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Improvement of rainfall forecast by assimilations of ground-based GPS data and radio occultation data

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Impacts of three kinds of GPS-derived water vapor data, i.e., precipitable water vapor (PWV), slant water vapor (SWV) and radio occultation (RO) data, were investigated using the Meso 4D-Var system of Japan Meteorological Agency (JMA) for a heavy rainfall case on 16 July 2004. When PWV or SWV data were assimilated individually, water vapor in the rainfall region was increased and on the northern sides was decreased, and then the shape of the rainfall region became similar to the observed one. However, the reproduced rainfall amount remained smaller than the observed one. Compared with PWV, SWV made the horizontal contrast of water vapor larger. When RO data were assimilated, the low-level water vapor was increased so that the rainfall amount was largely increased. However, the rainfall region became wider than the observed one. When SWV and RO data were assimilated simultaneously, low-level water vapor in the rainfall region and on its southern side was increased, and then both shapes of rainfall region and of rainfall amount became similar to the observed ones.

Keywords: Data assimilation, GPS-derived precipitable water vapor, GPS-derived slant water vapor, Radio occultation data, Heavy rainfall