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Generating high resolution area-wide precipitation fields from rain gauge measurements and satellite data

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Within the framework of the Hans-Ertel Centre for Weather Research (HErZ) a Retrospective Analysis of Regional Climate for Germany and Europe is being developed. The regional reanalysis is based on the recent operational version of COSMO-DE, which assimilates rainfall information via Latent Heat Nudging scheme to improve the analyzed precipitation fields. To this end, high resolution rainfall data with good representation of the spatio-temporal variability is needed. However, the rainfall variability is not well represented neither by the remotely-sensed estimates which suffer from large errors, nor by raingauge observations due to the sparseness of the point measurements.

In this scenario and considering the fact that radar data are not available for a long period back in time, we propose a Bayesian spatial generalized linear model for generating high resolution area-wide precipitation information. These fields will be assimilated in COSMO-DE for periods when radar data are not available. Our statistical model is conditioned on hourly rainfall observations from 121 synoptic stations distributed over Germany and infrared brightness temperature with 4km spatial resolution from Meteosat Second Generation (MSG). We apply this model to estimate the probability of rainfall occurrence yes/no (rainfall >= 0.1mm/h) in space over Germany in the most recent period between 2007-2011. Radar measurements and a comprehensive set of station measurements are available for this time and thus can be used for validation. The model presented in general 50% better performance in predicting precipitation yes/no than a climatological forecast. It further enables the generation of realistic precipitation yes/no fields that are conditioned on the MSG measurements and respect the gauge observations.