



VII Brazilian Symposium on Space Geophysics and Aeronomy

05 - 09 November 2018 - CRS/COCRE/INPE, UFSM - Santa Maria - RS

GROUND-BASED RADAR STUDIES OF THE GEOSPACE AT LOW LATITUDES AND SPACE WEATHER

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ABSTRACT

Studies of the space environment near Earth (geospace) are motivated by intriguing fundamental physical processes that have yet to be fully understood. Studies of the geospace are also motivated by technological applications whose performance depends on the state of this environment. The ionosphere is an important part of the geospace, and can be described as a weakly ionized, low-temperature, magnetized plasma. The ionosphere is created, in most part, by solar photoionization and is located between about 60 km altitude and extending above 1,000 km. This presentation will provide a brief introduction to the Earth's ionosphere, followed by targeted examples of current scientific challenges in the low latitude region. The presentation will then continue with a description of ground-based radar techniques commonly used for ionospheric observations. Then, radar systems available in the American longitude sector will be presented. This includes the incoherent scatter radar (ISR) of the Jicamarca Radio Observatory (JRO) in Peru, which is one of the largest radar systems in the world, and MELISSA, a low-power interferometric coherent scatter radar (CSR) system deployed in Sao Luis, Brazil. Examples of measurements, challenges, and results obtained with these radar systems will be presented and discussed. The results will focus on studies related to the generation and specification of large-scale interchange instabilities in the low-latitude ionospheric plasma. We will highlight the potential of combining radar observations with numerical models of the ionosphere and other types of independent ground- and space-based observations for advancing our understanding of the low-latitude ionosphere and space weather. The presentation will conclude with thoughts on future directions, and a short summary of research and training opportunities for students interested in atmospheric and space sciences.