



Cedre's experience and the Migr'hycar project (modelling in inland waters)

Cedre Information Day
27 March 2013,
Direction de l'Eau et de la Biodiversité,
Paris la Défense.

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Requirements

- Applicable worldwide (seas, oceans, estuaries, rivers) with environmental data: bathymetry, currents, weather, coastline, other GIS data...
- "Product" database associated with the model (physical and chemical behaviour)
- 24/7 access
- Rapid access to results:
 - ✓ Simple to use (for operational personnel)
 - ✓ Rapid to implement model and access environmental data
 - ✓ Rapid calculation time
- Simulation period of several days (max: 1 week)
- Formatting of results, cartographic presentation
- User-friendly

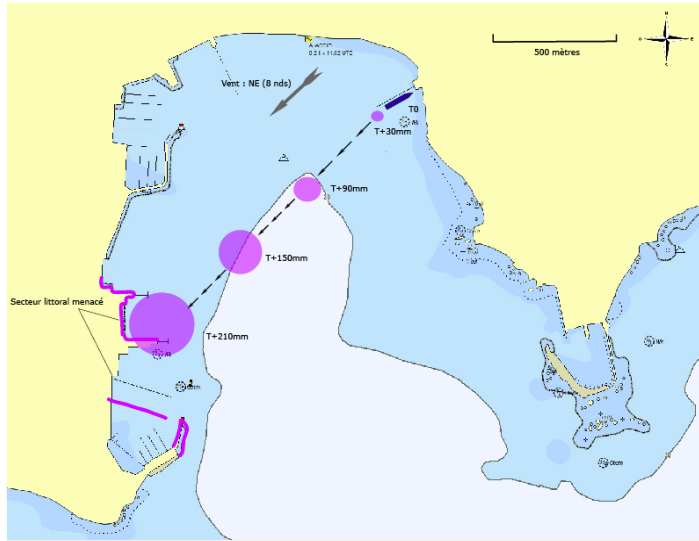
Non-emergency use

- **Planning:** contingency plans (development of incident scenarios showing probable drift of oil slicks in the geographical area of the response plan)
- **Operational guides** on chemicals (development of incident scenarios showing the behaviour of hazardous substances)

Non-emergency use (contingency planning)

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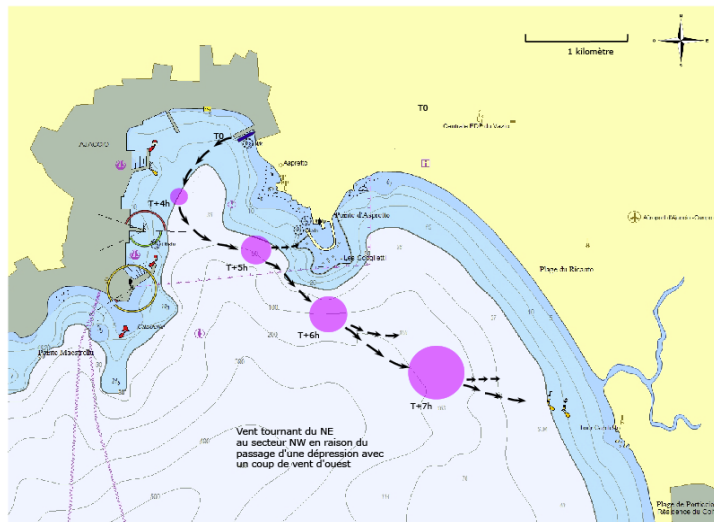
Scénario majeur 1



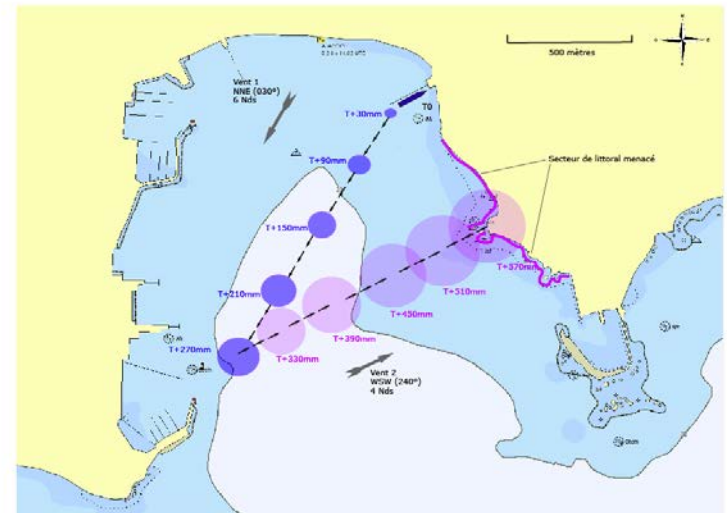
Scénario moyen 1



Scénario majeur 2



Scénario moyen 2



Non-emergency use (operational guide)



Comportement de l'acide phosphorique 48 heures après son déversement

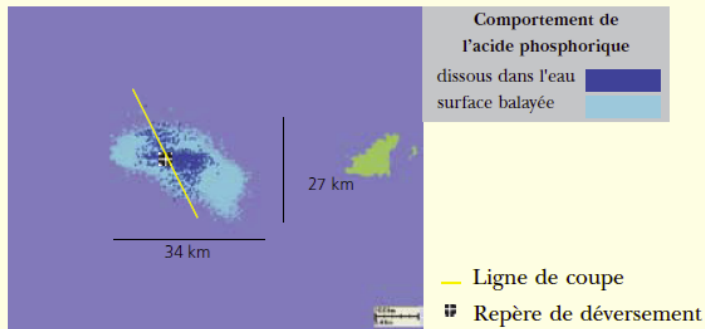


Figure 20 : comportement de l'acide en plan

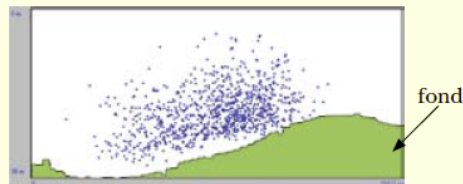


Figure 21 : comportement de l'acide en coupe

La surface balayée par l'acide phosphorique est d'environ 34 km sur 27 km. L'acide dissout dans la colonne d'eau sur une hauteur d'environ 80 mètres à partir du fond.

C- Résultats du scénario "Zone portuaire"

Déversement instantané de 200 tonnes d'acide phosphorique en surface, sans vent et avec une vitesse de courant nulle.

Comportement de l'acide phosphorique 48 heures après le déversement

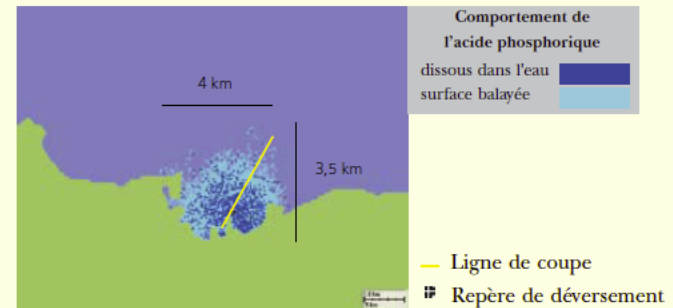


Figure 24 : comportement de l'acide en plan

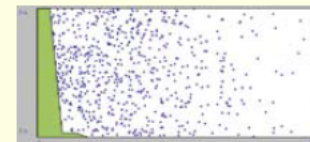


Figure 25 : comportement de l'acide en coupe

La surface balayée par l'acide phosphorique est d'environ 3,5 km au nord sur 4 km d'est en ouest. L'acide libéré se dissout sur toute la hauteur de la colonne d'eau qui est de 3 mètres.

Concentrations d'acide phosphorique dissous dans la colonne d'eau, obtenues 30 minutes après le déversement

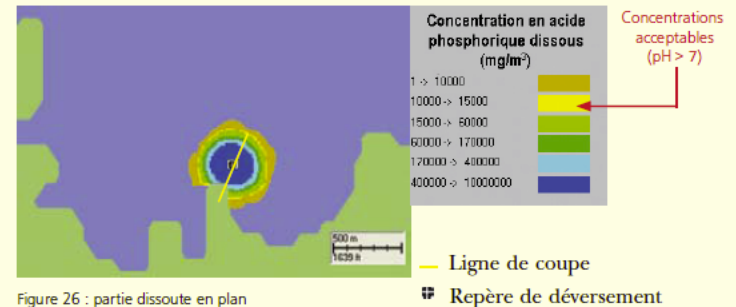


Figure 26 : partie dissoute en plan

Emergency use / Response

- To predict the transport of the pollutant at the surface and arrivals on the shore, to support:
 - response at sea and on land
 - identification of the polluter
 - planning of overflights

- To predict the main behaviour of the hazardous substance (Evaporator, Floater, Dissolver, Sinker) to support:
 - response strategies
 - assessment of toxicological risks for human health, marine flora and fauna

Activation of *Cedre*

- 24/7: *Cedre* alert – duty engineer
- Rapid initial response (under an hour) on the substance, its characteristics, general behaviour (safety datasheet, product database)
- If necessary, use of a model to complete the response. Météo France (MOTHY) provides the result of the drift forecast in less than 30 minutes
- If justified by the situation, in-depth study with consideration of various scenarios and parameters, then submission of a report with comments and detailed analysis of results (maps, graphs etc.) - >(half a day)
- For a major incident, establishment of a technical committee (Cedre, Météo France, Ifremer, SHOM, Ineris etc.) for joint forecast including elements from all contributors

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Importance of input data

- Exact location (latitude / longitude), date and time (UTM)
- Incident circumstances
- Quantity spilled
- Tank capacity
- Continuous or instantaneous leak / size of breach
- Surface spill? Subsurface spill? Deep-water spill?
- Immersion level for container (data on pollution and environmental data)
- Bathymetric data (for hazardous substances dispersing in the water column)
- Weather forecast / currents
- Regular readjustment based on observations

Example of models and software (non-exhaustive):

Models and software used at Cedre:

- ✓MOTHY model (Météo France) 24/7 - slick and container drift model
- ✓OILMAP model (ASA) - oil drift and behaviour - and CHEMMAP (ASA) - drift and behaviour of hazardous substances
- ✓ADIOS (NOAA) oil behaviour, ALOHA (NOAA) atmospheric dispersion
- ✓CLARA 2: Mediterranean (*Ecole des Mines d'Alès Cedre Ifremer INERIS Météo France APSYS -EADS MERCLEAN IRSN TOTAL SDIS 30 UBO - Université de Bretagne Occidentale LSIS - Laboratoire des Sciences de l'Information et des Systèmes*)
- ✓MIGR'HYCAR: oil drift and behaviour in rivers

Other examples of models:

- ✓ICHTHYOP model (Ifremer, IRD): surface drift
- ✓OSCAR (oil) and DREAM (hazardous substances) / SINTEF

OILMAP: oil drift and behaviour

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WORLD_CEDRE_OIL1 - Trajectory Scenario - [C:\OILMAPV6\LOC_DATA\WORLD_CEDRE\GISDATA]

File Zoom GIS Data Model Tools COASTMAP Help

Info Zoom In Zoom Out Pan Print Pathway Polygon Move Object Edit Vertices Add Object Vector Show All Distance Redraw 49.7085 N, 5.292 W

Display **Legends**

Model Information

Model Display Settings

Surface Oil 6 Pixel Size

Swept Area

Track Line 12 Hours Label

Oil Ashore

Oil Thickness

Uncertainty Particles

Subsurface Particles

Display Model Currents

Display Model Winds

Layers

All On All Off

111128_EXD_PC - Grid

Depths (meters)

- 0 -> 20
- 20 -> 40
- 40 -> 60
- 60 -> 80
- 80 -> 100
- 100 -> 120
- 120 -> 140
- 140 -> 160
- 160 -> 180
- 180 -> 200
- 200 -> 220
- 220 -> 240
- 240 -> 260
- 260 -> 280
- 280 -> 300
- 300 -> 320
- 320 -> 340
- 340 -> 360
- 360 -> 380
- 380 -> 400
- 400 -> 420
- 420 -> 440
- 440 -> 460

Model Information

Start Time: 28/11/2011 07:00:00

Current Time: 29/11/2011 07:00:00

Elapsed Time: 1 Day 0 Hours

Tonnes

On Surface: 819

Ashore: 0.0

Total Evaporated: 179

Total in Water Column: 1.05

Total Cleaned: 0.0

Total Dispersed: 0.0

Oil Spill Model Weathering Information

Print Options Fates Viscosity Thickness Area Volume Flash

Weathering/Fates for INTERMEDIATE FUEL OIL 300

Surface Water Column Ashore Evaporated Stranded

Oil Mass Balance

Surface 81.910%

Evaporated 17.885%

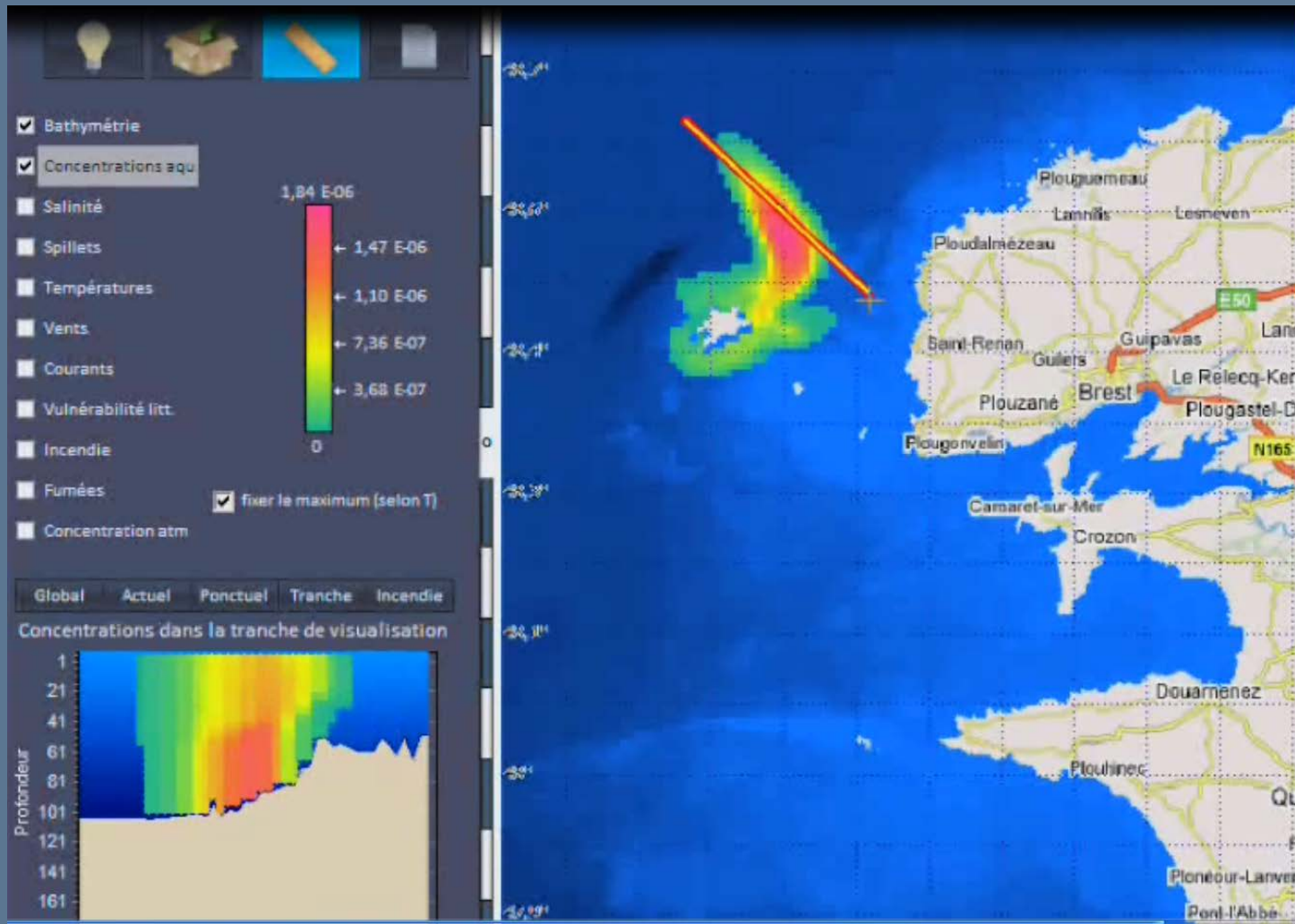
Water Column 0.105%

* Zero Data: Ashore, Cleaned, Dispersed, Not Tracked, Stranded

28/11/2011 07:00:00 (GMT) Settings Interval (hrs:min) 01:00 29/11/2011 07:00:00 29/11/2011 07:00:00 (GMT)

CLARA 2: modelling of hazardous substances

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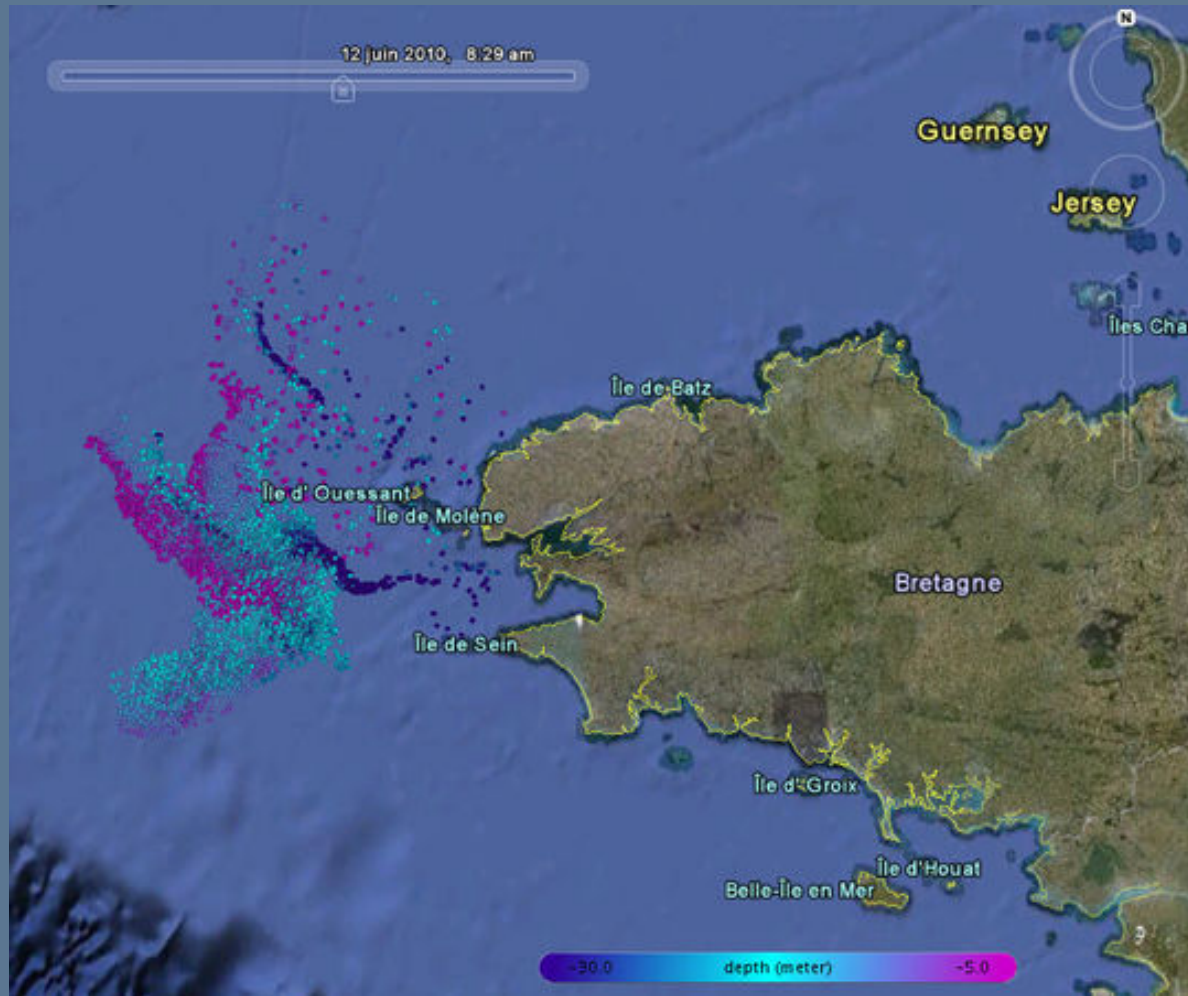


Partners: Ecole des Mines d'Alès, Cedre, Ifremer, INERIS, Météo France
APSYS –EADS , MERCLEAN , IRSN , TOTAL, SDIS 30, UBO (Université de Bretagne Occidentale)
LSIS – Laboratoire des Sciences de l'Information et des Systèmes

ICHTHYOP (Ifremer / IRD)



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ICHTHYOP is an offline Lagrangian transport module.
It is interfaced with real-time PREVIMER forecast databases
for backtracking and forecast simulations

Constant improvement of models:

- Different version of MOTHY Version 4.0 (scheduled for April 2013)
- Possibility of improvement / validation / readjustment of models from real slick drift or drifter buoy observation data

Improvement of met-ocean data and their integration in models:

- Integration of several met-ocean datasets in the same model to determine most probable drift
- Access to currents via servers with pre-calculated forecasts, extractable for a defined area and accessible 24/7
- Incident area overlapping over several coverage areas: improvement of current extraction from several "high resolution" models
- Model comparison (MOTHY, OILMAP etc.)

Distribution and communication

WEBCARTO - MOTHY (oil slick drift model)

Applications Raccourcis Système

GeoViewer - liferay.com - Mozilla Firefox

File Edit View History Bookmarks Tools Help

GeoViewer - liferay.com

http://www.ifremer.fr/sextant/fr/web/netmar/geoviewer#

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Ouvrir une session

Welcome Pilot GeoViewer

Thèmes

- Continent
- oilmep_line
- oilmep_spillet
- metno_merc6
- metno_merc5
- metno_merc4

polrep_netmar

- SATELLITE EMSA

MOTHY_20aout2010 (lignes)

- Ligne intra-barycentre

MOTHY_20aout2010 (points)

- Point de départ simulation à 0h le 20/08/2010
- Barycentre à 12h le 20/08/2010
- Tête de nappe à 12h le 20/08/2010
- Corps de nappe à 12h le 20/08/2010
- Barycentre à 0h le 21/08/2010
- Tête de nappe à 0h le 21/08/2010
- Corps de nappe à 0h le 21/08/2010
- Barycentre à 12h le 21/08/2010
- Tête de nappe à 12h le 21/08/2010
- Corps de nappe à 12h le 21/08/2010
- Barycentre à 0h le 23/08/2010
- Tête de nappe à 0h le 23/08/2010
- Corps de nappe à 0h le 23/08/2010
- Barycentre à 12h le 23/08/2010
- Tête de nappe à 12h le 23/08/2010
- Corps de nappe à 12h le 23/08/2010
- Barycentre à 0h le 24/08/2010
- Tête de nappe à 0h le 24/08/2010
- Corps de nappe à 0h le 24/08/2010
- Ligne intra-barycentre

Lat:52.025 Lon:-0.384

0 40 80 KM

démarrer

N... C... D... C... C... Se... po... C... ht... M...

copernic

18:08

Cedre

Distribution and communication

WEBCARTO - OILMAP (oil slick drift model)

The screenshot shows a web browser window displaying the GeoViewer application. The browser's address bar shows the URL <http://www.ifremer.fr/sextant/fr/web/netmar/geoviewer#>. The application header features the LIFERAY logo and the tagline "Enterprise. Open Source. For Life." with a link to "Ouvrir une session".

The main interface is divided into several sections:

- Thèmes (Layers):** A list of layers on the left side, including "Continent", "oilmap_line", "oilmap_spillet", "metno_merc6", "metno_merc5", and "metno_merc4".
- Chantiers (contours):** A section for contour lines, currently empty.
- Chantiers (polygones):** A section for polygons, currently empty.
- Chantiers (points):** A section for points, currently empty.
- polrep_netmar:** A section with a "SATELLITE EMSA" layer selected.
- oilmap_spillet:** A section showing a legend for oil slick drift times, with colored circles representing different time intervals: 08:20:2010 22:00:00 (red), 08:21:2010 10:00:00 (orange), 08:21:2010 22:00:00 (yellow), 08:22:2010 10:00:00 (light green), 08:22:2010 22:00:00 (green), and 08:23:2010 10:00:00 (dark green).
- oilmap_line:** A section for line layers, currently empty.

The main map area displays a satellite view of the North Atlantic Ocean, showing the coastlines of North America and Europe. A series of colored circles (red, orange, yellow, green) are plotted in a line across the ocean, representing the drift of an oil slick over time. The map includes a search bar, navigation tools, and a scale bar at the bottom right showing 0, 40, and 80 kilometers. The current coordinates are Lat:52.025 Lon:-0.384.

The Windows taskbar at the bottom shows the "démarrer" button, several open applications, and the system tray with the date and time "18:09".

Distribution and communication

WEBCARTO - METNO (oil slick drift model)

Applications Raccourcis Système 50 °C 50 °C 72 °C 2,13 GHz mar. 31 janv., 14:21

GeoViewer - liferay.com - Mozilla Firefox

File Edit View History Bookmarks Tools Help

GeoViewer - liferay.com

http://www.ifremer.fr/sextant/fr/web/netmar/geoviewer#

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Ouvrir une session

Welcome Pilot GeoViewer

- Chantiers (contours)
- Chantiers (lignes)
- Observations pollutions
- Observations pollutions
- Observations pollutions
- Observations pollutions

metno_merc1
aout 20 2010 22:00:00

metno_merc2
aout 21 2010 10:00:00

metno_merc3
aout 21 2010 22:00:00

metno_merc4
aout 22 2010 10:00:00

metno_merc5
aout 22 2010 22:00:00

metno_merc6
aout 23 2010 10:00:00

Continent
gris

Localisation

Lat:53.384 Lon:-0.240

0 40 80 KM

démarrer copernic 18:11

Distribution and communication

WEBCARTO - MOTHY (oil slick drift model)
+ current from PREVIMER

Map - EUMIS - Mozilla Firefox : Ifremer

EUMIS | Map

sxt-geoviewer

Themes

- Continent
- Bathymetry
- oilmap_line
- oilmap_spillet
- MOTHY_20aout2010 (points)
- MOTHY_20aout2010 (lignes)

Layers

- MOTHY_20aout2010 (lignes)
 - Options
- MOTHY_20aout2010 (points)
 - Options
- barotropic_sea_water_velocity
 - Options
- Bathymetry
 - Options
- Continent
 - Options
- Legends
- Overview map

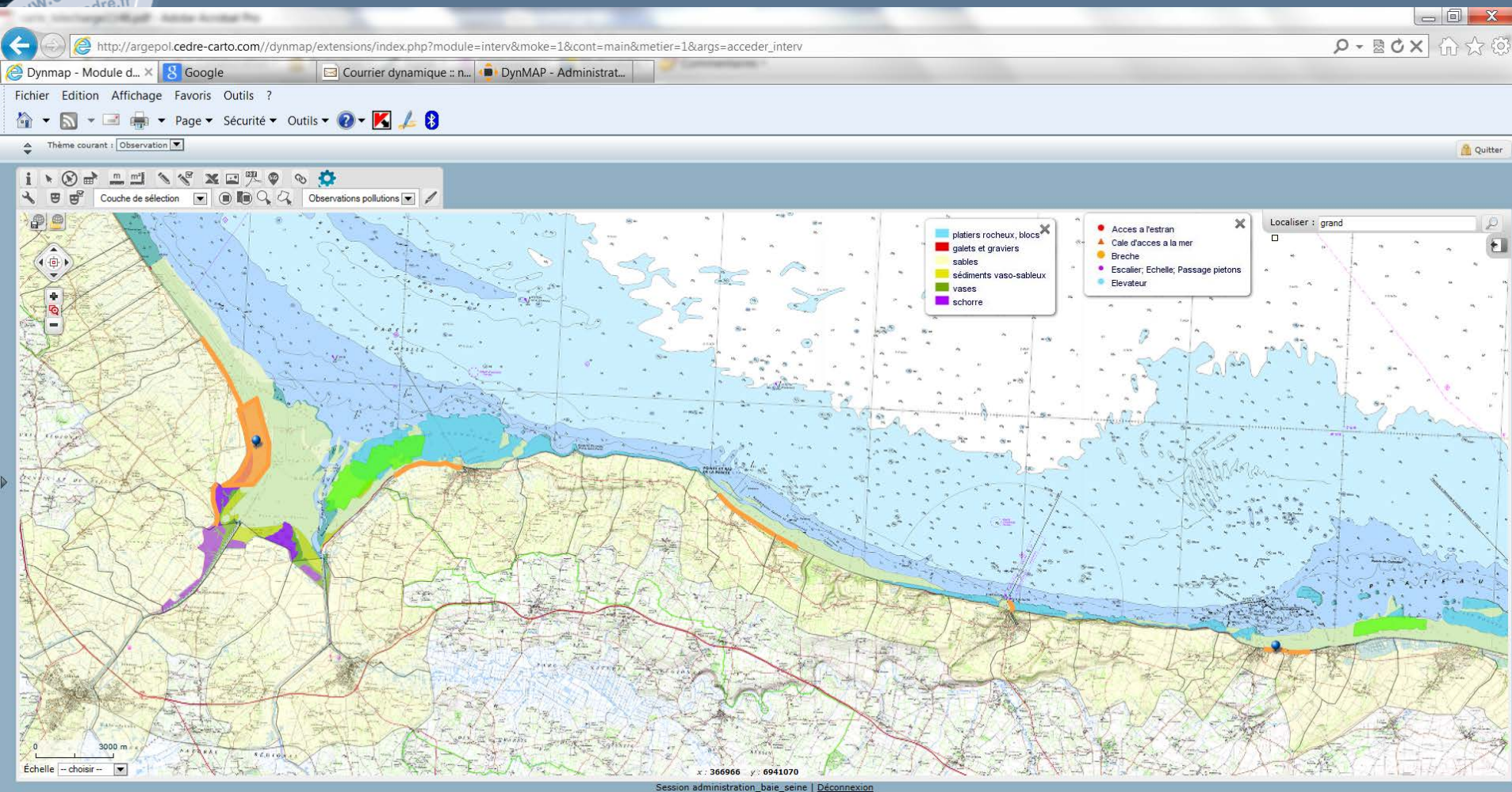
Lat:52.694 Lon:-0.018

0 20 40 MI

Distribution and communication

Bay of Seine exercise - *ARGEPOL extract*

- Pollution observations
- Clean-up sites



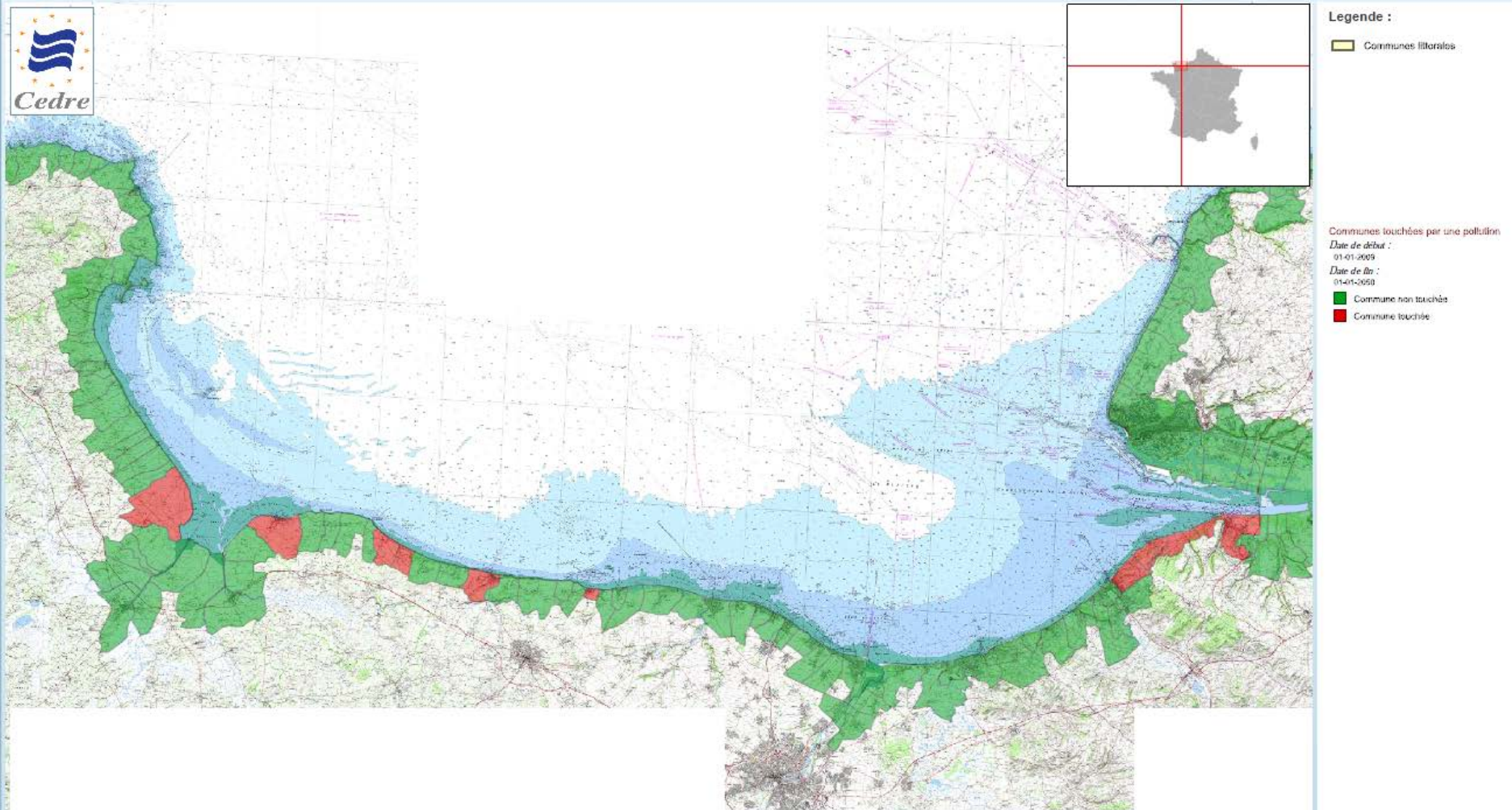
Distribution and communication

Bay of Seine exercise - *ARGEPOL* extract

Red: communes affected by a spill

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Communes touchées par une pollution



Distribution and communication

Bay of Seine exercise - *ARGEPOL* extract

Red: communes with active clean-up sites

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The screenshot displays the ARGEPOL web application interface. At the top, the browser address bar shows the URL: http://argepol.cedre-carto.com/dynmap/extensions/index.php?module=interv&moke=1&cont=main&metier=1&args=acceder_interv. The application header includes the ARGEPOL logo and the text "Le suivi des chantiers de nettoyage et des reconnaissances du littoral". Below this, logos for ARUPOL, Cedre, AQUITAINE, BRETAGNE, and ATLANTIC AREA are visible, along with the European Union flag and "Projet Partiel Financé par les Européens". The main interface features a map of the Bay of Seine with a yellow overlay representing the coastline and communes. Several communes are highlighted in red, indicating active clean-up sites. The interface includes a toolbar with various map controls, a search bar, and a right-hand panel with filters and analysis options. The bottom of the screen shows the session information: "Session administration_baie_seine | Déconnexion".

Distribution and communication

Bay of Seine exercise - ARGEPOL extract

The screenshot displays the ARGEPOL web application interface. At the top, the browser address bar shows the URL: http://argepol.cedre-carto.com/dynmap/extensions/index.php?module=interv&moke=1&cont=main&metier=1&args=acceder_interv. The application header includes the ARGEPOL logo and the text "Le suivi des chantiers de nettoyage et des reconnaissances du littoral". Below this, there are logos for ARCUPOP, Cedre, AQUITAINE, ALPES BRETAGNE, ATLANTIC AREA, and the European Union. The main map area shows a coastal region with various data layers. A legend in the center-left lists categories such as "plattiers rocheux, blocs", "galets et graviers", "sables", "sédiments vaso-sableux", "vases", "schorre", "Huître", "Huître, moule, coquillages", and "Moule". The map also features a "Chantier de nettoyage" (cleaning site) and an "Observation pollution du 16/10/2012" (pollution observation on 16/10/2012). On the right side, there is a "Localiser" search bar and a "Situation" panel with a list of environmental indicators and their status (checked or unchecked). The bottom of the map shows coordinates (x: 435485, y: 6923315) and a session ID "Session administration_baie_seine | Déconnexion".

http://www.ifremer.fr/services/wms_mimel?SERVICE=WMS&VERSION=1.1.1&REQUEST=GetLegendGraphic&LAYER=DDAM14_CADASTRE_CONCH_P&Format=image/jpeg

Distribution and communication

Bay of Seine exercise - ARGEPOL extract

Site: Port-en-Bessin / pollution observation (orange)

The screenshot displays a web-based GIS application interface. At the top, a browser window shows the URL: http://argepol.cedre-carto.com/dynmap/extensions/index.php?module=interv&moke=1&cont=main&metier=1&args=acceder_interv. Below the browser is a menu bar with options: Fichier, Edition, Affichage, Favoris, Outils, ?. A toolbar contains various icons for map navigation and editing. The main map area shows an aerial view of a coastal region with a town and a harbor. An orange line highlights a specific area in the harbor, representing a pollution observation. On the right side, there is a 'Localiser' search bar and a 'Thèmes' (Layers) panel. The 'Thèmes' panel is organized into several categories:

- Données opérationnelles**
 - Chantiers
 - SUIVI DES CHANTIERS
 - Observations pollutions
- Référentiels**
 - départements
 - zones_defense_L93
 - regions_fr_L93
 - Toponymie
 - Communes littorales
 - SUIVI DES POLLUTIONS
 - SUIVI DES CHANTIERS
 - Orthophotos Littorales
 - SHOM_IGN France
- Données nationales**
 - Somme protection enviro - Basse-Normandie
 - Concessions conchyliques - 14 & 76
 - Indice vulnérabilité avifaune - Normandie
 - Cadastre mytilicole - 50
 - Accès au littoral - 50
 - Nature trait de côte - 50
 - sensibilité socio-économique - 50
 - Concessions conchyliques - 50
 - Accès au littoral - 14
 - Nature estran - 14

At the bottom of the map, there is a scale bar (0 to 250 m) and a status bar showing coordinates: x: 424574 y: 6924561. The bottom of the screen shows a Windows taskbar with various application icons and a system tray with the date 16/10/2012 and time 08:55.

Distribution and communication

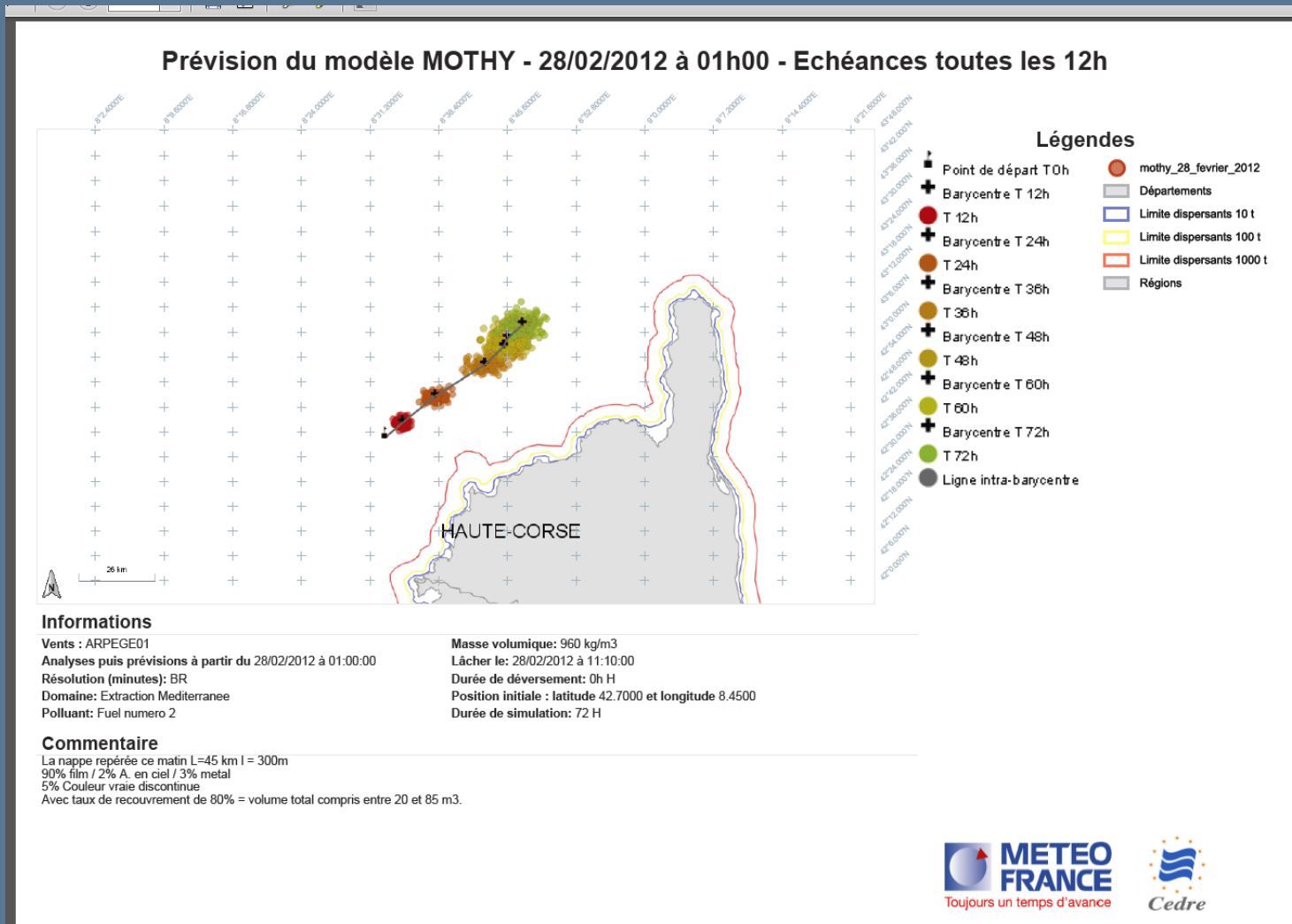
Bay of Seine exercise - *ARGEPOL* extract

Site: Port-en-Bessin / pollution observation (orange)

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Automatic summary for distribution and communication:

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Information presented in order to be understood by decision-makers and operators and possibly the general public



Conclusion

- Models: decision support
- Model limitations
- The more accurate the input data (operational and environmental), the more accurate the results...
- Technical committee in case of a major spill (joint forecast)
- In rivers: MIGR'HYCAR