

1. Background

- **Stable oxygen isotope** concentration $\delta^{18}\text{O}$ gives valuable **information on climate variations** from seasonal to multidecadal and longer time scales.
- $\delta^{18}\text{O}$ **variability** depends on:
 - Local parameters (**temperature, precipitation, etc.**)
 - **Atmospheric** and oceanic **circulation patterns**

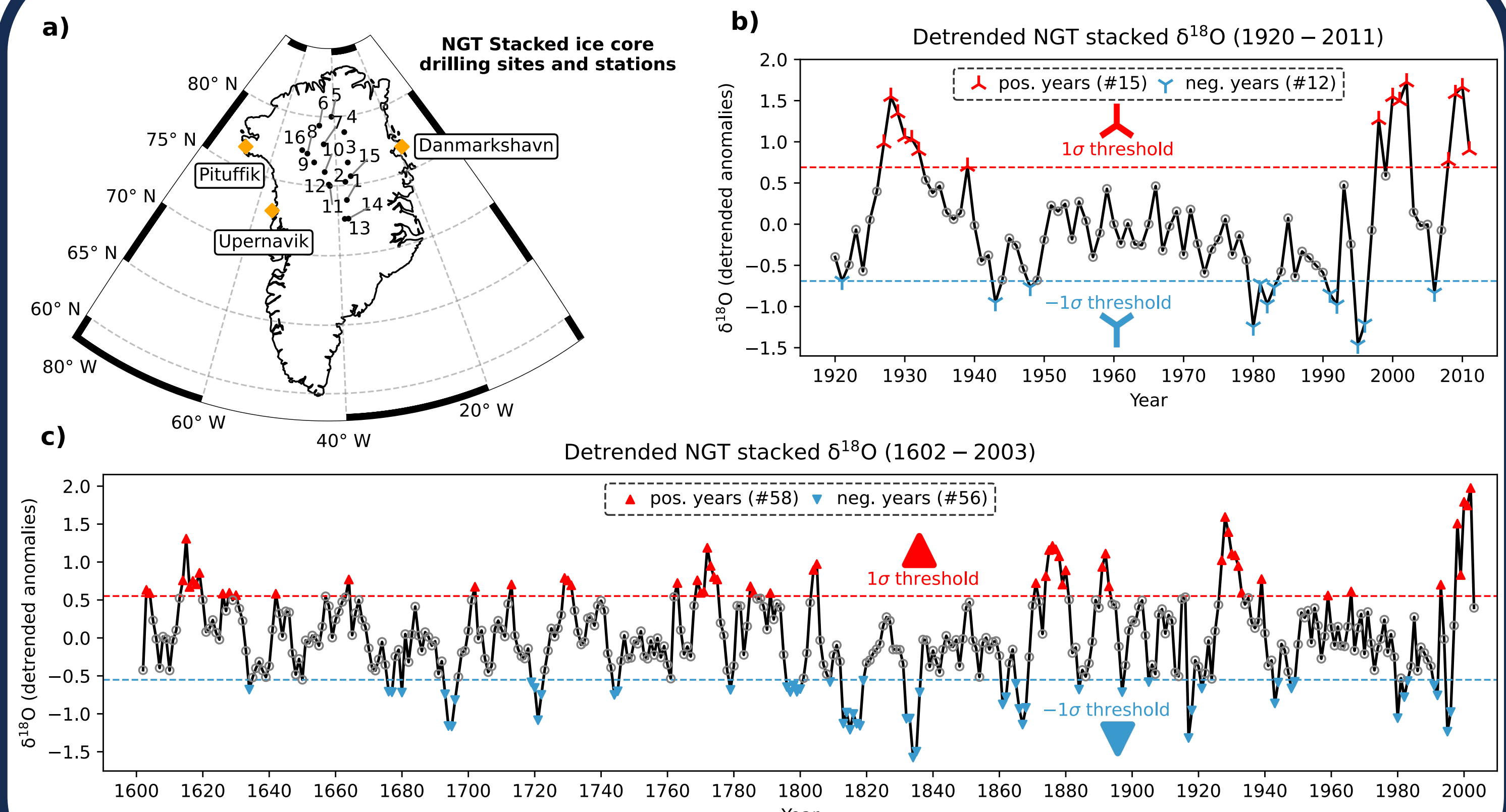
3. Data

- Northern Greenland Transect (NGT) stacked ice core (Hörhold, 2023):
 - Time resolution and range: Annual, 1602 – 2011
- 20th Century Reanalysis v3 (Slivinski, 2019):
 - Time resolution/range: Daily (winter season: DJF), 1920 – 2011
 - Spatial resolution: $1.0^\circ \times 1.0^\circ$
- E-OBS (Cornes, 2018):
 - Time resolution/range: Daily (winter season: DJF), 1920 – 2011
 - Spatial resolution: $0.25^\circ \times 0.25^\circ$
- Ensemble Kalman Filter v2 Paleo Reanalysis (Valler, 2022):
 - Time resolution/range: Monthly (winter season: DJF), 1602 – 2003
 - Spatial resolution: $1.875^\circ \times 1.86^\circ$

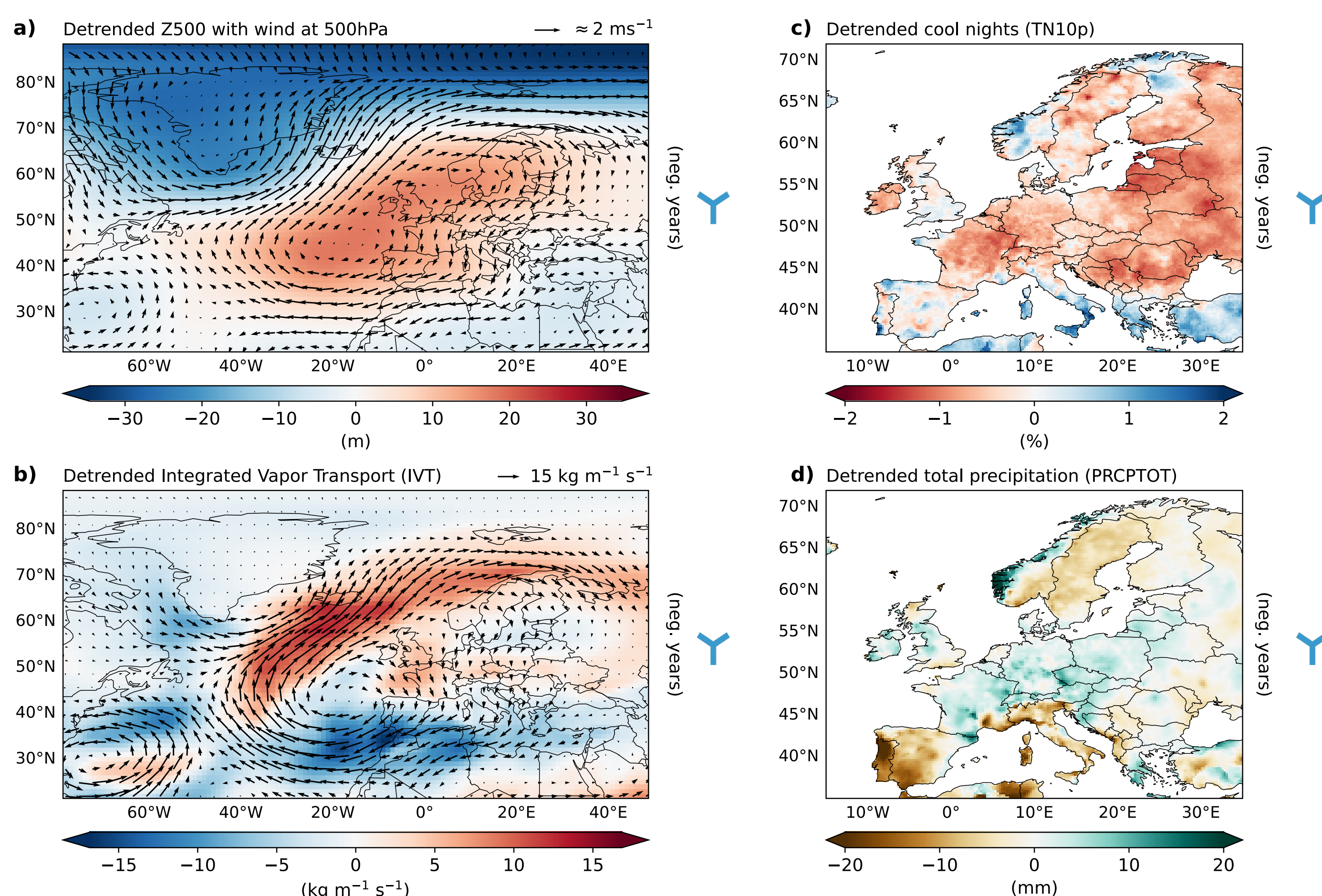
2. Research Question

- Is **variability** of $\delta^{18}\text{O}$ in Greenland ice cores be a **proxy** for the occurrence of **extreme hydroclimatic events over Europe**?

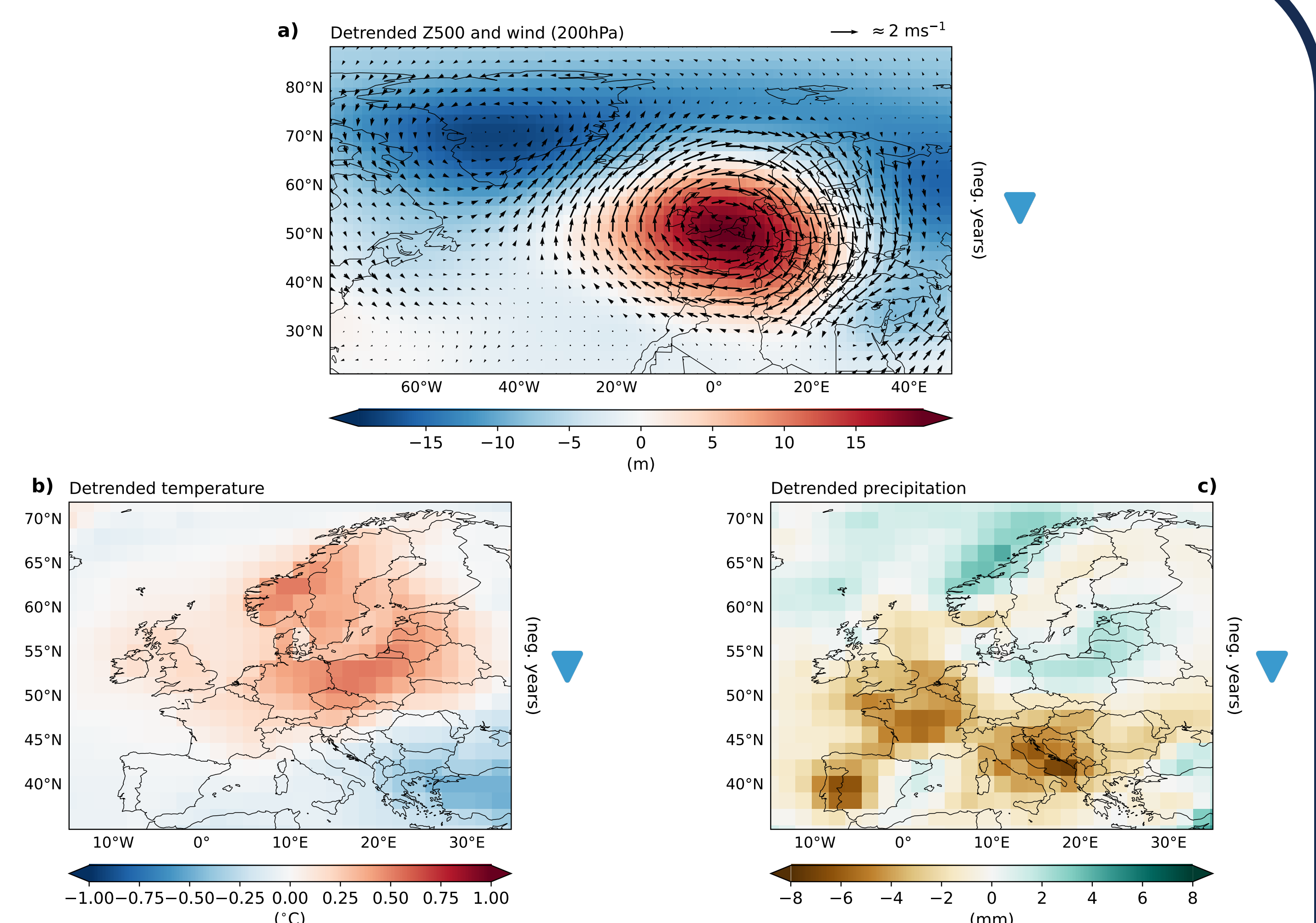
4. NGT Stacked Ice Core



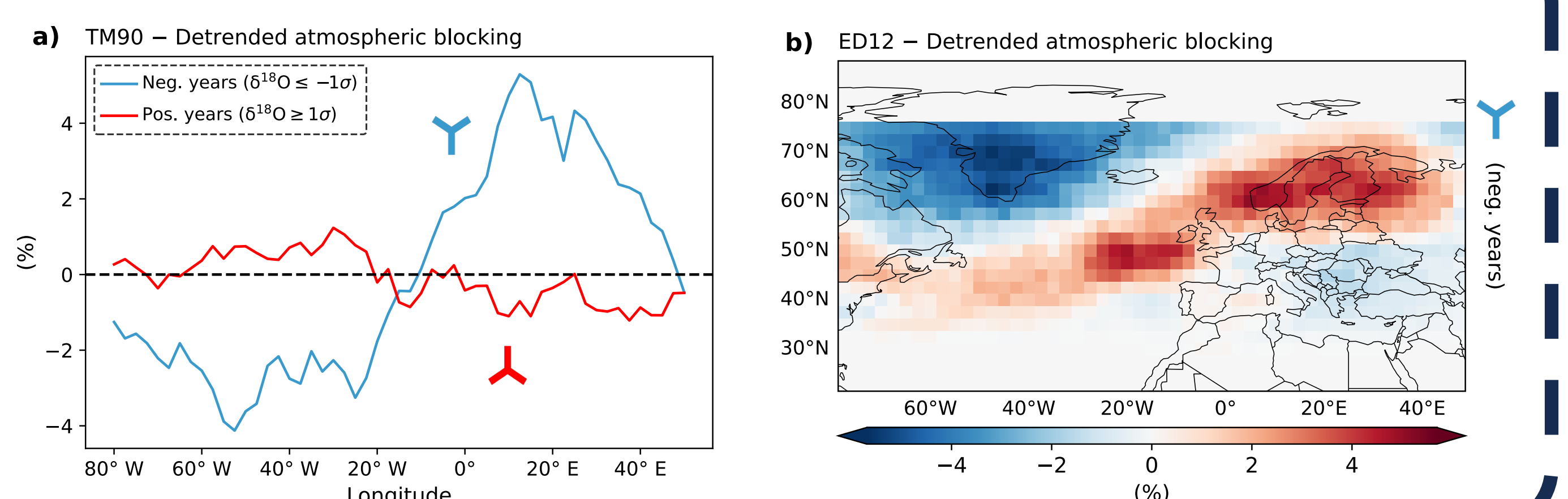
5. Observational Period (1920 – 2011)



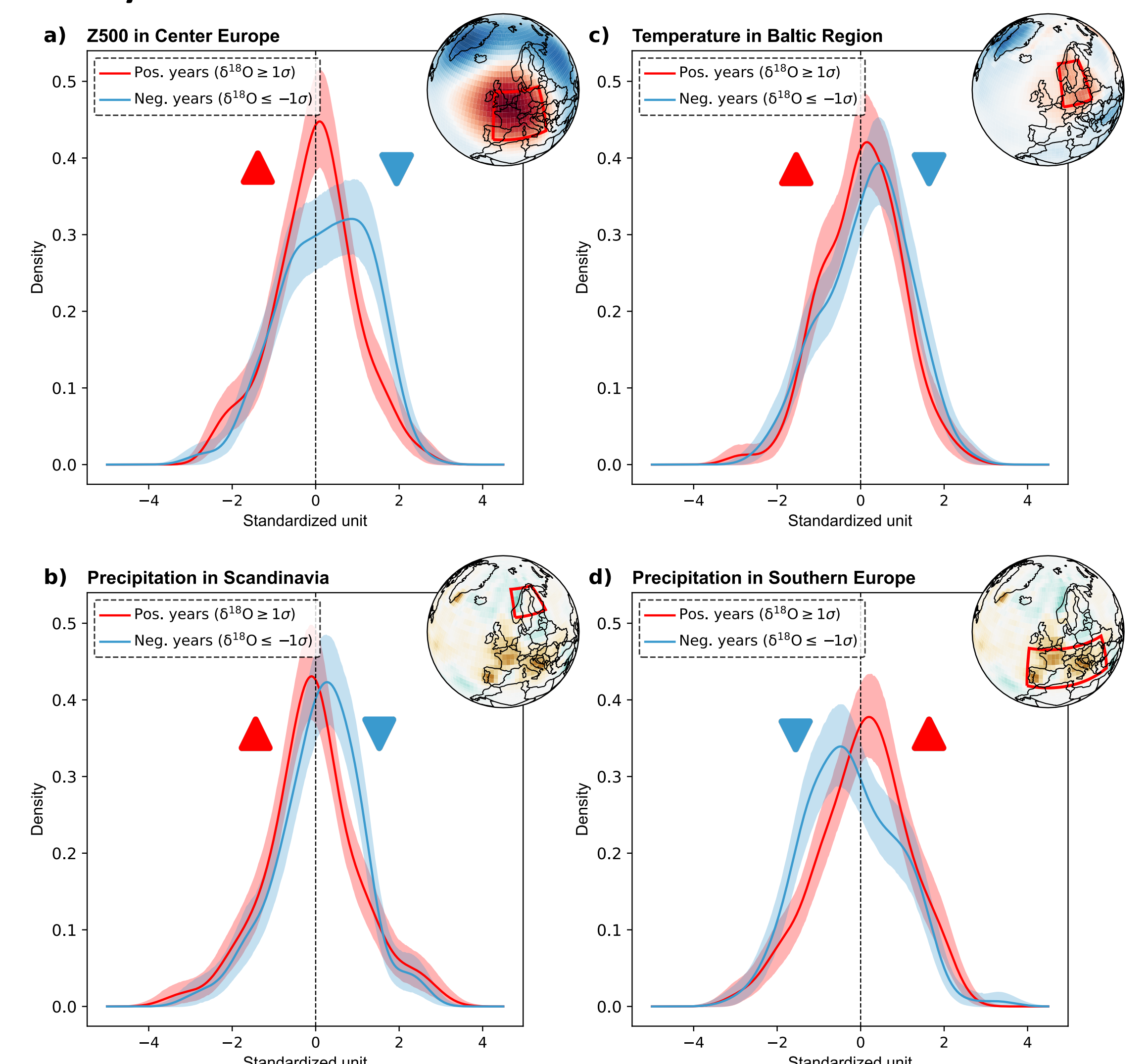
6. Long-term Perspective (1602 – 2003)



5a. Atmospheric Blocking



6a. Hydroclimatic Indexes



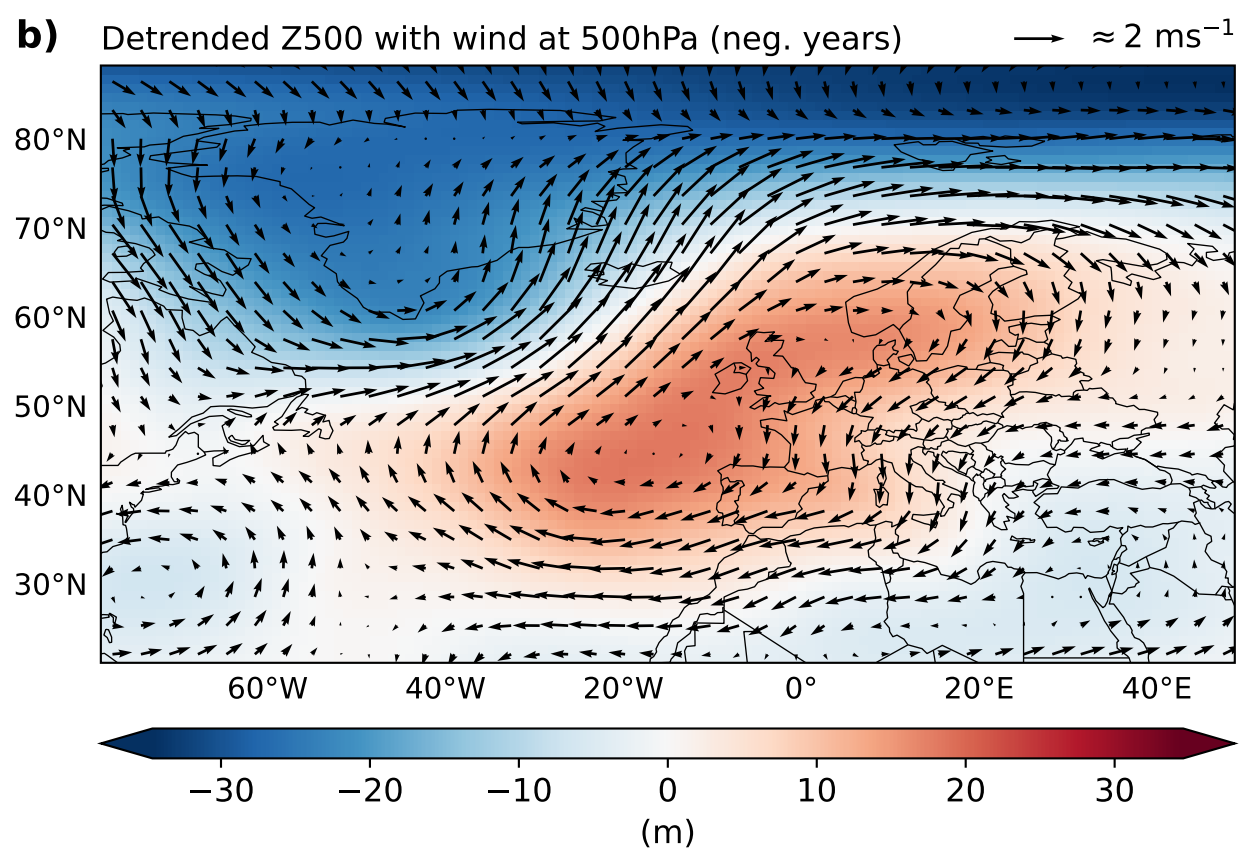
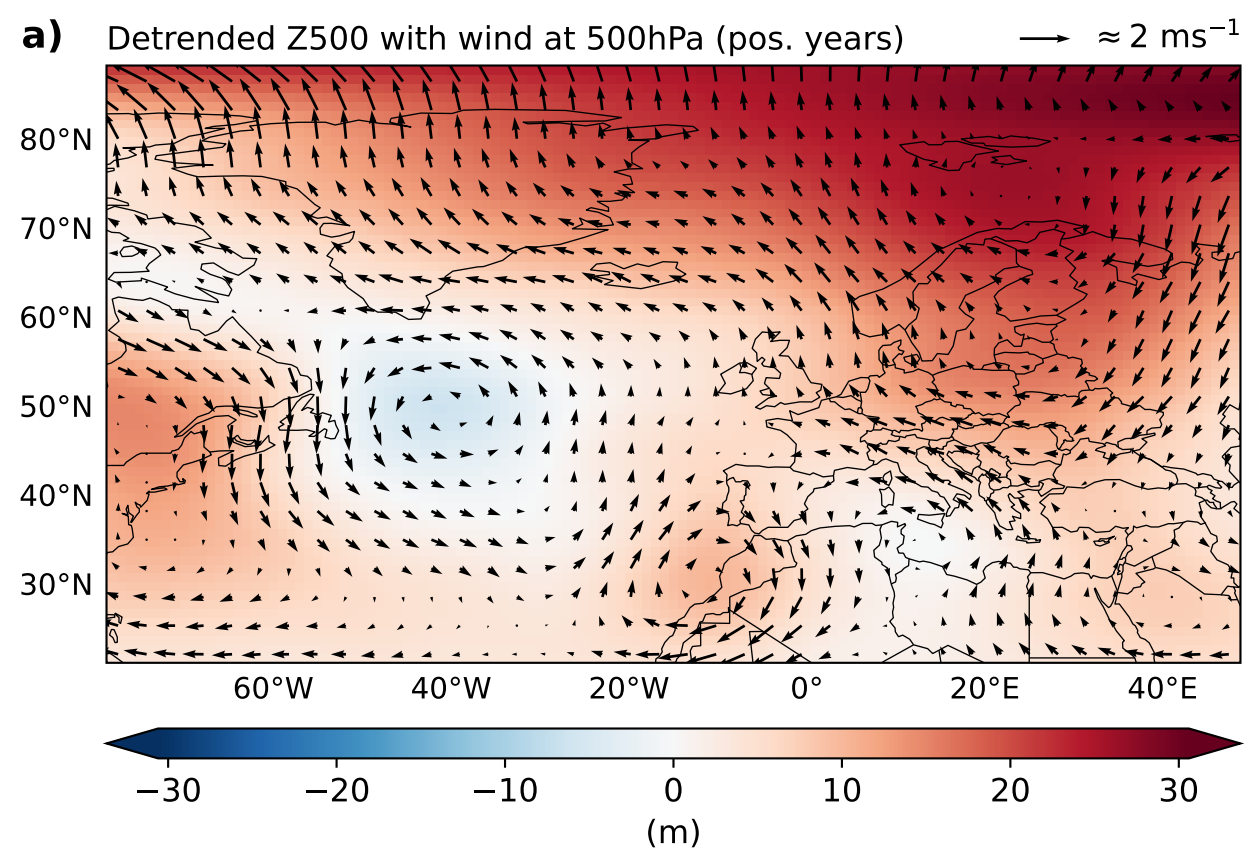
7. Key Findings

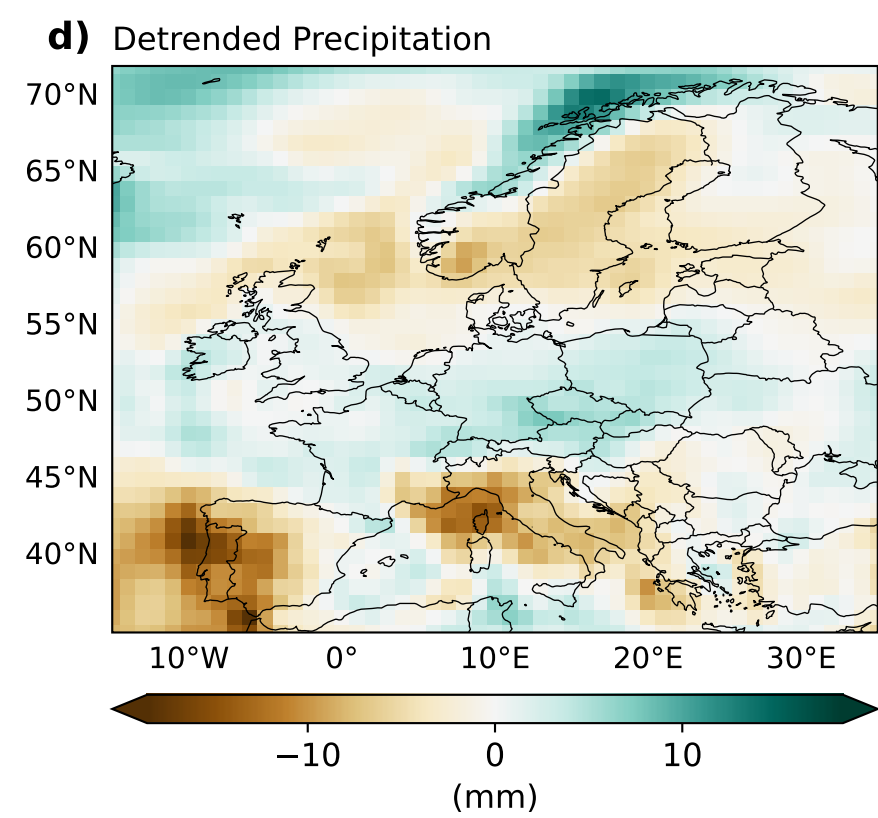
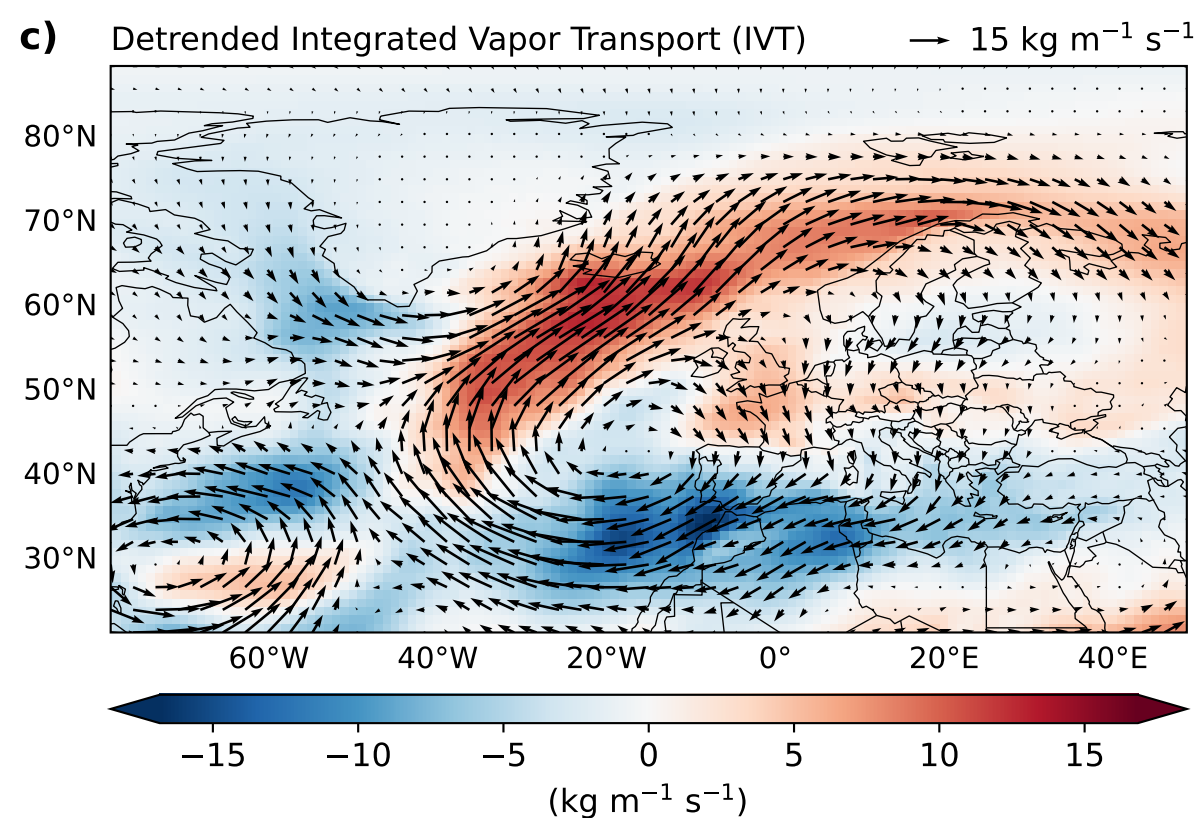
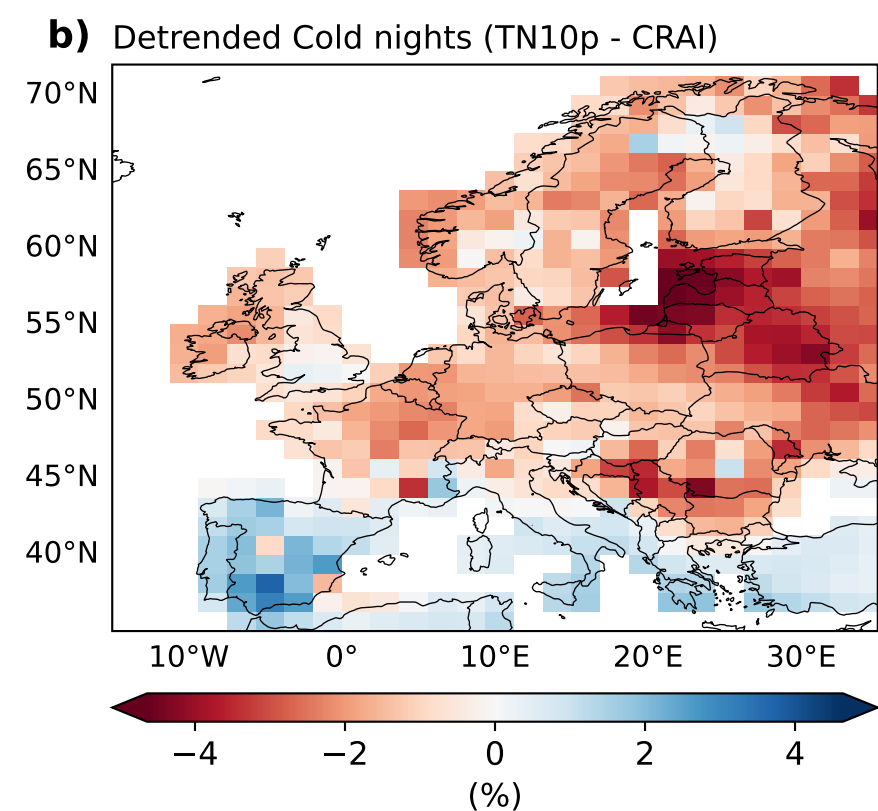
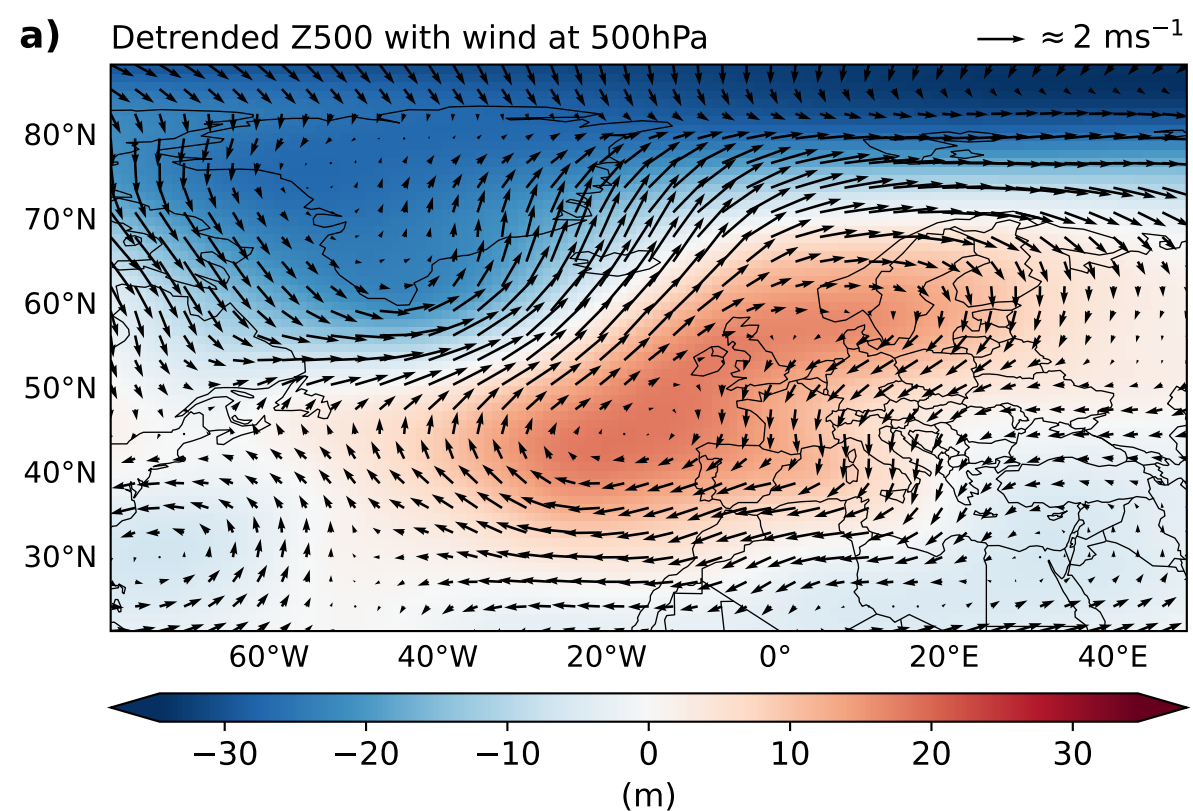
- **Variability of $\delta^{18}\text{O}$** in NGT stacked ice core is a good proxy of occurrence of extreme hydroclimatic events over **Europe**;
- **Atmospheric blocking: wetter** conditions in Norway and **drier** conditions over **Southern Europe**
- **Asymmetrical atmospheric circulation** in years of higher and lower values of $\delta^{18}\text{O}$;

8. References

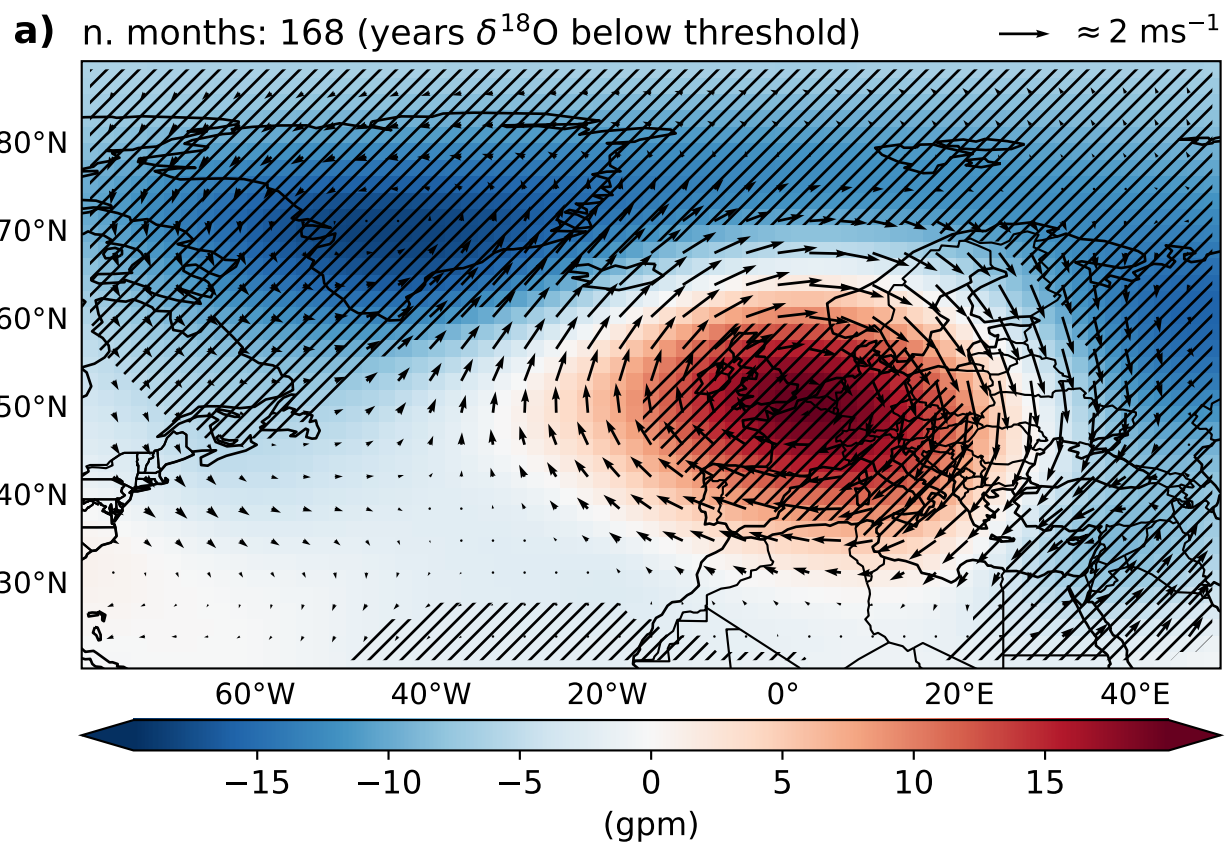
- Gagliardi A. *et al.*, in preparation.
- Cornes *et al.* (2018), 123, 9391–9409, *J. Geophys. Res. Atmos.*
- Hörhold *et al.* (2023), 613, 503–507, *Nature*.
- Slivinski *et al.* (2019), 145, 2876–2908, *Q.J.R. Meteorol. Soc.*
- Valler *et al.* (2022), 9, 89–107, *Geosci. Data J.*



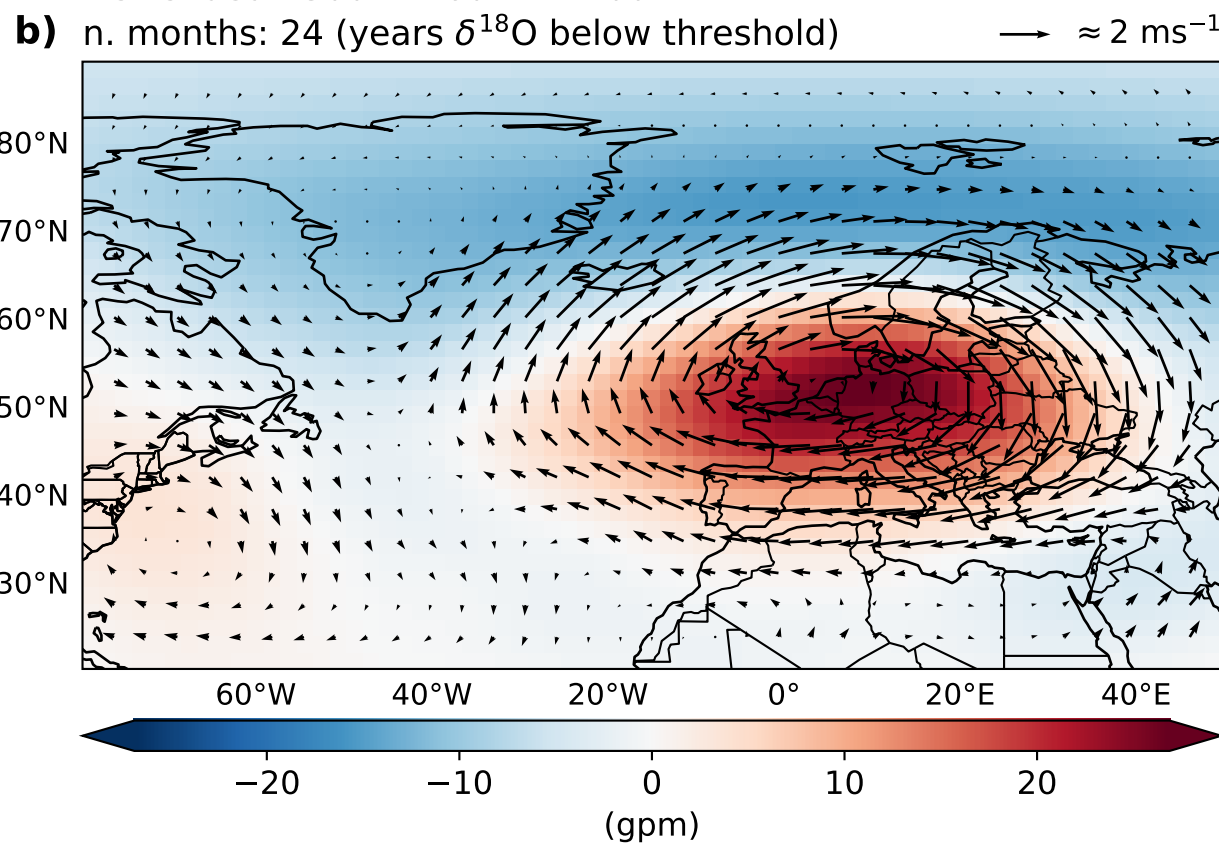




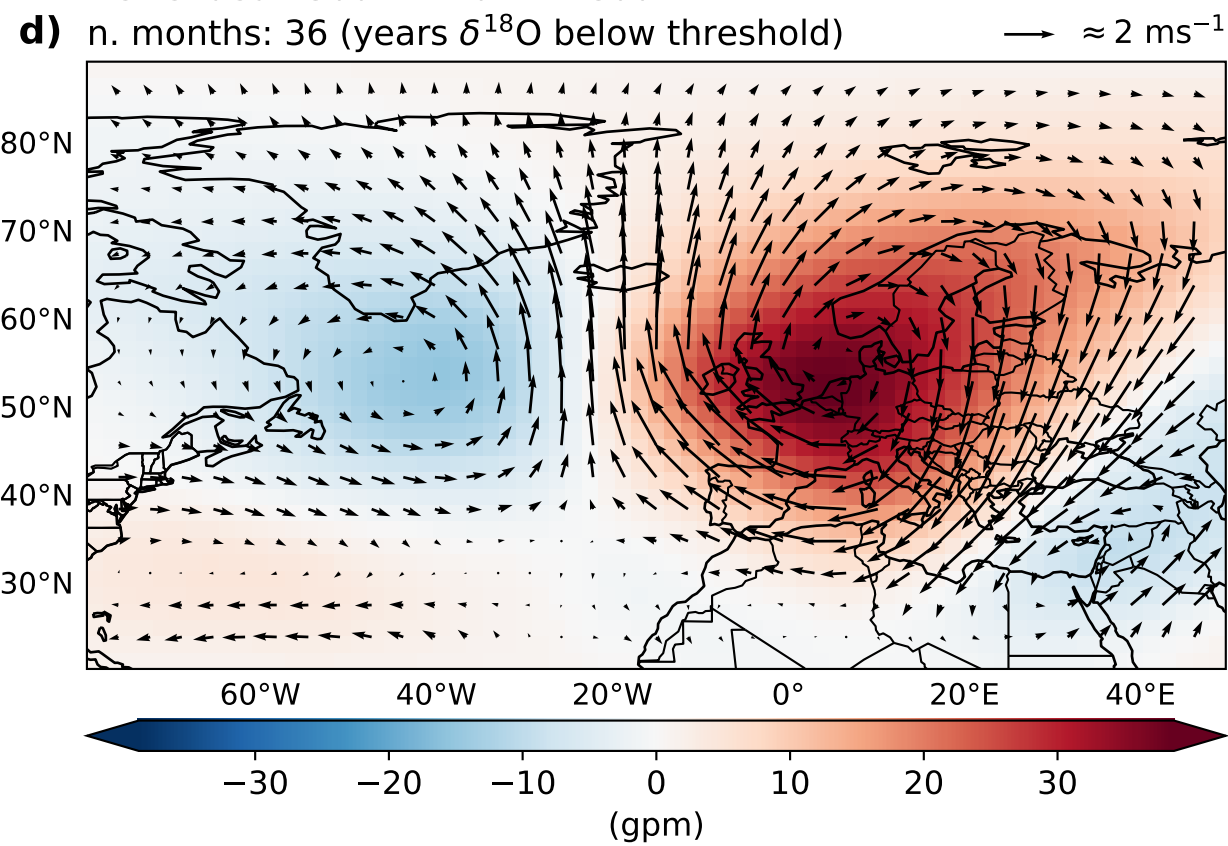
Detrended Z500 in 1601 – 2003



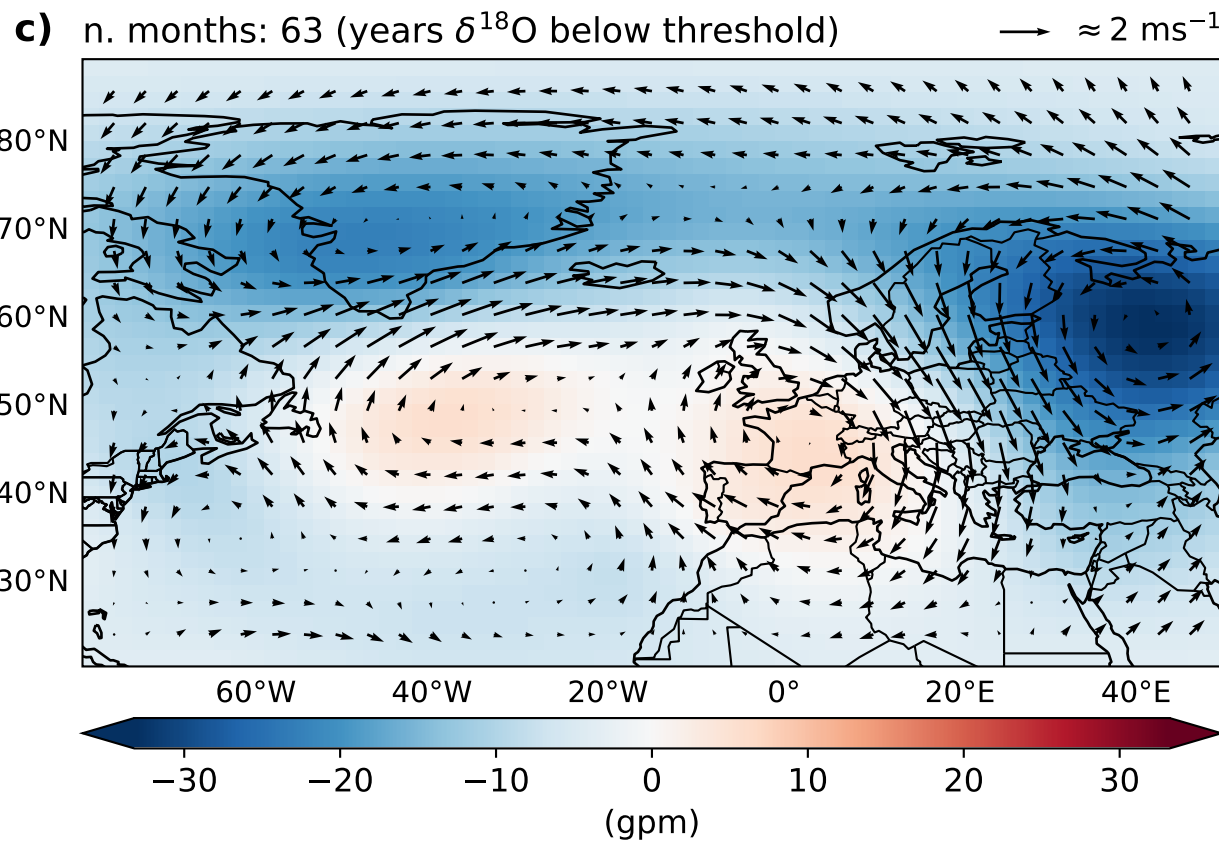
Detrended Z500 in 1601 – 1700



Detrended Z500 in 1701 – 1800



Detrended Z500 in 1801 – 1900



Detrended Z500 in 1901 – 2003

