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A multi-instrument study of high-latitude ionospheric irregularities and their effects on GPS ionospheric scintillation

Christer van der Meeren (1,2), Kjellmar Oksavik (1,2), Jøran Moen (3,4), and Vincenzo Romano (5)

(1) Department of Physics and Technology, University of Bergen, Bergen, Norway, (2) Birkeland Centre for Space Science, Bergen, Norway, (3) Department of Physics, University of Oslo, Oslo, Norway, (4) University Centre in Svalbard, Longyearbyen, Norway, (5) Istituto Nazionale di Geofisica e Vulcanologia, Italy

Scintillations are rapid amplitude and phase fluctuations of electromagnetic signals. GNSS-based systems may be disturbed by plasma irregularities and structures such as plasma patches (areas of enhanced electron density) and plasma gradients in the ionosphere. When the GNSS radio signals propagate through such areas, in particular gradients, the signals experience scintillations that at best increases positioning errors and at worst may break the receiver's signal lock, potentially resulting in the GNSS receiver losing track of its position.

Due to the importance of many GNSS applications, it is desirable to study the scintillation environment to understand the limitations of the GNSS systems.

For this study, GPS receiver scintillation and Total Electron Content (TEC) data from high-latitude locations will be combined with several other data sets, including the EISCAT Svalbard Radar (ESR) and allsky cameras to perform a multi-instrument case study of GPS ionospheric scintillations. The EISCAT data provides a means to determine the altitude and density of the F layer, which can then be used to calibrate allsky projections as well as coordinates of ionospheric piercing points of the GPS signals.

The focus will be studying any connection between scintillations and polar cap patches; however, other interesting and related findings will also be presented, herein statistical long-timespan studies of GPS TEC and/or scintillation data.