The Role of Internal Variability in Springtime Arctic Amplification from 1980 to 2022

Date: May 28th, 2026
Time: 3:00 pm (GMT)

Sky Gale
University of Washington

Observed Arctic amplification (AA) during spring substantially exceeds that simulated by most coupled climate models. From 1980–2022, the observed Arctic-to-global surface air temperature (SAT) trend ratio in spring reached 4.2, compared to 2.7 in the multi-model mean (MMM). Using a machine learning framework trained on large ensemble simulations, we isolate the contribution of internal variability to observed Arctic warming trends. Results suggest that circulation-driven internal variability accounts for approximately 37% of recent spring Arctic warming, substantially reducing the observed–model discrepancy. Monthly analysis further shows that the contribution from internal variability is month-dependent across March, April, and May, with the strongest influence occurring in April, when internal variability explains roughly 40% of the observed Arctic SAT trend. Approaches capable of capturing nonlinear relationships produce larger estimates of internal variability than linear methods, suggesting that nonlinear circulation–temperature interactions are important for understanding springtime AA. Strong spatial correlations between the difference in SAT trend patterns (observations minus MMM) and that derived from wind-nudged experiments further imply that the simulated forced trend pattern is broadly realistic. The observed spring circulation–temperature configurations also remain rare in coupled climate models, implying that models may underestimate the magnitude of Arctic internal variability and/or that the observed trends represent an unusually rare realization.

Join the PAMIP group:
https://groups.google.com/u/1/g/pamip?hl=en

Contacts
Joonsuk Kang (jk5081@columbia.edu)
Lantao Sun(lantao.sun@colostate.edu)
Yu-Chiao Liang (yuchiaoliang@ntu.edu.tw)

@PAMIP_news

https://www.cesm.ucar.edu/projects/cmip6/pamip/webinars