



Lightning activity in the deep convective clouds with the overshooting tops

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In this study, spatial and temporal characteristics of lightning distribution and polarity as well as portion of cloud to ground (CG) and intra cloud (IC) lightning in the convective clouds with overshooting tops (OT) are analyzed. Analysis of lightning activity in the thunderstorms with OT was done for the warm part of the year, from May to September during 2009 and 2010. The study area covers region from approximately 41°N 8°E to 49.5°N 24°E. Deep convective clouds with OT were detected from the Meteosat 9 data, using a so called COMB method based on the infrared window (IRW, 10.8 μm) channel and the absorption channels of water vapor (WV, 6.2 μm) and ozone (O_3 , 9.7 μm) in form of brightness temperature differences (BTD). COMB method combines the criteria for the IRW brightness temperature and the criteria for two BTDs, WV-IRW and O_3 -IRW. All pixels with O_3 -IRW BTD larger than 13 K in the region where IRW brightness temperature is lower than 215 K and WV-IRW BTD larger than 4 K are characterized as OTs.

Lightning data were provided by the Lightning Location System, which is part of the International Lightning Detection Network in Europe (LINET). The LINET system detects total lightning discharge, but it also separately detects cloud to ground (CG), or intra cloud and cloud to cloud strokes (IC). For each satellite pixel meeting the OT, occurrence of lightning discharge was searched 5 min before and after the time of the scan within the range of 0.05° from the pixel position.

The results show that spatial distribution of lightning activity coincides well with the spatial distribution of the detected OTs. The largest numbers of lightning strokes, as well as OTs were detected in the western Hungary, southeastern Germany, northern Adriatic and southern Adriatic coastal region at the slopes of the Dinaric Alps. In general, the largest number of OTs occur between 14 and 21 UTC, while from 06 to 10 UTC OT detections are rather rare. Lightning activity shows similar temporal distribution. Sharp increase in lightning activity and larger values of the electric current are evident at the time of the OT detections. At those times, lightnings occur well above the tropopause, being clearly related to the OT parts of the Cumulonimbus cloud.