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Mesoscale simulations of the gravity waves observed during VOROCRE

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The VORCORE campaign (September 2005-February 2006) has provided aunique dataset for the investigation of gravity waves and the associated momentum fluxes in the lower stratosphere (16-19km) above Antarctica. Because the measurements were made with superpressure balloons that behave as quasi-Lagrangian tracers, they provide direct estimates of key quantities such as the intrinsic frequencies of the gravity waves.

In order to investigate further the gravity wave field, numerical simulations with the mesoscale meteorological model Weather Research and Forecast have been conducted on a domain covering the Antarctic continent, for several periods during the VORCORE campaign. The VORCORE dataset provides a unique opportunity to test several modelling issues:

1) what part of the gravity wave spectrum can we simulate with available resolutions (typically 15 to 20 km in the horizontal, and more than a hundred levels in the vertical, up to the mid-stratosphere)?

2) How does the agreement between model and observations vary for different types of gravity waves (e.g. orographic waves / non-orographic waves, low-frequency / high frequency)?

3) How sensitive are the simulated waves to different parameters of the model setting (length of simulation, height of model top, sponge layer, parameterizations for boundary layer)?

Simulations have been conducted in different settings to bring answers to these questions and determine how close an agreement we can expect to find between observations and simulations. To the extent that such simulations reproduce quantitatively well the gravity wave field in the locations where observations are available, they can be used to investigate other aspects of the wave field. For example, a more global view of the momentum fluxes, their variability and their evolution with height can be obtained. Also, the sources of the gravity waves, in particular of non-oographic inertia-gravity waves, can be investigated.