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The Influence of Atmospheric Boundary Layer Turbulence on a Microbarometer Array for Infrasound Detection

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The Royal Netherlands Meteorological Institute (KNMI) operates a three-dimensional microbarometer array at the Cabauw Experimental Site for Atmospheric Research (CESAR) observatory in The Netherlands. The array consists of a surface based infrasound array with 10 elements. By exploiting the 213 m meteorological tower at the site, five additional microbarometers are positioned at the 60, 100, 140, 180, and 200 m level. This setup is used for the study of infrasound, and density waves in the atmospheric boundary layer (ABL). The ABL plays a central role in the detectability of infrasound, for 1) the propagation conditions which depends on temperature and wind stratification, and 2) the wind noise levels. The surface sensors are shielded against direct wind thrust by burying them in the ground. Porous tubes connected to the microbarometers and laid out over the surface further filter possible wind induced noise. The elevated sensors will be influenced by the wind thrust induced pressure field around the mast. By laying the porous tube around the cylinder of the mast some canceling of wind thrust is expected. In the present work, the behavior of the array is analyzed under various ABL conditions with an emphasis on the difference between the surface and tower based instruments. Use is made of the comprehensive meteorological observational program of CESAR. Statistical parameters and spectra of the pressure sensors are related to independent ABL measurements, like turbulence and stability, that characterize the conditions of the ABL. Also use is made of simultaneous turbulent wind observations by means of sonic anemometers in the main tower. Such information is of great use to understand which processes in the ABL influence the detectability of infrasound throughout the day.