

A CO₂ Observatory for Marseille Metropole

COCOOM

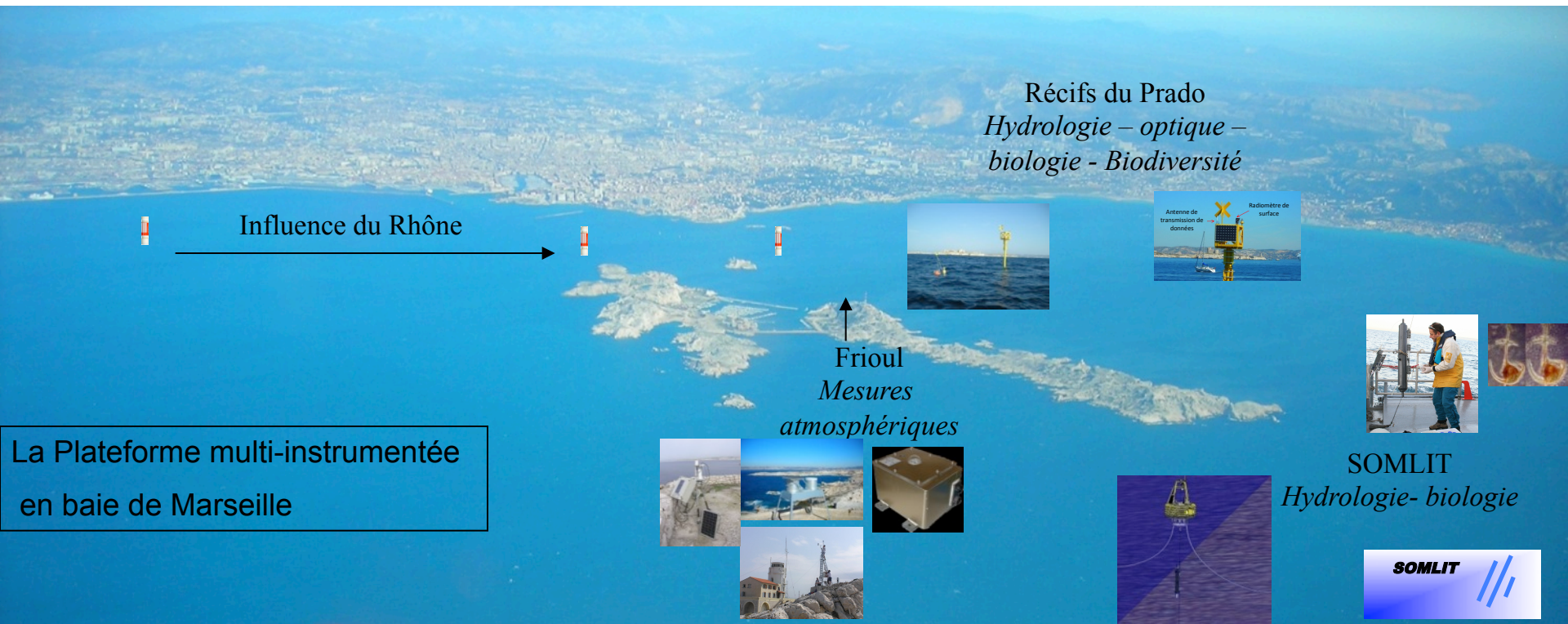
From an idea an ambitious project for Marseille metropole

Ocean acidification and microbial
biodiversity

PI - MIO

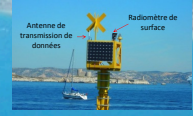
D. Lefevre & G. Grégori

PI others...

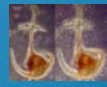


Récifs du Prado
*Hydrologie – optique –
 biologie - Biodiversité*

Influence du Rhône



Frioul
*Mesures
 atmosphériques*



La Plateforme multi-instrumentée
 en baie de Marseille



SOMLIT
Hydrologie- biologie



Marseille 's Bay

Site to follow anthropogenic impact

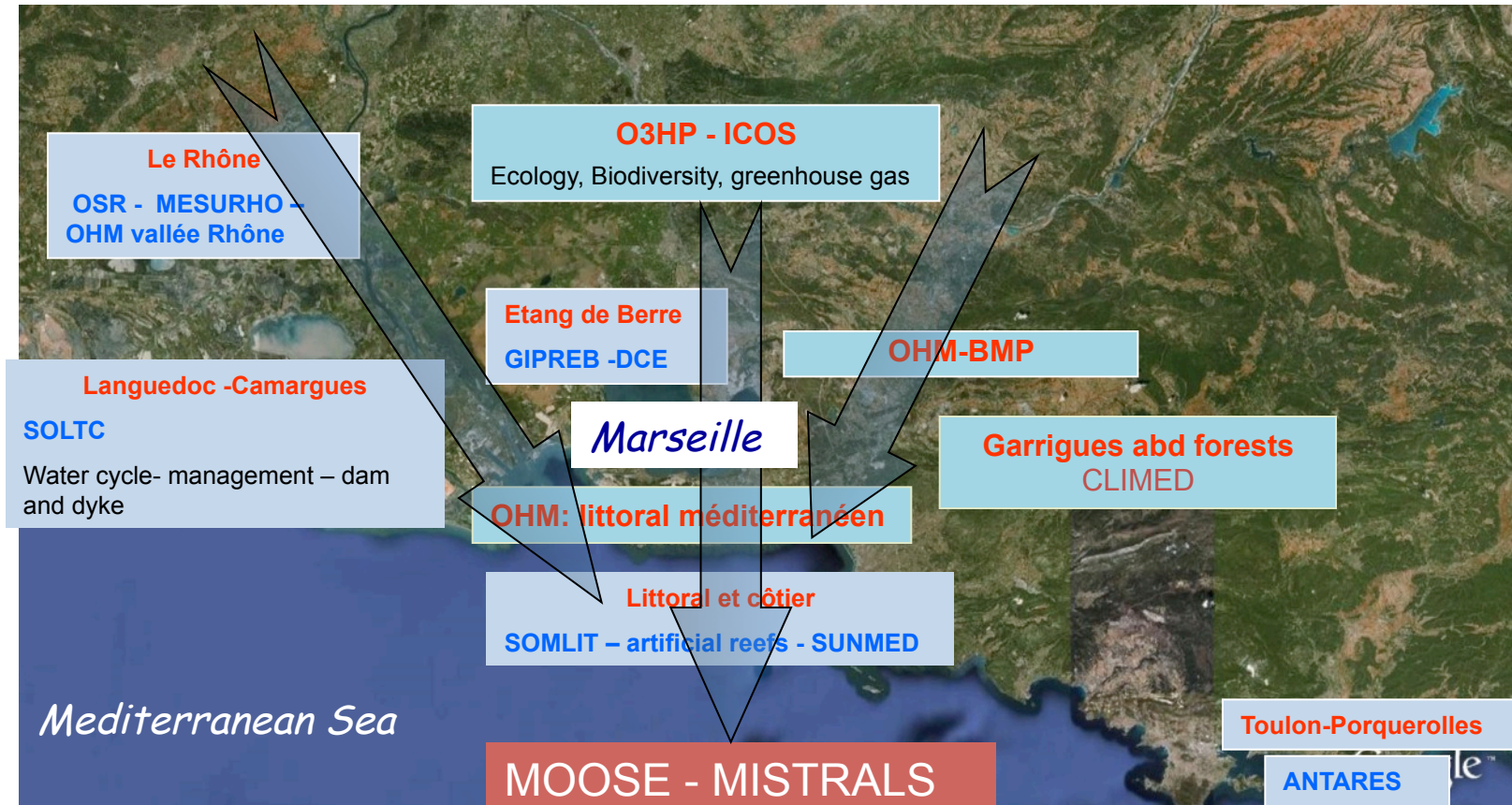
Socio-economical interest

Interfaces continent/sea et atmosphere/sea

Programs & Partners

Continuum: atmosphere/landscape/city/littoral/coastal sea/offshore

Gradient from natural to anthropic systems



Marseille and surroundings is a interesting case study where an important part of OT-Med strengths are focussed

Why observing CO₂

- Marseille is the second largest metropole in France enclosed between hills and sea
- Industry, car induces CO₂ emission with a daily, seasonal, annual variation which is impacting our local biosphere.
- Monitoring CO₂ to constrain atmospheric CO₂ forcing on the marine, terrestrial and urban biota
- Acidification effect on marine microbes (Diversity, biomineralisation,....)

Existing infrastructure and observing system



A European infrastructure dedicated to high precision monitoring of greenhouse gases

<http://www.icos-infrastructure.eu/>

Atmospheric and ecosystem stations



ICOS stations feature:

- Standardized components and methods
- Automatic operation
- Local and remote control
- Continuous measurements and periodic intelligent sampling
- Modularity and technological updates (new techniques or parameters)
- Two levels of sites (L1 – full suite of parameters and L2 – subset)
- Continuous improvement through R&D and link with SMEs

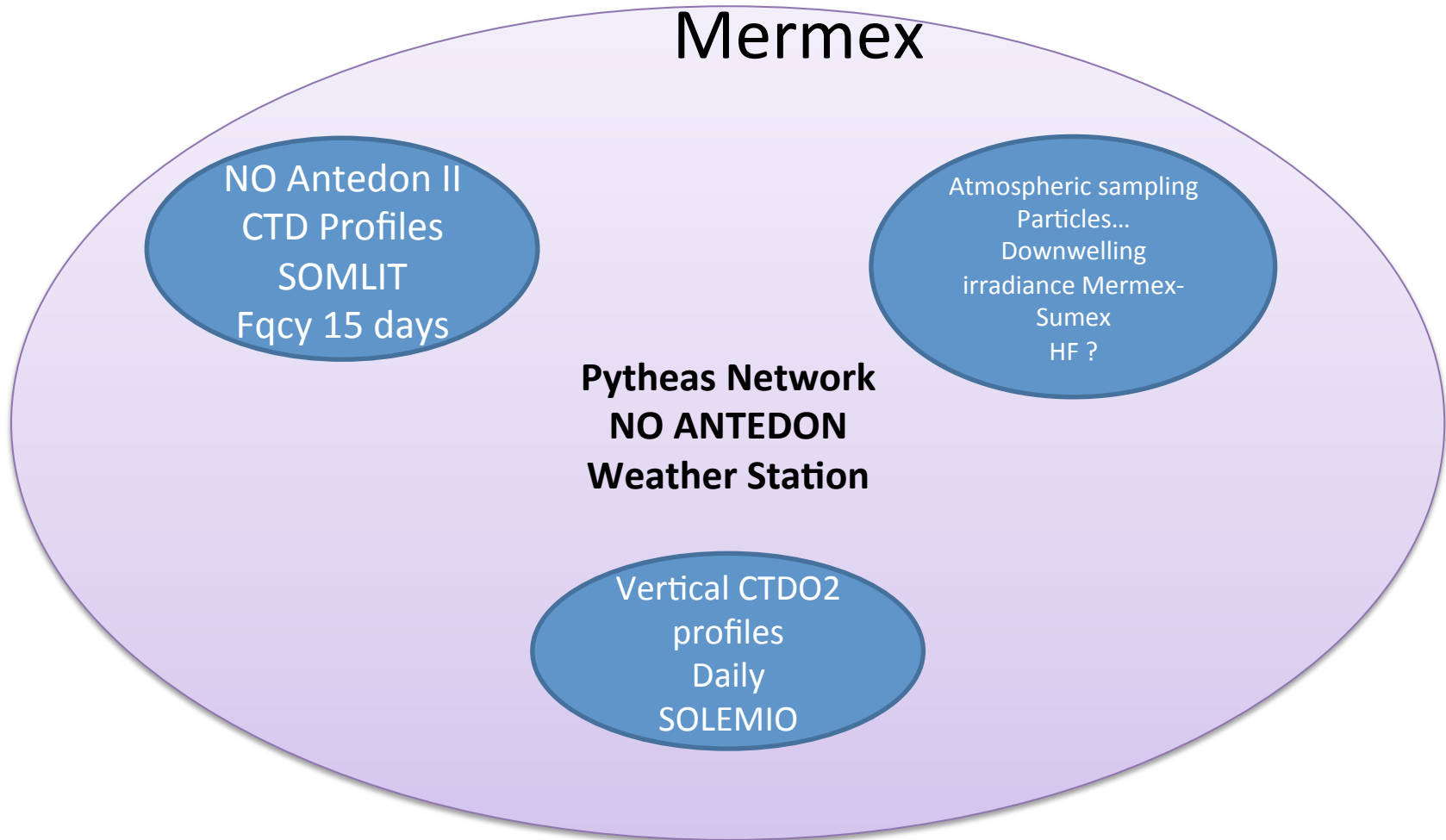
- 1) Atmospheric network
- 2) Terrestrial ecosystem
- 3) Marine ecosystem

OHP Tower : 3 levels (100- 50 - 10 m) - O3HP

Weather station : Pytheas Network (Operational)

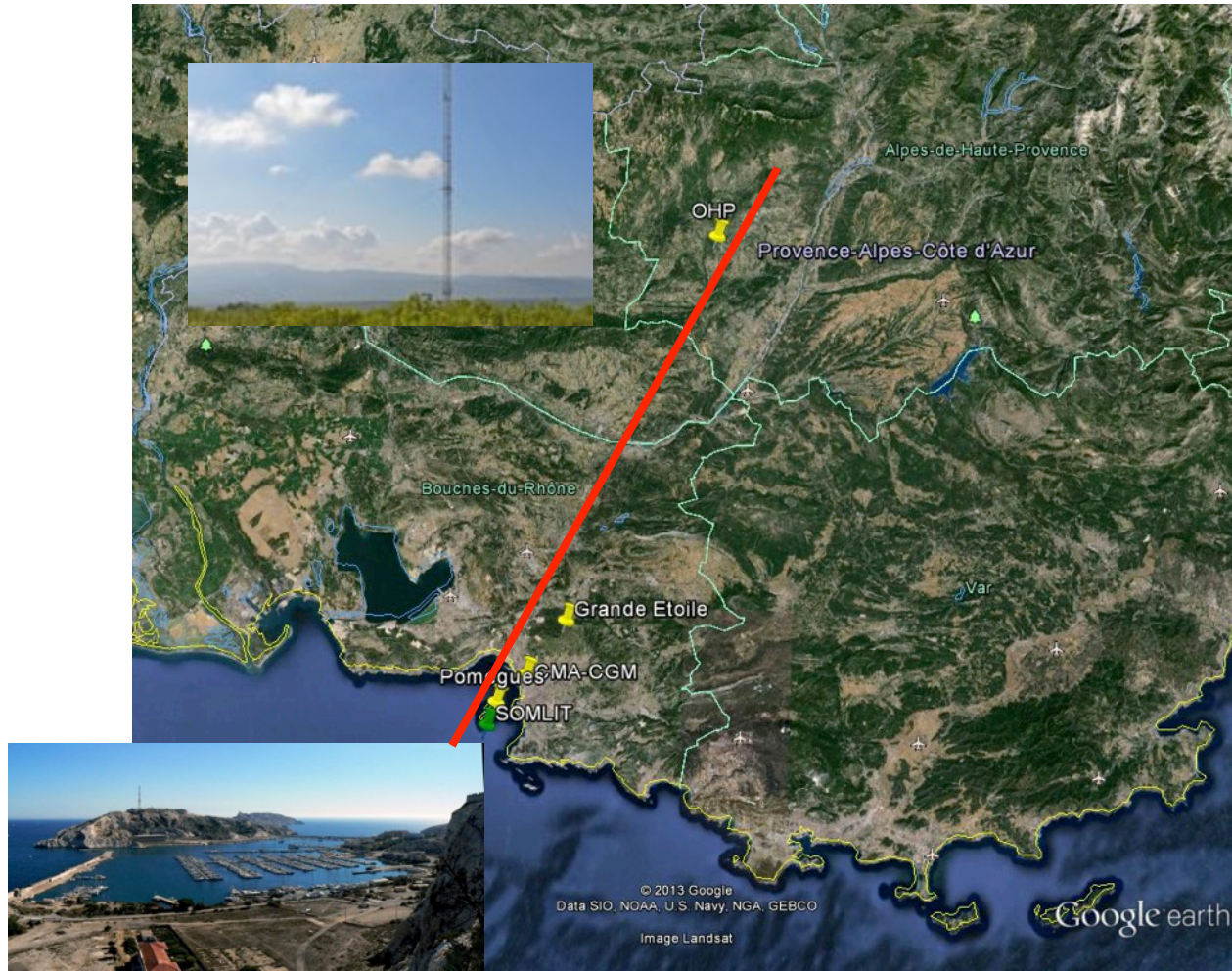
Existing infrastructure and observing system (2)

- SOMLIT – SOLEMIO – ROMARIN - MOOSE -



Collaborative strategy

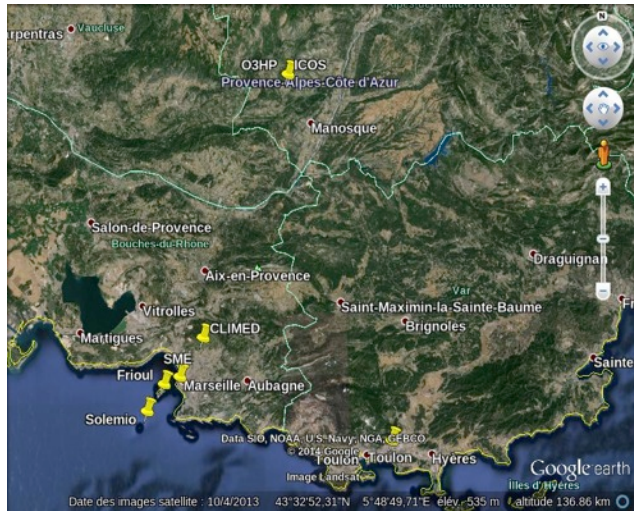
A Pytheas initiative



Observation strategy

Observing instrumentation

- **Atmospheric monitoring:**
 - OHP Tour ICOS, 650m + 100 m existing
 - Massif de L'étoile 626 m + 148m **(to be implemented)**
 - Tour CMA CGM 4 m + 145m **(to be implemented)**
 - Pomègues Frioul 53m + **84m (to be implemented)**
- **Terrestrial ecosystem monitoring**
 - OHP
 - Marseille metropole **(to be implemented)**
- **Seawater monitoring**
- **High and low Fqcy : Somlit-Moose-Specimed**
 - An in situ 3 levels instrumented marine observatory
 - **to be implemented**



Weather station network within Pytheas OSU

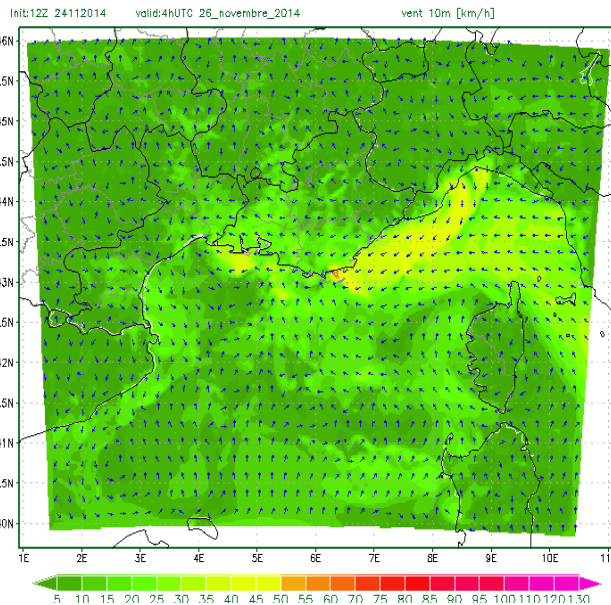
Evloving network

Measured parameters :

- Température
- Wind
- Rainfall
- Hourly acquisition

Weather Modelling platform

- Operational models
- Data storages since Sept 2014
- Modelling previous events
- Data available :
 - Air mas instability criteria (Lift Index, potential eergy ...)
 - rainfall (convective and non convective)
 - Rainfall type
 - Conservative parameters (absolute eddy, potential, relative)
 - Irradiance (short and lond wave length received and emitted)
 - Pressure, geo-potential, wind, temperature
 - surface temperature, wind, humidity
 - Microphysics (cloud type, altitude vapor pressure)
 - Vertical movement (ascending/descending velocities)
 - Each data is part a 3D picture from the surface to the troposphere)



Ocean Observation

- Acidification
- pCO₂ forcing
- Biodiversity evolution

- Automated buoy with Flow cytometry, pCO₂ sensors, pH sensors @ 3 depths : surface, middle near bottom
- Complete SOLEMIO setup and SOMLIT bi monthly survey
- Weather station network to be completed and made more robust to protect data acquisition
- Atmospheric particles collection (MOOSE)
- Sunmex

Preliminary step – Marine Site

1 Z 1 lot instrumenté

Surface Buoy



Fixed mooring

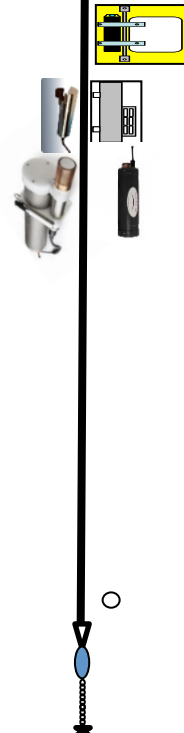
Instrumentation @ 1 depth

Then

3 depth

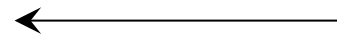
Then ...

-  CTD-SBE37 SMP ODO
-  ADCP AQUADOPP
-  Fluorimeter
-  Seafet pH sensor
-  Contros pCO2 sensor



Depth : 60 m

Weight 400 kg



SOMLIT MARSEILLE

A unique station for a pilot project to monitor climate change and marine biota response



Buoy Mobilis EOL
Power data transmission



CO2 dynamics, in situ high frequency for Carbonate system
biotic response assessment
Contros pCO₂ sensor

Moored buoy for ecosystem monitoring

Currentmeter
ADCP ou
Aquadopp

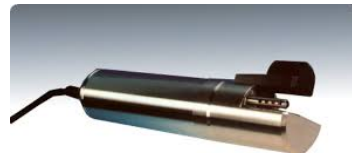


Hydrology

p, t, S and O₂ high frequency
Seabird microcat ODO



Phyto biomass proxy
Fluorescence in vivo



Biodiversity
High frequency
Cytobuoy Flow Cytometry



Acidification
carbonate system
Seafet pH sensor

O3HP



- **L'O3HP (Oak Observatory at the OHP), un observatoire pour étudier la dynamique, le fonctionnement et la biodiversité d'une forêt méditerranéenne face aux changements climatiques ...**
- Ce dispositif, géré et coordonné par le Consortium IMBE/OSU PYTHEAS/ECCOREV est fortement soutenu par l'Institut Ecologie et Environnement ([INEE](https://inee.cnrs.fr/))
- <https://o3hp.obs-hp.fr/index.php/fr/>

Equipex ASTER – CEREGE

Prof E. Bard

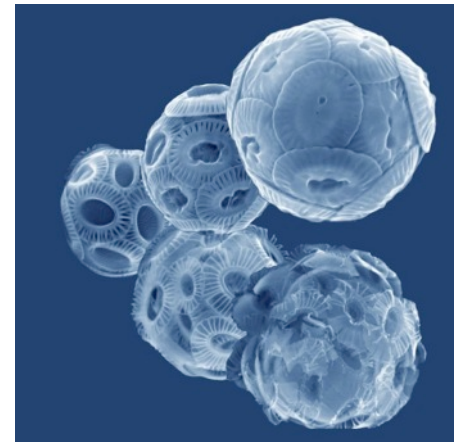


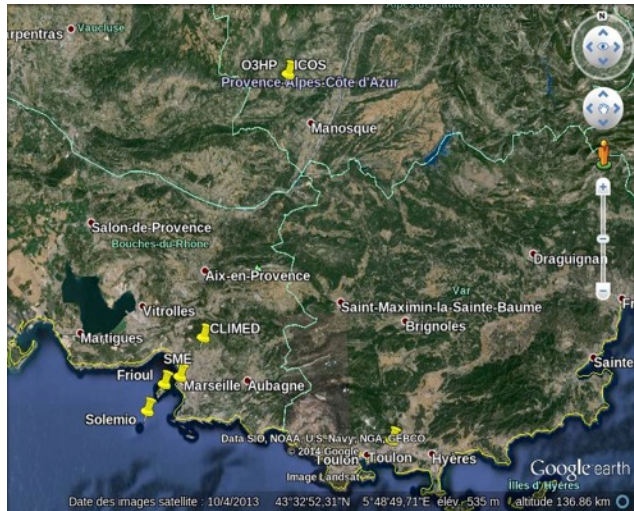
- Plateforme de géochimie isotopique
 - La reconstitution des variations passées du niveau marin et des mécanismes de déglaciation, pour contribuer à améliorer la modélisation du changement climatique actuel et de la dynamique des calottes de glace.
 - L'étude du cycle du carbone et des échanges naturels et anthropiques de CO₂ entre l'atmosphère, l'océan, la végétation et les sols grâce au traçage par le ¹⁴C (cosmogénique et d'origine thermonucléaire).
 - L'étude des perturbations géochimiques en cours dans l'environnement en réponse aux changements globaux et aux pressions anthropiques. Une approche novatrice de traçage isotopique multi-élémentaire permettra d'étudier la distribution naturelle et la dispersion anthropique de certains métaux.
 - Equipement AixMICADAS sur de petits échantillons.
 - Aérosols carbonés en interaction avec

CALHIS

- **Projet CALHIS (ANR Blanc) : Histoire de la calcification pélagique durant les 300 dernières années**

- Suivi de la calcification du microplancton (coccolithophores, foraminifères et ptéropodes) et microbenthos carbonaté en réponse au système carbonaté. Suivi initié depuis 2012 avec une résolution bimestrielle (station Julio).
- Reconstruction de la calcification au cours des 300 dernières années
- **Sensitivity of coccolithophores to carbonate chemistry and ocean acidification.** [L. Beaufort](#) et al. Nature 2011.





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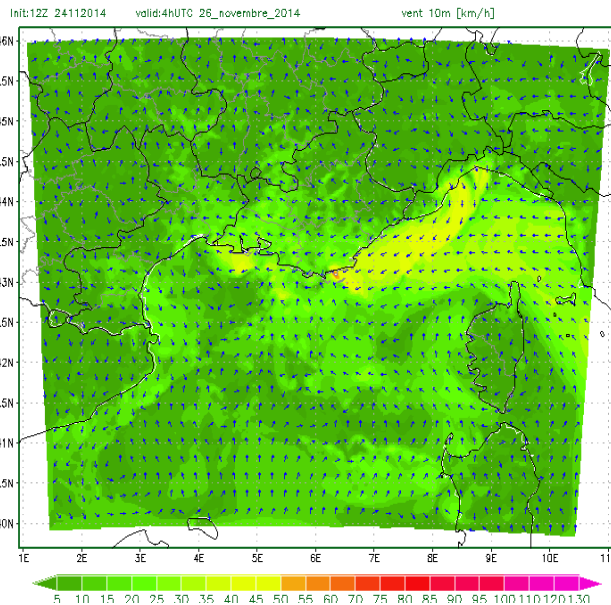
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Collaborative study

- What is Marseille metropole influence on CO2 source/sink and associated gazes ?

Atmospheric content and connected ecosystem

– At the daily and weekly scale

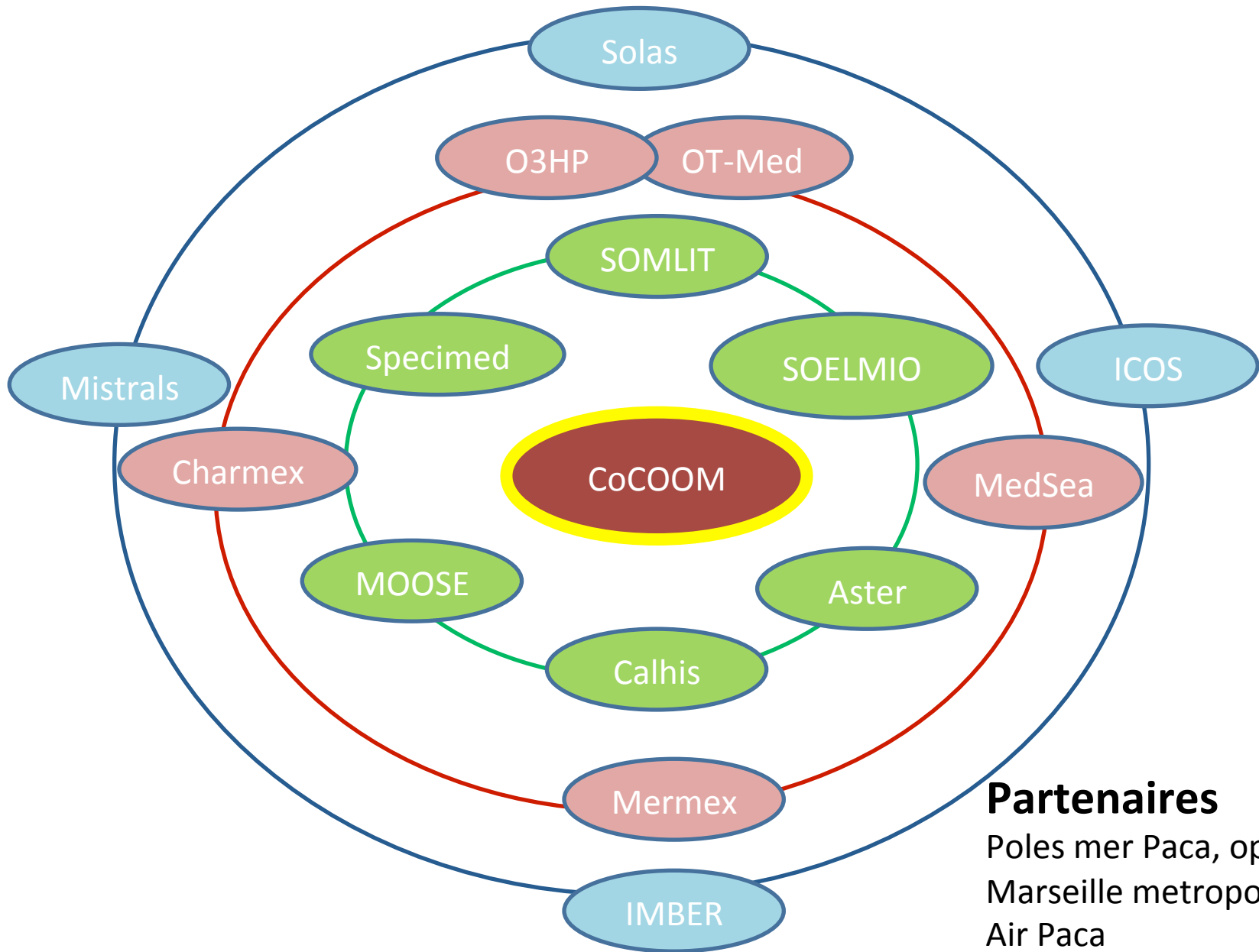
- urban activity
- Industrial activity
- Weather event

– On the long term

Social and economic scale ...

Meeting in Luminy –Oceanomed 2 building next
December 17th

- Time and room yet to be settled



Partenaires

- Poles mer Paca, optique, ...
- Marseille metropole
- Air Paca
- CG 13
- Region Paca
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