البحث السابع

Title

Can the Comprehensive Model (CM4) predict global features of sudden commencements?

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English Abstract

We investigate the capability of the Comprehensive model CM4 to predict features of geomagnetic sudden commencements (SCs) focusing on observations from five ground-based observatories along the African chain. A list of 153 SC events has been selected within the period 2011–2015 to compare between modelled and observed SCs at different seasons and local times. The study reflects the degree of consistency between the CM4 model and the real physics occurring at each ground station. It also compares the characteristics of observed and modelled SC field to show how well the model performs for predicting the SC field variation. Results of feeding the CM4 model by the SYMH index data shows that the CM4 model provides a reasonable fit of the observed SC field at stations located closer to the average latitude of Dst index stations. Positive SC field variations during the day and night times for both CM4 modelled and observed fields are expected to be a signature of the magnetopause and field aligned currents rather than the axial ring current. The dawn-dusk asymmetry of the SC modelled field, which resembles the observed field at stations located poleward of the equatorial region, reveals a significant contribution from the partial ring

current. At the magnetic equator, the equatorial ionospheric electrojet current plays a significant role in enhancing the observed SC field during daytime hours, which is not parameterized in the CM4 model. The latitudinal profile of the modelled field exhibits its maximum variation at the magnetic equator, decreasing towards the poles. This latitudinal profile resembles the observed field but is weaker. The modelled field at the latitudes of the Dst index stations has the same local time features of the observed field, but its strength is much smaller than the observed field and also it does not exceed its corresponding SYMH variations. In addition, the modelled SC field has a weak smooth variation with respect to local time, unlike the broad scattering of the observed field. Despite the substantial correlation between the modelled SC field and its associated SYMH field variations, the model always under-estimates the SYMH variations even at the magnetic equatorial station. Also, the CM4 model has no information about the SC seasonal variation, even at stations located within the same latitudes of the Dst index stations. These limitations should be considered when using the CM4 model to describe the external magnetospheric field