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An investigation of infrasound propagation over mountain ranges

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Linear theory 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 mountain gravity wave model. For the infrasound component, this paper solves the wave equation under the effective sound speed approximation using both a finite difference method and a Wentzel–Kramers–Brillouin 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, situations that are common during night over land in winter, the mountain waves induce a strong Foehn effect downstream, which shrinks the waveguide significantly. This yields a new form of infrasound absorption that can largely outweigh the direct effect the mountain induces on the low-level waveguide. For the opposite case, when the low-level flow is less statically stable (situations that are more common during day in summer), mountain wave dynamics do not produce dramatic responses downstream. It may even favor the passage of infrasound and mitigate the direct effect of the obstacle.