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## Comprehensive evaluation of precipitation analyses using a very dense rain gauge network in southeast Austria

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Precipitation is one of the most important inputs of meteorological and hydrological models and also flood warning systems. Thus, accurate estimation of rainfall is essential for improving the reliability of the models and systems. Although remote sensing (RS) techniques for rainfall estimation (e.g., weather radars and satellite microwave imagers) have improved significantly over the last decades, rain gauges are still more reliable and widely used for this purpose and also for the evaluation of RS estimates. Since the characteristics of a rainfall event can change rapidly in space and time, the accuracy of rain gauge estimation is highly dependent on the spatial and temporal resolution of the gauge network.

The main aim of this study is to evaluate the ability of the Integrated Nowcasting through Comprehensive Analysis (INCA) of the Central Institute for Meteorology and Geodynamics (ZAMG) to detect and estimate rainfall events. This is done by using 12 years of data from a very dense rain gauge network, the WegenerNet Feldbach region, as a reference, and comparing its data to the INCA analyses. INCA rainfall analysis data are based on a combination of ZAMG ground station data, weather radar data, and high-resolution topographic data. The system provides precipitation rate data with a 1 km spatial grid resolution and 15 minutes temporal resolution. The WegenerNet includes 155 ground stations, almost uniformly spread over a moderate hilly orography area of about 22 km × 16 km.

After removing outliers and scale WegenerNet data to 1 km, the accuracy of INCA to detect and estimate rainfall events was investigated using 12 years of the dataset. The results show that INCA can detect rainfall events relatively well. It was found that INCA overestimates the rainfall amount between 2012 and 2014, and generally overestimates precipitation for light rainfall events. For heavy rainfall events, however, an underestimation of INCA is prominent in most events. Based on the results, the difference between INCA and WegenerNet estimates is relatively higher during the wet season in the summer half-year (May-September). It is worth pointing out that INCA performs better in detecting and estimating rainfall around the two ZAMG stations located within the study area.

