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Observations, simulations, and analyses of topographically induced gravity waves

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High resolution observations and mesoscale numerical simulations are beginning to demonstrate a wide spectrum of gravity waves forced by flow over actual topography with peaks and valleys of various sizes and shapes. In particular, MODIS satellite imagery and high rate aircraft data both demonstrate large variability in gravity wavelengths and orientations. Examples are presented of data collected from several NCAR Hiaper GV ferry legs across the Colorado Rockies during the T-REX campaign which show the ubiquitous nature of the waves and the variety of wavelengths encountered. When the climatology of the combined spectrum of this superposition of waves is examined, two $k^{-5/3}$ regions are obtained, one at lower wavenumbers with higher spectral levels due the gravity waves and another at higher wavenumbers with lower spectral levels corresponding to the background small scale turbulence, which is probably caused by a history of breaking waves and other instabilities, such as KH instabilities. This seems to be connected with higher levels in the east-west structure functions derived from NWP model output. Simulations are consistent with the observations, showing large spatial variability of the turbulent structures.