Visualisation and Production using NinJo

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Abstract

The meteorological workstation NinJo as result of an international software development project is presented. An overview on the modular software architecture is given and the potential to integrate new applications is emphasized. The basic concepts which form the base of all visualisation layers serving a large variety of meteorological data types are described. The visualisations of the most important data types are introduced. Interactive tools are presented which support specific meteorological production processes connected to deterministic forecasts, warning, and quality control. Recent developments are introduced which aim at supporting the production by specific calculation processes fully integrated within the NinJo server architecture.

1 Overview

During the last years a new meteorological workstation has been collaboratively developed by Deutscher Wetterdienst (DWD), the Geophysical Service of the German Army (BGS), the Danish Meteorological Institute (DMI), the Swiss meteorological service MeteoSwiss (MCH), and the Meteorological Service of Canada (MSC). All project partners were faced with the challenge to replace aging legacy systems with a new architecture open to incorporate the rapidly growing amount of meteorological data and supporting a large variety of complex and differing production processes of national weather services today.

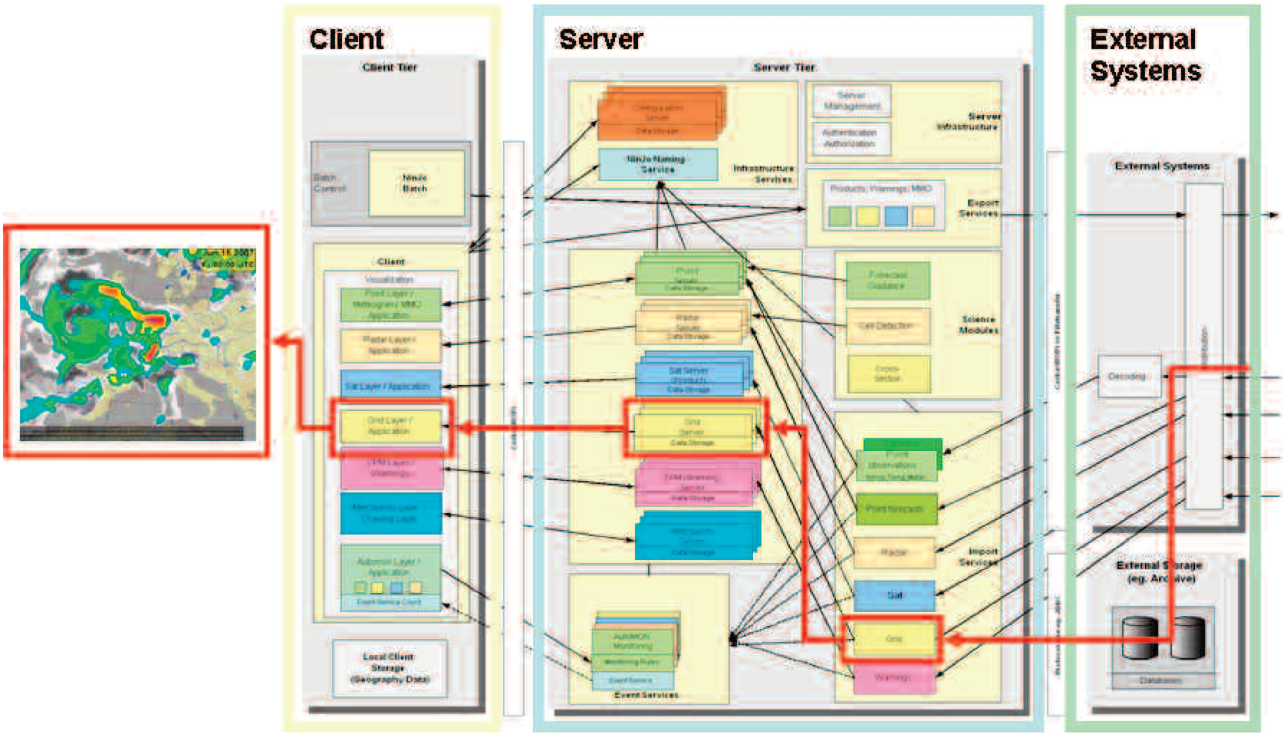

Fig. 1 The modular architecture of NinJo providing a building kit for future meteorological data types and their visualisation.

The project partners decided to join their efforts and expertise in the international development project NinJo. They decided to build a system which would offer a high degree of freedom towards the very diverse requirements of meteorological expert systems and the different computer platforms being used within different work areas of meteorologists. These challenges were met by deciding in favour of a fully Java based implementation with a high degree of generic architecture where the system behaviour can be controlled to a large extend by configuration.

2 Visualisation

The modular design ensures high flexibility together with a clear strategy when constructing operationally used image scenes by combination of data layers representing a specific selection from the large variety of available information. Different geo layers can be freely superimposed enabling optimal navigation by precise definition of geographical objects (land, see, rivers, cities, airports, orography, road, railways, national and political borders, etc.).

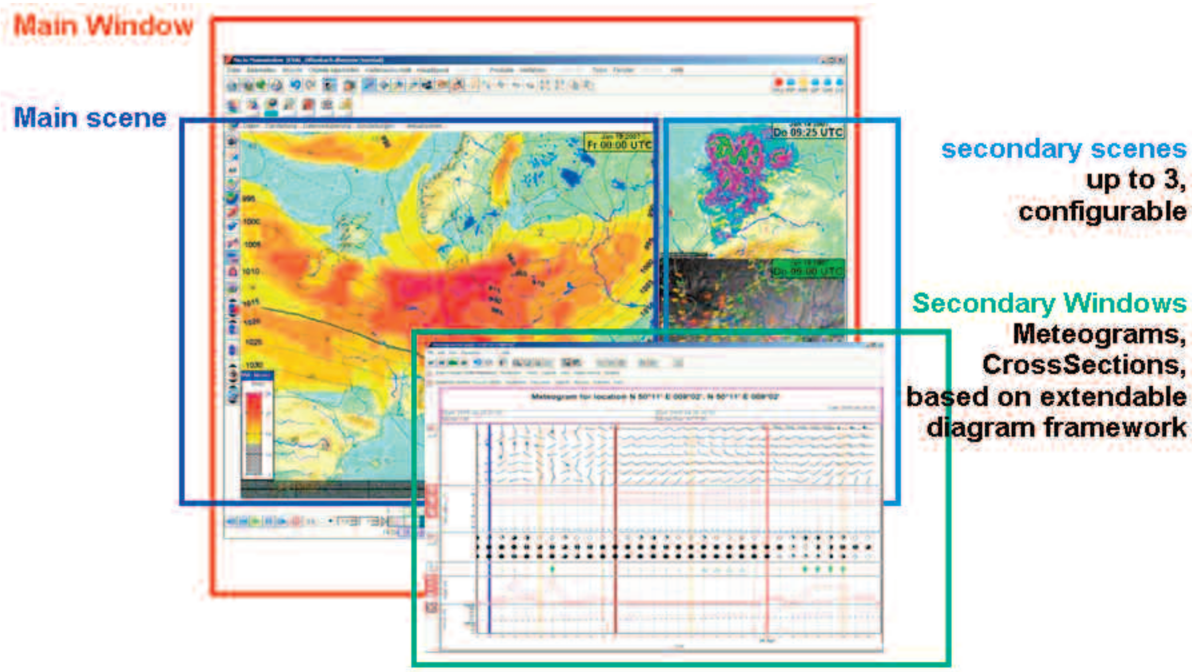

Fig. 2 NinJo layer concept to support free superposition of different meteorological information

The free superposition of different meteorological data sets (satellite, NWP fields, soundings, radar, observations, lightening detection, convective cells, etc.) allows to quickly build a meteorological meaningful scene according to the specific forecasting task to be performed.

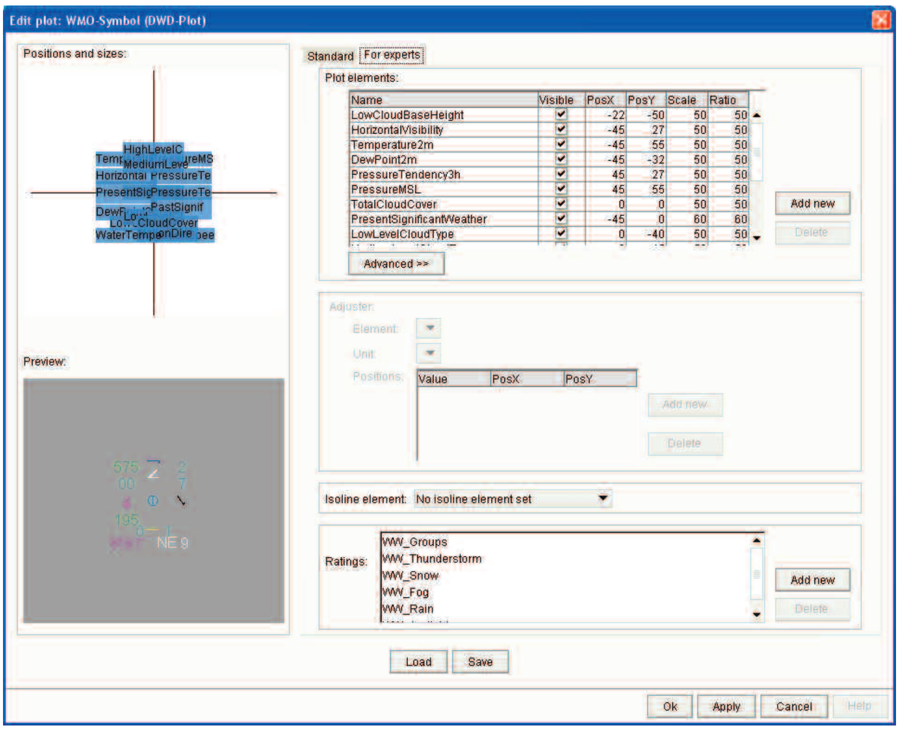

Fig. 3 Configuration of the plot model for the visualisation of surface observations.

Different scenes can be managed simultaneously and simple mouse click allows to immediately change focus on a different scene and potentially different meteorological perspective on the same area of responsibility. Very specific visualisation details can be easily configured in order to adopt a certain layer best to the own operational practice such as designing a particular plot model for the visualisation of different meteorological elements at observations stations (Figure 3). Finally, specific detail information can be visualised separately at user specified locations such as a drilldown along horizontal lines (cross sections) or the temporal evolution of meteorological parameters (meteograms). NinJo provides a flexible and general architecture (diagram framework) to define and implement new visualisation types re-using already existing technical infrastructures. As an example a sounding diagram is show in Figure 4.

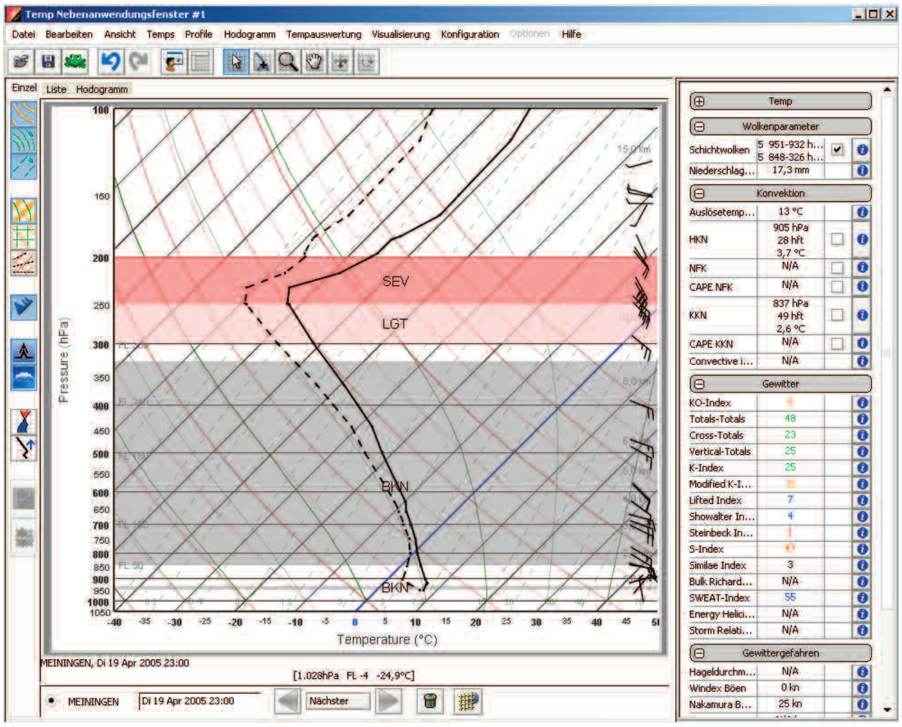

Fig. 4 Sounding diagram as an example of the usage of the NinJo diagram framework.

3 Product generation

Besides the pure visualisation functionality addressing the huge variety of meteorological data types specific layers have been implemented focusing on specific task in different areas of operational meteorology. An example is the alerting to important meteorological situations by a continuously monitoring of different data types and the possible exceedance of freely configurable thresholds and conditions (AutoMON") in Figure 5. Another example is the production layer EPM which serves to define meteorological warnings for predefined or freely configurable geographical areas (Figure 6).

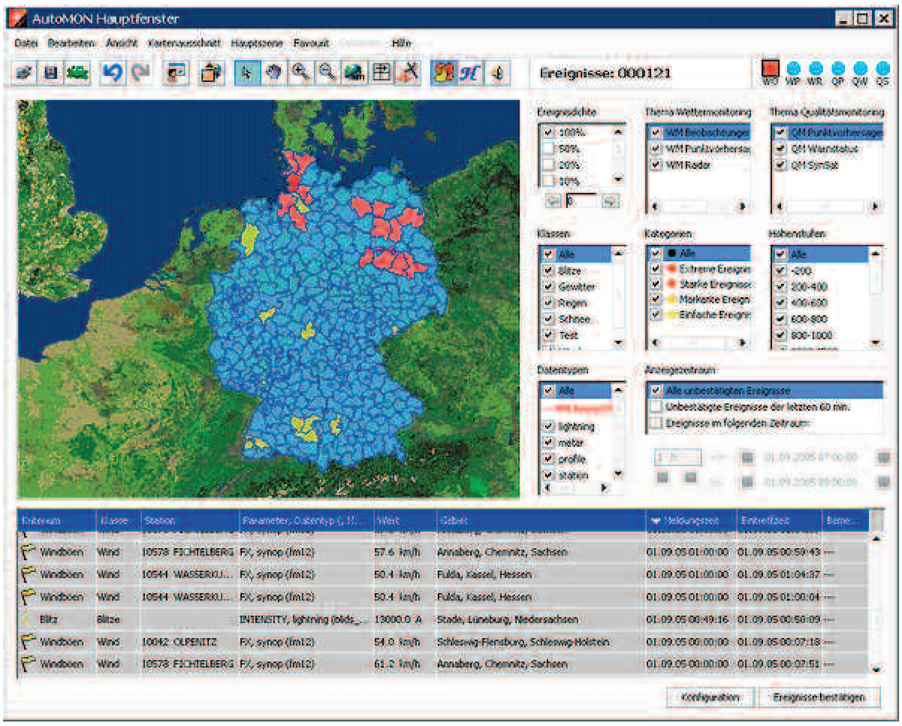

Fig. 5 The NinJo AutoMON tool for contiously alerting of significant meteorological situations.

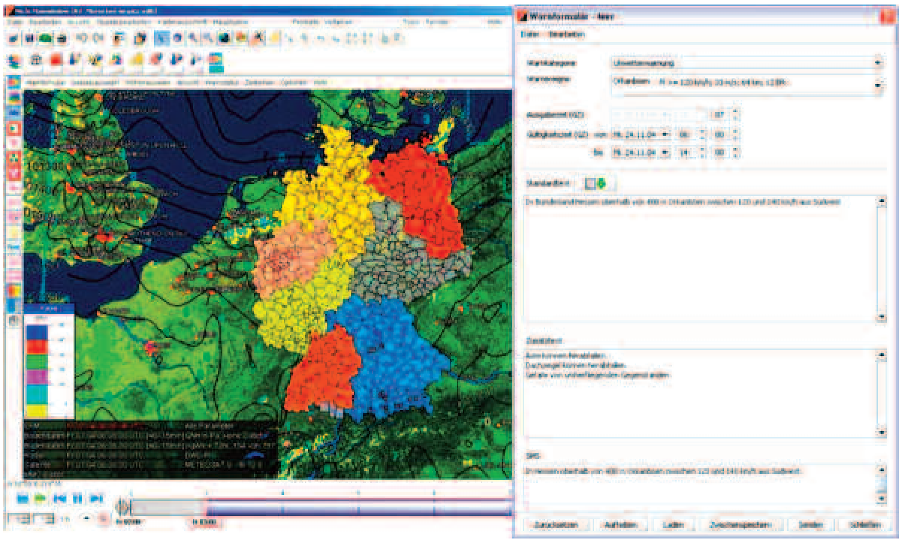

Fig. 6 The NinJo EPM layer for editing and managing meteorological warnings.

Finally, a third operational tool is the so-called NinJo MMO layer which provides all functionality for the quality control of site specific point forecasts together with a comprehensive set of tools to modify single point or entire point sets together with the necessary consistency checks and optional automatic corrections.

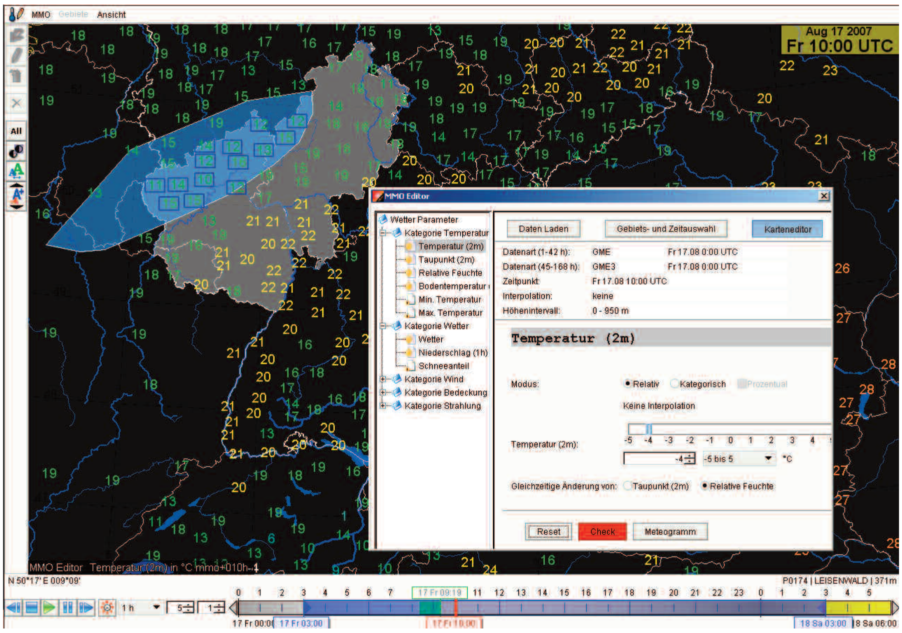

Fig. 7 The NinJo MMO point editor for the quality control and correction of site specific forecasts.

Other production layers are under development or exist as prototypical implementation aiming at editing meteorological objects for the generation of operational weather charts or the direct editing of the NWP output as a field based tool for the quality control and modification of numerical forecast data.

4 Automatisation with NinJoScience

The process of local weather forecast is based upon the assessment of a large variety of different point forecasts from numerical model output, observational data, and nowcasting products, mainly from remote sensing techniques such as radar and satellite. In order to issue a single forecast all these data sources have to be evaluated, the most valuable information has to be identified, and different data has to be combined by the forecaster into one final forecast product. By doing so, the forecaster includes meteorological experience, the knowledge of the synoptic situation and of the specific site characteristics. The assessment of all available data types, the required work in decision taking and merging of information is a challenging task which requires considerable personal resources. Hence, any support in minimizing the manual workload appears helpful. A calculation process “Objective Optimisation” has been implemented directly into NinJo which attempts to support the production process based on site specific forecasts by an automated integration of the large variety of available data. The process of “Objective Optimisation” performs an automatic blending of different point forecasts from different NWP models and post processing techniques. Additionally, the model information is continuously relaxed towards the latest available nowcasting information and observations. The observational corrections are extrapolated in time and interpolated horizontally in order to ensure an acceptable spatiotemporal transition from observations to pure model information. Again, a general infrastructure “NinJo-Science” has been implemented which serves to be re-used by other calculation processes.

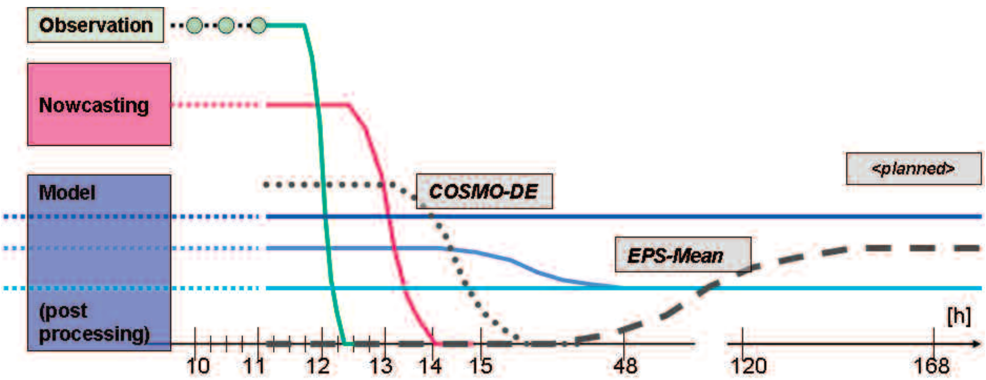

Fig. 8 Time dependant weighting of different meteorological informations within the NinJoScience process Objective Optimisation.

Already existing examples are the extraction of nowcasting information for specific locations (“Nowcasting Adaptation”) and the generation of site specific forecast for road maintenance application (“AutoSWIS”). The result of the process “Objective Optimisation” is directly available within NinJo and the integration within the NinJo server architecture enable the visualisation of “feedback” information on the overall calculation process, thus allowing that the final result can be reproduced from the incoming data sources (Figure 9). Future similar implementations are already being envisaged for the generation of trajectories from NWP data or the identification of convective cells on the base of radar data.

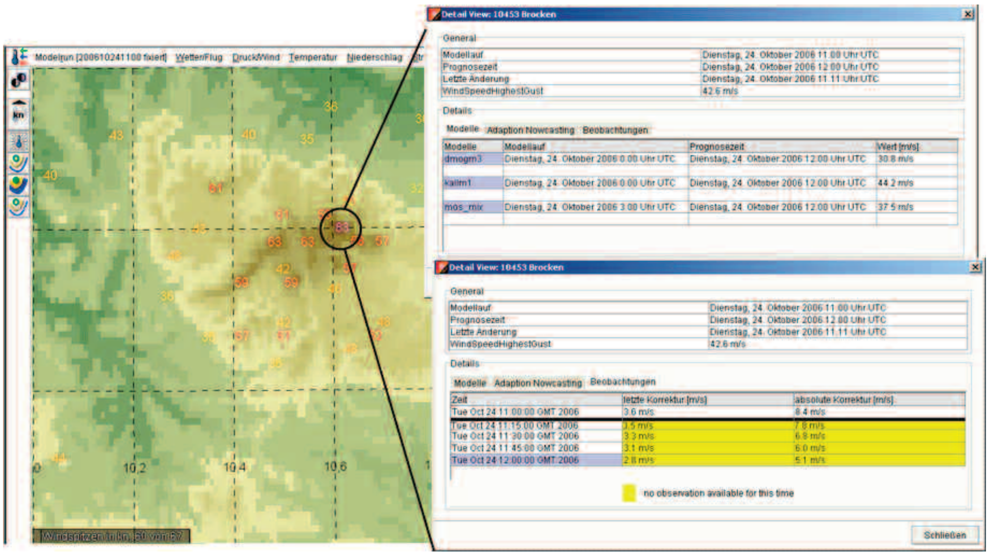

Fig. 9 Visualisation of detailed information on different input data and the observations correction in order to keep the process “Objective Optimisation” reproducable.

5 Status and Outlook

NinJo provides a complete package of layers supporting the entire forecast process. The visualisation covers all meteorological data types ranging from deterministic forecasts to probabilistic information for warnings. Specific tasks of a meteorological service are supported by special interactive production layers to enable the continuous monitoring of incoming data and the manual quality control and optional editing of forecast information and products Finally, a NinJoScience framework has been implemented to support the forecast process by automated calculation processes. At DWD, NinJo replaced the legacy system MAP in October 2007, MSC plans the operational implementation early 2008. The future extension of NinJo aims at incorporating new functionalities and providing a complete tool kit to enable third parties the development of own specific functionalities.