

## Round Table PS2.5

### Data Assimilation and observation targeting

**Objective: “Identify the data assimilation systems and targeting observations systems that could be run in real time during SOP/EOP/LOP Hymex periods”**

# Oceanography

# Current or future oceanic operational systems (oceanic models and assimilation algorithms)

- **Mercator (France): (NEMO + SEEK)**  
=> Atlantic + Mediterranean **6-7km**  
=> NEATL36 (include West Med **2-3km**) : will be operational at the end 2010 ...
- **MFS (Italy): (NEMO + 3DVar)**  
=> Mediterranean **6-7km**
- **FOAM (UK): (NEMO + OI)**  
=> Atlantic + Mediterranean **12km** (NEMO + OI)
- **Poseidon II : (POM + SEEK)**  
=> Mediterranean **5km**
- **Others ???**

# Observations

## **Observations that could be assimilated in real time:**

=> Already used:

- Satellite altimetry (SLA)
- Temperature and salinity profiles (Argo, CTD, XBT, ...)
- Satellite SST
- Gliders (T/S)

⇒ In the future ?

- tides gauge
- Satellite SSS (may have serious limitations for the Med Sea)
- Drifters and profilers velocity (lagrangian information)
- New high resolution altimetry missions : the shelves will be better observed
- Radar HF

## **In terms of Resolution, frequency, accuracy, ...**

We need :

- Times series (how long?) to tune properly assimilation systems
- Accuracy of observations error.
- Different sources of observations at the same position at the same time.
- More T/S profiles ...

**Data broadcast (Coriolis) ? MOOSE ?**

# Modelling/ Assimilation periods

Strong link with modelling strategy : To “build” the background errors covariances, we need a “free” simulation (without assimilation) ~ 10 years => Need of “GOOD” free simulation ...

## What could be done for Hymex?

- Oceanic Reanalysis (~ 10-20 years) ? (=> LOP ?)
- ⇒ Contribute to the understanding of the long-term water cycle over the Med basin in terms of variability and trend.
- Assimilative systems can be a provider of boundary and initial conditions for coastal models with higher resolution (downscaling).
- Candidates : Mercator, MFS, others ???

# Hydrology

## “Current” hydrological (non) operational systems

- Data assimilation is still a recent and on-going scientific subject in the hydrological community:
  - Bayesian approaches
  - Adjoint models
  - Statistical/neuronal approach
  - Ensemble forecasts/simulations
  - Others?
- Not yet widely used in real-time floods forecasting systems

# Observations

## **Observations that could be assimilated in real time:**

- River heights measurements and/or discharges estimations?
- Piezometrics measurements for groundwater/karsts simulations?
- Soil water content?
  - Local scale fields measurements network
  - and/or satellite?
  - SIM?
- Hillslope scale evaporation measurements?
- ?

## **Choice, Resolution, frequency, accuracy**

- Depends of the hydro-meteorological contexts (temperate, arid, hortonian, hewlettian, etc.)
- Depends of the time response of the catchments and of targeted hydrological processes
- Depends of the complexity of the hydrological models used
- => Needs of some spatial sensitivity analysis (adjoint?) to optimize the instruments deployment according to the models implementations

## **Data broadcast ?**

- Where could be held the real-time hydrological assimilation experiment? Operational services in France and other countries?
- Data policy agreement, collecting data, etc.



## Specific observation zones

- Some existing well-known surveyed catchments:
  - OHMCV flash floods
  - MEDYCIS flash floods and karstic questions
  - OMERE
  - Others?
- Depending of the actions that will be decided, some preliminaries works need to be done to collect new data where there are some gaps
  - Available/missing data all around the Med sea?

# What could be done and what for?

- Examples of possible data assimilation experiments:
  - Action 1: real-time assimilation in flash-flood hydrological models?
    - Understand impacts of intense storms events on flash floods
    - Assimilated variables: H,Q, SIM water content, E, ...?
  - Action 2: real-time assimilation within the Rhône river?
    - May lead to quantify impacts of dams and water resource managements on contributors to the Med sea.
    - Assimilated variables: Q, ...?
  - Action 3: off-line assimilation (=> LOP) for all main rivers around the Med sea
    - to provide accurate reanalysed times series of fresh water as inputs to the oceanic models → long-term water cycle trends and variability in the Med sea
    - Social impacts in various contexts
    - Assimilated variables depend on the hydro-climatic contexts of the targeted Med rivers and of the various complexity of the hydrological models used for that:
      - Q, H, Soil water content (local scale, satellite), piezometric data, ...

Atmosphere

# Data assimilation for atmosphere models (what do we expect during HYMEX )

Algorithms:

- 4DVAR/global model (towards 10km...)
- 3DVAR (FGAT in order to assimilate the observations at appropriate time) in LAM D.A.. (10km to 2.5km/nh). 5 consortia covering the Med. Area

Hymex : an opportunity to involve multiple models+ assimilation systems

## Observations:

- more sat. data (IR and MicroW); closer to the ground, in cloudy conditions
- Better spatial resolution; links with algorithms (observation errors correlations...)
- Radar reflectivities within LAM DA system
- But still need of wind and moisture observations...

EOP/SOP design should take care at:

- The real-time dissemination of the observations that can be assimilated (in order to contribute to the special NWP effort).
- Not neglecting reanalysis datasets
- The collection and storage of data dedicated to verification and processes description

# Adaptive observations

How and where to plan the deployment of observations tomorrow in order to reduce the analysis error uncertainty leading to large forecast error uncertainty within the Mediterranean.

# 1. Principe de l'observation adaptative

Le schéma temps réel



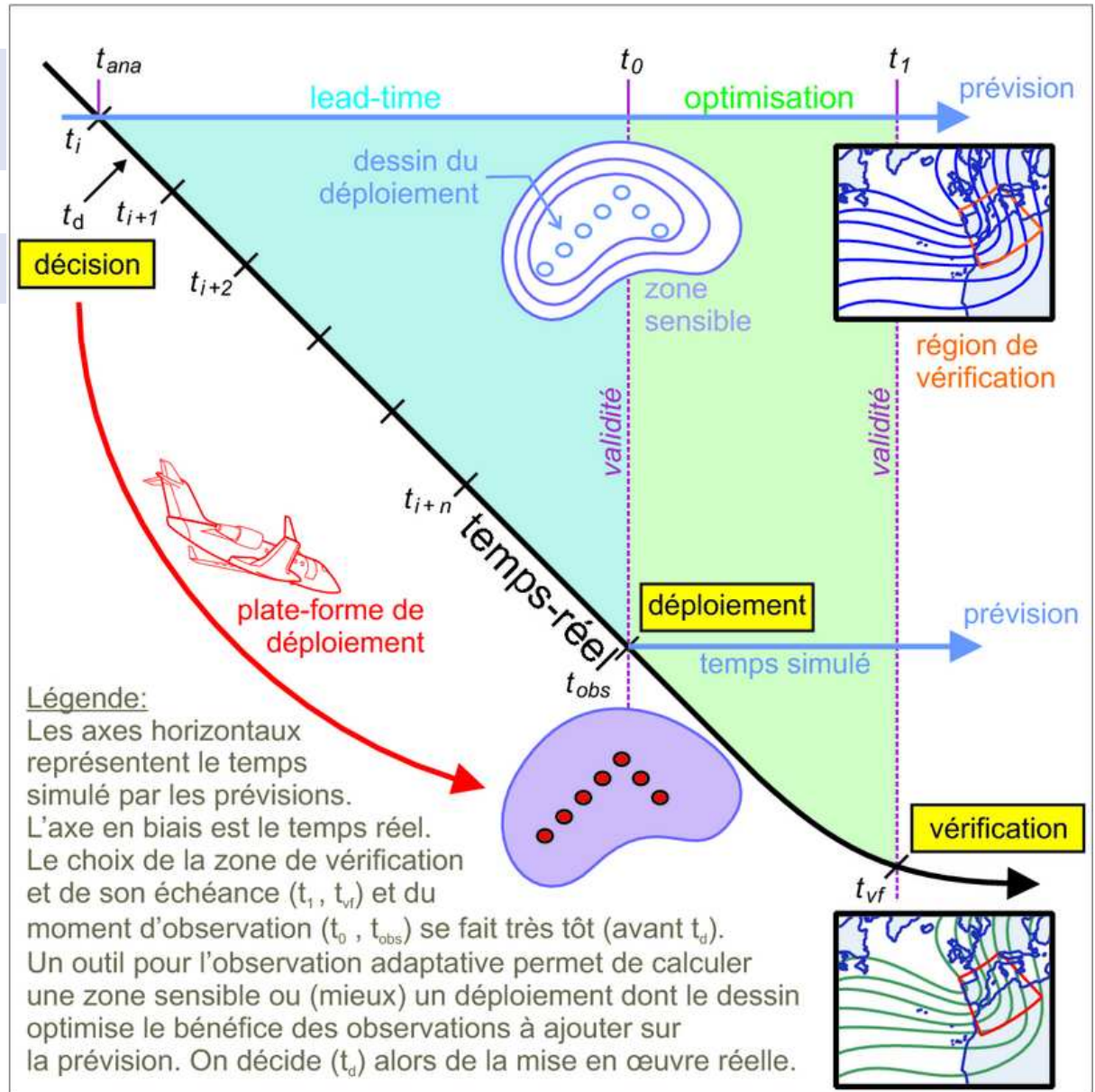
## Applications

### Campagnes passées :

- FASTEX 1997,
- NORPEX 1998,
- WSRP 1999-2008,
- TReC (THORPEX) 2003,
- COPS 2007...

### Campagnes à venir...

- CONCORDIASI 2008
- T-PARC 2008 + 2009
- HyMeX...





Targeting in Hymex: a new challenge optimization  
of an adaptive mesoscale observing system

An opportunity to use sensitive area prediction that  
take into account the analysis uncertainty and  
regular observation systems

Adaptive observation in Hymex requires a Data  
Targeting System (weather watch, sensitive area  
computation, decision making)