

A study on gravity wave parameterization including three dimensional propagation

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Background

Gravity wave parameterizations, which calculate momentum forcing due to unresolved gravity waves, are necessary component of GCMs including the middle atmosphere. They usually consider only **vertical propagation** of GWs for simplicity. However, its validity has been questioned and considered a possible cause of the known model bias around the polar night jet in the southern hemisphere stratosphere winter.

Methodology

We developed a new orographic GW parameterization scheme.

- Location and local wavenumbers of steady GW packets are calculated by **integrating the ray tracing equations** in the vertical.
- GW amplitude is diagnosed using the 'saturation' criterion, and GW forcing is calculated as the convergence of pseudomomentum flux, which includes **the forcing due to horizontal refraction**.
- Horizontal inhomogeneity are approximated using Taylor series expansion, so that the calculation can be performed exclusively in each vertical column under the parallelization.

Results

Simulated climatological GW forcing in the SH winter is **expanded in horizontal** and **the well-known gap at 60°S is alleviated**. The climatological polar night jet seems not much influenced, suggesting **the contribution of zonally asymmetric response** like the enhancement of planetary waves.

