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Improved nowcasting of precipitation based on convective analysis fields

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A high-resolution analysis and nowcasting system (INCA = Integrated Nowcasting through Comprehensive Analysis) has been developed at the Austrian national weather service. It provides three-dimensional fields of temperature, humidity, and wind on an hourly basis, and two-dimensional fields of precipitation rate every 15 minutes. The system operates on a horizontal resolution of 1 km and a vertical resolution of 100 m. It combines station data, remote sensing data (radar, satellite), forecast fields of a numerical weather prediction (NWP) model, and high-resolution topographic data, in order to generate analysis fields.

An important hydrological application of INCA is nowcasting of convective precipitation. We are particularly interested in determining to what extent the formation of convective cells can be predicted before seen on radar. Such forecasts are particularly important for flash-flood prediction in small river catchments. This requires a fine scale analysis of the state of the mountain convective boundary layer (CBL). Derived from INCA analyses, a number of convective analysis fields are routinely generated. These fields include, for example, flow convergence and specific humidity within the CBL, the Lifted Condensation Level (LCL), Convective Aavailable Potential Energy (CAPE), Convective Inhibition (CIN), and various stability indices. Based on a number of case studies it is shown that the purely translational forecast of convective cells can be improved upon by using a subset of the above fields, combined with visible satellite imagery.