HIC 2018

13TH INTERNATIONAL HYDROINFORMATICS CONFERENCE HIC 2018

1-6 JULY 2018 | PALERMO | ITALY

Flood forecasting with uncertainty using a fully automated flood model chain: A case study for the City of Kulmbach

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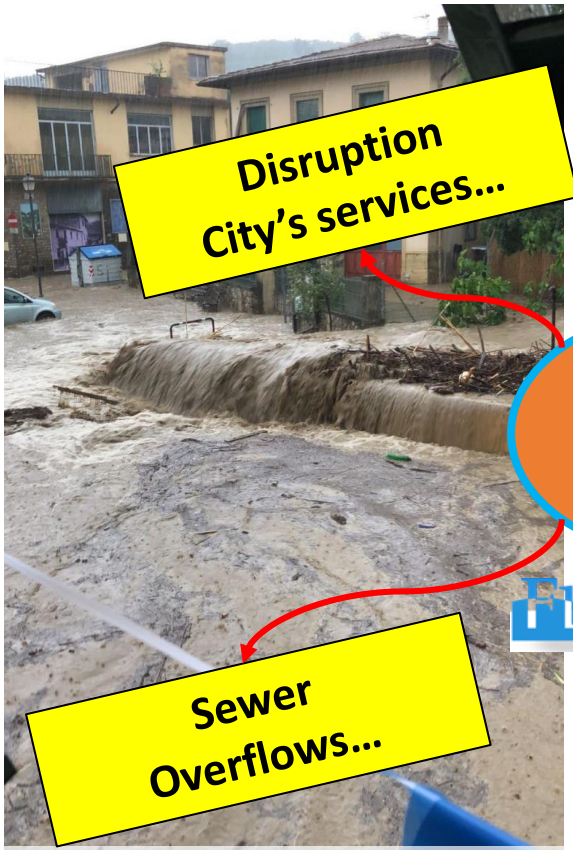
Introduction/Motivation



Floods in San Polo, Tuscany, Italy, 08 May 2018. Photo: Region of Tuscany Government

Early Warning Systems

FLOODEVAC

ods in Heinsberg, Germany, 22 May 2018. Photo: Feuerwehr gelt via Twitter

Swollen Seine river, Paris, January 2018. Photo: Julien Colin

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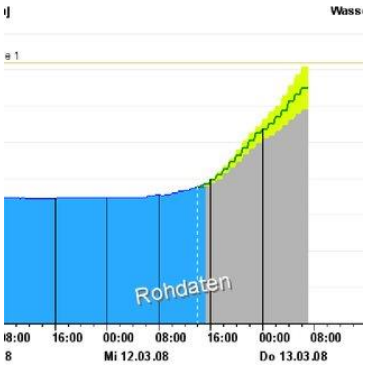
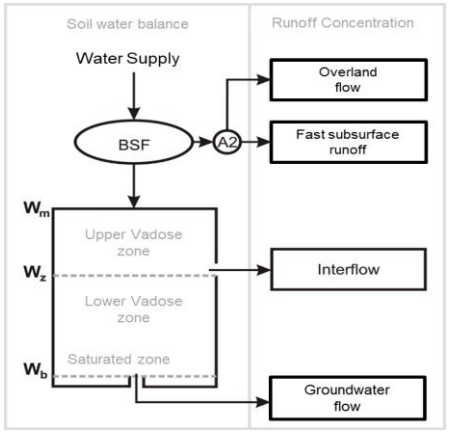
Flood forecasting

- Bayerisches Landesamt für Umwelt
  - Flood Forecast Center

  - Predicting High discharges (statistical approach)



LARSIM



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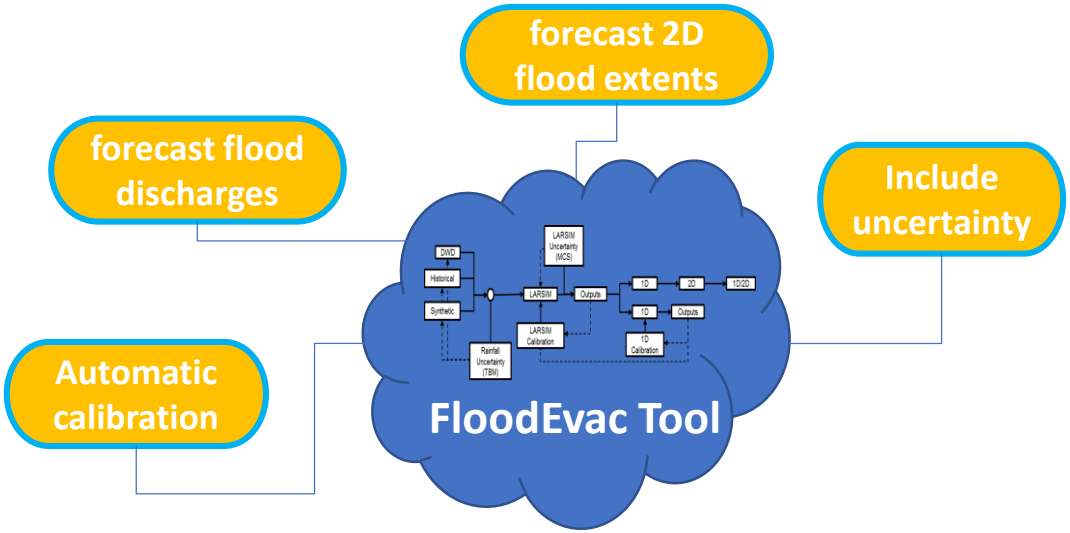
Methodology: Flood forecasting



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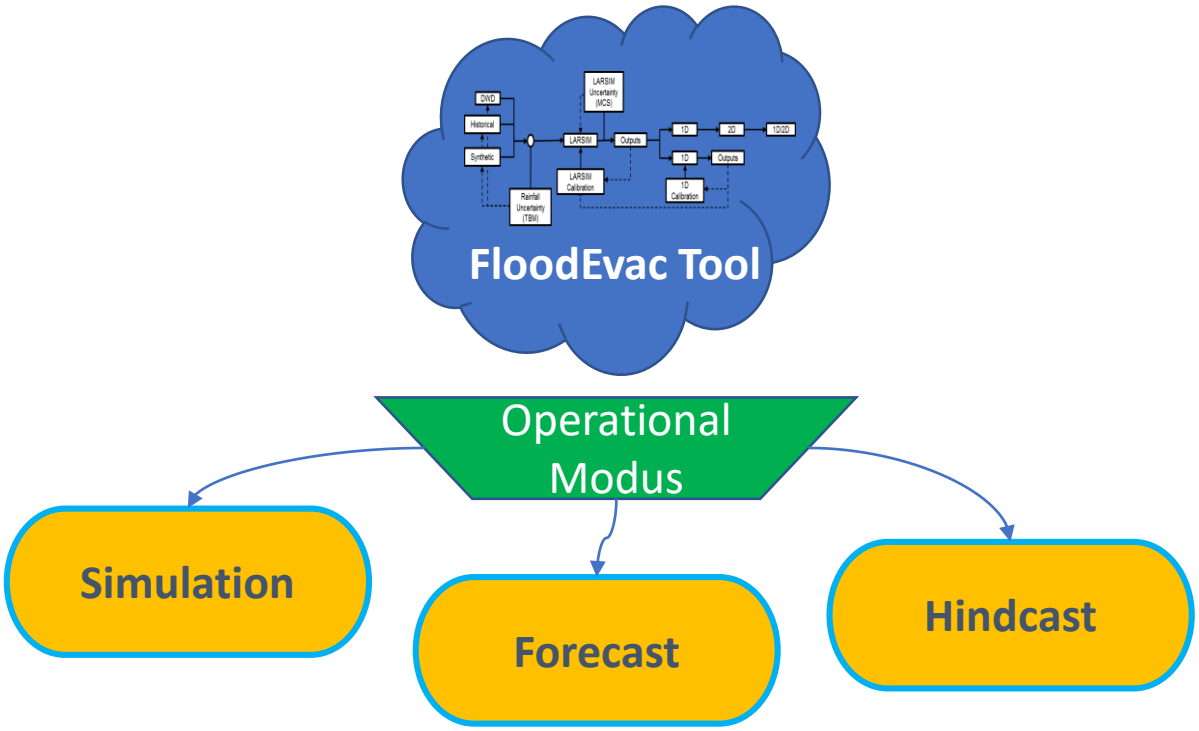

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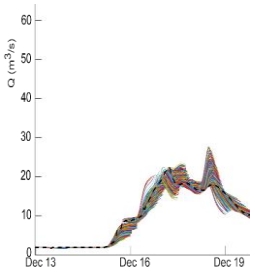
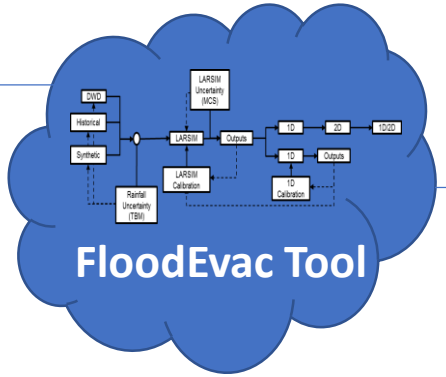
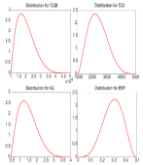


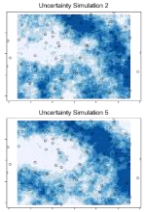
forecast flood discharges



Include uncertainty

- Model Parameter
- Rainfall





Operational Modus

Hindcast

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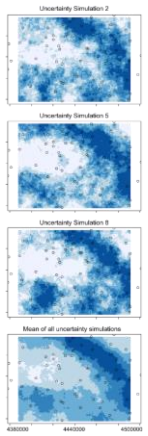
Methodology: Flood forecasting

- Checks observed or forecasted rainfall data
- Distribute the data within the whole catchment area considering **sequential conditional geospatial simulation**.
- Spatial resolution of 1 km x 1 km. (whole catchment as 4000 km^2)

Include uncertainty

- **Rainfall**

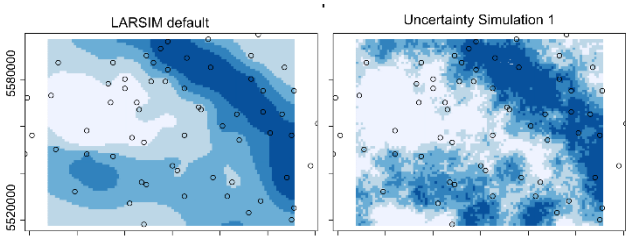


P_1

P_2

...

P_m



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Methodology: Flood forecasting

- Sensititivity analisys on the paremeters
- 8 out of 34 are selected
- **Monte Carlo for generation of ensemble of models**
- LARSIM Model from Flood Forecast Center – LFU

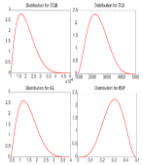
MP_1

MP_2

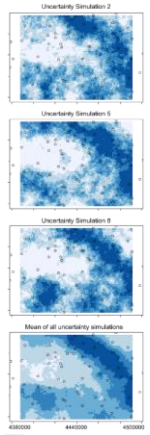
...

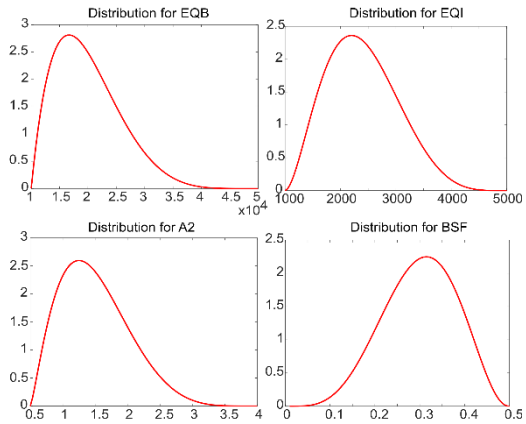
MP_n

Include uncertainty



- **Model Parameter**
- **Rainfall**





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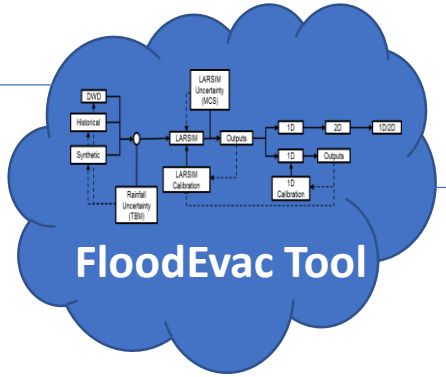
Methodology: Flood forecasting

forecast flood discharges



Include uncertainty

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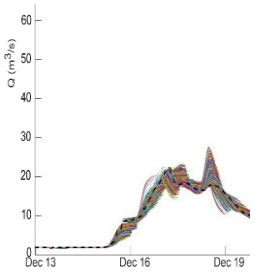
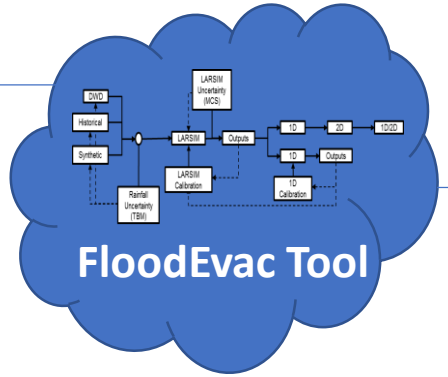
Methodology: Flood forecasting



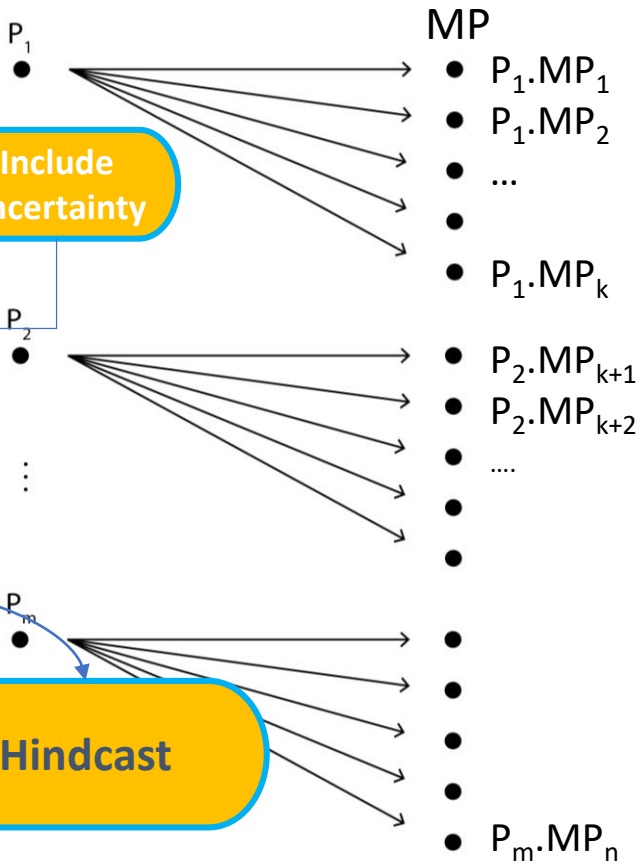
forecast flood discharges



Include uncertainty

Operational Modus

Hindcast



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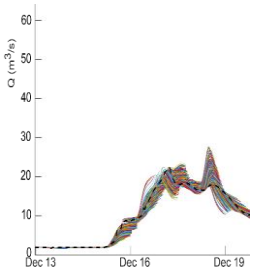
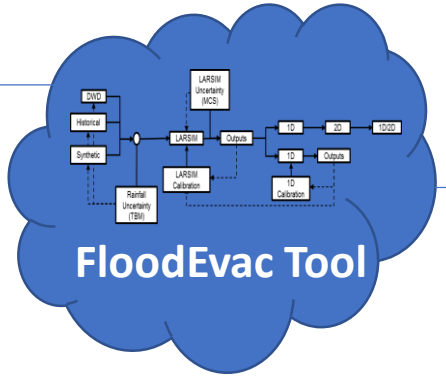
Methodology: Flood forecasting



forecast flood discharges



Include uncertainty

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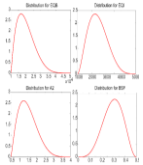
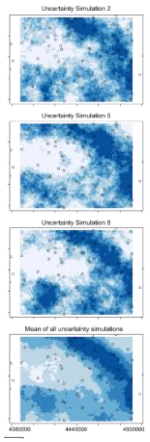
- **Rainfall**





- one year warm-up period
- forecast is repeated every hour, length of 12 hours
- 50 MP (parameter sets) and 10 P (rainfall sets)
- 25 minutes (3 core desktop in parallel)

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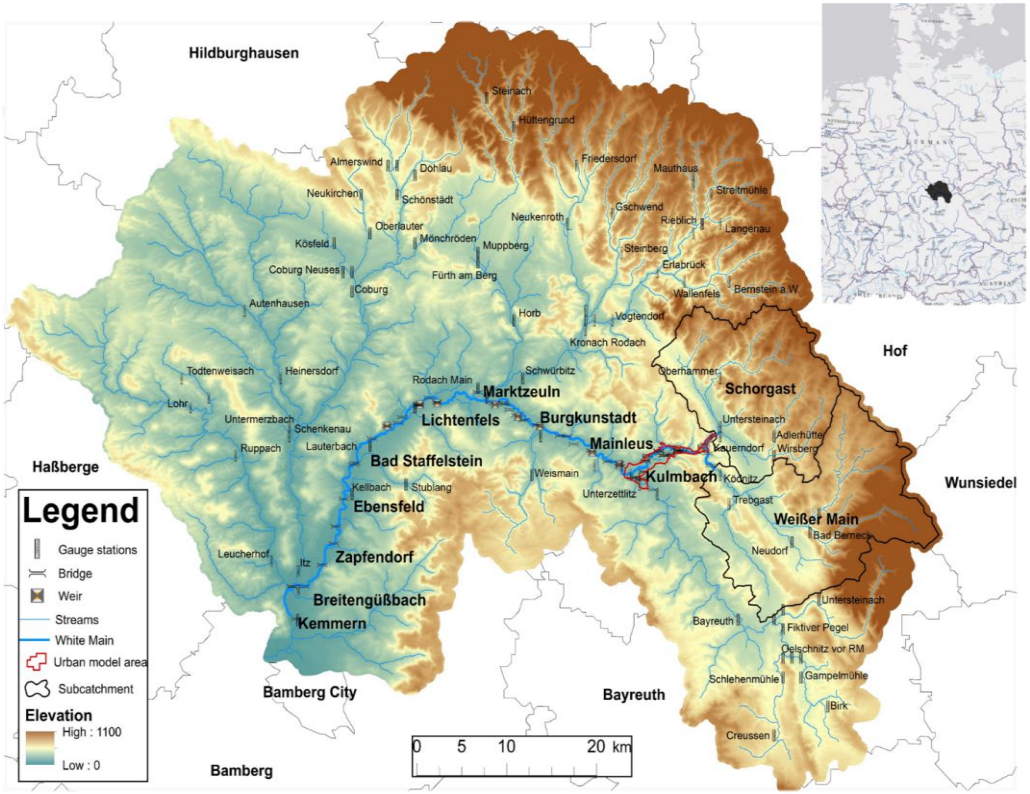
Case study: Upper Main catchment, Kulmbach

- Germany, Bavaria
- Area=4244 km^2
- December, 2012
- January, 2011
- January, 2012



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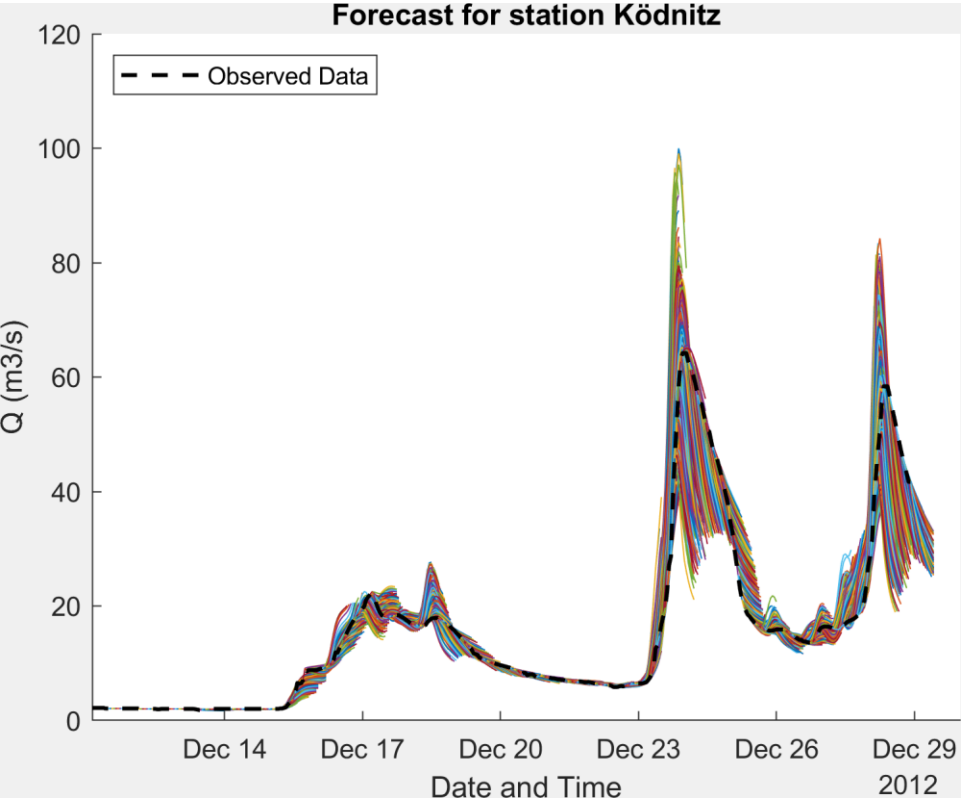
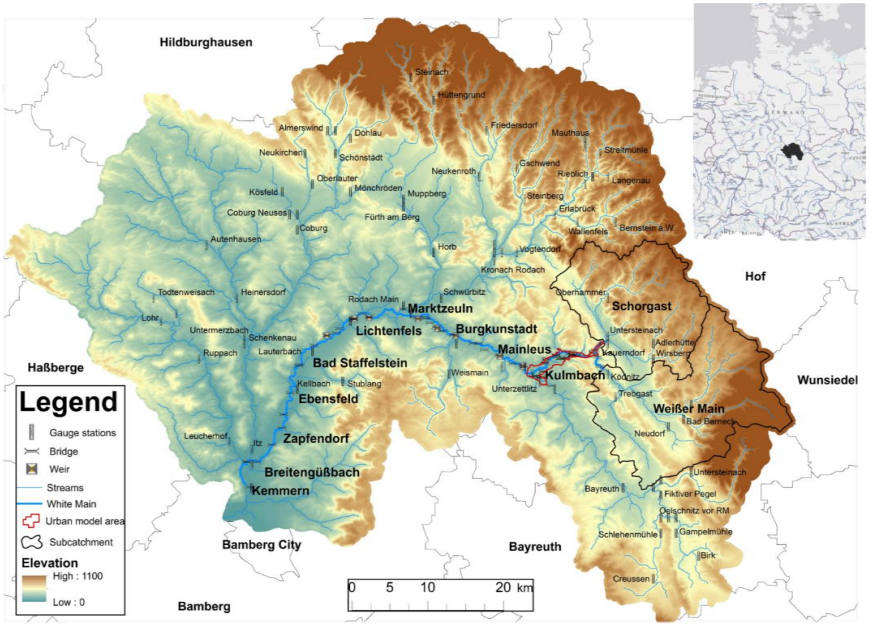
Results: flood forecasting Dec-2012





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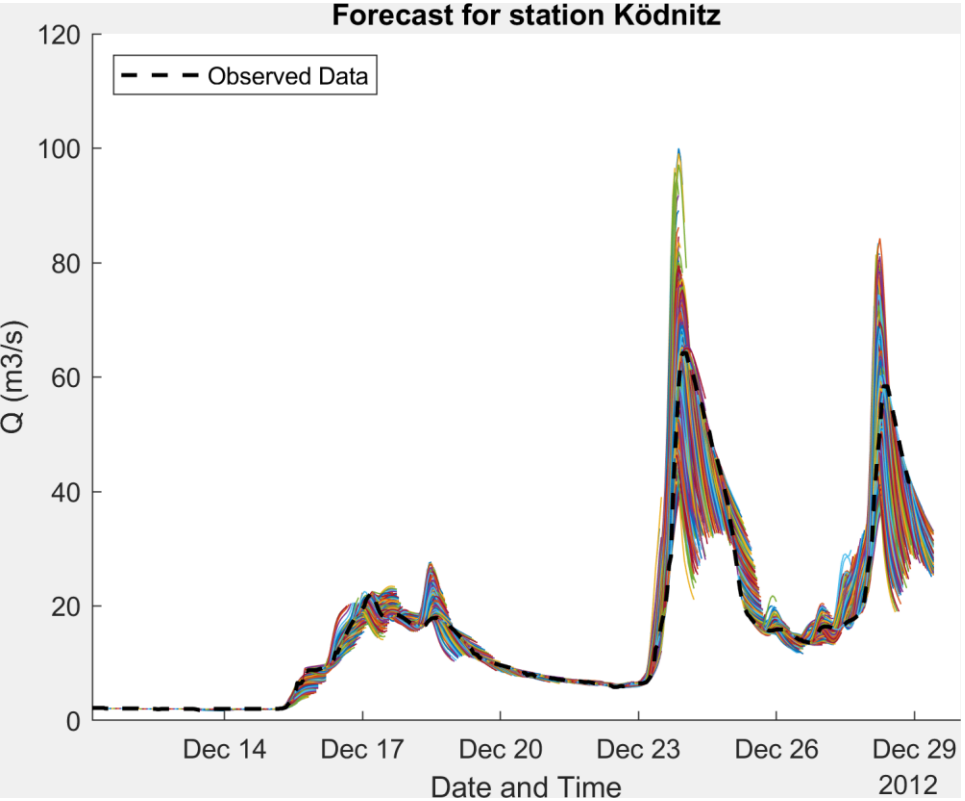

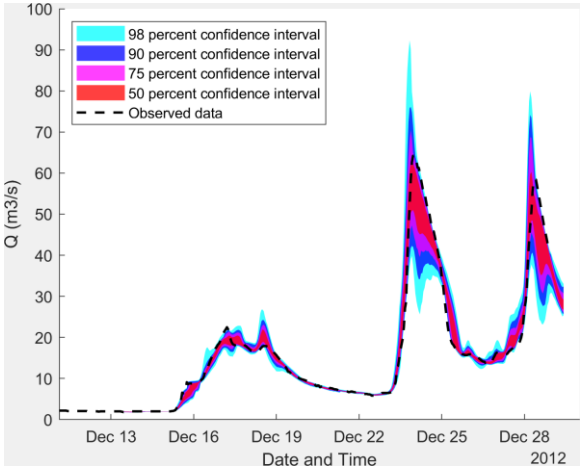

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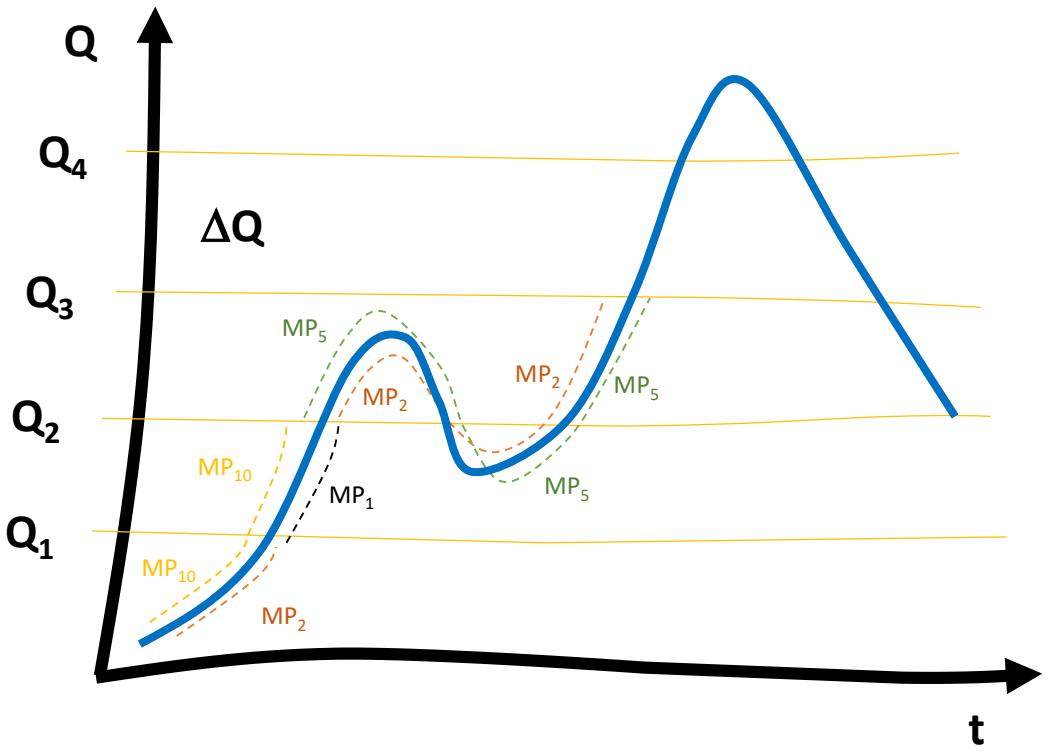
Methodology extension



ΔQ	up	lr
0-Q_1	MP_2	MP_{10}
Q_1-Q_2	MP_1	MP_{10}
Q_3-Q_4	MP_5	MP_2
....	....	...
....		

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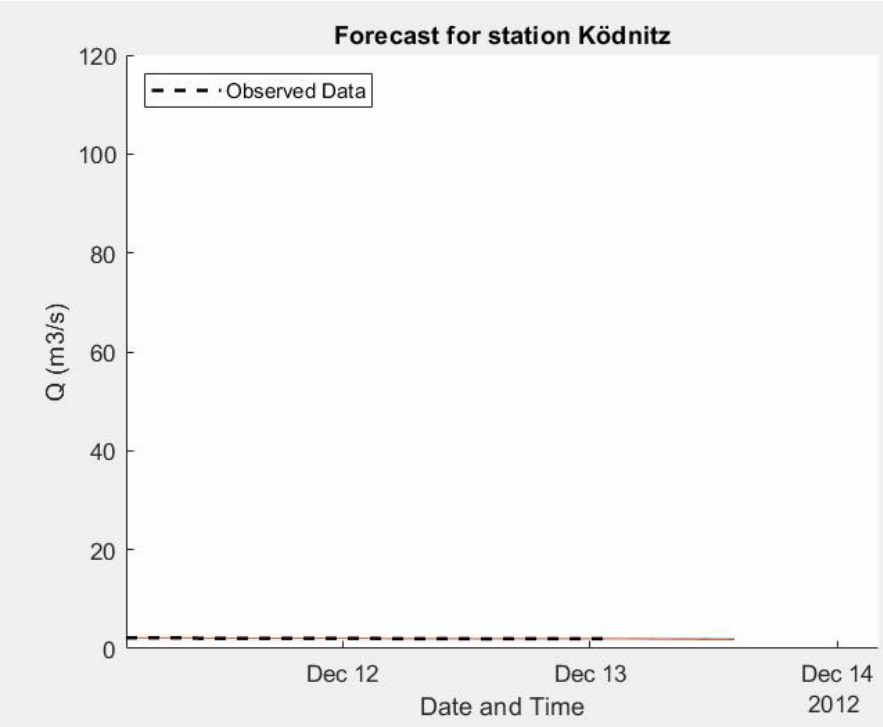
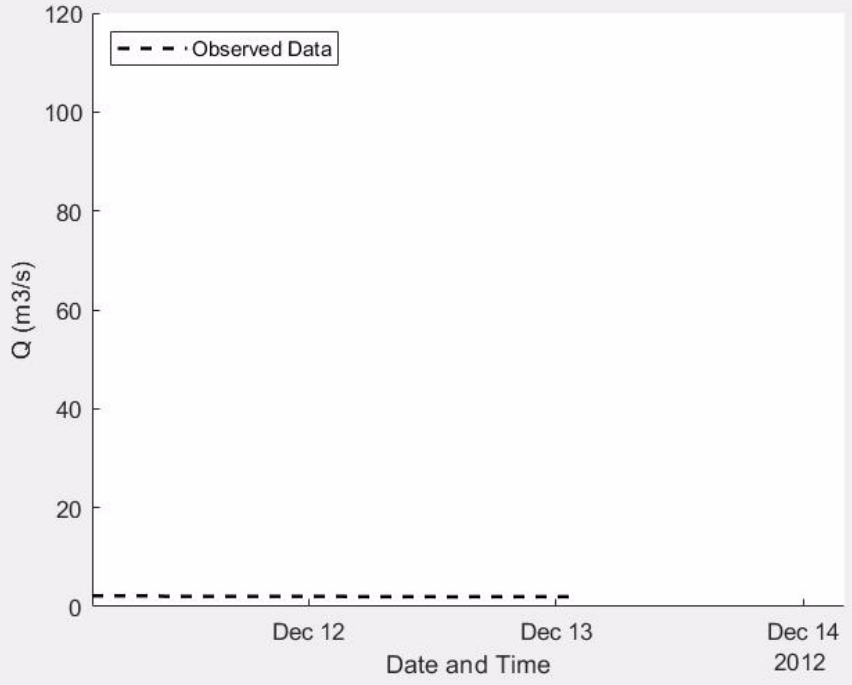
Validation: Event 1 Dec-2012





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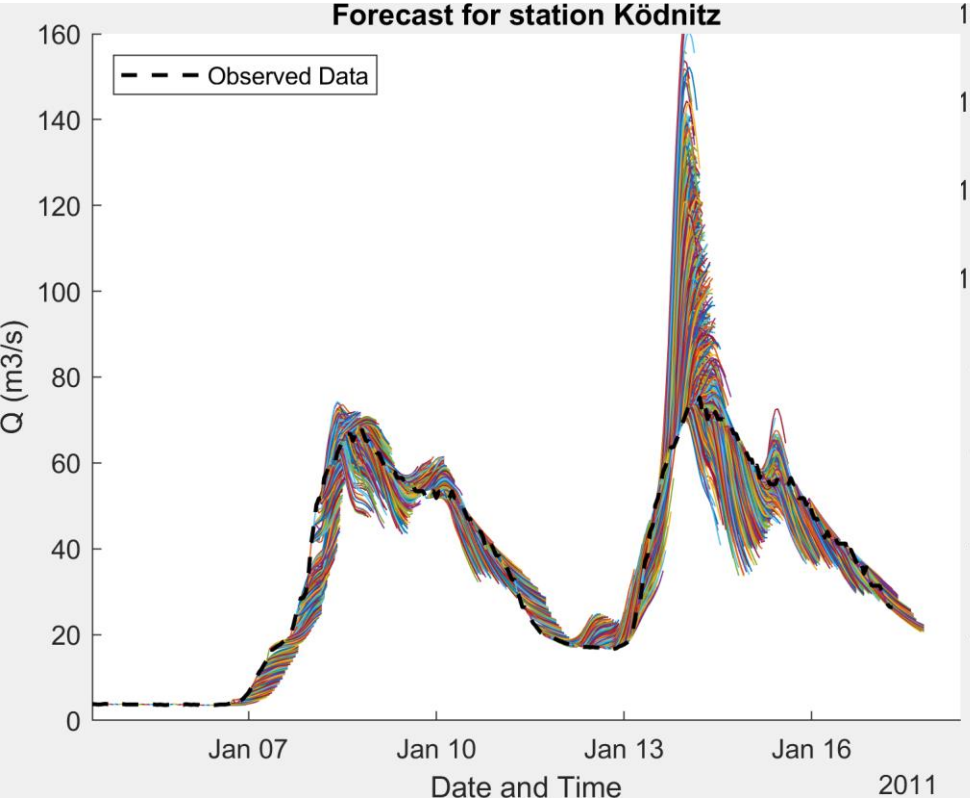
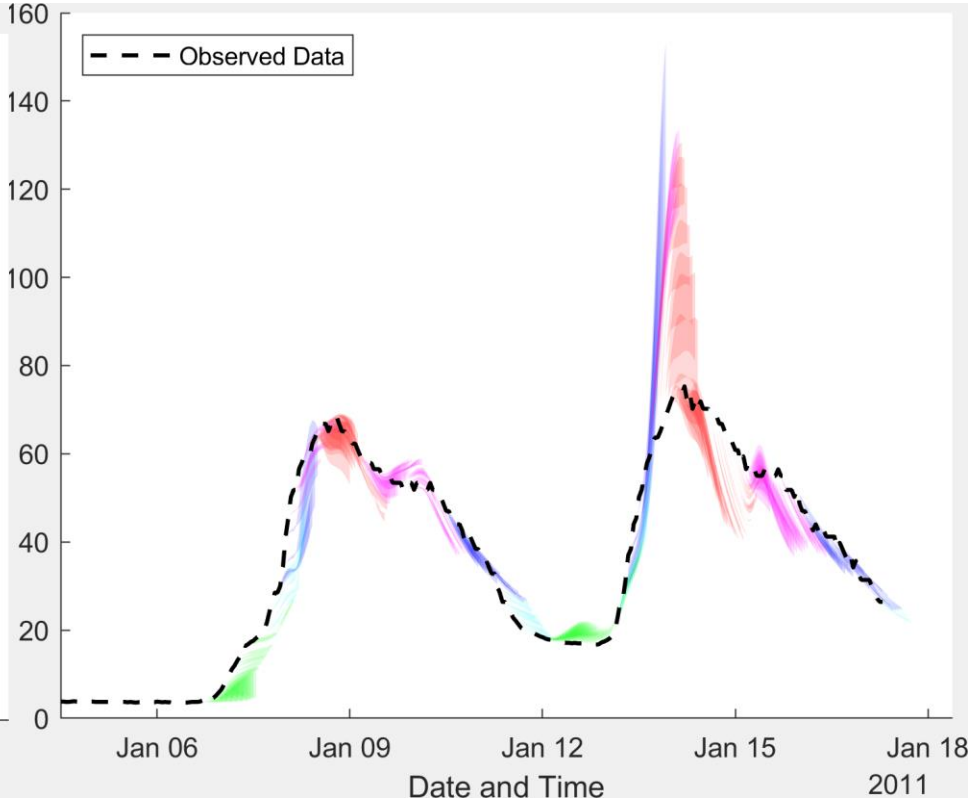
Validation: Event 2 Jan-2011





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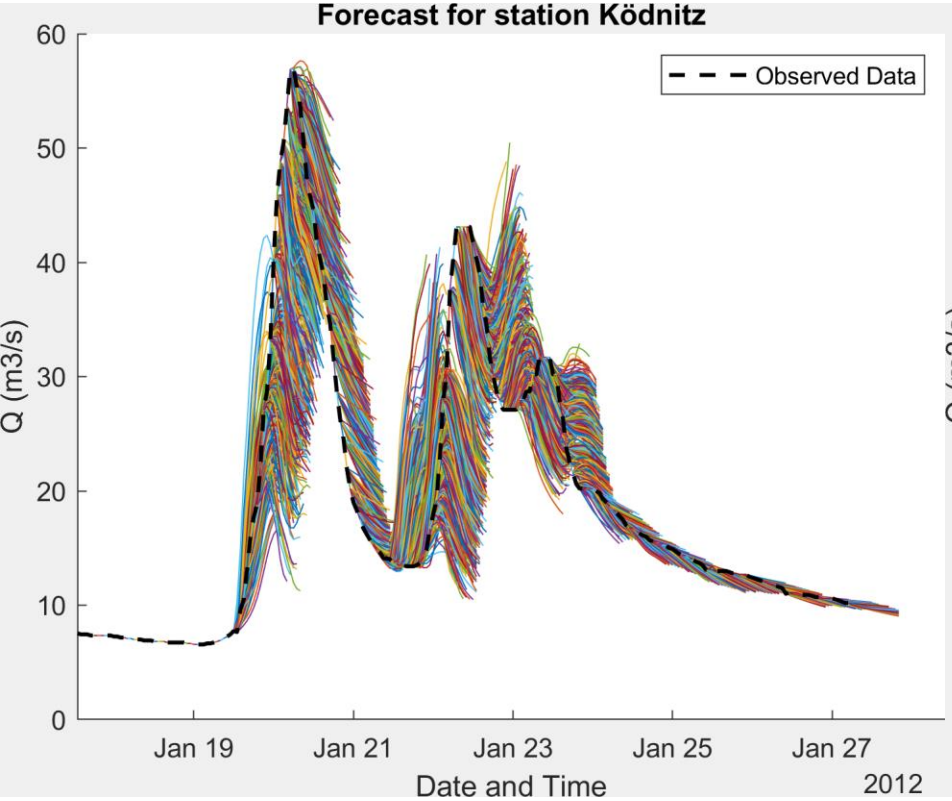
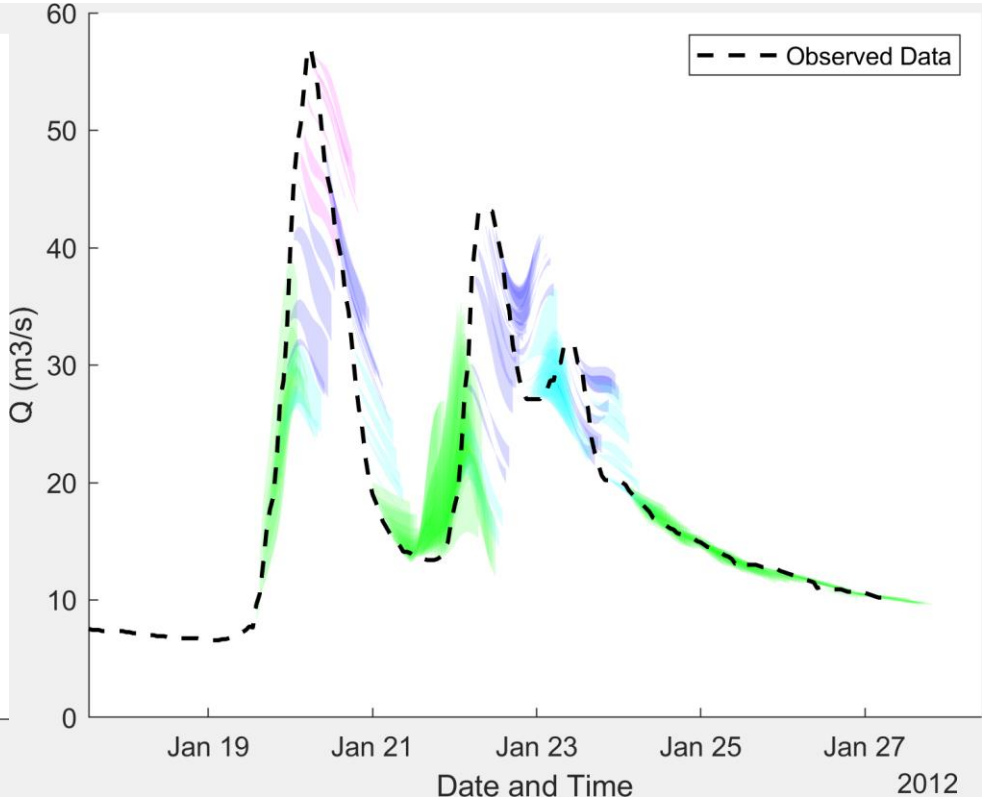
Validation: Event 3 Jan-2012





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Conclusions

- Flood forecasting with uncertainty using a fully automated flood model chain: FloodEvac tool
- A case study: City of Kulmbach
- Possible to reduce the uncertainty band in the forecasts
- Possible to improve computational time
- Validated in 3 Events

Acknowledgement

The tool is developed within the **FloodEvac project** funded by the *Bundesministerium für Bildung und Forschung* (**BMBF, FKZ 13N13196** (TUM)).

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Thank for your attention!

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