EGU2020-19506
https://doi.org/10.5194/egusphere-egu2020-19506
EGU General Assembly 2020

Scattering of lightning optical radiation by complex, inhomogeneous clouds

Alejandro Luque Estepa[1], Francisco José Gordillo-Vázquez[1], Dongshuai Li[1], Alejandro Malagón-Romero[1], Sergio Soler[1], Francisco Javier Pérez-Invernón[2], Olivier Chanrion[3], Matthias Heumesser[3], and Torsten Neubert[3]

[1]Instituto de Astrofisica de Andalucía (IAA-CSIC), Solar System Dept., Granada, Spain
[2]Institut fu□r Physik der Atmospha□re, Deutsches Zentrum fu□r Luft- und Raumfahrt, Wessling, Germany
[3]National Space Institute, Technical University of Denmark (DTU Space), Denmark

Lightning flashes emit intense optical radiation that can be detected from space. Several space missions work by observing this light in order to investigate lightning, thunderstorms, and other phenomena closely associated to them such as Transient Luminous Events (TLEs) and Terrestrial Gamma-ray Flashes (TGFs).

In its path towards a satellite-borne observing device, the optical radiation emitted by a flash is scattered many times by the droplets and ice crystals in the cloud. The detected signal is thus shaped by and contains information about the cloud geometry and composition. This is particularly relevant for instruments with a high spatial resolution such as the cameras in the Modular Multispectral Imaging Array (MMIA), which is part of the Atmosphere-Space Interactions Monitor (ASIM) currently onboard the International Space Station. These cameras provide images of lightning-illuminated cloud tops with a resolution of about 400 m.

We present a numerical code that can simulate light scattering in clouds with complex geometries and location-dependent droplet density and effective radius. The cloud geometry is specified by a number of elementary shapes (e.g. spheres and cylinders) that can be linearly deformed as well as combined by set operations such as unions, intersections and subtractions. The cloud composition can be specified by arbitrary functions. Designed to aid in the interpretation of satellite images, the code simulates spatially resolved observations from an arbitrary viewpoint. Some examples and applications of this tool will be discussed.