Presentation and evolution of the Shipboard automatic weather station BATOS

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ABSTRACT

This presentation consists of a general and technical description of the weather station BATOS. The latest evolution with improved functionalities and easier set up onboard Voluntary Observing Ships (VOS) is described.

BATOS is a shipboard automatic weather station which allows for the acquisition of basic weather surface parameters (measured by sensors), manual observations, data quality control, data processing and storage, the generation and transmission of encoded messages (via satellite) and the display of parameters in real time.

The automatic station consists of the following components : weather sensors (pressure, temperature, relative humidity, wind speed and direction, water temperature), compact protective housing for sensors, satellite communication components and a central computer.

In the first version of BATOS, analog sensors are used so that it's necessary to put an interface (a sensor collector) between sensors and the data collecting computer.

The system has been improved in the second version so that the station has become more compact, easier to be set up and wired on a ship. In addition, the added flexibility of the system configuration enables the use of digital sensors.

The initial system is at present set up on 30 French VOS. As of this year, installations of the second version has been completed.

Future works will be done to start a connection with oceanographic measurements (thermosalinometer) and to reduce the transmission costs.

INTRODUCTION

The automatic weather station BATOS is intended to be set up on VOS (Volontary Observing Ships) and allows measurement of all the basic meteorological surface parameters. Manual observations may also be input, so that the station can send a complete SYNOP SHIP message.
The first version of the BATOS system, set up on VOS for several years now, proved its robustness in a marine environment.
A second version with the same functionalities has been improved : size has been reduced, the wiring is easier, new generation of digital sensors can be connected.
The next parts of this article deal with a description of the two systems and of the present network of Meteo France.

GENERAL DESCRIPTION OF THE SYSTEMS

The first version of the automatic station BATOS allows:

- acquisition of the basic weather parameters measured by analog sensors: wind speed and direction, temperature, relative humidity and sea surface temperature
- input of human observation (present weather, visibility, clouds, state of the sea, ...) with a full on-line help
- data check, proccessing and storage
- generation and transmission of normalized encoding messages by satellite
- data display on dedicated screen
- normalized data transfer (NMEA standard).

This station consists of:

- analog weather sensors
- sensor collector which collects data and converts to digital

- transmission system
- computer processing unit

(see fig. 1).

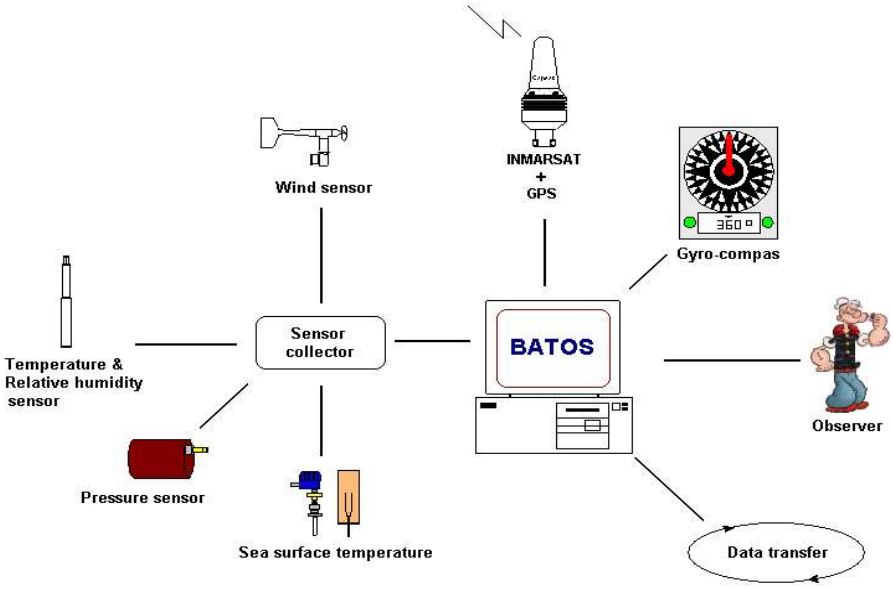

Fig. 1: BATOS first version.

In the second version of BATOS, the system allows direct acquisition of digital sensors so that the sensor collector can be removed. Wiring and installation of the station are simplified.
New sensors are used: the wind sensor, which is a new generation of ultrasonic and digital sensors, and the combined pressure, temperature and humidity digital sensor, which replaces analog ones (see next figs. 2 and 3).

Fig. 2: Components of the BATOS II system.

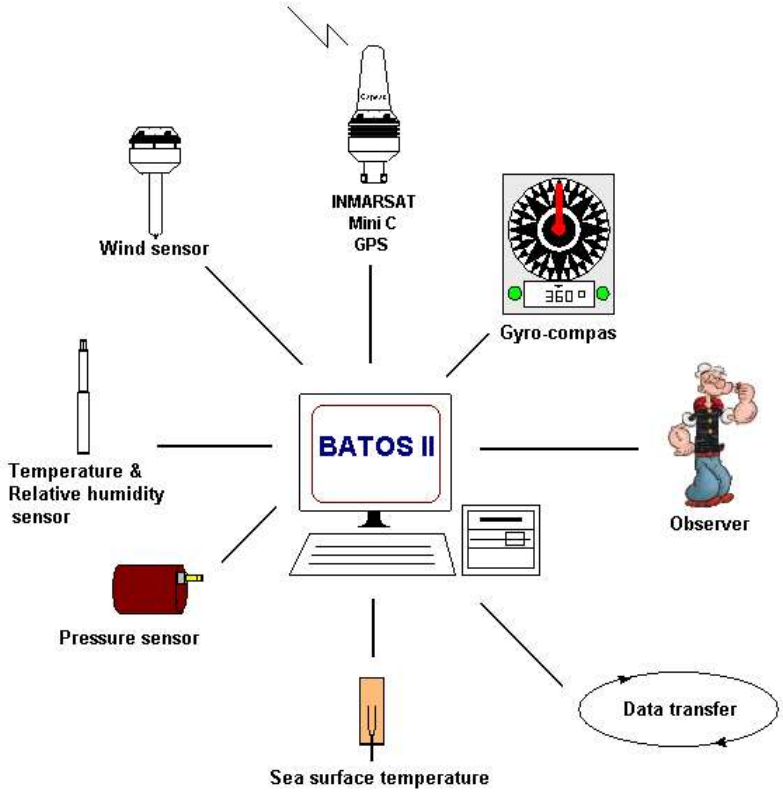

Fig. 3: BATOS Second version.

DESCRIPTION OF THE COMPONENTS

Pressure, Temperature and relative humidity

- ***BATOS:*** *PTB220* barometer (Vaisala) is used for pressure measurement, *PT100* platinium thermometer (Heraeus Sensor) for temperature, and *HMP35 DE* hygrometer (Vaisala) for relative humidity.
- ***BATOS II:*** *PTU 200* (Vaisala) is a combined sensor which consists of a pressure unit (*PTB220* equivalent) and the *HMP 45 D* sensor for temperature and relative humidity measurement.

Ranges:

- pressure: 800 hPa to 1100 hPa
- temperature: -30 to 50 °C
- humidity: 0,8 to 100 %

Wind sensor

- ***BATOS:*** *05106* (YOUNG)
  - Speed range : 0 to 60 $m.s^{-1}$
- ***BATOS II:*** *CV3F* (LCJCAPTEURS)
  - Speed range: 0 to 50 $m.s^{-1}$
  - Temperature range: 0 to 40 °C

  Another ultrasonic wind sensor from GILL, suited for a larger temperature range, is currently under test and can be connected to the system.

Sea Surface Temperature

BATOS & BATOS II: a hull contact sensor PT100 (SPCK PROSENSOR) is affixed on the hull of the ship and under the waterline.

- Range: -80 to 160 °C

Screen
BATOS & BATOS II: the naturally ventilated multiplate screen *Miniature Marine* (SOCRIMA) is used to protect the *HMP 45 D* sensor.

- Enclosure: (Ø x H) 20 cm x 50 cm.

Transmission System
BATOS: Inmarsat standard C, antenna and GPS receiver, separated transceiver
BATOS II: Inmarsat standard Mini C, transceiver, omni-directional antenna and GPS receiver in one single unit.

Sensor collector
BATOS: *QLI50* sensor collector(Vaisala) acts as the interface between analog sensors and data collecting computer.

Software BATOS
BATOS: version 1, linked to the sensor collector for data acquisition, calculates the true wind (from the apparent wind and the speed and heading of the ship), allows the input of human observations, checks quality and coherence of the data, creates and sends messages every one, three or six hours (using code 41).
BATOS II: version 2, performs all functions described above by communicating directly with sensors.

CURRENT NETWORK

The first version of BATOS has been set up on thirty VOS in 2004.
The robustness of the BATOS station had been proved and the number of marine observations had been significantly increased since the beginning of the BATOS deployment. The histogram on fig. 4 shows the total number of annual French VOS observations compared to the observations done by BATOS only. According to fig. 5, the number of French VOS from 2000 to 2004 decreased, because of the progressive elimination of ineffective ships using manual sensors. In spite of this, observations have still continue to increase, due to the BATOS network expand during this 4 years (fig. 5). The quality and the punctuality of the messages had also been improved.

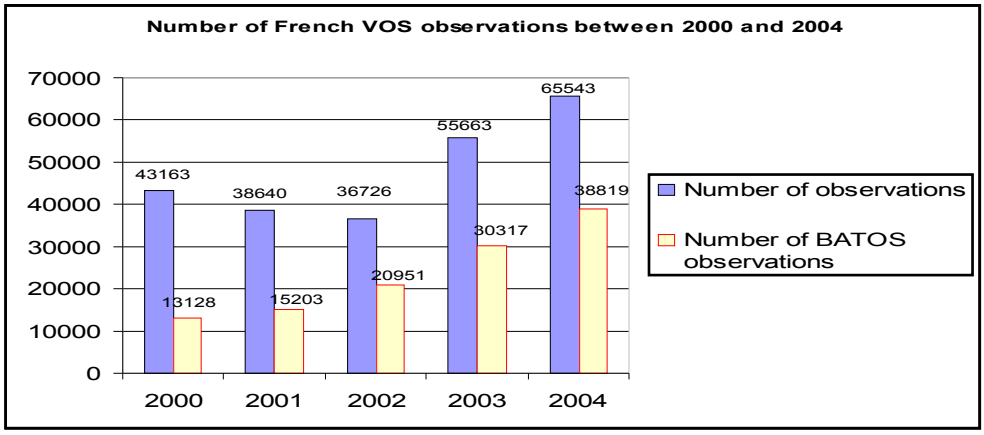

fig. 4: Number of annual French VOS observations between 2000 and 2004.

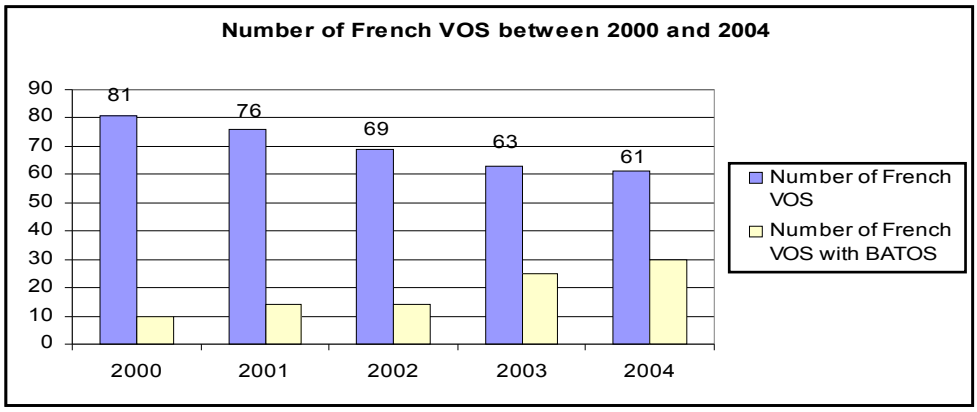

fig 5: Number of annual French VOS between 2000 and 2004.

Six of the thirty ships equipped with BATOS have been selected since two years for the VOSClim project (the ongoing project within JCOMM's Voluntary Observing Ships' Scheme which aims to provide a high-quality subset of marine meteorological data, to be available in both real-time and delayed mode to support global climate studies).

FUTURE WORK

The next generation of BATOS will include a thermosalinometer acquisition system which will send TRACKOB messages every one, three or six hours. This evolution corresponds to the intention of making a connection between oceanographic and meteorological measurements.

The station will be made available for EUMETNET members, within the context of the E-SURFMAR program.
At present, the transmission costs are not optimized. With Inmarsat C, one message costs about 0,70 euros. In the E-SURFMAR context, a study to reduce this costs will be started during this year. By using data compression and a different Inmarsat protocole, it will be possible to cut them by about a third.