

Heavy rain in March 2025 Argentina floods mostly strengthened by human-driven climate change

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Press Summary

- Meteorological conditions leading to March 2025 Argentina floods are becoming 4mm/day (up to 7%) wetter in the present than they would have been in the past.
- This event is associated with exceptional meteorological conditions.
- We mostly ascribe the increased precipitation in March 2025 Argentina floods to human driven climate change and natural climate variability likely played a modest role

Event Description

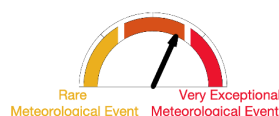
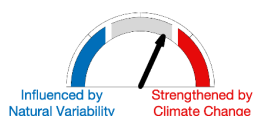
The [catastrophic floods in Bahía Blanca](#) on March 7, 2025, were primarily caused by an unprecedented and intense rainfall event. Within a span of approximately eight hours, the city received over 400 millimeters (15.7 inches) of rain, which is equivalent to its average annual precipitation. [This deluge](#) led to severe flash flooding, resulting in loss of life (16 deaths registered already and more than 150 people still missing three days after the event), significant infrastructure damage, including the destruction of bridges and the collapse of asphalt roads. The rapid accumulation of water overwhelmed the city's drainage systems, causing widespread inundation of homes, hospitals, and streets. In addition to this, according to medical experts, the spread of diseases could be expected as a forthcoming consequence.

ClimaMeter for Argentina Floods

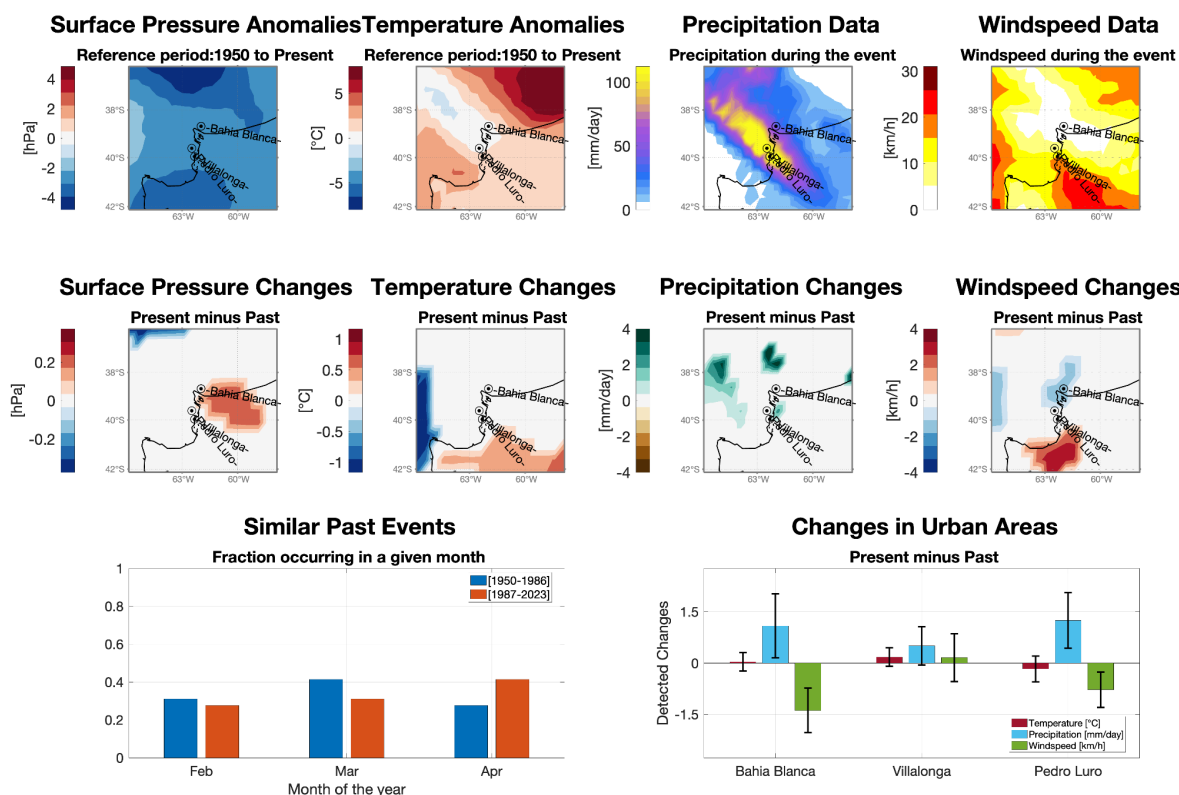
07-Mar-2025



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The event occurred in the context of a cold front that, at the time of the event, remained rather stationary along a northwest-to-southeast axis. The surface pressure anomalies show two areas of negative pressure anomalies to the north and the south of Bahia Blanca. Temperature anomalies display a complex structure with land areas of positive (+5°C) and negative (-2°C) anomalies, with a cold component in the area with maximum precipitation. Precipitation data indicate extremely high daily amounts exceeding 100 mm/day over the upper part of the basin of Bahia Blanca. Wind speed data indicate moderate sustained winds (up to 100 km/h) towards the coast and no winds in the area most affected by the precipitation. Our analysis is based on ERA5 data, which integrates some station observations, especially for rain data. The values reported here can differ from those observed at individual weather stations.

Climate and Data Background for the Analysis

The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) highlights that climate change is influencing the frequency and intensity of extreme weather events, including floods, globally. While the report does not provide country-specific details for Argentina, it offers regional insights for South America, which are relevant to Argentina. In particular for Southern East South America increasing trends in the magnitude and frequency of extreme precipitation events of precipitation have been observed with high confidence. For the period 1950-2014, a positive trend in summer precipitation has been detected across the entire region, ranging from 2.8 to 3.5 mm per month and decade. This trend is also evident in both monthly and daily extreme precipitation events. The report emphasizes that these changes are expected to worsen with further global warming, particularly if global temperatures rise beyond 2°C. For the future projections there is a consensus among available models on further increase for this region for both extreme precipitation events and river floods with medium confidence. (IPCC AR6 WGI, Chapter 11 and 12.)

Bahía Blanca is a major port city located in the southeastern region of Buenos Aires Province, Argentina, and one of the most densely populated urban centers in the southern part of the province, with an estimated population of approximately 336,000 inhabitants according to the 2022 census. The city plays a pivotal role in the regional economy, particularly in the sectors of commerce, industry, petrochemicals, and energy, due to its strategic geographic location and deep-water port. Bahía Blanca is situated within a regional hydrological basin, associated to the Ventania mountain range and primarily drained by the Napostá Grande and Sauce Chico rivers. The region receives an average annual precipitation of approximately 700 mm, with rainfall patterns strongly influenced by seasonal atmospheric variability. The mean discharge of the Napostá Grande River is approximately estimated at 6 m³/s, while the Sauce Chico River typically exhibits an average flow of around 3 m³/s. To mitigate urban flooding in the city, the Maldonado Channel was developed as a critical drainage infrastructure, designed to divert excess water from the Napostá Stream during periods of intense precipitation. However, extreme meteorological events, such as the unprecedented rainfall event documented in this study, have significantly exceeded the channel's capacity, leading to severe urban flooding.

Our analysis approach rests on looking for weather situations similar to those of the event of interest having been observed in the past. For this event, we have low confidence in the robustness of our approach given the available climate data, as the event is very exceptional in the data record.

ClimaMeter Analysis

We analyze here (see [Methodology](#) for more details) how events similar to the meteorological conditions leading to the Argentina Floods have changed in the present (2001–2023) compared to what they would have looked like if they had occurred in the past (1979–2001) in the region [66°W 58°W 36°S 42°S]. The *Surface Pressure Changes* show no significant changes (<1 hPa). *Temperature Changes* show that similar events produce similar temperature than in the past. *Precipitation Changes* show that there are up to 4 mm/day (up to 7%) wetter conditions over localised areas of the region analysed. *Wind speed changes* have shown reduced windier conditions, with decreases of up to 4 km/h (up to -10%) around Bahia Blanca area and stronger winds up to 4 km/h (up to 10%) in the coastal area south of Pedro Luro. We also note that similar past events occur with similar seasonality in the past and present periods. Changes in urban areas reveal that Bahia Blanca, Villa Longa and Pedro Luro experience heavier rain in the present than in the past (+1.5 mm/day, namely up to 3% more rain than in the past). The city of Bahia Blanca and Pedro Luro also experiences less windy conditions.

Finally, we find that sources of natural climate variability, notably the Atlantic Multidecadal Oscillation, may have only partly influenced the event. This means that the changes we see in the event compared to the past may be mostly due to human driven climate change.

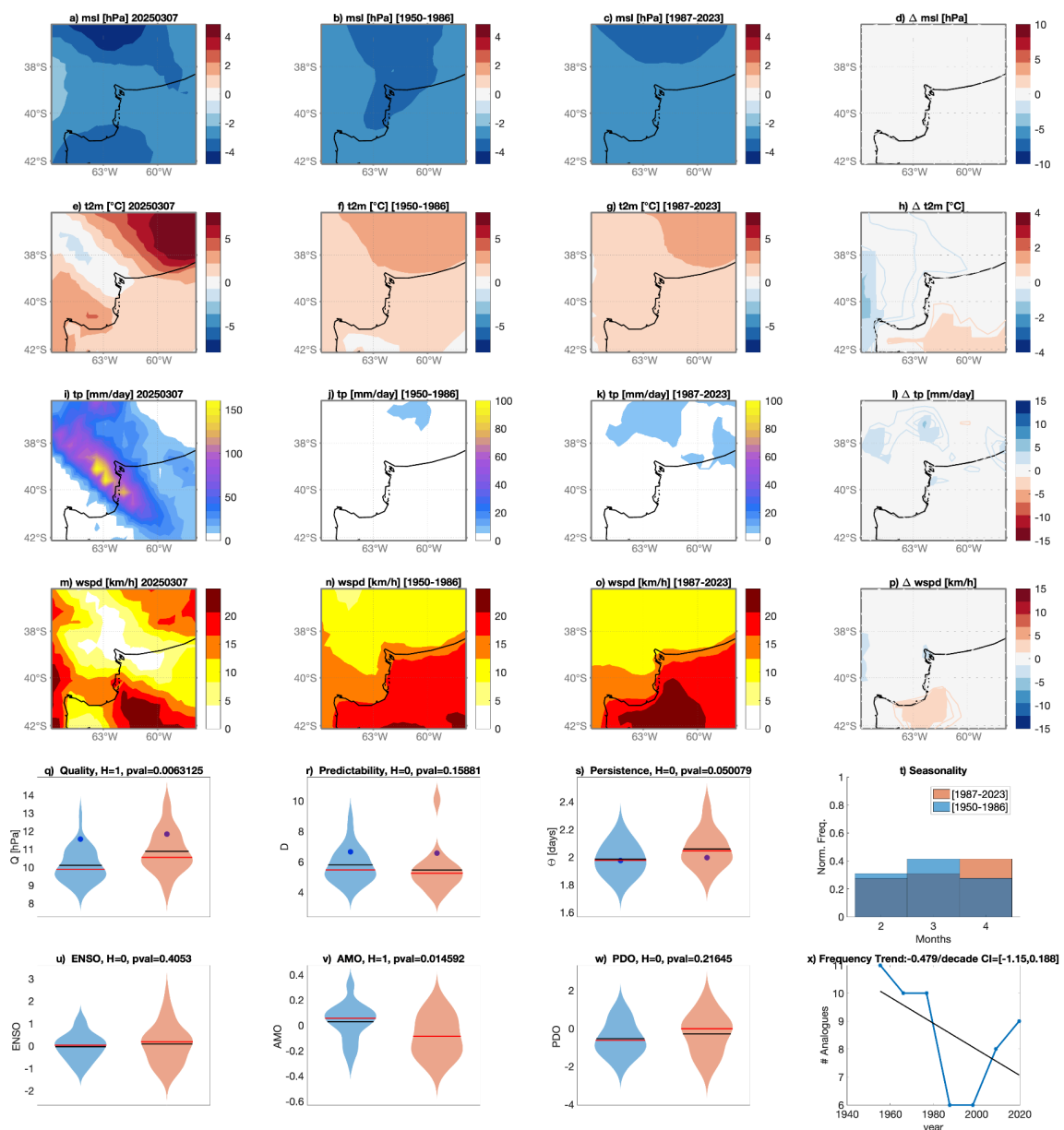
Conclusion

Based on the above, we conclude that meteorological conditions leading to the March 2025 Argentina floods are locally wetter by up to 4 mm/day (7%), in the present compared to the past. We interpret the March 2025 Argentina floods as an event driven by exceptional meteorological conditions whose characteristics can mostly be ascribed to human driven climate change.

Additional Information : Complete Output of the Analysis

NB1: The following output is specifically intended for scientists and contain details that are fully understandable only by reading the methodology described in Faranda, D., Bourdin, S., Ginesta, M., Krouma, M., Noyelle, R., Pons, F., Yiou, P., and Messori, G.: A climate-change attribution retrospective of some impactful weather extremes of 2021, *Weather Clim. Dynam.*, 3, 1311-1340, <https://doi.org/10.5194/wcd-3-1311-2022>, 2022.

NB2: Colorscales may vary from the ClimaMeter figure presented above.



The figure shows the average of surface pressure anomaly (msl) (a), average 2-meter temperatures anomalies (t2m) (e), cumulated total precipitation (tp) (i), and average wind-speed (wspd) in the

period of the event. Average of the surface pressure analogs found in the counterfactual (b) and factual periods (c), along with corresponding 2-meter temperatures (f, g), cumulated precipitation (j, k), and wind speed (n, o). Changes between present and past analogues are presented for surface pressure Δslp (d), 2 meter temperatures Δt_{2m} (h), total precipitation Δtp (i), and windspeed $\Delta wspd$ (p): color-filled areas indicate significant anomalies with respect to the bootstrap procedure. Violin plots for past (blue) and present (orange) periods for Quality Q analogs (q), Predictability Index D (r), Persistence Index Θ (s), and distribution of analogs in each month (t). Violin plots for past (blue) and present (orange) periods for ENSO (u), AMO (v) and PDO (w). Number of the Analogues occurring in each subperiod (blue) and linear trend (black). Values for the peak day of the extreme event are marked by a blue dot. Horizontal bars in panels (q,r,s,u,v,w) correspond to the mean (black) and median (red) of the distributions.