

空间物理学★大气物理学★大地测量学

### GRAPES全球非静力大气模式的正规模分析

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收稿日期 2008-9-22 修回日期 2009-11-2 网络版发布日期 2009-12-20 接受日期

**摘要** 为分析数值模式动力学框架中不同波动的特性及对数值天气预报模式计算稳定性的影响, 文章对GRAPES (Global/Regional Assimilation and PrEdiction System) 全球非静力大气模式进行了正规模分析. 首先, 建立了静止大气状态下模式的线性化系统, 并在适当的边界条件下将线性化系统分解成具有垂直与水平结构方程的本征值、本征函数耦合问题. 然后在等温大气条件下, 利用耦合问题的数值结果分析得出: GRAPES非静力模式除了有几乎和对应的静力模式一致的向东、向西传播的重力惯性波及向西传播的Rossby波外, 还有一个向东、向西传播的声惯性波; 特别是, 只有当纵横比较大时, 非静力模式对重力惯性波才会有显著影响.

**关键词** [正规模](#) [GRAPES非静力大气模式](#) [重力惯性波](#) [声惯性波](#) [Rossby波](#)

**分类号** [P435](#)

**DOI:** [10.3969/j.issn.0001-5733.2009.12.005](#)

### Normal mode analysis of the GRAPES global non-hydrostatic atmospheric model

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Received 2008-9-22 Revised 2009-11-2 Online 2009-12-20 Accepted

**Abstract** In order to analyze the effects of different atmospheric modes on dynamic procedures and the computational stability in numerical weather prediction, this paper gave a normal mode analysis of the GRAPES (Global/Regional Assimilation and PrEdiction System) global non-hydrostatic atmospheric model. First of all, a system of linearized equations was set up with respect to an atmosphere at rest, and a couple eigenvalue-eigenfunction problem was formulated, which consists of horizontal and vertical structure equations with suitable boundary conditions. By means of numerical analysis for the couple problem under isothermal atmosphere, we arrived at the following conclusion: for the non-hydrostatic model, there is an additional kind of eastward and westward propagating acoustic-inertial oscillation besides eastward and westward propagating gravity-inertial oscillation and westward propagating Rossby oscillation are identical to those in the hydrostatic version of the model. Especially, the non-hydrostatic effect on the gravity-inertial oscillation becomes significant only when the aspect ratio is large.

**Key words** [Normal mode](#); [GRAPES non-hydrostatic atmospheric model](#); [Gravity-inertial wave](#); [Acoustic-inertial wave](#); [Rossby wave](#)

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