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Impact of GPS-derived Precipitable Water on simulating a Mesoscale Convective System over the Korean peninsula: Application of MM5 4DVAR System

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Precipitable water is a powerful constraint in both synoptic analysis and numerical weather prediction, because precipitable water provides an estimate of the available moisture that fuels convection and severe weather phenomena. As it has been shown that the vertically integrated water vapor can be determined from the GPS signal delay due to atmospheric water vapor [1], the GPS water vapor sensing technique has been developed and applied for study of the impact of GPS water vapor observations on short-range forecast of convective weather system [2].
In this study, the data assimilation experiment of GPS-derived precipitable water was carried out using the MM5 four-dimensional variational data assimilation (4DVAR) system in order to investigate the impact of GPS-derived precipitable water on simulating a mesoscale convective system over the Korean Peninsula. During 3-h assimilation window, we assimilated the precipitable water derived from the zenith wet delay of GPS signals for 42 GPS stations into the model.
The MM5 4DVAR system successfully assimilated GPS-derived precipitable water observations for a strong mesoscale convective system. We confirmed that the moisture fields and wind fields are dynamically consistent with a given GPS-derived precipitable water information in assimilation window. The adjustments of GPS-derived precipitable water to the model initial condition by the 4DVAR procedure were all within reasonable ranges and the optimal initial condition was created. The additional results of this study will be discussed in more detail.

Keywords: four dimensional variational data assimilation; GPS-derived precipitable water; initial condition; mesoscale convective system; rainfall

References

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