



Contribution of seasonal presence of cetaceans, earthquakes, drifting icebergs and anthropogenic activity to the ambient noise level in the Southern Indian Ocean

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Assessing the ambient sound level in the oceans is essential for a better understanding of the interactions between the ecosystem and anthropogenic activities. Ambient noise studies conducted in the North Pacific and Atlantic oceans, have shown that since the 60's oceanic noise level increases with the ship traffic, even if potential impacts of shipping noise on the ecosystem is not yet fully understood. However long-term acoustic records for the Indian Ocean are still limited. Here we present long-term statistics on the ambient sound in the Southern Indian Ocean basin based on 2 years of data collected at 5 widely distributed autonomous hydrophones. The data consist of single hydrophone spectra (10-100 Hz in 1-Hz bins) averaged using Welch's method over 200 s. Spectral probability distributions of the ambient sound level are analyzed in order to identify the main sound sources and their geographical and time variability. The mean sound level within the array is 10 to 20 dB lower than in other oceans, revealing a weaker influence of shipping on the Southern Indian Ocean noise budget. Seismic events are evenly distributed in time and space and mostly contribute to the general low-frequency background noise. Periodic signals are mainly associated with the seasonal presence of 3 types of blue whales and fin whales whose signatures are easily identified at target frequencies. Winter lows and summer highs of the ambient noise levels are also well correlated with ice volume variations. Icebergs are found to be a major sound source, strongly contributing to seasonal variations even at northernmost sites of the array. Although anthropogenic factors do not seem to dominate the noise spectrum, shipping sounds are present north and east of the array. Observed higher sound levels are consistent with the proximity of major traffic lanes.