

FNRS

FRIA

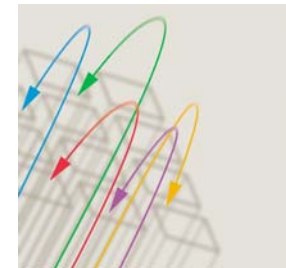
**The Second-generation,
Louvain-la-Neuve, Ice-ocean Model
(SLIM)**

*<http://www.climate.be/SLIM>
<http://www.climate.be/TIMOTHY>*



COMMUNAUTÉ
FRANÇAISE
DE BELGIQUE

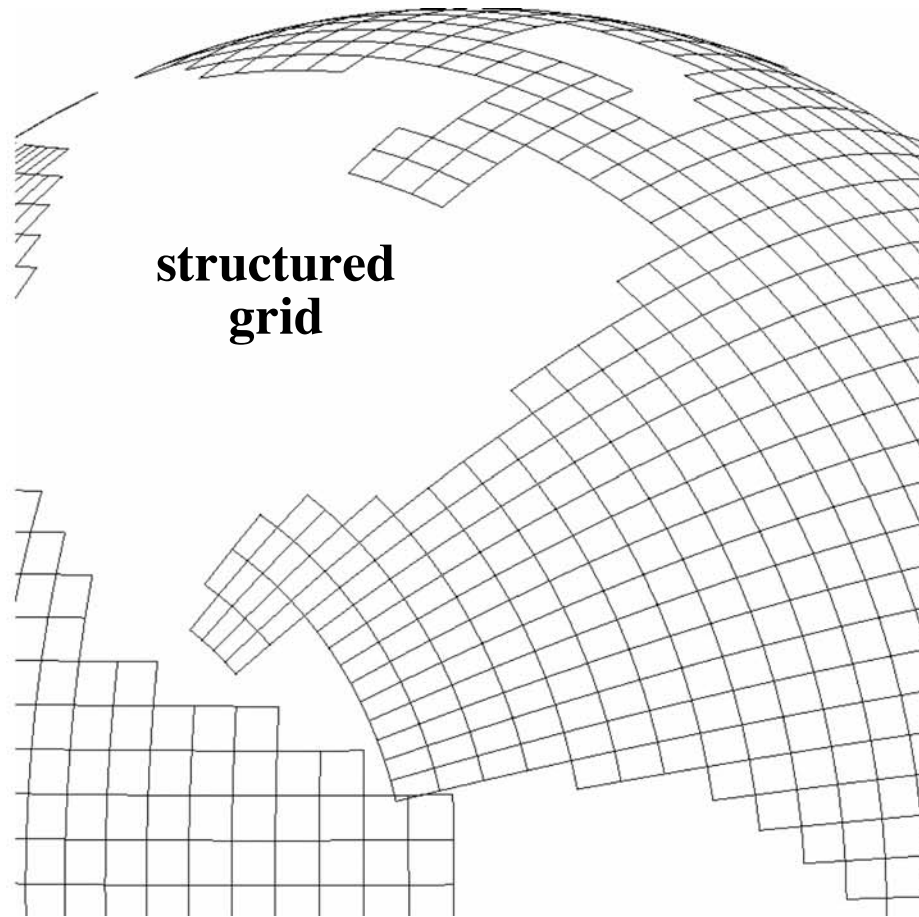
BELGIAN SCIENCE POLICY



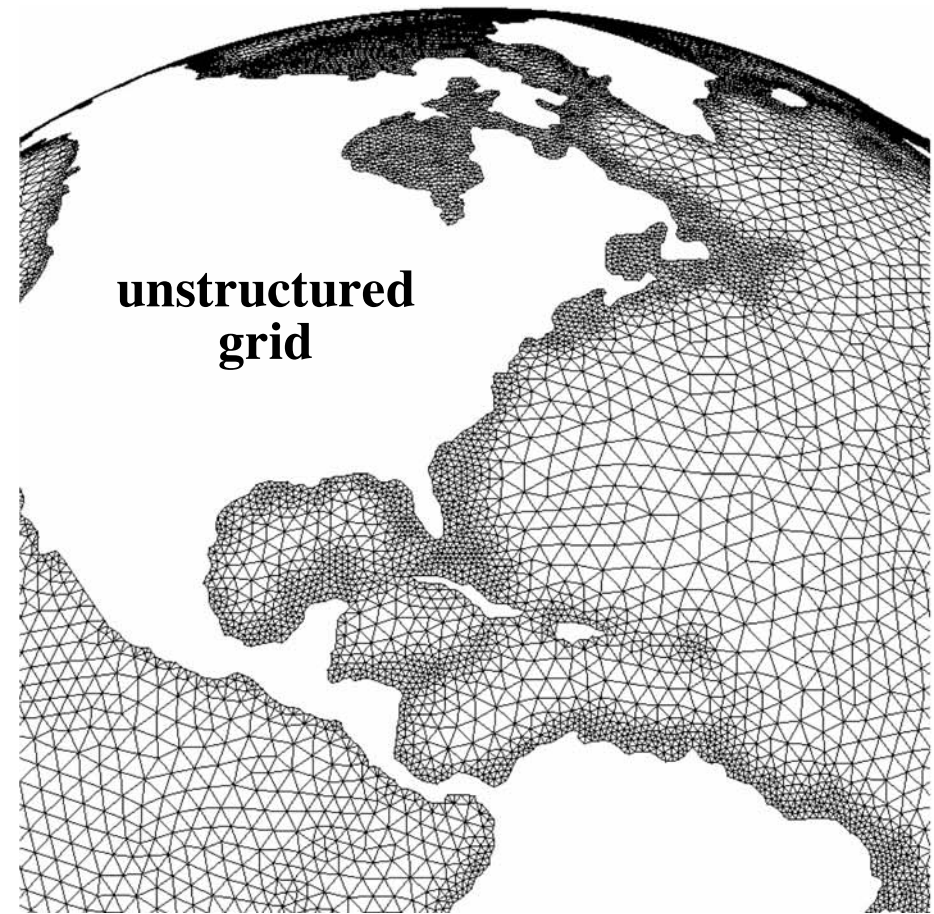
ÉCOLE
POLYTECHNIQUE
DE LOUVAIN



Structured vs unstructured grids



first generation



second generation

Structured grids

Advantages

- Finite-difference methods are easy to implement.
- Programming is easy.
- Well known in the realm of oceanography/meteorology.

Disadvantages

- Representation of the coastlines (staircase-like).
- Difficult to enhance resolution (even with curvilinear coordinates or embedded grid systems).
- Singularity of the pole(s) in global models.

Unstructured grids

Disadvantages

- Numerical methods are uneasy to implement.
- Programming is uneasy.
- Not well known in the realm of oceanography/meteorology.

Advantages

- Representation of the coastlines.
- Easy to enhance resolution (including adaptive strategies).
- No singular points in global models.

=> movie0

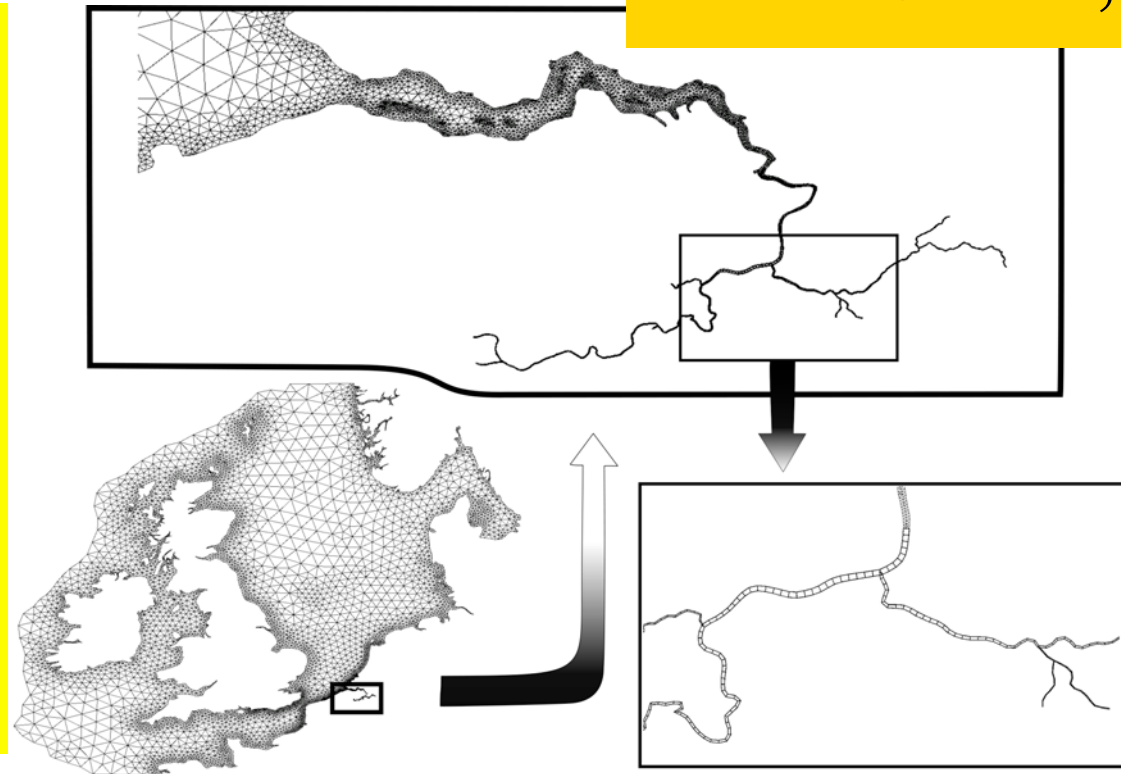
Multi-scale modelling

The main advantage of unstructured meshes probably is that multi-scale modelling is rendered easier. Example: the Scheldt River, Estuary and ROFI.

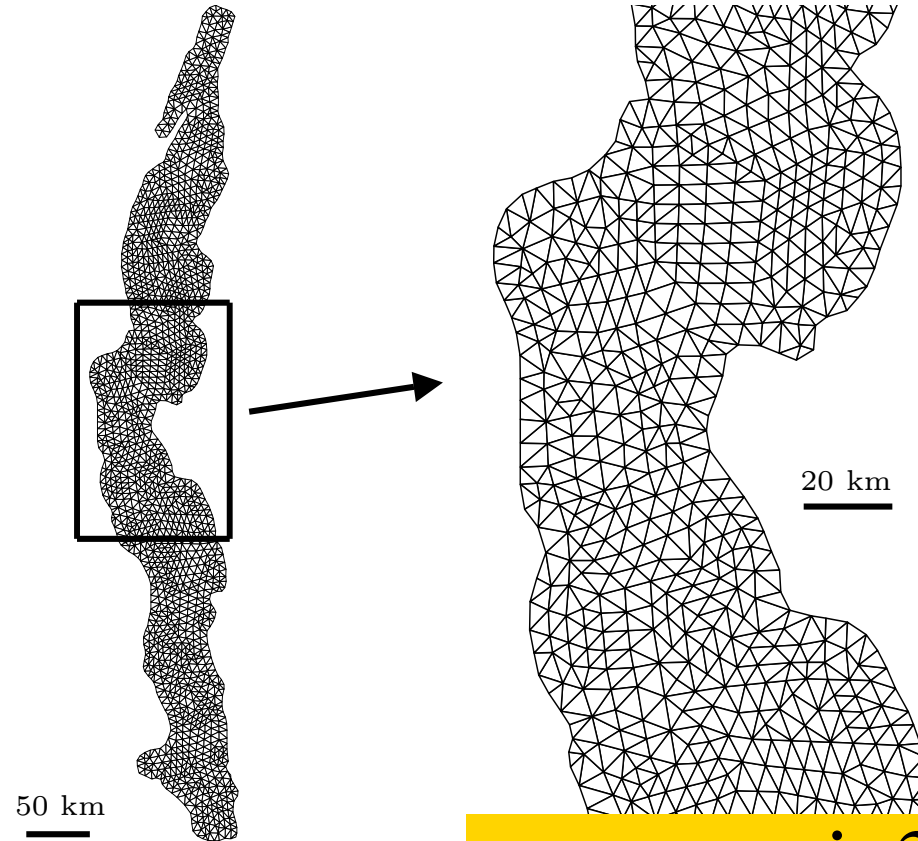
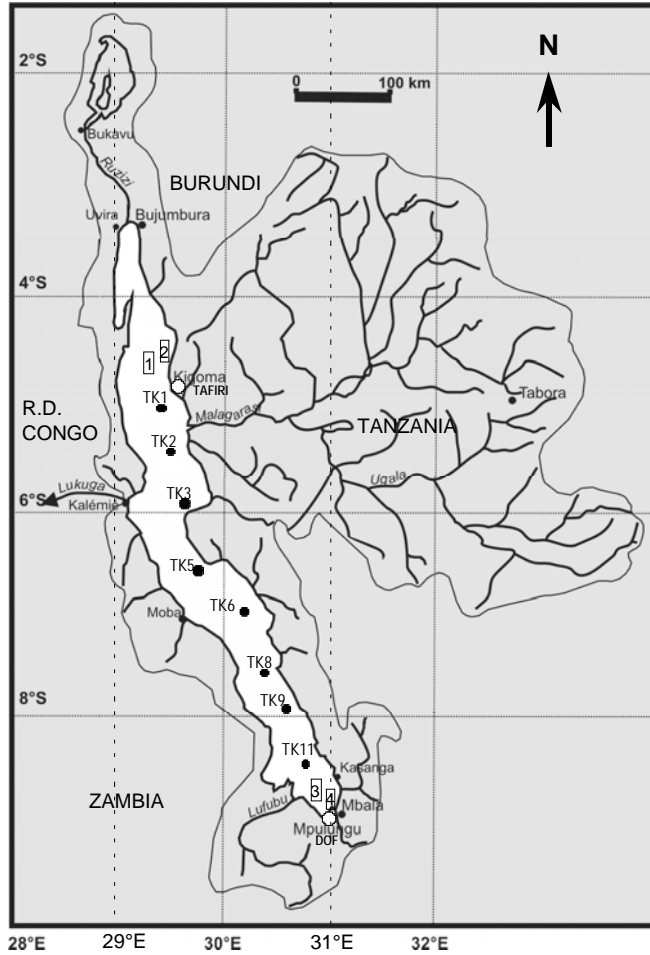
=> movie1,2

A hot topic:

- Special issue in *Ocean Dynamics* (December 2008)
- Workshop in Reading, UK, in March 2009
- Workshop in Louvain-la-Neuve in September 2009 (www.uclouvain.be/umm2009)

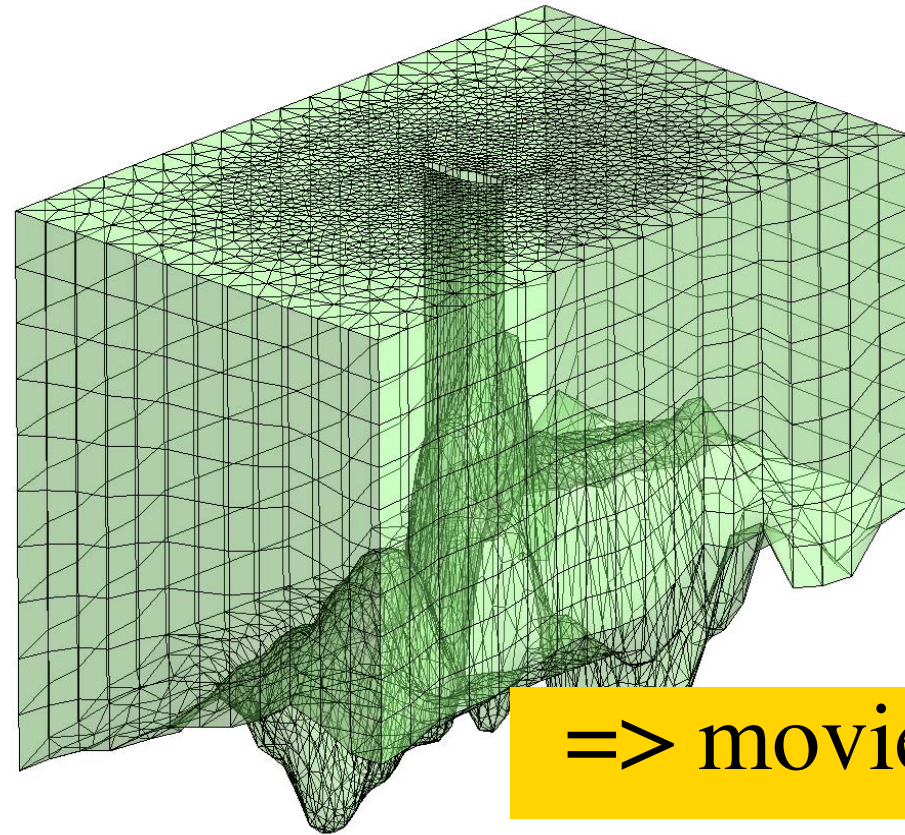
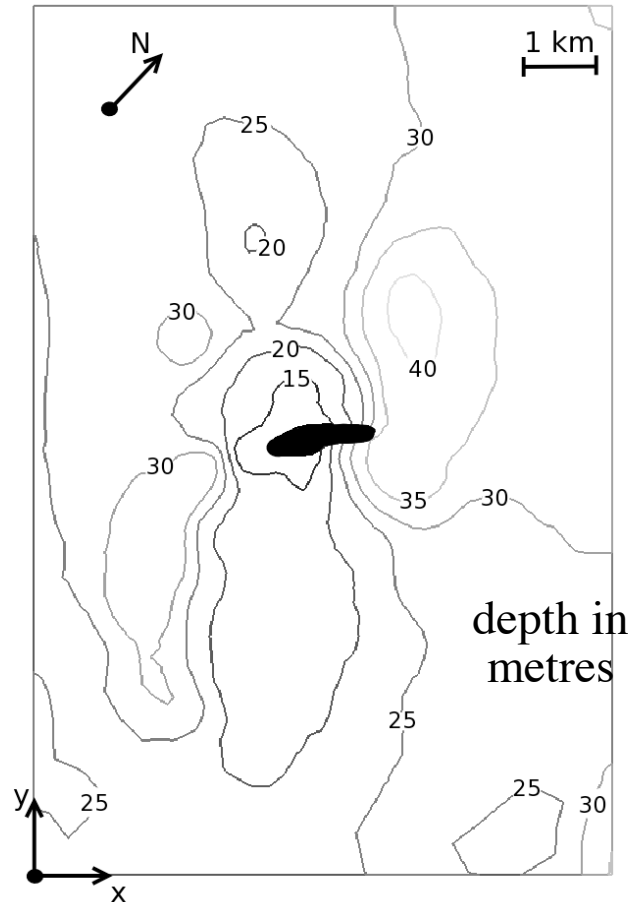


Renewal of Lake Tanganyika's mixed-layer water

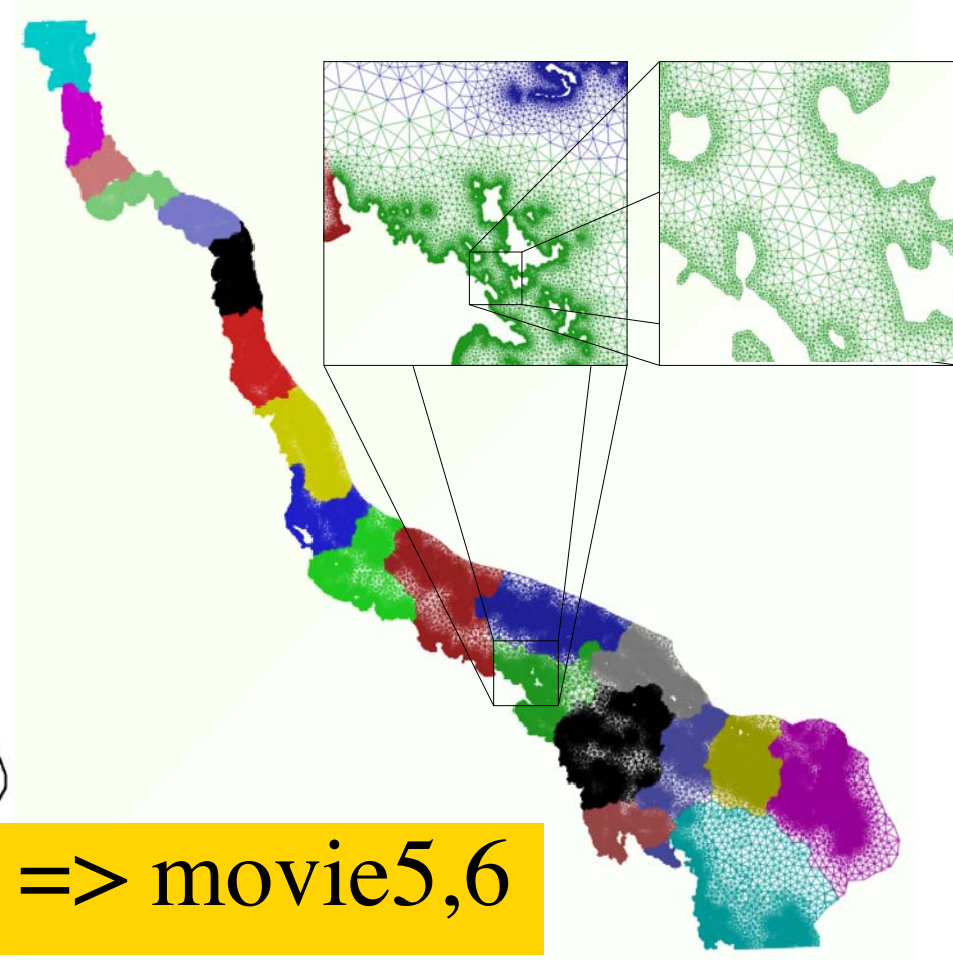
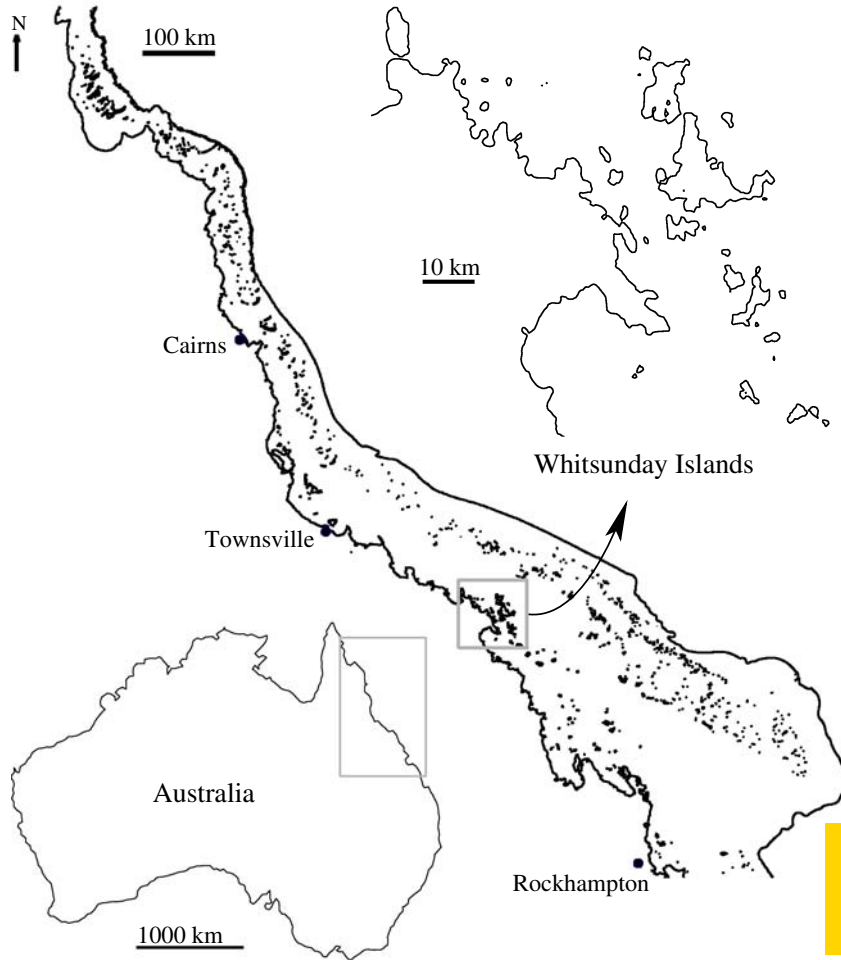


=> movie3

Rattray Island eddies and associated upwelling

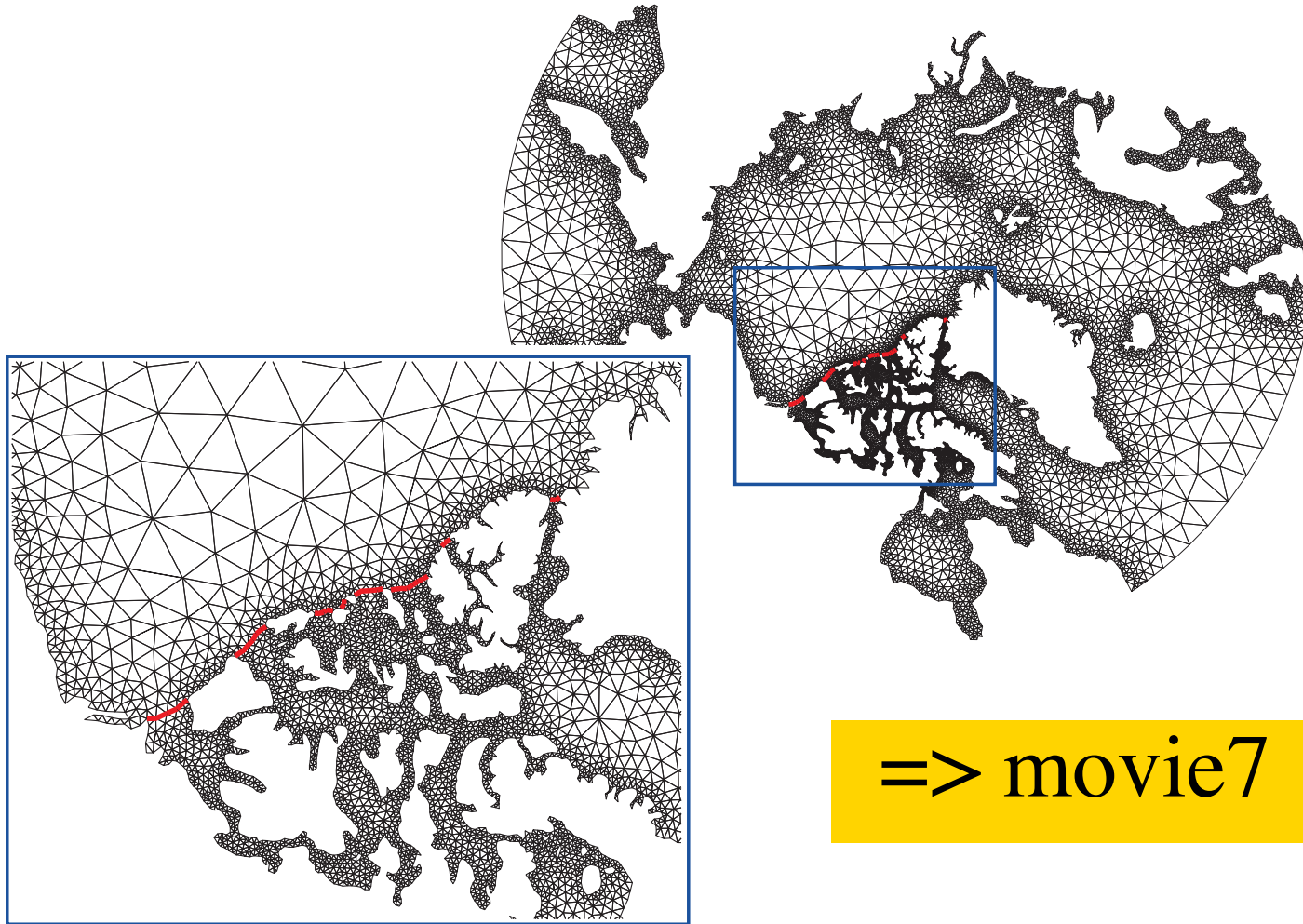


The Great Barrier Reef, Australia



=> movie5,6

Sea ice in the Arctic



There is more in SLIM than just Colourful Fluid Dynamics*.

**There is also the hard work of the team,
leading to a bunch of scientific publications
and
promising scientific career debuts...**

(*: the widely-accepted meaning of CFD is *Computational Fluid Dynamics*)

Second-generation Louvain-la-Neuve Ice-ocean Model (SLIM)

Peer-reviewed publications

- Legrand S., V. Legat and E. Deleersnijder, 2000, Delaunay mesh generation for an unstructured-grid ocean general circulation model, *Ocean Modelling*, 2, 17-28 ([Article](#))
- Hanert E., V. Legat and E. Deleersnijder, 2002, A comparison of three finite elements to solve the linear shallow water equations, *Ocean Modelling*, 5, 17-35 ([Article](#))
- Hanert E., D.Y. Le Roux, V. Legat and E. Deleersnijder, 2004, Advection schemes for unstructured grid ocean modelling, *Ocean Modelling*, 7, 39-58 ([Article](#))
- Pietrzak J., E. Deleersnijder and J. Schroeter (Editors), 2005, The Second International Workshop on Unstructured Mesh Numerical Modelling of Coastal, Shelf and Ocean Flows (Delft, The Netherlands, September 23-25, 2003), *Ocean Modelling* (special issue), 10, 1-252 (Preface pp. 1-3) ([Article](#))
- Le Roux D.Y., Sène A., V. Rostand and E. Hanert, 2005, On some spurious modes issues in shallow water models using a linear algebra approach, *Ocean Modelling*, 10, 83-94 ([Article](#))
- Hanert E., D.Y. Le Roux, V. Legat and E. Deleersnijder, 2005, An efficient Eulerian finite element for the shallow water equations, *Ocean Modelling*, 10, 115-136 ([Article](#))
- Vancoppenolle M., T. Fichefet and C.M. Bitz, 2005, On the sensitivity of undeformed Arctic sea ice to its vertical salinity profile, *Geophysical Research Letters*, 32, L16502, doi: 10.1029/2005GL023427 ([Article](#))
- Burchard H., E. Deleersnijder and A. Meister, 2005, Application of modified Patankar schemes to stiff biogeochemical models for the water column, *Ocean Dynamics*, 55, 326-337
- Hanert E., E. Deleersnijder and V. Legat, 2006, An adaptive finite element water column model using the Mellor-Yamada level 2.5 turbulence closure scheme, *Ocean Modelling*, 12, 205-223
- White L., J.-M. Beckers, E. Deleersnijder and V. Legat, 2006, Comparison of free-surface and rigid-lid finite element models of barotropic instabilities, *Ocean Dynamics*, 56, 86-103
- Hanert E. and V. Legat, 2006, How to save a bad element with weak boundary conditions, *Computers & Fluids*, 35, 477-484
- Legrand S., E. Deleersnijder, E. Hanert, V. Legat and E. Wolanski, 2006, High-resolution, unstructured meshes for hydrodynamic models of the Great Barrier Reef, Australia, *Estuarine, Coastal and Shelf Science*, 68, 36-46
- White L., V. Legat, E. Deleersnijder and D. Le Roux, 2006, A one-dimensional benchmark for the propagation of Poincaré waves, *Ocean Modelling*, 15, 101-123
- Vancoppenolle M., T. Fichefet and C.M. Bitz, 2006, Modeling the salinity profile of undeformed Arctic sea ice, *Geophysical Research Letters*, 33, L21501, doi: 10.1029/2006GL028342
- Bernard P.-E., N. Chevaugnon, V. Legat, E. Deleersnijder and J.-F. Remacle, 2007, High-order h-adaptive discontinuous Galerkin methods for ocean modeling, *Ocean Dynamics*, 57, 109-121 (+ Erratum, 2007, 57, 579-580)
- Hanert E., E. Deleersnijder, S. Blaise and J.-F. Remacle, 2007, Capturing the oceanic bottom boundary layer in finite element ocean models, *Ocean Modelling*, 17, 153-162
- Delhez E.J.M. and E. Deleersnijder, 2007, Overshootings and spurious oscillations caused by biharmonic mixing, *Ocean Modelling*, 17, 183-198
- Vancoppenolle M., C.M. Bitz and T. Fichefet, 2007, Summer landfast sea ice desalination at Point Barrow, Alaska: Modeling and observations, *Journal of Geophysical Research*, 112(C4), C04022, doi: 10.1029/2006JC003493
- Legrand S., E. Deleersnijder, E.J.M. Delhez and V. Legat, 2007, Unstructured, anisotropic mesh generation for the Northwestern European continental shelf, the continental slope and the neighbouring ocean, *Continental Shelf Research*, 27, 1344-1356
- Spivakovskaya D., A.W. Heemink and E. Deleersnijder, 2007, Lagrangian modelling of multi-dimensional advection-diffusion with space-varying diffusivities: theory and idealized test cases, *Ocean Dynamics*, 57, 189-203
- Gourgue O., E. Deleersnijder and L. White, 2007, Toward a generic method for studying water renewal, with application to the epilimnion of Lake Tanganyika, *Estuarine, Coastal and Shelf Science*, 74, 628-640
- White L. and E. Deleersnijder, 2007, Diagnoses of vertical transport in a three-dimensional finite-element model of the tidal circulation around an island, *Estuarine, Coastal and Shelf Science*, 74, 655-669
- Blaise S., E. Deleersnijder, L. White and J.-F. Remacle, 2007, Influence of the turbulence closure scheme on the finite-element simulation of the upwelling in the wake of a shallow-water island, *Continental Shelf Research*, 27, 2329-2345
- Bernard P.-E., E. Deleersnijder, V. Legat and J.-F. Remacle, 2008, Dispersion analysis of discontinuous Galerkin schemes applied to Poincaré, Kelvin and Rossby waves, *Journal of Scientific Computing*, 34, 26-47
- White L., V. Legat and E. Deleersnijder, 2008, Tracer conservation for three-dimensional, finite-element, free-surface, ocean modeling on moving prismatic meshes, *Monthly Weather Review*, 136, 420-442
- White L. and E. Wolanski, 2008, Flow separation and vertical motions in a tidal flow interacting with a shallow-water island, *Estuarine, Coastal and Shelf Science*, 77, 457-466
- White L., E. Deleersnijder and V. Legat, 2008, A three-dimensional unstructured mesh finite element shallow-water model, with application to the flows around an island and in a wind-driven, elongated basin, *Ocean Modelling*, 22, 26-47
- Lambrechts J., E. Hanert, E. Deleersnijder, P.-E. Bernard, V. Legat, J.-F. Remacle and E. Wolanski, 2008, A multi-scale model of the hydrodynamics of the whole Great Barrier Reef, *Estuarine, Coastal and Shelf Science*, 79, 143-151
- Lietaer O., T. Fichefet and V. Legat, 2008, The effects of resolving the Canadian Arctic Archipelago in a finite element sea ice model, *Ocean Modelling*, 24, 140-152
- Blaise S. and E. Deleersnijder, 2008, Improving the parameterisation of horizontal density gradient in one-dimensional water column models for estuarine circulation, *Ocean Science*, 4, 239-246
- Deleersnijder E. and P.F.J. Lermusiaux (Editors), 2008, *Multi-scale Modeling: Nested-Grid and Unstructured-*

Home
People
Project
Results
Benchmarks
Publications
Events
Jobs
FAQs
Links
Files

User: Password:

Mesh Approaches, in: *Ocean Dynamics* (special issue), 58, 335-498

- Lambrechts J., R. Comblen, V. Legat, C. Geuzaine and J.-F. Remacle, 2008, Multiscale mesh generation on the sphere, *Ocean Dynamics*, 58, 461-473
- Comblen R., S. Legrand, E. Deleersnijder and V. Legat, A finite element method for solving the shallow water equations on the sphere, *Ocean Modelling* (accepted for publication)
- Bernard P.-E., J.-F. Remacle and V. Legat, Modal analysis on unstructured meshes of the dispersion properties of the P1NC-P1 pair, *Ocean Modelling* (accepted for publication)
- Bernard P.-E., J.-F. Remacle and V. Legat, Boundary discretization for high order discontinuous Galerkin computations of tidal flows around shallow water islands, *International Journal for Numerical Methods in Fluids* (accepted for publication)
- Munday P., J. Leis, J. Lough, C. Paris, M. Kingsford, M. Berumen and J. Lambrechts, Climate change and coral reef connectivity, *Coral Reefs* (accepted for publication)
- Vancoppenolle M., T. Fichefet, H. Goosse, S. Bouillon, G. Madec and M.A. Morales Maqueda, Simulating the mass balance and salinity of Arctic and Antarctic sea ice. 1. Model description and validation, *Ocean Modelling* (submitted)
- Vancoppenolle M., T. Fichefet and H. Goosse, Simulating the mass balance and salinity of Arctic and Antarctic sea ice. 2. Sensitivity to salinity processes, *Ocean Modelling* (submitted)
- Kärnä T., E. Deleersnijder and A. de Brauwere, Simple test cases for validating a finite element unstructured grid fecal bacteria transport model, *Applied Mathematical Modelling* (submitted)
- de Brauwere A., F. De Ridder, O. Gourgue, J. Lambrechts, R. Comblen, R. Pintelon, J. Passerat, P. Servais, M. Elskens, W. Baeyens, T. Kärnä, B. de Brye and E. Deleersnijder, Design of a sampling strategy to optimally calibrate a reactive transport model: exploring the potential for *Escherichia coli* in the Scheldt Estuary, *Environmental Modelling & Software* (submitted)
- Comblen R., J. Lambrechts, J.-F. Remacle and V. Legat, Comparison of finite element pairs for the shallow water equations, *International Journal for Numerical Methods in Fluids* (submitted)

This document was last modified at 2008-12-13 19:18:08