Impact of the analysis method on an Hydrological model

Skawa Catchment

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01 - Introduction: Study Area

Skawa Basin, Poland

Subcatchment	Area (km²)
Bystrzanka Cisnowa	42.81
Bystrzanka od Zrodla	36.59
Skawa od Zrodla	45.73
Od Pozogi do Malejowki	32.71
Od Malejowki do Bystrzanki	45.26
Od Bystrzanki do Osielca	36.98
Total Area	**240.08**

- Elevation: 700 to 1100 m;
- Annual rainfall: 700 to 1200 mm;
- Flash floods: 2010, 2014 and 2019.

Figure 1: Catchment location.

02 - Methodology

- HEC-HMS
  - Rainfall data: Observed (rain gauge); Radar vs Satellite
    - Radar: spatial 1 km - temporal 10min
    - Satellite: spatial 12.5 km - temporal 30 min
  - Setting up the hydrological model
  - Semi-distributed

Parameters for transform method

Curve Number [-]	Initial Abstraction [mm]	Impervious [%]
41.18	27.21	2.2516
43.02	25.23	1.4947
50.88	18.39	1.1063
52.82	17.01	1.6057
51.51	17.39	12.093
51.73	17.77	2.0053

Parameters for loss method

Lag time [h]	Peaking coefficient [-]
5.04	0.4
3.79	0.4
3.75	0.4
4.39	0.4
5.00	0.4
2.91	0.4

Parameters for baseflow method

Initial Discharge [m³/s]	Recession Constant [-]	Threshold Flow [m³/s]
0.5	0.9	0.7
0.5	0.9	0.7
0.5	0.9	0.7
0.5	0.9	0.7
0.5	0.9	0.7
0.5	0.9	0.7

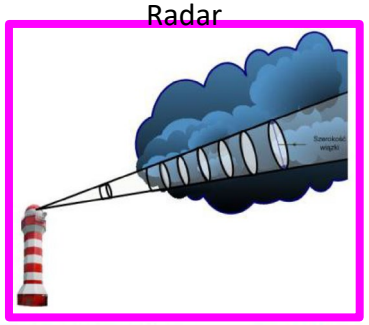
03 - Running the model: Simulation 1

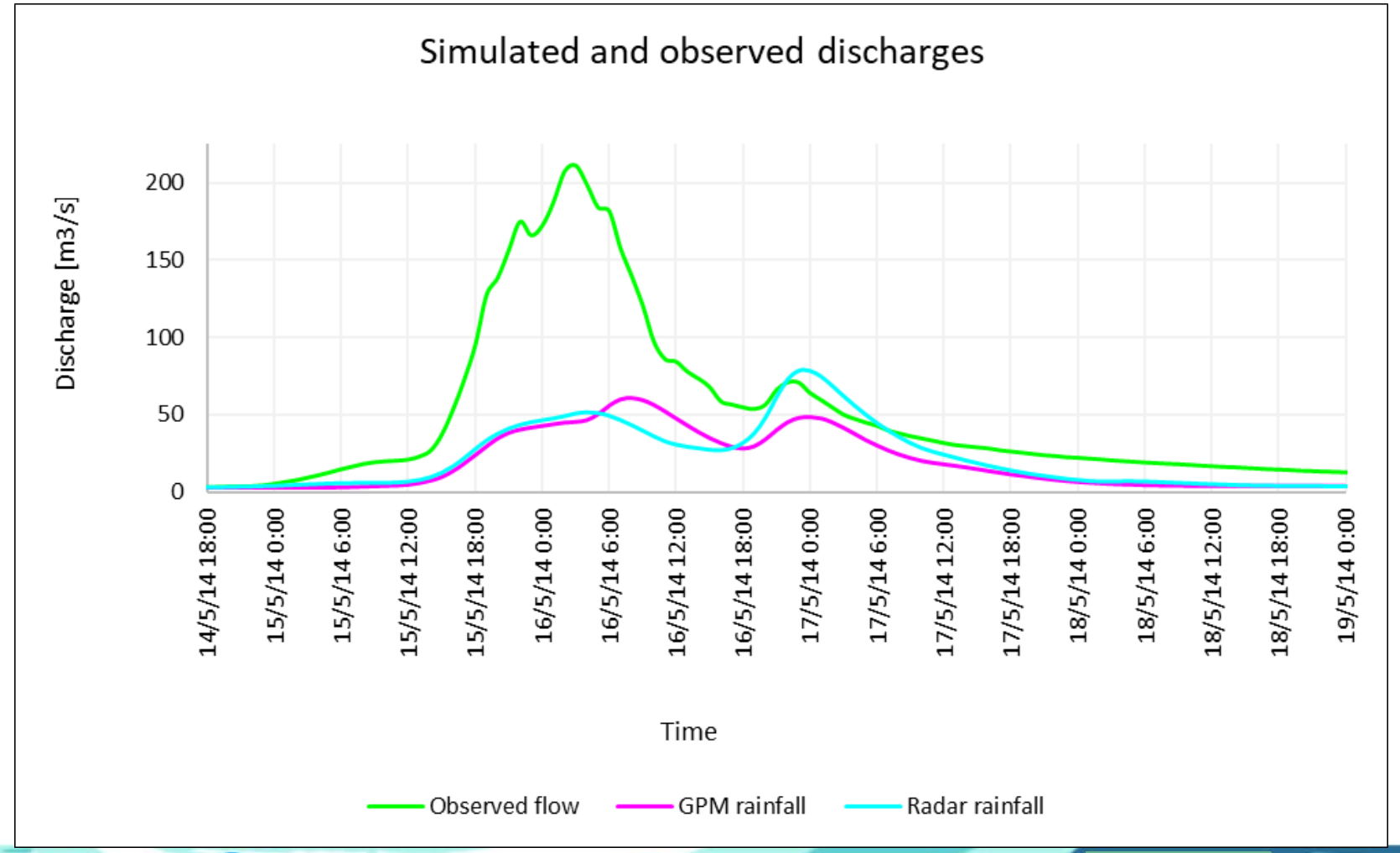
1. Rainfall data

Observed: river gauging station

Satellite GPM

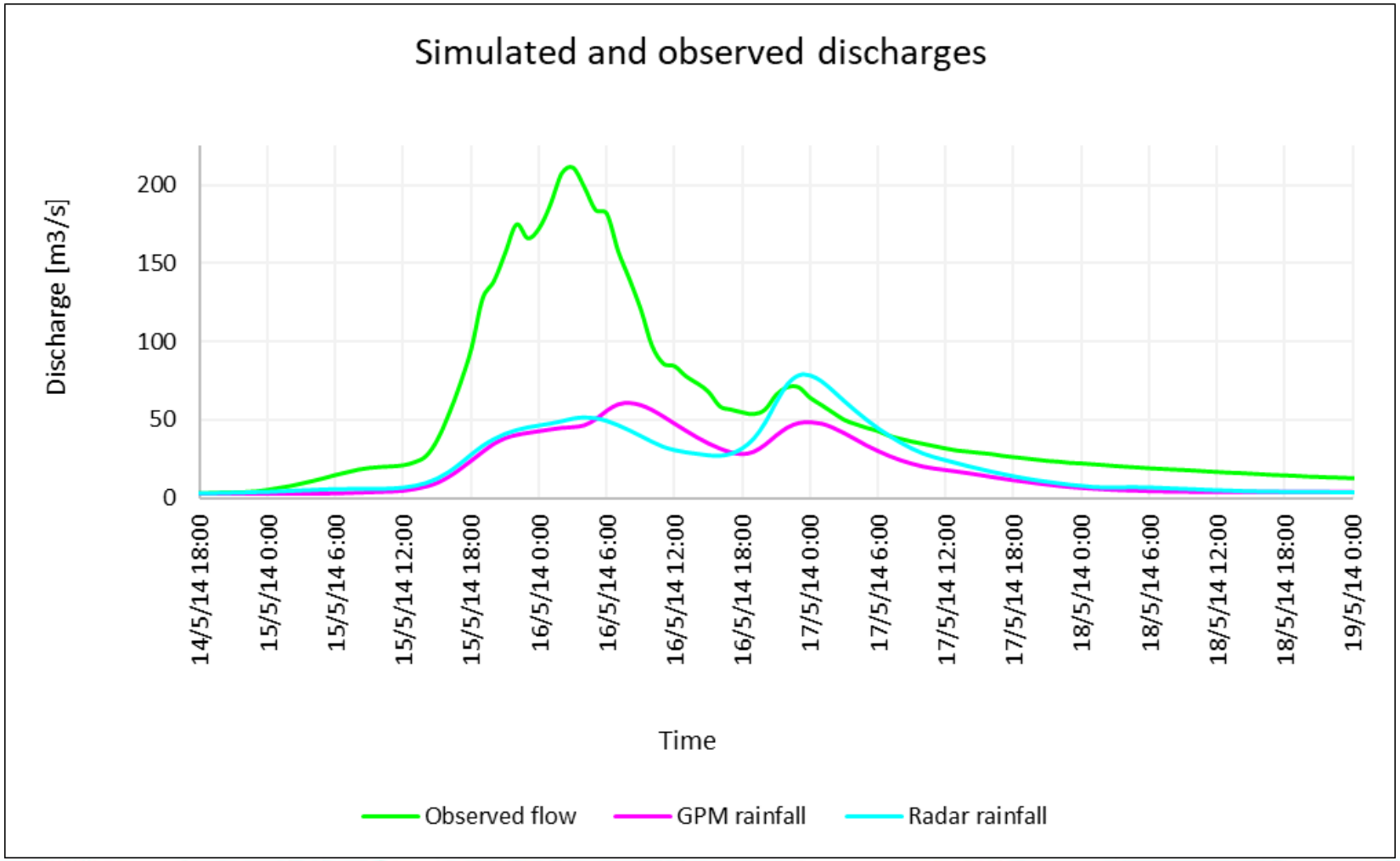
Radar





03 - Running the model: Simulation 1

1. Rainfall data



Radar

NSE	PBIAS
0.183	54.89

Satellite GPM

NSE	PBIAS
0.185	60.76

03 - AMC

AMC	Accumulation of precipitation [mm]	
	non-growing season	growing season
I	< 13	< 35
II	13-28	35-53
III	> 28	> 53

AMC I : Dry period
AMC II : Normal period
AMC III : Wet Conditions

13/05/2014	Spytkowice	Makow	Zawoja	Markowe
Accumulation [mm] (last 5 days)	13.7	11.7	18	0.8

Additional data:

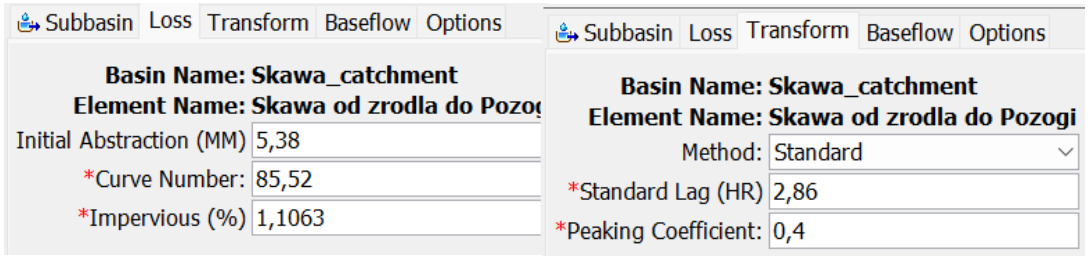
- Growing season In POLAND : 26 March to 7 November

Conclusion: Before the flood event the soil is in dry period so the initial abstraction tends to be small which means that the soil will not absorb water efficiently.

03 - Running the model: Simulation 2 - Calibration → CN

Raising of CN (Overestimation):

CN = 99

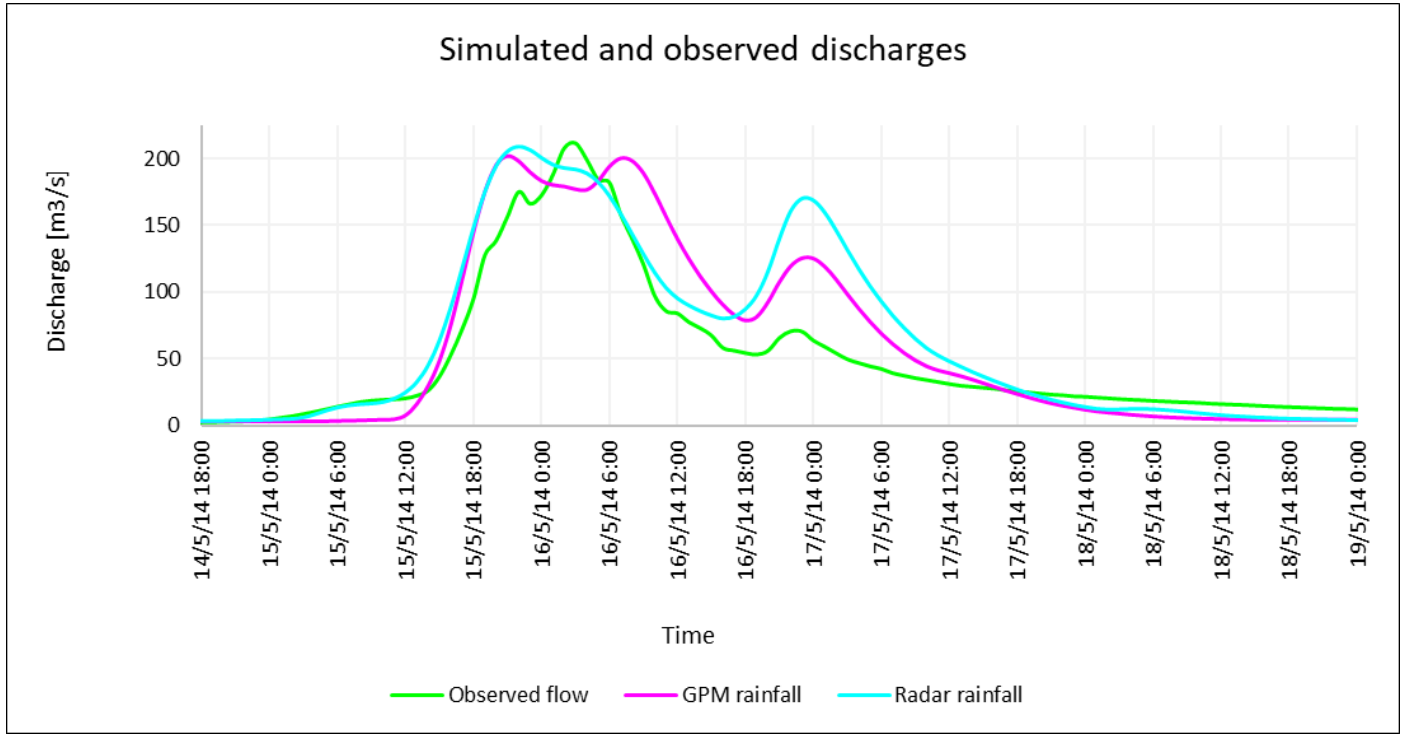


Satellite GPM

NSE	PBIAS
0.762	-17.11

Radar

NSE	PBIAS
0.671	-26.38

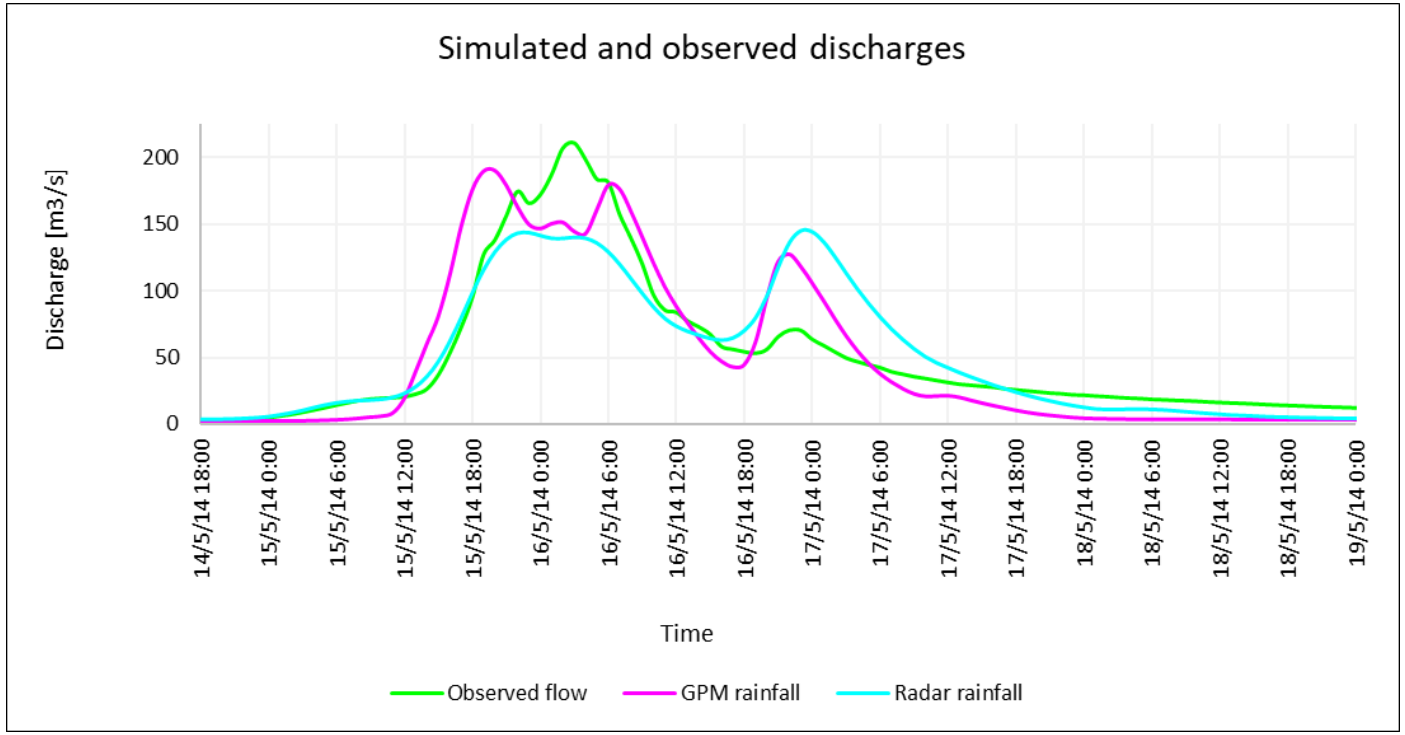


Good results in terms of calibration but not realistic.

03 - Running the model: Simulation 3 - Final Calibration → CN, Lag time and Initial Abstraction

Raising of **Curve Number**
Lowering of **Initial Abstraction**
Adjusting of **Lag Time**
Raising of **NSE**
Lowering of **PBIAS**

	Original data	Final GPM Calibration	Final Radar Calibration
Curve number	51.73	82.96	81.33
Initial Abs. [mm]	17.77	4.3	6.17
Lag Time [h]	4.15	2.61	4.15
NSE	0.18	0.84	0.82
PBIAS	60.76	3.15	0.71



04 - Sensitivity analysis with other parameters: slope, river-length and Manning's

	Initial values after calibration	+20% of LENGTH	+20% of SLOPE	+20% of MANNING
PEAK FLOW [m3/s]	190,5	186,3 ↘	192,1 ↗	187,3 ↘
VOLUME	78,40	78,38	78,40	78,39

05 - Uncertainties

Precipitation data errors

- **Radar method**
- **GPM method**

Computational errors

Land use

Initial abstraction

Meteorological conditions

06 - Conclusions

GPM method is **better** than **RADAR** method in terms of analysis of precipitations.

But, regarding all the **uncertainties** that we have, the model could comport some **errors** and not be truthful.

What we could do? Calibration with **more parameters**, analyse with **more precipitation data…**

THANK YOU!

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