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Analysis of precipitable water vapour from GPS data in West Africa: first results and perspectives for the AMMA project

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The Global Positioning System (GPS) is a well-established technique for the retrieval of precipitable water vapour (PWV). However, to date it has mostly been used in studies conducted at mid-latitudes. The potential of GPS in West Africa, for application in the AMMA (African Monsoon Multidisciplinary Analysis) project, has been assessed through the analysis of data from existing permanent GPS network (maintained by IGS, the International GPS Service). The analysis of error sources in GPS data in Africa is presented in another EGU abstract. Similar performance as at mid-altitudes is demonstrated. Here, we compare PWV retrievals from GPS to radiosonde (RS) data and ERA40 reanalyses from the ECMWF. We also present the first study of PWV variability in West Africa from GPS data. The three datasets show an overall good consistency, but biases are evidenced. The GPS minus RS PWV comparison at Dakar shows a bias of 3-4 mm and a standard deviation (STD) of 3-4 mm. The large bias is likely due to RS data since the humidity sensors used on these radiosondes are known to exhibit dry biases. The GPS minus ERA40 PWV comparison shows a bias in the range -2 to +4 mm (depending on the GPS station) and a STD of 3 mm. Since RS data are assimilated in the model, an overall dry bias is also reflected in the reanalyses. However, there are known shortcomings in the assimilation system and in the representation of hydrological cycle in the Tropics in the ECMWF model. These are under improvement at ECMWF and might be assessed with GPS PWV retrievals over Africa. Further comparisons are planned with water vapour observations made from

space (e.g., MODIS, AIRS). The analysis of GPS PWV variability over of 1999-2004 period shows distinct features on five IGS stations in the AMMA domain. Annual, semi-annual, and shorter time-scale signals are evidenced. Correlation with convective activity, precipitation, and Monsoon surges are under study. These results led us to develop a GPS component in the AMMA ground-based observing network, in order to complement the enhanced RS network which will be deployed during the experiment. The strategy for the GPS component will be presented along with the potential applications in AMMA (e.g., integrative studies, satellite and atmospheric model validation, assimilation).