3D coastal modelling with MARS-AGRIF: an example from the GIRAC project

Nicolas Pérenne (Hocer SAS)
Franck Dumas (Ifremer/Dyneco/Physed)
Laurent Debreu (INRIA)
Mars-Agrif for Girac

- background: the Girac project
- Adaptive Grid Refinement in Fortran
- example: beaches near Brest
Bathing water quality

- European directive 2006/7/CE
- long-term goal: reduce bacterial loading of coastal waters
- decision making tools:
  - close the beach before a (short-term) pollution event occurs
  - avoid de-classification
The GIRAC project (1/2)

- aims at providing an operational system for the monitoring and prediction of bathing water quality
- model coupling: (i) urban hydraulics, (ii) rural watersheds, (iii) coastal ocean
The GIRAC project (2/2)

- partners:
  - governmental agencies: Ifremer, MétéoFrance
  - private companies: Veolia, Nke, Hocer

- locations:
  - PACA: Antibes, Toulon
  - Bretagne: Brest, Saint-Malo
The Brest location
Methodology

- highest resolution on the areas of interest (the beaches)
  - near-field effects included
- far-field outlets in the “coarse” domain
  - the pollutant plumes exhibit a weaker spatial variability in the far-field
Nesting tactics for the Brest location
Mars-Agrif for Girac

- background: the Girac project
- Adaptive Grid Refinement in Fortran
- example: beaches near Brest
What is Agrif

- Adaptive Grid Refinement in Fortran
  - space and time
  - fixed or moving grids
- Supports staggered grid.
- No need to program your (Fortran) model in a special way.
- [http://www-lmc.imag.fr/MOISE/AGRIF/](http://www-lmc.imag.fr/MOISE/AGRIF/)
AMR method

- Run the same code over a grid hierarchy
- Inter-grid exchanges (two-way coupling):
  - interpolation (from coarse to fine grid)
  - update (from fine to coarse)
Spatial and temporal integration

- parent grid integrated before its children => provide them with boundary conditions (spatial and temporal interpolations)
- children update their parent on the overlapping areas (spatial averaging)
Mars-Agrif
Mars-Agrif for Girac

- background: the Girac project
- Adaptive Grid Refinement in Fortran
- example: beaches near Brest
Gridding tools
“Outward” influence (Moulin Blanc)
“Inward” impact
(Sainte-Anne du Portzic)
Conclusions

- The Mars + Agrif combination is well fit for coastal (water quality) studies:
  - far-field and “tidal come-back” effects on high-resolution grid at a reasonable computational cost
  - “numerical focus” on areas of interest is easy to set up
- However, special attention should be paid to bathymetry consistency between coarse and fine grids (need to preserve both cell volumes and flux sections).