

# On constraints and uncertainties for gravity wave parameterizations

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Gravity waves play a key role in driving the middle atmosphere's circulation. Their representation via parameterizations in climate models has successfully allowed to simulate the mean circulation in the mesosphere, and more recently to simulate the Quasi-Biennial Oscillation. Nonetheless, several aspects of the parameterizations remain poorly constrained. A variety of parameterizations exist, but nearly all make the same initial and justified assumptions: sources are in the troposphere, and only columnar, vertical propagation is considered. The resulting *framework* comprises 3 components: the sources, the propagation and the forcing resulting from their dissipation. (Systematic effects due to critical level filtering as waves propagate upwards are hence accounted for.) A major source of uncertainty, among those three components, comes from the very loosely constrained definition of the sources. Tremendous progress from both modelling and observations has provided an improved description of the gravity wave momentum fluxes in the stratosphere (*Alexander et al 2010*), making it possible to begin quantitative comparisons between different datasets (*Geller et al, 2013*). An interesting outcome of some of these observations has been to emphasize characteristics of the wave field such as intermittency, encouraging changes in the formulation of parameterizations. These changes in turn modify the distribution of the gravity wave forcing between the stratosphere and mesosphere with positive outcome for the stratospheric circulation (*de la Camara et al 2016*).

The present contribution proposes to sketch our expectations regarding gravity wave parameterizations (criteria for a *successfully tuned* parameterization?), to discuss constraints from observations and how they relate to these expectations, and to review emerging issues (uncertainties coming from the other assumptions in the *framework*). In particular, evidence for lateral propagation in a number of recent works will be reviewed, questioning whether this may yield a systematic effect that present models, by construction, would necessarily miss.

Key words: gravity waves, parameterizations

## References

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