Geophysical Research Abstracts
Vol. 20, EGU2018-14718, 2018
EGU General Assembly 2018

Laplace Transform Time Integration Scheme in a Baroclinic Model.

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The Semi-Implicit (SI) time integration scheme is widely used in numerical weather prediction models, and is well regarded as being stable and accurate, though it has known flaws, such as the slowing down of important wave components. The Laplace Transform Integration Scheme (LTIS) can be shown to be more accurate in simple analytic analysis and when implemented in numerical models. Unlike the SI scheme, the LTIS accurately treats important wave components and filters out high frequency components, while maintaining stability and accuracy.

Previous work has been restricted to barotropic Shallow Water models. Following the scheme in Lynch & Clancy 2016, the LTIS has now been applied in a baroclinic model for the first time. The original LTIS used a numerical form of the modified inverse Laplace Transform and was implemented in two SW models, Eulerian and semi-Lagrangian (Clancy & Lynch, 2011a/b). An analytic form of the modified LT inverse was later implemented in an Eulerian SW model (Lynch & Clancy 2016).

Favourable results comparing the LTIS against standard SI in test cases, including that of Polvani et. al. 2004 will be discussed.

References:
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