Geosci. Model Dev. Discuss., 4, C1191–C1192, 2011
www.geosci-model-dev-discuss.net/4/C1191/2011/

Geoscientific Model Development Discussions

Interactive comment on "CELLS v1.0: updated and parallelized version of an electrical scheme to simulate multiple electrified clouds and flashes over large domains" *by* C. Barthe et al.

Anonymous Referee #1

Received and published: 16 December 2011

This paper presents results of numerical simulations of two thunderstorm case studies, introducing a novel way to model lightning discharges as a function of time along the storm life cycle. The approach is innovative and prudent and is based on present understanding of the propagation of lightning channels and the removal of charge from different regions inside the electrified thunderclouds. The model proceeds beyond a single-cloud simulation and offers new insights on the overall lightning activity of the entire storm. As such it presents significant progress in modeling the electrical behavior of storm systems and in principal offers a tool for detailed study of large scale convective systems, their dynamics, microphysics and electrical states.

Major comments 1. In section 3.1 the authors chose to use the parameterization of the non-inductive charge separation mechanism based on the laboratory work of Takahashi (1978). However, this formulation had been modified and updated to accommodate the results of laboratory experiments by other groups (e.g. Avila et al., (1998) and Saunders et al., 1998). The integrated formulation is reviewed by Saunders (2008) . The authors need to explain their choice of the T78 parameterization, at least by referencing the sensitivity studies performed by Mansell et al. (2005) [E. R. Mansell, D. R. MacGorman, C. L. Ziegler, and J. M. Straka, 2005: Charge structure and lightning sensitivity in a simulated multicell thunderstorm, J. Geophys. Res., 110, D12101, doi:10.1029/2004JD005287]. 2. In section 3.1 the authors state that the magnitude of charge separated per rebounding collision is limited to specific values for the various types of collisions. There lacks a reference to experimental or empirical results for the values presented and it may seem arbitrary. Also it is not entirely clear if this value if prefixed for each collision or computed for individual collision between the various species. Please explain. 3. The present scheme includes charging by attachment of atmospheric ions (section 2.1.3), and introduces the term G for the generation of ions by cosmic rays. The value of G should be height dependent (G(z)) and should reflect the changes in ionization intensity along the solar cycle. It not clear if the same values of G were used for the two simulations - there are bound to be differences between the ionization profiles between case I (1996) and II (1998). Although this may be a few percent only, the authors need to address this issue.

Interactive comment on Geosci. Model Dev. Discuss., 4, 2849, 2011.