

# The CLIMAR Community Initiative: A 10-Year Vision (<http://www.marineclimatology.net/web/>)

Elizabeth Kent ([eck@noc.ac.uk](mailto:eck@noc.ac.uk)), Etienne Charpentier ([ECharpentier@wmo.int](mailto:ECharpentier@wmo.int)), Craig Donlon ([craig.donlon@esa.int](mailto:craig.donlon@esa.int)),  
Sissy Iona ([sissy@hnodc.hcmr.gr](mailto:sissy@hnodc.hcmr.gr)), Nick Rayner ([nick.rayner@metoffice.gov.uk](mailto:nick.rayner@metoffice.gov.uk)), Shawn Smith ([smith@coaps.fsu.edu](mailto:smith@coaps.fsu.edu)),  
Val Swail ([val.swail@ec.gc.ca](mailto:val.swail@ec.gc.ca)), and Scott Woodruff ([Scott.D.Woodruff@noaa.gov](mailto:Scott.D.Woodruff@noaa.gov))

**Corresponding author:**  
Dr. Elizabeth C. Kent  
National Oceanography Centre,  
European Way  
Southampton SO14 3ZH, UK  
Tel: +44 (0)23 8059 6646

**Presenting author:**  
Mr. Shawn R. Smith  
Center for Ocean-Atmospheric  
Prediction Studies (COAPS)/Florida  
State University  
smith@coaps.fsu.edu

## Abstract

Observations have been collected over the ocean for centuries and the surface marine observing system has continually evolved. The early ship observations are now supplemented by measurements for some variables from both autonomous platforms and Earth-orbiting satellites. Surface marine observations are primarily made for weather prediction and therefore climate requirements can be a lower priority. The Global Climate Observing System (GCOS) provides an Essential Climate Variable (ECV) framework to develop, monitor and assess the observing system. An unmet challenge is assessing the surface marine observing system against requirements for climate research, monitoring and services. Such assessments will lead to an improved picture of what is needed from the observing system and how it can be developed to better meet climate requirements.

The CLIMAR Community includes experts in the collection, management, rescue, analysis, exploitation, homogenisation and assessment of marine climate data. CLIMAR's 10-year vision includes: (i) developing a more systematic approach to climate observing system design, implementation and assessment; (ii) implementing a more integrated approach to the management of observations, metadata and documentation needed to monitor the marine climate; (iii) improving the climate record through data and metadata rescue and (iv) adding value to the marine climate record through research.

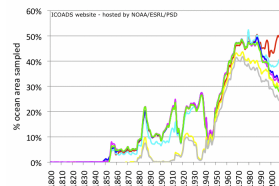
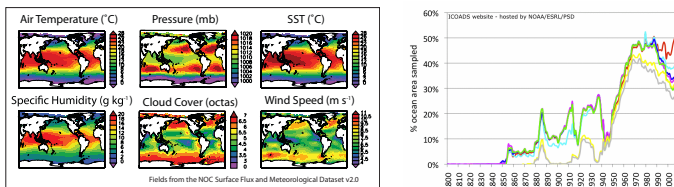
## Introduction: Essential Climate Variables at the Marine Surface

The GCOS Implementation Plan defines a range of ECVs near the world ocean's surface, both in the atmosphere and ocean. **Marine Surface ECVs include: air temperature; wind speed and direction; water vapor; atmospheric pressure; precipitation; surface radiation; cloud properties; sea surface temperature; sea surface salinity; surface currents and sea state.** All these variables are of high impact and can be observed globally with existing technology. Mean fields of ECVs are illustrated below.

ECVs are measured by voluntary observing ships, moored buoys, drifting buoys, research vessels, fixed platforms (e.g. oil rigs) and various types of island and coastal stations. Some platforms provide observations of a wide range of parameters, others a more limited range. Observation quality varies, as does the availability of detailed metadata describing the platform, measurement methods and instrument types. These metadata are critically needed to adjust for biases, and to assign estimates of uncertainty, for the observations.

Many marine surface ECVs observations are made by National Meteorological and Hydrological Services (NMHSs) in support of numerical weather prediction; therefore, the marine climate community has little influence on establishing priorities for most data collection. The community does manage data collection for a few specialized platforms dedicated to climate applications.

The International Comprehensive Ocean-Atmosphere Data Set (ICOADS) provides an archive of these ECVs and related surface marine observations—the earliest presently from 1662—together with available observational metadata. ICOADS is maintained with near-real-time updates, and forms a key international focal point for marine climate research. The CLIMAR community seeks to create an overarching data management and research framework, with ICOADS as a continuing central archival and user-interface element.



## The Observations

The **surface marine climate community** relies on observations of **many different variables from many different sources**. Our earliest data come from ships' logbooks, and merchant and research vessels still form an important part of the multi-variate record. In the more recent times these data are supplemented with observations from buoys and other automated platforms, and with observations made from space. The CLIMAR community seeks to ensure that we have sufficient observations of the necessary quality, consistency and adequate descriptions of the observations and how they are made. CLIMAR priorities for observations include:

- A consolidated data and metadata collection, management and archival system meeting climate standards for all surface marine ECVs—including for completeness, consistency, resolution, metadata and traceability
- Integrated access to archived observations, metadata and value-added information
- Traceability of observations to their source and appropriate platform and processing metadata



## The CLIMAR Community Vision

Sustained resources for a surface marine observing system designed, managed and assessed with a focus on meeting the requirements for climate research, monitoring and services.

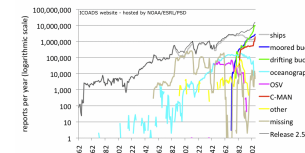


## The Observing System

The **diverse observing system for marine surface ECVs makes assessing the adequacy of the observations for climate applications difficult**. This difficulty means that even the requirements are not as well defined as they should be. The GCOS picture of observing systems contains 3 elements, a Global reference network, a Global baseline network and a Comprehensive network. These three elements represent a hierarchy in quality and sampling from very high quality, stable observations at the few reference locations, to a more widely distributed set of baseline stations, to the comprehensive network sampling at the space and time scales required to fully describe the nature, variability and change of a specific ECV.

However, the assessment of the surface marine climate observing system has not yet been considered in these terms, and more research and resources are required to make adequacy assessments for all ECVs for a wide range of climate applications. Such assessments are needed to feedback information to the many operators of the surface GCOS to ensure that future observations can meet, as far as is possible, the requirements of climate research, monitoring and services. CLIMAR priorities include:

- Determining user requirements, learning from the recent work of the European Space Agency Climate Change Initiative.
- Regular assessments of the adequacy of the surface marine observing system against a range of climate requirements
- Feeding back information from the adequacy assessments into improved climate observing system design
- An expanded role for research vessels including as providers of high-quality reference observations

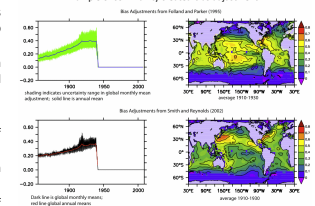


## Adding Value to the Climate Record through Research

The **marine community has long added value to the climate record through research into bias adjustments (see figure below left), uncertainty estimation and the development of methodologies to construct useful and well-characterized data products**. The challenge is to make the information from these efforts available to the wider GCOS community. CLIMAR priorities include:

- Establishing a mechanism within ICOADS to track data adjustments and enhancements to metadata or quality control. A pilot project to develop an ICOADS value-added database is underway.
- Continuing to develop new, high-quality data products which contain information on data uncertainty, with input from the land-surface and data homogenization communities.
- Providing expert advice on the quality of data and data products
- Identifying resources for the cataloguing, imaging and digitization of historical and legacy data and metadata (see figure to far right)
- Prioritizing candidate data and metadata recovery and integration into the climate archive.
- Developing technology to expand the range and quality of observations in remote regions and harsh environments

Example of community created bias adjustment



## Integration

Finally we consider the need for integration, recognizing the importance of dedicated infrastructure, interoperability, data discovery and standards to facilitate collaboration, but also the need for access to expert opinion in different communities to ensure wide use of data and products. **Efforts will promote the development of a standardized international system for managing a wide range of surface marine climate data, integrating their collection, description, rescue, quality control, formatting, archiving, exchange, and access.** The goal is for real-time, delayed-mode and historical marine surface climate observations, associated metadata and products to be managed to ensure known quality and traceability to satisfy the requirements for long-term climate research, monitoring and services.

## About CLIMAR

CLIMAR is a community of specialists in and users of surface marine climate data—brought together in a series of biennial meetings. CLIMAR and MARCDAT workshops include experts in the collection, management, rescue, analysis, exploitation, homogenisation and assessment of marine climate data. CLIMAR workshops are formally called by the WMO and IOC, have a broader participation than MARCDAT and focus on enhancing the capacities of developing countries in the field of marine climatology; while MARCDAT workshops focus on advances in the use of marine climate data. The ICOADS (<http://icoads.noaa.gov/>) forms the backbone of these activities but wider links have been fostered by CLIMAR to include, for example, the subsurface ocean, marine biological, land and satellite communities. CLIMAR has acted as a focal point for surface marine climate activities. Recent examples include providing marine expertise for the "Surface temperature datasets for the 21st Century" initiative and for the European Space Agency Climate Change Initiative (ESA CCI).