Oceanic Simulation and Studies at ALYOTECH

GLOBCURRENT

2012 - March

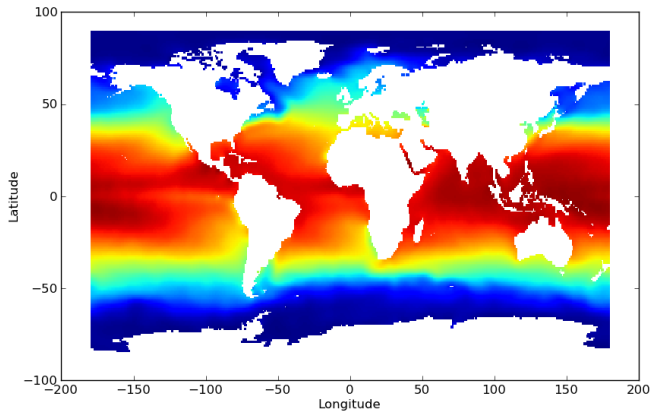
CONTEXT

- ALYOTECH is a Computer Engineering Company, with a specialized Scientific Computing Services (50 engineers)
- Delivering software with technology transfer from academic expertises & data in the field of environment simulation (ocean, land, sky, target…)
- Applications in ocean topics : maritime security & surveillance and renewable energies
- Our customers in this domain : Defense & Security (DGA, SHOM, THALES, DCNS, CASSIDIAN), Energy (TOTAL, GDF-SUEZ), Space (CNES)
- Business Partners Labs : Academic (IFREMER, TELECOM, IETR, ENSTA, CEDRE, INRIA, NERSC, ONERA), Private (CreOcean, Hocer, Nymphea-Environnement, DORIS)

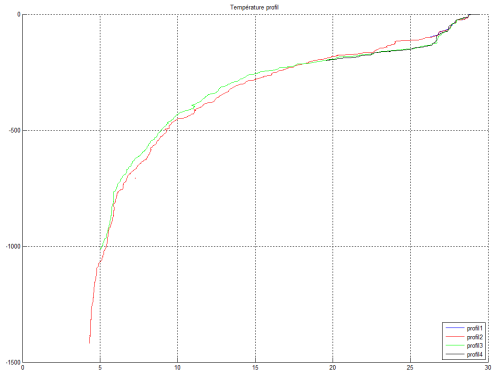
- We wish to highlight 2 R&D Projects potentially GlobCurrent users
    - OCEAN THERMAL ENERGY CONVERSION presented by Rudy MAUGE
    - SEA-CLUTTER SIMULATOR presented by Thierry LANDEAU

Ocean Thermal Energy Conversion (OTEC)

Use the heat energy stored in the Earth's oceans



Source : Levitus data



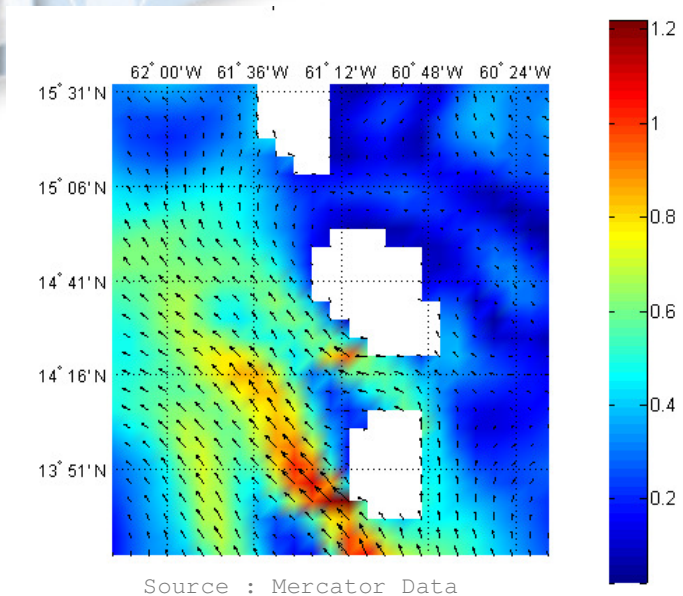
Source : DCNS data

Requirement for the engine heat: At least 20°C for the vertical gradient

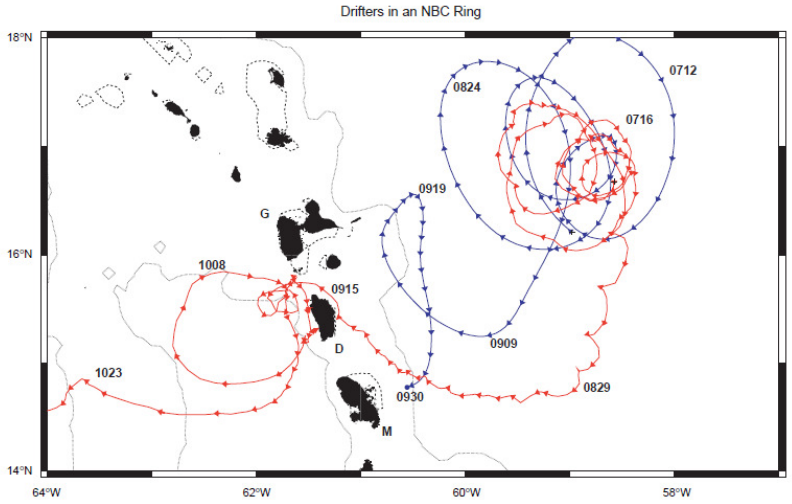
- Region with the warmest sea surface temperature
- Region with strong pycnocline

→Tropics

Currents and mesoscale activities



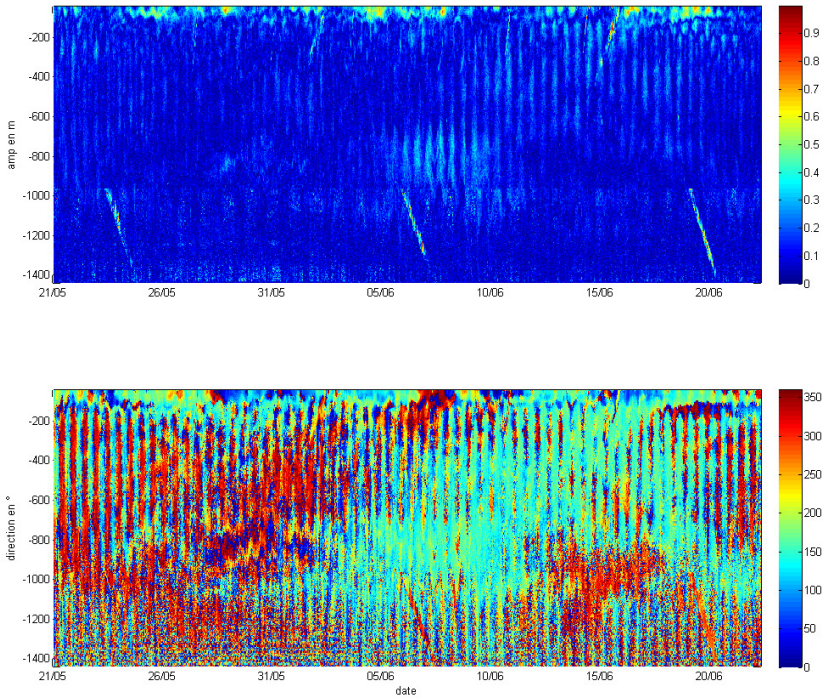
Source : Mercator Data



Source :Richardson (2005)

- Knowledge of the marine environment: ocean currents is required for the design (pipe, anchorage…)
- Mesoscale activities play an important role for the current, the heat and salt transport.

Example of interest for Globcurrent data



Source: DCNS DATA

Vertical profile time series for the amplitude and direction current

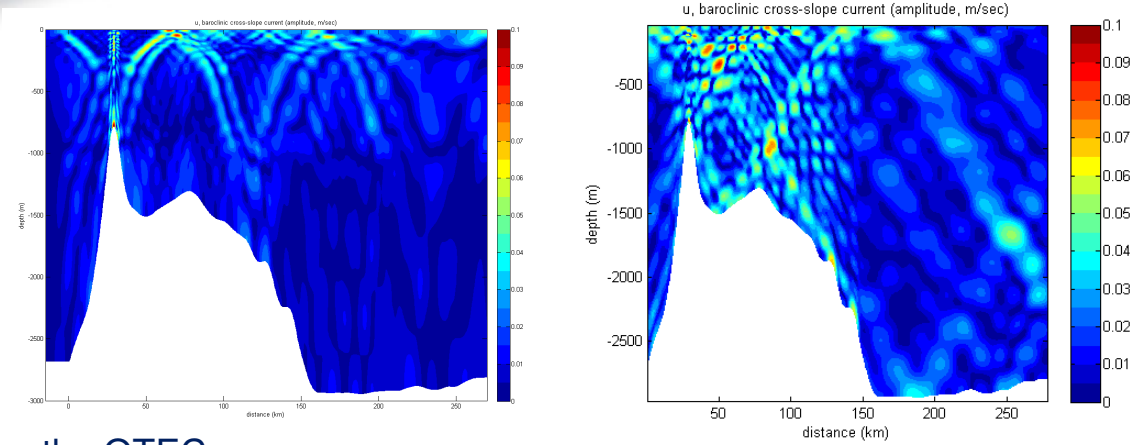
Help to remove some ambiguities

- Intensified Surface Currents
  - Southward direction
  - No correlation with the wind
  - No correlation with the tide

→ Local recirculation ?

→ Eddy or ring propagation ?

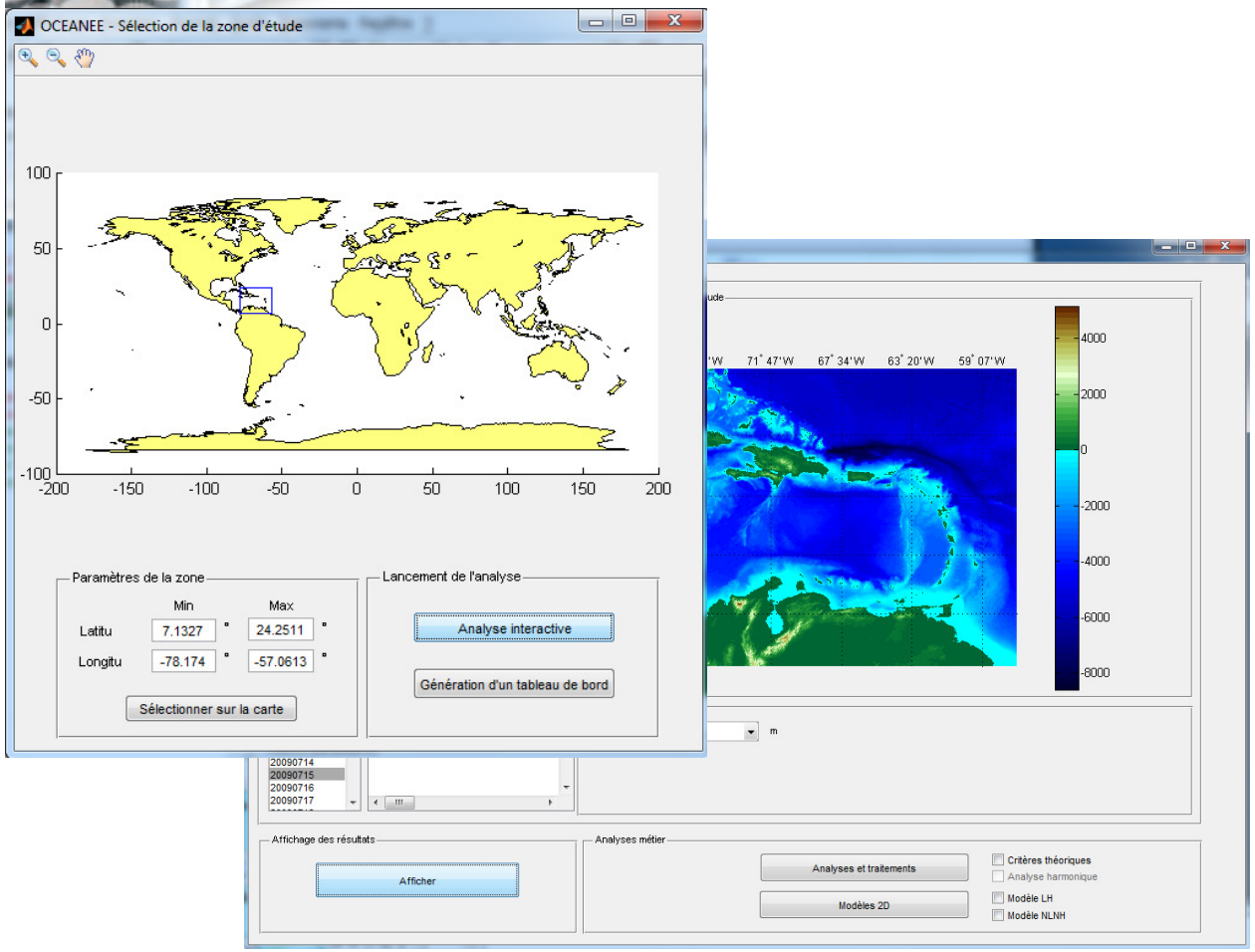
Internal waves



- Constraints for the OTEC
  - For the pipe (pumping at 1000m depth)
    - Strong current variations
    - Vertical shear currents
  - For the performance
    - Temperature anomalies
- The most remote sensor used ::SAR for the Internal Solitary Waves (nonlinear aspect)

→With high resolution (in both time and space) : we may assess the intensified surface currents far from the generation site and according to the IW theory.

Environment Database and dedicated applications



- Software for rapid assessment
  - Interactive exploration, visualization of key parameters
  - Advanced data, criteria
  - Desk studies
- We could add plugins
  - Ocean Surface Current Data

SEA-CLUTTER SIMULATOR

- **Consortium ALYOTECH[1] – IFREMER[2] – TELECOM BRETAGNE[3]**
  (Monnier[1], Houssay[1], Le Hellard[1], Landeau[1], Chapron[2], Garello[3])
- **With DGA (French MoD) financial support**

- **Goal : provide fast & physical simulated data of a maritime scene observed by sensors (visible, IR, X-band radar)**

- **Output Data :**
  - **EO/IR : images**
  - **Radar : IQ signal and Doppler spectrum**

- **Helpful to size, specify & develop maritime surveillance & security systems (threats detection, Search & Rescue) in addition to measurement campaigns**

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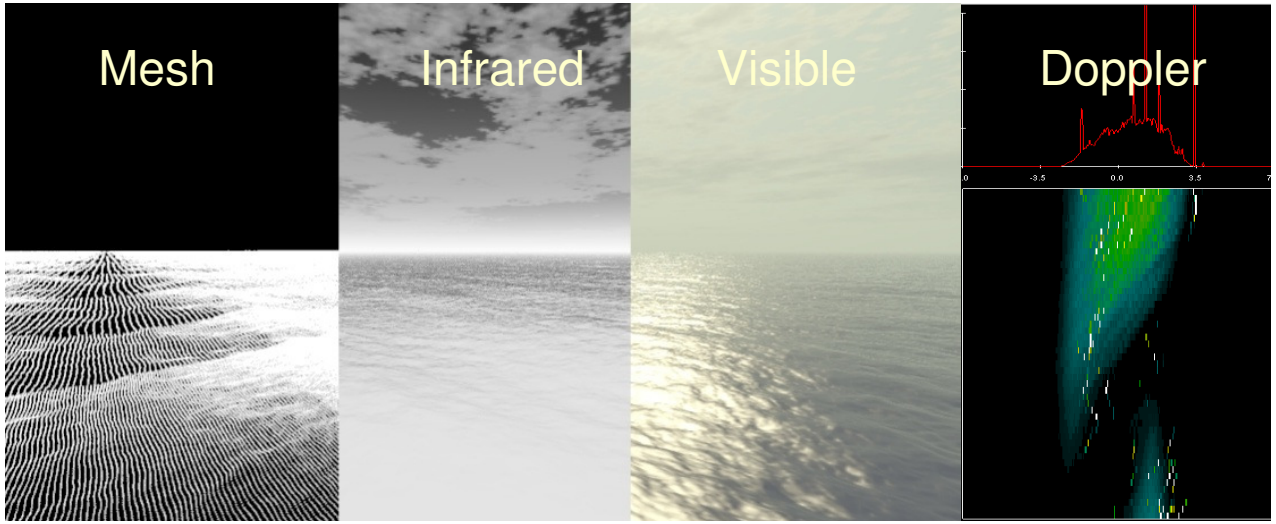
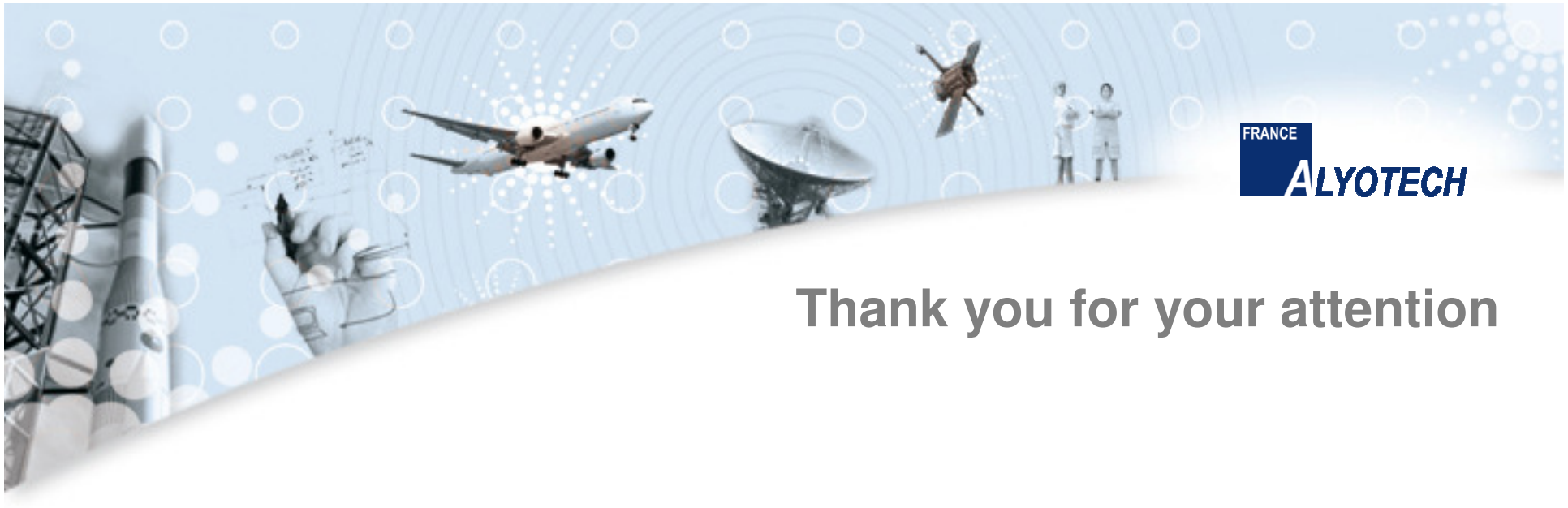
SEA-CLUTTER SIMULATOR

- **The model today :**
  - **State-of-the-art (recent literature)**
    - **Surface : 4D (XYZ,t) multi-resolution/variable mesh based on a wave spectrum + weakly non-linear model**
    - **EO signal : global illumination (sky & sun) + roughness dependent BRDF**
    - **EM signal : Bragg backscattering model + breaking-waves model (spatial distribution of short-life events)**
  - **Performance :**
    GPU implementation

- **GlobCurrent user :**
  - **Model is ready to account for current effects through**
    - **Wave spectrum**
    - **Roughness dependence**
    - **Spatial distribution**





Thank you for your attention