

# The GEWEX water vapor assessment (G-VAP) – results from inter-comparisons and stability analysis

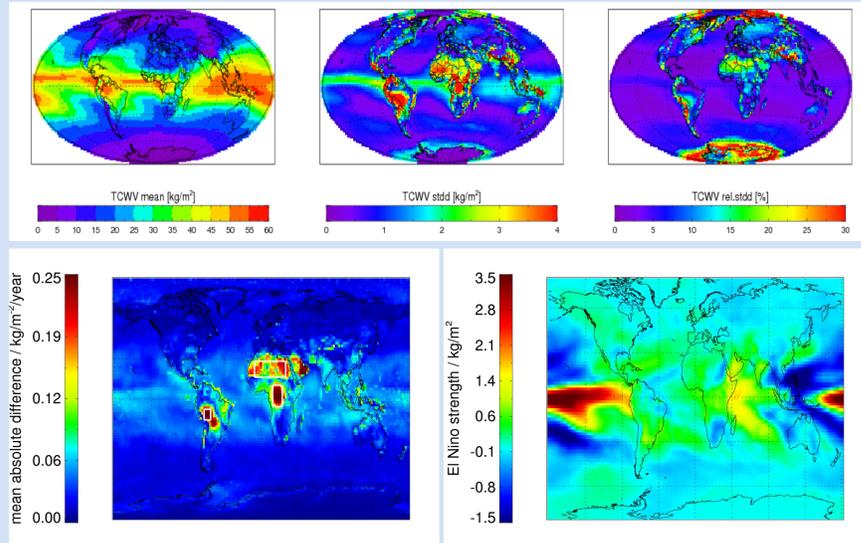
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The GEWEX water vapor assessment (G-VAP) was initiated by the GEWEX Data and Assessments Panel (GDAP). The major purpose of G-VAP is to quantify the state of the art in water vapor products being constructed for climate applications, and by this support the selection process of suitable water vapor products by GDAP for its production of globally consistent water and energy cycle products (more information is available at [www.gewex-vap.org](http://www.gewex-vap.org)).

The assessment will provide an overview on available data records (see [www.gewex-vap.org](http://www.gewex-vap.org) -> Data Records) together with detailed meta data as well as comparable evaluation results based on product inter-comparisons and comparisons to ground-based and in-situ observations. The inter-comparison results presented here consider seven of the longest (>25 years) TCWV (total column water vapor) and water vapour profile data records, namely ERA-Interim, HOAPS, JRA55 (profiles only), MERRA, NCEP/CFRSR, NVAP-M, SSMI-RSS, and are based on monthly means on a common grid (2°x2°) for the common time period 1988-2008.

## Intercomparison



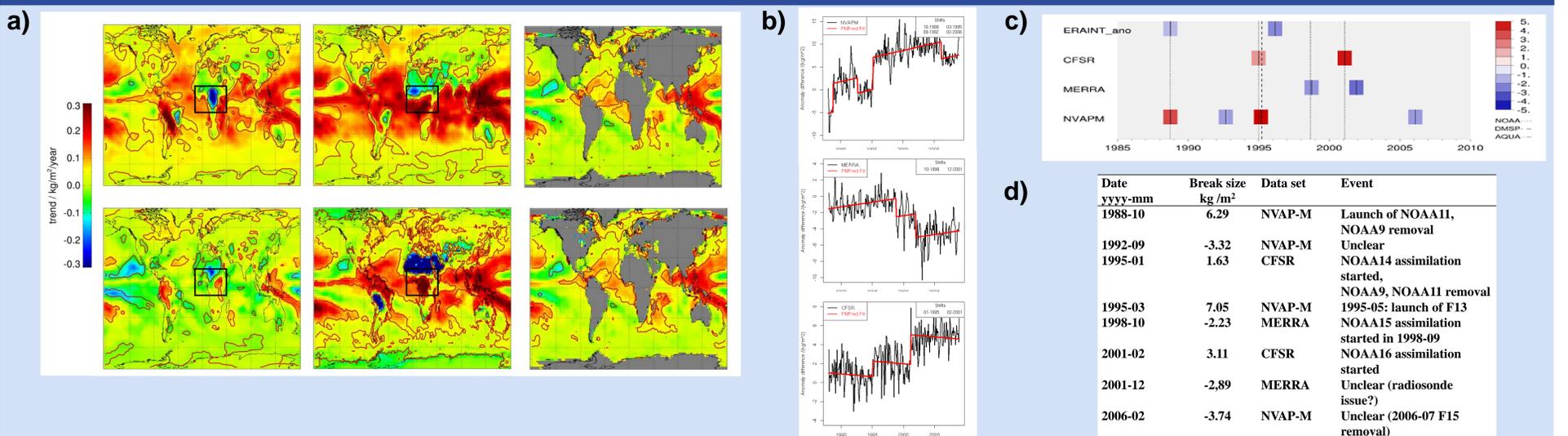
Top: Ensemble mean (left), standard deviation (middle) and relative standard deviation (right) based on the six long-term TCWV data records (four data records provide TCWV over land).

Bottom left: Mean absolute difference between linear trends which have been estimated for each of the six data records.

Bottom right: Amplitude of the El Niño for a single data record. The spatial pattern and the strength are coherent among the six data records.

Intercomparison and trend analysis: see Schröder et al. (2015) for more details.

## Trend analysis



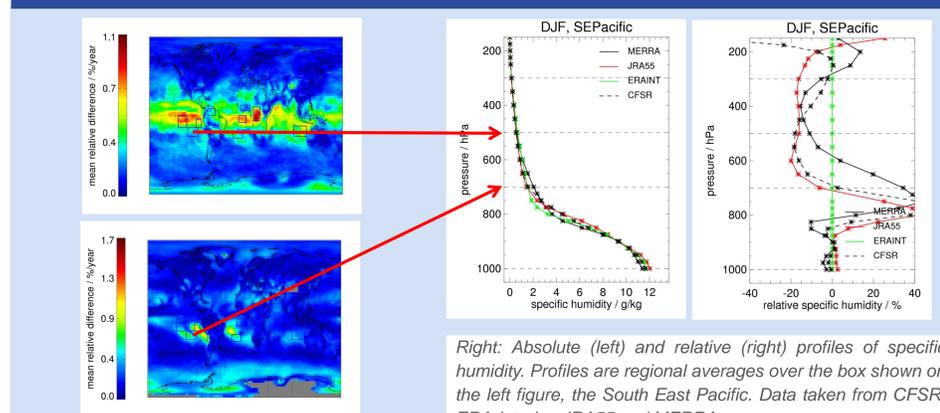
a) Trends in TCWV in kg m<sup>-2</sup> per year for the six different data records considered. Red contours indicate the 95% coverage probability.

b) Results of the PMF test (Wang 2008a,b) based on anomaly differences (black lines) for the region of "Central Africa" (see black box in a)) using ERA-Interim as reference.

c) Heatmap: Occurrence and break size of break points detected by the PMF test for the regions of central Africa. Vertical lines indicate match between changes in observing system and detected break point (within ±3 months).

d) Dates of detected break points and coincident changes in the observing system or changes of the input to the assimilation schemes based on the analysis of anomaly differences relative to ERA-Interim for central Africa.

## Comparison of specific humidity



Right: Absolute (left) and relative (right) profiles of specific humidity. Profiles are regional averages over the box shown on the left figure, the South East Pacific. Data taken from CFRSR, ERA-Interim, JRA55 and MERRA.

Left: Mean absolute difference among trend estimates using CFRSR, ERA-Interim, JRA55 and MERRA data at 500 hPa (top) and 700 hPa (bottom).

## Conclusions

G-VAP results on the inter-comparison of six long-term gridded TCWV data records showed that largest regional discrepancies between the data records are evident over land, especially over dry areas, polar regions and tropics. Differences in linear trends reveal distinct areas at central South America, central Africa, the Sahara and the Arabian Peninsula and the Arctic and the Antarctic. An analysis of regional anomalies showed that regions of distinct trends usually coincide with breakpoints in the time series. Most of the temporal inhomogeneities (break points) and other artefacts can be attributed to changes in the observing system (changes of satellites, observation frequency, etc.). Distinct regions in trend estimates of profile data mainly occur over the ocean and largely differ from the regions observed for TCWV. Here differences in vertical structure seem to dominate the observed differences.

The next workshop will take place at the University of Wisconsin's Lowell Center, Madison, WI, USA on 04+05 November 2015, that is, right after the ITSC.

## References

Schröder, M., M. Lockhoff, J. Forsythe, H. Cronk, T. H. Vonder Haar, R. Bennartz, 2015: The GEWEX water vapor assessment (G-VAP) – results from the trend and homogeneity analysis. Submitted to JAMC.

