L2/IASIL2-PG-index.htm>
- ESA DUE GlobVapour: www.globvapour.info
- ARM sites: <http://www.arm.gov>

International TOVS Study Conference, 17th, ITSC-17, Monterey, CA, 14-20 April 2010.
Madison, WI, University of Wisconsin-Madison, Space Science and Engineering Center,
Cooperative Institute for Meteorological Satellite Studies, 2011.