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Microseisms and sea wave height in the Ligurian Sea: a preliminary analysis.

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Analysis of the relationship between microseisms and sea wave heights is a fundamental step for understanding the interaction of sea storms with near coastal environment, as well as to gain insights about the possibility of forecasting sea wave heights from microseism. The possibility to predict sea wave heights in the Ligurian Sea is analyzed in this study using about a month of observations from both seismic recordings from a near-coast station (IMI - Imperia Monte Faudo) and significant sea wave heights measured from a buoy (Côte d'Azur buoy, Météo-France network). We focus on the analysis of the vertical component of microseism, which reveals a strong correlation with measured sea wave heights. Looking at the amplitude spectrogram of the vertical component of microseism, we recognize the effects of several meteo-marine events that can be ascribed to Atlantic barometric pressure lows and a series of sea storms in the Ligurian Sea. Moreover, the distinction between primary and secondary microseism is inferred from the spectrogram, even if, because of the superposition of Atlantic and Ligurian effects, it sometimes results difficult. Analysis of microseism polarization reveals a double origin which determines two prevailing orientations, corresponding to Atlantic and Ligurian meteo-marine phenomena. We feature the spectral properties of microseism making a close correlation among (1) the power spectral density spectrum of microseism, (2) the significant sea wave heights measured from the buoy and (3) sea storms occurred in the period under study, showing that there is a good correlation between spectral energy content of microseism and sea wave height. Finally, in order to set up a predictive law, we solve an inverse problem to find the optimal parameters that allow us to estimate the sea wave height given the vertical component of microseism. Specifically, the application of the definition of significant height wave height for the microseism needs the determination of some unknowns that, in our case, are sought employing a Monte Carlo Markov chain method. The resulting predictive law is based on the definition of significant sea wave height modified to account for the characteristics (both amplitude and frequency content) of microseism. Our simple predictive law demonstrates a good ability to reproduce the observed sea wave heights. This work represents a first step aiming at assessing the possibility of predicting significant sea wave height in the Ligurian Sea.