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Foreword

Hello All,

The Ocean Society of India (OSI) is a registered professional society, whose objectives are advancement and dissemination of knowledge in science and technology, and allied fields related to oceans. Its newest chapter has been established in Pune in 2013.

The editorial board of the OSI Newsletter, Pune chapter is privileged to bring you the first issue. An important aim of the letter is to disseminate the ocean science related information, along with information on forthcoming meetings and opportunities, relevant to the progress in the research & development. Another critical target is to generate awareness and interest among the students of various universities, colleges and schools toward the scope and opportunities in the R&D aspects of the oceanography and allied fields such as climate change, atmospheric sciences, biogeochemistry, etc.

As far as the contents are concerned, the newsletter will contain a Spotlight, which will focus on a current event of immediate interest. Each issue will also feature a popular invited article written by an eminent scientist. In addition, a brief discussion on a recent publication of general interest will be provided. Further, we also feature a student article, and an item that provides a historical perspective. In addition, the OSI Newsletter will also have information on forthcoming meetings, job opportunities, and list a few latest papers of interest. We welcome any comments and suggestions.

Editor, Ocean Digest



Fig. 1. Satellite image of the severe winter weather on 2 Jan 2014.
Source: NOAA

Warm Arctic and Cold Continents

Spotlight

As per the WMO media centre, for much of January 2014, the Eastern part of the United States experienced a cold Arctic weather (Fig. 1). Interestingly, this was counterbalanced by warmer than average temperatures in the western part of the country, so that overall, January temperatures were close to the 20th Century average, according to the U.S. National Oceanic and Atmospheric Administration (NOAA).

Several regions in Asia, including Japan, also suffered severe cold outbreaks. Contrastingly, much of Europe saw unusually mild temperatures in the first six weeks of 2014. The cold conditions in eastern USA were associated with a breakdown of polar vortex. As

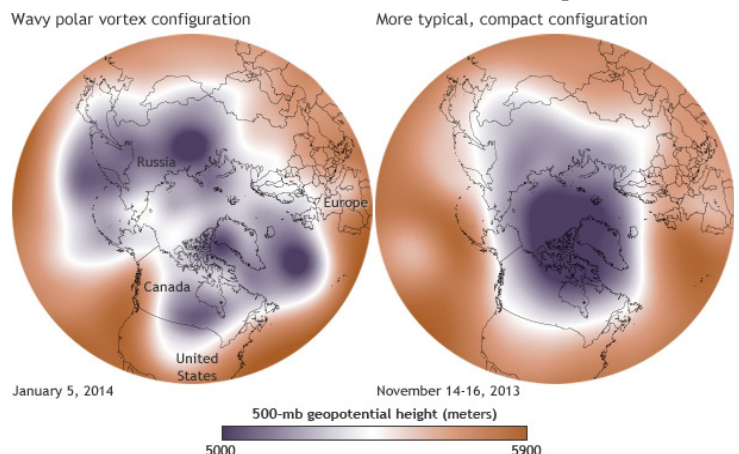


Fig. 2. Weakened vortex formation associated with the cold conditions.
Source: NOAA

per NOAA, in early January, the polar vortex (Fig. 2) weakened and broke down, allowing fragments of cold air to spill out into mid-latitudes. The high pressure building up in the Arctic slowed down the jet stream, which caused it to buckle into deep folds and flow farther south than usual, introducing cold Arctic air into the central and eastern U.S. The wobbling polar vortex continued to bring in cold air into the East Asia in February as well. - Editor

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Check www.tropmet.res.in/oceandigest/ for updates.

I wish I was a kid again

Invited Article

Prof. Raghu Murtugudde
University of Maryland

Indian mythology has always included very rich and imaginative descriptions of the ocean. Ksheera Sagar, the mythical Ocean of Milk, makes you wonder if our ancestors were looking at the cosmos and imagining the formations of galaxies and supernovae. Precious things like Amrita, the elixir of eternal life, that were supposed to be lost in the vast ocean could only be retrieved by the churning of the oceans by the gods and demons and Vasuki offered to be the giant rope needed to accomplish this Samudra Manthan. Images of giant tortoises, fishes, and so on are only confounded by the general taboo against crossing the seas. Some evidences in the ancient writings also indicate that seafaring likely occurred with ships and compasses. And yet the concept that the seas are resting places for gods and should not be disturbed is pervasive in the writings. Was it just an indication of the great respect for the bountiful ocean and the need to avoid polluting it? Did the great pralayas refer to the tsunamis? Do the gods and demons refer to the resources and the dangers of crossing the seas, respectively?

I wish I was a kid again so that I could explore the role of the oceans in Indian mythology in detail and end up learning much more about the incredibly exciting research that now goes on in biological, chemical, and physical oceanography. It is now possible to explore the oceans for their magnificence either in a ship as big as a multi-storied building or with a remote-controlled autonomous vehicle. Ocean's bountiful offerings of food, water, energy, minerals, and medicines in addition to the unimaginable biodiversity are now mapped extensively. With the scientific and technological advances that have occurred since I was a kid, the oceans can be exploited and appreciated sustainably if we are mindful in the way we do it. And yet, the general awareness remains fairly low in India regarding what the oceans have to offer to a country like India with its extensive and magnificent coastline, and what oceanography has to offer as a career option. We are subjecting our coasts to the same atrocities as the rich countries of the World – unplanned growth and urbanization, destruction of natural coastal defenses like the mangrove forests, pollution of groundwater and rivers that end up in the coastal oceans, and the list goes on. If only the children could be exposed to the incredible oceans during their early years including the exotic mega fauna like dolphins and the richness of the biodiversity in the corals so close to the coast! Of course, scientists can go on about the importance of the Indian Ocean for the lifeline of our nation, viz., and the monsoons.

Indeed, it is the scientific interest in the role of the Indian Ocean in the monsoons and coastal processes that have driven India's oceanographic enterprise. The National Institute of Oceanography (NIO) was established in 1966 in Goa and a handful of other academic institutions like Cochin



and Andhra Universities have had education and research in oceanography. The more recent offshoot of NIO is the National Institute of Ocean Technology (NIOT) which, as the name indicates, focuses on ocean technology. Also a relative late comer to India's oceanographic mission is INCOIS which has made the most direct contribution to society with its fisheries and tsunami forecast systems. The Indian Institute of Tropical Meteorology (IITM, see the image on the back cover) in Pune is now the premier research institution focused on climate, oceans, and monsoons. The difficulty faced by IITM in recruiting qualified young scientists to join the National Monsoon Mission is partially addressed by the job-cum-training program initiated a few years ago. But it is clear that a far broader base of talent will be needed in the coming years and this will require that we aim at sparking the imagination of kids at the middle school level. And between NIO, NIOT, INCOIS, IITM, and academic centers like the Indian Institute of Science, India has a significant resource base to generate science centers, museums, lectures, demonstrations, and internships to offer various forms and levels of research and education experience in biological, chemical, genetic, pharmaceutical, physical to technological aspects of oceanography. India's prowess in space sciences is now the envy of many other countries and yet, ISRO's vast data remain woefully underutilized in inspiring our children and enhancing their curiosity about the World and the ocean around them.

The imperative for developing such a broad base of talent in oceanography is particularly critical for the future of food, water, energy and health needs of India. India is losing more and more agricultural land to urbanization and population growth and this also comes with an ever increasing demand for energy, food, and water. While India has had a history of offshore oil and gas exploration, more renewable energy investments such as offshore wind and solar farms, and use of ocean thermal energy for coastal heating/cooling are not fully exploited yet. Fisheries in India remain largely subsistence or artisanal efforts but with the burgeoning middle class, demand for fish and thus for aquaculture and farming is increasing steadily. With the well-known vagaries of the monsoons becoming only more vague with global warming (especially the rapid Indian Ocean warming), large-scale desalination has to be considered as a priority with some attention to more exotic concepts like hydroponics



Ocean-atmospheric conditions over Arabian Sea during the Arabian Sea Monsoon Experiment, 2003. Source: Roxy Mathew Koll



for meeting future food and bioenergy demands. Active research exists on finding medicinal chemicals from algae and sea creatures like snails but it is hardly as extensive as the Indian coastline just as our mainly non-aquatic culture essentially leaves many of the recreational and ecotourism activities also underexploited. One can easily imagine that the congestion on the trains, planes, and automobiles in India can be significantly alleviated by having a well-designed water-based transportation along the entire coastline. The concern for the future is not just about economic growth but using this bountiful resource for sustainable development of the country. And this is where entraining young minds into oceanography will serve the country well in every aspect.

Developing an effective curriculum for entraining more young people into oceanography requires that we treat it as a part of an overall education in Earth System Science. This is critical for both urban and rural education systems. Rural kids live much closer to nature and yet are not receiving an education that builds on their intrinsic curiosity about nature to lead them to understand their role in the functioning the Earth System or the disruption of it. Urbanization gets blamed for a lot of things including its impact on weather and climate. I think one of the most insidious impacts of urbanization that it leads to a disconnection between a child's mind and nature rendering it less sensitive to the damage humans are doing to the environment. This ups the ante on the need for Earth System Science education in urban jungles. Ocean focus in the Earth System education can be brought to the fore by combining the coastal oceanographic scientific and technological needs of NIO, INCOIS and IITM with the technological expertise of NIOT and the educational needs of the country. A network of coastal oceanography centers from Gujarat down to Kerala on the west and from Tamilnadu to West Bengal on the east, and of course on the numerous islands in the Arabian Sea and the Bay of Bengal, each with an associated underwater aquarium built into the ocean and active jetties and research vessels can very effectively serve all of the scientific, technological, and educational needs of the country. These will also be excellent training grounds for the primary, secondary, and college teachers in oceanography.

Climate change is now a reality and it should really be referred to as environmental change since it is not just the warming that is of immense concern but also the pollution and acidification of the oceans, the sea level rise, unsustainable fisheries, and so on. Sea level rise is an international issue for the Indian subcontinent since the extreme vulnerability of our neighbors such as Bangladesh implies that Indian needs to be prepared for large-scale environmental migration in the coming years to decades. An oft underestimated impact of sea level rise is related to the fact that the storm surge

associated with cyclones and storms tend to push inward by many more kilometers with each centimeter rise in sea level. Global warming may not increase the number of cyclones but the number of cyclones of category 3 and higher may go up nonetheless. It is not just the built infrastructure on land that needs to worry about the impacts of climate change and sea level rise but also the offshore infrastructure and thus our definition of oceanography will need to include all aspects of related ocean engineering also. This is good news for Indian parents since our culture is more sharply focused on career opportunities when educational options are being considered. It is hard to imagine any aspect life and the socioeconomics that will be untouched by climate change in the coming decades. And considering that the ocean covers 70% of our planet and controls the climate with its high heat capacity, it is obvious that oceanography will be a big player at the poker table of climate impacts on our lives. This is especially so for India which sits so deep in the tropics in a warm ocean. Warm waters control the biggest chips in the climate casino. We will significantly improve our odds of not going bankrupt by systematically preparing ourselves for the future.

I wish I was a kid again. Because even though the future appears full of climate risks, it offers infinite opportunities to learn and to save the planet. And which kid doesn't want to dream about saving the planet? Let's hope for a lot of superheroes like Captain Planet and Captain Blue emerging out of our education system – the Mahatmas of the future that are all about saving the planet and the ocean from ourselves.

Global warming, and implications for extreme El Niños

Review

Summary of Cai et al., 2014: "Increasing frequency of extreme El Niño events due to greenhouse warming". *Nature Climate Change*, 4, 111–116.

There are a lot of discussions and debate about the future statistics of the El Niño Southern Oscillation (ENSO), its frequency and amplitude, and of course its flavors. In the recent few decades, we have experienced two well distinguished events of extreme El Niño (1982/83 and 1997/98), which apparently had an impact on the biosphere as well. The potential biological impacts of such extreme El Niños include disappearance of some marine species and the native birds species in the Galapagos Island. Further, severe coral bleaching occurred in the Pacific and beyond. Add to this an estimated loss of 23000 human life world wide and about US\$35-45 billion damages during a single event of 1997/98 (see references 2-4).

In this context, Cai et al published a research letter in the 2014 edition of the journal *Nature Climate Change* entitled "Increasing frequency of extreme El Niño events due to greenhouse warming". In addition to using the observed datasets, Cai et al. also utilised the projections of CMIP3 and CMIP5 models and selected 20 best models for the detailed study. Further, in order to check the consistency of the result in the context of the well known cold SST bias in the Coupled General Circulation Models (CGCM), they have done a bias

corrected perturbed physics ensemble (PPE) simulation using HadCM3 CGCM.

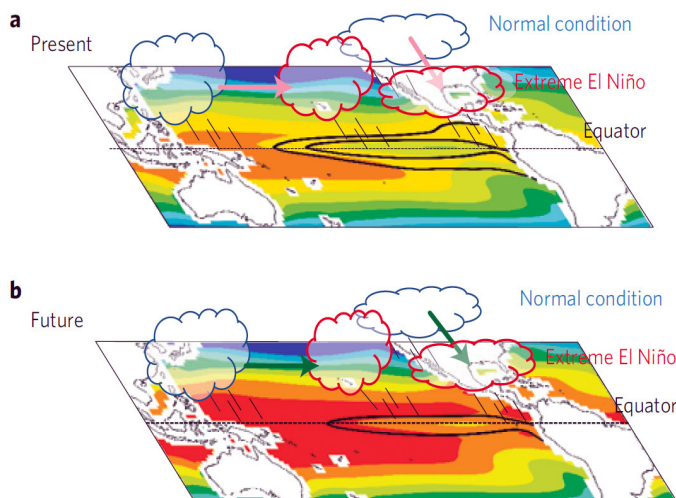


Fig. 1. Schematic depicting the mechanism of increased occurrences of El Niño under global warming.
Source: Nature Publishing Group

The authors have defined extreme El Niño events as those events that have a massive reorganisation of atmospheric convection such that the rainfall over the Niño3 region exceeds 5mm/day or more. These extreme El Niño events are also characterised by the Niño3 SST of 28°C, and hence a reversal of meridional SST gradient between the northern off-equatorial and equatorial Pacific. The reorganisation of the convection replaces easterly winds of the eastern Pacific with westerlies and leads to the suppressing of equatorial upwelling. This results in a positive feedback to the extreme situation.

The authors conclude that even though neither the average amplitude of El Niño related SST anomalies nor the frequency of El Niño change substantially, the weakening of SST gradients, associated with increased frequent occurrences of maximum SSTs and hence increased convection in the eastern equatorial Pacific lead to more frequent occurrence of extreme El Niño events. Figure 1 from the original article represent a nice schematic of the conclusion.

References:

1. Cai et al., 2014, Increasing frequency of extreme El Niño events due to greenhouse warming; *Nature Climate Change*, 111–116.
2. Valle, C. A. et al. 1987, The Impact of the 1982–1983 El Niño–Southern Oscillation on Seabirds in the Galapagos Islands, Ecuador. *J. Geophys. Res.*, 92, 14437–14444.
3. Merlen, G., 1984, The 1982–1983 El Niño: Some of its consequences for Galapagos wildlife. *Oryx*, 18, 210–214.
4. Sponberg, K. 1999, *Compendium of Climatological Impacts*, University Corporation for Atmospheric Research Vol. 1 (National Oceanic and Atmospheric Administration, Office of Global Programs).

Review Article compiled by Gibies George, IITM

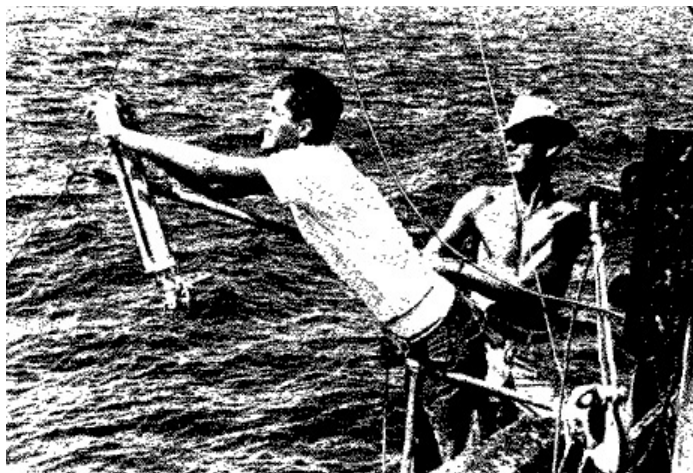
50 years of International Indian Ocean Expedition (IIOE)

History

The northern waters of the Indian Ocean have been a highway for international trade since the start of recorded history. The early navigators took advantage of the changing direction of prevailing winds during the winter and summer monsoons. However, the Indian Ocean was the least understood of the three major oceans – until fifty years ago.

During 1959–65, the international scientific community went out on an extensive expedition over the Indian Ocean, which revolutionized the scientific understanding of the oceans, and of the earth. The International Indian Ocean Expedition (IIOE) was an international co-operative multi-ship scientific expedition under the guidance of the Scientific Committee on Oceanic Research (SCOR), with a participation of forty ships from thirteen countries.

A major breakthrough of the IIOE was that it revolutionized our understanding of the earth's geology. It gathered the required knowledge and evidence to support the then controversial theory - of the continental drift. The study showed that the sea floor has been spreading from the mid-oceanic ridges. This proved the existence of a mechanism that could move continents by opening ocean basins. Seismic studies during IIOE also showed that earth's crust was much thinner beneath the ocean than under the continents. The



marine geological study of the Indian Ocean also helped in identifying the separation of the Indian subcontinent from the Madagascar/Seychelles micro-continent about 60 million years ago, which turned into a northward drift that ended 40 to 50 million years ago in the collision with Asia that gave birth to the Himalayas. The Ninety East (90°E) ridge is the major topographic feature discovered by the expedition. It is the longest, straightest feature on the earth, running to about 5000 kms from the Bay of Bengal to the southeast Indian Ocean.

The expedition helped us to learn mechanism of the monsoon, and the factors that lead to its onset and determine its strength and fluctuations. About 400 meteorological observations by ships and 2,000 by land stations reached the Mumbai Colaba Observatory setup by India, which had a computer financed through the World Meteorological Organization (WMO). They contributed to a meteorological atlas which charted the mean winds, pressure, air and surface temperatures, precipitation, etc. over the Indian Ocean.



On board marine observations during IIOE.

Source: Behrman et al. 1981.

IIOE was the first to confirm and clarify the existence, extent and strength of the equatorial and the Somali upwelling currents. The hydrographic studies showed that these currents were different in their dynamical properties and seasonality, in comparison with their counterparts over the Atlantic and Pacific. Along with the currents, the studies also gave an understanding of the distribution and seasonality of primary productivity and different marine species over the open oceans. In order to handle the samples from ships in the expedition, the Indian Ocean Biological Centre (now part of the Cochin University) was established at Kochi, on the Arabian Sea coast. As might be expected because of its size and considerable involvement in the expedition, India soon made a commitment to the marine sciences. The National Institute of Oceanography, situated at Goa, was an outcome of IIOE. An *Oceanographic Atlas of the International Indian Ocean Expedition*, describing the characteristics of the Indian Ocean, was published by the University of Hawaii in 1971. Oceanography got revolutionized ever since the extensive expedition over the Indian Ocean.

Reference:

Behrman, D., 1981, Assault of the largest unknown, The International Indian Ocean Expedition, Unesco Press, Paris.

History Article compiled by Roxy Mathew Koll, IITM

Chemical signatures of phytoplankton-bacterial interactions in an Arctic fjord

Student Article



Chaitri Roy

Indian Institute of Tropical Meteorology, Pune

The Polar Regions, namely, the Arctic and Antarctica are thought to be amongst the most vulnerable ecosystems impacted by rapid and long-term changes in climate. Stretching across the northernmost areas of Earth, the Arctic Circle (66° 33' N) is referred to as the starting point of the Arctic. Kongsfjorden, an Arctic fjord is an established reference site for Arctic marine studies (Figure 1). The current interest in the fjord is primarily based on the fact that Kongsfjorden is a particularly suitable site for exploring the impacts of possible climate changes, with Atlantic water influx and melting of tidal glaciers, both being linked to climate variability.

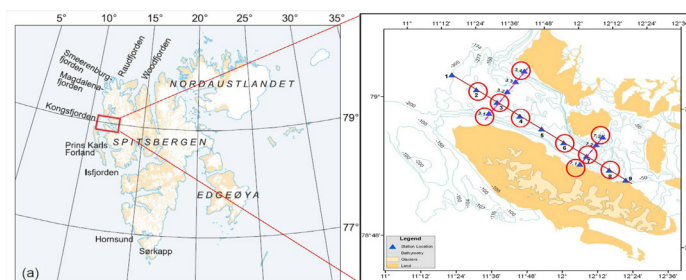


Fig. 1. Map showing sampling station locations at Kongsfjorden

Phytoplanktons are the major producers in the marine ecosystems. Their growth being extremely sensitive to the local environment could tell us about the changes in the local ecosystem. In the present study, hydrographic observations and water sampling was conducted during the boreal summer of 2012 (July and August) at ten stations along as well as across the fjord (Figure 1). Pigment characteristics of phytoplankton community were studied using High Performance Liquid Chromatography (HPLC) to understand their distribution. In order to know the contribution of each community, biomass proportion of major classes were determined. Concentration of Chl a was found to be higher in August at all the stations in comparison to July. Fucoxanthin, a marker for diatoms, was the next most abundant pigment, occurring at almost all stations. Diatoms are known to produce extra-cellular secretions through their pores and contribute significantly to the dissolved organic carbon pool, thus having a considerable impact on bacterial metabolism. Three dominant bacterial species, *Leeuwenhoikiella aequorea*, *Rhodococcus fascians* and *Psychrobacter glacincola* isolated from Kongsfjorden were selected for the studying carbon utilization pattern using Biolog assay. Analysis of average well colour development (AWCD) showed that isolates *L. aequorea*, *P. glacincola* and *R. fascians* developed highest AWCD for wells containing carbohydrates. Study of growth kinetics in presence of

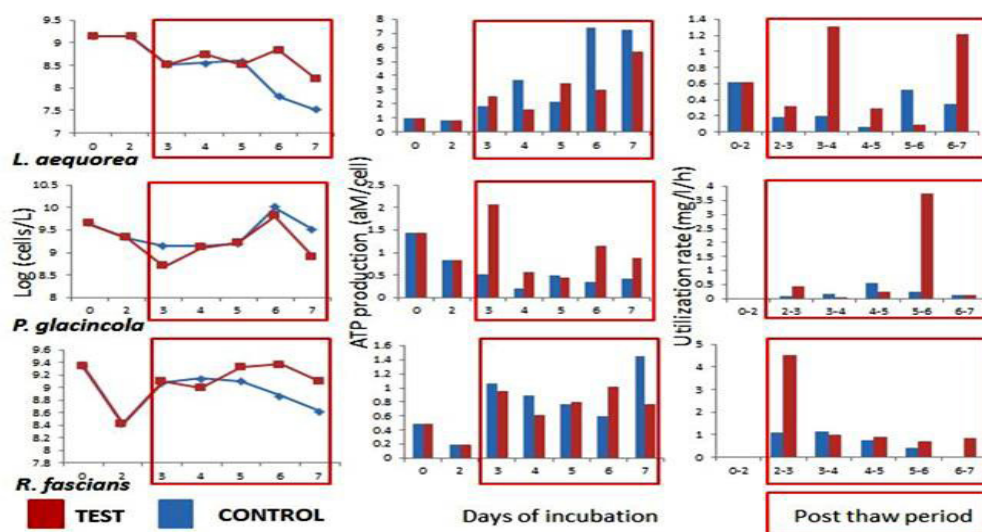


Fig. 2. Variation of Cell count (log cell/L), ATP concentration (aM/cell) and Raffinose uptake rate ($\text{mg L}^{-1} \text{h}^{-1}$) in *L. aequorea*, *P. glacicola* and *R. fascians* with time (days) in 300 ppm Raffinose, incubated at 4°C (Control) and $4/-15/4^\circ\text{C}$ (Test-freeze thaw).

preferred carbohydrates - glucose, sucrose, sorbitol and raffinose showed that growth and regeneration was stimulated faster with raffinose.

Freezing and thawing results in potential stress to the planktonic physiology. Kongsfjorden being situated in higher latitude is subjected to occasional freeze thaw cycling during summer-winter transitions.

Previous studies show that oligosaccharides (like raffinose) could be sourced from algal exudates in the oceanic environment. Hence, an experimental analysis on the role of this well-known but less studied cryoprotectant was conducted to understand mechanism of its uptake and utilization during freeze-thaw conditions.

For *P. glacicola*, *L. aequorea* and *R. fascians*, 300ppm concentration of raffinose could be significantly utilized post thawing (Figure 2). The increase in the cell growth during post-thaw (4-5 days) was observed in lower concentration compared to higher concentration of the raffinose amendment in *L. aequorea* and *R. fascians*. This signifies the excess species-specific requirement of different concentration of this cryoprotectant for cell survival during freeze-thaw cycle.

Thus, understanding the interactions between diatoms and bacteria is of prime importance to decipher critical steps in biogeochemical cycling of carbon as well as interdependence of these two communities. These studies will provide vital information pertaining to the response of microbial life to ice melt associated with change in climate.

Acknowledgements. This work was carried out as a part of IITM CAT training program, with the supervision from Dr. K. P. Krishnan, and assisted by Rupesh Kumar, NCAOR. Support from Prof. B. N. Goswami, Director, IITM and Dr. S. Rajan, Director, NCAOR, is acknowledged.

El Niño updates

News and Views

As per NOAA/IRI, ENSO-neutral continued during March 2014, but with above-average sea surface temperatures (SST) developing over much of the eastern tropical Pacific as well as near the International Date Line. The weekly SSTs were below average in the Niño1+2 region, near average but rising in Niño3 and Niño3.4 regions, and above average in the Niño4 region. A significant downwelling oceanic Kelvin wave that was initiated in January greatly increased the oceanic heat content to the largest March value in the historical record back to 1979 and produced large positive subsurface temperature anomalies across the central and eastern Pacific (Fig. 1). Also during March, low-level westerly wind anomalies were observed over the central equatorial Pacific. Convection was suppressed over western Indonesia, and enhanced over the central equatorial Pacific. Although these atmospheric and oceanic conditions collectively reflect ENSO-neutral, they also reflect a clear evolution toward an El Niño state.

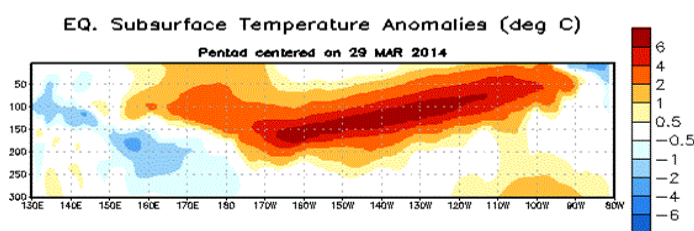


Fig. 1. Depth-longitude section of equatorial Pacific upper ocean temperature anomalies ($^\circ\text{C}$) centered on the pentad of 29 March 2014. The anomalies are averaged between 5°N - 5°S . Source: CPC/NOAA

The model predictions of ENSO for this summer and beyond:

Model forecasts are indicating an increased likelihood of El Niño this year compared with last month (Fig. 2). Most of the models indicate that ENSO-neutral (Niño-3.4 index between -0.5°C and 0.5°C) will persist through much of the remainder of the Northern Hemisphere spring 2014, with many models predicting the development of El Niño sometime during the summer or fall. Despite this greater

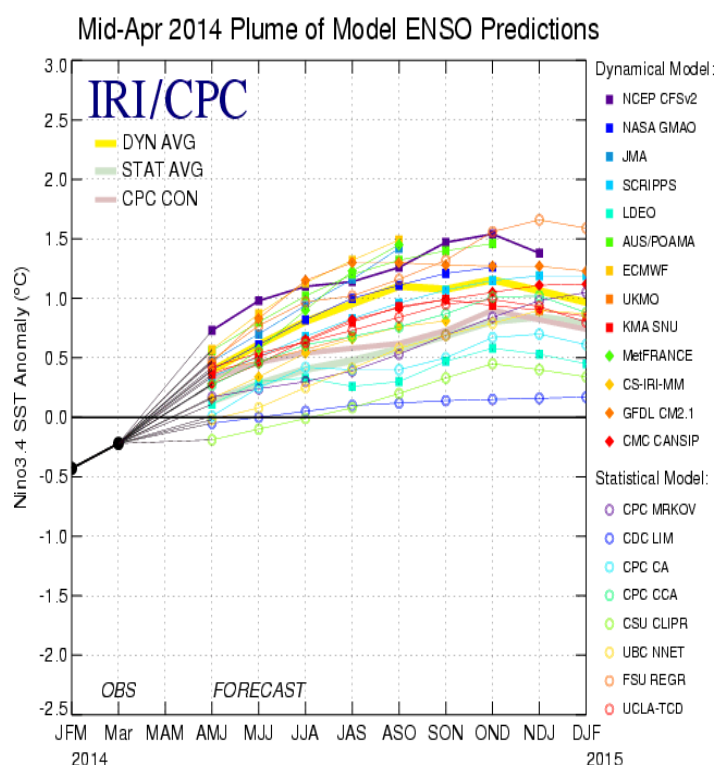


Fig. 2. Forecasts of SST anomalies for the Niño 3.4 region (5°N-5°S, 120°W-170°W). Figure updated 17 Apr 2014. Source: IRI/CPC

model consensus, there remains considerable uncertainty as to when El Niño will develop and how strong it may become. This uncertainty is amplified by the inherently lower forecast skill of the models for forecasts made in the spring. While ENSO-neutral is favored for Northern Hemisphere spring, the chances of El Niño increase during the remainder of the year, and exceed 50% by the summer and 60-70% by winter. This El Niño forecast is qualitatively consistent with those from other agencies such as APCC, JAMSTEC and BAM forecast.

News and Views Article based on ENSO Diagnostic Discussion issued by CPC, NOAA and IRI.

Compiled by Anant Parekh

Recent Articles

Recent Scientific Articles of Interest

1. Impacts of the north and tropical Atlantic Ocean on the Antarctic Peninsula and sea ice. Xichen Li, David M. Holland, Edwin P. Gerber and Changyun Yoo. *Nature*, 505, 538–542. <http://dx.doi.org/10.1038/nature12945>.
2. Australian tropical cyclone activity lower than at any time over the past 550–1,500 years. Jordahna Haig, Jonathan Nott and Gert-Jan Reichert. *Nature*, 505, 667–671. <http://dx.doi.org/10.1038/nature12882>.
3. Fifty thousand years of Arctic vegetation and megafaunal diet. Eske Willerslev et al. *Nature*, 506, 47–51. <http://dx.doi.org/10.1038/nature12921>.

4. High-precision timeline for Earth's most severe extinction. Burgess et al. *PNAS*, 111, 9, 3316–3321. <http://dx.doi.org/10.1073/pnas.1317692111>.
5. Interdecadal change in the Northern Hemisphere seasonal climate prediction skill: part II. predictability and prediction skill. Jia et al., *Climate Dynamics*. <http://dx.doi.org/10.1007/s00382-014-2084-x>.

Conferences and Workshops

Upcoming Events

- The 7th International Scientific Conference on Global Energy and Water Cycle will be held on 2014 July 14-17 at World Forum, The Hague, The Netherlands.
- AOGS 2014 will be held on 2014 July 28 (Mon)-August 1 (Fri) at Royton Sapporo Hotel, Sapporo, Japan
- World Weather Open Science Conference which will be held from 16th to 21st August in Montreal, Canada. http://wwosc2014.org/welcome_e.shtml

Opportunities

Job/Fellowship Opportunities

- Position for a Project Scientist, Plankton Ecosystem Modelling at JAMSTEC. See the following link for further details including the application procedure: (http://www.jamstec.go.jp/e/about/recruit/ricg_20140307.html).
- The Applied Physics Laboratory (APL) at the University of Washington Invites applications to a research position with principal investigator responsibilities in the Ocean Physics Department (<http://opd.apl.washington.edu>).
- Postdoctoral fellowship in marine biogeochemistry at The Helmholtz-Zentrum Geesthacht Geesthacht near Hamburg, and in Teltow, near Berlin, conducts materials and coastal research. More information at <http://www.hzg.de>.
- An open position as postdoctoral fellow in ocean carbon cycle research at the Bjerknes Centre for Climate Research, Bergen, Norway.
- CSIR-NIO invites applications for undertaking doctoral research leading to Ph.D. degree. The National Institute of Oceanography is a constituent research institute of CSIR under the Ministry of Science and Technology. Interested candidates in India and abroad may apply online before April 15, 2014.

Articles/Events compiled by Gibies George, IITM



Gallery

Snapshot of recent OSI activities



The Ocean Society of India, jointly with IITM, Pune, organized the third biennial conference OSICON-2013 on the "Role of Oceans in Earth System" during 26-28 November 2013. Over 300 participants from all over India participated in the conference. The idea of publishing a quarterly newsletter originated during the conference.

Messages

Greetings on the First Edition of Ocean Digest



Prof. B. N. Goswami
Director, Indian Institute of Tropical Meteorology, Pune

"On the occasion of the launch of Ocean Digest, I congratulate the members of OSI-Pune, and the editorial team of the newsletter. Learned societies such as the OSI play an important role in connecting the science to the society, and particularly bringing the relevance of importance of science as a career to the bright young student community. The Ocean Digest is a wonderful medium to achieve these objectives. I wish the newsletter every success."



Dr. C. Gnanaseelan
President, Ocean Society of India, Pune Chapter

"I am very happy that we are bringing out a Newsletter of Ocean Society of India (Pune Chapter) within one year of its inception. The idea of Newsletter came to our mind during the biennial conference OSICON-2013 hosted by IITM, Pune in November 2013 and is aimed to create interest in ocean science among students. I congratulate the editorial team for making it a reality."



Prof. P. V. Joseph
President, Ocean Society of India

"I am happy that the Pune Chapter of Ocean Society of India is launching the first issue of Ocean Digest in April 2014. The Newsletter will create interest in Ocean Science among students and young scientists which is very much needed in view of the ongoing global warming, climate change and sea level rise and the importance of ocean in other areas as well."

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