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Spatiotemporal Variations in the Diagnostics of Gravity Waves Associated with Jet/Front System and Their Correlations with GWs Revealed in High-Resolution Global Reanalysis Data

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Jet/Front system is one of the major sources of atmospheric gravity waves (GWs) that contribute significantly to global circulation in the middle atmosphere. Nevertheless, there is no comprehensive parameterization of GW drag (GWD) associated with Jet/Front system based on the formulation of the GW momentum flux at launch levels, unlike for mountain and convective GWD parameterizaitons, due primarily to uncertainties in their generation mechanisms. Although several attempts have been made to parameterize Jet/Front GWs, at this moment, only one GWD scheme that launches GWs at which the frontogenesis function (FF) is over certain threshold at mid-troposphere is utilized in a climate model (WACCM) that takes into account GWD associated with three major sources (mountain, convection, and Jet/Front) individually. In this study, we evaluate two major diagnostics of Jet/Front GWs, FF and residual of the nonlinear balance equation ( ) by examing their spatiotemporal variations using two global reanalysis data sets (MERRA and ERA-Interim) during 32 years (1980-2011), and by exmaining correlations between the diagnostics and GW momentum fluxes at 300, 70, and 5 hPa that are explicitly resolved from high-resolution (0.25o x 0.25o) reanalysis data (ECMWF) in January and July of 2007. It is found that FF and have maximum values in the mid-to-high latitudes of winter hemisphere with local maximums in Greenland, East Asia, West of North America, and Anthes Mountains in both reanalysis data sets. The GW momentum fluxes calcualted from ECMWF revealed two source regions in the upper troposphere : (i) poleward of 30o in both hemisphere with larger values in the winter hemisphere and (ii) tropical and subtropical regions in both hemispheres. The FF and are well correlated with GWs in mid-to-high latitudes follwing their seasonal variations, and this can successfully separate GWs in tropics and subtroics generated by convective sources, implicating for that the diagnostics are feasible. In the four regions of local maximums of FF and , GW momentum flux near the launch level (300 hPa) is correlated better with than FF for both January and July, except in East Asia. A parameterization of Jet/Front GWs based on the diagnotiscs of is implimented in WACCM, and a climate simulation result is compared with that of the original WACCM with a FF-based Jet/Front GWD parameterization. This also will be presented in the conference.