

Sura heating facility transmissions to the CASSIOPE/e-POP satellite

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Abstract

©2017. American Geophysical Union. All Rights Reserved. Throughout a nighttime pass of the CASSIOPE satellite at an altitude of about 1300 km above the Sura heating facility, transmission of O-mode radiation from Sura to the enhanced Polar Outflow Probe (e-POP) Radio Receiver Instrument on CASSIOPE was maintained. Also, during this pass, continuous VHF/UHF transmission from the e-POP Coherent Electromagnetic Radio Tomography radio beacon to three coordinated ground receivers in the Sura vicinity was achieved. Tomography of the VHF/UHF received wave data based on total electron content permitted the two-dimensional distribution of ionospheric ambient electron plasma frequency f_{pe} to be determined in the latitude-altitude space between Sura and CASSIOPE. The f_oF_2 values about 0.1 MHz above the Sura pump frequency of 4.3 MHz were measured by the tomography. We examine the question of whether the observations can be explained on the basis of classic propagation in a smooth ionosphere. Tracing of rays from Sura toward CASSIOPE orbital locations finds most rays reflected away from the topside by the patchy ionospheric structure in bottomside f_{pe} . It is concluded that O-mode ducting in underdense field-aligned irregularities is responsible for maintaining the transionospheric transmission across the 2 min pass. O- to Z-mode “radio-window” conversion in the F region bottomside is not required to explain these data.

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Keywords

CASSIOPE/e-POP, O-mode ducted propagation, radio receiver, Sura heating, transionospheric

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