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Assessment of extreme global precipitation over land in ERA-20C by comparison to GPCC's Full Data Daily data set

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The capture of extreme daily precipitation in forecast models is known to be a difficult task. This paper focuses on the potential of the ERA-20C centennial reanalysis to reproduce extreme events captured by in-situ measurements.

The ERA-20C reanalysis resulted from the projects ERA-Clim and ERA-Clim2. It was produced based on the ECMWF forecast model IFS model version Cy38r1 with a spatial resolution of about 125 km (T159) and covers more than one century from 1900 to 2010. Only surface observations of marine winds, sea ice concentration and pressure were assimilated, all other variables are prognostic so determined by the aforementioned IFS model. Full Data Daily (FDD) is an observation based dataset provided by the Global Precipitation Climatology Centre (GPCC). It covers global land surface precipitation from 1988 to 2013 with daily resolution and a spatial resolution of 1°. As precipitation is not assimilated in the multi-decadal reanalyses ERA-20C the predicted precipitation should be compared with in-situ measurements like FDD for an independent assessment of its uncertainty.

The joint CCl/CLIVAR/JCOMM Expert Team (ET) on Climate Change Detection and Indices (ETCCDI) proposed indices for different climate variables including precipitation to determine extreme values and their temporal change (Peterson et al., 2001, Appendix A). These indices include for example dry and wet spells or maximum precipitation within five consecutive days. Differences between ERA_20C and FDD based on ETCCDI diagnoses were detected particularly in regions with large precipitation totals in the overlapping period from 1988 to 2010. Strong disagreements occur especially in Africa in the ITCZ area and in Indonesia.

The overall comparison reveals geo-spatially heterogeneous results with areas of similar extreme precipitation characteristics, but also areas that still remain challenging for the reanalysis' fidelity to represent the FDD based ETCCDI diagnostics. The results serve good guidance where improvements of the future IFS model versions should be most effective.