MLS-Scientific Publication

Scientific Themes: Atmospheric Dynamics, Modeling

UARS MLS Observations of Gravity Waves Associated with the Arctic Winter Stratospheric Vortex. Jonathan H. Jiang and Dong L. Wu, *Geophys. Res. Lett., 28*, 527-530, 2001.

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Summary

Microwave Limb Sounder (MLS) radiances were used to study interactions between gravity waves and stratospheric winds in mid- to high latitude winter. We found that the radiance variances depend significantly on the instrument line-of-sight (LOS) and the background wind. The radiance variances have maxima at two viewing angles where the LOS is about *30*° or *90*° from the wind vector. Waves propagating in preferred directions likely cause the observed maxima at the two angles. The variances at the *90*° angle, located inside the polar vortex, seem to be produced by the gravity waves propagating nearly parallel to the wind direction. The variances at the *30*° angle, located near the edge of the vortex, are likely associated with perturbations propagating almost perpendicularly to the wind direction. The variance of both modes increases with the background wind speed, but saturation is observed for the waves inside the vortex as the background wind speed exceeds above *~60 m/s*. Interestingly, we also find that the temperature co-located with the variance inside the vortex is warmer by *20K* at background wind speeds *>60 m/s*, which might be correlated with the wave breaking in the vortex.

This work enhances our understanding of gravity wave propagations in the middle atmosphere, thus will benefit society by helping improve the predictability of climate modeling and weather forecast.

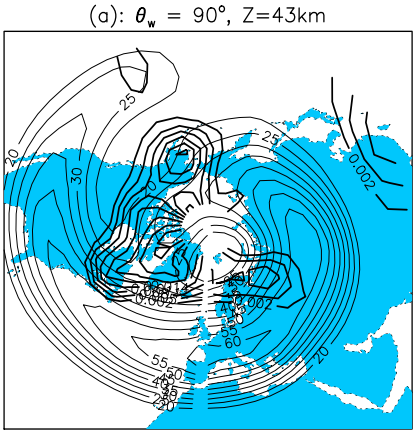

Figure (a) shows a map of the MLS radiance variances observed at viewing direction about *90*° from the background stratospheric wind vector. This group of associated atmospheric gravity waves propagates nearly parallel to background wind direction, increases with the wind speed, and saturates as the wind speed exceeds above *~60 m/s*. The temperatures associated with the variance saturation at the wind speed *>60 m/s* were found to be increased by about *20K*.

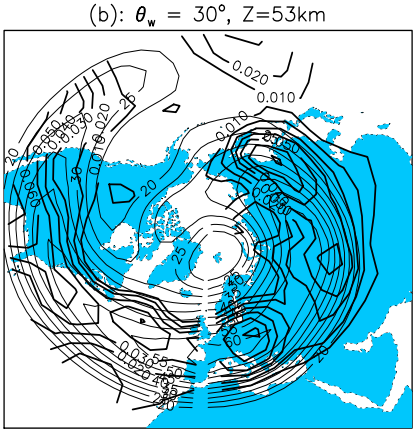

Figure (b) shows the map of another group of the MLS radiance variances observed at viewing direction about *30*° from the background stratospheric wind vector. This group of radiance variances is likely associated with perturbations propagating almost perpendicularly to the background wind direction. Amplitude of these waves increases with background wind speed without observed saturation.

Note: Thick contours are the MLS radiance variances, light contours are the United Kingdom Meteorological Office assimilated stratospheric background winds, both averaged over DJF of 1994-1997.