

E-SURFMAR – THE EUMETNET SURFACE MARINE OBSERVATION PROGRAMME

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1. THE E-SURFMAR PROGRAMME

The Surface Marine observation programme (E-SURFMAR) of the EUMETNET (the Conference of European National Meteorological Services) Composite Observing System (EUCOS) started in April 2003. It is an optional programme supported by 17 countries and is managed by Météo-France. Its main objectives are to co-ordinate, optimise and progressively integrate the European activities for surface observations over the sea. In 2009 its budget, from member's contributions, is 820 kEuro.

The programme delivers marine observations from Voluntary Observing Ships (VOS) operated by EUMETNET members, as well as from drifting and moored buoys. The programme has led to significant reorganisation in the management of drifting buoy observing programmes within Europe, as all E-SURFMAR drifter activities (e.g. purchase of buoys, network monitoring, deployment coordination etc.) are managed directly by an E-SURFMAR Data Buoy Manager.

Internationally E-SURFMAR contributes to the activities of the Ship Observations Team (SOT) and the Data Buoy Cooperation Panel (DBCP) of the Joint (WMO-IOC) Commission for Oceanography and Marine Meteorology (JCOMM).

2. E-SURFMAR PROGRAMME OBJECTIVES

The main aim of EUCOS is to improve the quality of numerical weather prediction (NWP) and general forecasts over Europe, for which the most important parameter over the sea is surface air pressure. As it cannot be measured by satellites, in situ observations are needed.

A network design study [1] was carried out in 2004, which recommended one observation every 12 hours at a density $225 \text{ km} \times 225 \text{ km}$ for E-SURFMAR. This represents 125% of the threshold density ($250 \text{ km} \times 250 \text{ km}$) required for regional NWP (the optimum is $10 \text{ km} \times 10 \text{ km}$). The other requirements (optimum/threshold) for time resolution, accuracy and timeliness being 0.5h/12h, 0.5hPa/1hPa and 0.5h/2h respectively.

Hence, a priority for E-SURFMAR was to increase the density of in situ air pressure observations over the ocean areas shown in Figure 1(a). This is being achieved through the introduction of Automatic Weather Stations (AWS) on ships alongside an increase in the number of drifting buoys deployed. However, to achieve the target density would require the deployment of 160 - 175 SVP-B drifters per year plus 45 shipborne AWS systems in addition to the VOS ships presently operating in the North Atlantic and the Mediterranean.

Figure 1(b) shows the locations of surface marine observations collected during July 2008. Other key issues for the programme are to improve the quality and timeliness of the observations, whilst reducing operating costs.

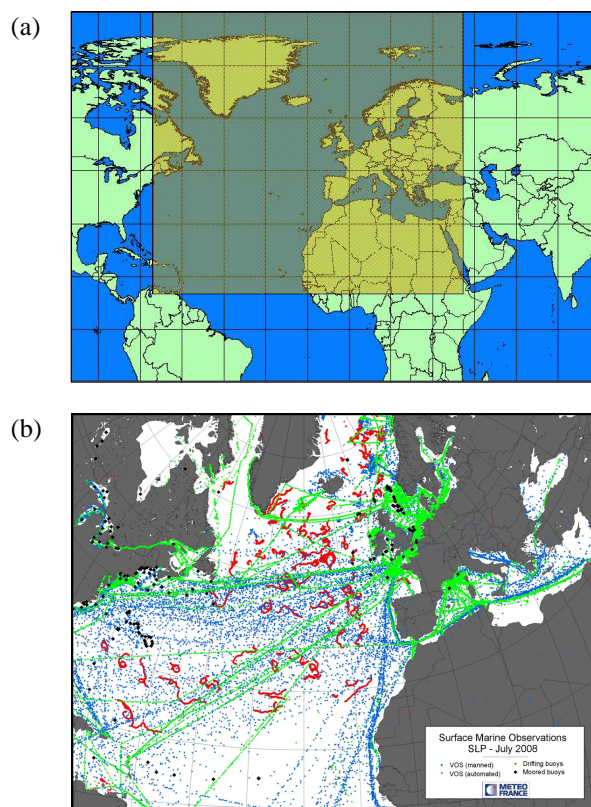


Figure 1. (a) The EUCOS area of interest and (b) surface marine observations collected during July 2008.

3. E-SURFMAR OBSERVATIONS

By mid 2009, more than 1,300 observations from the Atlantic Ocean and the Mediterranean Sea are being reported daily by EUMETNET VOS and disseminated via the WMO Global Telecommunications System (GTS).

About 1,000 of these daily observations are now made using ship-borne AWS such as BATOS, MILOS, BAROS or MINOS, as shown in Figure 2(a). E-SURFMAR contributes financially towards ship observations by providing compensations to VOS operators related to the number of observations their ships report. At the same time, around 2,500 daily observations from drifting buoys (many of which are directly funded through the E-SURFMAR programme) are also transmitted onto the GTS, see Figure 2(b). Both Figures 2(a) and 2(b) shown the steady increase in the number of surface marine observations being reported since E-SURFMAR began in 2003.

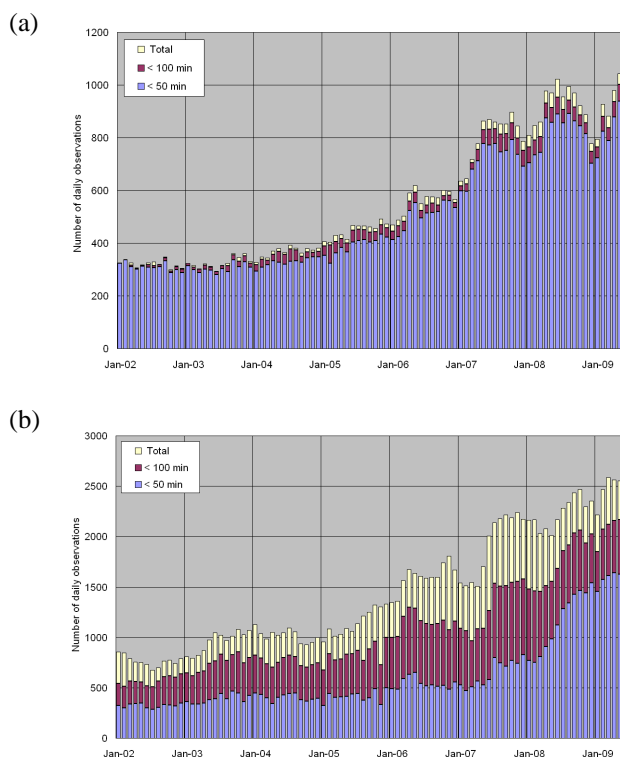


Figure 2. Average number of observations in the EUCOS area collected each day from (a) EUMETNET ship AWS and (b) drifting buoys.

3.1 VOS observations

Traditionally, VOS observations have been made manually by ships officers using meteorological instruments provided by the recruiting National Meteorological Service (NMS). These data, together with visual observations of the sea state and weather

conditions, are entered into an electronic logbook. (Within E-SURFMAR the TurboWin software is recommended). The logbooks incorporate a number of standard quality checks prior to generating an FM-13 SHIP message which is usually transmitted through the ships Inmarsat C transmission system. E-SURFMAR has developed a system to help compensate its members for their Inmarsat transmission costs.

AWS systems generally fall into two categories – ‘simple’ autonomous systems and more ‘complex’ integrated systems. Simple systems typically measure only a few parameters (usually air pressure and temperature) and are largely independent of the ships infrastructure, while complex systems measure a wider range of parameters (air pressure, air temperature, humidity, wind, sea surface temperature) and also allow the ships officers to add their visual observations (visibility, weather, clouds and sea state) before transmission.

Although there are relatively few autonomous systems currently in use, the most common ones are the MINOS AWS which measures atmospheric pressure and air temperature and transmits the data through the Argos system, and the BAROS AWS which transmits its pressure data through Iridium (which gives better timeliness and at lower cost). Complex systems used on E-SURFMAR members’ ships include the BATOS AWS, the MILOS AWS and the AVOS AWS. Data from these systems are coded and automatically transmitted back to the NMS (usually via Inmarsat-C for BATOS and AVOS, or by Meteosat for MILOS).

Although complex AWS systems provide greater functionality they are difficult to install and maintain. Hence, an emphasis in the coming years is expected to be on the development of more cost effective autonomous AWS that are essentially plug and play systems requiring minimal interference with the ships infrastructure.

Each month weather reports are being received from more than 80 ship-borne AWS systems and 400 manned VOS operating in the EUCOS area – typically amounting to approximately 300 manned and 1,000 fully automated observations each day.

3.2 Drifter observations

The SVP drifter, with a pressure sensor (SVP-B), is nowadays the ‘standard’ drifter used by the E-SURFMAR programme. Its standard measurements include the surface atmospheric pressure, its tendency, and the sea surface temperature, all reported hourly. In the past data transmission and positioning have been done using the Argos system. However, in recent years, E-SURFMAR has taken the lead internationally in

moving to the use of Iridium for data communications, as this provides more timely data and at a lower transmission cost. The impact of this can be seen in Figure 2(b) which shows an increasing number of drifter observations being available on GTS within 50 minutes of the observation time. As Iridium cannot be used to position the drifter with sufficient accuracy GPS is used to provide accurate locations as needed to derive surface ocean currents.

In 2008, 80 SVP-B drifters (including their communications costs) were funded by E SURFMAR. They have been deployed in the North Atlantic Ocean. In parallel, through cooperation with the NOAA Global Drifter Programme, E-SURFMAR also funded 30 barometer upgrades to NOAA drifters in 2008.

3.3 Moored buoy observations

Several E-SURFMAR participants (Met Office, Irish Marine Institute and Météo-France) operate 'K-series' open ocean moored buoys off European and Mediterranean coasts. These buoys report hourly the basic meteorological parameters (atmospheric pressure and its tendency, air temperature and sea surface temperature, wind speed and direction, humidity, significant wave height and average period). The data are transmitted in real time using either Meteosat DCPs and/or Iridium.

In addition, Puertos del Estado operate an oceanographic moored buoy network (Fugro-Oceanor SeaWatch and Wavescan buoys) around the Spanish coast, and in the Balearics and Canaries. As well as the parameters noted above, they also measure currents and salinity. Data and directional wave spectra are transmitted via Inmarsat-C and disseminated on GTS in FM-94 BUFR code.

Four buoys (K5, M6, Lion and Cabo-Silleiro) are designated by E-SURFMAR as a baseline for satellite calibration/validation and so the operating costs for these buoys are part financially compensated through the E-SURFMAR programme. A specific requirement for these four buoys is to measure directional wave spectra and 10-minute wind data for satellite calibration/validation. Cabo-Silleiro already has a directional spectral wave capability and in August 2008 a Triaxys spectral wave sensor was installed on the K5 buoy. This capability will be introduced on the M6 and Lion buoys in due course.

4. SUMMARY AND FUTURE DEVELOPMENTS

Although E-SURFMAR has seen a significant increase in the number of surface marine observations being reported since 2003, this has been limited by the funding agreed and so it has not yet achieved the target observation density specified in the design study [1].

The design study is currently being reviewed, through a series of observing system experiments (OSE's) which will examine the impact of the data through three scenarios: (i) all drifting buoy and all non synoptic ships data will be removed, (ii) half of the drifting buoys and all non synoptic ships data will be removed, and (iii) all data will be assimilated. It is likely that the results of these OSE's will define the coverage of surface marine observations that E-SURFMAR will aim to sustain over the coming years.

Other objectives are to continue to reduce communications costs for VOS and the data buoys, as and when technology permits, and to complete the operational deployment of spectral wave and 10-minute wind measurement capability on the 4 E-SURFMAR moored buoys and to move towards 100% compensation for their operation.

5. REFERENCES

1. EUCOS Surface Marine Programme - Network Design Study. Document SURFMAR-102-131, 14th September 2004.