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Overview of the 2009 and 2011 Sayarim Infrasound Calibration Experiments

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The establishment of the International Monitoring System (IMS) of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) has stimulated infrasound research and development. However, as the network comes closer to completion there exists a lack of large, well-constrained sources to test the network and its capabilities. Also, significant uncertainties exist in long-range acoustic propagation due to a dynamic, difficult to characterize atmosphere, particularly the thermosphere.

In 2009 and 2011 three large scale infrasound calibration experiments were performed in Europe, the Middle East, Africa, and Asia. The goal of the calibration experiments were to test the IMS infrasound network and validate atmospheric and propagation models with large, well-constrained infrasound sources. This presentation provides an overview of the calibration experiments, including deployment, atmospheric conditions during the experiments, explosion characterization, infrasonic signal detection and identification, and a discussion of the results and implications.

Each calibration experiment consisted of singular surface detonation of explosives with nominal weights of 82, 10.24, and 102.08 tons on 26 August 2009, 24 January 2011, and 26 January 2011, respectively. These explosions were designed and conducted by the Geophysical Institute of Israel at Sayarim Military Range, Israel and produced significant infrasound detected by numerous permanent and temporary infrasound arrays in the region. The 2009 experiment was performed in the summer to take advantage of the westerly stratospheric winds. Infrasonic arrivals were detected by both IMS and temporary arrays deployed to the north and west of the source, including clear stratospheric arrivals and thermospheric arrivals with low celerities. The 2011 experiment was performed during the winter, when strong easterly stratospheric winds dominated in addition to a strong tropospheric jet (the jet stream). These wind jets allowed detection out to 6500 km, in addition to multiple tropospheric, stratospheric, and thermospheric arrivals at arrays deployed to the east. These experiments represented a considerable, successful collaboration between the CTBTO and numerous other groups and will provide a rich ground-truth dataset for detailed infrasound studies in the future.