FREQUENCY OF EXTREME TEMPERATURE EVENTS AT REGIONAL AND GLOBAL SCALES

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RESEARCH GOALS

- Investigate frequency of extreme temperature events, defined as daily departures of more than 2 standard deviation RELATIVE TO the historical mean (1981-2010)
- Compare projected changes of these events in the future as simulated by the different "Shared Socioeconomic Pathways" of phase 6 of the Coupled Model Intercomparison Project (CMIP6)
- 4 Regions of study: Global, Arctic, Alaska, and Eastern North America

DATA

- CMIP6 combines models from modelling teams around the world under shared guidelines for forcing scenarios and outputs
- 7 models were used for this study: ACCESS-CM2, ACCESS-ESM1-5, NorESM2-LM, NorESM2-MM, CanESM5, MPI-ESM1-2-HR, MPI-ESM1-2-LR
- We look at surface air temperature under 3 scenarios: historical simulations (1980-2014), ssp2-4.5 and ssp5-8.5 (2015-2100)
- NCEP/NCAR (National Centers for Environmental Prediction/ National Center for Atmospheric Research) Reanalysis data is used for comparison with the historical models to observe accuracy

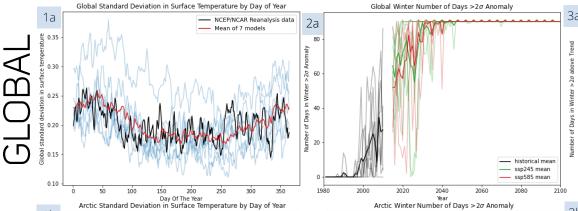
ANALYSIS

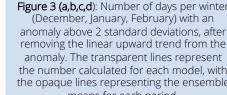
- Remove the linear upward trend in temperature over the historical period to calculate the year-to-year standard deviation of surface temperature anomaly for each day of the year in 1981-2010
- Calculate the number of days per year in Dec-Jan-Feb (Northern hemisphere winter) that are above 2 standard deviations, both in the raw anomaly and anomaly after removing the linear
- For each model the analysis is done separately, with the final number of extreme heat days per year averaged over the ensemble

DISCUSSION

- For Alaska, the arctic, and eastern North America, the standard deviation is much higher during the winter than the summer, and the smaller regions (Alaska & NE America) have more variability than the arctic and global, which is expected.
- Over the forecasted time period, the number of days with a $>2\sigma$ anomaly (from the 1980-2010 mean) increases significantly, but some of this is due to the overall increase in surface temperature over time
- After removing the linear trend from the anomaly timeseries, global and arctic plots still show a scenario-dependent increase in the number of anomalous hot days. Alaska and NE America plots show a high year-to-year variability among all the models.
- In the Arctic, the number of $>2\sigma$ days (with the trend removed) rises from <5 days per year in the historical period to >20 days for both scenarios by 2060, to >30 for ssp2-4.5 and >50 for ssp-5.85 by the end of the century.

Figure 1 (a,b,c,d): standard Figure 2 (a,b,c,d): Number of days per winter deviation in daily surface (December, January, February) with an temperature over the anomaly above 2 standard deviations. The transparent lines represent the number lines representing the ensemble means for





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