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Is the global MHD modeling of the magnetosphere adequate for GIC prediction?

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Practical steps taken by the international community to reduce the damage to technological systems from space weather include the development of numerical models capable of real-time predictions of electromagnetic disturbances at the Earth's surface. Here we examine the feasibility of a version of the Space Weather Modeling Framework (SWMF) global MHD simulation code similar to that used by the NOAA Space Weather Prediction Center to predict the level of geomagnetic field variability, and consequently geomagnetically induced currents (GICs). We consider the contribution of geomagnetic disturbances to the bursts of GIC in the electric power line of the Kola Peninsula during the May 27-28, 2017 storm and compare the observations with results of the global MHD model. During the maximal disturbance magnetic field variations at East Scandinavian stations become more chaotic, as intense irregular Pi3 pulsations are superposed on the magnetic bay. These pulsations are not quasi-sinusoidal waves like typical Pc5 pulsations, but they are rather a quasi-periodic sequence of magnetic impulses with time scales ~5-15 min. During this period with elevated Pi3 activity very high values of GIC were recorded (variations >100 Amperes) in the electric power transmission line. The SWMF modeling reasonably well reproduces the global magnetospheric parameters, such as SYM-H index or cross-polar potential. However, the magnetic field variability dB/dt in the East Scandinavia predicted by the modeling has turned out to be more than order of magnitude less than that observed. Thus, the version of SWMF with the grid used by NOAA SWPC still cannot adequately predict for the May 27-28 event the fine structure of the storm/substorm - Pi3 geomagnetic disturbances, and consequently the magnitude of the GIC that they drive.