

DUNE

compiled by Cecile Guieu

Notes:

Reporting Period is January 2011 – December 2011

Information will be used for: reporting, fundraising, networking, strategic development & outreach

1. Key scientific SOLAS-relevant highlights/findings (you may include figures and references)

New methodologies developed during DUNE and successfully implemented for the first time.

The project comprised strong risk-taking as it was based on 2 methodological challenges:

1. To be able to reproduce a real atmospheric deposition event necessary for the controlled seeding in seawater. The goal was to produce hundreds of grams of particulate material identical to aerosols depositing at the surface of the ocean. This was achieved by experimental simulation of (i) production of desert aerosols and (ii) chemical aging mimicking their transport in the atmosphere.
2. Conception of seeding experiments in large clean mesocosms. With a list of specifications (such as that those systems should be totally made with plastic material, transportable etc.), the DUNE team worked on the concept of holding structures, enclosure (52 m³), sampling systems, anchoring. Those systems were successfully deployed twice (DUNE1 experiment in 2008 and DUNE2 experiment in 2010) in the preservation area of Scandola in Corsica.

Main results of the project.

The original methods developed and validated during DUNE have been published and can be used in the frame of other projects (for example, the DUNE mesocosms are going to be used in the frame of the MedSea European project on Mediterranean acidification ; other projects related to marine biogeochemistry at the atmosphere-ocean interface based on that tool are currently being submitted).

Chemical and biological changes, along with modification of the dynamic of particles following a dust event have been followed and the multidisciplinary results obtained are bringing new insights regarding the role of atmospheric deposition on oligotrophic ecosystem and carbon export. Among those results, we have shown that the cycles of elements of biogeochemical interest (nutrients, metals) are modified by the atmospheric deposition; that new nutrients introduced are uptake by biota very rapidly; that there is a competition for the new nutrients and that this competition is in favor for heterotrophic bacteria; that among phytoplankton, diazotrophs – although only responsible for few percent of the induced new production - are well stimulated by atmospheric input; that particulate carbon export is in part due to aggregation processes between organic matter and lithogenic particles. All those results indicate that the role of atmospheric deposition on oligotrophic area cannot be seen only like a simple fertilization effect but, induce also a significant export of particulate organic carbon to the deep ocean, through aggregation processes.

2. Activities/main accomplishments (research projects, cruises, special events, workshops, remote sensing used, model and data intercomparisons etc)

During this last year 2 workshops were organized in Villefranche sur Mer among the DUNE group: a final workshop event in Avril 2011 (20 people) and a specific meeting in October 2011 dedicated to the final publications of the project during which it was decided to propose a series of 14 papers to constitute a Special Issue to BIOGEOSCIENCE (work in progress).

Several oral presentations specific to the DUNE project were done during the ASLO conference in Puerto Rico in Feb. 2011, during the SOLAS-IGAC France joint open meeting in Paris in June 2011 (see details in DUNE web site).

3. Human dimensions (outreach, capacity building, public engagement etc)

During the course of the project, in addition to several undergrad students, 5 PhD were involved (2 in France, 1 Italie and 2 German) and 4 post-doc were recruited among which 2 have now permanent positions in Research Institute in France.

4. Top 10 publications in 2011 (Reports, articles, models, datasets, products, website etc)

Bressac M., C. Guieu, D. Doxaran, F. Bourrin, G. Obolensky and JM Grisoni, 2011, A mesocosm experiment coupled with optical measurements to observe the fate and sinking of atmospheric particles in clear oligotrophic waters, *Geo-Marine Letters*, DOI 10.1007/s00367-011-0269-4.

Ye Y., Wagener T., Volker C., Guieu C., Dieter A. Wolf-Gladrow D.A., 2011, Dust deposition: iron source or sink? A case study, *Biogeosciences*, 8, 2107–2124, 2011

Wagener, T., Guieu C., Leblond N., 2010, Effects of dust deposition on iron cycle in the surface Mediterranean Sea: results from a mesocosm seeding experiment., *Biogeosciences*, 7, 3769-3781, 2010

Laghdass M., S. Blain, M. Besseling, P. Catala, C. Guieu, I. Obernosterer, 2011, Impact of Saharan dust deposition on the bacterial diversity and activity in the NW Mediterranean Sea. *Aquatic Microbial Ecology*, vol 62: 201-213, 2011.

Guieu C., F. Dulac, K. Desboeufs, T. Wagener, E. Pulido-Villena, J.-M. Grisoni, F. Louis, C. Ridame, S. Blain, C. Brunet, E. Bon Nguyen, S. Tran, M. Labiadh, and J.-M. Dominici, 2010, Large clean mesocosms and simulated dust deposition: a new methodology to investigate responses of marine oligotrophic ecosystems to atmospheric inputs, *Biogeosciences*, 7, 2765-2784, 2010

Pulido-Villena E. , Rerolle V., Guieu C. , 2010, Transient fertilizing effect of dust in P-deficient LNLC surface ocean, *Geophysical Research Letters* , 37, L01603, doi:10.1029/2009GL041415, 2010

5. International interactions and collaborations (including contributions to international assessments such as the IPCC, links with observation communities etc)

International interactions and collaborations were reinforced and several papers will be proposed for publication in the planned Special Issue. Following the success of the methodology established during DUNE, the DUNE-type large clean mesocosms will be used in the framed of the FP7 MedSea project (9 mesocosms to be deployed in June in Corsica).

6. Goals, priorities and plans for future activities/events

Main goal is to prepare the Special Issue dedicated to the DUNE project (a meeting 'before submission is scheduled for the end of February).

7. Other comments

The DUNE project a DUst experiment in a low Nutrient, low chlorophyll Ecosystem, is a fundamental research project coordinated by Cécile Guieu at LOV. It was conducted in partnership with the laboratory of LISA (Créteil), LEMAR (Brest), LOCEAN (Paris), and in collaboration with the laboratories LOMIC (Banyuls), IRD/LOBP/COM (Marseille), CEFREM (Perpignan), ERES/ERTI, ENS (Paris) and the Regional Parc of Corsica, Preservation Area of Scandola. DUNE was also conducted in strong collaboration with foreign research institute: the Institut des Régions Arides (IRA), Médenine (Tunisie), IFM-GEOMAR, Kiel (Germany), Station Zoologique-Naples (Italie) and Alfred Wegener Institute, Bremerhaven (Germany).

The project started in nov-2007 and ended in July 2011 (43 months). Funding from ANR (Agence Nationale pour la Recherche) was 500 000 € for a total estimated cost of 1 500 000 € excluding permanent personal costs. Original project bringing together scientists from atmospheric and ocean fields, it was endorsed by the international SOLAS program in Feb 2009, see: (<http://solas-int.org/science/researchendorsements/resendprojects/endorsedprojects.html#dune>).

Web site of the project: <http://www.obs-vlfr.fr/LOV/DUNE/>