Systematic deviation of COSMO-EU forecast precipitation amount and measured precipitation

HYDROLOGY

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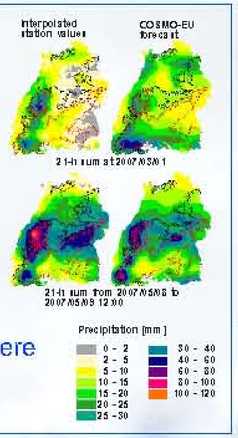
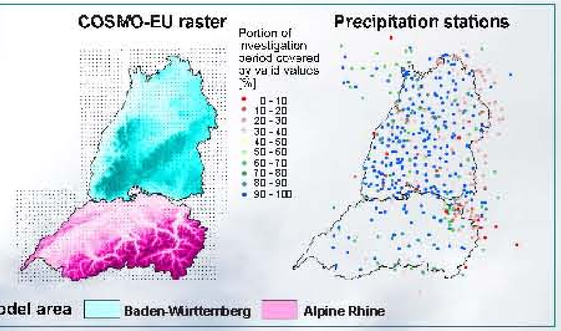
Motivation

- Comparison of measured and forecasted individual precipitation events showed remarkable deviations.
- The spatial patterns of precipitation deviation vary strongly form event to event.
- An analysis based on a long time series covering a large number of precipitation events was carried out to test if there is a systematic bias in precipitation forecast.



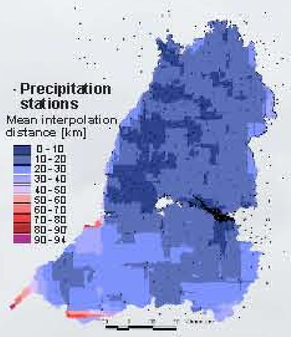
Database

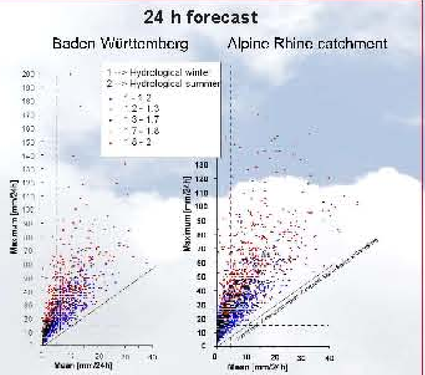
- Observed precipitation of 543 stations from 2007/02/01 to 2012/02/27
- COSMO-EU-78h-forcast at 00:00 and 12:00 (total 3698 forecasts) for the state of Baden Württemberg and the Alpine Rhine catchment. Only the 24h forecast were analysed



Methods

- Interpolation of hourly precipitation data (measured and forecasted) to the target (1*1 km²) raster of the LARSIM-Model, which is used for flood forecasting in Baden-Württemberg





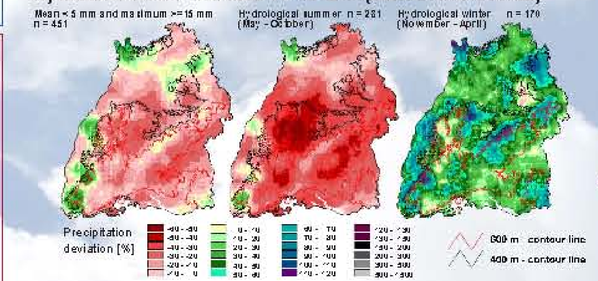
- Selection of 24-h-forecast periods relevant for flood generation
  (area wide mean >= 5 mm or maximum value >= 15 mm)
  1110 forecasts in Baden-Württemberg
  1461 forecasts in the Alpine Rhine
- The subsets
  A) mean < 5 mm and max >= 15 mm
  B) mean >= 5mm
  are expected to represent convective respectively advective events
- Calculation of daily differences between measured and forecasted precipitation for each forecast

$$\text{Deviation [\%]} = \frac{P(\text{measured}) - P(\text{forecasted})}{P(\text{measured})} * 100$$

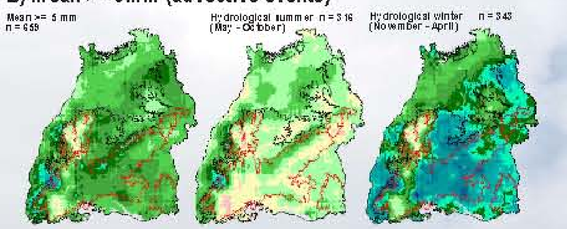
Results

Baden-Württemberg

A) mean < 5 mm and max >= 15 mm (convective events)



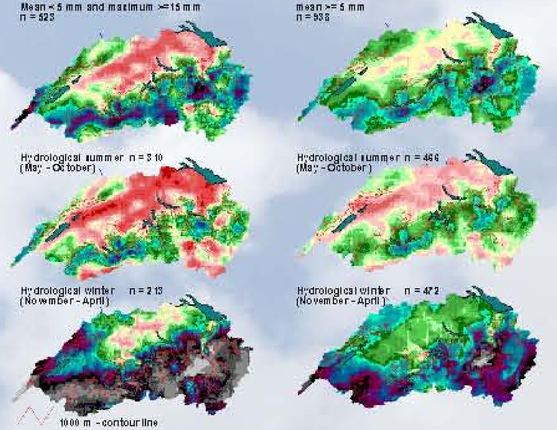
B) mean >= 5mm (advective events)

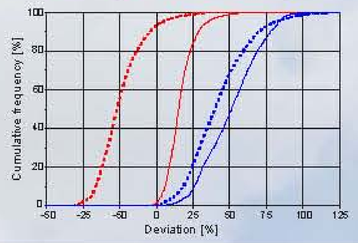


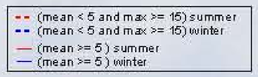
Alpine Rhine catchment

A) mean < 5 mm and max >= 15 mm (convective events)

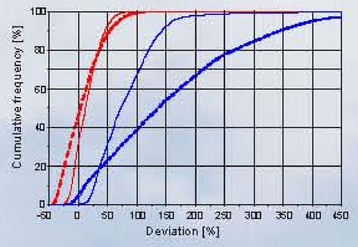
B) mean >= 5mm (advective events)







Cumulative share of area of deviation classes



Conclusions

- Pronounced spatial patterns of precipitation deviation
- Different spatial pattern of precipitation deviation for different event types and seasons
- Dominant overestimation of precipitation for advective events (area wide mean >= 5 mm / 24h)
- Dominant underestimation of precipitation for convective events (area wide mean < 5 mm / 24h and Maximum >= 15 mm) in summer
- The spatial patterns are related to topography and the most frequent air mass transport direction (west), implying an overestimation of the effect of ascending and descending air in the lee and luv of mountains.

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