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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

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EXPERT TEAM ON MARINE CLIMATOLOGY

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REVIEW OF CONTRIBUTIONS AND REQUIREMENTS OF THE WORLD CLIMATE PROGRAMME AND OTHER CLIMATE RELATED PROGRAMMES

Report on the Second Meeting of the Expert Team on Climate Change Detection and Indices Meeting (ETCCDI-II, Niagara-on-the-Lake, Canada, 14-16 November 2006)

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Summary and purpose of document

This document provides a report on aspects of the Second Meeting of the Joint CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI-II).

ACTION PROPOSED

The Expert Team on Marine Climatology is invited to comment on the information provided and to consider:

(a) Whether the ET has a role to play in the development of marine indices.
(b) Possible connections on developing marine indices with the JCOMM Services Programme Area (SPA), and its ETs, as appropriate.
(c) Whether marine indices should be strongly promoted at the proposed CLIMAR-III Session.

Appendix: (A.) Terms of Reference for the CCL/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices

DISCUSSION

1. Background

The Expert Team on Climate Change Detection and Indices (ETCCDI) is currently co-sponsored by the World Meteorological Organization (WMO) Commission for Climatology (CCl), the World Climate Research Program (WCRP) Climate Variability and Predictability (CLIVAR) program and the JCOMM. The JCOMM was added to the list of sponsoring organizations in 2005, as it was felt that the oceans were under-represented on the Expert Team, and that the JCOMM, with primary responsibility for marine climate within WMO, should be represented organizationally.

The Terms of Reference of the ETCCDI are provided in Appendix of this document. The Second Meeting of the Expert Team on Climate Change Detection and Indices (ETCCDI-II, Niagara-on-the-Lake, Canada, 14-16 November 2006), was the first at which the JCOMM had been formally represented. However, two of the four JCOMM Representatives (Mr Chris Folland and Mr Val Swail) had also attended the First Meeting of the ETCCDI, which was held Norwich, United Kingdom, from 24 to 26 November 2003) in other capacities (e.g., Chris Folland served on the predecessor WMO Working Group on Climate Change Detection as Deputy Chairperson, while Val Swail made presentations describing JCOMM in particular, and marine climatology in general, at the first session).

Past achievements of the ETCCDI have included: (i.) the sponsoring of a number of regional climate change workshops resulting in capacity building, (ii.) improved data availability, (iii.) published papers and contributions to the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report, particularly on changing extreme events, and (iv.) the development of climate change indices and analysis tools and contribution to the WCRP cross-cutting program on extreme events. In addition to the achievements mentioned above, the ET has also had a remit for climate change monitoring. This responsibility has now been transferred to a new CCl ET on Climate Monitoring, including the Use of Satellite and Marine Data and Products, which held its first meeting in Tarragona, Spain, from 20 to 22 September 2006. However, close cooperation between the two ETs is clearly needed, especially in the marine area.

Further information on the ETCCDI can be found at the following web address: http://www.clivar.org/organization/etccdi/etccdi.php.

2. Summary of Aspects of 2nd Meeting of ETCCDI, (ETCCDI-II, Niagara-on-the-Lake, Canada, 14-16 November 2006).

The JCOMM was represented at the meeting by Mr Chris Folland (Hadley Centre, Met Office, United Kingdom), Dr Elizabeth Kent (National Oceanography Centre, Southampton, United Kingdom), Val Swail (Climate Research Division, Environment Canada, Canada) and Scott Woodruff (NOAA Earth System Research Laboratory, Boulder, Colorado, USA).

The perspectives of the JCOMM were presented by Mr Val Swail and Mr Scott Woodruff. They emphasized the enhanced climatological links that are being made across the JCOMM Programme Areas. The ET was also shown the progress that had been made toward implementing the Global Ocean Observing System for Climate. The work of the Expert Team on Marine Climatology was also presented, along with a question as to whether the ETMC might be a good forum to promote the development and construction of a wider range of marine indices.

Most of the work previously considered by the ETCCDI has been focused on land-based indices with immediate human impacts. Examples include: minimum, mean and maximum temperatures, length of the growing season, drought durations and heat wave frequencies. Marine indices have typically been large scale temperature averages, and the familiar overlying atmospheric circulation indices such as the North Atlantic Oscillation or the Southern Oscillation Index. Whilst there is much to be learned from the experience of those who have developed indices, based on land data, it is clear that some of the indices will require adaptation to the marine environment, others are simply not relevant or possible to calculate, while there are further indices which are unique to the marine environment. It was noted that impacts of marine indices on humans and the environment are sometimes harder to demonstrate that those for land, for example, lack of rain over a populated region can have an immediate and obvious

impact, whereas any impact of lack of rain over the ocean will be indirect through the potential for changes in ocean circulation and weather patterns. Marine winds and waves are obvious examples of marine parameters with direct impacts on people through the potential for disruption of shipping, fishing and of oil and gas production.

There are a range of marine datasets, both *in situ* and model-derived, that could be used in the development of the indices. Examples include: re-analysed wind and wave datasets, ICOADS surface marine reports and summaries, sea ice extent and thickness, sea level from tide gauges and satellites, and the World Ocean Database of sub-surface parameters. Data products such as the United Kingdom Met Office Hadley Centre Sea Surface Temperature datasets (www.hadobs.org) are already used in the calculation of indices such as annual mean global surface temperature. Some of these data sets include satellite data, which are likely to make an increasing contribution in the future to marine indices of various kinds. The ETCCDI also heard about a new data set under development, the Hadley Centre Global subsurface Ocean Analysis (HadGOA), designed to study some unexplained variations in ocean heat content over the last half-century, most notably the apparent sharp global sub-surface cooling between the periods of 2003-2005. This cooling is contradicted both by surface temperature changes, and by recent satellite measurements of ocean gravity changes and ocean surface height. Indices of homogenized global and regional ocean heat content are being created with error estimates, including bias corrections.

The talks (e.g., those of Folland and Karoly), raised a variety of issues, including:

- Indices should cover a range of time and space scales, multi-decadal to daily, global to regional and be relevant to their target audience which should be identified.
- Indices should represent important impact-relevant aspects of the climate system and where possible link to the IPCC.
- It must be possible to calculate and update the indices from existing data.
- The indices must be prioritized due to limits in capacity.
- Indices can synthesize information from different aspects of the climate system and reduce noise by combining different components of the climate system.
- Indices should be based on homogenized and quality controlled datasets, well-understood models or re-analyses, or reliable predictions.
- There is currently no single place to go to find information on a wide range of indices.
- Land-based and global (land and marine) indices have received much more attention and resources than marine meteorological and ocean indices.
- The challenges for those developing marine indices are often very different from those faced by those developing land-based or global indices.

The priority variables for the JCOMM might include: winds, waves, sea surface temperature, air temperature, humidity, sea level, ice parameters and a range of subsurface variables including temperature, salinity and ocean heat content. Further investigation is required to identify other marine variables which are impact-relevant, for example, those variables which might indicate favorable conditions for Harmful Algal Blooms (HABs). Homogenization techniques are well advanced for land station data and it was thought important to try to construct daily time series from the ICOADS data, and to apply these techniques to the marine data, as appropriate.

ETMC's discussion of climate indices should also consider possible interrelationships with:

(i.) The JCOMM Services Programme Area (SPA), including its ETs on Wind Waves and Storm Surges and Sea Ice (ETWS and ETSI)

(ii.) The proposed modernization of the Marine Climatological Summaries Scheme (MCSS)

Summaries (MCS). Requirements for these 1960s vintage tabular/graphical MCS (annual and decadal, for the JCOMM Member Areas of Responsibility) are still documented in the *Manual on* and *Guide to Marine Meteorological Services* (WMO-No. 558 and WMO No. 471; see ETMC-II/Docs. 6.1 and 8.2).

(iii.) JCOMM-II (2005): "…noted that the work carried out by ETMC was strongly focused on marine meteorology. It urged the ETMC to include in its work plan for the inter-sessional period, an examination of how both oceanographic climatologies and ice climatologies could be coordinated so as to be seen as an integrated product."

Note under (iii) that the United Kingdom Met Office Hadley Centre has already has an integrated sea ice extent and sea surface temperature climatology available through the HadISST data set. In the next few years, besides enhancements to the HadISST and its climatology, it is hoped to integrate a homogenised HadGOA subsurface temperature data set, and thus its climatology with HadISST. In the longer term, and depending on resources, this may be expanded to include surface and subsurface salinity, and thus ocean water density.

3. Some examples of indices currently available online

IPCC, e.g. Chapter on Observed Climate Variability and Change in 3rd Assessment report and similar chapters in 4AR: http://www.ipcc.ch/

WMO statements on status of global climate:
http://www.wmo.ch/web/wcp/wcdmp/statement/html/statement.html or
http://ams.allenpress.com/perlserv/?request=get-toc&issn=1520-0477&volume=87&issue=6

Regional Climate Bulletins: http://www.wmo.ch/web/wcp/wcdmp/csm/html/accesscsmprod.html

Earth System Research Laboratory: http://www.cdc.noaa.gov/ClimateIndices/

NOAA US National Indicators: http://lwf.ncdc.noaa.gov/oa/climate/research/cie/cie.html

Ocean Observing Panel for Climate, state of the ocean:
http://ioc3.unesco.org/oopc/state_of_the_ocean/all/

UK Met Office Hadley Centre: http://www.hadobs.org/

Hurrell: http://www.cgd.ucar.edu/cas/jhurrell/indices.html

4. Future Work

Remaining tasks include:

- Investigate how to expand the range of useful and homogeneous climate change indicators available for the ocean including information from both the ocean surface and subsurface;
- Consider how these might be used in a Fifth IPCC Assessment Report (should one be planned);
- To engage with other relevant JCOMM Programme Areas, as appropriate, and the broader marine climate community in the development, calculation and maintenance of marine indices;
- Use CLIMAR-3 to promote marine indices, perhaps with a special session and breakout group;
- Liaise with other groups interested in marine indices such as the Ocean Observing Panel for Climate; and
- Report back on progress to the Third ETCCDI meeting in 2008, with a proposal, as appropriate, for further development of marine climate indices.

A short summary of the meeting was published in Clivar Exchanges (Caltabiano, et al. 2007).

Caltabiano, A., F. Zwiers and A. Klein-Tank, 2007: Clivar Exchanges, No 40, (Volume 12 No. 1), January 2007.

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Appendix: 1

APPENDIX A

TERMS OF REFERENCE FOR THE CCL/CLIVAR/JCOMM EXPERT TEAM ON CLIMATE CHANGE DETECTION AND INDICES

Terms of reference

1. To provide international coordination and help organize collaboration on climate change detection and indices relevant to climate change detection;

2. To further develop and publicize indices and indicators of climate variability and change from the surface and sub-surface ocean to the stratosphere;

3. To encourage the comparison of modeled data and observations perhaps via the development of indices appropriate for both sources of information;

4. To coordinate these and other relevant activities the ET chooses to engage in (such as perhaps observing system experiments that help determine where observations are needed for climate change detection) with other appropriate agencies such as GCOS, CBS, CIMO, CAgM, CHy, IPCC, START etc. as well with the joint WCRP JSC/CLIVAR Working Group on Coupled Modelling, the WCRP Observations and Assimilation Panel and regional associations;

5. To explore, document and make recommendations for addressing the needs for capacity building in each region, pertinent to this topic;

6. To submit reports in accordance with timetables established by the OPAG chair and/or Management Group.