Seasonal and regional variability in scaling properties and correlation structure of high resolution precipitation data in a highly heterogeneous mountain environment (Switzerland)

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Abstract. Stochastic scaling models of precipitation are based on relationships between distribution properties of precipitation observed at different temporal resolutions. Here we use a large dataset of time series of high resolution precipitation data to explore the generality of the scaling relationships and of the correlation structure in precipitation. We focus in particular on the seasonal and spatial variability in parameters estimated from scaling and correlation analyses in the highly heterogeneous mountain environment of Switzerland where we expect some variability due to local climatology and topographic effects to occur. The data used are 10-min precipitation records at 62 stations of the SMA MeteoSwiss network with an average of 21 years of observations. For all stations coarse-graining of 10-min precipitation data up to a scale of approximately 1-day was conducted, the moment scaling relationships were estimated on annual and seasonal bases, and intermittency, breakdown and correlation functions were parameterised at all timescales. Relationships between the parameters that describe the precipitation scaling and correlation structure and measurement station characteristics such as location, altitude, mean annual precipitation, climatological region, etc., were investigated. The results indicate that there is high seasonal and regional variability in the estimated parameters. Seasonal effects are generally stronger than regional ones. The summer season generally shows more structure in precipitation, shorter autocorrelation range due to convective activity, high growth of intermittency and variability, and a resulting multiscaling behaviour in moments. Winter is at the opposite range, with spring and autumn in between. Al-though smaller than the seasonal effects, coherent and sometime strong regional differences are apparent. Most obvious and evident are the differences in the high Alpine region, where precipitation exhibits lower growth of intermittency, lower variability, and stronger autocorrelation, all of which lead to a simple scaling tendency in the moments. The analysis of precipitation scaling and correlation parameters shows that parameter uncertainty/variability may be large and depend on season and local climatology. This fact has to be accounted for if scaling-based models are to be used for precipitation disaggregation at ungauged sites.

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