

## OBSERVATIONAL SET-UP OF INDIAN VOLUNTARY FLEET\*

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### ABSTRACT

This is a brief review article on the Voluntary Observing Fleet (V.O.F.). The scheme of Voluntary Observing Fleet as a part of World Meteorological Organisation is of basic importance in collecting Meteorological observations on voluntary basis from the sea areas, thus functioning as floating weather observatories.

Other non-meteorological observations which have bearing on the related sciences such as Marine Biology, oceanography and Astrophysics are also collected by the ships under the heading of special phenomena.

World Meteorological Organisation and other Institutions such as the National Oceanographic Institute, U.K., undertake certain research schemes for which special observations from sea areas, besides routine meteorological observations, are necessary. The ships of V.O.F. collect these observations according to special requirements and co-operate whole-heartedly for such endeavours.

In this article the historical development of the organisational set-up and the present activities of the V.O.F. are reviewed and it is also discussed how the observations of this Fleet are utilised in furthering the development and progress of the oceanic and atmospheric sciences.

### INTRODUCTION

UNDER the auspices of the World Meteorological Organisation, the India Meteorological Department maintains a Voluntary Observing Fleet which is doing a very valuable work of collecting observations over the sea areas which cover three-fourth surface of the earth and thus act as floating observatories. The development of this scheme, its organisational set-up and its present activities are presented in this review paper so that the scientists of various disciplines, connected with marine sciences, may have an idea of the same, and may like to utilise some of the data which are available through this agency.

### HISTORY OF METEOROLOGICAL OBSERVATIONS

To study the complete weather phenomena in the atmosphere quantitative and qualitative observations of a multitude of basic weather elements, such as atmospheric pressure, air temperature, humidity, wind velocity, cloud types, precipitation etc. and their variations in time and space are required. Collection of land observations is made possible by all nations of the world by establishing representative meteorological stations. But to establish such stations on high seas only to

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collect weather observations is uneconomical and impracticable, although such observations are of great help to locate weather disturbances as they mostly form over sea areas; and it is imperative to keep a vigilant watch over their movement so as to issue timely warnings to ships and ports for taking necessary precautions. In view of the importance of weather observations from sea areas some countries sought active co-operation of the merchant ships and requested them to take weather observations while navigating over seas. Ships' Officers readily agreed to the request and collected weather observations as detailed to them and passed them on to the meteorologists, when ships touched the ports. These observations were mainly non-instrumental and different nations had different units of measurements and also there was no uniform system of recording observations. The need for exchange of weather observations with uniform procedure of recording them was keenly felt by all the nations and with the initiative of M. F. Maury, an Officer of the U.S. Navy, who was the first man to realise the commercial and scientific value of the ships' observations, the first International Meteorological conference was held at Brussels, in 1853 in which a general form of weather register was drawn up. In 1874 Captain Toynbee prepared a 'Meteorological Log' form which was approved internationally and has been the means of providing 'Climatological Atlases' for all oceans, and has provided a basis for scientific investigation.

In 1861, Admiral Fitzrald, under whom the British Meteorological Office was established in 1854 as department of the Board of Trade, instituted a system whereby certain ports were informed by telegram of impending gales and were asked to hoist visual gale warning signals for the benefit of Shipping. The invention of wireless telegraphy opened up a new era in marine meteorology. As early as 1906, the British ships sent observations to the meteorological Office by radio while in 1909, a number of Transatlantic lines commenced a similar service of reports by radio. Owing to the disruption caused by the World War I it was not until 1921, that as a result of arrangements made by the International Meteorological Organisation, radio weather messages from merchant ships were organised and transmitted at the internationally agreed hours of 0000, 0600, 1200 and 1800 GMT in international code. These messages were sent from all oceans through the designated shore radio stations to various meteorological centres. Thus an exchange of weather observations on an international basis was started and all principal maritime nations co-operated in this scientific endeavour.

As it was considered important for shipping operations to supply advisory weather bulletins to ships on a regular basis, a conference was held at London in March, 1946 to draw up a scheme to equip a few merchant ships of every nation with tested meteorological instruments, according to international standards, to record accurate observations. The co-operation of the Shipping Companies and the ships' Officers in recording and transmitting the ships' observations has been on a voluntary basis and the ships thus selected by any nation are grouped together as 'Voluntary Observing Fleet' of that nation. In return for the services rendered by the ships, the meteorological services of different nations broadcast advisory weather bulletins at internationally fixed timings to ships for their safe navigation and protection of cargo. At the International Meteorological Organisation conference at Washington in 1947, it was agreed to increase the number of ships in the 'Voluntary Observing Fleet' and maps were drawn up showing (a) the areas from where the ships would transmit their weather messages to various national services, and (b) the areas for which the respective nations would be responsible for issuing weather information for the benefit of shipping.

Under the auspices of the 'World Meteorological Organisation the scheme of "Voluntary Observing Fleet" briefly mentioned as "V.O.F." was adopted by all the maritime nations of the world.'

#### DEVELOPMENTS IN INDIA

The India Meteorological Department, which has the responsibility of maintaining a vigilant watch over the Indian seas, is one of the thirty-one maritime countries which has successfully introduced the scheme of 'V.O.F.' since 1946, equipping 45 merchant ships on the Indian Register for collecting and transmitting weather observations from the sea areas. For this purpose the V.O.F. ships are divided into three categories :

1. Selected.
2. Supplementary.
3. Auxiliary.

This depended upon their frequency of voyages and number of days of navigation done during an year. The main factors considered for the recruitment of a ship in the V.O.F. are :

1. Number of Officers available on a ship, for recording observations and the hours of wireless telegraphic watch maintained by the ship's radio Officers.
2. Wireless telegraphic equipment on ship—whether it is capable of transmitting on short wave in addition to long and medium waves.
3. The routes followed by the ship—The ships following less frequented routes are given preference.
4. The ability and willingness of ships' Officers to do the meteorological work.

The India Meteorological Department provides, on loan tested standard meteorological instruments to all the Indian V.O.F. ships for recording weather observations. The Selected ships record and transmit a full set of synoptic observations for which purpose they are supplied with (1) A mercury barometer, (2) a psychrometer, (3) a Marine Bucket, (4) a sea thermometer for recording sea surface temperature, and (5) a microbarograph to record continuously the variation of atmospheric pressure.

The Supplementary ships record and transmit a reduced set of synoptic observations for which only (1) a mercury barometer, and (2) a psychrometer are supplied.

The Auxiliary ships are only expected to send radio weather messages, in certain oceanic areas where the shipping is sparse or under specified conditions, in abbreviated code or in plain language. Such ships use their own instruments after they have been inspected and approved for the purpose.

Besides supplying appropriate instruments, the India Meteorological Department also provides relevant meteorological publications to all the V.O.F. ships for reference at sea.

#### *Port Meteorological Liaison Units :*

The I. Met. D. has established Port Meteorological Liaison (P.M.L.) units at Bombay and Calcutta and proposes to establish some more such units at Madras, Cochin, Mangalore, Marmagoa and Visakhapatnam also. These Officers maintain a close liaison between the Department and the Shipping Companies for enrolling

their ships in the list of Indian V.O.F. The Officers at these units visit the ships which call at their ports and give instructions to the ships' Officers in their meteorological work. They also check and service the meteorological instruments on board the ships regularly to maintain them in good condition.

*Collection of observations :*

The World Meteorological Organisation with the consultation of all the member-maritime nations has evolved a uniform system of ships weather code to be followed by all ships of the V.O.F. Accordingly an officer of a ship transmits a meteorological observations in coded form to the nearest designated coastal radio station by wireless telegraphy immediately after the hour of observation. The observations are recorded at internationally fixed hours viz. 0000, 0600, 1200 and 1800 G.M.T. and more frequently when requested by the weather forecasting Offices during the time of disturbed weather. Coastal Radio Stations of Post and Telegraph Department receive the coded messages from the ships and send them on teleprinter to all the forecasting centres and also to the Northern Hemisphere Exchange Centre at New Delhi for Global distribution. Thus the observations from ships on high seas are received by all the interested maritime nations of the world before the issue of their official weather bulletins.

India Meteorological Department also receives observations from seas all over the world through global exchange transmission by an International arrangement. The transmission of weather observations from the ships is done free of cost to the ships.

*Weather bulletins to the ships of V.O.F. :*

The ships' observations from sea areas are plotted on the relevant weather charts together with the land observations in all the forecasting centres of the India Meteorological Department. The plotted charts are analysed and daily weather bulletins, intended for maritime and various other services are issued, normally twice daily and more often, when the weather is disturbed. The weather bulletins are broadcast by the P & T Department on several frequencies from coastal Radio Stations at Bombay, Calcutta and Madras regularly. The weather bulletins convey to the ships on the high seas the information about (i) winds, (ii) weather (iii) visibility, (iv) the state of sea, etc. Different maritime nations have different sea areas for which they are responsible to issue weather bulletins. India has responsibility for issuing bulletins for Arabian Sea, and Bay of Bengal and North Indian Ocean. Special observations are called for, from the ships for 0300, 0900, 1500 and 2100 hrs GMT during the time of disturbed weather and special bulletins are issued on the basis of these observations.

*Coastal Weather Bulletins :*

Coastal weather bulletins, for the benefit of the fishing and sailing vessels are issued for weather conditions along and off the Indian coasts up to 75 Kms twice daily in normal weather and more often during the time of disturbed weather. Special bulletins are also issued when there is development of bad weather which may cause danger to shipping and fishing operations. All these bulletins are broadcast from different coastal wireless stations of the P & T for the corresponding coastal strips.

*Port Warnings :*

A port warning system in conjunction with the coastal weather bulletins is maintained by the department, by which the port Officers at most of the Indian ports

are warned by high priority weather telegrams. On receipt of the warning telegrams from the Storm Warning Centre, the port officers hoist appropriate visual signals prominently by day and night. Mariners and fishermen are generally made aware of the meanings of the signals by the port authorities.

*Scrutiny of logs :*

Besides taking and transmitting weather observations, the officers of the ships of the V.O.F. are requested to enter them in log sheets having internationally accepted format. The logsheets are supplied by the I. Met. D. and the ships' Officers are requested to return the completed log sheets to the Department, where they are scrutinised and transferred to the accepted punch-cards as permanent records. They are available for exchange of Data with other National Meteorological Services. These records are used for research work and are supplied on request. It may be worth mentioning here that India has been assigned a special responsibility by W.M.O. to collect and compile marine meteorological data of the Indian Ocean north of 15°S. The punched cards of marine observations are used for this purpose.

*Reports of Special Weather Phenomena :*

Apart from the weather observations, the Officers of the ships of the V.O.F. collect and record observations of some special phenomena which they encounter during their voyages. These reports are studied in more details by the Department and are classified into different categories depending upon different branches of science such as marine biology, oceanography etc. The reports having bearing on weather conditions, like squall, rainfall and visibility, seas and swells are studied in greater details with reference to weather charts of the department. The reports which have bearing on other allied subjects like sighting of a big whales, rare marine biological animals and plant specimen, presence of gigantic icebergs and the impending disaster of their collision with ships and reports of locust swarms will be found to be of great use for research purposes. The following are certain examples to show how these reports are utilised by the meteorological Department and any other research organisation to which they are sent for expert study and comment.

(1) Reports of the presence of locust swarms over the sea will be useful to take necessary precautions to stop damage to standing crops. These reports are also sent to antilocust centre, London for investigational purpose.

(2) Reports of sighting whales are collected from all parts of the sea area in order to study their concentration and probable course of their movement during different seasons. Such study was started by the National Institute of Oceanography, London in 1951, where a plan was formulated and the mariners including the V.O.F. ships were requested to record observations on whales. The finding, that there is a relative high concentration of whales in the Gulf of Aden and scarcity in the Central Indian Ocean, is of significance for oceanography.

(3) The knowledge of the presence of vast population of fish and their probable movements is being utilised for fishing purposes. Report on the mackerel breeze i.e., the breeze, which is favourable for the presence of mackerel fish, will be intimated to the fishing authorities to conduct operations within specified time.

Some-time vast populations of fish die due to some reason or other. Report on this and collection of sample of the fish will be useful to study the cause of death

of the fish, and appropriate measures to counter it could be undertaken. Some of the ships of the Indian V.O.F. are supplied with special bottles containing preservative for collecting marine biological samples mainly for the study of fish mortality. The collected samples are to be sent to the Central Marine Fisheries Research Institute, Cochin-18 for further research.

(4) At times, ships navigating in different parts of sea, are drifted away from their scheduled course due to the strong ocean currents and heavy sea waves. There are instances when ships have been drifted miles away causing damage to ships, besides causing loss of time and fuel. The ships' Officers record the distance and direction of a ship driven by strong current and report the observations giving the location of the ship in the sea, so that the direction and the force of strong current or waves can be estimated. Such observations are called 'Set and drift' observations and are reported under the heading of special phenomena.

(5) There are some other interesting phenomena, which are not observed often but are of scientific importance. These are bioluminescence, discolouration of sea water, lunar rainbows, solar and lunar halos, abnormal refraction, corona, meteors, comets, etc. Observations of these phenomena are also taken and reported by the ships' Officers.

Selected reports of special phenomena are published in the *Indian Journal of Meteorology and Geophysics*.

#### WORLD METEOROLOGICAL ORGANISATION PROGRAMMES

The W.M.O. undertakes, from time to time, certain scientific projects/programmes for the intensive study of oceans and weather over them. For this purpose some special and non-meteorological observations from the sea areas are arranged. All the maritime member-nations of the W.M.O. seek co-operation of their V.O.F. ships who in turn extend it willingly for the success of the projects. The following are some of the important projects/programmes which have been undertaken so far.

##### 1. *International Indian Ocean Expedition (I.I.O.E.) :*

India took part in the five-year programme of I.I.O.E. during 1961-65 as a member of W.M.O. along with the other maritime nations. The object of this programme was to observe, describe and possibly explain the circulations of the ocean and the atmosphere and exchanges across their interface, the chemical compositions and distribution of living things in the oceans, and the bottom topography and the coastal structure of the Indian Ocean. Officers of the India Meteorological Department participated in the observational cruises of the oceanographic research vessels, and important oceanographic and upper air observations were recorded in the Arabian Sea, the Bay of Bengal and the South Indian Ocean. USSR vessel Vityaz, U.S. Research Vessel Anton Bruun and India Naval Ship Kistna took active part in collecting the observations.

##### 2. *Global Atmospheric Research Programme (GARP) :*

This is a world project taken up under the auspices of the W.M.O. and the International Council of Scientific Unions (ICSU) and will be the first global study taken up so far. The purpose of the GARP programme for 1969-70 was to obtain,

for a limited period, global sets of meteorological data, as complete as possible at present, to be used in numerical experimentation and with the aim to increase our understanding of a number of physical processes of the atmosphere in order to produce improved weather forecasts. All the ships of the V.O.F. and other non-V.O.F. ships and fishing vessels were asked to co-operate in this programme of collecting weather observations.

3. *International Global Ocean Station System (IGOSS) :*

The purpose of IGOSS is to provide more extensive and timely information on, and prediction of the state of ocean and its interaction with the atmosphere and to support research on the process of the oceans so that nations can provide improved oceanographic services to increase the safety and efficiency of their marine activities. This comprises of acquisition of oceanographic data and its quick transmission to the designated centres for data processing product formulation. IGOSS programme is still in the initial stage and will be implemented when all the details of the stages of developments are worked out. Some ships of the V.O.F. in addition to the other research vessels, will be requested to take oceanic observations besides the weather observations.

Weather service can advance rapidly only if observations from the entire globe are available and hence the importance of meteorological observations from the high seas becomes paramount. The scheme of Voluntary Observing Fleet has been introduced by the W.M.O. to get these observations with the co-operation of the Officers of the V.O.F. ships and the Shipping Companies. The W.M.O. with active co-operation of all the maritime member-nations, extends all possible help to Shipping operations and strives hard for the advance of weather science and its benefits to mankind. The progress in the field of studies on the air sea interaction can in return, greatly help in economical running and safety of shipping. Thus, the V.O.F. while serving science, also serves itself.