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Multidecadal Northern Hemisphere Climate Variability during the 20th Century

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The Northern Hemisphere temperature record of the last 150 years is characterized by a long-term warming trend, with strong multidecadal variability superimposed. The mid-century warming during 1920-1940 is an example. Arctic climate indices such as sea ice extent also exhibit strong multidecadal variability. The existence of the pronounced multidecadal variability makes the quantification of anthropogenic climate change a challenge, since Global Warming evolves on a similar timescale. The ongoing discussion about a potential anthropogenic signal in the Atlantic hurricane activity exemplifies this. A lot of work was devoted during the last years to understand the dynamics of the multidecadal variability, and external as well as internal mechanisms were proposed. The paper discusses the different mechanisms, with special emphasis given to the role of the Meridional Overturning Circulation (MOC) in the Atlantic. Model studies and indirect observational evidence indicate a strong connection between multidecadal MOC changes and changes in surface air temperature on a regional, hemispheric, and even global scale.