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calibration of global climate models using infrasound events

While stochastic parameterizations in Global Climate Models (GCMs) are promising for improving longstanding climate predictions, there is no consensus regarding the values of tunable parameters. In this work, we propose a Bayesian hierarchical approach to calibrate the input parameters of a stochastic multiwave gravity wave (GW) scheme, which is currently in use in the LMD GCM. The GW field is obtained as a combination of individual wavepackets, whose horizontal wavenumber, direction and phase speed are chosen randomly. These parameters are inferred using ground-based infrasound records as tracers of small-scale GW variability. In a sense, the acoustic signals are "back propagated" to adjust the GW sources on a daily basis, using for this a WKB approximation of the Taylor-Goldstein equation to represent the upward-propagating GWs. The method is applied using acoustic signals observed at the Norwegian station in August-September every year. These signals are known to be generated by the well-characterized daily ammunition destruction explosions that occur at the Hukkakero site, in northern Finland. The performance of the method is demonstrated by comparing the updated climatology and variability of the middle atmosphere with the reanalysis provided by the European Centre for Medium-Range Weather Forecasts.

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