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A comparison between observed and modeled precipitation at different spatial scales on the Norwegian mainland

Cristian Lussana (1), Barbara Casati (2), Hilde Haakenstad (1), Thomas N. Nipen (1), and Ivar A. Seierstad (1)

(1) Norwegian Meteorological Institute, Oslo, Norway (cristianl@met.no), (2) Meteorological Research Division, Environment and Climate Change Canada, Dorval (QC), Canada

An accurate representation of the precipitation field available on a hourly basis at high spatial resolution is of paramount importance for climatological, meteorological and hydrological applications. On the Norwegian mainland, most applications require a reliable representation of the atmospheric dynamics down to the lower bound of the Meso-scale and the users demand a realistic description of the uncertainty associated with the precipitation fields.

Nowadays, Limited Area Models (LAMs) provide such high-resolution precipitation fields. At the same time the observational systems are measuring precipitation both at higher sampling rates and spatial resolutions than before. As a consequence, it becomes feasible to provide the users an idea of the quality of the model outputs even for thunderstorms or other local-scale phenomena by comparing LAMs with observations.

MET Norway makes available to its users the modeled hourly precipitation fields obtained from: AROME-MetCoOp on a 2.5 Km grid (NWP model output) for recent years; NORA10 on a 10 Km grid (atmospheric downscaling based on ERA40 from 1957 to 2002 and on ECMWF operational analyses from 2002 onwards) back to 1957. On the other hand, MET Norway produces the seNorge v2.0 gridded observational dataset of daily precipitation (available from 1957 onwards) and KliNoGrid RR1, which is a combination of radar-derived and rain-gauge measured hourly precipitation. Both datasets are available on a 1 Km grid.

In this work we focus on the inter-comparison of the aforementioned datasets by using a scale-separation spatial verification method similar to the Intensity-Scale Technique (Casati, 2010). Forecast and reference precipitation fields are decomposed into the sum of orthogonal wavelet components each characterized by a different spatial scale. The scale-dependence of the bias and the capability of the forecast to reproduce the observed scale structure are then assessed by comparing the wavelet component power spectrum. The scale dependence of the forecast accuracy and skill are assessed with the MSE and a MSE skill score (with reference = random), evaluated on the wavelet components for each spatial scale, separately. Note that since the MSE for reference = random is proportional to both observed and forecast variability (as opposed to the traditional MSE skill score, which uses as reference the climatology, which is proportional solely to the observed variability), the scale-separation MSE skill score was specifically designed for comparing the performance of high resolution versus coarser resolution precipitation forecasts. The scale-separation verification can be applied both to original or thresholded precipitation values: the latter enables to focus on low versus high precipitation intensities, and bridges the scale-separation verification to traditional categorical scores. The scale-separation assessment is performed on our datasets with different goals: regarding NORA10 our interest is in the description of the precipitation climatology, where we assume seNorge v2.0 to be a reliable reference dataset; while for AROME-MetCoOp, we assess the added value of the enhanced resolution and in this case we use as a reference dataset KliNoGrid RR1.