EGU24-16821, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-16821
EGU General Assembly 2024
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Anthropogenic Climate Change Attribution to a Giant Hail Event in August 2022 in Northeastern Spain

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On August 30th, 2022, a giant hailstorm occurred in northeastern Spain with hailstones reaching up to 12 cm, a record for Spain. In addition to the damage to roofs, cars, and croplands, the giant hailstorm caused 67 injuries and even one fatality. During the event, the weather pattern over Europe was a quasi-omega block in the Western Mediterranean with a narrow cut-off low over the center-eastern of France, inducing the development of the very short-wave trough in extreme northeastern Spain. Such setup, the typical summer thermal-low and very high Mediterranean SSTs, promoted vorticity advection and a high amount of moisture in low-levels. In this study, that constitutes the first climate change attribution to giant hailstorms, we study the climate change effect in the hail-favorable environment, in which hailstone growth was promoted, by applying the pseudo-global warming approach. Three climatic models from CMIP6 (EC-EARTH3, CESM-WACCM and MRI-ESM2-0) are used to obtain the climate change increment (Present-Preindustrial), needed in the pseudo-global warming approach. The increment is computed for all the prognostic variables and added to ERA5 to be used as initial/boundary conditions. The WRF-ARW model is used to simulate the event. A control simulation is performed using the ERA5 initial conditions without perturbation to compare it with the preindustrial-like climate. The results indicate that the environment in a preindustrial-like climate would have been less conducive to convective hazards with a significant reduction in the studied thermodynamic parameters. The hailstorm event considering the preindustrial-like climate would have been less severe than the real event in the present climate. The applied methodology opens up the possibility of a new way to attribute such events to the anthropogenic climate change.