

Properties of High Latitude Irregularities with a Short-Baseline 2D GPS Scintillation Array

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Variations in plasma density in the ionospheric layer can cause fluctuations in the received amplitude or phase of a trans-ionospherically propagating radio wave. Such fluctuations are termed scintillation, and can lead to loss of continuity in radio-navigation for users of Global Navigation Satellite Systems (GNSS) such as GPS, Beidou, GLONASS, and Galileo. A scintillating signal can cause a user's receiver to lose lock on one or more satellites at a given instant. These satellites are then temporarily unavailable for position, navigation and timing estimates, reducing accuracy. Scintillation is observed most frequently in the equatorial and auroral zones. In these regions, different physical mechanisms are responsible for the formation of ionospheric irregularities that cause scintillation.

With a focus on high-latitude scintillations, we have established an array of GPS scintillation monitors at the Poker Flat Research Range (the "Range"), Alaska, in the USA. The array of 6 receivers are separated by no more than about 2 km and are distributed in latitude and longitude. The purpose of this array is to examine phase variations spatially and temporally, and to estimate properties (scale sizes, velocities, altitudes) of the irregularities causing them. The array of receivers produces amplitude and phase scintillation indices at 100-s intervals, as well as 100 Hz raw IF samples. The scintillation indices are streamed to a server and hosted at a website available to the public. The database from the Range dates back to late 2013. In addition, data from the test array site (University of Calgary, Canada) in early through mid-2013 are available.

In this work, we present an overview of the short-baseline scintillation array, processes for automation and "QuickLook" evaluation, and studies of two-dimensional plasma velocity and spectral estimates. We correlate these observations with data from the Advanced Modular Incoherent Scatter Radar (AMISR) at Poker Flat as well as all-sky cameras established there, in order to examine the relationship of the occurrence of L-band scintillation with auroral activity.