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# EVALUATING CONVECTIVE CLOUDS AND PRECIPITATION IN ICON USING DEEP LEARNING AND HIGH RESOLUTION OBSERVATIONS

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Due to climate change, the severity of storms, particularly in the Alpine region, is expected to increase. At the same time, the current models' ability to accurately predict extreme rainfall in complex terrains remains limited. At the same time, the World Climate Research Programme highlights gaps in observing, understanding, and modeling precipitation, particularly over mountainous terrain. To reduce the modeling and observational gaps over orography, the year-long TEAMx measurement campaign took place over the Alps in 2024/2025. In the region around Bolzano, a complete setup of profiling ground-based instruments was located during the summer of 2025 to detect convection onset and precipitation variability with elevation. Beyond the local observations, the new MTG FCI satellite observations with improved temporal and spatial resolution are available over the area. In this contribution, we propose an approach to evaluate numerical weather prediction's ability to produce realistic cloud spatial structures using a self-supervised deep learning framework trained on satellite data. Once trained with 10.8, and 6.2 microns brightness temperatures, the algorithm creates a feature space where cloud classes are clustered based on semantic similarities. We then use the feature space to evaluate the ICON-GLORI model by simulating the satellite channels from the ICON-GLORI runs for significant case studies. In our results, we characterize the obtained cloud classes in terms of cloud properties (cloud optical depth, cloud phase, cloud top height) and precipitation amounts using satellite observations. Then, the simulated satellite channels get classified by the algorithm to verify, also exploiting the additional ground-based datasets, if similar cloud patterns were generated in analogous conditions. We can in this way characterize the evolution of relevant case studies collected during the TEAMx campaign over the Bolzano region in model and observations, highlighting relevant aspects of the spatiotemporal evolution of the observed cloud properties.

**Key words:** Convection, Infrared Imagery, Model Evaluation, Precipitation, Deep Learning, Self-supervision, Ground-based profiling