

**Operational use of Synergie for aeronautical forecasts**  
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## 1. INTRODUCTION

Until the release 3.1 of Synergie, the developments answered specifications common to all types of users. Since the last operational release, Synergie offers some functionalities dedicated to specific profiles of forecasters. The purpose of this paper is to enhance how its open architecture and its clear interfaces allow to plug the value added by any algorithm of pre or post processing into a main operational and evolutionary system and to exchange expertise in an efficient way. This will be demonstrated taking as an example all the recent facilities dedicated to the aeronautical forecasts.

## 2. PLUGGING OUTPUTS FROM SPECIALIZED ALGORITHMS INTO SYNERGIE VISUALIZATION COMPONENT

Synergie uses an Oracle data base enriched with the NEONS facilities. The content of this data base is site-dependent and the data are usually kept on line for 5 days This data base is not at all encapsulated into the server part of Synergie which can be considered as an ordinary client.

During the last years, the aeronautical developers have designed special post-processing algorithms from NWP aiming at producing icing or turbulence GRIB fields, freezing level isotherms, -10°C isotherm level, contrails, jet streams...

Thanks to Metview , they prototyped and tested routinely during several months the best visualization options. (Figure1)

It was then easy to find a machine able to run these algorithms daily in order to feed the data base operationally. These fields can be considered as diagnostic parameters derived from the NWP models. Adding new parameters into the user interface is done by configuration files without touching the code of the system. At last, the only modification of the code a Synergie specialist had to do consisted in integrating the Magics parameters settings that where prototyped by the users themselves. Therefore all general functionalities like zoom, cross-section, animation, .. offered by the Synergie kernel where of course available for all this new parameters. ( Figure 2)

Using flight levels has been made in the same way, the data base being just enriched with new data. Flight levels where then considered as a new vertical coordinate. ( Figure 3)

This means that thanks to this system, we need a limited investment to provide the forecasters operationally with the value added by specialized algorithms developed by any specialized meteorologist of Meteo-France.

This can be applied not only to classical NWP outputs but also to any other type of data like observed data. An interesting example is that recently, the forecasters experimented routine provision of the results of the prototype of the Rapid Developing Thunderstorm product of Eumetsat's Nowcasting SAF, which describes mesoscale convective systems using satellite images and presented as meteorological objects. These product is still on a research status.(Morel & Senesi , 1999<sup>1</sup>) This experiment allowed a daily control of the quality of this algorithm taking advantage of all the Synergie diagnostics functionalities and above all of the operational daily work of experimented forecasters.

Some visualizations are presented at the end of this paper. (Figure 4 and 5)

### 3. EXCHANGING FORECASTERS EXPERTISE

When the aeronautical forecaster has built her/his conceptual model of the weather analysis and evolution, the significant weather chart module allows her/him to put her/his expertise over the geographical domains she/he is in charge of into the data base. (Figure 6). At this stage, the data are available from the data base for any tool, any piece of software , any system that would need it.

One of these tools is the interactive Synergie system of information. As soon as this expertise is validated , all the other forecasters of the same site are informed by the user interface that they can access this piece of information in a visualization mode. This expertise is also sent to other remote databases. When it arrives into the remote databases the forecasters of the distant sites is informed by their own user interfaces. They are then able to reuse this expertise on their domain of responsibility or get several pieces of expertise to make a consistent and global forecast over a large domain taking advantage of the work and expertise of regional forecasters. In this way Synergie supports any forecast master plan, any multi level or segmented organization allowing a cooperative work of distant chief forecasters. It is ready also to support any international cooperation if Meteo-France receives meteorological objets coded in BUFR from any other meteorological service.

Another of these tools is the Synergie-batch version of the software. This software can be run automatically and can use any predefined canvas to present raw data or expertise. Typically, this is used to build the Significant Weather Charts that are disseminated on the GTS. Figure 6 presents a screen of expertise input. Figure 7 presents the result of the formatting of this expertise by Synergie-batch. The software takes the expertise, plots it, extracts from it the data needed to build the cartouche, builds it

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<sup>1</sup> Ref : Morel C. et S. Senesi, 1999 : The Rapid Developing Thunderstorm product of the nowcasting SAF. In Proc. , the 1999 Meteorological Satellite Data User's Conference. pp(to appear). Copenhagen-Denmark-Eumetsat and DMI

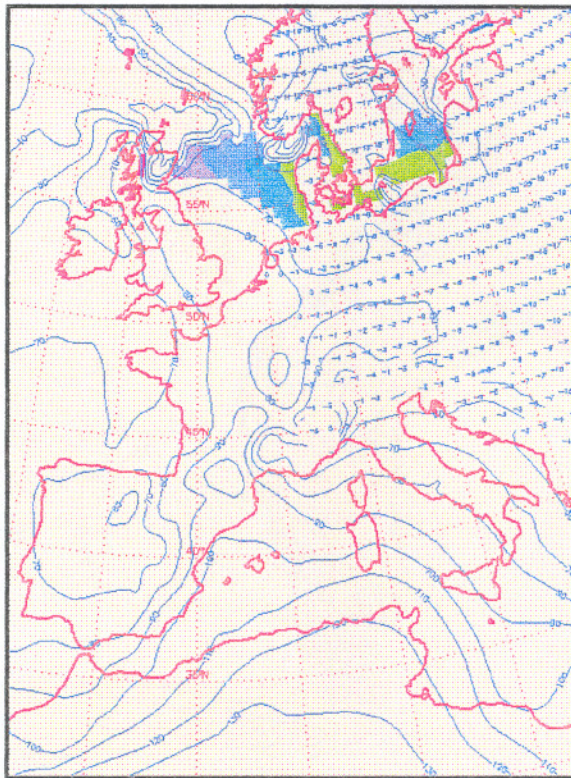
and makes the final overlay thanks to a predefined canvas. The canvas are built totally out of Synergie with TGIF. They could be built by any other graphic editor providing a Postscript driver.

Right now Synergie-batch is run by the standard Unix cron tool. In the next operational release it will be run by a "resource availability manager" in order to speed up the product when possible and to avoid poor results when the availability of some resource is delayed.

Of course any other production system is able to take advantage of this expertise and raw data database.

#### 4. CONCLUSION

Synergie allows the integration of any kind of meteorological expertise: National and Regional forecasters, but also researchers, applied developers, computer programmers... helping a global cooperation among different departments in order to support the forecasters in their daily challenges. It provides a data base of raw meteorological data but also derived parameters and meteorological expertise. This database can then be used by any simple or complex production system.



*Figure 1 : Metview prototyping for multiple freezing level isotherms*

*Isolines : Flight level of main freezing level ;  
Shaded areas : nearest to the ground second freezing level,  
Ground temperatures plotted only when they are negative*

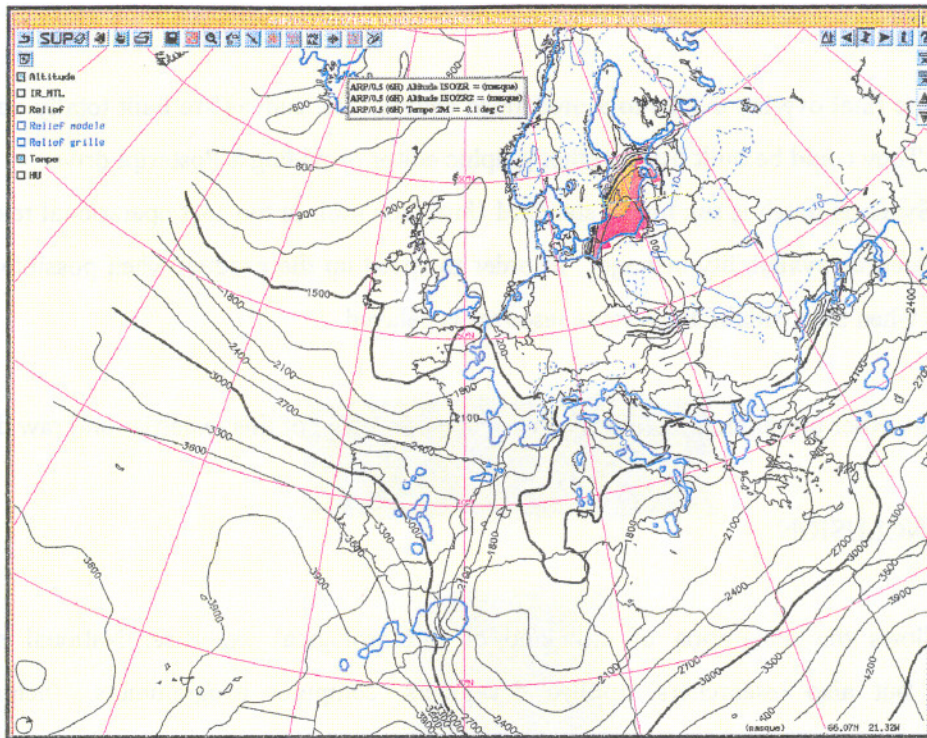


Figure 2 : Synergie operational presentation for multiple freezing level isotherms

Black Isolines : Flight level of main freezing level ;  
 Shaded areas : nearest to the ground second freezing level,  
 Blue isolines : Negative ground temperatures

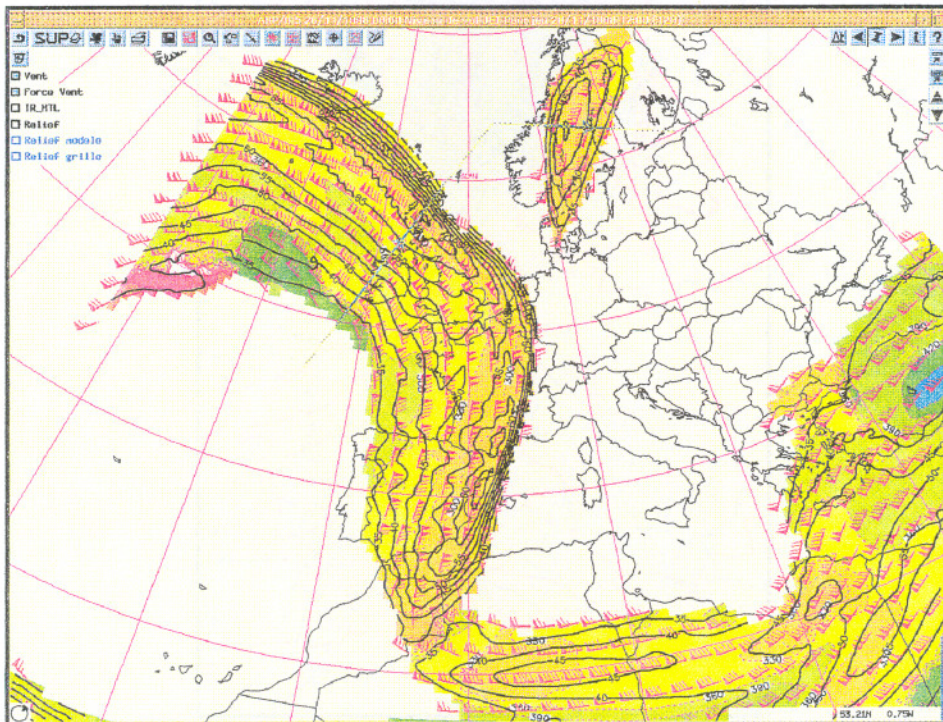
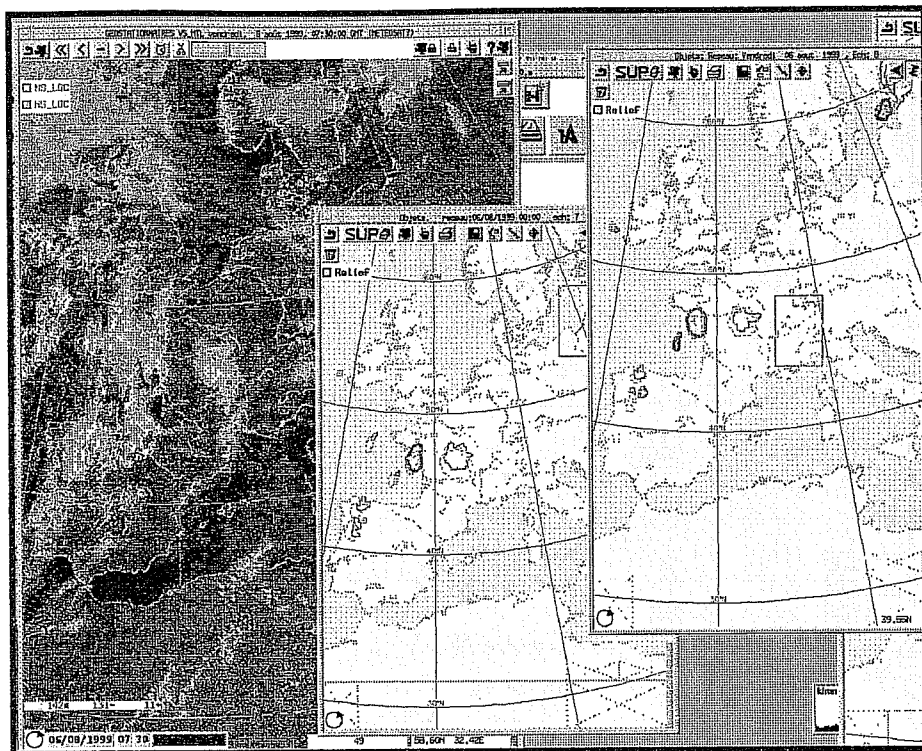
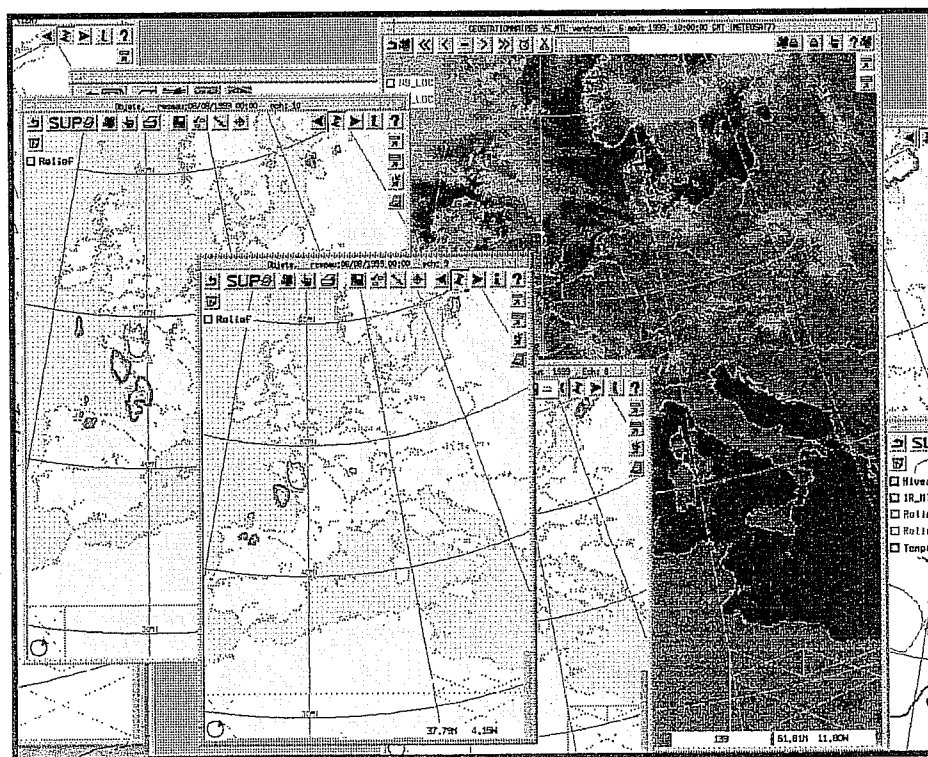


Figure 3 : Synergie operational presentation for Jets

Black Isolines : Jet strength isotachs(each 10 m/s) ;  
 Shaded areas : jet streaks flight level (warm colors= low flight level ; cold color=high flight level),  
 Arrows : Jet wind



*Figure 4 : Validation of the RDT product  
Lightning impacts combined with satellite imagery  
Convective cells presentation*



*Figure 5: Validation of the RDT product  
Evolution of convective cells at different time steps*

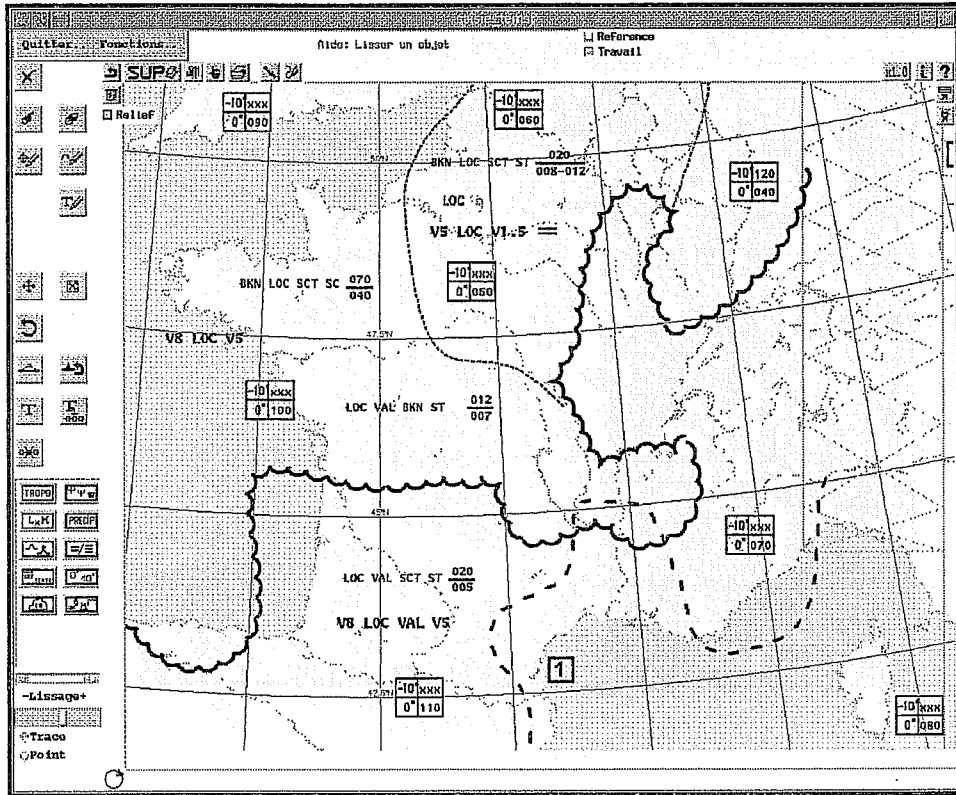


Figure 6: Significant weather chart expertise input via an interactive Graphical User Interface  
 These expertise elements are saved into the data base as Meteorological Objects reusable over any domain by any production system

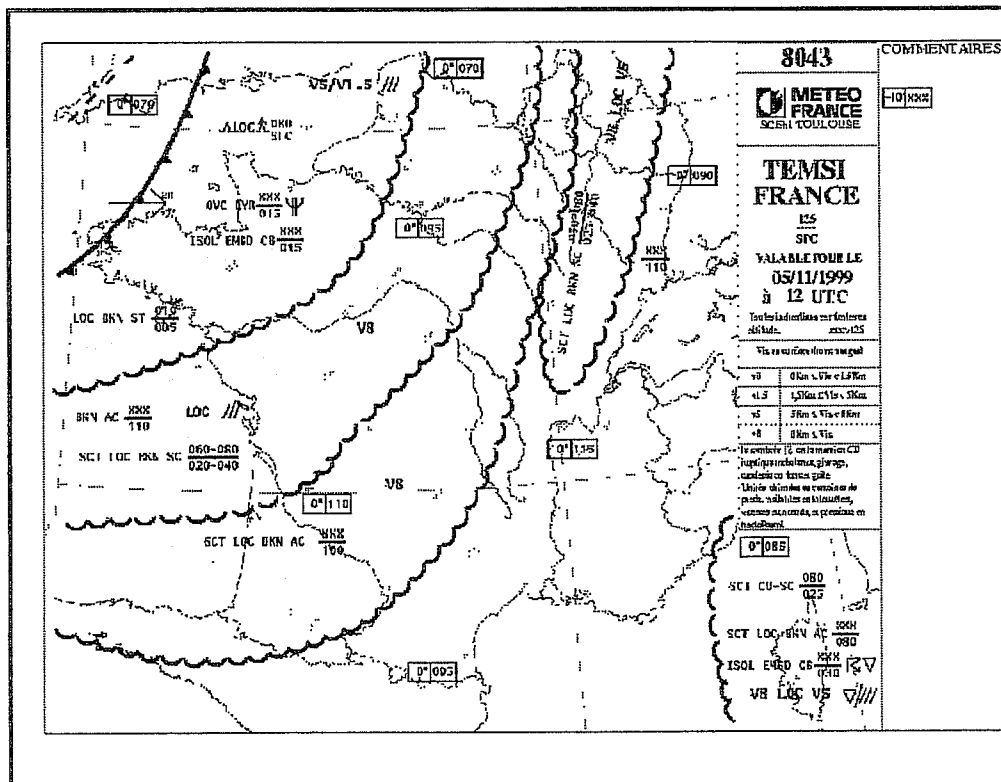


Figure 7: Significant weather chart produced by the synergie-batch system