HyMeX(*)

http://www.hymex.org/

WG2: Hydrological Continental Cycle

I. Braud [1], A. Chanzy [2]

(1) CEMAGREF, UR HHLY, Lyon, France –

(2) UME EMMAH, INRA, Avignon, France

*Hydrological cycle in the Mediterranean eXperiment

HyMeX

❑ Water resources: a critical issue because freshwater is rare and unevenly distributed in space and time with few short duration heavy precipitation events and long drought periods

❑The watersheds have characteristic features of the Mediterranean environment: medium to small size catchments, with a mountainous upstream area and a quite flat outlet downstream

❑High anthropogenic pressure: recent change in land use and land cover, strong urbanization and population growth, particularly in the coastal areas

Annual mean precipitation

>2 m/y	0.2-0.5 m/y
1-2 m/y	0.1-0.2 m/y
0.5-1 m/y	< 0.1 m/y
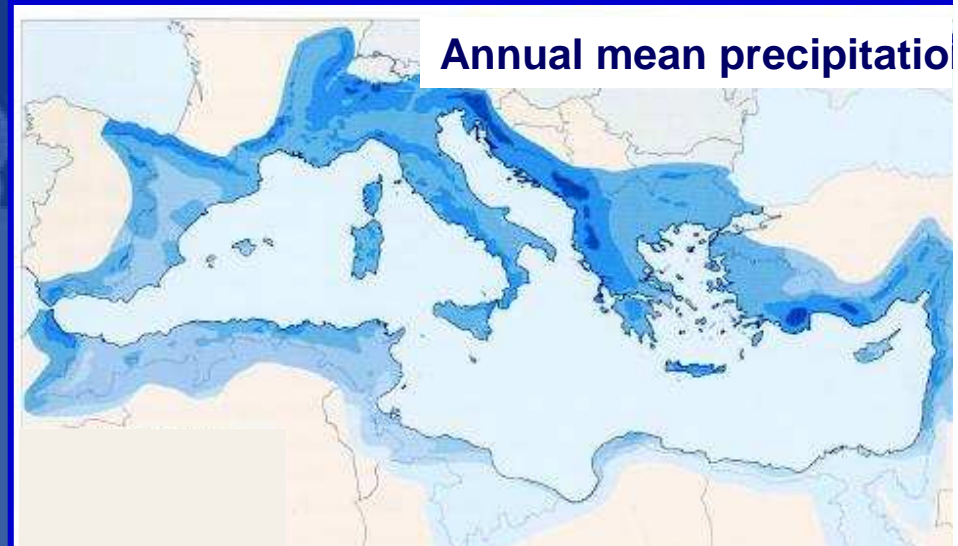
➤*30 M Mediterranean people, particularly in the South and East, are deprived of access to drinking water = 60% of the worldwide population lacking drinking water*
➤*During the second half of the 20th century, water demand has increased twofold (Source: Plan Bleu).*

HyMeX

Hydrological continental cycle

Heavy Precipitation

Key questions:

What is the variability of the components of the water cycle (precipitation, evaporation, run-off, transport, etc) within a context of global climate change ?

What are the impacts on the water resources ?

Better understanding of the *long-term water cycle* over the Mediterranean basin: *variability and trend*

Water budget of the Mediterranean Sea

Event — Seasonal — Annual — Century

HyMeX

Improve our understanding and the modelling of the water cycle components over the whole Mediterranean basin from the event to the decadal time scale

In order :

→ To quantify fresh water inputs (river and groundwater flows) to the Mediterranean sea (link with WG1)

→ To quantify evapotranspiration (coupling with the atmosphere)

→ To quantify soil moisture (coupling variable with the atmosphere, initial condition for flash flood events)

→ As a basis for water resources management

→ Drought early warning system

→ Adaptation to global change

- **WG2-SQ1**: How to set up and develop an hydro-meteorological framework allowing the simulation of the water cycle over the whole Mediterranean basin?

- **WG2-SQ2**: Can we improve the regional simulation of the continental hydrological cycle by better accounting for specific Mediterranean characteristics?

- **WG2-SQ3**: How will the continental hydrological cycle evolve in relation to global change?

WG2 overview

Data base :
Climate
Surface
Human activity
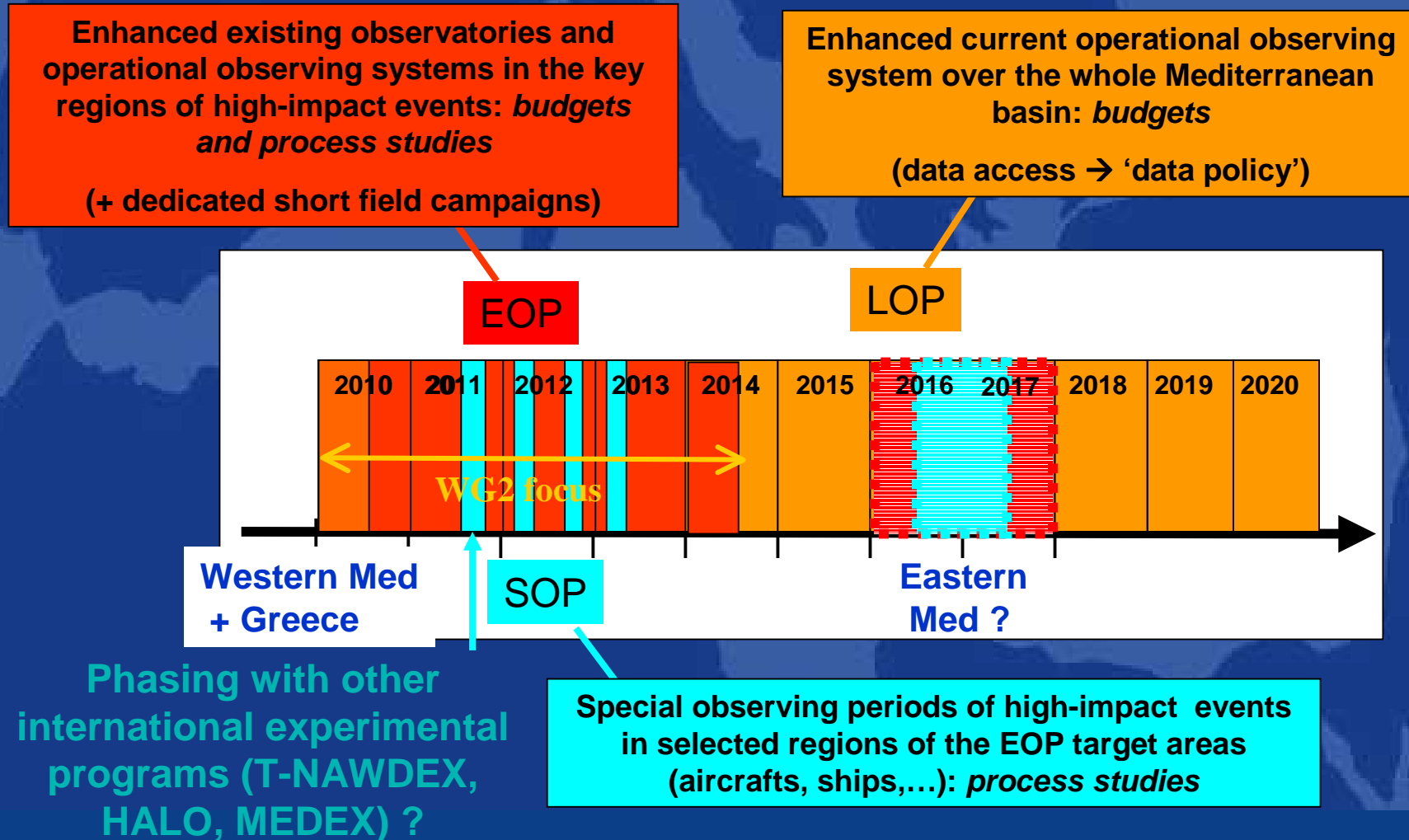Hydrology

Hydrometeorological
model
Mediterranean Basin

Coupling
Ocean
Atmosphere
Human
activity
Global
change
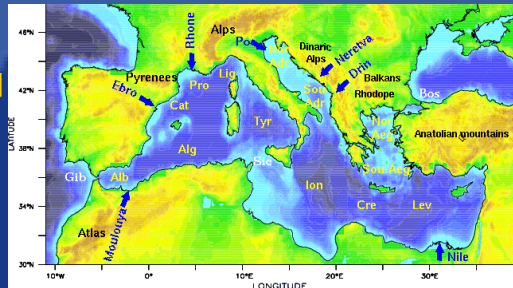
Regional Modelling

Experiment

WG2-SQ1 : hydro-meterorological modelling framework of the water cycle over the whole Mediterranean basin/LOP

❑ Describe the water budget on the whole Mediterranean watershed at high resolution (~1 to 10 km) with the quantification of :

✓the amount of freshwater arriving to the sea from river streamflow, karstic and coastal aquifers.

✓the evapotranspiration

✓the soil moisture

❑Considering two levels of investigation

✓The Whole mediterranean area (implementation over the LOP)

✓Regional scale (large river basin) to take profit of already implemented models (LOP/EOP)

❑Open the modelling framework to updates (process modelling, parameters) from process analysis (SQ2) and experimental results (IIP).

✓Anthropogenic activities (urbanization, irrigation, pumping)

✓Coupling with Ground water

✓ Improvement of mediterranean ecosystems parameterization

WG2-SQ1 : Data collection at he whole Mediterranean basin scale?

❑ **Climatic data**
- ✓ ECMWF reanalysis (70 km, ~15 km in the future)
- ✓ Solar radiation (SAF land and MSG/SEVERI Products)
- ✓ Vapour pressure products (willing of developping new tools)

❑ **Land use**
- ✓ ECOCLIMAP II, POSTEL 300m land Use map
- ✓ Water use by human activities : Irrigation, urban areas

❑ **Digital Elevation Model**
- ✓ American DEM model

❑ **Soil map**
- ✓ European soil map at the 1/1000000 scale
- ✓ FAO map for non european countries
- ✓ Which strategy to gather existing national or regional soil map?
- ✓ Surface albedo (remote sensing)

❑ **Aquifer geometry and hydrological data** (harmonisation at the internat. level)

❑ **Soil moisture and vegetation**
- ✓ satellite products (SMOS, ASCAT, LAI, Fcover, FAPAR…)

WG2-SQ2: Can we improve the continental hydrological cycle simulation through a better account of Mediterranean specificities? (EOP)

Q1: Water balance of typical Mediterranean vegetation covers

Q2: *Water and energy budget of urbanised areas*

Q3: Improving the water balance of aquifers

Q4: Quantify the contribution of karstic sources and coastal aquifers to the Mediterranean

Q5: Impact of soil moisture redistribution by topography on the water balance

Q6: Snow processes

Q7: Anthropogenic influence (irrigation, groundwater pumping, water consumption)

EOP: Sites and supersites

- Observation strategy based on nested sub-catchments from 10 km^2 (densely instrumented sites) to $100\text{-}500 \text{ km}^2$ (less densely instrumented sites)
- Several super-sites in France (also associated with WG3)
  - OHM-CV obs. Q1, Q5 (in relation with WG3)
  - MEDHYCIS obs. Q3 (karst)
  - Crau-Camargue obs. Q1, Q3, Q4 and Q7 in connection with groundwater
  - Draix/Bléone area for erosion studies
- Localised sites in other countries
  - Various location for evapotranspiration monitoring (France, Italy) Q1
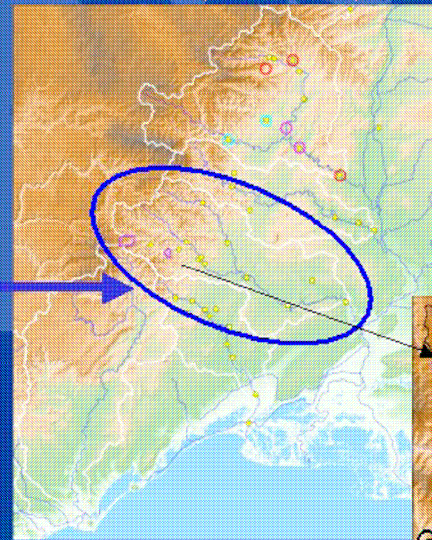 - Monitoring of some karstic sources Q4
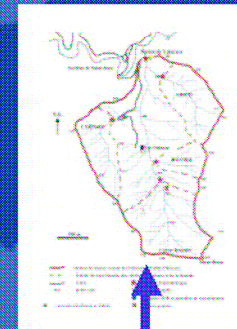
HyMeX Sites/Pilot sites/Super sites
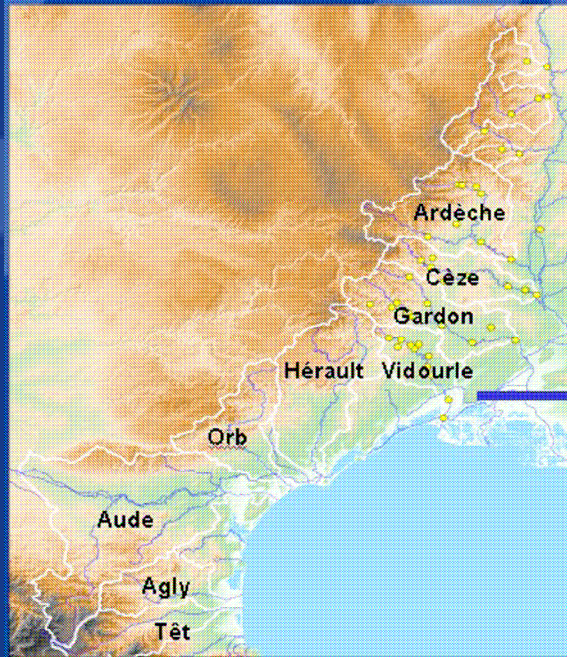
WG2-SQ3 : Impact of Global change on the continental hydrological cycle
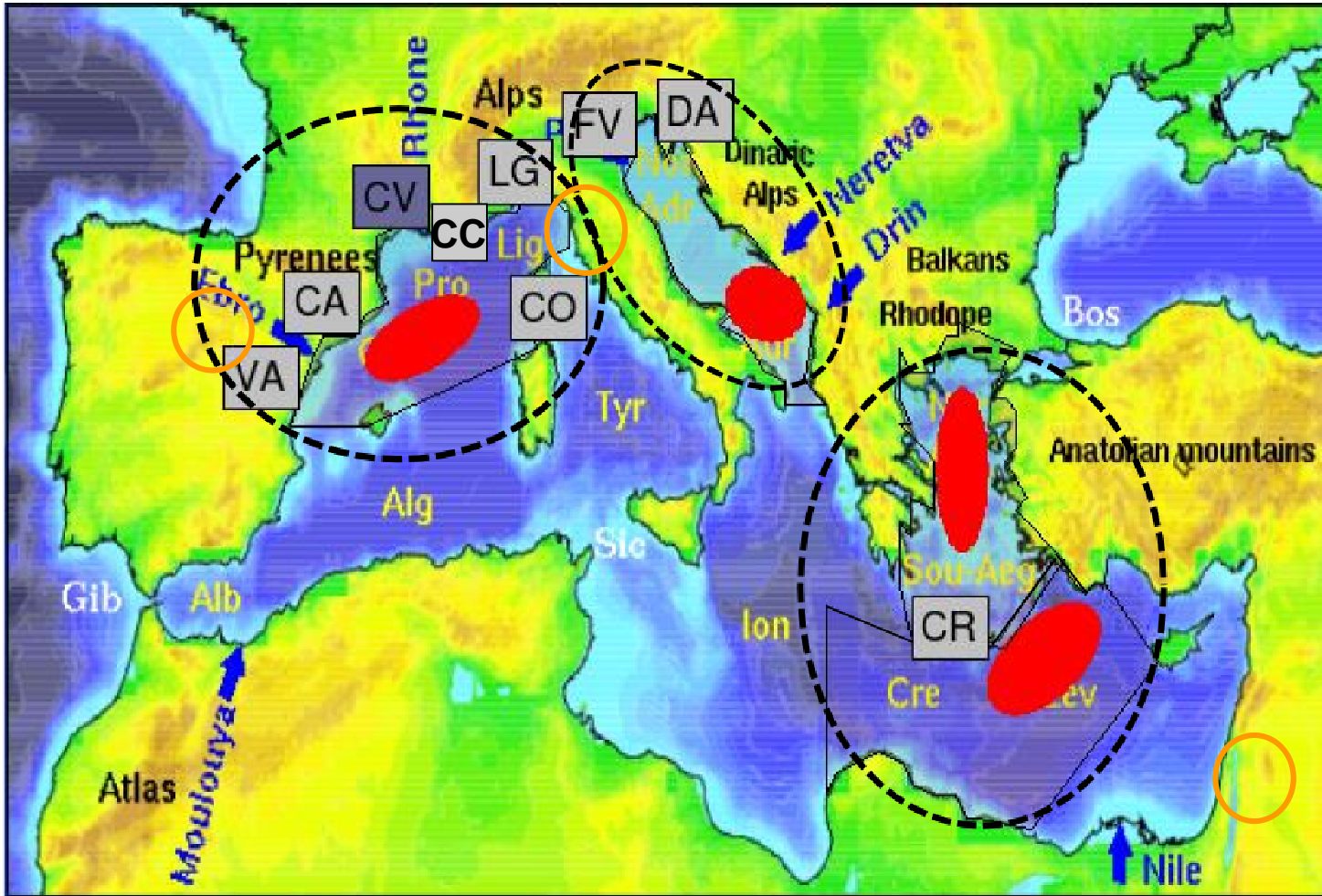
- Build a database of high resolution regional climate scenarios for the region, in order to run impact models.
- Improve our knowledge on socio economic feed backs induced by global change.
- Provide land-use change scenarios (and past-reconstruction) consistent with the socio-economic scenario
- Improve impact models on both physical and socio economic aspects.

- Climate change : A warm topic ➔ A lot of proposals
- Nothing on the socio economy side
    - Socio-economic feed back
    - Land-use change scenarios

- Water balance : Characterisation of water uses (drinking water, irrigation, waste water, etc..)
  - Amount of water
  - Water origin
  - Temporal and spatial dynamics

- Global Change : Combine land use changes with Climatic Changes (Past and future)
  - Evolution of land use and associated surface properties in relation with hydrological processes (surface sealing, crop type, irrigation)
  - Impact of political options on land use evolution
  - Typology of land use management practices (irrigation, farms management, urbanization, etc..). Derivation of statistical representations of these practices
  - Temporality and spatial evolution of these practices

$\Rightarrow$ To be connected to hydrometorological models thanks to improved parameterization representing land use and management practices

Interest of hydrometeorological model output for social sciences ?
  - Feedback of management practices on water ressources.
  - Risk and vulnerability Indicators

Thanks for your attention