Changes in severe precipitation events over Europe under Global warming

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Projections of future climate change of extreme precipitation for Europe already exist, but are deficient in terms of their regional detail. High-resolution (50 km) climate change simulations for an area covering the entire European continent and a substantial part of the North Atlantic sector have been conducted with the regional climate model HIRHAM4. The experiments were driven by large-scale atmospheric conditions from transient climate change scenario simulations performed with the Max Planck Institute for Meteorology coupled ocean atmosphere general circulation model ECHAM4/OPYC3 with a resolution of ~300 km. The emission scenarios used were the IPCC SRES marker scenarios A2 and B2. Three 30-year time slice experiments were conducted with HIRHAM for periods representing present-day (1961-1990) and the future (2071-2100) in the two scenarios.

Resolution limitation in an OAGCM precludes the simulation of realistic extreme events and the detailed spatial structure of variables like temperature and precipitation over regions characterised by heterogeneous surfaces. Due to a much better representation of the surface topography in an RCM, the geographical distribution of seasonal mean precipitation patterns generally represents a substantial improvement compared to the driving OAGCM. Likewise, high resolution is needed to provide sufficient information on the distribution of daily rainfall events. Based on the HIRHAM simulations, we estimate that the risk for an increase in the occurrence of severe precipitation events is everywhere largest during autumn and winter, while most of Europe will experience little change or even a reduction during the rest of the year. In spite of this, in many areas and in all seasons, the relative change in the 95% fractile of daily precipitation is positive. This also holds for intermediate to weekly time scales, and in some cases even with a larger increase. With the caveat in mind that the statistics is poor, we also find that for events with a longer return period (i.e. 2 years), this is true as well, and again with an enhanced amplitude.