Gravity wave propagation over the polar regions

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Mesospheric short-period (<1-hr) gravity waves are of great importance for dynamics in the mesosphere-lower thermosphere (MLT) region, and are typically measured by instruments capable of high temporal and/or spatial resolutions such as lidars and airglow imagers. These waves have been studied extensively at low- and mid-latitudes where known wave sources are well established. The results show strong dependence on the background wind and temperature fields, which can act as a barrier prohibiting vertical propagation of the waves, as well as providing a ducted environment in which the waves can travel large horizontal distances. In fact, results show that up to 75% of these waves may exhibit ducted wave motion.
Recent airglow imaging measurements over Antarctica have revealed a large number of short-period gravity waves in absence of the prominent wave sources present at lower latitudes. In contrast to results at lower latitudes, very few waves (~5%) observed over Halley (76°S) exhibited Doppler ducted motion. Most recent analysis suggest that thermal ducting of these waves in the MLT regions is more prominent than Doppler ducting. In this work, we expand on this analysis to include more observation sites in both polar regions, as well as a high-altitude numerical weather prediction system, NOGAPS-ALPHA, to investigate propagation conditions (particularly, the role of thermal ducting) spanning the entire the polar regions.