Background & objective
- Increase of drought and heatwave events + compound & cascading (CnC) events + impacts due to CC in Europe.
- Challenge: many studies analyzed future drought & heatwaves as singly, no prediction future hazard impacts.
- Objective: to predicts the characteristics of CnC drought & heatwaves and their impacts using an ML model under different SSPs (SSP1-2.6 and SSP5-8.5).

Data & method
- 5 GCMs & CWatM HM from ISIMIP.
- Tmax, Tmin, & SM data (10 km).
- Drought: the SMI.
- Heatwaves: VTM (90th) & 9 days CMW*.
- Characteristics: duration, number of events, & frequency
- Updated impact database (EDII & Heatwaves)**

Characteristics of CnC events
- Increase of compound drought and heatwaves (CDH) by 30 events > reference under SSP5-8.5 (Fig. 1a).
- Highest change for CDH duration in the west, south, and east Europe (Fig. 1b,c).
- Frequency of CDH will increase around 0.4 event per year with maximum frequency of 0.76 (Fig. 1d).

Figure 1. Changes in compound event characteristics across Europe under SSP5-8.5 (median): a) number of compound, b) total duration (month), c) average duration (month) and d) frequency.

Summary of single & CnC events
- Table 1 summarizes the characteristics of single & CnC events in Europe under different scenarios.
- CnC:
  - N of events
  - Duration
  - Frequency

Table 1. A summary of singe and CnC hazard characteristics in each European region. Units: D=month, H=day, CnC=month.

Predicting hazard impacts in Germany
- Fig. 2 shows the projections of drought and heatwave impacts in Germany under SSP1-2.6 & SSP5-8.5.
- Economic: increases from 3 to 5 months (median).
- Non-economic: increases 1 month longer for each SSP.
- Ecosystem: increases twice, from 2 to 4 months.
- Humans: increase double and quadruple.

Figure 2. Change in the total month of future impacts: a) for economic sector, b) for non-economic sector, c) for ecosystem sector, and d) for heatwave impact on human.

Conclusion and outlook
- Table 1 summarizes the characteristics of single & CnC events in Europe under different scenarios.
- CnC:
  - N of events
  - Duration
  - Frequency

South Europe:
- Longest duration

West Europe:
- Highest number of events

Impacts:
- Drought: in average 2 months longer
- Heatwaves: 2 and 4 months longer