Global warming will leave different fingerprints on global subtropical anticyclones

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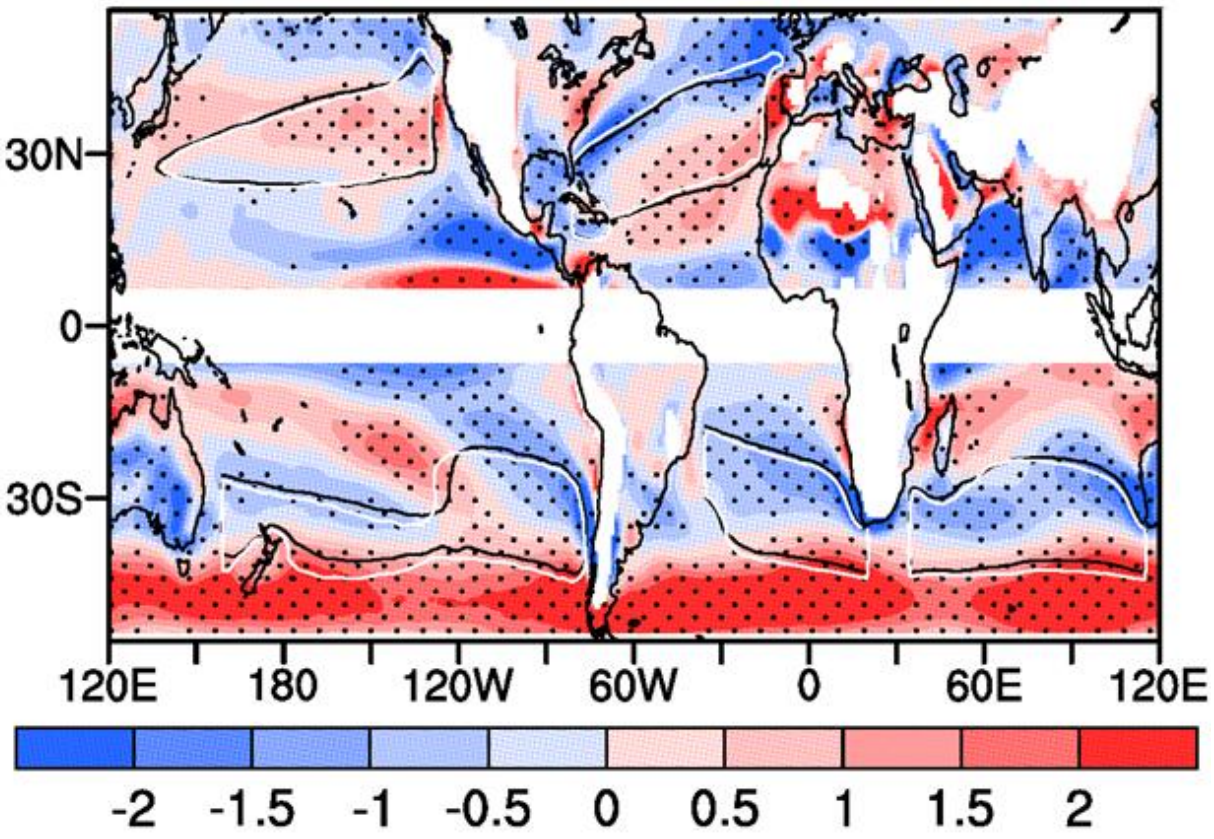

Projected future change of relative vorticity at 925 hPa. The black and white contours show the climatology for the 20th and 21st centuries. The shading shows the projected change by the ensemble mean of 30 models, and projected sign of change agreed by more than 70% of the models is stippled. Credit: He et al, 2017

Subtropical anticyclones are essential components of the atmospheric circulation in the subtropics, and are responsible for the formation of subtropical monsoons and deserts. There are two subtropical anticyclones in the subtropical northern hemisphere in boreal summer, and three subtropical anticyclones in the subtropical southern hemisphere in austral summer. These five summertime subtropical anticyclones are all located at the lower troposphere over the subtropical oceans.

To assess the possible responses of the subtropical anticyclones to greenhouse gas (GHG) forcing, a multi-institutional research collaborative adopted multiple metrics and obtained robust results. Coupled models under GHG forcing show that the subtropical anticyclones over the North Pacific, South Atlantic and South Indian Ocean will become weaker in the future under RCP8.5 scenario, whereas the subtropical anticyclones over North Atlantic and South Pacific will become stronger.

"Intensity change of the subtropical anticyclones to GHG forcing is dominated by two factors—the enhanced tropospheric static stability and the pattern of change in diabatic heating," said Dr. HE Chao from China Meteorological Administration. "The tropospheric static stability is enhanced via moist adiabatic adjustment under GHG forcing, and it acts to reduce the intensity of all the subtropical anticyclones. Meanwhile, the pattern of change in the tropospheric diabatic heating acts to weaken the North Pacific subtropical anticyclone but to enhance the subtropical anticyclones over North Atlantic and South Pacific."

"Our findings show evidence that global warming will have different impacts on the global subtropical anticyclones," said Dr. ZOU Liwei, the co-author of the paper. "The intensity of the North Pacific subtropical

anticyclone reduces significantly, since both the enhanced static stability and enhanced diabatic heating act to weaken it. Over the South Atlantic and South Indian Ocean, the effect of enhanced static stability dominates, and the subtropical anticyclones over these two basins also become weaker. The effect of reduced diabatic heating overwhelms the effect of enhanced static stability over North Atlantic and South Pacific, and their combined effect enhances these two subtropical anticyclones." This study was recently published in *Journal of Climate*.

More information: Chao He et al, Responses of the Summertime Subtropical Anticyclones to Global Warming, *Journal of Climate* (2017). DOI: 10.1175/JCLI-D-16-0529.1

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