Study links changes in length of day with climate prediction

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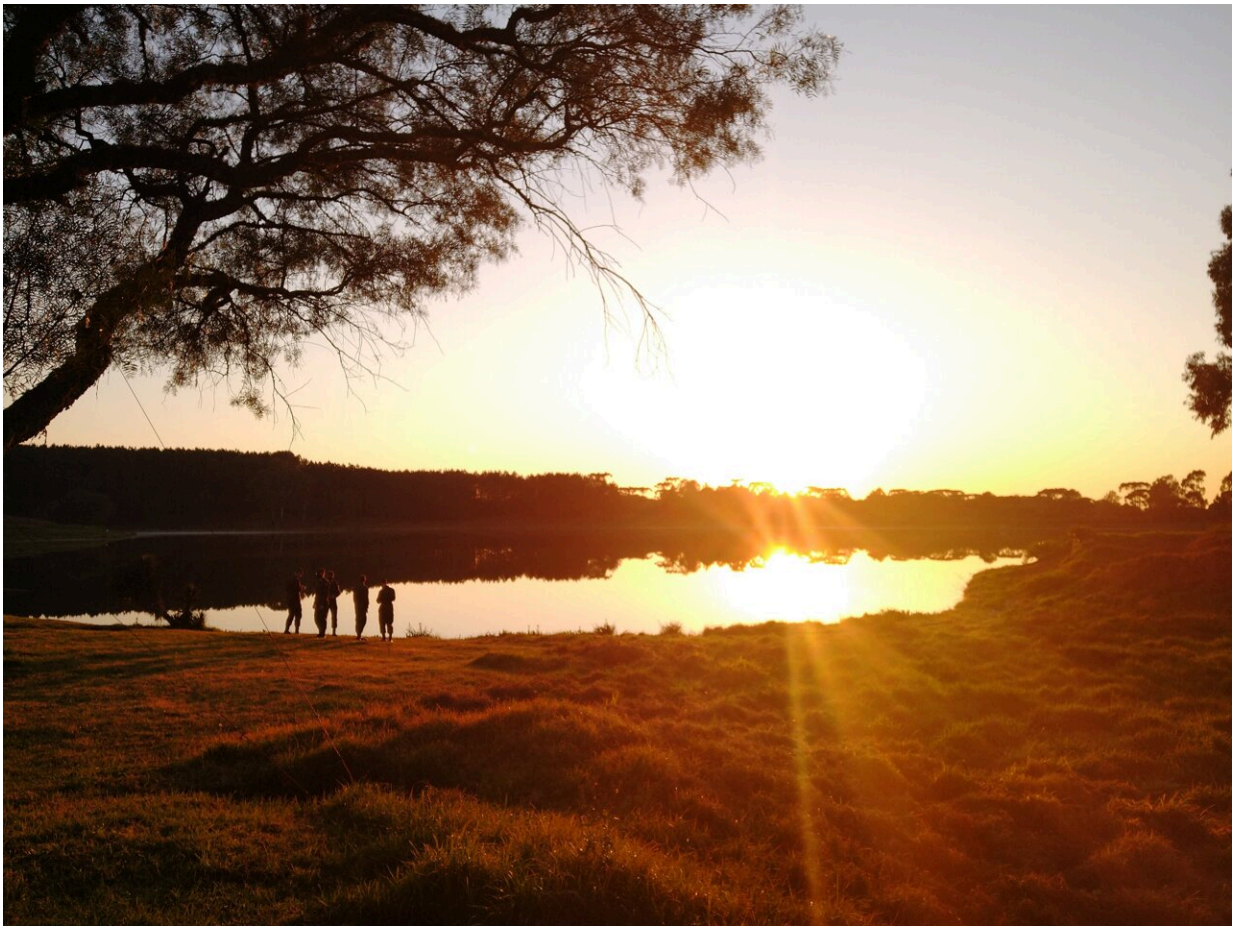

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Scientists have made a key breakthrough in the quest to accurately

predict fluctuations in the rotation of the Earth and so the length of the day—potentially opening up new predictions for the effects of climate change.

A team of scientists, led by Professor Adam Scaife from the University of Exeter, has used state-of-the-art mathematical modeling to show how fluctuations in the length of the day can be predicted more than a year in advance—significantly longer than currently possible.

The team suggest this long-range forecasting also originates from a new atmospheric source for long-range predictability of weather and climate changes.

Crucially, the research shows a definitive link between geodesy—or accurately measuring and understanding the shape, size, orientation and gravity on Earth—and climate prediction.

The study is published *Nature Geoscience*.

Professor Scaife, a climate expert from the University of Exeter's Mathematics department says that "while the changes in day length are tiny, they are important for applications that require very accurate time measurements like GPS."

Angular momentum has long been known to play a fundamental role in the structure and variability of the Earth's atmosphere.

As the Earth spins around its axis, its overall mass and rotation result in what appears to be a steady rotation. However, surface wind changes and changes in high and low-pressure patterns can change this and if the atmosphere speeds up due to stronger winds, the Earth's rotation consequently slows down, causing the length of day to increase.

However, until now the long-range predictability of these fluctuations in the length of the day was unknown.

The new study shows that fluctuations in atmospheric angular momentum and the length of day are predictable out to more than a year ahead and that the atmospheric changes have an important influence on regional weather and climate.

Using a range of forecasts from a dynamical climate model, the scientists were able to predict signals in the atmosphere that spread slowly and coherently towards the poles.

These signals precede changes in extratropical climate via the North Atlantic Oscillation and the extratropical jet stream. These new findings point to a source of long-range predictability from within the atmosphere that will help us to understand and better predict weather and climate.

Professor Scaife added that "we usually look to the ocean for long range prediction signals but these new results show that long range forecasts can also be driven from within the atmosphere."

More information: A. A. Scaife et al, Long-range predictability of extratropical climate and the length of day, *Nature Geoscience* (2022). DOI: 10.1038/s41561-022-01037-7

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