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Impact of wind on ambient noise recorded by the "13 BB star" seismic array in northern Poland

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Seismic interferometry and beam forming techniques were applied to ambient noise recorded during January 2014 at the "13 BB star" array, composed of thirteen seismic stations located in northern Poland, with the aim of evaluating the azimuth of noise sources and the velocities of surface waves. After normalizing the raw recordings in time and frequency domain, the spectral characteristics of the ambient noise were studied to choose a frequency band suitable for the waves' retrieval.

To get the velocity of surface waves by seismic interferometry, the crosscorrelation between all station pairs was analysed for the vertical and horizontal components in the 0.05-0.1 Hz, 0.1-1 Hz and 1 10 Hz frequency bands. For each pair, the crosscorrelation was applied to one hour recordings extracted from the ambient noise. The obtained traces were calculated for a complete day, and then summed together: the daily results were stacked for the whole January 2014. In the lowest frequency range, most of the energy is located around the 3.0 km/s line, meaning that the surface waves coming from the uppermost mantle will be retrieved. The intermediate frequency range shows most of the energy between the 2.0 km/s and 1.5 km/s lines: consequently, surface waves originating from the crust will be retrieved. In the highest frequency range, the surface waves are barely visible on the crosscorrelation traces, implying that the associated energy is strongly attenuated.

The azimuth variation associated to the noise field was evaluated by means of the beam forming method, using the data from the whole array for all the three components. To that, the beam power was estimated in a small range of frequencies every day for the whole month. For each day, one hour long results of beam forming applications were stacked together. To avoid aliasing and near field effects, the minimum frequency was set at 0.05 Hz and the maximum to 0.1 Hz. In this frequency band, the amplitude maximum was sought corresponding to the best fit between phase slowness and back azimuth. The azimuth was mainly associated to the angle of the highest peak on the vertical component; however, if the related energy was not large enough, the angle of the main noise source on the horizontal component was employed. In some cases, the azimuth of the secondary peak was taken into account, if its energy was strong enough.

The results were related to the daily mean wind speed around Europe recorded during the same month. A significant correlation between the daily average level of ambient noise and the mean wind speed was found. The main source of the ambient noise was located in the Atlantic Ocean and in the North Sea: some weaker sources, however, were identified as the Barents, Baltic, Mediterranean, and Black Seas.

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