

On Relations of Gridded Data and Weather Objects in Forecasting

Chatting with a senior colleague at FMI yesterday, the issue of usefulness of abstractions for weather condition or meteorological phenomena, like WOML Weather Objects, was raised once again. What is the point of forecasters spending their valuable working time drawing the charts with weather symbols, rain or cloud areas copied from the visualizations of the numerical weather model results when they should create added value to the forecasting process by guiding the automated systems to create products of better quality and accuracy for the current weather situation? In a very good point, we definitely should focus on creating weather objects that are highly usable in the creating automated weather products.

We have very good numerical models - why create manual forecasts?

Today the modern numerical weather models combined with high-resolution, near real-time weather radar data and satellite imagery provide a lot of very good quality weather data in numerical gridded form. This gridded data is very convenient for making automated weather products, because the high-resolution weather data can be interpolated for almost any location and for any requested instance of time. Graphical and textual weather forecasts currently created by meteorologists on the other hand consist mostly of local "picks" of the foreseen weather conditions, local interpreted in both spatial and temporal senses. Forecaster may for example include the daily minimum and maximum temperatures and the general weather type for 10 biggest cities in a country in a forecast product. It is up to the human reader of the forecast to do the "interpolation" of the local weather conditions in time and place.

One might ask whether the human aspect is needed anymore in creating weather forecasts? If the computers do the forecasts so well and so fast why spend a lot of time manual forecasting? Unfortunately the weather models alone are not always accurate enough to create reliable forecasts. There is also a lot of conflicting weather information available and uncertainty involved: one model says the rain will start at 12:00 and the other that it's pouring heavily already at 11:30. Or that the temperature in certain area will stay above +2 degrees Celsius the next night, but what about the parts of the road going through a valley in that area? Will there be still be icing on the road? In many situations the forecasters are able to improve the numerical forecasts by using several sources of information and their personal experience in both the weather and the typical behavior of the different weather models in different meteorological situations. At the same time it is important not to waste forecasters time in creating forecast features by hand when they could as well be automatically produced by the computer-aided forecasting software.

Consolidated view: gridded forecast data and forecasters' adjustments

So, both the numerical, gridded data and the human interpretation of the predicted weather are needed to make good forecast products, but how to best use them together? One thing the meteorological offices around the world very much try to avoid is sending contradicting weather information out to the public. It does not seem very professional if the issues weather products for the same time do not say the same thing.

There are many ways to make the products based on gridded data and the ones created manually more similar. Perhaps the most simple one is carefully selecting the best model result for the current weather situation. One could also change the underlying gridded data from some close-enough model to fit the manually created forecast, or you could stick to the numerical model's forecast and hope your doubts were unfounded. Adjusting the results of the pre-calculated weather model run is not so easy however. The physical model behind the weather model is a very complex one, and changing one parameter in one place and time should be reflected by adjusting some other parameters too, to keep the model consistent and usable. The more radical changes you make the more difficult it becomes to keep the model result consistent.

In principle one would have to re-run the model a little bit different way to create the adjusted result from the same source data (weather observations). Running the model on-demand is typically not feasible, but having several variations of the same model run pre-calculated helps in choosing the best fit and evaluating the uncertainty of the forecasting situation at hand. Sometimes simple adjustments can be applied quite consistently however, like accelerating or slowing down the model's time, or speed of events happening. One could locally adjust a weather model's time so that a weather front with heavy rain that was observed reaching city A at 12:00 would reach the city B one hour sooner than the model predicts. This "time forgery" often works better than trying to actually adjust the model results' parameter data, because most of the valuable weather information, like the detailed structure of the rainy areas can be kept intact.

Weather Objects as annotations to the numerical data presentation

To enable smooth drill-down of weather information the forecast products should provide good linking between the abstract weather forecast objects and the underlying grid data. The object notation should provide a good overview of the weather conditions. When an interesting object or area is found, more detailed information based on gridded weather data could be provided in the forecast product context. When seen like this the weather objects become a kind of annotations of the underlying numerical weather data, enabling the forecasters to highlight certain features and the most important weather conditions. This vision seems like a helpful to me when developing WOML: Create meaningful annotation-like objects and always provide a good links to the underlying, possibly slightly adjusted, numerical data. I don't yet know how exactly these ideas will be reflected in the future WOML versions, but at least I feel a bit more confident now in using the WOML together with other kinds of meteorological data.