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The influence of ENSO on Arctic surface temperatures

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Accelerated Arctic warming over the last few decades is a widely recognised feature of climate change, with speculation that this rapid warming may have far reaching implications such as on weather and climate at lower latitudes. The mechanisms which have driven these rapid changes, however, are still debated. Previous research has specified that Arctic sea ice decline and subsequent ice-albedo feedback may be the largest contributor to Arctic amplification. More recent thought, however, indicates that tropical and extratropical regions may play an equally important role in Arctic warming due to poleward heat transports through poleward propagating Rossby waves. ENSO has been proposed as a potential driver of Arctic warming through the tropically excited Arctic warming mechanism (TEAM) which describes the generation and propagation of Rossby waves from the West Pacific, during its cool phase (La Niña), to the Arctic resulting in warming in the Kara and Barents Sea regions. However, as this work is based on one dataset, here we aim to further investigate and quantify the role of La Niña on Arctic surface climate and understand the mechanisms linking the two regions through assessing regressions and composites based on reanalysis data, ERA-Interim and JRA-55 and model output from CMIP5 and the CESM Pacemaker Experiments.

ERA-Interim and JRA-55 demonstrate similar relationships in Arctic surface air temperatures to ENSO forcing. Both reanalysis datasets show significant positive anomalies over northwest North America and significant negative anomalies in northeast Eurasia and in the Barents Sea, indicating areas of cooling and warming respectively, as further evidenced in the composite analysis. Model relationships to ENSO, however, are more variable. The CMIP5 multi model mean demonstrates some similarity to the reanalysis but the anomalies here are of a much larger amplitude and spatial area while the CESM Pacemaker data does not capture any of the patterns presented in the reanalysis. These results indicate that the relationship between ENSO and the Arctic is not as simple as presented previously with either internal variability potentially masking this teleconnection or that the influence of the La Nina forcing on the Arctic is not well understood.