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Discussions

Interactive comment on "QUAGMIRE v1.3: a quasi-geostrophic model for investigating rotating fluids experiments" *by* P. D. Williams et al.

Anonymous Referee #2

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As I noted in my previous comment. This is a well written paper which provides a detailed description of the implementation of the Quagmire model. As such I recommend its publication in GMD subject to the authors addressing the points below and in my previous reviewer comment.

1 Numerical accuracy

The paper contains a detailed description of the numerical schemes employed in Quagmire. However, the paper lacks any analysis of the order of convergence the schemes presented in either time or space. This is usually considered an important aspect of

any numerical scheme. The authors cite a number of published papers which contain comparisons of Quagmire with laboratory experiments, which is naturally a reasonable alternative to publishing them here. However, none of the published results appears to contain any attempt to demonstrate spatial or temporal convergence.

2 Physics and equations

On p188 at line 25, the authors state the importance of a match between the aspect ratio of laboratory experiments and that of the atmospheric flow. However, the annulus has an aspect ratio of order 1 while that of the atmosphere is more like 1000. How do the authors reconcile this?

On p190 at line 24-25, the authors claim that the shallow water equations arise as a result of "only minor approximations". I would question whether the hydrostatic approximation is minor, especially in the case of laboratory scale experiments. It may well be justifiable for the annulus problem but it is nonetheless an important change to the model physics.

3 Code correctness

The authors make a number of strong statements about the correctness of their code which are not fully substantiated by the tests undertaken.

On p190 at line 16, the authors state that "the code is tested in order to ensure that it is free of errors". Running tests, while undoubtably essential, will never actually ensure that a code is free of errors. The strongest statement it is ever possible to make is that a model is well tested in a particular regime and there do not appear to be any significant errors.

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Similarly, on p223 at line 3-5, the authors claim that a particular test applied to the code which produces derivative terms in the equations implies that "the code for these routines is free from errors". I beg to differ. The test applied is a necessary condition for error-free code but it is not sufficient to demonstrate that the code is free of errors. The claim of error-free code at lines 10-12 on the same page is similarly flawed.

4 Typographic error

In addition to the errors noted by the other reviewer, on p198 line 22 the absolute value signs should be around $\nabla\eta$, not around the whole inequality.

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