

Work group

The group work was carried out from 25 to 27 June 2025.

Location: Università di Torino (Via Pietro Giuria 1) and Politecnico di Torino (C.so Duca degli Abruzzi 24), Turin.

Participants

- Alberto Viglione (PoliTo)
Anna Basso
Luca Lombardo
- Enrico Arnone (UniTo)
Vikas Kumar
- Ilaria Tessari (CNRBo)

Agenda

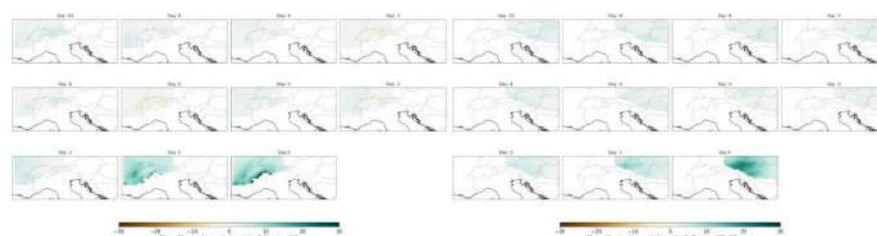
- 1) Wednesday 25 June 2025: PoliTo, UniTo and CNR discussion about the progress achieved;
- 2) Thursday 26 June 2025: Anna, Luca, Vikas and Ilaria group work and joint activities;
- 3) Friday 27 June 2025: Final meeting.

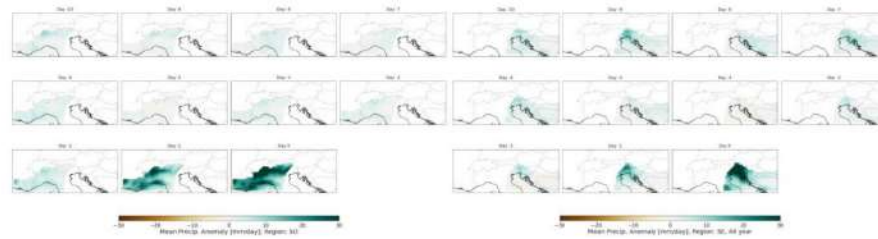
Final presentation

Observing a connection between year-round Weather Regimes (WRs), categorizing the Euro-Atlantic (EAT) large-scale, low-frequency circulation and the occurrence of extreme precipitation events in the Greater Alpine Region (GAR), we try to observe if a relation exists even between the given EAT WRs and the major flood events happening in the GAR. To do so using the TUWmodel, we simulate flood events from 1951 and 2023 and among all the events we select the major 73.

- How is the higher precipitation anomaly during the start date of the flood and days before?

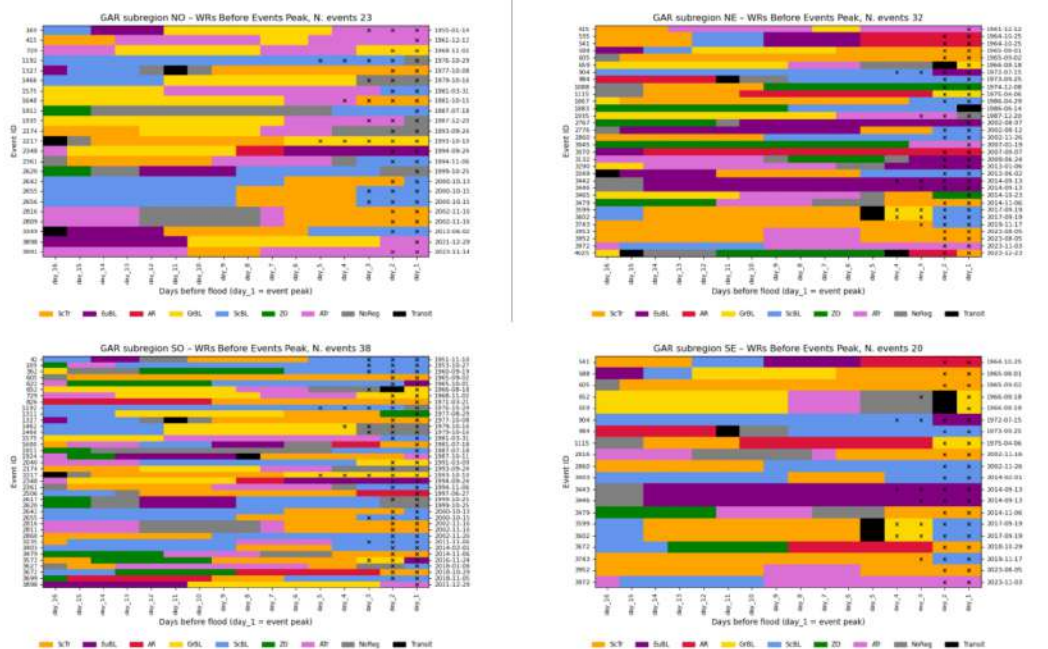
Firstly, we try to assess a connection between floods and the precipitation field, given that precipitation is one of the main drivers of flood events. Here we observe that higher precipitation anomalies return during the start day of the flood and the day before. This result is something expected, as the flood event is usually triggered by extreme precipitation events.





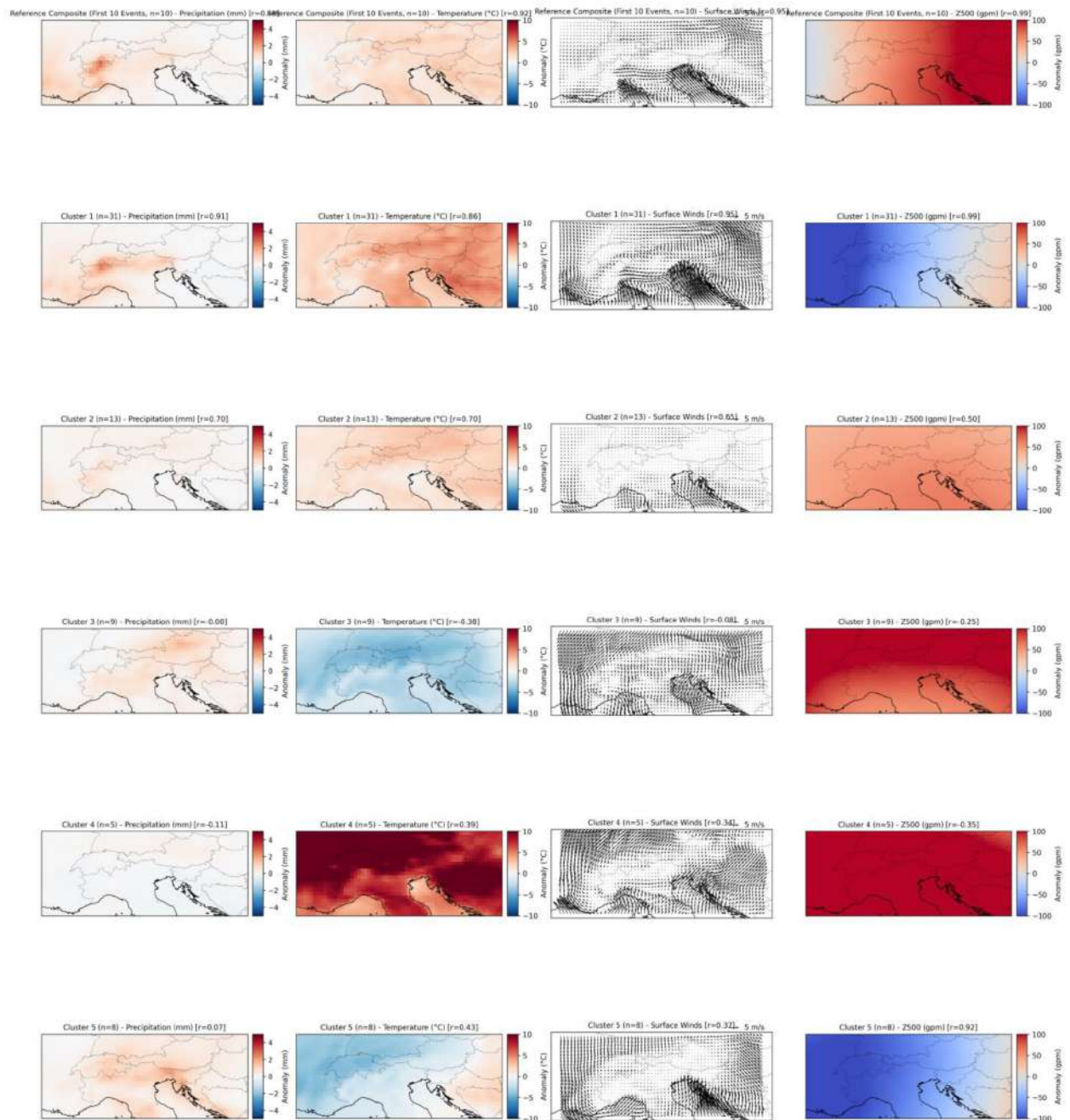
- Which WRs characterized mainly these days?

We try to categorize if the events are connected to similar atmospheric circulation conditions, to derive hints about the variability leading to such extreme hydrological events. We detect that these days are characterized by mainly 2 WRs: ScBL, ScTR which are mainly persistent and not transient. As can be detected from the plot below the same result is obtained looking at the day of the peak or at the start day.



- Which environmental conditions characterized mainly these days?

We are interested in understanding the environmental conditions (wind, air temperature, precipitation and geopotential height) during these days so we aggregate them into 5 groups using a supervised k-means cluster. As reference event we took the average properties of the top 10 among the 73 events.



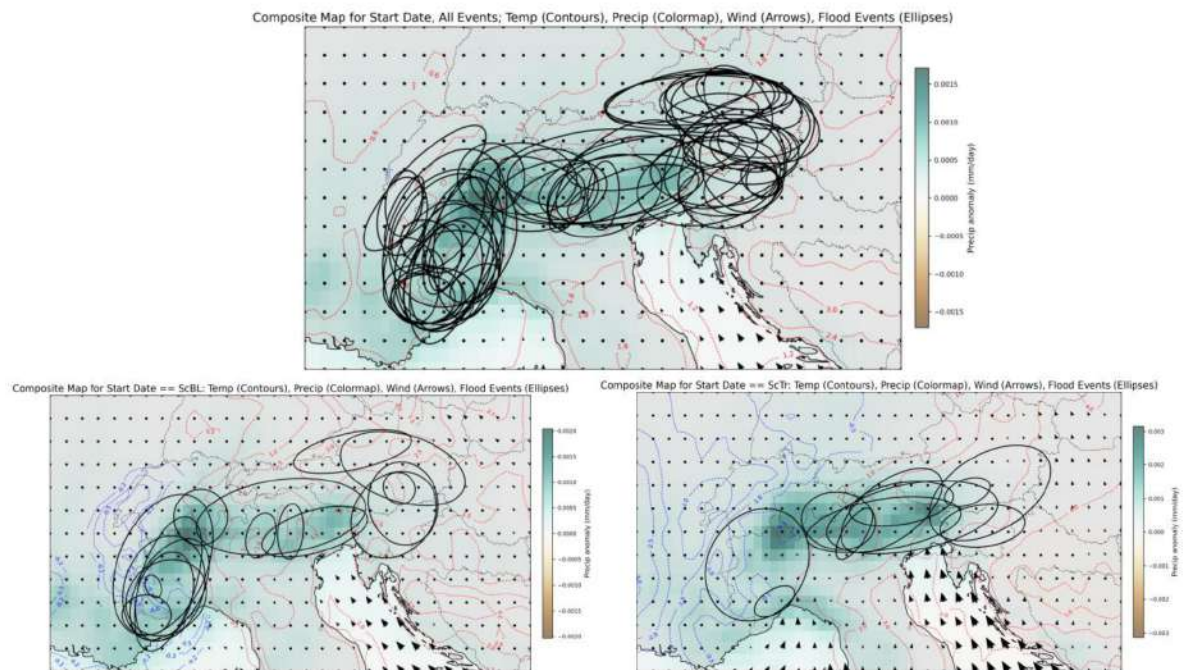
Cluster_ID	Date_of_Flood_Extreme	index
1	11/8/1951	4
1	10/25/1953	4
1	1/12/1955	6
1	9/17/1960	4
1	9/30/1965	4
1	11/1/1968	3
1	3/20/1971	0
1	4/5/1975	3
1	10/25/1976	4
1	10/7/1977	0
1	10/13/1979	3
1	10/14/1979	7
1	3/30/1981	4
1	10/11/1987	6
1	3/8/1991	3
1	10/6/1993	3
1	11/5/1994	4
1	6/27/1997	2
1	10/24/1999	7
1	10/25/1999	7
1	10/12/2000	0
1	10/13/2000	4
1	11/15/2002	0
1	11/25/2002	4
1	11/4/2011	4
1	1/31/2014	4
1	11/5/2014	0
1	11/22/2016	3
1	1/7/2018	7
1	11/15/2019	0
1	12/29/2021	6

The table shows the WRs related with the closest cluster of the reference event: out of 31, 17 are related with the prominent WRs, ScBl and ScTr.

- Which properties have the events of different WRs and climatological clusters?

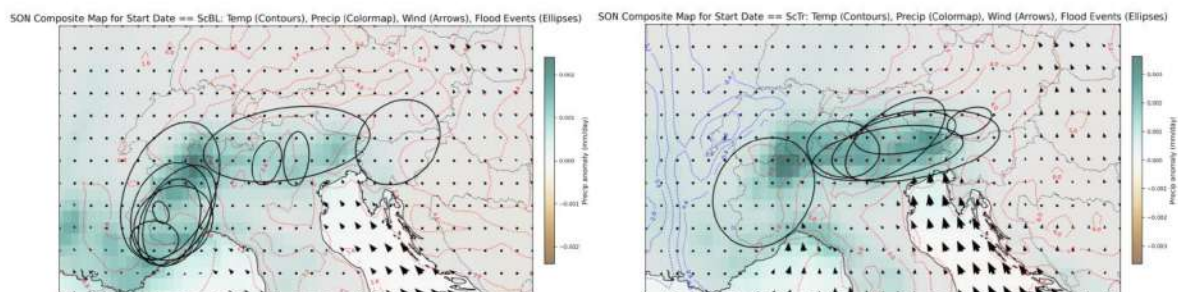
We will associate the events of different WRs and climatological clusters with: seasonality, GAR zones, soil conditions (7 – 30 day before), space-time organization, nature of the inducing event and decade.

- Draft first main plot of the paper



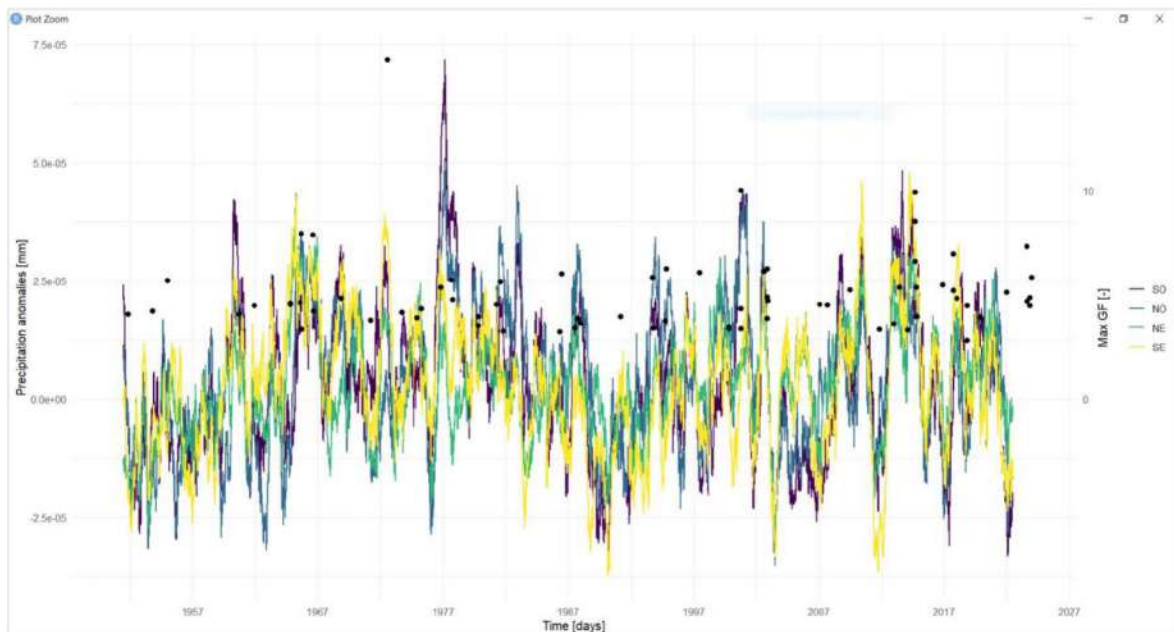
We can see that most the events are related to precipitation anomalies; in the NE the signature was no significant.

GAR Subreg	Tot events	ZO	ScBL	ATr	EuBL	ScTr	GrBL	AR	NoReg	Transit
NO	23	0%	30.4%	26.1%	4.3%	17.4%	8.7%	0%	13%	0%
SO	38	2.6%	34.2%	5.3%	2.6%	23.7%	13.2%	2.6%	15.8%	0%
NE	32	6.2%	18.8%	12.5%	15.6%	18.8%	9.4%	12.5%	0%	6.2%
SE	20	0%	20%	5%	10%	35%	15%	5%	5%	5%
WRs Freq	15.1%	14.0%	12.2%	13.4%	12.7%	12.4%	10.8%	7.9%	1.4%	

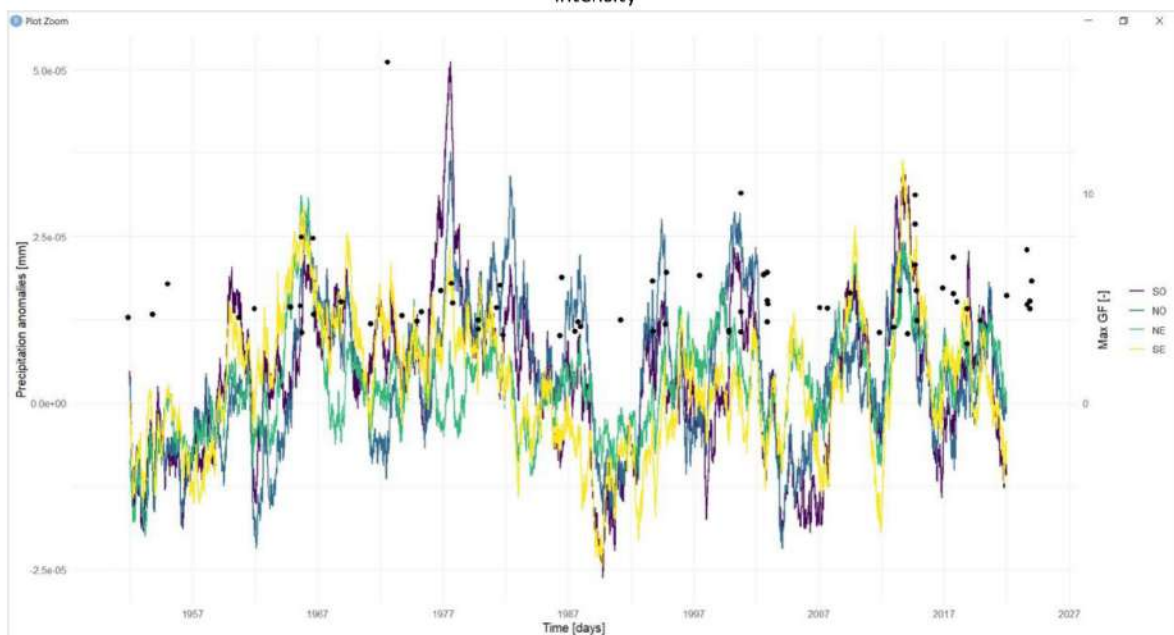


Also in autumn we can see that the majority of the extreme events are related to the extreme precipitation.

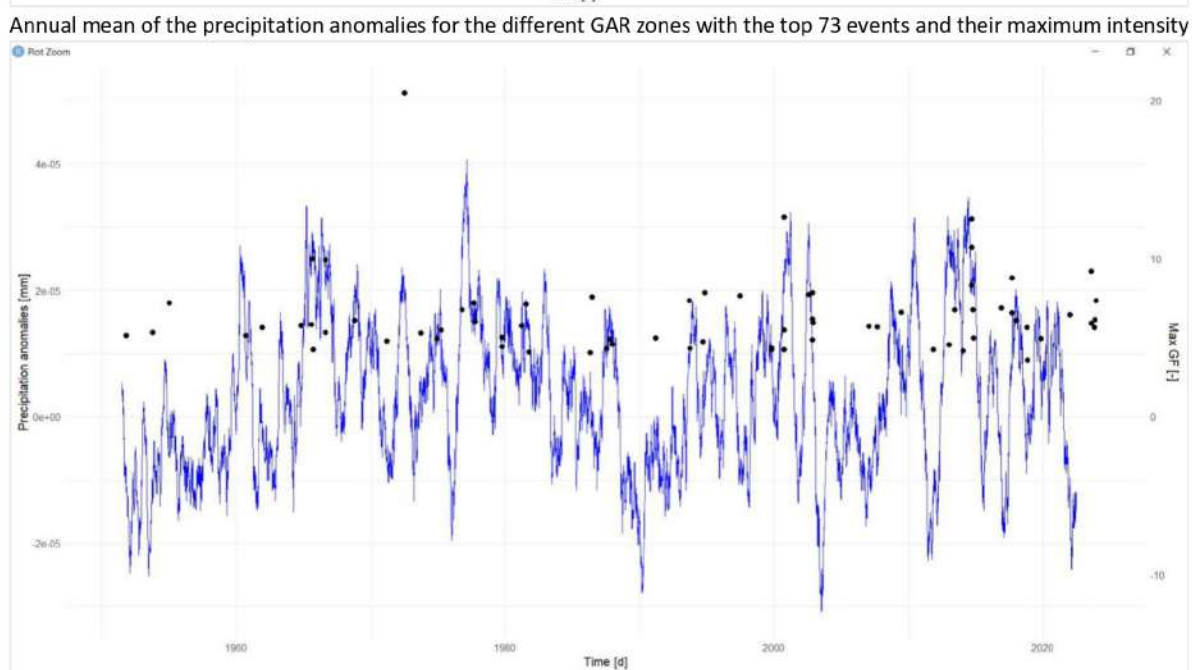
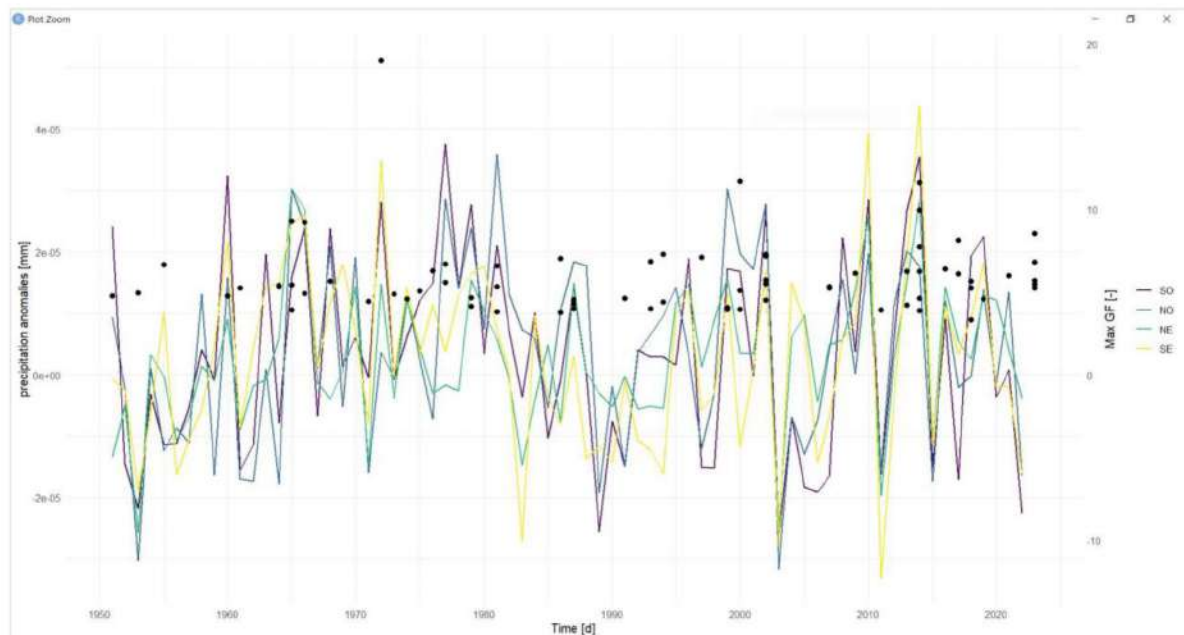
- Draft second main plot of the paper



Moving window of 1 year of the precipitation anomalies for the different GAR zones with the top 73 events and their maximum intensity

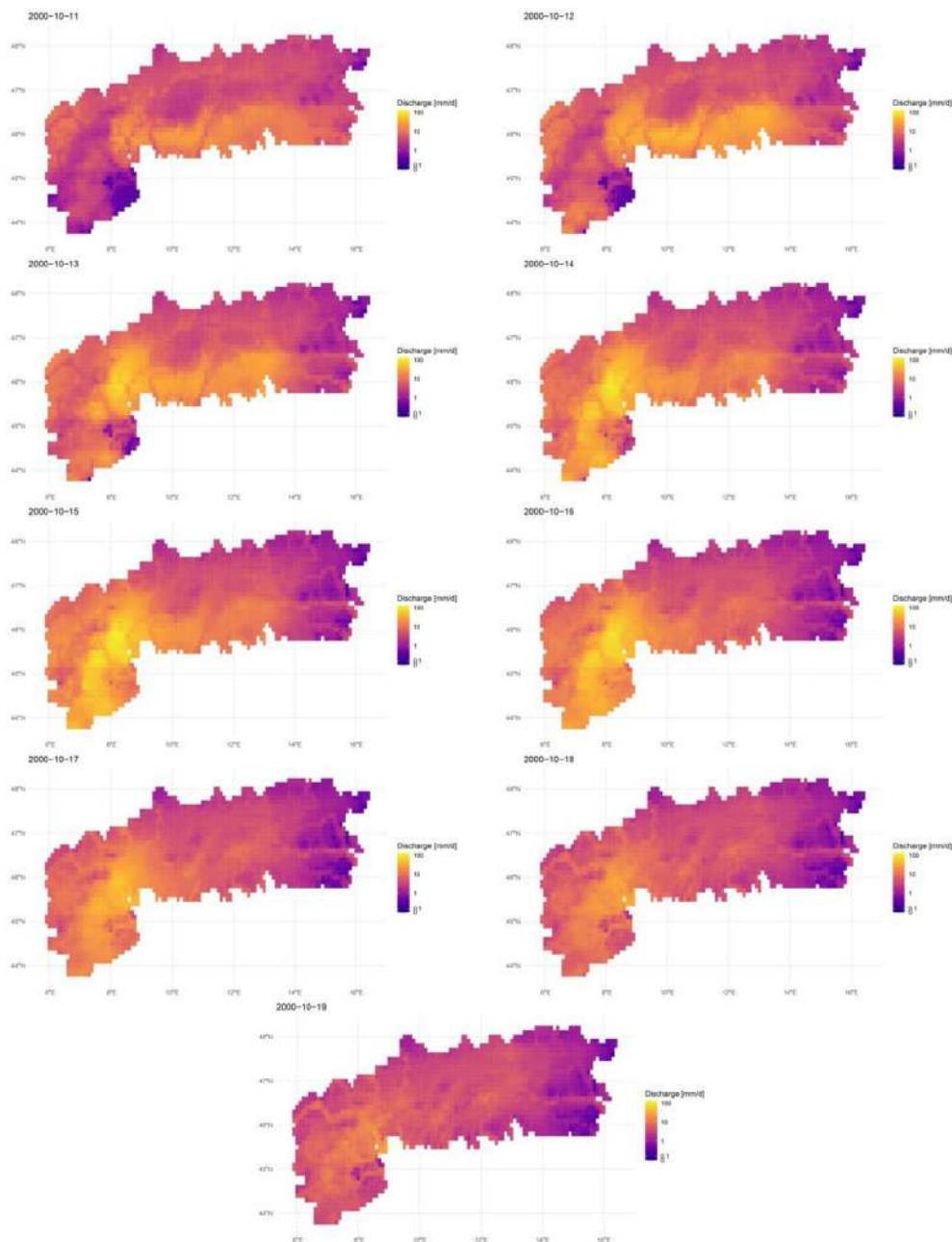


Moving window of 2 years of the precipitation anomalies for the different GAR zones with the top 73 events and their maximum intensity



- Gridded discharge

To facilitate the joint analysis of discharge and precipitation, a gridded model output has been created. This can have different resolutions and can also be applied to model outputs from different climatological input data.



Example of gridded output for one of the 73 major events

Anna Basso, Ilaria Tessari, Vikas Kumar and Luca Lombardo