Supplement to poster "Analysing drought-flood transitions in Europe*: How does antecedent drought affects flood event runoff coefficient?*"

Event definition

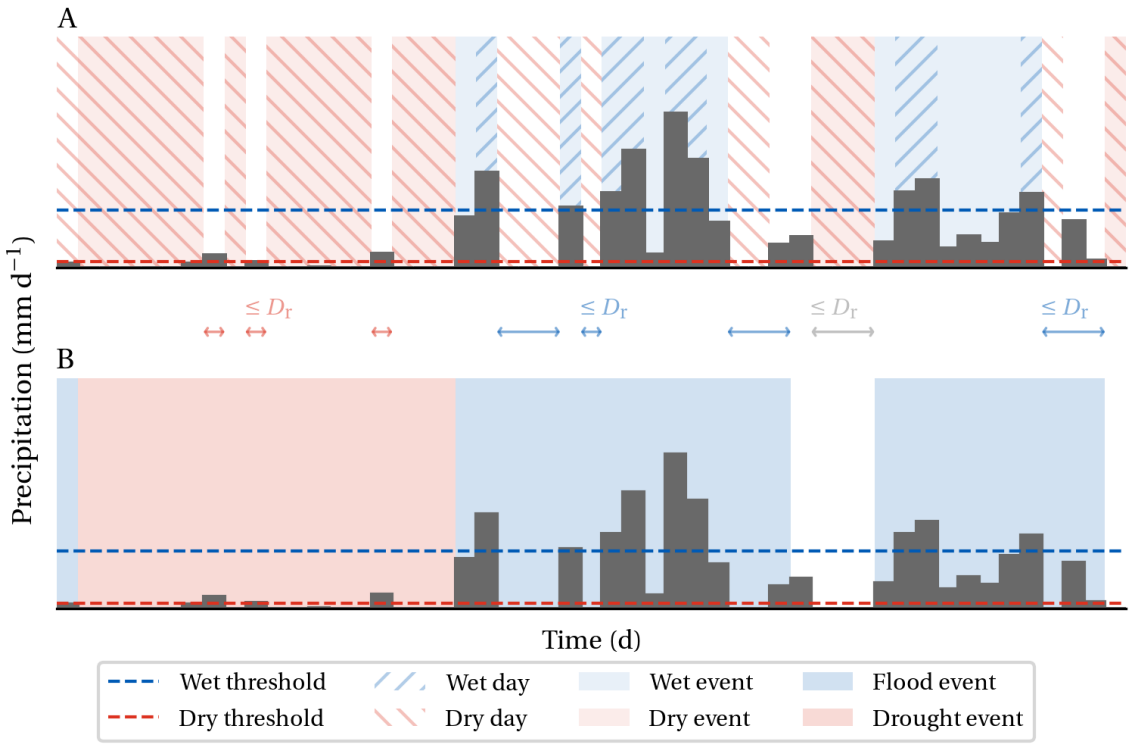


Figure S.1: Illustration of the definition of flood and drought events (B) and how they are derived from meteorological wet and dry events (A) in a system of interest. The meteorological wet and dry events are obtained by implementing corresponding wet and dry thresholds. A catchment response time (Dr) is deduced from the rainfall-runoff response to extract the flood and drought events induced by the meteorological events. All ↔ represent time ≤ Dr.

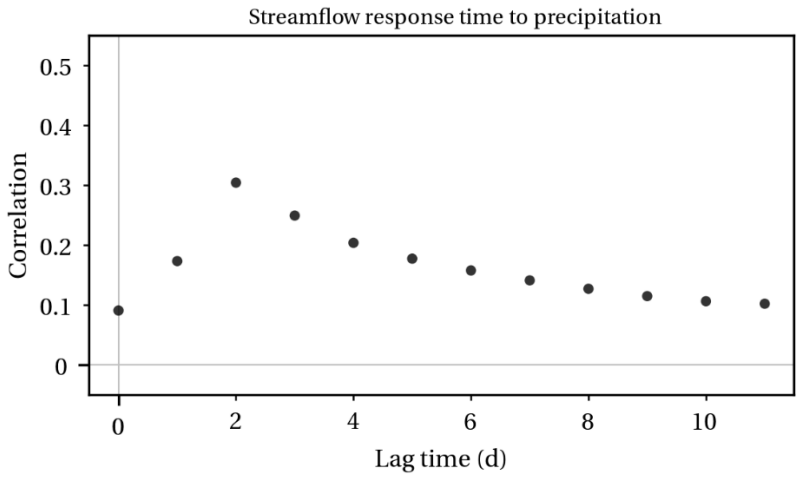


Figure S.2: Illustration of catchment response time deduction based on correlation between streamflow and precipitation lagged over difference days.

Event characteristics explored

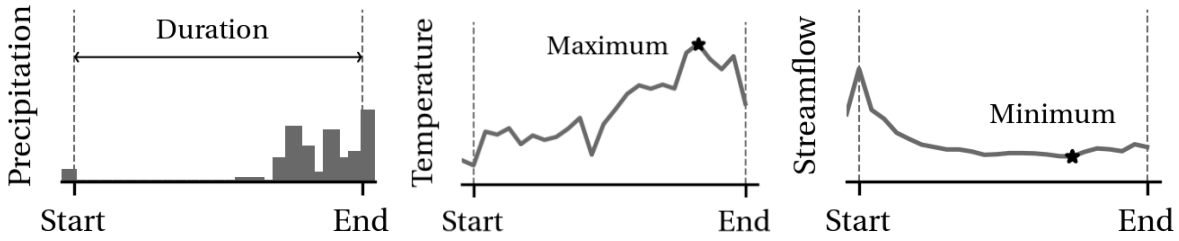


Figure S.3: Illustration of (antecedent) drought event characteristics explored, namely, $D_{P,d}$, $T_{x,d}$, and $Q_{n,d}$ respectively from left to right.

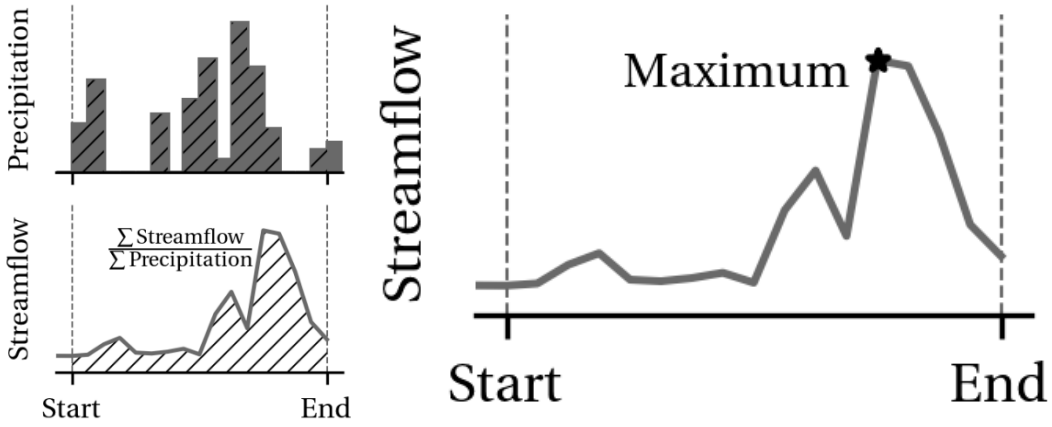


Figure S.4: Illustration of (subsequent) flood characteristics explored, namely, C_f, and $Q_{x,f}$ respectively from left to right.

Kendall τ correlation analysis for European basins

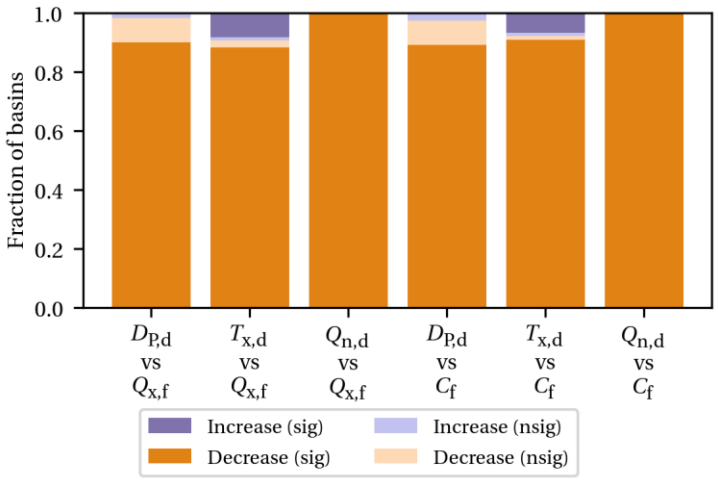


Figure S.5: Summary of correlations (significant with p-value < 0.05) between antecedent drought and subsequent flood event characteristics obtained for different event characteristics

considered in the analysis. Correlation sign is used to determine whether antecedent drought increases (purple) or decreases (orange) the subsequent flood event intensity.

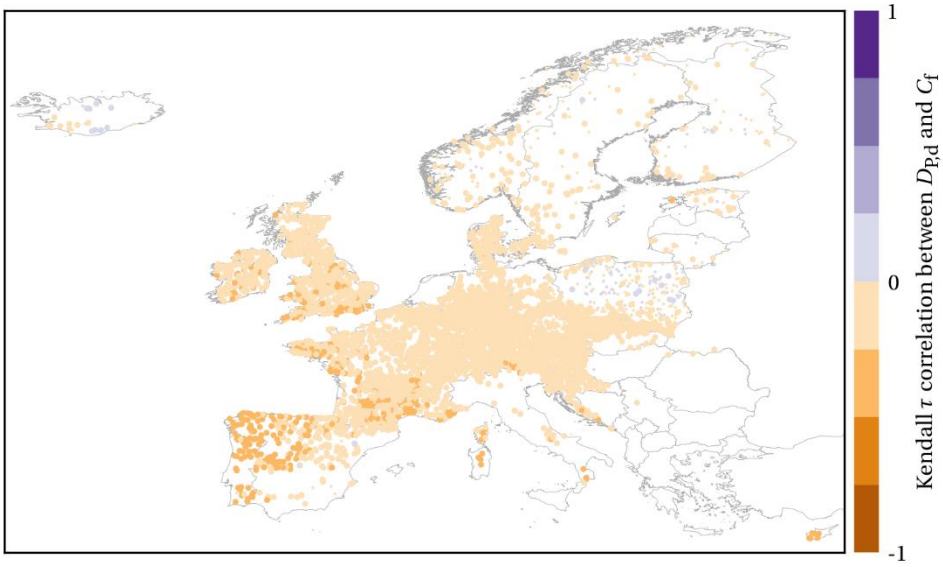


Figure S.6: Magnitude of correlations between antecedent drought duration and subsequent flood event runoff coefficient obtained across Europe. Statistically significant correlations with p-value < 0.05 are shown in larger circles and correlations not statistically significant are shown in smaller circles. Positive correlations imply an increase (purple) in flood event runoff coefficient following longer antecedent drought whereas negative correlations imply a decrease (orange).

Difference in distribution for flood events with antecedent drought and with no antecedent drought for European basins

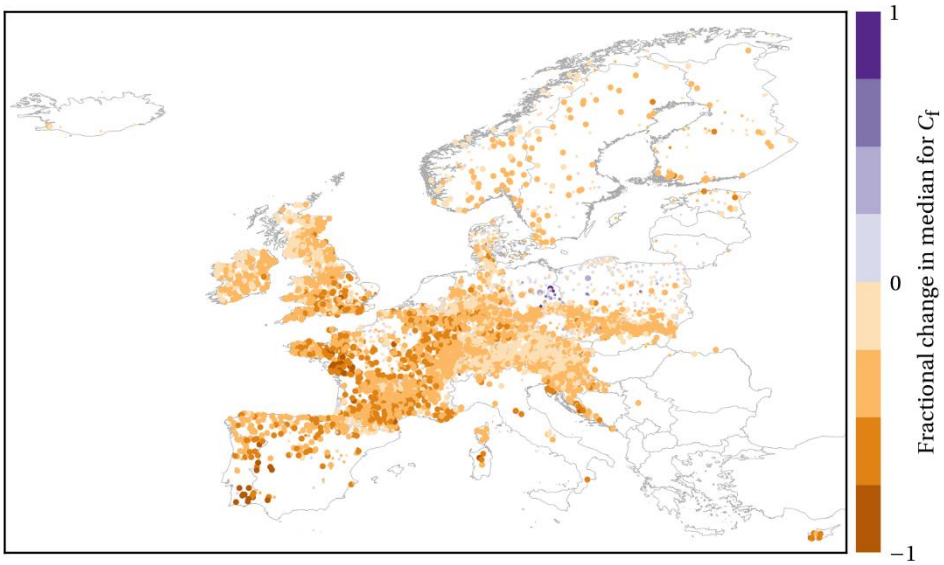


Figure S.7: Fractional change in median of flood event runoff coefficient for flood with antecedent drought compared to flood with no antecedent drought obtained across Europe. Values are shown in larger circles when the difference in distributions is statistically significant (p-value < 0.05) as per the Kolmogorov–Smirnov test. If distributions are not statistically significant, values are shown in smaller circles. Positive fractional change implies an increase (purple) in flood event runoff coefficient when preceded by a drought whereas negative correlations imply a decrease (orange).

Evidence categories for the effect of antecedent drought on subsequent flood event:

Evidence categories are derived from the direction of relationship and significance (p-value < 0.05) of effect suggested by the correlations and the difference in distributions obtained through the Kolmogorov–Smirnov test and fractional change in median of flood characteristic. Each basin (row) will fall into one of these mutually exclusive categories:

1. Both (sig) — correlation is significant, KS-test is significant, and direction is consistent
   → *Strong evidence for effect*
2. KS-test only (sig) — correlation is not significant, KS-test is significant and direction is consistent
   → *Effect observed but no evidence of relationship*
3. Correlation only (sig) — correlation is significant, KS-test is not
   → *Potential effect suggested by correlation*
4. Consistent (nsig) — correlation and KS-test not significant but direction is consistent
   → *No statistical evidence but consistent*
5. Inconsistent (nsig) — correlation and KS-test not significant and direction is inconsistent
   → *No statistical evidence and inconsistent*
6. Inconsistent (sig) — correlation and KS-test are significant and disagree in direction
   → *Contradictory evidence*
7. Unclear— KS-test significant, correlation not significant and inconsistent direction
   → *Unclear behaviour*

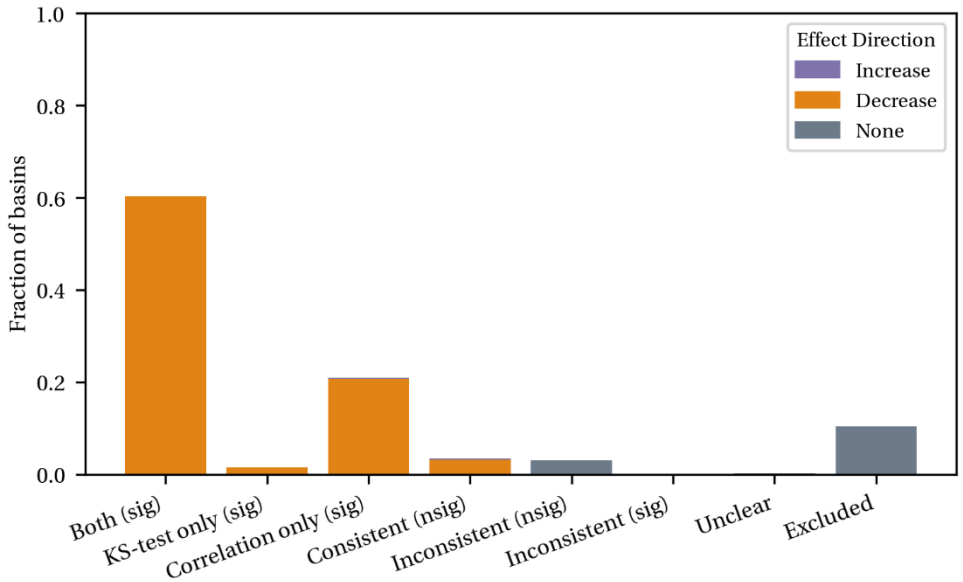
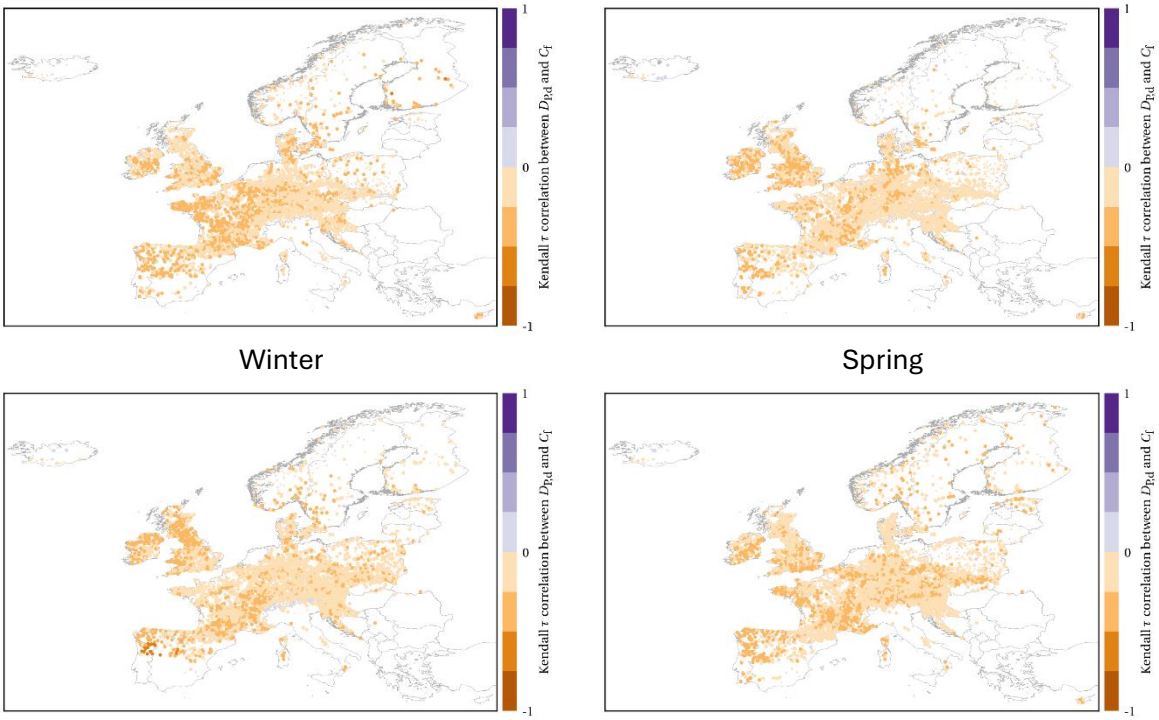


Figure S.8: Summary of evidence for sensitivity of flood event runoff coefficient to antecedent drought duration across Europe. Legend increase (purple) indicates an increase in flood event runoff coefficient following longer antecedent drought whereas decrease (orange) indicates a decrease in flood event runoff coefficient following longer antecedent drought.

Seasonal effects

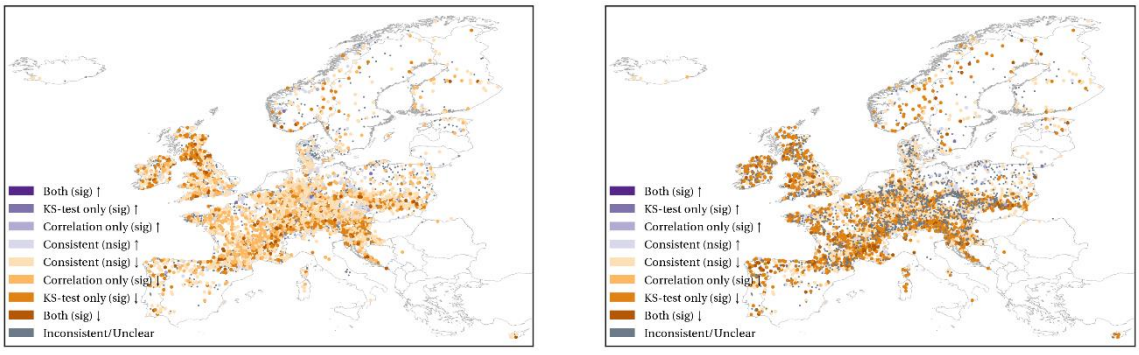


Winter Spring

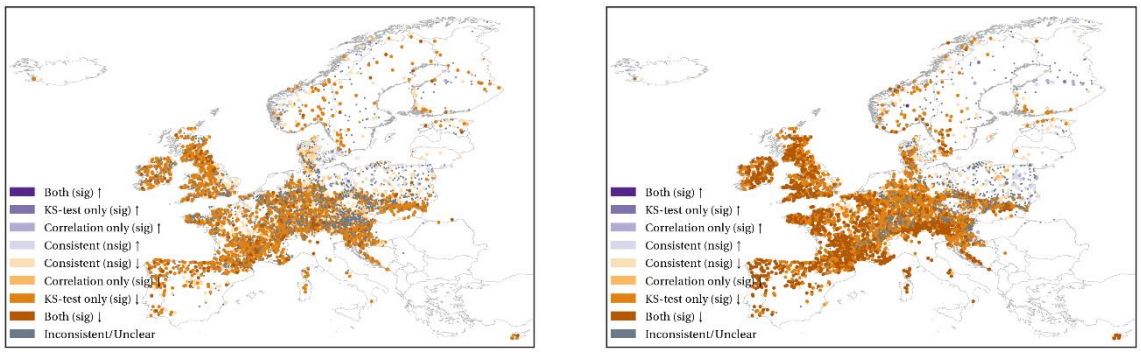
Summer Autumn

Figure S.9: Magnitude of correlations between antecedent drought duration and subsequent flood event runoff coefficient obtained across Europe for different seasons in which the flood event occurs. Statistically significant correlations with p-value < 0.05 are shown in larger circles and correlations not statistically significant are shown in smaller circles. Positive correlations imply an increase (purple) in flood event runoff coefficient following longer antecedent drought whereas negative correlations imply a decrease (orange).

Sensitivity to antecedent drought duration



Q1 Q2



Q3 Q4

Figure S.10: Evidence for the sensitivity of flood event runoff coefficient to antecedent drought duration across Europe, categorized by increasing length of antecedent drought. Events are grouped into quantiles based on the distribution of antecedent drought durations within each corresponding basin.

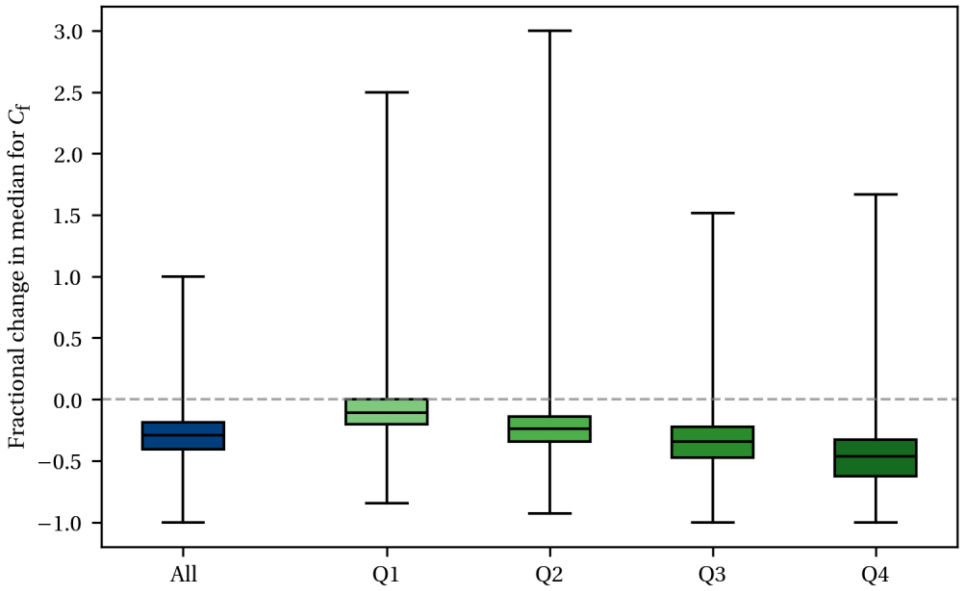


Figure S.11: Boxplots of fractional change in median runoff coefficient between floods with antecedent droughts and floods with no antecedent droughts across European basins for increasing intensity of antecedent drought duration. Events are grouped into quantiles based on the distribution of antecedent drought durations within each corresponding basin.

Sensitivity to flood event precipitation amount

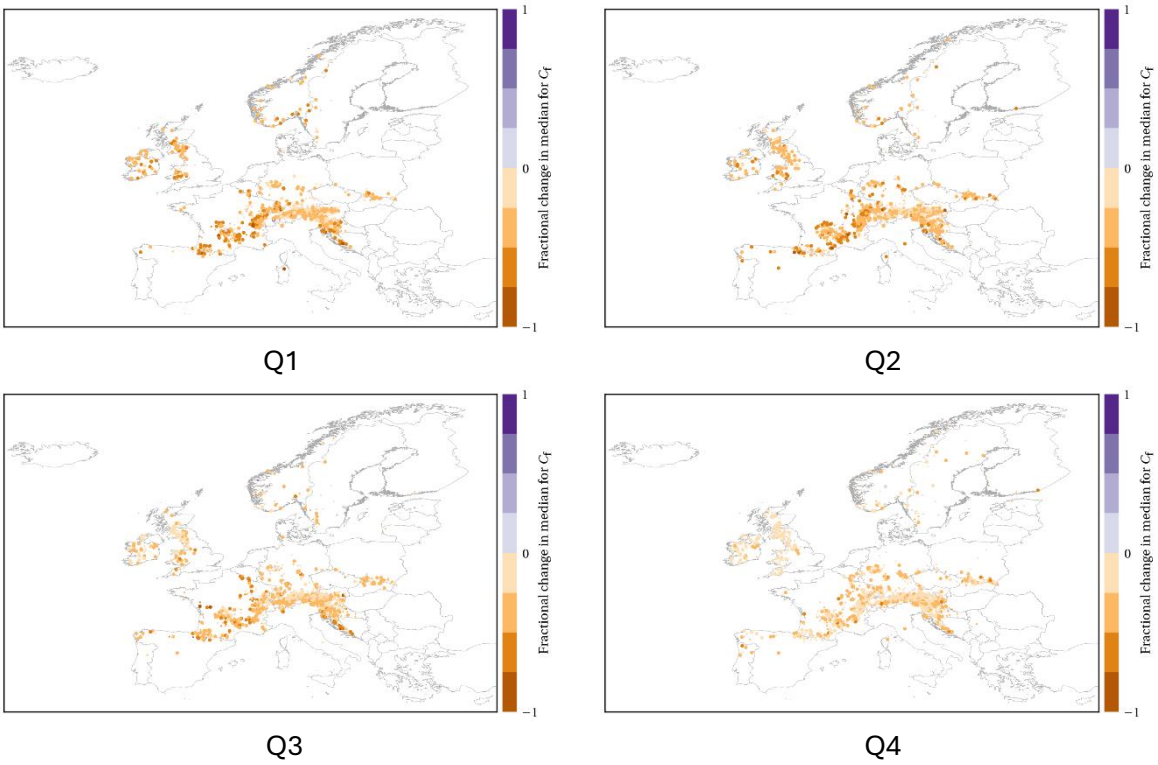


Figure S.12: Fractional change in median runoff coefficient between floods with antecedent droughts and floods with no antecedent droughts across European basins for increasing intensity of antecedent drought duration. Events are grouped into quantiles based on the distribution of antecedent drought durations within each corresponding basin.

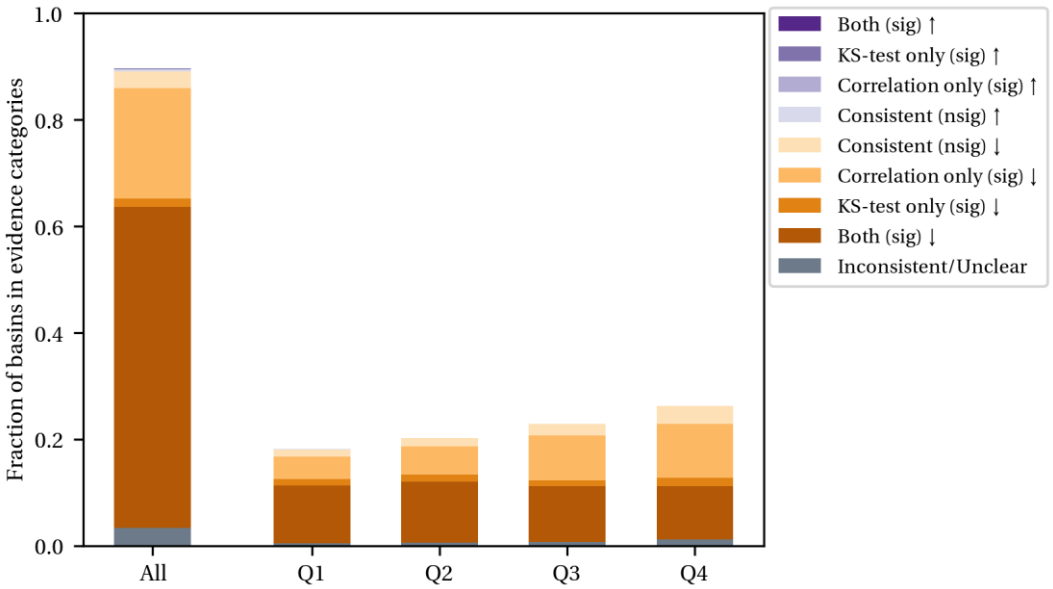


Figure S.13: Summary of basins exhibiting different levels of evidence for the sensitivity of flood event runoff coefficient to antecedent drought duration across Europe, categorized by increasing amount of precipitation received during the flood event. Events are grouped into quantiles based on the distribution of flood precipitation amounts within each corresponding basin.