

Time-integration of a Barotropic Meteorological Model by Non-modal Matrix Approach

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Abstract

The spatial-discretized DYNAMO model is formulated as a first-order matrix differential equation for prognostic variables. The solution of this matrix differential equation can be written in such a way that it depends essentially on a particular matrix solution and its convolution with the non-linearity (as a forcing term). The knowlegde of an explicit non-modal formula for this latter matrix solution allow us to perform the integration.

The reconstruction of the wind field is obtained from the solution of an algebraic linear equation, which corresponds to the discretized Poisson equation for finding the zonal and meridional wind from vorticity and divergence. Since this matrix equation is singular, a least-square solution is proposed by using the Moore-Penrose matrix inverse. We calculate this inverse with the singular value decomposition of the matrix coefficient.