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JOINT WMO/IOC TECHNICAL COMMISSION FOR  
OCEANOGRAPHY AND MARINE METEOROLOGY (JCOMM)  
SHIP OBSERVATIONS TEAM

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ITEM I-3.1.2

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## **REPORT ON ASSOCIATED PROGRAMMES AND REQUIREMENTS FOR SHIP-BASED OBSERVATIONS**

### **Use of VOS data in Climate Products**

*(Submitted by Dr Elizabeth Kent and Mr Scott Woodruff)*

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### **Summary and purpose of document**

This report updates information provided to the SOT-III on the climate applications of VOS reports.

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### **ACTION PROPOSED**

The Ship Observations Team is invited to:

- (a) Review and comment on the information provided;
  - (b) Consider how the SOT, and especially the VSOP, can best contribute to meeting the needs and requirements of the Global Climate Observing System;
  - (c) Consider the recommendations proposed in paragraph 3.
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## DISCUSSION

### 1. Background

In 2003, the SOT-III was provided with information on the marine climatological applications of the Voluntary Observing Ship (VOS) data collected by operators. Important applications included: the Intergovernmental Panel on Climate Change (IPCC) Assessment reports, assimilation into multi-decadal atmospheric re-analyses, development of datasets for climate research (including for example of sea surface temperature, wave height, air temperature, humidity, surface fluxes and precipitation) and for calibration and validation activities.

### 2. Recent Developments

#### 2.1 JCOMM-II and GCOS Climate Monitoring Principles

Although the JCOMM did not feel able to explicitly incorporate the Global Climate Observing System Monitoring Principles into revised Terms of Reference (ToR) for its subsidiary bodies, it was pleasing to see that at JCOMM-II (Halifax, Nova Scotia, Canada, 19-27 September 2005), a statement of support for the principles were made:

"The Commission also acknowledged that continuity in the observing system was of central importance for climate applications, accepted the GCOS Climate Monitoring Principles as best practice, and noted that the work of the DBCP, SOT, and GE-GLOSS would be conducted in accordance with the GCOS Climate Monitoring Principles wherever possible." (JCOMM 2005)

#### 2.2 Ship callsign masking

Security concerns raised at the SOT-III and JCOMM-II led to the decision at the WMO Executive Council (EC-LVIII) in 2006 to allow the masking of callsigns for a trial period of 12 months. This trial was extended in the recently held WMO-IMO Consultative Meeting (Geneva, Switzerland, 12-13 February 2007). The current reliance of the climate record on data largely available in real-time means that this decision will impact on the climate record in the following ways:

- 1) Any observation made using the generic callsign SHIP cannot be monitored by the operational centres for biased or poor-quality data, and the resulting lack of feedback on poor observing practice will, over time, degrade the quality of the available data.
- 2) Any observation made using the generic callsign SHIP cannot be associated with the metadata available in WMO Publication No. 47 and will be of very limited value to the climate record.
- 3) Any observation made using a masked callsign (i.e. with unique ship identifier other than callsign known to the operational monitoring centres) will be of somewhat limited value to the climate record unless a mechanism is put in place to communicate these callsign replacements to the archival centres.

#### 2.3 MARCDAT-II and CLIVAR Exchanges Article

The Second International Workshop on Advances in the Use of Historical Marine Climate Data (MARCDAT-II) was held at the Hadley Centre, Met Office, Exeter, United Kingdom, from 17 to 20 October 2005. Users of Voluntary Observing Ships (VOS) and other historical ship observations were well represented at the meeting and further details can be found on the meeting website (<http://icoads.noaa.gov/marcdat2/>). The recent decline in the numbers and coverage of meteorological observations from ships was noted with regret. It was further realised that the users of marine climate data needed to improve their relationships to those responsible for setting user requirements and collecting the data. The links to the SOT are important, but it is also necessary to influence those who set the priorities for marine observations within the countries contributing to SOT.

The Meeting Report from MARCDAT-II, published in CLIVAR Exchanges (Kent, et al., 2005) lead to a

further article solicited by the International CLIVAR Project Office on the VOS (Kent, et al., 2006). This article was important in raising the awareness of the scientific community, beyond those involved in dataset development, of the need to engage with the process for specification and implementation of the Global Ocean Observing System/Global Climate Observing System (GOOS/GCOS).

#### 2.4 User requirements and adequacy monitoring

Increased efforts to define and refine requirements for the GOOS/GCOS and to monitor the performance of the observing networks against these requirements have been seen in recent years. This approach has had some notable successes, particularly where user requirements were clearly defined and could be simply expressed. Argo has a stated requirement for 3000 floats, and the array is expected to be completed this year. The target of 1250 drifting buoys required to provide accurate large-scale SST fields for satellite SST bias correction was met in 2005. However, it should be noted that the number of buoys required would be much larger if part of the requirement for *in situ* SST measurements, particularly in the Northern mid-latitudes, was not being met by reports made by the VOS.

Progress toward completion of the observing system has been monitored by the NOAA Office of Climate Observations (OCO, <http://www.oco.noaa.gov/>). Often, the VOS are left out of the summary assessments presented at meetings, probably at least partly because of the difficulty of assessing the adequacy of the VOS data and the absence of clearly stated user requirements. The observing system is made up of many different parts, and there are obviously simplifications that have to be made when assessing overall progress toward targets. More focus could be useful on the parts of the observing system that are failing to reach their targets, or for which targets are poorly defined. Refinement of observing requirements is an important element of the assessment of adequacy, because often there is not enough information *a priori* to define the requirements with confidence.

The Eleventh Session of the Ocean Observing Panel for Climate (<http://ioc3.unesco.org/oopc/meetings/oopc-11/index.php>) noted that at the JCOMM-II (JCOMM 2005), a requirement for the assessment of the requirements of both the VOS and VOSclim programs had been stated:

"[The Commission] asked the Management Committee ensure that an appropriate group of experts undertook a scientific review of the requirements for the VOSclim and VOS programs, for use in both numerical weather prediction and in climate studies, and reported back to the next session of the Commission (JCOMM 2005)."

The United Kingdom Met Office also took note of this requirement, and funded a small project to begin an assessment of requirements and for metrics to monitor the adequacy of the VOS observations. The project is due to report in March 2007, and information on findings will be available via the project website in due course at the National Oceanography Centre, Southampton (<http://www.noc.soton.ac.uk/ooc/PROJECTS/ASMOS/>). This observational monitoring is only a start, but it is hoped that it will lead to an improved specification of user requirements and much-needed research into how better to assess adequacy. Given the large amounts of funding required to support the observing programs, it is essential that some priority is given into researching techniques for both the assessment of user requirements and the production of adequacy assessments.

#### 2.5 The Climate Data Stream

Historically, the marine meteorological climate archives were populated with observations taken from ship's logbooks, evolving nowadays, in many cases, towards electronic submissions. More recently, the ready availability of observations from the Global Telecommunications System (GTS) has led to a reliance on these observations and it has not been possible to find resources to include the delayed-mode (traditionally the climate mode) observations in the International Comprehensive Ocean-Atmosphere Dataset (ICOADS, <http://icoads.noaa.gov/>) past 1997. The impacts on the quality and completeness of the climate data stream have not yet been quantified, but among the questions that should be formulated and answered should include the following:

1) How adequate are the GTS reports for climate applications?

- *For example, the delayed-mode (IMMT) format contains some additional data elements, and more detailed field configurations, that cannot be reported in the traditional*

*alphanumeric format (FM 13). Moreover, preliminary comparisons of the GTS data streams from 2 different operational centres have shown overall differences in content order 10%.*

- *The same preliminary comparisons showed that adjustments have been made to observations (without any flagging) that this has occurred and that differences in some observations are due to different conversions from knots to m/s for wind speeds.*
- 2) What impact will the WMO-mandated transition (by 2012) to table driven formats (i.e., BUFR and/or CREX) for data circulated on the GTS, have on data quality and consistency?
- 3) How much additional value do the delayed mode observations add to the climate record?
- *A percentage of VOS data is still reported only in delayed-mode (likely varying nationally to a significant degree), which needs to be better quantified.*

### **3. Recommendations**

The SOT is invited to consider the following recommendations:

- SOT should consider adding its support to the request by the JCOMM for a scientific review of user requirements for the VOSclim and VOS programs, spanning both real-time and climate applications.
- SOT should aim to deliver the requirement for ship identification information to be available for all observations in the climate archive to ensure that observational metadata available in delayed-mode (such as WMO Publication No. 47) can be associated with individual ship reports.
- SOT should call for additional support to be made available for the provision of VOS metadata, both in near real-time and delayed-mode.
- The SOT should call for a review of the provision of VOS reports both in real-time and delayed-mode and contribute to the new Expert Team on Marine Climatology (ETMC) Task Team on Delayed Mode-VOS (TT-DMVOS).

### **4. References**

JCOMM, 2005: Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology, Second Session, Halifax, Canada, 19-27 September 2005. Abridged Final Report with Resolutions and Recommendations, WMO–No. 995 (available from: [ioc.unesco.org/jcomm/meetings/jcomm2/](http://ioc.unesco.org/jcomm/meetings/jcomm2/))

Kent, E. C., D. I. Berry, S. D. Woodruff and P. K. Taylor, 2006: Voluntary Observing Ships: A Vital Marine Observing System in Decline, CLIVAR Exchanges, 38, 20-21 (figs page 15), July 2006. [available from <http://www.clivar.org/publications/exchanges/exchanges.php>]

Kent, E. C., S. D. Woodruff, N. A. Rayner, C. K. Folland, D. E. Parker, R. W. Reynolds and T. Yoshida, 2005: Report on the 2nd International Workshop on Advances in the Use of Historical Marine Climate Data, CLIVAR Exchanges, 36, 29-30, December 2005. [available from <http://www.clivar.org/publications/exchanges/exchanges.php>; Note: an abbreviated meeting report is also in press for BAMS, April 2007.]

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