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# Resonance vibrations of the Ross Ice Shelf cause persistent atmospheric waves

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Recently reported lidar observations have revealed a persistent wave activity in the Antarctic middle and upper atmosphere that has no counterpart in observations at mid- and low-latitude locations [Chen et al., 2016]. The unusual wave activity suggests a geographically specific source of atmospheric waves with periods of 3–10 hours. Here, we investigate theoretically the hypothesis that the unusual atmospheric wave activity in Antarctica is generated by the fundamental and low-order modes of vibrations of the Ross Ice Shelf (RIS). Simple models are developed to describe basic physical properties of resonant vibrations of large ice shelves and their coupling to the atmosphere. Dispersion relation of the long surface waves, which propagate in the floating ice sheet and are responsible for its low-order resonances, is found to be similar to the dispersion relation of infragravity waves in the ice-free ocean. The phase speed of the surface waves and the resonant frequencies determine the periods and wave vectors of atmospheric waves that are generated by the RIS resonant oscillations. The altitude-dependent vertical wavelengths and the periods of the acoustic-gravity waves in the atmosphere are shown to be sensitive to the physical parameters of the RIS, which can be difficult to measure by other means. Predicted properties of the atmospheric waves prove to be in a remarkable agreement with the key features of the observed persistent wave activity], including frequency band, vertical wavelength range, and weak variation of the vertical wavelength with the height. The present work is a motivation for in-depth studies of coupling between vibrations of ice shelves and waves in the upper and middle atmosphere at high latitudes.