Abstract

High frequency waves in the polar vortex have been observed since the 1980's and are believed to be created by instabilities in the vortex winds. These eastward propagating waves consist of zonal waves 1 through at least 4 all moving at approximately the same phase speed, so that when wave 1 has a four day period, wave 2 will have a 2 day period, and so on. These waves are generally referred to as the 4-day wave because the wave 1 component is often dominant and is easily resolved by daily observations. However, past studies have shown that the 2-day, wave 2 component can be larger than the 4-day, wave 1 component at certain times and locations. This study examines the winter southern hemisphere vortex of 1998 using four times daily output from a data assimilation system to focus on the polar 2-day wave and its relation to the 4-day wave.

The data assimilation system products are from a test version of the finite volume data assimilation system (fvDAS) being developed at Goddard Space Flight Center (GSFC). The fvDAS has many new features and improvements that help in polar wave analysis, including a general circulation model with accurate advection near the poles and an analysis system that interactively assimilates satellite radiance observations. Ozone products are also available from the GSFC ozone assimilation system.

Results show that the polar 2-day wave dominates during July 1998 at 65S. The vertical structure of the 2-day wave shows only one peak with westward phase tilt with height above the peak and eastward phase tilt with height below the peak. This differs from the more poleward 4-day wave that tends to have two out of phase peaks in the vertical. The 2-day wave is somewhat faster than 2 days during July 1998 with a period closer to 1.6 days and an average amplitude for the month of over 2.5 K. Results for potential vorticity and ozone also show the 2-day wave consistent with the temperature signal. The 2-day wave represents a major source of ozone variation in this region.