

# **Ionospheric irregularity drift velocity estimation using multi-GNSS spaced-receiver array during high latitude phase scintillation**

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## **Abstract**

The spaced-receiver technique using GNSS receivers offers an inexpensive approach for estimating ionospheric irregularity velocity during ionospheric scintillations. Our previous work has demonstrated that correlative studies of the GNSS carrier phase variations can be used to derive irregularity drift velocity at high latitudes. In this study, GPS, Galileo, and GLONASS satellites are all incorporated in the high latitude spaced-receiver study. The variations in the estimated results caused by different assumptions on ionospheric irregularity heights are investigated. A case study is presented that utilizes three GNSS constellation measurements during a geomagnetic storm event on 2015/12/20 obtained from a closely spaced receiver array in Poker Flat, Alaska. The GNSS-estimated irregularity drift velocities are in general agreement with the measurements from the Poker Flat Incoherent Scatter Radar and the Poker Flat All-sky Imager. The study also shows that the irregularity altitude assumption will not lead to significant variations in the irregularity drift velocity estimations, especially for satellites with relatively high elevations. The techniques presented in this paper demonstrate that GNSS receiver arrays can be used to as a powerful means to monitor the ionospheric plasma dynamics during space weather events.