Geophysical Research Abstracts
Vol. 16, EGU2014-14795, 2014
EGU General Assembly 2014

On the role of non-electrified clouds in the Global Electric Circuit

Andreas J. G. Baumgaertner, Greg Lucas, and Jeffrey P. Thayer
University of Colorado, CCAR, Aerospace Engineering Sciences, Boulder, United States (work@andreas-baumgaertner.net)

Non-electrified clouds in the fair-weather part of the Global Electric Circuit reduce conductivity because of the reduced mobility of charge due to attachment to cloud water droplets. A high-resolution GEC model is used to show that for small clouds the cloud resistance is less when considering current flow around the cloud, i.e. not limited to only the vertical direction. For these clouds, the increased resistance vertically through the cloud is larger than the horizontal resistances around the cloud, leading to current convergence at the cloud edges above the cloud, and divergence below the cloud. An analysis of this effect is presented for various types of non-electrified clouds, i.e. for different altitude extents, and for different horizontal dimensions, finding that the effect is most pronounced for small cirrus clouds. ISCCP cloud data as well as the CESM1(WACCM) model is used to calculate the effect of this phenomenon on total global resistance. It is found that when including non-electrified clouds in the fair weather estimate of resistance the total global resistance increases by between 130 and 170 Ω, depending on the parameters used. Furthermore, the non-electrified-cloud contribution to total resistance would be an additional 40 Ω larger if the current convergence/divergence phenomenon is neglected. Overall, a careful treatment of these clouds appears to be necessary, contrary to previously assumed.