Assimilation of GOLD disk observations in WACCMX+DART for a better thermosphere

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Abstract: The Global-scale Observations of Limb and Disk (GOLD) imagers scan the Earth's Thermosphere-Ionosphere in the far ultraviolet wavelengths. Measurements from GOLD daylit spectrum are used to retrieve the column integrated atomic oxygen to molecular nitrogen density ratio (O/N2) and disk temperature (Tdisk) over about one fourth of the globe. The present investigation assesses the impact of assimilating GOLD disk O/N2 and Tdisk observations in the Whole Atmosphere Community Climate Model with thermosphere-ionosphere eXtension (WACCMX) using the Data Assimilation Research Testbed (DART) ensemble adjustment Kalman filter. Several Observing System Simulation Experiments (OSSEs) are performed, and improvements are quantified by calculating root mean square error (RMSE) and bias with respect to a true run. In addition to solar and geomagnetic forcing, we introduced gravity wave forcing perturbations to increase the ensemble spread, which has not previously been used in ensemble assimilation for the thermosphere-ionosphere. It is observed that the assimilation of both O/N2 and Tdisk performs better in reproducing thermospheric neutral density than individual assimilation of either Tdisk or O/N2. The results demonstrate that the assimilation of GOLD observations can improve thermospheric neutral density estimations and therefore space weather forecasts.