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The ionospheric current system and its contribution to the Earth's magnetic field

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The ionospheric currents are a highly variable part of the coupled Magnetosphere – Ionosphere – Thermosphere (MIT) system. This system is driven by the solar wind and Interplanetary Magnetic Field (IMF) interaction with the Earth's magnetosphere. The solar wind and IMF interactions transfer energy to the MIT system via reconnection processes at the magnetopause. The Field Aligned Currents (FACs) constitute the energetic link between the magnetosphere and the Earth's ionosphere. The system of ionospheric currents depends on the geomagnetic conditions and has significant seasonal and UT variation.
The first aim of the present investigation is to model the global dynamic ionospheric current system. For this purpose, we use an improved version of the first-principle, time-dependent, and fully self-consistent numerical global Upper Atmosphere Model (UAM-P). This model describes the thermosphere, ionosphere, plasmasphere and inner magnetosphere as well as the electrodynamics of the coupled MIT system for the altitudinal range from 80 (60) km up to the 15 Earth radii. For this study, the lower latitudinal and equatorial electrodynamics of the UAM-P model was improved.
The second aim of this research is to calculate the ionospheric contribution to the Earth's magnetic field. The additional magnetic field is obtained from the global ionospheric current system calculated with the UAM-P model. The ionospheric magnetic field is calculated using the Biot-Savart law. The maximum magnitudes of the ionospheric magnetic field are located close to the areas of the auroral and equatorial electrojets. The contribution of the equatorial electrojet to the magnetic field is significant and comparable to the influence of the high latitude current system.