Ground-based water vapor retrieval over Polar Regions

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Polar Regions are important in the global budget of water vapor as atmospheric water vapor is a significant indicator of the Earth's climate state and evolution. Both Arctic and Antarctic water vapor plays a central role in snowfall accumulation and surface ice mass balance. Thus, accurate long time series of water vapor content are crucial to understand the recent climate behavior and to assess the reliability of global climate models.

GPS has proven to give a strong contribution in the calculation of the amount of Precipitable Water (PW). We focus on polar regions, especially Antarctica, where data are sparse and hard to collect. Our aim is to exploit the old and new permanent GNSS systems located at permanent research stations, maintained by different institutions and belonging to international and regional networks (IGS, POLENET, VLNDEF). 20-year GPS observations, acquired by more than 40 geodetic stations, were processed with the purpose of ensuring the utmost accuracy of the time series adopting homogeneous, consistent, and up-to-date processing strategies [1].

Results are shown for the available GPS sites, giving a picture of the PW behavior over Arctic and Antarctic regions. To overcome systematic errors and obtain accurate results, data from different and independent sensors have been used. Thus, Radio Sounding (RS) observations carried out at coastal stations using Vaisala radiosondes have been analyzed, to fully exploit the capability of GPS to provide reliable PW estimates, also in areas where RS observations are not available. As an additional tool for validation and comparison of the results, the global atmospheric reanalysis ERA-Interim [2] was used for all the selected GPS stations.

Once validated, long-term trends for both Arctic and Antarctic regions were estimated, the results and the implication for the weather and climate discussed.

References

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