qgsolver_doc Documentation

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Contents

CHAPTER 1

Equations of motion

See this *Equations of motions*

CHAPTER 2

Install

We recommend conda for dependencies, see README on pistol github repository

CHAPTER 3

Tutorial

To do . . .

```
mpirun -n 4 python analytical.py -mf -ksp_view -ksp_monitor -ksp_converged_reason
```

Profiling:

```
mpirun -n 4 python -m cProfile -o output.prof uniform.py
snakeviz output.prof
```

CHAPTER 4

API

4.1 Equations of motions

4.1.1 Continuous form

Boussinesq, adiabatic, hydrostatic and nonlinear shallow water equations for conservation of momentum:

$$\partial_t \mathbf{u}_n(x,y) + (\zeta_n + f)\mathbf{k} \times \mathbf{u}_n = -\nabla \left\{ M_n + \frac{1}{2}|\mathbf{u}_n|^2 + g\Pi \right\} + \mathbf{H}_n + \mathbf{V}_n$$

for $n = 0, \cdots N-1$ and where f is the Coriolis frequency and $\zeta_n = \mathbf{k} \cdot (\nabla \times \mathbf{u}_n)$ is the relative vorticity, M_n is the perturbation Montgomery potential. The latter is given by:

$$z_0 = \eta$$
$$z_n = z_{n-1} - h_n, n > 0$$

$$M_0 = g\eta$$
$$M_n = M_{n-1} + g(\rho_n - \rho_{n-1})z_n, n > 0$$

$$p_n(x,y,z) = M_n(x,y) - g\rho_n z$$

Thickness tendency equations:

$$\partial_t h_n(x,y) + \nabla \cdot (\mathbf{u}_n h_n) = 0.$$

References: …

4.1.2 Spectral discretization

4.1.3 Temporal discretization

AB or RK for now, time splitting latter

Hallberg09, Vitousek14

4.1.4 QG formulation

4.2 qgsolver package

4.2.1 Submodules

4.2.2 qgsolver.grid module

4.2.3 qgsolver.inout module

4.2.4 qgsolver.omegainv module

4.2.5 qgsolver.pvinv module

4.2.6 qgsolver.qg module

4.2.7 qgsolver.state module

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4.2.9 qgsolver.utils module

4.2.10 qgsolver.window module

4.2.11 Module contents

CHAPTER 5

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