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Tropospheric circulation during the early twentieth century Arctic warming

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The early twentieth century Arctic warming (ETCAW) between 1920-1940 is an exceptional feature of climate dynamics in the last century and its warming rate was only recently matched by anthropogenic global warming amplification in the Arctic region. However, atmospheric warming during the ETCAW was strongest in the mid-troposphere and is believed to be triggered by an exceptional case of natural climate variability. Nevertheless, ultimate mechanisms and causes for the ETCAW are still under discussion.
Here we use state of the art multi member global circulation models, reanalysis and reconstruction datasets to investigate the internal atmospheric dynamics of the ETCAW. We use these gridded datasets to investigate the role of boreal winter mid-tropospheric heat transport and circulation in providing the energy for the large scale warming. Analysing heat flux components and regional differences, it was found that climate models are not able to reproduce the heat flux evolution shown by reanalysis and reconstruction datasets. These datasets compute an increase of stationary eddy heat flux and a decrease of transient eddy heat flux during the ETCAW. Moreover, tropospheric circulation analysis revealed the important role of both the Atlantic and the Pacific sectors in the convergence of southerly air masses into the Arctic during the warming event. Subsequently, it could be shown that the internal dynamics of the atmosphere played a major role in the formation in the ETCAW.