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A celebration of the 150th anniversary of the Brussels Maritime Conference of 1853

and

CLIMAR-II
Second JCOMM Workshop on Advances in Marine Climatology

Brussels, Belgium, 17-22 November 2003

Poster Presentation Abstracts

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- US steam frigate Mississippi, in the Gulf of Mexico, March 1847: Library of Congress, Prints & Photographs Division [reproduction number LC-USZC2-3129] (originally published by N. Currier, New York, 1848).
- Florida peninsula, January 1985: NASA Space Shuttle Earth Observations Photography database [photo STS51C-44-0026].
- TAO (Tropical Ocean Atmosphere) buoy and anemometers on NOAA ship Ka'Imimoana. Photo by Jason Poe, courtesy of TAO Project Office.

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P-150-1

Contribution of Portugal to the development of meteorology, oceanography and geophysics

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A brief summary on the contribution of Portugal to the development of meteorology, oceanography and geophysics since the XV century, including the epic navigations and discoveries during the XV, XVI and XVII centuries, the implementation of the surface networks in the Portuguese mainland, Azores and Madeira islands during the second half of the XIX century and the global networks implemented in the Portuguese colonies during the first half of the XX century.

P-150-2

WaMoS II - X-band radar: from spectral to single wave detection

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X-band radars have been used in recent years to image ocean surface waves. The present poster presents the wave monitoring system WaMoS II based on a standard marine X-Band radar generally used for navigation and ship traffic control. This system has been developed 25 years ago and is now commercially available for real time wave measurements. It operates from fixed and moving platforms in deep as well as in coastal waters and allows obtaining directional spectral wave parameters, such as the integrated sea state parameters significant wave height, peak wave period and peak wave direction.

Within the EU funded project MaxWave, which focuses on extreme wave events, and the national funded project SinSee, WaMoS II has been used to study the occurrence and properties of extreme waves, and to develop new algorithms to infer sea surface elevation maps from nautical radar images sequences. First results of the inferred sea surface elevation maps are presented. The integration potential of this type of data for offshore and ship applications will be discussed.

P-150-3

Marine forecasting in rapid development

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Since the early days of Wilhelm and Jack (son) Bjerknes' work in the Bergen school of meteorology, weather forecasting has been a priority in Bergen, Norway. Our neighboring sea areas, the North Sea and the Norwegian Sea, have always been exploited and have for centuries been the most common travel route along the long Norwegian coast. Nevertheless, this rough sea way has always been a threat to human life in bad weather. When Norwegian Meteorological was established in Bergen, marine weather had to be the main focus. Since then traditional weather forecasting for fisheries have been made regularly. In the early 1970's oil exploration and production became an important industry in Norway, and site specific marine forecasting and 1st generation contingency services were borne.

In the early 1990's, the need for further specialising into marine forecasting was evident, and in 1996 the Marine Forecasting Centre at met.no (MFC) was established. Our main aims are to use the best available numerical model output and marine observations, do maximum value adding and present the results in an user friendly and innovative way through use of new technology. To fulfill these aims MFC modernised production, focused on product development for end users and encouraged scientific development within marine weather such as contingency models, extreme waves, current measurements etc.

P-150-4

Potentiality of marine climatological data for the western Mediterranean from Catalan ships' log-books (18th and 19th centuries)

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In order to obtain more information about past climates, new palaeoclimatic techniques and sources are needed to evaluate the present climatic change. Marine meteorological data from documentary sources, i.e. ships' log-books, is a recognized *proxy* tool for climatic reconstructions. The Mediterranean basin, due to its historical background, has an enormous amount of information not yet exploited. In addition, the geographical characteristics of the region (a closed sea surrounded by mountains and dotted with islands) and its latitudinal situation makes this area exceptional since is affected by many climatic interactions.

This investigation analyses the potentiality of the information provided by this source during the golden period of Catalan trade with America (eighteenth and nineteenth centuries), focusing on the type of meteorological data available for the western Mediterranean basin. The structure and evolution of the log-books and the methodology used for the transcription of weather data will also receive attention.

P-150-5

Completion of the digitized Kobe Collection

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An eight-year project which aims at digitizing the Japanese historical marine meteorological observations known as the Kobe Collection finished in March 2003. The project has been carried out by the Japan Meteorological Agency and the Japan Weather Association with a financial support of the Nippon Foundation. The completed digitized Kobe Collection contains 5.8 million in situ marine meteorological observations out of 6.8 million observations in the form of log sheets for the period from 1890 to 1960. The 2.7 million observations for the period from 1933 to 1960 had been included in the Comprehensive Ocean-Atmosphere Data Set (COADS) before the project. The rest of those for the period from 1890 to 1932 have been digitized under the eight-year project and are now available on a CD-ROM. It is a remarkable Japanese contribution to the development of the International COADS.

P-150-6

Advances in the global ocean observing system

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Central to describing, understanding, and predicting the Earth's climate system is observation. The NOAA Climate Observation Program supports oceanic and marine meteorology projects designed to contribute to the implementation of a global climate observing system that is needed to satisfy the long-term requirements of operational forecast centers, international research programs, and the major scientific assessments, and to effectively plan for and manage responses to climate change. NOAA has worked with national and international partners to begin building a sustained global ocean system for climate, focusing first on the Pacific Ocean, expanding to the Atlantic, and promoting future research in the Indian Ocean. Sponsored projects are primarily U.S. contributions to global networks coordinated through international science and implementation panels, and managed in cooperation with the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology. The Climate Observation Program seeks maximum efficiency by promoting the utilization of platform and data infrastructure for several objectives, including understanding the Earth's climate system, and the global carbon and water cycles. Although the focus of the Climate Observation Program is to support projects that deploy autonomous *in situ* platforms, the underlying objective is to foster a "system" approach to effective international organization of complementary *in situ*, satellite, data, and modeling components of climate observation. This poster provides a view of advances made in the last two decades in the global ocean observing system and the predicted evolution of the system in the near future to develop a more robust understanding of sea level, carbon, heat, salinity, and air-sea exchange parameters. With the initial system design nearly 40% complete, the Climate Observation Program’s goal includes enhancing each of the eleven complementary *in situ*, space based, data and assimilation subsystems including addition of new tide gauges, Argo profilers, drifting buoys, moored buoys, expendable bathythermographs, ocean reference stations, and ocean carbon measurements.

P-150-7

Maury and German Involvement in the marine meteorological observation scheme

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Germany was not represented at the 1853 conference in Brussels when Matthew F. Maury, established *inter alia* a standardization of meteorological and oceanographic observations from ships at sea. The difficulty for Germany, in not being a single national state at that time, is demonstrated. We illustrate the individual efforts of scientists leading to the foundation of the „Norddeutsche Seewarte“ (Marine Observatory of Northern Germany) in 1868. The Norddeutsche Seewarte adopted and developed the Maury schemes.

We also illustrate an independent approach in the European area at that time. The Werners Wetterbuch (Werner’s Weather Diary) had its own meteorological journals and schemes, totally independent from Maury’s approach.

We highlight the development of German/American relations in the field of marine ship borne observations in the mid-19th Century. Personal links between Maury and the Deutsche Seewarte, as well as the data exchange, both contributed to these relations.

The status of the historical marine meteorological observational material in Germany, the state of its evaluation and further plans are shown.

P-150-8

The original draft logs which the international abstract logs (1853) are based upon

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Prior to the Brussels Conference in 1853, Lt. M.F. Maury already prepared a draft model of a meteorological abstract log for use on board ships. As this model could be useful for the Maritime Conference, it was tested in May and June 1853 on board two Dutch naval frigates: 'Prince of Oranje' and 'Palembang'. The international abstract logs, a result of the Brussels Conference, are mainly based on the experience gained with these two logbooks. One of the original logbooks is exhibited and an explanation of its use is given.

Posters:

CLIMAR-II Session I: Cross-cutting Issues

P-I-1

Progress on marine data management in a developing country: the case of the marine climatology of Ecuador

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The Oceanographic Institute of the Ecuadorian Navy has been collecting oceanographic and marine meteorological data since 1950. At the beginning, the data was stored in hard copy storage systems: later a basic database system was developed to store both oceanographic and meteorological data. This caused some problems, such as loss of data, difficulties in recovering data and deficient usage of storage capacity. In early 2000 a project to improve the data management system was developed. This project started by data archaeology to recover hard-copied oceanographic and meteorological data: the process produced the digitizing of 25 years of cruises and land stations data and at the same time developed a robust database based on the Oracle operating system. The data acquisition process was increased by the implementation of oceanographic data buoys and automated meteorological land stations, which transmit on a real time basis a great amount of data. This proved the necessity of a data quality control system for both historical and new data. The quality control system was developed and created to work jointly with the database system. At this moment, most of the data are marked with our quality control tool that uses international flag standards. Another important part of the system consists of the metadata implementation in order to establish a mechanism to allow data interchange and distribution. Currently, with the implementation of the project, researchers from many institutions of Ecuador have the capacity to create elaborate, reliable and accurate data products, such as the new marine climatology of the Ecuadorian sea that was developed using the acquisition, storage, and processing data system. This local climatology is being used to determine anomalous weather and climate patterns derived from ocean and atmosphere extreme events such as El Niño and La Niña, which cause huge economical and social impacts in Ecuador.

P-I-2

A Hydrometeo Atlas of 25 year measurements along the Flemish coast

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Since end 1977 wave-, wind- and tidal observations have systematically been executed in the Belgian Coastal Area and on the Belgian Continental Shelf. The measuring results have periodically been converted into useful statistical information. During the years the measuring sensor data was considerably extended and evolved. In 1986, after ten years intensive measuring, a global overview of the results has been drawn up and these results have statistically been converted in the shape of a Hydrometeo Atlas.

Recently the existing Hydrometeo Atlas has been actualised. The project has started with a thorough study of the statistical methods applicable on the different data types. This has been executed by simulation and fitting of various statistical distributions. Once the suitable methods were selected, various modules have been developed which interrogate directly the hydrometeo data (25 years data). The following statistical modules are developed:

- Extreme value computation of wave heights
- Statistical fit of the data on the theoretical Weibull distribution. Techniques are developed to calculate the range of accuracy of the results.
- Peak over Threshold (POT) method: statistical fit of values that are exceeding a given threshold
- Calculation of the return period
- Regression analysis
- Analysis of tidal data (harmonic analysis, Fourier analysis,…)

The former Hydrometeo Atlas has been replaced by an interactive CD-ROM, by which the most recent media- and presentation techniques are used. The files holding the results are organised in Web-based HTML folders. The CD-ROM can be accessed by means of a Web-browser.

The Hydrometeo Atlas can also be consulted via the AWZ website.

P-I-3

The Hydrometeo system Flemish Banks

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The Waterways and Maritime Affairs Administration (AWZ) in Flanders manages a Hydrometeo System delivering current hydrological and meteorological measurements and marine meteorological forecasts. The Hydrometeo System consists of a measuring network, called “Monitoring Network Flemish Banks” (Meetnet Vlaamse Banken) and a marine forecast centre – OMS – “Oceanographic Meteorological Station”.

The monitoring network was set up for the acquisition of real-time oceanographic and meteorological data along the Belgian coast and continental shelf. The oceanographic parameters monitored are waves, tidal height, current and water temperature; meteorological parameters are wind, air pressure, air temperature and rainfall. The network consists of small measuring platforms on the North Sea with hydrometeo sensors, of wave buoys, meteorological stations and telemetric water level gauges at the coast. Twice a day, on a dedicated computer system, hydrodynamic models calculate forecasts for tidal elevation and wave conditions in the southern North Sea and along the Flemish coast.

The data resulting from the Monitoring Network are an important information stream for the AWZ Oceanographic Meteorological Station in Zeebrugge. At the OMS, marine meteorologists of the Belgian Royal Meteorological Institute produce marine weather forecasts of tidal heights, waves, wind and visibility along the coast and in the shipping lane to the coastal harbours and to the estuary of the River Scheldt.

Real-time measurements as well as forecasts are distributed in different ways: dedicated links to internal and external users, websites, the Hymedis system, SeaNet (online data exchange between six monitoring networks in the North Sea region).

P-I-4

The NOAA Climate Database Modernization Program

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The Climate Database Modernization Program (CDMP) is managed through the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC). Its major goal is to make major climate databases accessible through the World Wide Web. CDMP's primary focus is on imaging and keying of climate data. CDMP has grown to include tasks from all five major NOAA line offices, and internationally to include digitizing historical upper air records from six African nations, with an agreement to cooperate with Canada to provide access to archived marine observations. The amount of images on-line in mid 2003 reached 39 million records, totaling over three terabytes of data.

In support of the International Comprehensive Ocean-Atmosphere Data Set (I-COADS) and related programs interested in marine observations, CDMP has supported the imaging and keying of numerous marine observational records. As part of the NCDC operational incoming records effort, CDMP contractors are imaging and keying all U.S. Navy and Voluntary Observing Ship records received for archiving. As the forms are received the images are on-line within 48 hours, and keyed within days of imaging.

CDMP with the great support and cooperation of Deutscher Wetterdienst, the German Meteorological Service in Hamburg imaged all the German Maury logbooks in their archives. Deutscher Wetterdienst transported the logbooks to NCDC, where they were imaged, indexed, and placed on-line by CDMP before the original logbooks were returned to Germany. Another task included keying a special collection of marine observations from Japan.

This year, CDMP has allocated resources for imaging and keying the early editions (1955-1972) of WMO Pub. 47. The WMO Library has graciously consented to loan their copies of the publication to CDMP for up to two months for imaging. This important metadata information will then be keyed from the images. Also slated for this year is the imaging and placing on-line of the U.S. Maury Collection (1796-1861) and the U.S. Marine Meteorological Journals (1879-1893) off of microfilm copies from the National Archives and Records Administration (NARA). These observations were keyed earlier in cooperation with the Chinese National Oceanographic Data Center (CNODC) from paper copies produced from the microfilm. CDMP has also scheduled a visit to NARA to image a number of historical collections, including a large number of Atlantic lightship logbooks to be keyed along with the lightship records housed at NCDC. The keying of the NCDC-archived lightship records has already begun, and will be available for the National Marine Fisheries Service and for merging into I-COADS.

In keeping with the goal of making climate data accessible over the Internet, CDMP is continually searching for and supporting tasks to accomplish this objective.

P-I-5

Analysis of meteorological observations from Station “M” (MIKE) 1949-2002.

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Weather information became very important to secure the civil air traffic between Europe and America that developed after the Second World War. A net of weather ships was therefore established in the North Atlantic with start in 1948. The net consisted of 13 ships and the main purpose was to take meteorological observations. Secondly they would participate in rescuing of airplanes in trouble and thirdly participate in air traffic control and other radio securing duties. All the weather ships in this net are now history with exception for W/S Polarfront holding the position ”M” (MIKE) in the Norwegian Sea (66ºN, 2ºE). Besides the meteorological observations W/S Polarfront has been measuring important oceanographic parameters from the bottom of the sea (2000 m) up to the surface. The record of oceanographic variables is one of the longest of its kind in the world. Especially the radiosonde data from W/S Polarfront is very important input for the numeric weather prognoses. Several environmental data both from air and sea has been measured and are still measured from W/S Polarfront. Here we will concentrate on the analyses of the long series of meteorological parameters near the sea surface.

P-I-6

Quantifying random errors in VOS meteorological observations

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Estimates of random errors in measurements of marine surface meteorological variables are important for generating and understanding fields of these variables. Information about random errors is necessary for the construction of climatological and model forcing fields, data assimilation and for the analysis of biases in the variables themselves. We present estimates of random errors calculated using a semivariogram technique for the meteorological variables reported by Voluntary Observing Ships (VOS) and collated in the International - Comprehensive Ocean Atmosphere Dataset (I-COADS). The estimates are calculated for each month in the period 1970 to 1997 for pressure, wind speed, air and sea temperature and humidity. The random errors are shown to vary with region, time, the quality control applied, the method of measurement, the recruiting country and the source of the data.

P-I-7

Optimal estimation of the model covariance matrix of oceanic data assimilation system by neural network method

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In this paper, we propose a method to estimate the model covariance matrix (MCM) of oceanic data assimilation system (ODA) on the basis of the neural network method. Firstly, we suppose that MCM can be described by a unified formula (Gaussian type function) and its value is determined by the amplitude and the correlation length, which are spatial and time function. Then, we construct an object function consisting of squared deviation of ODA from the observations on some points selected previously. The neural network is trained by optimizing this object function so that a relative reasonable shape of MCM may be obtained.

Using the observation data from 1997 to 2001, we have performed several numerical experiments on ODA of National Climate Center of China (a 3DV assimilation system) and get a MCM by this method. Then, we run ODA with this MCM from 1982 to 2003. Comparing with NCEP's results, ODA and this MCM has been improved obviously.

Key words: Data Assimilation, neural network.

P-I-8

Marine data rescue, archival and management project

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The aim of this project is to rescue marine data especially meteorological and oceanographic data which are scattered in various raw forms in certain institutions in the countries bordering the Western Indian Ocean. These include Kenya, Tanzania, Mozambique, Somalia, Mauritius, La Reunion and Seychelles. Such data are those collected through the Voluntary Observation Ships (VOS) of WMO and Ships of Opportunity Programme (SOOP) of former Intergovernmental Global Ocean Observing System (IGOSS) over many years. This data is stored in logbooks and some of them have become too old and there is danger that all or some of that valuable data can be lost if quick action to rescue them is not taken.

It is hoped that funding will be found for the project. If successful it will run as follows:

STEP ONE will identifying where the data is and in which form.
STEP TWO will be decoding those messages which are in WMO code forms.
STEP THREE will be entering the data into the computer in the format of the logbooks.
STEP FOUR will be quality control.
STEP FIVE will be transferring the data to more permanent media such as CD-ROMS.

If funding and time will allow, further analysis will be done to obtain products useful for climate studies and other scientific research.

It is a fact that once National Meteorological Services have used maritime data for realtime weather forecasts the data is never retained in permanent form. This project therefore will try and rescue from original records the data which would otherwise be lost forever.

P-I-9

Hymedis – a real-time distribution system for Hydrometeo data

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The pilots, the service vessels (e.g. tugboats and lifeboats) and the shore stations (radar centrals) play a crucial role in the process of guiding the ships in a safe way to and from the different harbours in the area. For that reason they need to have to their disposal accurate and real-time information concerning the hydrological (draught, surge, …) and meteorological circumstances as well as the predictions for the area. To meet these requirements the Hymedis project was set up.

Hymedis is a real-time wireless distribution system for HydroMeteo data that became operational in September 2003. It is a joint AWZ (Waterways and Maritime Affairs Administration – Belgium) – RWS (Rijkswaterstaat – Netherlands) project and managed by the Management and Exploitation Team of the Scheldt Radar Chain (BET-SRK). Hymedis is delivering real-time measurements from the monitoring networks “Flemish Banks” of AWZ and “ZEGE & MSW” of RWS. These data, e.g. water levels, wave heights, wind speed and direction, are distributed through mobile data communication technology to mobile devices (GSM, PDA, laptop). The pilots are users of this distribution channel. On service vessels the same wireless information stream is imported in an ECDIS-application. For users on shore stations a web based application is available. The data for these clients are distributed over the internet using the HTTP protocol.

P-I-10

A 114-year record of spring-summer surface water temperature based on oxygen isotope ratios across bivalve mollusk shells, Arctica islandica (North Sea)

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Although the North Sea is one of the most intensively studied marine ecosystems, there is a lack of continuous, long-term and high resolution record on surface water temperature (SST); SST models still require verification. We approach this deficiency by analyzing seasonal and inter-annual stable isotope variation of the long-lived (>210 years) bivalve mollusk Arctica islandica. $\delta_{18}O$ ratios were measured in specimens of A. islandica specimens collected alive from the North Sea at 25 m depth. Temperature values calculated from the $\delta_{18}O$ values range from 6.54°C to 16.69°C. There is a significant correlation and a high running similarity between surface water temperatures measured by satellite, buoys and shipboard measurements and those reconstructed from $\delta_{18}O$ of the shells. Currently, our SST reconstructions from A. islandica shells cover the period from 1889 to 2002 with a resolution ranging from about two weeks to about six months. This temporal resolution was achieved through micro-milling technique. Our study demonstrates that the bivalve species Arctica islandica provides an excellent archive for testing the accuracy of SST models prior to direct measurements. Such data can be used for calibrating and testing Global Circulation Models.

P-I-11

Synthesis of basin-scale air-sea flux fields

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New basin-scale air-sea flux fields are being developed based on the following strategy: 1) deployment of surface flux reference sites, surface moorings deployed in key meteorological regimes around the world and equipped with accurate, well-calibrated sensors that sample once per minute, capture surface meteorological variability (wind speed and direction, air and sea temperature, barometric pressure, incoming shortwave and incoming longwave radiation, precipitation, relative humidity), provide the data needed for computation of bulk-formulae air-sea fluxes of heat, freshwater, and momentum; 2) equipping the VOS doing the high resolution XBT lines with the same sensors to obtain spatial information; 3) rigorous calibration procedures; and 4) use of these in-situ data to guide a data assimilation effort that brings in remote sensing data and surface fields from numerical weather prediction models. Observations from two operating surface reference station and from the VOS are shown as are air-sea flux fields for the Atlantic Ocean.

P-I-12

The quality of surface meteorology from unattended buoys and from VOS

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Surface flux reference sites, surface moorings deployed on an annual cycle in key meteorological regimes around the world and equipped with sensors that sample once per minute, capture surface meteorological variability (wind speed and direction, air and sea temperature, barometric pressure, incoming shortwave and incoming longwave radiation, precipitation, relative humidity) and select Volunteer Observing Ships (VOS) instrumented with the same sensors are being used to collect the surface meteorological data needed to produced air-sea fluxes for climate studies. The characteristics and performance of these unattended sensors are presented, and the calibration and comparison procedures used to estimate the accuracies of the observations, which include laboratory calibration and intercomparisons in the field and on land, are discussed. Finally, plans to address issues that now limit quality and gain further improvements are outlined.

Posters:

CLIMAR-II Session II: Pressure and Wind

P-II-1

Methods to homogenize wind speeds from ships and buoys

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Long-term homogeneous datasets of marine surface winds are required for climate analysis. However significant temporal changes, in the size and type of observing platform and in the method, have introduced inhomogeneities to databases of archived marine winds. We describe some of the sources of bias in wind reports of recent decades, and apply and assess methods to homogenize these data sets.

This study uses wind reports from buoys moored in Canadian waters and reports of visually estimated and measured wind speeds from nearby ships, from 1980 to 1995. We show that adjusting measured wind speeds to a standard reference level, and using Lindau's improved Beaufort equivalent scale for estimated winds, significantly improves the agreement between ship and buoy. We test several regression methods to remove the remaining difference. An orthogonal regression method produces a relationship that is most effective for converting one dataset to have the same statistical characteristics as the other. We show the effect of the time of day on estimated wind speeds.

P-II-2

Effect of vessel type and platform relative wind direction on the comparison between buoy and ship wind speeds

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Some inhomogeneities between ship and buoy wind reports are due to factors (such as different anemometer heights) whose effects can be computed theoretically and compensated for. Other factors such as air flow distortion and differences in averaging technique are less well understood, and not easily predicted from theory. This study attempts to identify these factors and to quantify them using statistical techniques. In particular we study the influence of the platform relative wind direction on the reported wind speed, with data primarily from tankers and container ships.

Comparing u10n buoy winds (adjusted to 10 m effective neutral) to u10n measured and Lindau-adjusted estimated ship winds, we find that the ship-buoy wind speed relationship is significantly dependent on the heading of the ship relative to the wind and seas, and on the vessel type.

Posters:

CLIMAR-II Session III: Marine Temperatures and Sea Ice

P-III-1

Influence de la variabilite climatique sur l'oceanographie côtiere du Benin

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Les moyennes mensuelles de température de l'air à la station de Cotonou Cadjehoun (06 21 N X 002 23 E) sur 10ans (de 1975 à 1984), les moyennes par quinzaine et par mois des températures de surface de l'Océan à Cotonou pour la même période ont été étudiées et analysées. Les hauteurs des pluies (précipitations) ont été analysées et mise en corrélation avec les températures de l'air, de l'eau de mer en surface.

Le second schéma étudié concerne les variations des températures et les salinités de l'eau de mer en fonction des profondeurs sur la base des données collectées par notre Centre. Il s'agit d'identifier les zones de thermocline pour voir les variations en profondeur, du phénomène d'Upwelling au cours de l'année.

Une tentative de corrélation de la production mensuelle d'une espèce pélagique (Sardinella spp.), indicateur du phénomène a permis de voir la corrélation inverse entre la température de l'air.

P-III-2

A hindcast simulation of the Arctic and Antarctic sea-ice variability, 1955-2001

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A hindcast simulation of the Arctic and Antarctic sea-ice variability has been performed with a global, coarse-resolution iceocean model driven by the National Centers for Environmental Prediction (NCEP) National Center for Atmospheric Research (NCAR) reanalysis daily surface air temperatures and winds. Both the mean state and variability of the ice packs over the satellite observing period are reasonably well reproduced by the model. Over the 47-year period, the simulated ice area (defined as the total ice-covered oceanic area) experiences in each hemisphere large decadal variability together with a decreasing trend of ~1% per decade. In the Southern Hemisphere (SH), this trend is mostly caused by an abrupt retreat of the ice cover during the second half of the 1970s and the beginning of the 1980s. The modelled ice volume also exhibits pronounced decadal variability, especially in the Northern Hemisphere (NH). Besides these fluctuations, we detected a downward trend in Arctic ice volume of 1.8 % per decade and an upward trend in Antarctic ice volume of 1.5% per decade.

P-III-3

On homogeneity and use of SSTs for seasonal forecasting in the coastal areas of Nigeria

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It is essential that rainfall data are quality controlled for reliable prediction. Prediction models have indicated that seasonal fluctuations in global parameters like El Nino, SOI indices, SST anomalies and other parameters influence seasonal rainfall (Ward, 2000; Ogallo, 1994 and Cadet, 1985 etc.).

In this work, anomalies of SSTs over North Atlantic, South Atlantic and Nino 3 regions and Southern Oscillation indices (SOI) are correlated with the monthly and seasonal anomalies of rainfall in the six coastal stations of Nigeria. The rainfall data are from 1910 –2002. Visual inspection of graphs of the monthly and seasonal anomalies of rainfall is carried out before double mass curve analysis is used for quality control of the rainfall data.

Results showed that:

1. Out of the six coastal stations used, Ikeja, Warri and Port Harcourt displayed non-homogeneity in their mass curve graphs. This is mainly due to urbanization and heavy industrialization near the stations.

2. Most of the stations showed significant correlations with the global SST anomalies and SOI. Of great interest is January/February SST, which can be used to predict the onset of rainfall at the stations.

P-III-4

Interannual variability of SST observed in the Central Arabian Sea

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The time series observations of sea surface temperature (SST), from a moored buoy location at central Arabian Sea (Lat: 15.5 N; Long: 69.2 E) for a period of four years during 1998-2001 is used for interannual variability study. The climatological pattern of SST exhibits a bimodal distribution with a primary warming during pre-monsoon period (March to May) reaching a maximum just before the onset of southwest monsoon and a secondary warming after the withdrawal of the monsoon (September to November). The annual distribution of SST during 1999, 2000 and 2001 agrees well with the climatology whereas the year 1998 is distinct without the signal of secondary warming which coincides with the El Nino event. The primary warming mode during the year 1998 and 2001 exhibits relatively high SST maximum exceeding 31°C, which favoured the tropical cyclone activity. The cyclone passage during pre-monsoon is followed by an abrupt drop in SST of the order of 3-4°C due to wind induced mixing.

P-III-5

Homogeneity analysis of Portuguese SST time series

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Before study of climatic fluctuations and changes over sea surface temperature time series, it should be analysis the homogeneity of them, to avoid spurious trends and/or gradual shifts associated with artificial irregularities that may mask the climatic variability and natural trend. With this purpose have been adopted the Homogeneity Test (SNHT) for a single shift (Alexandersson, 1986), the Range-test (Buishand, 1982), and the classic von Neumann Raio (von Neumann Raio, 1941) to several Portuguese SST time series. The results suggest that there are some inhomogeneities but without statistical significance. However, it is important to have information of metadata that will provide the identification and correction of these inhomogeneities.

P-III-6

Finding the true temperature of the ocean surface

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Observations of Sea Surface Temperature (SST) made by merchant ships have been analysed to identify biases which depend on how the measurement was made. The analysis is complicated by the circular nature of the problem: biases in SST depend on the heat fluxes, which are calculated from the SST. The analysis method uses pairs of co-located SST observations obtained by different measurement techniques: one ship using an insulated bucket to measure the SST and the other reporting the temperature of the engine intake water. A simple physically based model is used to parameterise the expected difference between the two observations based on environmental conditions. In order to estimate the empirical coefficients in the model it is necessary to account for the error and correlation structure of the dataset. The results show climatologically significant biases in the night-time bucket-derived SST and provide information on interdecadal variations in SST bias.

P-III-7

Regime shift and ENSO event in the global SSTs

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Significant phase changes in the global SST anomaly field are found five times from the 1910s to the 1990s, which are consistent with the Northern Hemisphere regime shifts already reported by other studies. The regime shifts happened concurrently with the ENSO event. The seasonal evolutions of the regime shifts resemble those corresponding to series of the evolution of ENSO events. After the shifts happened, the spatial patterns of changes at the regime shift persist until the next shift. From the EOF analyses, four dominant variation modes are detected in the global SSTs; the ENSO mode, the trend mode, the North Pacific (NP) mode, and the Arctic Oscillation (AO) mode. At the years when regime shifts occurred, the ENSO mode, the NP mode, and the AO mode show significant concurrent phase reversals.