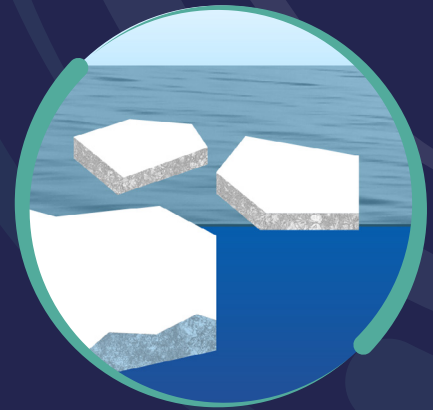


EXTREME WEATHER AND CLIMATE EVENTS IN THE ARCTIC

HOW ARE EXTREME WEATHER AND CLIMATE EVENTS IN THE ARCTIC CHANGING? WHAT DRIVES THESE CHANGES, HOW WELL ARE THEY REPRESENTED IN CLIMATE MODELS, AND WHAT ARE THEIR SOCIETAL AND ENVIRONMENTAL IMPACTS?



RESEARCH

The research done under PolarRES reviewed current knowledge of Arctic extremes, combining observations with process-based and modelling analyses. It identified key knowledge gaps in drivers, predictability, and risks related to temperature, precipitation, and compound events. A case study was conducted on the record-warm summer of 2024 in Svalbard, showing that persistent atmospheric circulation and anomalously warm sea surfaces drove the extreme heat. Advanced climate modelling was carried out using global atmospheric models, both with and without enhanced regional resolution over the polar regions, to analyse present and future Arctic extremes under different “storylines” of climate change.



POLICY ACTIONS NEEDED

- Strengthening monitoring and early-warning systems for Arctic extremes.
- Investing in resilient infrastructure and enhancing emergency response capacity.
- Broadening communication with indigenous communities and integrating local knowledge into adaptation strategies.
- Enhancing international collaboration and linking scientific insight with policy and investment.

Coordinated, science-based action will reduce risks, protect livelihoods, and enable sustainable development in an Arctic increasingly shaped by extreme weather and climate events.



RESULTS

- Arctic warming amplifies extremes: Rising temperatures are increasing the frequency and intensity of extreme events, reshaping ecosystems and challenging community resilience.
- Complex drivers: Extremes result from interactions between background global warming and natural variability, with persistent uncertainties in their future evolution.
- Future projections: Simulations show strong, storyline-dependent increases in temperature and precipitation extremes, especially in minimum temperatures and heavy precipitation.
- Added value of high resolution: Regional refinement improves the representation of precipitation extremes, capturing enhanced moisture transport, convergence, and the influence of orography and jet-stream shifts.

IMPORTANCE

Local communities need reliable information to ensure safety and adapt livelihoods. Emergency services and policy-makers depend on accurate forecasts for planning and disaster response. The industry, infrastructure operators, and insurers require robust projections to manage risk, while scientists and international bodies use this knowledge to strengthen preparedness and cooperation across the Arctic.

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