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4P76 - Topanga: A Modern Code for E3 EMP Simulations

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We are developing the Topanga code for predicting E3 electromagnetic pulse building on our experience with hybrid plasma simulation. The E3 component has a long pulse, lasting tens to hundreds of seconds. It is caused by the nuclear detonation's temporary distortion of the Earth's magnetic field. The E3 component has similarities to a geomagnetic storm caused by a solar flare. Like a geomagnetic storm, E3 can produce geomagnetically induced currents in long electrical conductors, damaging components such as power line transformers. Our new code's attributes include the following: spherical geometry for simplified boundary conditions and computational efficiency; couples a hybrid plasma model (fluid electrons and neutrals, particle ions, Ohm's law, and reduced Maxwell's equations) to a finite-difference time-domain electromagnetic solver (FDTD-EM); uses the International Geomagnetic Reference Field magnetic field model, neutral atmosphere profiles from the US Standard Atmosphere or the NRL MSISE (mass spectrometer and incoherent scatter radar + exosphere) model, ionosphere profiles from the International Reference Ionosphere model; has ion-neutral, electron-ion, electron-neutral collisions; uses a fluid algorithm for motion of the neutral atmosphere; and has limited atmospheric chemistry. An overview of the code and simulations examples with some comparison to experimental data will be presented.
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