Polar region Scintillation research in the GPS Era - What went wrong in the last several years?

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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. As our society moves towards an increasing dependence on space technologies and our environment affects our daily life like never before, understanding the Solar-Terrestrial interaction, and its impact on technologies has become critical to the well being of our modern technology-dependent society. One of the major impact of Solar-Terrestrial interaction on technology is the radio wave scintillation. Scintillation, random rapid fluctuations of the trans-ionosphere radio signal, is caused by the refractive and diffractive properties of the medium, and the structures within it. Understanding the generation and dynamics of these irregularities will in turn help model/forecast this physical phenomenon, and mitigate it if possible.

Over the last few decades we have been focussing on the so called scintillation indices to develop a better understanding of the underlying physics of the scintillation producing irregularities, and attempt to develop predictive models. However, we believe that relying on such indices may very well be the wrong approach especially in the polar regions. We will show with evidence, using very high sampling rates (50 &100 Hz), that the conventional approach of deriving scintillation indices and relying on these indices for system application and understanding the micro-physics of plasma irregularities led us down the wrong path. We will propose a new approach to study the micro-physics of scintillation producing ionospheric structures.