



RÉPUBLIQUE
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300 ans d'hydrographie

PARTITIONING OCEAN DYNAMICAL PATCHES USING MODELLED ADDED-VALUE VARIABLES AND DATA MINING IN THE NORTHWESTERN MEDITERRANEAN SEA

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*⁽¹⁾: SHOM/DOPS/STM/DTO

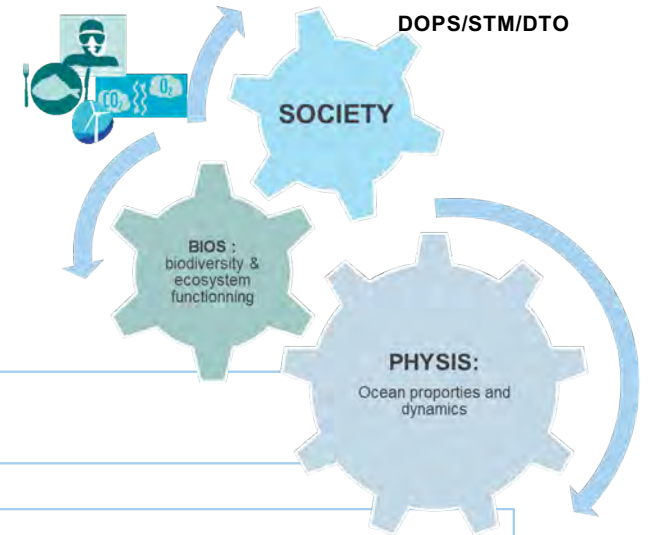
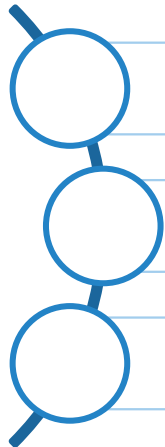
*⁽²⁾: CNRS-M2C



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Why partition the ocean?



There is therefore a need to develop spatialized and dynamic operational tools supporting governance for a sustainable and equitable exploitation of the marine resource

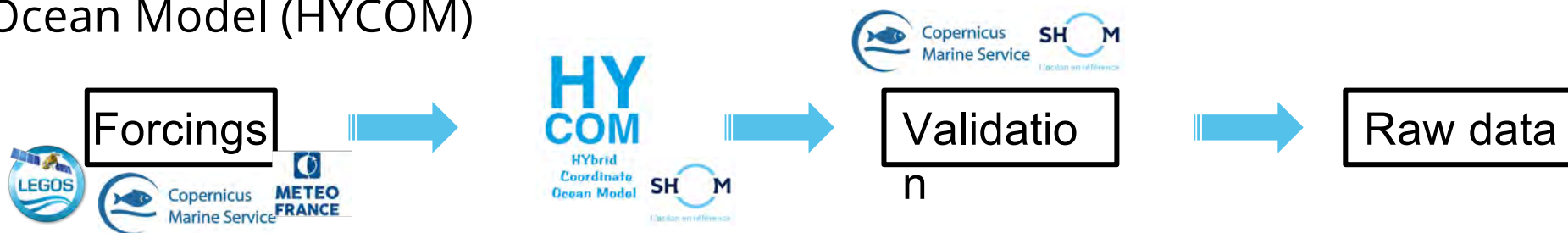


Added-value products

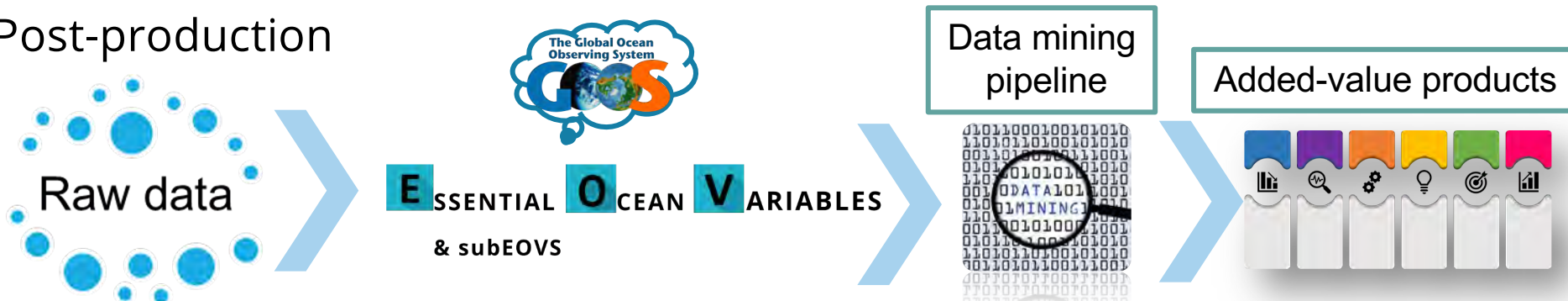
How?

Using Operational Coastal Ocean Model and Data-mining pipeline

- 1 A 3-D circulation model solving primitive equations: Hybrid Coordinate Ocean Model (HYCOM)



- 2 Post-production



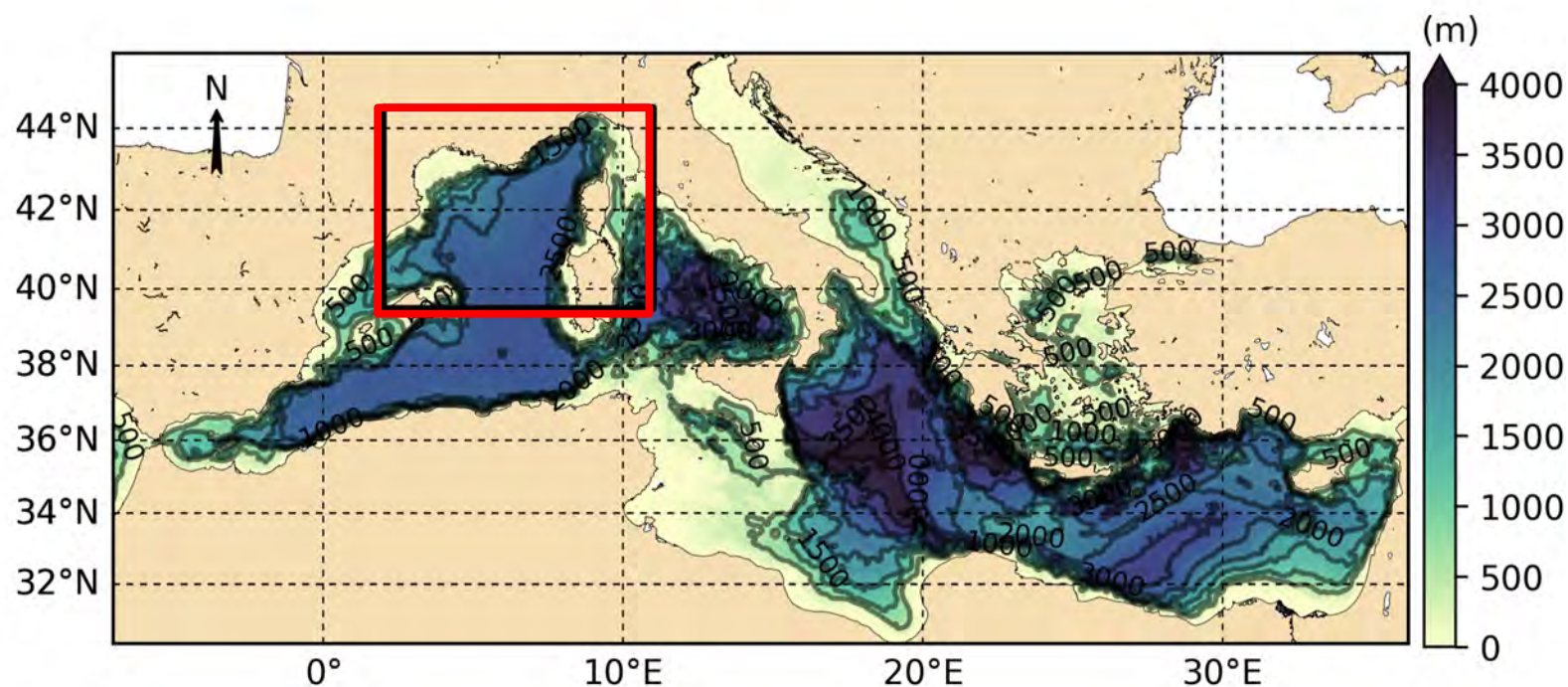
Operational Coastal Ocean Model

HYCOM-MED hindcast 2012-2019

- 2595 x 936 horizontal grid cells (~1,8 km grid step)

- 32 vertical levels (hybrid coordinates)

- French EEZ for the calculation of EOVs & subEOVs



Operational Coastal Ocean Model

Replicate the diversity of water masses

- 11 monthly mean EOVs & subEOVs calculated from 1-h frequency raw data

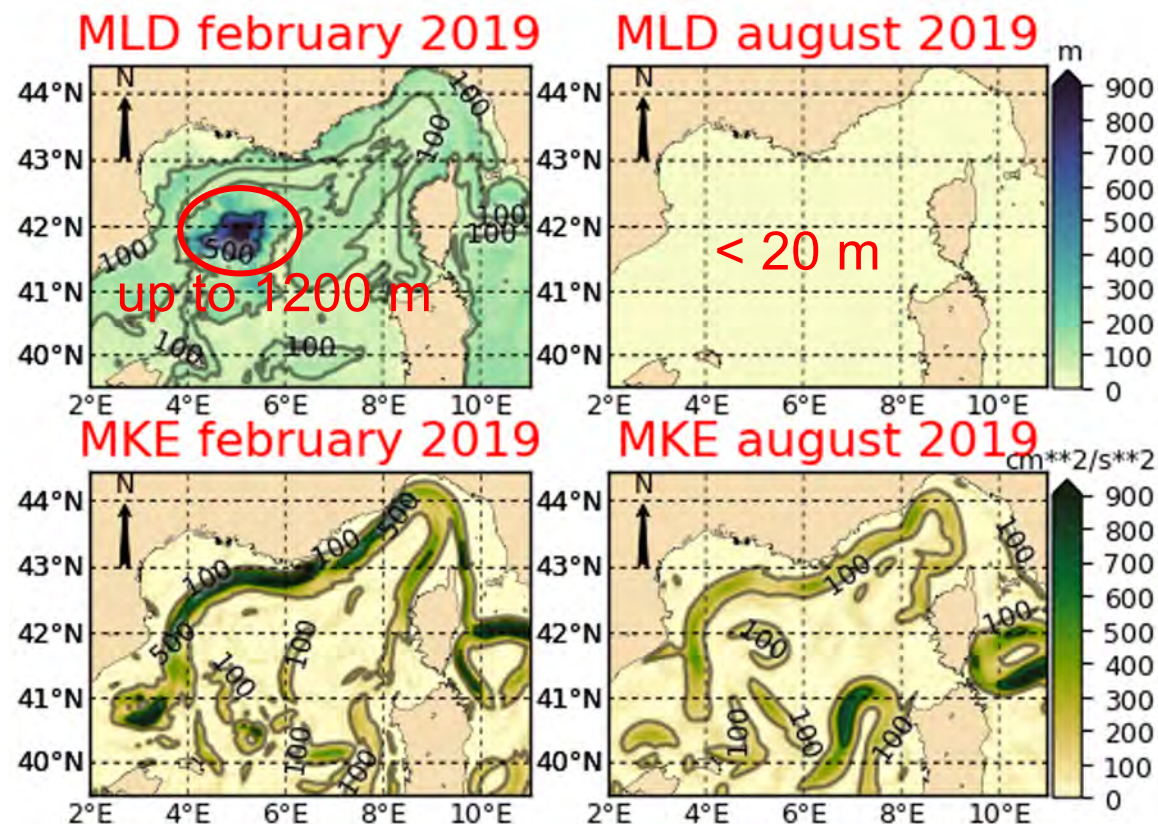
- we need to catch the main oceanographic features but also seasonality, mesoscale activity...

- ❓ hydrologic variables: sst, sss, def_pot_energy, mld, grad_sst, grad_sss

de Boyer Montégut et al. (2014); Huret et al. (2013)

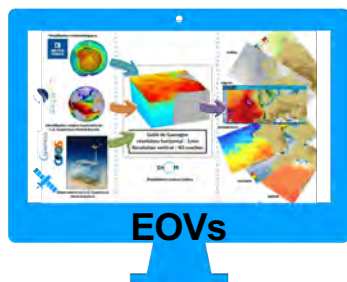
- ❓ dynamic variables: rms_filt, eke, mke, relat_vort, okubo_weiss

Charria et al. (2013)

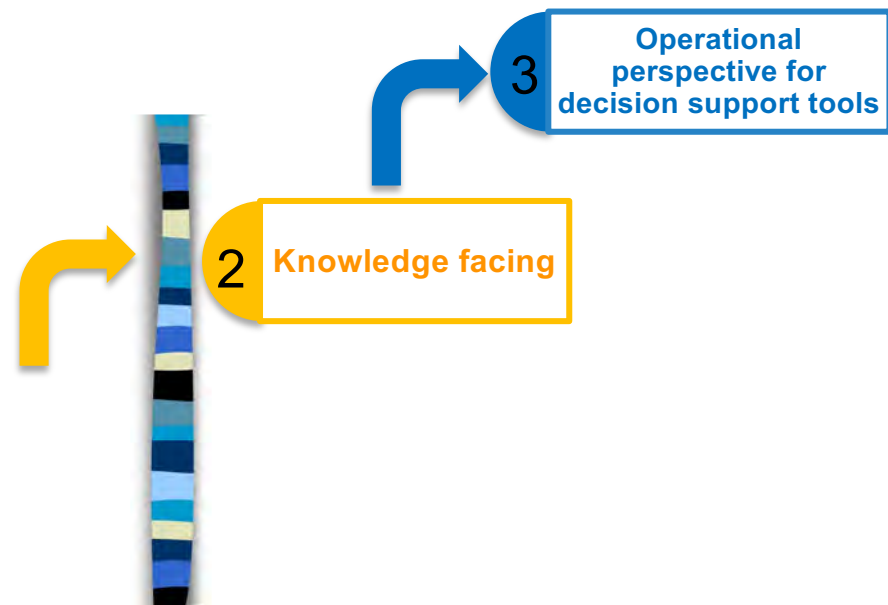
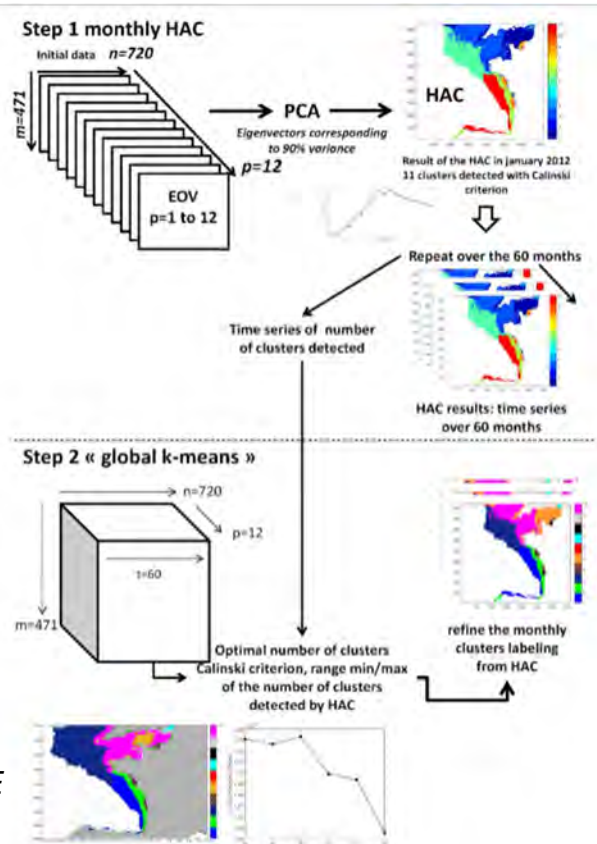


Extraction of knowledge from the data to define typical physical features

Pipeline to detect pattern



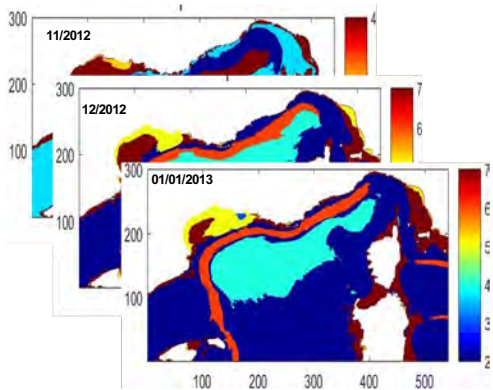
1 **Pattern recognition**



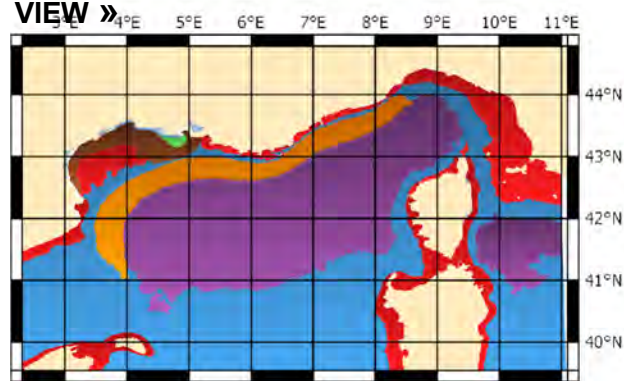
Tew-Kai et al. (2020), JMSE

1 Pattern recognition

(1) MONTHLY PATCH TIME SERIES OF 96 MONTHS (2012-2019)



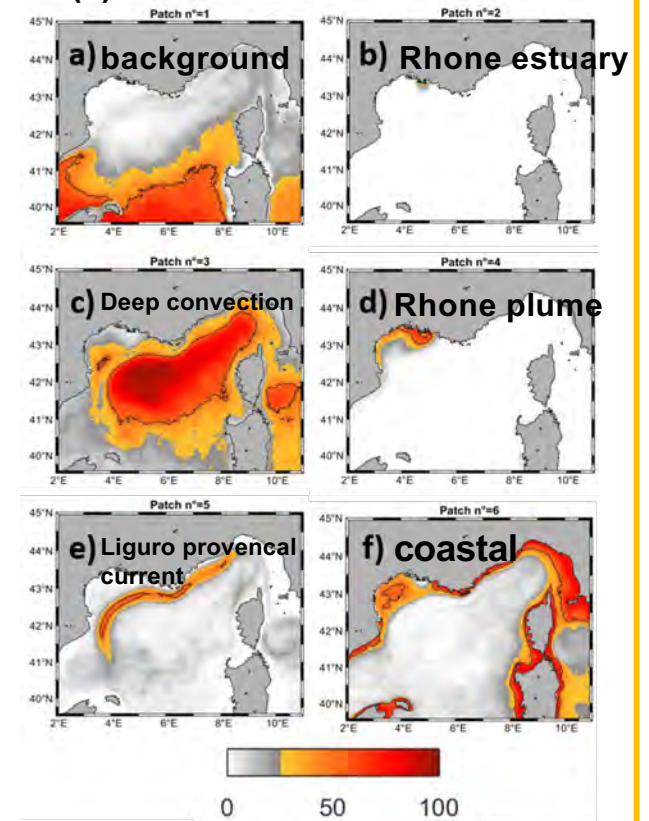
(2) MEDIAN PATCHES « STATIC VIEW »



- MED_2012_2019_patches
- background
 - coastal
 - deep convection
 - liguro provencal current
 - rhone estuary
 - rhone plume

2 Knowledge facing

(3) OCCURRENCE OF PATCHES



« Water mass Patch » ID cards

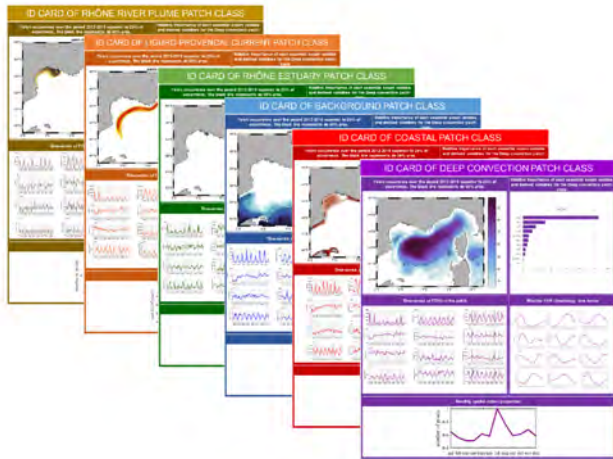


FIGURE 1

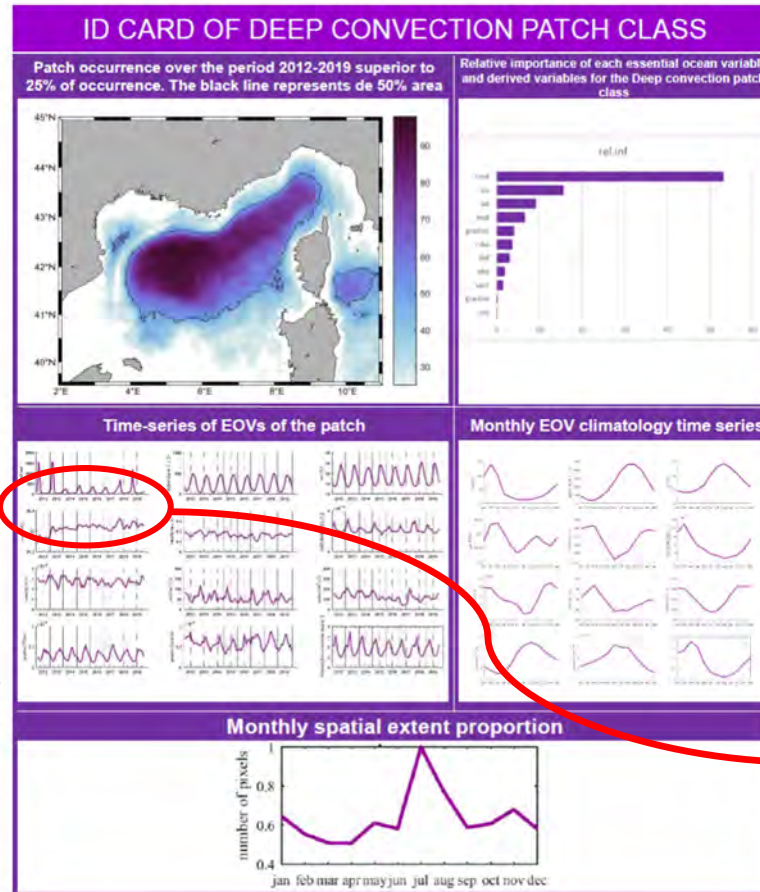


FIGURE 3

Houpert et al (2016)
SEAEXPLORER GLIDER (2018)

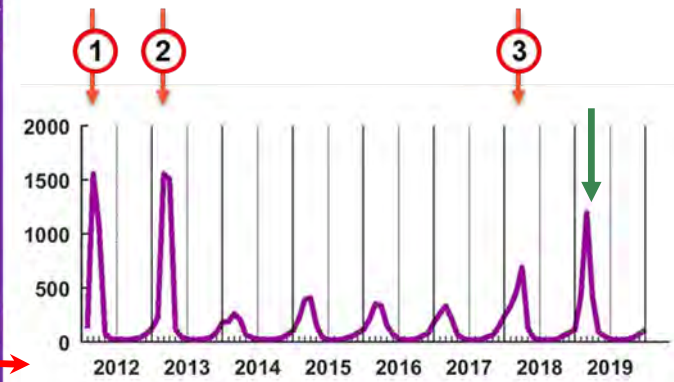
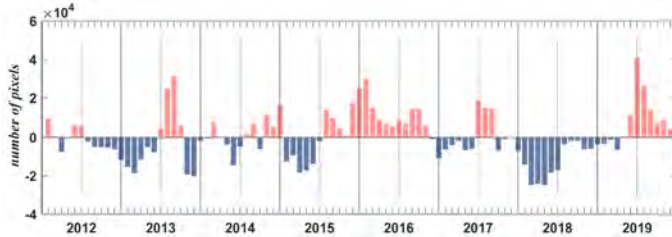


FIGURE 2

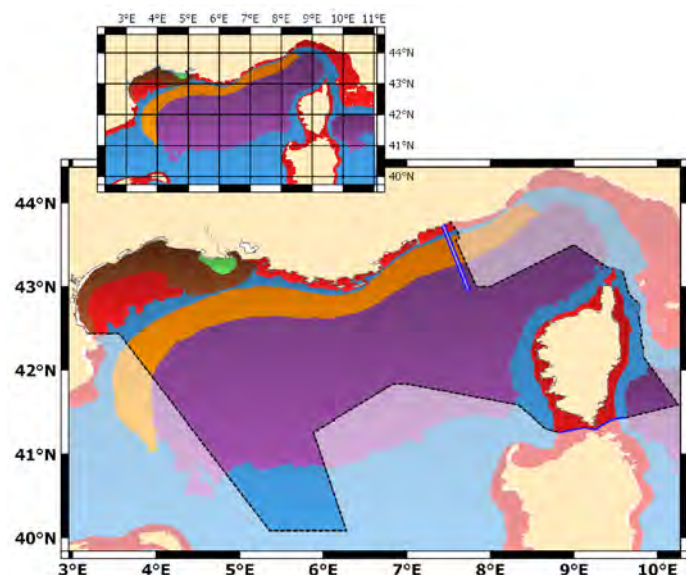
Spatial Extent time serie of Deep Convection patch class



3 operational perspective for decision support tools

Identification of ecologically-relevant scales and areas for assessment of pelagic (broad) habitats

Coupling « natural » boundary of physical patches with regulatory boundary giving seascapes



MSFD French Mediterranean sub-region as a seascape composed by 6 patches class

- background
- coastal
- deep convection
- liguro provençal cur
- rhone estuary
- rhone plume

----- Maritime boundaries unilaterally claimed by France in the absence of agreement
 ——— Maritime boundaries established by a bilateral agreement or decided by an international juridical body

Few perspectives

- Compute seasonal or monthly ID-Cards
- Add new abiotic variables like turbidity
- Characterize the biotic part, using satellital data of surface chlorophyll
- Improve the numerical model using data assimilation &/or spectral nudging techniques



Thank you!