Yoshimori, M., T. Kawasaki, A. Abe-Ouchi, and H. Hasumi (2025): Arctic amplification in the past, present, and future: A review for the challenge to the integrative understanding of its mechanism. *J. Meteor. Soc. Japan*, **103**, http://doi.org/10.2151/jmsj.2025-027.

Plain Language Summary: The Arctic is warming at a much faster rate than other regions of the world. This geographical signature of warming is referred to as Arctic amplification (AA). As AA is known to have occurred frequently throughout the Earth's history, a concerted effort to synthesize the characteristics of these events over time may increase the confidence with which we can predict changes in the future. In this article, we review studies about observed Arctic changes, their externally forced and internally generated components, Arctic feedback processes, influence from lower latitudes, and climate in the distant past. Discussion focuses on the key points for developing an integrated understanding of the mechanisms underlying AA.

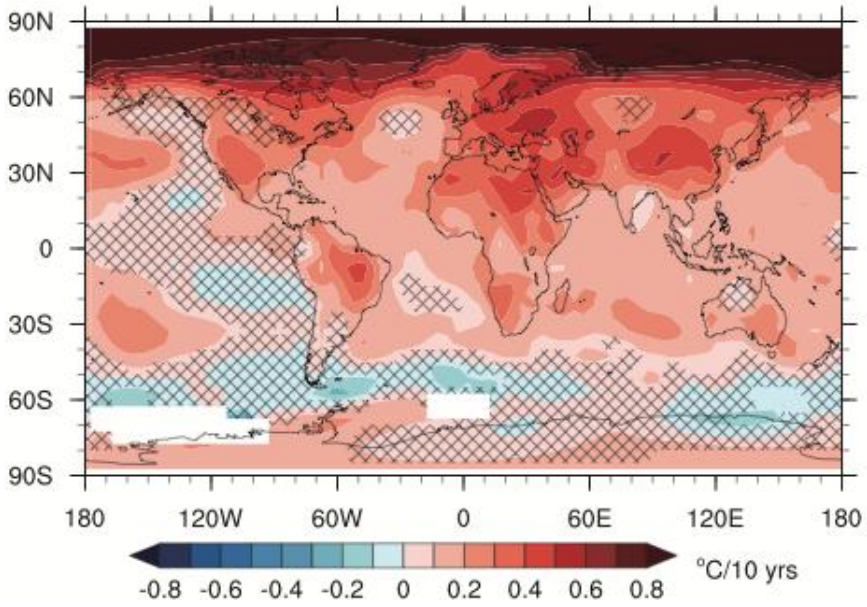

Figure 1. Linear surface temperature trends from 1979 to 2017 (ºC per decade) after Fig. 2.11 of Gulev et al. (2021). Grid points with missing data are not colored. Grid points where the linear trend is not statistically significant at the 5% level are hatched. The data are from HadCRUT5 (Morice et al., 2021).

- Large-ensemble model simulations made an essential first step in attributing the observed AA, but it remains a challenge to verify the model-based attribution empirically.
- While our understanding of Arctic feedback processes has advanced considerably over the last decade, interactions with lower latitudes are still poorly understood.
- The hierarchical observational insight and modeling activity would connect the process-oriented bottom-up perspective and the system-oriented top-down perspective.
- Paleoclimate studies warn against climate models in their ability to reproduce the winter and annual mean warming to a sufficient degree at northern high latitudes, and more effort is required to integrate the understanding of AA in the past, present, and future.