

# Toward an european Med HF-radar coastal monitoring

Anne Molcard, LSEET Univ. Toulon-CNRS (future MIO)

## Process Studies

**Evidences of sub-mesoscale eddies by HF coastal radar observations in the Gulf of Lion: eddy generation and driving mechanisms numerical study** Schaeffer, P. Garreau (*IFREMER*), P. Fraunié, P. Forget

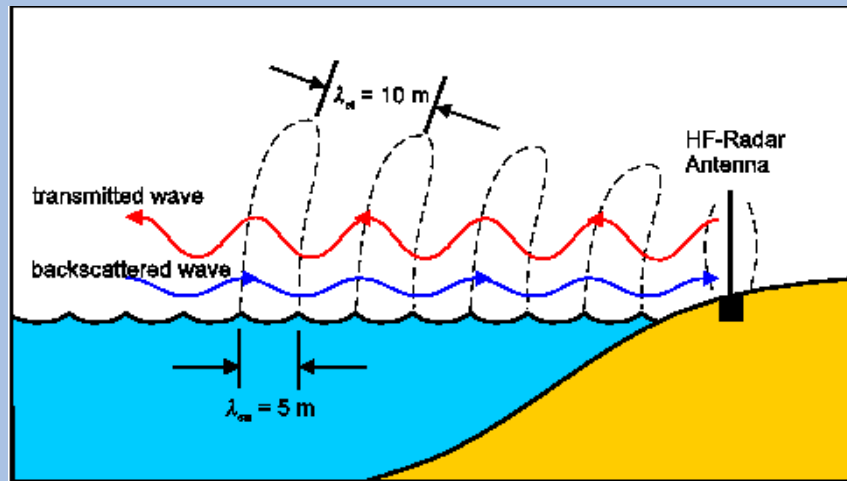
**VHF coastal radar observations in the Gulf of La Spezia, data validation with drifters. FSLE for transport barriers?** A. Griffa (*ISMAR-CNR*), A. Haza, T. Ozgokmen (*RSMAS*), P.M. Poulain (*OGS*) , P. Forget, Y. Barbin, J. Gaggelli

**Toulon site** J. Marmain , LSEET

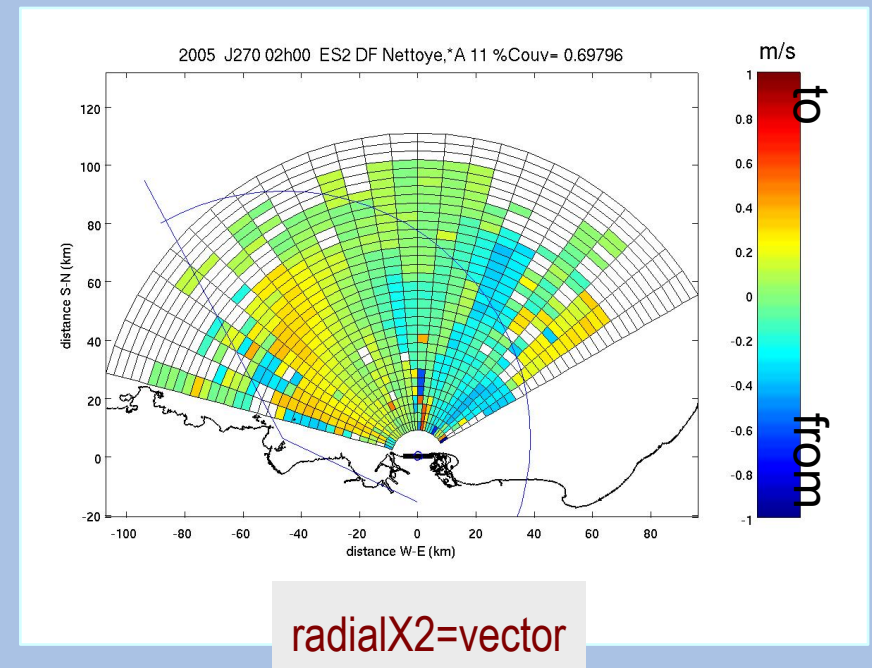
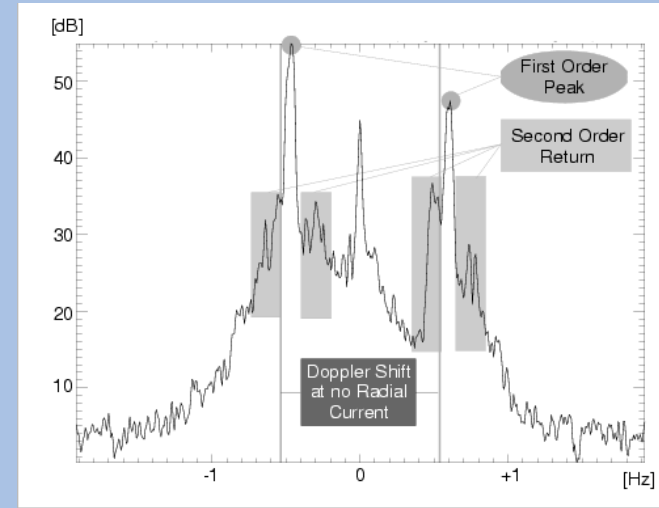
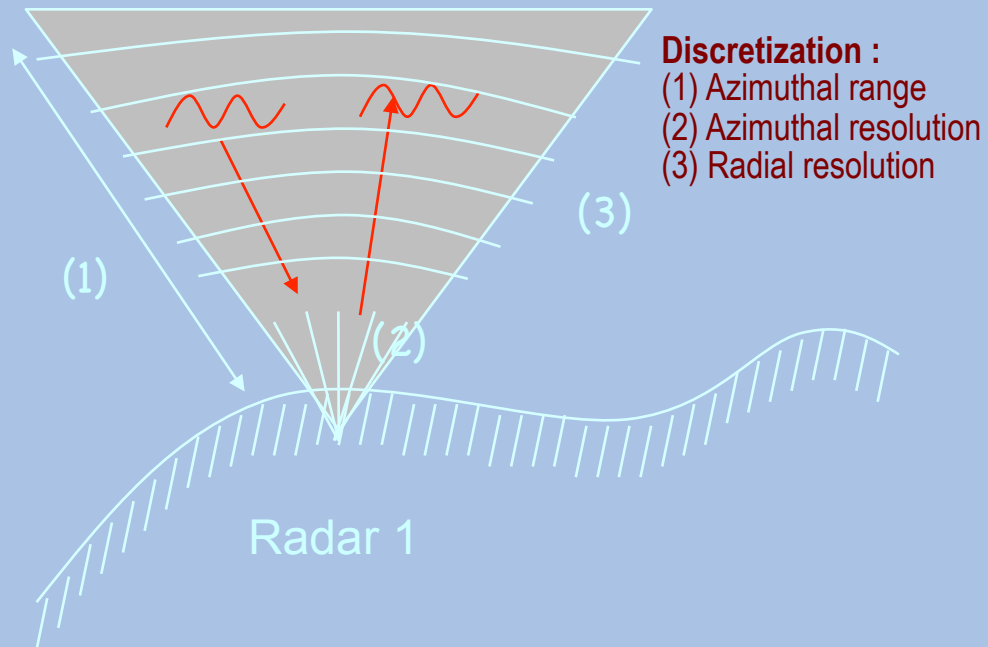
## Radar Networks

**TOSCA & MOOSE partners**

# Coastal radar WERA : how does it work ?

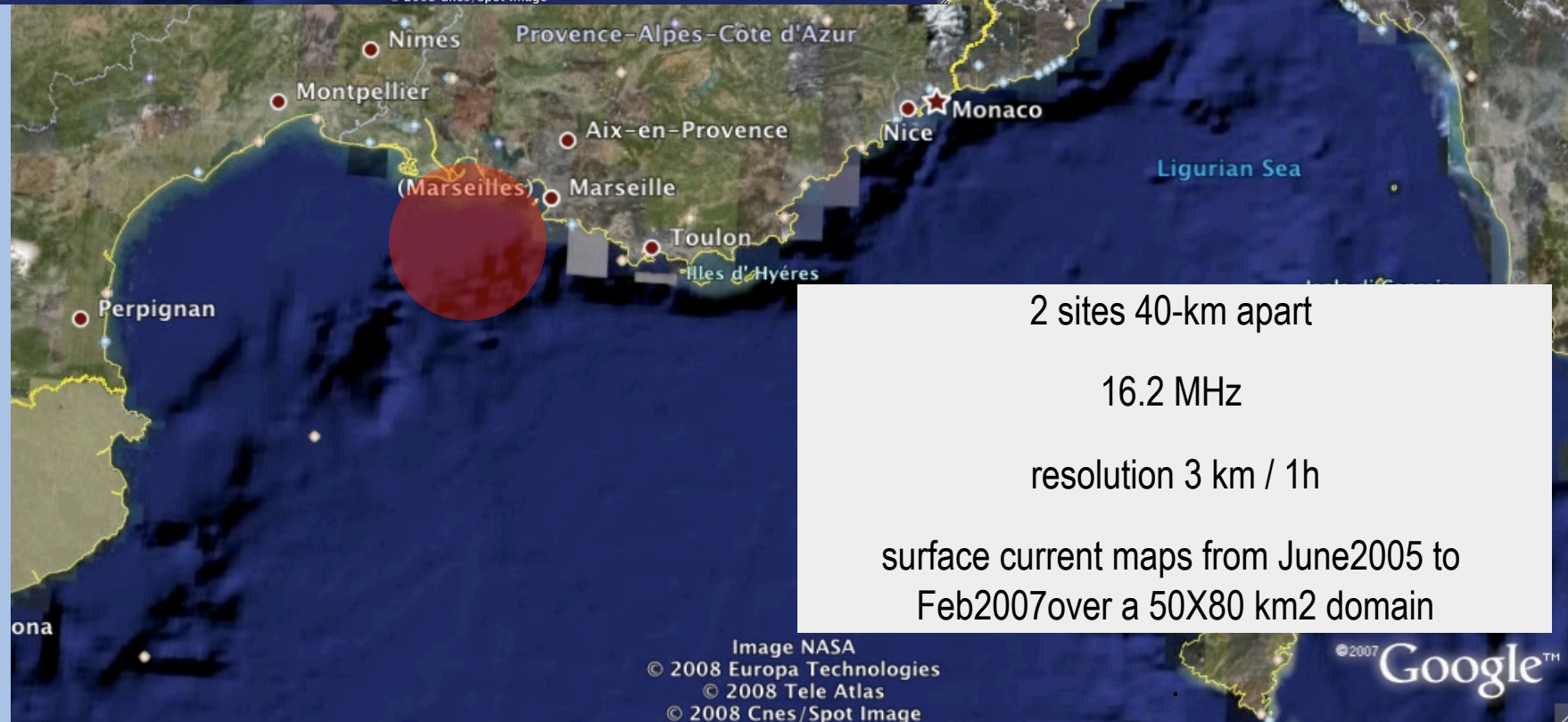


<http://ifmaxp1.ifm.uni-hamburg.de/WERA.shtml>





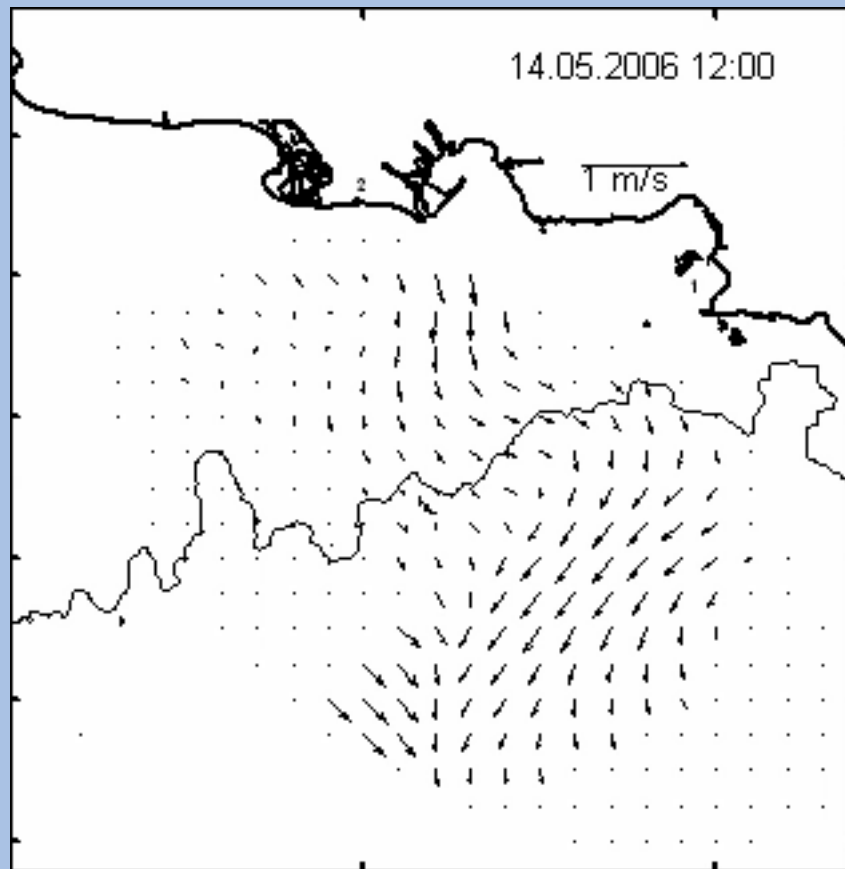
## HF-radar observations in the Gulf of Lions (2005-07)



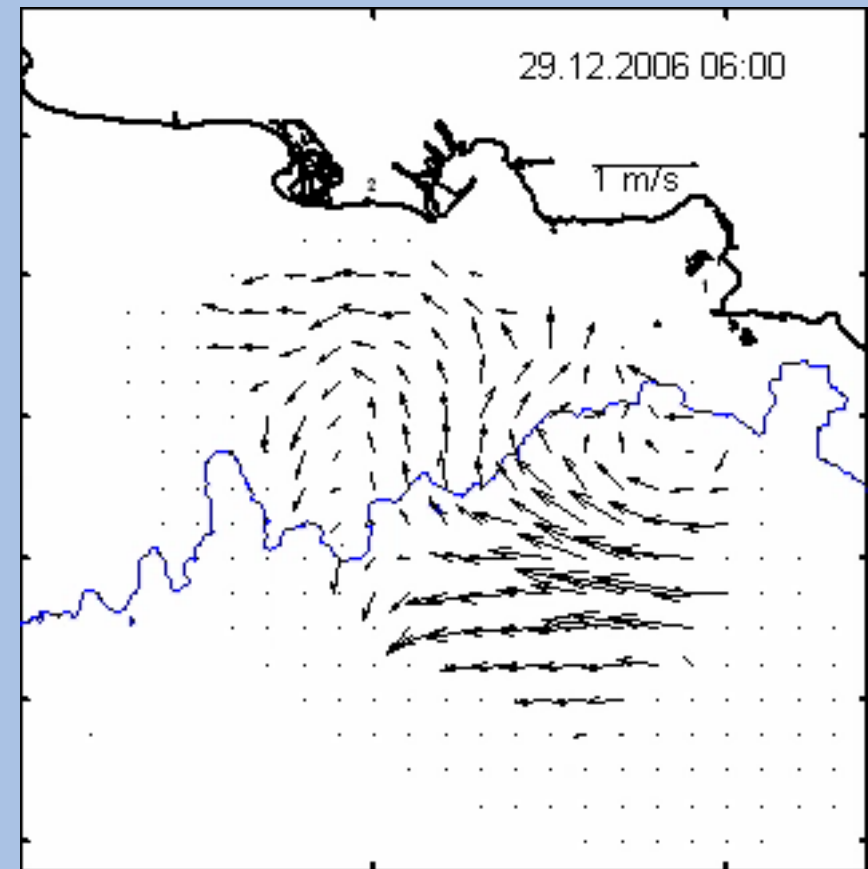
## Radar observations in the Gulf of Lions

Geographical context: strong wind activity (mistral), complex bathymetry and coastline, NC intrusions, Rhône outflow, mesoscale activity

Inertial circulation



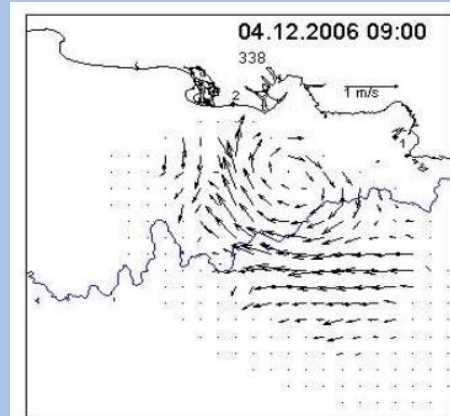
Anticyclonic circulation





# Process oriented study

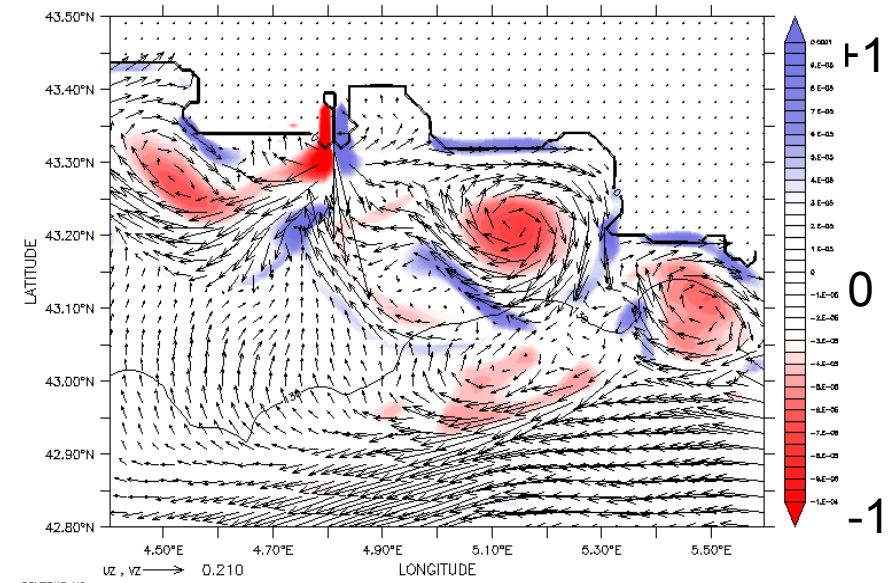
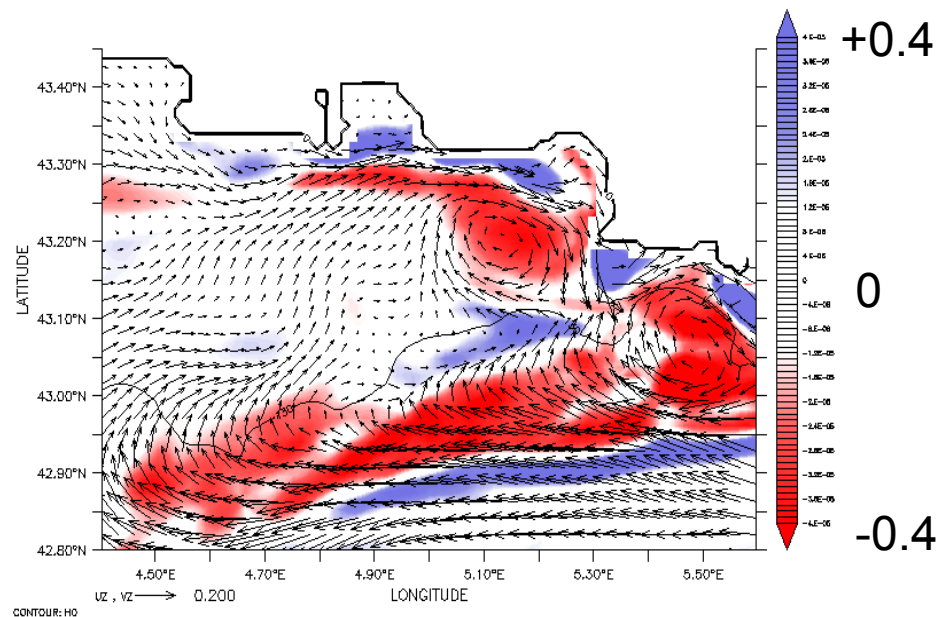
## COMBINATION RADAR-MODEL



● **Strong Mistral (and/or Tramontane) :**  
bottom generated eddy following the establishment of an eastward coastal jet blocked by coastline and bathymetry

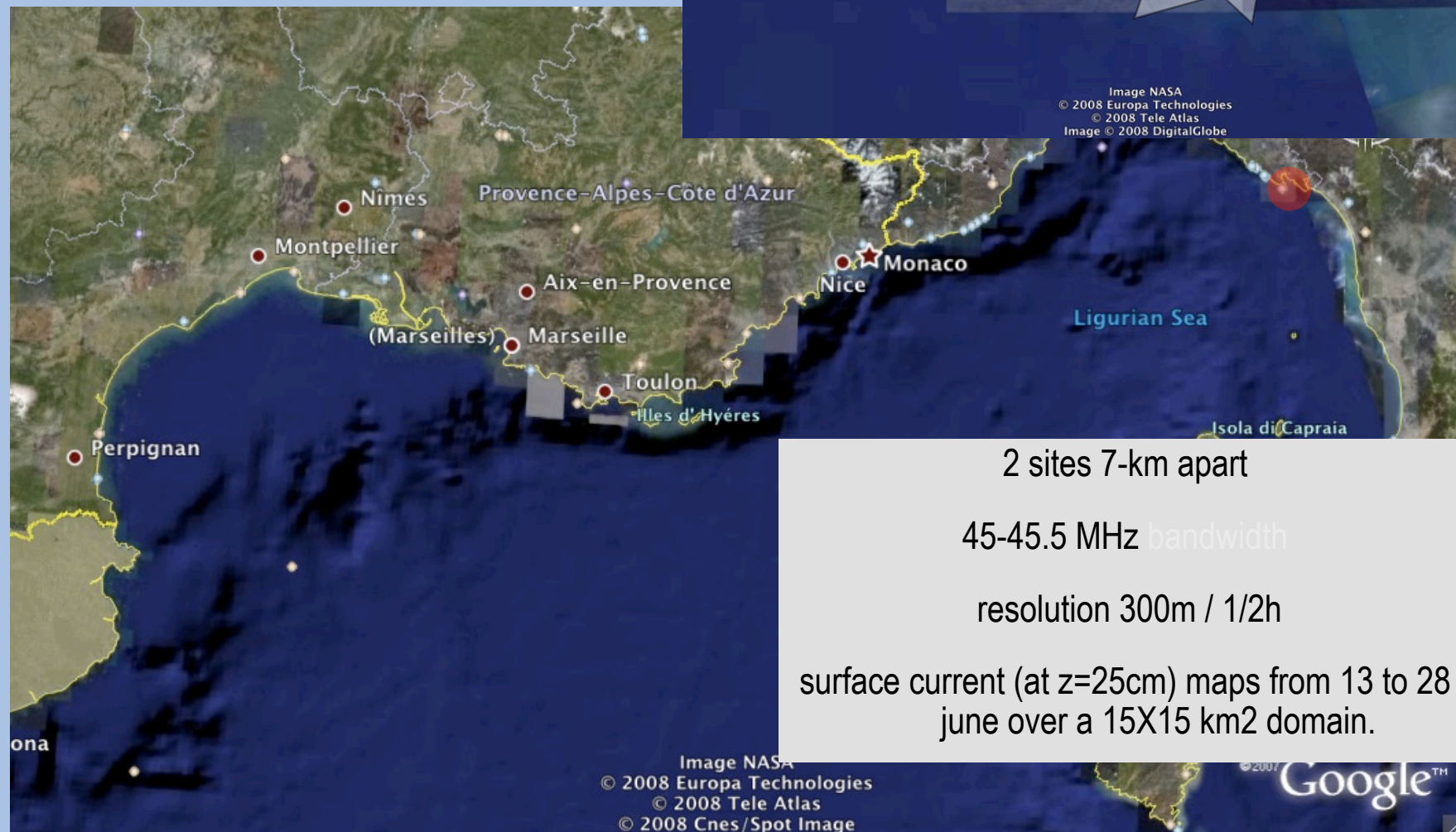
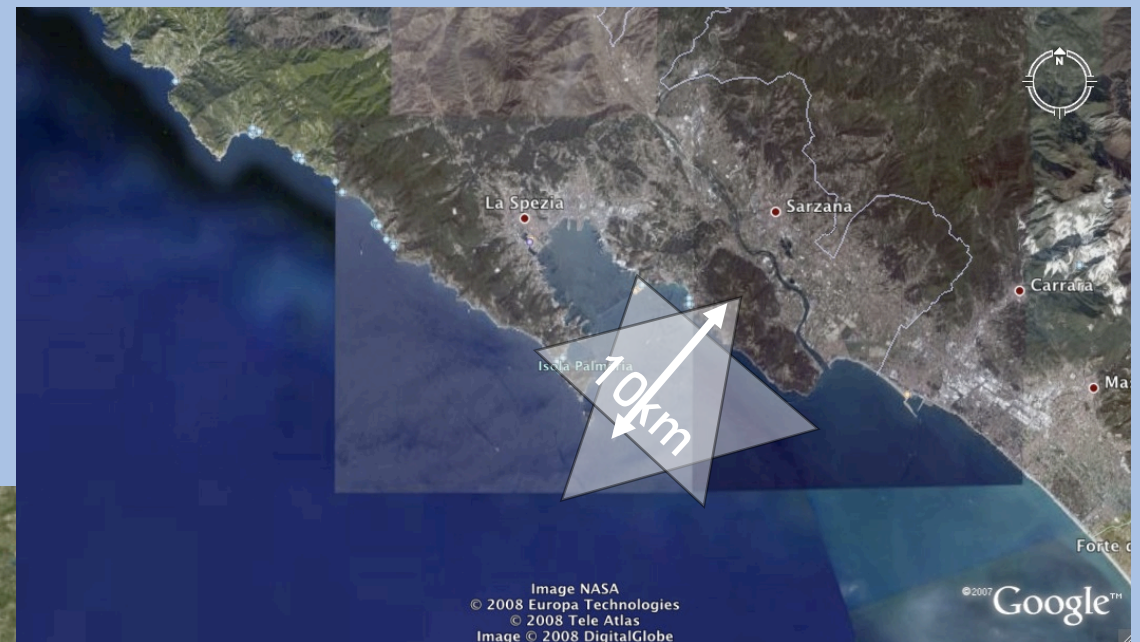
● **South wind forcing**  
surface generated eddy following the formation of a fresh and cold cell, i.e., Rhône freshwater pilling up eastward are blocked by coastline and bathymetry

surface signature only visible after wind relaxation



Surface Okubo-Weiss parameter ( $10^{-4} \text{ s}^{-1}$ )

## VHF-radar observations in the Gulf of La Spezia (2007)

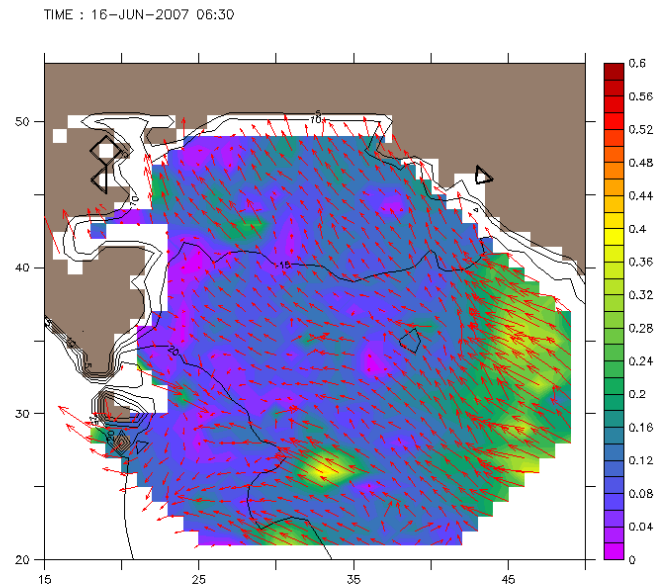


2 sites 7-km apart

45-45.5 MHz bandwidth

resolution 300m / 1/2h

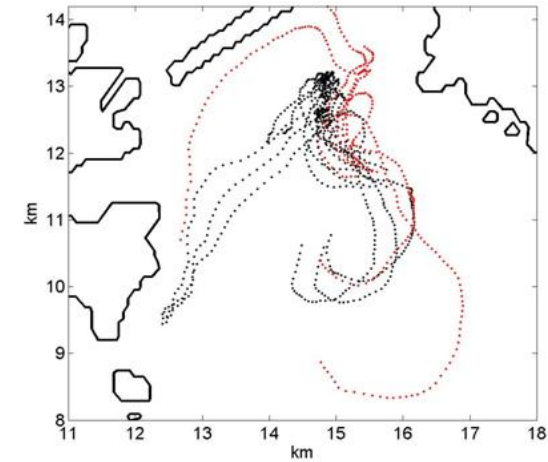
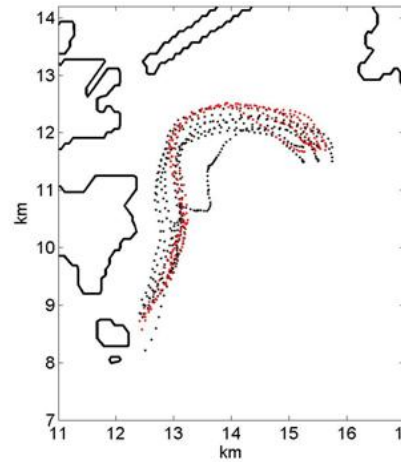
surface current (at  $z=25\text{cm}$ ) maps from 13 to 28  
june over a 15X15 km<sup>2</sup> domain.



Radar and multiple drifter launchings (strategy according to NRT radar maps)

Flow variability and relative dispersion studies (and recovery of coastal GMS drifters)

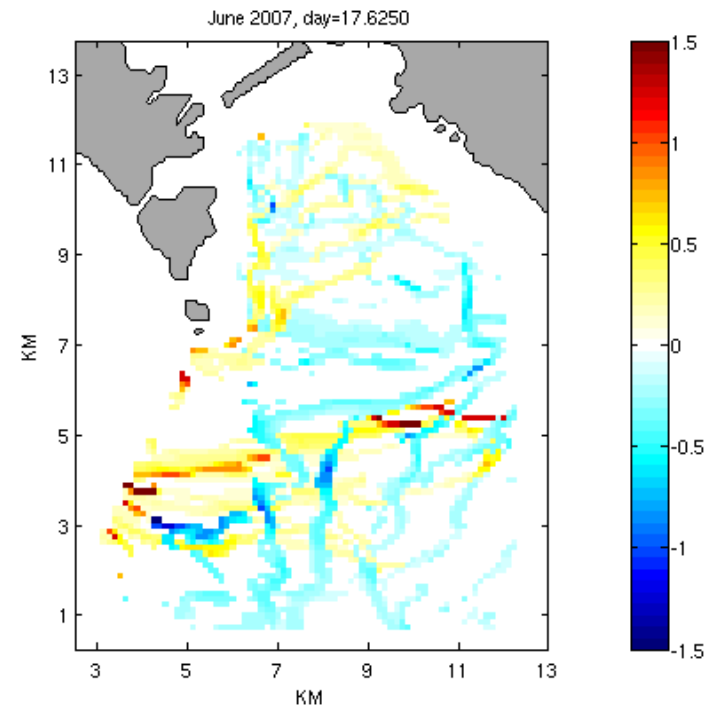
General patterns & branching reproduced



## COMBINATION RADAR-DRIFTERS

Identification of HP (FSLE) for:

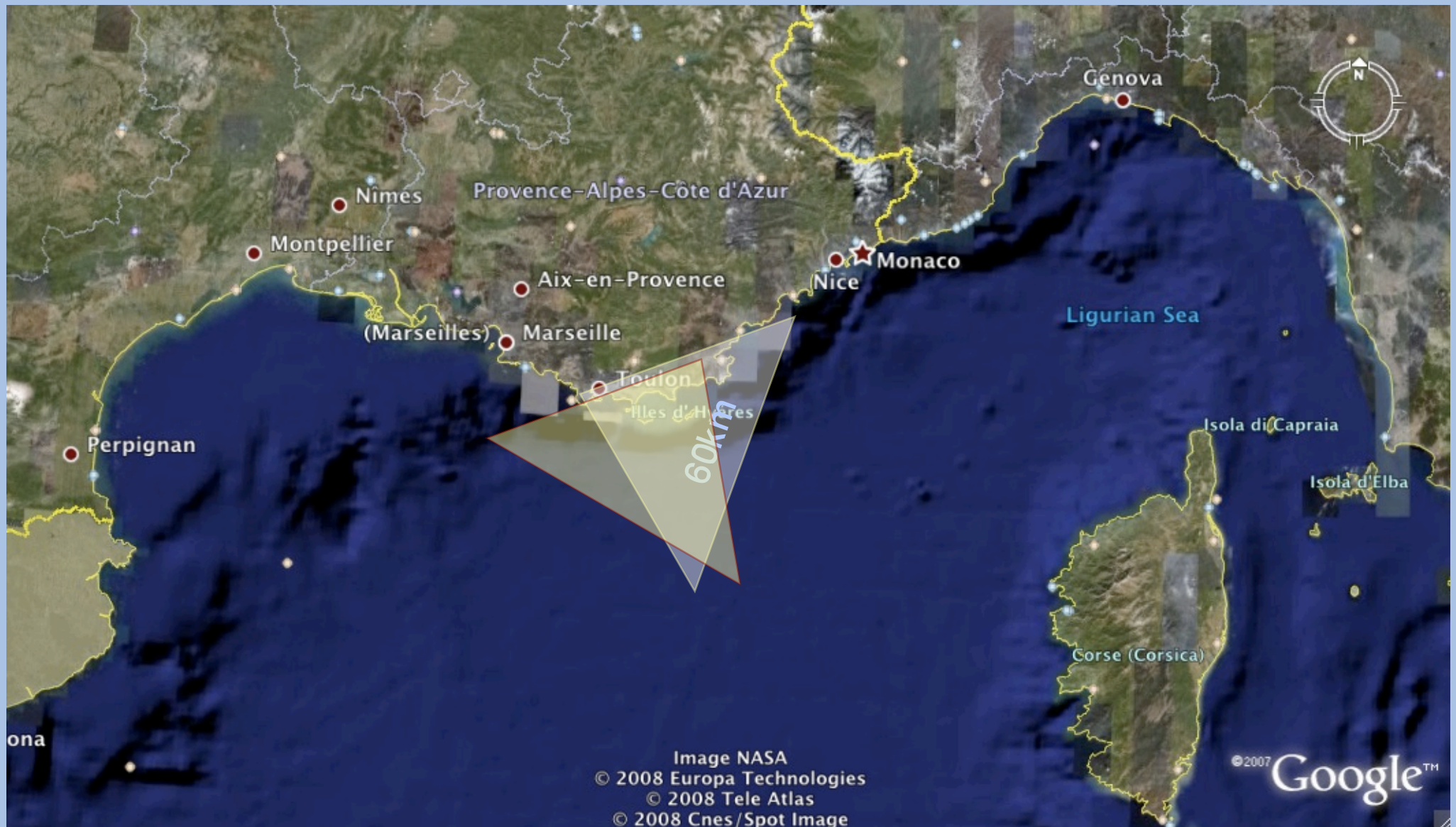
optimal sampling strategies for data assimilation; target  
geometric features associated with the coherent turbulent  
structures: eddies, jets, gyres;  
quantify water mass exchanges, flow barriers.



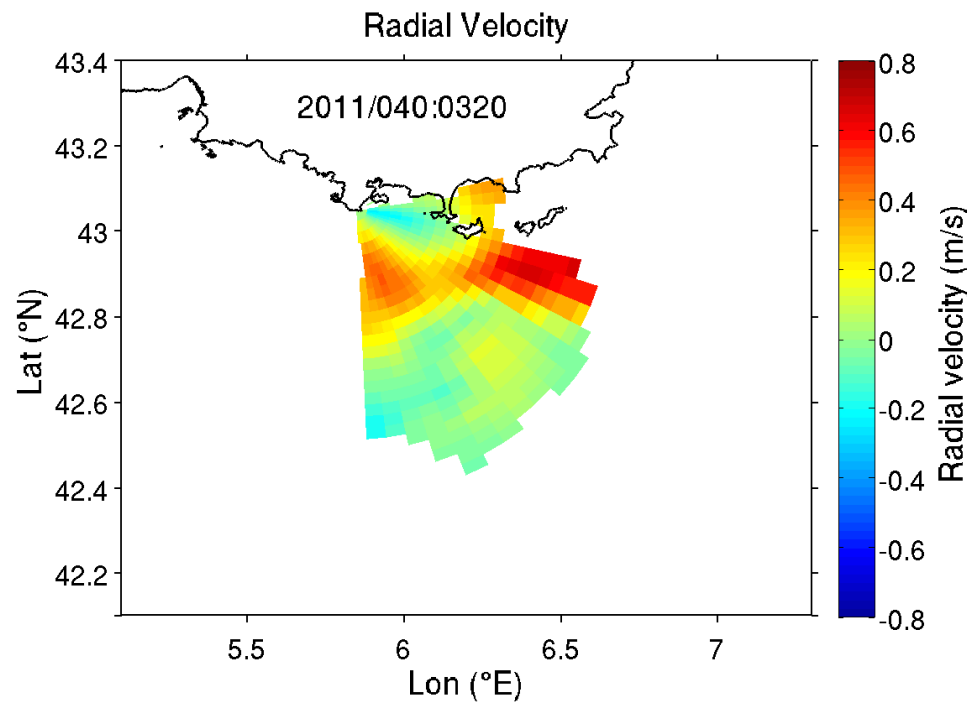


## Toulon site (2010-11)

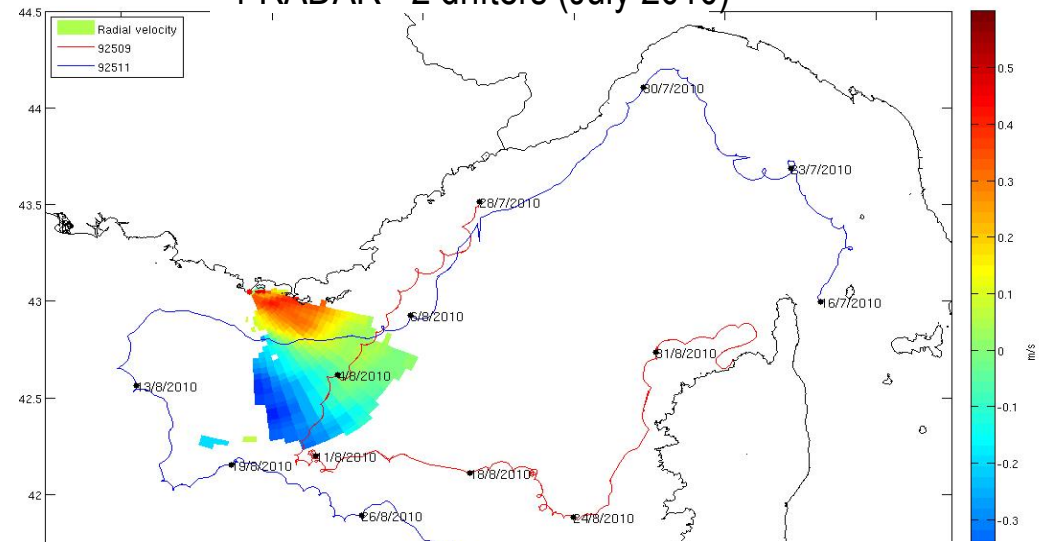
1 unique site, Fort Peyras Cap Sicié  
16.15 MHz



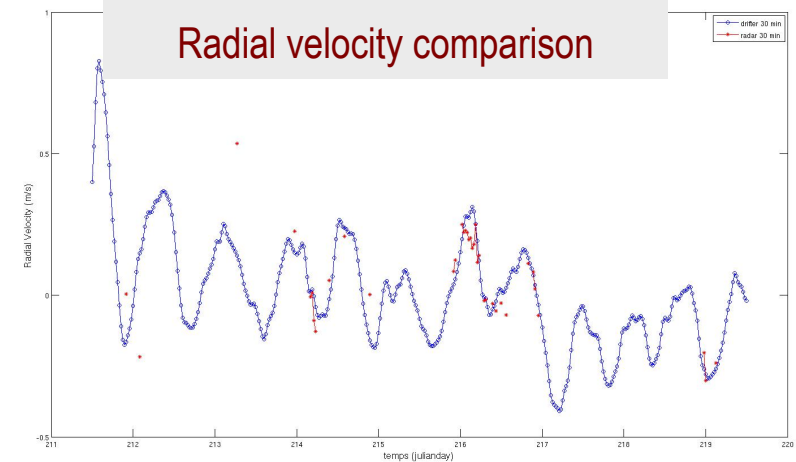




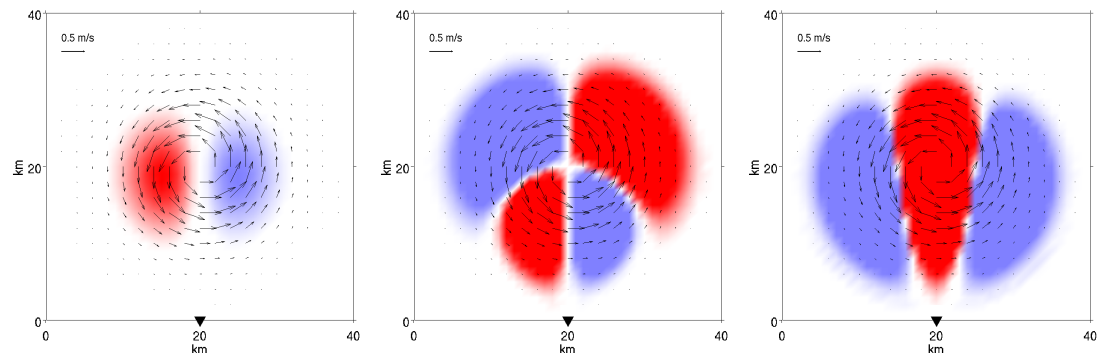
1 RADAR+ 2 drifters (July 2010)



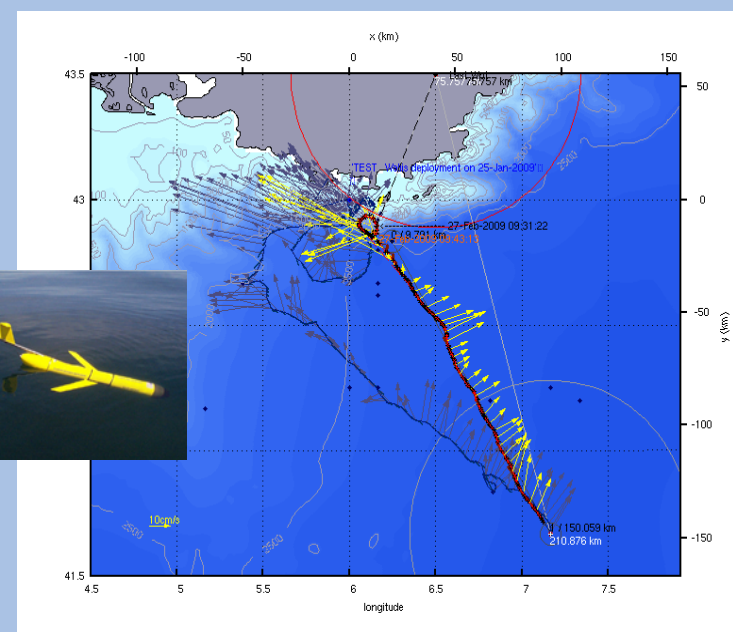
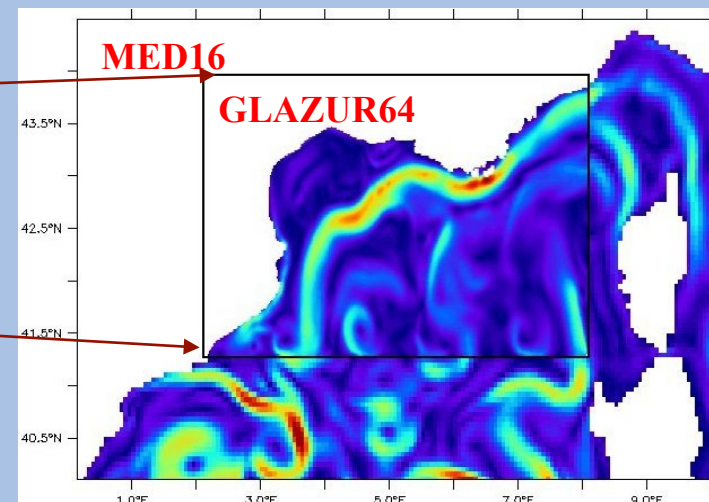
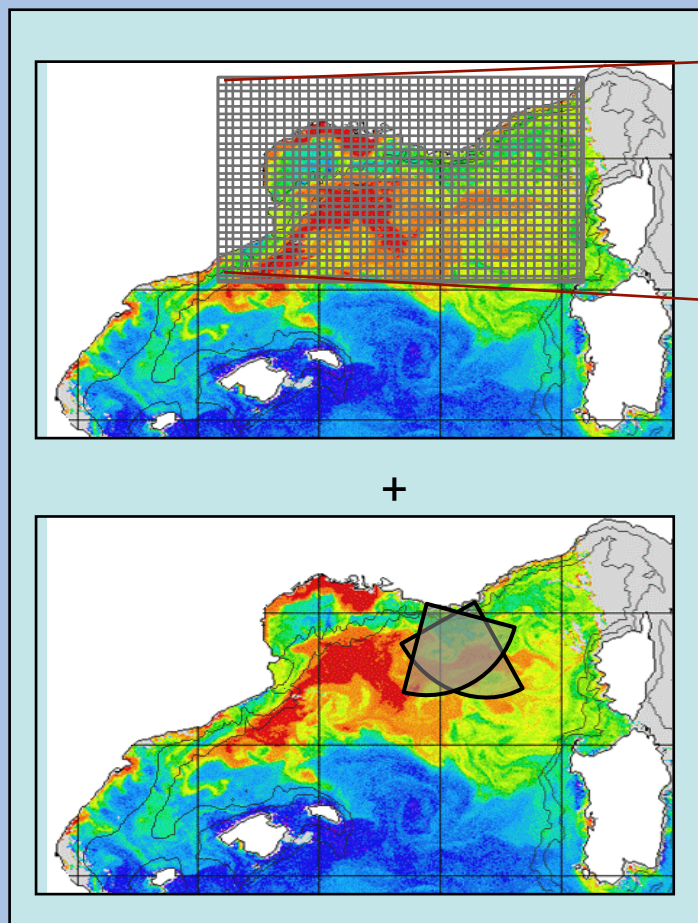
Radial velocity comparison



Characteristics Method for Vector Reconstruction based on a divergence-free assumption, or Vortex Identification Method based on  $V_r$  and its derivatives.



# Research projects at LSEET



(by courtesy of the EGO)

ECCOP: NC variability and transport

JELLYWATCH: jellyfish stranding

TOSCA: Tracking Oil-Spill & Coastal Awareness network

MOOSE: Med Ocean Observatory System for Environment

# An example of an international network: **TOSCA**

Tracking of Oil Spills and Coastal Awareness network



# TOSCA 13 partners

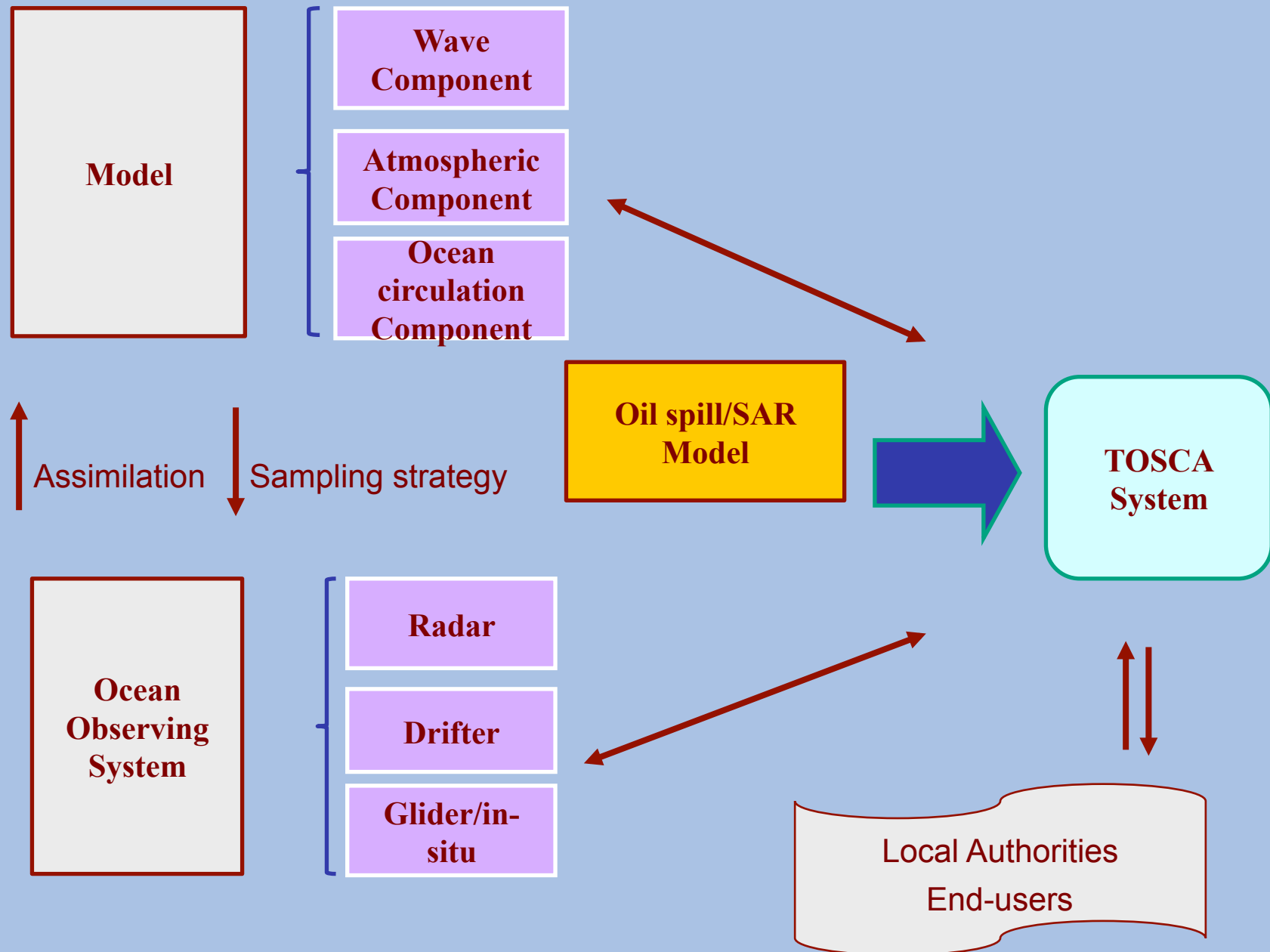


V. d'Angelo, C. Blottiere, C. Codina, E. Garcia-Ladona, A. Griffa, A. Molcard, G. Nicolaidis, A. Orfila, P.M. Poulain, A. Proal, S. Sofianos, J. Tintoré, E. Tragou, A. Verdeaux, A. Vetrano, E. Zambianchi, V. Zervakis

## TOSCA objectives

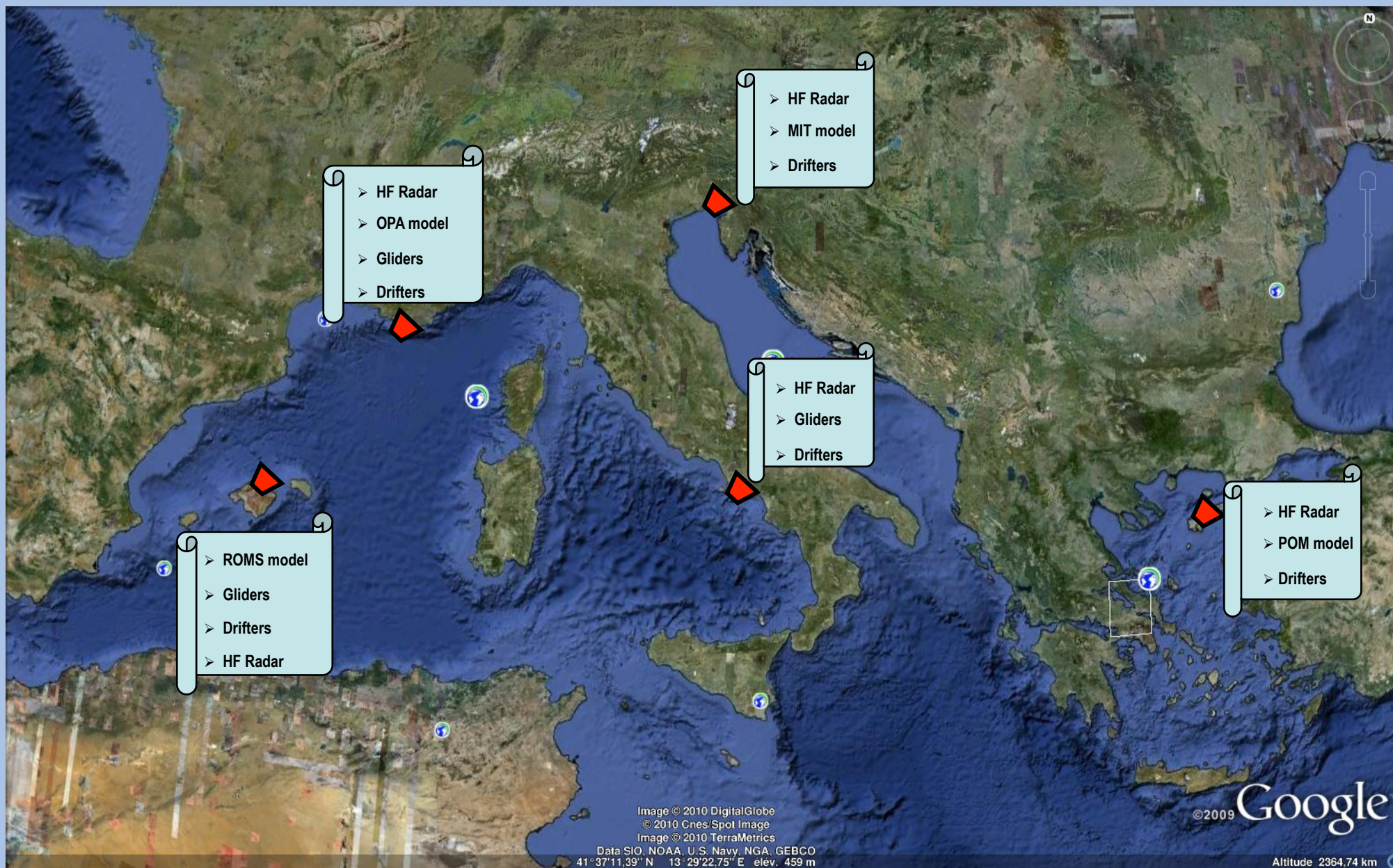
- ✓ **develop** a long-lasting **network** of policy makers & scientists for observation & forecasting of marine accidents (oil pollution, Search And Rescue (SAR) operations ...), in the Mediterranean Sea.
- ✓ **monitor** in real time and predict the **transport** of marine currents with an observational **network** based on coastal-radar and Lagrangian platforms coupled with a forecasting circulation oil-spill dispersion model.
- ✓ supply **forecast models, risk maps & action plans** developed by the scientists in collaboration with the local authorities.
- ✓ includes the high risk regions of oil pipeline outlets in the Eastern Mediterranean, as well as high traffic areas in the Western Mediterranean.

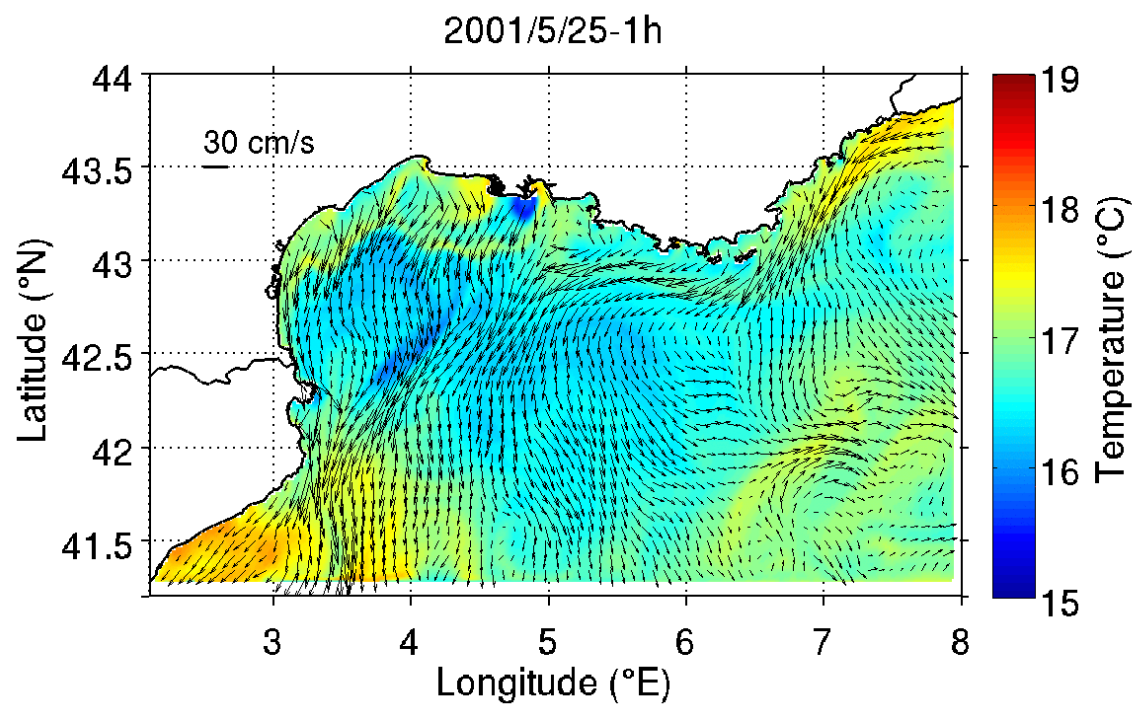
# TOSCA system





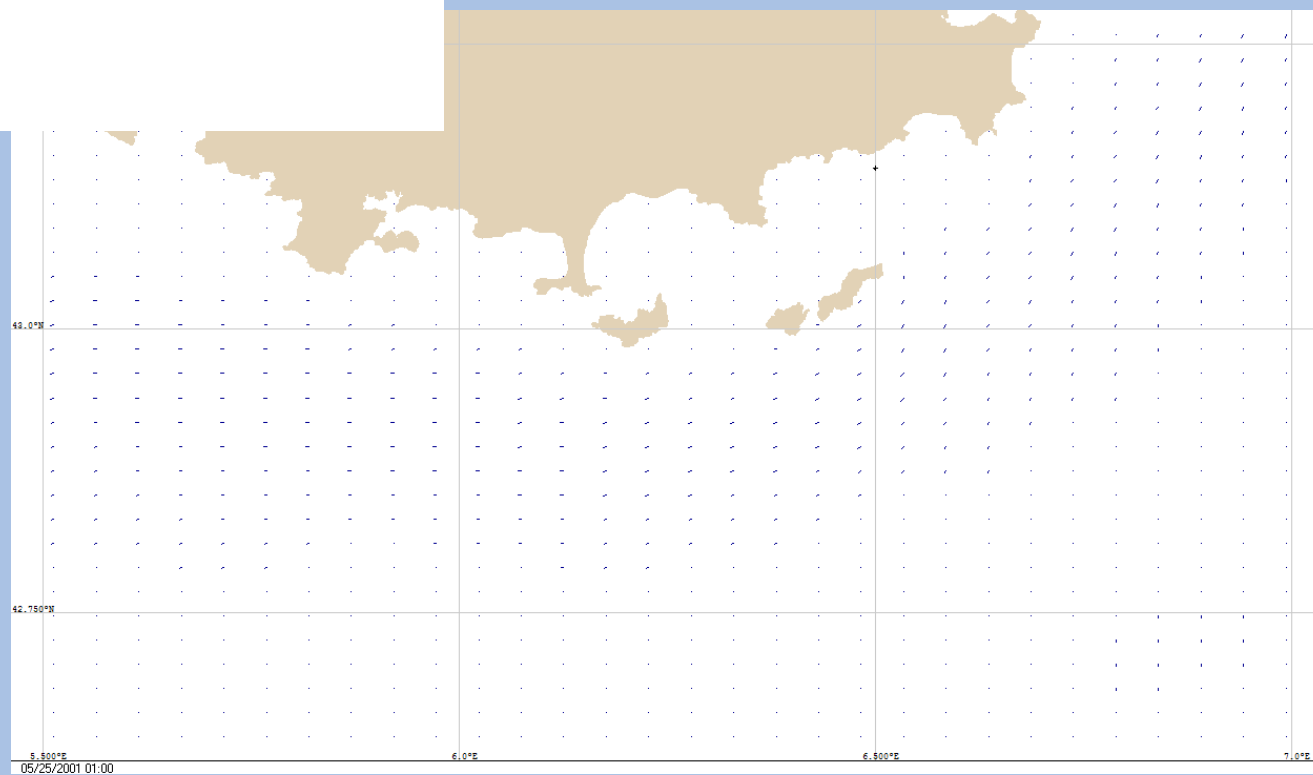
# TOSCA sites & means



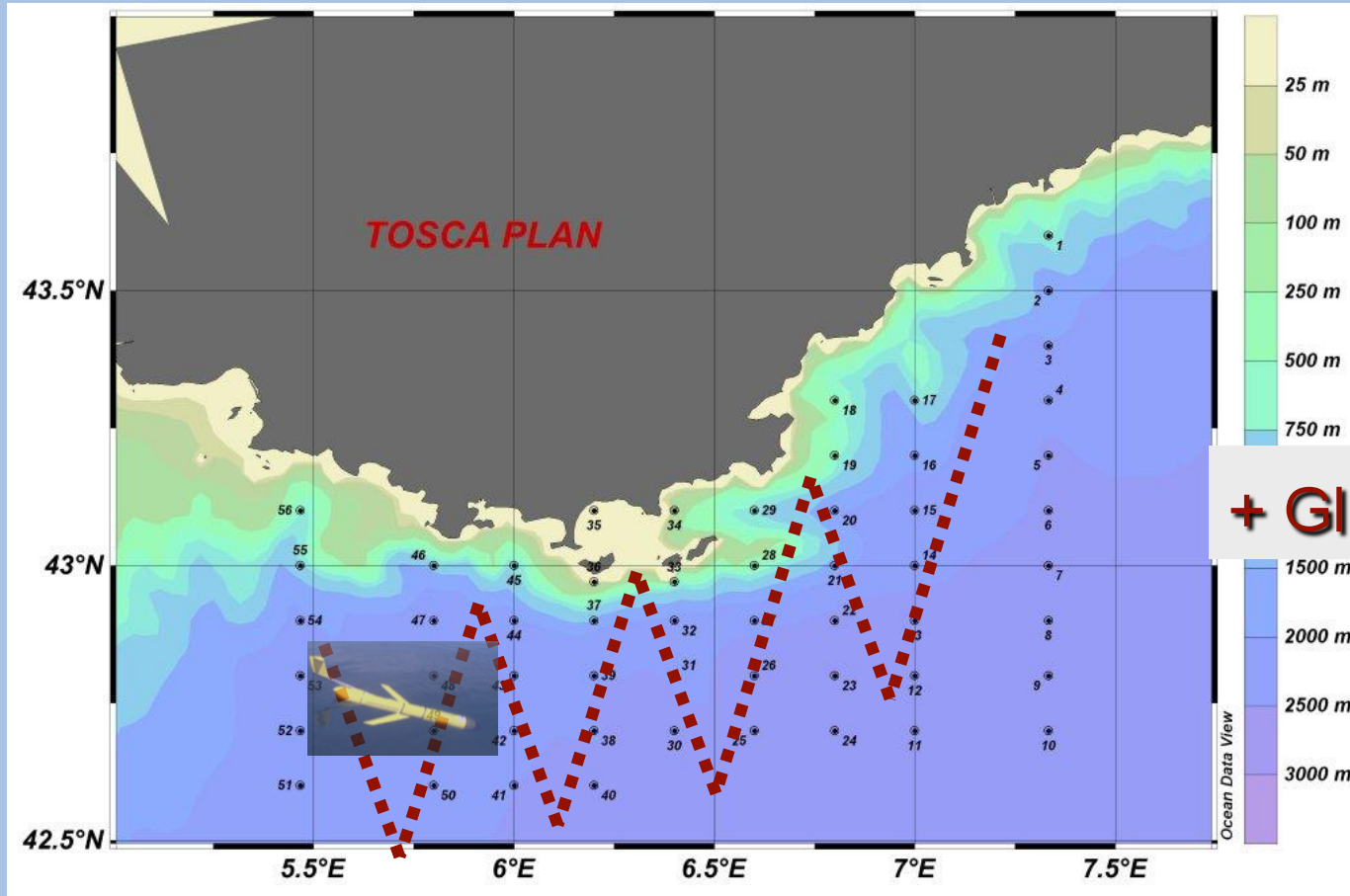


**NEMO  
GLAZUR64**

**GNOME-NOAA**

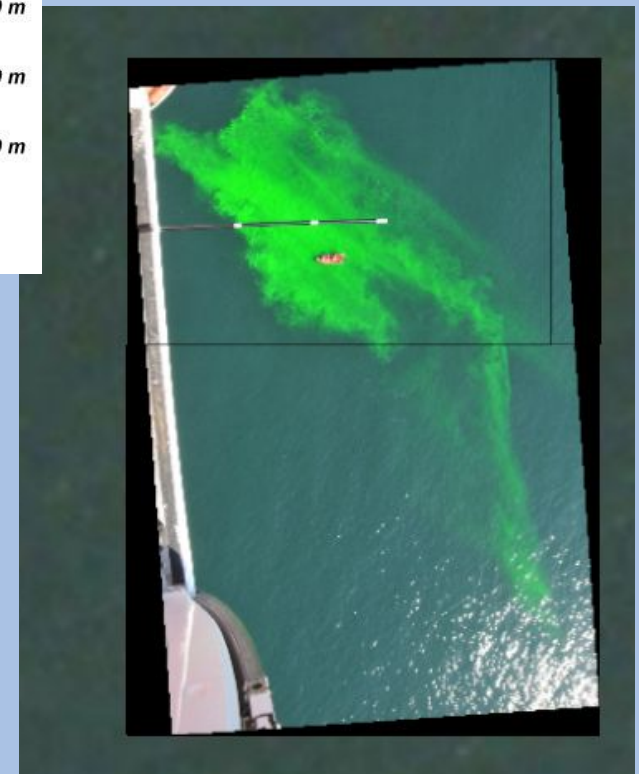






10-20 december 2011  
CTD (max 1000m), ADCP

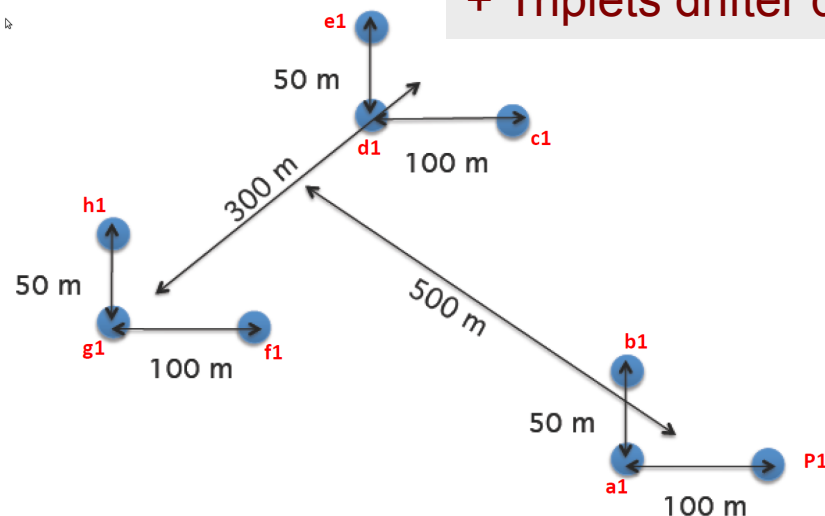
**+ Glider**



**+ Dye & PhotoID**

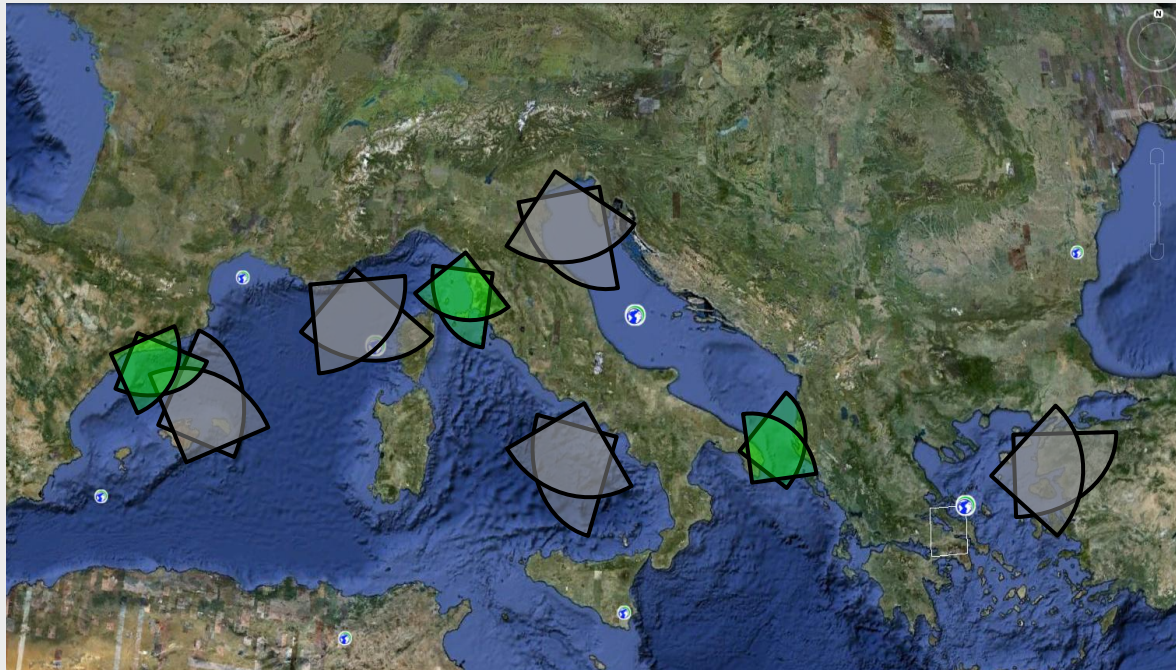
Name convention for single drifter locations with

**+ Triplets drifter deployment**





# Radar Networks

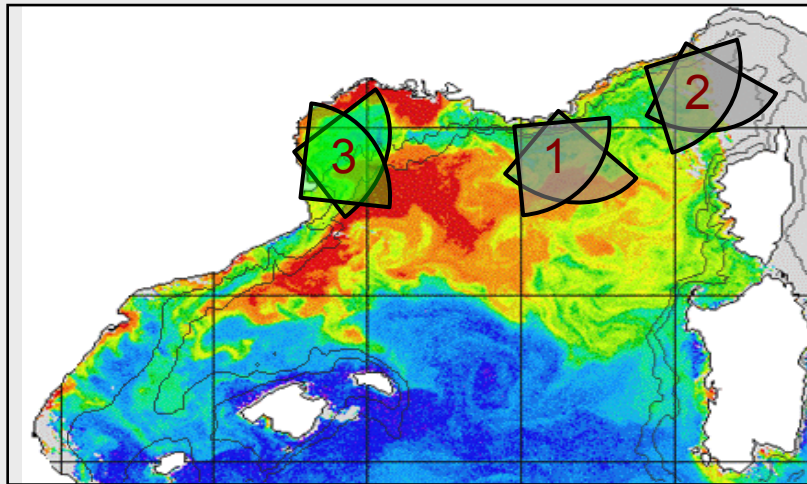


**TOSCA 2**

Tracking of Oil Spills and  
Coastal Awareness  
network

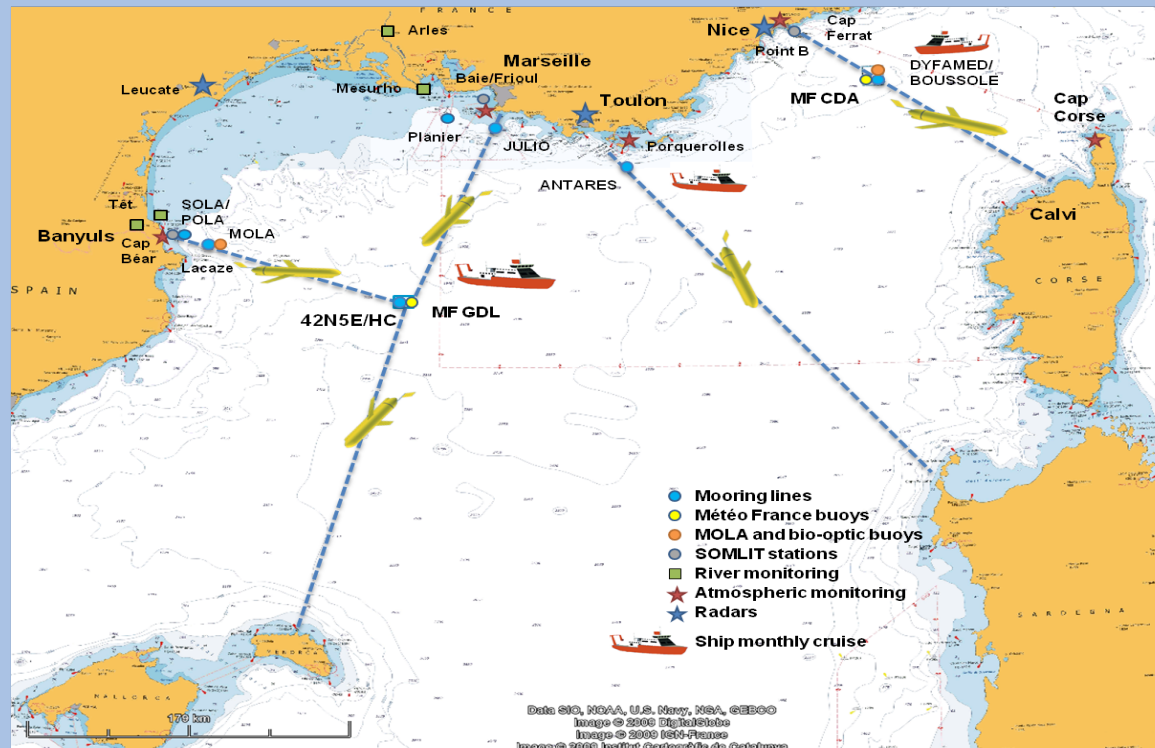
To be combined with other data (drifters, moorings, profilers, gliders, satellite)  
and model

# MOOSE



MOOSE

Mediterranean Ocean  
Observing System of the  
Environment



**Moral of the story:**  
**Unity (& Pooling) is strength**

THE END