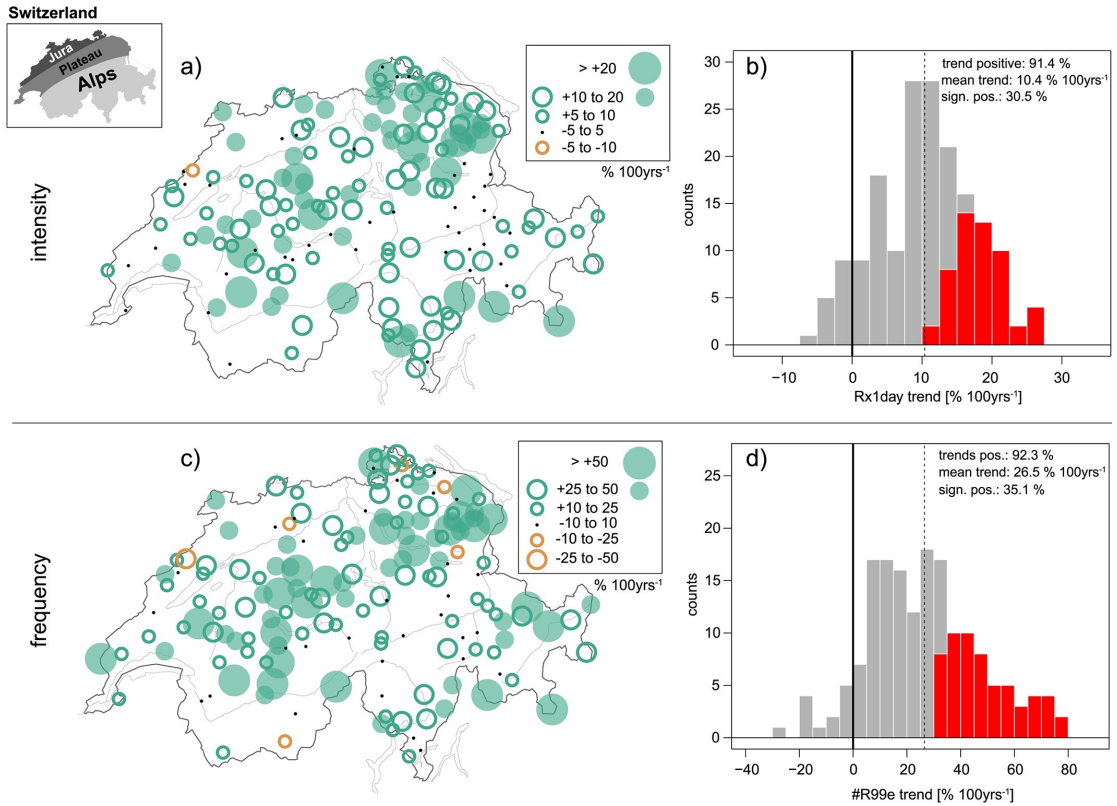
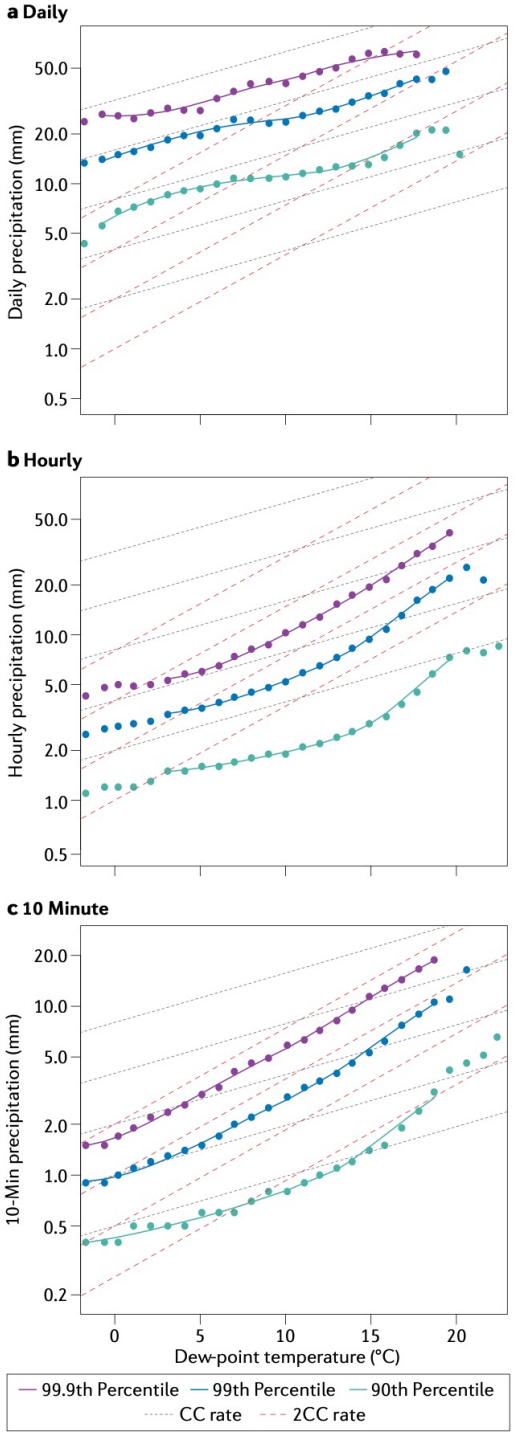
Emerging trends in heavy precipitation and hot temperature extremes in Switzerland



(a and b) Observed 1901–2014 trends of the annual daily maximum precipitation (Rx1day) and (c and d) the number of days exceeding the 99th percentile (#R99e) at ~170 Swiss precipitation stations, in % 100 yr s−1. Filled circles and red histogram bars indicate trends that are statistically significant at the 5% level. The main geographical regions of Switzerland are shown in the inset on the top left corner.

Scherrer, S. C.; Fischer, E. M.; Posselt, R.; Liniger, M. A.; Croci-Maspoli, M.; Knutti, R. (2016): Emerging trends in heavy precipitation and hot temperature extremes in Switzerland. Journal of Geophysical Research 121 (6): 2626–2637. https://doi.org/10.1002/2015JD024634

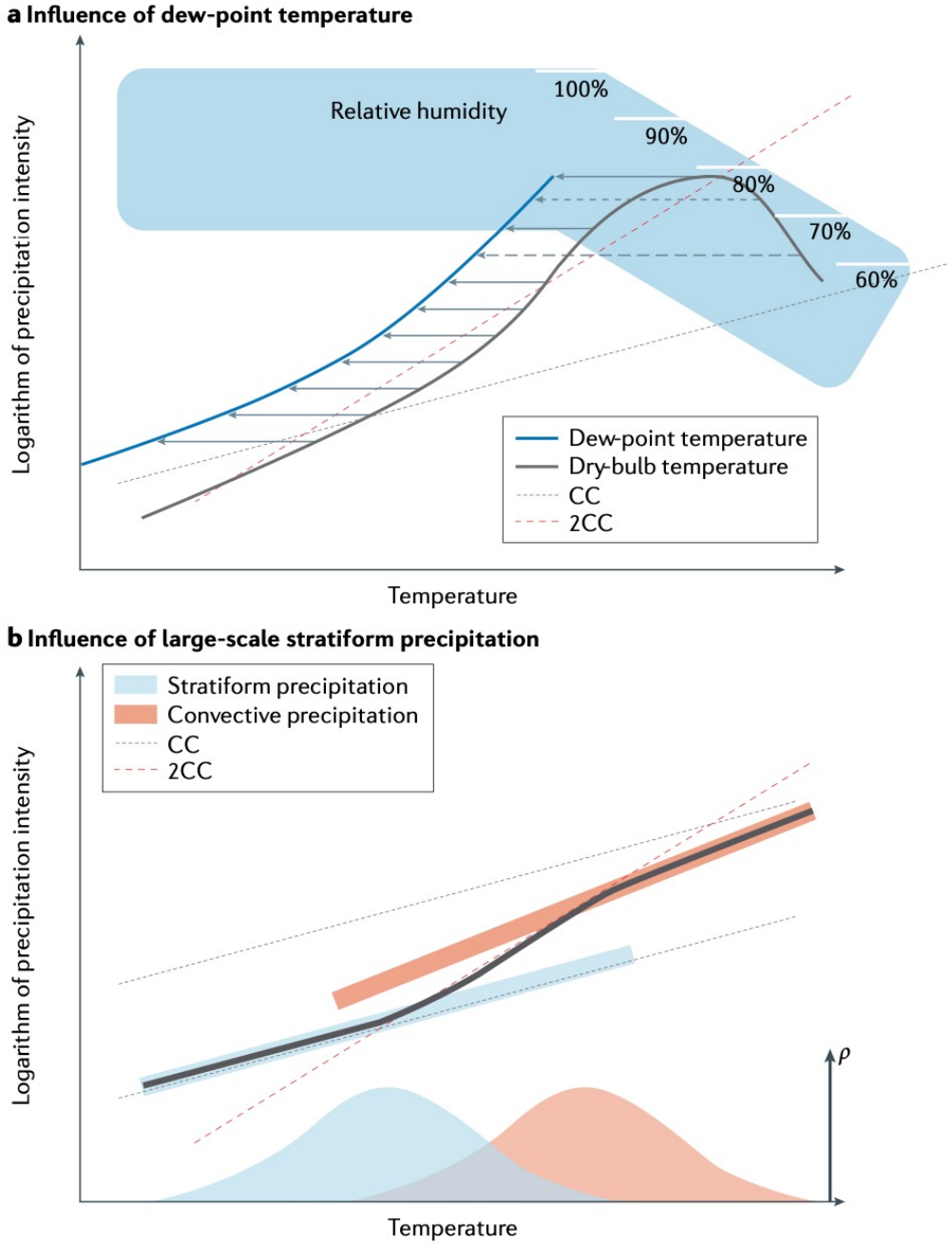
Temperature scaling of rainfall intensities



Apparent scaling of rainfall intensities with dew-point temperature at daily (panel a), hourly (panel b) and 10-min (panel c) resolution for the Netherlands, showing the 99.9th, 99th and 90th percentiles. Note that panel c has a different y-axis scale to panels a and b. The figures show the gradual change in apparent scaling rates from the Clausius– Clapeyron (CC) rate for daily precipitation to twice the CC rate (2CC) for 10-min rainfall extremes. Data from the Royal Netherlands Meteorological Institute (KNMI).

Fowler, H. J.; Lenderink, G.; Prein, A. F.; Westra, S.; Allan, R. P.; Ban, N.; Barbero, R.; Berg, P.; Blenkinsop, S.; Do, H. X.; Guerreiro, S.; Haerter, J. O.; Kendon, E. J.; Lewis, E.; Schaer, C.; Sharma, A.; Villarini, G.; Wasko, C.; Zhang, X. (2021): Anthropogenic intensification of short-duration rainfall extremes. Nature Reviews Earth & Environment 2, 107–122. https://doi.org/10.1038/s43017-020-00128-6

Influence of accounting for humidity effects and rain types on the apparent scaling of high-percentile extreme rainfall



a | Plot showing the effect of using dew-point temperature instead of dry-bulb (near-surface) air temperature on the apparent scaling of rainfall intensities. When relative humidity is declining at higher temperatures, the dew-point temperature decreases more strongly relative to the dry-bulb temperature, indicated by the grey (solid and dashed) lines, such that the hook shape seen in the dry-bulb curve is reduced or disappears.
b | Rainfall intensity of large-scale stratiform precipitation distributed across a lower temperature range and convective precipitation across a higher temperature range, illustrating the differences in the intensity and apparent scaling (Clausius–Clapeyron (CC) and super-CC, respectively). Probability density functions (where ρ is the probability density) of the occurrence of each rainfall type are also shown as shaded surfaces. The combined apparent scaling (black solid line) becomes much steeper in the transition between the two distributions. 2CC, twice the CC rate.

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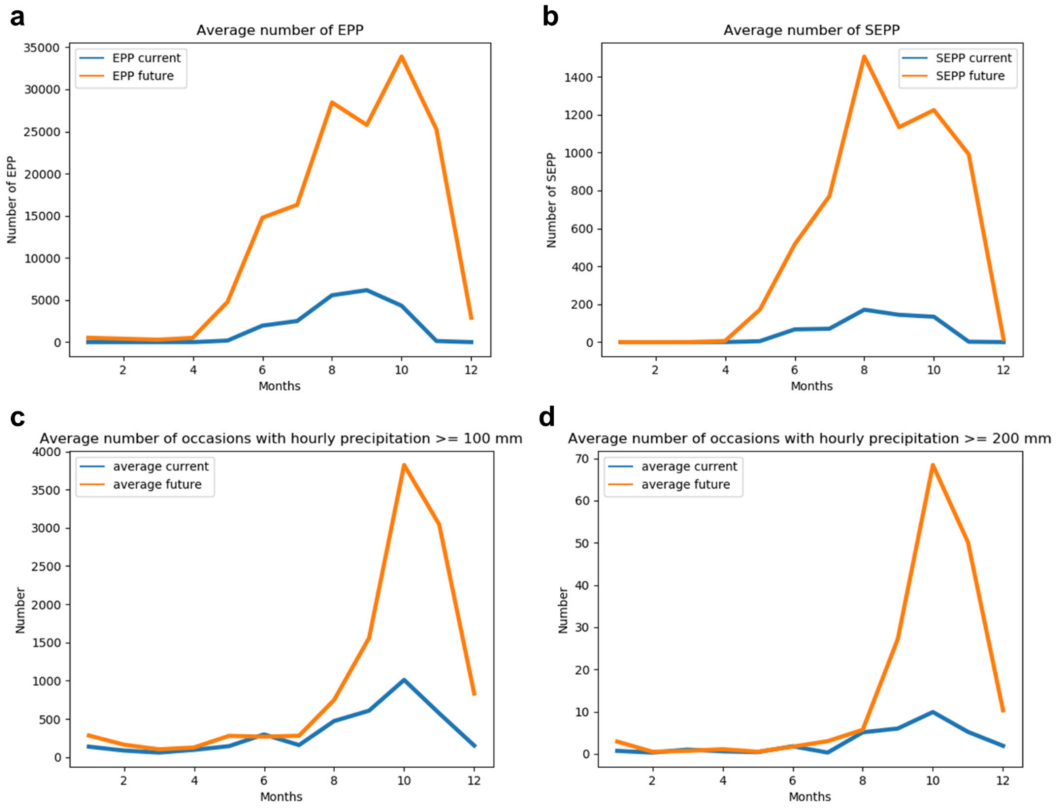
Quasi-Stationary Intense Rainstorms Spread Across Europe Under Climate Change



Average number of (a) Extreme Precipitation Potential cases, (b) Slow-moving Extreme Precipitation Potential cases, (c) hourly precipitation ≥100 mm, (d) hourly precipitation ≥200 mm, per month in current and future climates for whole domain (including land and sea).

Kahraman, A.; Kendon, E. J.; Chan, S. C.; Fowler, H. J. (2021): Quasi-Stationary Intense Rainstorms Spread Across Europe Under Climate Change. Geophysical Research Letters 48 (13). https://doi.org/10.1029/2020GL092361