URSI AP-RASC 2019, New Delhi, India, 09 - 15 March 2019

How scintillating is scintillation?

P. T. Jayachandran
Physics Department, University of New Brunswick, Fredericton, NB, Canada

ABSTRACT

Global Navigation Satellite Systems (GNSS), including the Global Positioning System (GPS), GLONASS and Galileo, support a wide range of civilian and military applications, and have become indispensable in precise positioning and time keeping. Ever-increasing dependence on space technologies pervades every area of our daily life like never before in history. Investigating and understanding the Solar-Terrestrial interaction, and its impact on these technologies has become critical to the stability of our modern technology-dependent society. One of the major impacts of Solar-Terrestrial interaction on technology is the effect of ionosphere on radio waves. One of the effects of ionosphere on radio signal is the scintillation. Scintillation, random rapid fluctuations (a stochastic process) of amplitude and phase of the trans-ionosphere radio signal, is caused by the diffractive properties of the medium, and the structures within it. Understanding the generation and dynamics of these structures/irregularities will in turn aid modeling/forecasting this physical phenomenon, and mitigate it if possible.

Modelling and/or mitigating the effect of a stochastic process such as scintillation is an impossible task especially when underlying mechanism that is causing the scintillation is not well understood. This is complicated by the fact the signal, as they propagate through the ionosphere, undergoes refractive variations (deterministic) as well. These refractive variations can mimic scintillation if the data is not treated properly. Compounding this fact is the arbitrariness in quantifying/identifying the scintillation, especially in the high-latitude region. In recent years, we have been concentrating our attention on data mining (automation), modeling, and forecasting using the so called scintillation indices. However, we believe (based on recent data) that relying on such indices may very well have been the wrong approach. We will show with evidence, using data of very high sampling rates (50 & 100 Hz), that the conventional approach led us down the wrong path. This talk will focus on the metrology of scintillation measurements and a new approach for studying the micro-physics of scintillation producing ionospheric structures.