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High resolution precipitaion mapping over the South of Norway using a linear model of orographic precipitation

Sara Martino (1) and Sjur Kolberg (2)
(1) Sintef Energy Research Norway (sara.martino@sintef.no), (2) Sintef Energy Research Norway

Spatially distributed precipitation estimates are needed in hydrological modelling as well as in regional climate analysis. In mountainous regions, interpolating data from a rain gauge network often provides mediocre results, in particular due to high terrain-induced variability on a smaller scale than the gauge network typically resolves. The interpolation is particularly difficult at short time scales like daily or hourly precipitation.

Smith and Barstad (2004) introduced a linear model for simulating orographic precipitation over a digital elevation model (DEM), driven by spatially homogeneous input of wind, temperature and humidity. The model has been used to dynamically downscale reanalysis data and future climate predictions (Crochet et al 2007; Johannesson et al.2007). The current investigation applies the orography model in conjunction with interpolation from precipitation gauges, in order to construct daily precipitation maps with a level of detail finer than the gauge network density. The experiment is carried out over the southern part of Norway, a region with high mountains, glaciers, and strong precipitation gradients. We feed the orography model with the last re-analysis data from ECMWF (ERA-Interim) over the period 1979-2012.

Preliminary results using the older ERA40 reanalysis data show the simulated orographic precipitation to be in good agreement with precipitation observations accumulated over various time scales. In particular, the orographic prediction improve on lapse rate based methods to incorporate terrain effects. However, the first experiments have also revealed practical challenges in applying the model on a permanent basis for large regions. Work therefore continues to adapt the theory to operational use, to optimize pre-processing and data flow, and to identify scale limits and situations for which the model is inadequate. A cross-validation approach is used to quantify performance and compare different settings in the orography model.