GPS METEOROLOGY IN AFRICA: HIGHLIGHTS FROM AMMA PROJECT

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A network of six ground-based GPS receivers has been established over West Africa, as part of the instrumental setup of the African Monsoon Multidisciplinary Analysis (AMMA) project. The receivers are located in Djougou (Benin), Niamey (Niger), Gao (Mali), Tamale (Ghana), Ouagadougou (Burkina-Faso), and Tombouctou (Mali). The former three are in operations since June 2005 and the latter since May 2006. Precipitable water vapour (PWV) estimates are retrieved hourly using a geodetic processing of the GPS phase data. Both near-real time (NRT) and post-processed solutions are used depending on the application. The NRT solutions have been useful for verifying numerical weather model predictions mostly during the main observing period (2006) when aircrafts were operated from Niamey and Ouagadougou. The more accurate post-processed solutions have been used for verifying model analyses and have proven extremely useful for detecting and quantifying humidity biases in radiosonde data (some of which were propagated to the model analyses). Radiosonde data represent a major source of information on the upper air variables (humidity, temperature and wind) which are used for process studies (convection during the monsoon season).

The seasonal cycle of PWV is very marked and shows a strong correlation with precipitation over West Africa. Analysis of daily GPS PWV estimates reveals five distinct periods within the monsoon season, characterized either by positive or negative tendencies which result from a complex balance between evapotranspiration from the surface, precipitation, and dry and moist air advections in different layers of the atmosphere. Intra-seasonal variability in July to September is observed in precipitation, PWV, and moisture advection at 10-20 day periodicities. The pre-onset period (May-June) is marked by large variability in PW at 3-5 day periodicities, especially at the northern sites. The GPS data provide also unprecedented insight into the diurnal cycle of PWV and thus the water cycle at local scale. The comparison of more than three years of observations reveals significant inter-annual variability in all these process-level characteristics of the monsoon system. Future perspectives for the AMMA GPS stations will be discussed in the framework of AFREF.