



High-Power Large-Aperture radar echoes – possibly due to long-distance and high-altitude meteor echoes

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Meteor echoes of several types and auroral radar backscatter are known to occur frequently in the E-layer. They arise due to meteor plasma bursts and/or field-aligned irregularities (FAIs). Both of these phenomena can be efficiently studied by high-power large-aperture (HPLA) radars at the under-the-horizon (UTH) and over-the-horizon (OTH) distances. In this paper we highlight long-range high-altitude (LRHA) meteor echoes collected at low elevation angles and distances of 1200-2000 km where their rectilinear-ray altitudes are 150-300 km.

The LRHA meteor echoes are mysterious because the facts: (a) they cannot be attributed to regular meteor echoes due to their high altitudes, (b) nor FAIs: measured altitudes correspond to large aspect angles, (c) nor a space debris or Earth-orbiting objects due to a lack of regular path sequence of these echoes and (d) none of these echoes were matched with known objects from NORAD catalog.

Although previous studies of LRHA radar backscatter [1] and of high-altitude meteor echoes exist [2, 3], there are still no satisfactory explanations available. Here we suppose that LRHA echoes are formed through the E-layer radar backscatter at OTH distances of 1200-1600 km by forward scattering (two ways) of a suitable specular meteor trail in the D-layer. Meteor echoes at 1600-2000-km distances, we believe, are products of forward scattering with a low-incident-angle illumination (LIAI) of the E-layer and enhanced intermittent radiowave semi-ducting at proper tilted parts (roughly the same as the radiowave incident angle) of ionospheric low-frequency acoustic/gravity waves [4].

We have shown that due to LIAI our HPLA radar with poleward-oriented field of view in OTH area had better aspect angles than at UTH area. Furthermore, according to our simulations the propagation losses of forward scattering can often be close to line-of-sight path losses, which also supports the existence of OTH echoes.

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