



ESA DUE GlobVapour water vapour products: retrieval methods and validation

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The main objective of the ESA DUE GlobVapour project is the development of multi-annual global water vapour data sets. Since water vapour is a key climate variable it is important to have a good understanding of its behaviour. Especially in the lower troposphere, condensation of water vapour into precipitation provides latent heating, which dominates the structure of tropospheric diabatic heating. It is also the strongest gaseous source of infrared opacity in the atmosphere, accounting for about 60 % of the natural greenhouse effect for clear skies, and provides the largest positive feedback in the model projections of climate change. Most of the water vapour sources can be found in the boundary layer but the major contribution to the feedback is from mid to upper tropospheric humidity. Unfortunately, difficulties in observing water vapour in the upper troposphere have long hampered both observational and modelling studies, and significant limitations remain in coverage and reliability of observational humidity data sets.

By the ESA DUE GlobVapour project, data of water vapour will be provided including error estimates based on carefully calibrated and inter-calibrated satellite radiances in response to user requirements for long time series satellite observations. The project also focuses on a systematic validation of water vapour products against ground based, airborne and other satellite based measurements, which are taking into account the error structures of the individual observations as far as possible.

Current long-term climate data sets are based mainly on observations by the operational satellite systems. Many problems are associated with issues as for instance instrument calibrations lack traceability, sensors and onboard calibration sources degrade in orbit, orbital drift changes the satellite observation time during the lifetime of the satellite, and the need of stitching together a series of overlapping satellite observations over time. All this can introduce artefacts into long-term time series and needs careful attention when a data set is produced. Furthermore, a problem to almost all data sets produced up to now is the missing information on the uncertainty of the estimates in the end product. This can only be realised if a full chain of error propagation from the radiance observation to the product on a regular grid is established. The ESA DUE GlobVapour project tries to achieve this for its data sets.

The Deutscher Wetterdienst (DWD) has been participating in the development and modification of two retrieval methods for water vapour data products. The first one is a combined SSM/I+MERIS product on a global grid from a combination of MERIS (Medium Resolution Imaging Spectrometer) onboard ENVISAT and SSM/I (Special Sensor Microwave Imager) onboard the DMSP satellites. The new SSM/I products retrieved with the 1D-Var method are used for building global total columnar water vapour (TCWV) data sets over the period of 1996 to 2008 with a spatial resolution of $(0.5 \times 0.5)^\circ$ over ocean. This product is combined with the (high spatial resolution) MERIS Level 2 water vapour over land on a $(0.05 \times 0.05)^\circ$ grid. The second product is a merging of the Infrared Atmospheric Sounding Interferometer (IASI) onboard MetOp-1 and the Spinning Enhanced Visible and InfraRed Imager (SEVIRI) onboard MSG on SEVIRI-Disk. The advantage of this product is the combination of the high temporal resolution of SEVIRI and the vertical resolution of IASI, resulting in a combined end product of three vertical layers with a spatial resolution of $(0.25 \times 0.25)^\circ$. In addition, a combined GOME/SCIAMACHY/GOME-2 TCWV product will be provided by German Aerospace Center (DLR) on global grid with a resolution of 0.5° .

This presentation discusses the retrieval methods, the data processing and the validation of the first two mentioned GlobVapour products.

For more information and data download follow the link: www.globvapour.info