

partner projects



GLOBEC-CLIOTOP symposium

A major symposium organised by the GLOBEC regional programme, Climate Impacts on Oceanic TOP predators (CLIOTOP) has recently been announced. The symposium will consist of sessions from the four CLIOTOP working groups plus cross-cutting sessions on climate change and top predators; meso-scale issues; global change implications for management and conservation strategies of top predators; and future scientific challenges. The symposium will be held 3-7 December 2007 in La Paz, Mexico.

Further details: www.globec.org

GLOBEC is also holding a workshop on the "impact of climate variability on marine ecosystems: a comparative approach". The aim of the workshop is to enhance understanding of the response of marine ecosystems to environmental change and to improve our knowledge of the impact of climate variability on marine ecosystems. The workshop will follow the Dahlem conference format and will be devoted entirely to discussion, with background papers submitted prior to the workshop. These papers, plus summaries of the discussions, will be published in a special volume of the 'Journal of Marine Systems'. If you would like to be kept informed of the outcome of the meeting please contact the GLOBEC IPO: globec@pml.ac.uk



On 4-5 September, a joint meeting of the WCRP Working Group on Surface Fluxes (WGSF; Chris Fairall, Chair) and the SOLAS Focus 2 Implementation Group (IMP2; Wade McGillis, Chair) met at the University of Heidelberg in Germany. These closely affiliated groups got together to discuss coordination and collaboration, along with planning future directions for the projects prior to participation in the International Workshop on Transport at the Air-Sea Interface. In particular, WGSF participated in the October 2006 WCRP Working Group on Numerical Experimentation (WGNE) Surface Flux Analysis Project (SURFA) in Boulder Colorado. WGSF will provide a plan to create a SURFA archive, including a list of in situ platforms; a list of numerical weather prediction products; a prospective site for the archive; and a list of interested researchers. WGSF has also most recently developed a Handbook of Climate Quality Measurements at Sea and are in the process of completing two review papers on air-sea gas and particle fluxes. Other WGSF/IMP2 discussions were conducted on current field campaigns, including a proposed Southern Ocean GasEx cruise, the UK-led DOGEE cruise, laboratory work, and advances in remote sensing of gas transfer.



Dr. Hema Naik is a scientist at NIO. Her primary research interest is biogeochemical cycling of nitrogen in the oceanic oxygen minimum zones.

The western continental shelf of India: A hotspot of anaerobic biogeochemical transformations including production of nitrous oxide

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Oceanic oxygen-deficient zones (ODZs) are sites of N_2 production through heterotrophic denitrification and autotrophic anaerobic ammonium oxidation. Such production of N_2 makes up for N_2 fixation, thereby keeping atmospheric N_2 content constant over geological time scales. However, an imbalance between the two terms can bring about sizable changes in the combined nitrogen inventory and affect oceanic capacity to sequester atmospheric CO_2 , thereby modulating climatic (glacial-interglacial) cycles (Altabet et al., 2002; Codispoti, 2006). Moreover, ODZs are also important for the global N_2O budget with the oceanic efflux accounting for about one-third of all N_2O inputs to the atmosphere (Bange, 2006). N_2O emission does not occur uniformly over the oceanic surface, though. In fact, the surface seawater is nearly saturated with N_2O in most areas, and substantial supersaturations are only observed in upwelling zones especially those containing ODZs. This is because N_2O is formed both during nitrification and denitrification. Production via both pathways is very sensitive to oxygen distribution in the low range. N_2O yield during nitrification increases greatly at low oxygen levels. N_2O is both produced and consumed during denitrification ($NO_3^- \rightarrow NO_2^- \rightarrow NO \rightarrow N_2O \rightarrow N_2$). In most denitrifying environments, characterized by the accumulation of nitrite, N_2O concentrations are generally quite low (<10 nM), but its accumulation invariably occurs at the boundaries of the ODZs making them strong net sources of N_2O to the rest of the ocean and ultimately to the atmosphere (Codispoti & Christensen, 1985).

ODZs are located along the eastern boundaries of the oceans with the exception of the Indian Ocean where the ODZ is found in the northwest – in the Arabian Sea - and it impinges upon a much larger area of the continental margin than do the ODZs of other oceans. The major portion of the Arabian Sea ODZ lies beyond the continental shelves in the northeastern and central regions. Vertical profiles of N_2O here contain two maxima sandwiching a minimum, and since the upper N_2O maximum is located barely a few tens of metres beneath the sea surface it sustains large efflux of N_2O to the atmosphere. In addition to the perennial open-ocean ODZ, reducing conditions also develop seasonally over the western continental shelf of

India (Naqvi et al. 2000). Although the largest of its kind in the world (area ~200,000 km²), the coastal ODZ still occupies a two orders of magnitude smaller volume than its perennial open-ocean counterpart. During the summer monsoon, coastal circulation is conducive for upwelling off the Indian west coast, which brings low-oxygen water over the shelf. But this water is generally prevented from surfacing due to the presence of a thin (<10 m) warm, fresher layer formed as a result of intense rainfall. Respiration of organic matter coupled with strong near-surface stratification leads to suboxia/anoxia at very shallow depth (sometimes within 10 m) of the sea surface. Off Goa, where sustained observations have been made since 1997 at a time-series station (depth ~ 28 m) CATS (Candolim Time Series), near-bottom oxygen reaches suboxic levels in August, and complete denitrification is followed by sulphate reduction in September-October (Figure). With the reversal of surface currents, oxic conditions are re-established in November-December. While the oxygen deficiency over the Indian shelf has been known to occur for several decades, there is no indication of sulphate reduction in the historical data sets. Therefore, it would seem that the intensification of the oxygen-deficient conditions has occurred in recent years, possibly as a consequence of increased loading of nutrients from land (Naqvi et al., 2000).

The most unexpected aspect of N_2O distribution is the unprecedented accumulation of N_2O observed during the late summer – early autumn in the inner- and mid- shelf regions north of 12°N. The highest concentration (765 nM) observed is about four times the highest values reported from the eastern tropical South Pacific. The N_2O build-up coincides with the accumulation of nitrite and depletion of nitrate, the telltale signs of denitrification. This is in sharp contrast to the above-mentioned trend in the open ocean ODZ. These observations strongly point to transient production of N_2O from nitrate through a reductive pathway.

Even when a net consumption of N_2O occurs in near-bottom waters, surface concentrations (5-436 nM, mean 37.3 nM) during the upwelling period are almost always far in excess of the corresponding saturation values. Employing available models of air-sea gas

exchange, the average N_2O flux to the atmosphere has been computed to range from 39 to 264 $\mu\text{mole.m}^{-2}.\text{d}^{-1}$. An extrapolation of this flux, over a period of six months, yields a total N_2O efflux of 0.05-0.38 Tg N_2O from the study region (Naqvi et al. 2006). This is roughly of the same magnitude as the most recent estimate of N_2O efflux (0.39 Tg $N_2O \text{ y}^{-1}$) from the entire Arabian Sea (Bange et al., 2001). If some of the high efflux is due to above-mentioned intensification of the coastal ODZ, it would imply that human activities may lead to an enhancement of N_2O emission from the ocean.

References

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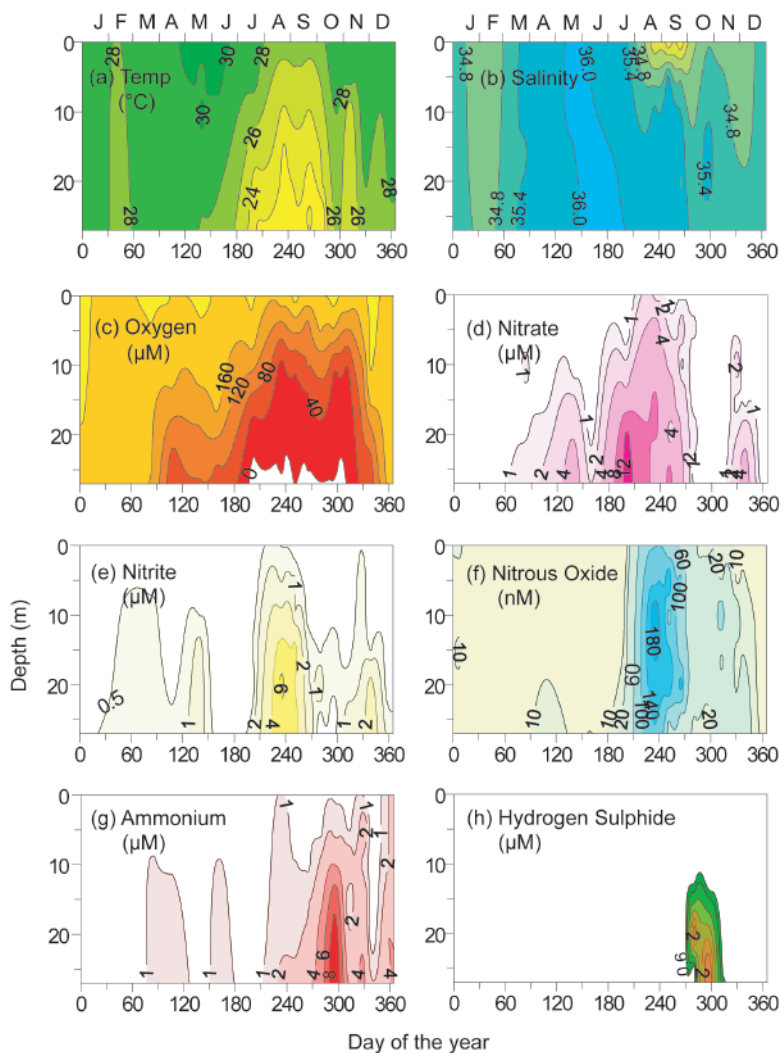


Figure 1: Monthly/fortnightly-averaged records showing annual cycle of (a) temperature, (b) salinity, (c) O_2 , (d-g) inorganic nitrogen species, and (h) hydrogen sulphide at the Candolim Time Series (CATS) site ($15^{\circ}31'N$, $73^{\circ}39'E$) based on observations from 1997 to 2004 (from Naqvi et al., 2006).

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GREENCYCLES is a Marie Curie Research Training Network (RTN), funded by the European Commission's Sixth Framework Programme. Like all RTNs, GREENCYCLES has both scientific and training aims. Its overall scientific aim is to reduce uncertainties associated with biogenic feedbacks on climate and ecosystems. Its training aim is to support the development of young scientists interested in a research career in global biogeochemical cycles. To this end, 17 researchers are being hired across the 11 labs in the network. GREENCYCLES researchers are working on marine-related projects at LSCE (Gif-sur-Yvette, France), UEA (Norwich, UK), and MPI-BGC (Jena, Germany).

Maciej Telszewski, originally from Poland (it is necessary for RTN researchers to move country to undertake their research), is a GREENCYCLES researcher based at UEA. Maciej is developing novel techniques to reconstruct atmosphere-ocean surface CO_2 fluxes from satellite measurements, in order to better constrain ocean carbon general circulation models. Meike Vogt, also at UEA but originally from Germany, is working on the development of DMSP and DMS parameterisations for the Dynamic Green Ocean Model (DGOM)

UEA is hosting British researcher, Nicholas Stephens, and MPI-BGC is hosting Italian researcher, Valentina Sicardi. Nick is also working on the DGOM, but concentrating on the implementation of a nitrogen cycle, including the role of nitrogen fixers. In contrast, Valentina, originally from Italy, will be using an atmospheric tracer transport model in various modes to quantify oceanic carbon processes and detect changes in the general ocean circulation.

GREENCYCLES sponsors the integration of these projects across interested European labs, and especially with the development of earth system models. GREENCYCLES also sponsors the organisation of relevant workshops and meetings, and the attendance of GREENCYCLES researchers and senior scientists at training events such as the SOLAS summer school.

For more information on these and other GREENCYCLES projects please go to www.greencycles.org

SOLAS Special Report: Chinese Information Center for Global Environmental Change Studies

In China, the research groups that focus on the global change issues were greatly increased since the end of last century. The information demands of the international global change research and co-operation were raised. In 1999, a professional institute for global change information service, named the Chinese Information Center for Global Environmental Change Studies (CICGECS), was established in Lanzhou City, northwestern China. CICGECS is sponsored by the Scientific Information Center for Resources and Environment of Chinese Academy of Sciences (CAS), also named Lanzhou Library of National Scientific Library, and Chinese National Committees for IGBP, IHDP and WCRP. Some other important related organizations, for example, are the Chinese National Committee for DIVERSITAS, the Institute of Geographic Sciences and the Natural Resources Research of CAS, who have given CICGECS some special supports.

The focus of CICGECS is to:

- Serve the researchers on global change studies with data, documents and information;
- Enhance information exchange and academic intercommunions between Chinese and international organizations and researchers;
- Maintain and build databases and information systems related to global change studies;
- Vacate time for information analysis and soft science research on global change.
- CICGECS has been one of the important information service institutes in China. It is playing indispensability roles in the fields of global change studies.

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