PDE Software has changed from the 1990s to 2005

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- If they program, they often prefer Matlab
- The problems get more complex:
  multi–physics/domain/scale/institutional/code
- More high-quality/mature software libraries exist
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- Legacy codes are here to stay – could we integrate them in new systems as black boxes?
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- Software tools must be *programmable* at all levels
- Users can program with a Matlab-like syntax (Python)
- Problem solving environment = set of Python modules
- "Standard operations" are performed by "standard libraries": LAPACK, PETSc, Trilinos, ML, Hypre, Vtk, ...
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Example on connecting single-PDE components

Build turbulent flow solvers from PDE components

- Basic idea: solve PDE systems by operator splitting
- Can also split an implicit formulation by block preconditioning
- Navier-Stokes solver: Stokes solver, advection solver
- k-ϵ model: N-S solver, convection-diffusion-reaction solvers
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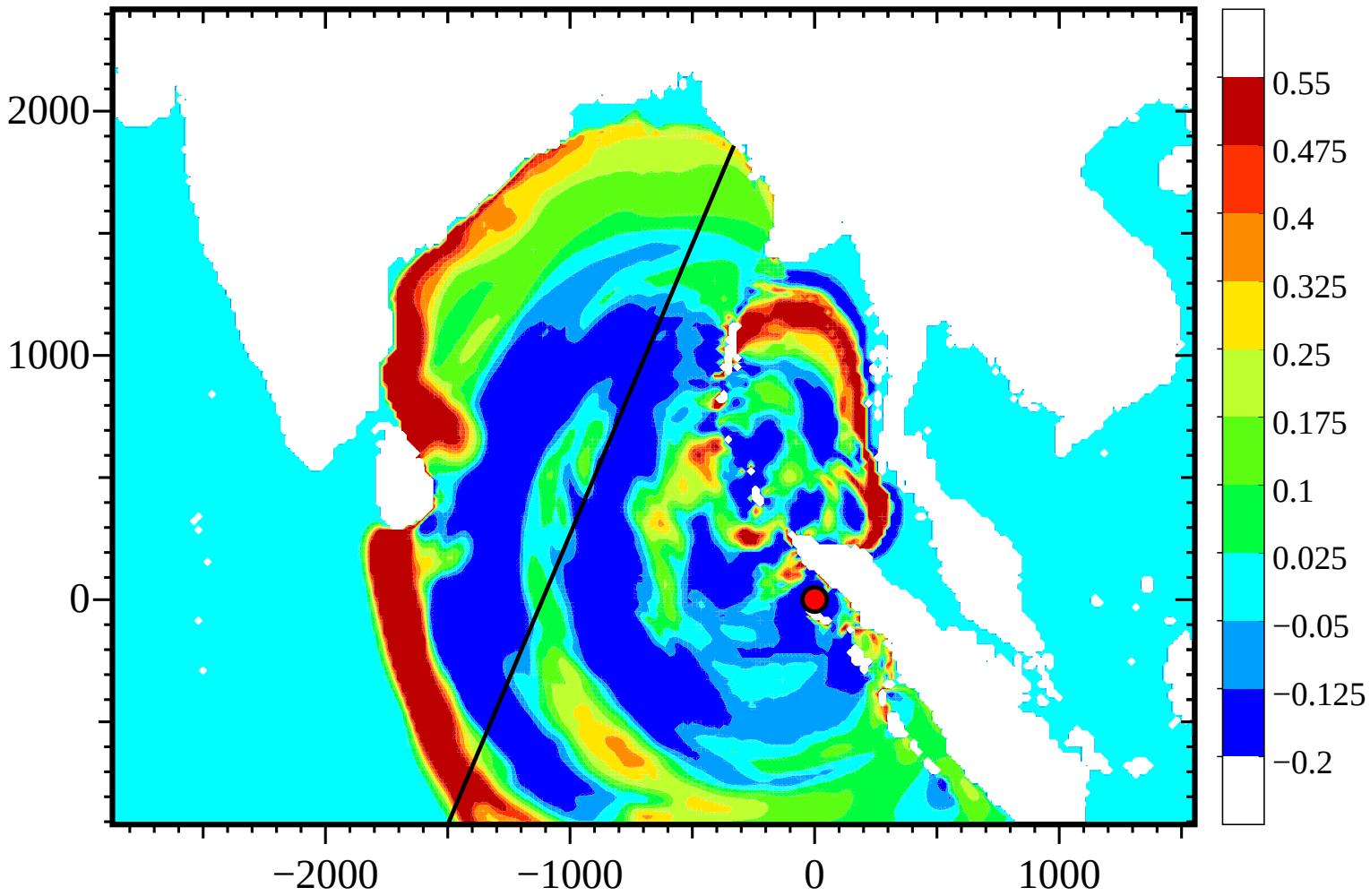
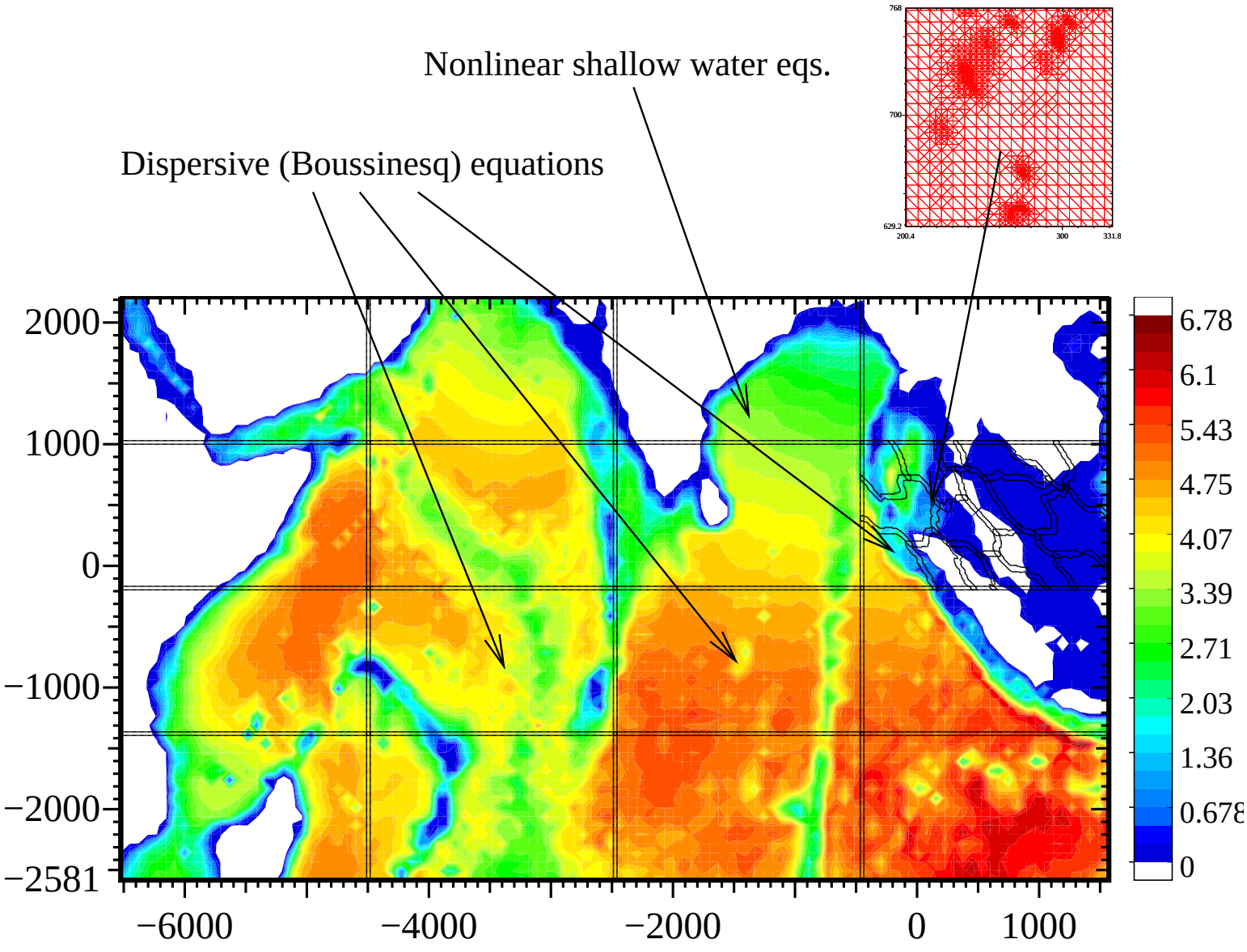
Example: tsunami simulation (the Dec 26, 2004 event)



Multi-physics/domain/code via domain decomposition



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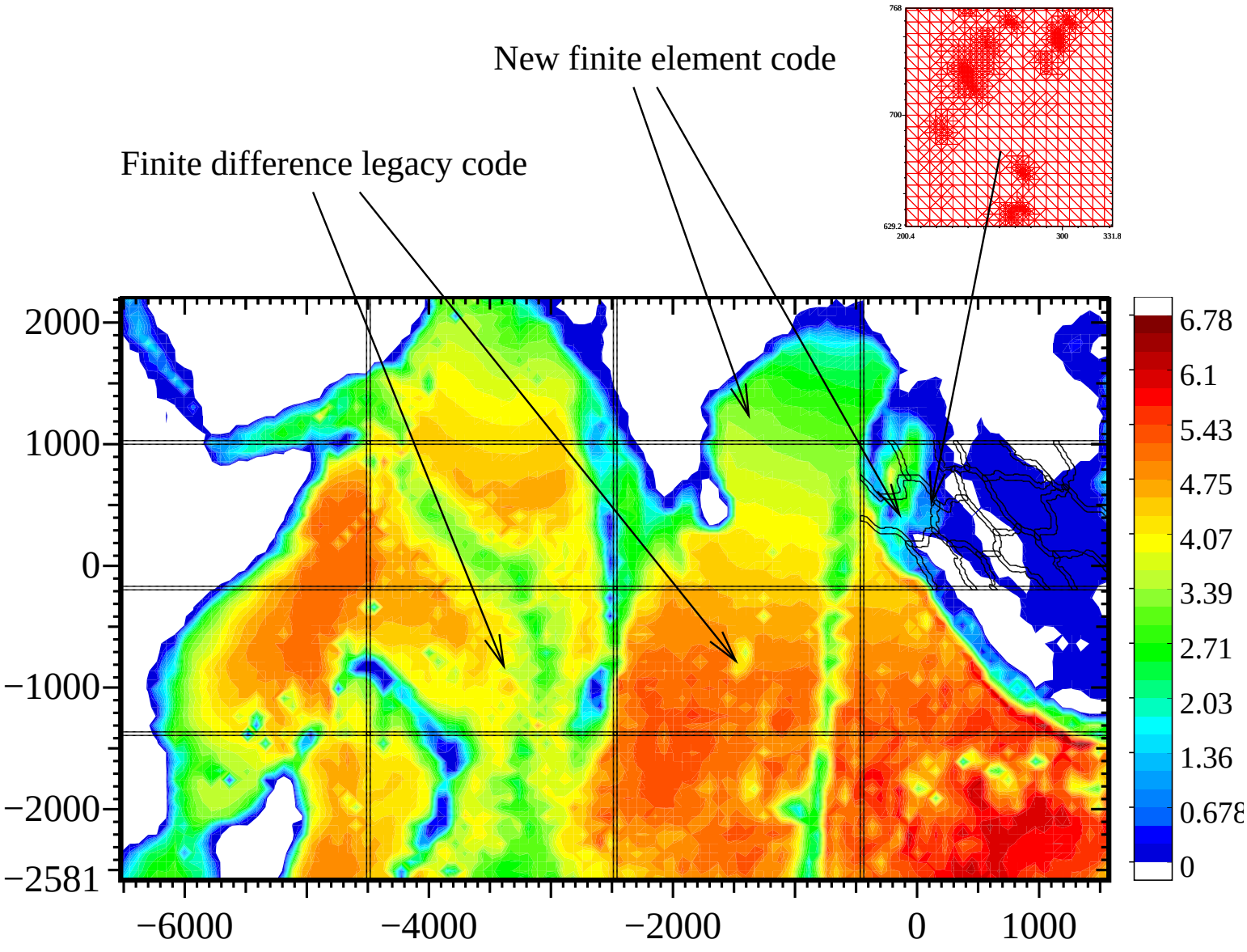

Summary: Simula $\leftrightarrow$ FEniCS

- We see FEniCS as a good place to publish software
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