

**SOLAS Open Science Conference 2009**  
**Discussion Session Report:**  
**Air-sea gas fluxes at Eastern Boundary upwelling and OMZ systems**  
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All Eastern Boundary Upwelling EcoSystems (EBUES) are associated with relatively high biological activity, and a more or less intense oxygen minimum zone (OMZ), especially in the low latitude component. OMZs, known as suboxic layers, play a crucial role in climate evolution (greenhouse gases production) and marine ecosystems (respiratory barrier, nitrogen deficit). The co-existence of OMZ-specific processes induces an oceanic perturbation of the biogeochemical cycles (e.g. nitrogen loss; acidification), acting as an “engine” of climatically active gases produced or consumed in the OMZ: O<sub>2</sub>, CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>, H<sub>2</sub>S, DMS, halogens compounds. The project will focus in the Eastern Pacific, the largest OMZ which undergoes atmospheric human releases in the Northern part. The scientific objectives are:

- 1) to quantify the overall role of the OMZs on climate change considering their impact on the greenhouse gases, clouds formation and the O<sub>3</sub> and O<sub>2</sub> control,
- 2) to determine the responsible mechanisms associated with the bio-, photo- or chemio-degradation of the organic matter (including CDOM) for the production of greenhouse gases, e.g. the switch from an aerobic (O<sub>2</sub>-respiration) towards an anaerobic remineralization (through NO<sub>3</sub>, SO<sub>4</sub>, methanogenesis, IO<sub>3</sub>, Fe).

The Discussion Session has yielded an enthusiastic response in order to develop into an articulated international project, connected with other mid-term SOLAS strategies, IGBP core-projects (IMBER and PAGES) and the SCOR project GEOTRACES. The interests focused on the need of *in situ* observations (e.g. CO<sub>2</sub>, N<sub>2</sub>O, but also DMS) to quantify the coupled or decoupled source and sink effect in the EBUES, due to their high spatio-temporal variability. In particular, the Atlantic EBUES appear to be very different from those in the Pacific: e.g. weaker N<sub>2</sub>O emissions, lower denitrification and no report of H<sub>2</sub>S emissions off Mauritania. The upwelling feeding of the oligotrophic gyres due to filaments, is also to be studied (e.g.: nitrogen source/sink; DMS increase/decrease linked with the shift of plankton/bacterial communities and grazing). In paleoceanographic records, fluctuations observed on several decades are important to be considered with specific OMZs proxies. Finally, the impact of chemical low O<sub>2</sub> conditions (e.g. higher iodide and reduced iron off Peru than off Mauritania) have to be investigated.

The project covering the low atmosphere, the ocean micro-layer, surface and subsurface, and all their interfaces, will combine:

- i) short- and long-term data acquisition (cruises, laboratory experiments, network, moorings, gliders, ARGO floats, ASIP, aircrafts) associated with the use of historical and new databases (e.g. MEMENTO for N<sub>2</sub>O and CH<sub>4</sub>, and maybe later for H<sub>2</sub>S), remote sensing and analysis,
- ii) parameterizations, coupled biogeochemical/physical modelling, new numerical tools and large scale validation based on intercomparisons (mainly between the Atlantic and Pacific).

The overarching outcome being a complete understanding of the OMZs role in the present ocean, will include both the ocean and the atmosphere SOLAS components. The first step will be a SOLAS conference on 8-10<sup>th</sup> November 2010 in Lima (Peru) at IMARPE with ~50 participants, in order to focus on a limited amount of specific questions.