



When at what scale will trends in European mean and heavy precipitation emerge

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A multi-model ensemble of regional climate projections for Europe is employed to investigate how the time of emergence (TOE) for seasonal sums and maxima of daily precipitation depends on spatial scale. The TOE is redefined for emergence from internal variability only, the spread of the TOE due to imperfect climate model formulation is used as a measure of uncertainty in the TOE itself. Thereby the TOE becomes a fundamentally limiting time scale and translates into a minimum spatial scale on which robust conclusions can be drawn about precipitation trends. Thus also minimum temporal and spatial scales for adaptation planning are given. In northern Europe, positive winter trends in mean and heavy precipitation, in southwestern and southeastern Europe summer trends in mean precipitation emerge already within the next decades. Yet across wide areas, especially for heavy summer precipitation, the local trend emerges only late in the 21st century or later. For precipitation averaged to larger scales, the trend in general emerges earlier.

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