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Applying Mean-Shift – Clustering for 3D object detection in remote sensing data

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The timely warning and forecasting of high-impact weather events is crucial for life, safety and economy. Therefore, the development and improvement of methods for detection and nowcasting / short-term forecasting of these events is an ongoing research question. A new 3D object detection and tracking algorithm is presented.

Within the project "object-based analysis and seamless predictin (OASE)" we address a better understanding and forecasting of convective events based on the synergetic use of remotely sensed data and new methods for detection, nowcasting, validation and assimilation.

In order to gain advanced insight into the lifecycle of convective cells, we perform an object-detection on a new high-resolution 3D radar- and satellite based composite and plan to track the detected objects over time, providing us with a model of the lifecycle. The insights in the lifecycle will be used in order to improve prediction of convective events in the nowcasting time scale, as well as a new type of data to be assimilated into numerical weather models, thus seamlessly bridging the gap between nowcasting and NWP..

The object identification (or clustering) is performed using a technique borrowed from computer vision, called mean-shift clustering. Mean-Shift clustering works without many of the parameterizations or rigid threshold schemes employed by many existing schemes (e. g. KONRAD, TITAN, Trace-3D), which limit the tracking to fully matured, convective cells of significant size and/or strength. Mean-Shift performs without such limiting definitions, providing a wider scope for studying larger classes of phenomena and providing a vehicle for research into the object definition itself.

Since the mean-shift clustering technique could be applied on many types of remote-sensing and model data for object detection, it is of general interest to the remote sensing and modeling community. The focus of the presentation is the introduction of this technique and the results of its application on our remote-sensing composite.