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Interhemispheric comparison of mesosphere/lower thermosphere winds from GAIA, WACCM-X and ICON-UA simulations and meteor radar observations at mid- and polar latitudes

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There is a growing scientific interest to investigate the forcing from the middle atmosphere dynamics on the thermosphere and ionosphere. This forcing is driven by atmospheric waves at various temporal and spatial scales. In this study, we cross-compare the nudged models Ground-to-topside model of Atmosphere and Ionosphere for Aeronomy (GAIA) and Whole Atmosphere Community Climate Model Extended

Version (Specified dynamics) (WACCM-X(SD)), a free-running version of Upper Atmosphere ICOsahedral Non-hydrostatic (ICON-UA) with six meteor radars located at conjugate polar and mid-latitudes. Mean winds, diurnal and semidiurnal tidal amplitudes and phases were obtained from the radar observations at the mesosphere and lower thermosphere (MLT) and compared to the GAIA, WACCM-X(SD), and ICON-UA data for similar locations applying a harmonized diagnostic.

Our results indicate that GAIA zonal and meridional winds show a good agreement to the meteor radars during the winter season on both hemispheres, whereas WACCM-X(SD) and ICON-UA seem to reproduce better the summer zonal wind reversal. However, the mean winds also exhibit some deviation in the seasonal characteristic concerning the meteor radar measurements, which are attributed to the gravity wave parameterizations implemented in the models. All three models tend to reflect the seasonality of diurnal tidal amplitudes, but show some dissimilarities in tidal

phases. We also found systematic interhemispheric differences in the seasonal characteristic of semidiurnal amplitudes and phases. The free-running ICON-UA apparently shows most of these interhemispheric differences, whereas WACCM-X(SD) and GAIA trend to have better agreement of the semidiurnal tidal variability in the northern hemisphere.