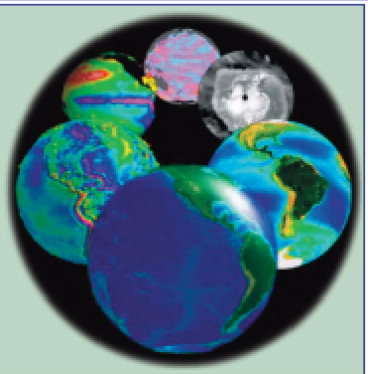
BULLETIN
of the
PORSEC
Association



Volume 2.2 July 2008

Letter from the editor

Dear Members of the PORSEC Association,

As I write, there are 5 months left until many of us will meet in Guangzhou, China. It is really something to look forward to. The Local Organizing Committee has made great plans for this conference. I hope you have all read the 3rd announcement on the web-page. We have quite a complete program under the theme Oceanographic Manifestation of and Global Changes. A recap of the Conference Status is found under its own heading later in the Bulletin.

The scientific articles in this issue of the Bull PA are written by Dr. H. Shimoda of the Japan Aeronautics and Exploration Agency, JAXA, and Dr. Jarl-Ove Strömberg, the former director of Kristineberg Marine Research Station in Sweden (in 2008 it became part of Sven Lovén Centre for Marine Sciences within Göteborg University). Dr.Shimoda describes the next series of satellites in the Global Change Observation Missions (GCOM). In this issue, Dr. Strömberg, reviews the processes of climate change in a somewhat popular manner. He has many years experience in international oceanographic affairs and is a life-long observer of the ocean and its changes due to natural causes and human activities. Many of the graphs are based on the recent International Panel of Climate Change, IPCC. report. This is Part I; Part II will appear in Vol 2(3) in November this year. The current article describes the well documented and rather dramatic effects of the warming in the North Atlantic on plankton presence and the herring fishery. Both parts of this review may evoke some discussion and commentary, which would be relevant to our conference topics. Feel free to submit any written comments for publication in future Bulletin issues. The two articles in this issue and Part II in the next issue should inspire us to work hard in our own communities to inform people everywhere that we are affecting our world in dramatic ways and we must alter our behavior collectively and individually, if we want to have the world we are used to. Such behavior changes will include better managing the Earth's population and natural resources—bringing both to a sustainable level, but that is not a discussion that the remote sensing community can lead.

Our role as natural scientists carries a great responsibility, because we must present the FACTS as we know them in well defined terms with the appropriate uncertainties also revealed, in order to retain credibility. However, we can not "sit-on-our hands" and wait for a final result with all uncertainty removed. We must bring forth the changes and threats that we perceive. My own objective with the session WS2: Satellite Sensor Data for Climate and International –Cooperation is to focus on sampling, consistency, archiving and distribution; and to stimulate communication and cooperation

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JAXA's New Earth Observation Program: Global Change Observation Missions (GCOM)

Haruhisa Shimoda

In the late 20th century, it had been pointed out that changes of the global environment could alter the living environment for human beings. Such global environmental changes include, but are not limited to, climate warming, sea level rise, decrease of tropical forests, desertification, destruction of the ozone layer, acid rain, and the decrease of bio-diversity. What makes recent global changes different from natural fluctuations is that many of them are taking place due to anthropogenic causes. Although these changes are not yet directly affecting the life of humankind, there is a possibility that they will have major impacts in the latter half of 21st century.

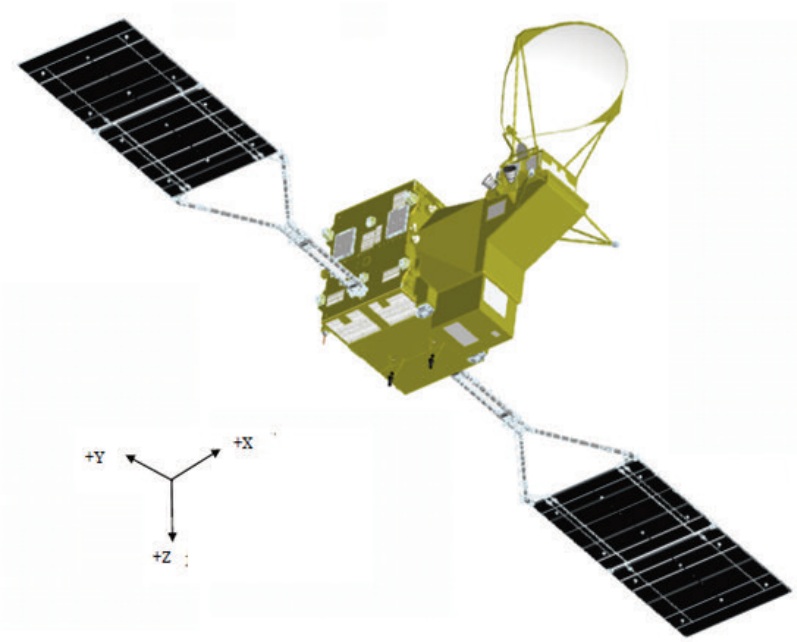
For the protection and survival of humankind's future generations, it is essential to predict the future courses of these global changes, so that efforts can be made to mitigate their adverse impacts. It must be said, however, that the prediction of global changes is extremely difficult. In the case of global warming caused by increases of atmospheric greenhouse gases like CO2, while most scientists agree with the general concept, there is no commonly agreed quantitative prediction of how and when this phenomenon and its consequences will manifest themselves.

The reasons for this lack of a common prediction lie with the extreme diversity of the factors determining the global climate and the complicated interaction of these factors on which much scientific knowledge is still to be gathered and established. Any adequate understanding of global changes must be based on an approach that regards the earth as a single system within which various global geophysical parameters, the processes affecting each parameter, and the interaction between the parameters are understood. The establishment of various global geophysical parameters using conventional observations and measurement methods based primarily on field campaigns, however, was found to be extremely difficult, if not impossible. Satellite observations are therefore essential for any attempt to solve global environmental problems.

Global environmental changes are not only due to anthropogenic causes but are also due to natural fluctuations. Long-term observations covering the period of natural fluctuations are essential in order to distinguish the natural fluctuations components from anthropogenic ones. It is against this background that the JAXA (Japan Aerospace Exploration Agency) has launched the ADEOS-II in 2002, following on the launch of the ADEOS in 1996. However, after about 10 months operation, ADEOS-II had lost most of its power due to the solar paddle failure. As a follow on of the ADEOS-II mission, JAXA is now planning the Global Change Observation Mission, GCOM, mission, which is composed of a series of satellites. Those are now tentatively called the GCOM-W and GCOM-C satellites. Both satellites series are composed of 3 satellites with a 5-year lifetime each. Hence, 13 years of continuous observation with 1 year overlaps can be assured. The orbit of GCOM-W will be similar to that of EOS-Aqua, while the orbit of GCOM-C will be similar to that of ADEOS-II. The first satellite of GCOM-W (GCOM-W1) will be launched in 2011, while the first one of GCOM-C (GCOM-C1) will be launched in 2013.

GCOM-W1 will carry AMSR-2 (Advanced Microwave Scanning Radiometer-2). AMSR-2 is a conical scanning microwave radiometer with 2 m (TBR) aperture parabolic antenna. The incidence angle is 55° and the swath width is more than 1,420 km (TBR) for 700 km altitude orbit. The AMSR-2 will be the follow on of the AMSR on board the ADEOS-II and will aim at measuring the same geophysical parameters, such as total water vapor, total cloud liquid water, precipitation, sea surface temperature, sea surface wind speed, sea ice concentration, snow amount, and soil moisture.

There are several improvements from AMSR and AMSR-E. The first one is the improvement of the hot load.. As is well known, the hot loads on board AMSR and AMSR-E had a large temperature gradient. This gradient was mainly caused by the low thermal conductivity of the hot load material and also the reflection from the surroundings by Multi Layer Insulation (MLI) over the hot load. To avoid this phenomenon, JAXA is now examining the addition of a temperature-controlled reflector over the hot load. Another problem of AMSR and AMSR-E was electromagnetic interference from the ground to C-band data. JAXA is now considering adding a 7.3 GHz experimental band to AMSR-2. This frequency is mostly free from interference based on the preliminary study over Japan and the US.



GCOM-C1 will carry the Second Generation Global Imager (SGLI). The SGLI sensor will be a multi-purpose visual infrared imager and an advanced version of the GLI. It will consist of 11-channels in the visible and near infrared push broom scanner: 2-visible channels in 3 directions as push broom scanner, and a 5 channel shortwave and thermal infrared optical mechanical scanner. It will be capable of measuring ocean color, land cover and vegetation, snow and ice, clouds, aerosols, water vapor, etc. The differences from GLI are as follows:. a) The main of objective of SGLI is to retrieve global aerosol distributions. In order to achieve this target, SGLI will have 2 polarization channels with 3 directions, b) SGLI is mainly focused onto land and coastal areas. There are 11 250 m IFOV channels compared to 6 250m channels in GLI. c) The Visible and Near-Infrared (VNR) component of SGLI is a push broom scanner.

GCOM Satellite

The GCOM aims at continuing and improving the observations obtained by the ADEOS and ADEOS-II with a view to accumulating the scientific knowledge necessary to elucidate global environmental problems. In regard to global warming, the GCOM is intended to measure most of the factors involved in the energy and water cycle and chemical cycles, which are the main mechanisms determining climate change, and also to allow analysis of the relevant processes. The measurable geophysical parameters that are directly related to the energy and water cycles are temperature, water vapor, precipitation, clouds, aerosols, albedo, heat radiation from the atmosphere and estimated air-sea energy flux. Within the chemical cycles, measurement of the carbon cycle is a key subject. In this particular field, the GCOM aims at estimating the primary production as well as carbon flux based on measurement data on land vegetation and phytoplankton. In regard to changes of the land environment, the measuring objectives include the tropical forests and the global distribution of vegetation and its changes. In regard to the cryosphere, the sea ice concentration and snow coverage are measured so that their interaction with the other climate determinants is analyzed.

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Dear Members...Continued from page 1.

at least within the remote sensing community. Prof. Shimoda's article and his talk in the Special Session on Space Agencies at our conference gives us an idea of what the satellite remote sensing community can do in the 21st century to monitor the changes taking place. The JAXA plan is in "sync" with plans at many other space agencies, which we will also hear about in Guangzhou.

I encourage you to register very soon (before August 15, when the price increases) and prepare for your VISA application and travel. Looking forward to seeing you and our stimulating discussions.

Members of the Scientific Organizing Committee, SOC, should plan to arrive so they can participate in the SOC meeting in the afternoon on December 2 (details to come separately). It is an important occasion for the governance of the PORSEC Association. Ideas for inclusion in the agenda are most welcome. It is an open meeting so observers (non-SOC members) are certainly welcome. We expect to rotate-in new folks into the membership of the SOC, as some retire from its ranks, so "training " by observation is a practical preparation.

Greeting in the spirit of PORSEC!
Kristina Katsaros, President of PORSEC Association

Climate Change and Effects on the Ocean and its Biota

Jarl-Ove Strömberg, Prof. Ph.D.

Part 1: Physical and chemical changes as background for understanding biological variability and changes.

This is the first part of two trying to give as correct an evaluation as possible 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.

A second part will deal 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.

Possible causes for climate change

1. Solar radiation

The climate is never in a steady state. It is always changing with varying frequencies. Some changes are cyclic, and some represent a steady trend towards a different system, which may or may not be reversible on a time scale from centuries to several millennia. The opposite are the short term changes over days or a few weeks, which we call weather.

Obviously the ultimate forcing factor for changing weather or climate is the sun. Various regions of the earth reflect or absorb solar energy differently and the resulting temperature differences tend to be equalized in the open atmosphere through winds from high to low pressures and in the ocean through the current systems.

The energy reaching the earth is also changing depending on the rotation of the earth itself (day and night) and the orbit around the sun (seasons during a year). A changing orientation of the earth's axis is of major importance as is a certain wobbling - a change in the relative direction of the axis.

During the last million years the earth has experienced ice ages about every 100 000 years. This seems to fit best with the time for change from a circular to an elliptic orbit around the sun. At present the northern hemisphere is closest to the sun during northern hemisphere summer which becomes warmer than average, but it is farthest from the sun during northern hemisphere winter which means it is then cooler than average. A change of the angle of the Earth's axis in relation to the orbit plane has a period of about 41 000 years going from 22.1 to 24.4 degrees. Now the angle is 23.5 degrees. A big angle means warm summers and cool winters in the north. A small angle results in the opposite effect. The wobbling has a period of 21-23 000 years. In about 10 000 years the North Pole will be closest to the sun and thus relatively warmer because of this and with cooler winters.

These so called Milankowić cycles make it possible to calculate changes of solar influence in the past as well as in the future. The co-occurrence in the north of extreme elliptic orbit, small axis degree and summer occurring when the Earth is farthest away from the sun would create the most favourable conditions for the start of an ice age. This also means that events must not necessarily be synchronous at the two poles.

Changes in solar energy on shorter timescales have been much discussed in relation to global warming. Before the industrial revolution (late 1800s) but still within historical perspectives it is clear that the northern hemisphere experienced both a warm period in medieval time (e.g. when Greenland was colonized from Scandinavia) and a cold one during the 17th century. There is little else than changes in the sun's radiation that can account for these temperature differences. Sunspot activity is a factor that has been observed during centuries and historical records from the 17th century indicate that it was then abnormally low.

The eleven year cycle, with which we are so familiar, is rather steady but the peak of sunspot activity can vary in intensity and thus influence our climate and warm it when intensity is high and cool it when it is low.

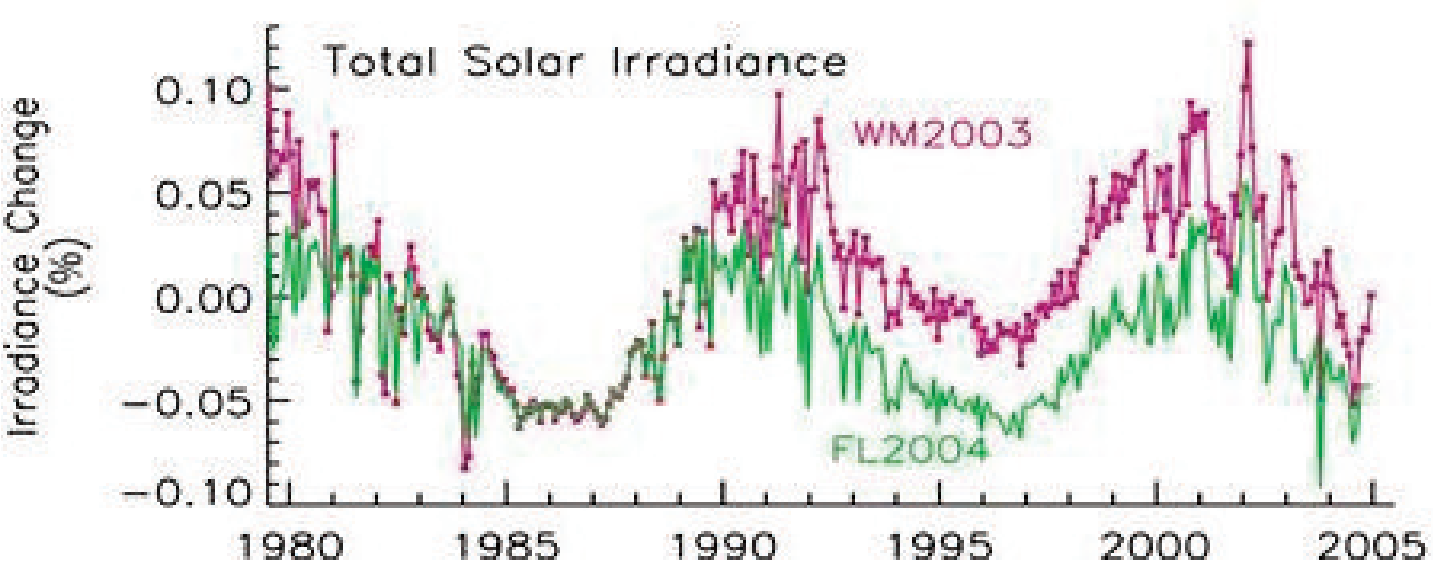

Figure 1 *Percentage change in monthly values of the total solar irradiance composites of Willson and Mordvinov (2003; WM2003, violet symbols and line) and Fröhlich and Lean (2004; FL2004, green solid line). (IPCC, AR4, WG1, Chapter 2, 2007)Reliable measurements of solar irradiation are only available from the late 1970s, and during the period up till the present time (2008) the increased radiation change has been so small, that this cannot be accounted for as a major factor for the global warming we are now experiencing. However, many scientists believe that up till the mid 1900s, high solar radiation played a more important role for the temperature development.*

2. Reflection and retention of solar energy

Albedo (reflecting light/energy) is very different depending on the surface of the globe the sunlight is hitting. Water is a poor reflector if light is coming at almost vertical incidence (3%). This can only occur between the tropical circles (Cancer and Capricorn), and to the north and south of them reflection increases with lowering incidence angles. Naked earth and forests (5-15%), grassland (15-20%), sea ice (30-40%), thin clouds (35-50%) and thick clouds or new snow (70-95%) are other examples of highly different Earth surface albedo. Changes in land use, natural changes in vegetation, cloudiness or varying sea ice extent (in polar seas) mean major changes in reflected energy.

Changes in atmospheric concentrations of aerosols (type and colour, incl. clouds) and greenhouse gases (esp. CO2, CH4, N2O and various halocarbons) have a major effect on the heat budget of the global system. There is an increasing number of ocean and atmospheric scientists claiming that humidity and clouds contribute most to the present global warming, but that the greenhouse gases certainly are contributing. The IPCC, the Intergovernmental Panel on Climate Change (WMO and UNEP), is very clear in its judgement that greenhouse gases, and especially CO2, are the major forcing factors, but with humidity and clouds also having a large role in the warming (and cooling) process. There seems to be an almost total agreement among scientists that during the last 25-30 years these factors are the major players for the global warming.

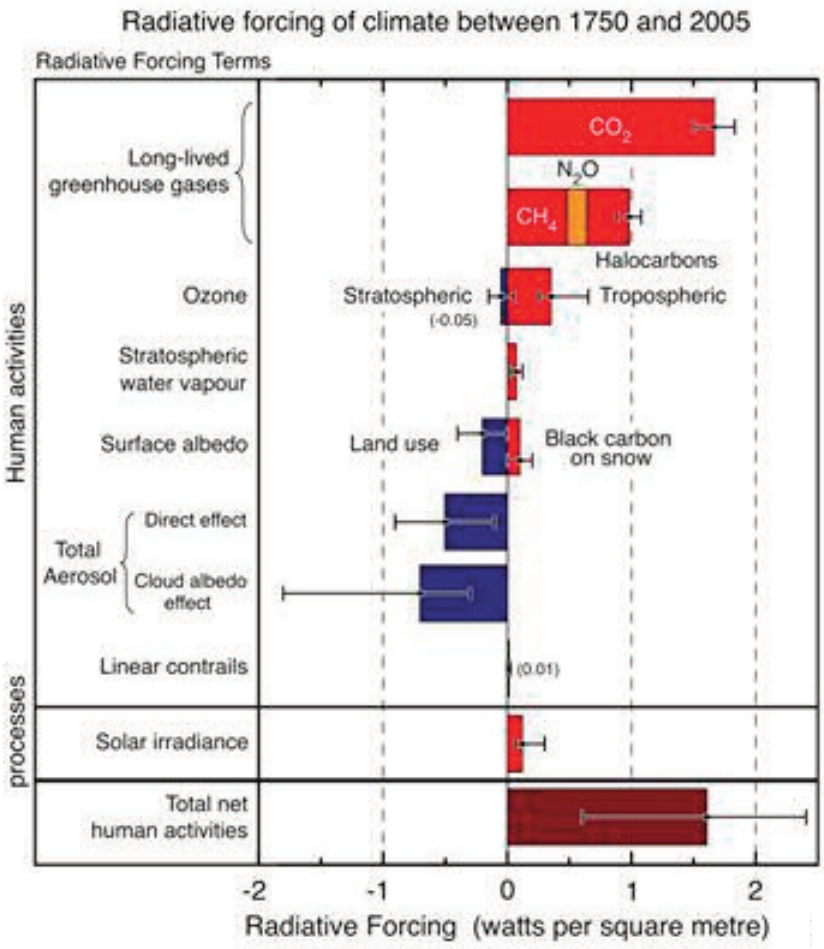

Figure 2. *Summary of the principal components of the radiative forcing of climate change. All tFhese radiative forcings result from one or more factors that affect climate and are associated with human activities or natural processes as discussed in the IPCC text. The values represent the forcings in 2005 relative to the start of the industrial era (about 1750). Human activities cause significant changes in long-lived gases, ozone, water vapour, surface albedo, aerosols and contrails. The only increase in natural forcing of any significance between 1750 and 2005 occurred in solar irradiance. Positive forcings lead to warming of climate and negative forcings lead to a cooling. The thin black line attached to each coloured bar represents the range of uncertainty for the respective value.(IPCC, AR4, WG1, Chapter 2, 2007)*

The role of aerosols must not be neglected, which has been clearly demonstrated during major volcanic eruptions, when particles thrown all the way up in the stratosphere have had a temporary shielding effect and lowered the temperature on the ground. It has also been shown that air from the Indian mainland, which carries dust and particles from agricultural and industrial activities (or sandstorms) cause a reduced air temperature on the Maldives Islands, as compared to the situation when clear Antarctic air reaches north to these islands allowing more of the sunlight to reach the ground and warm it. There are many more examples of such shielding but often short-lived effects, e.g. the lack of condensation trails (contrails) from airplanes above Los Angeles a few days after 11 September 2001, when no air traffic was allowed and the clear sky gave a little higher temperature on the ground during daytime. However, contrails on average have a small but positive radiative forcing (cooling) effect (Stuber et al. 2006).

Climate variability

Examples of climate variability are the cyclic phenomena:

1. In the North Atlantic we have NAO (North Atlantic Oscillation), which is a change in the winter weather pattern depending on the air pressure gradient between the Icelandic low and the Azores subtropical high. When the difference is large the NAO is said to be positive with wet, south-westerly winds dominating over NW Europe, and with a dry and cool Mediterranean area. On the North American side Eastern Canada and Greenland experience cold and dry winters. With a weak pressure gradient the negative NAO leads to a wet Mediterranean and a dry and cool NW Europe with mainly northerly winds. The east coast of the U.S. gets cold outbreaks, often with snowy conditions. The different phases may last between a few and 20 or more years. At present (2008) the NAO is in a long-lasting positive phase. The NAO has an influence also on the weather in the Atlantic sector of the Arctic and the so called Arctic Oscillation (AO).

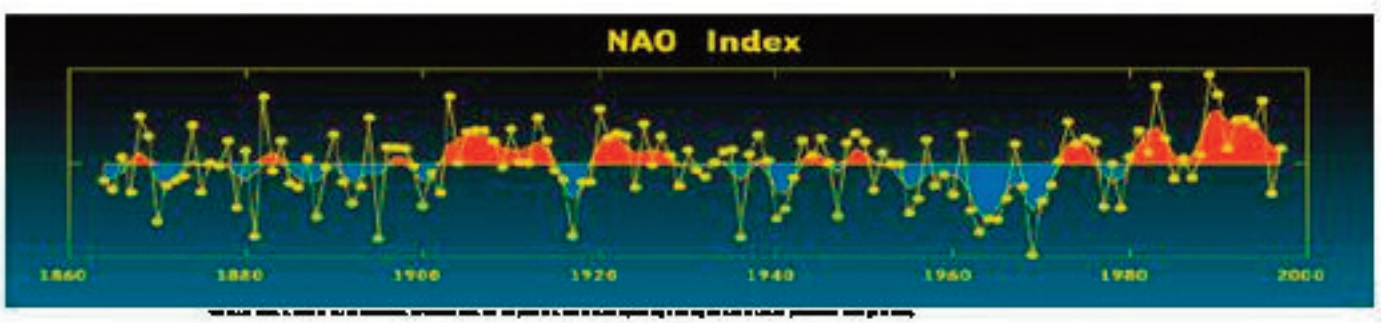

Figure 3. *Variaition in NAO index with time from about 1860 to late 1990-ies. Red indicates positive NAO and blue negative NAO index.(Permission by Dr. Martin Visbeck; for more information see: http://ldeo.columbia.edu/NAO)*

2. Another cyclic phenomenon, having a periodicity of a few years (2-5) is the ENSO event(El Niño-Southern Oscillation) in the equatorial Pacific Ocean.

During the normally dominating situation (La Niña) the strong trade winds push water from the eastern to the western Pacific. The water outside Ecuador, Peru and Chile is cold because of the northward running Humboldt current and because of the upwelling of deep water along this coast. The air sinking down the western slopes of the Andes warms up and becomes very dry. Any rain will fall in the cold ocean, while the warm coastal land areas are dry and in Peru and northern Chile dominated by deserts.

The water level is about 0.7m lower on the east side than on the western (Indonesian) side, and the thermocline of the deep water is 150 m shallower outside South America than to the west. Indonesia then has warm and rainy weather. (Fig. 4)

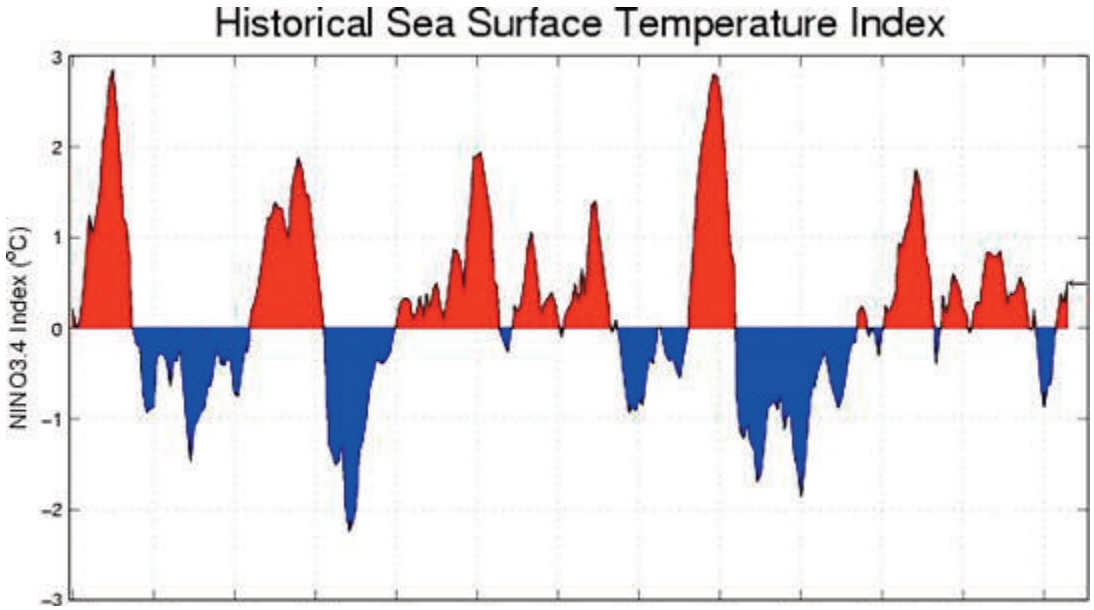

Figure 4. *Variation in sea surface temperature in central eastern Pacific Ocean between 1982 and 2005. Red indicates El Niño incidences and blue La Niñas (or "normal" conditions (from The International Research Institute for Climate and Society. For more information see: http://iri.columbia.edu/climate/ENSO/currentinfo.html)*

During an El Niño, which normally starts at the end of the year, the conditions are opposite from the above. Trade winds are weak and wind forcing may even be towards the east, leading to higher water level at South America (+0.4m) than in Indonesia. The Humboldt current is shifted west and a warm equatorial counter current appears outside the South American northern coast and turns south. The warm water causes torrential rains on land along this coast while relatively dry conditions are found in Indonesia. The thermocline between the deep water and the warm surface water is pressed down in the east and rises some 25m in the Indonesian area.

These shifts have a fundamental influence on agriculture and fishing on both sides of the ocean but especially in South America, where often the national economies have suffered heavily. Prediction of a coming El Niño has therefore become a high priority, but it is still a question of about half a year to forecast an event – and its strength is also difficult to tell.

Until the mid 1970s the ENSO events were thought to be restricted to the Pacific regions mentioned above, but they have later been shown to affect much larger areas and having effects also in California, Southern Africa, the Indian Ocean and parts of Australia.

Since both NAO and ENSO have occurred during times long before the industrial revolution, they are looked upon as natural fluctuations. Are they then influenced by global warming?

As long as the major pattern of ocean currents is not changed, then the main forcing factors for the events will remain. However, the frequency, duration and the strength of them may well be affected. Critical observations are as yet too short to say anything for certain about the degree of possible changes.

Global Change (warming)

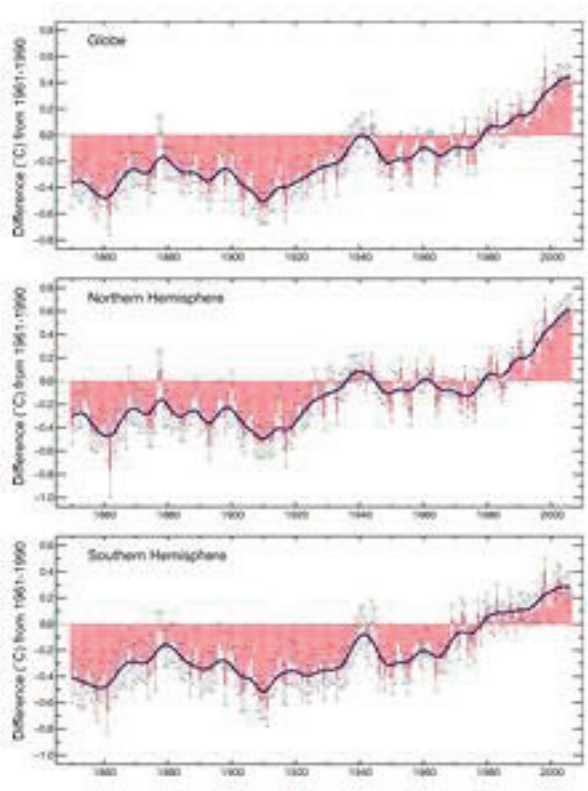

Figure 5. *Global and hemispheric annual combined land-surface air temperature and SST anomalies (°C) (red) for 1850 to 2006 relative to the 1961 to 1990 mean, along with 5 to 95% error bar ranges, from HadCRUT3 (adapted from Brohan et al., 2006). The smooth blue curves show decadal variations (see Appendix 3.A in IPCC Report).(IPCC, AR4, WG1, Chapter 1, 2007)*

It is absolutely clear that the earth is getting warmer (Fig. 5). During the last century the global temperature increase was about 0.6oC, most of which, or 0.4oC, occurred during the last 25-30 years. The northern hemisphere (north of 20oN) has warmed up most, 0.7oC, because of the influence of the continents, while the ocean dominated southern hemisphere (south of 20oS) has had an increase of 0.3oC. The warming has not been a linear process. A warming period between the 1930s and 1960s was followed by a cooler period during the following 20 years only to become warmer again from the mid 1980s (Fig.). This warming is continuing, and it has become a political issue to find means to restrict the increase during the present century to 2oC. This goal does now seem to be very difficult to reach. The great majority of climate, atmosphere and ocean scientists agree that greenhouse gases (including humidity) are the major driving forces for the temperature increase. Since it is hardly possible to influence the humidity, the target is now to reduce the production of greenhouse gases – and especially CO2.

Preindustrial concentration of CO2 in the atmosphere is estimated to have been 280 ppm. When reliable measurements started on Hawaii 1957 the concentration was 315 ppm, which in the 60 years since then has passed 380 ppm. The increase from 350 to 380 ppm took less than 20 years. From ice core research we know that during the past 450 000

years CO2 concentration never reached above 300 ppm and for most of the time was far below 250 ppm. The quickest build up of 30 ppm in preindustrial time took approximately 1000 years, a clear indication that the present increase is dramatic. There is no doubt that human activities, above all the burning of fossil fuels, play a major role in this.

Global warming and the ocean

1. Sea level rise

There are two main causes for sea level rise. One is thermal expansion of the water and the other is melt water from the continental ice caps on Antarctica and Greenland and to some extent also from mountain glaciers.

Thermal expansion:

During the 20th century sea level raised 17 cm. Satellite measurements, which started 1993, give a present rate of sea level rise of 3.5 cm per decade, which shows a clear acceleration of the rate. This is likely to increase even more during the present century. The mean temperature of the world oceans increased about 0.1oC between 1960 and 1993 in the depth layer 0-700 m. Thermal expansion of this water would then account for about 25% of the sea level rise. The much more rapid rise observed via satellites is estimated to have been caused to at least 50% by expansion.

A doubling of the atmospheric CO2 concentration has by some models (IPCC) been estimated to give a temperature rise of the oceanic surface water of 3-4oC. Depending on the water volume involved, this would account for at least 50 cm in sea level rise, which certainly is bad news for most low-lying coastal areas and islands.

Melting of continental ice caps:

Melting of the big ice sheets on Antarctica and Greenland has become a serious component in the sea level rise. It was long regarded as having little impact because of increased precipitation on higher altitudes that balanced the increased melting at lower levels of the ice caps. Thus the ice mass was thought to be relatively constant.

West Antarctica has been regarded as the most vulnerable part since much of its base is below sea level. Increased temperatures both in the air and the sea could thus cause melting on both sides of the ice cap. On the east side of the Antarctic Peninsula a 200 m thick and more than 3000 km2 large ice shelf broke up in one month (Larsen B ice shelf, February 2002). Probably this ice shelf had been there since the last ice age, but during the second half of the 20th century the mean air temperature in that area increased by 1.5oC, which most likely was the reason for this event. This did not add anything noticeably to the sea level, but afterwards the glaciers feeding into the ocean there moved towards the coast with a speed almost eight times faster than before. Thus, iceberg formation increased. Very likely the ice shelf acted as a brake for the glaciers. Recent estimates of loss of ice (E. Rignot et al. 2008) based on satellite radar observations in West Antarctica between 1982 and 2006 showed an increase in ice sheet loss in the 10 year period 1997-2006 of 59% in the Bellingshausen and Amundsen seas (in 2006 132±60 Gt yr-1). During the same period the loss in the Peninsula area increased by 140% (to 60±46 Gt yr-1 in 2006). Much of the increase was related to a faster flow of the glaciers, and thus having a large influence on the mass balance of the ice cap.

East Antarctica is receiving more precipitation than before at higher elevations. More and more lakes are found under the ice, which could indicate that somehow ice is melting and the melt water reaching the bottom of the ice sheet. Some of this water may become a lubricating layer under the peripheral glacier tongues and speeding the flow of them also here. However, the impression is that the mass balance of the East Antarctic ice cap is not yet changing (E. Rignot 2008).

The Greenland ice cap is gaining snow and ice at elevations above 2000 m, but loosing ice below this level and at the periphery. Large melt water lakes appear at the top in summer and through cracks in the ice some of this water reaches down to the ground under the ice and under peripheral ice tongues out into the sea. The mass balance of the ice cap is negative and estimates of the loss of fresh water per year is about 100 km3 . This equals about 25 times the increase of river waters reaching the Arctic Ocean per year. If this trend is kept at the present level, it would mean a sea level increase of more than 60 cm at the end of this century. With an increasing global warming, which is very likely, the sea level could rise even more.

The combined effect of thermal expansion and melt water from Greenland will very likely mean a sea level rise of more than one meter during the 21st century. The growing contribution from West Antarctica will also contribute, but the extent of it during this century is hard to predict.

2. Changes in ocean circulation

The Oceanic Conveyor Belt:

The general oceanic circulation is characterized by deep water formation (downwelling) in the North Atlantic (Iceland and Labrador Seas) and in the Atlantic sector of the Antarctic Ocean (Weddell Sea). Deep water comes to the surface (upwelling) in north-central Indian and Pacific Oceans and flows back to the Atlantic as a warm surface current. If this so called Oceanic Conveyor Belt (W. Broecker 1987) will change because of global warming, the critical area will be the North Atlantic and the thermo-haline circulation (THC).

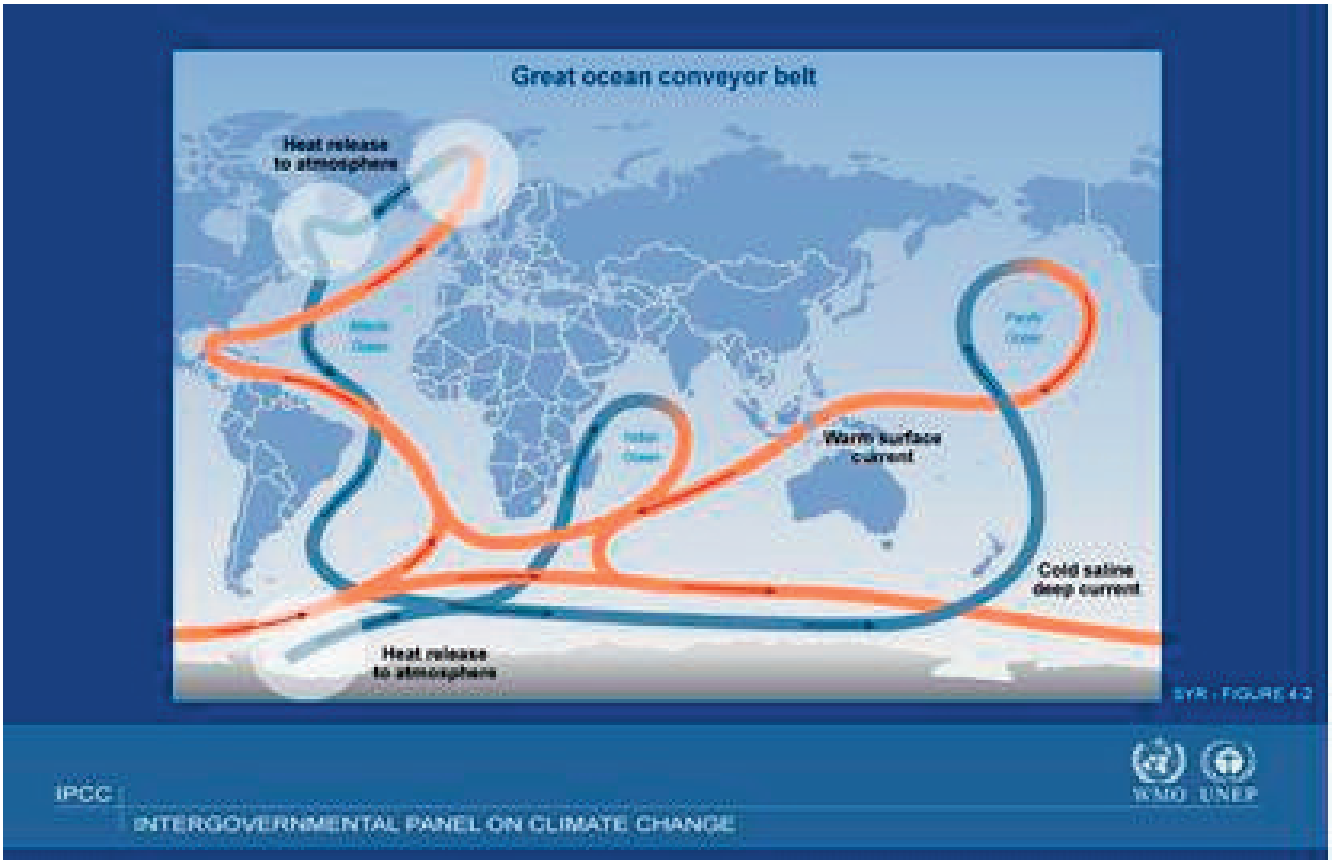

Figure 6. *A generalized picture of the major ocean currents. Blue currents are in the deep sea and orange are surface currents. Deep water is formed in the North Atlantic and in the Weddell Sea in Antarctica. The deep waters enter the surface in the north areas of the Indian and Pacific Oceans. (IPCC, Climate Change – Synthesis Report 2001)*

The Thermo-Haline Circulation (THC):

The formation of deep water is due to a combination of cold temperature and high salinity, and thus high density water. It is the inflow of Atlantic water with hifgh salinity water to the Arctic Ocean and the cold outflow from the Arctic back to the Atlantic which are the triggering factors for the deep water formation (Fig.).

Warm surface water reaches the Nordic Seas (sometimes called the GIN seas: Greenland, Iceland and Norwegian Seas) via the Gulf Stream (GS) and its continuation in the North Atlantic Current (NAC) and the North Atlantic Drift Current (NADC). Part of this enters the Barents Sea via the Norwegian Current and continues into the Arctic Ocean as a subsurface but still shallow current over the extensive Russian/Siberian continental shelf. Another part enters the Fram Strait between Greenland and Svalbard and reaches further into the central Arctic Ocean. A third part turns around into the Greenland Sea below the cold East Greenland Current, which is the major surface outflow from the Arctic. The originally warm and salty inflow currents are cooled in the Arctic and the Greenland Sea by the cold surface waters and sink towards the bottom, but pass to the south over the shallow passages between Scotland and Iceland and Iceland to Greenland (about 800 and 500 m respectively) and further down into the North Atlantic.

The inflow into the Nordic Seas has a magnitude of about 8 Sverdrup (1 Sv = 106 m3 s-1). The outflows are the East Greenland Current (2 Sv), the deep water west of Iceland (3 Sv) and the deep water coming through the Faroe Channel

(3 Sv). These flows should be compared to the Gulf Stream E of Florida (a mean of >30 Sv) and the North Atlantic Current in the mid-Atlantic (~20 Sv).

What will then happen with this THC in the future, and has something already happened?

First we can conclude that there is a fair amount of annual fluctuations, up to ~3 Sv.

All of the coupled models, except one, presented by the IPCC forecast a decline in the transport of the THC in the Atlantic. By the year 2100 it would be a decrease of about 5 Sv according to three of the models, while four predict a steeper decline (> 8 Sv) and one with almost no change (-0.5 Sv). One model diverges completely and predicts an increase of about 2 Sv.

Direct measurements between 1990 and 2000 show a decrease in the deep outflow from the GIN Seas with somewhat lower salinity and higher temperature (Hansen et al. 2001). The sea ice extent during summer in the Arctic Ocean has decreased by7% per decade during the last 30 years (satellite observations) and was record small in 2007, when both the North-West and North-East Passages were ice-free for the first time in historic records. These satellite observations show a faster ice retreat than most models have suggested (Stroeve et al. 2007). The ice thickness has also decreased – even in the permanent ice cover north of Greenland. All this means that at least in the summer the surface layer of fresh water increases. The yearly added freshwater volume from the melting sea ice is said to be 150 km3.

The increased precipitation above all over north Europe and Siberia has increased the river discharge to the Arctic Ocean since 1970 by ~4%. and the total volume of this river water is estimated to 3300 km3 per year (Petersen et al.2002). The annual increase is said to be about 4 km3. In comparison with the yearly increase in freshwater from the sea ice (150 km3) and from Greenland (100 km3) it is obvious that the increase in river discharges to the Arctic is of minor importance. However, the modelled change of the THC as a result of the increased river water discharge shows a slow decrease of the THC (Rennermalm et al. 2006).

Models indicate that there would be a need of 1100-1800 km3 more fresh water per year to get a really marked change in the THC. A possible scenario would be a maximum yearly addition of river water of 100 km3, from sea ice of 700 km3 and at least a tenfold increase of melt water from Greenland, 1000 km3. Heat transport to the Arctic has increased and is likely to increase even more during the present century, since most reports suggest that a stop in the global warming at +2oC will not be possible to achieve. Even so, it is unlikely that the figures given above will be reached. A total stop of the THC in the North Atlantic does not seem possible during this limited time frame, but a clearly reduced deep water formation is likely.

Change in deep water formation in the Weddell Sea will depend on the stability of the ice shelves. At present there are no reliable models on this, because of the complexities in the reactions of the driving forces to the global warming in East Antarctica.

3. A shallow ocean

Should deep water formation come close to a stop at the two major places where it occurs, we would end up with a surface (shallow) ocean to a large extent separated from the deep ocean. Although this does not seem to be a risk for a few hundred years, in the long run this could happen if the global warming accelerates and reaches 3-4oC (or even more). Deep water is also formed in the eastern Mediterranean Sea thanks to heavy evaporation and a limited circulation in the surface layer. However, there are very few other places, if any, where such a combination of deep water, limited surface circulation and dry air combine allowing for the evaporation and deep water formation. The deep and warm Mediterranean water coming through the Strait of Gibraltar into the Atlantic does not sink very deep, so there would still be a real deep ocean without oxygenated water reaching down. This would obviously be disastrous to all the fauna living there, which depend on oxygen for their respiration.

Off the west coasts of the continents we have now areas of upwelling, which supply the surface waters with nutrients and allow for rich floras and faunas. Would these persist in such a warm world? It might be possible from intermediate waters (a few thousand meters) but hardly from the really deep oceans. In the South Pacific Ocean during an El Niño the upwelling stops when the warm water from the west hits the South American coast and forces the Humboldt Current offshore. Could this become a permanent feature? Or would the trade winds be too strong to allow for this? A continued upwelling from intermediate water levels would, however, not carry the amount of nutrient load that the deep water now brings up. Also the pelagic life in surface waters outside continental shelf areas would indeed suffer.

4. Storms and extreme weather events

There are conflicting reports on how global warming will influence the frequencies and/or wind velocities of hurricanes (typhones, cyclones etc.).

In this paper there is no need to go into the details about these major storms. A good summary can be found in http://earthobservatory.nasa.gov/Library/Hurricanes.

A few facts are however of interest:

An ocean surface temperature of 26.5oC or more is a prerequisite for the formation of hurricanes. Other important factors are high humidity and only light winds and low vertical wind shear (in upper winds). El Niño events increase hurricane activities in the tropical East Pacific Ocean because of the higher than normal ocean temperature there, but they decrease the storm activity in the west Atlantic Ocean although the water temperature may be equally warm. Vertical wind shear then increases over the Atlantic sector, which should help prevent hurricanes to develop, while a decrease on the Pacific side will increase the risk of storms.

La Niña phase of ENSO cools the waters on both sides of the Panama isthmus and thus reduces hurricane activity. This is the likely reason for the low activity during the summer-fall of 2007.

An indication of a possible effect of global warming on the frequency of violent hurricanes (categories 4 and 5) is found when comparing their numbers between 1975-89 and 1990-2004. In all areas where violent cyclones formed they were much more frequent during the second period. The numbers more than doubled in the SW Pacific and the S. Indian Ocean. Also the intensity of the storms may increase because of global warming. Intense hurricanes in the 1950s and 1960s were followed by less intense storms in the 1970s and 1980s only to increase again in the 1990s and onwards (Webster et al.2005). Fluctuations in global warming actually followed this pattern very closely in the lower northern latitudes (from about 10o to 30o N).

Extreme weather situations, although temporary, will always have a dramatic effect on the coastal areas which are hit – both on land and in the water. Sea level rise in combination with wave actions is destructive as well as the heavy rains on land. It is well documented that e.g. coral reefs may be badly damaged by violent cyclones.

5. Changing biogeochemistry

Salinity changes/haloclines:

In the Arctic Ocean and the adjacent parts of the Pacific and Atlantic Oceans global warming means more river water, melting of sea ice and melt water from Greenland, all of which adds fresh water to the ocean surface and the establishment of a stronger and probably deeper halocline in the summer. During the winter sea ice will still be formed over the shelves, with salty and dense water underneath which will continue to be the source for deep water in the Arctic basins. However, the depth to which this water sinks may decrease with time, when the fresh surface layer gets thicker and when less sea ice is formed in a warmer climate.

As already stated, a weaker THC in the Iceland and Labrador Seas will change the deep penetration of this water and thus we will get shifts in both haloclines and thermoclines in the North Atlantic. Similar effects, but less pronounced because of water circulation pattern can be expected in the Southern Ocean (around Antarctica).

At present the surface of the North Atlantic Ocean has a higher salinity than that of the North Pacific Ocean. The main reason for this is all humidity carried across the low Panama isthmus from the Atlantic to the Pacific by the trade winds. Estimates of the amount of water being transported by the air is the astounding figure of 150 000- 200 000 $m^3 s^{-1}$, which is more than the melt water coming from Greenland and mountain glaciers around the North Atlantic also in a warmer world (pers.comm. Prof. Anders Stigebrandt, www.tellus.science.gu.se). IPCC has found that already the salinity in the North Pacific Ocean is decreasing and that of the North Atlantic Ocean is increasing. With continued global warming we can expect that the salinity difference between the two oceans in the northern hemisphere can become even more pronounced. If the air transport will overcompensate the melting of water from Greenland, then the Atlantic is getting so saline that the THC could even be strengthened. Whether the process outlined in the previous chapter or this one, just discussed, will dominate is too early to say.

Heat budget in the Arctic:

The heat budget of the Arctic will change. The inflow of water to the Arctic Ocean may become warmer also with a reduced flow from the south. Less sea ice will mean a change in albedo during the light period of the year and more heat

stored in the open water. With a disappearing sea ice cover the plankton flora will certainly change and new species will gradually move in. This might then change the algal production of dimethylsulfide, which acts as condensation nucleus for the Arctic mist. If the change will have the effect of less mist, that will also affect the heat budget.

Turbidity:

More river water and melt water from the continental ice or glaciers will increase turbidity in coastal and near coastal waters. Effects of this could be e.g. change in algal vertical distribution because of light dependence, excess of sediments which will settle on the bottoms and change the sediment composition. If large and unstable sediment packs build up on the continental slopes this could cause turbidity currents with large effects on sediments and faunas further down the slopes.

pH changes:

With increasing CO2 concentration in the atmosphere and with the surface of the oceans absorbing more and more of this gas, saturation will finally take place, even with functioning deep water formation. This will affect the carbonate cycle, with less calciumcarbonate available for the organisms needing it for interior or exterior skeletons. Recent experiments also show that many physiological functions in marine biota are strongly affected by increased pH.

Some references and more to read:

- General climate change:

IPCC, 2007, Climate change 2007.; The physical science basis. Working Group I contribution to the fourth assessment report of the IPCC (Edit. S. Solomon et al.),Cambridge University Press. Or

http://www.ipcc.ch/ipccreports/ar4-wg1.htm

- Influence of the sun:

FRIIS-CHRISTENSEN, E. and LASSEN, K., 1991, Length of the solqr cxycle: an indicator of solar activity closely associated with climate. Science 254, 698-700.

FRÖHLICH, C. and Lean, J., 1998, The sun´s total irradiance: cycles, trends and related climate change uncertainties since 1976. Geophysical Research Letters, 25, 4377-4380.

BERARDELLI, P. 2008, Not much warming under the sun. http://sciencenow.sciencemag.org/cgi/content/full/2008/312/3?etoc

- Glacial cycles and general ocean circulation:

BROECKER, W.S. and DENTON, G.H., 1990, What drives glacial cycles? Scientific American, January 1990, 43-50.

http;//en.wikipedia.org/wiki/Milankovitch_cycles, 2008

QUADFASEL,D., 2005, Oceanography: The Atlantic heat conveyor slows. Nature 438, 565-566

- Shorter climate cycles:

http://www.cdc.noaa.gov/ENSO/enso.descriptrion.html, 2008-05-24

http://iri.columbia.edu/climate/ENSO/currentinfo/QuickLook.html, 2008

http://www.ldeo.columbbia.edu/NAO/, 2008

- Contrails:

STUBER, N. and FORSTER, P. 2006, Global contrail radiative forcing and the impact of diurnal variations of air traffic, Atmospheric Chemistry and Physics Discussions 6, 9123-9149.

- Arctic-Subarctic seas:

HANSEN et al. 2001, The Arctic-Subarctic ocean flux study, rationale, scope and methods. Nature 411, 927-930.

STROEVE et al. 2007, Information on the early Holocene climate constrains the summer sea ice projections for the 21st century. Climate of the Past, Discussions 3, 999-1020.

(www.clim-past-discuss.net/3/999/2007/)

RENNERMALM et al. 2006, Sensitivity of the thermohaline circulation to the Arctic runoff. Geophysical Research Letters, 33, L 12703, doi 10.1029/2006GL026124.

- Storms and extreme weather events:

http://earthobservatory.nasa-gov/Library/Hurricanes.

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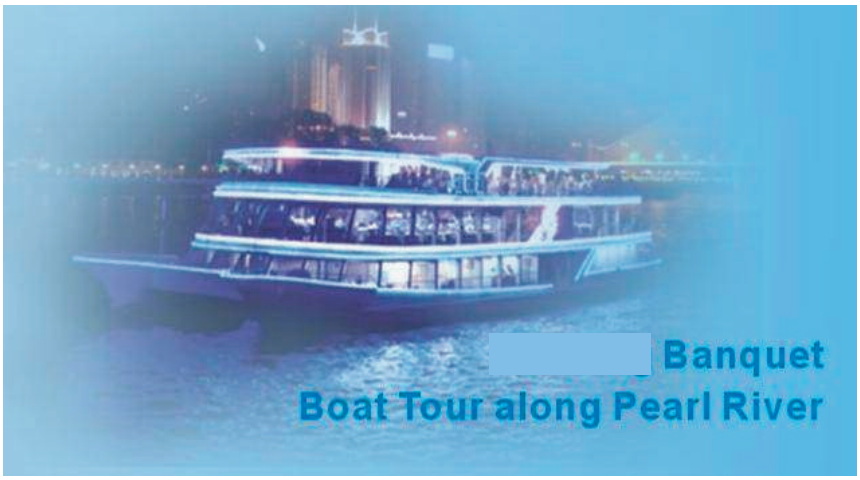
Current Status of the Conference Preparation/ Schedules

Five month before the start of the PORSEC 2008, we are on track and the plans look good. http://ledweb.scsio.ac.cn/porsec2008/Announcement.asp , we encourage you to go browsing on this beautiful web-site.

Please review the program and sessions and all the well planned social activities. We expect a thoroughly enjoyable and stimulating conference. Among the Keynote speakers are two prominent members of the Chinese establishment: Drs.Guanhua Xu and DL Pa. We are very glad for their support of our conference. Here is the Tentative Daily Schedule with some modifications from the old web-page.

Nov 28,	Fri:	Tutorial courses
Nov 29,	Sat:	Tutorial courses
Nov 30,	Sun:	Science expedition in Daya Bay
Dec 1,	Mon	(Group preparations for SOC meeting and for conference)
Dec 2,	Tue:	Registering (afternoon)
		SOC meeting (afternoon)
		Welcome reception (evening)
Dec 3,	Wed:	Opening Ceremony (morning)
		Sessions
Dec 4,	Thu:	Sessions
		General Assembly of the PORSEC Association
		Visiting SCSIO, City Tour (afternoon and evening)
Dec 5,	Fri:	Sessions
		Banquet (Boat tour along Pearl River)
Dec 6,	Sat:	Sessions and Closing ceremony



ABSTRACTS: The deadline for sending abstracts of your scientific contribution is listed as July 15, but the program committee will accept a short delay until July 31.

We repeat the abstract instruction at the end of this section, but do go to the web-page for submittal. There will be no extended abstract volume at this meeting. The submitted abstracts will be printed for use during the conference. Full papers related to this conference can be submitted to the peer-reviewed journals: International Journal of Remote Sensing, Acta Oceanologica Sinica, and Journal of Tropical Oceanography. A Special issue of IJRS from PORSEC 2006 will be available at the conference.

We encourage you to find support to send one or more of your students (who can become student members of PORSEC Association) and young professionals in your group to the tutorial courses. Each student has to be supported by their mentor-sponsor. We cannot offer financial support.

Abstract instructions:

Sample abstract Single Affiliation:

Title of the Abstract (Oral)/ (Poster)
First Author (speaker) and Second Author
Single Affiliation
Email of author if possible

Sample abstract Multiple Affiliations:

Title of the Abstract (Oral)/ (Poster)
First Author[1], Second Author[2] (speaker), Third Author[3]
[1]Affiliation1
[2]Affiliation2
[3]Affiliation3
Emails of each author (if possible, thanks. At least leave a correspondent author's email.)

Body of the abstract:

All abstracts must be in English.
Maximum Length of abstract: 500 words
Title: Times New Roman, 12 point
Font style: Times New Roman, 11 point
No photographs, figures, tables, reference or abbreviations
No footnotes or endnotes

Please specify whether the paper is to be considered for oral presentation or for poster presentation. As abstracts for oral presentation, please underline the name of the speaker and write "speaker" in the round brackets beside the name of the speaker.

Some full papers will be published in IJRS, other full papers may be in Acta Oceanologica Sinica, or Journal of Tropical Oceanography.

Notices

News; Remote Sensing of Cyclone Nargis And Myanmar Floods:

Canadian Earth Observation Satellite In Response To Myanmar Disaster:

Through the International Charter "Space and Major Disasters", products showing flood extent and damages have been developed with Canadian Earth Observation satellite RADARSAT-1 and RADARSAT-2 in collaboration with UNOSAT. For more information, please visit: http://www.disasterscharter.org/disasters/CALLID_203_e.html

Response From ENVISAT To Cyclone Nargis And Myanmar Floods

Tropical cyclone Nargis hit the capital of Myanmar Yangon in May, causing widespread devastation in the city and the surrounding areas. Entire villages were submerged when the storm hit the low-lying coastal delta, a heavily populated area. With inundated areas typically visible from space, Earth Observation (EO) is increasingly being used for flood response and mitigation. The EO Satellite Envisat captured Cyclone Nargis making its way across the Bay of Bengal just south of Myanmar on 1 May 2008. The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) asked the International Charter on 'Space and Major Disasters' for support. A series of Envisat radar images highlights the extent of flooding caused by the cyclone. For more information, please visit: http://www.esa.int/esaEO/SEMV0TZXUFF_index_0.html

Workshops; Courses; Conferences

Satellite Oceanography Course August 3 - 23, 2008

This is the sixth edition of the International Advanced Course on Satellite Oceanography summer-school series. It will be hosted in Ensenada, B.C. Mexico by the Physical & Biological Oceanography departments, CICESE, and co-sponsored by ESA, CSTARS, IOC, CONACyT, LOICZ, GKSS, DLR and UABC. This year the focus is on extreme events.

Lecturers:
Werner Alpers (U Hamburg, Germany)
Johnny Johannessen (NERSC, Norway)
Peter Challenor (NOC, UK)
Mati Kahru (SIO, UCSD, USA)
Bertrand Chapron (IFREMER, France)
Susanne Lehner (DLR, Germany)
Fabrice Collard (BOOST, France)
Ken Melville (SIO, UCSD, USA)
Yves-Louis Desnos (ESRIN, ESA, Italy)
Greg Mitchell (SIO, UCSD, USA)
Roland Doerffer (GKSS, Germany)
Rosemary Morrow (LEGOS, France)
Reginaldo Durazo (UABC, Mexico)
Francisco Ocampo-Torres (CICESE, Mexico)
Jochen Horstmann (GKSS, Germany)
Trevor Platt (BIO, Canada)
Hans Graber (CSTARS,U Miami, USA)
David Sandwell (SIO, UCSD, USA)
Chris Stewart (ESRIN, ESA, Italy)

Registration fee is $300.00 USD (or equivalent in Mexican Pesos), which covers all course activities and materials, including laboratory sessions, lecture notes, EO data and imagery, etc. The deadline for application has actually passed, but here is some contact information in case a space might have opened up.

Local Organizing Committee:
Ms. Elvia Serrano, Course Secretariat
Dr. Rafaél Hernández Walls, Lab Coordinator
Dr. Francisco J. Ocampo Torres, Course Director
Dr. Pedro Osuna Cañedo; Guillermo Díaz Méndez, Centro de Investigación Científica y Educación Superior de Ensenada, CICESE
Km 107 carretera Tijuana-Ensenada, Ensenada B.C., 22860 México ()
Tel: +52 (646) 175-0500 ext. 24027; Fax: +52 (646) 175-0547 & 175-0574
eserrano at cicese.mx

Drought Workshop, Oct 20-24 2008

Lincoln, NE, USA

NOAA's 33rd Climate Diagnostics and Prediction Workshop (CDPW) will be held jointly with a US CLIVAR Drought Workshop in Lincoln, NE, on 20-24 October 2008. The workshop will be hosted by the National Drought Mitigation Center, University of Nebraska, Lincoln; and co-sponsored by the Climate Prediction Center (CPC) of the National Centers for Environmental Prediction /NOAA and the U.S. Climate Variability and Predictability (US CLIVAR) Program. The AMS is a cooperating sponsor.

The workshop will focus on the status and prospects for advancing climate monitoring, assessment and prediction, with major emphasis on drought. This includes three major themes: (i) improving climate predictions /predictability,

(ii) understanding and attribution of drought and its impacts, and (iii) incorporating climate predictions / projections in the development and delivery of drought products.
Note that in a departure from past years, the 2008 CDPW will address drought across multiple time scales (weekly through decadal to centennial and longer) and for multiple regions (North America, South America, Africa, Asia, etc.). Thus, papers that assess the role of ocean, land, and seasonal cycle in multi-year droughts as evidenced in coupled models (especially from IPCC CMEP-3 runs) to complement DRiCOMP and US CLIVAR drought working group research results, and that link drought research and societal needs (e.g. the NIDIS program) are strongly encouraged. The results from DRiCOMP investigations and the US CLIVAR Drought Working Group will also be presented and discussed. The Workshop will feature focused oral sessions with a mix of invited and submitted presentations, thematic poster sessions (including an evening reception), and a drought Town Hall discussion. The majority of contributed papers will be presented in poster sessions. The primary focus areas for the workshop will include:
1. A review of recent climate conditions and forecasts for week-2 to seasonal time scales.
2. A review of prediction practices, predictability, and forecast verification assessments for time scales from week to seasonal, and for lead times from zero to 12 months.
3. Status and prospects for improvements in observing, monitoring and simulating drought
4. Advances in understanding and predicting present and future droughts, including the contributions of natural and human-induced forcings.
5. Drought impacts, products and meeting societal needs.

The outcome of this year's workshop will be an assessment of our current understanding and ability to predict drought, including identifying opportunities for advances, and exploring new products to support regional decision making.

Instructions on submitting your abstract will be posted on the Workshop webpage. The abstract deadline is "AUGUST 4, 2008". Meeting information, including lodging, registration and other information will also appear on the Workshop webpage:
http://www.cpc.ncep.noaa.gov/products/outreach/meetings.shtml)

To sign up to receive future announcements about the 33rd CDPW, see
https://lstsrv.ncep.noaa.gov/mailman/listinfo/ncep.list.cpc-cdworkshop

2008 GEOSS in the Americas Symposium
30 September to 3 October, 2008,
Panama City, Panama

The 2008 GEOSS in the Americas Symposium will take place in Panama City, Panama from 30 September to 3 October 2008. The purpose of the symposium is to increase understanding of GEOSS in the region, promote and raise awareness about existing activities and potential new projects, strengthen partnerships, and advance a dialogue about opportunities, capabilities, and requirements.

The symposium will build on the success of the first GEOSS in the Americas Symposium hosted by INPE in Brazil in 2007. As before, the symposium will emphasize communication among experts from the region around specific aspects of GEOSS implementation.

Watch the GEO Meetings and Events calendar for detailed information and links to a symposium website:
www.earthobservations.org

Intensive Course on Data Assimilation
October 27 - November 7, 2008
Buenos Aires, Argentina

All the information about this activity can be found in the web site: http://4dvarenkf.cima.fcen.uba.ar/course/

Please notice that the course has no registration fee, but a subscription form has to be filled in order to be admitted, since we have limited capacity.
If you need further information, you can contact the organizing committee:
Eugenia Kalnay (ekalnay at atmos.umd.edu)
Celeste Saulo (saulo at cima.fcen.uba.ar)

International Conference on Tsunami Warning
12-14 November 2008
Bali, Indonesia

http://www.pirba.ristek.go.id

International Conference on S. Hemisphere Meteorology and Oceanography
9-13 February 2009
Melbourne, Australia

The Ninth International Conference on Southern Hemisphere Meteorology and Oceanography is a joint conference of the American Meteorological Society (AMS) and Australian Meteorological and Oceanographic Society

(AMOS) and will be held from 9-13 February 2009 in Melbourne, Australia. Preliminary programs, registration details, hotel, and general information will be posted on the AMS Web site (http://www.ametsoc.org) and on the Local Organizing Committee web site (http://9icshmo.org).

Poster as well as oral presentations are solicited on all aspects of the meteorology and oceanography of the Southern Hemisphere. The meeting is organized around the broad theme: "Extremes: Climate and Water in the Southern Hemisphere".

The Program Committee also encourages submissions on recent scientific accomplishments and synthesis for the Southern Hemisphere for global programs like WCRP, CLIVAR, GEWEX, IGBP, GCOS, GOOS, GEOSS, and IPCC.

Please submit your abstract electronically via the Web by 1 August 2008 (refer to the conference Web page at http://9icshmo.org for instructions).

There will be a limited amount of funding to support the participation in 9ICSHMO of graduate students, young scientists, or scientists from developing countries, and information on that will be available on the conference web site.

For additional information please contact the Program co-chairpersons as follows: Howard Diamond (tel: +1-301-427-2475; e-mail: howard.diamond at noaa.gov) Kevin Walsh (tel: +61-3-8344-6523; email: kevin.walsh at unimelb.edu.au).

Be sure to register early for the conference of PORSEC 2008. Make sure you fill in the form for the VISA application (the local organizing committee will send you a letter for the Chinese Consulate where you get your VISA.)

Travel Grant Opportunity:

A request for funding is pending at the National Science Foundation and will be decided early in September 2008. Applications are sought from students and investigators at U.S. institutions for partial travel support to participate in the PORSEC 2008 tutorial workshop and conference, if requested funding is available. The support is intended for early-career investigators and students; under-represented groups are especially encouraged to apply.

Eligibility and Application: Successful applicants must attend the tutorial course or present a talk or poster at the symposium and must be enrolled at or employed by a U.S. institution. Priority will be given to students, early-career scientists, and members of under-represented groups in the science. The awards are expected to cover up to 75% of the travel, where applicants will be expected to receive the remaining support from their institution. All associated air travel must comply with The Fly America Act and its current implementing regulations. Please download an application form from http://porsec.nwra.com/scholarship.doc and submit by e-mail to scholarships (at) porsec.nwra.com

Application deadline: Sept. 14, 2008

Announcement of Workshop on Sampling etc. and Request for White Papers

During PORSEC 2008, we are planning a half-day workshop, where we will discuss needs for sampling of climate and environmentally important variables and consider strategies to meet these needs. We expect researchers and agency representatives to participate in these discussions. The first hour will be devoted to short presentation of the issues defining global climate variability with the use of satellite data. We will have to focus on only specific climate variables: sea surface temperature, SST, wind patterns, cloudiness, surface radiation, evaporation and precipitation. (The ozone issue we leave for other forums more focused on the atmosphere. Carbon dioxide on the other hand is intimately related to SST.) We will then have a panel discussion about the strategies of constellation planning in order to obtain sufficient sampling for accurate definition of climate variability (including interannual, El Nino- type variations, and seasonal patterns). During the third hour of the workshop we will break into smaller groups for defining data consistency, archiving and distribution. A workshop report, possibly in the IJRS - Special Issue of PORSEC 2008 is planned. PORSEC participants eager to contribute a white paper to this workshop ahead of time are encouraged to do so by writing to: K. Katsaros, katsaros at porsec.nwra.com. Such contributions are most welcome and would make the workshop more efficient.

The Second Announcement for PORSEC 2008 is now published: http://ledweb.scsio.ac.cn/porsec2008/. Time to begin to prepare abstracts and plan your travel. The Pan Oceanic Remote Sensing Conference 2008 will take place 2-6 December 2008 in Guangzhou, China. There will be pre-conference tutorials and at least one workshop (see herein). Post-conference tours are available for you to take into consideration in your travel planning. You should also allow time to get a visa to China.

Tutorial Courses The contents of the tutorial courses and the list of teachers will soon be posted on the PORSEC 2008 home page (see above) and on the Association's home page: http://porsec.nwra.com. Please look for this information in the near future. We will cover topics such as ocean color, SST, scatterometry, statistics and "How to publish your research in a peer-reviewed journal". The dates of the course offerings are still being defined, but will probably be from Nov 30 (a Sunday) through December 2, a Tuesday. They will be held on the SCSIO campus. We are attempting to keep the time between the course offerings and the conference short and at the same time not interfere with the conference sessions.

The Scientific Organizing Committee, SOC, will meet on Tuesday, December 2, in the afternoon. This is **the "congress" of the PORSEC Association** and an important event. SOC members vote, but anyone interested in the health of our organization is welcome to attend. The deliberations of the SOC will be reported on to the full membership at a Plenary Session during the conference.

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.