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# Convective gravity wave propagation and breaking in the stratosphere: comparison between WRF model simulations and lidar data

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In this work we perform numerical simulations of convective gravity waves (GWs), using the WRF (Weather Research and Forecasting) model. We first run an idealized, simplified and highly resolved simulation with model top at 80 km. Below 60 km of altitude, a vertical grid spacing smaller than 1 km is supposed to reliably resolve the effects of GW breaking. An eastward linear wind shear interacts with the GW field generated by a single convective thunderstorm. After 70 min of integration time, averaging within a radius of 300 km from the storm centre, results show that wave breaking in the upper stratosphere is largely dominated by saturation effects, driving an average drag force up to $-41$ m s $^{-1}$ day $^{-1}$. In the lower stratosphere, mean wave drag is positive and equal to 4.4 m s $^{-1}$ day $^{-1}$. In a second step, realistic WRF simulations are compared with lidar measurements from the NDACC network (Network for the Detection of Atmospheric Composition Changes) of gravity wave potential energy (E p) over OHP (Haute-Provence Observatory, southern France). Using a vertical grid spacing smaller than 1 km below 50 km of altitude, WRF seems to reliably reproduce the effect of GW dynamics and capture qualitative aspects of wave momentum and energy propagation and transfer to background mean flow. Averaging within a radius of 120 km from the storm centre, the resulting drag force for the study case (2 h storm) is negative in the higher ($^{-1}$ m s $^{-1}$ day $^{-1}$) and positive in the lower stratosphere (0.23 m s $^{-1}$ day $^{-1}$). Vertical structures of simulated potential energy profiles are found to be in good agreement with those measured by lidar. E p is mostly conserved with altitude in August while, in October, E p decreases in the upper stratosphere to grow again in the lower mesosphere. On the other hand, the magnitude of simulated wave energy is clearly underestimated with respect to lidar data by about 3–4 times.

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