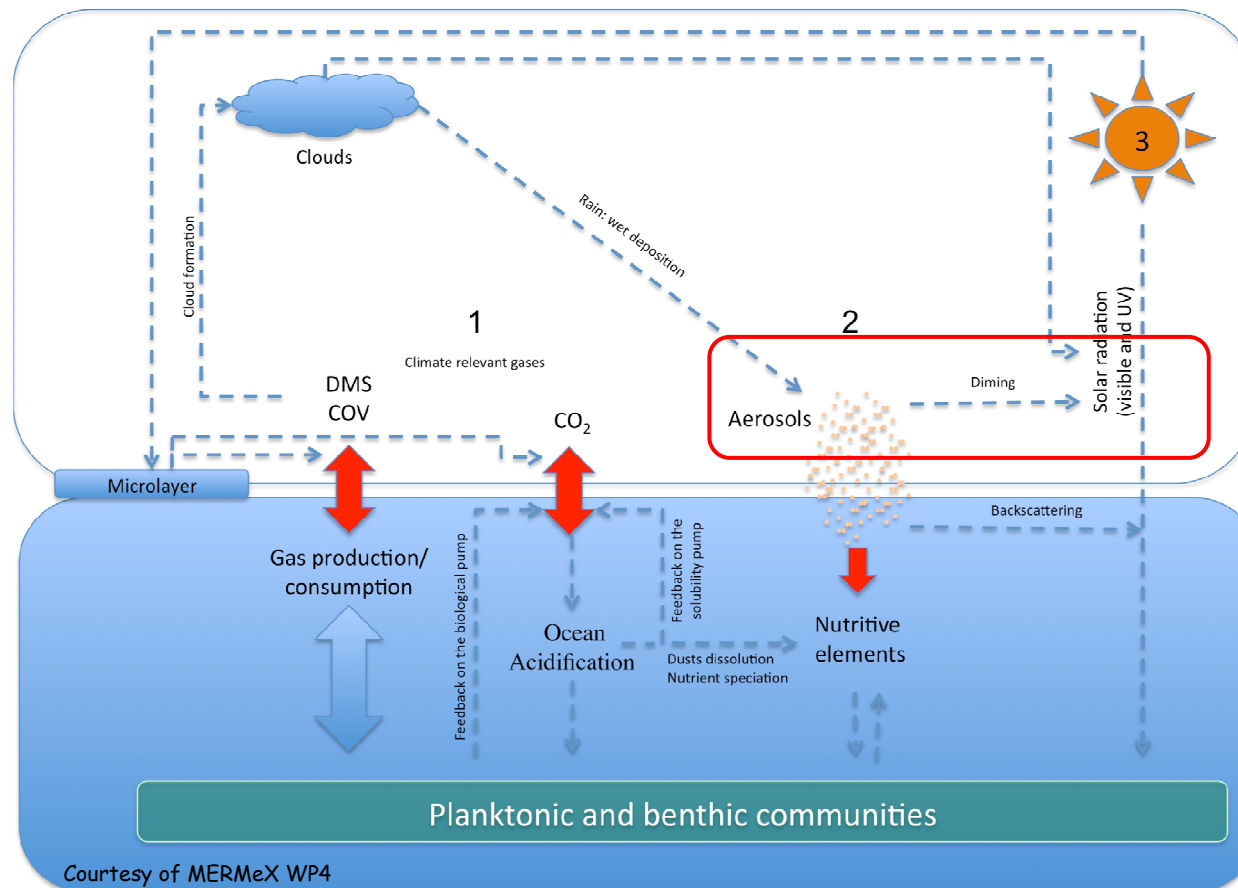


Effect of the aerosol sea-surface « dimming » -> on marine ecosystems

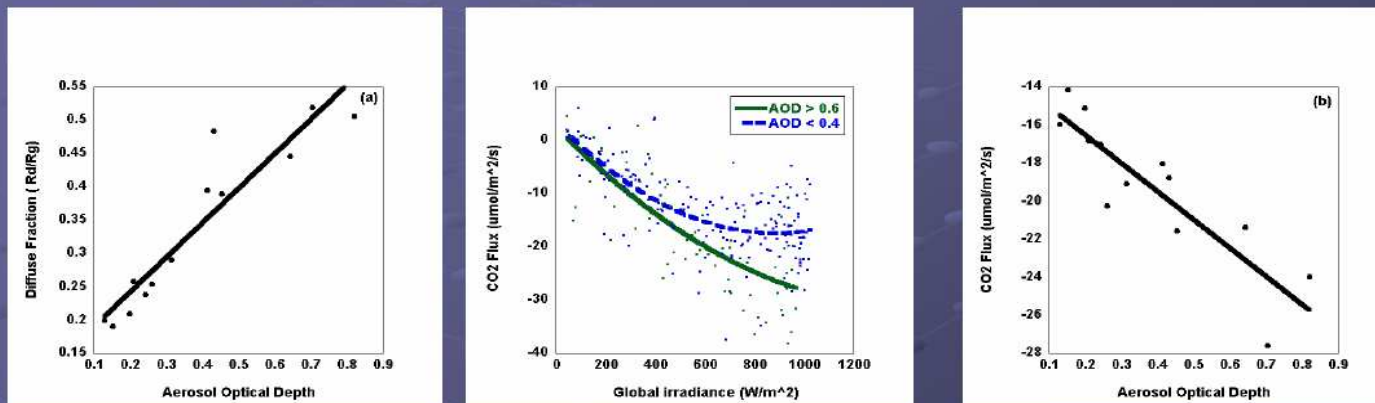


M. Mallet, M. Chami, B. Gentili, R. Sempere, B. Charriere, P. Dubuisson



- Context : (1) aerosols are able to significantly modify the solar radiations -> surface
- (2) previous works -> aerosol surface forcing could change the continental exchanges (ex. -> CO₂ flux)

Do Aerosols affect field scale CO₂ Flux?



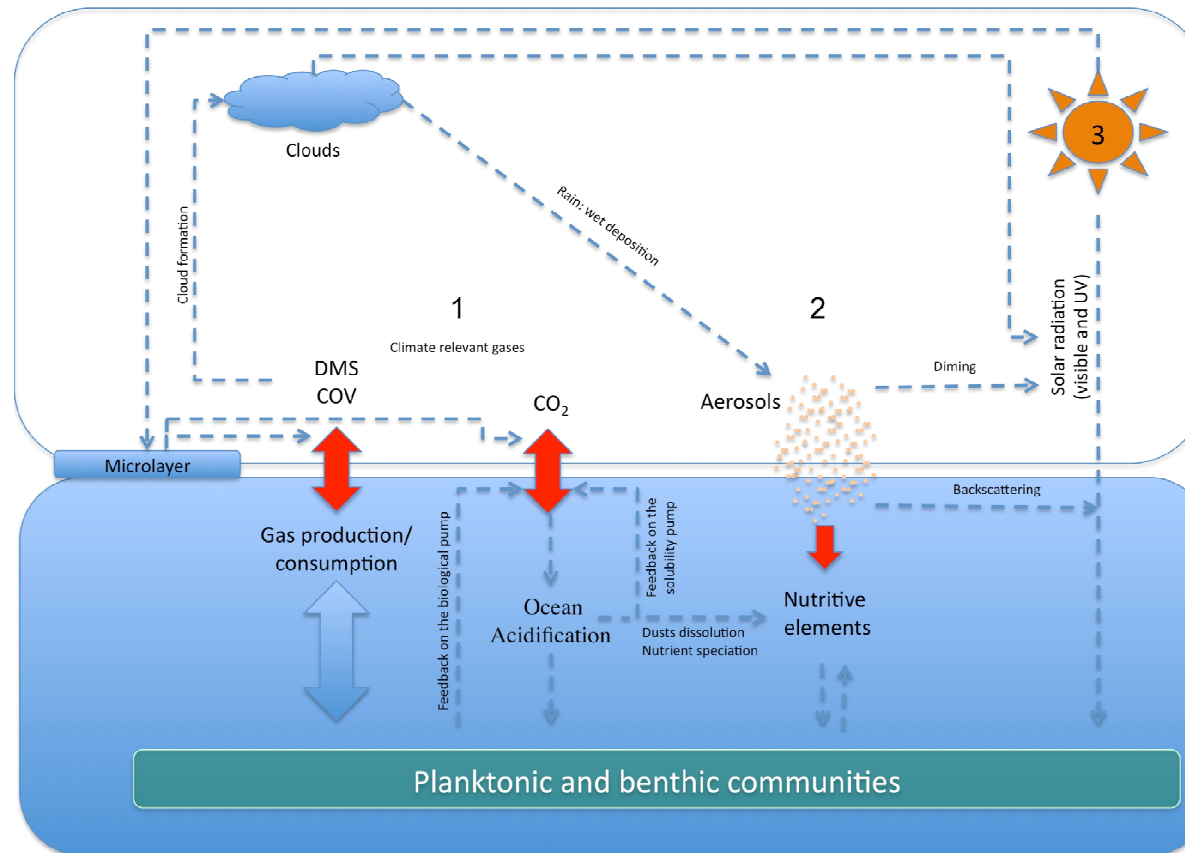
- Increase in AOD (no cloud conditions) causes increase in DDR (diffuse fraction)
- CO₂ flux into the vegetation (due to photosynthesis) is larger for **higher AOD** conditions
- Aerosol loading appears to cause field scale changes in the CO₂ flux

Niyogi et al., 2004

- At present -> most of works are dealing with effects on continental ecosys. surfaces
 - This study investigates the possible effect of the aerosol sea-surface dimming (for selected λ) on marine ecosystems ?

Scientific objectives ?

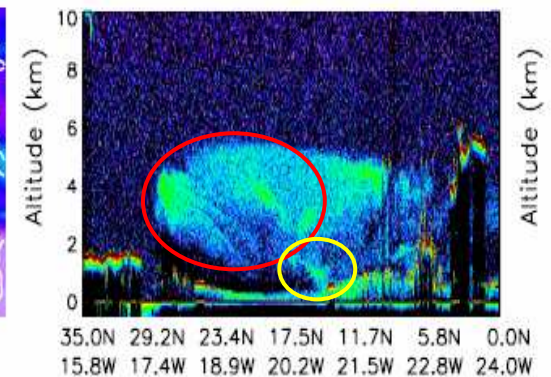
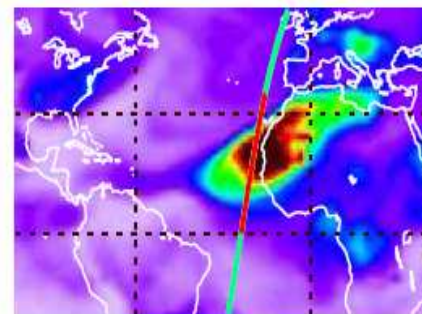
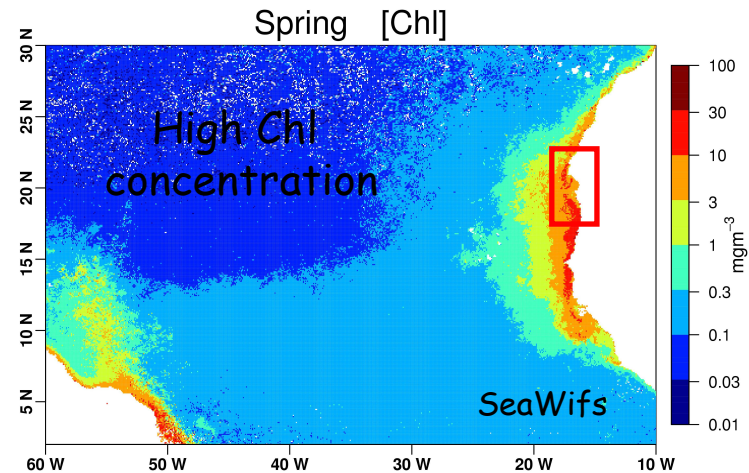
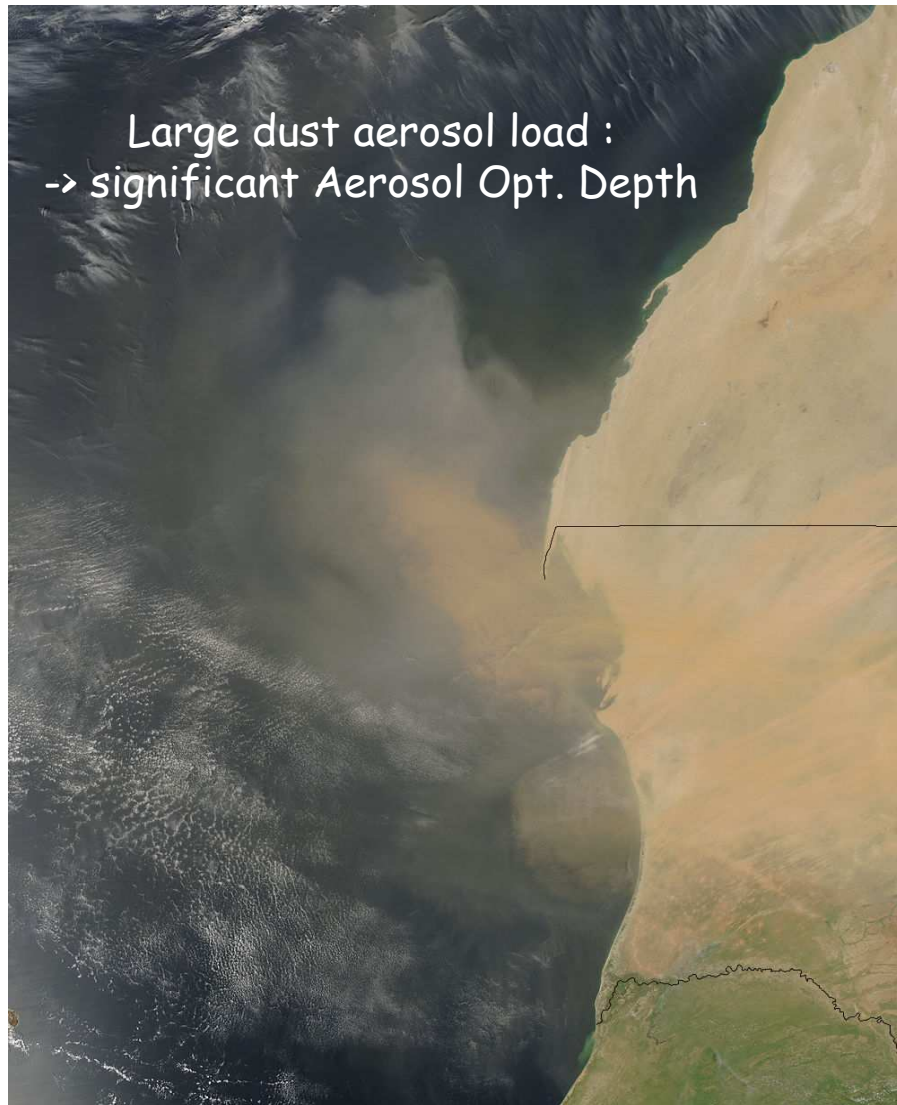
- 1) To determine how aerosols modify UV & Photosynthetically Available Radiant (PAR) at the sea-surface ?
- 2) To determine how UVR & PAR penetration is affected by the aerosol dimming ?
- 3) To determine the potential effect on marine photochemistry and photosynthesis ?
- 4) Are the effects significant so as to be included in biogeochemical regional models ?



First Step :

A 1D "simple" modeling study : effect of aerosols on the PAR(0+) & PP -> West African Coast

Why the west African coast ?

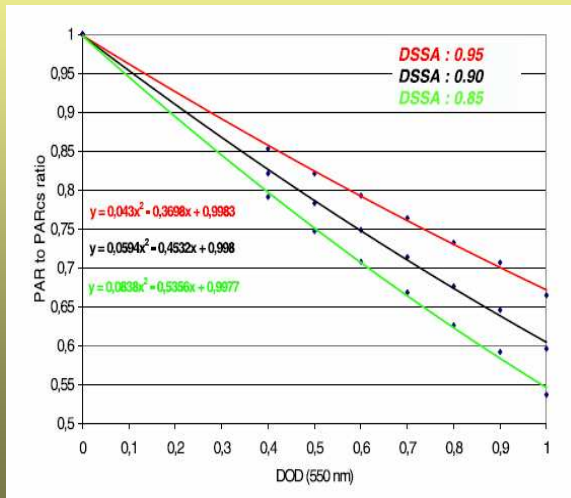


A fraction of dust is transported in altitude
-> not always deposited !

First Step : 1D modeling study -> effect of aerosols on the PAR₀₊ & PP

GAME RTM associated with a Prim. Production models

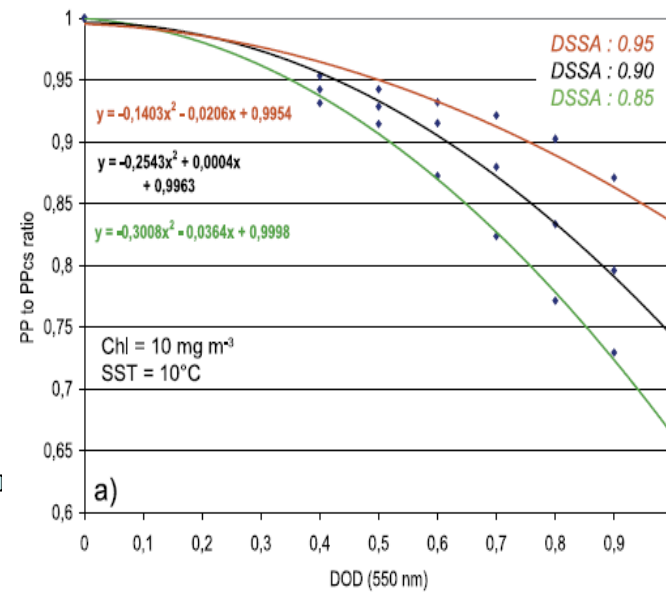
GAME RTM calculations :
-> PAR₀₊ (400 - 700 nm)
for different Dust Opt. Depth
(0 -> 1 at 550 nm)
& dust SSA (0.85 -> 0.95 at 550 nm)



PP model (Morel 1991, Antoine and Morel, 1996) calculations :

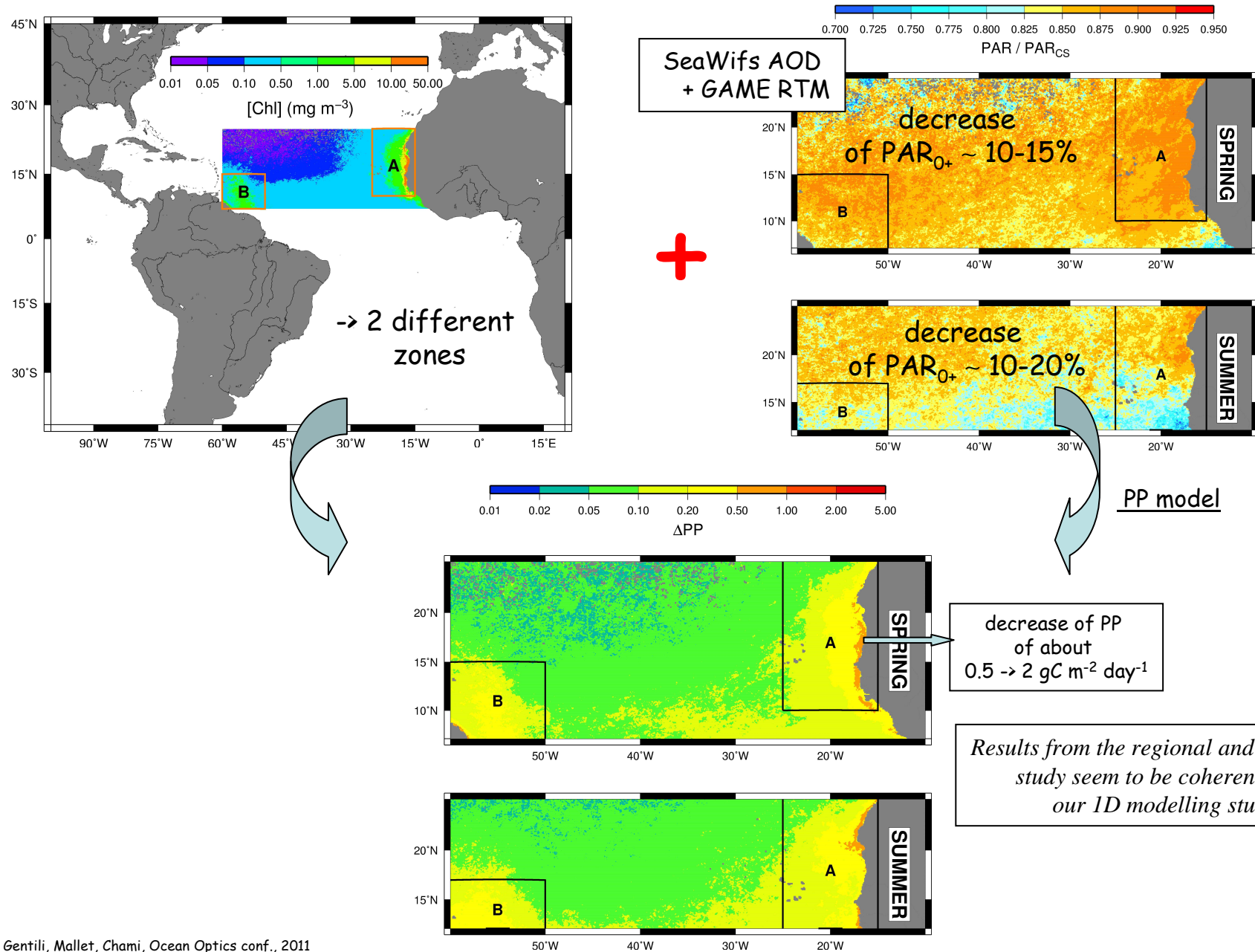
PP for different surface Chl concentration, SST,
Chl vertical stratification
-> and for PAR₀₊ clear-sky (cs) and PAR₀₊

$$PP = (1/39)PAR(0+)Chl_{tot} \psi^*$$

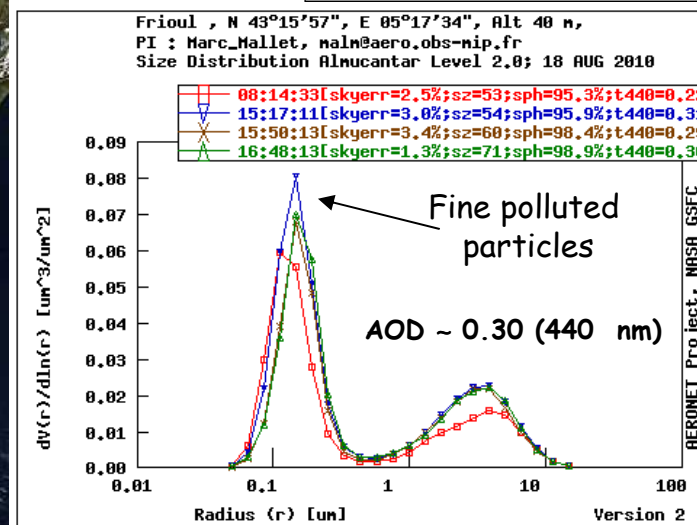
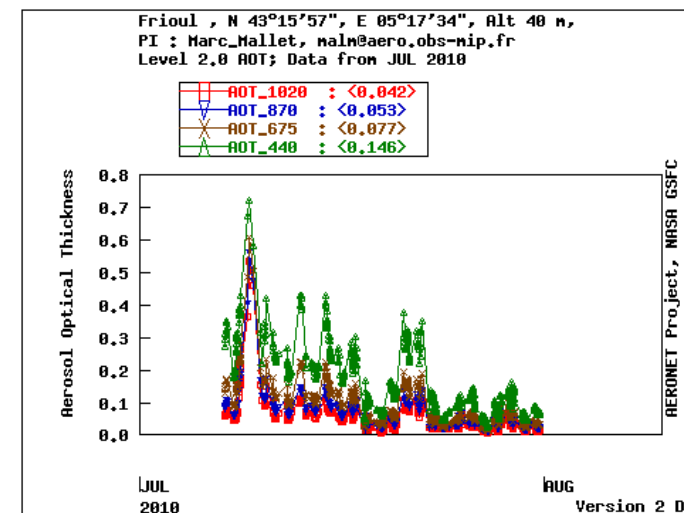
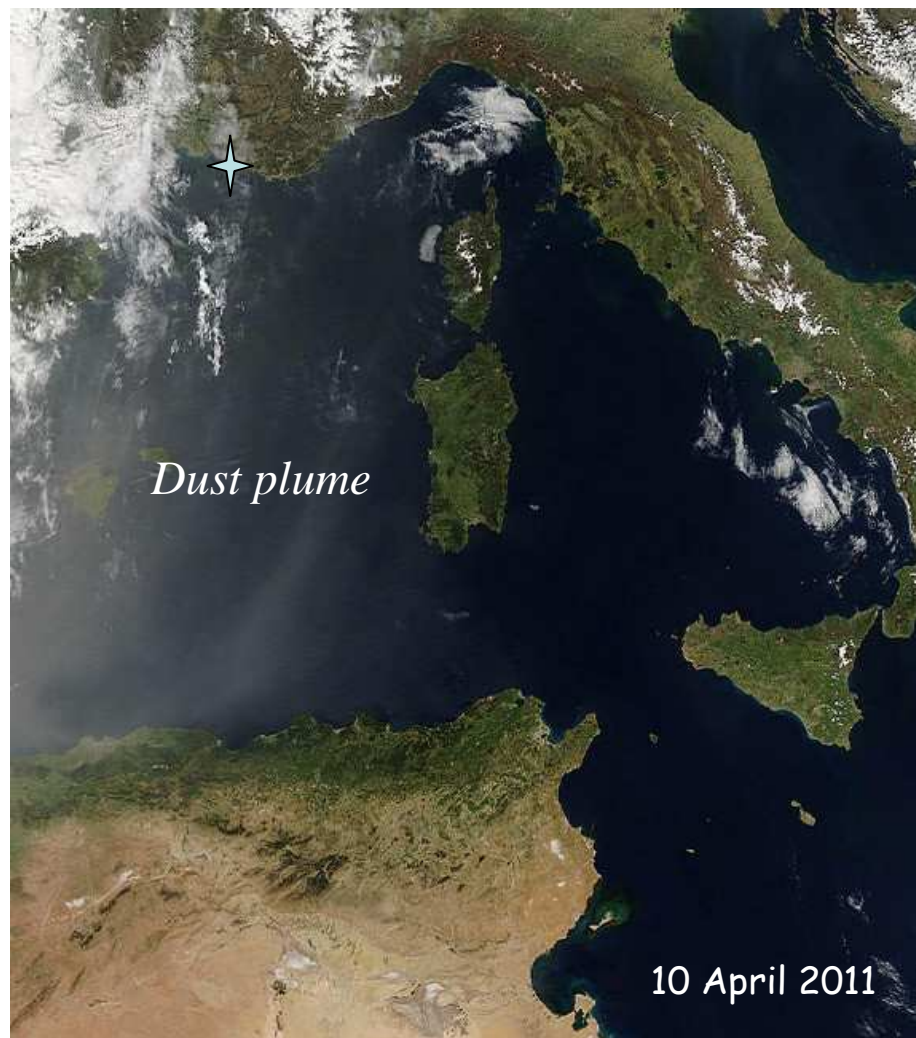


*Effect on DSSF on PP
is about 10-20 % decrease
for typical DOD (0.5 -> 1 at 550 nm)*

Second Step : study at the regional scale and for a long-term (1998 - 2010) period
 -> SeaWiFs data & GAME radiative transfer model.



The following step -> in-situ optical observations over the Bay of Marseille
 (-> WP 4.3 MERMeX)

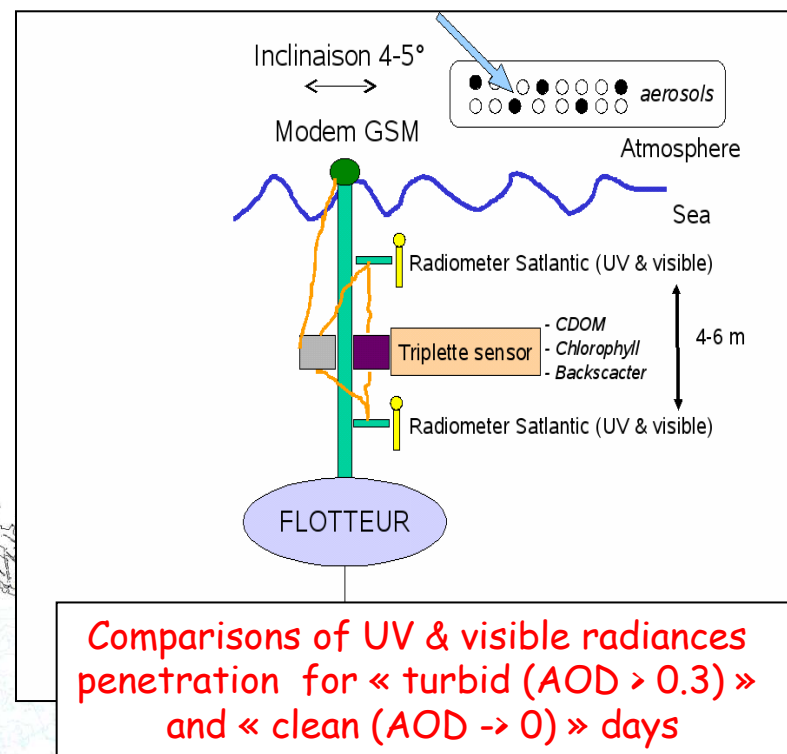
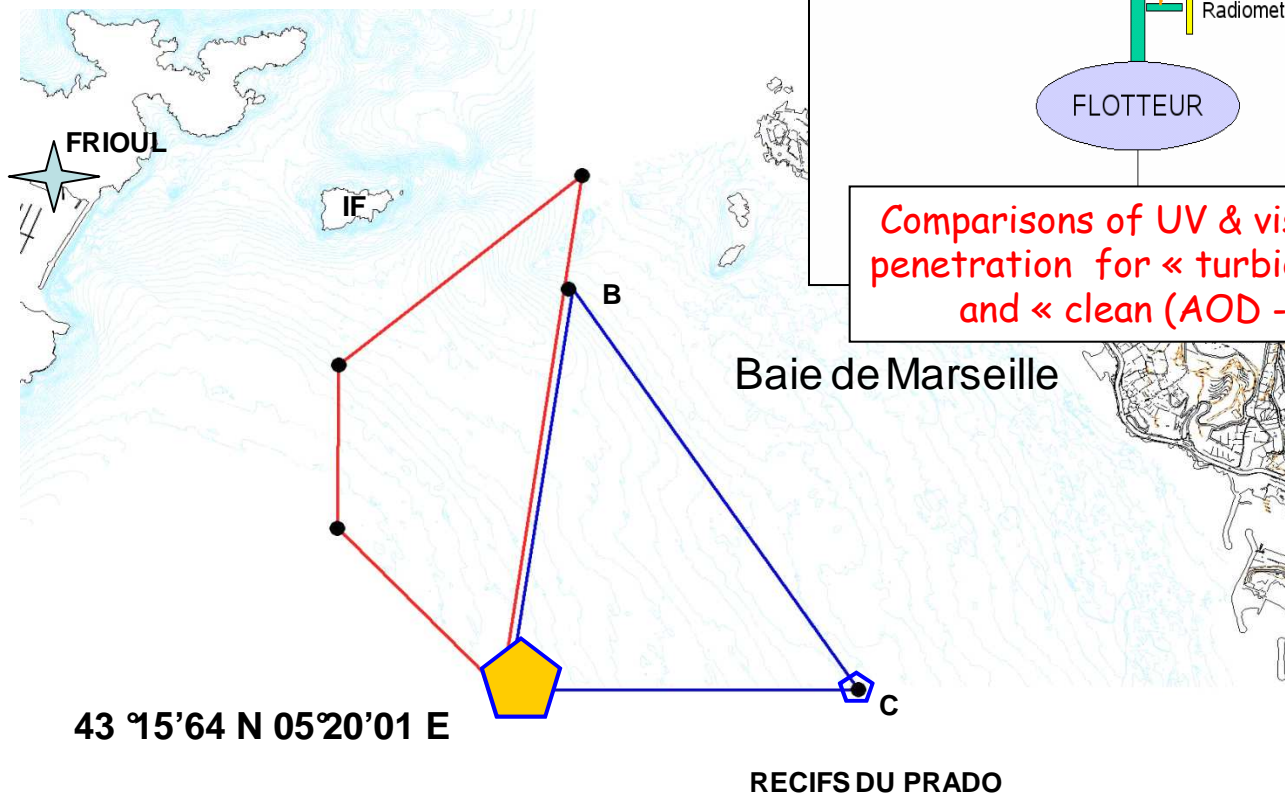


The « Bay of Marseille » is able to observe mineral dust and polluted fine aerosols

The following step -> in-situ optical observations over the Bay of Marseille

Light monitoring in the Mediterranean Sea

Localisation : Bay of Marseille (Pl. R. Sempéré)



★ Sun-photometer (-> deployed in summer 2011)

Summary

- 1) We start with a « simple » 1D modelling RTM & PP simulation -> non negligible impact of dust sea surface forcing on Prim. Production
- 2) First results using regional long-term SeaWiFS observations seem to consolidate the « 1D result »
- 3) Future investigations using in-situ optical observations over the Bay of Marseille
-> first data during summer 2011 ?
-> looking at UV radiations !

