

Modelação hidrodinâmica

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sumário

- ▶ introdução
- ▶ aplicações
- ▶ formulação matemática
- ▶ *software*
- ▶ gpu – quais as potencialidades?

introdução

hidrodinâmica

introdução



introdução

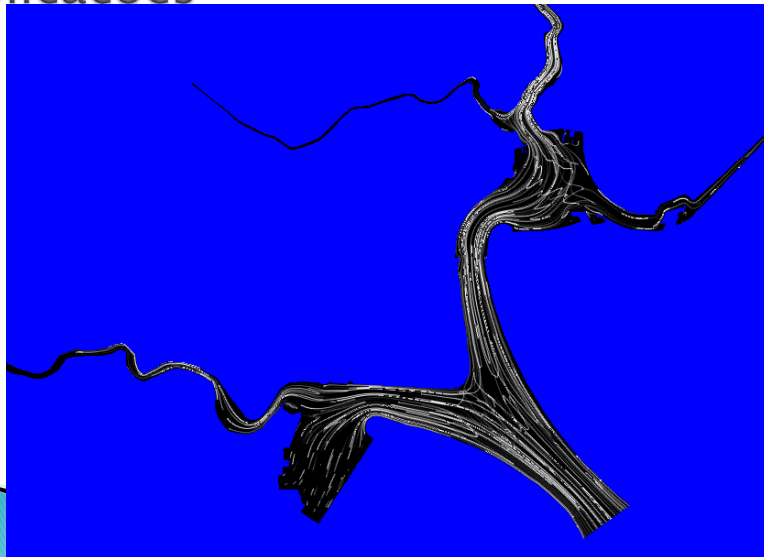


aplicações



Marina Bay
Singapura

aplicações



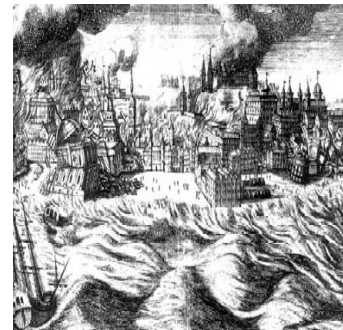
aplicações



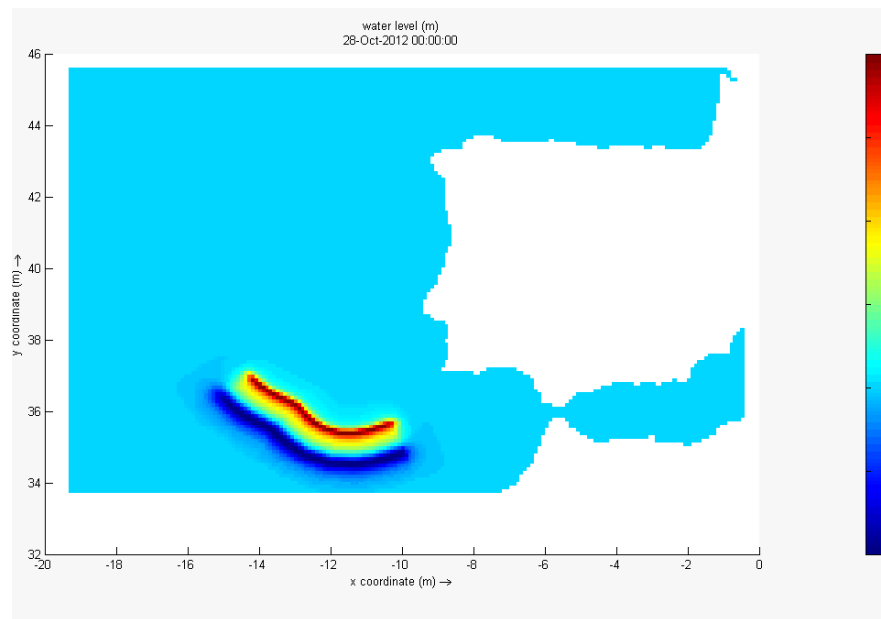
Estuário do rio Lima



aplicações

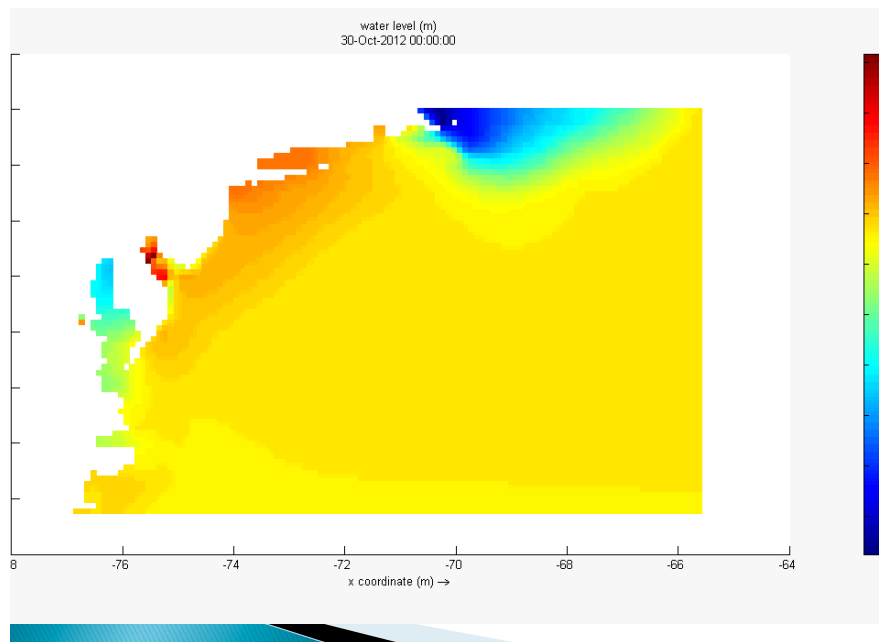


Terramoto seguido de tsunami
Lisboa, 1755



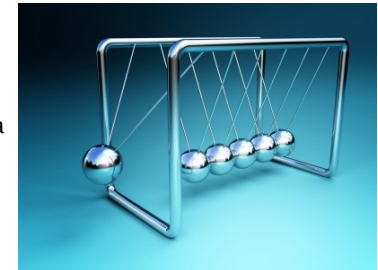
aplicações





formulação matemática

- 1 – conservação de massa
- 2 – conservação de quantidade de movimento
- 3 – transporte de calor
- 4 – transporte de sal
- 5 – transporte de escalares turbulência
- 6 – transporte de escalares qualidade da água
- 7 – transporte de sedimentos



formulação matemática

CM
$$\frac{\partial \eta}{\partial t} + \frac{\partial [(h+\eta)U]}{\partial x} + \frac{\partial [(h+\eta)V]}{\partial y} = 0$$

CQM-XX
$$\begin{aligned} \frac{\partial U}{\partial t} + U \frac{\partial U}{\partial x} + V \frac{\partial U}{\partial y} = fV - g \frac{\partial \eta}{\partial x} - \frac{g}{\rho} \frac{\partial \rho}{\partial x} \frac{h+\eta}{2} + \\ + \frac{\rho_a k W_v^2 \cos \varphi}{h+\eta} - \frac{g n^2 U \sqrt{U^2 + V^2}}{(h+\eta)^{4/3}} + \frac{\varepsilon}{\rho} \left(\frac{\partial^2 U}{\partial x^2} + \frac{\partial^2 U}{\partial y^2} \right) \end{aligned}$$

CQM-YY
$$\begin{aligned} \frac{\partial V}{\partial t} + U \frac{\partial V}{\partial x} + V \frac{\partial V}{\partial y} = -fU - g \frac{\partial \eta}{\partial y} - \frac{g}{\rho} \frac{\partial \rho}{\partial y} \frac{h+\eta}{2} + \\ + \frac{\rho_a k W_v^2 \sin \varphi}{h+\eta} - \frac{g n^2 V \sqrt{U^2 + V^2}}{(h+\eta)^{4/3}} + \frac{\varepsilon}{\rho} \left(\frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} \right) \end{aligned}$$

TM
$$\frac{dc}{dt} + U \frac{dc}{dx} + V \frac{dc}{dy} - \frac{d}{dx} D_x \frac{dc}{dx} - \frac{d}{dy} D_y \frac{dc}{dy} - \sigma + R(c) = 0$$

formulação matemática

CM
$$\frac{\partial \eta}{\partial t} + \frac{\partial}{\partial x} (uD) + \frac{\partial}{\partial y} (vD) + \frac{\partial w}{\partial \sigma} = 0$$

CQM-XX
$$\frac{\partial}{\partial t} (uD) + \frac{\partial (uuD)}{\partial x} + \frac{\partial (vuD)}{\partial y} + \frac{\partial}{\partial \sigma} (wu) - f_v D = -DP_1 + \frac{\partial}{\partial \sigma} \left(\frac{K_M}{D} \frac{\partial u}{\partial \sigma} \right) + DF_1$$

CQM-YY
$$\frac{\partial}{\partial t} (vD) + \frac{\partial (uvD)}{\partial x} + \frac{\partial (vvD)}{\partial y} + \frac{\partial}{\partial \sigma} (wv) + f_u D = -DP_2 + \frac{\partial}{\partial \sigma} \left(\frac{K_M}{D} \frac{\partial v}{\partial \sigma} \right) + DF_2$$

T Calor
$$\frac{\partial}{\partial t} (\Theta D) + \frac{\partial (u\Theta D)}{\partial x} + \frac{\partial (v\Theta D)}{\partial y} + \frac{\partial}{\partial \sigma} (w\Theta) = \frac{\partial}{\partial \sigma} \left(\frac{K_\Theta}{D} \frac{\partial \Theta}{\partial \sigma} \right) + DF_\Theta$$

T Sal
$$\frac{\partial}{\partial t} (SD) + \frac{\partial (uSD)}{\partial x} + \frac{\partial (vSD)}{\partial y} + \frac{\partial}{\partial \sigma} (wS) = \frac{\partial}{\partial \sigma} \left(\frac{K_S}{D} \frac{\partial S}{\partial \sigma} \right) + DF_S$$

Modelo Turbulência - q²
$$\begin{aligned} \frac{\partial}{\partial t} (q^2 D) + \frac{\partial (uq^2 D)}{\partial x} + \frac{\partial (vq^2 D)}{\partial y} + \frac{\partial}{\partial \sigma} (wq^2) = \frac{\partial}{\partial \sigma} \left(\frac{K_\varepsilon}{D} \frac{\partial q^2}{\partial \sigma} \right) + \frac{2K_M}{D} \left[\left(\frac{\partial u}{\partial \sigma} \right)^2 + \left(\frac{\partial v}{\partial \sigma} \right)^2 \right] + \\ + 2K_H \frac{g}{\rho} \frac{\partial^2 D}{\partial \sigma^2} - \frac{q^3 D}{B_1 l} + DF_q \end{aligned}$$

Modelo Turbulência - q^{2l}
$$\begin{aligned} \frac{\partial}{\partial t} (q^2 l D) + \frac{\partial (uq^2 l D)}{\partial x} + \frac{\partial (vq^2 l D)}{\partial y} + \frac{\partial}{\partial \sigma} (wq^2 l) = \frac{\partial}{\partial \sigma} \left(\frac{K_\varepsilon}{D} \frac{\partial q^2 l}{\partial \sigma} \right) + \\ + K_M E_1 \frac{l}{D} \left[\left(\frac{\partial u}{\partial \sigma} \right)^2 + \left(\frac{\partial v}{\partial \sigma} \right)^2 \right] + K_H E_3 l \frac{g}{\rho} \frac{\partial^2 D}{\partial \sigma^2} - \frac{q^3 D}{B_1} \left[1 + E_2 \left(\frac{l}{\kappa L} \right)^2 \right] + DF_l \end{aligned}$$

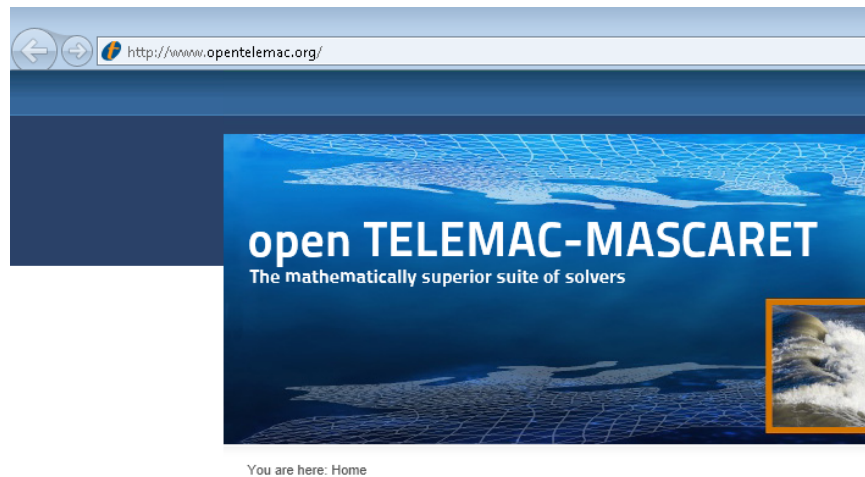
software

► Telemac

- Autores: Electricité de France; BundesAnstalt für Wasserbau (BAW, Germany) ; Centre d'Etudes Techniques Maritimes et Fluviales (CETMEF, France); aresbury Laboratory (United Kingdom); Electricité de France R&D (EDF, France); HR Wallingford (United Kingdom); Sogreah (now in Artelia group, France)
- Idade: 19 anos
- Linguagem: Fortran 95
- SO: Unix, Linux, Windows

software

► Telemac



Welcome to TELEMAC-MASCARET

TELEMAC-MASCARET is an integrated suite of solvers for use in the field of free-surf. context of many studies throughout the world, it has become one of the major standards

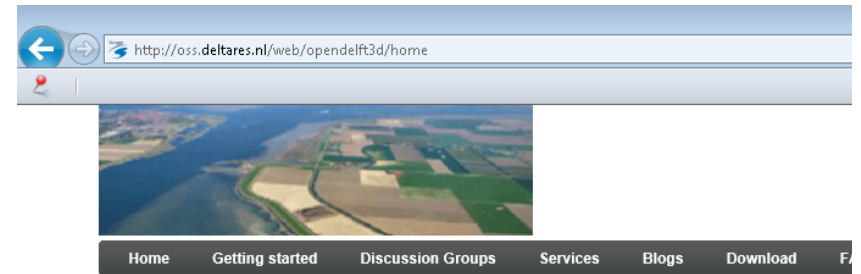
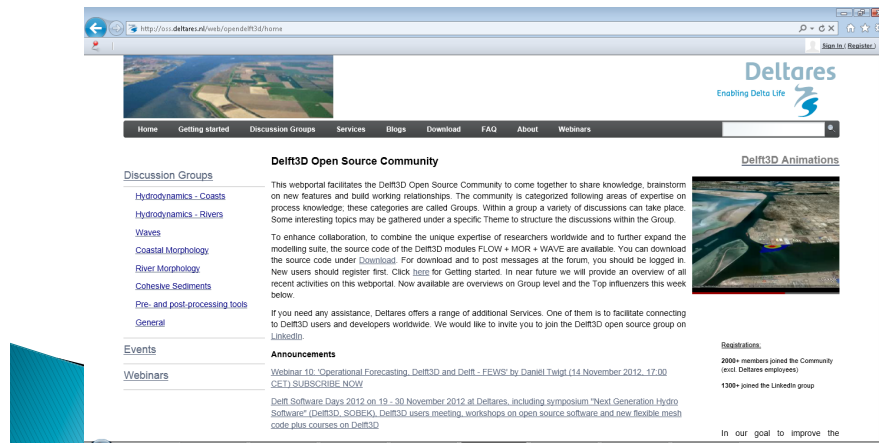
software

► Delft3d

- Autores: Deltares (Holanda)
- Idade: 30 anos
- Linguagem: Fortran 90
- SO: Unix, Linux, Windows

software

► Delft3d



Discussion Groups

[Hydrodynamics - Coasts](#)

[Hydrodynamics - Rivers](#)

[Waves](#)

[Coastal Morphology](#)

[River Morphology](#)

[Cohesive Sediments](#)

[Pre- and post-processing tools](#)

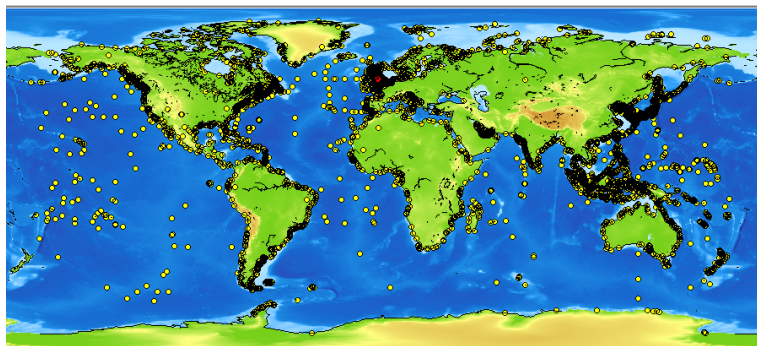
Delft3D Open Source Community

This webportal facilitates the Delft3D Open Source Community on new features and build working relationships. The community is categorized following areas of expertise on process knowledge; these categories are called Groups. Within a group a variety of discussions can take place. Some interesting topics may be gathered under a specific Theme to structure the discussions within the Group.

To enhance collaboration, to combine the unique expertise of researchers worldwide and to further expand the modelling suite, the source code of the Delft3D modules FLOW + MGR + WAVE are available. You can download the source code under [Download](#). For download and to post messages at the forum, you should be logged in. New users should register first. Click [here](#) for Getting started. In near future we will provide an overview of all recent activities on this webportal. Now available are overviews on Group level and the Top influencers this week below.

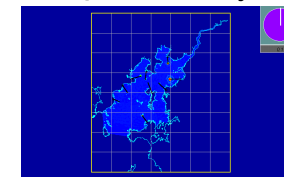
software

► Implementação de modelos

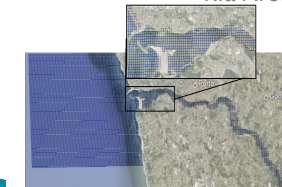


software

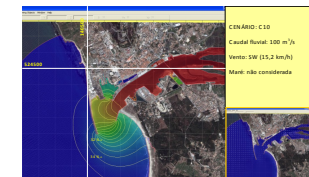
► Implementação de modelos



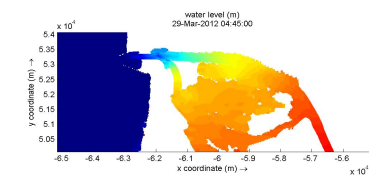
Ria Arosa



Estuário rio Douro



Estuário rio Lima



Estuário rio Mondego

software

- processamento paralelo

Delft3d

- Decomposição do domínio
- MPI

Telemac

software

- processamento paralelo

Telemac

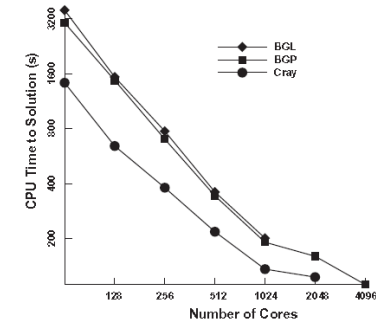


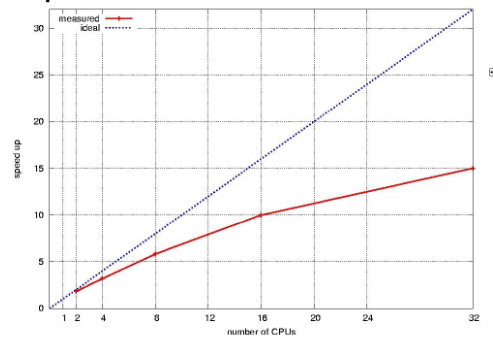
Fig. 2. TELEMAT 2D performance for a 2 million element mesh.

C. Moulinec et al. / Computers & Fluids 51 (2011) 30–34

software

- processamento paralelo

Delft3d

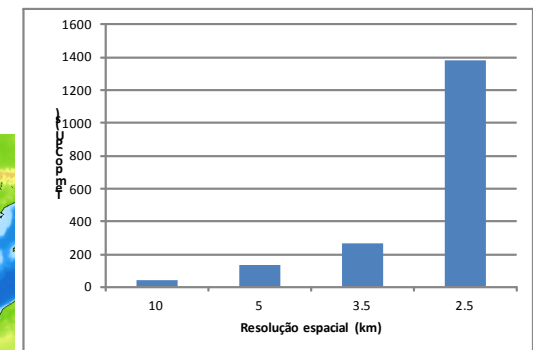
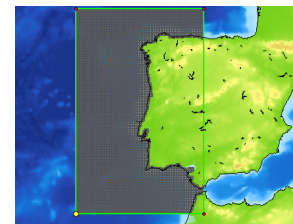


Jagers, B. / 4th PRACE International Seminar "HPC driving innovation in Europe" Bologna, 16–17 april 2012

software

- processamento

Delft3d



gpu – quais as potencialidades?



gpu – quais as potencialidades?

- ▶ previsões hidrodinâmicas
- ▶ sistemas de suporte à decisão:
 - conjuntos de simulações em condições de incerteza
 - problemas de otimização envolvendo estruturas hidráulicas

gpu – quais as potencialidades?

- ▶ Principais tarefas a desenvolver:
 - instalação do software (DEC+DI)
 - pesquisa e análise de trabalhos anteriores (DEC+DI)
 - dados de base para criação de modelos (DEC)
 - simulação de exemplos e avaliação de desempenho (DI)
 - redação de relatório/artigo com metodologias e resultados (DEC+DI)

Questões?