Temporal Changes in trace metal concentrations during an artificial dust deposition to Large Mesocosms

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OBSERVATOIRE OCEANOLOGIQUE • VILLEFRANCHE/MER •

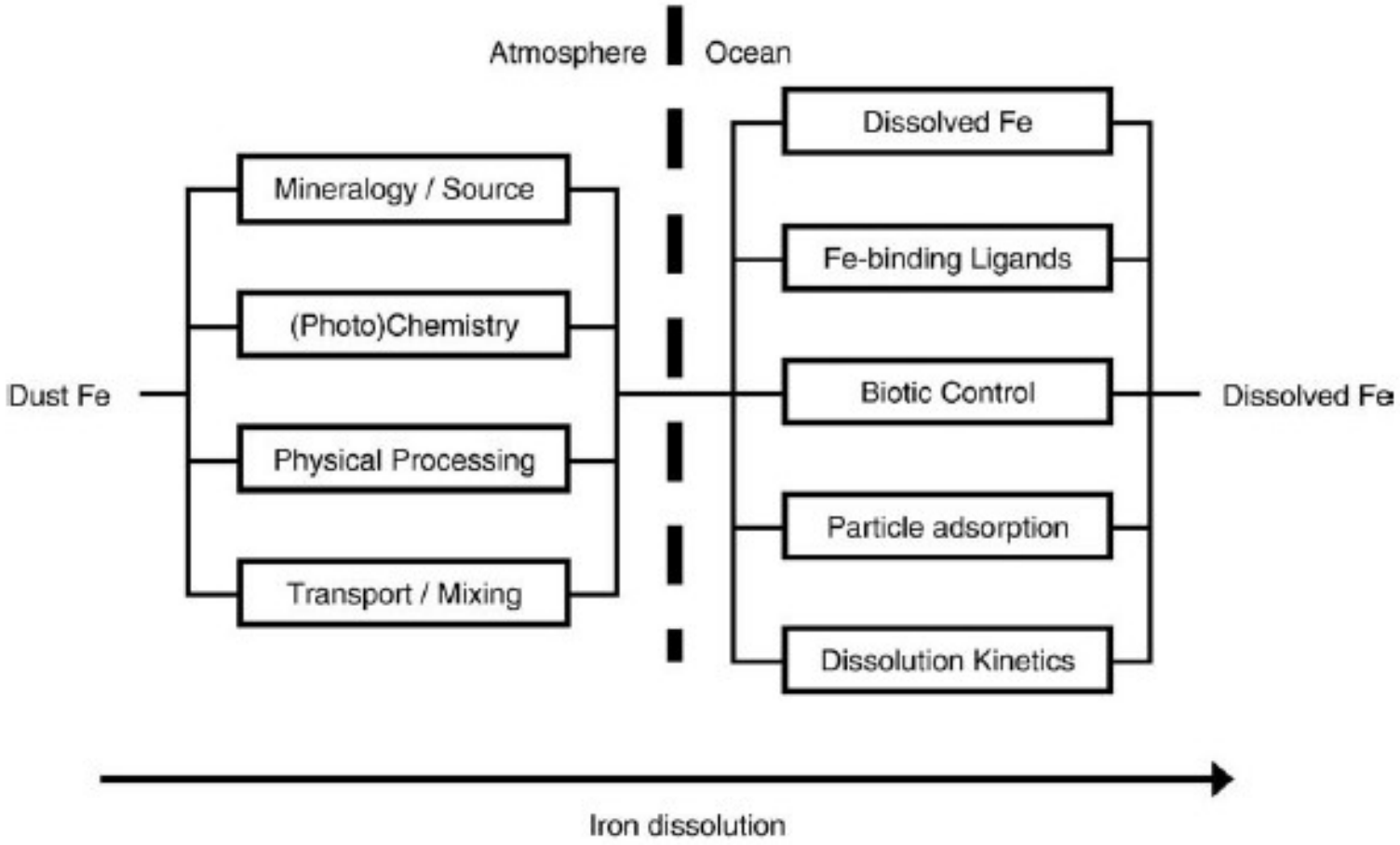
MARIE CURIE ACTIONS

IFM-GEOMAR

Réserve Naturelle SCANDOLA

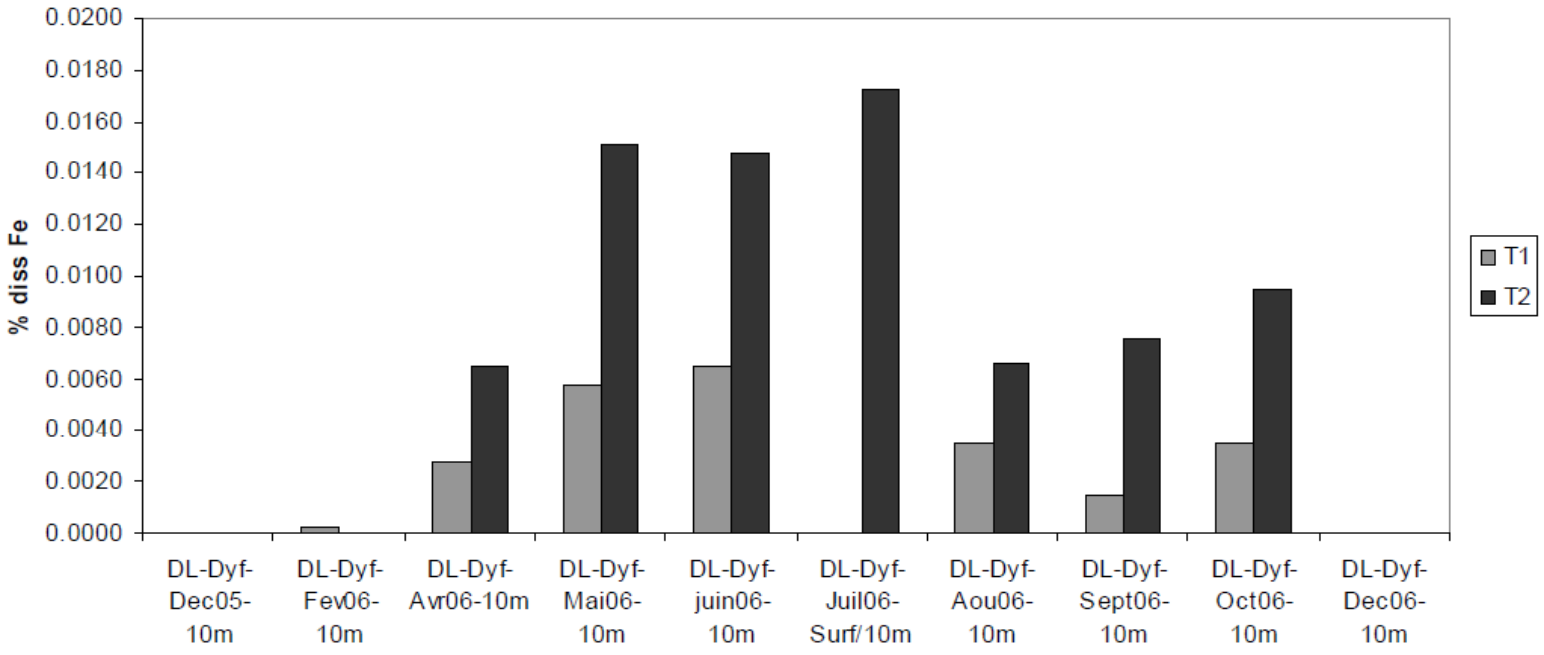
DFG Deutsche Forschungsgemeinschaft

Motivation



Baker and Croot 2010, Marine Chemistry

Variation de dissolution au cours de l'année



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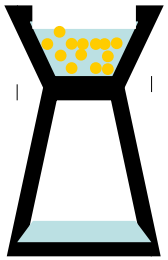
Motivation

The project DUNE aims at better understanding the effect of dust deposition on the biogeochemistry of surface waters of the Mediterranean Sea.

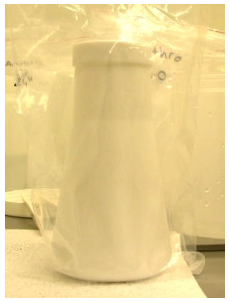
The approach applied in this project was to perform a dust pulse into large clean mesocosms.

The original design of these mesocosms represented a unique opportunity to study trace metal cycles at a scale which has been poorly explored so far.

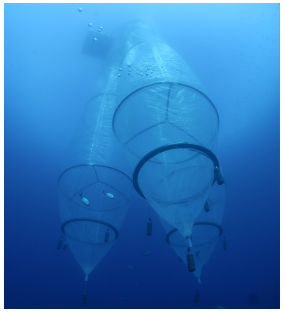
« Leaching » protocol



« Batch» protocol

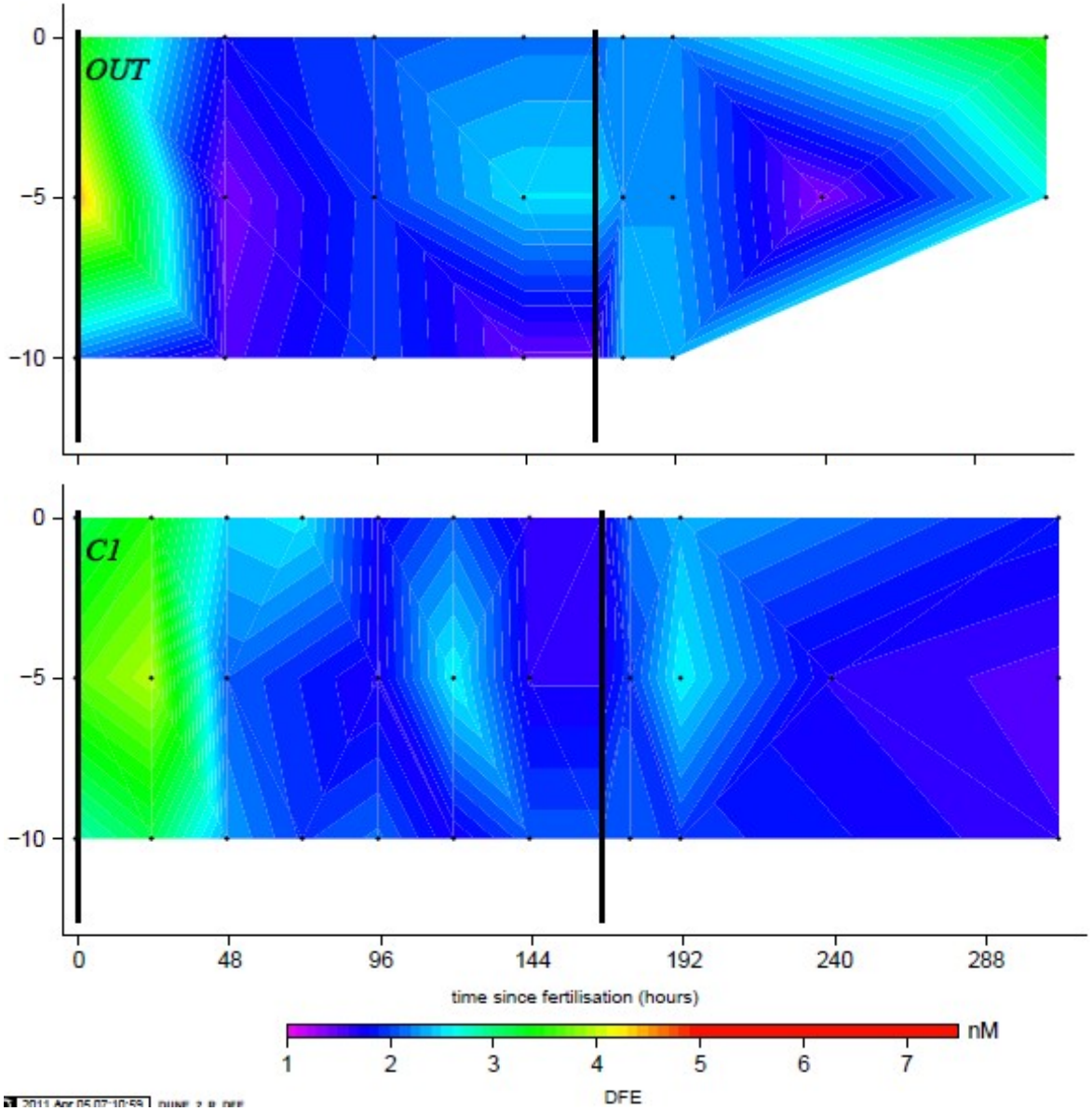


« DUNE» Protocol



Comparison between inside and outside the mesocosms

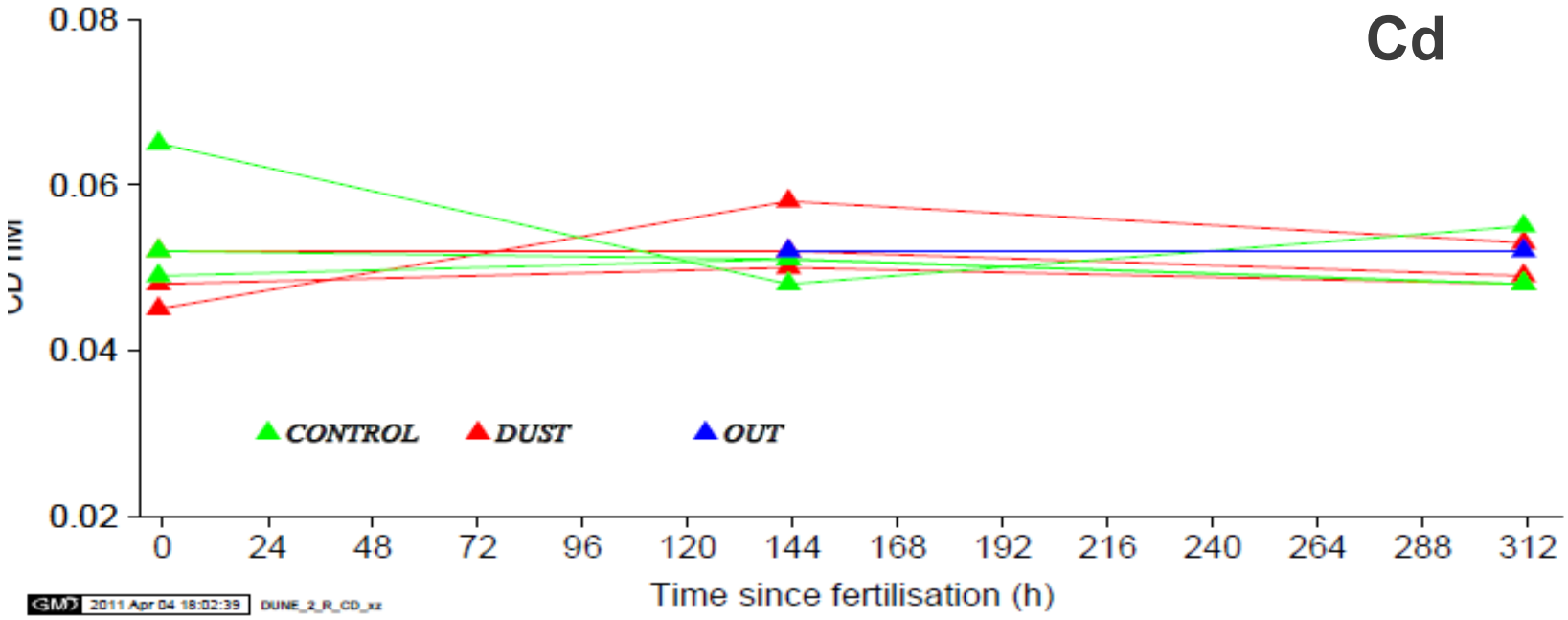
dFe



Other trace metals

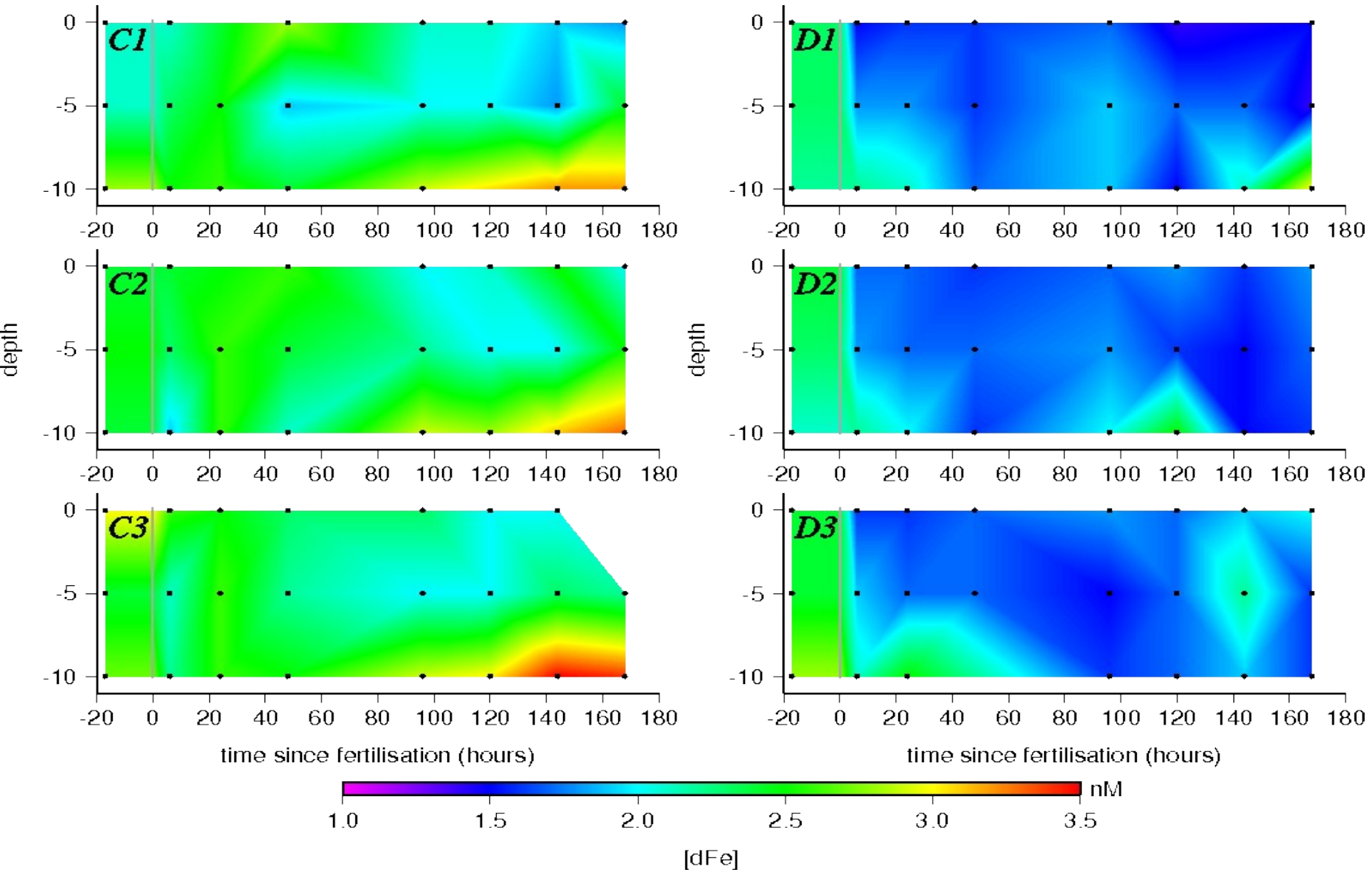
Cd, Mn, Al, Co, Cu, Ni, Pb and Zn

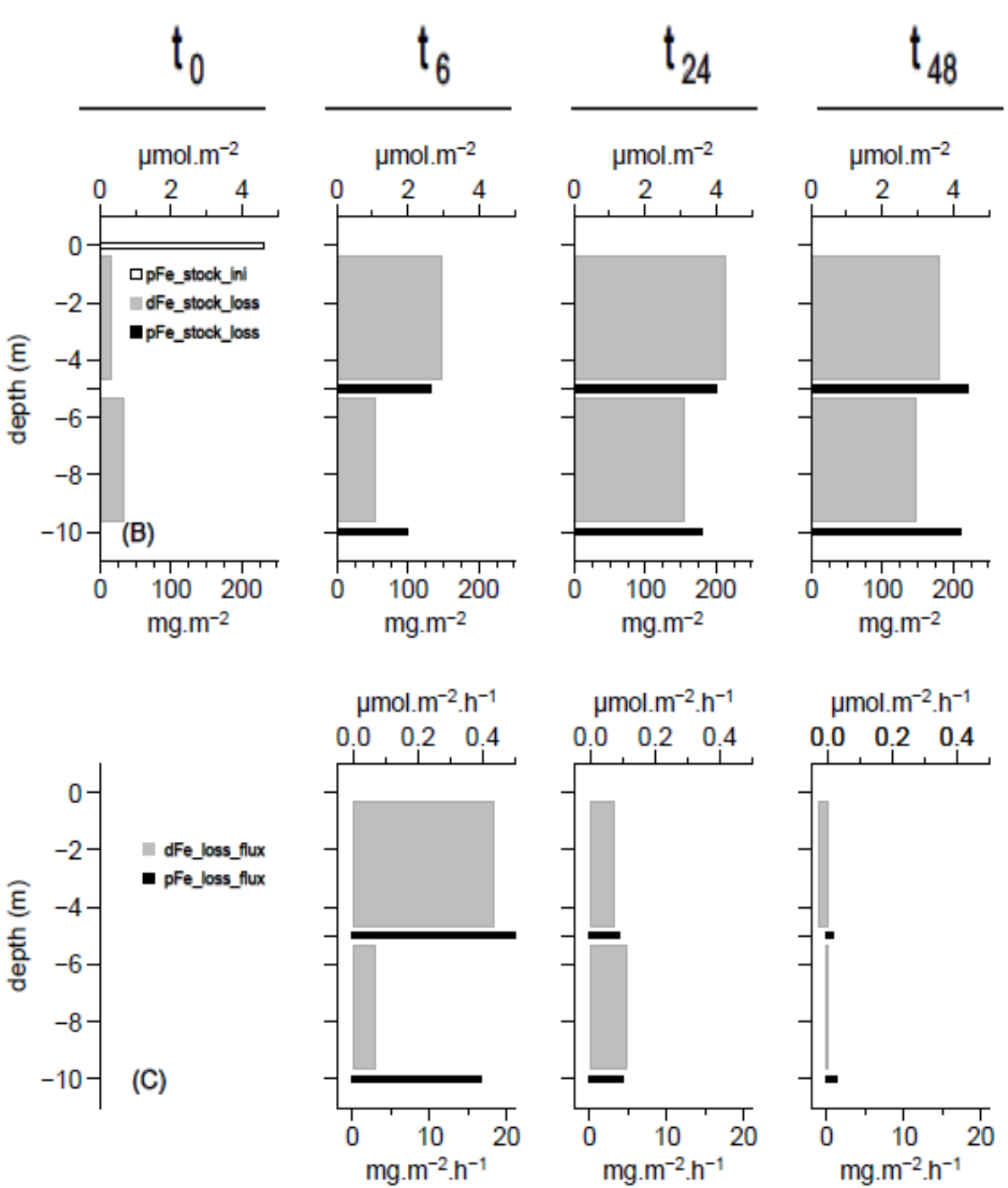
- No significant change between « OUT » and the mesocosms
- Typical values for western Mediterranean bassin



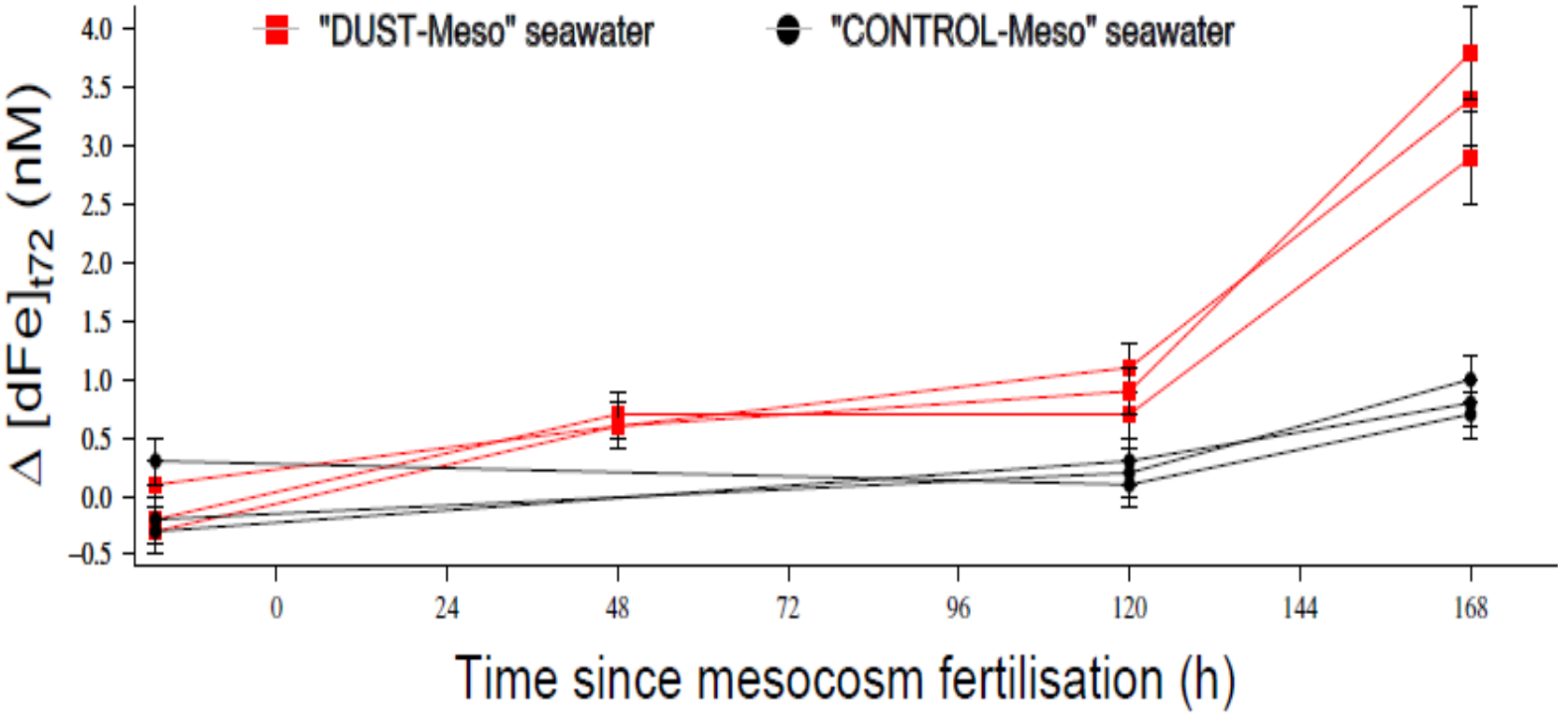
No contamination from the mesocosm for all the measured elements

Changes in dFe concentration in DUNE-1-P




t0
t6
t24
t48
µmol.m−2
0
2
4
depth (m)
0
−2
−4
−6
−8
−10
pFe_stock_ini
dFe_stock_loss
pFe_stock_loss
(B)
0
100
200
mg.m−2
µmol.m−2.h−1
0.0
0.2
0.4
dFe_loss_flux
pFe_loss_flux
(C)
0
10
20
mg.m−2.h−1

Iron dissolution from dust during DUNE-1-P



Wagener et al., 2010 Biogeosciences

Changes in strategy between DUNE-1 and DUNE-2

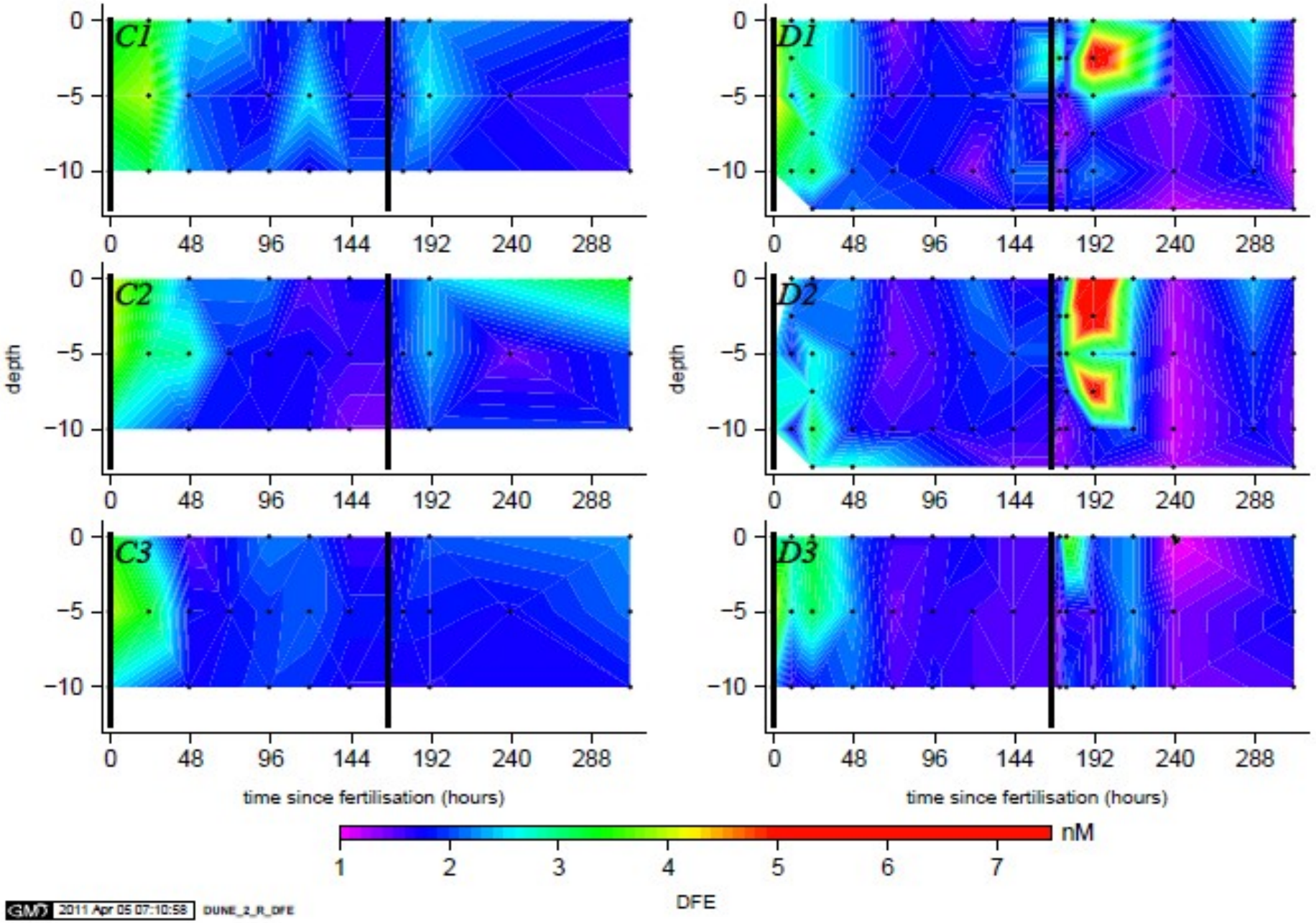
DUNE-2

1. Two succesive seedings

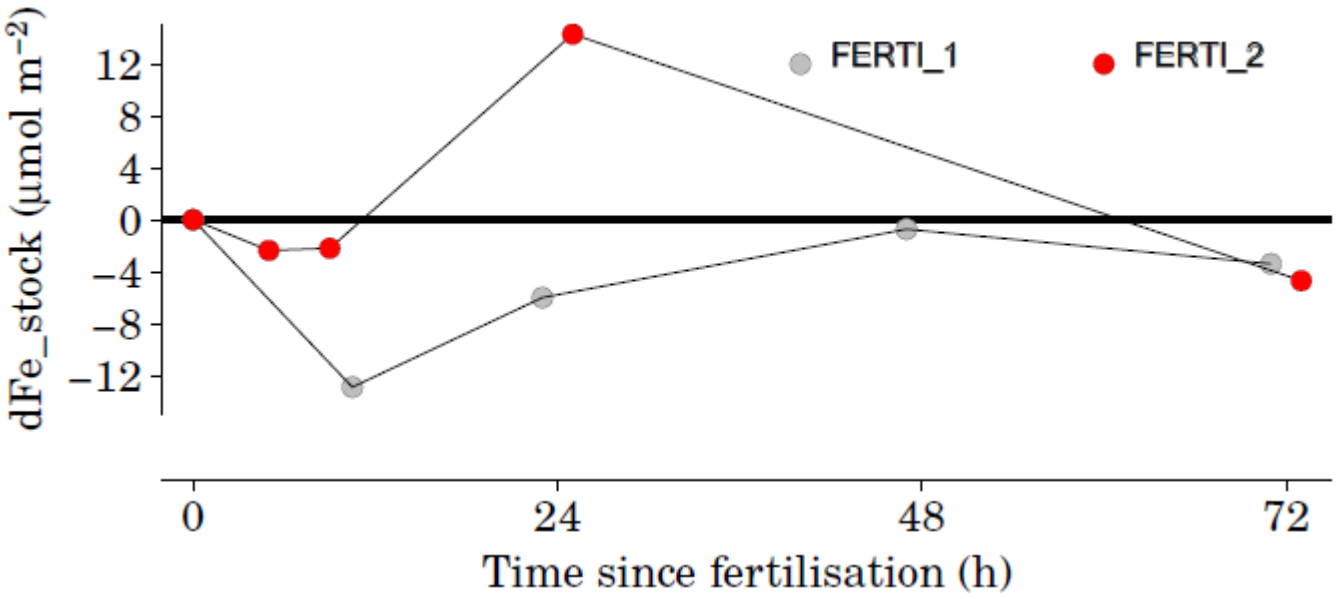
2. More dissolved trace metals measured:
   - Al: Lithogenic tracer - main source in ocean is from dust dissolution
   - Fe: micronutrient, released from dust

3. Better vertical resolution in two mesocosms (D1 and D2)

Dissolved Fe



Dissolved Fe



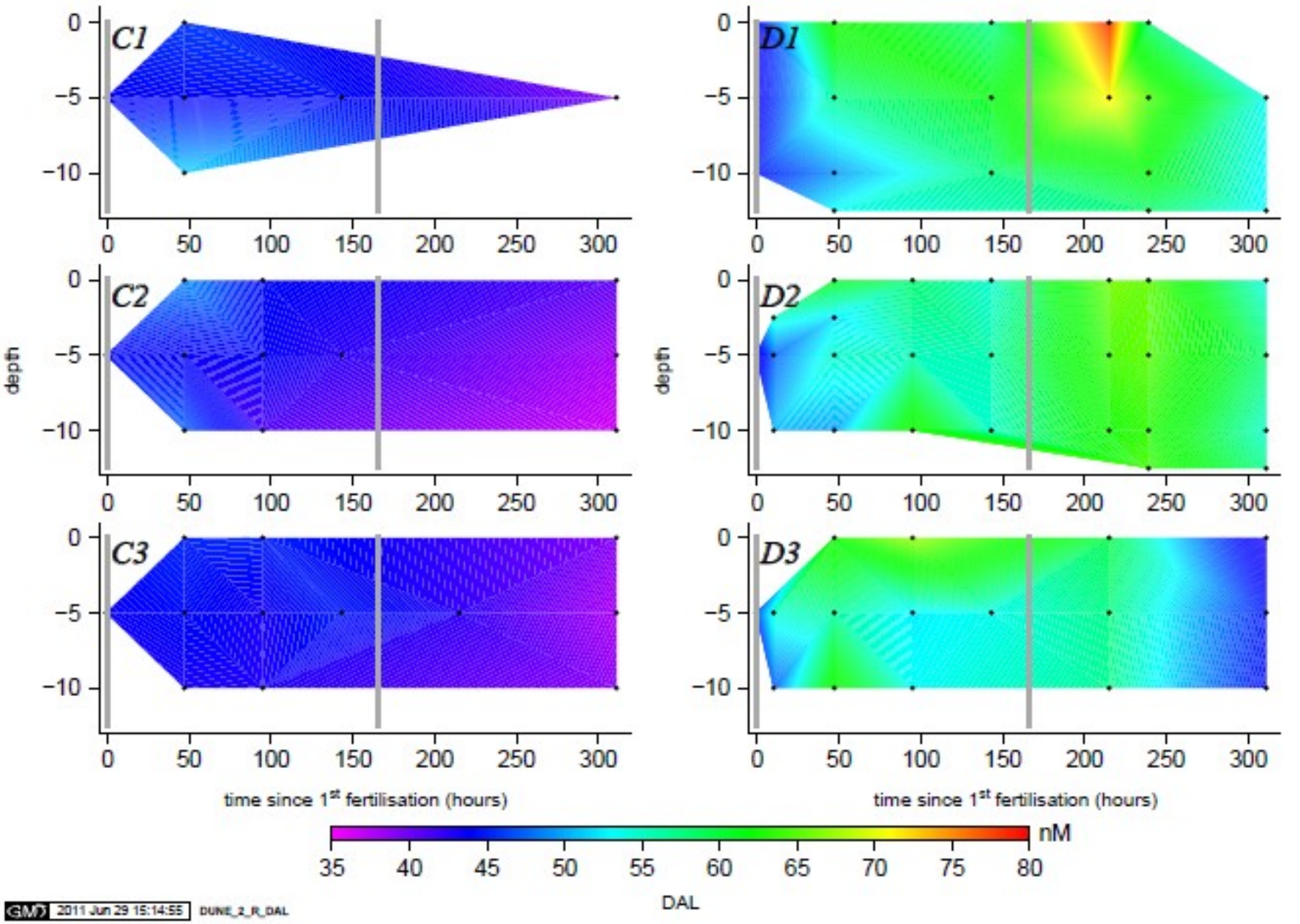
- After 1st seeding : slight scavenging (less then DUNE1)

- After the 2nd seeding : significant dissolution is observed after 24 hours

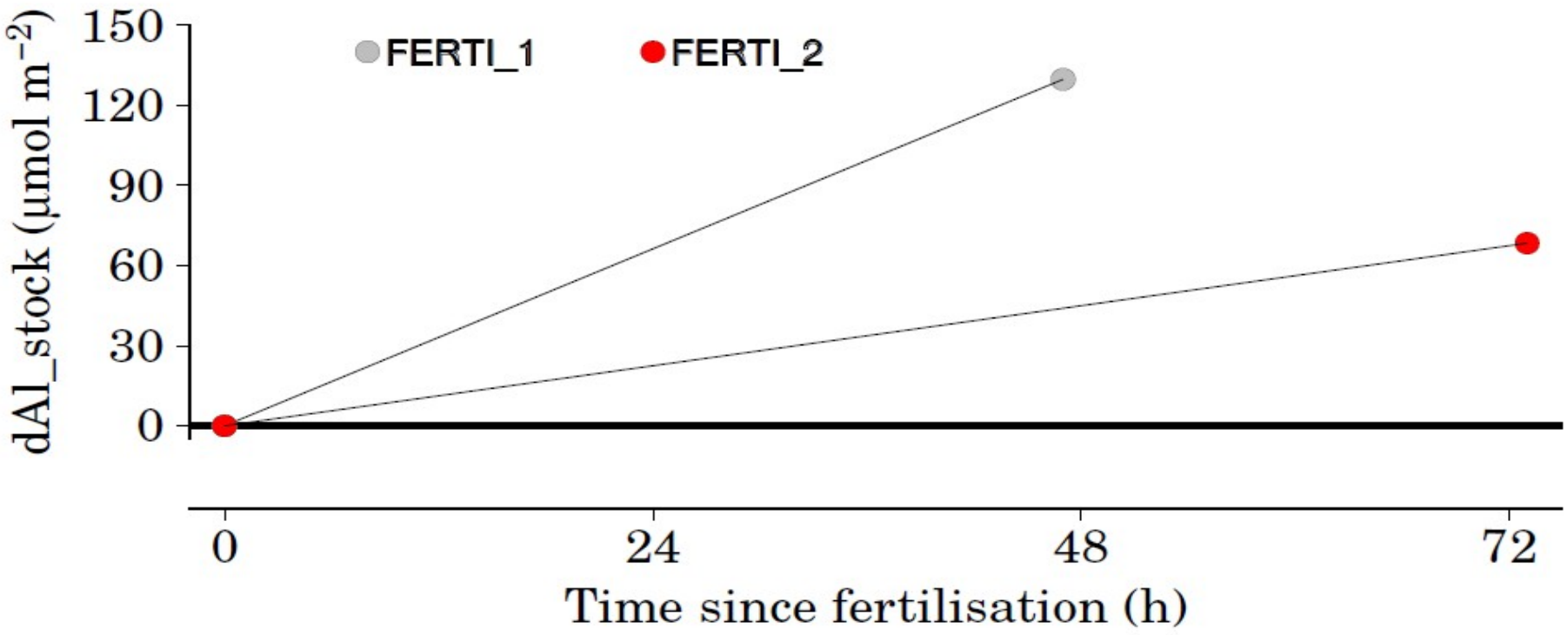
- **Changes in seawater characteristics explains the difference between the 2 seedings.**

Oceanic factors controls predominantly the dissolution of iron from dust particles

Dissolved Al



Dissolved Al



- Each seeding corresponds to an increase in dAl concentration

- Atmospheric factors certainly mainly control the dissolution of Al from dust particles

Conclusions

- Mesocosms are a great tool to follow the processes following a dust event.
- Two consecutive dust inputs may have very different impacts in seawater
- dAl is a good tracer of lithogenic material inputs, but it does not account for postdepositionnal processes which control the concentrations of some bioactive metals (for exemple Fe)