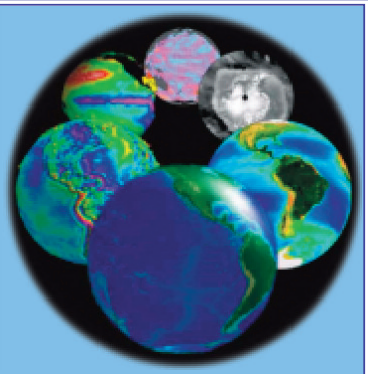
BULLETIN
of the
PORSEC
Association



Volume 2.3 October 2008

Dear Members of PORSEC Association,

This is the Bulletin of the PORSEC Association (BPA) just before PORSEC 2008. On behalf of the Executive Board and the Local Organizing Committee (LOC) we welcome all participants to what appears to become a very interesting meeting. We have more than 300 oral and 70 poster presentations, a number of well-known Keynote Speakers and broad international representation. The Social Program offered by the LOC, looks very promising and gives us an opportunity to get to know one another personally. Please review the program on the web-site regularly and check on your own paper, so any mistakes can be corrected quickly. It is a rather complex undertaking to get all the papers fitted in.

We are sad to note the passing of past president of the PORSEC Association, Hiro Sugimori, who served for many years. You can read about his many accomplishments in the Memorial Note provided by Dr. Kubota and co-authors in this issue. We will also honor Prof. Sugimori during the PORSEC Assembly on December 6, 2008 with Mrs.Yoko Sugimori in attendance.

In this issue of BPA you will find Part 2 by J-O Strömberg of his review of Climate Change and its importance for the oceans and the life within it.

Please check further on in this issue on the opportunity to acquire the Special Issue of the International Journal of Remote Sensing covering PORSEC 2006 articles. We have an agreement to produce such an issue for PORSEC 2008 in addition to other Chinese publications.

Hope you are all receiving your VISA for China and have your travel arrangements confirmed. We look forward to seeing you there and catch up with old friends and colleagues and get-to-know those of you who participate for the first time.

WELCOME!
Sincerely Yours,
Kristina Katsaros and Gad Levy
Co-Editors of BPA

Contents

Memorial note for Hiro Sugimori

Yasuhiro Sugimori, the second president of Pan Oceanic Remote Sensing Conference (PORSEC), died on the 5th of September 2008 in Yugawara, Japan.

He was born on May 17, 1938 in Nara, which is an ancient capital in Japan. In 1968, he completed his Master degree in Applied Physics at the Osaka University. In 1976, he finished his thesis entitled " Study of the directional wind waves determined by hologram method" and received his PhD degree in Kyoto University. From 1968 to 1971, he worked at Ocean Research Institute of the University of Tokyo as a research associate. From 1971 to 1973, he visited Texas A & M University, where he participated in several big projects such as the Coastal Upwelling Experiment (CUE) conducted in U.S.A. After returning to Japan, he joined the Research Institute for Disaster Prevention, Science and Technology Agency as chief scientist. In 1976 he joined the Faculty of Marine Science and Technology at Tokai University as an Associate Professor, and was promoted to Professor in 1979. He was invited by many foreign universities as a visiting Professor, including Ocean University of China in 1983, Chiba University 1994-1995, University of Conception in Chile in 2000, and Udayana University in Indonesia in 2002. He moved from Tokai University to Chiba University in 1998. During his stay at Chiba University for 6 years, he made every effort to supervise many graduate students, who earned PhD degrees related to oceanography and remote sensing. His remarkable efforts and contributions to this field are worthy of praise. After he retired from Chiba University, he joined Udayana University, Bali, Indonesia. He was the prime architect in establishing the Center for Remote Sensing and Ocean Science, CReSOS, as a joint science and education project between Indonesia and Japan. By his enthusiastic persuasion, the Indonesia Space Organization (LAPAN) and Japan Aero Space Exploration Agency (JAXA) have been contributing both financial and technical support since the CReSOS inauguration. He had been serving as Director of CReSOS since its inception in 2003 until his passing.

His original research interest was related to observation of ocean wave spectra. His interests have been extended to many important and more recently developing research fields, in particular, ocean remote sensing. He was a pioneer in ocean remote sensing in Japan and made important contributions in this field. In 1978, SEASAT, the first ocean satellite in the world, was launched. Though the life of the satellite was only three months, we learned about the great possibilities offered by the SEASAT instruments. Yasuhiro Sugimori realized the importance of satellite ocean remote sensing, not only for science but also for our society, and started to analyze various kinds of data observed by SEASAT, e.g., altimeter, scatterometer and radiometer data. Everybody knows those data are indispensable for solving Earth environmental problems at present. He published an important textbook entitled "Satellite Oceanography" in 1982, which was the first book in Japan to cover ocean remote sensing. In addition, he edited "Marine Optics and Environment " with Professor Wataru Sakamoto in 1983. This was also the first book in Japan to cover marine optics and the bio-optical environment. Considering the importance of publishing a good textbook, particularly in a new research field, his contribution to this field was greatly memorable.

He supervised more than 50 graduate students to complete their degrees. He was very kind and helpful to his students and looked out for the welfare of others including that of the students. In particular, he made huge efforts to enlighten young people in foreign countries. Many foreign students were included among his graduate students. Most of them are in position of leadership in their country now. His educational contribution was not limited to Japan but was truly international.

In 1989 he constructed an important conference entitled Advances in Marine Technology Conference (AMTEC) in order to promote interdisciplinary research fields of science and technology related to the ocean. He is the first person to recognize the importance of interdisciplinary research fields of oceanography in Japan. In 1994 AMTEC was developed to become the Advanced Marine Science and Technology Society (AMSTEC) in order to expand the sphere of activity. He served as a president of AMTEC and AMSTEC during 1992 and 1996. His enthusiasm for international contributions was realized as the Pan Oceanic Remote Sensing Conference (PORSEC) Association. He is one of the two founding fathers of PORSEC with strong cooperation with the late Professor Robert W. Stewart. He served as vice-President (1992-1996) and as President (1996-2004) of the PORSEC Association and greatly contributed to the formation and growth of PORSEC. Everybody knows that PORSEC would not have existed if it were not for his vision. He was a man of foresight. He had a special sense for the future beyond day-to-day affairs. The establishment of the PORSEC Association and the inauguration of CReSOS are his brilliant accomplishments to promote and enhance international research and educational cooperation on climate change and oceanography. Without Professor Sugimori, our understanding of the climate change, and in particular the role of the ocean, might have been delayed by ten years at least. He created a friendly atmosphere with his tactful remarks many times. It is regrettable for us not to have a pleasant and exciting time with him again in the future. We will remember his contributions and his strong passion for building an international community in ocean remote sensing.

Professor Kubota Masahisa, Tokai University, School of Marine Science and Technology,
Professor Tanaka, Tasuku, Yamaguchi University, Graduate School of Science and Engineering,
Professor Fukushima Hajime, Tokai University, School of High-Technology for Human Welfare

Climate change and effects on the ocean and its biota

Jarl-Ove Strömberg, Prof. Ph.D.

Part 2: Global Warming and Marine Biology

This is the second part of two trying to give a brief account of the present understanding of the causes of global warming and its effect on the oceans and their biota. It is a study based on the most recent available scientific literature in conjunction with the published reports by the WMO/UNEP Intergovernmental Panel of Climate Change (IPCC), the latest one being the Fourth IPCC Assessment Report 2007. In the present short account the aim is obviously not to give a complete coverage of all ideas, theories or results, but to give a rough understanding of the current main thinking.

This part deals with some of the effects the physical/chemical changes have on the marine biota with emphasis on some of the faunal elements in polar, temperate and tropical environments, e.g. plankton in the Arctic, Antarctic and the North Sea, corals in the tropics and the coastal bottom faunas on the west coast of North America.

All species have one or more centres for their distribution, where they are normally abundant and occurring regularly year round. Towards the periphery of their distribution their presence becomes irregular and their number decreases because of changing environmental conditions, or in other words, an increased stress on the individuals. The requirements may also be different between various developmental stages, and many species have a succession of larval stages. Fluctuations are thus common and may be caused by extreme weather situations – e.g. extra cold winters or warm summers, which could affect general survival of any part of the life cycle, availability of food, predation pressure or failure in reproduction for a number of reasons. Animals which have had a long time to adapt to stable environmental conditions, e.g. in temperature or salinity, will tolerate less variation in these factors than those being used to variability in them. They are termed stenotopic or eurytopic respectively. Examples of the former are species in the cold waters surrounding the Antarctic continent or in the warm waters of the Indonesian and North Australian region. In these cases stable conditions have lasted for millennia, and higher temperature may be disastrous to these faunas, because there is no way to escape and changes are happening so quickly that adaptation to the new situation is hardly possible. Also deep sea faunas have had stable environmental conditions for long times, but they are exposed to slower environmental changes. In some other tropical waters as well as in the Arctic there has been less time to become as highly stenotopic and adaptational possibilities are then better.

For eurytopic species living in more variable marine environments different possibilities are at hand. A general trend in distributional changes, because of global warming, is expected to be a shift towards the north in the northern hemisphere and to the south in the southern hemisphere. From what is said above it is obvious that not all species react in the same way, and mildly stenothermal species will move when eurythermal species can stay and endure the new situation. The one factor which is particularly important in this context is how quickly the changes occur. In the present scenario with a time frame of decades to a few centuries there might be too little time for adaptation and thus more extinction of species can be expected. During the last 600 kyears there have been six glacial periods with intervening warm periods, but then the changes have been slower and taking several thousand years allowing for more of both migrations and adaptations.

Global warming will not only affect temperature, but also changes in salinity, distribution of oxygen and nutrients, acidity etc. which will all have influences on the possibilities for species survival.

Some Recorded Changes in Abundance and/or Distribution

There are relatively few examples where changes in distribution can be clearly attributed to global warming. Extreme weather events can have relatively long lasting effects and often the observational periods are too short for distinguishing between weather fluctuations and climate change. However, there are some good examples:

Zooplankton in the NE Atlantic

Long term monitoring of plankton communities have been conducted in the North Atlantic for about 50 years. This is mainly thanks to the Continuous Plankton Recorder survey (CPR) managed by the Sir Alister Hardy Foundation for Ocean Science (SAHFOS; www.sahfos.org). During this time the NE Atlantic sea surface temperature has increased by 2-3oC, which has caused a northward shift of warm water plankton communities of about 1000 km.

Also the North Sea has undergone this warming, that, for not yet understood reasons, has resulted in a marked general decrease in copepod populations of the genus Calanus, which started in the mid-1980s. It is also obvious that there has been a shift in the distribution of two of its species, which is particularly marked during summer and fall. Before the warming period a cold-temperate species, Calanus finmarchicus, dominated, but gradually another closely related species, the warm-temperate C. helgolandicus, invaded from the south. The former species has a thermal upper boundary of 10-11oC while the other one has it at 14oC. For the European cod in the North Sea and adjacent waters this may have had a serious impact. The larval and juvenile cod normally feed on C. finmarchicus and, with a change in copepod species, this could have had a negative effect on the viability of the young cod. Thus it might not only be overfishing that helped deplete the cod population to a seriously low level in these waters.

Further to the north, in Kongsfjord at Svalbard advection of warm Atlantic water has brought a larger population than earlier of C. finmarchicus into the fjord, which otherwise was characterized by the arctic species C. glacialis or C. hyperboreus at different times of the year. Thus for the species C. finmarchicus there has been a general northward shift in its distribution but also a clear physical advection via a somewhat warmer current entering Arctic waters (Willis et al. 2007).

P.C. Reid at SAHFOS (Reid et al. 2005) summarized the changes until 2005 in zoo- and phytoplankton in waters around the British Isles as follows:

- Pronounced stepwise change (regime shift) in marine ecosystems since the mid-1980s,
- Northerly movement of warmer water plankton by 10o latitude in 40 years and a similar retreat of colder water plankton to the north,
- Considerable changes in the seasonal timing (phenology) of the plankton have been observed,
- Pronounced change in the composition and abundance of the phyto- and zooplankton,
- Large increase (400% for sea urchins) in the larval stages of animals living on the bottom in the North Sea since the mid-1980s,
- ~50% increase in phytoplankton biomass and an associated long-term decline in zooplankton biomass that includes a 70% decline in the important copepod genus Calanus in the North Sea since the late 1950s,
- Increase in biodiversity although the species (mostly copepods) are smaller and production is likely to be less.

Reid states that all the above changes must be coupled to the Northern Hemisphere temperature rise, although there are also components of the North Atlantic Oscillation (NAO). Satellite measurements and single point time series observations, e.g. at Helgoland, seem to confirm the conclusions.

Benthos (Bottom-Living) Organisms

Changes in benthic floras and faunas caused by global warming are more difficult to find well documented. In coastal areas there is so much influence from local or regional anthropogenic disturbances or cyclic phenomena like NAO or ENSO, not to talk about extreme weather occasions. With the more pronounced ocean warming since the mid-1980s we are likely to receive more reliable reports as the observational periods become longer. The intertidal fauna of the rocky central California coast was however well studied (Barry et al. 1995, Sagarin et al. 1999).

During the 60 years between 1921-31 and 1983-93 the mean shoreline water temperature increased by 0.75oC and the maximum summer temperature by 2.2oC. This increase obviously influenced the abundance of a number of the local species. 45 species were studied in detail and of these 8 of 9 southern species increased significantly while 5 of 8 northern species decreased in abundance. This indicated a shift towards the north although no species disappeared. Possible other causes for this change were considered but ruled out, e.g. ENSO-associated effects, change in predator populations, anthropogenic impacts and random variation.

Bacteria and Viruses

Other organisms like bacteria and viruses may also benefit from warmer water, and when introduced into the coastal water in some place, their chance to survive and multiply will increase. NW Europe has experienced a number of warm summers in recent years, with more frequent reports of dangerous levels of coli bacteria (Escherichia coli) and the need to temporarily close popular swimming places. The outbreaks clearly have local anthropogenic background and do not reflect a spread by currents, but a better possibility to survive and multiply temporarily in the warm water.

A bacterium causing gastroenteritis, Vibrio parahaemolyticus, can be found in oysters. Since these mussels are often eaten raw, the risk for human infection is high. An outbreak of this disease in Alaska in 2004 was attributed to rising seawater temperature; the temperature had increased by 0.21oC per year since 1997. Before 2004 the disease was never recorded so far north (McLaughlin et al. 2005). Most likely this was also caused by local human infection and not by a spread in waters from the south, but it shows survival capabilities in northern waters, which could not have happened before the warming trend.

The bacterium *Vibrio cholerae* causing cholera spreads easily via fresh water around the world and has caused many pandemics. It has now been shown to have an association with zooplankton and especially those having an exoskeleton of chitin, e.g. copepods. Thus the disease may also spread in seawater via ocean currents with chitinaceous taxa as vectors.

The bacterium may also survive in association with water hyacinths (in fresh water) and blue-green bacteria (e.g. Anabena) in brackish or salt water (Colwell, R. 1996, Harwell et al 1999). A possible coupling between human health and global climate change is obvious in these cases.

Also marine invertebrates and mammals fall victims to diseases. Reef corals exposed to high temperature often bleach as a result of loosing their symbionts, the zooxanthellae, but their resistance to diseases is also weakened, Thus bacteria or viruses may be an additional major reason for a high mortality of tropical corals, although so far the micro-organisms have rarely been identified (http://www.reefbase.org). Protozoan parasites are reported to infect oysters in the Gulf of Mexico – often in conjunction with ENSO events, so again - increased temperature may influence and weaken immunity systems in invertebrates. Marine mammals are exposed to both bacteria and viruses and outbreaks of viral diseases are common in seals. Vectors for these have rarely been identified, and it is unlikely that global warming so far has played a major role in their spreading.

The Arctic

The flora and fauna in polar oceans are especially exposed to climate changes. In the Arctic the warming is particularly strong and the reduction in sea ice is very marked as is the inflow of river and glacial water. In the Antarctic it is especially the Peninsular area where the warming is very obvious and the sea ice extent is likely to be affected. On the east side of the Peninsula a major part of the Larsen B. shelf ice has recently broken up and disappeared in a very short time. The pelagic ecosystems are very much affected by these changes in sea ice extent. Smetacek and Nicol (2005) give a good summary of what might happen to the polar ecosystems in the near future.

In the Arctic Ocean productivity is limited under the perennial sea ice because of reduced light rather than nutrient supply. Ice algae and phytoplankton form the base for the production of amphipods and copepods and also for the upper parts of the food chain, e.g. polar cod, seals and polar bears. Supply of macronutrients to the open water is limited even though much is transported via the rivers from the Eurasian continent, but the amount of fresh water also limits any exchange of these nutrients from deeper waters. There is downwelling during winter when sea ice forms and brine water under the ice sinks towards the shelves and further down the continental slopes, but there is no upwelling. Iron is provided especially from river outflows, so there is no lack of this micronutrient. This means that it is nitrate depletion that limits phytoplankton blooms causing low production in the central parts of this ocean. Shrinking sea ice cover will not mean a rich production although ample light supply will be available during the summer period.(C.f. the situation in the ice-free water of the adjacent SW deep part of Bering Sea where supply of macronutrients is good, but iron is limited – leading to a high nutrient – low chlorophyll situation.)

Through the shallow Bering Strait (~50 m) water enters the Arctic from the deep Bering Sea, which is iron depleted but rich in macronutrients. With the iron added in the Chukchi Sea and during the passage through the strait a highly productive area of the Arctic Ocean can be found here. Nutrient recycling between the water and the sediments at shallow depths form a good feeding ground for the bottom fauna and animals feeding on it, e.g. walrus and fish.

On the Atlantic side nutrient rich water enters via Fram Strait and Barents Sea. The latter is relatively deep and nutrient recycling via bottom sediments is limited. However, the production in the water column is very high with phytoplankton and zooplankton allowing a rich population of planktivorous fish, like herring and capelin, and their predators exemplified by cod, birds, seals and at times also whales. It could be noticed that overfishing (also on cod) and hunting (seals and whales) meant a decrease in these populations and thus they consumed less of the phyto- and zooplankton. More plankton would then sink towards the bottom, which would mean more food for the benthos and most likely also for animals living on top of or just above the bottom. This would possibly favour the populations of epibenthic crustaceans like shrimps and krill.

The Antarctic

Conditions around the Antarctic continent are very different from the Arctic. The shelf around the Antarctic is deep (> 500 m; pressed down by the huge continental ice cap), there is virtually no river discharge and almost no atmospheric dust from the other continents reaching so far south. However there is a similarity in iceberg formation and melting from the continental ice caps. The surface water between the continent and the Antarctic Convergence is isolated from the rest of the world oceans, while intermediate and deep waters are in open communication with them. The extent of sea-ice is huge but the seasonal and annual variation is large. In spring the melting sea ice stabilizes a mixed layer of not more than 40m depth. Not surprisingly production has been shown to be iron limited and nutrients mainly supplied from sediments but only in shallow inshore areas. Only rarely is production limited by macronutrients. Both in the Arctic and Antarctic the greatest blooms are found close to the edge of the melting sea ice. With a reduced extent of the winter sea ice the areas with dense shallow blooms will decrease and it has been suggested that deep blooms (below 40m) will increase with marked effects on biogeochemical cycles and grazer populations (Smetacek and Nicol 2005). Change in phytoplankton species composition is likely to occur as is changes in timing of production.

Fig. 1. The krill Euphausia superba is a key species in the Antarctic marine ecosystem. They occur in large swarms of several metric tons (sometimes in megaswarms of hundreds of tons) although the maximum size of an individual is less than 6 cm. They feed mainly on phytoplankton and are heavily predated on by whales, seals, penguins and other marine birds, as well as by fish and squids. They are rarely found in any numbers in the same water masses as salps. (Photo by J-O Stromberg)

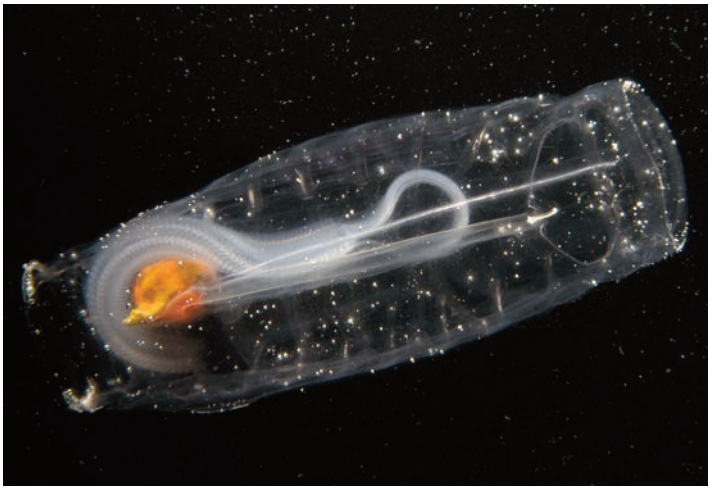


Fig. 2. Salps are wholly planktonic and efficient filter-feeding tunicates that live on phytoplankton. They are gelatinous and may occur as separate individuals, as in this picture of the Antarctic Salpa thompsoni, or they reproduce rapidly under favourable feeding conditions to form colonies of long chains of connected individuals. (Photo by Laurence Madin, Woods Hole Oceanographic Institution)

Major grazers of large phytoplankton are copepods, krill and salps, Figures 1 and 2. Copepods are short-lived(less than 2 years) and are usually found in the same highly productive waters as krill (which can be up to 7 years old). The salps are rapidly reproducing but rather short-lived and are rarely found in the same waters as krill, i.e. they are found in more impoverished waters.

The most abundant krill species is Euphausia superba, which is dominating in offshore waters, but may come closer to the continent during reproduction. Huge swarms (so called mega-swarms) were earlier commonly found between the Antarctic Peninsula, south of Cape Horn and South Georgia which used to be the most popular area for krill fishing (east of Drake Passage).

This is also an area with large sea ice fluctuations. It seems that krill abundance correlates positively with extensive sea ice areas of the previous year, which could indicate that the krill during their larval and subadult stages take advantage of the rich flora commonly found on the underside of the ice during the winter and spring period. To a large extent the krill is also protected from most predators under the ice, but during spring and summer the adult krill swarms in the open, ice free waters.

The krill is a key organism in the Antarctic ecosystem, since so many of the species in the higher food web rely on them as the major food source. This is true for many of the fish and squid species and for most of the seals and seabirds (esp. penguins) found in the Antarctic.

Also many of the more land-based birds prefer krill as a food source, not to talk about the visiting baleen whales during the time with open waters. Fluctuations in krill abundance are thus affecting the reproduction success of these predators, which can be easily studied in e.g. the penguin colonies. A recent study (Atkinson et al. 2004) has shown that more than 50% of the krill stocks are found in the Atlantic sector mentioned above, and that their densities have declined since the 1970s. In contrast the gelatinous salps have increased, but these animals cannot replace krill as food items for the predators just mentioned.

The Antarctic Peninsula has been found to experience the highest temperature increase recorded anywhere during the most recent years, when also reproduction has been less successful among many penguins and seals. This might indicate that krill populations have decreased or at least become less readily available for these predators. A positive correlation with declining sea ice extent is likely, but not yet clearly proven.

The Role of pH on Marine Organisms

Marine organisms relying on interior or exterior skeletons for their body support or protection will find a new difficulty in the reduced pH of the sea water. With increased atmospheric CO2 more of this gas will dissolve or be absorbed into the ocean surface layers and more bicarbonate ions formed as a result. Since the beginning of the industrial revolution in the early 1800s to the recent time, ocean surface waters have had a mean pH reduction from 8.16 to 8.05. Before the end of the 21st century it may sink below 8.00. In numbers this may not seem much but one should remember that the pH scale is logarithmic (meaning a 25% increase in acidity) so the effect may be profound in many organisms. Calcium is involved in so many physiological/biochemical processes in all organisms that change in its availability or exterior concentration may dramatically influence the function of most organ systems. We are presently in the very beginning of such physiological research. So far mainly adult corals, copepods, sea urchins and some molluscs have been investigated, but often at pH far below what can be expected during the 21 century (e.g. Kurihara et al. 2004). Research on developmental stages of crustaceans, bivalves, and echinoderms are more recent (e.g. Kurihara et al. 2007, Kurihara and Ishimatsu 2008, Dupont and Thorndyke 2008). Especially interesting is the experimental study on the effect of a 0.2 reduction in pH on the early development of a brittle star (Dupont at al. 2008), which shows that it causes very high larval mortality and also abnormal larval skeleton development. Since brittle stars are very common and important species in coastal marine bottom faunas, such effects (if general) could be interpreted to have a profound impact on the ecosystem level. However, in a subsequent study Dupont and Thorndyke (2008) found that another brittle star did not react much to the increased acidity, although survival of larvae was still impaired. They also found in a sea urchin that the development of larvae was slower at the lower pH, but that more of the larvae managed to develop into later stages than in the control. Thus the lower pH could have a positive influence. Also in other experiments they found conflicting results, but the message was clear. Reactions can be species specific and may be influenced by the timing and length of the exposure to low pH. There is a need to study the whole life cycles as well as the effect of pH e.g. on generation time, life-history strategies and adaptation potentials in a number of important species of the ecosystems, before any definite conclusions can be drawn.

Returning to plants and animals with calcified exterior ornaments or exoskeletons, these may be especially affected by pH decrease (e.g. Orr et al. 2005). Coccolithophores are tiny phytoplankton carrying nicely sculptured calcite coverings. When they bloom their calcite covers reflect the sun and the mass effect gives the water a turquoise colour. Experiments have shown that with decreasing pH – corresponding to a tripling of the CO2 concentration in the atmosphere – the calcite covering is reduced to about half. This affects the buoyancy and thus also the grazers feeding on these very abundant phytoplankton. With less density they may not sink all the way to the bottom, and the fauna there then looses an important food source. The reduced reflection will affect the energy taken up by the water and thus help increase the water temperature.

In shallow waters exo- and endoskeletons are most often made up by calcite, while in deep water it is most common with aragonite. The latter is more soluble than calcite which means that animals living deep down run the risk of not being able to form skeletons. Sea urchins living deeper than about 4000m cannot form the typical skeleton of this taxon, so their body shape is kept up by interior water pressure. This is not a function of global climate change but of the effect of high water pressure on calcium carbonate, which then changes into bicarbonate. It illustrates what can happen to shallow living sea urchins, snails, clams and other shell-bearing animals in waters with gradually lowering pH.

Deep living corals (non-hermatypic corals, not depending on symbiotic unicellular algae and solar energy for their energy requirement) have most of the skeleton made up of aragonite, while hermatypic, tropical corals that are living in shallow waters (depending on zooxanthellae and sunlight) have skeletons of calcite. The deeper corals may suffer more from climate and pH change than the shallow-living species. However, it has been shown very clearly that the tropical coral reefs suffer much from temperature increases. It is especially the symbiotic zooxanthellae that suffer from the increased temperature and leave or are expelled from the corals, giving the corals the whitish colour we all have seen (bleaching) – at least on pictures. If the warm period is short the coral may pick up new unicellular algae from the water and can thus survive. However, longer periods of heat cannot be tolerated and the coral then dies, very often after being overgrown by multicellular algae. The resistance to infections by bacteria or viruses has already been discussed.

So far little is known of the effects of acidification on marine ecosystem structure and functioning. Coral reefs are best studied, but too often the causes for change are complex and therefore the role of just pH is difficult to pinpoint.

Hindcasting and Forecasting

Hindcasting is a relatively new term for looking back on historical data and try to understand what happened in the past. A very modern case of hindcasting is to investigate air bubbles enclosed in continental ice where analyses can give direct measures of composition of the air at the time of enclosure. This has been very much used in climate research and records going back some 800 000 years are now available. Other means are found in deep sea sediments where remains of phytoplankton, foraminiferans, mollusc shells and fish scales can be used to appreciate what has been going on in the upper water layers. Especially in areas with laminated sediments a rather precise dating can be made. A third way is to estimate growth rate in coral heads or tree rings in old or fossil tree trunks. Isotope techniques are then available for dating the age. This in combination with data records from present times give a good background, which can be used in evaluating models to see how well these fit into the past events.

Forecasting is obviously more difficult and dependent on the development of numerical models. In the beginning they were very coarse, but with the addition of more and more factors that influences what we want to model, the more robust they become. This is well illustrated by the gradual development of climate models illustrated by Figure 3 from IPCC Third Assessment Report (TAR 2001).

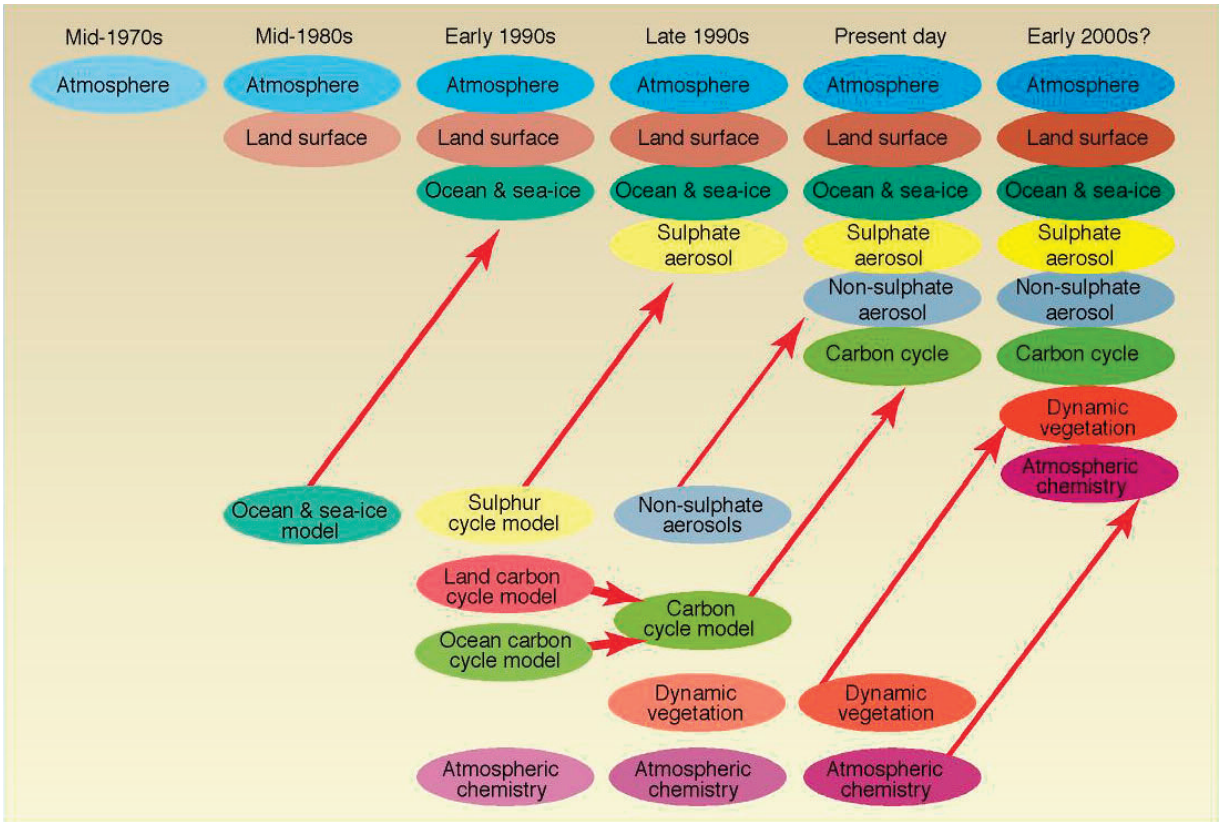


Fig. 3. As more and more factors can be included in the models the more reliable they become, but their robustness need to be tested and hindcasting and testing on available data series must be done. The figure gives an indication of the complexity that is gradually achieved when building the models. Source: Intergovernmental Panel on Climate Change (http://www.ipcc.ch)

There are almost always factors that have not been considered in enough detail, and even major factors might have been missed. This has been illustrated by cases, where many different models have been compared in so-called intercomparison studies. Relatively large differences have been found between current models developed by different groups.

(Meehl G.A. and Stocker T.F. /Lead authors/ 2007. IPCC Fourth Assessment Report, Chapter 10. Global Climate Projections)

Conclusion

The major change in future development, as shown by climate models, all point in the same direction. Global warming is a fact. It is also clear that pre-industrial temperature changes must have been caused by the effect of varying solar radiation, but that presently greenhouse gases constitute a major influencing factor. How this will affect climate on regional and local levels will clearly vary in different parts of the globe. The impact of climate change on marine biota is understood in a general way, but the details are mostly missing. Biological models need to be fine-tuned before they can be applied in climate modelling. Undoubtedly the interaction between the biota and the environmental parameters are of utmost importance to fully understand climate change. The influence of global warming on the human population will in the end be dramatic with necessary changes in almost all our interactions with nature.

Some References and More to Read

• Plankton

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See also SAHFOS web site, http://www.sahfos.org

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http://www.reefbase.org . This site has up to date information about coral reefs status in all tropical waters, an extensive online library, and links to organisations involved in coral research.

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Graphics 2001
http://www.ipcc.ch/graphics/gr climate changes 2001 wg1.htm

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http://www.ipcc.ch/pdf/assessment report/ar4/wg1/ar4 wg1 chapter 10.pdf

Jarl-Ove Strömberg, Prof. Ph.D.
Royal Swedish Academy of Sciences and University of Gothenburg
Address: Kristineberg 566, SE-45034 Fiskebackskil, Sweden. j.stromberg at marecol.gu.se

NOTICES:

Announcements

IJRS Special PORSEC Issues:

Books of the International Journal of Remote Sensing - PORSEC Special Issue are now available:

Books of the International Journal of Remote Sensing - PORSEC Special Issue featuring full papers first presented during PORSEC 2006 in Busan, Korea, are now available. For pre-order information of the 374 pp volume, please see: http://porsec.nwra.com/porsec2006/
There will be a limited number of issues available at PORSEC2008, so make sure that you pre-order a copy.

International Journal of Remote Sensing, PORSEC-2008 Special Issue Submission Instructions:

The International Journal of Remote Sensing (ISRS) is planning a special issue based on papers presented PORSEC 2008. The deadline for paper submission for this issue is December 31, 2008. For submission instructions please see: http://porsec.nwra.com/ijrs-instructions/

News

Remote Sensing of sea-ice and Togo Floods; New AMS Journal:

ENVISAT ASAR animation shows Arctic ice on the verge of another all-time low:

The European Space Agency (ESA) has published an animation that is comprised of Envisat ASAR mosaics of the Arctic and highlights the changes in sea ice between June and mid-August 2008: To watch, please visit: http://www.esa.int/esaEO/SEMCKX0SAKF_index_1.html

Response From RADARSAT To Togo Floods

On August 6, over 10,000 people were affected by the floods in the Lake Togo region. Six people died, roads and railways were impracticable which caused a lack of access to entire communities, isolating the north from the south of the country. In addition, some 400 houses collapsed and the telephone network was also cut in some flooded areas. The United Nations Institute for Training and Research (UNITAR) Operational Satellite Applications Program (UNOSAT) has developed floodwaters maps of the affected areas Togo with information collected with the Canadian satellite RADARSAT-1. To view an example of RADARSAT-1 flood maps, please visit:

http://www.disasterscharter.org/graphics/dis/CALLID_214/bp_UNOSAT_Flood_Assessment_15August2008_highres.jpg

New AMS Journal: Weather, Climate, and Society

A new quarterly journal of the American Meteorological Society, publishes scientific research and analysis on the interactions of weather and climate with society. The journal encompasses economic, policy, institutional, social, behavioral, and international research, including mitigation and adaptation to weather and climate change. Articles may focus on a broad range of topics at the interface of weather and/or climate and society, including the socioeconomic, policy, or technological influences on weather and climate, the socioeconomic or cultural impacts of weather and climate, ethics and equity issues associated with weather, climate, and society, and the historical and cultural contexts of weather, climate, and society. Because of the interdisciplinary subject matter, articles that involve both natural/physical scientists and social scientists are particularly encouraged. Visit: http://www.ametsoc.org/pubs/journals/wcs/index.html

Courses, Workshops, and Conferences

CSDA Summer Colloquium on Data Assimilation

The NASA/NOAA/DoD Joint Center for Satellite Data Assimilation (JCSDA) is pleased to announce a Summer Colloquium on Data Assimilation in 2009 engaging graduate students and individuals with early postdoctoral appointments in the science of data assimilation for the atmosphere, land, and oceans. The program will include lectures by internationally recognized experts in data assimilation and an opportunity for students to interact with the lecturers in an informal setting. The objective of the program is to foster the education of the next generation of data assimilation scientists.
Deadline for application: December 1, 2008
http://www.jcsda.noaa.gov/meetings_2009SummerColloq.php

8th International NCCR Climate Summer School with participation of IGBP-PAGES "Climate variability, forcings, feedbacks and responses: the long-term perspective" 30 August - 4 September 2009 *Grindelwald, Switzerland*

The NCCR Climate, Switzerland's Centre of Excellence in Climate and Climate Impact Research, invites young scientists to join leading climate researchers in a scenic Swiss Alpine setting for keynote lectures, workshops and poster sessions on the occasion of the 8th NCCR Climate Summer School 2009.

The topics covered at the NCCR Climate Summer School 2009 will include:

* climate variability: the long-term perspective

* reconstruction techniques, past climate modelling and data assimilation

* forcings, feedbacks and responses of the climate system

* impacts of climate change: the hydrological cycle

The Summer School invites young researchers from all fields of climate research. The courses cover a broad spectrum of climate and climate impact research issues and foster cross-disciplinary links. Each topic includes keynote plenary lectures and workshops with in-depth discussion in smaller groups. All Summer School participants present a poster of their research and there will be ample opportunity for discussion.

Lecturers for keynotes and workshops (confirmed): International speakers: E. Cook (LDEO, USA); N. Graham (Scripps SIO, USA); G. Hegerl (U Edinburgh, UK); B. Otto-Bliesner (NCAR, USA); Swiss speakers: J. Beer (EAWAG); N. Buchmann (ETH Z¸rich); J. Esper (WSL); J. Luterbacher (U Bern); F. Joos (U Bern); C. Sch‰r (ETH Z¸rich); M. Schwikowski (PSI); T.F. Stocker (U Bern); W. Tinner (U Bern); H. Wanner (U Bern) and others.

The Summer School is open to young researchers (PhD students and Post-Docs) worldwide. Participation is highly competitive and will be limited to a maximum of 70. The registration fee (1'200 CHF) includes half board accommodation, excursion and teaching material. A small number of grants will be available for students from developing countries.

DEADLINE FOR APPLICATIONS: 20 DECEMBER 2008 Successful applicants will be notified in February 2009. On-line information and the application form are available at
http://www.nccrclimate.unibe.ch/summer_school/2009/

Contact:
University of Bern, NCCR Climate Management Centre, Zhringerstrasse 25, CH-3012 Bern, Switzerland, Telephone +41 31 631 31 45, Telefax +41 31 631 43 38
nccr-climate at oeschger.unibe.ch

US CLIVAR Western Boundary Current Workshop 15-17 January 2009 *Phoenix, Arizona, USA*

The overall objective of the Workshop is to seek better understanding of WBC ocean-atmosphere interaction that can improve the decadal and longer timescale predictability of the climate system, and to assess our present knowledge and to explore future directions/opportunities in studies of WBC ocean-atmosphere interaction. The Workshop will feature focused oral sessions with a mix of invited and contributed presentations, thematic poster sessions, and a round-table discussion.

For additional information:
http://www.usclivar.org/WBCWorkshop2009.php

The 3rd Argo Science Workshop: the Future of Argo, 25-27 March, 2009 *Second Institute of Oceanography Hangzhou, China*

Talks and posters are invited on any topic and any region provided that substantial use is made of Argo data. The purpose of the meeting is to assess the general utility of the Argo array and its future direction. ***Deadline for abstract submission is 19 December 2008. Deadline for registration is 23 January 2009.***

Please contact asw3 at ucsd.edu with any questions

http://www.argo.ucsd.edu/ASW3.html

Ocean Observation 2009 Announcement *Venice, Italy, 21 to 25 September 2009*

The World Climate Research Programme (WCRP), the Global Ocean Observing System (GOOS), and the Global Climate Observing System (GCOS) have called for the OceanObs'09 conference, charging the organizers to address the issues raised above and to help lay out a path for sustaining the benefits of ocean information and services in the coming decade. To accomplish those goals, the conference will be different from OceanObs'99.

OceanObs'09 will celebrate the benefits of the existing initial ocean observing system and highlight its potential, developing a consensus plan for sustaining and evolving systematic and routine global ocean observations in the coming decade. Equally important, OceanObs'09 will outline a framework to develop ocean information and service systems over the coming decade, with benefits for the scientific community, and to support sound decisions in other areas of societal benefit including agriculture, adaptation to climate change, hazard warnings, health, and other economic sectors. The conference will define the observing system required for the development of these information and service systems.

The conference will be structured around three pillars of community input. The core input solicited are Community White Papers on various elements of the observing in situ or satellite observing system, data system, and services. These are asked to be group contributions, refreshing existing plans in light of new information and technology, or describing contributions to the sustained global ocean observing system from new communities with a plan for a globally-deployed network, infrastructure, or service.

Additional Contributions, which describe new developments in observing hardware, or regional observing efforts, infrastructures or services that contribute to the global system, are also invited, with first drafts due in March 2009. These will be presented as posters at the conference.

During the conference itself, plenary talks will be given by invited lead authors representing community consensus on key topics as laid out in integrating Plenary Papers which draw on the Community White Papers and Additional Contributions. These plenary presentations will follow the hemes in the agenda of the conference.

For more information please visit:

http://www.oceanobs09.net/

Position Announcements

Dean, College of Geosciences of Texas A&M

The College of Geosciences of Texas A&M is seeking an exceptional individual as Dean. The holder of this position is the chief executive officer of the College with 110 tenured and tenure-track faculty members, 16 research scientists, 265 graduate students, 489 undergraduate students, and a total research and teaching budget of $84 million. The College of Geosciences seeks to provide an understanding of our changing planet: the solid earth, the oceans, the atmosphere; coupled human and natural systems; and the application of state-of-the science research to energy, environment and climate change. The College includes the Departments of Atmospheric Sciences, Geology and Geophysics, Geography, and Oceanography and a variety of research units including the Integrated Ocean Drilling Program, the Sea Grant College Program, and the Geochemical and Environmental Research Group. Close collaborations, through programs such as the Center for Atmospheric Chemistry and the Environment and to Sustainable Coastal Margins Program, exist with other colleges across the campus.

Texas A&M is seeking distinguished, proactive, and visionary candidates with • Dedication to the goals of the College of Geosciences and commitment to energizing and enhancing the activities of the College within and outside the university;

• Distinguished record of accomplishment in academia, industry, or government appropriate for a tenured full Professor in one of the Departments of the College;
• Proven and distinguished record of administrative service;

• Demonstrated ability to recruit, retain, and develop outstanding faculty, staff, and students;
• Clear and demonstrated commitment to excellence in research, undergraduate and graduate education, and active engagement with our federal, state, industry and community partners;
• Commitment to diversity, equal opportunity, and global perspectives;
• Commitment to leadership in fund-raising and obtaining enhanced external support.

The Search Advisory Committee will begin to review applications on November 15, 2008. The review will continue until the position is filled. Applicants should submit a letter of application, 1-2 page narrative summary of experience and administrative philosophy, curriculum vitae and the names and telephone numbers of at least three references. (References will be contacted only after permission is obtained from the candidate.) Applicants should also provide a preferred telephone number and mailing and e-mail addresses.

Please send applications and nominations to:

Dr. H. Joseph Newton, Chair
Dean of Geosciences Search Advisory Committee Texas A&M University
College of Science
3257 TAMU
College Station, TX 77843-3257
Phone: (979) 845-8817
Fax: (979) 845-6077
e-mail: jnewton at tamu.edu

Texas A&M University is an Equal Opportunity and Affirmative Action Employer. The University is dedicated to the goal of building a culturally diverse and pluralistic faculty and staff committed to teaching and working in a multicultural environment. We strongly encourage applications from women, underrepresented ethnic groups, and individuals with disabilities.

Find more information about this position at http://geosciences.tamu.edu

MIT Postdoctoral Scientist in Atmospheric Climate Modeling

The MIT Joint Program on the Science and Policy of Global Change has an immediate opening for a postdoctoral scientist to study the impacts of climate change. The successful applicant will join an effort to use 3D atmospheric and coupled climate models to study climate change impacts, which will include, but are not limited to, the effects on atmospheric chemistry, ecosystems, water resources, and human health. This will be a major component of the MIT Integrated Global System Model and used to explore uncertainty in climate predictions and policies.

Requirements: A Ph.D. in atmospheric sciences is required. Experience with atmospheric general circulation models is strongly preferred, particularly CAM and/or CCSM. Familiarity with a parallel computing environment and climate models is desirable. Salary is negotiable. Proposed start date is as soon as possible. The initial appointment is for two years with a possible extension of up to two additional years depending on performance and availability of funding.

To apply, please send a curriculum vitae, a letter of interest with the names of three references to:

C. Adam Schlosser
Assistant Director of Research
Joint Program on the Science and Policy of Global Change
Massachusetts Institute of Technology
Building E40-413
1 Amherst St.
Cambridge, MA 02139-4307
email: casch at mit.edu
Phone: +1-617-253-3983
Fax: +1-617-253-9845

More information on the Joint Program can be found at: http://mit.edu/globalchange/

University of California Irvine, Postdoctoral Position in Tropical Atmospheric Dynamics

The Department of Earth System Science at the University of California, Irvine (UCI) seeks a postdoctoral research associate to work on innovative research in tropical atmospheric dynamics, with close collaboration with groups in both the Computer Science Department and the Statistics Department at UCI. The successful candidate will work on statistical modeling of the dynamic Intertropical Convergence Zone (ITCZ) using satellite observations as well as assimilated data. Additionally, a newly developed Bayesian tracker (which also "tracks" intensity) will be used to characterize tropical variability including genesis/lysis and mergers of vortex structures. The research will focus on relating ITCZ activity and intensity of disturbances to the atmosphere/upper ocean background state.

Scientists with a strong background in tropical meteorology, large-scale atmospheric dynamics and possessing excellent computational and statistical skills are encouraged to apply. Candidates must have a strong programming background (in Matlab for example). A PhD in atmospheric or related sciences is required. The initial appointment

is for one year. Salary is commensurate with experience.

Please send a CV with the names of three references to:
Prof. Gudrun Magnusdottir´
Dept. of Earth System Science
University of California, Irvine
Irvine, CA 92697-3100 or by email to: gudrun at uci.edu.

The University of California, Irvine is an equal opportunity employer committed to excellence through diversity.

Research Director for G.C. Rieber Climate Institute at Nansen Environmental and Remote Sensing Center Bergen, Norway

Vision The Nansen Center's vision is to make a significant contribution to the understanding, monitoring and forecasting of the world's environment and climate on local, regional and global scales.

Main research areas are:

• Climate understanding – its variability and change
• Global ocean studies and ocean forecasting
• Development and use of satellite based methods for marine studies
• Satellite monitoring of global environment and climate
• Wind energy mapping in coastal areas
• Socioeconomic impact of global change

Organization The Nansen Center is an independent nonprofit research foundation affiliated with the University of Bergen, Norway. The Nansen Center conducts basic and applied research funded by research councils, space agencies, national and international governmental agencies, industry and private donations.

The Nansen Center is organized in three groups, the Mohn-Sverdrup Center for Global Ocean Studies and Operational Oceanography, The Polar and Environmental Group and the G.C. Rieber Climate Institute. The total staff is 70 including 10 scientists in adjunct positions. The G.C. Rieber Climate Institute has a scientific staff of 15 including 5 PhD students. The main activity of the G.C. Rieber Climate Institute is devoted to the variability and the dynamic properties of the North Atlantic and Arctic climate system and teleconnection between high and low latitudes. The institute is a main contributor to the development and operation of the

Bergen Climate Model (BCM), and the construction of the new Norwegian Earth System Model (NorESM).

The Nansen Center is a major partner in the Bjerknes cooperation in Climate Research established in Bergen between the University of Bergen, the Institute of Marine Research and the Nansen Center (www.bjerknes.uib.no; http://www.bjerknes.uib.no/filer/912.pdf) The Nansen Center is also a partner in the Nansen Centers in St.Petersburg, Russia (www.niersc.spb.ru; www.nersc.no/main/about/annual_reports/NIERSC-2007.pdf) in Cochin, India (www.nersc.no/main/about/annual_reports/NERCI-2007.pdf) and in Beijing, China (http://nzc.iap.ac.cn; http://www.nersc.no/main/about/annual_reports/NZC_2007.pdf).

The position as Research Director of the G.C. Rieber Climate Institute is vacant. The Nansen Center is seeking a senior climate scientist of international standing to lead the group. Candidates must also have proven management experience and fund raising capacity.

Applications will be reviewed from December 1, 2008.

Application with CV and publications list should be sent by e-mail to the Founding Director of Nansen Center, Prof. Ola M. Johannessen (ola.johannessen at nersc.no)

Tenure-Track Faculty Position in Earth System Science

The Geology Program in the College of Science and Technology, Texas A&M University-Corpus Christi, invites applications for a tenure-track faculty position at the Assistant Professor level in Earth System Science with a starting date of September 2009, pending available funding. We are looking for a broadly trained Earth System Scientist, who uses the geologic record to investigate coastal, oceanic, watershed, or atmospheric processes of ancient and/or modern systems. Applications are especially encouraged from individuals whose research interests include, but are not limited to global change/paleoclimatology, sedimentology, low-temperature geochemistry, and/or paleoceanography. We are looking for energetic candidates to pioneer new research directions on our growing campus. They should be able to engage in interdisciplinary research involving our existing programs and build on current research strengths in the Department of Physical and Environmental Sciences. The successful candidate will be expected to develop a vigorous, externally funded research program and be able to teach undergraduate and graduate courses in geology as well as other courses supporting interdisciplinary degree programs in Environmental Science (M.S.) and Coastal and Marine System sScience (Ph.D.). The position will be rooted in the Geology program, which offers the B.S. degree, and the successful candidate will have the opportunity to supervise graduate students in the Environmental Science and Coastal and Marine System Science programs. For further information about the department and individual degree programs see http://pens.tamucc.edu.

A Ph.D. is required at the time of appointment and some post-doctoral experience is desirable. Texas A&M University-Corpus Christi is a doctoral Hispanic Serving Institution located on the Gulf of Mexico with a modern campus overlooking Corpus Christi Bay. With over 9,100 students, the university offers a wide array of academic programs with 18% of the students enrolled in graduate programs. Applications must include a cover letter, statement of research and teaching interests, a curriculum vita, and the names and phone numbers of four or more references. Materials should be sent to:

Mr. Ken Brown
College of Science and Technology
Texas A&M University-Corpus Christi
6300 Ocean Drive, Unit 5806
Corpus Christi, Texas 78412-5806

or sent as a formatted e-mail attachment to kenneth.brown at tamucc.edu. ***The position will remain open until filled but preference will be given to applicants submitting all requested documentation by November 21, 2008.*** Texas A&M University-Corpus Christi is an Affirmative Action/Equal Employment Opportunity employer committed to excellence (http://www.tamucc.edu/~hrweb/).

Boston University Faculty Positions in Terrestrial Carbon & Water Cycle Science

Boston University invites applications for two tenure track assistant professorships in terrestrial carbon and water cycle science, with a Fall 2009 start date. These positions will enhance crosscutting research and teaching in terrestrial biogeosciences in the departments of Earth Sciences, Geography and Environment, and Biology.

Position (i): ***Carbon Cycle Science***. This appointment will be made in the Department of Geography and Environment (www.bu.edu/geography). We seek a scholar with research and teaching interests in the terrestrial carbon cycle and its role in the global climate system. Specific potential research foci include, but are not limited to, measurement and/or modeling of land-atmosphere carbon fluxes, studies of coupled water and carbon dynamics in terrestrial ecosystems, the impact of humans on regional to global carbon budgets, linkages between terrestrial carbon and nitrogen cycles, and the use of remote sensing for carbon cycle science.

Position (ii): ***Terrestrial Hydrology***. This appointment will be made in the department of Earth Sciences (www.bu.edu/es). We seek a scholar with research and teaching interests in the terrestrial water cycle and its role in the global climate system. We welcome a wide range of approaches including experimental soil physics, geophysical and geochemical field experiments and monitoring, remote sensing, and modeling.

Candidates should have a commitment to teaching and research, and a desire to work in an interdisciplinary setting. Applicants should submit a CV, a statement of teaching and research interests, and contact information for at least three referees. Address Carbon Cycle Science applications to Mark Friedl, Department of Geography and Environment, Boston University, 675 Commonwealth Ave, Boston, MA, 02215-1401. Address Terrestrial Hydrology applications to Guido Salvucci, Department of Earth Sciences, Boston University, 675 Commonwealth Ave, Boston, MA, 02215-1401. Electronic submissions are welcome and should be sent to ge at bu.edu with the subject "Terrestrial Carbon Position" and to earth at bu.edu with the subject "Terrestrial Hydrology Position". ***Review of applications will begin on December 15, 2008 and will continue until the positions are filled.*** Boston University is an Equal Opportunity/Affirmative Action Employer.

Tenure-Track Faculty Positions

The College of Marine Science at the University of South Florida (USF) invites applications for two tenure-track, nine-month academic faculty positions. Appointments are expected to be at the Associate Professor or Professor rank. Salaries are negotiable and competitive.

Minimum Requirements: Must have a PhD in a relevant scientific discipline. For the Associate Professor rank, must have an outstanding record in research, including a substantive publication record, evidence of success in attracting extramural research funding and a strong record in graduate education as evidenced by successful direction of master's and doctoral candidates. For the Professor rank, must also have evidence of service on high profile national and international panels and committees, established record of productive research/creative work of at least national visibility, high productivity in research/creative work throughout the individual's career, substantive contributions in the area of service, and significant recognition by peers at the national or international level.

Fish Ecologist Position # 4061

We seek a candidate with experience in establishing quantitative relationships between fish populations and ecosystem dynamics linked to natural and anthropogenic factors.

Preferred qualifications: Demonstration of a comprehensive investigative approach that considers ecosystem interactions with all life stages and trophodynamics. Broad taxonomic expertise, strong data analysis skills, and an immediate capacity to establish an interdisciplinary research program that focuses on developing theoretical and field-based tools for ecosystem-based management. Use of diverse and novel research tools as well as emphasis on the Gulf of Mexico and Southeastern US waters.

Oceanographer Specializing in Satellite-Remote Sensing Position # 2909

We seek a candidate with experience in applying satellite remote sensing to problems of Earth systems science.

Preferred qualifications: Combines the tools of satellite remote sensing with other quantitative techniques for describing the state of the ocean and the interactions between the oceans and the atmosphere and land. Integrates satellite remote sensing with other large scale data sets to understand processes of multidisciplinary importance. Emphasis on either regional or global oceanography.

Contact: Applicants should specify the position number(s) for which they are applying and submit a curriculum vitae, statement of research and teaching interests, and the names, addresses (including email) and phone numbers of three references. All required information should be submitted to Desiree Woroner, Search Committee Designee, College of Marine Science, University of South Florida, 140 Seventh Avenue South, St. Petersburg, Florida 33701. Full consideration will be given to complete applications received by November 14, 2008. However, applications will be accepted until positions are filled.

The University of South Florida's College of Marine Science is a multidisciplinary college with 23 core faculty, a Center for Ocean Technology, a large research staff and over 120 graduate students in the fields of biological, chemical, geological, and physical oceanography. The candidate will be expected to interact with the faculty, staff, and students of the College, USF at large, as well as other relevant local, regional, national, and international organizations. Additional information about the College is available at the website: http://www.marine.usf.edu.

The University of South Florida is among the nation's top 63 public research universities, is one of 39 community engaged public universities as designated by the Carnegie Foundation for the Advancement of Teaching, and placed among the nation's top 20 "up and coming universities" in the 2009 U.S. News & World Report annual college rankings. USF is one of Florida's top three research universities. The University was awarded $366 million in research contracts and grants last year. The university offers 219 degree programs at the undergraduate, graduate, specialist and doctoral levels, including the MD degree. The university has a $1.8 billion annual budget, an annual economic impact of $3.2 billion, and serves more than 45,000 students on campuses in Tampa, St. Petersburg, Sarasota-Manatee and Lakeland. USF is a member of the Big East Athletic Conference.

The University of South Florida is an Equal Opportunity/Affirmative Action/Equal Access Institution. For disability accommodations, please call 727-553-1632. According to Florida law, applications, and meetings regarding them, are open to the public.

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PORSEC 2008, December 3-6,

---- where we will learn together about the ----

Latest in
International Remote Sensing of the Oceans.

http://ledweb.scsio.ac.cn/porsec2008/3nd%20Announcement.asp

Please update your information in the PORSEC Database.

http://porsec.nwra.com/membershipform.php

PORSEC Database

For our database of the PORSEC Association members we would like you to enter your information directly into our web membership form, if you haven't already done so: http://porsec.nwra.com/membershipform.php

Please fill this form even if you have already given the information to us in any other format since we may not have all that information down correctly. **Please use this form to update your information whenever you have any changes.** It can also be used to pay your membership fee.

This form is also accessible through our main page (http://porsec.nwra.com) by clicking on "Join the PORSEC Association".

Please work on getting us more members; use the PORSEC home page and the above links for information. The prospective member provides us with the same information through the form. We will bill the person for the membership fee, which can now be paid via "Pay Pal" on the Internet.

Information

For information about the association and links to Newsletters from the president and Bulletin issues go to: http://porsec.nwra.com/. To join the PORSEC Association go to membership on the web site or contact one of us directly. The Bulletin of the PORSEC Association is edited by Gad Levy and Kristina B. Katsaros. Production Editor Susanne Öhrvik. ***We welcome contributions about your work and about any activities of our PORSEC members that may be of interest to other members for future issues of the Bulletin.*** To submit articles for this Bulletin of the PORSEC Association, please contact gad at porsec.nwra.com or katsaros at porsec.nwra.com.