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GPS-derived Precipitable Water Vapour in Antarctica and validation with radiosoundings

Monia Negusini (1), Pierguido Sarti (1), Claudio Tomasi (2), Boyan Petkov (2,3), and Alessandro Capra (4)

(1) Istituto di Radioastronomia, Istituto Nazionale di Astrofisica, Bologna, Italy , (2) Istituto di Scienze dell'Atmosfera e del Clima, Consiglio Nazionale delle Ricerche, Bologna, Italy, (3) International Centre for Theoretical Physics, Trieste, Italy, (4) Dipartimento di Ingegneria Enzo Ferrari, Università di Modena e Reggio Emilia, Modena, Italy

In Polar regions, the atmospheric precipitable water vapour (PWV) content is approximately one third or less than that present at mid latitudes. On the Antarctic Plateau, it drops down to less than a few mm. As a consequence, the use of GPS data in sensing the atmosphere can be reliably applied only on coastal areas, were the PWV is large enough to exceed the sensitivity of the method. Radio-soundings (RS) are periodically performed at several coastal Antarctic stations, where permanent GPS equipments are also installed. The sites to be analyzed were selected according to the radiosonde equipment: the Vaisala sensors' readings were corrected specifically with ad hoc models. The co-location of GPS and radio-soundings allows us to validate the PWV content with totally independent techniques.

In this investigation we present the results of the analysis of continuous long time series of GPS data acquired at Mawson (MAW1), Casey (CAS1), Davis (DAV1), McMurdo (MCM4) and Mario Zucchelli (TNB1) stations over twelve years (1999-2010). Particularly, at each site, the PWV is determined with GPS data and the same parameter derived from the analysis of the radio-sounding is used for validation. The GPS analysis is optimized for Antarctic data, using specific atmospheric models (e.g. the Vienna Mapping Function) and particular care in the data screening and elimination. The ZHD values are extracted from a grid model provided by the TU Wien (http://ggosatm.hg.tuwien.ac.at/DELAY/GRID) and bilienarly interpolated at the site location. At MZS, surface met parameters are available and used to compute the ZHD which is compared with the corresponding grid-derived ZHD series. We find discrepancies and a seasonal signal that straightforwardly impact the PW time series.