Paper ID: 21796
student

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Near-Earth and Interplanetary Communications (3)

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EVALUATION OF THE POTENTIAL OF SMALL SATELLITE GROUND STATION FOR ATMOSPHERIC SCIENCE USING NEAR EARTH SPACE COMMUNICATIONS.

Abstract

The ionosphere has a great impact on the transmission of radio frequency signals. Inhomogeneities in the ionosphere give rise to several atmospheric phenomena like Travelling Ionospheric Disturbances (TID's), scintillations etc. which in turn have an impact on the performance of GNSS, radar. This study assesses the feasibility of obtaining scientific measurements of the ionospheric structure from a small satellite ground station by analysing signal perturbations. The inhomogeneities in the ionosphere which cause these atmospheric phenomena are predominant in the F region of the ionosphere between 250 km to 400 km. In this altitude there are several satellites whose beacon can be received with the help of a small satellite ground station. The telemetry of satellites which are above this altitude is also affected while passing through the ionosphere. A 430 MHz UHF transceiver and a 70 cm antenna has been used. The project contributes to the science objective by taking data from a small satellite ground station and analyses the Doppler shift for ionospheric science. First, by creating the data acquisition flow, the data available from the Ground Station through Tracking, Telemetry and Command operation has been acquired and analysed. Then the signal has been investigated using the Doppler shift of the signal for orbit determination and finally, the project has been extended to the study of the ionosphere. QB50 is an international mission using 50 cubesats and is a highly relevant future mission from which this project will be able to get further important information about atmospheric science. In the QB50 mission the cubesats will be launched in a circular orbit at about 350 km altitude to explore the lower thermosphere. A low Earth orbit allows high data rates because of the short communication distances involved. The scientific objective of the QB50 project is to get multi-point, in situ measurements of key constituents of the lower thermosphere using satellites separated by few hundred kilometres. If all the project goals are met then a new method of studying the ionosphere will be available, which could be extended globally.