

Combined meteorological-hydrological forecasting for the Alpine region with hydrological focus on the Ammer catchment

Joint
MAP D-PHASE Scientific Meeting -
COST 731 mid-term seminar

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Motivation



<i>Flood Event</i>	<i>Total (Mio. €)</i>	<i>Insured (Mio. €)</i>
Bavaria 1999	393	30
Bavaria 2005	205	46
Total 1999	409	40
Total 2005	3000	1700

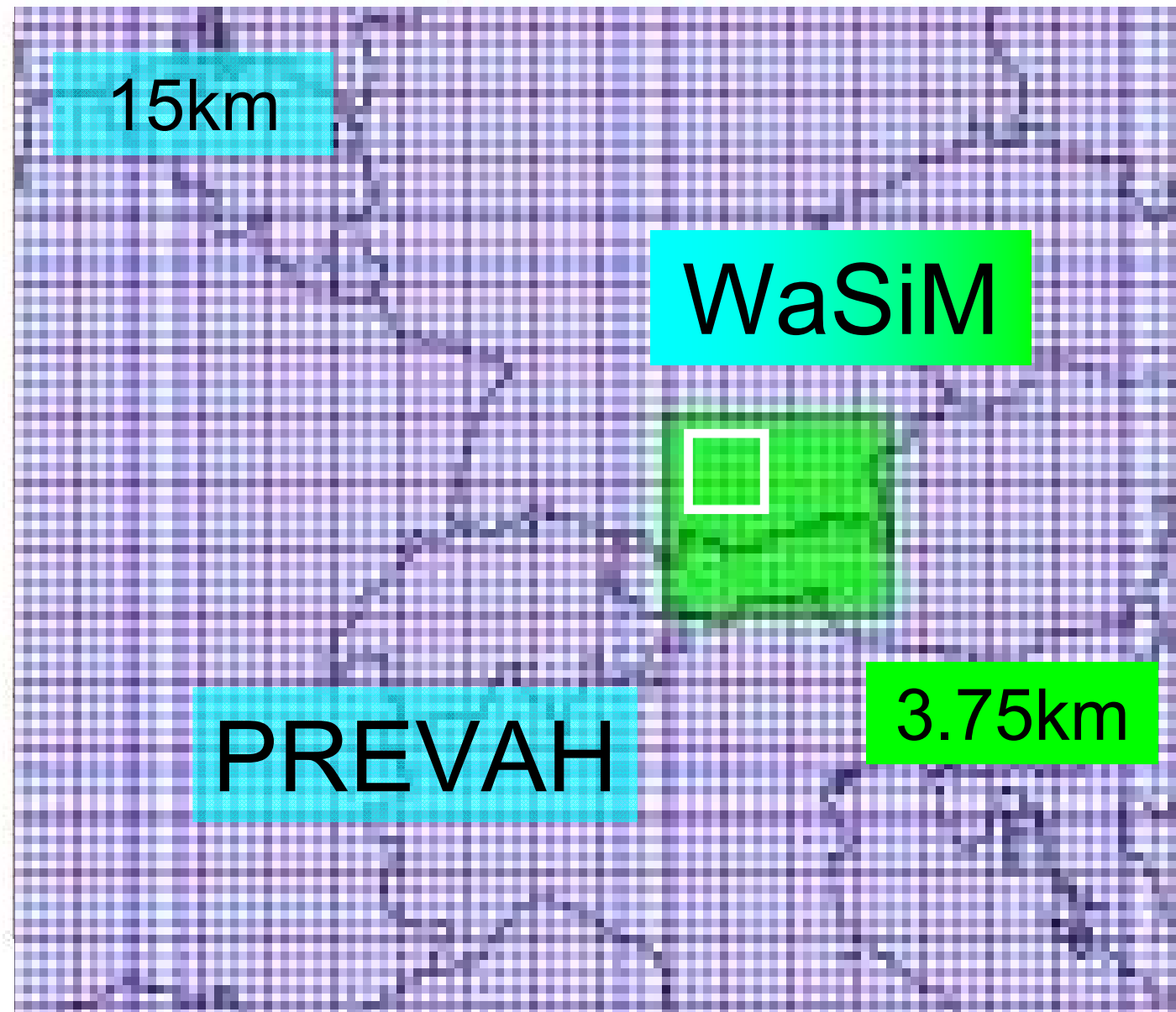


- operational NWP (MM5) since 1999 (Christophorus flood) at IMK-IFU
- MCCM (MM5+chemical solvers)
- 3 Domain Setup MM5/MCCM, Δx 60 – 15 - 3.75 km
- MM5 results are published @ <http://imk-ifu.fzk.de>
- operational NWP (WRF-ARW) since 2007
- 72h-Forecast twice daily
- GFS input data – no ensembles

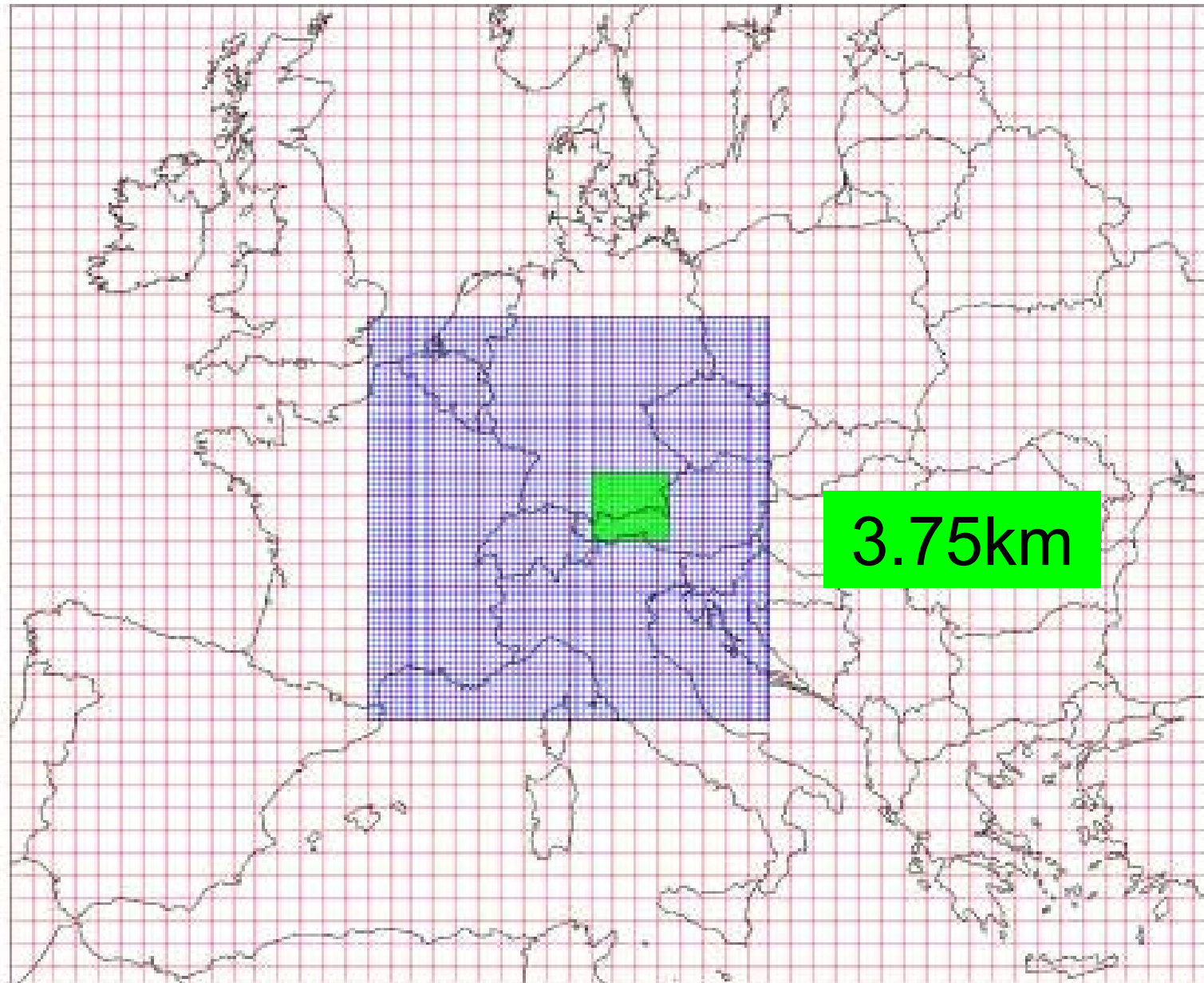
**Domain 1: 55 x 45
grid cells, 60x60 km²**

**Domain 2: 77 x 73
grid cells, 15x15 km²**

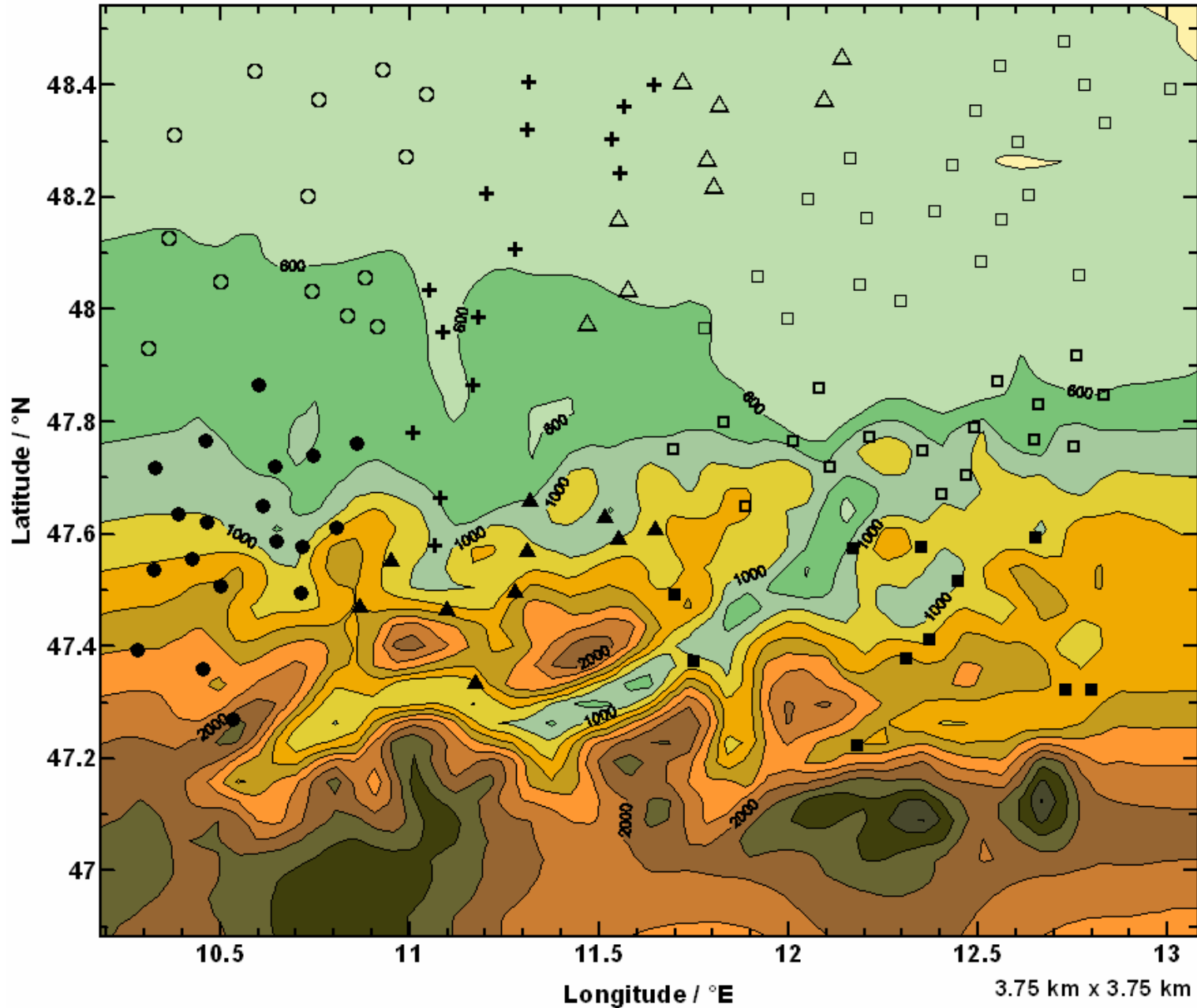
**Domain 3: 57 x 49
grid cells, 3.75x3.75
km²**



Results for MM5 D03

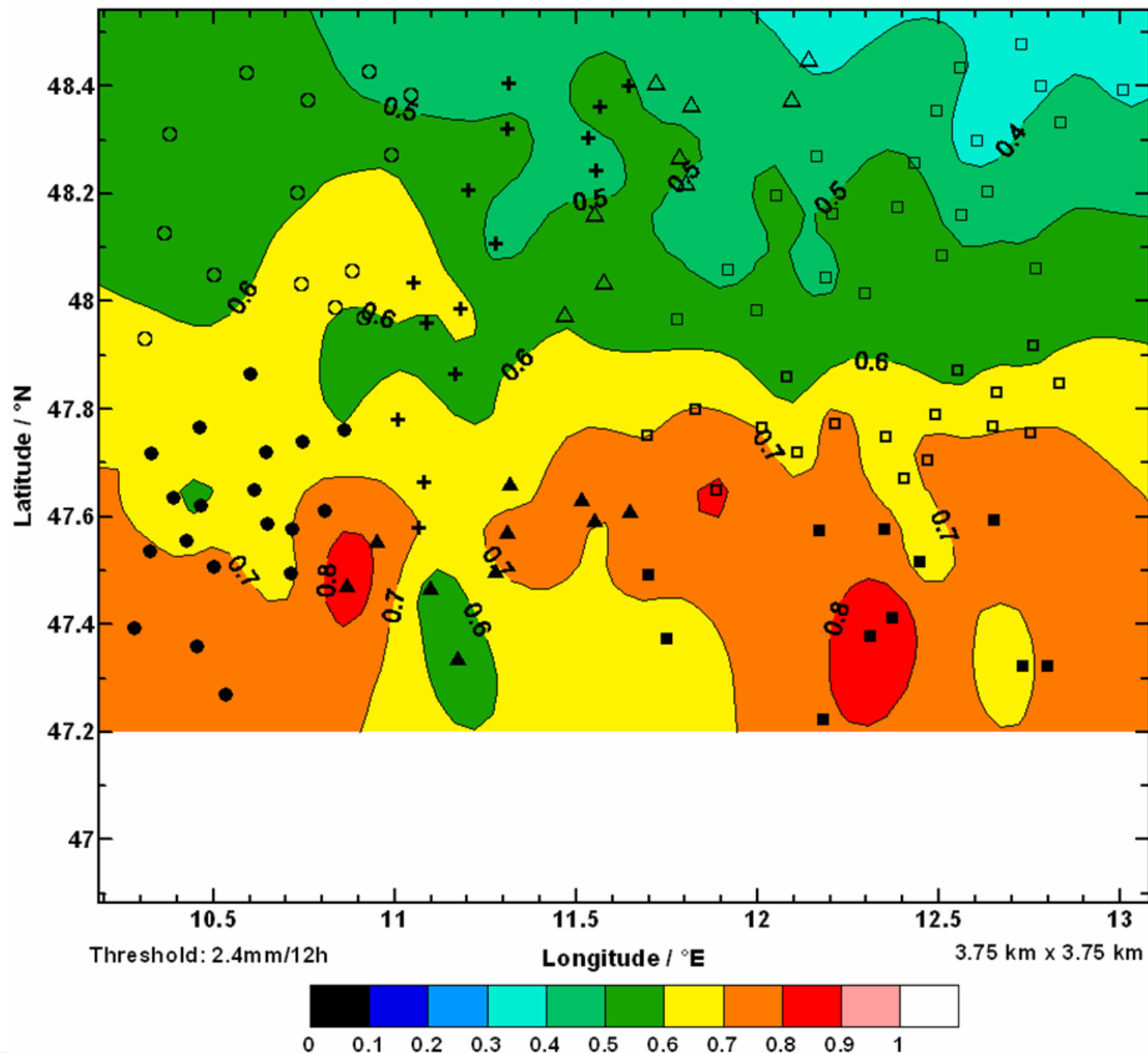


DEM D03 & available 113 observation stations



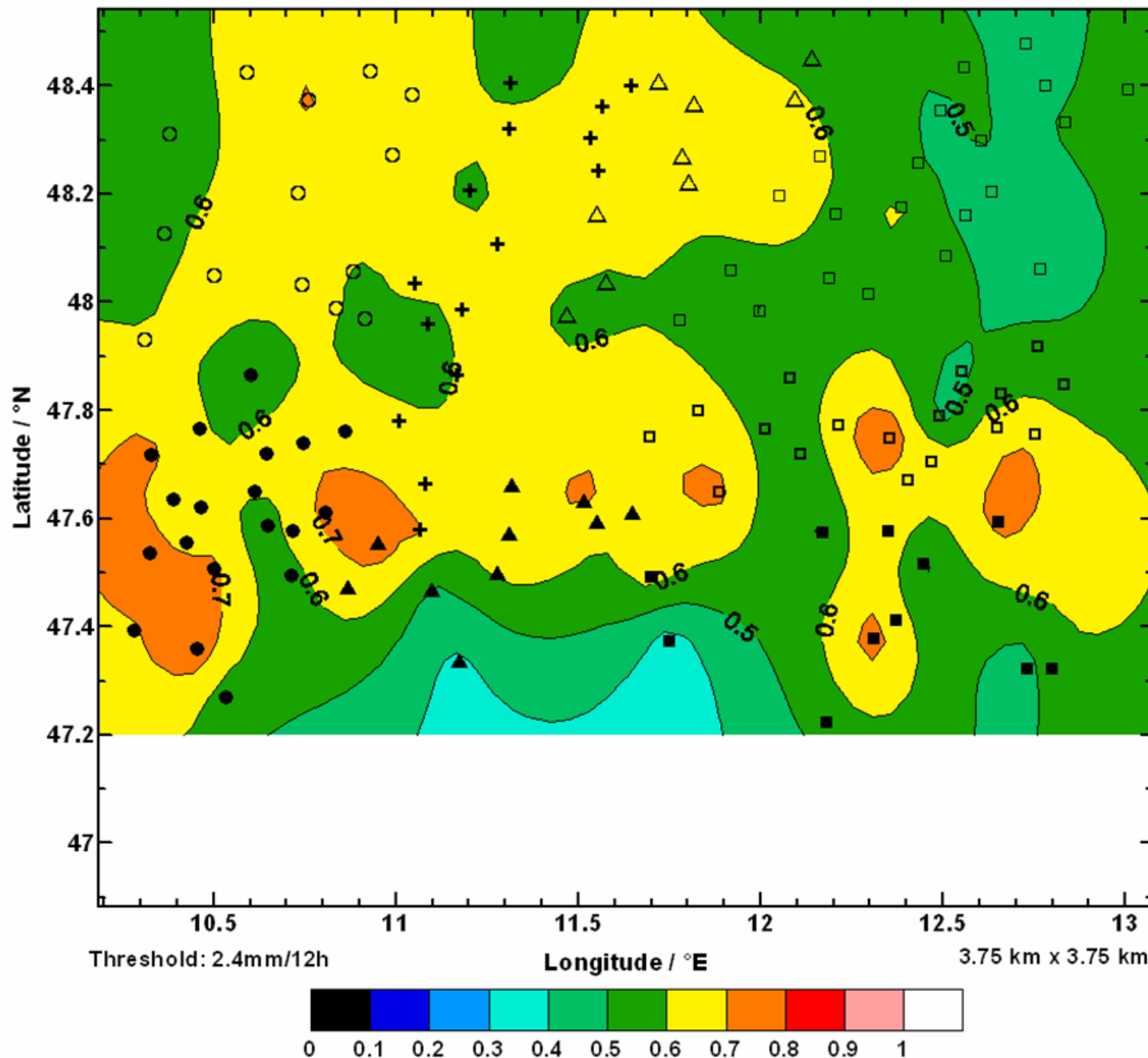
Results for MM5 D03

Probability of
 Detection POD,
 forecast 1-12h,
 MM5 3.75km,
 all forecasts
 june-oct. 2007,
 12h accumulated
 rain,
 threshold 2.4mm



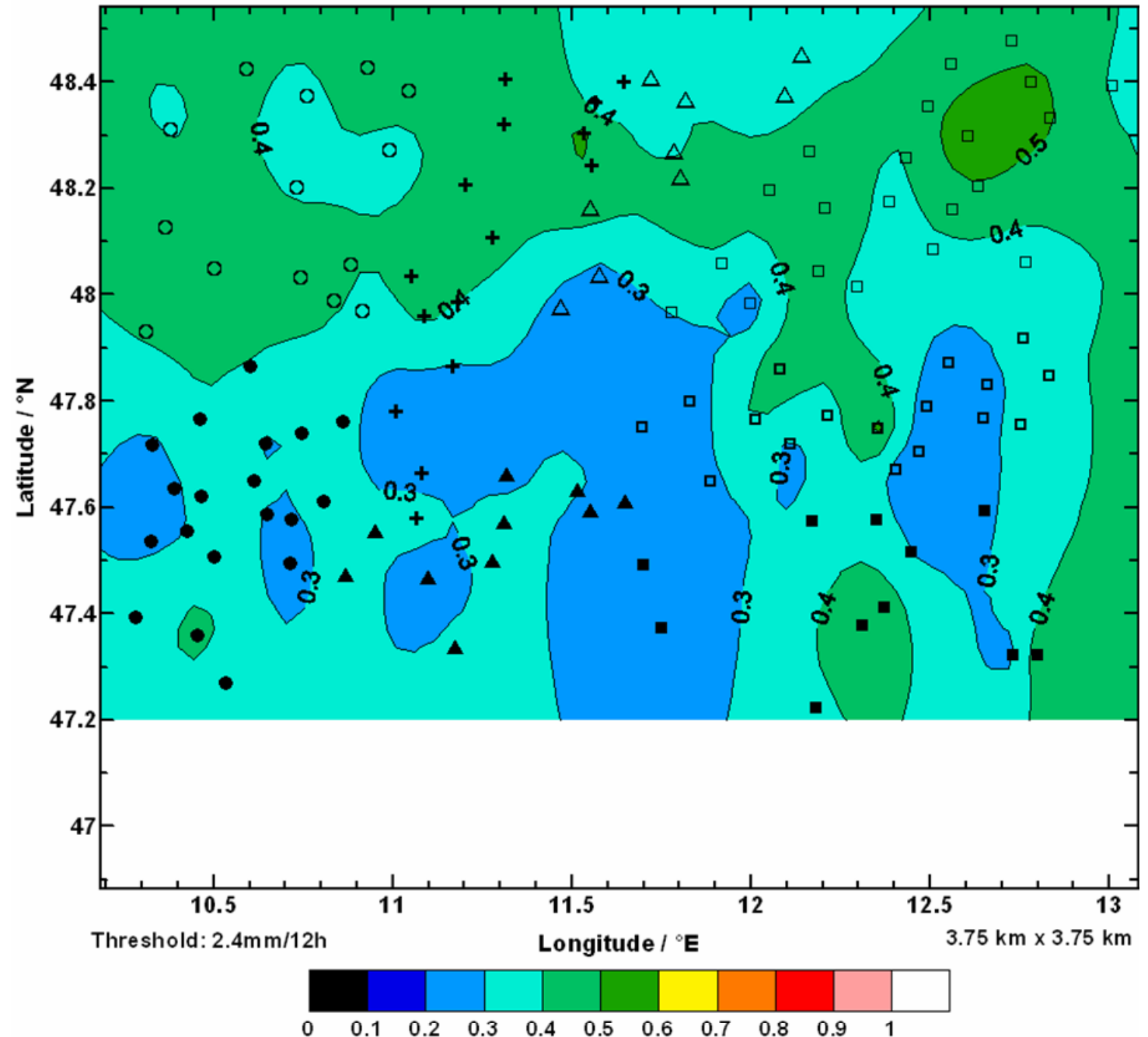
Results for MM5 D03

Probability of
 Detection POD,
 forecast 49-60h,
 MM5 3.75km,
 all forecasts
 june-oct. 2007,
 12h accumulated
 rain,
 threshold 2.4mm

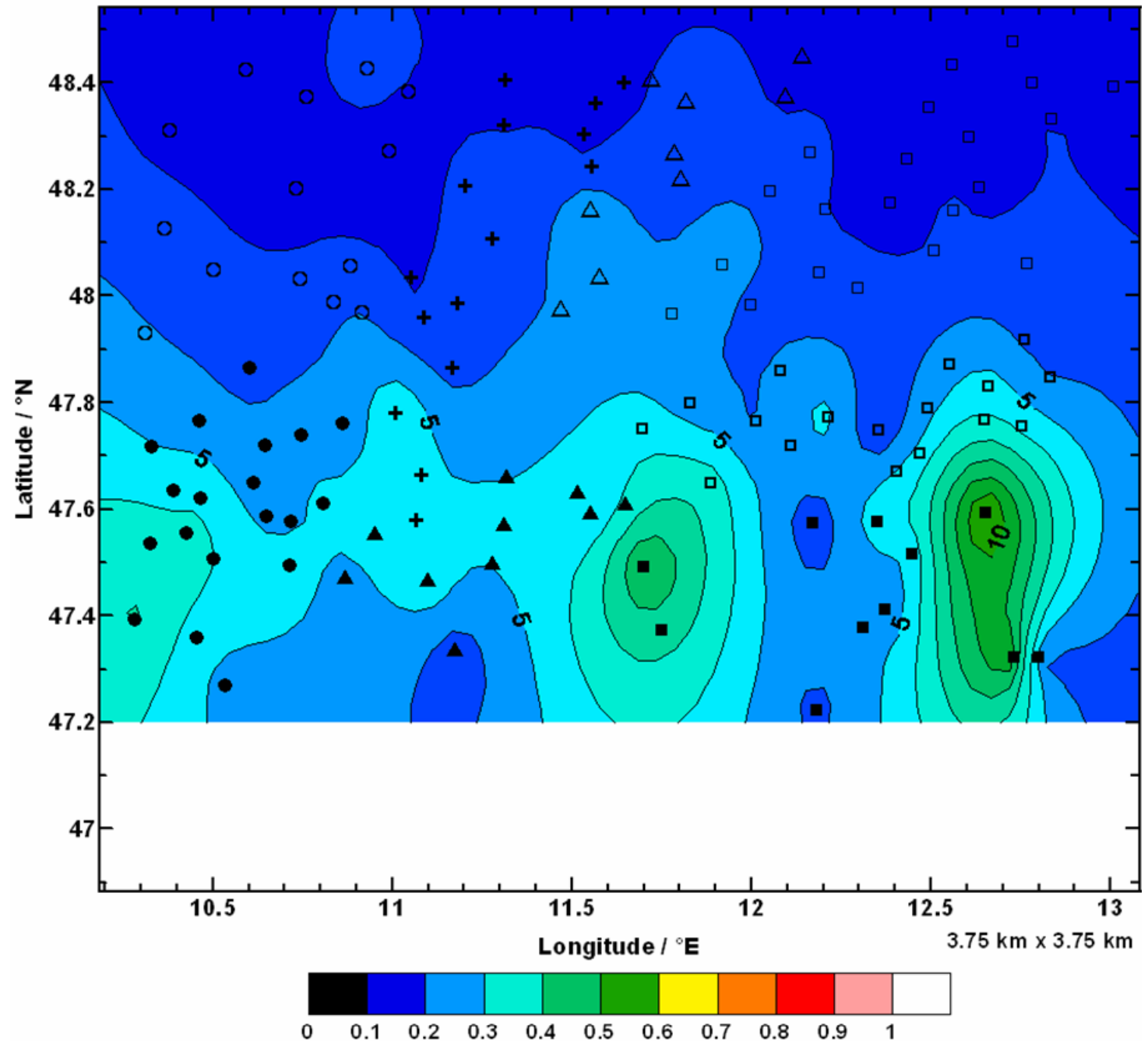


Results for MM5 D03

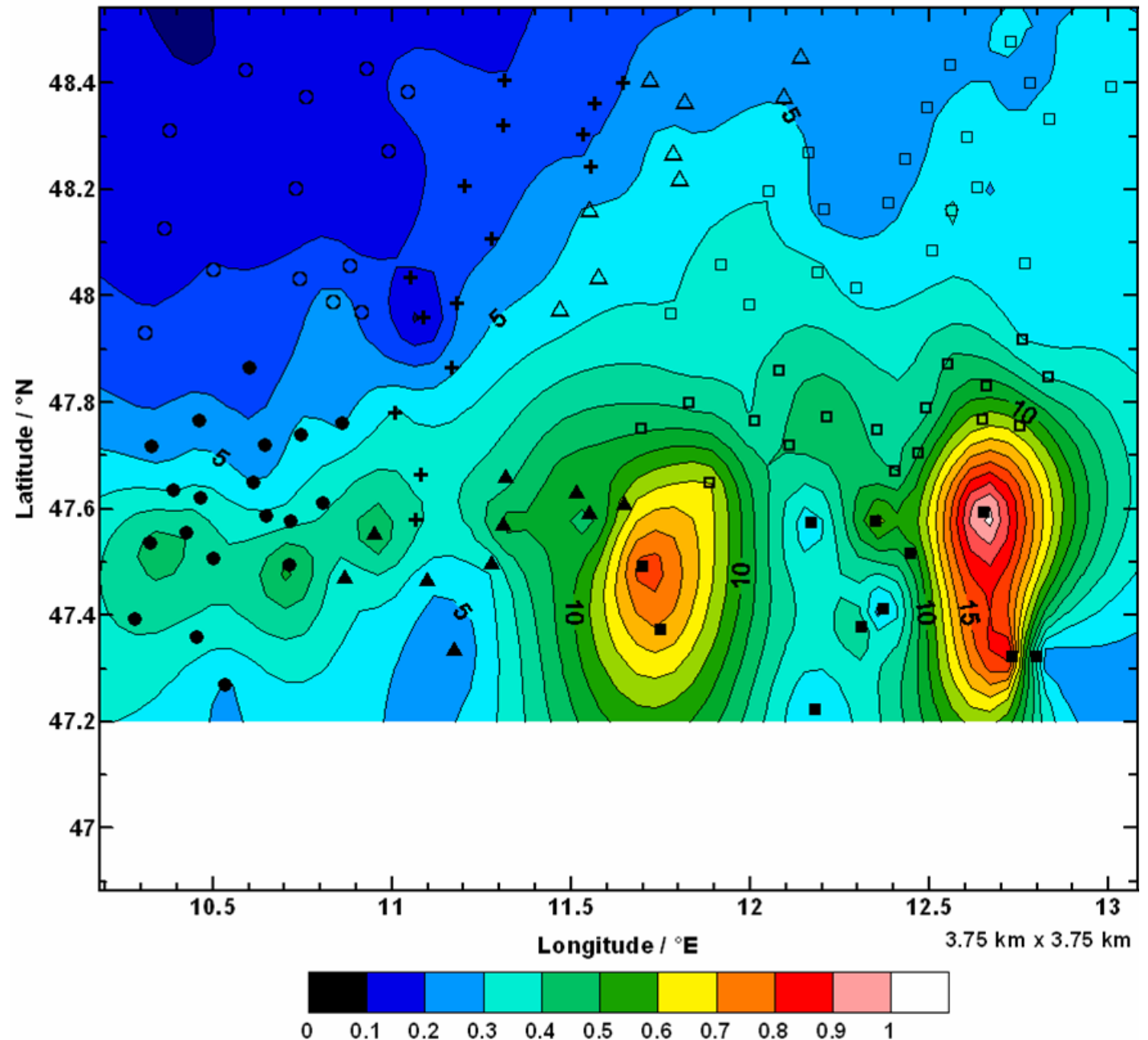
False Alarm
Ratio FAR,
forecast 1-12h,
MM5 3.75km,
all forecasts
june-oct. 2007,
12h accumulated
rain,
treshold 2.4mm



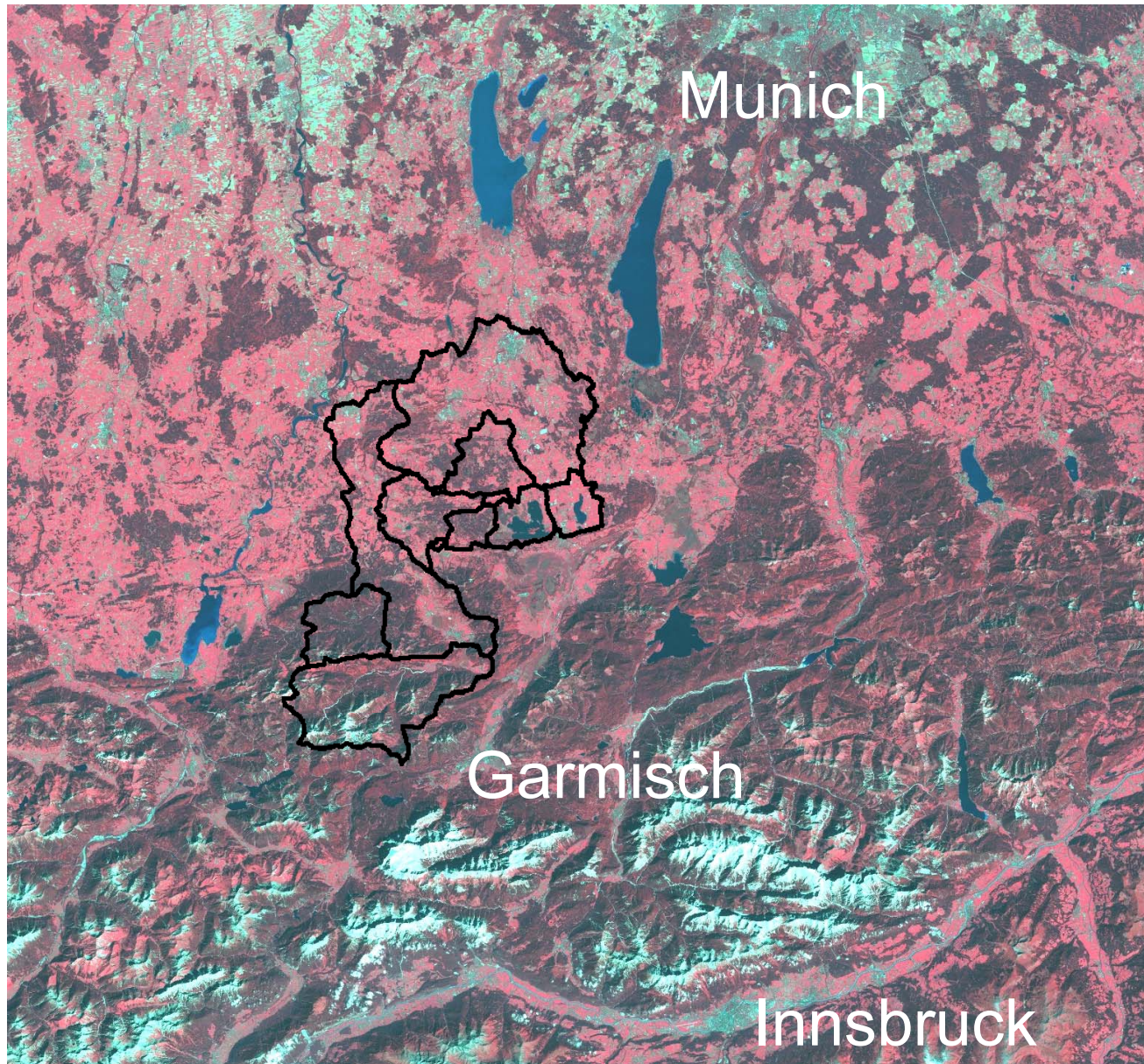
Relative Error,
all forecasts,
MM5 3.75km,
june-oct. 2007,



Relative Error,
all forecasts,
MM5 3.75km,
September 2007



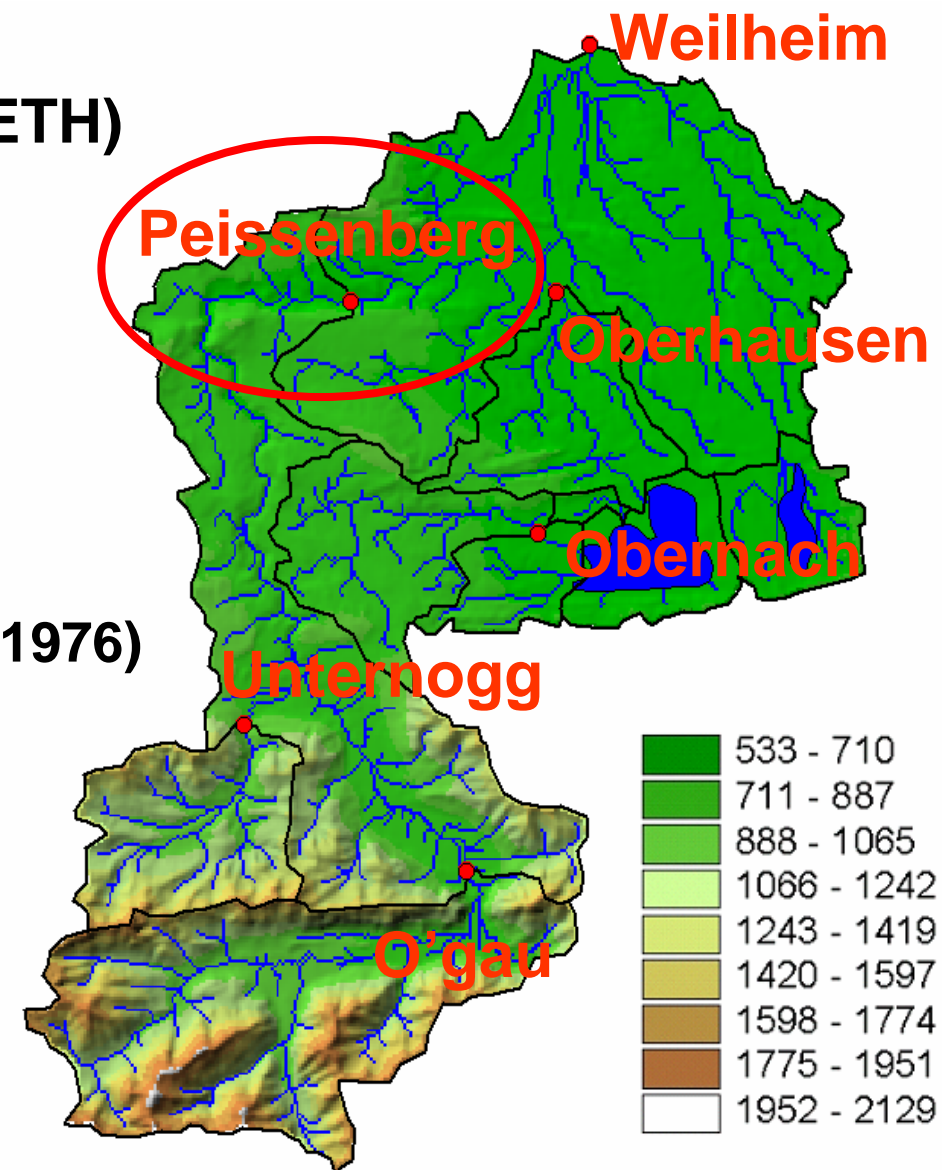
Hydrological testbed: Ammer Catchment



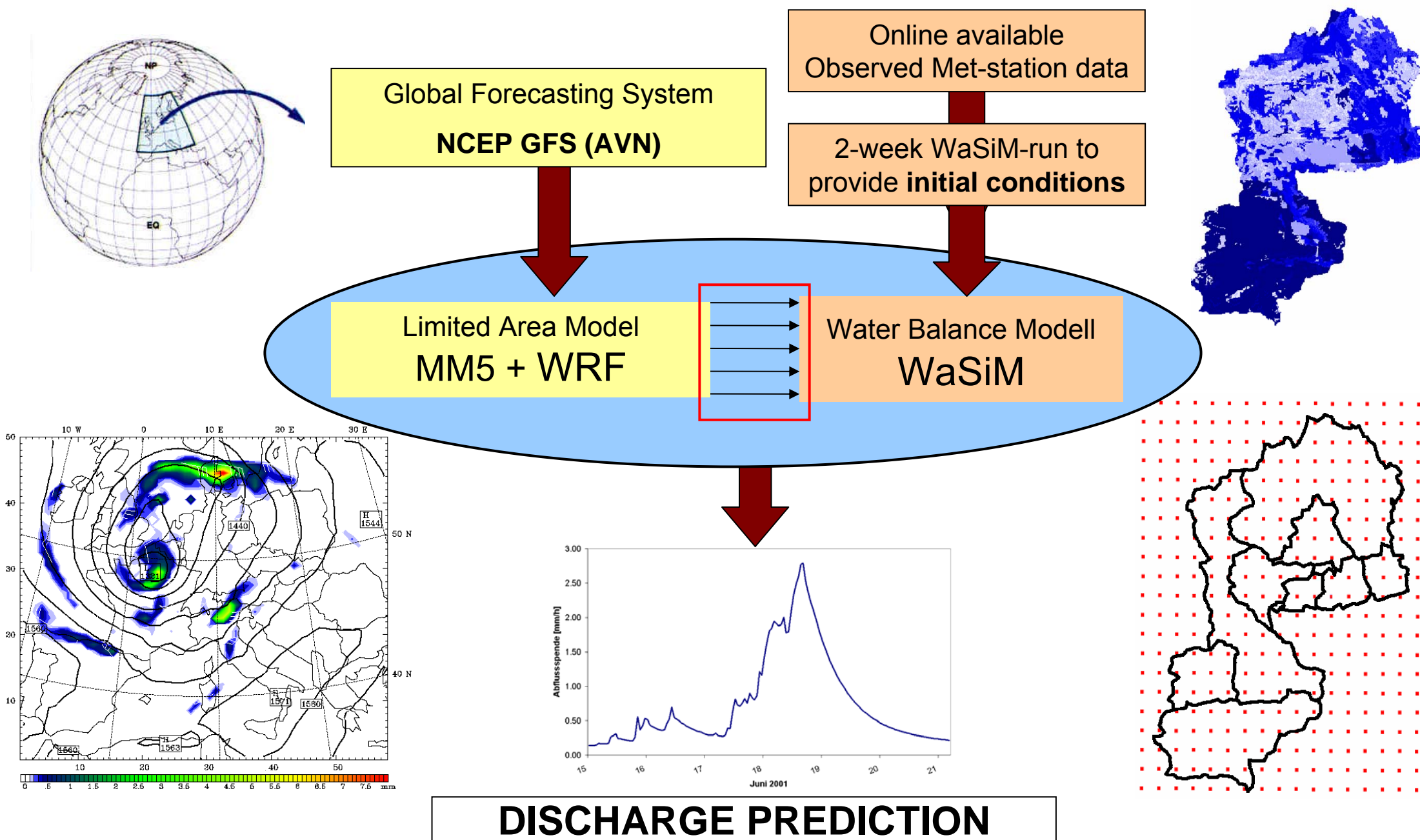
Landsat TM (30m)
[ch 7-5-3]
1991-30-08

Water Balance Simulation Model (WaSiM-ETH) (Schulla & Jasper 2001 / 2007)

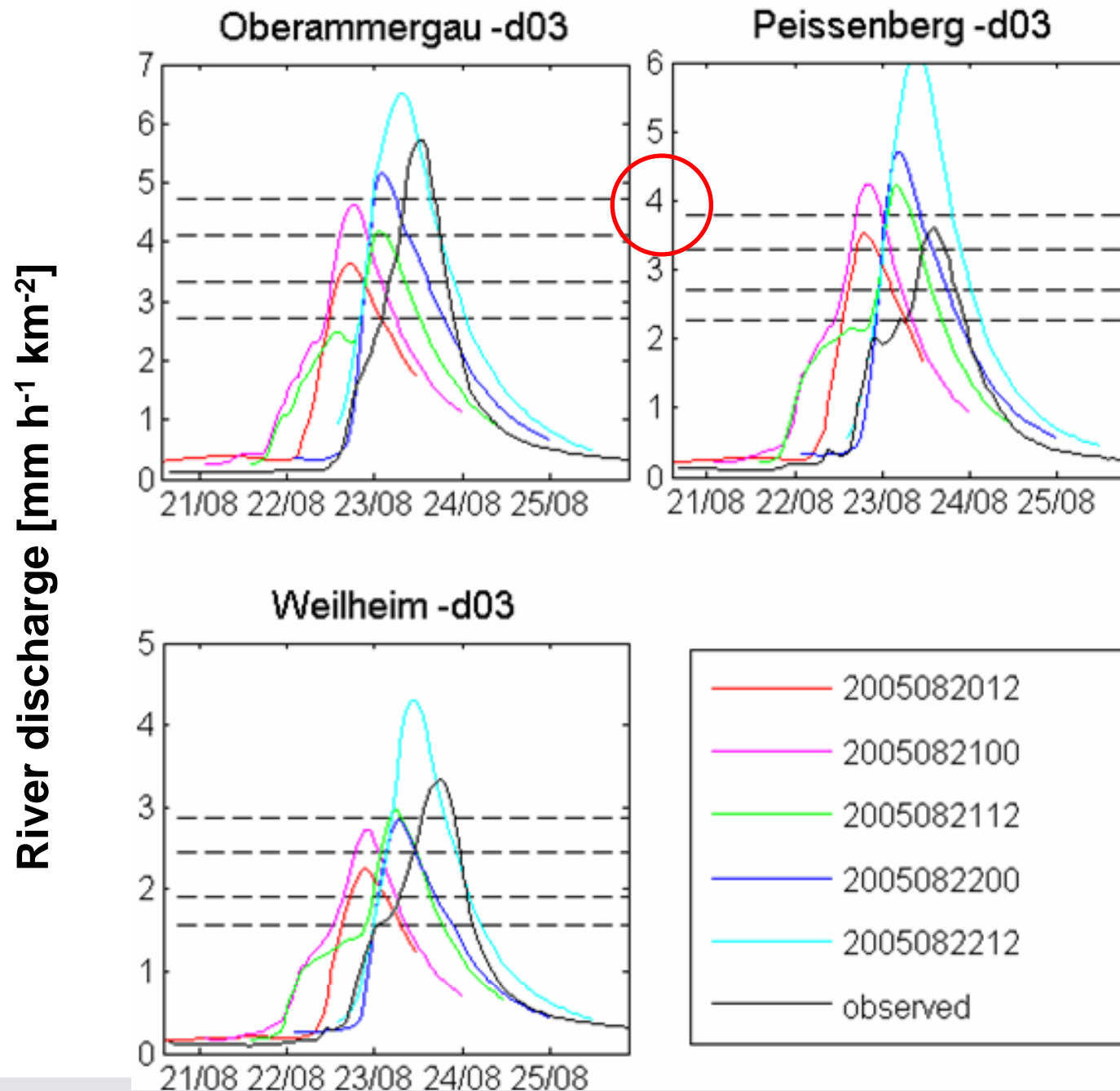
- distributed Modell, 100 m raster resolution
- physically based process descriptions
- Richards equation (Richards, 1931)
- hydraulic conductivity after van Genuchten (1976)
- Evapotranspiration after Penman-Monteith (Monteith, 1975; Brutsaert, 1982)
- Snow storage model (Anderson, 1993)
- Soil moisture storage



Hydrometeorological Prediction System

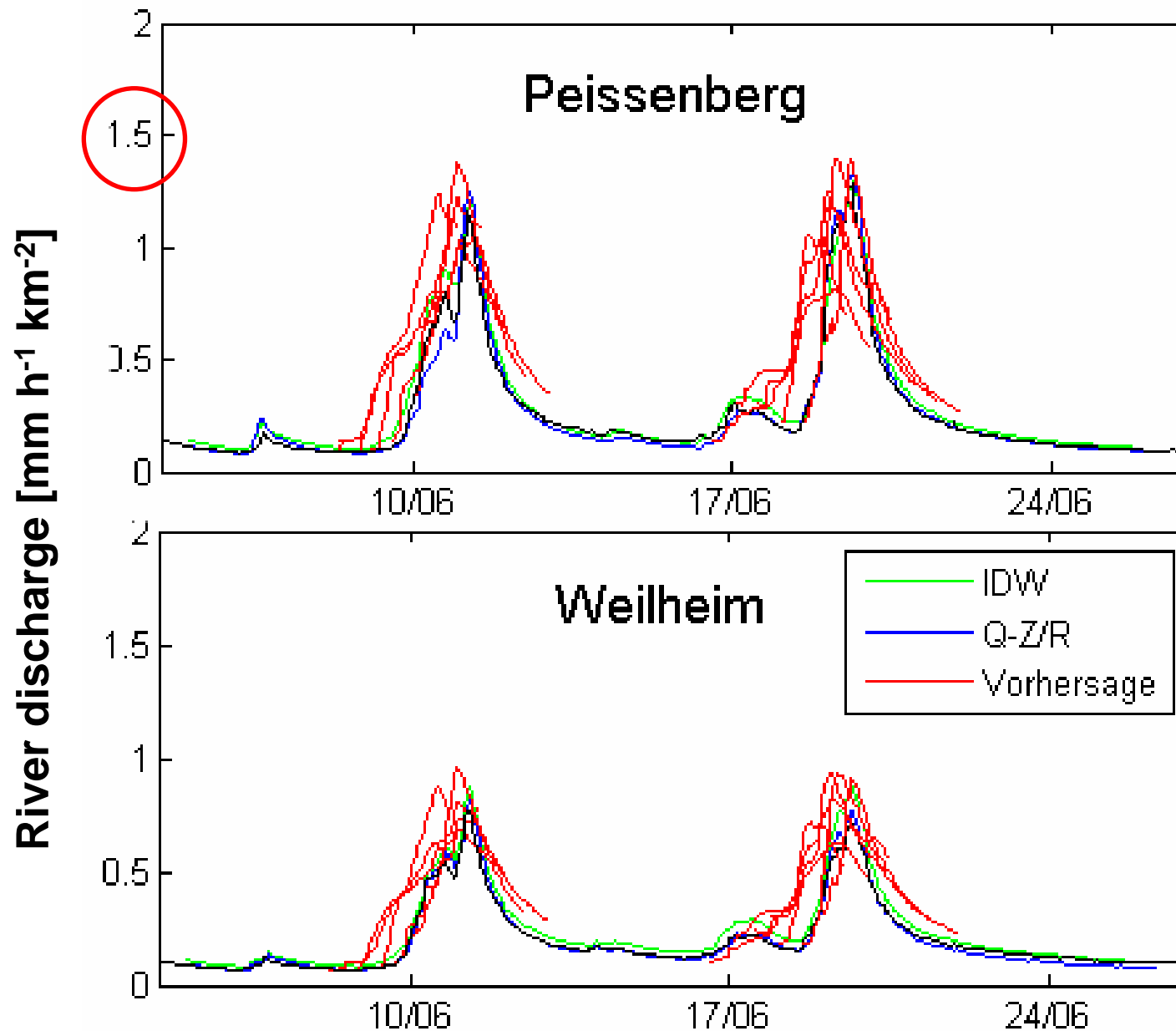


WRF-WaSiM Prediction Century flood 2005



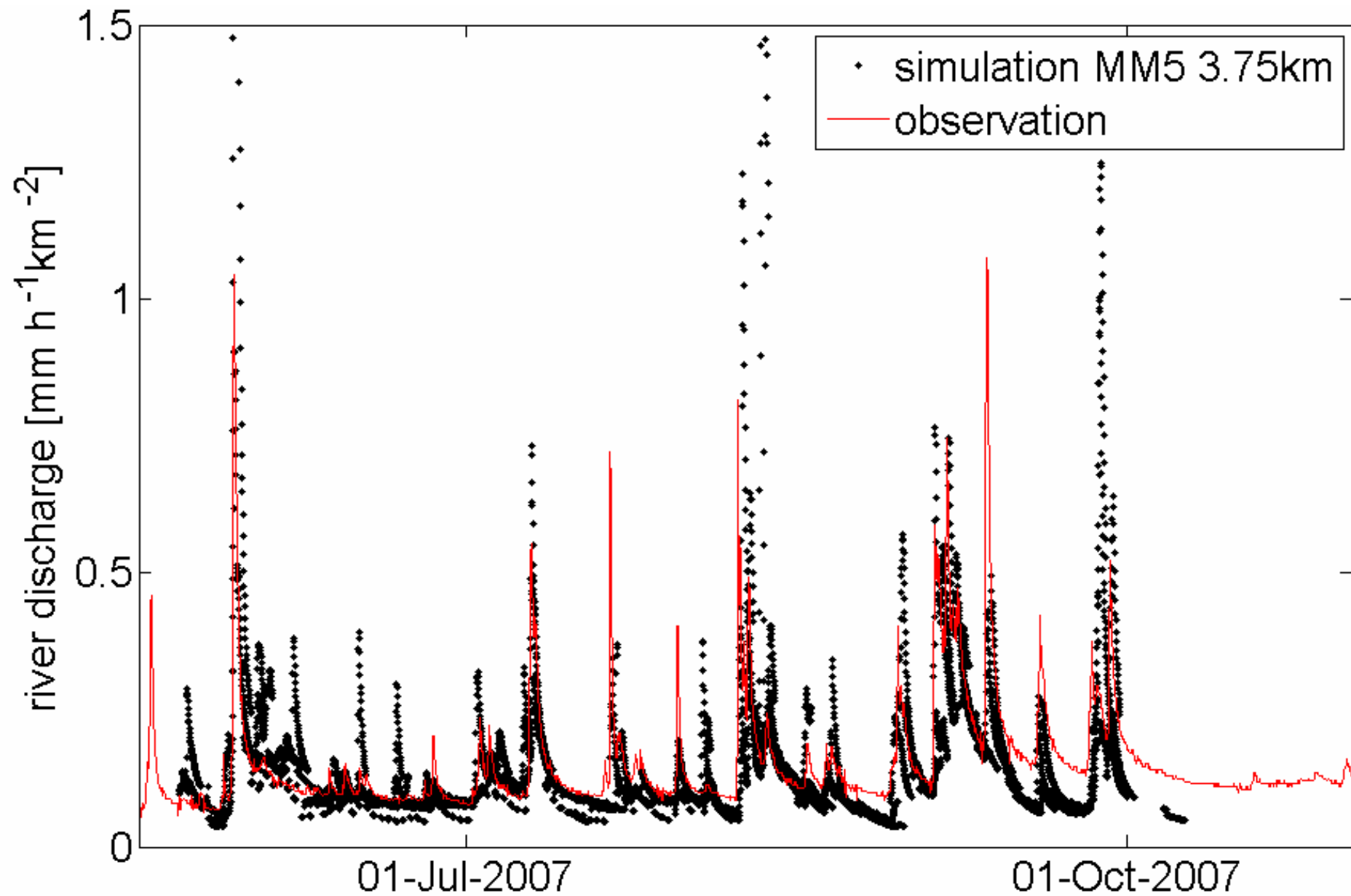
Return period
100 years
10 years

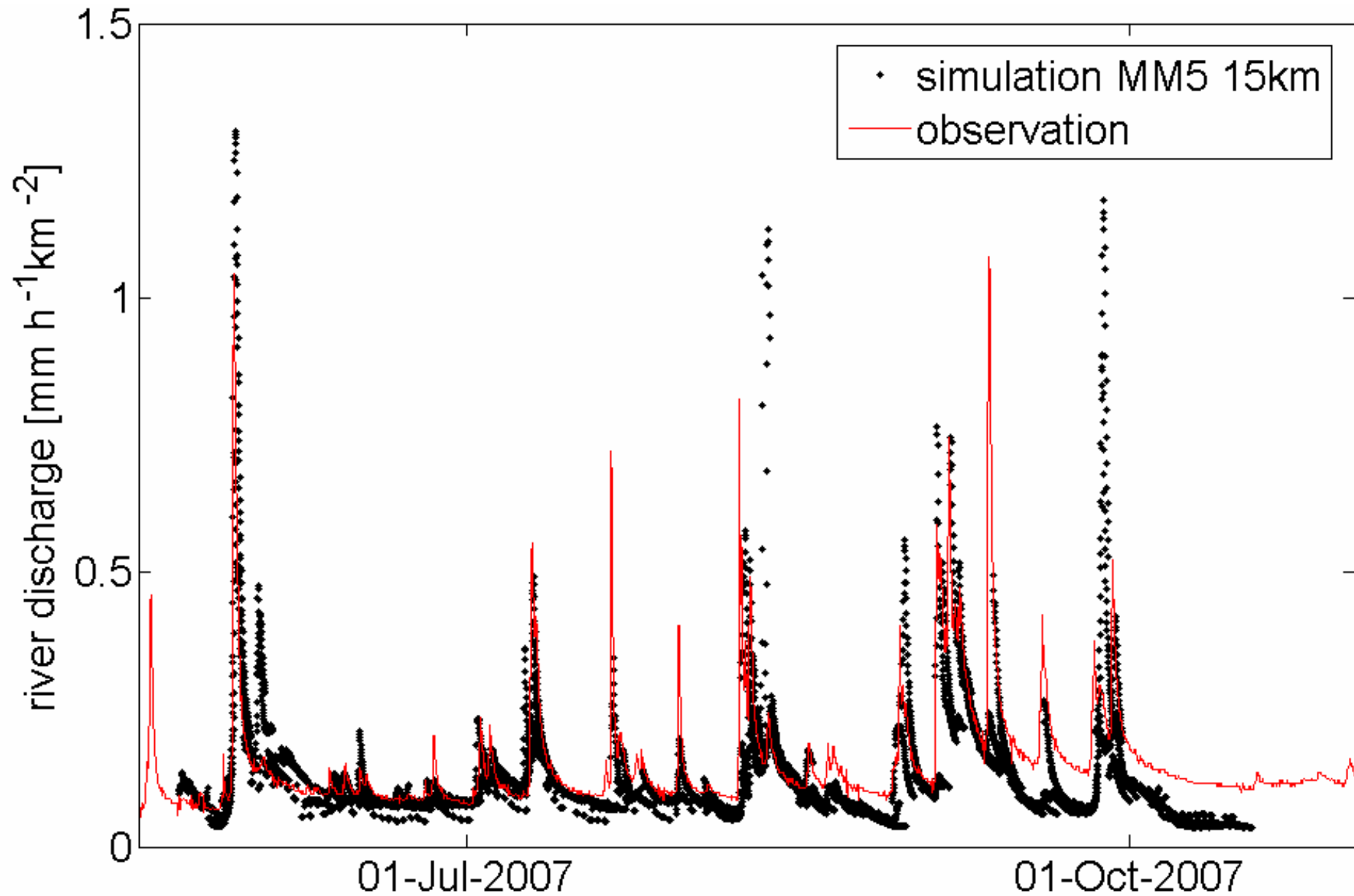
Validation WRF-WaSiM Period 2001



red line: forecast
black: observation
green: rain gages
blue: radar rainfall

13 flood forecasts for
two runoff events in
June 2001





- higher horizontal resolution does not automatically tend to better rainfall forecasts in both MM5 and WRF
- MM5 15km/WRF 20km rainfall predictions outperform higher resolutions
- Rainfall overestimations (MM5 3.75km/WRF 5km) propagate to river discharge forecasts
- Calibration of hydrological models: resolution of observation stations $< 20\text{km}$!
-> horizontal resolution of input data effects surface runoff generation



Thank you for your attention!