

Amplificación del cambio climático antropogénico en la dinámica del sistema convectivo en la catastrófica inundación de Valencia en 2024

Human-induced climate change amplification on storm dynamics in Valencia's 2024 catastrophic flash flood

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RESUMEN

Global warming alters the hydrological cycle, increasing heavy rainfall events worldwide. In October 2024, Valencia (Spain) experienced rainfall accumulations in a few hours surpassing annual averages (771.8 mm in 16 hours in the official weather station at Turís) and breaking the record for one hour rainfall accumulation in Spain (184.6 mm), resulting in 230 fatalities. Here, we present a physical-based attribution study employing a km-scale pseudo-global warming storyline approach to assess the contribution of anthropogenic climate change. We show that present-day conditions led to a 20% °C⁻¹ increase in 1-hour rainfall intensity, exceeding Clausius-Clapeyron scaling. This intensification was driven by enhanced atmospheric moisture from warmer sea surface temperatures, leading to increased convective available potential energy, stronger updrafts, and microphysical changes including elevated graupel concentrations. These results demonstrate that anthropogenic climate change could intensify the occurrence of flash-floods in the Western Mediterranean region: in this particular case, it intensified the 6-h rainfall rate by 21%, amplified the area with total rainfall above 180 mm by 55%, and increased the volume of total rain within the Júcar River catchment by 19% compared to the pre-industrial era. This study highlights the urgent need for effective adaptation strategies and improved urban planning to reduce the growing risks of hydrometeorological extremes in a rapidly warming world.