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A validation of frontal sources in a parameterization of gravity waves using a 7-km global climate simulation

Alvaro de la Cámara (1,2,3) and Laura Holt (4)

(1) Universidad Complutense de Madrid, Física de la Tierra y Astrofísica, Fisica de la Tierra y Astrofisica, Madrid, Spain (acamarai@ucm.es), (2) Instituto de Geociencias, UCM-CSIC, Madrid, Spain, (3) National Center for Atmospheric Research, Boulder CO, USA., (4) NorthWest Research Associates, Boulder CO, USA

An important challenge regarding the representation of gravity waves (GWs) in parameterizations for climate models is to improve our understanding of the mechanisms involved in the generation of gravity waves from frontal systems and jet imbalances. The stochastic parameterization introduced by de la Cámara and Lott (2015) presents the novelty of applying a simple theory on the spontaneous emission of GWs during the evolution of a near balance flow (i.e. spontaneous adjustment), to predict the GW momentum flux based on the grid-scale potential vorticity (PV) field and Richardson number. Here we implement this source parameterization in the Whole Atmosphere Community Climate Model (WACCM), and validate the parameterized GW momentum flux using the GWs resolved by the high-resolution GEOS-5 Nature Run; this run has been recently shown to present global patterns in gravity wave amplitude, horizontal wavelength, and propagation direction that are realistic compared to observations (Holt et al. 2017). Our results show that the parameterized momentum flux in the Southern Hemisphere (SH) winter lower stratosphere presents a geographical distribution and intensity very similar to that given by the Nature Run. The parameterized high-amplitude, intermittent momentum flux enhances the GW drag in the lower stratosphere, and the cold pole bias in the SH lower stratosphere in WACCM is alleviated in more than 2 K.

References:

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