Geoelectric Field Caused by Flux Transfer Events in an Ionosphere-Coupled Vlasiator Simulation

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We report on the relationship between flux transfer events (FTEs) at Earth's magnetopause and the geoelectric field that is induced near the FTEs' magnetic footpoints. We study this system using the global hybrid-Vlasov code Vlasiator, which has recently been extended to model ionospheric physics. We also highlight the significance of 3D magnetic null points, which in our simulation can separate the FTEs into multiple flux ropes. Near the null points, the coiled FTE magnetic field lines are rerouted towards Earth, so that the magnetic footpoints are planted near the Region 1 ionospheric current system. The helicities of the flux ropes are organized by the y-component (GSE) of the magnetic field at the Earth's magnetopause. This occurs in our simulation due to the absence of a y-component of the interplanetary magnetic field, which would normally supply the FTE guide field that determines the helicity. We observe Alfvenic, Earthward-flowing field-aligned currents generated near the magnetopause that correlate with the passage of FTEs nearby. These pulses of current coincide with the formation of rotational geoelectric field structures, that appear near the noon meridian and propagate around the auroral oval towards the nightside.