IDENTIFYING THE DRIVERS OF THE OBSERVED SPRINGTIME COOLING TREND IN NORTHERN NORTH AMERICA USING LARGE ENSEMBLES

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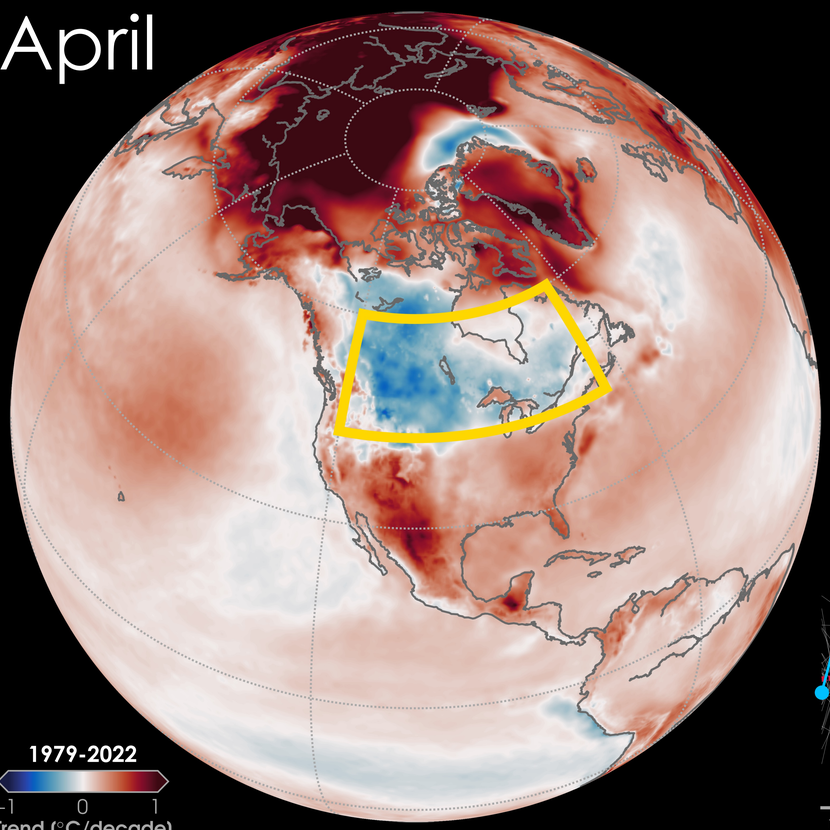
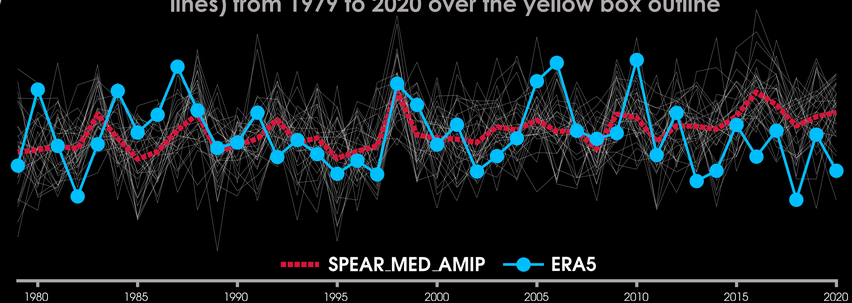
April

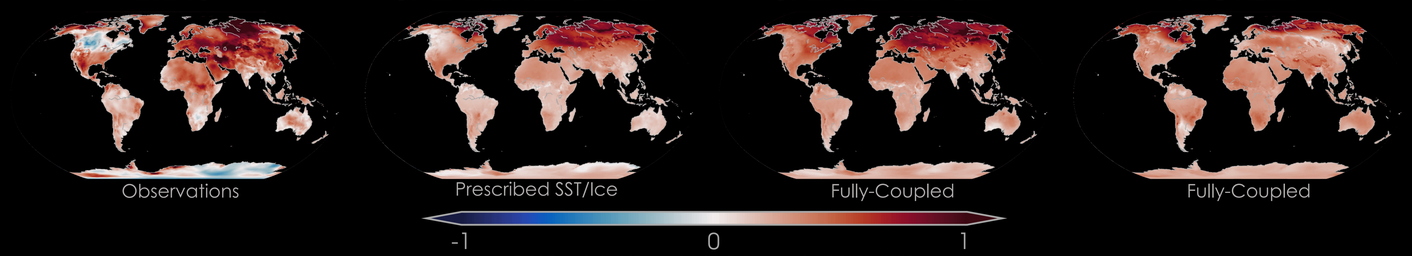


The recent springtime warming hole is a rare realization of internal climate variability.

Mean April temperature in ERA5 (blue line) and the ensemble mean of SPEAR_MED_AMIP (red dashed line) and for 30 ensemble member (white lines) from 1979 to 2020 over the yellow box outline

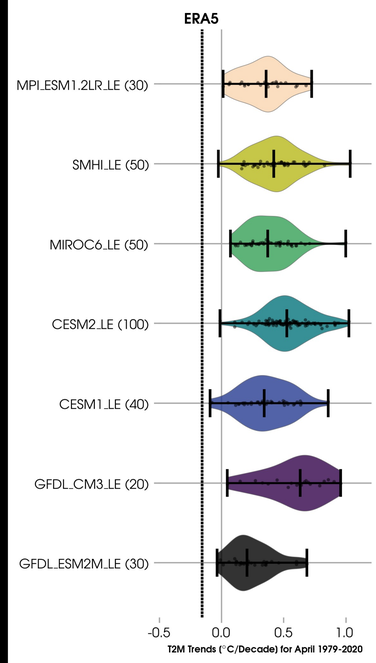


February to April near-surface temperature (T2M) trends over land areas using large ensembles (LE) (ensemble means)



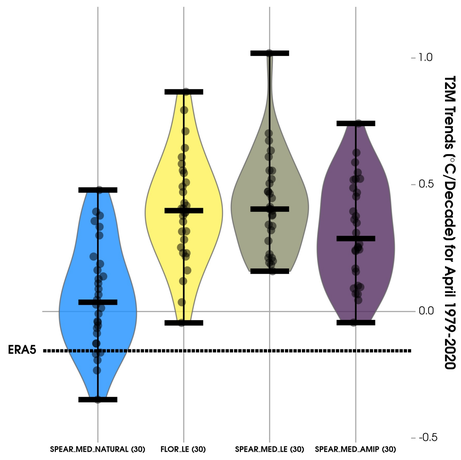
The opportunity

Over the last four decades, observations reveal widespread warming in the mean surface temperature for most land areas around the globe. However, one exception from this trend is found extending across the northern United States and southern Canada during late winter and early spring. In fact, atmospheric reanalysis and station-based observational datasets all reveal surface cooling within this same area, which is largest in the month of April. It remains unclear whether this regional temperature trend is due to external forcing, internal variability, or a combination of factors.



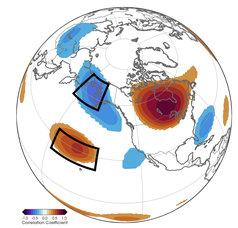
April temperature trends over northern North America are outside the spread of ensemble member trends using many CMIP5/6 initial-condition large ensembles

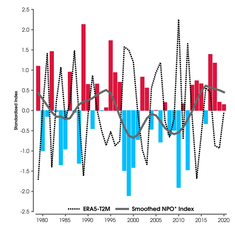
Trends comparing coupled SPEAR/FLOR with an AMIP run and a large ensemble prescribed with only natural forcings

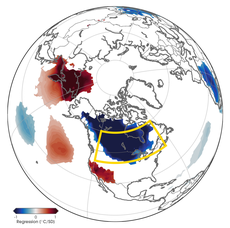


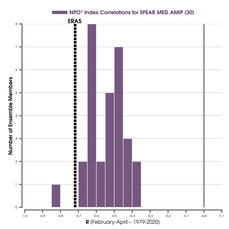
Correlation of geopotential heights at 500 hPa with a standardized index of near-surface temperature over northern North America for observations (ERA5)

Boxes denote the calculation of our modified North Pacific Oscillation (NPO*) index









Map shows near-surface temperature regressed onto our NPO* index in observations (only statistically significant)

Distribution of correlations between the NPO* index and northern North America temperatures for each ensemble member in the SPEAR_MED_AMIP experiment

The conclusions

While observed trends are well below the multi-model ensemble mean, a few individual ensemble members simulate a similar warming hole spatial pattern. T2M variability is predominately driven by the NPO, and observed shifts in its pattern may be related to this anomalous cooling.

The data

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