

## Construction of Explicit Quasi-complete Square Conservative Difference Schemes of Forced Dissipative Nonlinear Evolution Equations<sup>①</sup>

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### ABSTRACT

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Based on the forced dissipative nonlinear evolution equations for describing the motion of atmosphere and ocean, the computational stability of the explicit difference schemes of the forced dissipative nonlinear atmospheric and oceanic equations is analyzed and the computationally stable explicit complete square conservative difference schemes are constructed. The theoretical analysis and numerical experiment prove that the explicit complete square conservative difference schemes are computationally stable and deserve to be disseminated.

**Key words:** Forced dissipative nonlinear evolution equation, Explicit quasi-complete square conservative difference scheme, Computational stability

### 1. Introduction

In medium- and long-range numerical weather prediction and ocean current numerical simulation, the finite-difference schemes are most employed to carry out the numerical computation of nonlinear atmospheric and oceanic equations. So it is a key problem how to design the long-time computational stable difference schemes. Zeng (1978), Ji (1981a, b), Zeng and Ji (1981), Wang and Ji (1990, 1994), Ji and Wang (1991), Wang et al. (1995), and Ji et al. (1998) systematically studied the computational stability of the adiabatic or non-dissipative nonlinear evolution equations and constructed the computationally stable implicit and explicit complete square conservative difference schemes. For the forced dissipative nonlinear evolution equations, however, its computational stability analysis has been dealt with a little so far because of its inherent complexities and difficulties. Wang et al. (1990), Lions et al. (1992), Chou (1995), and Li and Chou (1996, 1997a, b, c) have systematically carried out the basically theoretical works for the forced dissipative nonlinear evolution equations, analyzed the basic characters of the forced dissipative nonlinear atmospheric and oceanic systems, transformed the integrated forced dissipative nonlinear atmospheric and oceanic equations into an equivalent operator equation in Hilbert space and studied the characteristics and physical meanings

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## 强迫耗散非线性发展方程准完全平方守恒格式的构造

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### 摘    要

从描述大气和海洋运动的强迫耗散非线性发展方程出发,对强迫耗散非线性大气和海洋方程组显式差分格式的计算稳定性进行了分析,构造了一类强迫耗散性发展方程的显式准完全平方守恒差分格式,理论分析和数值试验证明,这类显式准完全平方守恒差分格式是计算稳定的,值得推广应用.

关键词: 强迫耗散非线性发展方程,显式准完全平方守恒差分格式,计算稳定性