Understanding Ring Current Sources of Moderate and Intense Storms at Solar Maximum: Global Modeling Using Superposed Epoch Upstream Conditions

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With the Space Weather Modeling Framework (SWMF), we conduct storm simulations for superposed epoch upstream solar wind conditions of 34 moderate storms and 64 intense storms at solar maximum (July, 1999 - June, 2002). In comparison with superposed epoch averages of *Dst*, *Sym-H*, and the Los Alamos Magnetospheric Plasma Analyzer (MPA) observations at geosynchronous orbit, modeling results are validated. It is shown that the SWMF is sophisticated enough to make quantitative data-model comparisons. The major storm characteristics are successfully reproduced. With the two levels of storm intensity and different SWMF parameter settings, the influences on storms of upstream conditions, ionospheric outflow and ionospheric conductance are assessed. It is shown that the integrated energy input for a storm is much more important than the short-lived peaks in the upstream solar wind values. Consistent with the MPA averaged measurements, it is found that in the inner magnetosphere in the simulated main phase plasmas become denser near dawn than around duskside; plasma temperature is higher in the afternoon and pre-midnight sectors; but enhanced plasma pressure is always symmetric on the nightside with a peak at midnight. Possible reasons for these plasma parameter asymmetries and symmetries are investigated and discussed.