Session: C28 Poster: W61A

Global and local approaches for gravity wave drag parameter estimation

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The impact of using optimal parameters in a gravity wave drag (GWD) parameterization in a simple mechanistic atmospheric model is examined. The hydrostatic nonrotating version of the Scinocca gravity wave drag scheme is used. The observed gravity wave drag used in this work is the one estimated in Pulido & Thuburn 2008. The parameter estimation is done using a genetic algorithm. Parameters are estimated monthly for each column of the grid, though zonally means are used to simplify the scheme. To reduce the variation experienced by the cost function and parameters between different latitude points, a temporal average of daily estimations is used reducing in this way random errors. The global optimal parameter estimation problem is also examined. We show that the use of optimal parameters in latitudinal bands is less costly than column-by-colum estimation and provides a closer match of gravity wave drag than using global standard parameters or global optimal parameters. This may lead to a sub-optimal scheme for GWD parameter estimation. The impact on the general circulation of a mechanistic model, the University of Reading model, using optimal parameters is examined. A significant improvement of the model is found, in particular the RMS diminishes significantly comparing a simulation with a standard set of parameters and a simulation with optimal parameters against Met Office analysis. Features like the capability of the model representing the QBO and high latitude jets are also evaluated.