

# WMO GUIDE TO MARINE METEOROLOGICAL SERVICES (WMO NO. 471)

## CHAPTER 6

### THE WMO VOLUNTARY OBSERVING SHIPS' SCHEME

#### 6.1 Introduction

The international scheme under which ships plying the various oceans and seas of the world are recruited for taking and transmitting meteorological observations is known as the WMO Voluntary Observing Ships' Scheme. The forerunner of the scheme dates back to 1853, the year in which delegates of 10 maritime countries came together at a conference in Brussels, on the initiative of Lieutenant Matthew F. Maury, then director of the U.S. Navy Hydrographic Office, to discuss the establishment of a uniform system for the collection of meteorological and oceanographic data from the oceans and their use for the benefit of shipping. In the twentieth century, the system was recognized in the *International Convention for the Safety of Life at Sea (SOLAS) as amended*, which specifies in Regulation 5 of Chapter V — Safety of navigation — that 'the Contracting Governments undertake to encourage the collection of meteorological data by ships at sea and to arrange for their examination, dissemination and exchange in the manner most suitable for the purpose of aiding navigation'.

Voluntary observing ships make a highly important contribution to the Global Observing System of the World Weather Watch. They also contribute substantially to the IOC-WMO-ICSU-UNEP Global Climate Observing System (GCOS), and the IOC-WMO-ICSU-UNEP Global Ocean Observing System (GOOS). Relevant standard and recommended practices and procedures are contained in Volume I, Part III, Section 2.3.3 of the *Manual on the Global Observing System* (WMO-No. 544). Although new technological means, such as satellites and automated buoys, are used to gather data from the oceans, voluntary observing ships continue to be the main source of oceanic meteorological information.

From the beginning of such activity shipping has assisted in the scientific exploration of the oceans, as well as in the development of suitable measuring techniques for use by shipborne observers. Nowadays, the cooperation of voluntary observing ships is sought in each of the large-scale scientific experiments conducted by special research vessels in order to furnish the additional data needed for complete analyses of environmental conditions. In addition, the participation of these ships is regularly requested in technical studies and investigations concerning observing methods, such as the measurement of sea-surface temperature, precipitation and wind.

#### 6.2 Classification of voluntary observing ships

##### 6.2.1 Types of surface synoptic sea stations

Meteorological observing stations include surface synoptic sea stations of different types. The terminology used in the *Manual on the Global Observing System*, Part III, Section 1 is as follows:

Sea stations:

- Fixed sea stations
  - Ocean weather stations
  - Lightship stations
  - Fixed platform stations
  - Anchored platform stations
  - Island and coastal stations
- Mobile sea stations
  - selected ship stations
  - supplementary ship stations

- auxiliary ship stations
- ice-floe stations
- Automatic sea stations (Data may be asynoptic when collected by satellite)
  - fixed sea stations
  - mobile sea stations
  - drifting buoy stations

Since this *Guide* emphasizes the mutual collaboration between marine users and meteorologists, only the activities of Meteorological Services with regard to mobile ship stations are described in the following paragraphs. There are eight types of mobile ship stations engaged in the WMO Voluntary Observing Ship Scheme, namely:

- (a) Selected ships;
- (b) Selected AWS ships;
- (c) VOSCLim (VOS Climate) ships;
- (d) VOSCLim (VOS Climate) AWS ships;
- (e) Supplementary ships;
- (f) Supplementary AWS ships;
- (g) Auxiliary ships; and.
- (h) Auxiliary AWS ships.

The types of observation normally made by each of these types of ship stations is shown in Table 6.1.

### **6.2.2 Selected ships**

A mobile ship station equipped with sufficient certified meteorological instruments for making observations, transmits regular weather reports and enters the observations in a meteorological logbook. A Selected ship should have at least a barometer, a thermometer to measure SST, a psychrometer (for air temperature and humidity), a barograph and possibly an anemometer. Selected ships constitute the large majority of voluntary observing ships.

### **6.2.3 Selected AWS ships**

A mobile ship station equipped with an Automatic Weather Station (AWS) system comprising certified meteorological instruments to measure at least air pressure, pressure change, temperature and humidity. Optional sensors would include wind speed and direction and sea temperature measurement. The AWS may or may not have the facility for manual input of the visual elements, and transmit reports at least three hourly or more frequently. The AWS should have the facility to log the data.

### **6.2.4 VOSCLim (VOS Climate) ships**

A mobile ship station equipped with sufficient certified meteorological instruments for making observations, transmits regular and timely weather reports, enters the observations in an International Maritime Meteorological Tape (IMMT) compliant electronic logbook and has a proven record of providing high quality observations. A VOSCLim ship should have at least a barometer, a thermometer to measure SST, a psychrometer (for air temperature and humidity), a barograph and possibly an anemometer. The full range of metadata must be maintained in WMO No. 47, the full suite of digital images, sketches and drawings must be available, and the delayed-mode IMMT data must be submitted to the Global Collecting Centres (GCCs) according to the procedures described in Chapter 3 of this guide. It is highly desirable for a VOSCLim ship to be inspected at less than six monthly intervals.

### **6.2.5 VOSCLim (VOS Climate) AWS ships**

A mobile ship station equipped with an AWS system comprising certified meteorological instruments to measure at least air pressure, pressure change, temperature and humidity. Optional sensors would include wind speed and direction and sea temperature measurement. The AWS may have a facility for manual input of the visual elements, and transmit reports at least three hourly or more frequently. The AWS must have the facility to log the data including the additional IMMT delayed-mode VOSClim groups. The full range of metadata must be maintained in WMO No. 47, the full suite of digital images, sketches and drawings must be available, and the delayed-mode IMMT data must be submitted to the GCCs according to the procedures described in Chapter 3 of this guide. It is highly desirable for a VOSClim ship to be inspected at less than six monthly intervals.

#### **6.2.6 *Supplementary ships***

A mobile ship station equipped with a limited number of certified meteorological instruments for making observations. It transmits regular weather reports and enters the observations in a meteorological logbook.

#### **6.2.7 *Supplementary AWS ship***

A mobile ship station equipped with an AWS system comprising a limited number of certified meteorological instruments and reporting regularly.

#### **6.2.8 *Auxiliary ships***

A mobile ship station normally without certified meteorological instruments, which transmits in a reduced code form or in plain language, either on a routine basis or on request, in certain data sparse areas and under certain conditions.

#### **6.2.9 *Auxiliary AWS ship***

A mobile ship station equipped with an AWS system comprising non-certified meteorological instruments and reporting regularly.

#### **6.2.10 *International list of selected, VOSClim, supplementary and auxiliary ships***

Selected, Selected AWS, VOSClim, VOSClim AWS, Supplementary, Supplementary AWS, Auxiliary and Auxiliary AWS ships constitute an important source of marine data. In analysing these data, Meteorological Services should be aware of the type of instrumentation onboard a given ship, or the particular method of observation when several methods are generally in use. To this end WMO compiled the International List of Selected, VOSClim, Supplementary and Auxiliary Ships (WMO-No. 47) which is kept up to date through information supplied by Members, and for each ship. The information contained covers such particulars as:

- (a) Name of ship;
- (b) Call sign;
- (c) Vessel type;
- (d) Vessel dimensions;
- (e) Area or routes the ship normally plies;
- (f) Type of barometer;
- (g) Type of thermometer;
- (h) Exposure of thermometer;
- (i) Type of hygrometer or psychrometer;
- (j) Exposure of hygrometer or psychrometer;
- (k) Method of obtaining sea surface temperature;
- (l) Type of barograph;
- (m) Various other meteorological instruments used aboard the ship;
- (n) Types of radio equipment, including INMARSAT;

- (o) Height of barometer, in metres, measured from maximum load line;
- (p) Height of anemometer, in metres, measured from maximum load line; and,
- (q) Depth of sea temperature measurement.
- (h) Ships routes
- (i) Satellite transmission system
- (j) Make and model of AWS system
- (k) Name and version of electronic logbook software

The *International List of Selected, VOSCLim, Supplementary and Auxiliary Ships* needs to be regularly updated (see the *Manual on the Global Observing System*, Volume I, Part III, paragraph 2.3.3.3) because of frequent changes in the international merchant fleet and changes in the recruitment of observing ships. Members are asked to provide to the WMO Secretariat at least every quarter, but preferably every month, updates of their list of Selected, VOSCLim, Supplementary and Auxiliary ships, as an email attachment in approved format. This is the most efficient means of keeping the master list updated, as no retyping is required. The Secretariat makes available the master list through its web page (<http://www.wmo.int/pages/prog/www/ois/pub47/pub47-home.htm>).

### **6.3 Recruitment of voluntary observing ships**

#### **6.3.1 Requirement to recruit ships**

According to the *Manual on the Global Observing System*, Volume I, Part III, paragraph 2.3.3.2, each Member shall recruit as mobile ship stations as many ships as possible that traverse data-sparse areas and regularly follow routes through areas of particular interest. In fulfilling this obligation, each Member contributes to the common objective of obtaining sufficient coverage of meteorological observations over the sea. While a uniform coverage of the oceans is desirable, this is difficult to achieve in view of the large differences in the density of shipping traffic. This traffic is comparatively dense in the northern hemisphere, but this is not the case in the tropics or in the southern hemisphere. Consequently, greater attention should be given to the recruitment of voluntary observing ships in these areas. Monthly maps showing the density of observations received from ships are available from JCOMMOPS ([http://wo.jcommops.org/cgi-bin/WebObjects/JCOMMOPS.woa/wa/map?type=GTSM\\_VOS](http://wo.jcommops.org/cgi-bin/WebObjects/JCOMMOPS.woa/wa/map?type=GTSM_VOS)).

Meteorological Services in many countries are required to provide more detailed information of the weather and sea conditions in coastal areas. Some services recruit ships of local shipping companies to make and transmit observations during their voyage from harbour to harbour along the coast. Their observations have been widely recognized as being of great value.

#### **6.3.2 Criteria for recruitment**

Several criteria can be used in deciding whether a particular ship should be recruited as a Selected, VOSCLim, Supplementary or Auxiliary ship, to satisfy national and international needs. Questions which should be examined are whether all the necessary instruments can be installed with adequate exposure, whether the ship's officers will have the time available for recording and transmitting the observations and whether the necessary regular contact can be established for training the observers and for the receipt of electronic or hardcopy logbook data. Ship owners and masters are generally very cooperative in these matters; however, it is advisable that these questions be thoroughly discussed at the recruiting stage. In all cases observations should never be undertaken if they will impair the safe navigation of the recruited ship.

Contrary to the early days of the VOS Scheme ships are now registered in a variety of different countries. Ships registered in ports outside those of the recruiting country are therefore commonly recruited, although it is advisable to contact the Meteorological Service of the flag state beforehand and to check that the ships hasn't already been recruited by reference to WMO Publication 47. Care should be taken to ensure that duplicate recruitment is avoided.

Members should establish a suitable organizational structure for the maintenance of their marine networks and for the recruitment of voluntary observing ships. It will often be necessary to contact shipping companies, managers and shipping agencies to enlist their cooperation by arranging visits to ships and the provision of instruments. Port Meteorological Officers play a large role in the recruitment of ships.

Complaints about meteorological observations from a particular observing ship should be directed to the Member with which the ship is registered. If the ship was recruited by another Member, the Member receiving the complaint should forward it to the Member concerned.

## **6.4 Meteorological observations from ships**

### **6.4.1 *Danger messages***

The International Convention for the Safety of Life at Sea (SOLAS), 1974, in its Regulation 31, Chapter V, concerning the safety of navigation, specifies that ship masters are obliged to issue a danger message when a ship meets with objects or conditions which are of direct danger to navigation. As far as meteorological phenomena are concerned, danger messages should contain information on dangerous ice, tropical storms, encounters sub-freezing air temperatures associated with gale force winds causing severe ice accretion on superstructures, or winds of force 10 or above on the Beaufort scale for which no storm warning has been received.

Details concerning the contents of danger messages and their transmission are described in Regulation 32 of Chapter V of the *International Convention for the Safety of Life at Sea*. The information given in these messages directly serves the safety of navigation. Those containing meteorological information are of vital importance to Meteorological Services for the preparation of weather and sea bulletins.

### **6.4.2 *Surface observations***

#### **6.4.2.1 CONTENT OF SURFACE OBSERVATIONS FROM SHIPS**

The elements observed by the various types of voluntary observing ship are shown in Table 6.1.

Table 6.1  
Observations made by mobile ships stations

	<i>Selected</i>	<i>Selected AWS</i>	<i>VOSClm</i>	<i>VOSClm AWS</i>	<i>Supplementary</i>	<i>Supplementary AWS</i>	<i>Auxiliary</i>	<i>Auxiliary AWS</i>
Present and past weather	x		x		x		x	
Wind direction and speed	x		x		x		x	
Cloud amount	x		x		x		x	
Cloud type and height of base	x		x		x			
Visibility	x		x		x		x	
Temperature	x	x	x	x	x		x	
Humidity (dew point)	x	x	x	x				
Atmospheric pressure	x	x	x	x	x	x	x	
Pressure tendency	x	x	x	x				
Ship's course and speed	x	x	x	x				
Sea temperature	x		x					
Period and height of wind waves	x		x					
Direction, period and height of swell	x		x					
Sea-ice and/or icing (if appropriate)	x		x		x		x	
Special phenomena (if appropriate)	x		x					
Max height of deck cargo above the SLL	-	-	x	x	-	-	-	-
Height difference from the SLL to the water line	-	-	x	x	-	-	-	-
Course of ship over ground	-	-	x	x	-	-	-	-
Ship's ground speed	-	-	x	x	-	-	-	-
Ship's heading	-	-	x	x	-	-	-	-

*x = mandatory*

#### 6.4.2.2 PROGRAMME FOR SURFACE OBSERVATIONS ON BOARD SHIPS

The basic programme for making surface observations on board ships consists of the following procedures:

- (a) Synoptic observations should be made at the main standard times: 0000, 0600, 1200 and 1800 UTC. When additional observations are required, they should be made at one or more of the intermediate standard times: 0300, 0900, 1500 and 2100 UTC;.

- (b) While taking observations, atmospheric pressure should be read at the exact standard time, the observation of other elements being made within the ten minutes preceding the standard time;
- (c) When operational difficulties on board ship make it impracticable to make the synoptic observation at a main standard time, the actual time of observation should be as near as possible to the main standard times. In special cases, the observations may even be taken one full hour earlier than the main standard time, i.e. at 2300, 0500, 1100 and 1700 UTC. In these cases the actual time of observation should be indicated; however, these departures should be regarded only as exceptions;
- (d) When sudden or dangerous weather developments are encountered, observations should be made for immediate transmission without regard to the standard times of observation (see paragraph 6.4.1 above for obligations under the *International Convention for the Safety of Life at Sea*);
- (e) In accordance with SOLAS Chapter V regulation 32, when a master has reported a tropical cyclone or other dangerous storm, it is desirable but not obligatory, that further observations be made and transmitted hourly, if practicable, but in any case at intervals of not more than 3 hours, so long as the ship remains under the influence of the storm. Meteorological Services may also request more frequent observations for storm warnings, particularly for tropical cyclones and special observations may also be requested for search and rescue operations or other safety reasons;
- (f) When required for scientific studies supplementary observations should be made at intermediate standard times, subject to non-interference with navigation duties;
- (g) Ships' officers should be encouraged to continue taking and reporting observations while the ships are in coastal waters, provided it does not interfere with their duties for the safety of navigation;

#### **6.4.2.3 OBSERVATION OF SEA AND SWELL**

The distinction between two separate wave trains and particularly the distinction between sea and swell can be difficult for an inexperienced observer. Sea waves are systems of waves observed at a different place than within the wind field producing the waves. Swell waves are systems of waves observed at a point remote from the wind field which produced the waves, or observed when the wind field which generated the waves no longer exists.

The distinction between sea and swell can be made on the basis of one of the following criteria:

Wave direction — if the mean direction of all waves of more or less similar characteristics differs 30° or more from the mean direction of waves of different appearance, then the two sets of waves should be considered to belong to separate wave systems.

Appearance and period — when typical swell waves characterized by their regular appearance and long-crestedness arrive approximately, i.e. within 20°, from the direction of the wind, they should be considered as a separate wave system if their period is at least four seconds greater than the period of the larger waves of the existing sea.

More guidance on the observation of waves and swell, as well as the observation of sea ice, can be found in the *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) Part II, Chapter 4, Marine observations.

#### **6.4.3 Upper air observations**

In the past very few mobile ship stations were equipped for making upper-air synoptic observations. An automated means of making upper air soundings from a merchant ship has now been developed under the Automated Shipboard Aerological Programme (ASAP). The balloon is filled with helium and released by a ship's officer. After launch, the observations are automatically received, encoded, and transmitted to the NMS.. However, the number of ships making upper-air observations is still small and mostly concentrated in the North Atlantic.

An upper-air synoptic observation consists of one or more of the following elements:

- (a) Atmospheric pressure;
- (b) Air temperature;
- (c) Humidity; and,
- (d) Wind speed and direction.

The standard times of upper-air synoptic observations are 0000, 0600, 1200 and 1800 UTC, although most ASAP ships report only two times per day. The actual launch time of regular upper-air synoptic observations is about 60 minutes before these standard times to provide sufficient reserves for re-launches as well as delayed satellite transmissions.. The actual time of a balloon observation may deviate from this time range if wind observations at considerably greater heights can be achieved.

In the basic programme of upper-air soundings from mobile ships the general objective is to obtain reports from positions which are not more than 1000 km apart and the observations are typically required at 0000 and 1200 UTC. These observations are to be coordinated within the framework of an international programme to ensure that data are obtained from those parts of the oceans where upper-air data are most needed. Members establishing a programme of upper-air observation on board voluntary observing ships are required to complete the ASAP section of the national SOT Annual Report.

#### **6.4.4 Sub-surface observations**

Selected ships may also be equipped to make bathythermograph observations during ocean crossings. The use of an expendable bathythermograph (XBT) does not oblige the ship to reduce speed or make course alterations. All arrangements for this type of observation are made within the framework of the JCOMM Ship Observations Team (SOT) and its Ship of Opportunity Programme (SOOP).

Procedures for the collection and exchange of BATHY and TESAC (temperature, salinity and current) observations are specified in the *Guide to Operational Procedures for the Collection and Exchange of JCOMM Oceanographic Data (IOC/WMO Manuals and Guides No. 3)* and the *WMO Manual on the Global Telecommunications System, Volume 1, Part 1, Attachment I-1 (WMO-No. 386)*. The preferred times for BATHY and TESAC observations are 0000, 0600, 1200 and 1800 UTC. However observations taken at any time are useful and should be transmitted.

#### **6.4.5 Special observations**

In relation to international programmes of scientific or economic significance, observations of a special nature are needed from ships at sea and WMO is requested to assist through its Voluntary Observing Ships' Scheme. One such example is the request for observations on locust swarms in the seas around Africa, Arabia, Pakistan and India. This programme, which is of great importance to the agricultural economy in the countries concerned, is described in Annex 6.A of this Chapter.

Another example is the report of freak waves. A freak wave is defined as a wave of very considerable height preceded by a deep trough. It is the unusual steepness of the wave which makes it dangerous to shipping. Favourable conditions for the development of freak waves seem to be strong current flows in the opposite direction to a heavy sea and especially when this occurs near the edge of the continental shelf. The reports may contribute to a mapping of these particularly dangerous areas and to a better understanding of the phenomenon. Guidelines covering the content and form of the report and the forwarding arrangements are described in Annex 6.B of this Chapter (see also Chapter 3, paragraph 3.3.1).

Sea-surface currents are also subject to special observation. These data are derived from measurement of ships' set and drift and form the basis for consideration of the ocean surface current circulation. They are of value to research and climatic studies and are collated by the



International Surface Current Data Centre (ISCDC) in the United Kingdom which sends a copy of the stored data to the World Data Centres for Oceanography. In order to improve this database, all vessels are encouraged to obtain and supply such data on a voluntary basis. Details of the form of the report and the forwarding arrangements are given in Annex 6.C of this Chapter (see also Chapter 3, paragraph 3.3.2).

#### 6.4.6 Coding of observations

Ships' observations are coded in the international meteorological codes published in the Manual on Codes, Volume I (WMO-No. 306). The various code forms are given code names which are sometimes included in the heading of the ship's report. In all cases, however, a 4-letter identification group is used (see code 2582 in the Manual on Codes). The identification groups normally used by ships are shown in Table 6.2.

Table 6.2

#### Identification groups of codes reported by SHIPS

<i>Code name</i>	<i>Identification group(s)</i>	<i>Content of the code</i>
SHIP	BBXX	Surface report from a sea station
PILOT SHIP	QQAA, QQBB, QQCC, QQDD	Upper-wind report from a sea station; Parts A, B, C, D respectively
TEMP SHIP	UUAA, UUBB, UUCC, UUDD	Upper-level pressure, temperature, humidity and wind report from a sea station; Parts A, B, C, D respectively
BATHY	JJVV	Bathothermal observation
TESAC	KKYY	Observation of temperature, salinity and current from a sea station
TRACKOB	NNXX	Report of a marine surface observation along a ship's track
BUFR	BUFR	Binary Universal Form for the Representation of meteorological data (specific sequences and/or templates should be used for specific ship reports)
CREX	CREX	Character form for the Representation and EXchange of data (specific sequences and/or templates should be used for specific ship reports)

#### 6.4.7 Electronic Meteorological logbooks

The manual coding of shipboard observations has been greatly aided by the use of electronic logbook software and by the increased availability of satellite communications on merchant ships. Observations are taken manually in the traditional way and then entered into a dedicated software programme loaded onto a personal computer. This may be in the form of a laptop provided by a National Meteorological Service (NMS), or by installing the software on a ship's computer (with the permission of the shipowner). The computer programme then:

- (a) Provides screen prompts to assist with data entry;
- (b) Calculates the true wind, MSL pressure and dew point;
- (c) Checks the validity of some data, e.g. month in range 1–12, observations near climatological extremes;
- (d) Allows the real time observation in SHIP code to be downloaded to a floppy disk or USB device so that it can then be transferred to the ships Inmarsat system for transmission to the

Meteorological Service; Because most ocean going ships are required to carry INMARSAT-C equipment, the floppy disk can usually be placed in the INMARSAT terminal and the observation can be transmitted without rekeying. However some ships Inmarsat equipment may not have this facility, in which case the data will need to be transcribed.

(e) Automatically formats and stores the observation in IMMT format (referred to in Chapter 3, paragraph 3.2.7), which can be subsequently downloaded to floppy disk or USB. These data are usually collected by a Port Meteorological Officer at the time of inspection, or emailed directly from the ship to the NMS when email is available.

## **6.5 On-board meteorological instrumentation**

### **6.5.1 General**

Full guidance on the basic meteorological instruments suitable for use onboard ships making observations under the Voluntary Observing Ships Scheme, together with advice on methods of observations, is provided in the Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8), Part II, Chapter 4, Marine observations.

Experience shows that certain features of these meteorological instruments onboard ships require constant attention. The following comments emphasize where special care should be paid and are fully complementary to the general guidance in the above-mentioned *Guide*.

### **6.5.2 Instruments measuring atmospheric pressure**

Aneroid barometers, precision aneroid barometers and digital barometers are commonly used on VOS to measure atmospheric pressure. These instruments are subject to drift and require regular checking by a PMO using a Transfer Standard Barometer, preferably at intervals not exceeding three months. A permanent record of all such checks should be maintained by the PMO, with a copy attached to the barometer showing the date of the check, and the ambient temperature and pressure.

Some aneroid (dial type) barometers are set to indicate Mean Sea Level pressure when they are installed on the ship. Other aneroid barometers, precision aneroid barometers and digital barometers require correction to Mean Sea Level. The barometer height can vary significantly with the loading of the ship, so the barometer correction table for height needs to provide a range of height reduction constants. The draught of very large tankers can vary by as much as 10 metres between a sea-going ballast condition and a fully-loaded condition. If the barometer elevation is great, air temperature may also have to be taken into consideration when preparing reduction tables. At all times the limit of accuracy of the applied reduction should be kept within 0.2 hPa.

The correction of the barometer to Mean Sea Level may be made manually by use of correction tables, or in the case of ships using electronic logbook software, computed by the software.

Barographs used on board ships should be supplied with an efficient built-in damping device and the instrument should be mounted on shock-absorbing material in a position where it is least likely to be affected by concussion, vibration or movement of the ship. The best results are generally obtained from a position as close as possible to the centre of flotation. The barograph should be installed with the pen arm oriented athwart-ship to minimize the risk of its swinging off the chart.

### **6.5.3 Instruments measuring wind speed and direction**

In order that wind reports from ships equipped with instruments are comparable with estimated winds and wind reports from land stations, anemometer readings should be averaged over 10 minutes. It is difficult to estimate 10-minute means by watching the dial of an anemometer. An

overestimation of more than 10 per cent is not uncommon. It is therefore preferable that the instrument read-out used for reporting wind velocities be automatically averaged over 10 minutes. If such read-outs are not available, careful instructions should be given in order to avoid overestimation.

Due to the flow distortion caused by superstructure, masts and spars, the site of the anemometer sensor has to be carefully selected, preferably as far forward and as high as possible, ideally on the foremast if this is possible. Wind speed also needs to be corrected for effective height (For further information see *Wind Measurements Reduction to a Standard Level*; R. J. Shearman and A. A. Zelenko (MMROA Report No. 22, WMO/TD-No. 311)).

Any anemometer mounted on a ship measures the movement of air relative to the ship and it is essential that the true wind be computed from the relative wind and the ship's velocity. A simple vector diagram may be used, although in practice this can be a frequent source of error. Special slide rules and hand computers are available and programs can be installed on small digital computers.

#### **6.5.4 Instruments measuring temperature and humidity**

Temperature and humidity observations should be made by means of a psychrometer with good ventilation and exposed in the fresh airstream on the windward side of the bridge. Many countries use a louvered screen and secure on each side of the vessel, so that the observation can be made on the windward side. The muslin and wick fitted to a wet-bulb thermometer in a louvered screen should be changed at least once a week, and more often in stormy weather, and the water bottle filled.

Automated or distant-reading thermometers and hygrometers should be sited in a well-ventilated and exposed screen with good radiation protection and placed as far as possible from any artificial source of heat. It is advisable to compare the readings with standard psychrometer observations at the windward side of the bridge at regular intervals, particularly when new types of equipment are introduced.

#### **6.5.5 Instruments measuring sea temperature**

It is important that the temperature of the uppermost thin film of water (measured by infra-red radiometers) should be distinguished from the temperature of the underlying mixed layer. It is the representative temperature of the mixed layer which should be reported by voluntary observing ships.

The 'bucket' instrument method is the simplest and probably the most effective method of sampling this mixed layer, but unfortunately the method can only really be used on board vessels with low freeboards and moving slowly. Other methods are:

- (a) Intake and tank thermometers, preferably with distant reading display and used only when the ship is moving;
- (b) Hull-attached thermometers located forward of all discharges;
- (c) Trailing thermometers; and,
- (d) Infra-red radiometers.

These instruments are described in Part II, Chapter 4 of the *Guide to Meteorological Instrument and Methods of Observation* (WMO-No. 8).

### **6.6 Transmission of ship's observations to the shore**

#### **6.6.1 INMARSAT**

Ship reports can be readily transmitted to an Inmarsat Land Earth Station (LES) which has been authorized to accept these reports. Such reports should always be sent via Special Access Code 41 to ensure that they are automatically routed to the Meteorological Service and that no cost is incurred to the ship. The NMS of the country operating the LES pays the cost. There are a number of such LESs in each satellite footprint and they are listed, together with the area from which they will accept reports in WMO-No. 9, Volume D, Part B, Coastal Radio Stations Accepting Ships' Weather Reports. To place a limit on the costs incurred by an NMS, a LES may be authorized to accept reports only from ships within a designated area of ocean. These limits should be drawn to the attention of the relevant ship's officers when recruiting a ship under the Voluntary Observing Ships Scheme.

An increasing number of ships are now willing to use their Inmarsat systems to send their weather reports by email direct to the Meteorological Services. In such cases however the cost of the transmission will be incurred by the shipowner, so it must be ensured that they are willing to accept such costs. In addition the Meteorological service will need to establish a secure system for the receipt and routing of the reports through their message switching systems.

### **6.6.2 Service Argos**

Service Argos is a system for receipt of data from automatic weather stations by orbiting satellites, and has been used for many years to collect data from drifting buoys and profiling floats. The data are sent from the satellite to ground stations for processing and distribution on the GTS.

### **6.6.3 Other satellite data telecommunication providers**

There are now private satellite data telecommunication service providers that offer the possibility to collect ship observations via specific satellite systems (e.g. Iridium). The data can be transmitted in free format to shore, and the Member recruiting the ship should be responsible for converting the raw data to geo-physical units, and applying the necessary quality control procedures before the dissemination of the data over the GTS.

## **6.7 Distribution of ships' weather reports over the GTS**

Ship weather reports received at an NMC from INMARSAT Land Earth Stations (LES) and coastal radio stations should be assembled into meteorological bulletins and transmitted over the GTS with minimum delay. Some Centres transmit a bulletin of available ship weather reports every 15 minutes. Because ship weather reports are a vital input to a variety of forecast models runs it is important that the data from different parts of the world is received with minimum delay.

## **6.8 Meteorological logbooks for ships**

### **6.8.1 Layout**

The recording of observations in permanent form is obligatory for selected, VOSCLIM and supplementary ships and recommended for auxiliary ships. Although most ships now use electronic logbooks for compiling their observations, a small number of ships still record their observations in a hardcopy meteorological logbook. The layout of logbooks is a national responsibility. Generally, the order of parameters recorded in the logbook follows the order of elements in the WMO SHIP code format. Thus the logbook can be used both for recording the synoptic weather report which is to be transmitted and to include additional information required for climatological purposes. For the latter use, the entries are subsequently transferred on to IMMT format (see Chapter 3, paragraph 3.2.7 and Annex 3.C).

Logbooks should contain clear instructions for entering observations. Code books or code cards should also be provided, along with logbooks, for ready reference and to help correct wrong entries as necessary. It is useful to mark in the logbook those columns which are earmarked for entries to be transmitted as part of the weather report. In some national logbooks, these columns

are lightly shaded or coloured and in others they are inserted in a special frame. Space is often also provided in logbooks to enter the various readings used to compute a meteorological element such as air pressure reduced to sea-level, or actual wind derived from a measured apparent wind and the ship's movement. This will enable a check of the computations carried out on board ship for subsequent quality control of the data during processing for climatological purposes.

Ships should be requested to return a completed logbook to the Meteorological Service or PMO which has recruited the ship. The period covered by a logbook should ideally not be more than three months, so that the delay in entering the observations in the climatological system is not too great.

Logbooks should be returned with information regarding the ship, the instruments used and other details of a general nature, and space should accordingly be provided for these entries. The name of the master, the observers and the radio officer ( if carried) should also be included, particularly if an Award system exists in the country where the ship has been recruited.

### **6.8.2 Supply and return**

The observations made by VOS using electronic logbook software, are archived by the programme and need to be downloaded by PMOs at regular intervals. Some VOS still use hard copy logbooks, so PMOs need to issue these ships with the required stationery and collect the completed logbooks. The completed paper logbooks and the electronic data are generally considered to be the property of the NMS which has recruited the ship.

The NMS should archive the paper and electronic logbook data and submit it to the Global Collecting Centres (GCCs) under the Marine Climatological Summaries Scheme (MCSS).

### **6.8.3 Scrutiny of entries**

However clear the instructions relating to entering observations in a logbook, there is always the possibility of errors occurring in entries to a logbook. Completed logbooks must therefore be scrutinized upon receipt and obvious errors corrected. It is of great importance that recurrent types of errors be brought to the attention of the observers concerned so that any misinterpretation of the instructions or erroneous practices in reading instruments or making entries can be corrected. When the logbooks are received by the Port Meteorological Officer, a first check should be made as soon as possible to permit a personal conversation with the appropriate ship's officers. Such conversations or written responses commenting on logbooks which have been received constitute an important element of the continuous training of shipborne observers. Without this feedback ship officers would soon become uncertain as to the quality of their work or the implementation of certain observing or coding procedures and, with the inevitable waning of interest, the quality of their observations may deteriorate.

Ships' officers often include questions on coding matters or on any special phenomena observed by them in the 'remarks' column of the logbook. Response to these questions is important, as this falls within the same spirit of maintaining interest in meteorological work. Some countries have instituted special periodicals for meteorological observers on board their ships in which these questions are discussed and explained (see paragraph 6.11 below).

## **6.9 Port Meteorological Officers (PMOs)**

In recruiting voluntary observing ships and assisting them in their meteorological work, direct contact with ships' officers is often needed to provide them with instructive material and other documents, to inspect meteorological instruments on board ships, to collect completed hardcopy logbooks and to download log files from electronic logbooks, and to provide feedback on the quality of their observations. For this purpose, Port Meteorological Officers (PMOs) ideally with seagoing experience should be appointed at the main ports routinely visited by observing ships.

PMOs are representatives of the Meteorological Service of the country as far as the local contact with maritime authorities is concerned. The role of PMOs is a very important one and the efficiency of the voluntary system of ships' observations often depends on the initiative displayed by these officers. They are in a good position to discuss with ships' officers any problems they have encountered and offer suggestions, bring to their attention any changes in procedures that may have taken place and give them the latest information which they may wish for. Opportunity should also be taken to explain various meteorological and/or oceanographic programmes whenever observations are specially needed from ships. Meteorological instruments on board ships should be checked and other advice or assistance in meteorological matters should be given by PMOs upon request by the master of any ship.

PMOs should also report to the meteorological authorities in their country if the meteorological work carried out on board the ship has not been entirely satisfactory. Members should immediately respond to these reports; when they concern the work carried out under the authority of another Member, the latter should be informed. If action has to be taken following complaints this can best be done through the PMOs who can play a very important role by a tactful approach to the masters and, if constructive criticism is expressed in positive terms, goodwill can be maintained all round.

The scope of the work of PMOs depends largely on the importance of the marine traffic in the particular area served. Before deciding to establish a PMO in a given port, a study must be made of the various services which should be provided. As marine activities develop, a review should be made from time to time to see whether new services should be provided. Guidelines for organizing PMO activities are given in Annex 6.D of this Chapter, and are also available on the VOS website (<http://www.bom.gov.au/jcomm/vos/>). A list of PMOs with their addresses and telephone numbers is available on the JCOMM website (<http://www.jcomm.info/pmos>).

#### **6.10 Incentive programme for voluntary observing ships**

In recognition of the valuable work done by ships' officers in taking and transmitting meteorological observations and as an incentive to maintaining a high standard of observation many maritime countries have established a national award or certificate system. These systems vary greatly from country to country; in some countries the ships receive the awards, while in other countries awards are made to the individual masters or officers. Sometimes recognition for the meteorological work done on board ships is given in the form of books, charts and other documents presented to the ship.

Members are encouraged to continue the practice of issuing national awards or certificates to Selected, VOSCLIM, Supplementary and Auxiliary ships recruited by them, or to the ships' personnel, as a sign of their participation in the WMO Voluntary Observing Ships' Scheme.

In addition to national award schemes, the JCOMM Ship Observations Team has produced a "Certificate of Appreciation" that can be issued by Meteorological services to participating observing ships

#### **6.11 Marine meteorological publications produced by National Services for seafarers and marine observers**

A number of National Meteorological Services in maritime countries publish magazines directed to the masters and officers of ships participating in the WMO Voluntary Observing Ships' Scheme. Although content and format differ widely, all these periodicals have two goals in common: first to stress the importance of ships' participation in the marine observing programme and second to offer timely marine meteorological information of interest. A list of these periodicals is given in Annex 6.E of this Chapter.

Among the material included in these periodicals are:

- (a) Incidents where ships' observations proved particularly useful;
- (b) Commendations on active participation in the WMO Voluntary Observing Ship Scheme;
- (c) Hints on observing practices;

- (d) Changes in broadcast schedules of weather and sea bulletins or radiofacsimile broadcasts;
- (e) Articles on important weather features of particular ocean areas.

Members are encouraged to produce such periodicals and supply them to voluntary marine observers.

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## ANNEX 6.A

### LOCUST REPORTS FROM SHIPS

(Reference: paragraph 6.4.5)

Members concerned should instruct reporting ships, regardless of their nationality, operating in the seas around Africa, Arabia, Pakistan and India, to send by radio, and in plain language, reports on any locusts seen to the Food and Agriculture Organization of the United Nations (FAO) in Rome Telex 610181 FOODAGRI. Costs are paid by the FAO.

Each locust report should contain the following elements:

- (a) Date and time (specifying UTC or zone time) when locusts first seen);
- (b) Latitude and longitude, if possible to nearest minute, where locusts first seen;
- (c) Time and position at which locusts last seen;
- (d) Whether *isolated locusts* (seen in flight singly), *locust group(s)* (flying locusts seen intermittently in numbers), *swarm* (flying locusts seen continuously in numbers, over a period of at least a minute), *dense swarm* (obscuring part of horizon or other background), *locusts appearing on board or floating dead locusts* (isolated, groups or swarms);
- (e) Colour of locusts (yellow, pink, grey);
- (f) Wind direction and speed.

Details of such reports should be entered in the ship's meteorological logbook or recorded in the ships electronic logbook, even when it has not been possible to send a radio report.

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**ANNEX 6.B**

**GUIDELINES FOR REPORTING OF INFORMATION ON FREAK WAVES  
AND FOR RECORDING IN METEOROLOGICAL LOGBOOKS, AND AN  
EXAMPLE OF A SPECIAL LOG SHEET**

(Reference paragraph 6.4.5)

(i) Guidelines

It is recommended that the following information be recorded in meteorological logbooks:

(1) *Information on freak waves*

Date: ..... Time: ..... Ship's position .....

Full description of freak wave (including height and horizontal distance between crest and trough, if possible)

Weather condition: .....

State of sea: .....

Any other factors that may have influenced the state of sea: .....

Any damage sustained by ship: .....

(2) *Information to be attached to freak wave reports by National Meteorological Centres:*

Ship's name: .....

Gross registered tonnage: .....

Ship's radio call-sign: .....

**FREAK WEATHER REPORT**

A freak wave may be defined as a wave of very considerable height, ahead of which there is a deep trough. Thus it is the unusual steepness of the wave which is its outstanding feature and which makes it dangerous to shipping.

ss/mv .....

Call sign .....

Gross tons .....

Date ..... Time .....GMT

Ship's position.....

**DESCRIPTION OF FREAK WAVE**

Height .....m Direction if known .....

Horizontal distance between crest and trough .....m

Depth of water .....m (either by sounding or from chart)

Remarks .....

**WEATHER CONDITIONS**

Wind direction ..... Wind speed .....knots

Any other weather factor applicable .....

**STATE OF SEA**

Sea waves: Height .....m Period .....sec

Swell waves: Direction ..... Period ..... sec Height .....m

Any other factor that may have influenced stat of sea (tide, currents, etc.) .....

DAMAGE TO SHIP (if any) .....

Signature of Observer .....

Signature of Master .....



## ANNEX 6.C

### GUIDELINES FOR THE OBSERVATION AND RECORDING OF SEA CURRENT DATA ON BOARD SHIP, AND AN EXAMPLE OF A SPECIAL LOG SHEET

(Reference paragraph 6.4.5)

#### (i) Guidelines

##### 1. *Introduction*

The knowledge which we now possess regarding surface currents in the world seas is, for the most part, based on information from current observations taken on board ships.

The systematic collection of surface current information had already begun in the middle of the nineteenth century. The famous Lieutenant Matthew F. Maury of the U.S. Navy was one of the first who saw the importance of gathering wind and current data from ship logbooks. In 1845, he published the first of a series of 'Wind and current charts'.

For constructing current charts, as many observations as possible are required, covering many years. As the variability of local currents can be examined only on the basis of a large number of observations, and as the number needed has not been reached for any place at sea, there is still a great need of current observations, especially from areas less frequented by ships outside the major shipping lanes. More observations are also needed to establish, year to year, variations in currents, as some of these are of great significance for marine science, e.g., the *El Niño*. The only way of obtaining enough observations is by the cooperation of voluntary observers.

By making and reporting observations of currents experienced, the seaman not only gains practical knowledge himself, but benefits shipping generally by adding to our statistical knowledge, so that up-to-date information can be published.

##### 2. *Methods of ocean-current observations and some definitions*

The method of making current observations is to calculate the difference between the dead reckoning (DR) position of the ship after making due allowance for leeway and the position by a reliable astronomical, land, radio, radar, electronic or satellite fix. The result is the set and drift over the ocean floor experienced by the ship during the interval since the previous reliable fix was obtained, and applies to a mean depth of about half the ship's draught.

The *sea of current* is the direction in which it acts; that is the direction toward which it flows. So, the current set is from the DR position to the fix.

The *drift of a current* is the distance measured in nautical miles from the DR position to the fix.

The *leeway* is the angular difference between the ship's course and the ship's direction of movement through the water (i.e., the direction shown by the wake). Leeway occurs when a ship is subjected by the wind to a pressure from a beam. The angle is rarely more than a few degrees, but there is a considerable loss of accuracy in the observation of the current if a realistic allowance is not made for leeway.

The "*FROM*" position is the true position at the beginning of the stretch over which the current is calculated.

The "*TO*" position is the true position at the end of the stretch over which the current is calculated.

The *dead reckoning (DR) position* is the position of the ship determined by applying to the last well-determined position (the "FROM" position), the run that has since been made, using only the true courses steered (corrected for leeway, if necessary) and the distance run, as determined by

log or engine revolutions, *without considering current*. It is important that the true course is corrected for the influence of the wind, so that the difference between the DR position and the true fix is caused only by the current.

### 3. *The calculation*

The calculation is done in two steps and is based on the following data:

First step — Calculation of the DR position

Data: (a) Position FROM;

(b) Course(s) steered, corrected for possible wind influence without considering current;

(c) The distance, calculated from speed and time, run along each of the course lines without considering current.

Second step — Calculation of the current

Data: (a) DR position;

(b) Position TO.

It is possible to do both calculations by computer. In this case, it is necessary that all three data for the first step and also the position TO are entered in the logbook by the observer.

The advantages of doing the calculation by computer are that the extra work involved for the observers on board is avoided and that errors in the calculation are practically eliminated. A disadvantage, however, is that errors in the basic data cannot be discovered and this inevitably leads to intractable faulty results. On the other hand, the observer is in a position to check the basic data for possible mistakes; also, he can check if the data are reliable enough for current calculation.

Calculation by computer therefore means an increased responsibility of the observer for entering the basic data correctly and for their reliability. For this reason, it is advisable to always enter the data carefully, and then, to check them.

However, in many cases, the officer will wish to calculate the current for his own interest and use, and this is to be encouraged. When the current is calculated on board, it should be entered in the logbook, along with the data from which it was calculated.

### 4. *The observation*

The following notes are intended to give practical guidance on the ways in which the most useful observations of currents can be made. The usefulness of an observed current depends largely on its representativeness and its accuracy. Nevertheless, an observation which might normally be rejected as being unlikely to have the desired accuracy might still be of value if it came from an area of sparse shipping, i.e., one about whose currents little was known. The observation of currents is particularly desirable in such areas.

The representativeness and accuracy of current observations are discussed below in more detail:

#### (a) Representativeness of observed currents

Ideally, each observation would represent a single current. In practice, though an observation is made over a distance over which there is likely to be some variation in current. An observation is not required if it is likely to incorporate currents from two different systems. In particular, it is desirable to interrupt an observation when passing a cape, a strait or a current rip, as they are likely to form boundaries between different current systems. Also, observations should not be made with the distance between FROM and TO positions, in excess of about 500 nautical or with the time interval between these positions in excess of about 24 hours. Observations should not be made where there are tidal influences, e.g., on coastal passages.

#### (b) Accuracy of fixes

The accuracy of current observations depends largely on the accuracy of the two fixes. In general, fixes accurate to within two nautical miles are required. Observations based on noon (sun) positions, derived by running fix, usually have less than the desired accuracy; the accuracy of such fixes depends on a due appreciation of the currents experienced — the very element we are trying to determine. On the other hand, the fixes derived from observing two or more planets or stars at twilight, are likely to be very suitable for calculating currents. When suitable equipment is available, fixes by such accurate methods as satellite navigation or OMEGA give especially useful current observations;

(c) Course

The true course, corrected for compass error, must be used. An error in the DR position, due to an incorrect course, has a direct influence on the current calculation. Therefore, the course must be corrected for leeway, whenever necessary. Estimating the correction for wind is not simple and can only be made by experience. However, at a meteorological service receiving current observations, it is hardly possible to make such corrections, because they are so very dependent on the type of ship and on its draught. If estimation of the leeway is impossible, for example, because of stormy weather, no current observation should be made. When, for some reason, the ship is stopped, it is also better to make no current observation if the wind is more than Beaufort force 3;

(d) Speed

It is of great importance that the speed of the ship *through the water* is known as accurately as possible. An electronic type of log is especially useful. With other, more common, types of log, the speed cannot be determined so precisely, and a compromise between log distance and distance by engine revolutions, making due allowance for slip, possibly gives the best results. The slip depends on several factors (such as draught, loading conditions, sea and swell and the time elapsed since the ship was in dry dock), but some of their effects are often hard to determine;

(e) Changes in course and speed between the FROM and TO positions

Between the FROM and TO positions, it is possible for the course to have been changed one or more times; also, it can happen that different corrections for leeway must be applied over a distance sailed with a constant course. In such circumstances, the distance is divided into parts, each with a constant course and speed through the water. If the current is not calculated on board, but later by computer for each part, each distance must be determined from speed and time noted in the logbook. More than three parts are not acceptable;

(f) Period between FROM and TO positions

The main considerations are that the period should be long enough for the current to have a measurable effect, yet short enough to make it unlikely that any large variation in current would have occurred over the distance covered. Thus, the desirable period depends on the accuracy of available navigational data. Exceptionally, with very accurate data, e.g., satellite fixes and speed through the water measured by electronic log, the current might justifiably be measured over a period as short as one or two hours. Also, when coasting, a period of a few hours between two shore fixes may be taken. Usually, however, a longer period is desirable and a period of about 12 hours between stellar fixes, determined at dusk and at dawn, for instance, would be very suitable. A period of about 24 hours is necessary when the only positions determined have been by running fix, e.g., noon (sun) positions, but such observations are barely acceptable. Observations from still longer periods are not acceptable. Since observations of current should be independent, period of observation should not overlap.

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## ANNEX 6.D

### GUIDELINES FOR ORGANIZING PORT METEOROLOGICAL OFFICER (PMO) ACTIVITIES

(Reference paragraph 6.9)

#### 1. Introduction

The functions of a Port Meteorological Officer (PMO) cover seven broad areas:

- (a) Recruitment of ships to take part in the Voluntary Observing Ships' Scheme;
- (b) Regular liaison with recruited ships to ensure the highest standard of observations;
- (c) Collection of completed ships' meteorological logbooks and data from Electronic logbooks;
- (d) Act as an interface between the meteorological service and the marine community;
- (e) In large ports act as a focus for the provision of meteorological services in the port.
- (f) Assist with arranging deployment of drifting buoys and profiling floats
- (g) Inspection of ships fitted with upper air radiosonde equipment, an AWS system, or XBT equipment.

##### 1.1 Personnel requirements

Each maritime Member of WMO should endeavour to appoint PMOs with maritime experience at its main ports. Their maritime experience enables them to communicate effectively with the ship's master and other officers. They should also have experience in, and knowledge of, meteorology, theoretical as well as practical. Knowledge of the English language would be an advantage, as most ships' officers whose mother tongue is not English are able to express themselves in this language. The necessary training of PMOs is described in the Manual on Marine Meteorological Services, Part IV, Section 3.

##### 1.2 Location of the office of a Port Meteorological Officer

The office of the PMO should preferably be situated in the centre of the harbour area. This allows the maximum of ships to be visited and facilitates visits by observers from voluntary ships to the PMO's office and gives them access to meteorological information. The PMO will need appropriate transport for instruments and supplies to ships as required.

#### 2. Duties of a Port Meteorological Officer

##### 2.1 Recruitment of observing ships

###### 2.1.1 MERCHANT SHIPPING

Recruiting of observing ships should be in the hands of the PMOs, but subject to overall guidance from the relevant section of the NMS. A worldwide distribution of observing ships is the objective to attain and every effort should be made to recruit ships which operate in data-sparse areas, e.g. the oceans of the southern hemisphere.

PMOs often prioritise the recruitment of ships which are registered in their own country, but ships of other registry are commonly considered for recruitment if they are regular callers and if the PMO considers that they would make a useful addition to the voluntary observing fleet.

Points to be considered when recruiting ships are:

- (a) Willingness of masters and officers to carry out the voluntary weather observing and to submit reports throughout the voyage;
- (b) Suitability of the ship to carry and care for the instruments.

Permission to recruit a ship should, whenever possible, be obtained from the ship owners or managers, usually through the marine superintendent of the company and from the master. It is recommended that only a verbal undertaking by a ship's master to carry out the work of an observing ship should be obtained. This service is voluntary, and it is therefore not desirable to create the impression that a formal binding contract will be imposed.

When a ship agrees to participate (or volunteer) in the scheme, the PMO equips the ship with the necessary instruments and stationery. This needs to be done quickly as many ships do not spend much time in port. A list of the instruments issued to the ship should be recorded along with the metadata required for WMO Pub 47 by the PMO.

If calibrated NMS instruments are available the ship should be recruited as a Selected or a VOSCLIM ship. If available, E-logbook software should be installed and training given on how to prepare observations.

Suggested lists of instruments and stationery for the various types of observing ships are as follows:

### **Selected and VOSCLIM ships**

- One suitably certificated precision or digital barometer;
- One barograph ( unless the digital barometer includes a tendency display);
- One whirling psychrometer OR two screens and two sheathed thermometers (1 air, 1 wet bulb) for each screen. plus two spares OR a suitable digital electronic device to measure temperature and humidity;
- Two sea thermometers and suitable sea buckets (if that bucket method is to be used for measuring sea-surface temperature);
- Electronic logbook software ( or hardcopy meteorological logbooks);
- Barograph charts;
- Plotting charts;
- Code and decode information ( usually in the form of a code card);
- State of sea card or booklet;
- Cloud types for observers booklet;
- Reduction to mean sea level card ( for ships where the pressure height correction isn't automatically applied by the electronic logbook software);
- Dew-point tables ( for ships that aren't equipped with electronic logbook software),

### **Supplementary ships:**

- One suitably certificated precision or digital barometer;;
- One whirling psychrometer OR two screens and two sheathed thermometers (1 air, 1 wet bulb) for each screen. plus two spares OR a suitable digital electronic device to measure temperature and humidity;;
- Electronic logbook software ( or hardcopy meteorological logbooks);
- Code and decode information ( usually in the form of a code card);
- State of sea card or booklet;;
- Cloud types for observers booklet;
- Reduction to mean sea level card; ( for ships where the pressure height correction isn't automatically applied by the electronic logbook software;

### **Auxiliary ships:**

- Aneroid barometer correction card; and,
- Code and decode information ( usually in the form of a code card);
- Electronic logbook software ( or hardcopy meteorological logbooks)
- State of sea card or booklet;

Cloud types for observers booklet;

Ships' officers should be asked to keep the Meteorological Service's instruments in good and clean condition. The position for the barometer in a ship's chart room should be chosen with care in consultation with the master. It should be as safe as possible from accidental damage, in a good light and clear of artificial heating. Advice should be given as to the best exposure for the thermometer screen if issued under differing conditions. The screen should be kept white. Special attention should be drawn to the care required in ensuring accurate sea temperature observations.

PMOs should ensure that observing officers understand the importance of reading wet and dry bulb temperatures in any one observation to the same degree of precision. All temperatures are required to be read to the nearest tenth of a degree. When this is not possible and the temperatures are read to the nearest whole degree, the tenth figure is reported as a solidus and not by a zero.

Subject to financial constraints, ships under construction may be supplied with distant reading equipment. PMOs should inform their headquarters of any ships being built in their area which would be suitable, and their respective owners and marine superintendents could then be approached by headquarters with a view to installing the necessary cabling and equipment during the construction.. When the necessary agreements and financial approvals with the shipowners or managers have been obtained, the PMO should be informed. He should then arrange to visit the ship with a technician if necessary to discuss the siting and installation of the instruments.

It is of the greatest importance that the PMO's initial guidance and instruction to newly-recruited ships officers should be as thorough and complete as possible. This will immediately ensure a uniformity in observing technique.

### **2.1.2 FISHING VESSELS AND SMALL CRAFT**

To help extend the collection of marine meteorological data small craft fitted with good communication equipment may be supplied with instruments or they may be recruited as non-instrumental observing ships and requested to report surface weather conditions, whenever possible. They become auxiliary ships under the Voluntary Observing Ships' Scheme.

Large fishing vessels and yachts can supply most valuable meteorological information from important areas from which there are normally very few ships' weather reports.

In ports from which fishing vessels and large yachts sail, the PMOs should do all that is possible to encourage and interest the owners and captains in marine meteorology. The captains should be assured of the usefulness to forecasting centres of their voluntary weather reports.

## **2.2 Visits to ships**

Visits and inspections are primarily intended to be occasions for giving encouragement and guidance to marine observers and for thanking them for their work, but they are also the occasion of checking on the continued accuracy of the instruments. Observing ships should, if possible, be visited at intervals of no more than three months and a report made on their instruments. A point to remember when visiting ships is that all the facilities being made available to the visitor are at the discretion and invitation of the ship's staff.

At each inspection any defective National Meteorological Service instruments should be replaced and a receipt should, if possible, be obtained from the master or his senior officer for all instruments issued.

The barometer is probably the most important instrument for weather observing. The reading should be checked by comparison with a PMO's Transfer Standard Barometer, such as a Vaisala digital barometer.

The barometer should be withdrawn from a ship if the difference from the Transfer Standard barometer exceeds 0.3 hPa.

It is recommended that a record card is kept for each barometer issued to a ship. On the card is recorded the difference between the barometer and the Transfer Standard barometer. The difference, however small, should always be entered on a form, so that an accurate record can be kept of the behaviour of each barometer. Plus or minus signs should be used to indicate high or low differences: the plus sign when the ship's barometer is reading higher than the Transfer Standard and the minus sign when the barometer is lower than the standard.

Distant reading equipment, if fitted aboard ships, should be checked at each inspection.

Hand anemometers, if issued to ships, should be returned to the NMS once a year for recalibration and a replacement issued.

In making out reports on instruments, care should be taken to distinguish between Meteorological Service instruments and the ship's own instruments. Where the ship's own instruments are used for observing, the PMO should record this on the visit form. This is necessary to avoid confusion between the property of the NMS and that of the owners or officers.

A standard inspection form should be used for each visit. Space should be available on this form for recording, for example:

- (a) Any replacement of instruments;
- (c) Any instruments which are the property of the ship's owners or officers;
- (d) Any instruments supplied by other authorities e.g. XBTs, plankton recorders, which affect the appropriate entry to the *International List of Selected, VOSCLim, Supplementary and Auxiliary Ships* WMO-No. 47);
- (e) Any metadata required by WMO Pub 47 (unless this data is collected using the ships electronic logbook)

The inspection report should be forwarded to the relevant section of the NMS as soon as possible after the inspection.

On visiting an observing ship, the PMO should ascertain that the necessary hardcopy logbooks (if applicable) and stationery are on board and are up-to-date. The ship's officers should be encouraged to understand the international meteorological codes and be familiar with the procedures to be carried out in transmitting weather messages to the meteorological centres ashore.

Courtesy visits should, if possible, be made to voluntary observing ships of other nations when they are in local ports and advice and assistance given as necessary.

### **2.2.1 WITHDRAWAL OF INSTRUMENTS**

It should be the duty of the PMO to recover instruments from ships which cease to observe. When ships cease observing for any reason, the fact should be recorded. PMOs should watch the shipping papers and journals to ascertain, among others, ship sales and change of registry and if these take place abroad they should consider requesting the assistance of the PMO in the relevant country and port.

On receipt of this information, the ship's name will be removed from the national fleet list in the relevant NMS.

When withdrawing instruments care should be taken that instruments which are not the property of the NMS are not included.

### **2.3 Collection of ships' hardcopy meteorological logbooks**



When completed ships normally return their hardcopy meteorological logbooks to the: NMS, but some may prefer to hand it to a PMO. The latter should see the meteorological logbook of all visiting ships and, if it is full or nearly full, they should forward it to the relevant section of their NMS as soon as possible after collection.

It is important to return completed logbooks from observing ships. When visiting observing ships, a PMO should therefore ascertain that the logbooks have been returned. If the book in current use has been started more than six months previously it should be withdrawn and the officers asked to start a new one. PMOs should take the opportunity, whenever possible, to give any advice as to the method of writing up the logbooks.

PMOs should make a special point of visiting observing ships' crews who appear to have difficulties in completing their logbooks and ascertaining the cause.

## **2.4 General liaison with ships**

A PMO's first duty is the care and supervision of the work of voluntary marine observers and they should give encouragement to the applications by the merchant marine generally of marine meteorology to safe and efficient navigation, comfort of passengers and the care of cargo.

A PMO is the channel used to communicate advice, instruction and correction to marine observers and also the gratitude of the meteorological departments responsible for coordinating the work. Thus a complimentary call by these officers upon the master and officers of a ship should be regarded as more valuable than a letter or email, but a complimentary card should be left if it was not possible to see the master.

PMOs should make themselves familiar with the current international meteorological codes for ships in order to be able to explain it to the masters and officers of the voluntary observing fleet.

Advice and encouragement to voluntary observing officers should be given at every opportunity during visits and, for example, through the medium of any national marine meteorological publications aimed at the voluntary observing ships.

Every encouragement should be given to marine observers and others interested in marine meteorology, to contribute papers or remarks on pertinent subjects, for publication in meteorological journals. Special attention should be directed to the pages, where provided, in the meteorological logbooks for 'additional remarks'. Masters and officers should be encouraged to write descriptions of their experiences not only as regards weather, but of all subjects of scientific interest. It is important that PMOs should maintain contact with their national navigation schools and colleges and give them any advice and assistance they may require.

PMOs of a Meteorological Service should remember that it is their duty to secure by the voluntary service of ships' officers the best possible information on meteorological conditions at sea, but it is also desirable to avoid imposing a workload which may interfere with, or adversely affect the main duties of a ships' officer to become, if excessive, detrimental to his or her main duties.

PMOs should make themselves thoroughly familiar with the scheme of communication for observing ships' routine weather reporting. They should give every encouragement and all necessary advice and instruction to observing ships.

Attention should be drawn to the Special Access Code 41 procedures for ships fitted with INMARSAT. Addressed telexes to Meteorological Services without the code 41+ procedures are chargeable to the ship.

PMOs should explain the use of radio weather bulletins, gale, storm and tropical cyclone warnings issued specially for shipping, and which radio weather bulletins, including facsimile broadcasts are the most suitable for masters and officers. They should be familiar with

Meteorological Maritime Safety Information (MSI) broadcasts such as SafetyNet and Navtex forecasts and warnings. Information on this the other meteorological services available to mariners should also be given to navigation schools .

PMOs should try to keep in touch with the management and marine superintendent of shipping companies with offices in their area and make regular visits to them.

## **2.5 *Provision of port meteorological services***

Shipping, fishing and other marine interests should be informed on how weather forecasts can readily be obtained in the port. They should also be kept informed of all meteorological services available to mariners.

Weather information useful to shipping, fishing or small craft should, if possible, be available at the Port Meteorological Office and details made available of marine forecast products that are available over the internet .. In large ports with a network of automatic weather stations the latest observations may be displayed electronically at the PMO's office (see Chapter 5 for more information on services in ports).

As the first point of contact by ships' officers on meteorological matters, the PMO may be asked for more specific technical information, e.g. on cargo ventilation. If the PMO is unable to answer the query himself, he should transmit it to the appropriate section of the Meteorological Service and ensure that a prompt reply is made.

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## ANNEX 6.E

### MARINE METEOROLOGICAL PUBLICATIONS PRODUCED BY NATIONAL SERVICES AND INTERNATIONAL ORGANIZATIONS OF INTEREST TO SEAFARERS AND MARINE OBSERVERS

(Reference: paragraph 6.11)

<i>Title of Publication</i>	<i>Editions per year</i>	<i>Country of origin</i>	<i>Language</i>
Boletín Climático Marino	3	Cuba	Sp.
Météo le magazine	4	France	F
Guide de l'Observateur Météorologiste en Mer	1	France	F
Der Wetterlotse	6	Germany	German
Newsletter V.O.S. from Hong Kong, China	2	Hong Kong, China	E
Ship and Maritime Meteorology (Fune to Kaijou Kishou)	3	Japan	Japanese
Meteorological Informationbulletin Maritime	4	Netherlands	Dutch and English
Monthly Weather Summary	12	Qatar	E
IMO News	4	United Kingdom	E
Mariners Weather Log	4	United States	E
Storm Data	12	United States	E
WMO Bulletin	4	Switzerland	E, F, R, Sp.

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