WEBINAIRE TRACCS

TRANSFORMER LA MODÉLISATION DU CLIMAT POUR LES SERVICES CLIMATIQUES

"LES CHANGEMENTS DES SITUATIONS MÉTÉOROLOGIQUES RENFORCENT LES IMPACTS DES VAGUES DE CHALEURS ET TEMPÊTES EN FRANCE ET EN EUROPE"

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RÉPUBLIQUE FRANÇAISE
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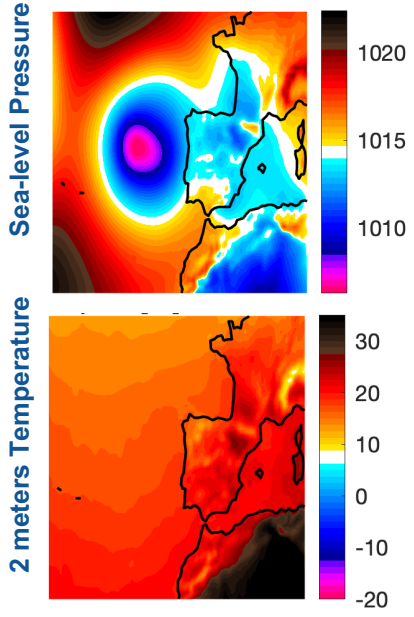
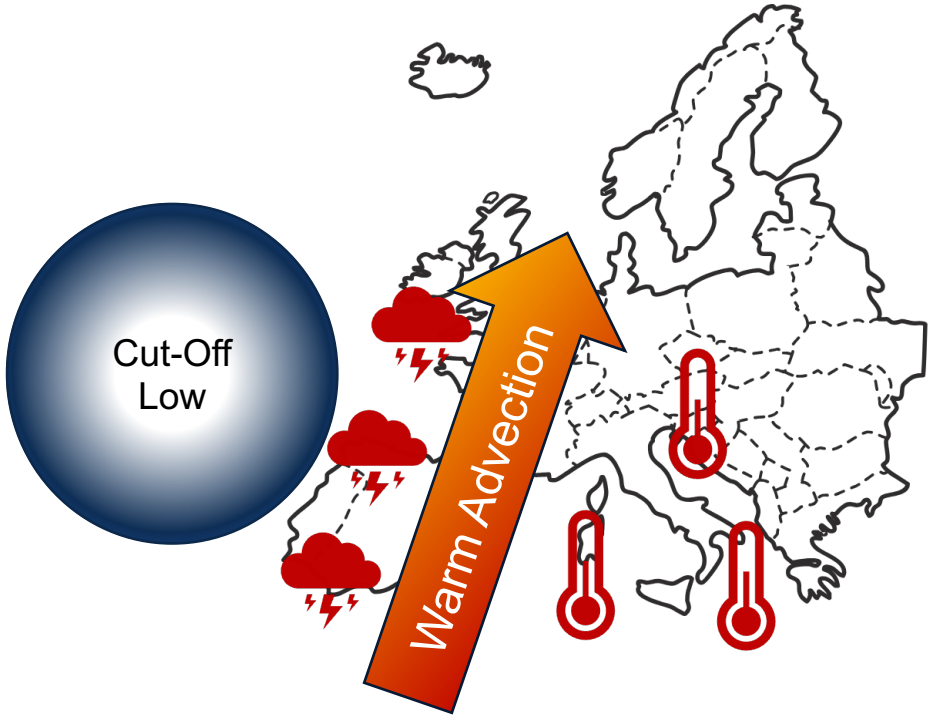
MOTIVATION
Impactful extreme events are largely driven by atmospheric dynamics

03 June 2022 Heatwave over France… A recurrent situation in recent years => Role of climate change?



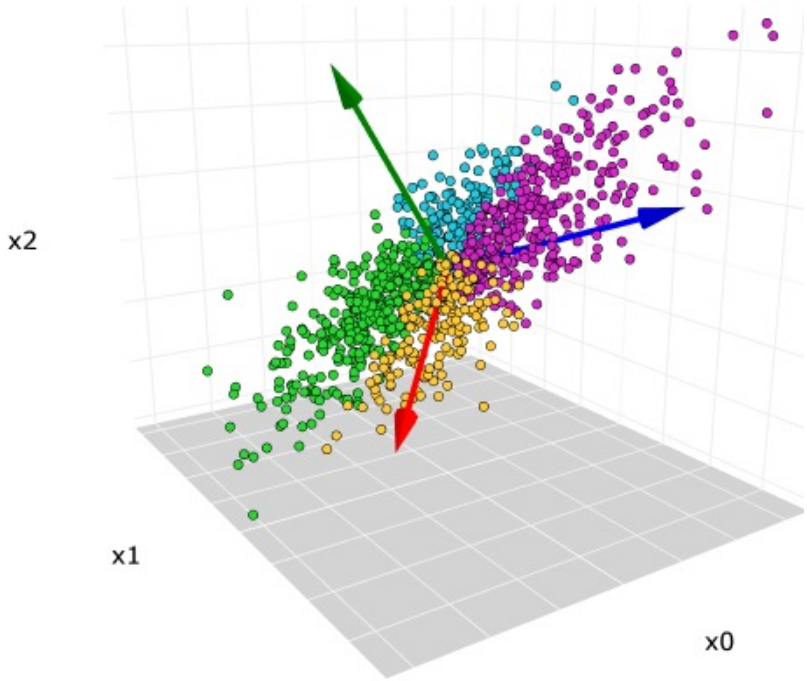


BOTTLENECK
Detecting robust changes in atmospheric circulation is difficult

1. **Previous studies are not conclusive on whether anthropogenic affects atmospheric dynamics** changing structure, frequency and persistence of patterns.

2. The diversity in the results comes from the **variety of indicators of atmospheric dynamics:** indices or projections that could hide robust changes.

3. Here we **employ a technique based on the study of analogues** of weather patterns, preserving all information contained in the weather fields to **detect robust changes**.

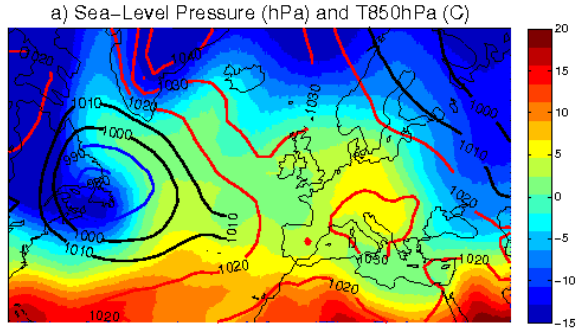


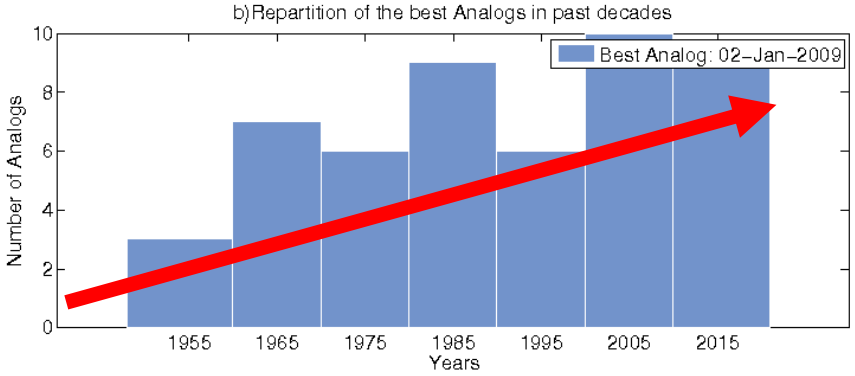
METHODS
Using analogs frequency changes to detect long-term dynamical changes

1.We select alternatively **all ERA5 Sea-level Pressure maps over the North Atlantic** from 1950-2021

2. For each map we compute the Euclidean distance between daily maps, and define **a high quantile to select the analogues**.

3. We count the **number of analogues per decade and we select those having an increasing trend and a decreasing trend**





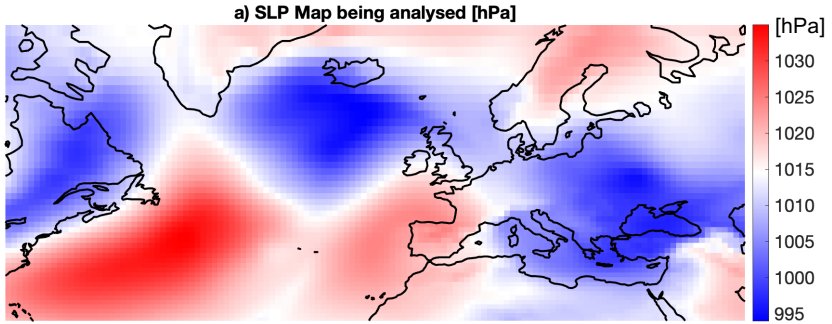
METHODS
Ensuring Robustness of Changes

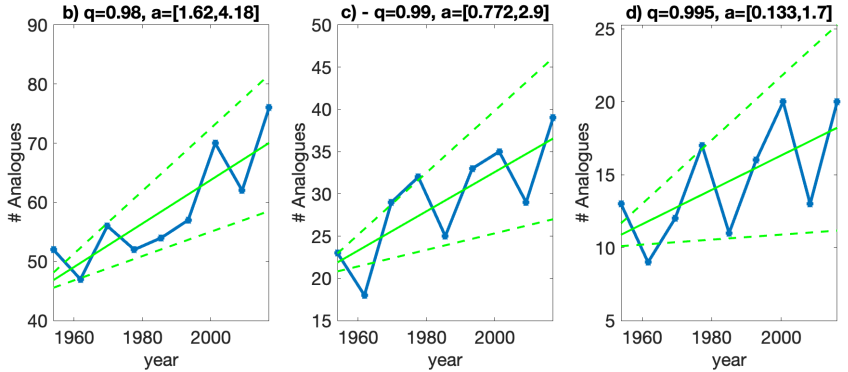
1. For each SLP map (a) **we take the best 2% (b), 1% (c) and 0.5% (d) analogues** in daily sea-level pressure maps from ERA5 starting in January 1950.

2. The **# Analogues counted in each decade** are then obtained (blue dots, panels b--d).

3. **A linear fit is performed (solid line) and the confidence intervals** for the slope are computed (dotted lines).

4. **Only if all confidence intervals have a positive slope, the map has increasing frequency**

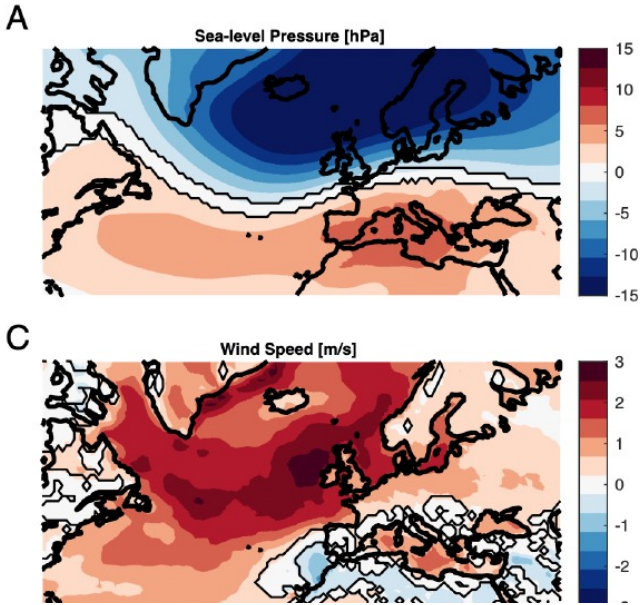




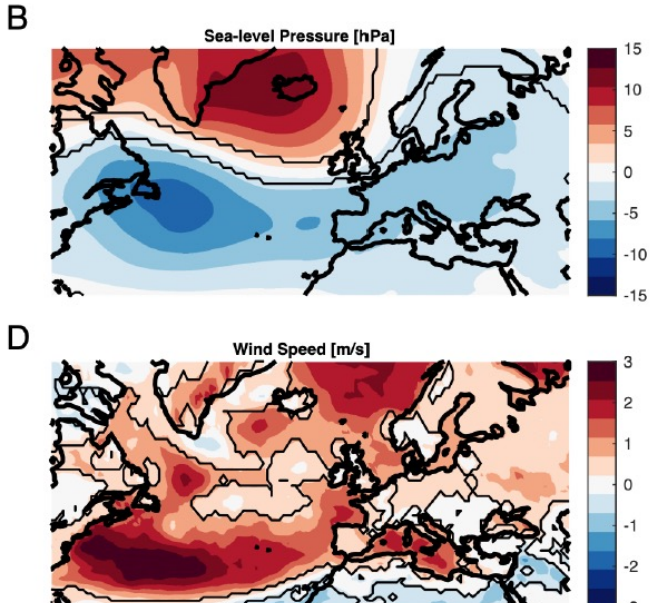
RESULTS: WINTER

The vast majority (92.7%) of circulation patterns show no significant occurrence trend in the historical period; 5.1% show increasing trends and 2.2% show decreasing trends

INCREASING TRENDS



DECREASING TRENDS



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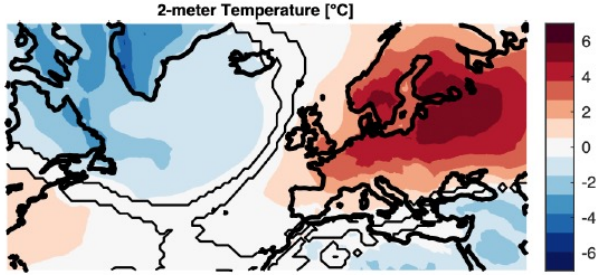
INCREASING TRENDS

E



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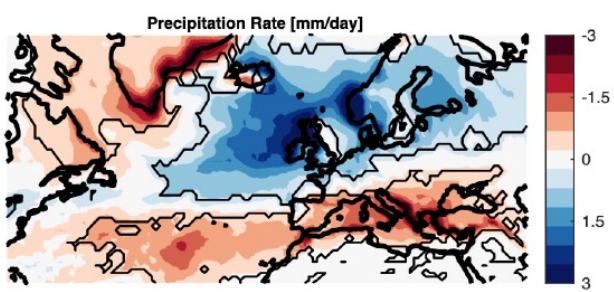
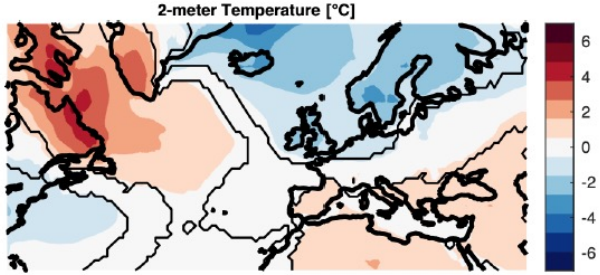


DECREASING TRENDS

F



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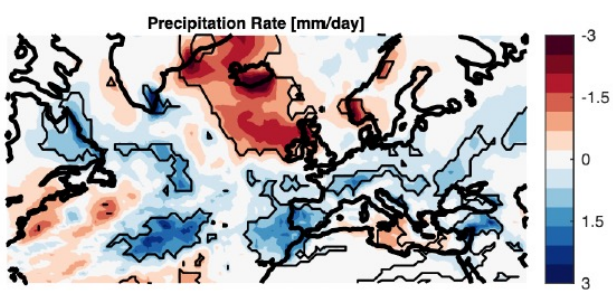
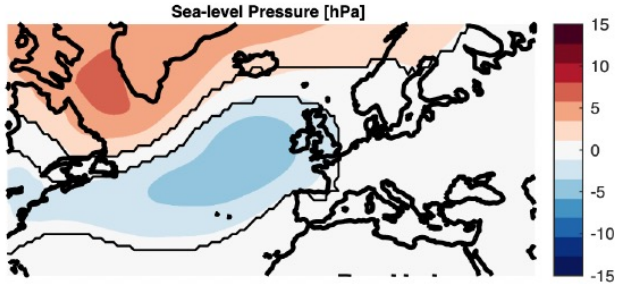


RESULTS: SUMMER

The vast majority (92.7%) of circulation patterns show no significant occurrence trend in the historical period; 5.1% show increasing trends and 2.2% show decreasing trends

INCREASING TRENDS

A



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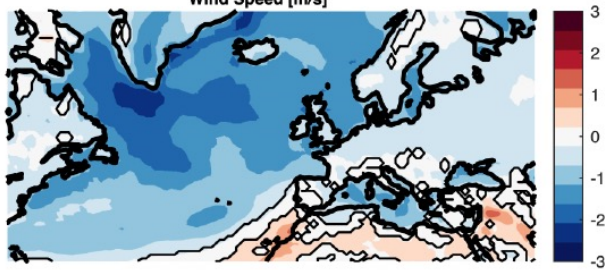
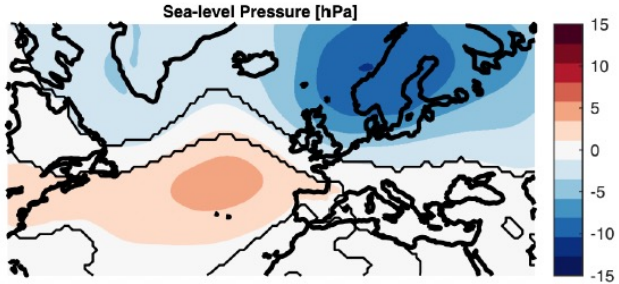


DECREASING TRENDS

B



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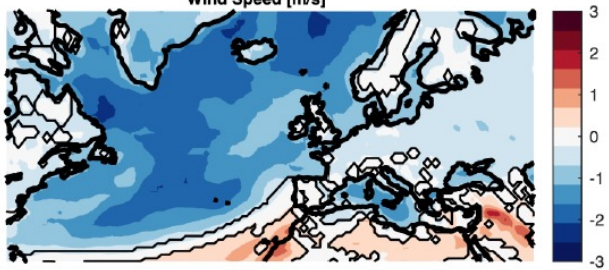

RESULTS: SUMMER

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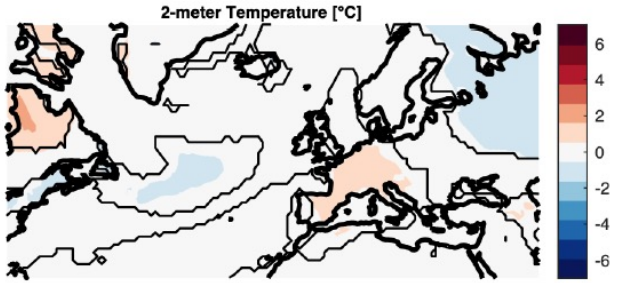
INCREASING TRENDS

E



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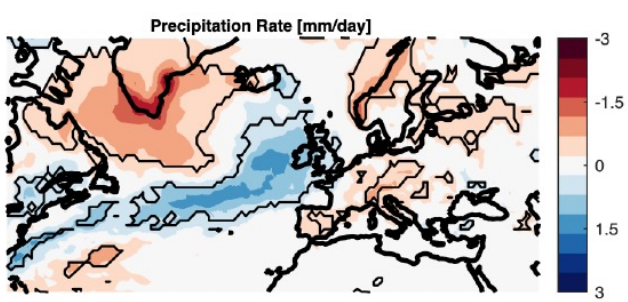
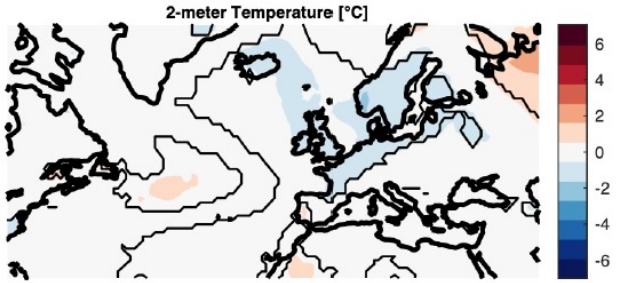


DECREASING TRENDS

F



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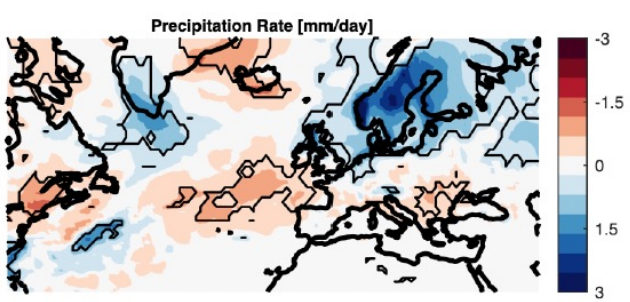
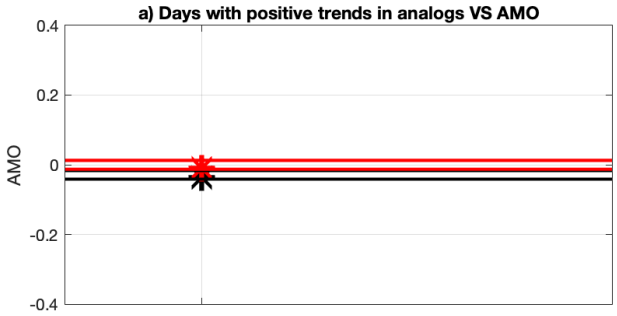
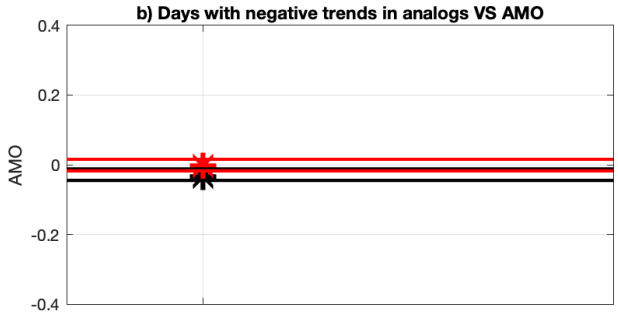
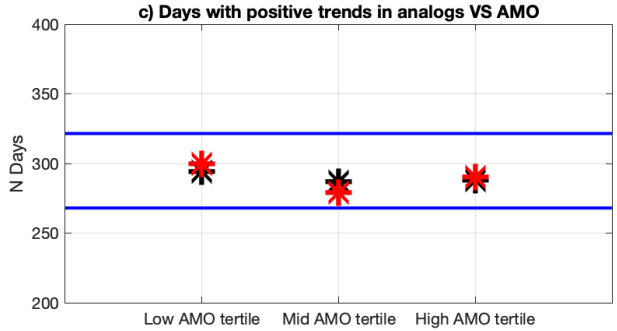


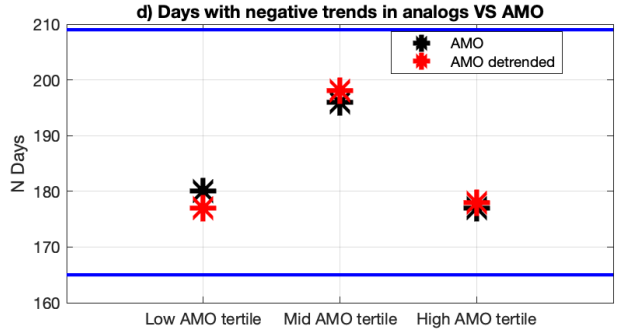
RESULTS:
Role of Interannual Variability

We find a non-significant influence of AMO in the trends



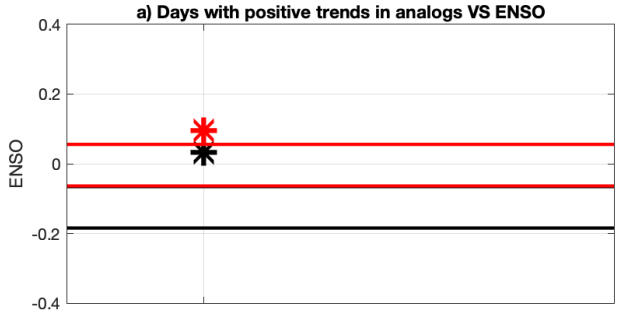


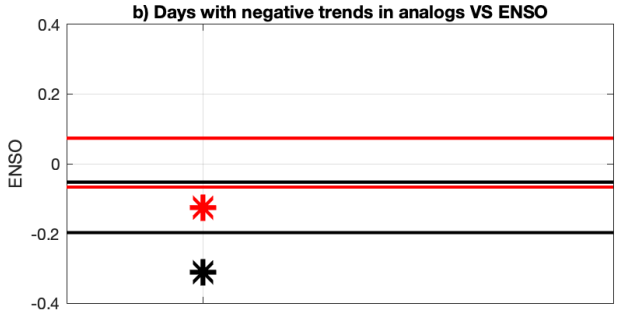


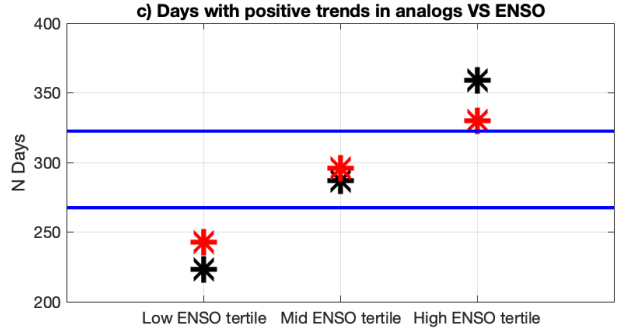


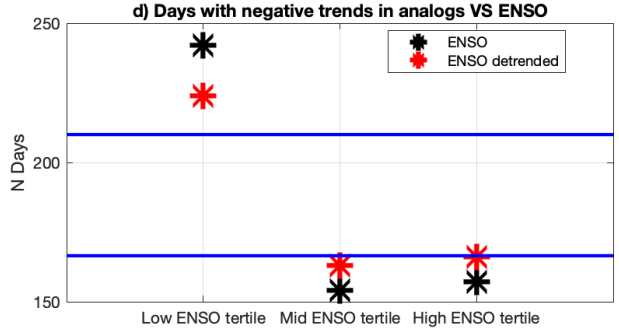
RESULTS:
Role of Interannual Variability

We find a moderate role of ENSO, but it is not sufficient to explain all the trends observed

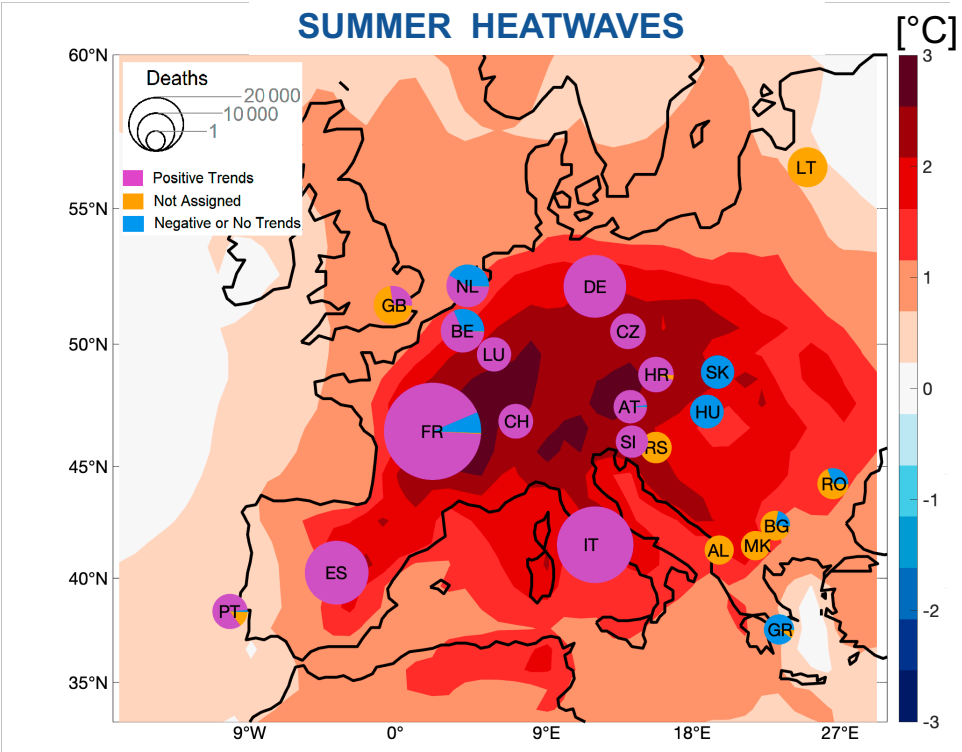


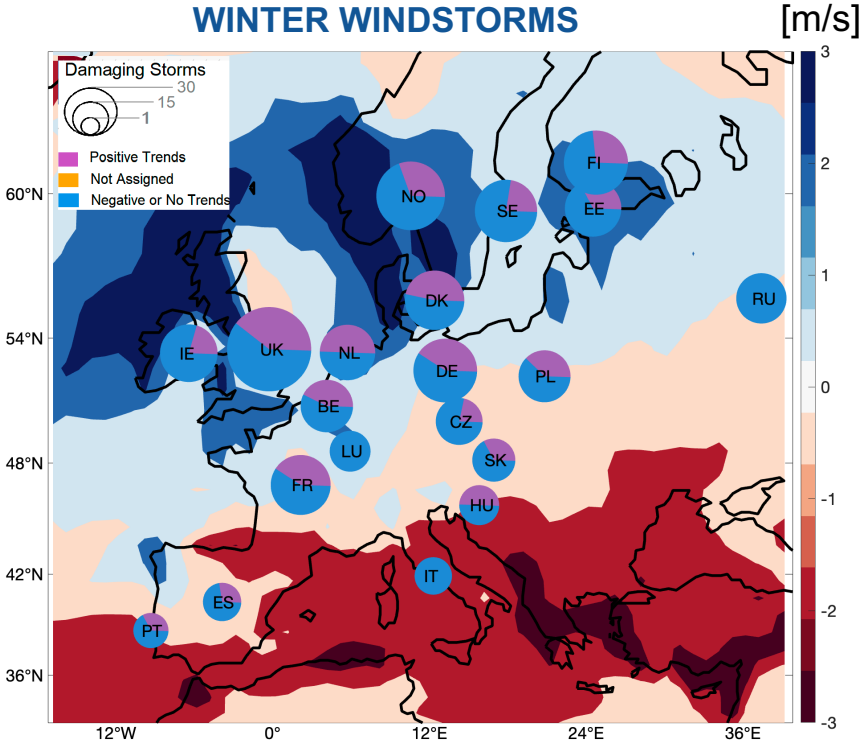






RESULTS:
Linking frequency changes to impactful extreme events





SUMMARY

We find that large scale atmospheric patterns which favor summertime heatwaves and wintertime windstorms over large parts of the continent are becoming increasingly frequent

We have also shown that ENSO and AMO play a minor role in these changes. These trends can be therefore linked to anthropogenic climate change.

A key implication of our work is that anthropogenically-induced circulation changes modulate extreme events already in the present climate.

JOUEZ À

CLIMA RISQ

COMPRENDRE LA COMPLEXITÉ DU SYSTÈME CLIMATIQUE ET L'URGENCE D'UNE ACTION COLLECTIVE

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