

Low-level meteor terminations over the Maritimes and New England previously misinterpreted as felt earthquakes

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Meteoroids may “burn up”, or vapourise, very high in the atmosphere and are seen as but a brief streak in the night sky. Larger asteroids, or bolides, survive to reach the lower atmosphere and where their disintegration can cause potentially hazardous effects at the Earth’s surface.

The 1908 Tunguska fireball in remote Siberia detonated as an “airburst” at an altitude of ~ 6–10 km and was the equivalent of ~ 5–15+ mt of trinitrotoluene (TNT). A 1930 ‘mini-Tunguska’ event near Curuçá in the Brazilian Amazon was barely 0.1–0.5 mt of TNT. The February 15, 2013 Chelyabinsk meteor entered the atmosphere at a low- angle, fragmented at ~30–50 km height, and released energy of ~500(+/-100) kt at an altitude of ~25 km.

The impetus for our study began when one of us (F-St L) started to re-examine our 1986–87 accounts of historical seismicity in Nova Scotia and New Brunswick (AR, JP, and KB) looking for accounts of earthquake lights. She quickly realised that some of the descriptions of events could be explained by meteor airbursts in the lower atmosphere and their seismic effects. The authors have now found accounts of three meteor terminations over the Maritimes and New England, where meteor airbursts created acoustically-heard sound and coupled with the Earth’s surface to create felt seismic vibrations.

One event on December 21, 1863, had been identified previously by AR and JP as a meteorite strike in the vicinity of Parrsboro and Amherst, Nova Scotia. Meteorite fragments may have reached the ground in the Parrsboro area since a strong odour of ‘brimstone’ nauseated residents shortly after the airburst. The “New Year’s” January 1, 1883 event was originally listed in felt-earthquake epicentre databases as being located in the Passamaquoddy Bay region. No seismic effects were observed at St Andrews on the coast of the Bay, but the meteor was observed as far south as Taunton, Massachusetts. The strongest effects were observed and felt in southwest Nova Scotia and the hypothesis being tested is that this was a meteor termination just to the south of Yarmouth with meteor ablation over the Halifax region.

A third event has been in the historic felt-earthquake database for southern New England for over 131 years but is clearly the result of a meteor airburst. This origin was flagged at the time but ignored in subsequent USGS tectonic earthquake catalogues. Continuing studies are showing that certain historic felt-earthquake events are attributable to meteor airbursts.