

MINISTÈRE DE LA DÉFENSE ET DES ANCIENS COMBATTANTS



Sea level modeling using HYCOM in the bay of Biscay : introduction of atmospheric pressure effects.

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Xynthia storm : February 28th, 2010



- How can we reproduce this type of event?
- « 1 week work » test
- Wind surge : Hycom run without tide
- Wave surge : Wavewatch III run + wave setup estimation
- Atmospheric pressure : inverse barometer estimation



Storm surge modeling



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Long term drift
No nonlinear effects tide-surge
No dynamical effects of atmospheric pressure surge





Revisit the barotropic open boundary conditions to remove any "long term" drift

implement the atmospheric pressure

Study the "inverse barometer paramaterization" biais during transitory phases (storm)

Get a tool to study the non-linear relationships between tide and surges



Sources of sea level variations



- ➤ Tides
- Barotropic large scale currents
- rivers

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- Steric effect
- Non conservative terms



Sources of sea level variations SHOM 2009 code



Tides : corrected every period
Barotropic large scale currents : corrected for each readed field
Rivers

Steric effect

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Non conservative terms

Sources of sea level variations SHOM 2011 code



- Tides
- Barotropic large scale currents
- rivers

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- Steric effect
- Non conservative terms

A unique correction for all terms
Computes the difference
between the modeled and
expected volume variations





Channel/Biscay configuration



 Low resolution (5.5 km)
A good configuration for tests
Tides, rivers, open boundaries



Mass splitting vs volume splitting





Tests of simulations including atm. pressure



- Low resolution (5.5 km)
- Tide, rivers, open boundaries
- Atm. forcing 0.5°/6 hours

Implementation of the atmospheric pressure

- Add the pressure gradient in barotp
- Add the inverse barometer in the expected volume variations

2011

Patm surge : SSH(run with

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Patm) – SSH(run without Patm)



Patm surge vs inverse barometer



Patm surge vs inverse barometer



Non linear interactions

Compare atm. Pressure surge in absence/presence of tides

Impact 1-6 cm



LOM 2011 – Atmospheric pressure effects

Sensitivity to resolution



Similar sensitivity to atmospheric pressure resolution?





Modification of open boundary conditions in order to "conserve" the volume

- Implementation of the atmospheric pressure
- Small differences with the "inverse barometer parameterization"
- But low resolution : higher differences expected with the high resolution configuration





Validation in the high resolution configuration (1.7km)

- Comparison with tide gauges
- Need to increase the temporal/spatial resolution of atmospheric forcings.
- Develop a case study to validate the implementation of tides and surges (open boundary conditions).
- Focus on some interesting events (storms).



