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- towards climate change services

Circulation type classifications and precipitation variability in the Alps

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This presentation consists of two parts. In the first part, we present a novel approach for the evaluation of circulation type classifications (CTCs) by assessing their ability to predict variations in a surface climate variable. The approach is analogous to the evaluation of probabilistic meteorological forecasts and is based on the Brier skill score (BSS). The BSS is shown to take a particularly simple form in the context of CTC evaluation, and to quantify the resolution of a climate variable by the CTC. The uncertainty in the BSS is estimated by means of nonparametric bootstrap resampling. We apply the evaluation approach for the intercomparison of 71 CTCs (automatic and manual, from COST Action 733) and assess their ability to resolve daily precipitation in the Alps. We discuss the variation of the BSS in the Alpine region and its dependence on precipitation intensity, the season, and the number of circulation types. Among CTCs with comparable type number, the best automatic CTCs (i.e. those with highest BSS) are found to outperform the best manual CTCs. According to our evaluation measure, there is no single best CTC for Alpine precipitation, but a small group showing particularly high skill. We have used one CTC of this group for the illustration of the relationship between circulation type and Alpine precipitation in a new plate of the Hydrological Atlas of Switzerland.

In the second part of the talk, a method for the near real-time spatial analysis of precipitation from a coarse gauge network is presented. We test the possibility of enhancing the analysis by considering – in addition to the in-situ data – the spatial covariance structure inferred from past observations with a denser network. To this end, a statistical reconstruction technique, reduced-space optimal interpolation (RSOI), is applied over Switzerland. RSOI consists of two main parts. First, principal component analysis (PCA) is applied to obtain a reduced-space representation of gridded high-resolution precipitation fields available for a multi-year calibration period in the past. Second, sparse real-time rain-gauge observations are used to estimate the principal component scores and to reconstruct the precipitation field. In this way, climatological information at higher resolution than the near real-time measurements is incorporated into the spatial analysis. We find that PCA efficiently reduces the dimensionality of the calibration fields and RSOI is successful despite the difficulties associated with the statistical distribution of daily precipitation (skewness, dry days). Examples and a systematic evaluation show substantial added value over a simple interpolation technique that uses near real-time observations only. The benefit is particularly strong for larger-scale precipitation and prominent topographic effects. Small-scale precipitation features are reconstructed at a skill comparable to that of the simple technique. Stratifying the reconstruction method by the types of CTCs yields little added skill.