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Internal variability in regional climate simulations

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Following the huge increase in computer power over the past fifty years, it is now possible to conduct regional climate simulations at the convective-permitting (CP) scale (horizontal grid spacing O(1-3km)). Societal relevance is evident, as a large fraction of high-impact weather operates on these scales (e.g., intense summer convection, extreme wind gusts, hail storms) and it is only partly known how these processes change as the planet warms. However, because the computational demands of running a CP regional climate model (CP-RCM) are formidable, most CP-RCM simulations to date are relatively short (O(10) years), with future trends being derived as differences between two time slices. Consequently, internal variability is considerable in these decadal simulations for most variables, but is difficult to estimate, especially for the extremes. Nevertheless, these simulations are the best we have at the moment.

For some variables such as summer rainfall, spatial pooling might be a way to increase the sample size. However we believe a careful analysis of the internal variability is still necessary to provide a context for the future changes. Here we examine different methods to estimate the amplitude of the internal variability of precipitation and temperature over Europe. Special focus will be on comparing the differences between such estimates obtained from O(10) years time-slice experiments and those obtained from long transient RCM simulations (which in contrast to the CP-RCMs are available!), with the expectation that some of the lessons learned in the "RCM-world" carry over to that of the CP-RCM.