Atmos. Chem. Phys. Discuss., 6, S1571–S1574, 2006
www.atmos-chem-phys-discuss.net/6/S1571/2006/
© Author(s) 2006. This work is licensed
under a Creative Commons License.

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Some experimental constraints for spectral parameters used in the Warner and McIntyre gravity wave parameterization scheme" *by* M. Ern et al.

Anonymous Referee #1

Received and published: 6 July 2006

Review of "Some experimental constraints for spectral parameters used in the Warner and McIntyre gravity wave parameterization scheme" by M. Ern et al.

This is an interesting paper addressing the important issue of the parameterization of pseudo-momentum fluxes due to unresolved non-orographic and non-convective gravity waves (GWs) in GCMs. For this purpose the temperature data sets from the two CRISTA missions are used to extract observed GW pseudo-momentum fluxes. By comparisons between these and corresponding predictions by the Warner-McIntyre scheme the free parameters of this scheme are optimized to give best agreement. Such studies are highly welcome since they yield valuable parameter constraints for

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

modelers but also represent useful tests for the realism of available parameterization schemes. They might thus also eventually help discriminating between the different approaches with regard to their ability to describe real nature. We need much more of this kind in order to get rid of the uncertainties still present in this field. Overall the manuscript is well written, and the openness of the authors in addressing potential weaknesses is to be commended. So I think the paper should be published in the end. My impression, however, also is that the authors could do even better, mostly with regard to the absolute value of the GW pseudo-momentum fluxes, and I recommend in their own interest to consider some modifications as detailed below.

Specific Comments:

- A major issue still seems to be the discrepancy between the magnitude of the fluxes in the data and the ones predicted by the model. The authors explain that there are substantial weaknesses in the flux estimates from the observations, possibly leading to an over-estimate which might explain the differences. A point they do not discuss is that their GW data might still be contaminated by non-GW contributions. The way the analysis discriminates between non-GW and GW contributions in the horizontal variations is by a Kalman filter which removes all variance due to zonal wave numbers less than seven. This appears to be somewhat coarse to me, since I do not see that all waves at wave numbers larger than six are necessarily GWs. Balanced dynamics might still contribute. While I am aware that it is hard to do better, I think this should at least be discussed somewhere.

- By reference to the work of Hocking (2005) the authors admit themselves that their fluxes might not be grossly over-estimated, and that a variation of the GW energy at the launch level might be an interesting option. No discussion of the effect of a variation of the corresponding parameter β is however given. Since this parameter does not enter into the GW fluxes at higher altitudes in a linear

ACPD

6, S1571–S1574, 2006

fashion, such an analysis seems desirable. I would thus encourage the authors to also come up with a recommendation for an optimal β and show what the fluxes would look like with this value.

- Something which I found regrettable is that after the authors had determined their optimal parameters for the spectral slope s in the undersaturated part of the spectrum and the wavelength at the launch level separating the undersaturated from the saturated part, they had not gone back and done the figures showing the effect of the parameter variations at this optimum point (e.g. by using in Figs.5 and 6 $\lambda_{z,launch}$ = 3km, and so forth). While I consider this not to be an absolute necessity, the paper would look nicer that way.

- P. 4756, bottom: Lindzen (1981) should be cited as the first work presenting an explicit parameterization of GW fluxes in the middle atmosphere.

- P. 4768, bottom paragraph, and Figs. 11 and 12: It took some time for me to understand what the authors mean by deviations. If I am not mistaken the meaning is rather regression coefficients between modeled and observed fluxes. Please clarify this.

- In the beginning of the reading I had been wondering why the authors do not rather compare temperature fluctuations (with less uncertainties on the observational side), until I realized that the Warner-McIntyre scheme provides fluxes averaged over the intrinsic frequency so that one cannot determine the temperature fluctuations in this scheme from the GW pseudo-momentum fluxes and the wave numbers. Perhaps it would be nice to shortly discuss this in the introduction.

Technical corrections:

- In Figs. 3 and 4, for the sake of better comparability, I would use at each altitude

ACPD
6, S1571–S1574, 2006

EGU

the same colors for model and observations. Also in these Figs., the contour labels are very hard to read.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 4755, 2006.