

## TOWARDS A SYNERGIE PROGRAM AT METEO-FRANCE ?

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*Summary* : The Synergie project has been launched in 1989. This project intend to give to all forecasters from the national and regional centers the convenient interactive tool for their daily work of forecasting and production. The project involves now about 30 people, working in coordination, development, and maintenance in the 16 Synergie sites. The first objective of the project (forecasting tool) will be soon reached with the move to the Neons-like database structure and a new data processing. The other objective (interactive production) is now focussed on with a high level of priority.

The coordination of all the specific developments that are necessary to the forecasting community and their integration into Synergie will be discussed, as well as the re-organisation of the global Synergie architecture that was achieved recently. The project faces now a new situation, since an important part of the software is in operations while continuous improvement or new modules are brought to the system. This is why Synergie, as an important axis of the Meteo-France strategy, is changing from a project status towards a program status.

### 1. INTRODUCTION AND SCOPE

The SYNERGIE project has been launched in 1989. This project intends to give to all forecasters from the national and regional centers the convenient interactive tool for their daily work of forecasting and production. This project has already been introduced during the last IIPS Conferences (*Voidrot et al.*, 1993; *Bénichou et al.*, 1994, 1995, 1996).

By the end of 1995, all the platforms that were planned to be implemented in Météo-France are operational in France and overseas territories. Moreover, implementation of SYNERGIE in military stations or control centers has begun, and SYNERGIE-Export systems are now in operations in some countries.

The coordination of all specific developments that are necessary to the forecasting community and their integration into SYNERGIE will be discussed in this paper, as well as the re-organisation of the global SYNERGIE architecture that was achieved by june, 95.

The SYNERGIE project faces now a new situation, when it has to manage simultaneously major developments on a ever changing system which has to be maintained in operations with a high level of reliability. As the developments of more and more sophisticated features on a system like SYNERGIE are expected to be asked for during the next years, Meteo-France is now switching to a concept of Program to ensure a long life to SYNERGIE as an important piece of the Meteo-France strategy.

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## 2. SYNERGIE IMPLEMENTATION AT METEO-FRANCE AND ABROAD

### 2.1 Hardware implementation at Meteo-France

By the end of 1995, it can be considered that 97% of the servers or stations that were to be implemented at Météo-France were in operations. This represents 23 servers and 47 workstations installed on 16 geographical sites, which corresponds to a 3 M\$ investment over the 1994-1995 period. All these equipments will be replaced by 1998. The general principle is to implement a (double) server at each geographical site, the power of the server depending on the number of local client stations. Hence the need for powerful lines to provide these servers with the relevant data : all the regional offices in France are connected to the national center of Toulouse through dedicated 64 kBytes lines (128 kBytes in 1996).

### 2.2 Software dissemination strategy at Meteo-France

The developments are performed according to an iterative scheme of requirements / development / validation. The last operational version at the time this paper was written (August, 1995) was the SYNERGIE\_2.1 release. The general principle is to provide at regular intervals (i.e. three months) the SYNERGIE sites with fully validated releases. The validation step have become crucial since production features have been brought into the system. Insuring all the SYNERGIE sites run the same release is not an easy matter but it illustrates well the will of disseminating techniques in an homogeneous way all over the Météo-Frances services, including Overseas territories (see also §4).

### 2.3 Synergie military implementation

During the past year, many French military centers have come to the SYNERGIE solution since this system meets most of their needs : for example the nuclear propelled aircraftcarrier (to be launched in 1998) will be equipped with a SYNERGIE server-client system.

### 2.4 Synergie implementation abroad

Export versions of SYNERGIE can easily be derived from reference versions and implemented anywhere in the world wherever data are available in a WMO format. The commercialisation of the SYNERGIE-Export Package is performed through the SOFREAVIA<sup>2</sup> company on the basis of an agreement with Meteo-France.

SYNERGIE is now implemented in Indonesia, Niger and in Morocco; it will be soon installed in Honduras, French Guyana (French Space Center), Philippines, ...

## 3. THE STATE OF THE SYNERGIE SOFTWARE

### 3.1 Human cost and priorities :

The project involves now about 30 people working in development, maintenance, operations or coordination throughout 16 SYNERGIE sites. The first objective of the project (visualization) will be soon reached at a reasonable level of satisfaction, with the move to the NEONS structure and a new data processing (see §3.5).

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As for the other objective (interactive production), it is now focussed on with a high level of priority. By the end of 1995, the total cost of the SYNERGIE system development corresponds to about 40 men-years.

### 3.2 Synergie new architecture : the "pineapple concept"

A major change of the SYNERGIE architecture occurred in the first part of 1995, when decision was made to re-organize the system in order to propose a more modular organization for the developments around SYNERGIE. There were many reasons for such a change : first SYNERGIE had to evolve to handle easily the connections with other developments going on at Meteo-France; secondly, the software architecture was to be consistent with the choice made by SYNERGIE to have people developing in many different sites. Last, SYNERGIE was to be developed according to a Quality Insurance Plan, which was not yet fully the case before. The new architecture was operational through the dissemination of the SYNERGIE release 2.0 in June 95. This new architecture has been surnamed "Pineapple-like architecture" since each subapplication may be seen as a separate slice of the SYNERGIE fruit, while the heart of the Pineapple symbolizes the vertical coordination and utilities managed by the central development team (see §4.5). Such an architecture allows not only to make anyone responsible for a subapplication but also to configure easily the application for any user, in terms of active and inactive subapplications.

### 3.3 Synergie recent visualisation features

The following new features of SYNERGIE give an illustration of the principles of the system.

- lightning impacts : this new type of data was integrated rapidly into SYNERGIE thanks to the new "pineapple" architecture ;
- new dynamical diagnostics from NWP model : these new fields, associated to SYNERGIE are a first step towards new methodologies for synoptic forecasting in a modern environment;
- interactivity with the visualisation parameters for satellite pictures, model fields, backgrounds;

### 3.4 Synergie recent production features

- *General principles for an efficient production*

The major principle of production in SYNERGIE relies in the way that only servers should exchange information with the outside world. Therefore any station producing data sends them to the local server ; then any client can access the products generated by any other local or distant station. This organization allows not only efficient production but also the necessary exchange of expertise between colleagues or distant sites.

The other principle is that the forecaster should feed in most cases a forecast database from which it is then easy to derive as many specific products as wanted by the customers. Nevertheless, by the beginning of 1996, specific or generic interactive production features are available on about 20 workstations on 8 sites.

- *Symposium : from Guidance to Production*

This project (*Landais, 1993*) partly developed within SYNERGIE has been partly put into operations in April, 1995. It allows the national forecasters to produce guidance charts for regional and local centers while regional forecasters are able to adjust the forecasts locally, feed a local weather elements database and answer

to the final users with specific and precise products. The production part is done with an Off the Shelf editor interfaced with the database.

- *Meteorological Objects* :

This new concept was introduced into SYNERGIE by the end of 1994. Its principle consists in graphical annotation of any SYNERGIE window, the annotations being turned into objects described in the SYNERGIE database. This principle has been or will be derived into several products such as SIGWX charts, simple annotations, new dynamic guidance charts, aviation charts,... In the case of SIGWX charts, the module is linked to an interactive field modification module, enabling for instance to edit a MSLP field (in final validation by the end of 1995).

- *TV Channels* :

Specific features are used daily since 1994, such as weather elements over Europe, validation of simulated satellite pictures,...and the products are made available on a central server, to be accessed by TV Channels on their own request.

### 3.5 New Data Processing and Move to Neons

The NEONS layer is being implemented since the end of 95, above the Oracle RDBMS. Higher performances and easier access to more data are expected from this major change. In fact, the move to Neons will be made simultaneously to the implementation of a new Data Processing that will allow SYNERGIE to decode more data types (e.g. BUOYS, SATEMS,...)

## 4. SYNERGIE BECOMES A PROGRAM IN THE METEO-FRANCE STRATEGY

### 4.1 Météo-France trusts the human expertise

The implementation of a new tool such as SYNERGIE in the Météo-France services must be understood as a will of homogeneization, optimization and modernization of the operational forecasting offices, in a particular political context : **Météo-France trust in the human expertise and on the added value that it can bring to the final product.**

This may explain the investment made by Meteo-France in this special field of interest which is Interactivity in Meteorology. Such an investment is of course not only a financial investment but also a human adventure since an significant part of the Meteo-France staff has to take responsibilities in or around SYNERGIE : computer specialists, forecasters, administrators, teachers,...

### 4.2 Synergie as the integrated solution

One of the main objectives of the project is to provide forecasters with a single tailorable and integrated forecasting AND production tool. This is possible only at two conditions :

a) a fitted software architecture to allow the integration of any new specific application (especially in production) into SYNERGIE : this is now the case (see § 3.1);

b) a will of homogeneity in the developments performed in this domain at all the Meteo-France sites : this criterion was fulfilled recently after the forecasting offices accepted SYNERGIE as their new reference tool .

From this stage, it is therefore possible to plan all the new developments in forecasting and production within the SYNERGIE development context.

### 4.3 High-Technology in all the Meteo-France services

A subsidiary objective of SYNERGIE was to provide all the forecasting offices (except the local offices) with a unique system. The most obvious reason for such a strategical choice is a diminution of the development and maintenance costs. Another reason is a better management of human resources, thanks to the homogeneity of the working tools for the forecasters as for the computer specialists, even in remote centers as Overseas Territories.

### 4.4 Synergie is becoming a Météo-France Program

For all the reasons listed before, a Program structure has been decided for SYNERGIE by the end of 1995. Perennial structures, as detailed in §4.5, have been created within all the met. services where SYNERGIE is operated, and SYNERGIE is now one of the Météo-France strategic axes. As a matter of fact, Meteo-France had to make sure that this system, which is the heart of the forecasting and production system, should work efficiently for a long time, while being able to evolve regularly on request from the users or from the Headquarters.

### 4.5 Necessary Structures

- *User's Group* : this Group was created in december 94. Its aim is to organize the feed-back for the recent developments provided by the project, to propose improvements with suggested priority levels. This Group is indispensable to focus the remarks coming from as many as 16 different geographic operational sites.
- *Training* : the Ecole Nationale de la Meteorologie (ENM) trains all the students who are to work within Meteo-France in an interactive multi-sites Unix environment. Its staff has been involved for a long time in the SYNERGIE development strategy. The ENM is also often used to train forecasters, as well as operators or system administrators.
- *Operations and supervision* : supervision is now part of the daily shift work of the National Center operators. The supervision module will soon be implemented in the other SYNERGIE sites, allowing to check the reliability of the system anywhere.
- *Administration* : competence in this field (installation of new SYNERGIE releases, database administration, product administration) exists (and is necessary) in all the SYNERGIE sites.
- *Development* : as a long term project aiming a fully integrated system, SYNERGIE needs many people to be developed and maintained. The strategy is to have trained SYNERGIE developers in almost all the sites : as a matter of fact, from the 27 people involved in the project (equivalent to 13 people working full time), 15 work in regional or overseas services.
- *Central team* : distributed development has of course a cost : SYNERGIE has a central team for development in Toulouse, who is responsible of the most important choices and who overlooks and integrate all the developments into the SYNERGIE releases.

- *Other projects connected to Synergie* : the developments that are to be made within the SYNERGIE environment should be performed under the responsibility of SYNERGIE, which avoid possible misunderstandings between projects.
- *Coordination* : the role of the project manager is to organize the work of the whole SYNERGIE community at Meteo-France and to define priorities in the developments. Communications facilities as e-mail make this job easier. The project manager is also the interface between the SYNERGIE project and the outside world.

## 5. CONCLUSION AND FUTURE

Meteo-France has made important efforts in interactive tools development for forecasters, which have led to an operational worldwide spread tool (SYNERGIE). It can be considered that this was a first important step on the endless way of modernization of forecasting and meteorological production.

The decision to transform SYNERGIE into a strategic program will be consistent with the will of trusting the human expertise in this particular field of interest.

Fitted structures have been created to integrate this new strategic axis in the Meteo-France's missions.

## 6. ACKNOWLEDGMENTS

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