A Study of Large Wind Shears Near the Mesopause

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Previous measurements have revealed very large wind and wind shears in the upper mesosphere and lower thermosphere [Larsen, 2002]. The large winds are probably related to the temperature structure in the MLT region: with the low temperature and rapid temperature increase the static stability around the mesopause/lower thermosphere is the largest within the whole atmosphere, so it can sustain large winds and shears [Liu, 2007]. However, even though these large winds and shears are theoretically feasible, they are not reproduced in GCMs. One possible explanation for the absence of these large winds/shears is that they are associated with GW perturbations, which are mostly unresolved in GCMs. And since they are associated with GW perturbation (rather than GW dissipation and forcing), they cannot be represented by a parameterization scheme. Recently we have performed Whole Atmosphere Community Climate Model (WACCM) simulations at ~0.25 degree horizontal and 0.1 scale-height vertical resolution using cubed-sphere [Liu et al., 2014]. From spectral analysis indicates that gravity waves down to ~200km are well resolved in the model. It is found that vertical shears of the horizontal winds from the model indeed display maximum values above the mesopause, similar to those seen in observations. In this study, we will analyze the contribution of gravity waves and tides to the large wind shears, and their latitudinal, longitudinal and height dependence.

References

Larsen, M. F., Winds and shears in the mesosphere and lower thermosphere: Results from four decades of chemical release wind measurements, J. Geophys. Res, 107, 1215, 2002.

Liu, H.-L., On the large wind shear and fast meridional transport above the mesopause, Geophys. Res. Lett., 34, L08815, doi:10.1029/2006GL028789, 2007.

Liu, H.-L., J. M. McInerney, S. Santos, P. H. Lauritzen, M. A. Taylor, and N. M. Pedatella, Gravity waves simulated by high-resolution Whole Atmosphere Community Climate Model, Geophys. Res. Lett., 41, doi:10.1002/2014GL062468, 2014.