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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY (JCOMM)
EXPERT TEAM ON MARINE CLIMATOLOGY

FIRST SESSION

GDYNIA, POLAND, 7 TO 10 JULY 2004

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ITEM 6

Original: ENGLISH

CLIMATE CHANGE DETECTION MONITORING INDICES

(Submitted by the Secretariat)

Summary and Purpose of Document

The original objective of the development of the Marine Climatological Summaries Scheme (MCSS) was to establish a joint effort of all maritime nations in the preparation and publication of climatological statistics and charts for the ocean. In this connection, this document briefly presents activities/discussion of the CCl/CLIVAR Expert Team on Climate Change Monitoring Detection and Indices.

ACTION PROPOSED

The Expert Team on Marine Climatology is invited to:

(a) Note and consider the information provided;

(b) Make recommendations on this issue, as appropriate, including possible revision of the guidance for the climatological summaries, which are included in the Guide to Marine Meteorological Services (WMO-No. 471) and Manual on Marine Meteorological Services (WMO-No. 558).

Appendices: A. Extract from the CCl/CLIVAR Expert Team for Climate Change Detection Monitoring and Indices (ETCCDMI) First Team Meeting Report

B. Terms of Reference for the Task Team on JCOMM Ocean Product Development

DISCUSSION

Introduction

1. The original objective of the development of the Marine Climatological Summaries Scheme (MCSS) was to establish a joint effort of all maritime nations in the preparation and publication of climatological statistics and charts for the ocean. The current version of the Guide to Marine Meteorological Services (WMO-No. 471) and Manual on Marine Meteorological Services (WMO-No. 558) include guidance for the climatological summaries, accordingly. The Team will be invited to review the guidance and consider needs for such guidance and revision of the Manual and the Guide as necessary. In this connection, this document briefly presents activities/discussion of the CCl/CLIVAR Expert Team on Climate Change Monitoring Detection and Indices.

2. The Expert Team for Climate Change Detection Monitoring and Indices (ETCCDMI) is jointly sponsored by the Commission of Climatology (CCl) of the World Meteorological Organization (WMO) and the Climate Variability and Predictability (CLIVAR) project of the World Climate Research Programme (WCRP). It plays an important role in developing and implementing CLIVAR's research programme for climate change detection and attribution and in coordinating and providing guidance for CCl's global climate monitoring activities

3. Mr Val Swail, Chair of the JCOMM Expert Team on Wind Waves and Storm Surges and a member of the former SGMC, was invited to participate in the first Team meeting of the CCl/CLIVAR Expert Team on Climate Change Monitoring Detection and Indices in Norwich, United Kingdom, 24-26 November 2003. Mr Swail gave two presentations to the ETCCMDI, one on JCOMM, and one on marine climate indices. By the report of the ETWS chairman submitted to the second session of the JCOMM Services Coordination Group (SCG-II) (Toulouse, France, May 2004), Mr Swail reported that the meeting considered that marine climate indices fell within the purview of JCOMM and encouraged JCOMM to work on their development. It was suggested that the ETWS develop its climate component beyond what presently exists. The final report of that meeting is available at: http://www.clivar.org/organization/etccd/docs/ETCCDMI1stReport.htm. Paragraphs relevant to JCOMM are shown in the Appendix. Mr Swail also suggested that the requirement for marine climate indices could possibly be available in the JCOMM Electronic Product Bulletin, or elsewhere such as a National Meteorological Service. Along with that is the suggestion from CCl/CLIVAR that JCOMM, and thus probably ETWS and maybe ETMC, develop more wave climate products, including indices.

4. SCG-II established a new Task Team on JCOMM Ocean Product Development, with Terms of Reference and proposed Membership given in *Appendix B.*. The team should have prepared a first draft proposal for review by the JCOMM Management Committee in February 2005, prior to submission to JCOMM-II in September 2005. With regard to marine climate indices, SCG requested the Task Team on JCOMM Ocean Product Development to provide advice on this issue.

Action proposed

5. The Expert Team is invited to note and consider the information provided. It is invited to make recommendations on this issue including possible revision of the guidance for the climatological summaries, which are included in the Guide to Marine Meteorological Services (WMO-No. 471) and Manual on Marine Meteorological Services (WMO-No. 558).

Appendices: 2

Extract from the CCl/CLIVAR Expert Team for Climate Change Detection Monitoring and Indices (ETCCDMI) First Team Meeting Report

3. The ET role in other programs

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JCOMM - Mr. V. Swail thanked Peter Dexter (JCOMM Secretariat, Geneva) for his input to his presentation. The WMO/IOC Joint Technical Commission for Oceanography and Marine Meteorology is an intergovernmental body of experts, which provides the international, intergovernmental coordination, regulation and management mechanism for an operational oceanographic and marine meteorological observing, data management and services system. As Mr. V. Swail showed, JCOMM makes effort to further develop the observing network, partly under the guidance of GCOS. Its data management activities are coordinated with other bodies including GOOS and WMO/CCl. JCOMM has archived various types of data for meteorology, surface oceanography, sea level and sea ice, including those from vo nteer vessels, drifters, buoys, and satellites, which are useful for studying seasonal to interannual and longer-term climate variability.

As Mr. Swail discussed, a notable JCOMM activity is the MCSS - Marine Climatological Summaries Scheme. Established in 1964, the MCSS has as its primary objective the international exchange, quality control and archival of delayed mode marine climatological data, in support of global climate studies and the provision of a range of marine climatological services. Two Global Data Collecting Centres (GCC) were established in 1993 in Germany and the United Kingdom. All data are eventually archived in the appropriate World Data Centres, such as the National Climatic Data Center (NCDC). Another notable advance took place with the CLIMAR workshops. As Mr. Swail outlined, the 1st CLIMAR workshop (Vancouver, 1999) brought together COADS and JCOMM, and was followed by workshop in Boulder (2002) and CLIMAR II (Brussels, 2003), which further developed CLIMAR's scope. CLIMAR set 3 streams of work on:

- historical data - to identify, locate, digitize, quality control, homogenize and exchange, leading to data products,
- climate analysis - mean, variability, extremes, uncertainty, trend, indices, leading to information products, and
- observational systems - involving GCOS/GOOS, VOSClim, AVOS, ocean observatories and satellite

A complete description of JCOMM's data activities can be found on the JCOMM website at: http://www.jcommops.org.

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6. Marine and oceanic aspects

There is great potential for developing marine and oceanic aspects in the area of CCDMI. A few talks were invited at ETCCDMI-1 to address relevant issues.

Status of marine data and monitoring - Prof. Folland provided a briefing on recent advances in developing global marine and ocean surface data sets, including:

- I-COADS - SST time series are being extended back to the 1840s (there are early sparse data) and improved with enhanced data since 1850 (compared to COADS), e.g., the Maury Collection of data, Japanese KOBE Observatory data, Japanese whaling ship data (30k reports). Sea ice data is also being enhanced that is not yet in the I-COADS set, e.g. with historical sea ice data from WMO Global digital Sea Ice Data Bank from Japan, Baltic, China and Russia. However, SST biases due to use of uninsulated buckets in earlier decades need re-assessing in the new I-COADS data set. In addition, there are thought to be smaller biases in some modern SST data which will need quantifying.
- Ocean air temperatures - recent improvements to NMAT using new corrections for marine screen heights and increased data from I-COADS.

- HadISST - improved from HadSST (used in IPCC 2001), HadISST1 combines SST and sea ice in a 'globally complete' data set. It is optimally interpolated and uses AVHRR satellite SST data.
- High-resolution Satellite SST - advances may be foreseen from the GODAE High Resolution (6 hour and 10 km) SST Pilot Project, aimed at high resolution global time and space SST analyses using polar orbiting and geostationary infrared data, microwave satellite data, and quality controlled ship, buoy and Argo data. A new HadISST2 analysis is planned which will include the new sea ice data and enhanced SST data from I-COADS.
- MSLP - development of HadSLP2m, with improved coverage (global 5x5deg) due to inclusion of I-COADS and additions from the terrestrial data bank, is underway. Daily gridded MSLP series 1850-2002 for the North Atlantic – European area is also being developed. The HadSLP2m data will be updated in near real time using GTS data.

Having illustrated some improvements and problems in data, Prof. Folland concluded:

- Historical SST and sea ice data can be considerably improved. Biases need additional attention post 1945 and around 1939-1941.
- Recent developments may particularly improve knowledge of ENSO, the Interdecadal Pacific Oscillation, and longer time scale SST variations in North Atlantic.
- Gridded SST data should be optimally interpolated (OI) with caution.
- Error bars should be placed on SST NMAT and MSLP with the help of optimum averaging and assessment of the bias correction uncertainties.
- It will be possible to develop high spatial and diurnal resolution worldwide SST using microwave and infrared satellite data and in situ data, perhaps including Argo.
- Substantial improvements to marine SLP data have emerged; The community is working towards two International historic SLP data sets (perhaps I-MSLPm and I-MSLPd).

Monitoring and assessing marine climate change - Focusing on winds and waves, Mr. Swail outlined current status, plans and targets for marine climate monitoring. A 42-year wind and wave hindcast developed by the Climate Monitoring and Data Interpretation Division of the Meteorological Service of Canada showed that in the period 1958-1997, the 90-percentiles of significant wave height for winter increased in the northeast North Atlantic by 2-6 cm/year and decreased by 1-3 cm/year in the subtropical North Atlantic. Analysis showed possible links between the wave height increases in the northeast Atlantic and the NAO variability. Study of marine climatology has obviously benefited our understanding of climate system. Mr. Swail noted that a first Global Wave Climatology Atlas derived from 45-year ECMWF reanalysis data was recently published (http://www.knmi.nl/onderzk/oceano/waves/era40/index.html). Monthly and seasonal statistics, anomalies and other wave/wind data and information are also available online, e.g., the I-COADS web http://www.cdc.noaa.gov/coads-las/servlets/dataset.

Mr. Swail briefed the ET on some of the recommendations from CLIMAR-II 2003, including

- Investigate how to apply proposed wind homogenization techniques to global data bases such as I-COADS where ancillary data and/or metadata are not always available. Is the SST adjustment approach suitable for winds?
- Recommend to I-COADS that they investigate the inclusion of wave information in their climate summaries.
- Develop a list of recommended climate indices for winds and waves, and pressures. Indices should be appropriate to the data bases used to develop them.
- Recommend to JCOMM that they promote the development of climate information, especially indices, as a logical update in technology to the outdated MCSS analysis.
- Recommend to JCOMM that they identify operational and experimental climate information products, and include these as part of the new JCOMM Products portal.
- Participate in the JCOMM Products Workshop Toulouse May 10-12, 2004.

The team discussed how to coordinate with JCOMM and agreed to write to JCOMM to express the need for marine and oceanic climate monitoring, change detection and indices.

Status of deep ocean data and monitoring - Dr. Bindoff reported on sub-surface ocean temperature

and salinity observations (deeper than 10m) that are part of the CLIVAR program. He briefed the ET on the historical data that exist prior to the 1990's, during the WOCE experiment, and those that are planned for the CLIVAR repeat sections and for the carbon cycle work over the next 10-15 years. In addition, Dr. Bindoff reported on the Argo program, and showed new results from the November 2003 Argo Workshop in Japan. Although there are only ~1000 floats currently deployed in the oceans these data are already useful for estimating heat and freshwater changes on a zonal basis in the Northern and Southern subtropical gyres over the last decade. The importance of the Argo data set for climate change detection in the coming decades is going to increase. He appealed to the CLIVAR International Program for additional help in promoting and supporting Argo, and the CLIVAR repeat hydrography and carbon cycle sections.

Monitoring and assessing ocean climate change - Dr. Bindoff went on to report on ongoing efforts internationally to detect climate change signals in the major ocean basins. He showed examples from all ocean basins that support the notion that key oceanographic water masses in both the Southern and Northern Hemispheres are changing, in particular, the mode waters and intermediate waters in both hemispheres. The mode waters show warming, and the intermediate waters show a freshening, suggesting that both the surface temperatures and surface salinities are changing. The changes are broadly consistent with results from climate changes simulations.
The team discussed indices for detection of marine and ocean climate change. As Dr. Bindoff pointed out, one of the key issues in detecting climate change is the selection of suitable variables. Signal and noise are important considerations. It is clear from coupled model simulations of natural variations and climate change that variables such as the transport of heat (at 24N in the Atlantic) are not significantly different from the control in the climate change simulations. On the other hand, sea-surface temperature, and water mass properties are significantly different. Similarly it is important to look at the water masses that are most likely to change, i.e., those that are relatively close to their source regions, and in areas where the natural variations are likely to be smaller. Coupled models suggest that water masses in the southern Ocean are a more sensitive indicator of change, because the signal-to-noise ratio is higher there. Thus, for the detection and attribution of climate change, the best ocean variables to use for indices would emphasize storage terms (such as heat, salt, carbon) variations in the water-mass properties and volumes, sea-level and perhaps large scale changes in ocean stratification. It is also important that these indices have value for establishing relationships between the oceans and terrestrial variations. Together, these requirements suggest that there will be a need for both global scale and regional scale indices.
The team recognized that for climate change detection and attribution, it is important to create proper indices. Example indices were proposed, including:

- global ocean heat content and sea level,
- zonally average salinity, temperature and heat content,
- water mass averaged quantities, thickness, etc.,
- indices indicating current bifurcation such as Indian Ocean Dipole and Aleutian Dipole,
- indices for ocean-atmosphere interactions such as Asian-Australian monsoon and overturning modes.

However, it was noted that the number of indices should remain small and should include those that have been commonly used, such as the well-known ENSO indices. The team charged Dr. Bindoff, Prof. Folland, Mr. Swail and Prof. Karoly with the task of summarizing and circulating a list of ET-recommended marine and oceanic indices for the IPCC AR4, together with the comparative list of indices made by Dr. Haylock.

Action 11. Prepare a short document on suggested large-scale atmospheric, oceanic and marine climate indices for monitoring and detection that should be considered for the IPCC 4th Assessment Report (AR4). *Bindoff/Folland/Swail/Karoly*

Action 12. Write to JCOMM expressing need for marine climate change detection, monitoring and indices. *Co-chairs/Swail*

Terms of Reference for the Task Team on JCOMM Ocean Product Development

Introduction

The JCOMM ocean products symposium, Ocean Ops 04, made a number of recommendations relating to the future development of operational ocean products and services within the context of JCOMM, and also provided a framework for this development. These were endorsed by the second session of the Services Coordination Group, and provide the basis for the work of the Task Team on the Development of Operational Ocean Products under JCOMM. It was also recognized that, in general, what are classified as JCOMM products are really intermediate products being made available for secondary users, not end users, except in clear cases of public good products (e.g. Maritime Safety Services).

Terms of Reference

In the light of the large number of operational or quasi operational real time ocean products now becoming available, and with a view to eventually developing formal guidance material under JCOMM for operational ocean products and services, prepare for JCOMM 2 a draft proposal relating to:

(i) standardisation of presentation and delivery formats, nomenclature, etc
(ii) classification according to users
(iii) detailed specifications for such user requirements
(iv) criteria for selection as "JCOMM products"
(v) data and metadata directories related to products
(vi) consideration of multi-disciplinary and non-physical products (chemical, biological, ecosystem) under JCOMM
(vii) data, products and services for developing countries
(viii) possible TOR for the future designation of specialized oceanographic centres under JCOMM

Proposed Membership

Services Programme Area Coordinator (chairman)
Observations Programme Area Coordinator
Capacity Building Programme Area Coordinator
Expert in data and metadata management (designated by Savi Narayanan)
…….representing GODAE (designated by the GODAE Project leader)
Julie Hall (GOOS/COOP)
Eric Lindstrom (TT satellite data requirements)
Ed Harrison (OOPC)
Polar product expert (designated by chair ETSI)
Craig Donlon (U.K.)
Takashi Yoshida (Japan)
Blue Link (Australia)
Ed Johnson (NAVOCEANO, USA)
Yves Tourre (JEB representative)
JCOMM Secretariat representative

Timescale

First draft proposal for MAN-IV, February 2005, final proposal for JCOMM-II.