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Modelling seasonal and diurnal effects on the magnetospheric and ionospheric plasma dynamics

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The present study focuses on a modelling of the seasonal and diurnal effects on the dynamics of the coupled magnetosphere-ionosphere system under different solar illumination conditions, to try to reproduce some of the observations concerning the region 2 field-aligned currents. This is performed by introducing in the Ionosphere Magnetosphere Model (IMM) the Earth's rotation axis tilt, the dipole axis tilt and an eccentric dipole. The simulated patterns of the R2 FAC agree rather well with the observations. In particular the dayside FAC density is two times greater in the summer hemisphere than in the winter one. The results show that season affect in an important way the distributions of the Pedersen conductances and FAC by 36.9-55.5% and don't have much influence on the distribution of the magnetospheric plasma. The diurnal variations are of the same order of magnitude and modify the interhemispheric asymmetry of the FAC by 26-63%. Then, the eccentric dipole induces an increase (decrease) of the daily variations of the conductances and the FAC by a factor 1.1-1.4 in the southern (northern) hemisphere, irrespective of the season, which contributes to increase the asymmetry between the two hemispheres. Finally, the IMM predicts an increase of the daily variations of the ion maximum pressure and of the electron maximum energy flux at the December solstice and at the March and September equinoxes, but a decrease at the June solstice. These results underline the importance of considering the three different effects at the same time. A better agreement with the observations might be obtained by including additional physical effects in the IMM.