18–22 September 2017, Pula, Croatia
ECSS2017-44

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In the last years, significant advancements have been achieved in nowcasting of thunderstorms leading to improved recognition of severe weather in near real time and numerical forecasting. Nevertheless, continued research can lead to significant optimization, especially for improvement of reliable warning and alarm. The present contribution describes a new method to identify, track and analyse thunderstorm cells continuously using stroke parameters from the European 3D-lightning detection network LINET.

Since 2006 LINET is in Europe-wide operation and provides VLF/LF lightning data in real time with unique properties. The three most important features are high detection efficiency yielding the reporting of weak strokes with currents down to about 2 kA, statistical location accuracy of some 100 m, and 3D-discrimination of cloud strokes with determination of emission altitudes.

As a first new feature, the approach presented here uses a continuous and event-driven analysis by monitoring stroke occurrences: storm cells are newly identified or updated when either a pre-determined number of strokes have occurred, or a pre-determined small time interval has elapsed. This cell update allows the calculation of influential cell parameters for the recognition of severe weather like number and density of strokes in time and space, absolute and relative fraction of cloud strokes, including their evolution of emission altitudes, and propagation in terms of direction and speed.

As a second new feature, cells are differentiated in more detail. In most of the cases, severe weather related to thunderstorms is a very small scale phenomenon. To take this into account, a particular algorithm is used that determines the core of the cells (‘sub-cells’), which represent the origin of most severe dangers such as strong downdrafts, wind shear, heavy precipitation, and hail. Severity levels can be assigned to sub-cells and other areas of the tracked and nowcasted thunderstorm cells leading to a more precise and reliable alarm and warning of storm related dangers.

Examples will be shown, including nowcasting of hail and observational verification using the European Severe Weather Database (ESWD). The usefulness of sub-cells is demonstrated, and reliability of warning and alarm is analysed as derived solely from lightning observations.