Data
pre-processing, analysis, forecast evaluation

Jan Danhelka, Jakub Krejci, Pavla Ricicova,Tomas Vlasak et.al

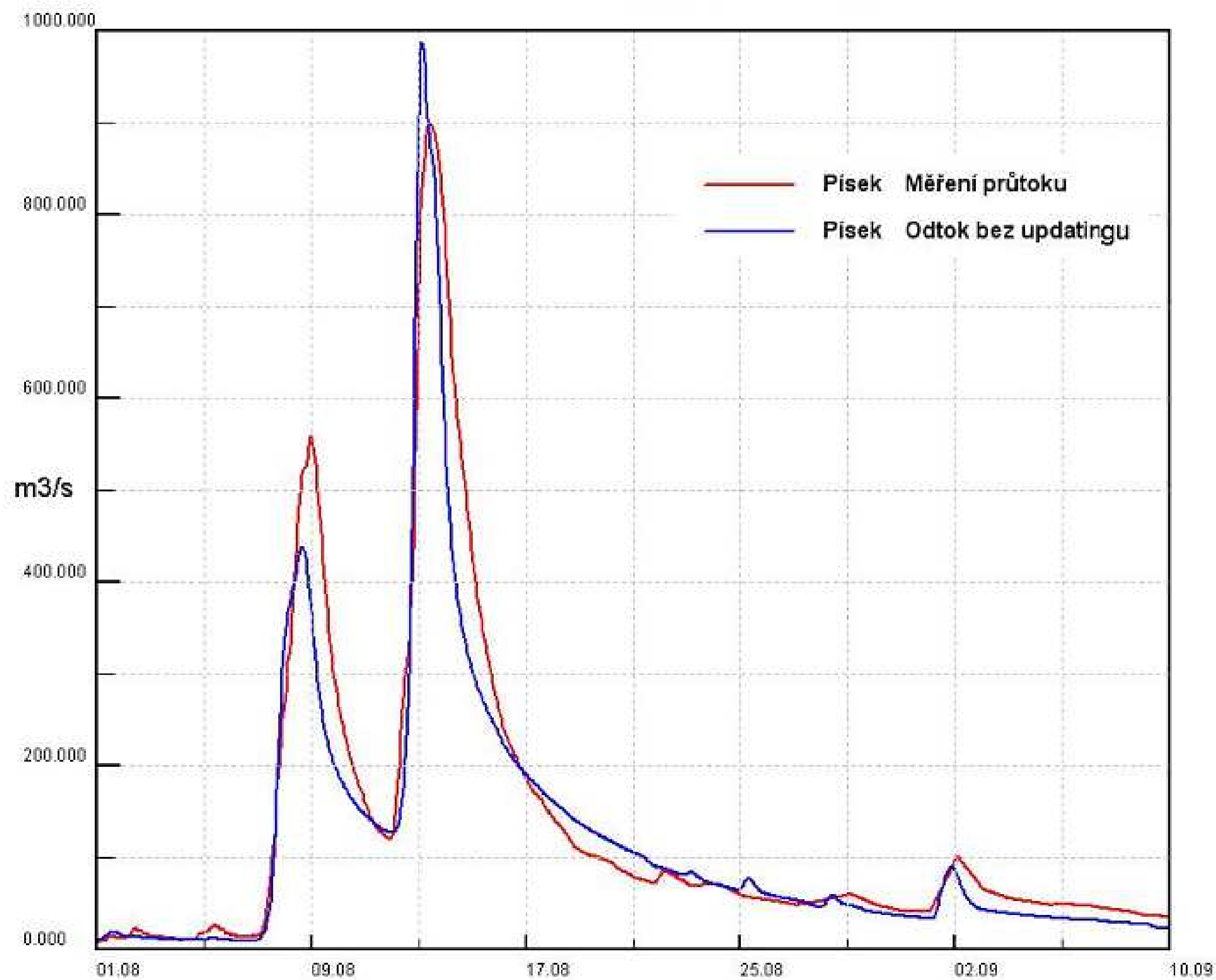
- Historical time series used for model calibration
  - average daily discharges and temperatures
  - daily precipitation totals
- Extent of time series
  - the series should cover both dry and wet years
  - longer series–positive impact on model calibration (60, 30, 10 yrs.)
- Historical Floods
  - number of flood hydrographs mostly adequate
  - lack of relevant meteorological data: 1 hr. precip data scarcely exist
  - missing 1 hr. precip in winter season – lack of heated rain gages

Forecast evaluation,

no precip prediction

Upon running-in the HFS, the model performance solely depends on:

- Parameter values
- Station location presentability
- Reliability of parameter datasets derived during calibration



Forecast evaluation,
precip prediction considered

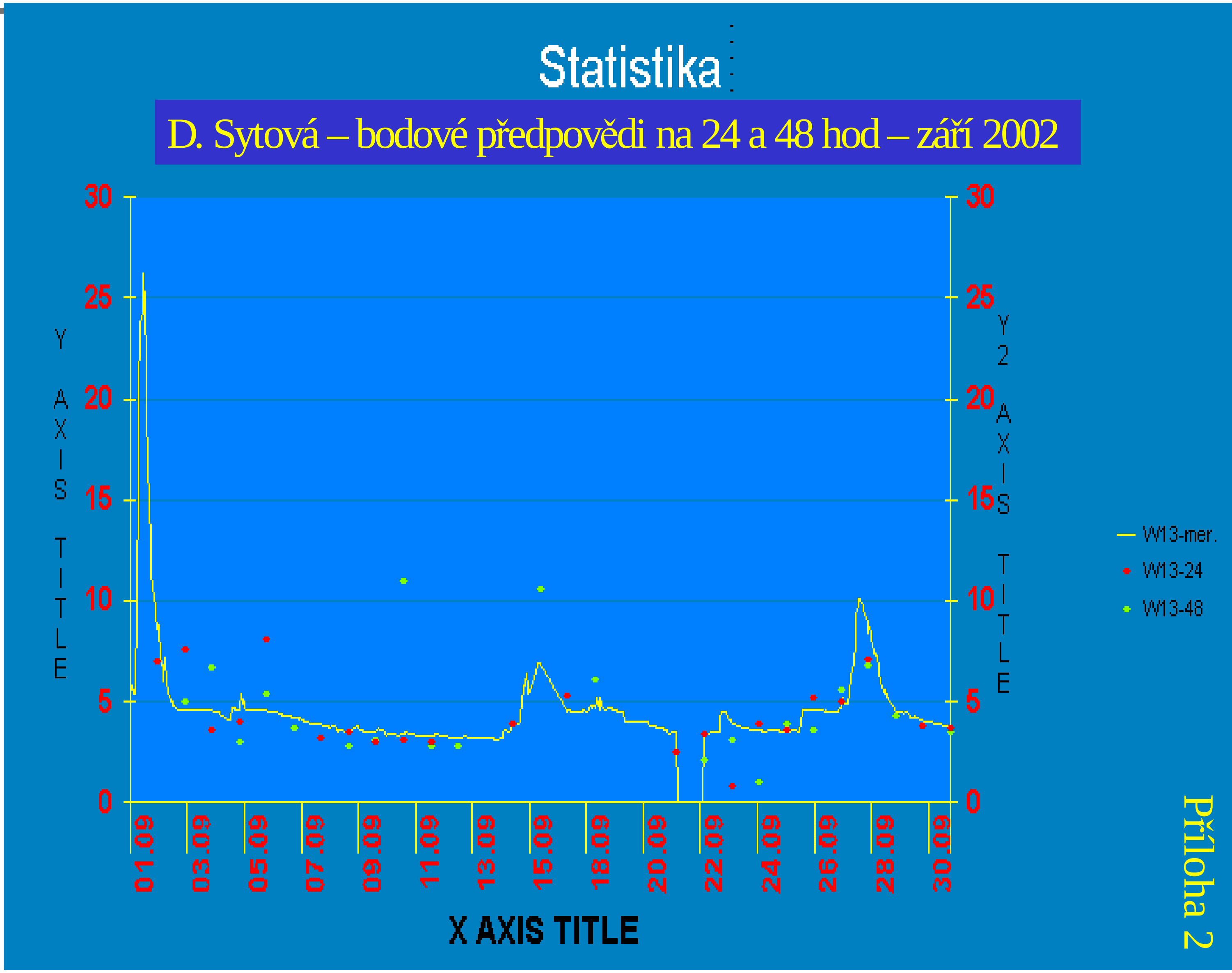
- Evaluation of time-constrained and point forecast of 24 and 48 hrs.lead time for selected stations in table and graphical form

- Forecasted value inter-comparison for values that drop into the 3-hrs interval
  - if the value drops into, then success,
  - otherwise compute the difference from the mean (if less than 20% then accept)

- Apply statistic criteria to evaluate 24 hr forecast
- Use the graphics

Forecast evaluation,
precip prediction considered ctnd.

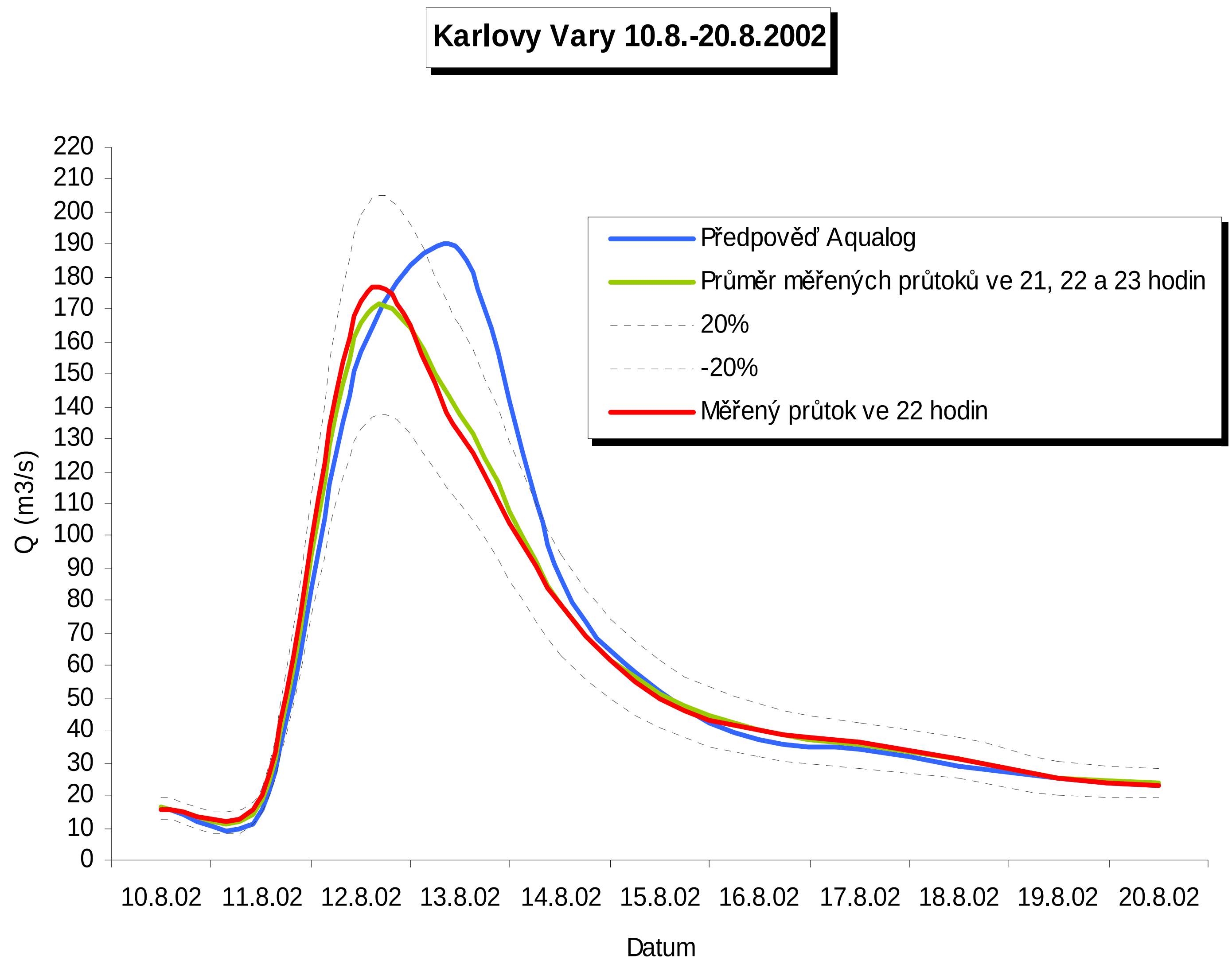
- Point-forecast evaluation of the 24 and 48 hrs for selected forecasting points
  - Use AquaLog graphics
- At small basins the forecast accuracy is proportional to the lead time



Forecast evaluation,
precip prediction considered ctnd.

Karlovy Vary, AUG2002:

- An inter-comparison of the forecast 22 hr advance with values varying from the 3 hrs. interval (21, 22, 23 hrs.)

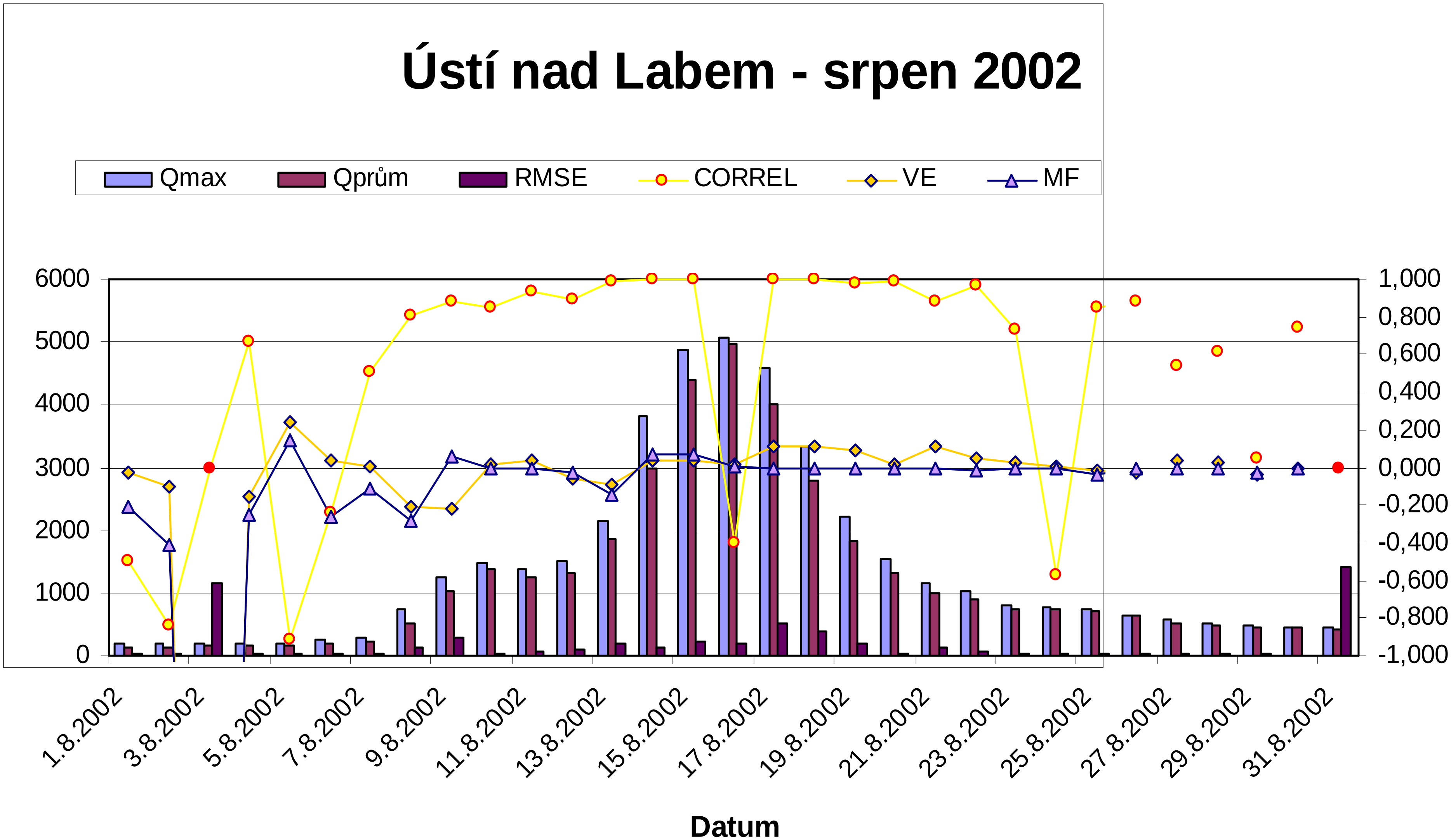


Forecast evaluation, precip prediction considered ctnd.

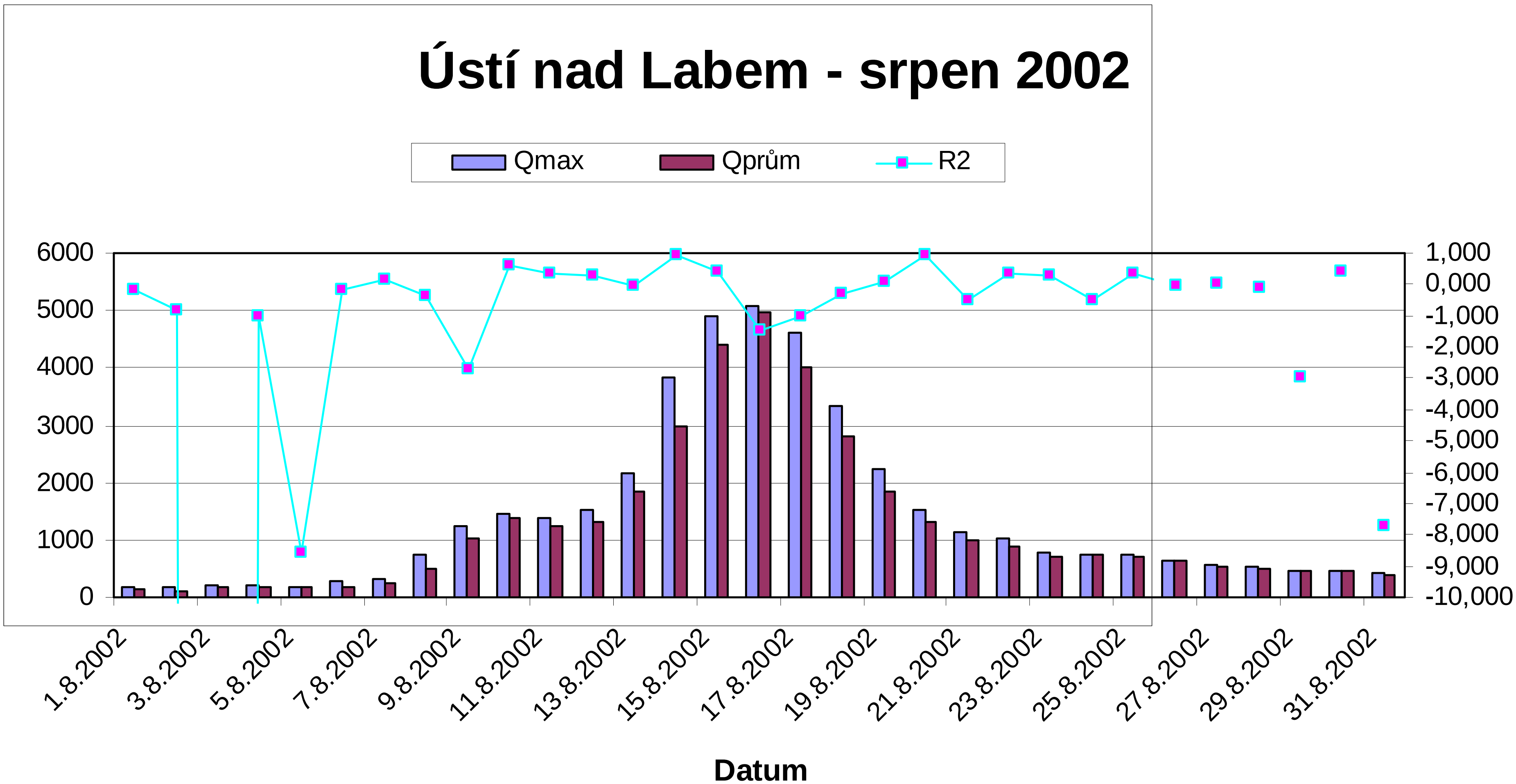
The following statistical criteria are used for continuous forecasting:

- Coefficient of correlation
- Coefficient of determination R^2 (best fit if R^2=1)
- RMSE (root mean square error) (best fit if *RMSE*=0)
- Relative volume error
- Relative error of culmination

Statistical criteria



Statistical criteria ctnd.



Evaluation of forecast
by means of statistical criteria

Values may suffer from uncertainties from precipitation forecast

- The values depart from tolerance limits with respect to recommended values from those evaluated from observed precipitations

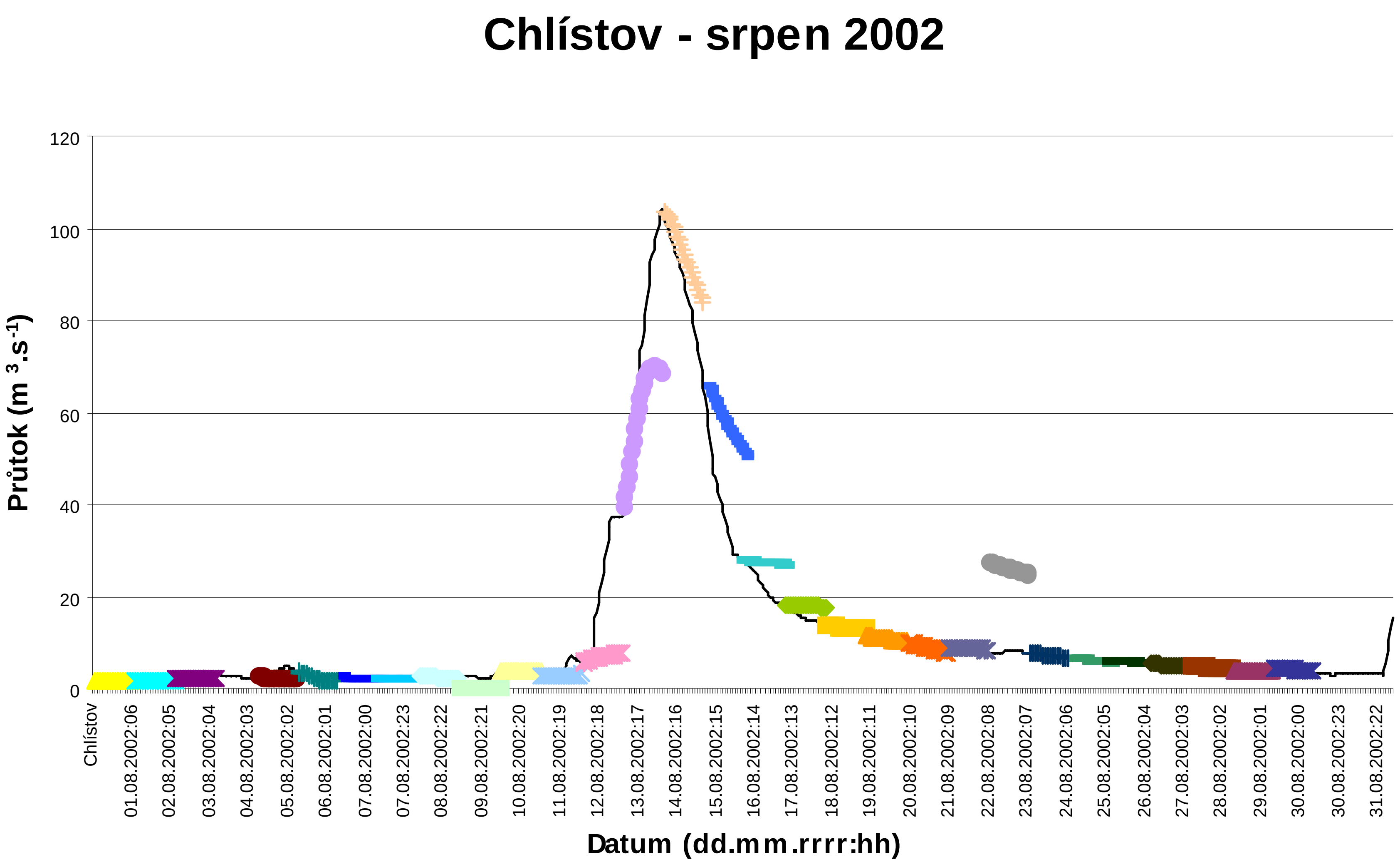
- It is possible to compare individual criteria with recording stations at individual water gaging sites to select the one of best fit to recommended values

- Graphic output comparison is an inevitable part of forecast computaion

Evaluation by graphics

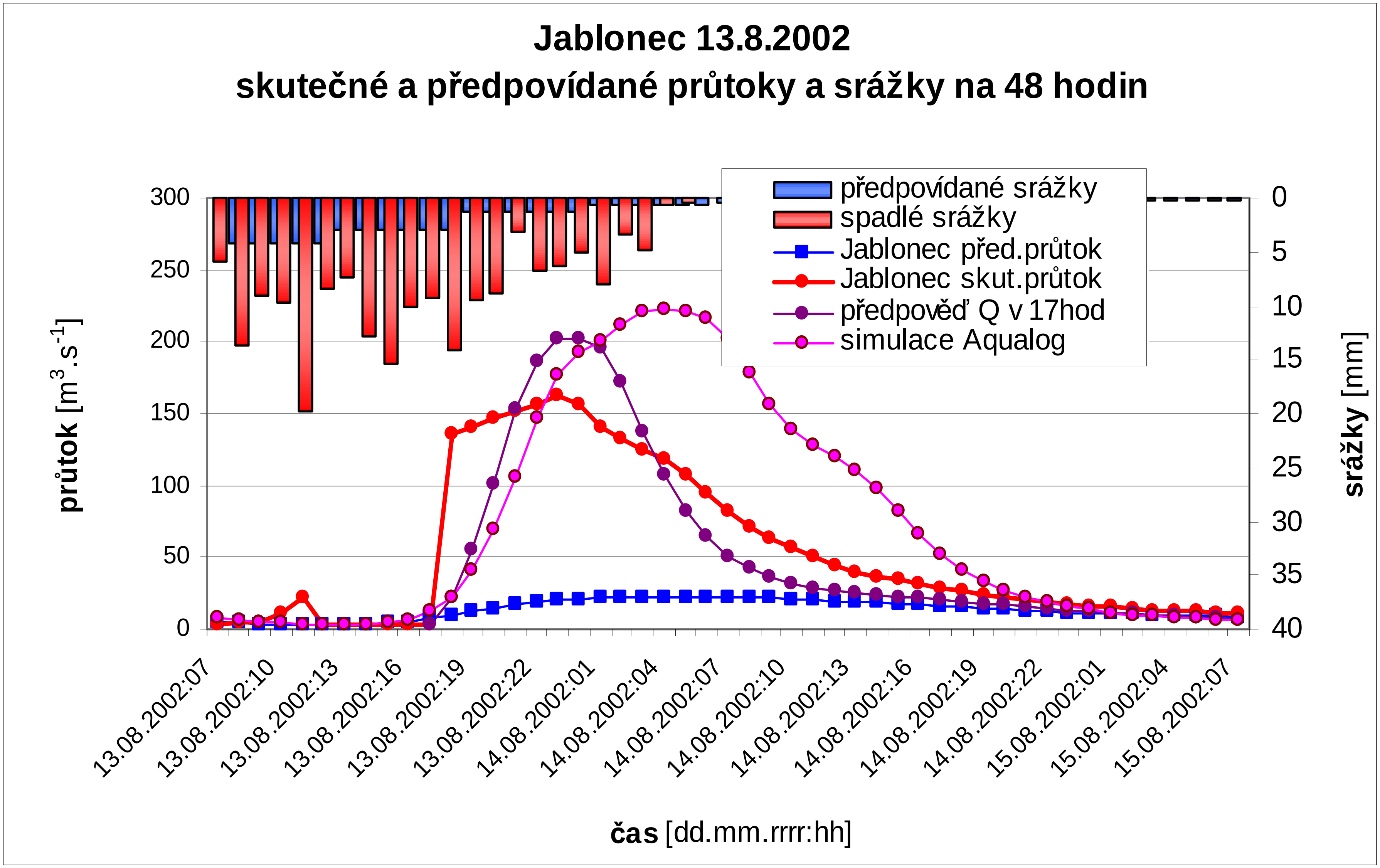
- Hydrographs should cover full extent of the flood event
  - Every computed day of forecast
  - For longer than 24 hr lead time, the fit of relation considerably deteriorates
    if compared with those at floods (AUG 2002)
- The evaluation should be vizualized in retro manner for model outputs irrespective of solution updating

Evaluation by graphics ctnd.



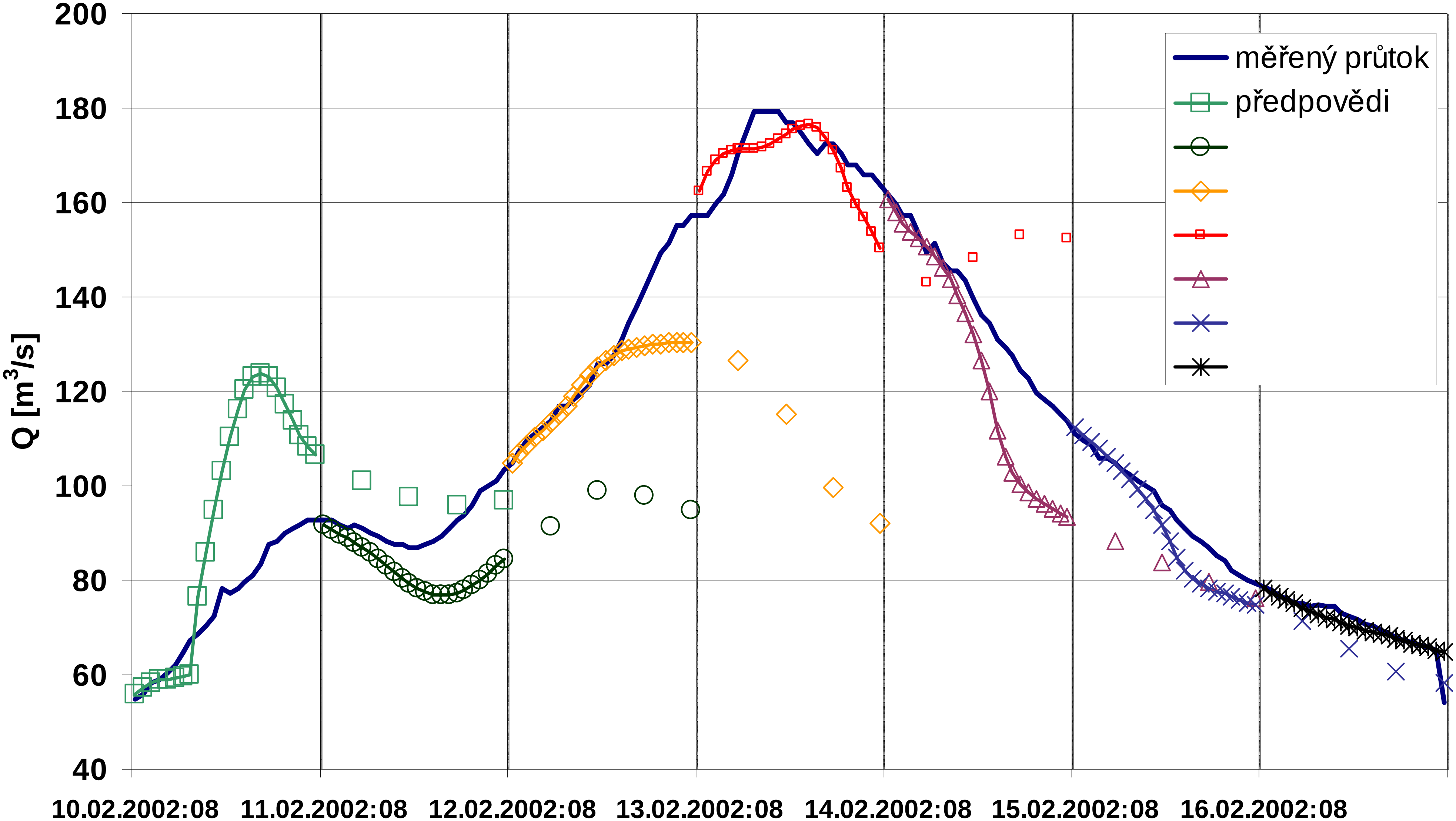
Evaluation by graphics

of daily records, precip QPF-forecasted vs. precip observed



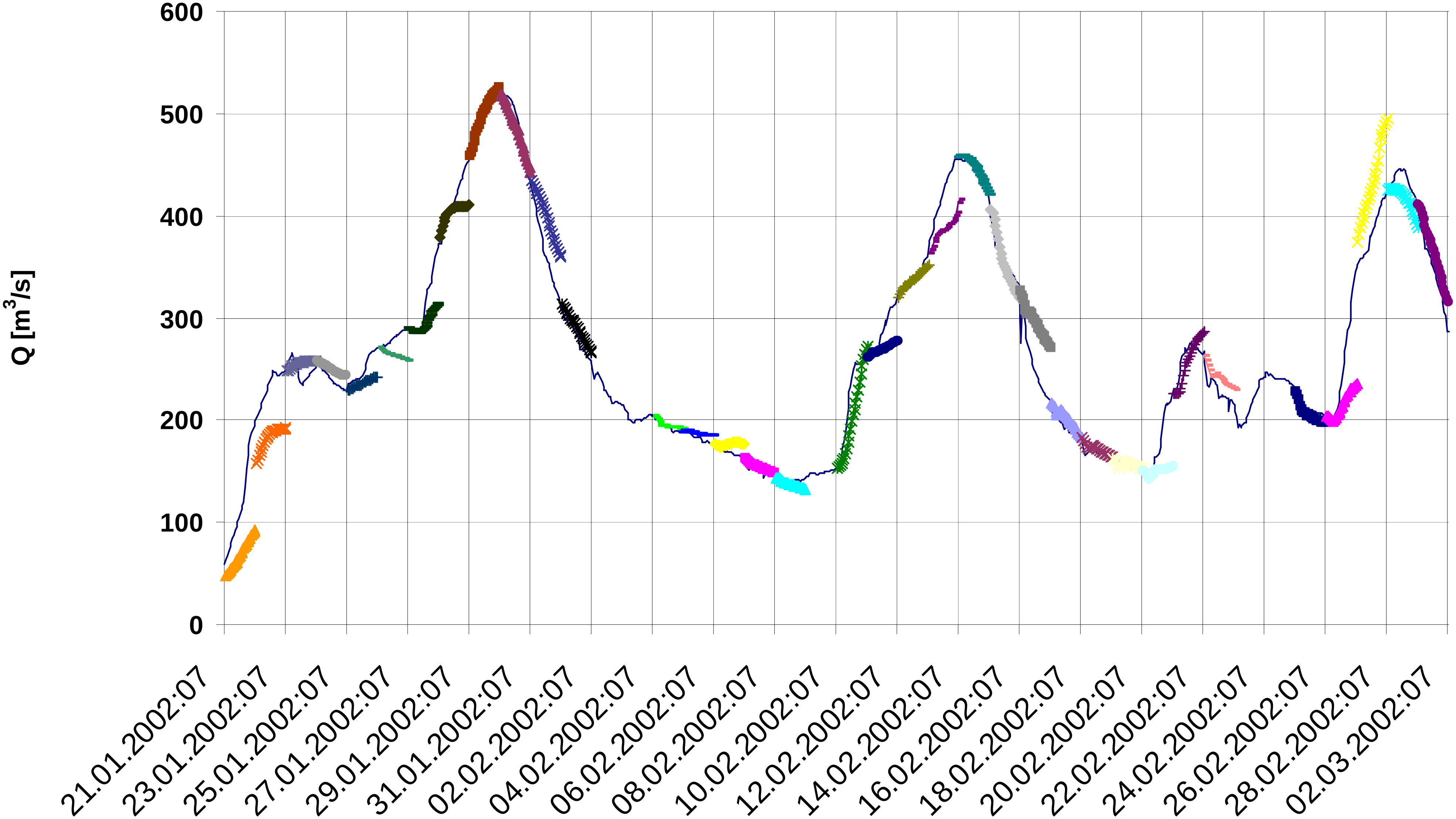
Retrospective inter-comparison of day-by-day forecast

at forecasting point Tyniste, Orlice river



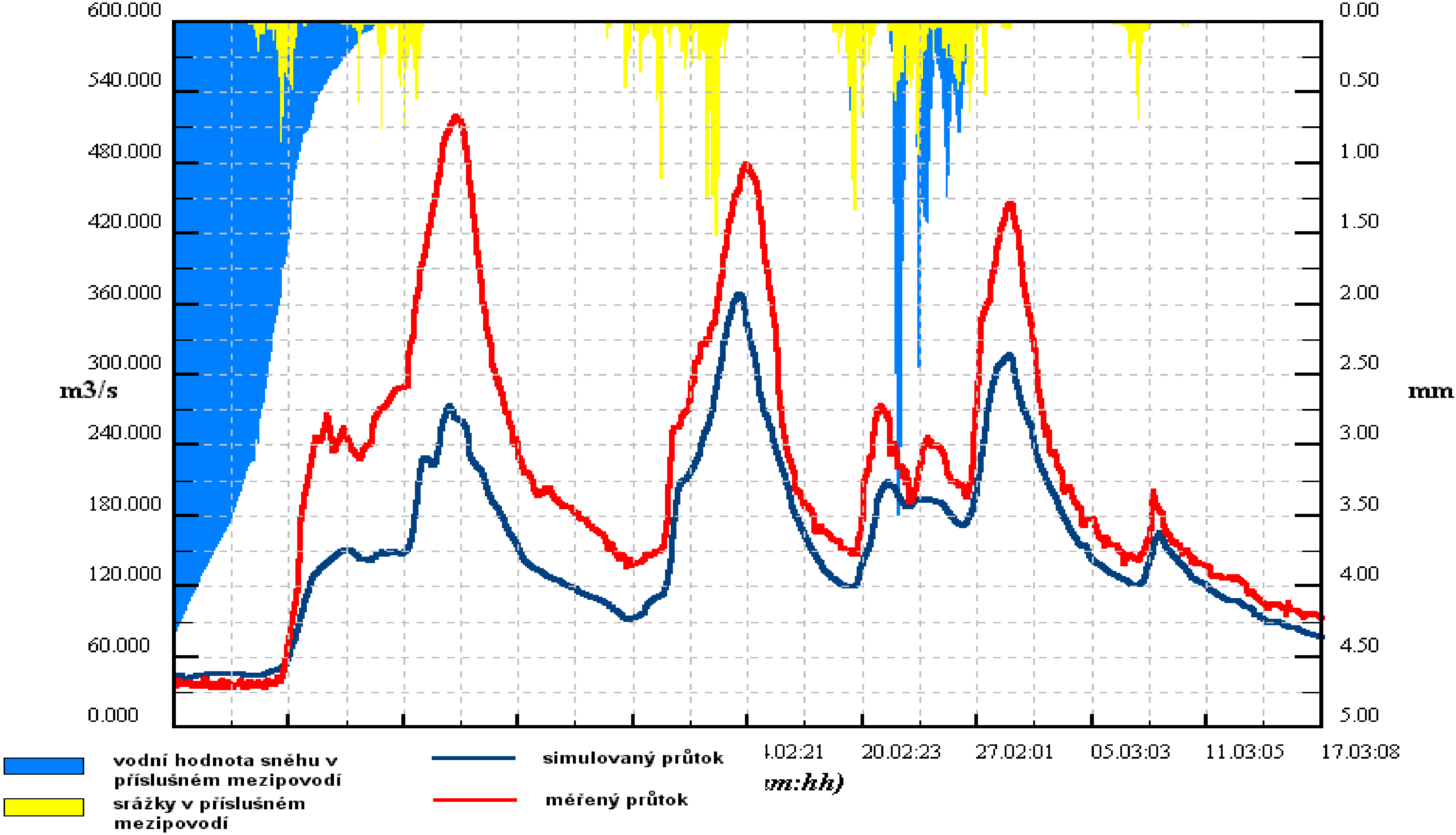
Retrospective inter-comparison of day-by-day forecast

at forecasting point Prelouc, Labe river
(January – February 2002)



Obvious errors in water balance:

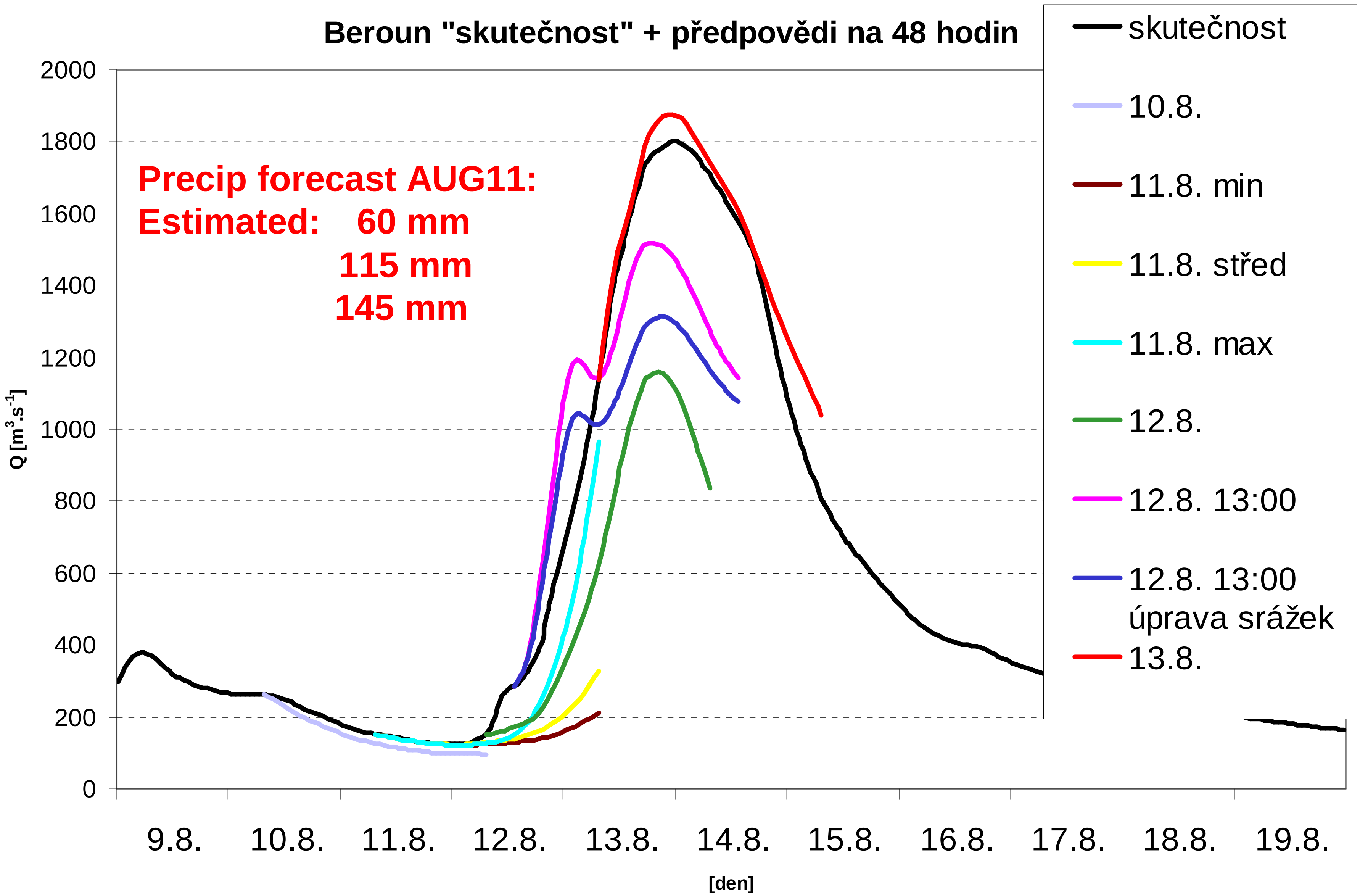
snow water eqv., precip, observed vs. computed outflow at Prelouc, Labe river



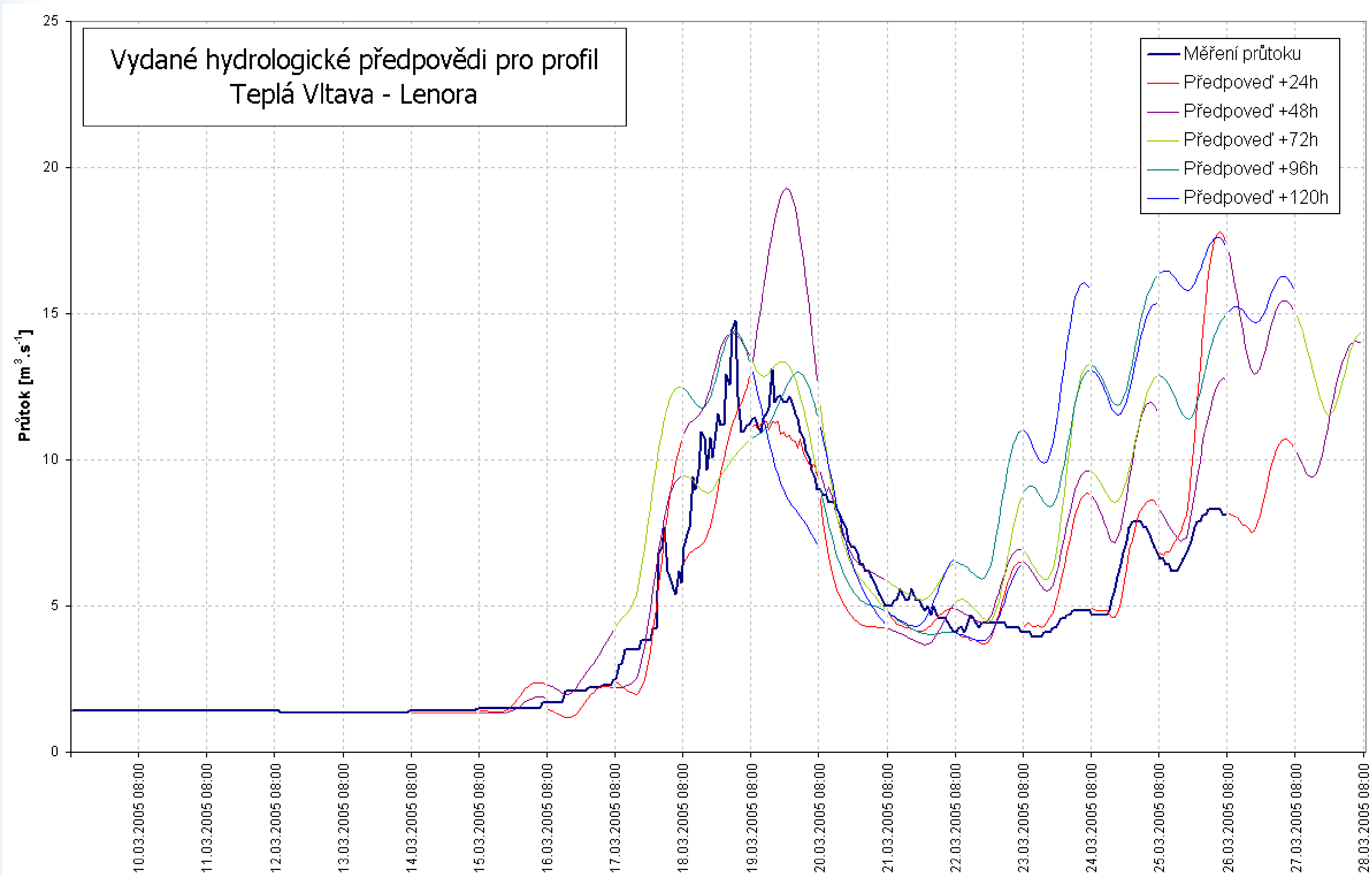
Case Study AUG 2002 flood:

Forecast sequences of Berounka river at Beroun.

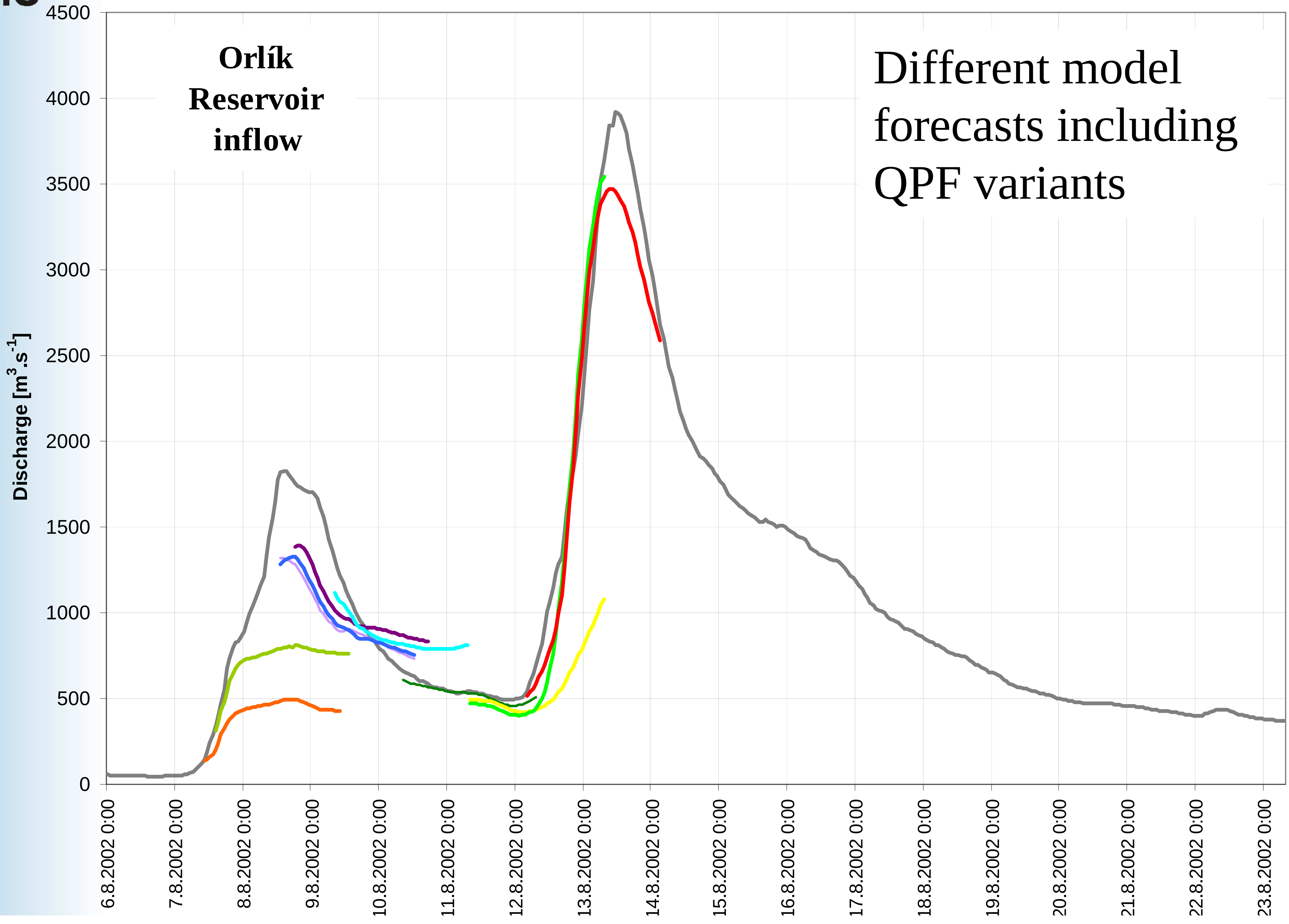
Retrospective evaluations



Forecast scenarios for Otava river at site Pisek. Retrospective evaluation



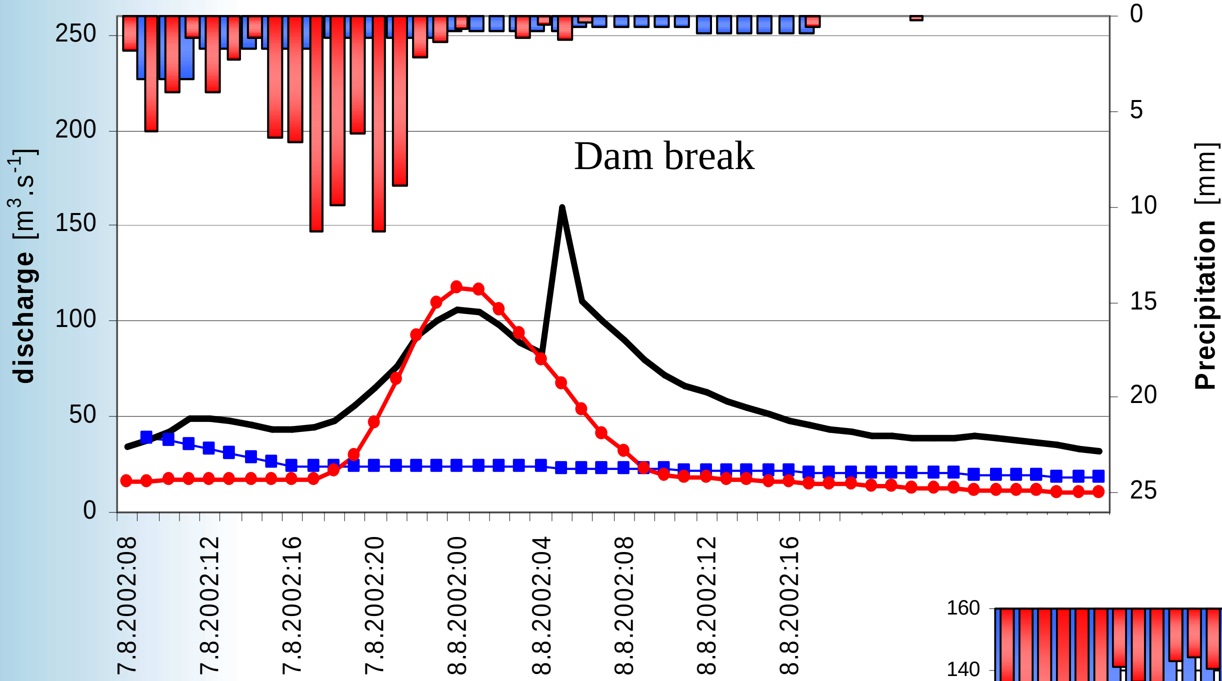
Orlik reservoir flood 2002 analysis



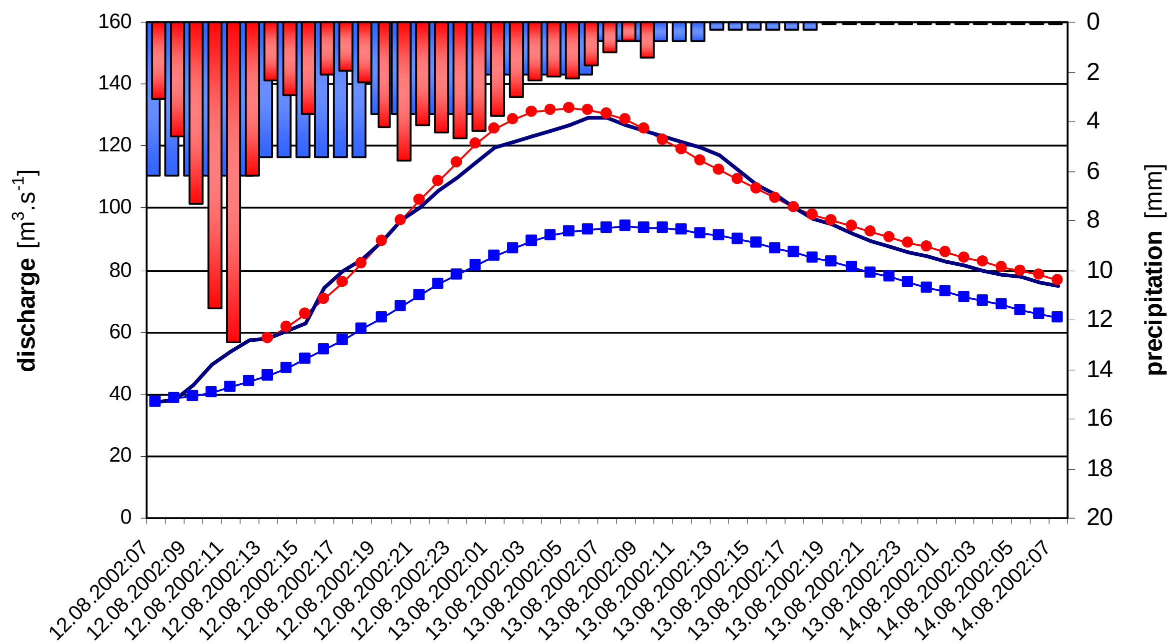
ČHMÚ

Analyses of forecast

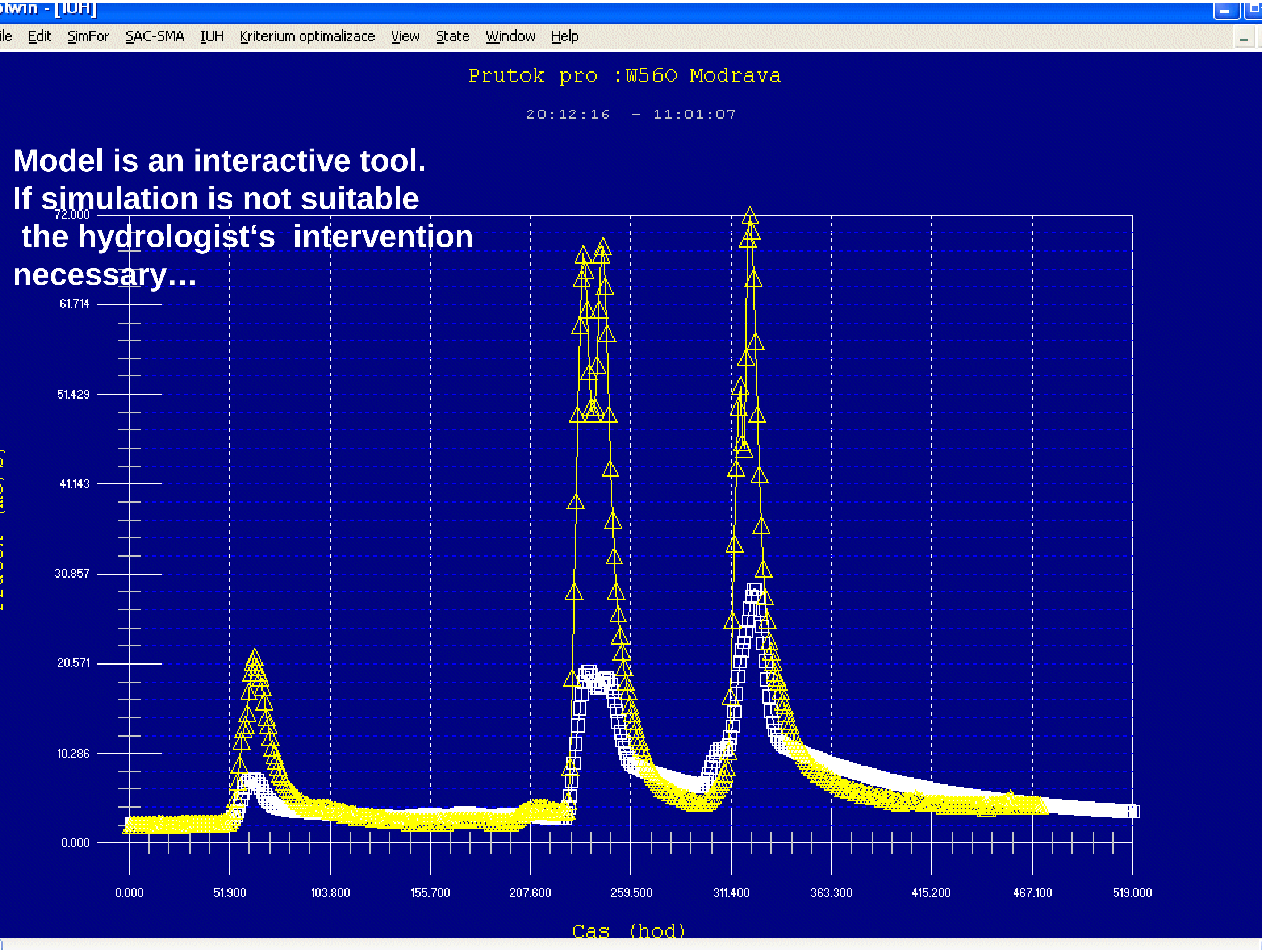
Černá River - Ličov 07.08.2002
operational forecast and later simulation



Úhlava - Klatovy 12. 8. 2002



Model is an interactive tool.
If simulation is not suitable
the hydrologist‘s intervention
necessary…



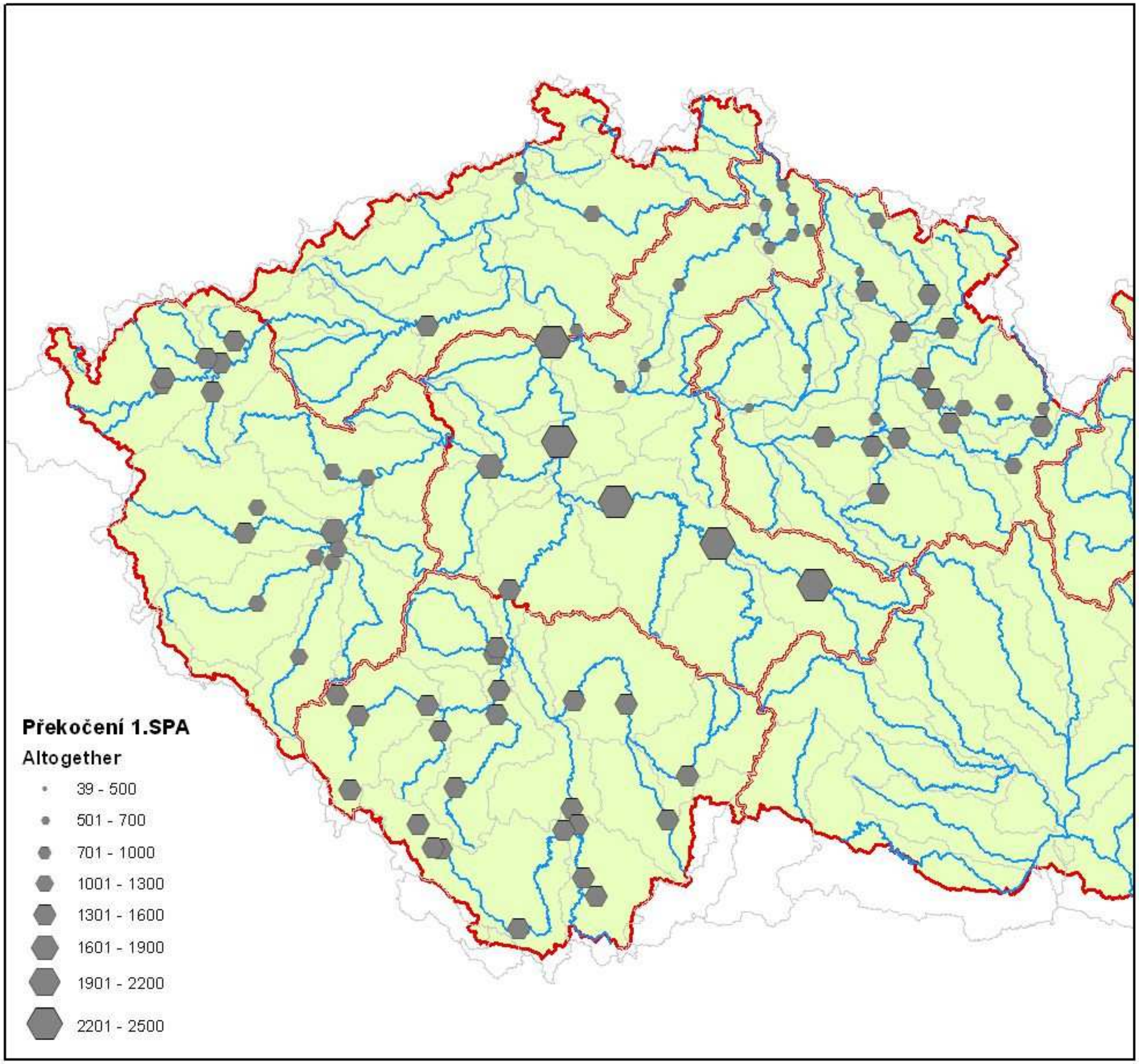
Overall AquaLog based forecast evaluation by CHMI 2002 – 2008

Tomas Vlasak

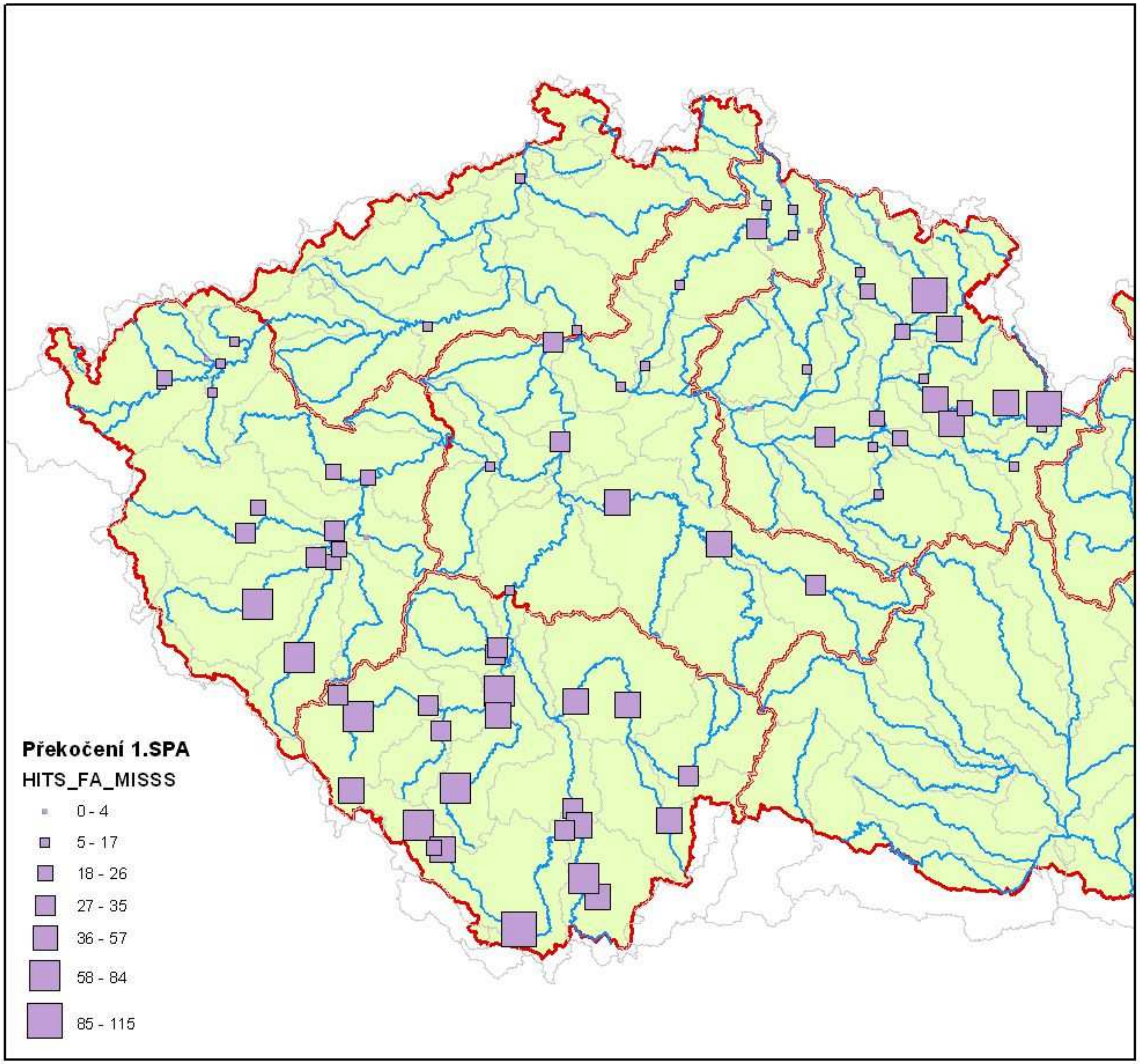
- Objective of evaluation:
  - To classify accomplished forecasts by dispassionate criteria when
    1st flood preparedness level (1. SPA) excceded

FCST / *reality*	*Yes*	*No*
Yes	*Hit*	*False Alarm*
No	*Miss*	*0 Forecast*

Forecasts evaluated

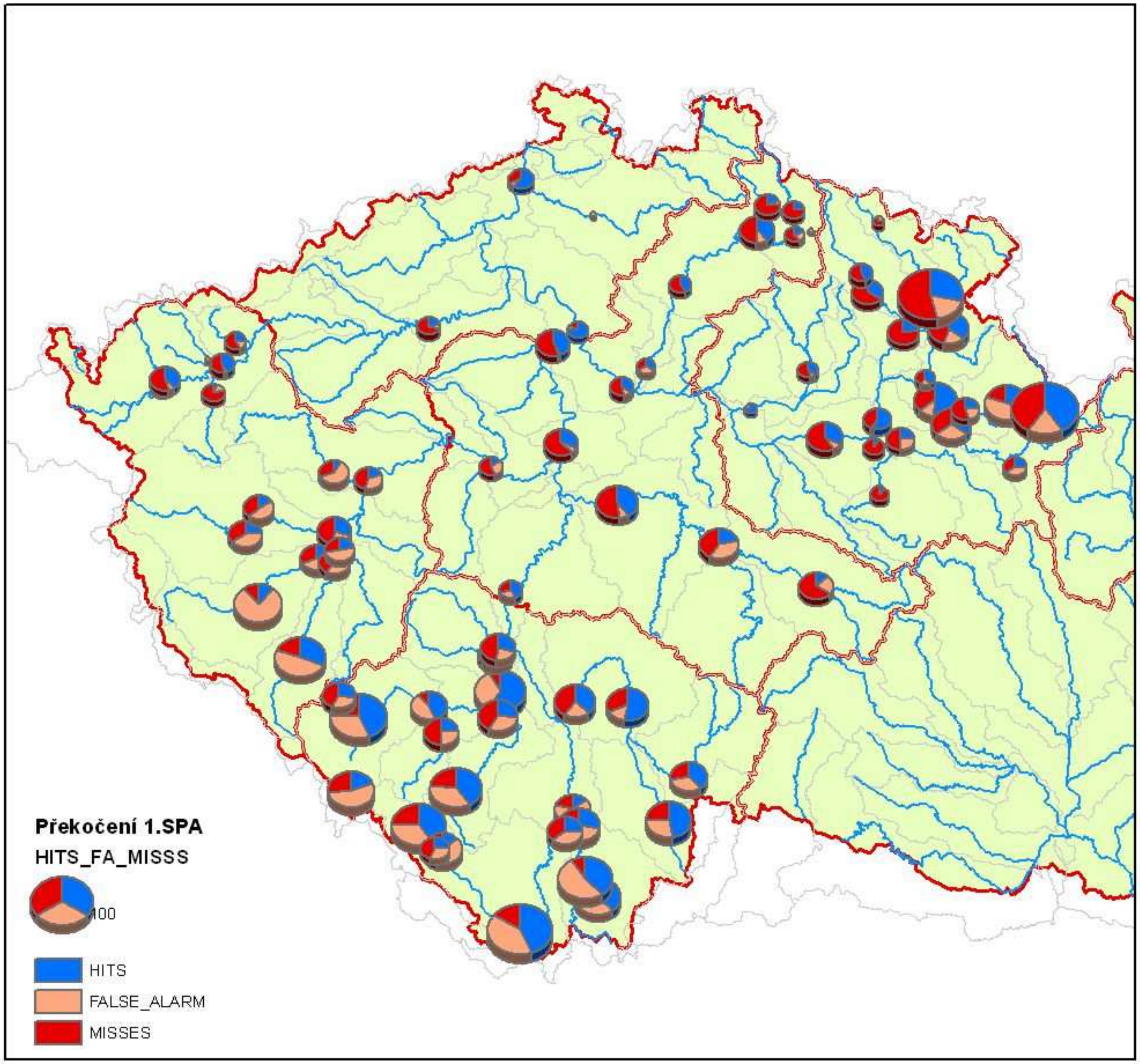


The number of forecasted events exceeding 1st preparedness level



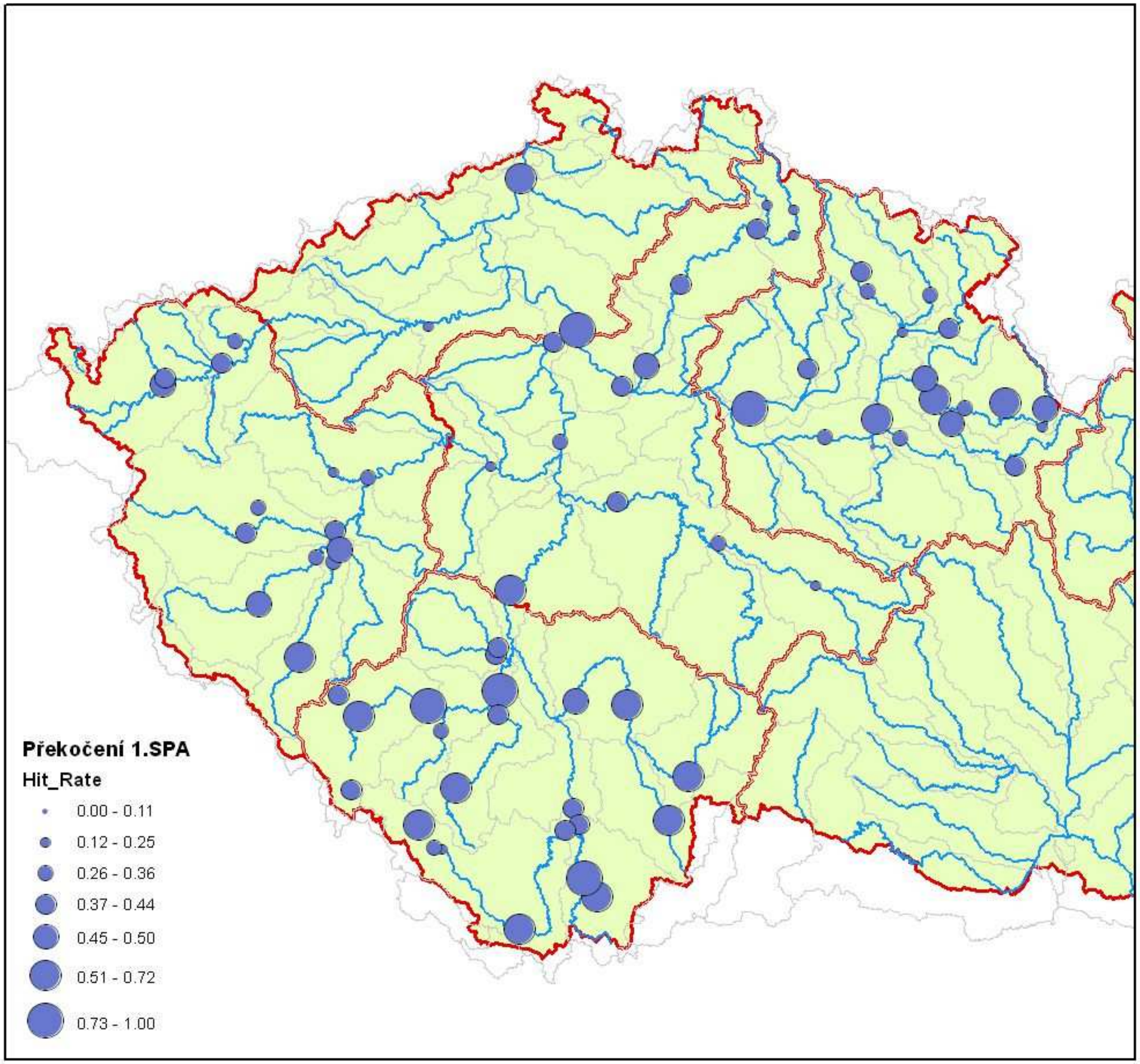
Size of the graph reflects the number of datasets

The number of forecasted events of cathegory HIT, FALSE ALARM, MISS



Size of the graph reflects the rate of reliability

HIT Rate
(POD – Probability of detection)

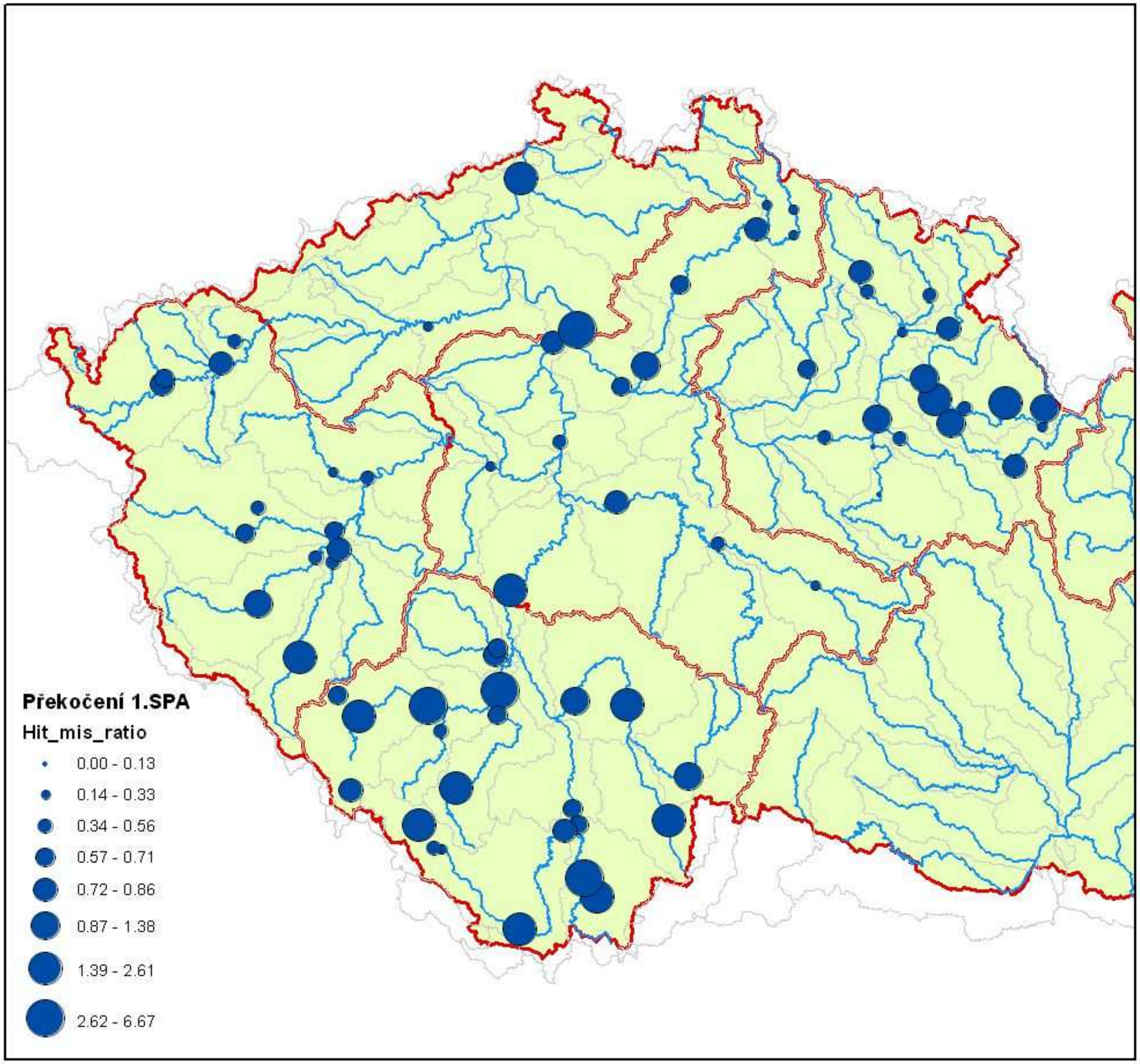


The HIT Rate is computed as

HR=HIT/(HIT+MISS)
HIT – number of forecasted HIT
MISS – number of forecasted MISS

The index varies in <0,1>,
the 1 being ideal

HIT – MISS rate

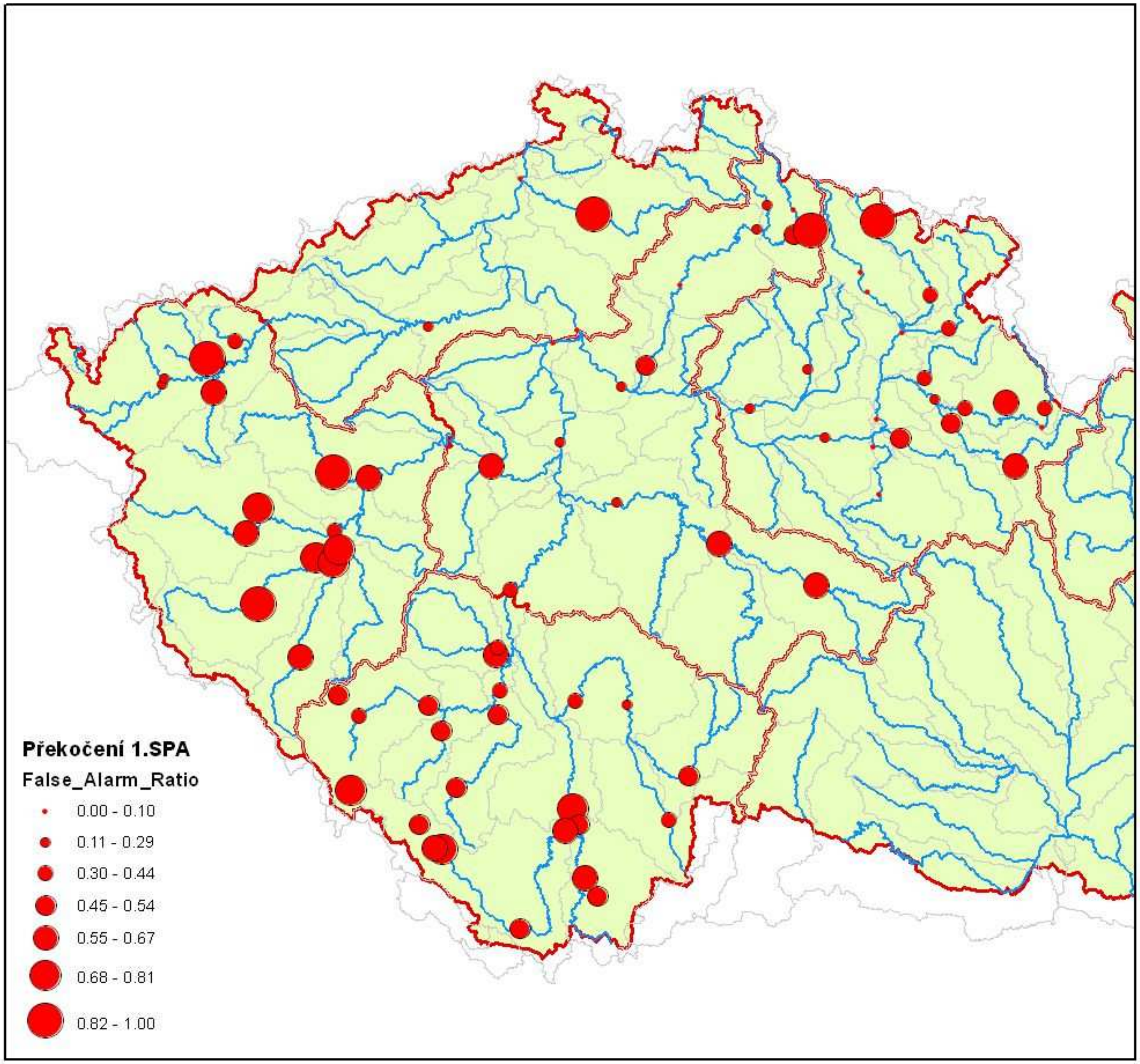


The HIT-MISS Rate is computed as

HMR=HIT/MISS

This is a different way of the HIT rate reprezentation

False Alarm Ratio

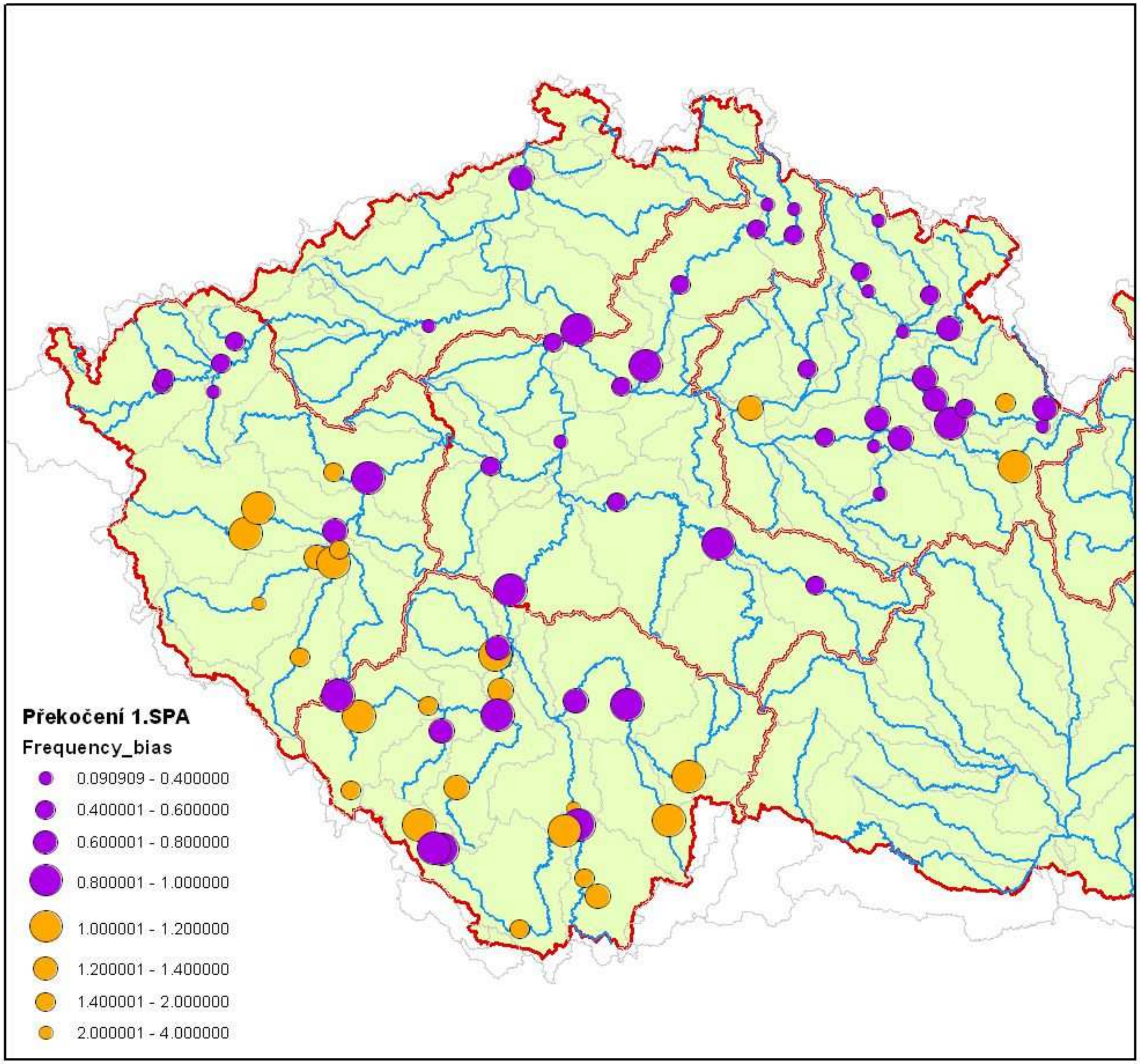


False Alarm Ratio
is computed from

FAR=FA/HIT+FA
FA - number of forecasted FALSE ALARM

This is the rate of False alarms of 1.SPA forecasts (over-warnings)

Frequency Bias



Frequency Bias Ratio

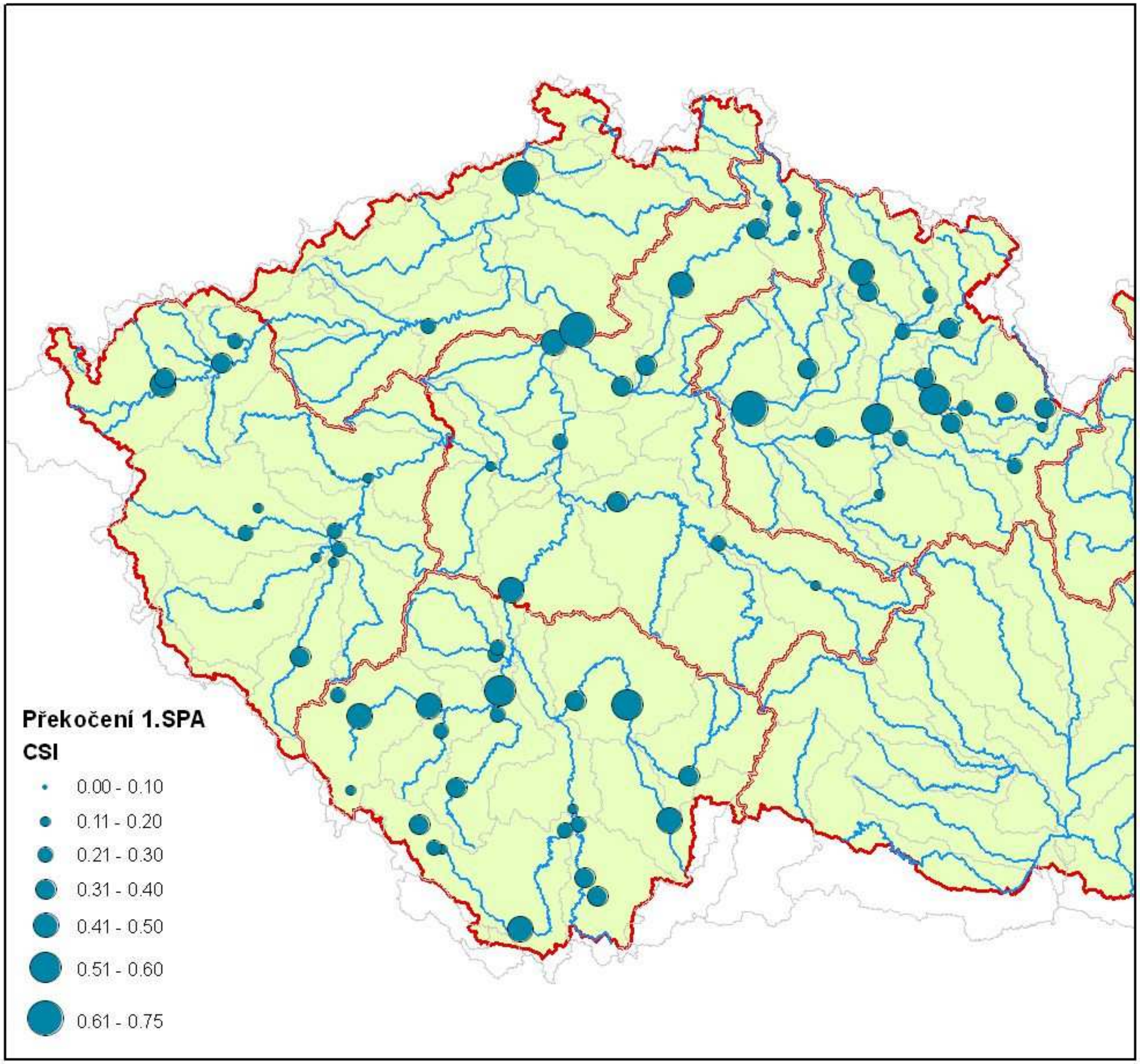
is computed from

FBI=(HIT+FA)/(HIT+MISS)

The index varies in <0,1>,

the 1 being ideal

CSI - Critical Success Index

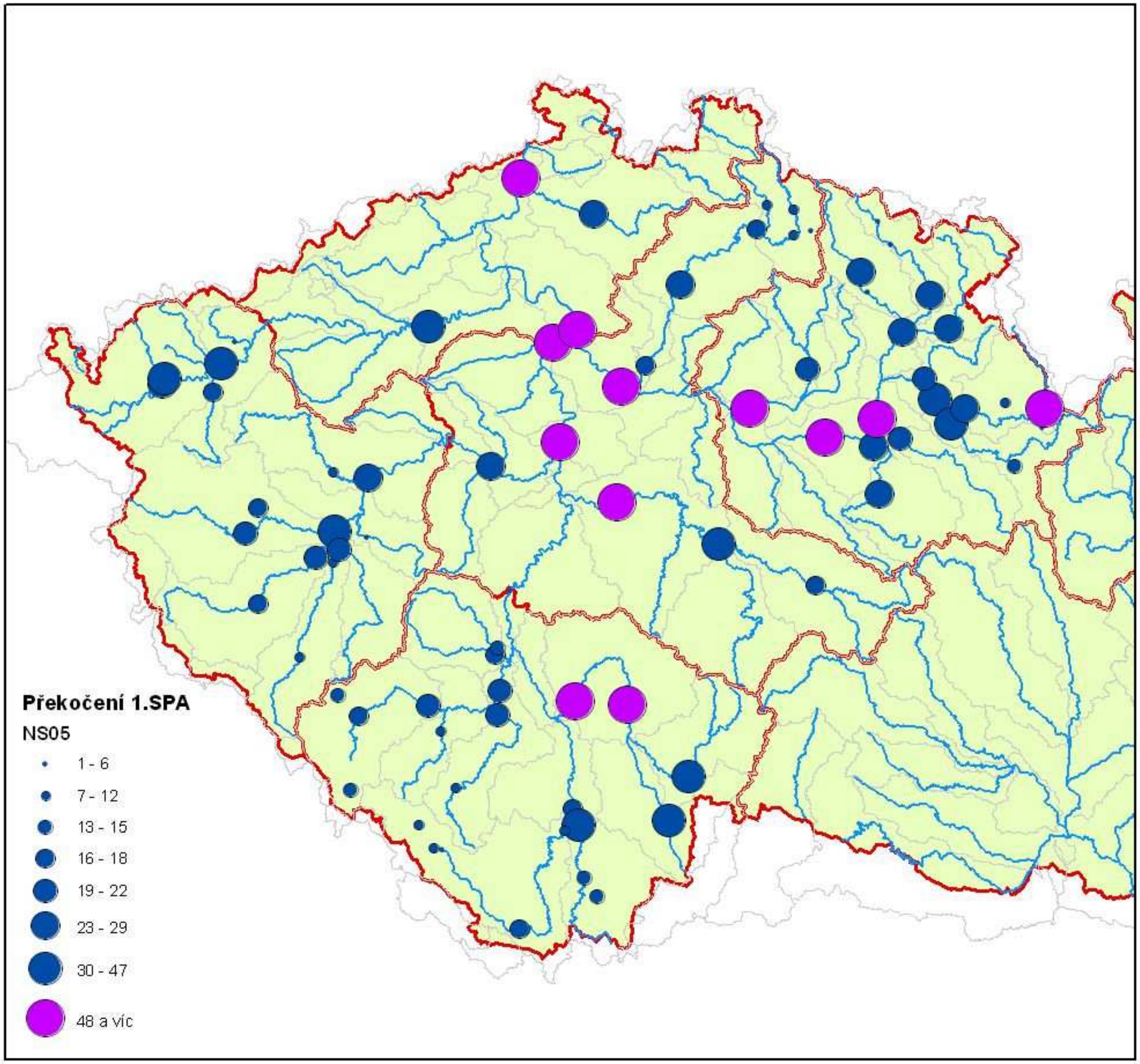


CSI – Critical Success Index:

CSI=HIT/(HIT+FA+MISS)

Index CSI relates to overall success of the forecast

Nash-sutcliffe coefficient



Nash-Sutcliffe coefficient is used to compare similarities in shape mof hydrographs. Its formulation is on Internet

End of 04_DATA_CHMI