An Observation Campaign for Precipitable Water Vapor in Indonesia using a GPS Network

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We conducted a campaign from 23 July to 2 August 2010 to measure the precipitable water vapor (PWV) in the atmosphere using four GPS receivers, stationed at different locations in Jakarta and Bogor, Indonesia. Radiosondes were also launched at an interval of 6 h, in this campaign to validate the recorded GPS-PWV data.

When estimating PWV from the zenith wet delay of a GPS signal, we have assumed a relationship between the surface pressure and the mean temperature (Tm). The presence of the inversion layer which was found in the radiosonde profiles at night resulted in an error of about 0.5 mm in the GPS-PWV. Furthermore, we evaluated the influence of GPS-PWV by the atmospheric pressure and temperature. During this study we observed a regular semi-diurnal pressure oscillation showing an amplitude of 3 to 5 hPa, which corresponds to 0.3 - 0.5 mm in the GPS-PWV.

During the campaign, there was a passage of a cloud moving southwestward from the equator toward the Indian Ocean through the Java Island during the period of 26 to 29 of July 2010. Time variations in the GPS-PWV were observed to be consistent with the satellite images. The peak of GPS-PWV (60-65 mm) occurred on 27 of July, which coincides with the rainfall event. Spatial variations in GPS-PWV between the four sites were observed to have enhanced just before the rains. We thus suggest of a possibility that the spatial inhomogeneity of PWV could be used as an index for predicting a rainfall event.

Keywords: Water vapor, GPS, radiosonde, tropical area, inversion layer, semi-diurnal pressure oscillation