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Non-orographic gravity waves: representation in climate models and effects on infrasound

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Long-range infrasound propagation is controlled by atmospheric waveguides that extend up to the mesosphere and lower thermosphere and whose efficiency is affected by gravity waves (GWs). These GWs are not explicitely represented in the global models often used to calculate infrasound propagation because their spatial scales are well below the models resolution. These unresolved GWs also transport momentum and control in good part the large-scale circulation in the middle atmosphere. These two issues make that the GWs need to be parameterized to improve the datasets used to calculate infrasound propagation as well as in the Atmospheric General Circulation Models (AGCMs) that are used to make weather forecasts and climate predictions. These two issues gain in being treated in conjonction. From this, improved infrasound calculations could be made by using a realistic amount of GWs. In return, using infrasound records could help specifying important characteristics of the GWs that are parameterized in the climate models.

The paper presents a research framework developed to address these issues. It first presents a non-orographic GWs parameterization used and tested in a well-established AGCM, emphasizing the most recent developments, like the introduction of stochastic techniques and a better specification of the GWs sources.

The significance of GWs on the global climate is then illustrated by making sensitivity tests where the frontal and convective GWs parameters are moderatly changed. These changes impact the structure of the jets in the midlatitude stratosphere and the intensity of the sudden stratospheric warmings.

The paper also presents a method to calculate long-range infrasound propagation, and to incorporate the contribution of the GWs that are parameterized in the AGCM. We then show that the changes in GW parameters tested in the model also impact infrasound propagation. This makes infrasound detection a potential tool to tune GWs parameterization in large-scale models.