Title:

Investigation of climatic changes for hail storms over the Alps using spatiotemporal satellite imagery and self-supervised machine learning

Authors:
Paula Bigalke [1], Claudia Acquistapace [1], Daniele Corradini [1]

[1] Institute for Geophysics and Meteorology, University of Cologne

Severe hailstorms are becoming more frequent in Central Europe showing increasing interannual variability. The Pre-Alpine and Alpine region seems to be especially affected due to its complex terrain, that initiates convection and can intensify many hail favoring processes. This results in increasingly strong large hail events, which are often very local phenomena. Ground-based observations from weather radars are most reliable for detecting hail, however, prove to be challenging in the Alpine region due to interference at mountain ranges.

Passive Microwave satellite observations offer a useful alternative for detecting hail: a probability for hail can directly be derived from Passive Microwave channels with a high spatial coverage. However, this data is only available at certain times during satellite overpasses, thus, capturing only a few of these events. The highest temporal coverage is given by visible, near-infrared and infrared data from MSG. Though not directly sensitive to hail its high spatiotemporal resolution can identify early stages of severe storm developments.

Recently, self-supervised machine learning approaches have been used to classify spatial cloud patterns from satellite measurements from MSG over the Atlantic and Germany. The model learns to sort similar cloud organization patterns into the same classes.

In this work, we aim at adapting this model to also include the temporal component to then classify the evolution of typical cloud patterns leading to severe hail storms over the Alpine region. The framework will later be used to characterize changes in spatiotemporal evolution of large hail bearing systems and associated environmental conditions across a multi-year dataset. First steps are presented here including the investigation of the optimal training dataset using the available data sources.