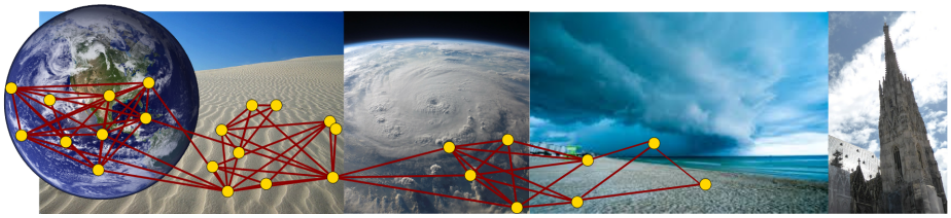

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Regime transitions in the atmosphere: insights from laboratory experiments

Sunday, 12 April 2015 08:45 (0:50)

Content

Several aspects of atmospheric flow are thought to exhibit regime behaviour. Regimes are a set of preferred circulation patterns that are qualitatively different from each other. When the flow is in one regime, it will persist there for an extended period of time, before undergoing a rapid transition to another regime. An example of atmospheric regimes is sudden stratospheric warmings, which occur when the stratospheric polar vortex undergoes a sudden transition from an axisymmetric state to a split or displaced state. Another example is the North Atlantic jet stream, which appears to have three preferred regimes that correspond to northern, southern, and central jet positions, and which are closely related to the North Atlantic Oscillation.

This talk will show that useful insights into atmospheric regimes - and the transitions between them - may be gained by studying experiments on rotating fluids in the laboratory. In this simple setting, regimes may be studied without the often ad-hoc approximations of numerical and theoretical approaches. In experiments with a two-layer rotating annulus, we have found that transitions between large-scale flow regimes may be triggered by small-scale gravity waves. These transitions may be mimicked in a numerical model via the injection of stochastic noise, motivating stochastic parameterisations in atmospheric models. The laboratory experiments have also inspired a new interpretation of sudden stratospheric warmings, as being gravity wave noise-induced transitions.

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