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Merging Infrasound and Electromagnetic Signals as a Means for Nuclear Explosion Detection

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The infrasound monitoring network of the CTBT consists of 60 stations. These stations are capable of detecting atmospheric events, and may provide approximate location within time scale of a few hours. However, the nature of these events cannot be deduced from the infrasound signal. More than two decades ago it was proposed to use the electromagnetic pulse (EMP) as a means of discriminating nuclear explosion from other atmospheric events. An EMP is a unique signature of nuclear explosion and is not detected from chemical ones. Nevertheless, it was decided to exclude the EMP technology from the official CTBT verification regime, mainly because of the risk of high false alarm rate, due to lightning electromagnetic pulses [1].
Here we present a method of integrating the information retrieved from the infrasound system with the EMP signal which enables us to discriminate between lightning discharges and nuclear explosions. Furthermore, we show how spectral and other characteristics of the electromagnetic signal emitted from a nuclear explosion are distinguished from those of lightning discharge. We estimate the false alarm probability of detecting a lightning discharge from a given area of the infrasound event, and identifying it as a signature of a nuclear explosion. We show that this probability is very low and conclude that the combination of infrasound monitoring and EMP spectral analysis may produce a reliable method for identifying nuclear explosions.

[1] R. Johnson, Unfinished Business: The Negotiation of the CTBT and the End of Nuclear Testing, United Nations Institute for Disarmament Research, 2009.