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A laboratory perspective of extreme events in a global warming scenario

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Laboratory experiments are used to study the effect of Arctic warming on the amplitude and zonal phase speed of mid-latitude jet meanders. Our results show that a progressive decrease of the meridional temperature difference 1) slows down the eastward propagation of the jet stream, 2) complexifies its structure, and 3) increases the frequency of extreme events. Extreme events and temperature variability show a clear trend in relation to the Arctic warming only at latitudes influenced by the jet stream, whilst such trend reverses in the equatorial region south of the subtropical jet. Despite missing land-sea contrast in the laboratory model, we find similar trends of temperature variability and extreme events in the experimental data and the National Centers for Environmental Prediction (NCEP) reanalysis data. Moreover, our data qualitatively confirm the decrease in temperature variability due to the meridional temperature gradient weakening (which has been proposed recently based on proxy data). Probability distributions are weakly sensitive to changes in the temperature gradient, which is in accordance with recent findings from quasigeostrophic models.