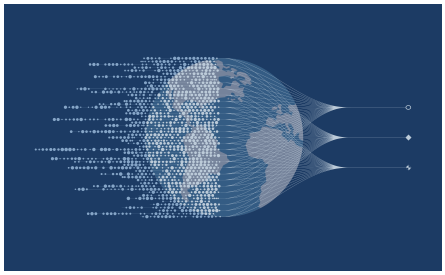

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bolide shock source and propagation variability through a case study

In theory, infrasound signals generated by bolides offer a window into understanding source properties, such as shock altitude and energy. However, to accurately leverage these signals, both ground truth and accurate atmospheric specifications are essential, as dynamic atmospheric variations over minutes to hours can affect signal viability, and complex propagation paths may lead to unexpected detections or missed signals. A noteworthy example is the 23 July 2008 bolide over Tajikistan, detected at two Comprehensive Nuclear Test-Ban Treaty Organization (CTBTO) International Monitoring System network stations (1500-2100 km from the source). Surprisingly, propagation models using realistic atmospheric profiles predicted signal arrival at one of the stations, yet detection occurred at both. This anomaly was likely caused by acoustic energy guided within a leaky stratospheric duct—a phenomenon only recently confirmed by high-altitude balloon infrasound experiments. The primary shock originated from a spherical blast due to the main fragmentation event of the bolide. This study demonstrates the capability of infrasound to characterize bolide events, supporting advancements in CTBTO's atmospheric event detection and interpretation.
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