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Would Sea Ice Reduction in Boreal High Latitudes Affect Tropical Rain Patterns?

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Sea ice is an important component of the Earth System and its continued loss in Northern Hemisphere high latitudes is one of the most anticipated consequences of global warming. Satellite-based data allowed the IPCC Report V to indicate the regional distribution of boreal high latitude sea ice reduction in decadal bases: 9.3% in Barents Sea, 6.1% at east of Greenland, 7.0% at west of Greenland, 2.5% in Foxe Bay, 4.6% in Hudson Bay, and 2.2% in the Arctic Sea. Those fractions were introduced in the SPEEDY model to run several experiments with the aim of simulating the global climate response to the boreal sea ice reduction in 2050.
Analyzing the anomalies of the Northern Hemisphere distribution of the geopotential height, temperature, and zonal and meridional wind components, our simulations show clear resemblance with the negative phase of both the Northern Annular Mode (NAM) and the North Atlantic Oscillation (NAO), as indicated in recent observational and modeled studies. Composites of the observed zonal and meridional wind during negative phases of the NAM and NAO corroborate the similarity with the model simulations of the boreal sea ice reduction. Specifically, the meridional wind anomalies in northern Ferrel cell latitudes allows one to suggest that the increase of energy that the boreal troposphere receives from ocean due the sea ice reduction results in an increase in the amplitude of the Rossby waves, connecting then the polar zone with the tropics.
The analyses of the anomalies of the vertical motion at 500 hPa and the rain distribution in the tropical belt, as simulated in the present study, show the repositioning of the Intertropical Convergence Zone (ITCZ) and also the South Atlantic Convergence Zone (SACZ). In the Atlantic, the ITCZ appears displaced southward, which is a result opposite to several studies that indicates the ITCZ displaced in direction to the hemisphere that is warmer. These discrepancies could be understood considering that the medium latitudes of the Northern Hemisphere seem to cool in response to the sea ice reduction in polar latitudes. Also in these simulations, the SACZ seems to be reinforced and displaced southward during local summer, corresponding to winter in Northern Hemisphere when sea ice reduction is stronger.