

Near-surface environmental changes on the Ross Ice Shelf observed with high frequency seismic noise

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Ice shelf weakening or collapse can herald grounded ice instability and thus contribute to sea level rise. A better understanding of collapse mechanisms combined with improved remote and in-situ monitoring of ice shelf properties and external meteorological and oceanic forcing is necessary to improve insight into instability processes. Two seasons of continuous data from a 34-station broadband seismic network spanning the Ross Ice Shelf reveal the presence of ambient seismic near-surface modes at frequencies >1 Hz. Spectral and particle motion properties of these signals are highly sensitive to small changes in shallow elastic properties and structure to depths of several m. We note progressive (on the scale of months) and rapid (on the scale of hours) changes. Large and rapid excursions are correlated with the redistribution of shallow snow in local storms, and, in one case, with an exceptional regional melt event in January 2016. Single-station observations are modeled and inverted for elastic structure using numerical wave propagation calculations, assuming a depth-separated wave equation and laterally homogeneous layering.