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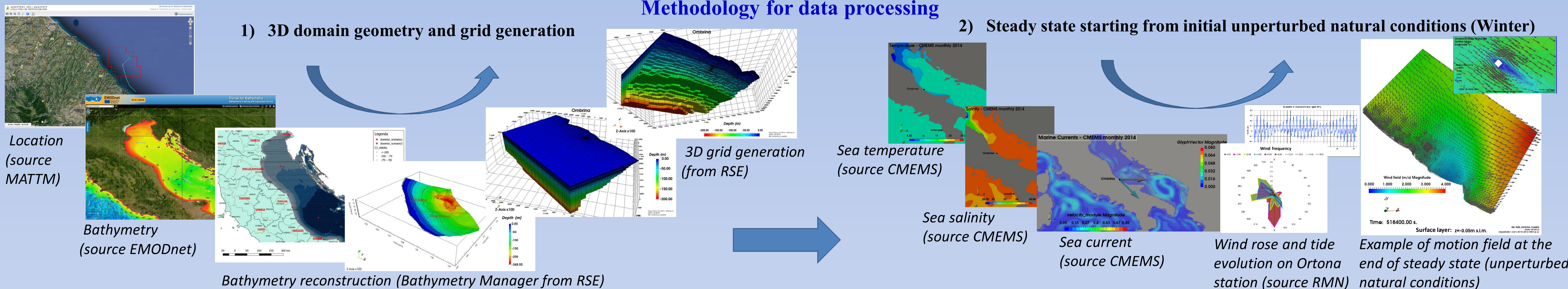
Summary:

The study describes the development of a methodology, based on a numerical 3D approach, for the evaluation of the dynamics related to the dispersion of hydrocarbons in the sea and the consequent environmental impact. The software for these calculations is therefore an essential tool in order to simulate the impact effects in the short, medium and long period, able to account for the complexity of the sea system involved in the dispersion process and its dependency on the meteorological, marine and morphological local conditions. The numerical model was applied to hypothetical spill scenarios which release sources, located both on surface and in depth, are due to platform or floating vessel (FPSO unit) accidents, occurring in the area of the field exploitation project “Ombrina Mare”, near the coast of Abruzzo Region. After an initial phase of collecting weather and sea data pertaining typical tidal conditions, wind and sea current, coastal morphology and bathymetry of the seabed, a 3D fluid-dynamic model of the entire area considered was carried out, using the HyperSuite software system developed in RSE and based on an Eulerian finite element approach. Subsequently, after reproduction of the natural conditions in absence of oil spill, the emission flow rates have been defined. Finally different possible scenarios have been analyzed considering both accidental release events of low intensity for long time and serious accident events with strong intensity emission but short duration, seeking out for each scenario the most critical weather and sea conditions from the emission and subsequent environmental diffusion point of view.

Methodology for data processing

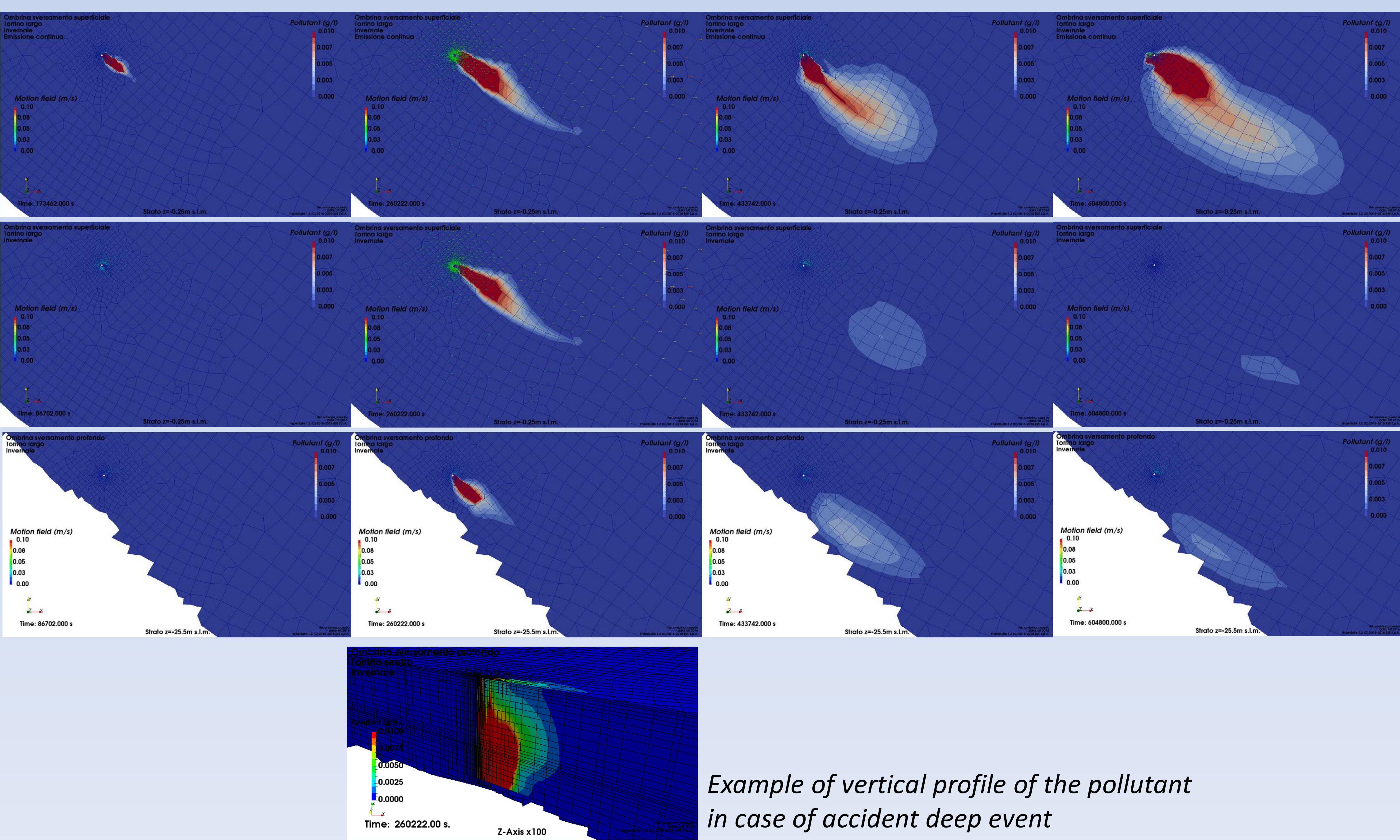
1) 3D domain geometry and grid generation

2) Steady state starting from initial unperturbed natural conditions (Winter)



Numerical modeling results

3) Simulation of a loss event (low intensity, long period), or accident event (strong intensity, short period), both on surface and in depth using variable conditions in time



Time sequences shown at left:
 - loss event (up)
 - accident event on surface (middle)
 - accident deep event (down)

- ✓ 1 day of simulation natural steady state (unperturbed conditions)
- + 6 days emission (accidental continued) or
- + 1 day emission + 5 days of diffusion (accident emission)
- ✓ Mean depth emission -0.5 m (surface emission) or -25.5 (deep emission)
- ✓ Start of simulation: 14/01/2015 00:00, start of emission: 15/01/2015 00:00 (winter)

Conclusions:

The results have shown a first phase of emission depending on the vorticity induced for all the duration of the spill in the emission point followed by the entrainment of the oil plume influenced by the most recurring weather and sea conditions. In the case of deep emission, during the first stage the buoyancy quickly leads the oil to the surface. The results allowed to evaluate the relevance of the effects due to the environmental parameters as wind, sea current and tide, putting in evidence the capability of the methodology to support the safety requirements of offshore oil exploitation projects in terms of environmental impacts, provided that an accurate characterization of the site and the real conditions of the event emission are satisfied.

It is important to notice that the methodology used allows to have a model that is able to take into account both the local effects at small scale and the diffusion effects at large scale, also providing indications about the evolution of possible emission of crude oil.

References:

- R. Guandalini, G. Agate - Study of environmental effects and dynamic dispersion of pollutants into the sea. Final report - Prot. RSE 16082117 (18 November 2016) in Italian
- Ministry of Economic Development. Directorate General for Safety - National Mining Office for Hydrocarbons and Georesources – Executive Act in implementation of the Agreement of Cooperation between MISE-DGRME and RSE year 2014 – Prot. RSE 15000356 (20 November 2014) in Italian
- Italian Ministry for the Environment, Territory and Sea <http://www.minambiente.it/pagina/vas-e>
- European Marine Observation and Data Network <http://www.emodnet.eu/>
- Copernicus: marine environment monitoring service providing products and services for all marine applications - <http://marine.copernicus.eu/>
- ISPRA. Italian National Institute for Environmental Protection and Research - Italian national tide gauge network (Rete Mareografica Nazionale -RMN) http://www.idromare.it/reti_rm.php