Morphology of the ionospheric scintillations over the southern polar cusp station, Bharati

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Under the influence of dynamic and turbulent solar wind, the terrestrial magnetosphere-ionosphere system exhibits highly complex behavior which forms the major component that decide the Earth's Space Weather. Since the polar ionosphere is directly connected to the solar wind and the magnetosphere, under open magnetic field line conditions, changes triggered by space weather events reaches the ionospheric altitudes giving rise to a variety of phenomena observed exclusively at these regions. Our knowledge of the magnetically quiet/disturbed time behavior of the southern polar ionosphere is however not comprehensive as it is under-explored in comparison to the northern polar region. With an aim to study the energetic coupling between the Sun-Earth system and its impact on the southern polar ionosphere, a dual frequency Global Positioning System (GPS) receiver was installed at the Indian Antarctic station, Bharati located in Larsemann Hill area of Antarctica in 2013. Bharati is an ideal location to study the solar wind-magnetosphere-ionosphere coupling as it changes from the vicinity of the polar cusp into the auroral zone and into the polar cap. The detailed analysis of the data from the GPS receiver spanning over a period of 7 years (2013-2020) provided the daily, seasonal, annual and solar cycle variations in the ionospheric electron density during both magnetically quiet and disturbed times. The long-term variations in the ionospheric irregularities and its correlation with the solar wind and geomagnetic conditions during periods of varying solar activity are also examined. The results of this study provides insight into the behavior of the southern polar ionosphere during varying space weather conditions and is useful in developing tools for the prediction of space weather effects over the high-mid latitude ionosphere.