



Assessing the relationship between lightning density and cloud top height parameters, based on NWC SAF estimations and lightning observations

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An assessment of the relationship between lightning density and cloud top height parameters is performed, using NWC SAF estimations of Cloud Top Height (CTH), Cloud Top Pressure (CTP), and Cold Cloud Depth (CCD), combined with ZEUS and LINET lightning observations.

The Institute for Environmental Research and Sustainable Development of National Observatory of Athens (IERSD-NOA) has installed and operates the 2013 version of NWC SAF, since spring 2015. NWC SAF operates in 15 minute cycles and produces a series of products in the native Meteosat grid. One such product is the Cloud Top Temperature and Height (CTTH) which is stored by the NWC SAF system in Hierarchical Data Format files (hdf5). The product includes instantaneous estimates of the CTH in Kilometers, and the CTP in hPa. ERA-Interim temperature data at various pressure levels are used in combination with the CTP estimations to compute the CCD in hPa. The latter is defined as the pressure difference between the 0°C pressure level and the CTP.

LINET and ZEUS lightning data are also used in the analysis. The LINET network is able to detect both Intra-Cloud (IC) and Cloud-to-Ground (CG) lightning with increased accuracy over central Europe. The ZEUS network can detect only CG lightning with a standard level of accuracy over continental Europe. The analysis was performed during the summer period (June-July-August) of 2016, and taking into account only daytime observations (06:00-20:00 UTC). The area of analysis is constrained by the parallels (45-55N/10-30E), which indicate that the results are representative of a continental region during summer.

It was found that both IC and CG lightning densities are higher at elevations around 12.6 Km, with a rapid increase from 8 to 12.6 Km of CTH. Regarding CTP, top density is found around 225 hPa, with the rapid increase starting around 400 hPa. CCD increases from 275 hPa, until the maximum value which is found at 400 hPa. Finally, it is shown that non-linear relationships between CTH, CTP, CCD and lightning density can be formulated, at least from the beginning of the rapid density increase until its maximization.