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On the convergence of the modified elastic-viscous-plastic method for solving the sea ice momentum equation. (English) Zbl 1352.86021

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Summary: Most dynamic sea ice models for climate type simulations are based on the viscous-plastic (VP) rheology. The resulting stiff system of partial differential equations for ice velocity is either solved implicitly at great computational cost, or explicitly with added pseudo-elasticity (elastic-viscous-plastic, EVP). A recent modification of the EVP approach seeks to improve the convergence of the EVP method by re-interpreting it as a pseudotime VP solver. The question of convergence of this modified EVP method is revisited here and it is shown that convergence is reached provided the stability requirements are satisfied and the number of pseudotime iterations is sufficiently high. Only in this limit, the VP and the modified EVP solvers converge to the same solution. Related questions of the impact of mesh resolution and incomplete convergence are also addressed.

MSC:

86A40 Glaciology

65T60 Numerical methods for wavelets

74C05 Small-strain, rate-independent theories of plasticity (including rigid-plastic and elasto-plastic materials)

Cited in 2 Documents

Keywords:

viscous-plastic rheology; elastic-viscous-plastic rheology; sea ice; FESOM

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