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A data centred method to estimate and map how the local distribution of daily precipitation is changing

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Estimates of how our climate is changing are needed locally in order to inform adaptation planning decisions. This requires quantifying the geographical patterns in changes at specific quantiles in distributions of variables such as daily temperature or precipitation. Here we focus on these local changes and on a method to transform daily observations of precipitation into patterns of local climate change. We develop a method[1] for analysing local climatic timeseries to assess which quantiles of the local climatic distribution show the greatest and most robust changes, to specifically address the challenges presented by daily precipitation data. We extract from the data quantities that characterize the changes in time of the likelihood of daily precipitation above a threshold and of the relative amount of precipitation in those days. Our method is a simple mathematical deconstruction of how the difference between two observations from two different time periods can be assigned to the combination of natural statistical variability and/or the consequences of secular climate change. This deconstruction facilitates an assessment of how fast different quantiles of precipitation distributions are changing. This involves both determining which quantiles and geographical locations show the greatest change but also, those at which any change is highly uncertain. We demonstrate this approach using E-OBS gridded data[2] timeseries of local daily precipitation from specific locations across Europe over the last 60 years.
We treat geographical location and precipitation as independent variables and thus obtain as outputs the pattern of change at a given threshold of precipitation and with geographical location. This is model- independent, thus providing data of direct value in model calibration and assessment. Our results show regionally consistent patterns of systematic increase in precipitation on the wettest days, and of drying across all days which is of potential value in adaptation planning.

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[2] Haylock, M.R., N. Hofstra, A.M.G. Klein Tank, E.J. Klok, P.D. Jones and M. New. 2008: A European daily high-resolution gridded dataset of surface temperature and precipitation. J. Geophys. Res (Atmospheres), 113, D20119