



Dependence of satellite derived cloud parameters on storm severity based on lightning activity over Ukraine

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Integrated information from lightning detection sensors network and satellite systems are the primary tools for severe storm analysis and nowcasting. Lightning detection network (Earth Networks Total Lightning Network), installed in Ukraine is capable to detect the components of both intra-cloud (IC) and cloud-to-ground (CG) flashes, and it uses algorithms of waveform shapes analysis to differentiate between the IC and CG pulses with a high efficiency and very precise spatial detection (200 m). The storm severity of a lightning cell (a cluster of flashes with a boundary as a polygon) is determined by the flash density value for a given period. Once a lightning cell is located and tracked, the total flash rates, including IC and CG, are calculated. By monitoring the flash rates and the rate changes, the severe storm cells or the ones to potentially become severe, can be identified. Depend on severity of storms there are three levels of lightning activity: level 1 (flashes/min in lightning cell < 3); level 2 (< 10 flashes/min in lightning cell < 25); Dangerous Thunderstorm Alert (flashes/min in lightning cell > 25).

Satellite images are extremely important for estimation of cloud parameters, such as brightness temperature (BT), optical thickness (OT), effective radius (ER) of ice particles, ice water content (IWC), cloud phase (CPH) and cloud top height (CTH). The MSG satellites, which has significant advantages compare to other one in spectral bands, spatial resolution and time sampling that provides a reliable tool for the estimation of these parameters in order to monitor the storm life-cycle.

This paper presents results of the analysis of cloud parameters (CP) determined from images of Rapid Scan Service of MSG (5 min update) and storm severity based on lightning activity (from level 1 to DTA). The CP are compared with total flash rates, IC/CG and Peak Current as measured by a ground lightning network. Results show a strong correlation of lightning activity with high IWC content, BT and CTH. Other cloud parameters have specific ranges, where most lightnings can be occur. It was shown, also, that in some cases a severe lightning activity can be produced by small cloud, which can not be detected by satellite.