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Now-casting of Lightning Clusters in the Mediterranean Region using WDSS-II

E. Galanti (1), M. Kohn (1), C. Price (1), K. Lagouvardos (2), and V. Kotroni (2)

(1) Department of Geophysics and Planetary Science, Tel Aviv University, Israel (galanti@tau.ac.il), (2) National Observatory of Athens, Greece

Lightning activity can be detected and monitored continuously from thousands of kilometers away. Therefore lightning data can be very useful in improving forecasts and now-casts of severe thunderstorms. These thunderstorms are often the cause of severe and disastrous flash floods. And an improvement in the now-casting of such storms can assist in giving better warning to prepare for upcoming storms.

The Warning Decision Support System – Integrated Information (WDSS-II) model is the second generation of a suite of algorithms and displays for severe weather analysis, warnings and forecasting. The model receives the raw data, grids it into a density matrix, and using hierarchical k-means clustering method is able to define storm clusters. The motion of the storm clusters is then estimated by comparing two consecutive frames, objectively matching clusters over time, thus finding the movement that minimizes the absolute-error between the two frames. The now-casting is done based on the motion estimates, growth and decay of the current data.

Now-casting simulations were run on the WDSS-II model with lightning data received from the ZEUS ground-based VLF lightning detection network on one year's data from the Mediterranean area, thousands of clusters were observed and now-casted 30, 60, 90 and 120 minutes ahead. Statistical analysis was then done by calculating hit, miss and false alarm rates, in order to determine the success of the now-casting.

The results show that the WDSS-II model is overall successful in now-casting the location of the lightning clustering, especially when applied to strong and consistent lightning events (which also have the largest correlation with flash floods). The now-casting has a low false alarm rate, which is also beneficial to the goal of flash floods now-casting.

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