The Earth's Ionospheric Response to the Complex Interplanetary Event of November 5-6, 2001

B.T. Tsurutani¹, A.J Manucci¹, B.A. Iijima¹, M.A. Abdu², W.D. Gonzalez², A. Saito³, T. Tsuda³, B. Fejer⁴, T. Fuller-Rowell⁵, J.U. Kozyra⁶ and J. Foster⁷

¹Jet Propulsion Laboratory, Pasadena, CA
²INPE, Sao Jose dos Campos, SP, Brazil
³Kyoto University, Japan
⁴Utah State University
⁵CIREIS, University of Colorado
⁶Univ. of Michigan, Ann Arbor
⁷Millstone Hill Radar MIT

Abstract: At ~115 UT 6 November, a fast forward shock overtook a magnetic cloud composed of a steady southwardly directed interplanetary magnetic field. The shock compression of this field caused intense Bs fields leading to a strong (dayside) eastwardly directed magnetospheric electric field and a major (Dₘ ~< -300 nT) magnetic storm. The interplanetary sheath fields steadily increased over the over the next ~2 hrs to reach a maximum of ~80 nT. We explore the dayside ionospheric responses to this interplanetary event. We use GPS receivers onboard CHAMP (~400 km altitude, upward viewing), SAC-C (~700 km altitude, upward viewing), dual frequency altimeter data from TOPEX (~1300 km altitude) and ~100 ground based GPS receiver data to determine the global ionospheric total electron content (TEC) as a function of the phase of the interplanetary event/magnetic storm. It will be shown that the shock generated prompt electric fields cause an immediate uplift of the entire dayside low latitude ionosphere. A few hours later, equatorial and low latitude ionospheric TEC increases occur. About ~6 hrs after the shock, there is a significant dayside TEC decrease. Signatures of the bottomside of the plasmasphere are evident in the CHAMP (~7 pm LT) data, and the inward motion of the plasmapause during the storm main phase can be tracked/identified. The interpretation of the results will be discussed in detail.