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Power density dissipated by field-aligned currents in the topside ionosphere

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The response of the magnetosphere-ionosphere (MI) system to the forcing by plasma of solar origin gives rise to several phenomena relevant to Space Weather. In particular, part of the energy injected into the ionosphere by means of field-aligned currents (FACs) connecting the magnetosphere with the high-latitude ionosphere is converted into mechanical energy and dissipated via Joule heating. Under reasonable assumptions, in the direction parallel to the geomagnetic field the only relevant contribution to dissipation is from the Ohmic term. Dissipated power density may significantly affect the physical parameters characterizing the upper ionosphere, such as electron temperature and density, and alter its chemical composition. This can result, for example, in the increased atmospheric drag and affect the satellite orbits. For this reason, understanding the dissipation of FACs in the topside ionosphere is important to shed light on the physical processes involved in MI coupling. Power density dissipated by FACs in crossing the topside ionosphere can be estimated by using Swarm data. Here, for the first time, we show statistical maps of power density features dissipated by FACs by using six-year time series of electron density and temperature data acquired by the Langmuir Probes onboard the Swarm A satellite (flying at an altitude of about 460 km) at 1 s cadence, together with the field-aligned current density product provided by the ESA's Swarm Team at the same cadence. Maps of the same quantity under different levels of geomagnetic activity are also shown and discussed in light of the previous literature.

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