Geophysical Research Abstracts
Vol. 20, EGU2018-1847, 2018
EGU General Assembly 2018

Long term changes in ambient seismic noise with a focus on the southern hemisphere

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Storminess across the globe has apparently increased over the past two decades, as shown by ocean wave height and wind speed deduced from satellite observations. In contrast, wave heights recorded at spot locations by waverider buoys in the Southern Ocean show little significant change over a similar time frame. We present the first results of a study that examines long duration records of ambient seismic noise across the Earth, but with a focus on the southern hemisphere. Any changes in ambient noise amplitude over the decades provide an independent line of evidence with regard to increased storminess or shifting storm patterns, which potentially allows the contradiction between satellite and waverider buoy observations to be reconciled.

In this investigation, we examine over 50 long duration seismic station records at a range of frequency bands (0.05 Hz to 0.4 Hz) along the spectrum from the lower-frequency primary microseisms to the higher-frequency secondary microseisms. Power spectral density is calculated for appropriate time windows and compared to ocean-wave hindcasts in the light of recent insights into the sources and propagation of ocean sources of ambient seismic noise gained from separate full wavefield seismic array investigations of such sources. After careful checking for instrumentation-related changes, we find that the long term changes are often different for individual stations, i.e. that an overall increase in noise amplitude in line with satellite observations is an oversimplified picture. The changes are both strongly frequency dependent, and strongly location dependent, pointing towards either a change in the locations of the most significant storms, or a shift in the track that the significant storms then follow.