



Gerris development: what's coming up?

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A brief history

- 12th September 2001: First release of Gerris
- 8th October 2004: First release of GfsView
- November 2004: 2D/3D VOF implementation
- December 2004: GfsOcean solver
- October 2006: Height-Function curvature calculation
- September 2007: Wiki web site
- September 2007: Gerris finalist for the NZ Open Source Awards
- 2009: Moving solid boundaries, axisymmetric version, Saint-Venant, terrain, dynamic load-balancing etc...

Numbers

Gerris: 80530 lines of code

GfsView: 30755 lines of code

327 subscriptions to gfs-users

Patches

Stéphane	1474	(91%)
Sébastien	94	(6%)
Daniel	22	(1%)
Jose-Maria	18	(1%)
Gaurav	9	
Cédric	3	
Kristjan	2	
Andris	1	

Recent developments 2009-2011

- Streamfunction/Vorticity solver
- Moved to gerris.dalembert.upmc.fr
- Spectral wave model
- Generic Lagrangian particles (Gaurav, Daniel)
- Open Dynamics Engine module
- Extraction of Poisson problem and Hype module (Sébastien)
- Electro-hydrodynamics module (Jose-Maria)
- 'Sinking velocity' for tracers
- Dirichlet boundary conditions for Poisson solver

- 'Bubble' module (Daniel)
- Monai tsunami and Indian ocean tsunamis examples
- General Orthogonal Coordinates

Recent developments 2009-2011 (GfsView)

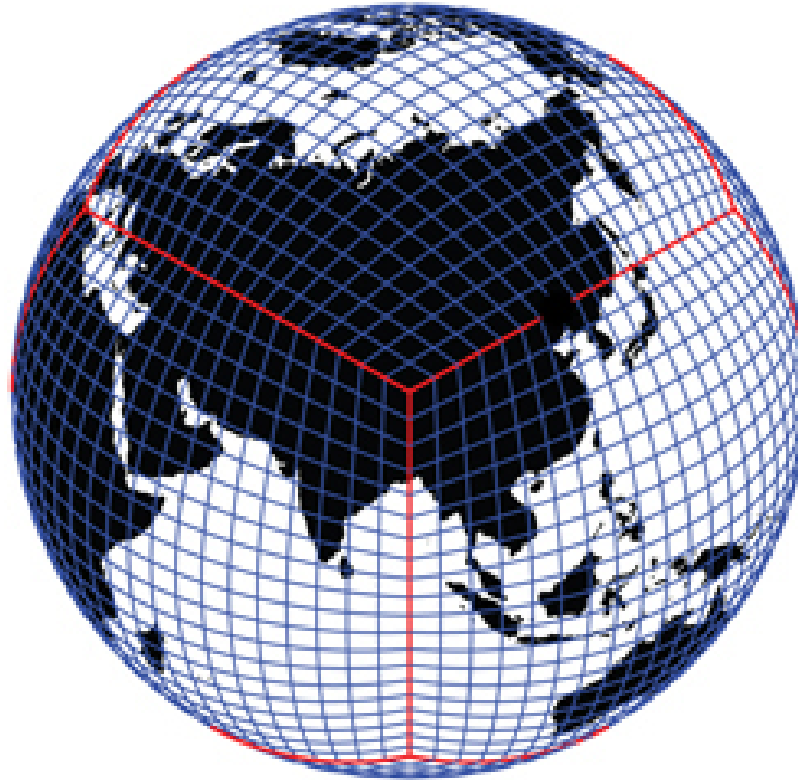
- Text labels
- GfsGLabel
- OutputView (parallel also)
- Continuous isolines
- Line width
- X11 independent

Geophysical Fluid Dynamics

- Long-term goal: 3D Navier–Stokes oceanic/atmospheric model
- Orthogonal Curvilinear Coordinates
- High aspect ratio
- Coriolis + geostrophic balance
- Free surface

Orthogonal Curvilinear Coordinates

- Lon-lat and **cubed sphere metric**



- New Poisson solver **test cases** with cubed metric (Sébastien)
- Stretch metric (Sébastien)

- Works for scalar equations (Poisson, advection etc...) and Saint-Venant (almost)
- Should work for simple metrics in the general case
- Christoffel symbols for vector equations in the general case
- Symbolic metric

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Metric {
```

$$X = x * x * \cos(y)$$

$$Y = x * x * \sin(y)$$

$$Z = z$$

```
}
```

- Support in GfsView to do

Solvers for anisotropic/stiff Poisson problems

- Geometric multigrid difficult to extend to anisotropic problems
- Hypre module (AMG) works well for large aspect ratios
- More testing required
- Need to be extended for Helmholtz (diffusion) equation
- Switch to Hypre also for the default solver?
- Use precomputed stencils also for geometric multigrid

Free surfaces and interfaces

- Be able to do what I could do 10 years ago! (free surfaces)
- VOF and/or markers?
- Free surfaces for geophysical applications
- Contact lines
- Surfactants and Marangoni effect

Optimisation

- Parallel performance (and debugging)
- Quadtree performance versus Cartesian
- Load-balancing and number of boxes

New solvers?

- Compressible gas dynamics
- Magnetohydrodynamics
- Dispersed phases
- Acoustics

Gerris and education

- Fluid physics book with Gerris experiments
- Gerris as a tool for Master's level fluid mechanics workshops
- Gerris tutorials (e.g. PUF course in Florida)
- Graphical User Interface?

How can we do all this?

- We need more developers!
- Funding?
- Is Gerris too hard to get into?
- Improved documentation