Multi-sensor field studies of thunderstorms and lightning

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Future geostationary satellite systems will offer a variety of improved observing capabilities which will be extremely useful for many applications like numerical weather forecasting, nowcasting of severe weather, climate research or hydrology. The planning for MTG (Meteosat Third Generation) and GOES-R (Geostationary Operational Environmental Satellite, R-Series) includes optical lightning imagers as part of the payload. One requirement for a proper interpretation of these optical data is a better understanding of what components of a flash are to be seen from space and how the storm structure affects the scattering of light inside the clouds.

The objectives of the present study concern the relation of optical signals to ground based radio frequency observations of lightning (VHF, VLF/LF) and precipitation (weather radar). We investigate the comprehensive lightning and radar data sets obtained from the recent CHUVA field experiment performed during the rainy season of 2011-2012 in the São Paulo area in Brazil. (CHUVA - Cloud processes of tHe main precipitation systems in Brazil: A contribUtion to cloud resolVing modeling and to the GPM (GlobAl Precipitation Measurement)). VLF/LF lightning observations from the DLR-LINET, VHF sources from the NASA LMA (Lightning mapping array), optical pulses seen from space by TRMM-LIS and X-POL polarimetric radar observations are analysed in a synergetic manner.

In confirmation of previous studies, it was found that often a direct temporal coincidence of RF signals (LINET strokes) and optical pulses (LIS groups) exists. The higher level LINET and LMA signals have higher probability to be optically detected. Lower level LINET and LMA signals are optically detected from above in case of missing high level precipitation as inferred from radar observations. The new comprehensive data set allows for constructing proxy data for the future geostationary lightning mappers.