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• The link between Atlantic Ocean warming and Antarctic climate change
In recent decades, Antarctica, especially the Antarctic Peninsula, has experienced dramatic climate change, one observed phenomenon being a dipolar pattern of high sea-level pressure south of Australia and low sea-level pressure in the Amundsen Sea during the southern winter. The mechanism driving this has been identified by researchers at NYU’s Center for Atmospheric and Ocean Science as warming in the northern and tropical Atlantic.

Xichen Li, David Holland, Edwin Gerber and Changhyun Yoo recently published a paper in Nature showing that this pattern of Antarctic sea-level pressure correlates with sea surface temperature in the north and tropical Atlantic, moreover that the Atlantic sea surface temperature is driving the Antarctic sea-level pressure and that the low pressure thus established in the Amundsen Sea enhances warm-air advection and warm-water transport to the Antarctic Peninsula, thus contributing to the observed climate change in that region.

The sea surface temperature in the north and tropical Atlantic has shown an increasing trend since 1870 overlaid on the Atlantic Multidecadal Oscillation (AMO), a longer-term, 60-70 year cycle in Atlantic sea surface temperatures. Since 1979 the AMO has been in an increasing-temperature phase of its cycle.

Xichen Li and colleagues used regression and maximum covariance analysis to establish the correlation between sea surface temperature in the north and tropical Atlantic and sea-level pressure in the Antarctic, as illustrated below. However correlation does not imply causation, and physical experiments testing the effect on Antarctica of altering temperatures in the Atlantic are not practical (or ethical!). But by running numerical simulations on NYU’s HPC clusters, using the Community Atmosphere Model (CAM4) from NCAR they were able to show that by forcing warming in the north and tropical Atlantic causes sea-level patterns in Antarctica corresponding to those observed. The researchers went further, running simulations using the dry dynamical core of a GFDL atmosphere model to show that Rossby waves link the tropical Atlantic to the Antarctic, providing the mechanism for this correlation.

Li et al have published their results in Nature, and their work has also been reported in the International Science Times, phsys.org and at NYU.