BE-AWARE II Project Seminar

Trondheim (Norway): 26-28 January 2015

- Task C:
  Methodology

Methodology

1. Problem:
   Changing risk patter (More traffic, different traffic, wind farms, offshore, increased safety options, …)

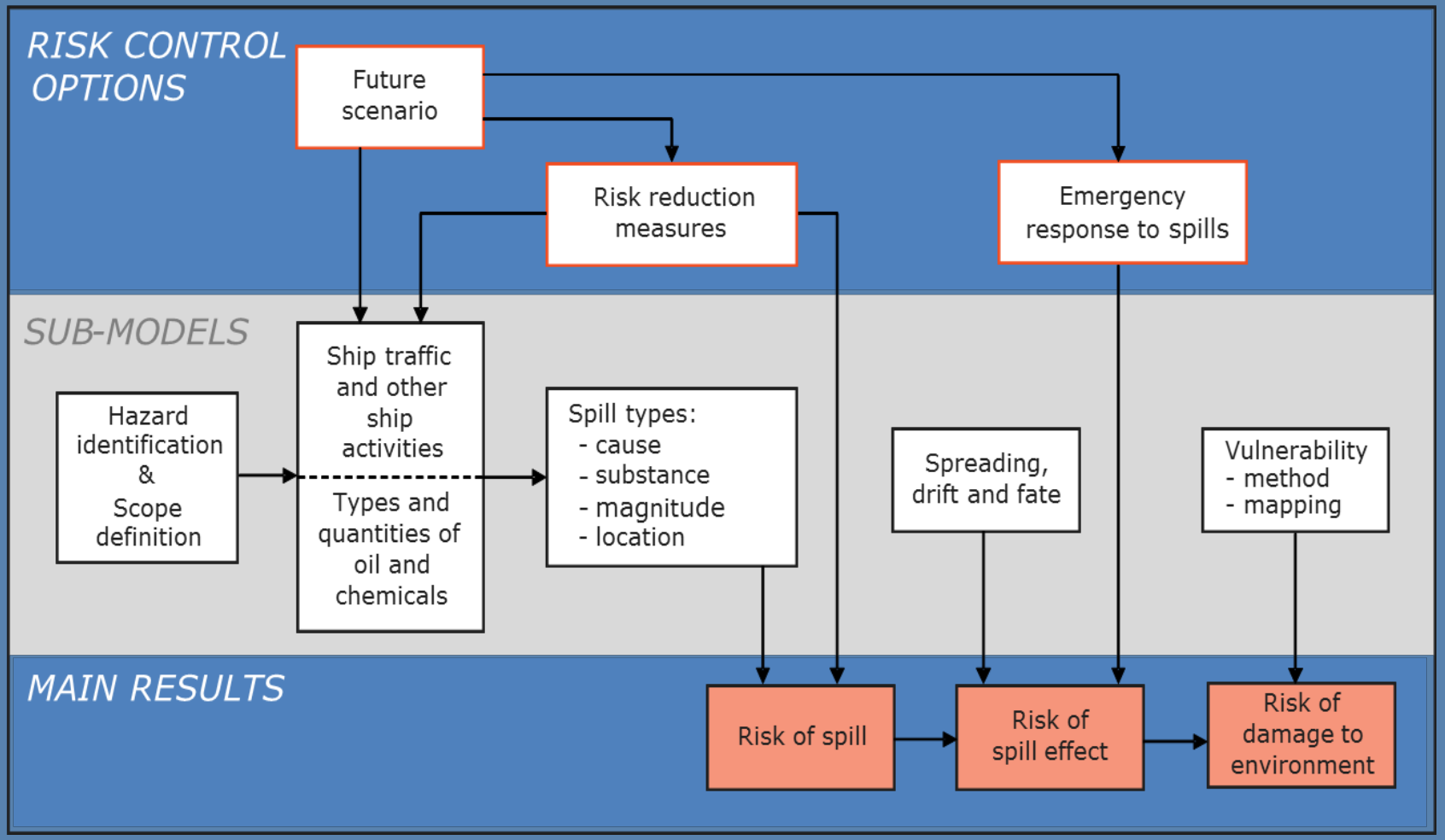
2. Overall objective
   Common ranking of different reaction options

3. Mean
   common comprehension of the risk for impacts (damages) from oil pollution

4. Tasks
   All BA-partner will work together on the development of a risk assessment tool (Dublin agreement)

Methodology

1. Principle



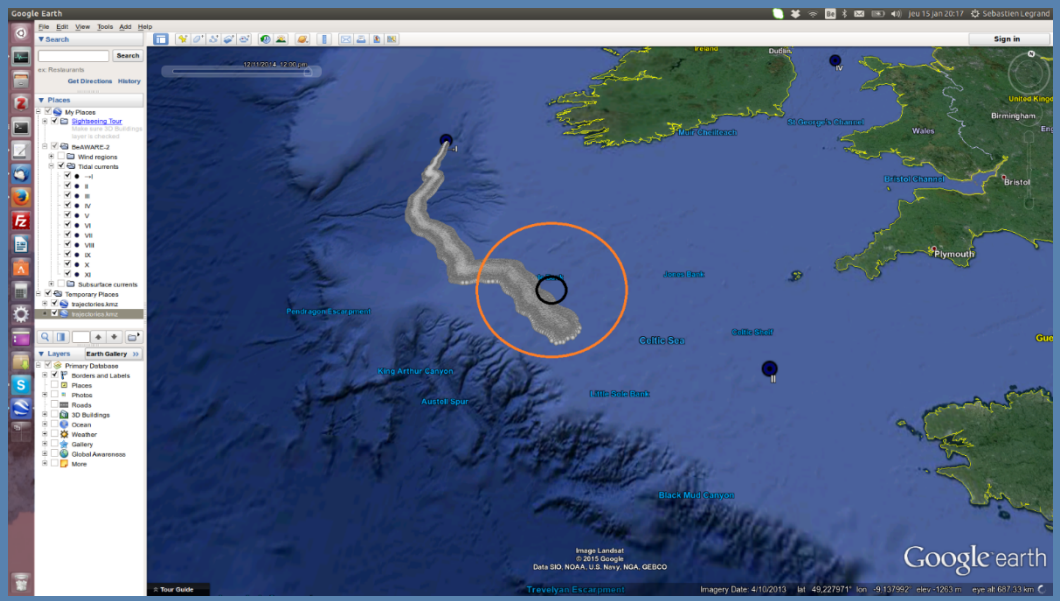
Methodology

Scenarios

Scenario name	Risk Reducing Measure	Response Measure
Reference 1	now	
Reference 2	2020	
Vessel Traffic Services (VTS)	X	
Traffic Separation Schemes (TSS)	X	
AIS alarm (Wind turbines)	X	
E-navigation	X	
New Emergency Towing Vessels (ETVs)	X	
Improved night detection capability		X
Further use of dispersants		X
50% increase in response equipment		X

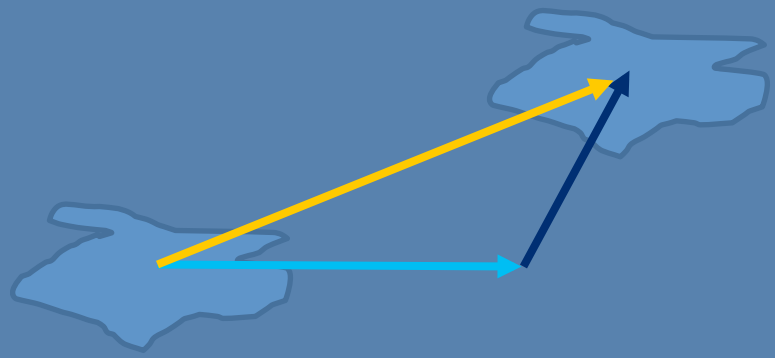
Methodology

- Task C:
  Methodology
  - Model Modifications and Methodology Note
    - Drift and spreading



Drift

- Drift at surface due to wind and mean current



Schematic illustration of the resulting drift velocity (yellow) as a superposition of wind drift (light blue) and mean current drift (dark blue).

Drift

- Drift at surface due to wind

Result from BRISK project:

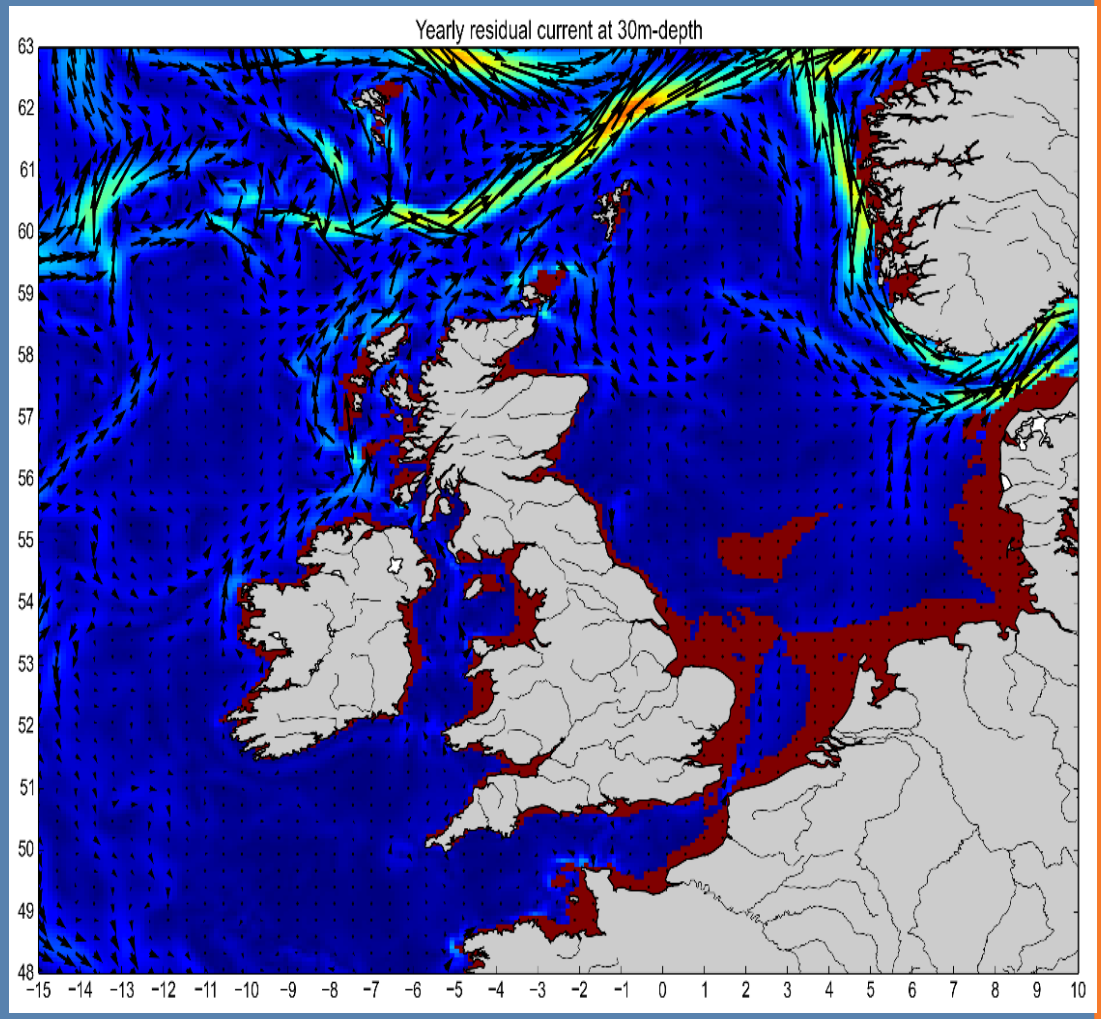
V-coeff = 0,023 => Vdrift = 0,023 · W, W: Wind speed (m/s)
D-coeff = 1 => Ddrift = D, D: Wind direction (deg)

(in consense with standard oil spill models)

Methodology

Drift

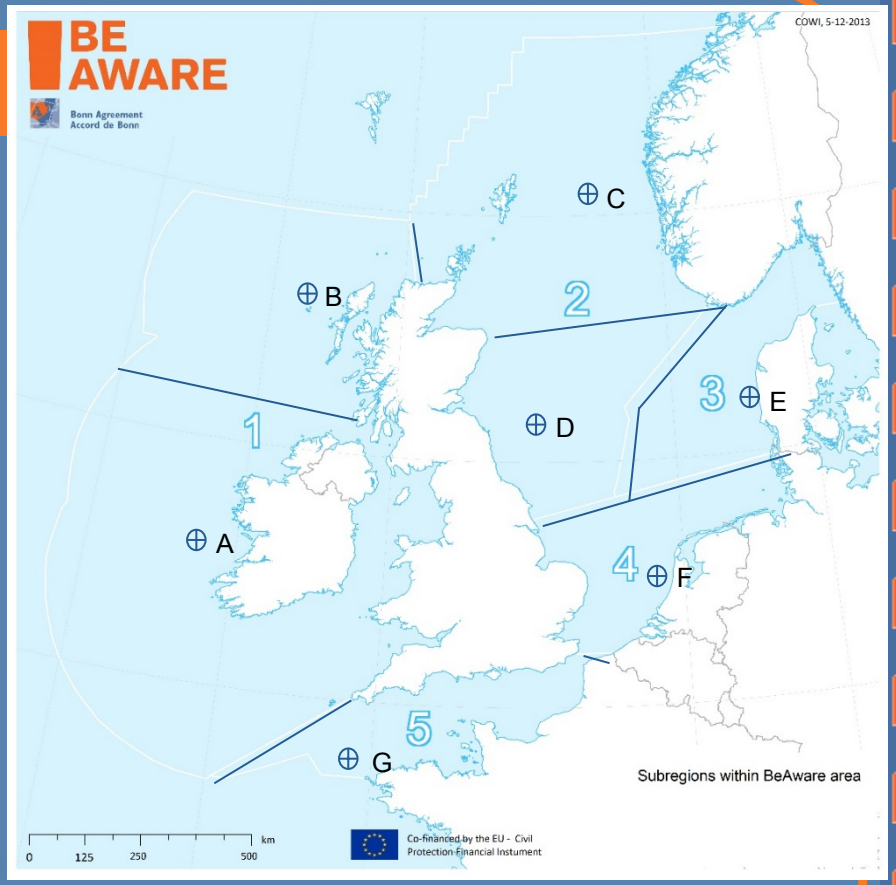
- Mean drift:
  One year OSERIT modelled average drift in upper 30 m:



Methodology

Drift

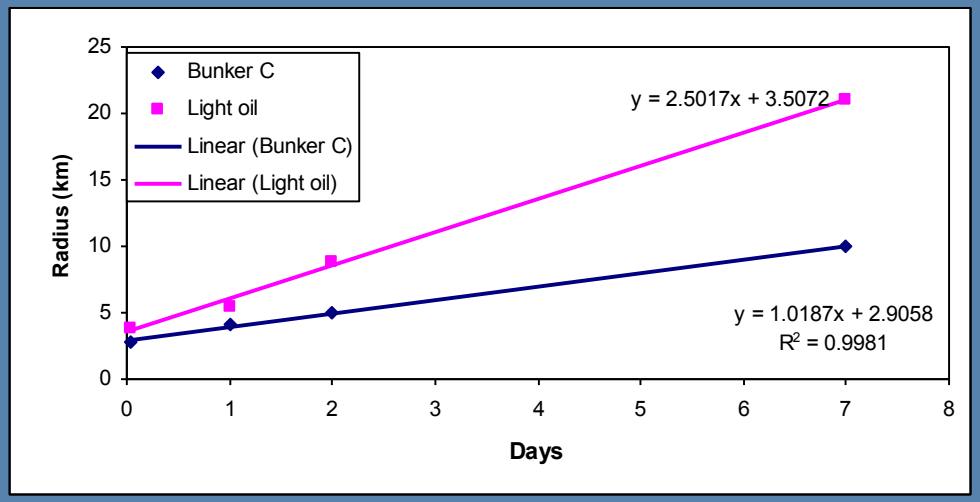
- Mean drift:
  Average over sub area,
- focus on areas with intensive traffic
- Channel: Wind dependency



Meteorological area	Description	Mean drift speed (m/s)	Direction of drift (ºN)
A	West of Ireland	0,05	45
B	NW of Scotland	0,07	45
C	West of Norway	0,10	45
D	East of UK	0,02	150
E	West of Denmark	0,07	45
F	Southern North Sea	0,01W, projected	30ºN, 210 ºN
G	English Channel	0,01W, projected	60ºN, 240ºN

Spreading

- Spreading at surface due to gravity and viscosity



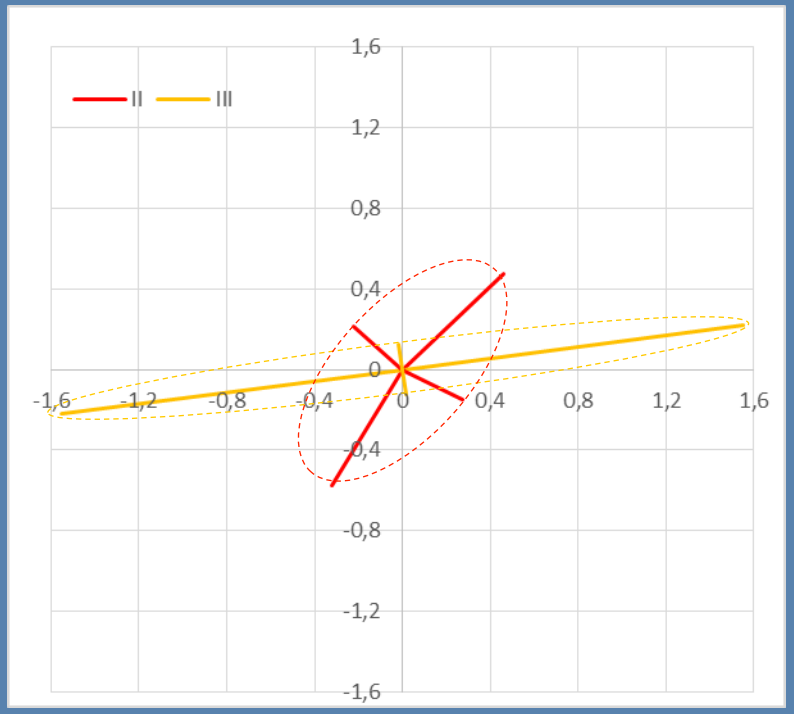
Example: Development of spill radius as function of oil type (viscosity) for a 30,000 t spill

$$R(\mathbf{t},\mathbf{M},\mathbf{v}) = 0.113 \cdot \mathbf{M}^{(0.22)} \cdot [\{0.13 - 0.02\log(\mathbf{v})\} \cdot \mathbf{t} + \{3.8 - 0.2\log(\mathbf{v})\}],$$

R	: Radius of oil spill (km)
t	: Time (Timer)
M	: Mass of spilt oil (t)
v	: Kinematic viscosity (cSt) at the given temperature
log	: 10- logarithm (Briggs)

Spreading

- **Tidal effect**
  Spreading at surface due to tidal ellipsoids

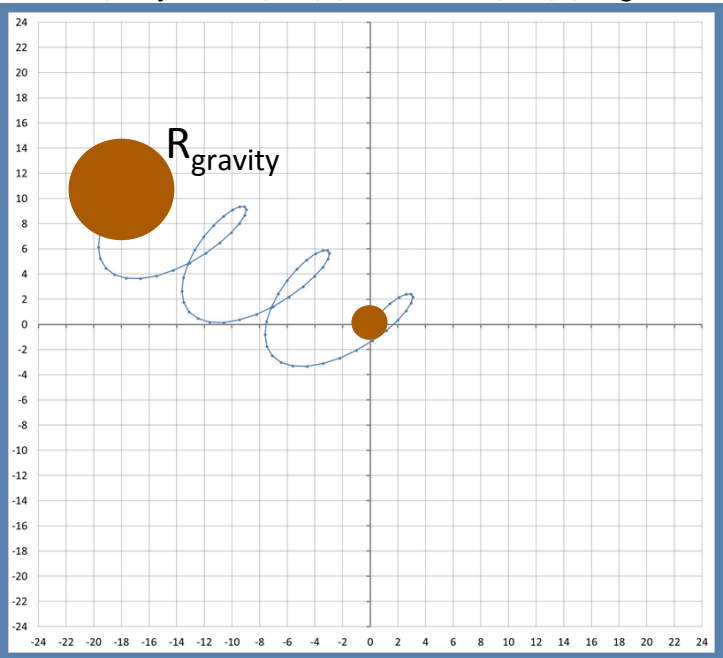


Tidal velocities (m/s):
II (red): Off Brest
III (yellow): Central English Channel
The axis of ellipsoids are determined based on the hydrodynamic modelling by MUMM, the ellipsoid is added for illustration purpose.

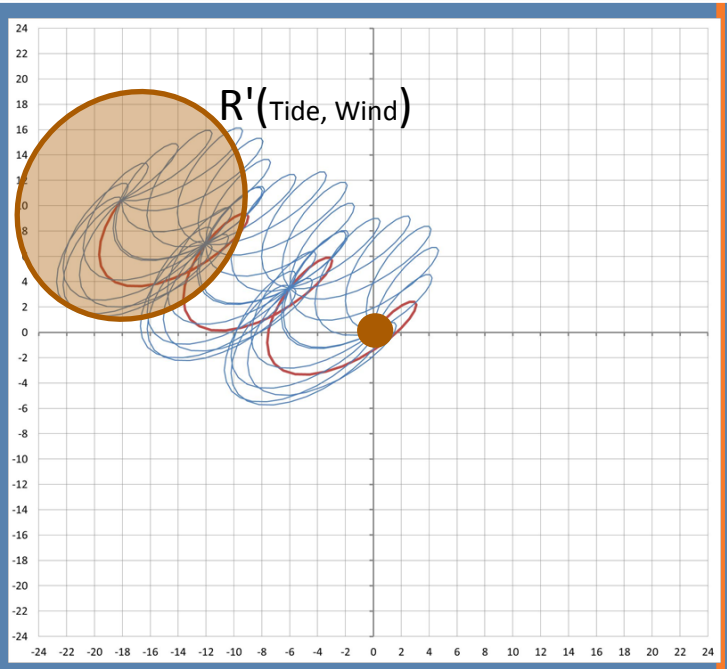
Drift and spreading

- Tidal ellipsoids + winddrift (after 1½ days)

Wind:	7 m/s, 120 Degrees North
Tide:	Off Brest, Major Axe 0,7 m/s, Minor Axe 0,3 m/s, Angle 45 Deg. North



As left, all time steps inside a tidal cycle are shown (1 hr steps)



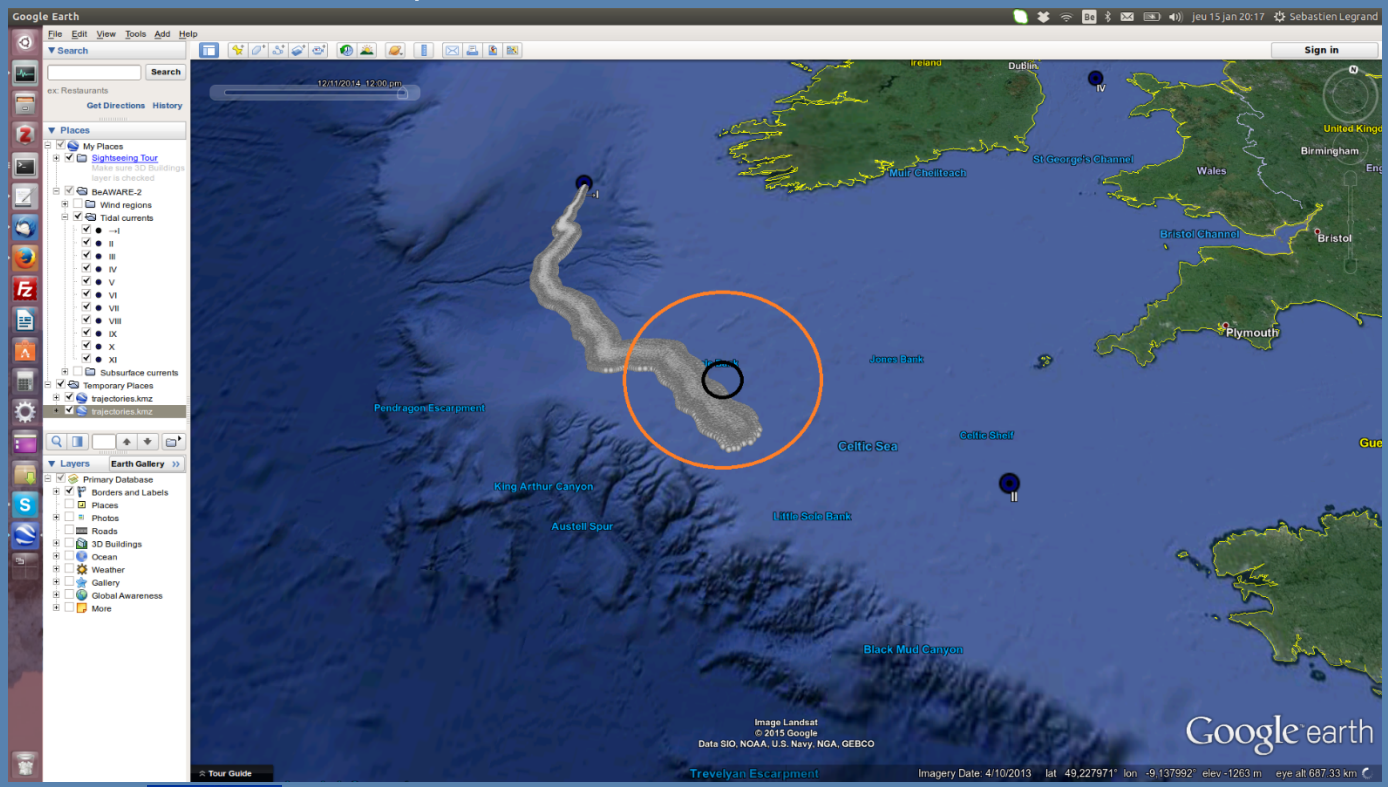
- Effective radius R' including tide: $R' = R_{gravity} + R_{tide}$

Chemical dispersion

- Drift: As main drift
- Spreading: Process is turbulent dispersion
  Plume spreading as 1:10
  => R of plume: $R(t)=Ro + 1/10 \cdot Vdrift \cdot t$
  (slow spreading comp to gravity and tidal)
- Degradation of chemically dispersed oil is faster than non oil on surface

Verification with OSERIT

- Comparison with prelim results from OSERIT 3D oil spill model (MUMM). 8700 m³, medium Arabian crude, 10 days, start 1. december 2014, Bft 4-8 from N and W)

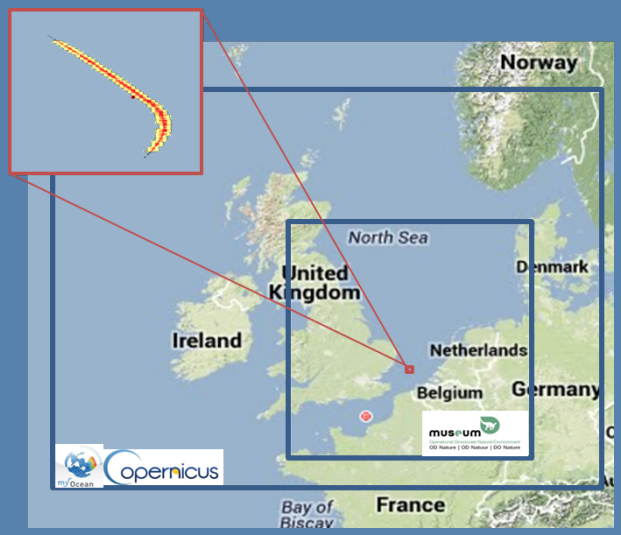


MUMM contribution to the modelling task E:

1. Provision of met-ocean data
   in support to COWI modelling activities

2. Validation of COWI's simple drift model against results from OSERIT, MUMM oil spill drift and fate model

Extension of OSERIT to the whole BA area



- BA area is 4 times wider than OSERIT's original area

- Wind forcing from the UK Met Office prediction

- Surface currents from the Copernicus Marine Service

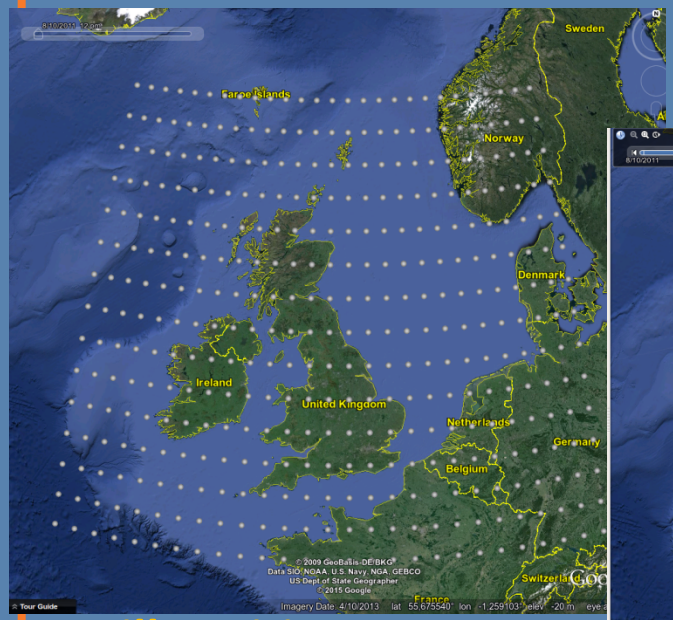
Implementation completed on 14/01/2015.

OSERIT to validate COWI results

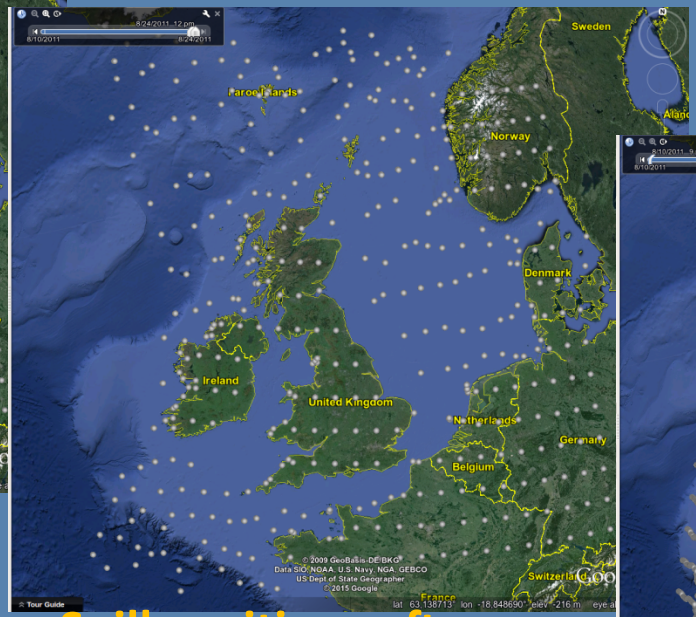
OSERIT will be used to validate COWI results on very specific scenarios:

- Release of 8700t of medium crude oil
- Dominant wind of ~7 Bft from SW
- One release location per sub-region

Studying the variability within each sub-region



Spill positions on 1°x1° array at T0



Spill positions after 14 days adrift

Spills trajectories

Redoing these simulations each day for a year will allow to gain an idea of the variability of the spill trajectories within each BA sub-region

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