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Generation of high-resolution wind fields from the dense meteorological station network WegenerNet in South-Eastern Austria

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To investigate weather and climate on a local scale as well as for evaluating regional climate models (RCMs) the Wegener Center at the University of Graz established the long-term field experiment WegenerNet Feldbach region, a dense grid of 153 meteorological stations. The observations of these stations are managed by an automatic WegenerNet Processing system. This system includes a quality check of collected observations and a Data Product Generator (DPG), among other subsystems. Products already implemented in the DPG are gridded weather and climate products, generated from the main parameters temperature, precipitation and relative humidity (Kirchengast et. al., Bull. Amer. Meteor. Soc., 95, 227-242, 2014). Missing elements are gridded wind fields from wind observations. Wind is considered as one of the most difficult meteorological variables to model and depends on many different parameters such as topography and surface roughness. Therefore a simple interpolation can only be performed in case of uniform characteristics of landscape.
The presentation introduces our method of generation of wind fields from near real-time observations of the WegenerNet. Purpose of this work is to provide a database with 3D wind fields in a high spatial and time resolution as addition to the existing products, for evaluating convection permitting climate models as well as investigating weather and climate on a local scale. Core of the application is the diagnostic California Meteorological Model (CALMET). This model computes 3D wind fields based on meteorological observational data, a digital elevation model and land use categories. The application generates the required input files from meteorological stations of the WegenerNet Feldbach region and triggers the start of the CALMET model with these input files. In a next step the modeled wind fields are stored automatically every 30 minutes with a spatial resolution of 100 x 100 m in the WegenerNet database. To verify the performance of modeling, wind speed is classified into weak and strong wind speeds. Furthermore a leave-one-out cross-validation is used. The conducted statistical evaluation shows good results for both wind speed classes. The values of the calculated statistical parameters applied to the vector mean of wind speed are slightly better for weak wind speeds than for strong wind speeds. The difference between modeled and observed wind directions though is smaller for strong wind speeds than for weak wind speeds.