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Gravity wave generation from jets and fronts: idealized and real-case simulations

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The generation of gravity waves from jets and fronts remains an outstanding issue in the dynamics of the atmosphere. It is important to explain and quantify this emission because of the several impacts of these waves, in particular the induced momentum fluxes towards the middle atmosphere, and their contribution to turbulence and mixing, e.g. in the region of the tropopause. Yet, the mechanisms at the origin of these waves have been difficult to identify, the fundamental reason for this being the separation between the time scales of balanced motions and gravity waves.

Recent simulations of idealized baroclinic life cycles and of dipoles have provided insights into the mechanisms determining the characteristics and the amplitude of gravity waves emitted by jets. It has been shown in particular that the environmental strain and shear play a crucial role in determining the characteristics and location of the emitted waves, emphasizing jet exit regions for the appearance of coherent low-frequency waves. It has also been shown how advection of relatively small-scales allow to overcome the separation of time scales alluded to above. Recent results, remaining open questions and ongoing work on these idealized simulations will be briefly summarized.

Nevertheless, unavoidable shortcomings of such idealized simulations include the sensitivity of the emitted waves to model setup (resolution, diffusion, parameterizations) and uncertainty regarding the realism of this aspect of the simulations. Hence, it is necessary to compare simulations with observations in order to assess their relevance.

Such comparison has been undertaken using the dataset from the Vorcore campaign (Sept. 2005 - Feb. 2006, Hertzog, *J. Atmos. Ocean. Techno.* 2007) during which 27 superpressure balloons drifted as quasi-Lagrangian tracers in the lower stratosphere above Antarctica and the Southern Ocean. High-resolution simulations ($dx =$ 20 km) have been carried out using the Weather Research and Forecast model for nearly two months. The realism of the simulated gravity waves is established based on systematic comparison with the observations and on case studies. The simulations are then used to quantify the importance and characteristics of gravity waves emitted from jets and fronts above the Southern Ocean. In particular, application of results from the idealized simulations to real cases, with a check provided by observations, will be discussed.