REPRESENTAION OF THE GLOBAL ATMOSPHERIC ELECTRIC CIRCUIT BY "EGATEC"

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The Engineering model of the Global ATmospheric Electric Circuit (EGATEC) is a novel high-resolution model of the Earth's global atmospheric electric circuit (GEC). It is generally accepted that the GEC is driven by the electric currents generated by electrified clouds. In EGATEC these lower atmosphere current generators are modelled as current sources. The cloud current generator models are constructed on the basis of the satellite measurements of surface area covered by various types of clouds available from the ISCCP D1 data, and model current densities of the cloud generators, derived from available observations of the electric activity of such clouds, in particular using the satellite OTD/LIS lightning flash rates. The area of the globe where the electric current is generated as well as in the current source-free area can be estimated with the spatial resolution of several degrees in latitude and longitude and three hour time resolution which is mainly limited by the ISCCP D1 data resolution. The resistance load of the atmosphere is calculated using an atmospheric conductivity model which is also spatially dependent and sensitive to the level of solar activity. The current sources and resistance of the cloud generators and resistance of the source-free area associated with a latitude and longitude in a model grid create one circuit branch. These branches can be connected in a network and create an electric circuit representing the GEC which can be solved numerically according to the standard circuit theory. In EGATEC this circuit is simulated by the PSpice software which calculates the electric potential at each circuit node and the electric current through each circuit element. As a result the global distribution and diurnal variation of the air-Earth electric current density due to lower atmosphere current generators and vertical electric field can be calculated from the simulation output with the spatial and time resolution used for the input data. The circuit can be constructed assuming the ionosphere as equipotential or non-equipotential surface while the ground is always assumed to be an ideally conducting surface. First example runs of the model are shown and the directions of the model development are discussed, such as the coupling to the ionospheric and magnetospheric current system.

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