Séminaire 13 Mai 2011 11h / Seminar Apr 13th 2011 11h

Conférencier/Lecturer:	Colm Clancy
Sujet/Subject:	A filtering Laplace transform integration scheme
Présentation/Presentation:	Anglais / English
Lieu/Room:	Salle des vents (Dorval)

iweb: http://web-mrb.cmc.ec.gc.ca/mrb/rpn/SEM/
web: http://collaboration.cmc.ec.gc.ca/science/rpn/SEM/index.php

Abstract

A filtering time integration scheme has been developed and tested for use in atmospheric models. The method uses a modified Laplace transform (LT) and is designed to eliminate spurious high frequency components while faithfully simulating low frequency modes. For numerical testing, the scheme was implemented in two spectral shallow water models; an Eulerian model and one using a semi-Lagrangian approach. The models were tested against reference semi-implicit methods using standard test cases and performed competitively in terms of accuracy and efficiency. Like semi-implicit schemes, the LT method has attractive stability properties. In particular, the semi-Lagrangian LT discretisation permits simulations with long timesteps, exceeding the CFL cutoff of Eulerian models. There are a number of additional benefits. The LT scheme has been shown, both analytically and numerically, to simulate accurately the phase speed of gravity waves. This is in contrast to semi-implicit methods which maintain stability by slowing down faster waves. In addition, the semi-Lagrangian LT method has advantages in the treatment of orography. Semi-Lagrangian semi-implicit discretisations have been shown to generate a spurious resonance where there is flow over a mountain at high Courant number. It is demonstrated here that the LT discretisation does not suffer from this problem.