ESI Erwin Schrödinger International Institute for Mathematics and Physics

universität wien

DVR 0065528

Seminar

Robin S. Johnson

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The mathematical fluid dynamics of atmospheric and oceanic flows

Wednesday, May 17, 2023

at 15:15 h

ESI, Boltzmann Lecture Hall and online via Zoom meeting

Abstract: In this talk, we aim to show that the dynamics of both the atmosphere and the oceans can be described by starting with the general equations of fluid dynamics and invoking only the thin-shell approximation. The equations are written in rotating, spherical coordinates, with a suitable adjustment to accommodate the Earth's geoid. The thin-shell approximation ensures that all the attributes of the flow are retained in the asymptotic solution, including the essential elements that accurately represent the spherical geometry. The overall approach is predicated on the philosophy that permeates mathematical fluid dynamics: never approximate unless necessary. In consequence, the way in which the reduced (asymptotic) equations arise is clear, as are the errors involved; indeed, higher-order correction terms are accessible.

The emphasis here will be on the atmosphere, because this is the more technically challenging application. This involves the perturbation of a (stationary) background state of the atmosphere; we show, in outline, how the perturbation includes all the dynamics and the thermodynamics of the motion. We will note that the familiar results, both steady and unsteady, associated with theoretical models of the atmosphere, are recovered from this one formulation (but within a more general framework), as well as a number of additional, novel applications.

We end by briefly outlining how the corresponding formulation can be applied to oceanic flows.

A. Constantin, D. Dritschel, N. Paldor
Zoom coordinates: https://univienna.zoom.us/

Meeting ID: 663 0694 7737
Passcode: hkmQPT

May 11, 2023