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Three-Dimensional Array for the Study of Infrasound Propagation Through the Atmospheric Boundary Layer

The Royal Netherlands Meteorological Institute (KNMI) operates a three-dimensional microbarometer array at the Cabauw Experimental Site for Atmospheric Research observatory. The array consists of five microbarometers on a meteorological tower up to an altitude of 200 m. Ten ground-based microbarometers surround the tower with an array aperture of 800 m. This unique setup allows for the study of infrasound propagation in three dimensions. The added value of the vertical dimension is the sensitivity to wind and temperature in the atmospheric boundary layer over multiple altitudes. In this study, we analyze infrasound generated by an accidental chemical explosion at the Moerdijk petrochemical plant on 3 June 2014. The recordings of the tower microbarometers show two sequential arrivals, whereas the recordings on the ground show one wavefront. This arrival structure is interpreted to be the upgoing and downgoing wavefronts. The observations are compared with propagation modeling results using global-scale and mesoscale atmospheric models. Independent temperature and wind measurements, which are available at the Cabauw Experimental Site for Atmospheric Research, are used for comparison with model output. The modeling results explain the signal arrival times; however, the tower wavefront arrivals are not explained. This study is important for understanding the influence of the atmospheric boundary layer on infrasound detections and propagation.

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