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Precipitation forecasting by a mesoscale numerical weather prediction (NWP) model: eight years of experience

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Abstract. The Swiss Model, a hydrostatic numerical weather prediction model, has been used at MeteoSwiss for operational forecasting at the meso-beta scale (mesh-size 14 km) from 1994 until 2001. The quality of the quantitative precipitation forecasts is evaluated for the eight years of operation. The seasonal precipitation over Switzerland and its dependence on altitude is examined for both model forecasts and observations using the Swiss rain gauge network sampling daily precipitation at over 400 stations for verification. The mean diurnal cycle of precipitation is verified against the automatic surface observation network on the basis of hourly recordings. In winter, there is no diurnal forcing of precipitation and the modelled precipitation agrees with the observed values. In summer, the convection in the model starts too early, overestimates the amount of precipitation and is too short-lived. Skill scores calculated for six-hourly precipitation sums show a constant level of performance over the model life cycle. Dry and wet seasons influence the model performance more than the model changes during its operational period. The comprehensive verification of the model precipitation is complemented by the discussion of a number of heavy rain events investigated during the RAPHAEL project. The sensitivities to a number of model components are illustrated, namely the driving boundary fields, the internal partitioning of parameterised and grid-scale precipitation, the advection scheme and the vertical resolution. While a small impact of the advection scheme had to be expected, the increasing overprediction of rain with increasing vertical resolution in the RAPHAEL case studies was larger than previously thought. The frequent update of the boundary conditions enhances the positioning of the rain in the model.

Keywords: numerical weather prediction, quantitative precipitation forecast, model verification

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