A man-machine mix supplies the MeteoSwiss WEB & APP with forecast data

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Summary

Since Autumn 2014, a new system is operationally producing forecast data for the *MeteoSwiss* WEBsite and for the smartphone APP. This system, called Data4WEB, combines high resolution meteorological fields coming from the ECMWF IFS model together with the expertise of bench forecasters, in order to provide the WEB and the APP with very localized forecasts but which remain under the supervision of *MeteoSwiss* forecasters. This "man-machine" system allows the forecaster to influence the NWP fields at a regional scale for correcting, whenever necessary, errors or bias of the model.

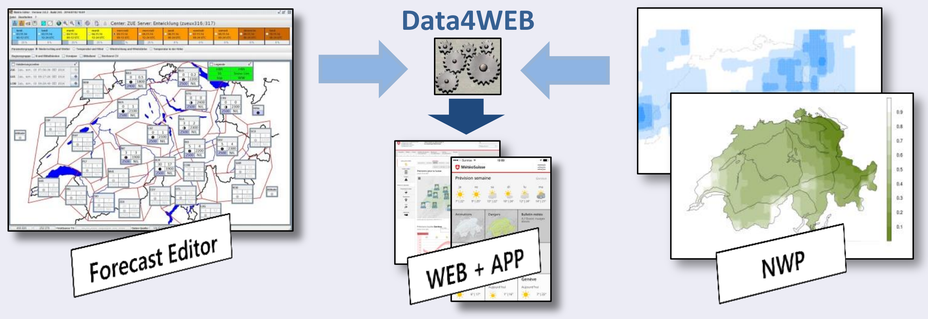

Figure 1: Man-Machine mix

Gridded Forecasts

Forecasters from the regional forecasting centres edit precipitation amounts and relative sunshine duration for a number of regions. The edited forecasts represent regional averages over 6h, 12h or 24h depending on the forecast lead-time. The Data4WEB algorithms use then the high spatio-temporal resolution of the IFS HRES forecasts to propagate both spatially and temporally the amounts edited by the forecasters.

Precipitation

a) temporal diffusion

For each forecast region, the IFS HRES provides the hourly temporal repartition to the 6h/24h-amounts edited by the forecaster. This repartition is performed so that the total regional amount over the considered time-interval is preserved.

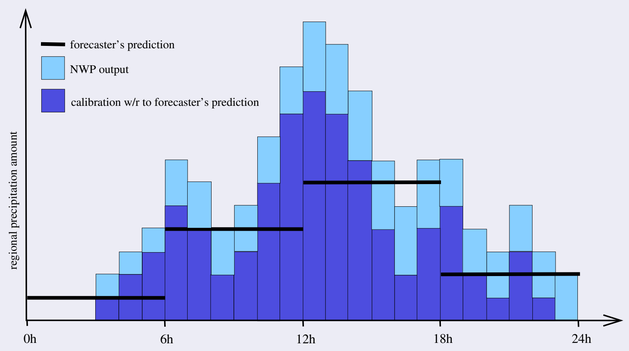

Figure 2: Temporal diffusion

b) spatial diffusion

A gridded forecast is then obtained for each time-step by setting at each grid-point the initial value provided by the model times the ratio between the calibrated regional mean obtained in a) and the regional mean provided by the model:

$$CAL_h(p) = GRID_h(p) \cdot \frac{CAL_h(\mathcal{R})}{M_h(\mathcal{R})}. \quad (1)$$

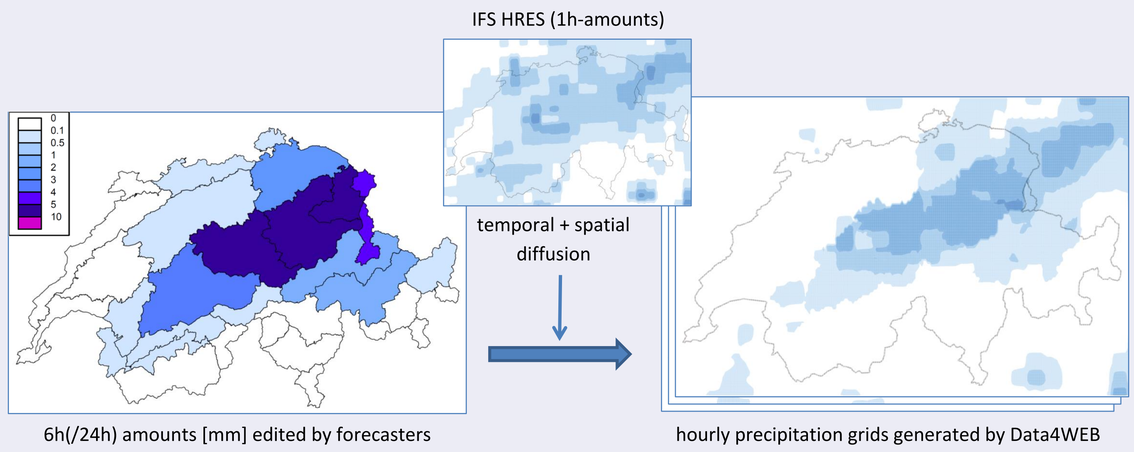

Figure 3: Spatial diffusion

If the forecaster predicts precipitation but the model not, a spatial profile based on the orography is generated.

Cloudiness

An analogous approach is used to derive nebulosity gridded forecasts from the regional predictions made by the forecasters. In addition to relative sunshine duration, forecasters can edit the occurence of low-level clouds or fog, which is especially useful for the frequent inversion phenomena occuring in flatland during Autumn and Winter. In addition to total cloudiness, this allows to provide gridded forecasts for low nebulosity as well.
In the following example, the forecaster predicted an inversion with low-level clouds and a top at 1000m.

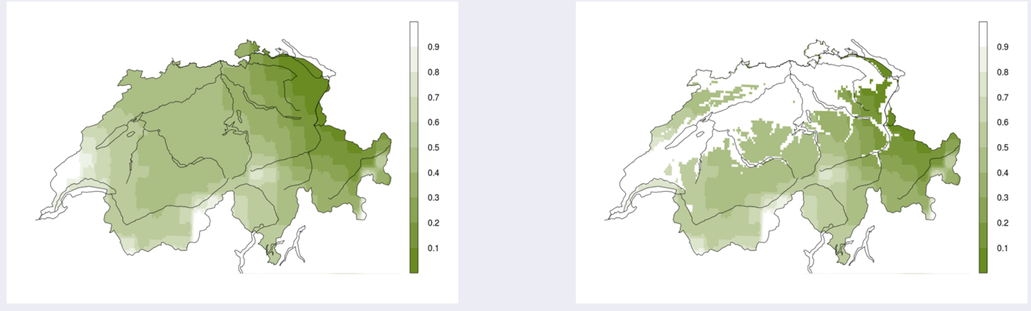

Figure 4: Total cloudiness predicted by IFS HRES (left) and by IFS HRES + forecaster (right)

Temporal Evolution and Dispersion

From the previously calibrated meteorological fields for precipitation and cloudiness, local hourly values for about 4500 sites in Switzerland are interpolated, using bilinear interpolation, up to seven days ahead.

For minimum/maximum daily temperature, high-resolution grids are constructed, following the methodology developed in [1], from approximatively 70 forecast sites, a half of which are supervised by the forecasters. A spatial interpolation using local temperature profiles is then used to extract daily extrema for each of the 4500 sites. Forecasts for hourly temperature are derived from evolution profiles provided by the IFS HRES. For each site, the profile is interpolated, calibrated to the daily extrema previously computed, and smoothed.

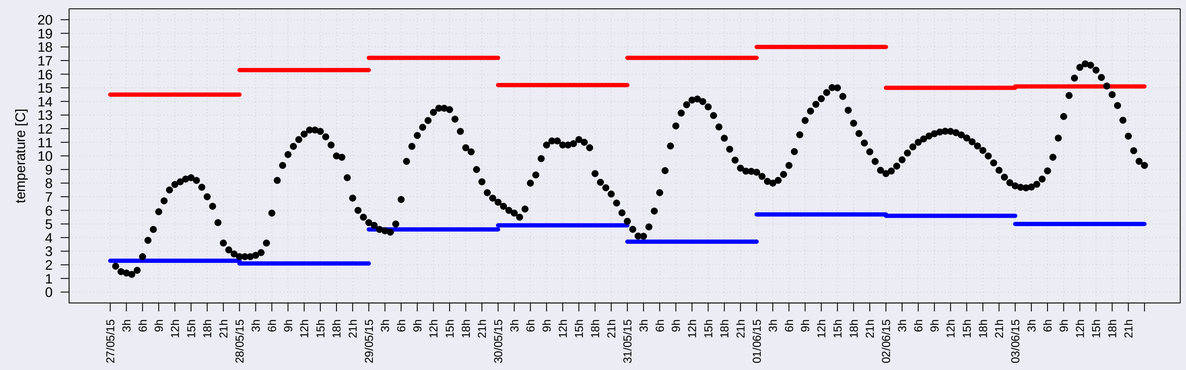

Figure 5: Hourly temperature evolution profile before calibration

For each site, the hourly temperature forecast is provided with dispersion. The dispersion profiles are derived from IFS ENS by extracting the 1st and 9th deciles. The dispersion interval is then translated so that the median of the ENS distribution matches the deterministic temperature forecast.

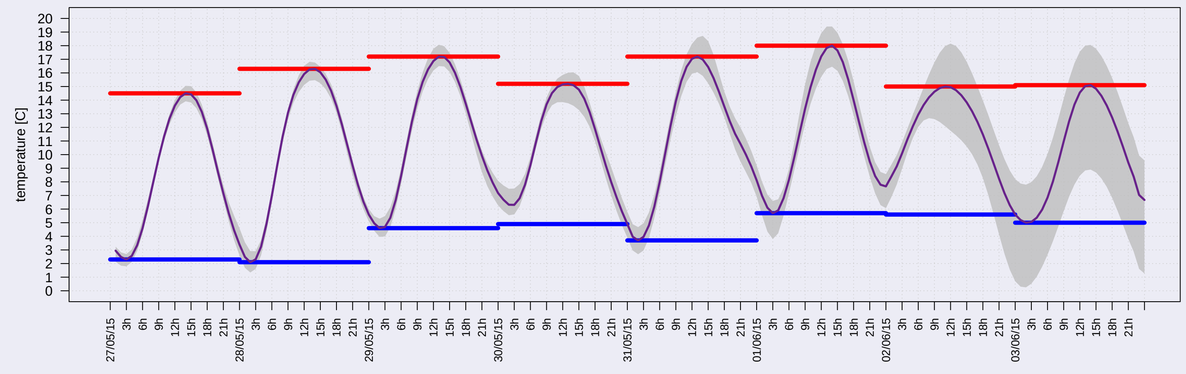

Figure 6: Hourly temperature consistant with daily extrema, and dispersion around it.

Similarly than for temperature, a dispersion for precipitation forecast is provided.

Final Products

Data4WEB is the main source supplying the *MeteoSwiss* WEBsite and the APP with forecasts. An update cycle is performed every half an hour, ensuring that the data on the WEB and the APP are refreshed shortly after every forecaster's intervention and after each new NWP input. This efficiency allows a high reactivity, for instance in the case of a fast evolution of the weather.

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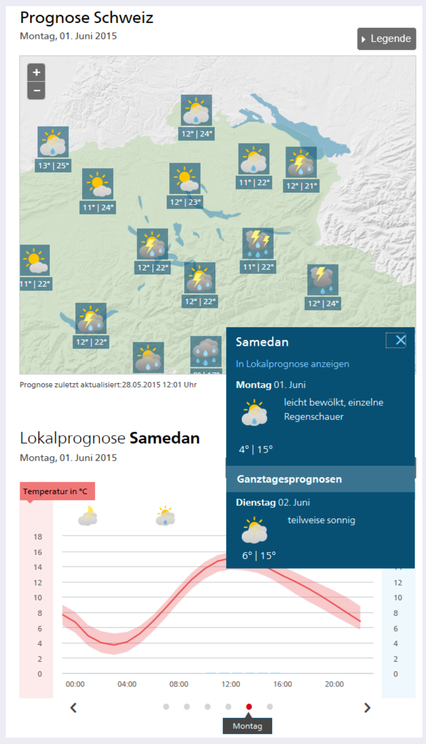
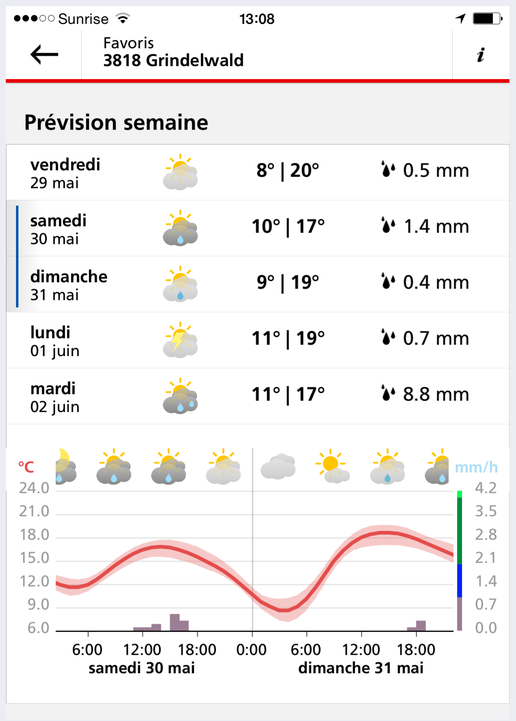


APP:



Conclusion and Further Developments

In the next months, releases of the operational program are scheduled, which will encompass among others: an optimization of the algorithms in order to support an increase of the processed data within a shorter refresh time, new forecast parameters, production of seamless forecasts for all sites during the very first forecast hours and introduction of probabilistic forecasts based on the IFS ENS.

Regarding new parameters, a certainly challenging issue will be the production of surface wind forecasts for all points of interest but remaining under the supervision of forecasters.

Currently, a forecast quality control is performed upstream by assessing the forecasts edited by the forecasters [2]. A verification of the end-forecasts produced by Data4WEB is in progress.

References

[1] Frei C. Interpolation of temperature in a mountainous region using nonlinear profiles and non-euclidean distances. *International Journal of Climatology*, 2013.

[2] Cattani D., A. Faes, M. Giroud Gaillard, and M. Matter. COMFORT: continuous MeteoSwiss forecast quality score. *Scientific Report MeteoSwiss*, 99:45pp, 2015.