Geophysical Research Abstracts
Vol. 20, EGU2018-2910, 2018
EGU General Assembly 2018

Oceanic Total Precipitable Water Estimation from HALE UAV

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This study presents the oceanic Total Precipitable Water (TPW) retrieval algorithm for observations at 16 km altitude of High Altitude Long Endurance Unmanned Aerial Vehicle (HALE UAV). Empirical equation based on Wentz method (1995) that uses the 18.7 and 22.235 GHz channels is developed using the simulated brightness temperature and SeeBor training dataset. To do radiative simulation, Satellite Data Simulator Unit (SDSU) Radiative Transfer Model (RTM) is used. The data of 60% (523) and 40% (349) in the SeeBor training dataset are used to develop and validate the TPW retrieval algorithm, respectively. The range of coefficients for the TPW retrieval at the altitude of 3$\sim$18 km with 3 km interval were 153.69$\sim$199.87 (α), 54.330$\sim$58.468 (β), and 84.519$\sim$93.484 (γ). The bias and RMSE at each altitude were found to be about -0.81 kg m^{-2} and 2.17 kg m^{-2}, respectively. Correlation coefficients were more than 0.9. To validate the accuracy of the oceanic TPW retrieval algorithm, radiosonde data observed from research vessel (Gisang 1) of the Korea Meteorological Administration (KMA) is used for six clear sky cases representing spring, autumn, and summer season. Differences between retrieved and observed TPW at 16 km altitude were in the range of 0.53$\sim$1.87 kg m^{-2}, which are reasonable for most applications. Difference in TPW between retrieval and observation at each altitude (3$\sim$15 km) is also evaluated. Differences of TPW at altitudes more than 6 km were between 0.3 to 1.9 kg m^{-2}. Retrieved TPW at 3 km altitude was smaller than upper level with a difference of -0.25$\sim$0.75 kg m^{-2}compared to the observed TPW.

Reference: Cho et al., 2017, Atmosphere, 27(3), 359-370;