

## ECASA - Model description template

<b>1</b>	<b>Name of model</b>	<i>Reporter/Institute (email address)</i>
1.a	<b>Hydrodynamic model</b>	C. Bacher/IFREMER (cbacher@ifremer.fr)
1.b	<i>date this form was completed or updated</i>	5 September 2007

<b>2</b>	<b>Short DESCRIPTION of model</b>	
2.a	<i>Main state variables:</i>	Current velocity, water level, temperature, salinity.
2.b	<i>Scale to which applicable:</i>	Coastal sea, Bay, lagoon, estuaries – spatial resolution between 50 and 5000 m.
2.c	<i>General description.</i> <i>NB: if the model is complicated, or has easily distinguishable components (such as a physical and a biological sub-models) that can be, or have been, used separately, it may be easier to complete one form for each of the main components.</i>	The hydrodynamic model solves the three dimensional Reynolds-averaged Navier–Stokes equations with hydrostatic approximation and free surface boundary condition. Density evolution is allowed and related to temperature and salinity variations through a state relationship. Bottom topography is taken into account via a s-transformation along the vertical axis (10 levels) of a Cartesian mesh. Horizontal computational domain is a regular grid.
2.d	<i>Key semi-universal parameters and example values (which should apply at least regionally or for at least one type of water body); summarize any restrictions or reservations about these parameters</i>	All parameters are universal and related to the Navier-Stokes equations.
2.e	<i>Main forcing data needed - initial values of state variables; boundary conditions; inputs; imposed environmental conditions; generalized loss terms. State whether single values or time-series needed.</i>	<ul style="list-style-type: none"> <li>• Times series of air temperature, light, wind</li> <li>• Time series of freshwater discharge</li> <li>• Boundary conditions (water height)</li> </ul>
2.f	<i>Restrictions to use of model</i>	None.

<b>3</b>	<b>possibly relevant INDICATORS and example EcoQOs</b>	
3.a	<i>Driver</i>	
3.b	<i>Pressure</i>	Freshwater discharge.
3.c	<i>State</i>	
3.d	<i>Impact</i>	
3.e	<i>Response</i>	

<b>4</b>	<b>STATUS of model</b> <i>NB: refers to scientific theory and equation set; distinguish from implementation</i>
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4.a	<i>Origin(ator) of model concept and initial formulation:</i>	IFREMER (Lazure (1995) on Thau lagoon; Struski (2005) and Stanisière et al. (2006) on Marennes-Oléron).
4.b	<i>Present status of model, including scientific basis of claimed robustness and key matters still needing study:</i>	Several publications and applications for IFREMER projects on all types of ecosystem, including ecological applications (eutrophication).
4.c	<i>Present use:</i>	<p>On Thau lagoon, assessment of the impact of shellfish aquaculture (anoxia, Chapelle et al., 2001) and impact of watershed on water quality (Fiandrino et al., 2003) and ecosystem functioning (Plus et al., 2003a, b, 2006).</p> <p>On Pertuis Charentais, the code has been applied to assess the extension of mussel longlines culture (see 'longline' template), for ecological and impact assessment studies and simulation of sediment dynamics (Stanisière et al., 2006; Struski, 2005).</p> <p>On Baie des Veys, it is under development to assess carrying capacity with a coupling between DEB, ecosystem dynamics and hydrodynamics</p>
4.d	<i>Potential use and development in ECASA :</i>	Local impact of shellfish aquaculture, by coupling with an ecophysiological model (see DEB template).

<b>5</b>	<b>IMPLEMENTATION of model</b>	
5.a	<i>State of implementation :</i> <i>(This refers to realization of model theory in numerical algorithms, spreadsheets, computer programs, etc. to provide solutions of the model equations when supplied with appropriate forcing data.)</i>	Fortran code and Matlab tools for post processing.
5.b	<i>State of documentation (which describes how to use an implementation as well as giving model theory)</i>	See 2 reports describing the model implementation in Marennes-Oléron Bay (Stanisière et al., 2006; Struski, 2005).
5.c	<i>Intellectual property concerns - if none stated here, model and implementation will be deemed to freely available on request</i>	IFREMER is the owner of this model and the software supporting it. ECASA participants need an agreement to apply it for their own needs when carrying the tasks identified within the ECASA contract.

<b>6.</b>	<b>TESTING of model</b>	
6.a	<i>Summary of conditions and measurements needed:</i> <i>Refer back to 2.e if necessary. Highlight observations needed for model testing.</i>	Air temperature and wind, freshwater discharge (when necessary), boundary conditions (water height), bathymetry.
6.b	<i>Criteria for model</i>	None.

7	<b>OTHER models</b>	
7.a	<i>Used explicitly or implicitly with this model</i>	<p>Longline model used to assess the effect of cultured mussels on particles and sediment.</p> <p>Anoxia model by coupling hydrodynamics and biological equations (mineralisation, biodeposition).</p> <p>Impact of freshwater inputs (bacteria, nutrients).</p>
7.b	<i>Similar models (which might serve roughly the same purpose in relation to mariculture)</i>	Any 2D or 3D model (e.g. MIKE, COHERENS etc.).

8. REFERENCES cited	<i>show in bold the most important paper describing the model</i>
<p>Chapelle A., Lazure, P., Souchu, P., 2001. Modélisation numérique des crises anoxiques (malaïgues) dans la lagune de Thau (France). <i>Oceanologica Acta</i> 24, 87-97.</p> <p>Fiandrino A., Y. Martin, P. Got, J.L. Bonnefont, M. Troussellier, 2003. Bacterial contamination of Mediterranean coastal seawater as affected by riverine inputs: simulation approach applied to a shellfish breeding area (Thau lagoon, France). <i>Water Research</i> 37, 1711–1722.</p> <p>Lazure, P. 1992. Etude de la dynamique de l'étang de Thau par modèle numérique tridimensionnel. <i>Vie &amp; Milieu</i> 42, 137-145.</p> <p>Plus M., I. La Jeunesse, F.al Bouraoui, J.M. Zaldivar, A. Chapelle, P. Lazure, 2006. Modelling water discharges and nitrogen inputs into a Mediterranean lagoon. Impact on the primary production. <i>Ecol. Modelling</i>, 193, 69-89.</p> <p>Plus, M., Chapelle, A., Lazure, P., Auby, I., Levavasseur, G., Verlaque, M., Belsher, T., Deslous-Paoli, J.-M., Zaldivar, J. M., Murray, C. N., 2003 a. Modelling of oxygen and nitrogen cycling as a function of macrophyte community in the Thau lagoon. <i>Continental Shelf Research</i>, 23: 1877-1898.</p> <p>Plus, M., Chapelle, A., Ménesguen, A., Deslous-Paoli, J.-M., Auby, I., 2003 b. Modelling seasonal dynamics of biomasses and nitrogen contents in a seagrass meadow (<i>Zostera noltii</i> Hornem.): application to the Thau lagoon (French Mediterranean coast). <i>Ecol. Model.</i>, 161: 149-252.</p> <p>Stanisière, J.Y, Dumas, F., Plus, M., Maurer, D., Robert, S., 2006. Hydrodynamic characterization of a semi-enclosed coastal system : Marennes Oleron (France) basin. Ifremer Report, <a href="http://www.ifremer.fr/docelec/notice/2006/notice2353-EN.htm">http://www.ifremer.fr/docelec/notice/2006/notice2353-EN.htm</a></p> <p>Struski C., 2005. Modélisation des flux de matières dans la baie de Marennes-Oléron : couplage de l'hydrodynamisme, de la production primaire et de la consommation par les huîtres. Thèse Univ. La Rochelle, <a href="http://www.ifremer.fr/docelec/notice/2005/notice554.htm">http://www.ifremer.fr/docelec/notice/2005/notice554.htm</a></p>	