



From Greenland to the Mediterranean Sea: Unveiling a new cascade mechanism under anthropogenic warming?

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On 17 August 2022, the western Mediterranean experienced an unusual thermodynamic environment with extremely high unstable atmospheric conditions, combined with strong wind shear. These conditions, occurring ahead of an eastward-moving weather disturbance called a shortwave trough, led to the formation of a bow-shaped system of thunderstorms. This system produced a long path of severe winds, stretching from the Balearic Islands to southern Czech Republic on 18 August. The strongest wind gust reached 62.2 m s^{-1} at Corsica, where numerous records were beaten. Unfortunately, 12 people lost their lives, and 106 were injured during this event. Such a system was classified as a derecho, a type of long-lasting and severe windstorm generated by a line of thunderstorms.

A record-breaking marine heatwave (MHW) was present in the western Mediterranean simultaneously during the summer of 2022, peaking in July. The sea surface temperature (SST) was more than $3 \text{ }^{\circ}\text{C}$ above normal levels in the region where the storm developed. The extremeness of the summer 2022 MHW is evidenced by the high SST anomalies in the first half of August 2022, ranking first among all years since 1940. An attribution exercise with numerical experiments and novel results (González-Alemán et al., 2023) indicated that this derecho event was substantially amplified by the extreme MHW and suggested that current anthropogenic climate change forcing contributed to triggering the severe storm by creating an environment more favourable for convective amplification. The study demonstrated that in case a similar dynamical synoptic situation had happened in a preindustrial climate, the derecho would have not developed, highlighting the role of thermodynamic contributions from global warming. However, no answers can be obtained regarding its dynamical contribution.

Thus, to further investigate this event and the dynamical role of global warming in it, we explore

the atmospheric mechanisms that potentially can lead to such a record-breaking event, from the atmospheric dynamics and circulation point of view, and try to answer why climate change has played a crucial role from this perspective.