Characterization of compound occurrence of heat waves and drought in Europe

Natalia Castillo [1], Marco Gaetani [1] and Mario Martina [1]

[1] IUSS Pavia, Italy

Why characterizing compound extremes events?

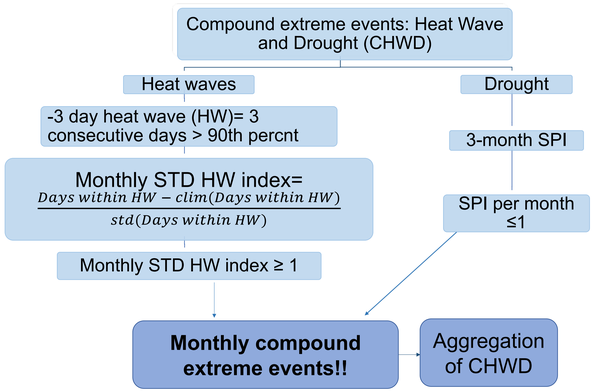
1) Background: Extreme events as HWs and droughts have strong impact in human activities, such as agriculture, and health especially when co occurr together (Compound Heat Wave and Drought-CHWD)

2) Motivation: Some compound extremes as CHWDs are not well understood yet or charaterised in a common framework neither their impacts in a present and future climate (Zscheischler et al., 2020)

3) Objective: Identify CHWDs in the present climate and identify atmospheric patterns associated with some extreme events

Data and Methods

Data: ERA5 reanalysis for JJA in the period 1959-2021



Overall findings

-Association with high wave number circulation

-Possible America-Europe-Asia connection

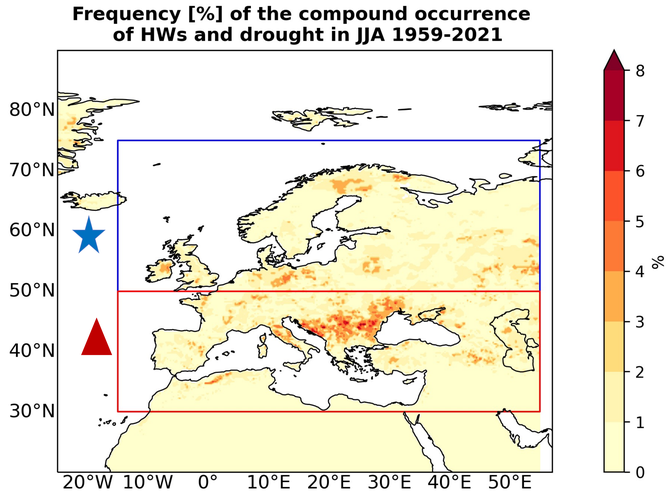
Northern Europe: the associated atmospheric circulation is characterised by a wave-6 pattern, jet displaced northwards. Negative q100 in central Asia and western North America and positive in the rest of domain

Mediterranean: The associated atmospheric circulation is characterised by a wave-4/5 pattern, the jet is displaced southwards.

Negative q1000 in Iberian peninsula, western North America and north of Mexico and positive in the rest of Mediterranean.

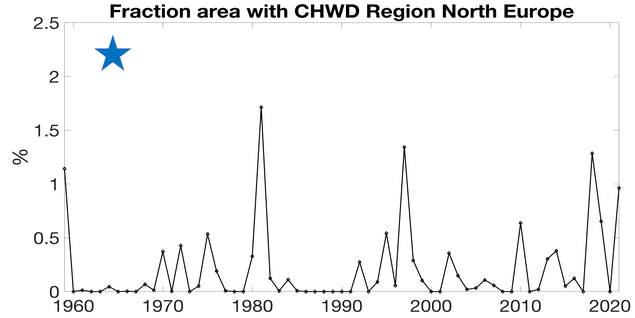
Preliminary Results

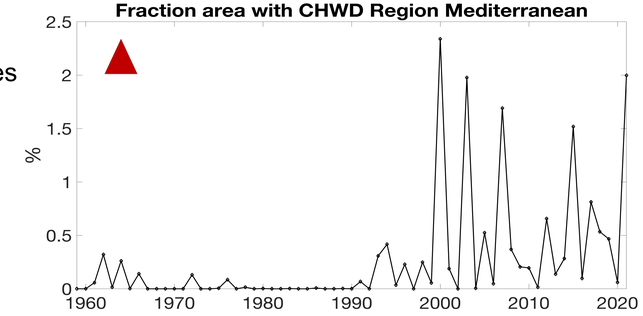
Some regions have experienced more than 7% frequency of CHWD in 63 years



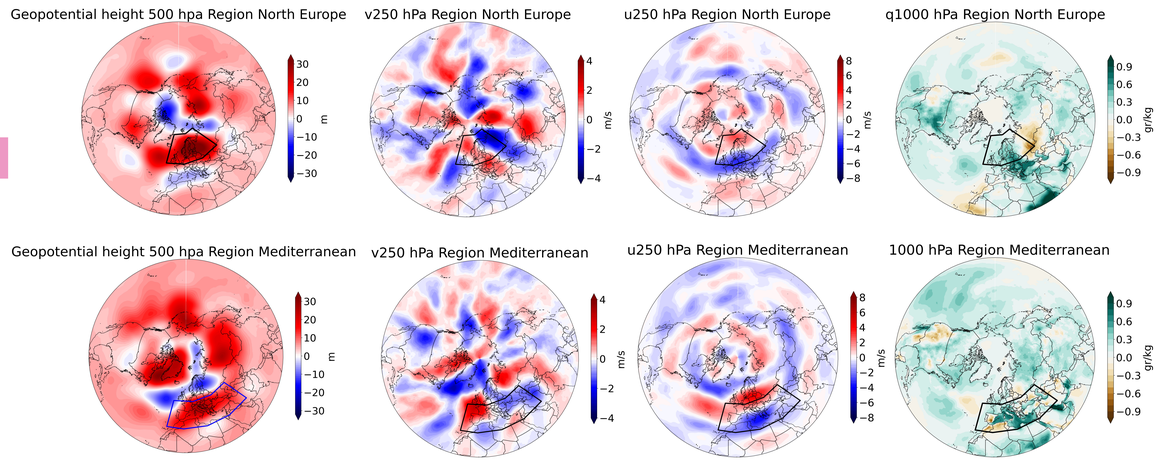
NE: Fraction of area varies more

Med: fraction area affected by CEE increased in last decades





Characterization of the atmospheric patterns associated with the CHWDs occurrence in Northern Europe and Mediterranean based on the composite difference of the years with fraction area above and below 75th percentile.



Some questions:

1) Europe-America connection,
2) possible role of the Arctic Oscillation (AO)
3) Climate attribution,
4) Reproducibility in models,
5) Future projections

Next steps

Other prec data sets and several climate model simulations with different scenarios and experiments

Machine learning (ML) techniques to characterize large circulation patterns related to CHWD and identify affected regions, to support impact assessment and reduction.

Contact: blanca.castillo@iusspavia.it