Operational oceanographic and meteorological data visualization

Marie-Francoise VOIDROT-MARTINEZ , METEO-FRANCE, Toulouse, France
Bénédicte EZVAN, SHOM, Brest, France
Antoine LASSERRE-BIGORRY, Brigitte BENECH, METEO-FRANCE, Toulouse, France
Pascal VENZAC, MFI, Toulouse, France

1 INTRODUCTION

In 2006, the French Service for Hydrography, Oceanography (SHOM) contracted Meteo-France to provide the operational oceanographic forecaster with a suite of tools to improve oceanographic data analysis, by developing a software based on the French tool for meteorological forecasters called SYNERGIE. This document explains the aim of this collaboration and it reviews the status of the project.

1.1 METEOROLOGICAL AND OCEANOGRAPHIC FORECASTING : SIMILARITIES AND DIFFERENCES

Water and Air are two fluids with very different physical characteristics (viscosity, density…) but featuring similar behaviours. As a matter of fact they obey the same physical laws of fluid mechanics: they are turbulent and suffer from currents or winds, vortices or eddies that can vary in terms of intensity or directions, trying to reach an unachievable balance.
A major common characteristic is that both of them are present respectively in the oceans and the atmosphere in huge volumes where it is impossible to make laboratory-like experiments. We are sentenced to try to analyse their state through limited observations and forecast their future evolutions through the interpretation of never perfect models.
Weather forecast has been naturally developed first for multiple reasons: air is a human-friendly environment, human activity is more evidently impacted by weather; observation is easy to perform whereas oceanographic observation requires instruments and sophisticated data gathering systems from the earliest stages.

In France, modern meteorology was born in the middle of the 19th century with Urbain Le Verrier who founded the Meteorological Institute. He also contributed to organise from 1855 on, a regular exchange of meteorological data between multiple European observatories, as suggested in 1853 by Matthew Fontaine Maury from the US Navy. Nicknamed F*ather of modern Oceanography and Naval Meteorology,* Matthew Maury also contributed at the same period to implement the exchange of oceanographic data.

Since then meteorological observations have been tremendously developed thanks to satellites, radars, soundings, aircraft sensors… and automatic observation. Telecommunications have developed as fast. Since 1951, the World Meteorological Organisation has been defining strict formats for data exchange, designing worldwide networks and awarding international responsibilities to support the continuous improvement of meteorology forecasting and populations safety all over the world.

Multiple meteorological models have been developed and improved but human expertise is still useful as none of them is perfect (Should models be perfect, meteorological forecast would be 100% right….and there would be only one meta-model left and no time limits to meteorological forecasts!)

In parallel, Oceanography has improved, but with a slower pace. For instance, satellite altimetry which was developed in the 70's has hugely improved thanks to Topex/Poseidon lift-off from the European Spatial Center of Kourou in French Guiana on 1992-08-10.
Oceanography models have been running operationnally since several years but the duty of marine operational forecaster is however quite recent.

2 NEED OF SPECIFIC TOOLS FOR DUTY FORECASTERS

In order to visualize, combine, criticize this ever-growing amount of data, specific software tools have been developed, the specificity of which are to be able to handle data which are :

- huge in term of volumes,
- real time,
- highly evolutive,
- multidimensional,
- based on heterogeneous observation sensors,
- observed but also forecasted,
- …

These tools have improved over the passed 15 years, in order to integrate more and more meteorological knowledge and core expertise. These softwares are now mature enough to be deemed as essential to operational forecasters' activity.

Since the physics of air and water are similar and the specificities of the data are also encountered in marine oceanography, the SHOM has contracted Meteo-France to provide the operational oceanographic forecasters with a tool to analyse Oceanographic data. It was interesting for the SHOM to take advantage of Meteo-France extensive know-how to handle multidimensional real-time data into an integrated and truly ergonomic tool.
Meteo-France business is not computer development per se, but it was deemed feasible to adapt the SYNERGIE.PC® software suite used by the French meteorological forecasters. Besides that, it was also expected to make the SHOM and the French Navy benefit from all the experience of the met community in handling operationally complex and evolutive data into complex distributed information systems. Last but no least, it seemed interesting to all to provide access to meteorological and oceanographic data into the same single tool.

3 MAIN MODIFICATIONS REQUIRED TO THE SYNERGIE SOFTWARE

Meteorological data remain relevant for forecasting for typically 5 days. As a consequence, data older than 5 days are normally rejected at the entry level in the database. Oceanographic data can be useful for 3 weeks and observations commonly come in 6 to 8 days after the actual measurement.
The software-user interface and database have been adapted to handle interactively data of up to 3 weeks age.

The system also had to be adapted to handle negative altitudes or immersions. The cross sections facilities have been adapted for instance as shown on figure 1.

Temperature observations are made at different levels and the upper measure is often done at various depths. A visualization as been adapted to plot the upper level observations with some information about the depth of measure (see figure 2)
A new module to plot vertical profiles under the sea has been developed (see figure 3).

This developments inherited naturally from all the basic facilities of the tool : zoom, panning, temporal series, metgrams, watching points, … and of course overlay with all the meteorological, oceanographic and wave data already available.

The developments have been subcontracted to Meteo-France International. Meteo-France was in charge of integration of the developments and the data flows.

4 CONCLUSION

Currently, the configuration is being enriched to handle a greater variety of models. The system is ready for acceptance.
Some functionalities to handle meteorological objects will be finalized during FY 2009. The next step will deal with training and implementation.

5 REFERENCES

Daabeck J., 2005: Overview of meteorological workstation development in Europe, AMS 21st Conf IIPS

Lasserre-Bigorry, A., Degrace J.N., Voidrot M.-F., Arbogast E., 2008: Synergie, French Forecasters Workstation – specific tool for Tropical Cyclone, AMS 24nd Conf IIPS.

Lasserre-Bigorry, A., Santurette P., Voidrot M.-F., Benech B., 2006: Decision aids products for forecasters, AMS 22nd Conf IIPS.

Voidrot, M.-F. Tamburini A., Autones F., Couzinier J., Desbios S., 1999 : Operational use of SYNERGIE for aeronautical forecast, ECMWF 7th Workshop on Meteorological Operational Systems

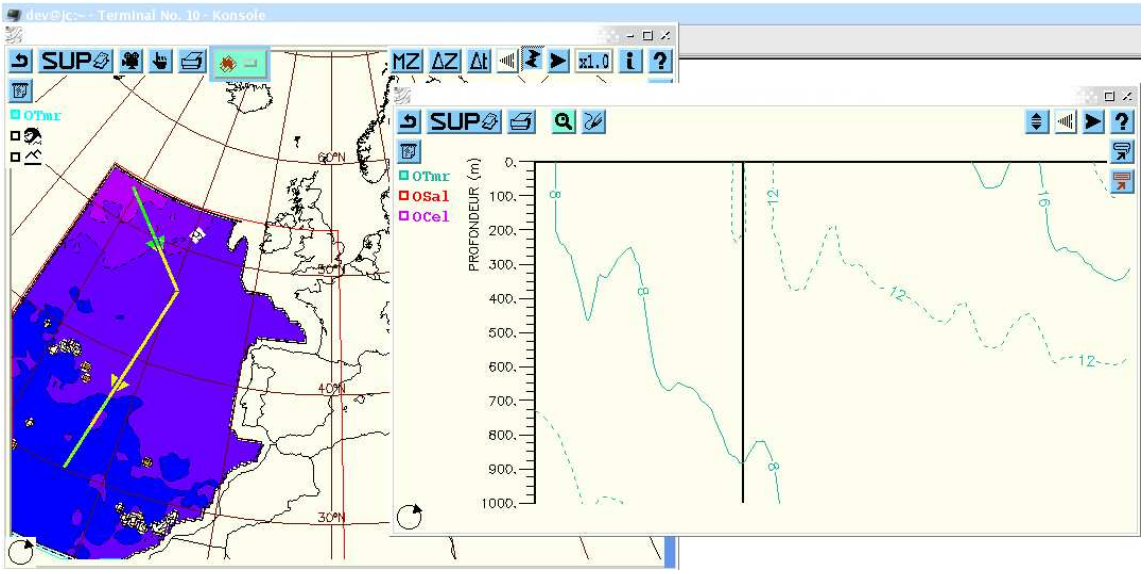

Figure 1 – Interactive Cross section through oceanographic numerical model output

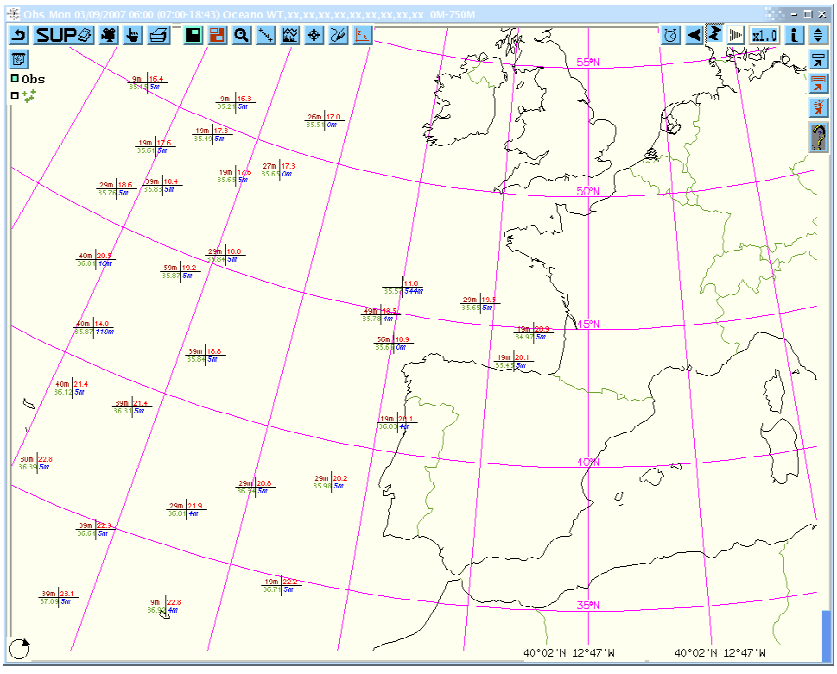

Figure 2 – Composite plotting of significant observed data

Figure 3– Vertical profile under the sea