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French activities related to JGOFS

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In 1989, the CNRS started the France-JGOFS Programme managed by a Scientific Committee and an Inter-Agency Committee. France-JGOFS develops three main types of operations :

1) processes studies in oceanic oligotrophic areas.

• *Eumeli* (1991-93) in the tropical oligotrophic area on the 20° N latitude is related to the North Atlantic Spring Bloom Experiment. With four research cruises of 45 days each in the period 1991-92, *Eumeli* involves a greater part of the french sediment-traps as well as an important material mobilisation.

• *Antares* (1992-95) will be focused on carbon and silicon cycles in three main subsystems: the Permanently Open Oceanic Zone, the Seasonal Ice Zone and the Polar Front Zone.

2) flux studis in high gradient transitional marine areas.

These operations are managed to reduce the time scale of observations and to focuse on key period in the production cycle:

• *Ecomarge* aims to quantify the carbon stored along the continental margins close to the french marine costs, with an emphasis on the exchanges at the water-sediment interface.

• *Frontal* try to know if the frontal systems are areas of increased vertical fluxes. During the 1991-93 period, *Frontal* will emphasize the study the Alméria-Oran frontal system in the Mediterranean Sea.

3) long term monitoring based upon multi-instrumented mooring stations

The three sites are selected in areas of easy access by coastal vessels in order to carry out regular transects and frequent examination of moored apparatus; in Ligurian Sea (1990), in the Gulf of Lions (1991) and in the Indian sector of the Southern Ocean (1992).

The french community is focused on a series of process studies:

Air Sea exchanges

Measuring and modelling the biogeochemical processes of air/sea fluxes of CO_2, sulfur compounds and organic material (aerosols).

Upper Ocean processes

Parametriation of the processes controlling the production in oligotrophic systems

The aim is to build a model of the main processes governing the exportation of C based on the physical forcing and the physiological behavior of algae. The ultimate goal is to drive the model with the pigment concentration in the upper layer as remotely detectable by an ocean color sensor.

Open ocean nitrogen cycling

The focus will be to study in detail nitrogen cycling in the euphotic zone of oligotrophic systems using ^{15}N-isotope tracer methodology and measurement of nitrate at nanomolecular levels.

Interactions and transfert rates in the microbial loop

Two main goals have to be solved : to determine the role of microzooplankton in the organic material transfer towards the

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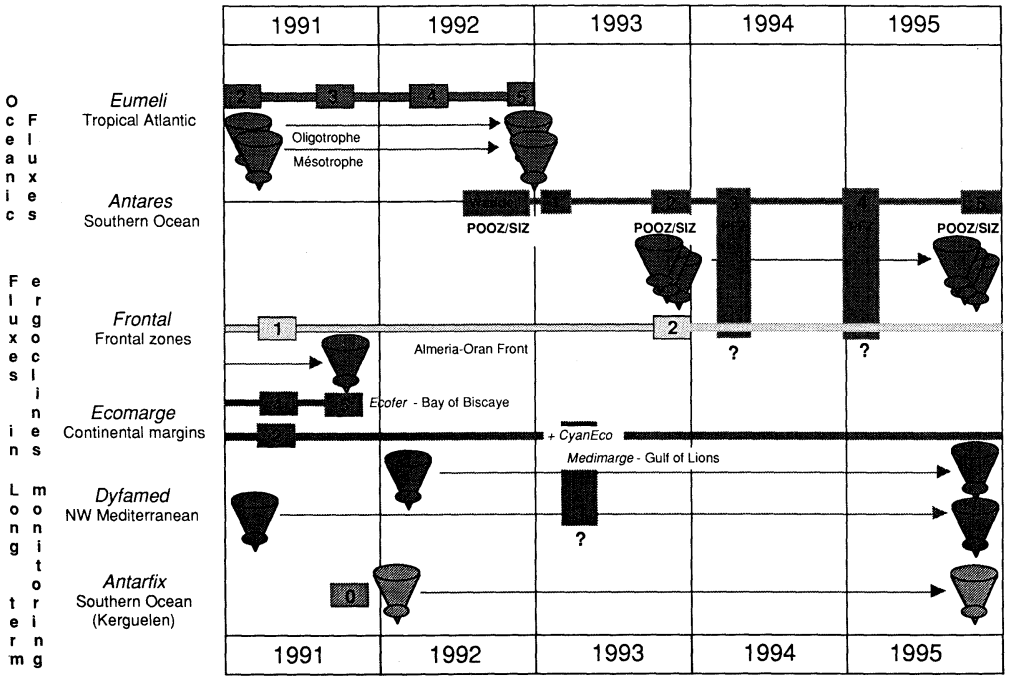

Fig 1

upper trophic levels and to estimate the respective production by ciliates of settling pellets and of non settling pellets.

Transformations and fluxes in the water column

Interactions between DOM-aggregates / micro-organims and zooplankton

The analysis of selected organic tracers could improve our knowledge about the respective roles of various types of organisms from the microorganisms to the macrozooplankton. Emphasis will be placed on the fate of organic material by the way of "gelatinous zooplank-ton", an efficient mucus producer.

Microbial activity

The evaluation of the DOM pool able to be uptaked by microorganisms (assimilation/ mineralization) will be done using an original experimental approach by microcosm simulating *in situ* conditons now under development.

Benthic processes

Particle fluxes and processes in the nepheloid layer

The different processes involved in the recycling of particles arriving at the sea floor must be examined as well as the quantification of their fluxes. A strategy of long term sea floor observations has been developped in order to display periods of deposition and periods of resuspension.

Spatial distribution: role of deep sea megafauna

Knowing the vertical particulate organic carbon input and in conjunction with estimate nutrition rates of deposit feeders, we try to strike the balance of nutritive requirements at the water sediment interface for dominant deep sea communities.

Modelling

Special attention is given to simulation and prediction of the biogeochemical cycles as the ultimate objective is to predict the

evolution of biogeochemical dynamic resulting from climate variability and other perturbatons of the system.

The french community is developping models coupling the dynamics of the system and the conservation of the biogeochemical species. These models are combined with a series of process-specific models:

Coupling physical and biological models on a seasonal time-scale.

Air-sea gas exchange.

Inverse models in steady state regime.

Ligh／photosynthesis relationships with geochemical and cimatological implications.

New and regenerated production.

N- and P- cycles.

Biogeochemical cycle of the organic sulfur compounds.

Zooplankton feeding

Biogenic transport in surface and deep marine waters.

Organic biomarkers to investigate transformation processes of organic matter.

Chemical fluxes at the sedimen-twater interfaces.

Biogeochemical processes at the sediment-water interface.

Biogeochemical benthic compartment.