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# Survey of GNSS scintillation-inducing irregularity layer altitude

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Caused by irregularities in plasma density, ionospheric L-band scintillation depends on total ionization as well as ionization rate. L-band scintillations have been observed at high latitudes during periods of visible aurorae. Auroral emissions models describe total emissions to a ground observer based on Maxwellian electron distributions with peaks at an electron characteristic energy. Emissions are related to ionization rates rather than total ionized density.

Previous surveys of Global Navigation Satellite System (GNSS) scintillation showed that the irregularity layer could be hypothesized based on the altitude of the peak ionized density, as measured by incoherent scatter radar (ISR). The study found that the majority of solar maximum scintillation events were hypothesized to be in the E layer, and a decreasing percentage and number of them were F layer during the declining solar cycle. However, these studies did not account for uncertainties in the density measurements.

In this work, we re-run the detection, classification, and hypothesis-of-layer, this time excluding events for which the peak altitude density ISR errors are high. We show how the layer hypothesis changes as a result. Next, we investigate how the layer as hypothesized by all-sky imaging (ASI) estimates of ionization rate compare to the layers based on peak density. Using a database from 2014-2018 of several thousand phase scintillation events recorded at Poker Flat Research Range, Alaska, we compare the percent of scintillation events hypothesized to be occurring in the E layer with ISR versus with ASI.