



→ MEASUREMENTS AND OBSERVATIONS IN THE 21st CENTURY CONFERENCE

Moving cars for rainfall estimation – laboratory and computer experiments

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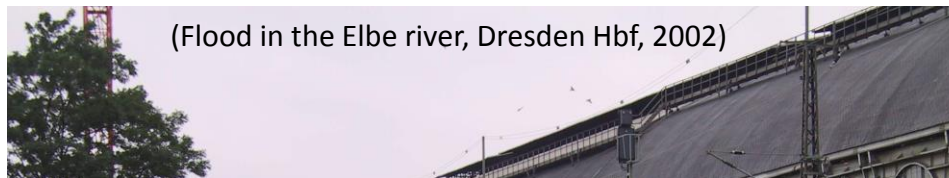
Outline

- Introduction and Motivation
- Moving cars measuring rainfall – laboratory experiments
- Areal rainfall estimation using RainCars – computer experiments including hydrological modeling

1: Introduction and Motivation

I. Rainfall is an important input for hydrological analyses.

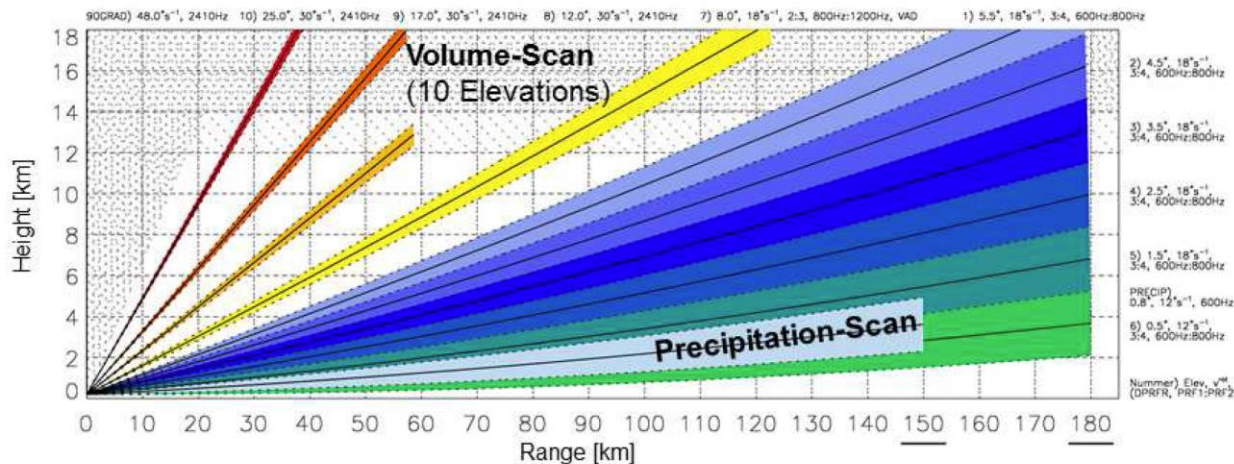
II. How to



II

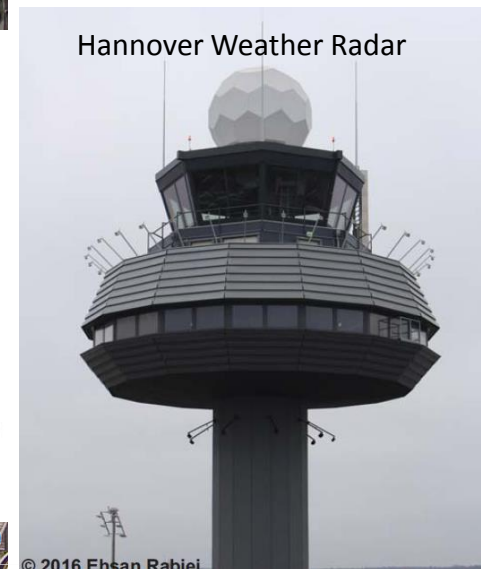
IV

V



DWD Weather Radar Scan strategy (HELMERT et al., 2014)

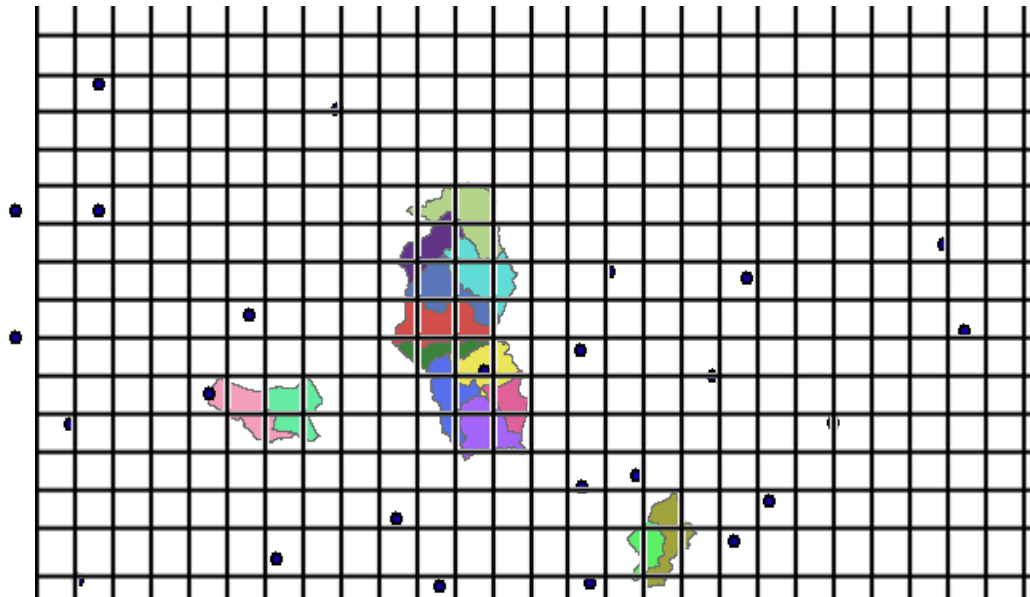
Hannover Weather Radar



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1: Introduction and Motivation

VI. Rainfall data and areal rainfall estimation



Areal precipitation is the precipitation depth averaged over a specific region with a defined area (DIN 4049).

2: RainCars - laboratory experiments

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Hydrology and
Earth System
Sciences



Rainfall estimation using moving cars as rain gauges – laboratory experiments

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2: RainCars - laboratory experiments

Why investigating moving cars as sensors measuring rainfall?

- I. They observed to be useful by Haberlandt and Sester (2010).

Objectives

- I. Deriving
- II. Investigating

How could

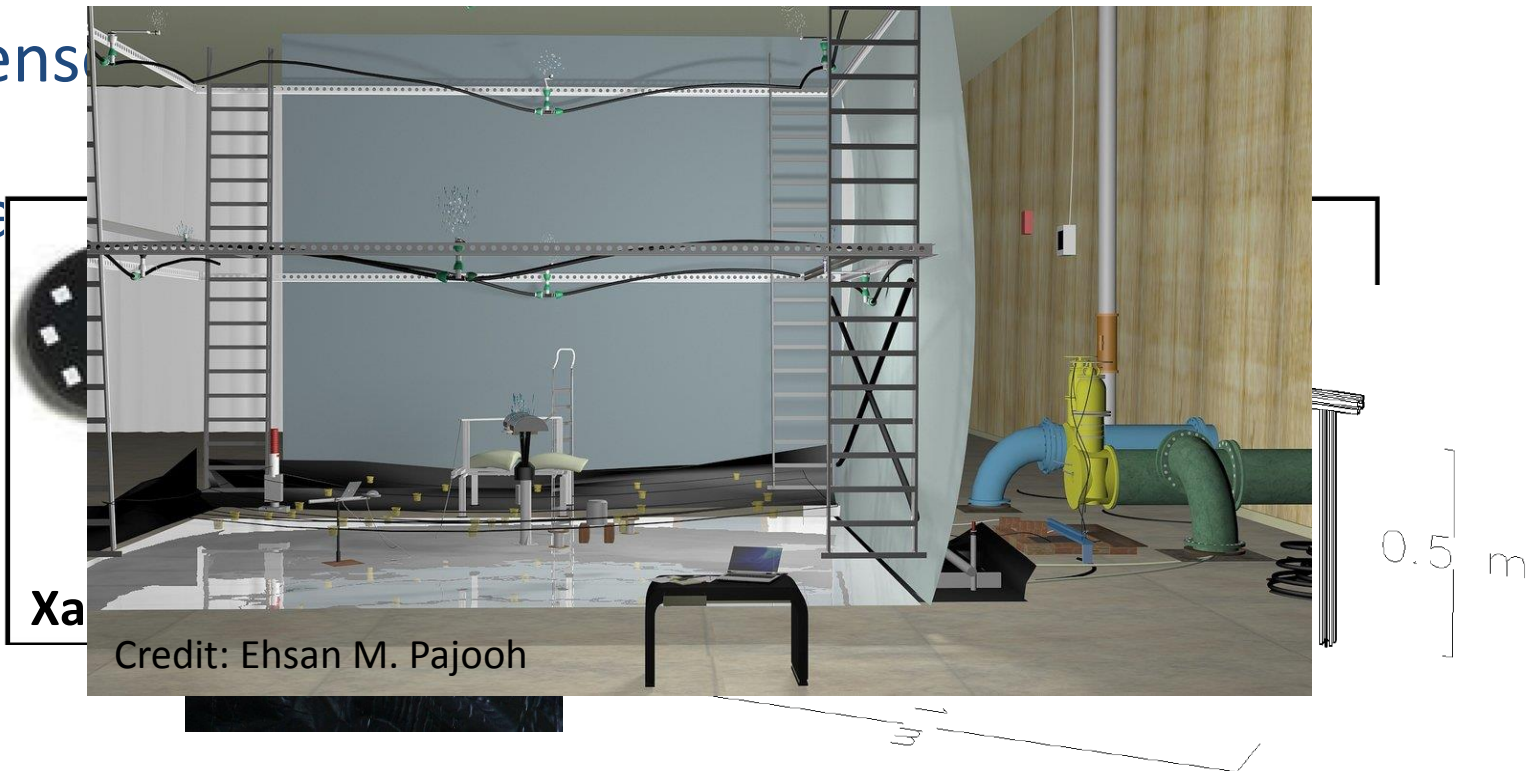


2: RainCars - laboratory experiments

- Rainfall simulator

- Sensor

- Camera



2: RainCars - laboratory experiments

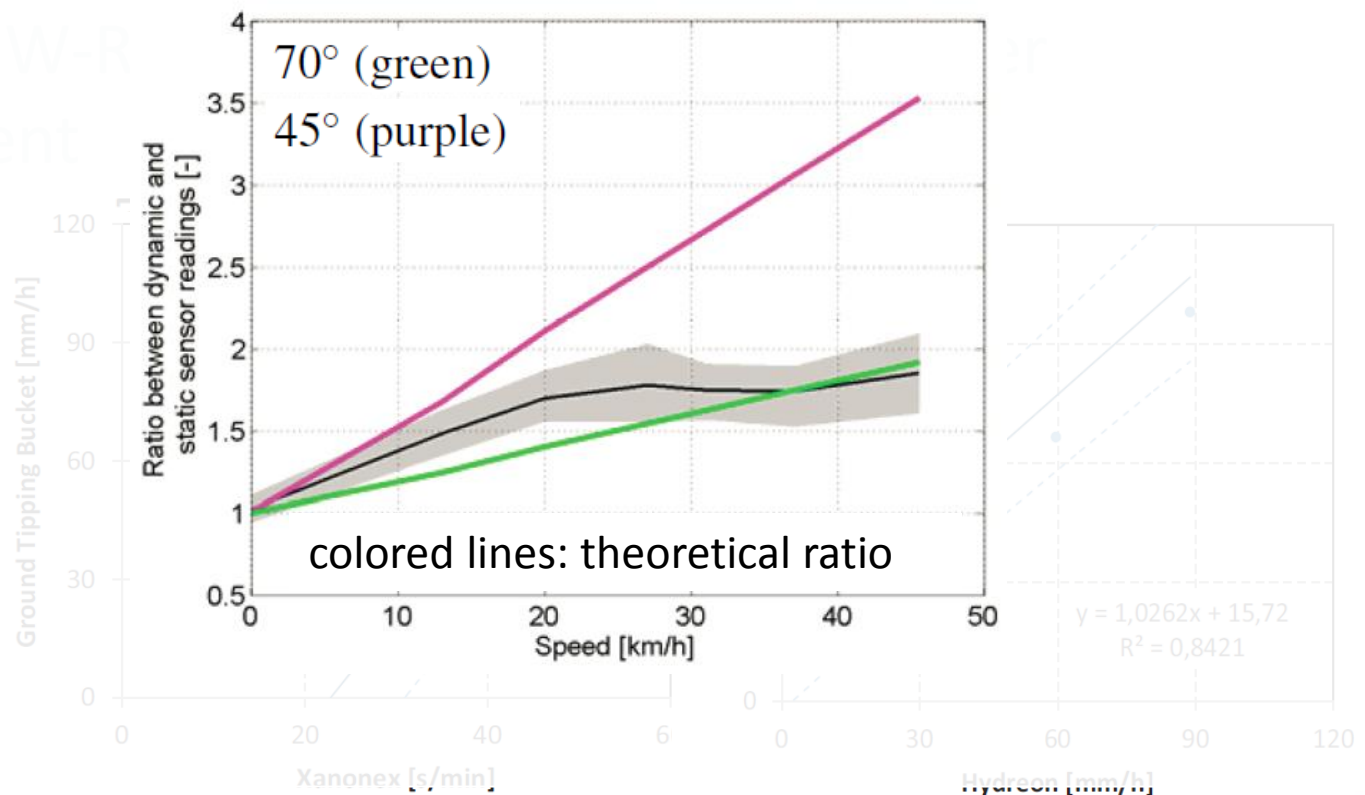
Conclusion:

I. A strong W-R adjustment

II. Promising

III. A relation

IV. The sens



3: RainCars - computer experiments

Hydrol. Earth Syst. Sci., 20, 3907–3922, 2016
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Hydrology and
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Areal rainfall estimation using moving cars – computer experiments including hydrological modeling

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3: RainCars - computer experiments

Following the results of laboratory experiments:

- I. Is the accuracy of optical sensors sufficient for areal rainfall estimation as well as discharge simulation?
- II. What is the minimum required accuracy for RCs?
- III. What is the influence of having different number of RCs?

Better assessment of the value of RainCars!

3: RainCars - computer experiments

- Study area and data:
[2006 to 2010]

Legend

- Rain Gauges
- ▲ Radar station
- Radar Range

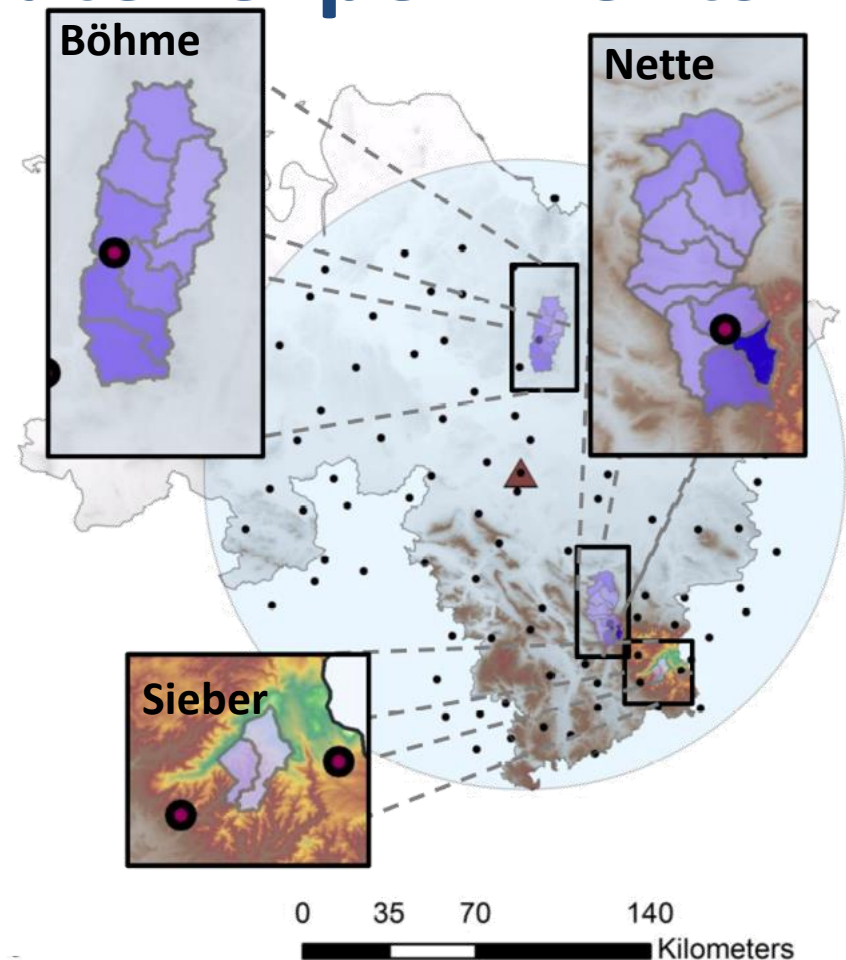
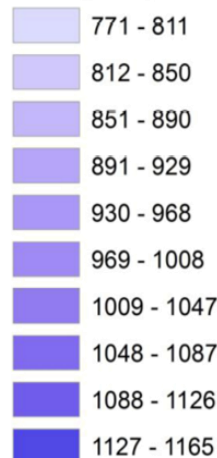
DEM

Value

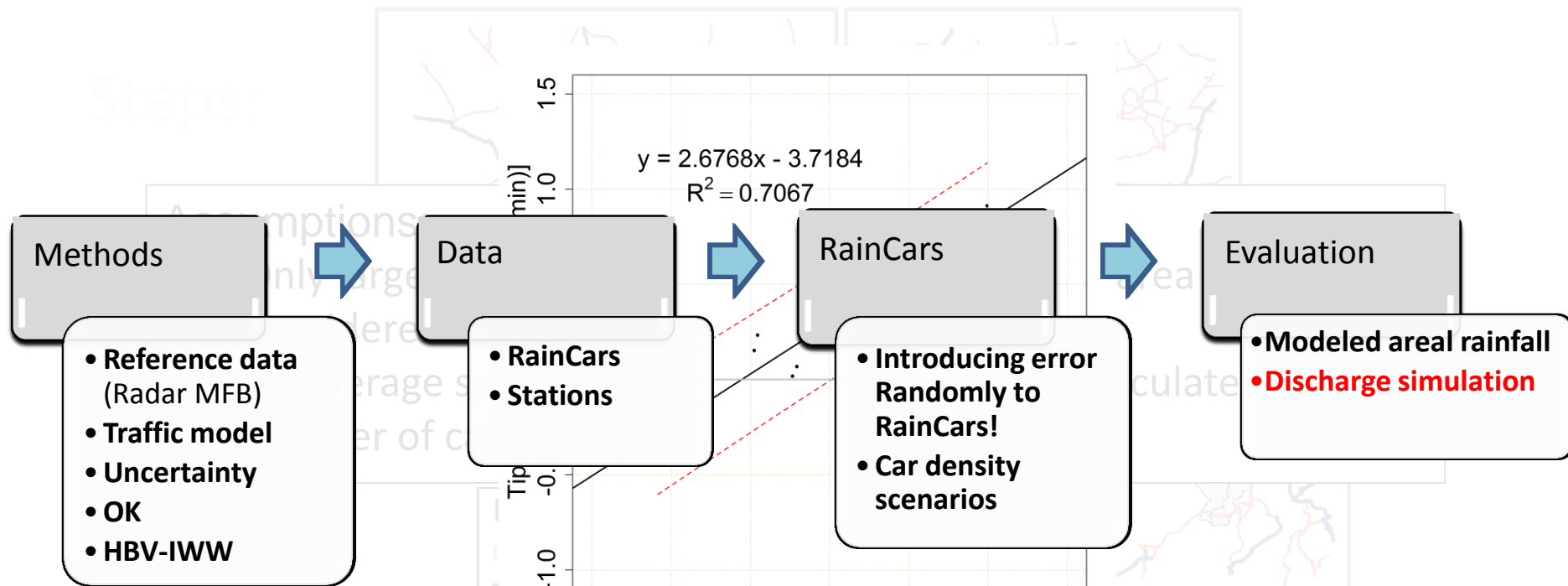


Yearly Avg.

Rain [mm]



3: RainCars - computer experiments



Compared with reference!

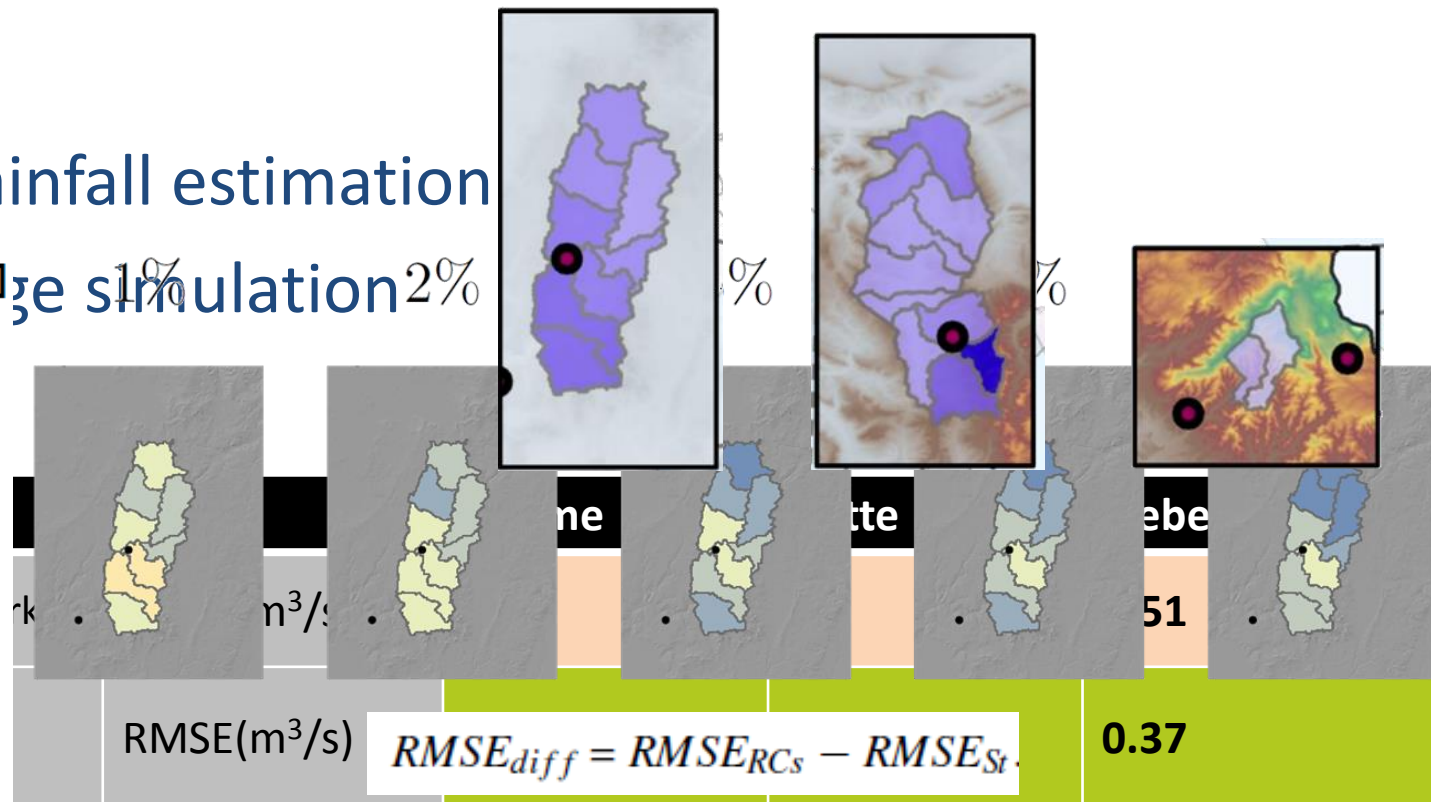
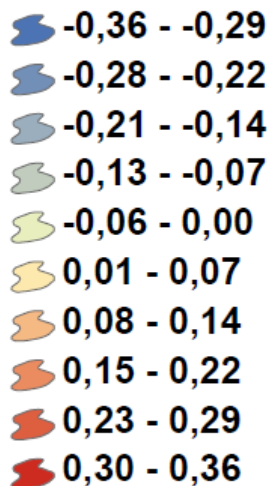
3: RainCars - computer experiments

Evaluation:

RainCars

- Areal rainfall estimation

RMSE_diff [mm/h]



3: RainCars - computer experiments

Evaluation: (Simulated discharge)

2. Different RainCar index (5% (Lab) uncertainty)

		St.	$\sigma^2=0.0$	$\sigma^2=0.01$	$\sigma^2=0.021$ [Lab]	$\sigma^2=0.04$	$\sigma^2=0.09$
Böhme	RMSE(m ³ /s)	0.98	0.34	0.38	0.57	1.05	2.64
Nette	RMSE(m ³ /s)	2.8	0.65	0.52	0.76	1.56	4.19
Sieber	RMSE(m ³ /s)	0.51	0.37	0.36	0.37	0.43	0.71

3: RainCars - computer experiments

Conclusions:

1. Improvement of the quality of modeled areal rainfall and the corresponding discharge simulation by RainCars
2. RainCars were observed to be useful up to a certain level of uncertainty
3. RainCars density was observed to be an influential factor, depending on the catchment characteristics

Thanks for your attention!



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