

A Preliminary Three-Dimensional Modeling of Ionospheric Irregularities Applied to the Scientific Mission of the SPORT Project

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Abstract: The SPORT (Scintillation Prediction Observations Research Task) project is an international collaborative space mission between institutes in Brazil (ITA and Instituto Nacional de Pesquisas Espaciais - INPE) and the United States (NASA Goddard Space Flight Center, NASA Marshall Space Flight Center, Utah State University, the University of Texas at Dallas and Aerospace Corporation) to explore the phenomenon of the equatorial plasma bubbles (EPBs) and their impact on scintillation using a CubeSat equipped with various instruments for diagnosing the ionosphere. In this way, scintillation is an electromagnetic signal distortion caused by ionospheric irregularities that has not yet been resolved due to the complicated interactions of these signals with the highly irregular and inhomogeneous medium of the EPBs, regions of low ionospheric plasma density. Hence, to analyze the EPBs main characteristics, we propose a three-dimensional model of ionospheric irregularities, which is under development. Our aim here is to present the mathematical derivation of the model, from the conservative form of the transport equations to the demonstration that the problem can be described through a convective-diffusive equation. We expect that this preliminary modeling will enable us make an initial analysis in terms of the variables involved in the study of ionospheric irregularities.

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