

Supplementary Material for: Heavy rainfall, sediment, and hydropower in S. France

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Contents



Figure S1. Avène lake (left) and Orb dam (right). Credit: A. Foucher, October 2023.

Land Use Change

- Forests -> Pastures
- Forests -> Scrub and/or herbaceous vegetation associations
- Scrub and/or herbaceous vegetation associations -> Forests
- Scrub and/or herbaceous vegetation associations -> Pastures

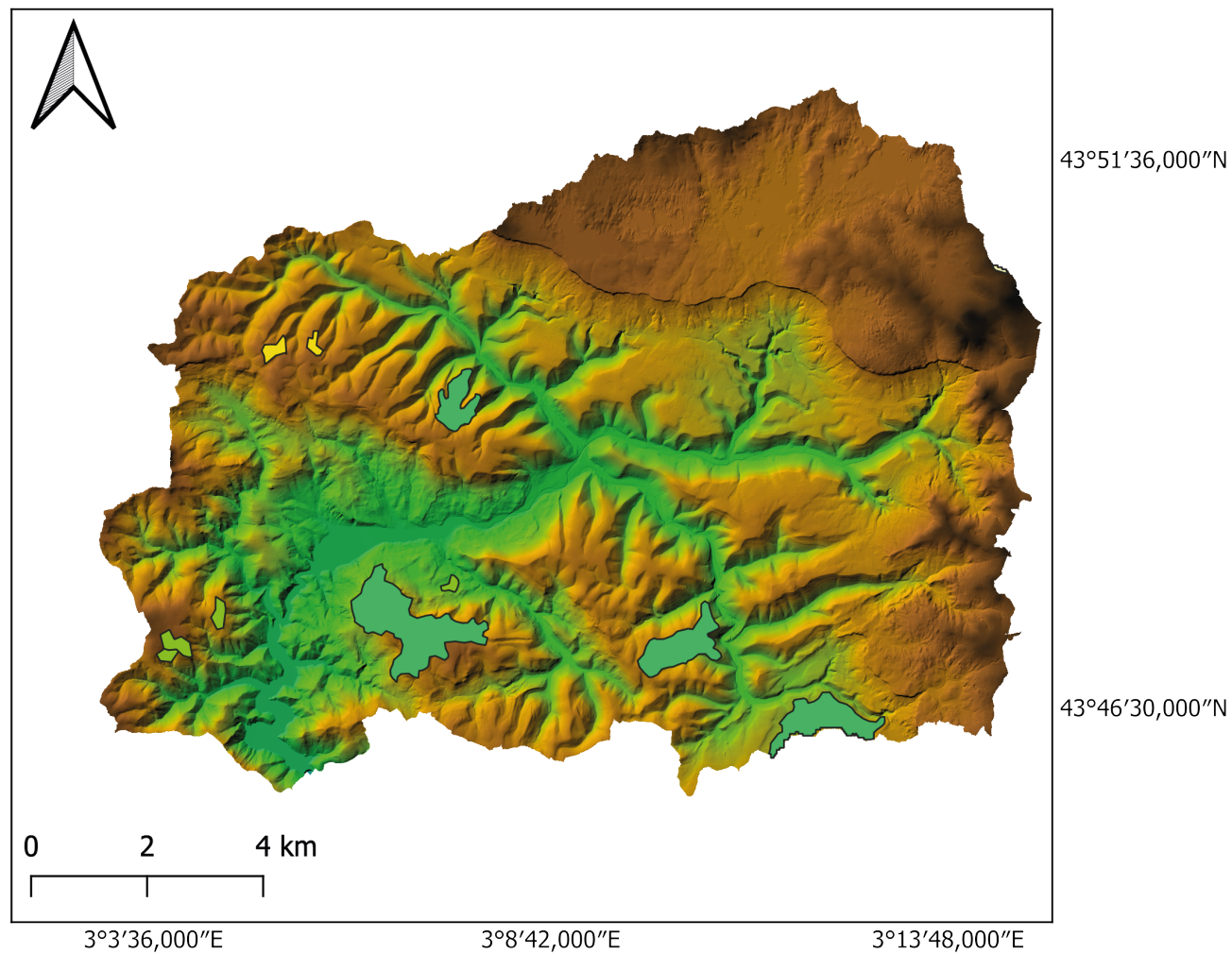


Figure S2. Land use changes (1990-2018) from IGN database showing urbanization patterns.

Accumulated precipitation trend

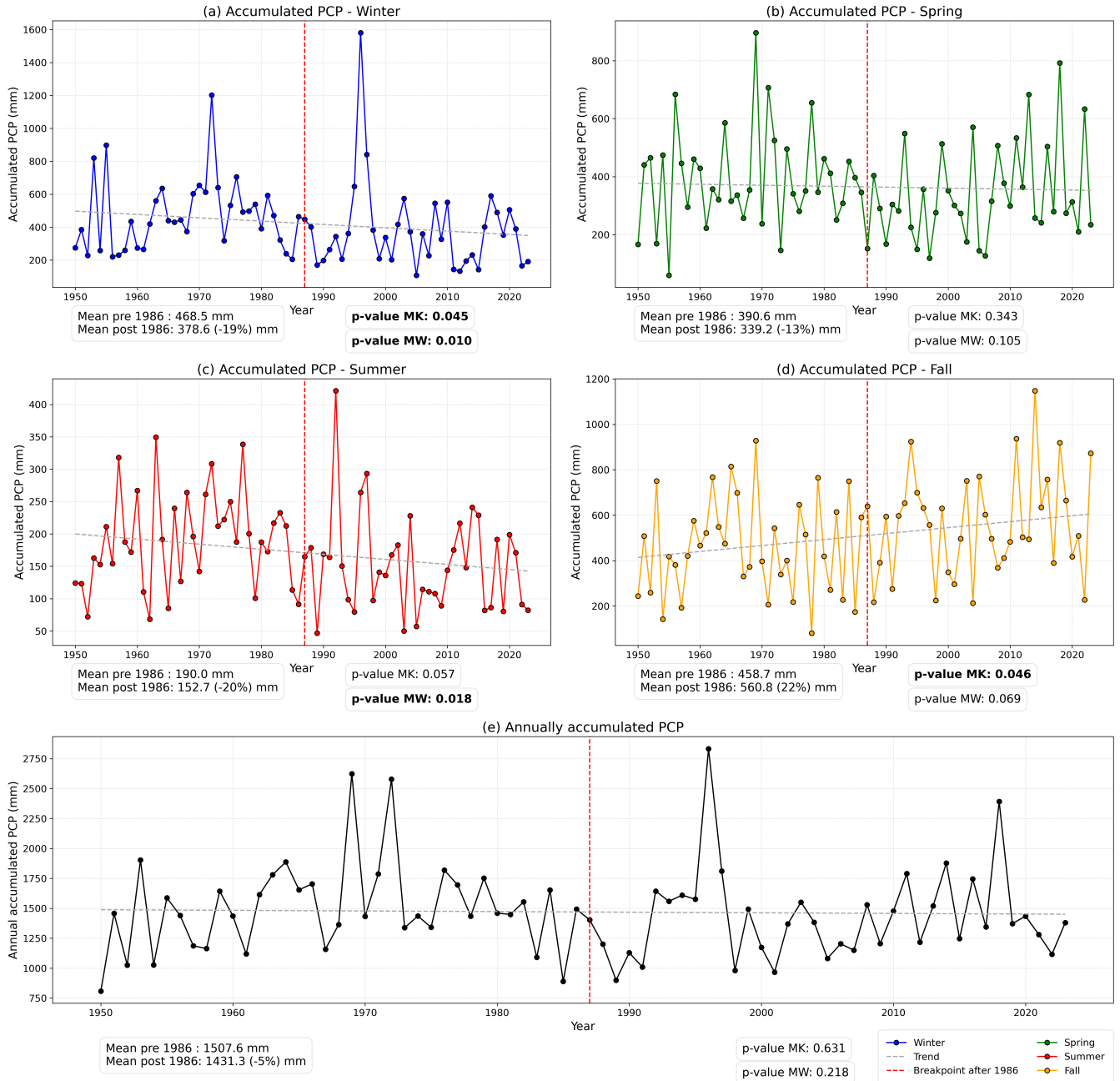


Figure S3. Seasonal and annual precipitation trends. Bold values indicate statistically significant changes (Mann-Whitney U test) and trends (Mann-Kendall test).

Daily Precipitation variability

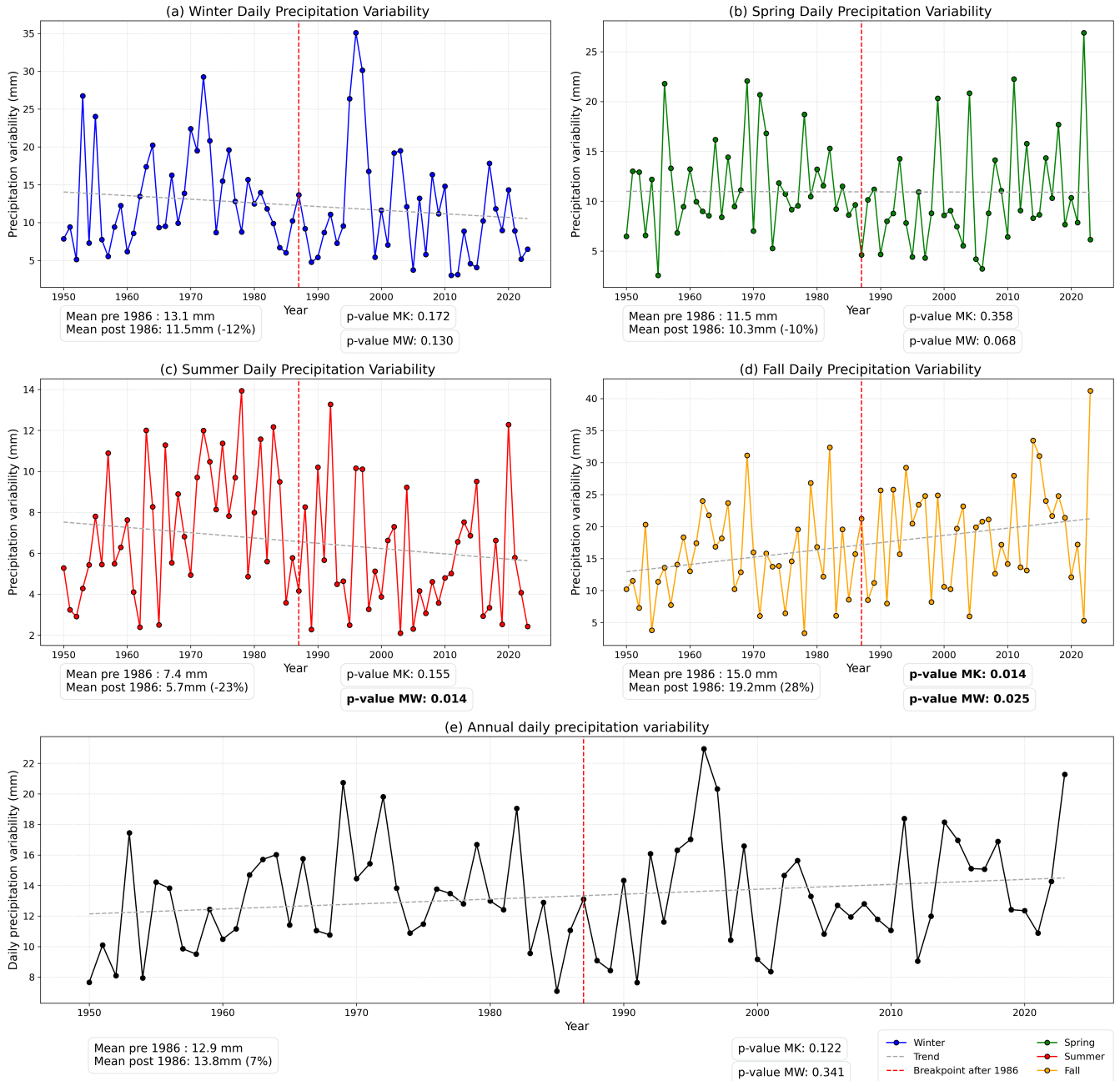


Figure S4. Precipitation variability analysis showing distributional shifts pre- and post-1986 (Mann-Whitney U) and monotonic trends (Mann-Kendall).

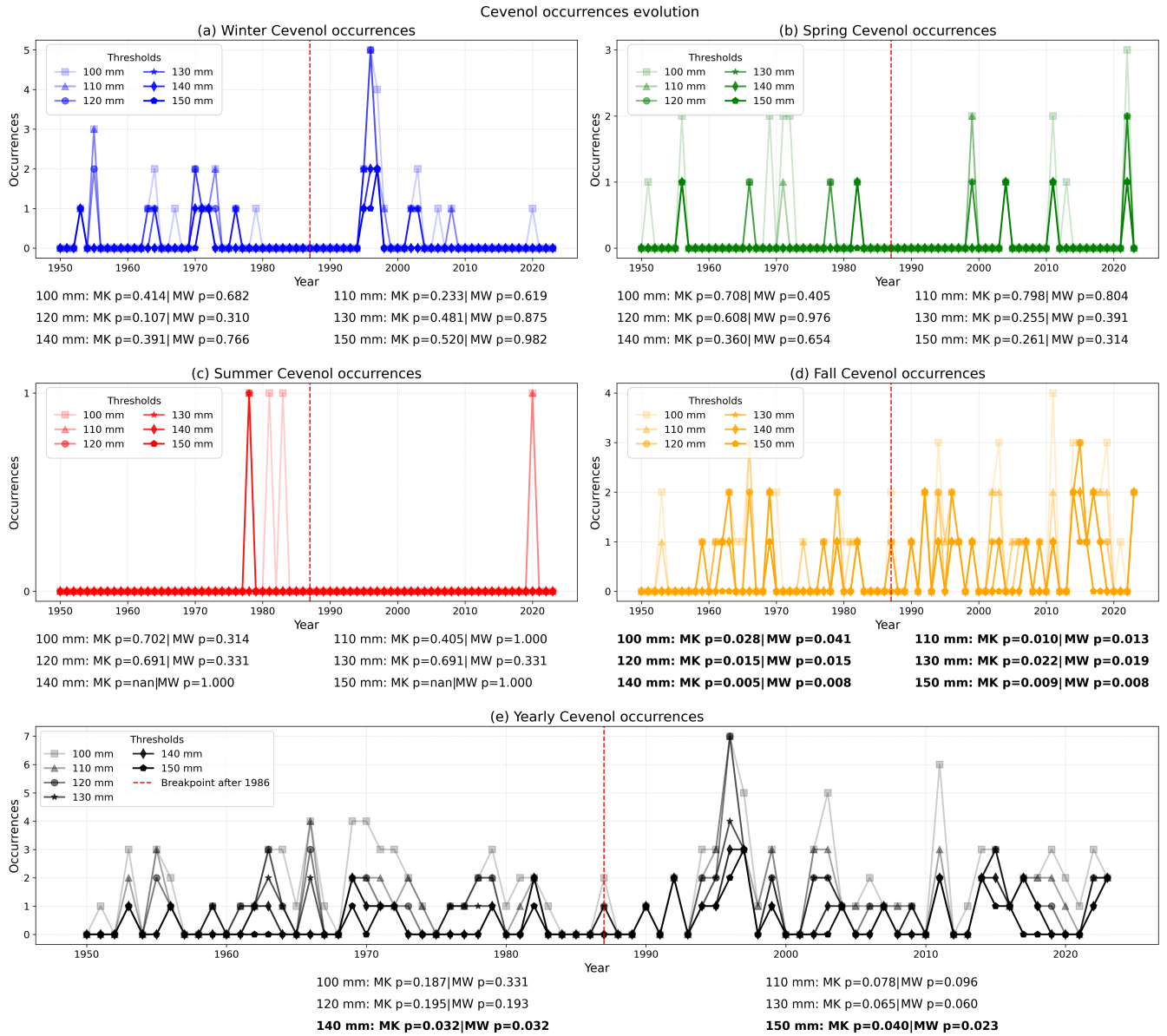


Figure S5. Frequency of Cevenol episodes showing significant increases in autumn (bold values, Mann-Whitney U and Mann-Kendall tests).

Maximum Daily Precipitation

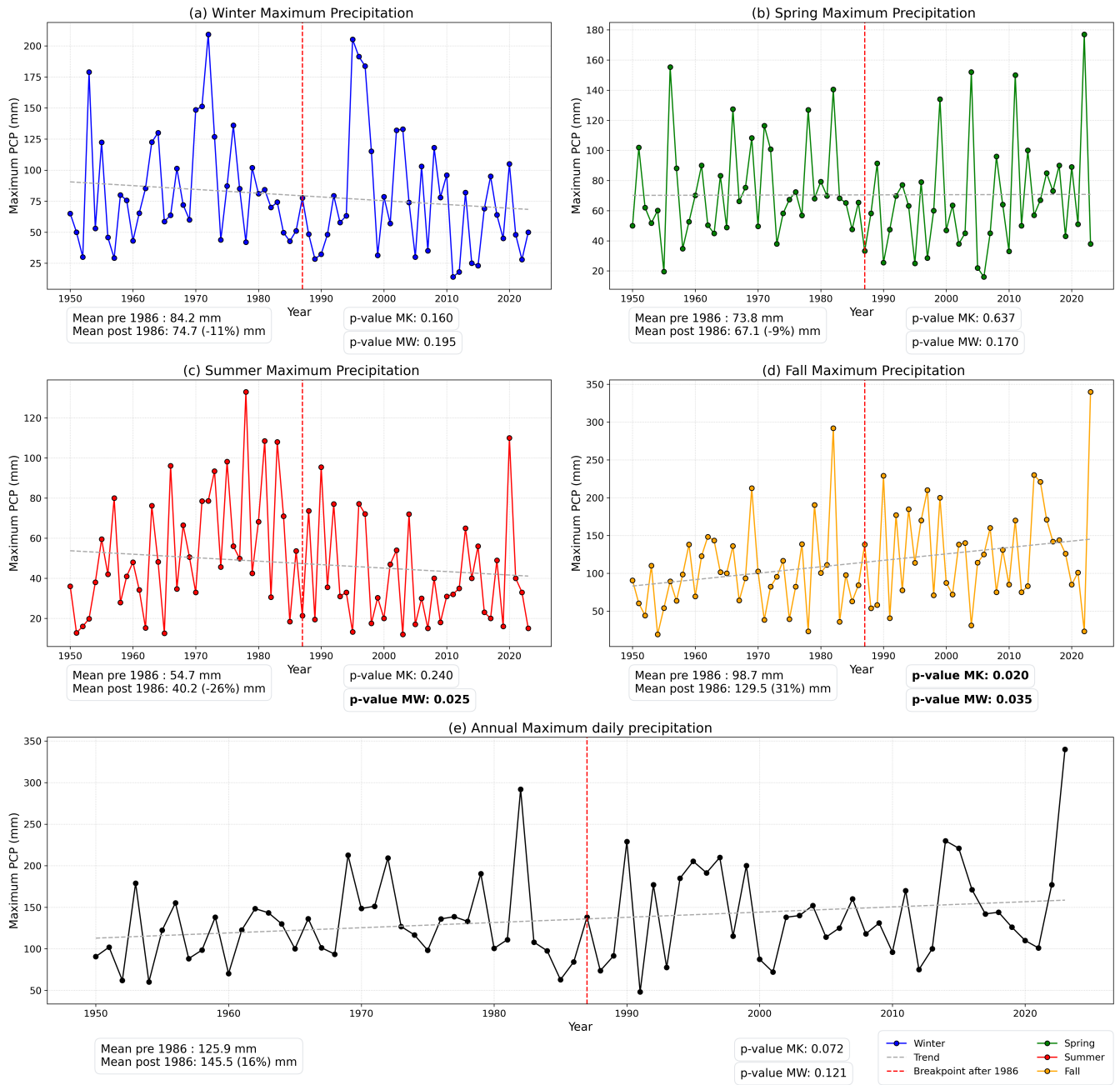


Figure S6. Intensity trends of Cevenol rainfall events. Significant results in bold.

Consecutive Dry Days occurrences evolution

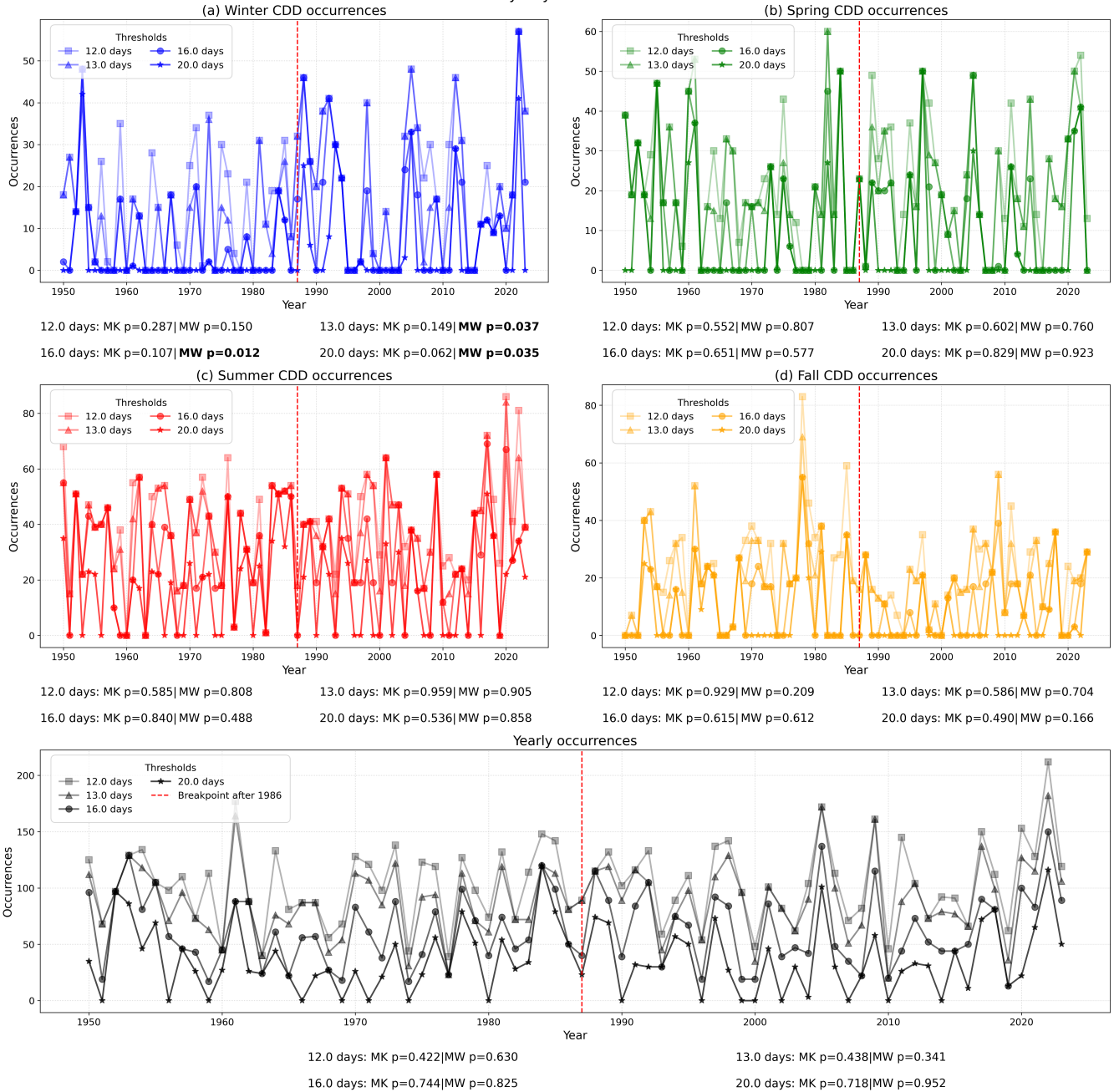


Figure S7. Consecutive Dry Days (CDD) frequency. Significant results in bold.

Maximum Consecutive Dry Days evolution

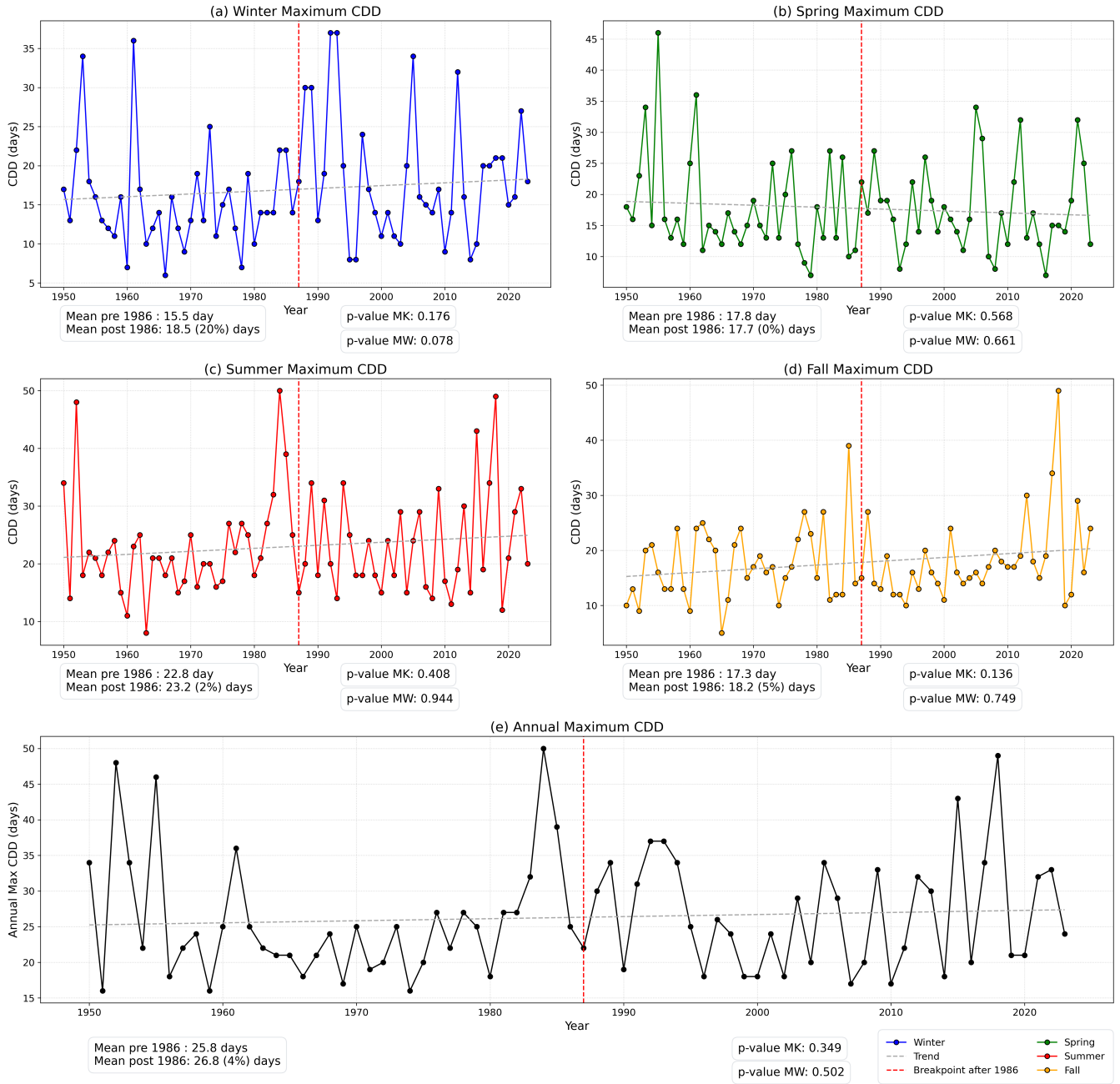


Figure S8. Drought intensity trends. Significance is shown with bold values.

Impact of Precipitation on Hydropower Generation (1976-2024)

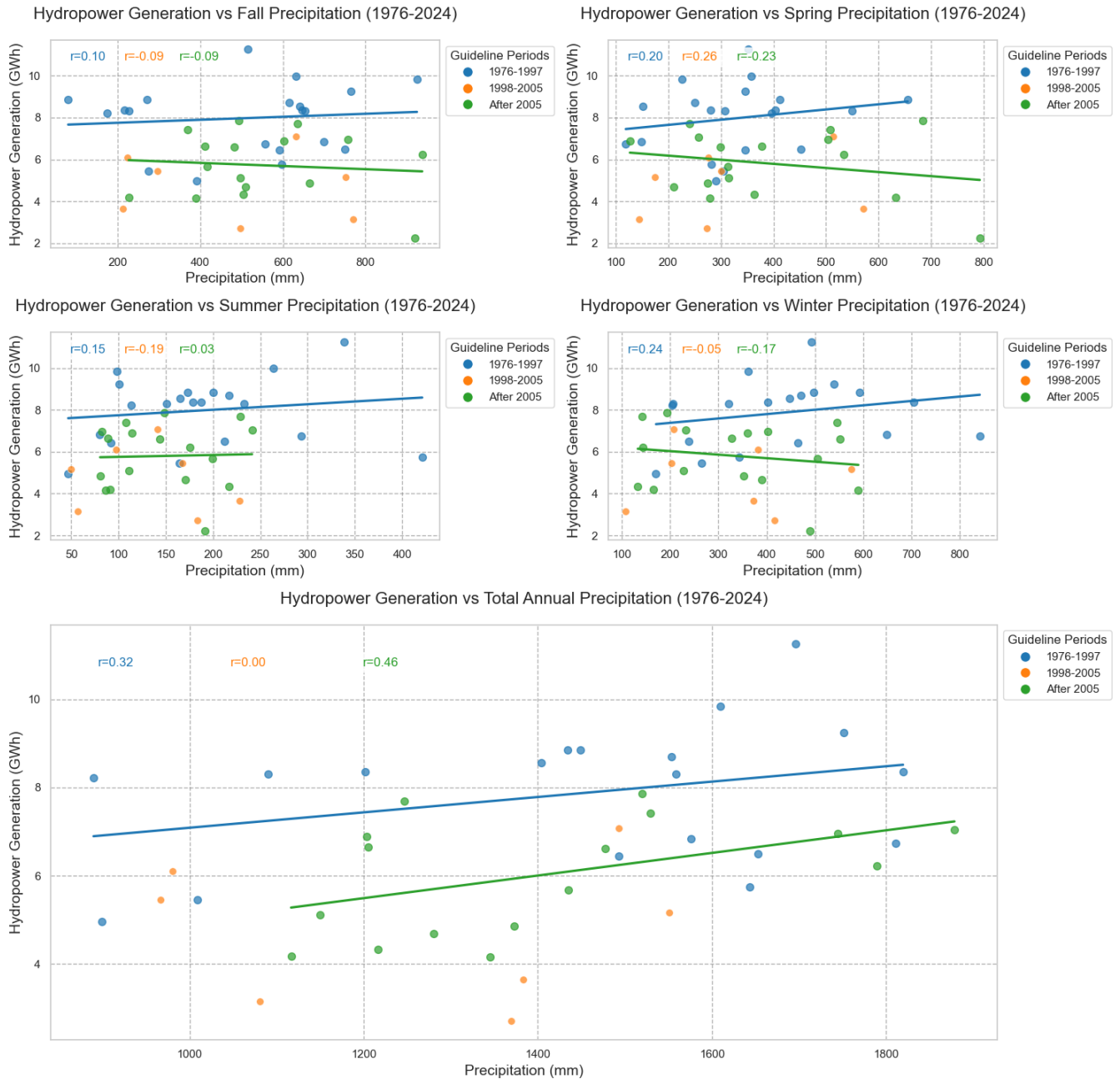


Figure S9. Hydropower production correlations with annual and seasonal precipitation.

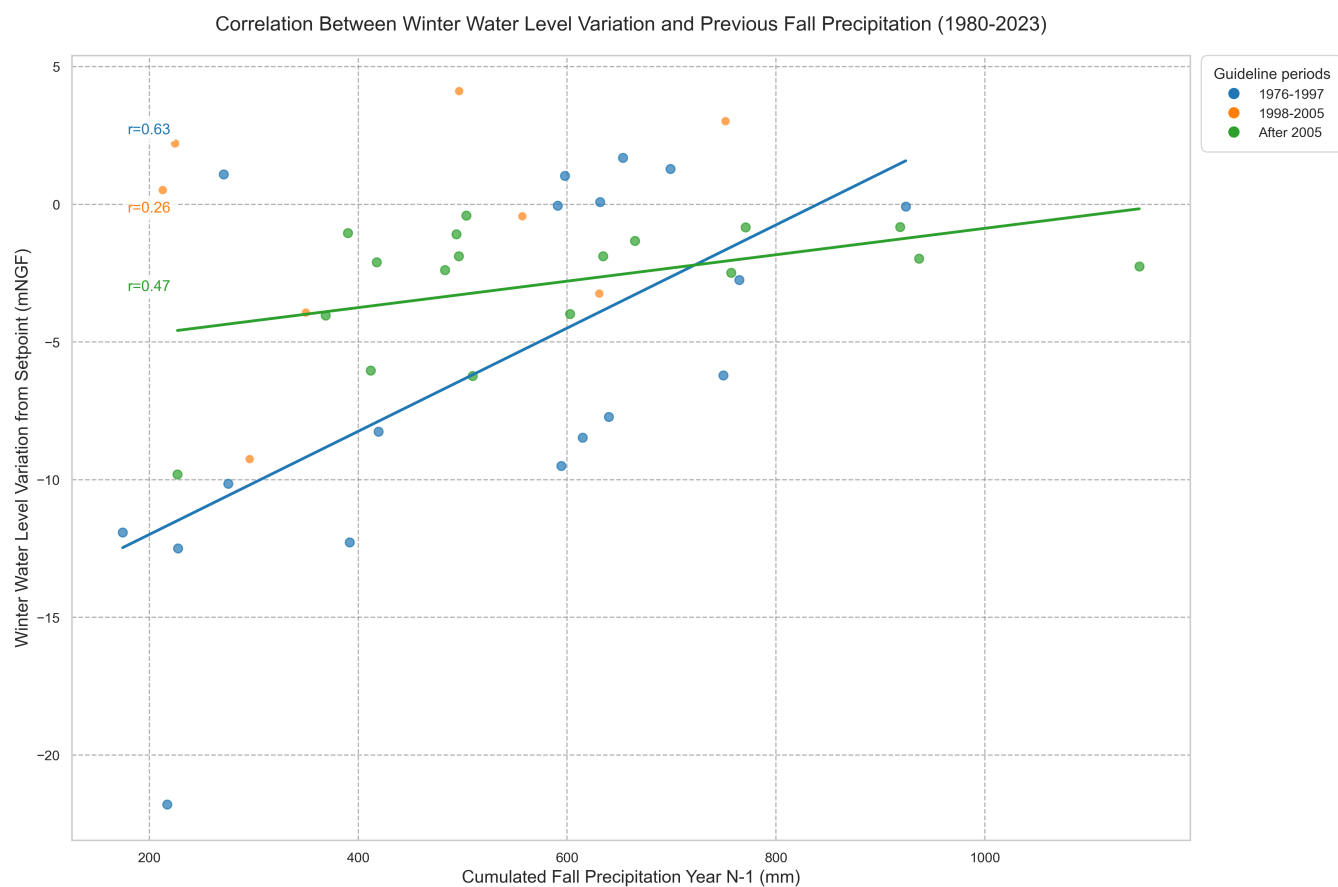


Figure S10. Correlation between average winter water level at year N and precipitation in fall at year N-1.

Hydropower under pressure: Mont d'Orb case study (France)

Context



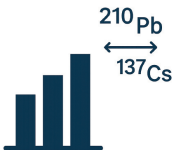
Study area: Southern France



Mediterranean episodes



Sediment Core Analysis



Radionuclide datation

Multidisciplinary approach

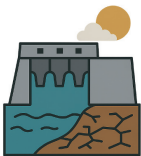
Key findings



1% of rainfall ~ 55% of sediment



+87%-400% frequency
+31% intensity



-20% winter rainfall



-25% hydropower

Future climate impacts



+Droughts / Extremes expected



Combined effect with sediment accumulation

Figure S11. Graphical abstract summarising the key findings and methodological approach of the study.