GEWEX water vapour and temperature assessment

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1 Introduction

The GEWEX Data and Assessment Panel (GDAP) has initiated a water vapour assessment intended to quantify the state of the art of water vapour data records as well as to eventually select a data record for use by GDAP for the generation of globally consistent energy and water cycle products.

Currently an assessment plan is drafted which will be distributed to the community in late summer 2012 to gather feedback and refine the plan.

The assessment plan will be finalised at a second workshop, hosted by DWD/CM SAF.

We look forward to your active participation in this important international activity under the framework of WCRP-GEWEX and are aspired to jointly carry out this activity to the benefit of the community.

Summary from First Workshop

On 8-10 March 2011 the GEWEX assessment started with a workshop on long-term water vapour data sets and their quality assessment. The workshop was hosted by ESA-ESRIN and aimed at the development of an assessment strategy. A summary is given in Kummerow et al. (2011).

Fig.: *Participants at the GEWEX/ESA DUE GlobVapour Workshop (from Kummerow et al., 2011).*

2 Assessment Overview

Objectives

- Set-up validation data base with observations of high quality and long term stability.
- Characterise the quality of water vapour records through sound validation against validation data base, keeping in mind the records' applications and requirements of GEWEX and the user community.
- Identification of critical gaps in existing and planned data sets.

Themes Upper tropospheric humidity (UTH) / Total column water vapour (TCWV) / water vapour and temperature profiles (WVTP)

Data records considered Data records provided by participants and all readily available data records such as reanalysis.

Timeline The assessment consists of two phases with an estimated duration of 1-2 years each. The first phase focuses on the validation of 3 years of recent data. The validation of long-term data sets is addressed in the second phase.

3a TCWV

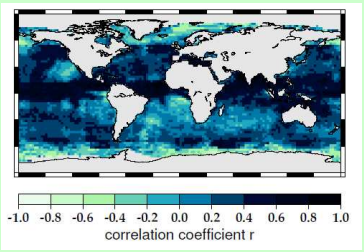

Fig.: *Correlation between bias in TCWV (GOME-SSM/I) and CLWP from ISCCP (Mieruch et al., 2010).*

The fig. (top) was part of an analysis of the retrieval and sampling bias associated to clear sky versus all sky observations (**retrieval/sampling bias**). The correlation of bias against CLWP is significant in 75% of the cases. Detailed explanations can be found in Sohn and Bennartz (2008) and Mieruch et al. (2010).

Other exemplary studies related to TCWV and UTH: Brogniez et al., 2009; Moradi et al., 2010; Randel et al., 1996 and Wagner et al., 2006. For ISCCP, see Rossow and Schiffer (1991).

3b UTH

Upper/free tropospheric humidity (UTH/FTH) can be derived from IR and microwave observations. After applying bias corrections via the zonal mean approach, the **inter-satellite biases** (here: HIRS) have been largely reduced (see Figs. below).

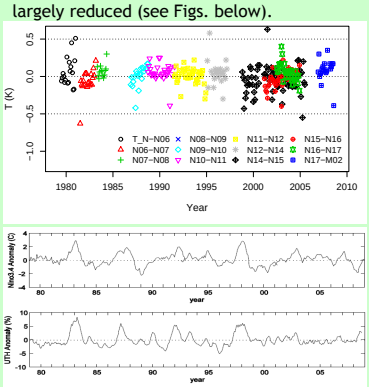

Fig.: *Differences of inter-satellite calibrated HIRS UTWV TBs in ±30°N/S (top). SST and UTH anomaly in Central Pacific (bottom; both from Shi and Bates, 2011; Nino 3.4 SST from NOAA Climate Prediction Center).*

3c Profiles

In the framework of the ESA DUE GlobVapour Project an assessment of 5 IASI water vapour retrievals (DLR, DWD, EUMETSAT, NOAA, UKMO) was conducted (see Fig. below). Also below an extract of **recommendations** from the related report:

- Utilise independent data, that is, not only not assimilated but also with spatial and temporal distance to position of assimilated data.
- It should be considered to prescribe common input fields such as cloud masks.

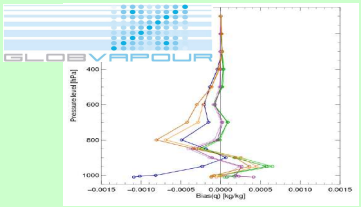

Fig.: *Standard deviation of retrieved water vapour compared to GUAN radiosonde observations.*

Other exemplary studies related to water profile retrieval quality: Divakarla et al., 2009; Fetzer et al., 2006; Hilton et al., 2009 and Ho et al., 2010.

3d Validation data

In October 2009 the MOHAVE campaign was carried out at JPL Table Mountain. Various ground-based remote sensing and in-situ observations have been inter-compared. One focus was on lidar observations (see Fig. below).

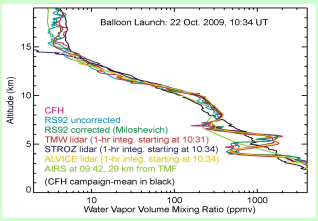

Fig.: *Co-located/simultaneous multiple lidar, satellite, CFH and RS profiles from MOHAVE campaign.*

Besides the global lidar network NDACC (JPL) the following preliminary list of validation data sets is considered to be of use to the assessment:

CFH (NOAA, FMI, DWD), ARSA RS (LMD), FTIR (e.g., MUSICA, KIT), GPS (e.g., NCAR), BSRN (AWI), CERES (NASA), RO (DMI) and more.

4 Announcement of Second Workshop

Workshop on the GEWEX water vapour and temperature assessment

Where? DWD, Offenbach, Germany

When? 26-28 September 2012

The main **objective** of the workshop is to finalise the assessment plan of the GEWEX water vapour and temperature assessment and to kick off the activity.

To **register** for the GEWEX assessment workshop send an email to patricia.willing@dwd.de. It is foreseen to have invited presentations only. Nevertheless you may submit abstracts, again to patricia.willing@dwd.de . We kindly ask you to register prior to 1 August 2012.

Your **feedback** to or **participation** in the assessment is highly welcome and appreciated. When interested, send an email to marc.schroeder@dwd.de or lei.shi@noaa.gov .

References:

Brogniez H.,et al., 2009 in *J. Clim.*, *22, 6773-6787.* - M. G. Divakarla et al., 2009 in *HISensE*, (Optical Society of America, 2009), paper HWC5. - Fetzer, E. J., et al., 2006 in J. Geophys. Res., 111, D09S16, doi:10.1029/2005JD006598. - Hilton et al., 2009 in EUMETSAT proceedings. - Ho, S.-P. et al., 2010 in *Rem Sens.* 2010; 2(5):1320-1330. - Kummerow, C., et al, 2011 in GEWEX News, Vol. 21(2). - Mieruch, S., et al., 2010 in J. Geophys. Res., 115, D23310, doi:10.1029/2010JD013946. - Moradi, I. et al., 2010 in *J. Geophys. Res.*, 115, D24310, doi:10.1029/2010JD013962. - Picon, L., et la., 2003 in J. Geophys. Res., 108, 4301, doi:10.1029/2002JD002640. - Randel, D. L., et al., 1996 in Bull. Amer. Meteor. Soc, 77, 1233-1246. - Rossow, W. B., and R. Schiffer, 1991 in Am. Meteorol. Soc., 72, 2-20. - Shi, L., and J. J. Bates, 2011 in J. Geophys. Res., 116, D04108, doi:10.1029/2010JD014847. - Sohn, B. J., and R. Bennartz, 2008 in J. Geophys. Res., 113, D20107, doi:10.1029/2008JD010053. - Sohn, B. J., et al., 2000 in *J. Geophys. Res.*, 105(D12), 15,673-15,680, doi:10.1029/2000JD900188. - Wagner, T. et al., 2006 in J. Geophys. Res. 111, *D12102, doi:10.1029/ 2005JD006523.*

5 Service and Summary on Planned Activities

Exemplary service to assessment participants and the community:

- Validation data base.
- Collocated data to ease verification of retrieval improvements at participant institute.
- External validation of data sets and feedback of validation results to participants (distribution of results only after consolidation and confirmation from involved participants).
- Recommendation for GEWEX.

The following activities are currently planned:

- Collection of comprehensive and complete description for the data records under consideration including their applications.
- Establishment of validation data group to advise on utilisation of ground-based observations and interpretation of results.
- Identification of fully independent validation data.
- Gather user/product requirements as reference for interpretation of validation results.
- Assess quality of Level 1 data (e.g., as in Brogniez et al., 2009; Picon et al., 2003; Shi and Bates, 2011 and Sohn et al., 2000).
- Consistent collocation and uncertainty estimation considering radiometric, retrieval, sampling, aggregation bias and more.
- Level 3 data analysis to address averaging uncertainties.
- Approach verification of uncertainty estimates included in participants data sets.
- Evaluate improvement of background by retrieval scheme.
- Analyse background error propagation into product uncertainty.
- Establish links to other international activities such as SPARC, GSICS, and SCOPE-CM.

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