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Atmospheric propagation of infrasound across mountain ranges

FLORENTIN DAMIENS, CHRISTOPHE MILLET, CEA, DAM, DIF, FRANCOIS LOTT, LMD, ENS Paris — Linear theory of acoustic propagation is used to analyze trapping of infrasound within the lower tropospheric waveguide during propagation above a mountain range. Atmospheric flow produced by the mountains is predicted by a nonlinear mounatin wave model. For the infrasound component, we solve the wave equation under the effective sound speed approximation using both a spectral collocation method and a WKB approach. It is shown that in realistic configurations, the mountain waves can deeply perturb the low level waveguide, which leads to significant acoustic dispersion. To interpret these results each acoustic mode is tracked separately as the horizontal distance increases. It is shown that during statically stable situations, roughly representative of winter or night situations, the mountain waves induce a Foehn effect downstream which shrinks significantly the waveguide. This yields a new form of infrasound absorption, that can largely outweigh the direct effect the moutain induces on the low-level waveguide. For the opposite case, when the low level flow is less statically stable (summer or day situations), mountain wave dynamics do not produce dramatic responses downstream. Instead, it favors the passage of infrasound, which somehow mitigates the direct effect of the obstacle.

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