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Finding pairs of optimal temporal and spatial resolution for precipitation analyses

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For proper choice of model output resolution, precipitation downscaling as well as biascorrection, the relation between the duration reduction factors (DRF's) as compared to area reduction factors (ARF's) is important. Originating from the radar data resolution of 5 min temporally and 1 km spatially, we produced sequences of aggregation, both in space and time, yielding: (i) temporally aggregated intensities for spatial scales held fixed; (ii) spatially aggregated intensity for temporal scales held fixed. Associating the respective aggregation resolution by matching the corresponding precipitation extremes, we yield pairs of temporal and spatial resolutions, which then define a curve. This curve is calculated for different regions of germany distinguishing predominantly convective, and predominantly stratiform cloud conditions by using synoptic observations. We show how this curve can be used to generalize the Taylor hypothesis to the situation where temporal scales change disproportionately with spatial scales. The results e.g. allow data analysts to identify pairs (Δx, Δt) of spatial and temporal resolutions for which the decrease in extreme precipitation intensities due to temporal aggregation matches that due to horizontal aggregation. Departing from the points on the graph would give only moderately increased statistical information. Interestingly, the slopes of the curves of convective and stratiform events are similar; the main scaling difference between convective and stratiform events can be described by a scaling factor. We find that in order to attain the optimal resolution, convective events require about 1.75 times higher horizontal resolutions at a given temporal scale than stratiform events.