



Stratospheric and Thermospheric Infrasound Signals Recorded at IS37, Norway

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The IMS infrasound array IS37, near Bardufoss in northern Norway, started providing data in October 2013. In the boreal summer, the stratospheric waveguide promotes the observation at IS37 of infrasound from numerous military and industrial sources of repeating explosions to the east and southeast at distances between 200 and 800 km. In August and September 2014, IS37 recorded for the first time infrasound signals from each of 15 ammunition destruction explosions at Hukkakero, a military site in northern Finland at a distance of 320 km. The first 12 of the explosions were large blasts with yields of approximately 20 tons and, for each of these events, an extensive wavetrain is observed. Approximately 18 minutes after the explosion (celerity 296 m/s) a long duration signal, rich in high frequencies, is observed that extends for approximately two minutes. Between 3 and 4 minutes after the arrival of this signal (celerity around 240 m/s) signals of far shorter duration and lower frequency are observed with higher trace velocities, indicating refraction from greater altitudes.

Modelling supports the hypothesis that these distinct parts of the wavetrain are stratospheric and mesospheric/thermospheric phases respectively. The array geometry provides excellent resolution of the backazimuth and trace velocity and we observe that the trace velocity for almost all of the stratospheric part of the wavetrain is essentially constant, whereas the thermospheric phases are associated with quite differing trace velocities: indicative of turning points at different altitudes.

The array design, 10 sites arranged around a central element in two approximately concentric rings with log-period radii, provides excellent suppression of noise and the forms of the signals become far better defined under a beam-forming operation, both for the low and the high frequencies.

The final three explosions at Hukkakero in 2014 were of far lower yield and only generated signal detections at IS37 in the stratospheric part of the wavetrain.