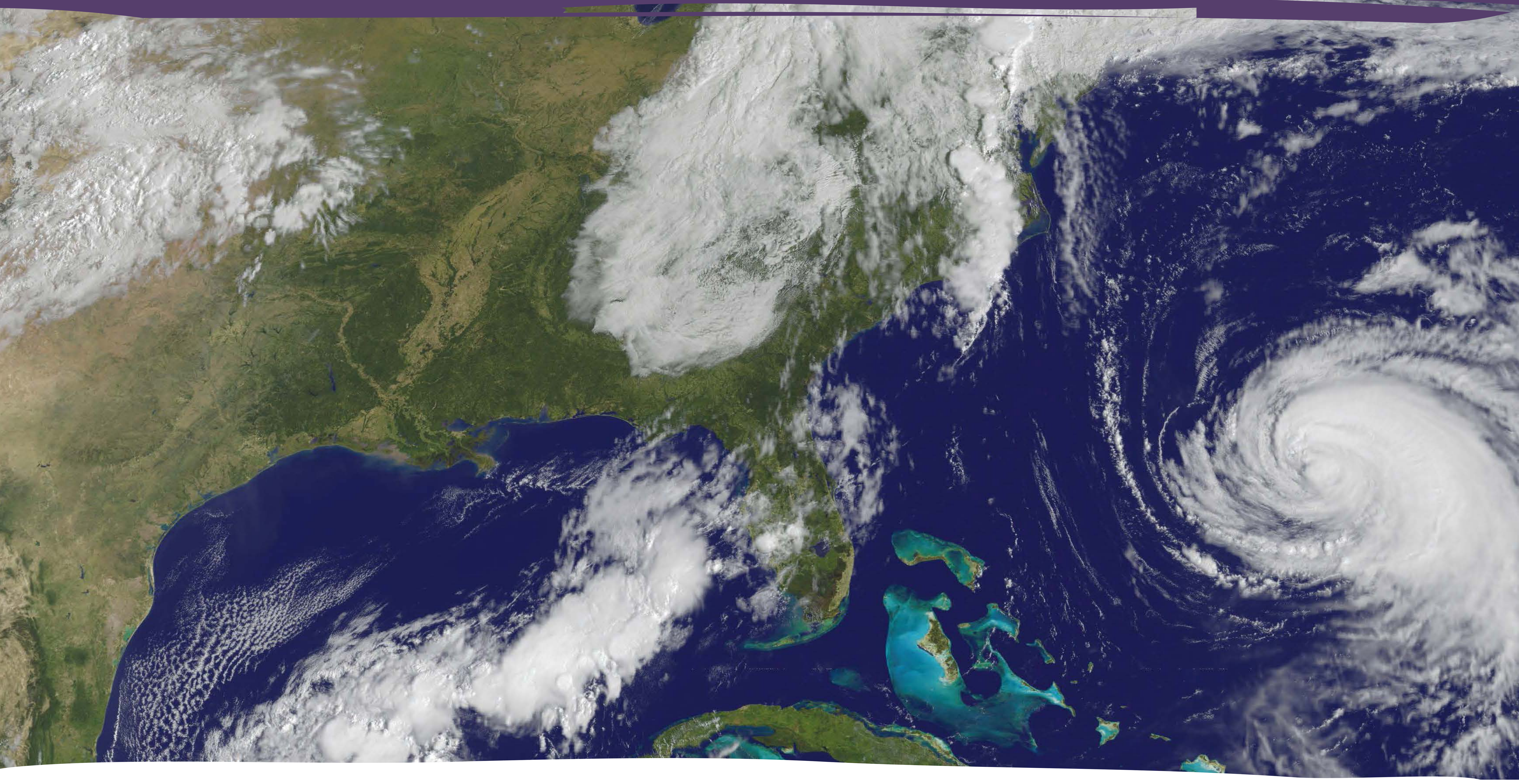

The challenge of exascale computing for weather and climate systems: the role of mathematics

Professor Beth Wingate, **Professor of Mathematics**

Wednesday 26 February 2014, 5.15pm

Harrison Lecture Theatre 004

Refreshments will be served after the presentation

One of the most important breakthroughs in computational physics was the understanding that 'fast' waves inherent in oscillatory PDEs were the root cause of instability in L.F Richardson's first numerical calculations. Insight into the physical system and mathematical structure of the equations provided 'reduced' equations that led to the first successful numerical weather prediction. Contemporary weather and climate models use more complex systems of equations to solve for the dynamics and pay the price by having to decrease the time step with every increase in model resolution.

Because computer processor speeds have increased with time physics that are described by highly oscillatory PDEs have been able to increase the numerical resolution, decrease the time step, but not notice an appreciable increase in wall clock time. This is about to change, since emerging exascale computer architectures are expected to have unprecedented degrees of parallelism but not expected to have processor speeds increase as dramatically as they have in the past.

In this talk we will explore how mathematics has led to new ideas for computing highly oscillatory PDEs for next-generation computer architectures and how this leads to new insight into the way we view systems like those governing atmospheres and oceans.

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