Study highlights ways to boost weather and climate predictions

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Long range weather forecasts and climate change projections could be significantly boosted by advances in our understanding of the relationship between layers of the Earth's atmosphere—the stratosphere

and troposphere.

A team of UK scientists have studied how a circulation changes in the stratosphere (above 10 km) can influence both weather and climate conditions on the surface of the Earth.

The experts, who include Professor Mark Baldwin from the University of Exeter, argue that the predictability and persistence of stratospheric events could help scientists enhance both short term, and seasonal, forecast skills.

They also suggest that some of the uncertainties that currently restrict the effectiveness of regional climate projections could be reduced through developing a better understanding of the stratosphere influence on surface-level jet streams, storm tracks and weather.

The review article, produced by experts from the University of Exeter, the Met Office and the University Of Oxford, is published online in the leading scientific journal, *Nature Geoscience*, on Monday 18 May.

Professor Mark Baldwin, from the University of Exeter Mathematics department and co-author of the study, said: "We have known for about 15 years that the stratosphere affects surface weather and climate, but only recently have we made significant progress in understanding why."

The research review studied the mechanisms whereby an event occurring in the stratosphere—which is found 10-50km above the Earth's surface - can influence ground-level climatic conditions.

It highlighted a series of global weather phenomena that resulted from this stratosphere-troposphere 'coupling'—such as the cold European winters and occurrences of extreme temperatures over eastern North America. The scientists also showed that events in the stratosphere could

affect weather patterns over much of the Southern Hemisphere including Australia and New Zealand, the Antarctic Peninsula and Patagonia during the summer months.

The experts suggest that, by using sophisticated computer modelling, scientists could develop a greater understanding of the relationship between events in the upper part of the atmosphere, and the effect they have on the weather experienced across the globe.

Professor Adam Scaife from the Met Office said "The stratosphere is now included in our computer models and is already helping to deliver improved climate predictions."

Professor Baldwin added: "Natural large pressure fluctuations in the polar stratosphere tend to last a long time—at least a month, and we see this reflected as surface pressure changes that look very much like the North Atlantic Oscillation—which has significant effects on weather and extreme events across Europe."

The research comes just months after a team of experts from The University of Exeter received a £1.1 million grant to fund pioneering new research that will significantly improve crucial long-term weather forecasts across Europe.

The team, which includes Professor Baldwin, will lead innovative new research, which aims to advance current understanding of three key conditions that influence seasonal weather across the continent—the North Atlantic upper-ocean heat content, Arctic sea-ice, and the stratosphere. They will exploit a combination of state-of-the-art climate model experiments, advanced statistical techniques and idealised dynamical frameworks to accomplish the project.

The motivation behind developing consistently reliable long-ranging

forecasting is clear. With almost every aspect of modern society reliant on improved predictions of both weather and climate both by decade and season—whether it be agriculture, energy, civil and military defence, urban planning or even commodity trading—the project has the potential to offer marked benefits to both UK and European businesses and communities.

More information: Stratospheric influence on tropospheric jet streams, storm tracks and surface weather, DOI: 10.1038/ngeo2424

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