Verification Results for LM at DWD

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1 Surface weather elements, verification based on SYNOP reports

Verifcation results are presented for stations in Germany with an elevation below 800 m. The following graphics (Figs. 1-4) with time series of forecast quality during the last year show the following remarkable model errors:

Diurnal cycle of temperature 2m:

- A phase shift of maximum temperature is visible. Maximum occurs too early, especially during spring.
- Temperature decreases too rapid during afternoon.
- During winter temperature is generally too low. During night time bias values of more than 1K occur.

Diurnal cycle of dew point 2m:

- The phase of daily wave is well modelled.
- The amplitude shows too wet forecasted values during spring and summer, too dry forecasted values during winter (except noon) and good agreement with observations during autumn.

Diurnal cycle of wind speed 10m:

- Maximum and minimum values are modelled for the time when they occur.
- Too high values are in general modelled for night time.
- Maximum values are correct during Spring.
- Maximum are too high during other seasons.

Diurnal cycle of maximum wind speed 10m:

- The phase of daily wave is well modelled.
- Too high average values are modelled for all seasons and all times of the day.
- Frequency biases are much higher than 1, especially for thresholds of 12 and 15 m/s.

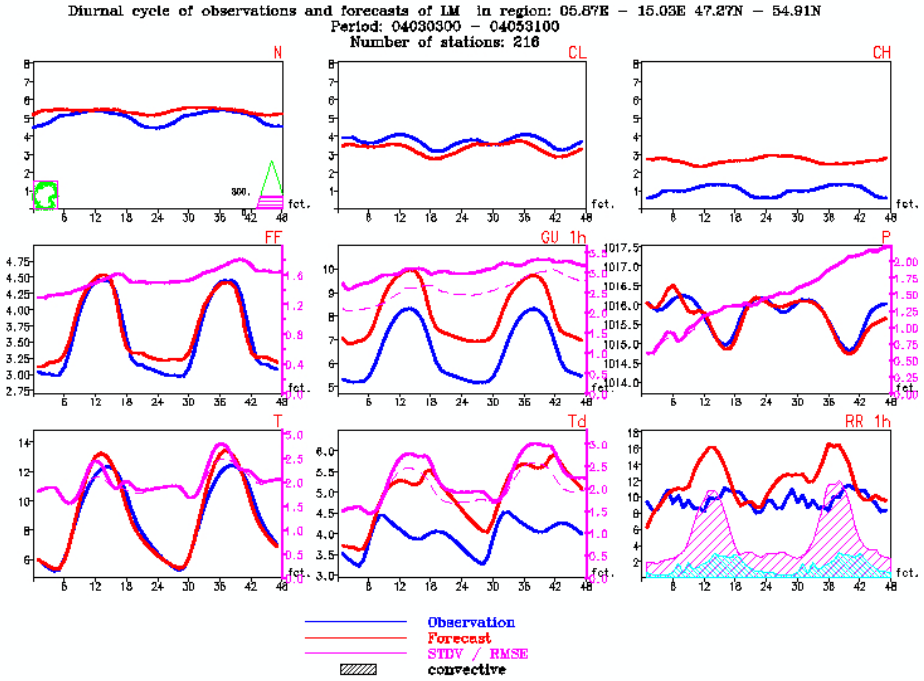

Figure 1: Time series of averaged observations and forecasts Spring 2004.

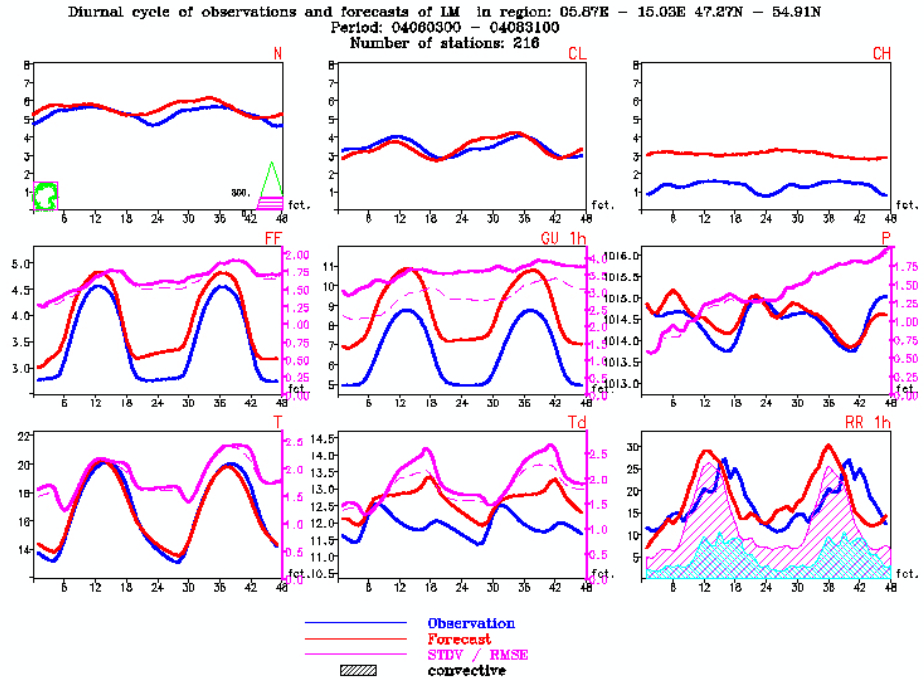

Figure 2: Time series of averaged observations and forecasts Summer 2004.

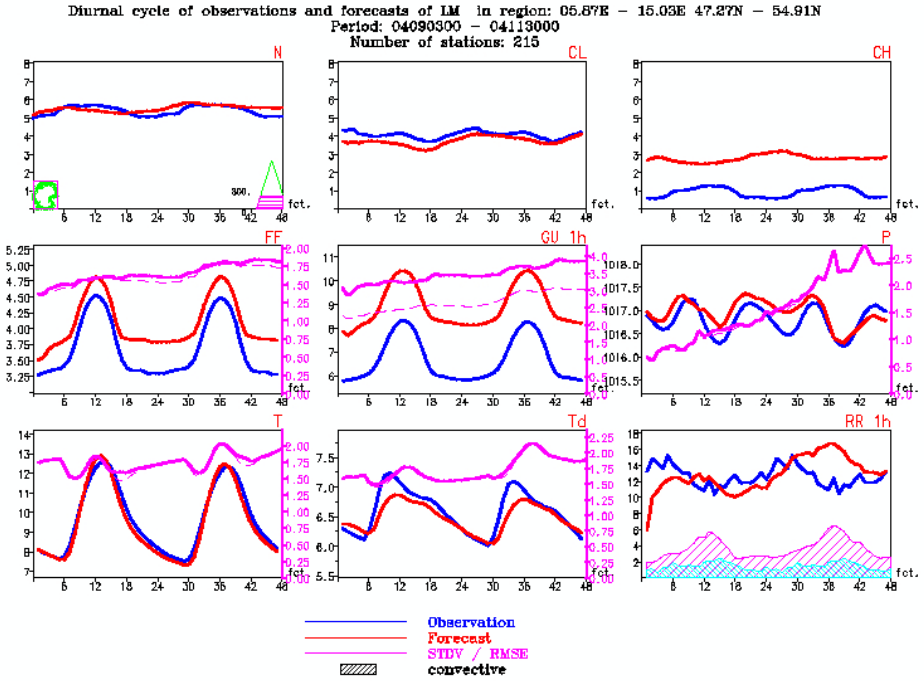

Figure 3: Time series of averaged observations and forecasts Autumn 2004.

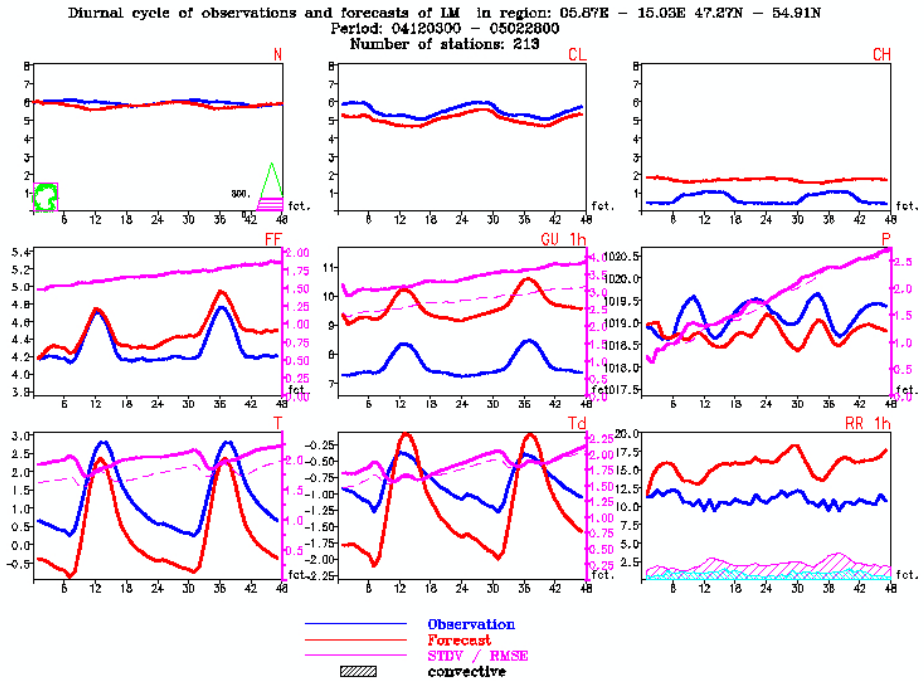

Figure 4: Time series of averaged observations and forecasts Winter 2004/2005.

Diurnal cycle of precipitation:

- The onset of convection (if happens) occurs too early.
- Convective precipitation amount are too high during morning and noon.
- During summer precipitation amount is too low during afternoon and first part of the night.
- An overestimation of precipitation amount around 50% occurs during winter. But his can be related to problems of snow height measurements.

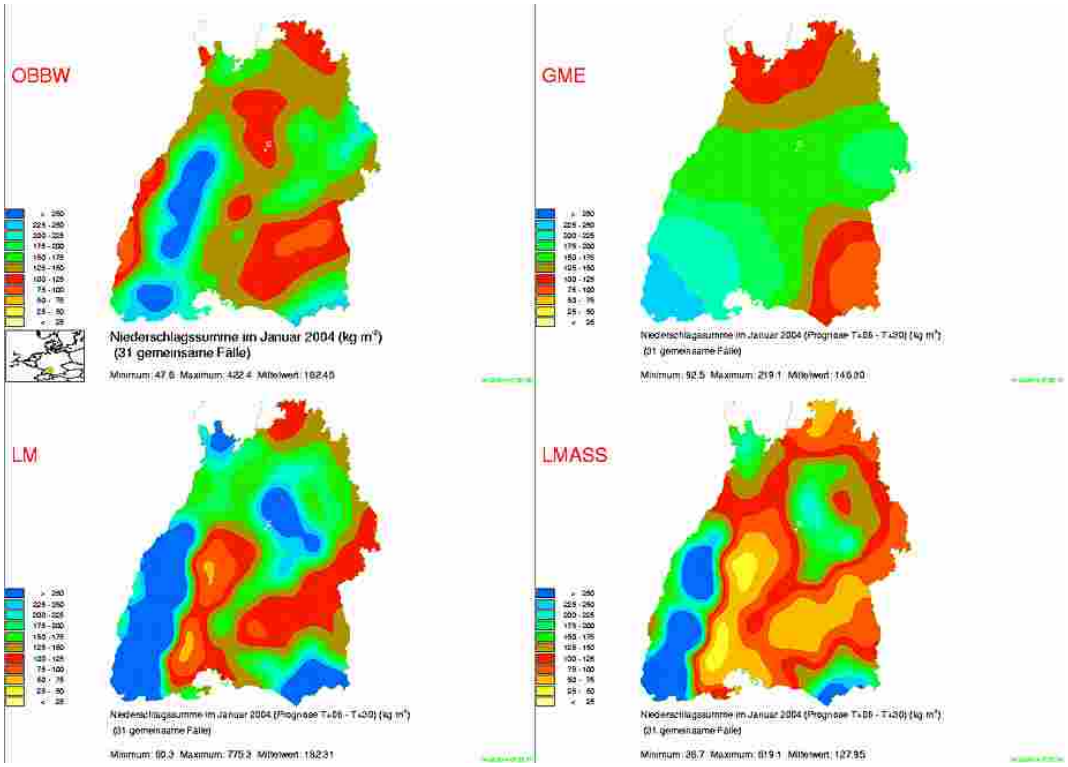

Figure 5: Horizontal distribution of precipitation over the Black Forest January 2004 (OBBW: observation, LM: LM-forecasts, GME: GME-forecasts, LMASS: Assimilation runs (8 forecasts over 3 hours)

2 Verification of precipitation based on measurements with high density network

This type of verification has been continued. The most interesting result is the demonstration of the effect of advected precipitation. This model version was introduced at the end of April 2004 into operational use. Fig. 5 shows the distribution of forecasted and observed precipitation over the Black Forest (Southwest Germany) during January 2004. This typical pattern occured during all months with intense precipitation over this area durng the whole time of operational use of LM. Maximum values were dramatically overestimated by the model. A phase shift of the zone with maximum precipitation towards the windward side of the mountains was modelled and in the areas of the leeward side a more or less strong underestimation of precipitation occured in the model output. With introduction of the advected precipitation this pattern has been changed in the following manner: The maximum of forecasted precipitation is shifted towards the peak of the mountains compared with the

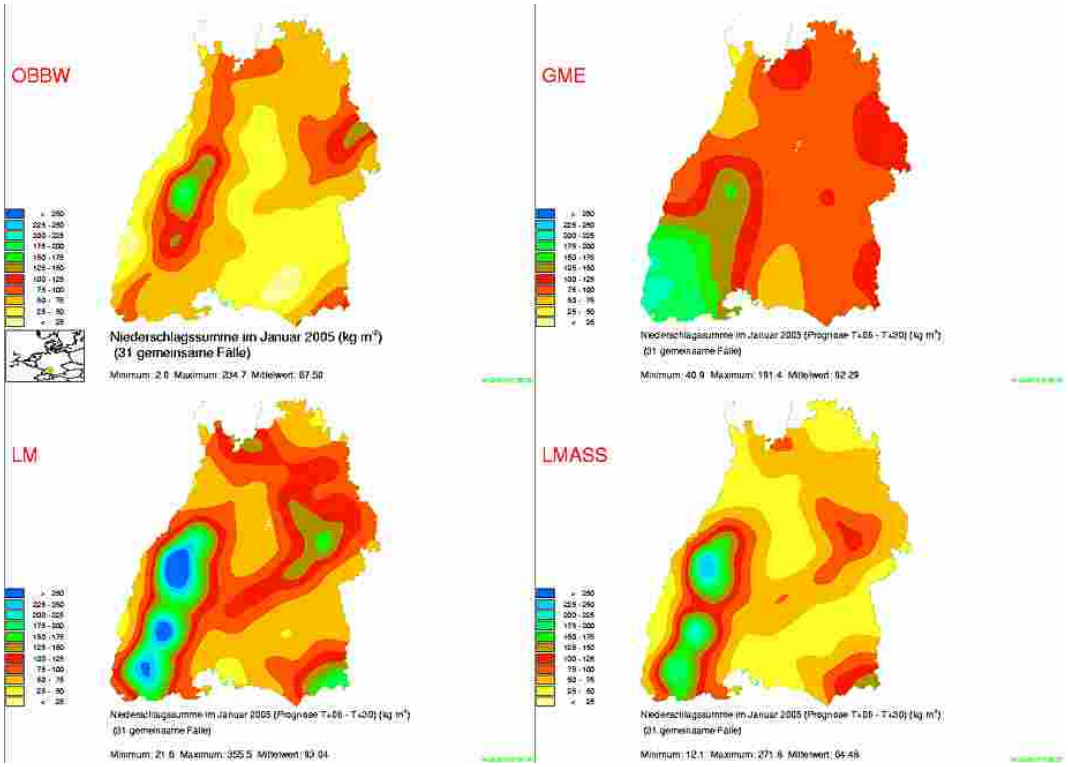

Figure 6: Horizontal distribution of precipitation over the Black Forest January 2005.

results of the years before. The strong underestimation of leeward minimum is damped. The remaining problems are the overestimation of precipitation in general (this could be a typical result for winter due to problems in measurements of fresh snow) and the fact that maximal precipitation amounts still occur in the windward side of the mountains instead near the top.