



Some Meteorological Aspects of Lightning Location Systems Using

I. Kononov, I. Yusupov

Institute of Radiophysics of St-Petersburg State University, St-Petersburg, Russia
(igor_kononov@mail.ru / Fax: +7 812 428-7289 / Phone: +7 812 428-4357)

Meteorological aspects of storm activity monitoring by means of radio-technical devices, location systems and networks are ones of the more important stimulus of their development and installation. Tendencies of two last decades for providing the more reliable detection, accurate location and tracking of storm activity on different spatial and temporal scales, estimation of their current state and hazardous level have required the modernization of existing and elaboration of new types of lightning location systems operating in different frequency bands.

It is known [1] that using of lightning electromagnetic radiation in VHF band associated practically with all types of intra-cloud (IC) and cloud-to-ground (CG) lightning discharge processes (total lightning) can provide a reliable information on rapidly developing and becoming hazardous storms and is a good base for creation and modification of devices and systems for a storm onset early detection, reliable warnings of lightning stroke hazard and damaging phenomena accompanying development of thunderstorm (strong downdrafts, intense precipitation at ground level, hail). Realization of high operational characteristics of VHF systems has brought also the necessity of changing traditional approaches to analysis of lightning location data, the elaboration of new methods and algorithms of their grouping into clusters corresponding to such physical objects as a single storm cell, a multi-cell storm cloud, a meso-scale storm complex. One of such clusterization methods based on the usage of some algorithms of objects classification from [2] has allowed to get a suitable form of storm activity monitoring and displaying in the manner of a set of cluster center tracks (CCTs).

Besides, it gave a possibility to identify the electromagnetic radiation of lightning flashes with separated clusters and to control temporal variations of its parameters with the purpose of the determination of a current state of cloud's complexes and to make a short-term nowcasting of their future development.

A brief description of clusterization algorithms and some preliminary results of the analysis of space-temporal distributions of storm activity and temporal variations of lightning flash electromagnetic fields parameters in relation to synoptic conditions (based on the data sets accumulated during continuous observations in France in July-August, 1995 with using of VHF location system SAFIR) are given in [3]. The analysed sets of considered parameters include: intensity I of lightning flashes, their duration D , extension E , ratio R of the number of IC flashes to the number of CG ones, and multiplicity M (the number of CG discharges in a flash).

This report contains some additional results of such a kind analysis for the data sets registered in 2001 in the south region of France on a smaller space-resolution scale (corresponding to a single storm cell) regulated by the choice of cluster's radius in the interval of values 5...10 km. This has allowed for researching the fine features of multi-cell storm clouds evolution in a process of their natural cycle of development. There were examined also relations between lightning flashes electromagnetic field parameters and intensity of precipitation.

References

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