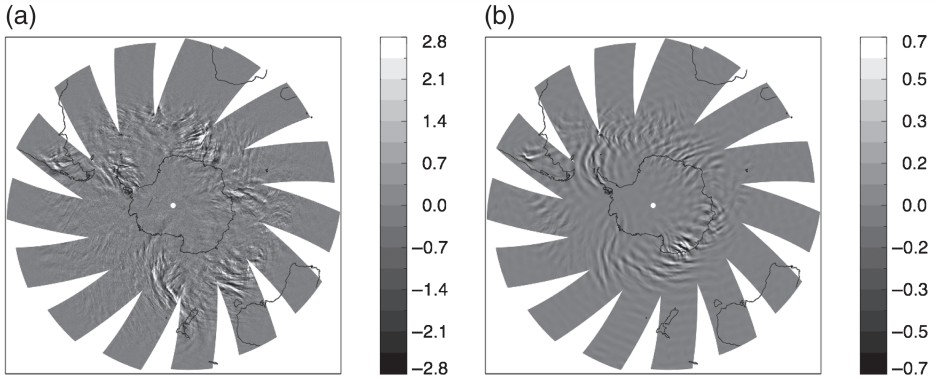
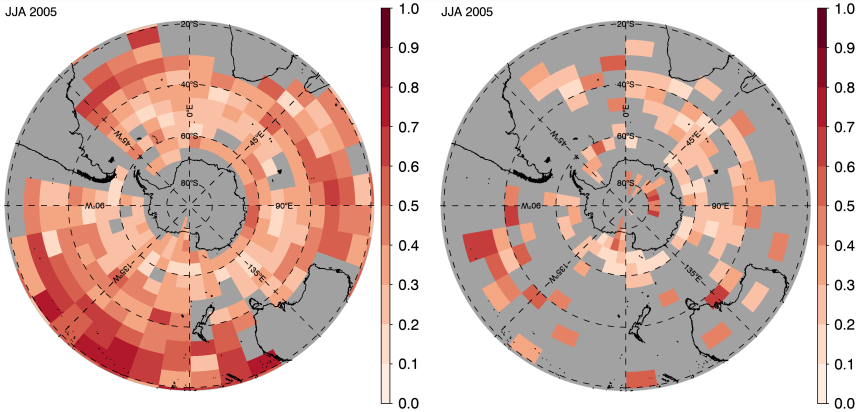
An evaluation of gravity waves and gravity wave sources in the Southern Hemisphere in a 7 km global climate simulation

Holt et al., 2017



Southern Hemisphere brightness temperature anomalies on 26 July 2005 for (a) AIRS and (b) the G5NR near 35 km. Note the different color bar ranges. The G5NR is a climate model, so individual wave features differ because of different meteorological conditions.



Spearman's rank correlation coefficient between (left) precipitation and (right) the frontogenesis function and absolute gravity wave momentum flux in the lower stratosphere. Gray areas are not significant or over orographic areas.

Science questions: How realistic are small-scale gravity waves in the Southern Hemisphere in the GEOS-5 7-km Nature Run (G5NR)? (2) What mechanisms are generating the small-scale nonorographic gravity waves in the Nature Run?

Results: Global patterns in GW amplitude, horizontal wavelength, and propagation direction in the G5NR are realistic compared to observations. However, as in other global models, the amplitudes are weaker and horizontal wavelengths longer than observed (see top figure). The global patterns in absolute GW momentum flux also agree well with previous model and observational estimates. The evaluation of model nonorographic GW sources in the Southern Hemisphere winter shows that strong intermittent precipitation (greater than 10 mm h^{-1}) is more strongly associated with GW momentum flux than frontogenesis is (see bottom figure).

Significance: Gravity wave parameterizations in global climate models are still poorly constrained by observations, which contributes to large biases in model temperature and winds. High-resolution climate model simulations with small-scale gravity waves that are validated with observations can be used to constrain and improve gravity wave parameterizations.

Reference: Laura A. Holt, M. Joan Alexander, Lawrence Coy, Andrea Molod, William M. Putman, Steven Pawson, and Chuntao Liu. An evaluation of gravity waves and gravity wave sources in the Southern Hemisphere in a 7-km global climate simulation. *Quart. J. Roy. Met. Soc.*, 143:2481–2495, 2017. doi:10.1002/qj.3101.