
TOSCA project

Deliverable D3.3.1

"Modeling system configuration: Available system and identified gaps"

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CP3: Analysis of past dramatic events and of different applied methodologies. Preparation and Development of tools & instruments

CP3.3: Modeling system development in test sites

- ✓ **Partners involved:** IASA-UAT (*CP3.3 coordinator*), LSEET, DISAM, OGS, UIB-IMEDEA
- ✓ **Duration:** 01/09/2010 to 31/08/2012
- ✓ **Deliverables:**
 - 3.3.1: Modeling system configuration
 - 3.3.2: Modeling system for simulation

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I. Introduction

Project description: “Ocean modeling systems will be implemented in **5 test sites** (Figure 1) around the Mediterranean Sea, **defined** in relation to the observational strategy (4.1 – 4.2). The **main goal** is to develop the capacity to simulate material transport at targeted areas (of high pollution risk).”

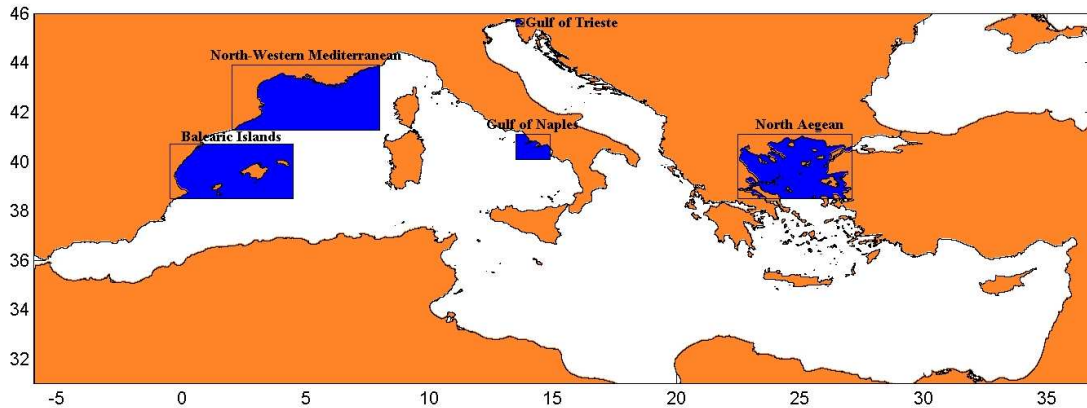


Figure 1. Modeling test sites

Project description: “The components of the modeling systems will include ocean circulation, sea state and material transport components (with modeling tools relevant to the local expertise and experimental needs of each site).”

The main experiments will be carried out with the material transport component **but** in order to run this we need atmospheric/oceanic and initial conditions (Figure 2) at the test sites and at the proper resolution. Namely, we need modeling components and/or data input that will provide the fields needed for running the material transport models and will enable us to perform the various modeling experiments (Figure 3).

- Atmospheric forcing
- Wave fields
- Ocean circulation

Furthermore, since all the experiments target specific episodes at various modes (e.g hindcast, forecast/pseudo-forecast) we will need synoptic and high resolution fields (i.e. we cannot rely on climatological fields or daily/weekly products) for previous and current periods. Based on that, we have to define at each site:

1. Domains that will be modeled with material transport modeling component
2. Available modeling components and/or fields that will be used as input for the material transport modeling component
3. Periods of available atmospheric/wave/ocean circulation data availability (in order to perform hindcast experiments)
4. Possibility to have all (or some) components at forecast or “pseudo-forecast” mode
5. Gaps in the whole system that need to be filled (e.g. components that cannot be developed in TOSCA and we need to fill by data/model sharing).

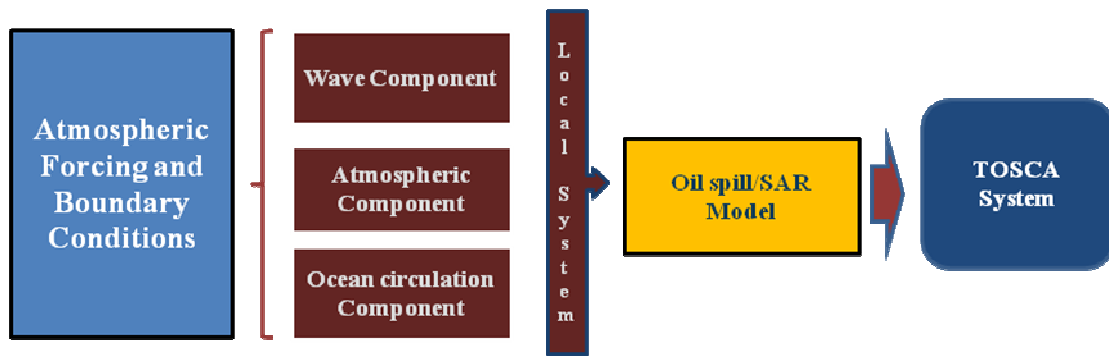


Figure 2. Modeling system “prototype”

Project description: “The modeling systems will be **tested** in hindcast and forecast modes. The final systems will be **validated** and tuned in the framework of 4.3.”

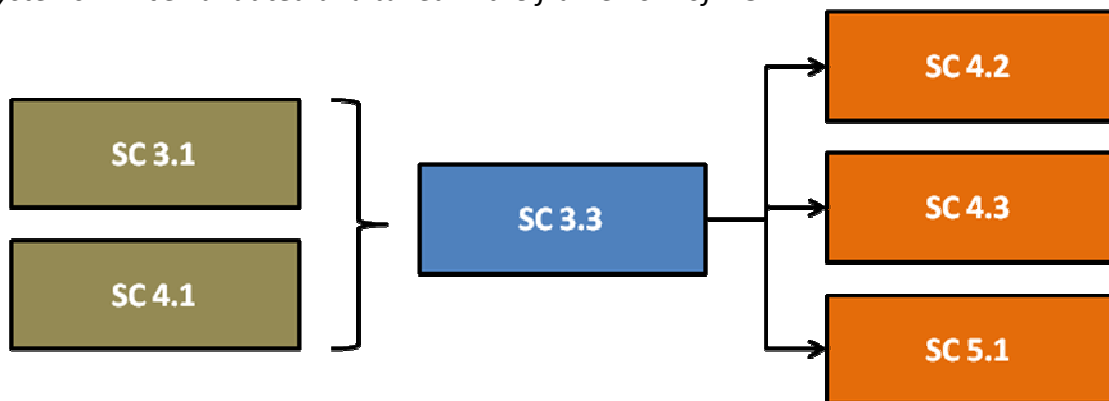


Figure 3. The interaction of SC3.3 with other TOSCA’s SCs (observational – experimental parts).

II. Available System

The availability of modeling components/inputs is described in the following five (5) tables, presenting the modeling components already in use (or currently under development) in the five test sites of TOSCA. The different colors show the development and mode of each component according to the following table:

Developed - Operational
Developed - Preoperational
Developed
Under development or established connection with data provider
Missing

2.1. SITE: North Aegean

Input modeling (and/or available data) components	
Atmospheric component	
Model/Data	
Available model/data	Skiron Forecasting System
Domain	Whole Mediterranean
Resolution	1°/10 – 1°/20
Start date	2004
Operational	Yes
Assimilation	Yes
Boundary conditions	NCEP 1°/2 global operational model
Available fields	Air temperature and relative humidity at 2m above sea surface, Wind velocity at 10m above sea surface, Sea level atmospheric pressure, Net shortwave radiation at the sea surface, Downward longwave radiation, Precipitation rate
Wave component	
Available model/data	WAM (North Aegean)
Domain	38- 41°N, 22.5-27°E
Resolution	1°/30
Start date	2002
Operational	Yes
Assimilation	No
Boundary conditions	Mediterranean Univ. Athens (1°/5) operational model
Available fields	Significant wave height and wave direction
Ocean Circulation component	
Available	POM

model/data	
Domain	38.5- 41.1°N, 22.5-27.1°E
Resolution	1o/16
Start date	2006
Operational	Yes
Assimilation	Yes
Boundary conditions	ALERMO 1°/30 operational model – MFS Mediterranean (1°/16) operational model
Available fields	3-D temperature, salinity, velocity and sea level
Material transport modeling component	
Available model	MedSlik/AUTH – Oil-spill
Type	Oil-spill dispersion
Domain	38.5- 41.1°N, 22.5-27.1°E
Resolution	Hydrodynamical
Start date	2007
Operational	Yes
Assimilation	No

2.2. SITE: Gulf of Trieste

Input modeling (and/or available data) components	
Atmospheric component	
Model/Data	
Available model/data	ETA006; ALADIN + MFS/ECMWF; (+ 8 meteorological stations located along GoT coast)
Domain	ETA006: 40-49°N, 8-21°E; ALADIN: 40.1-46.5°N, 11.2-20.8°E + MFS/ECMWF: 8.8°W-36.3°E, 30.2-46.1°N
Resolution	ETA006: 0.06°; ALADIN: 0.02 × 0.03°; + MFS/ECMWF: 1°/16
Start date	ETA006: 20/10/2006-31/07/2007; ALADIN+MFS/ECMWF: 01/08/2007-31/12/2008
Operational	ETA006: no ALADIN+MFS/ECMWF: yes
Assimilation	ETA006: ? ALADIN+MFS/ECMWF: yes
Boundary conditions	ETA006: ETA012 ALADIN: IFS/ARPEGE
Available fields	ETA006: wind velocity (10m), air temperature and relative humidity (2m), downward long and short wave flux, precipitation, sea level atmospheric pressure; ALADIN: wind velocity (10m)

	+ MFS/ECMWF : sea surface height, total upward water flux, net downward heat flux, net downward shortwave radiation
Wave component	
Available model/data	
Domain	WAM in collaboration with IASA-UAT
Resolution	
Start date	
Operational	
Assimilation	
Boundary conditions	
Available fields	
Ocean Circulation component	
Available model/data	MITgcm (Gulf of Trieste)
Domain	~45.47-45.80°N, ~13.50-13.83°E
Resolution	1°/320
Start date	01/08/2007-31/12/2008
Operational	no
Assimilation	nudging of satellite SST
Boundary conditions	MITgcm (Northern Adriatic Sea - 1°/64)
Available fields	3-D: temperature, salinity, velocity, density anomaly, pressure (hydrostatic and non hydrostatic), turbulent viscosity/diffusivity, Richardson number; 2-D: SS temperature, SS height, mixed layer depth
Material transport modeling component	
Available model	MITgcm transport package (Gulf of Trieste)
Type	passive tracer advection/diffusion
Domain	~45.47-45.80°N, ~13.50-13.83°E
Resolution	1°/320
Start date	01/08/2007-31/12/2008
Operational	no
Assimilation	no

2.3. SITE: Gulf of Naples

Input modeling (and/or available data) components	
Atmospheric component	
Model/Data	
Available model/data	Skiron Forecasting System
Domain	Whole Mediterranean
Resolution	1°/10 – 1°/20
Start date	2004
Operational	Yes
Assimilation	Yes
Boundary conditions	NCEP 1°/2 global operational model
Available fields	To be provided by IASA-UAT
Wave component	
Available model/data	WAM data to be provided by IASA-UAT
Domain	
Resolution	
Start date	
Operational	NO
Assimilation	NO
Boundary conditions	
Available fields	
Ocean Circulation component	
Available model/data	ROMS
Domain	13.5-14.9°E 40.1-41.1°N (box containing a rotated grid)
Resolution	1 X 1 km
Start date	
Operational	NO
Assimilation	NO
Boundary conditions	MFS Mediterranean (1°/16) operational model
Available fields	3-D temperature, salinity, velocity and sea level (right now we just plan to have these data...)
Material transport modeling component	
Available model	GNOME/LTRANS
Type	Oil-Spills Dispersion/Larval TRANSport Lagrangian model (LTRANS)
Domain	13.5-14.9°E 40.1-41.1°N
Resolution	1 X 1 km
Start date	
Operational	NO
Assimilation	NO

2.4. SITE: North-West Mediterranean Sea

Input modeling (and/or available data) components	
Atmospheric component	
Model/Data	
Available model/data	MétéoFrance ALADIN
Domain	Latitude : 55°N – 35°N ; Longitude : 11°W - 14°E
Resolution	0.1 ° x 0.1 °
Start date	2006
Operational	yes
Assimilation	yes
Boundary conditions	MétéoFrance ARPEGE
Available fields	Air temperature and relative humidity at 2m above sea surface, Wind velocity at 10m above sea surface, Sea level atmospheric pressure, Net shortwave radiation at the sea surface, Downward longwave radiation, surface upward sensible heat flux, surface upward latent heat flux, cloud area fraction
Wave component	
Available model/data	WAVEWATCH III model
Domain	0-11E, 40-45N
Resolution	3'
Start date	2005
Operational	yes
Assimilation	no
Boundary conditions	
Available fields	significant wave height, wind, current, depth, ...
Ocean Circulation component	
Available model/data	NEMO
Domain	Longitude: 2 ° – 8° E; Latitude : 41.26 °– 43.9° N
Resolution	1/64°
Start date	1999
Operational	no
Assimilation	no
Boundary conditions	NEMO MED12 and PSY2V3 (MERCATOR) , whole Mediterranean Sea at 1/12°, respectively none and operational mode
Available fields	3-D temperature, salinity, velocity , sea level – 2D : mixed layer depth, Vertical Eddy Diffusivity (KZ)
Material transport modeling component	
Available model	ARIANE and NEMO TOP2
Type	Respectively Lagrangian module and Passive Tracer Package

Domain	Similar to the ocean model configuration
Resolution	Idem
Start date	Idem
Operational	no
Assimilation	no

2.5. SITE: Balearic Island

Input modeling (and/or available data) components	
Atmospheric component	
Model/Data	
Available model/data	HIRLAM(but not available). Model property of Spanish Met Office. We are working (in progress) with WRF.
Domain	Balearic Sea
Resolution	0.16°-0.05°
Start date	2009
Operational	YES
Assimilation	YES
Boundary conditions	ECMWF
Available fields	--
Wave component	
Available model/data	SWAN/WAM
Domain	Balearic Sea
Resolution	600m
Start date	2009
Operational	Yes
Assimilation	No
Boundary conditions	Spanish Harbour Authority (WAM)
Available fields	Hs, Tp
Ocean Circulation component	
Available model/data	ROMS
Domain	Balearic Sea
Resolution	1 km
Start date	2007
Operational	Yes
Assimilation	Yes
Boundary conditions	MFS
Available fields	U,V,W,T,S

Material transport modeling component	
Available model	Gnome
Type	
Domain	
Resolution	Given by the above models
Start date	
Operational	Yes
Assimilation	No

III. Filling the gaps

The following inputs are proposed to fill the gaps identified in the various sites:

Atmospheric component:

Atmospheric component is (at this stage) missing from the Gulf of Naples and Balearic Island test sites. It is proposed to be filled by the Skiron Forecasting System (1^o/10 – 1^o/20 starting from 2004).

Wave component:

Wave component is missing from the Gulf of Trieste test site and it is proposed to be filled by the TRITON Wave Forecasting System (Adriatic Sea Model - University of Athens, 1^o/20). It is under development in Gulf of Naples and Baleraic Islands.

Ocean circulation component:

Ocean circulation component is available in all test sites. However, initial and boundary conditions for the experiments (past cases and validation/calibration experiments) will need hindcast and nowcast fields. These will be available by the MOON operational system (University of Athens will act as liaison for data acquisition).

Material transport modeling component:

Available in all test sites.