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The Arctic atmospheric circulation modes and their impact on lower latitudes

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The role of the Arctic sea ice in the climate system and particularly in the future warmer climate deserves further investigations due to its complex coupling with the polar atmospheric circulation and the North Atlantic Ocean. While different regimes of the Arctic atmospheric circulation (e.g., Arctic oscillation, Arctic dipole anomaly) control the Arctic sea ice export into the North Atlantic Ocean, this in turn alters the sea ice extent and the Atlantic meridional overturning circulation, and can also generate changes in the atmospheric circulation during the following seasons. Such modes of Arctic atmosphere played a role in those events of Great Salinity Anomaly and recent record lows of Arctic summer sea ice extent, and led to extreme weather in lower latitudes. Understanding the interannaul to interdecadal variability of the Arctic is therefore crucial to better predict the climate on the seasonal to interannual scale in the highly populated regions of midlatitudes. Here we study the first three dominant modes of the Arctic atmosphere by applying EOF analysis to the monthly mean sea level pressure data (north of 70 ºN) from ERA-20C reanalysis and CMIP5 models for the period of 1900-2010. We investigate the atmospheric teleconnections, changes in the Arctic sea ice and the North Atlantic Ocean, and extreme events that are associated with these modes. Furthermore, those regions of the Arctic that are more responsive to each of these modes are identified to better understand the dynamics controlling the sea ice. Our results also have implications for the impact of sea ice on lower latitudes.