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Simulating the optical characteristics of lightning as observed from above the cloud

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The next generation of geostationary satellites will carry instruments for permanent observation and detection of lightning by optical means. For the optimisation of the future instruments performance and the preparation of data processing algorithms the optical characteristics of the expected lightning signal have to be explored.
A lightning discharge radiates optical energy. This optical radiation is transported from the source location inside the cloud to the cloud surfaces by multiple elastic scattering. At the cloud surface the optical signal appears as a blurred optical pulse with certain spatial extend and temporal duration.
This multiple scattering process is modeled by a Monte-Carlo simulation with the simplified assumption of Mie-scattering on symmetric particles. The principal characteristics of the spatial pattern and the temporal pulse shape of the scattered signal are derived and compared with the observations by airborne and satellite born instruments.
The effects of the parameters of the clouds and the particle's size and distribution as well as the source characteristics on the resulting optical signal are demonstrated and discussed qualitatively and quantitatively.