Using the international monitoring system of seismic, infrasound, and hydroacoustic sensors for global airburst detection

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The impact of meter-sized objects with the Earth occurs every few weeks [1,2]. Most of these collisions result in airbursts, here defined as impacts where the meteoroid's initial kinetic energy is of order a small nuclear weapon ($>$ 0.1 kilotons of TNT equivalent = 4.185×10^{11} J) and where this energy is fully deposited at high altitude in the atmosphere. Historically, the majority of these airbursts go undetected over oceans or remote land areas as dedicated fireball camera networks (eg.[3]) cover less than 1 % of the globe. Airbursts often produce meteorite falls and hence airburst data may yield pre-atmospheric orbits and physical properties for the impacting NEO providing context for recovered meteorite samples [4]. With the advent of more capable telescopic survey systems, pre-atmospheric detection of NEO-producing airbursts has become possible as evidenced by the impacts of 2014 AA and 2008 TC_3 [5]. Detection of "terminal plungers" is expected to become more common as projects such as ATLAS [6] become operational. This increases the need for instrumental data of the corresponding airburst, particularly its location and energy.

Beginning in the late 1990s, a global network of seismic, infrasound, and hydroacoustic sensors has been deployed globally to provide treaty verification for a nuclear test ban. This network is the International Monitoring System (IMS) overseen by Comprehensive Nuclear Test Ban Treaty Organisation (CTBTO) [7]. The IMS is a unique global resource for detection of explosions worldwide and in recent years shock waves from many airbursts [8] have been detected by the system.

Data from the IMS permits airburst location, origin time and energy to be measured. In rare cases, source heights, trajectories, and details of fragmentation may be obtained. Here the current capabilities of the IMS will be presented in the context of airburst detection and characterization. Empirical characteristics of the long-range sound produced by airbursts through comparison with other technologies will be summarized [9] and some recent examples of IMS detected airbursts presented. Finally, the inferred flux of impactors based on global airburst monitoring will also be described.

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