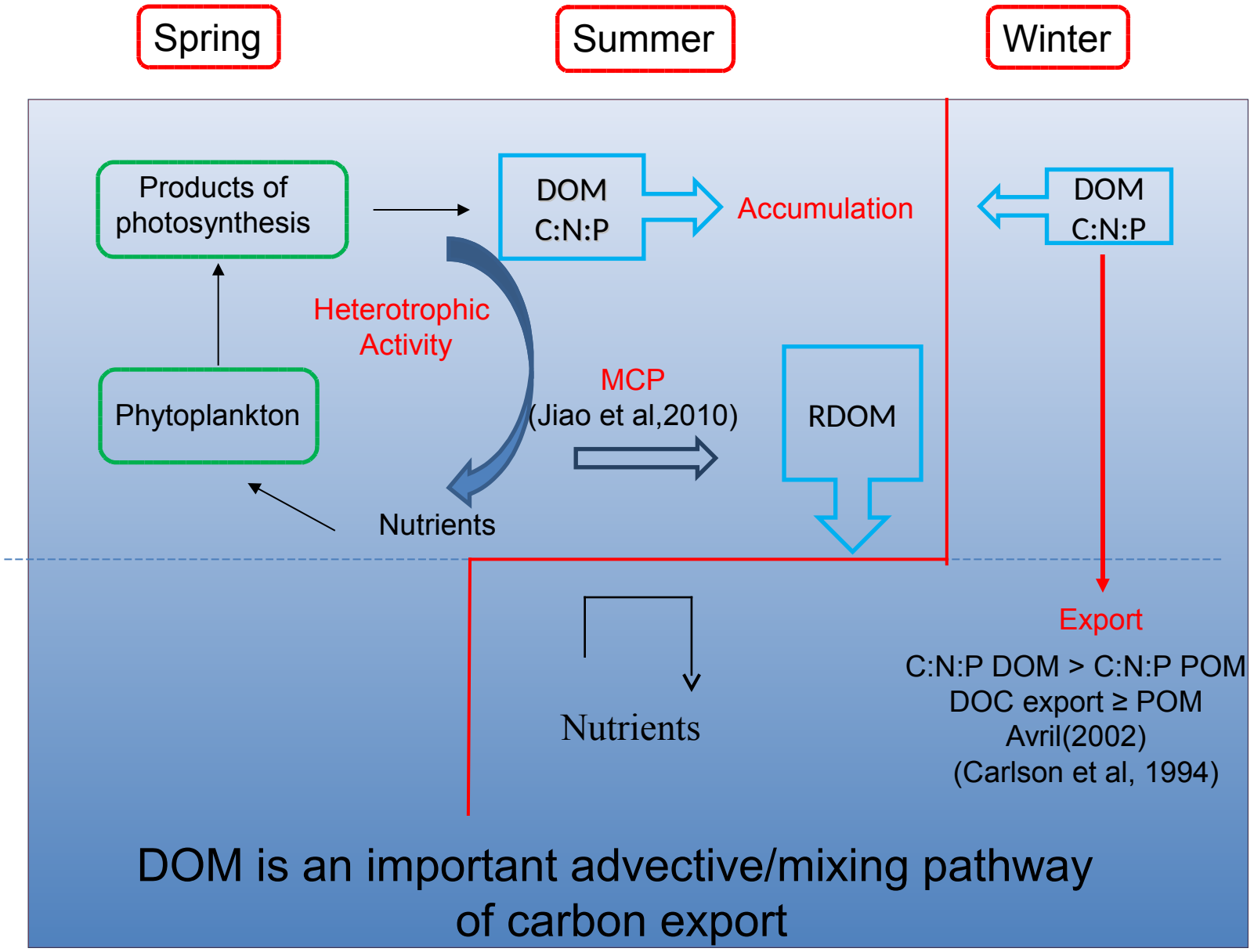
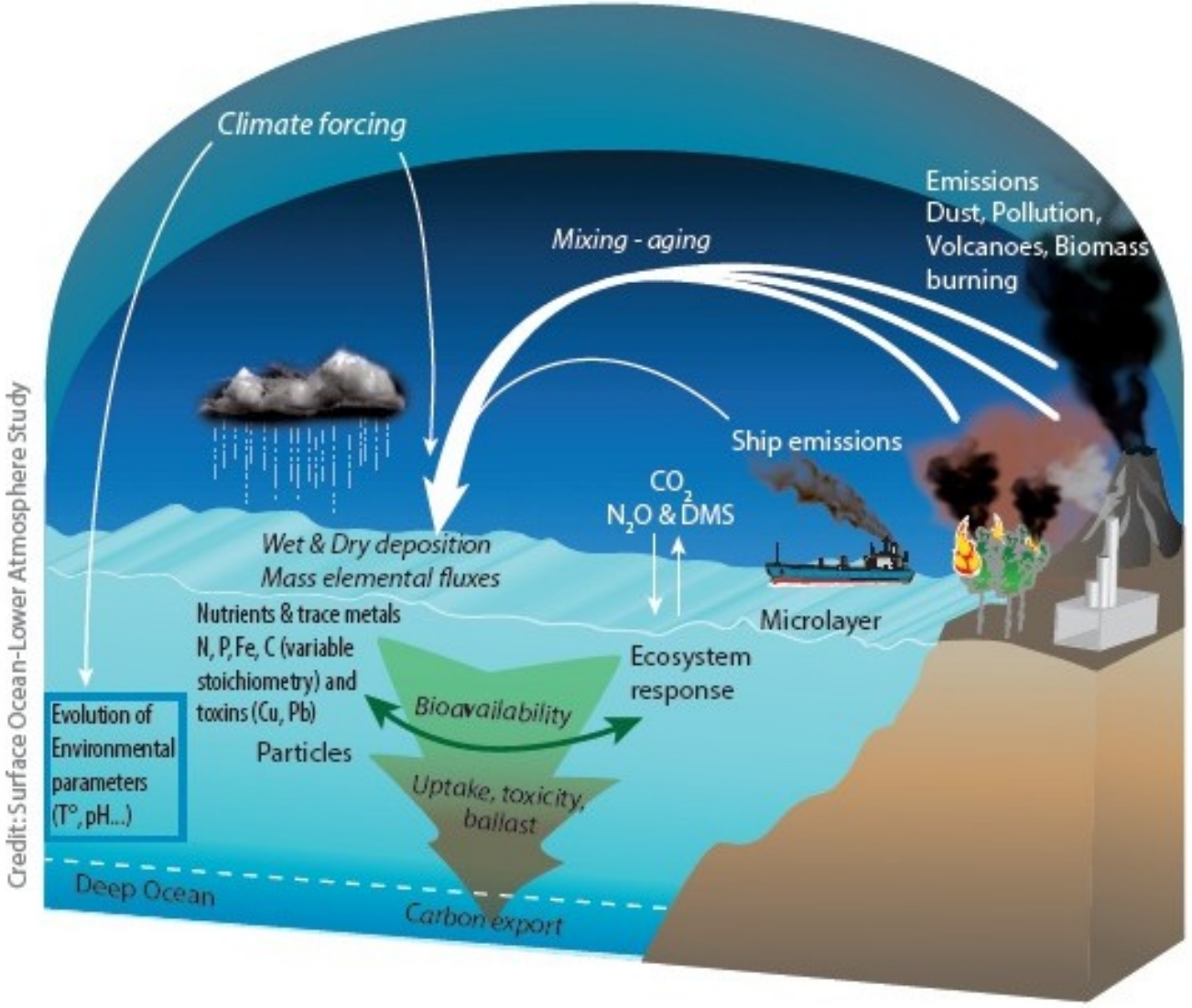
PhD thesis :2014-2017

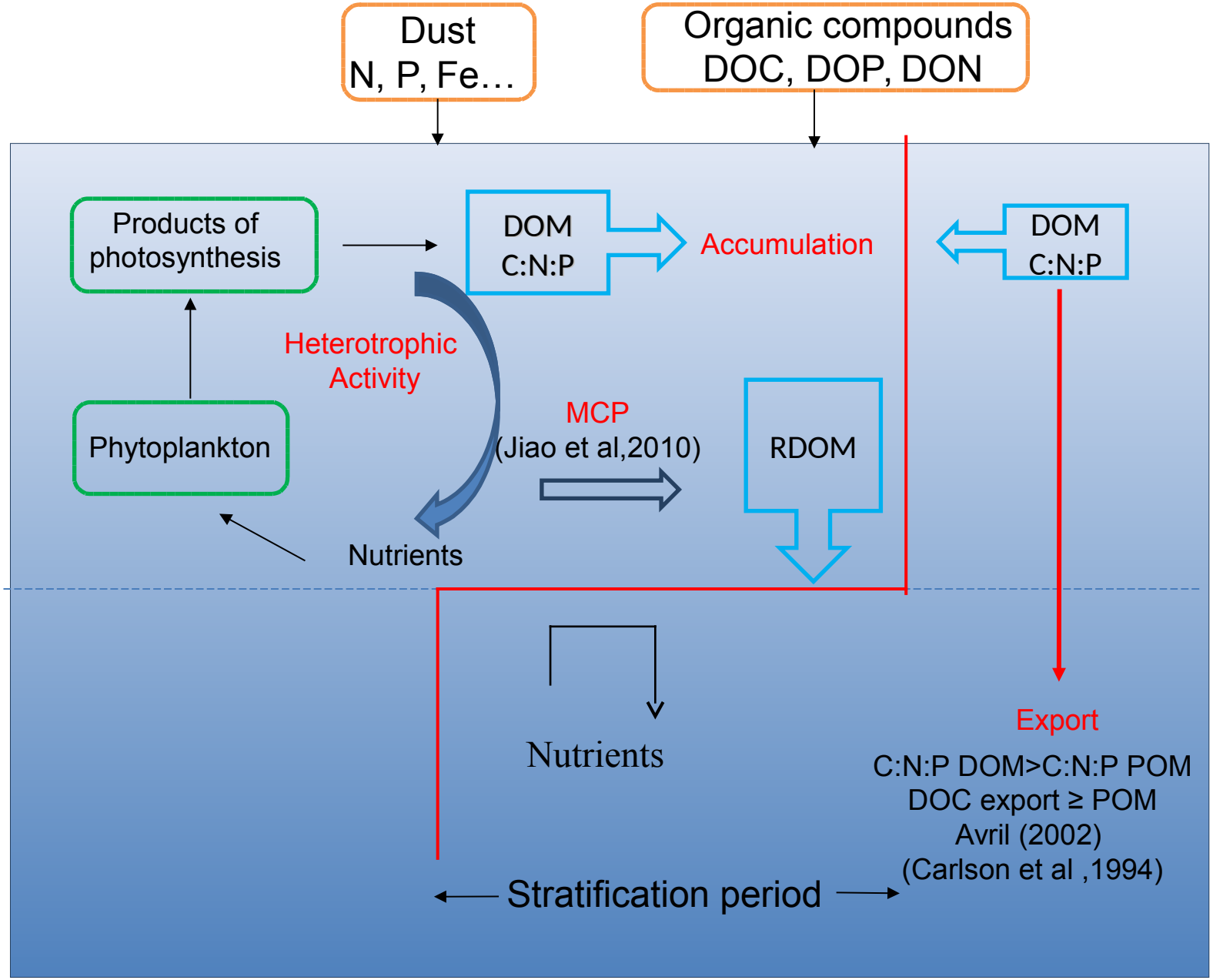
Role of atmospheric input on the stoichiometry of dissolved organic matter in the surface Mediterranean Sea

Kahina Djaoudi., Elvira Pulido-Villena and France Van Wambeke.

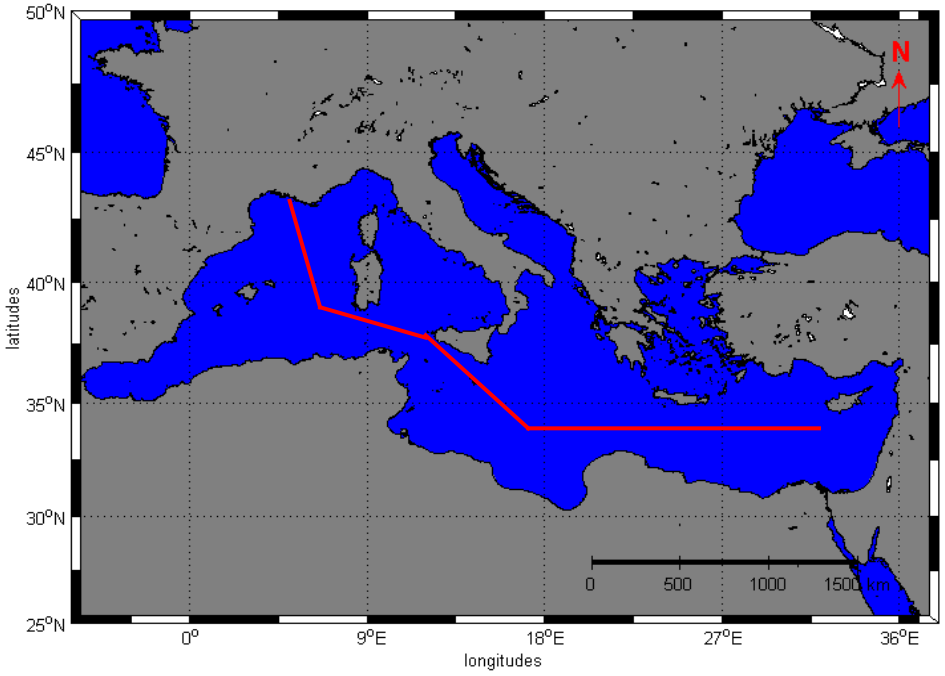
Mediterranean Institute of Oceanography, Marseille.


Spring
Summer
Winter
Products of photosynthesis
DOM C:N:P
Accumulation
DOM C:N:P
Heterotrophic Activity
Phytoplankton
MCP (Jiao et al,2010)
RDOM
Nutrients
Nutrients
Export
C:N:P DOM > C:N:P POM
DOC export ≥ POM
Avril(2002)
(Carlson et al, 1994)
DOM is an important advective/mixing pathway of carbon export

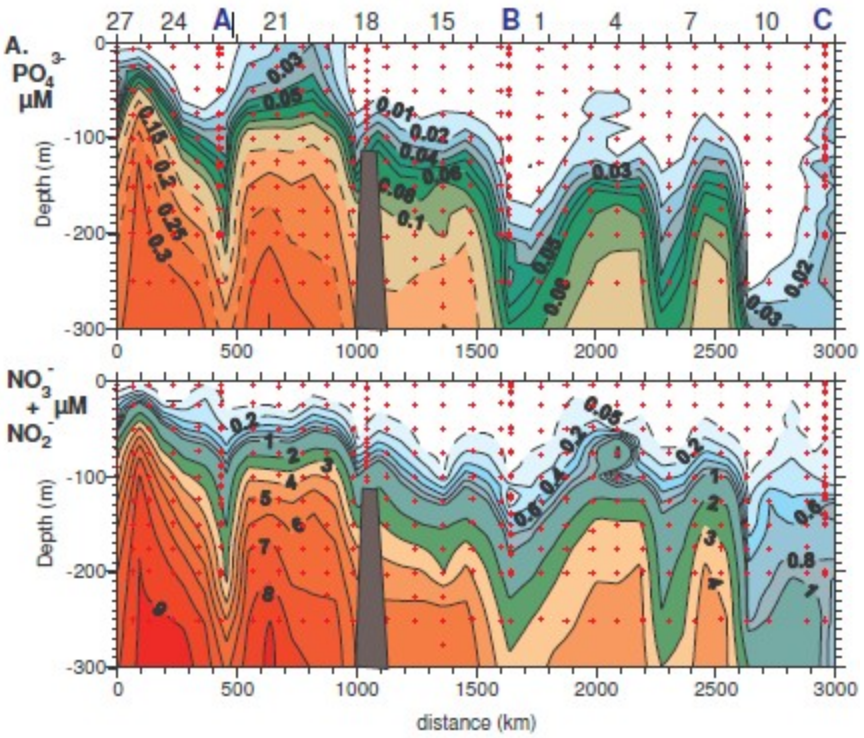

Climate forcing
Mixing - aging
Emissions
Dust, Pollution,
Volcanoes, Biomass
burning
Ship emissions
CO_2
N_2O & DMS
Wet & Dry deposition
Mass elemental fluxes
Nutrients & trace metals
N, P, Fe, C (variable
stoichiometry) and
toxins (Cu, Pb)
Particles
Microlayer
Ecosystem
response
Bioavailability
Uptake, toxicity,
ballast
Evolution of
Environmental
parameters
(T°, pH...)
Deep Ocean
Carbon export
Credit: Surface Ocean-Lower Atmosphere Study


Dust
N, P, Fe…
Organic compounds
DOC, DOP, DON
Products of photosynthesis
DOM
C:N:P
Accumulation
DOM
C:N:P
Heterotrophic Activity
MCP
(Jiao et al,2010)
RDOM
Phytoplankton
Nutrients
Nutrients
Export
C:N:P DOM>C:N:P POM
DOC export ≥ POM
Avril (2002)
(Carlson et al ,1994)
Stratification period

The Mediterranean Sea has long been known as a low nutrient concentration basin (Krom et al, 1991).

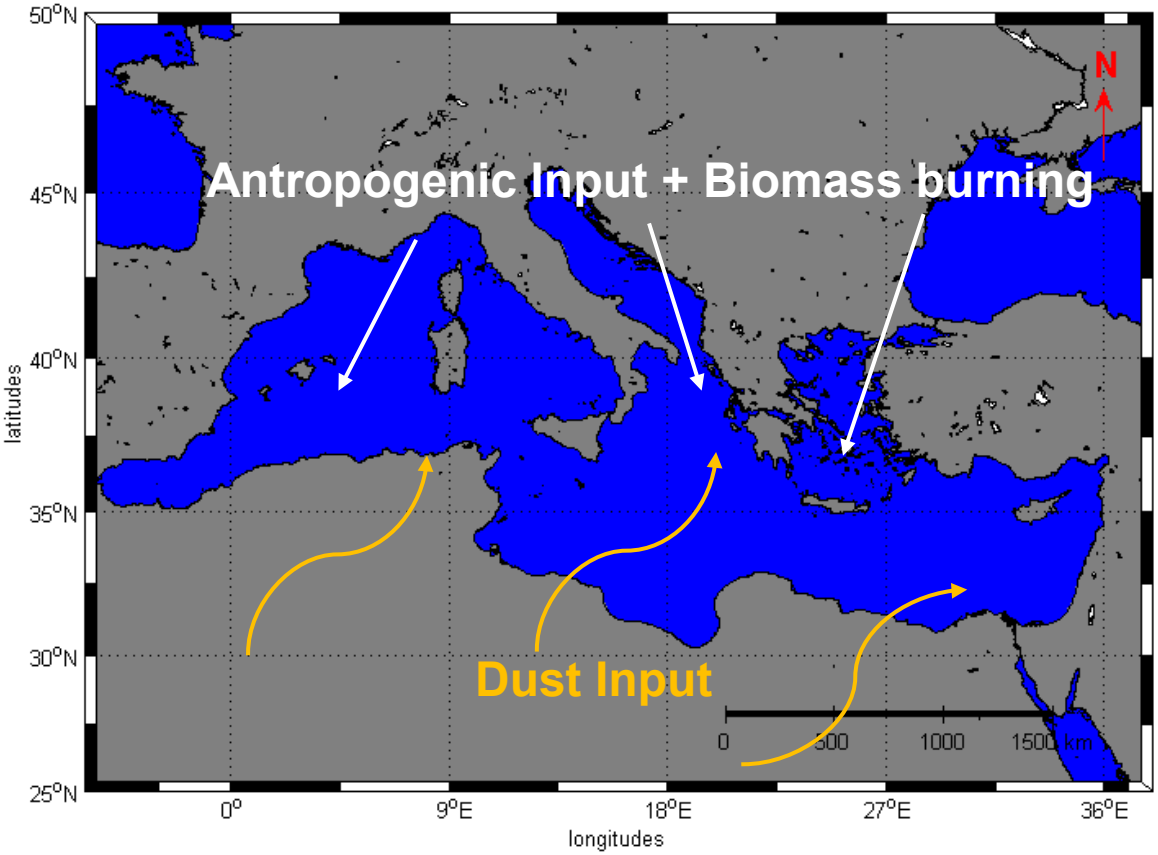


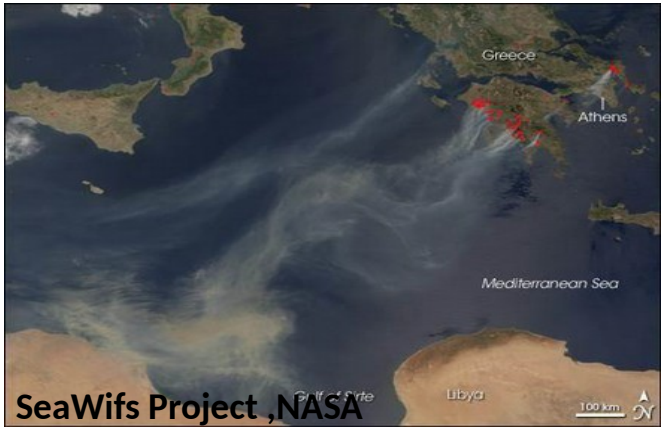
Boom transect (Pujo Pay et al,2011)

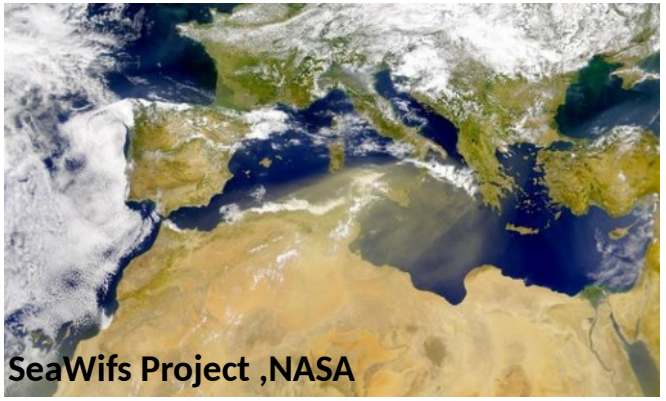


Phosphorus and nitrogen concentrations along the BOOM transect (Pujo Pay et al,2011)

The atmospheric input plays an important role in The Mediterranean Sea (LNLC region) where the vertical supply from the subsurface is low particularly during the stratification period.

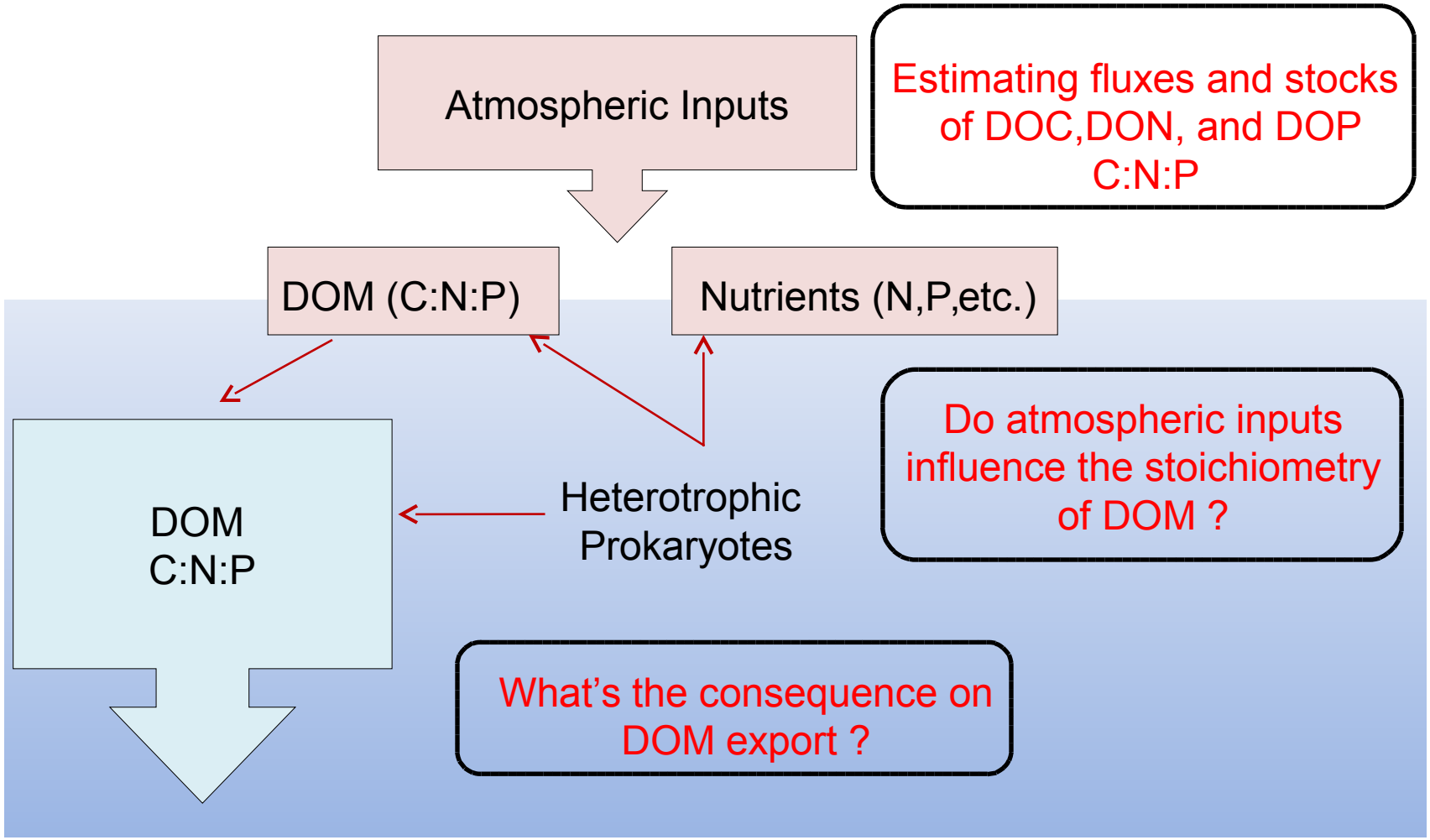






Atmospheric Input in the Mediterranean Sea

The aim of this PhD thesis

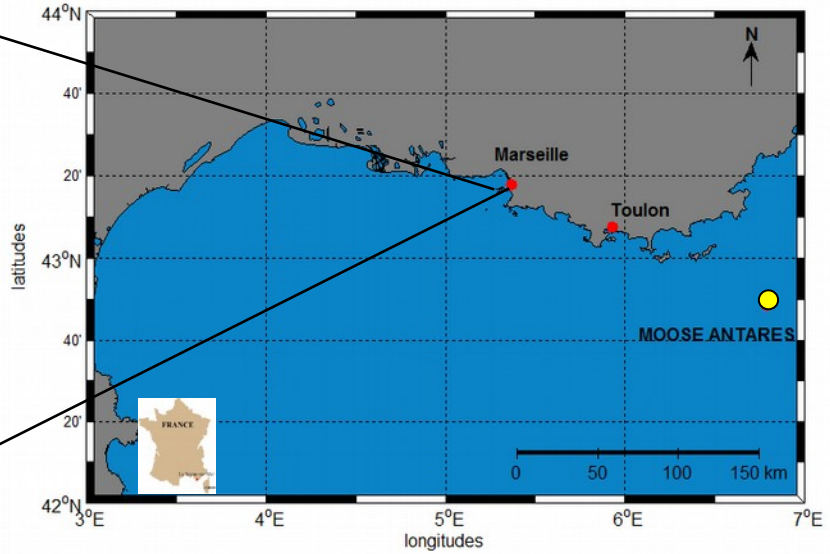


Observation approach

- Atmospheric survey
- Marine survey

DOC
DON
DOP
FDOM
LDOP

Collection of total atmospheric deposition : Frioul site

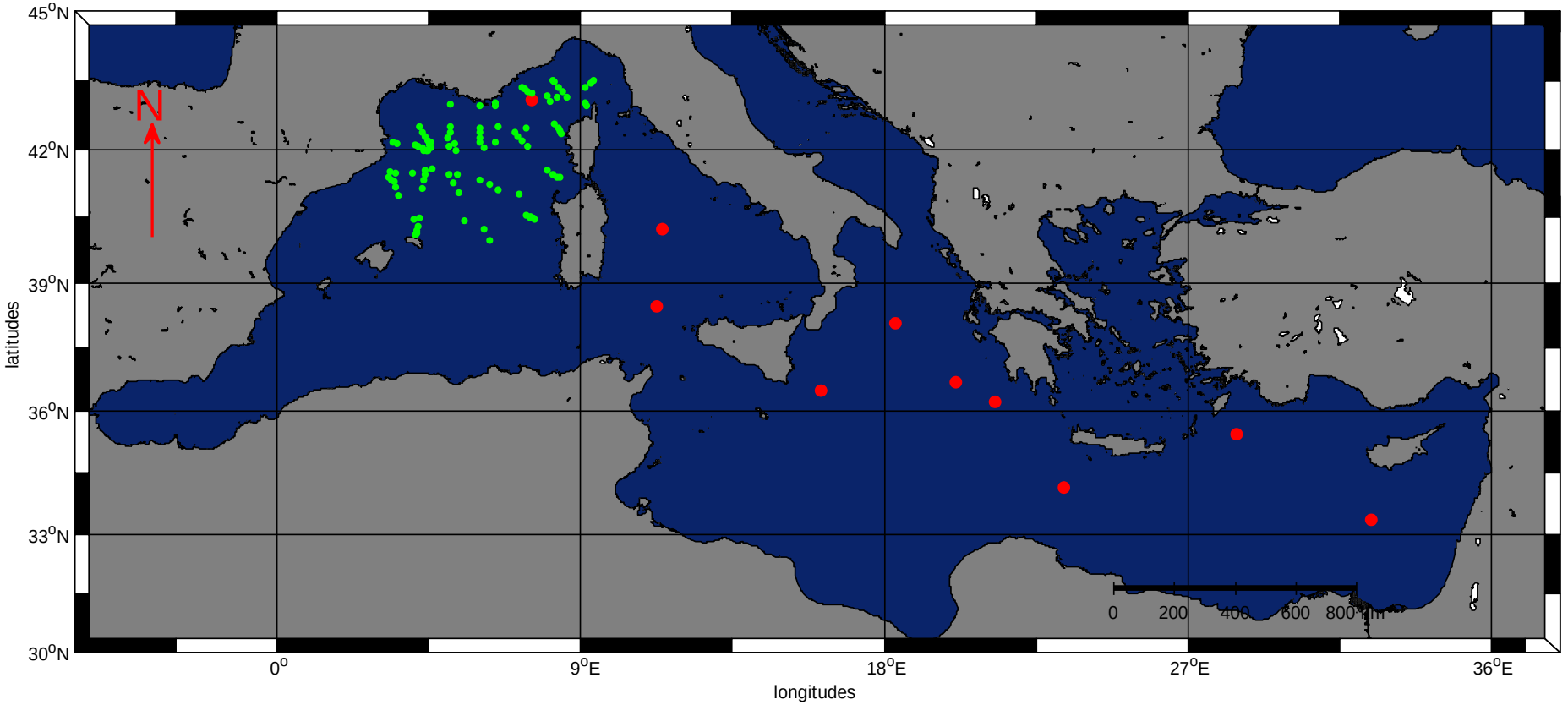


Location of the sampling station : Moose Antares

DOC
DON
DOP
LDOP
Bacterial activity

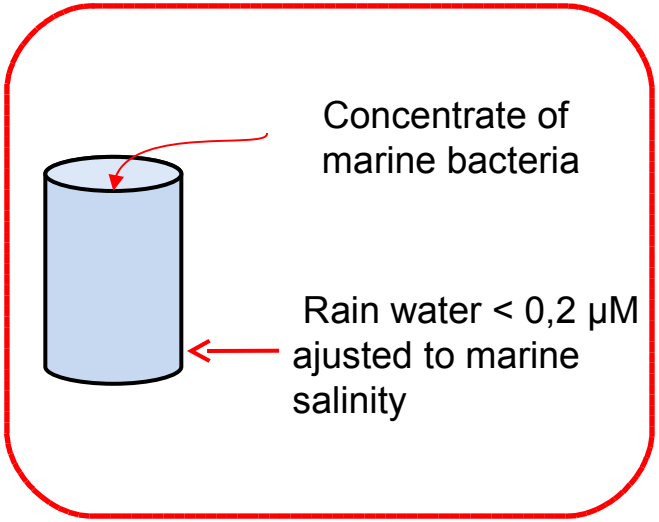
Moose Ge Cruise
09-07 to 27-07-2015
50 stations

BioArgomed cruise
13-05 to 03-06-2015
10 stations



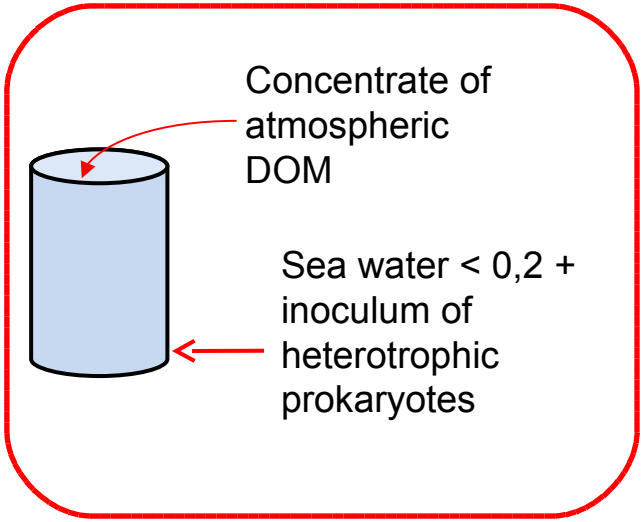
Experimental approach

Experiment 1



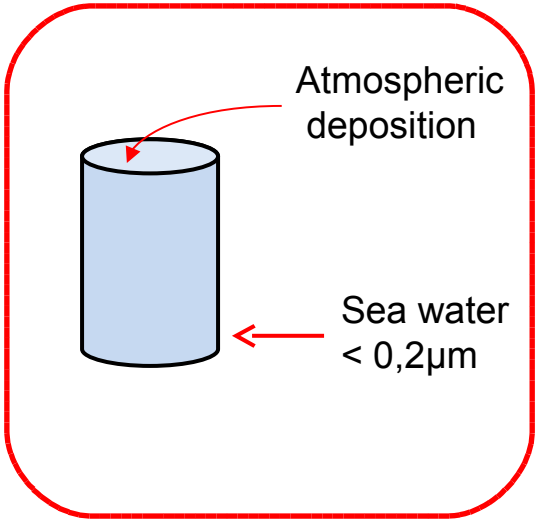
Evaluate the bioavailailability of DOM in atmospheric input.

Experiment 2



To parametrize the biological response and changes in DOM.

Experiment 3



Evaluate the direct effect of atmospheric input on marine DOM pool

The observation approach will allow to assess :

- Atmospheric fluxes of DOC, DON and DOP
- The seasonal variations of C:N:P ratio in atmospheric deposition
-The seasonal variations of C:N:P ratio in surface sea water
-The spatial distribution of DOC, DON and DOP in the surface Mediterranean Sea.

The experimental approach will acquire data on the links between atmospheric deposition and the cycle of DOM in the NW Mediterranean Sea.

The obtained parametrizations will be used to force Eco3M model (in collaboration with Melika Baklouti, MIO).

Atmospheric DOP and DOC fluxes

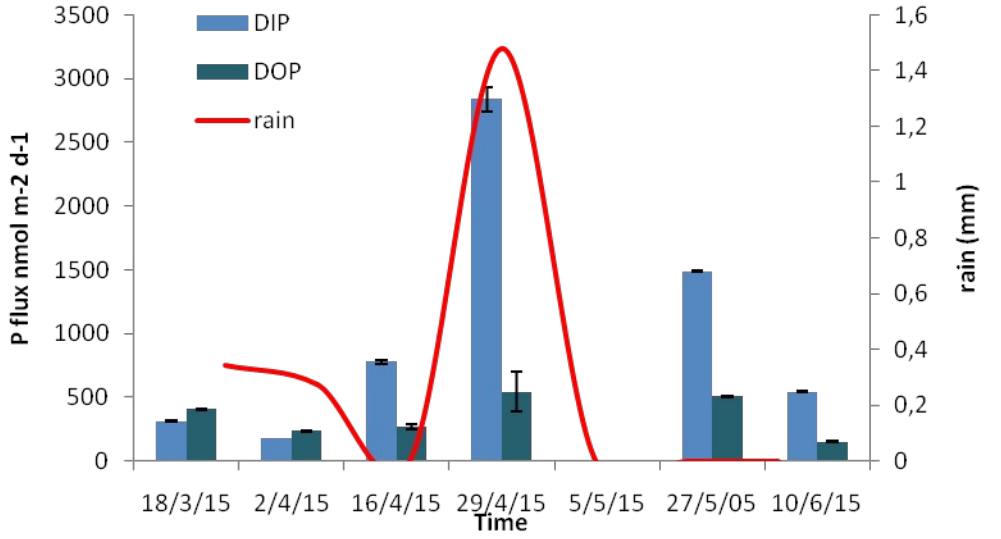
Average flux of DOP ~ 352 nmol m^{-2} d^{-1} and it contributes to ~ 33 % of the total fraction.

$0,42 – 1,53 * 10^{10}$ g P y^{-1}

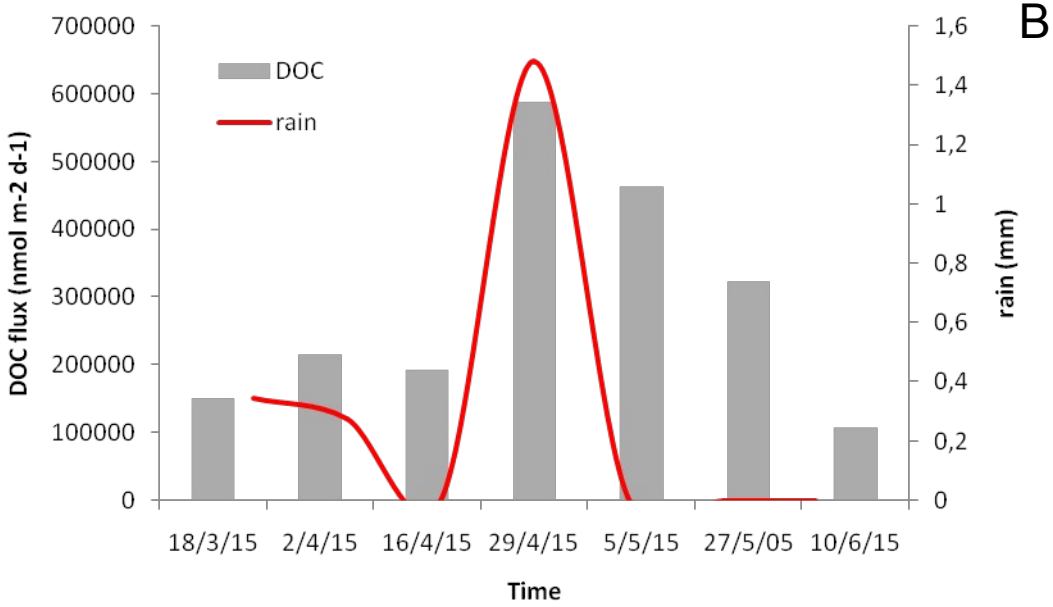
Average flux of DOC ~ 263 µmol C $m^{-2}d^{-1}$

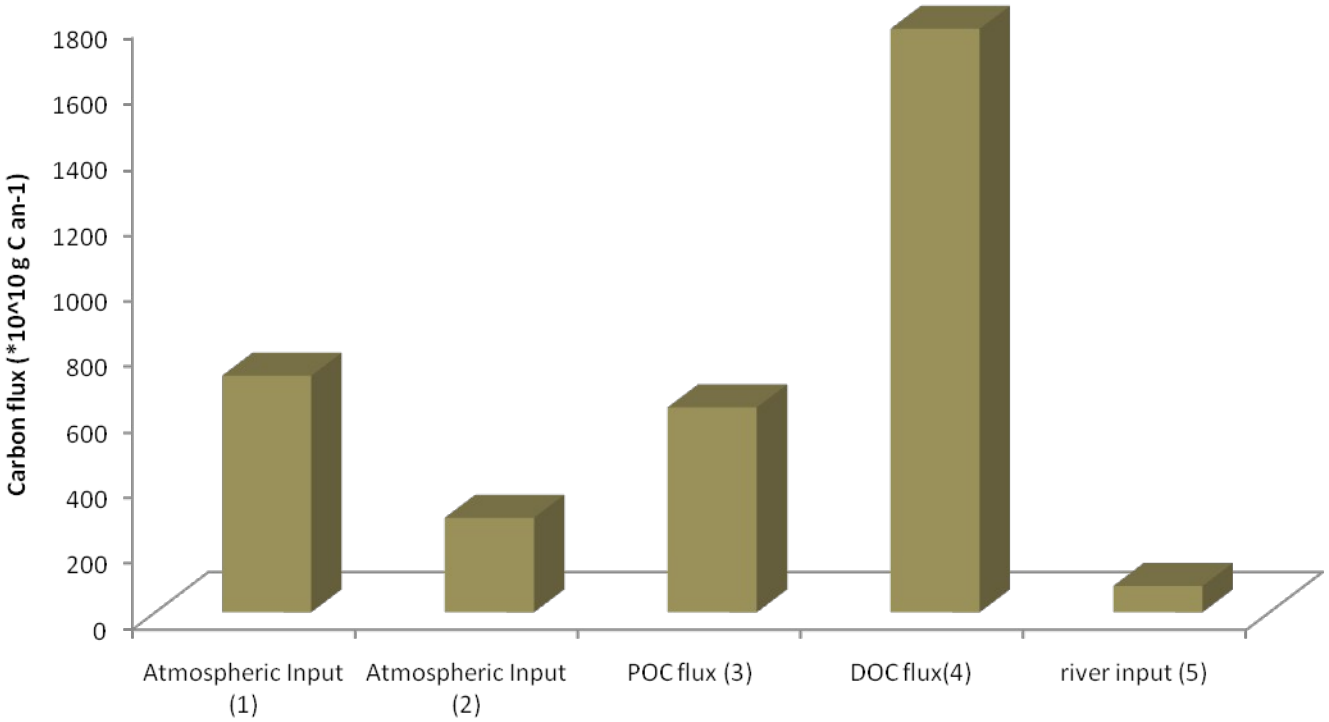
$1,17 – 6,43 * 10^{12}$ g C y^{-1}

A



B

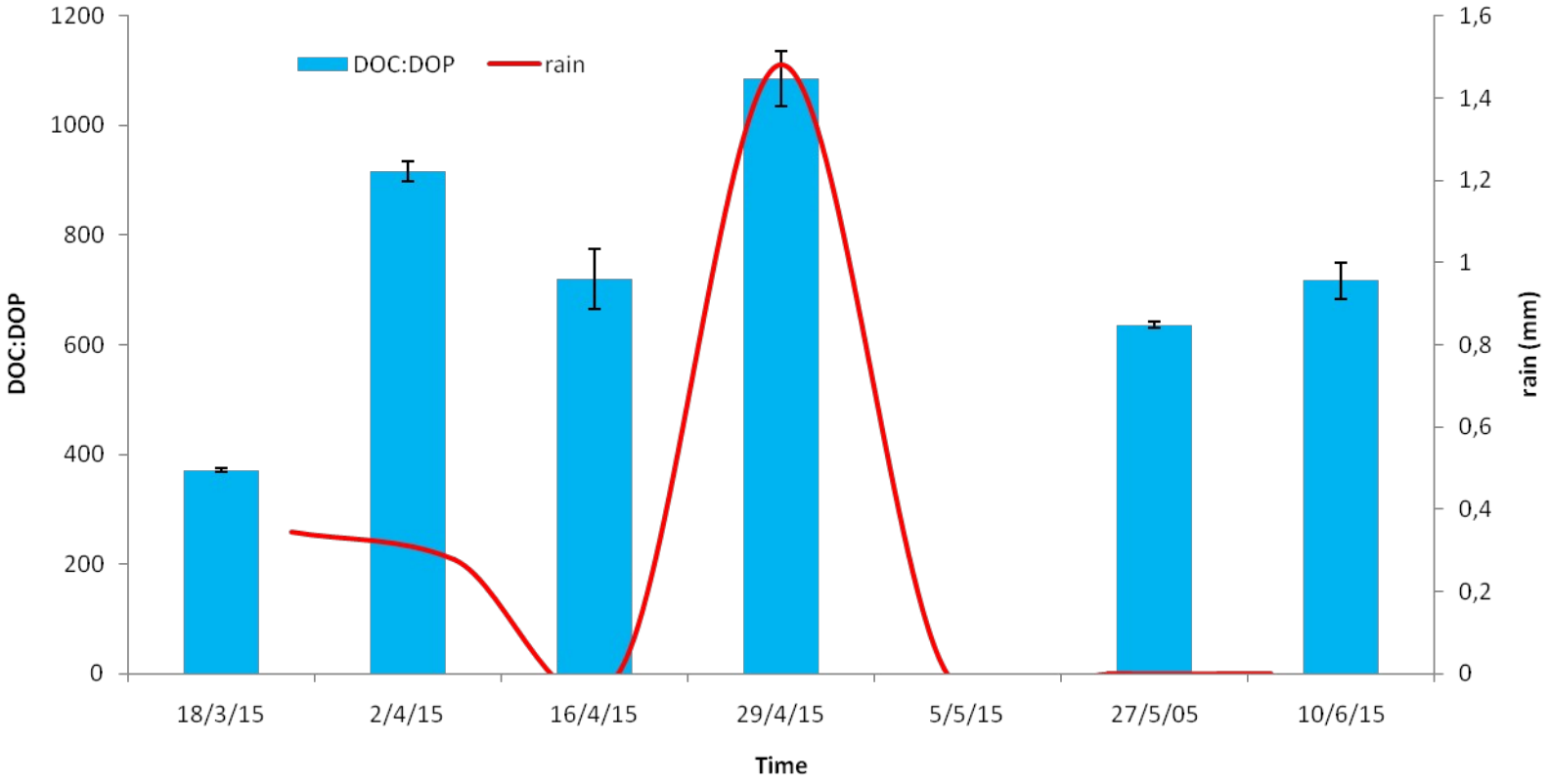




(1) Pulido-Villena et al,2008
(2) This study
(3) Miquel et al,2011
(4) Santinelli ,2015

C:P ratio of atmospheric deposition

DOC:DOP ~ 741



Thank you for your attention