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Solar-Ionospheric and Solar Wind-Ionospheric Coupling

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We have studied three large Halloween 2003 and the Bastille Day 2000 solar flares and their ionospheric responses. SOHO SEM data was used for the EUV flare intensity-time profiles and both ground- and satellite- GPS data were used to determine the ionospheric responses. It is found that the most intense flare in 26 to 34 nm wavelength range (by a factor of 2+) and the biggest ionospheric response (30% above background) occurred during the October 28, 2003 event. For all 4 flares, the total electron content (TEC) increases lasted ~3 hrs longer than the flare durations, indicating that the important photoionization is occurring at high altitudes where recombination rates are relatively long. This is consistent with the EUV wavelength band of the flare spectrum being the primary factor causing the TEC enhancements. We have also studied the solar wind-ionosphere interactions for the Halloween events as well as the November 2004 event. In all cases we find that the dayside ionosphere is strongly affected both in total TEC column density and in altitude (positive ionospheric storms) during magnetic storm intervals. We propose a mechanism (promptly penetrating electric fields) for the cause of both responses. Interesting consequences of ionospheric uplift will be discussed.