

On the application of low-cost ionospheric scintillation monitors to distributed sensor studies of ionospheric irregularities

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In this presentation, we will talk about ScintPi, which is a low-cost, easy-to-build scintillation monitor developed with a single-board computer (Raspberry Pi) equipped with an off-the-shelf single-frequency GPS peripheral (Adafruit GPS). Both components are relatively inexpensive, widely available and have been commonly used by hobbyists for different applications. Computer code required for data acquisition is also fairly simple.

We proposed and tested ScintPi for studies of intermediate scale-size (100s of m to a few km) ionospheric irregularities, more specifically those contributing to L-Band radio scintillation. For initial tests, ScintPi was deployed at a single location at low latitudes, where ionospheric irregularities causing scintillation are known to occur frequently. Continuous measurements were made for over an year.

In this talk we will briefly present examples of short- and long-term observations made at low latitudes with this sensor. The results serve to show that ScintPi can be used to detect and monitor ionospheric irregularities. We will also show comparisons of amplitude scintillation events detected by ScintPi and a collocated commercial GNSS scintillation monitor.

We will then present a new version of the system that we would like to deploy at distributed sites over the United States and Brazil for studies of mid- and low-latitude irregularities, respectively. In addition to advancing our understanding intermediate scale-size irregularities, the deployment provides an opportunity to engage citizen scientists, create research opportunities for undergraduate students in STEM fields, and increase literacy about geospace studies and space weather.

Finally, if time allows, we will present examples of successful observations made with new versions of ScintPi we developed: ScintPi 2.0 (multi-GNSS) and ScintPi 3.0 (multi-GNSS and multi-frequency).