Vrije Universiteit Brussel

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Institute for Water Education

Evaluating the simulation of evapotranspiration and groundwater-surface water interaction using SWAT: the river Zenne (Belgium) case study

Olkeba Tolessa Leta, Aklilu Dinkneh, Ann van Griensven, Christian Anibas, Willy Bauwens

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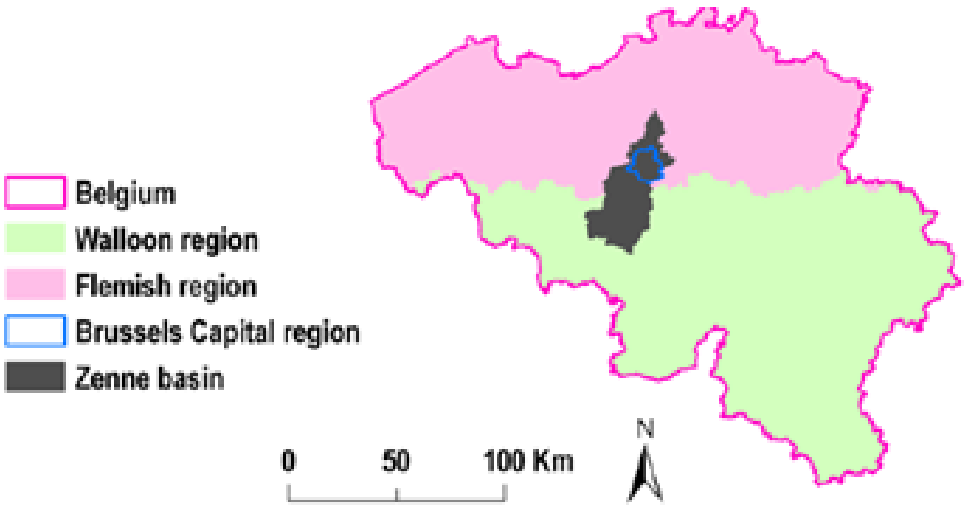
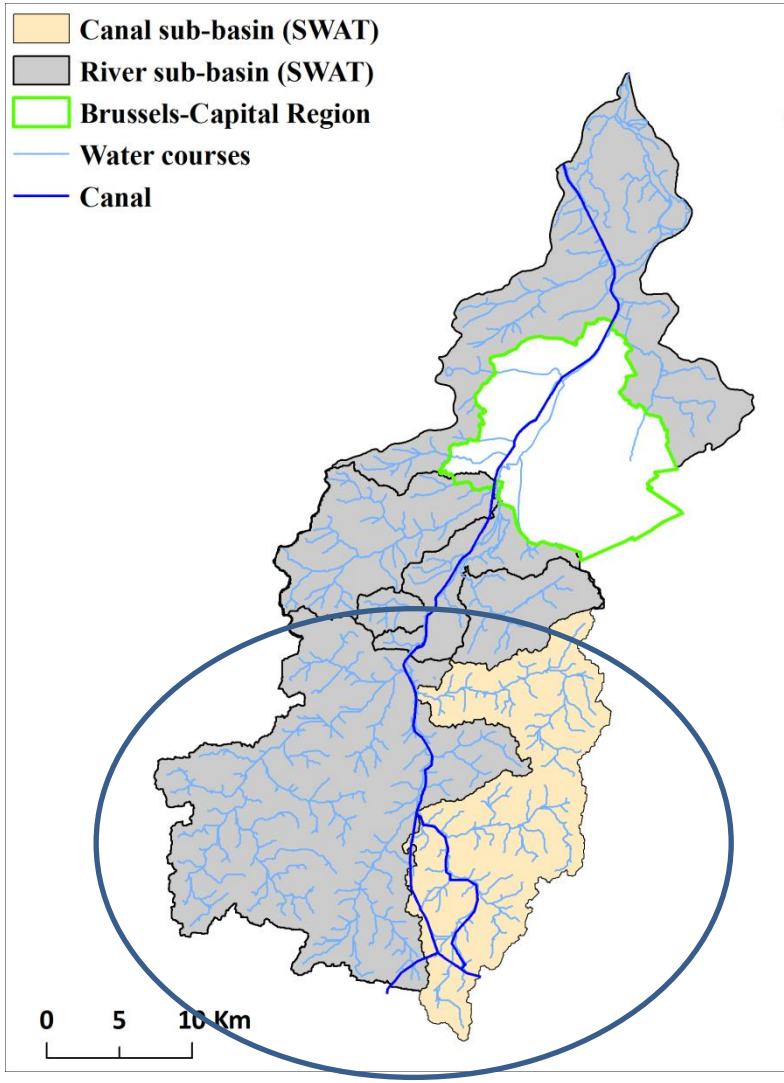
Zenne catchment

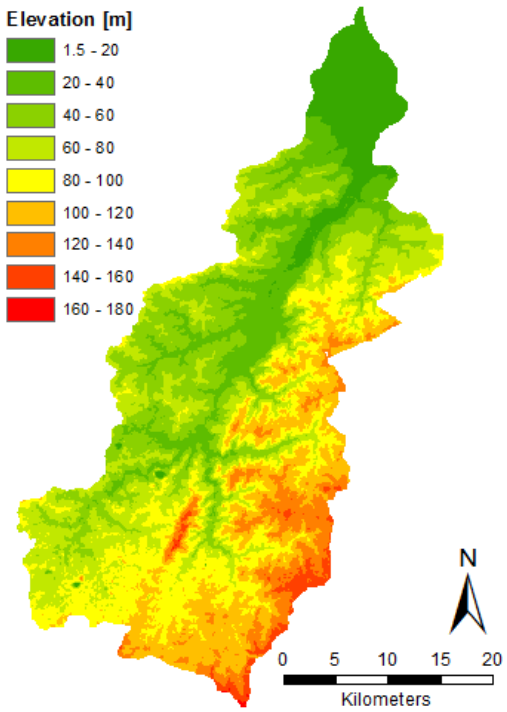
- Catchment area: 1,162 km²
- Zenne river
  - Interaction with Brussels-Charleroi canal
  - Discharge of about 10 m³/s in the Dijle river

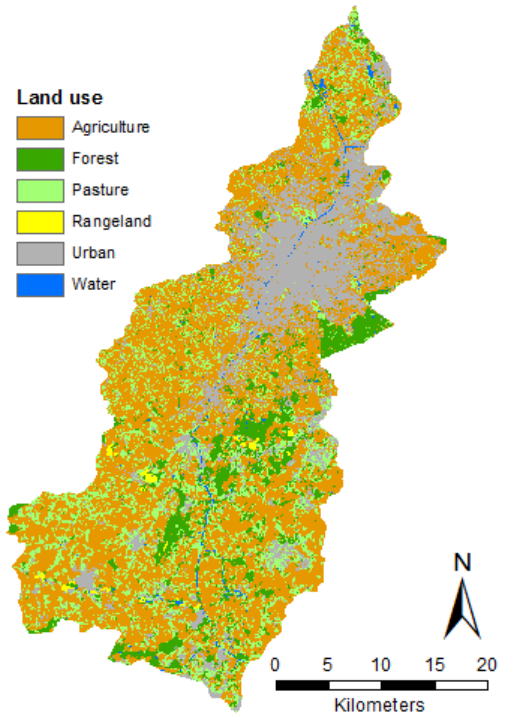




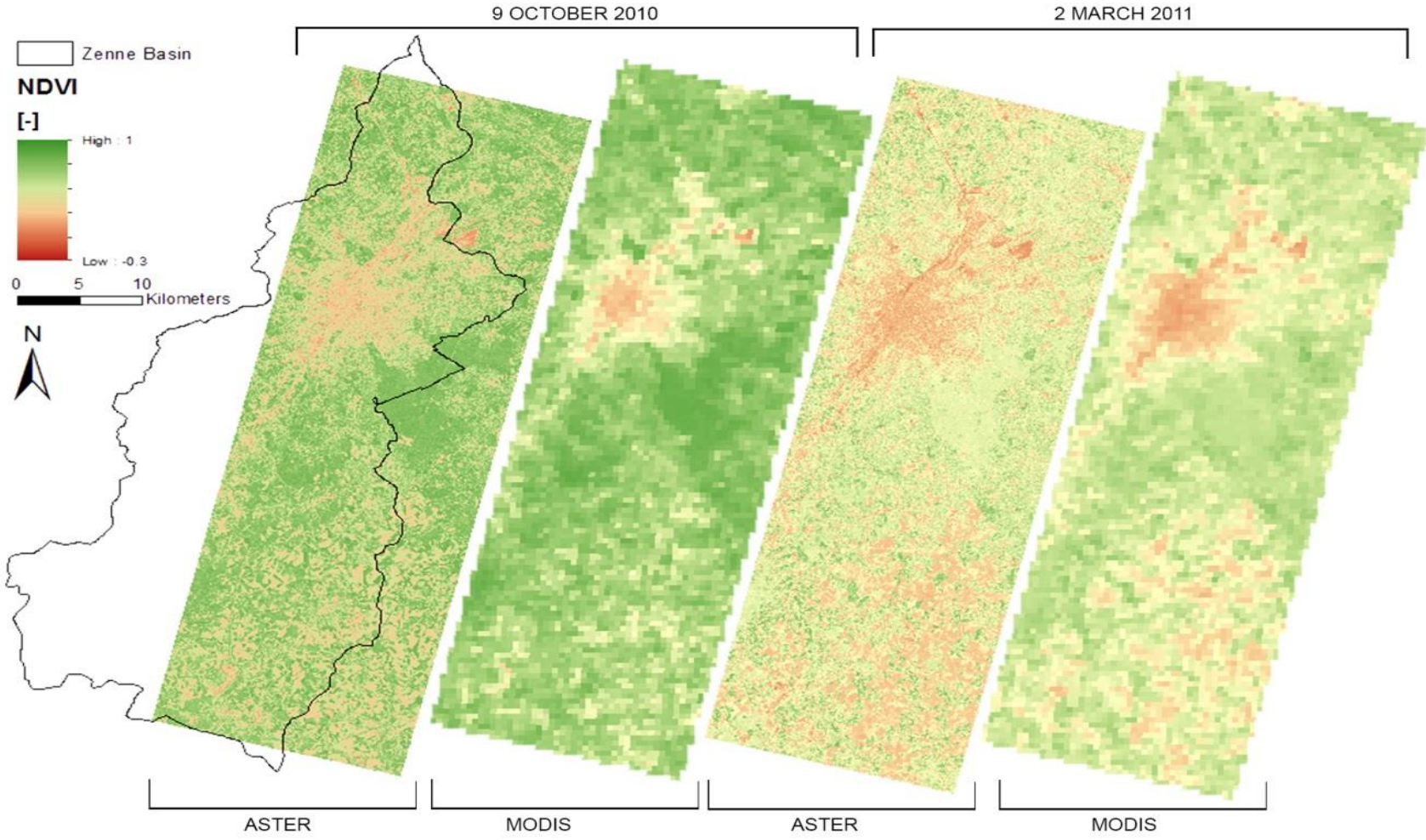
Zenne catchment

- City of Brussels, surrounded by Forest
- Land use
  - 51% agriculture
  - 19% urban
  - 18% pasture
  - 10% forest

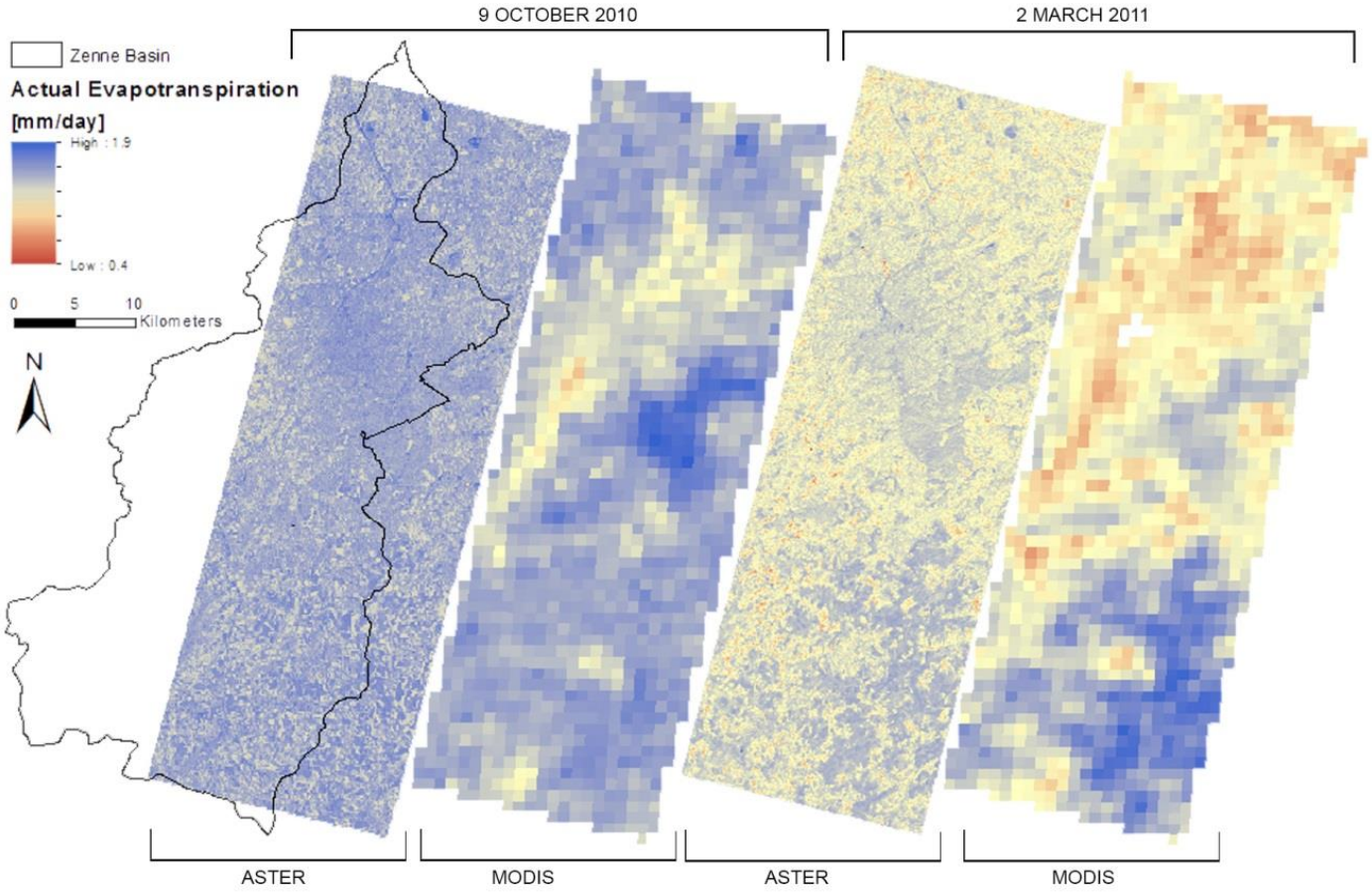




Zenne basin: Remote sensing

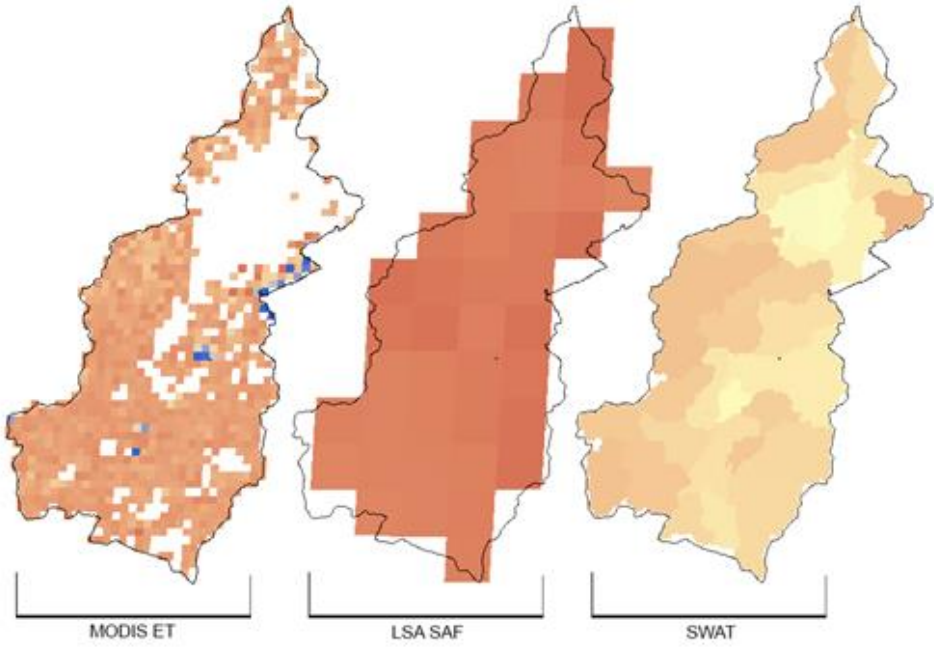


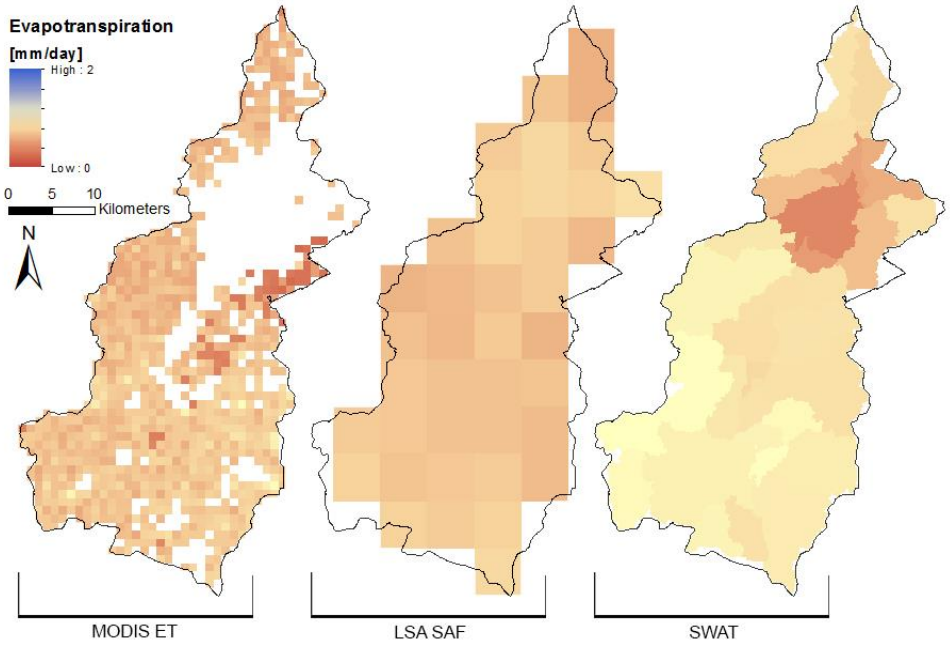
Actual ET


9 OCTOBER 2010
2 MARCH 2011
Zenne Basin
Actual Evapotranspiration
[mm/day]
High : 1.9
Low : 0.4
0 5 10
Kilometers
N
ASTER
MODIS
ASTER
MODIS

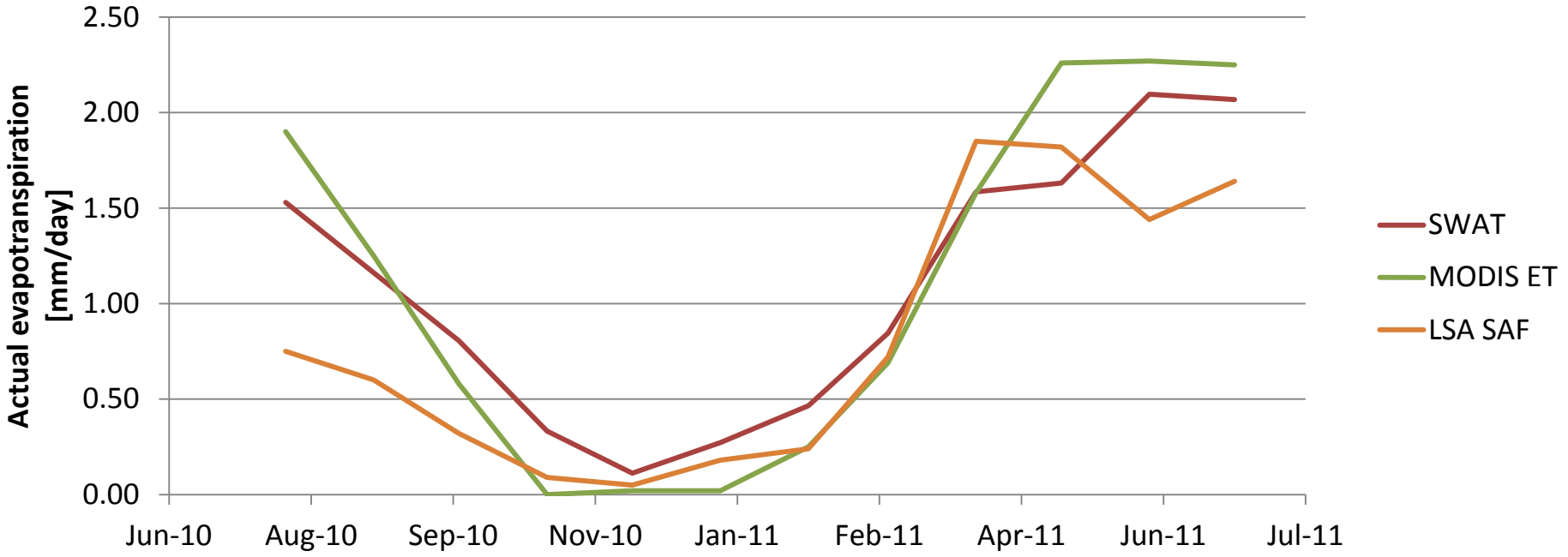
Comparison SWAT and remote sensing

- Actual ET [mm/day] averaged per month
- October 2010
- March 2011

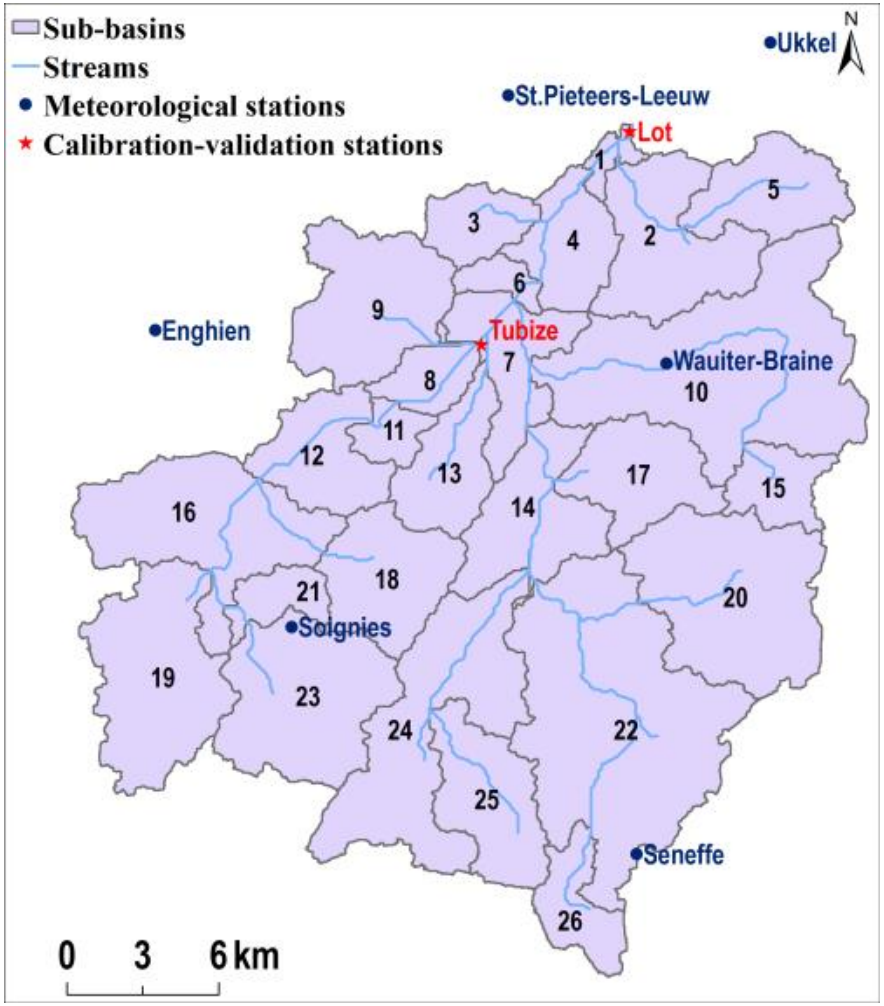




Comparison SWAT and remote sensing

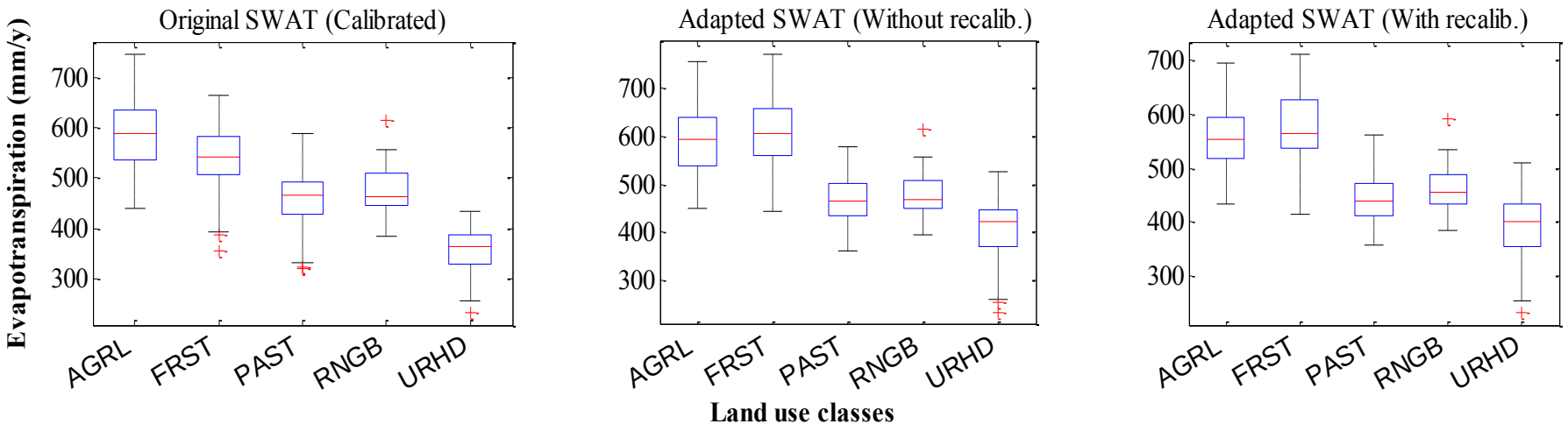


Calibrations on upper Zenne

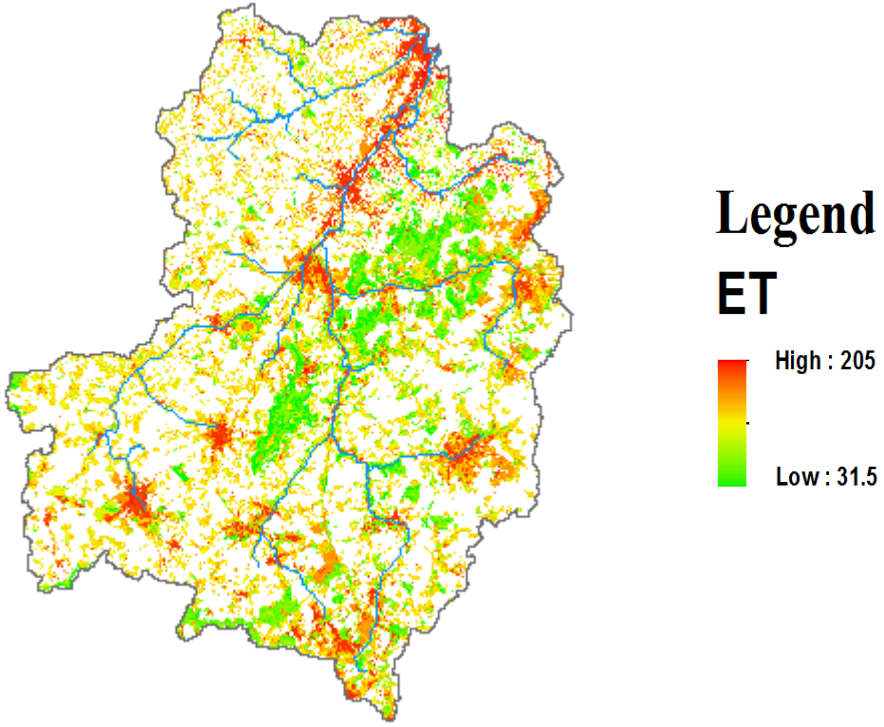


Adapted SWAT:

- Higher PET for Forest

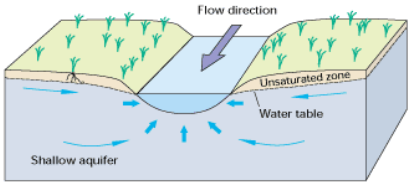


ET by roots from Forest? Comparison with WETSPA



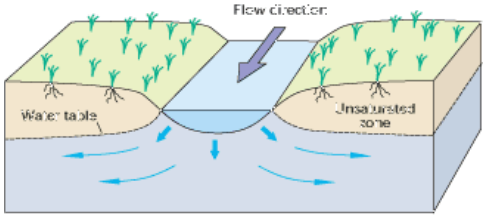
Groundwater-surface water interactions in SWAT

Gaining Stream



When gw_sub(i) > 0

Losing Streams



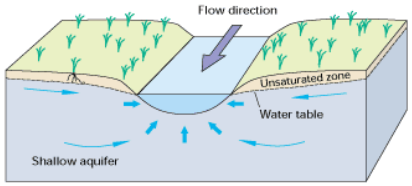
When RTTLC >0

Adaptations in SWAT

In original model: gaining and losing at the same time.

Adaptation to the code, either gaining or losing

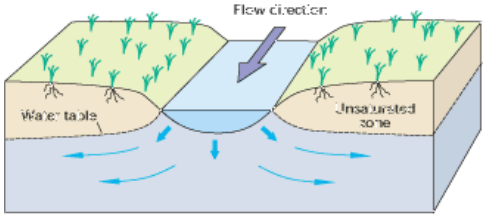
Gaining Stream



- When gw_sub(i) > 0

RTTLC =0 or negative (=positive flux)

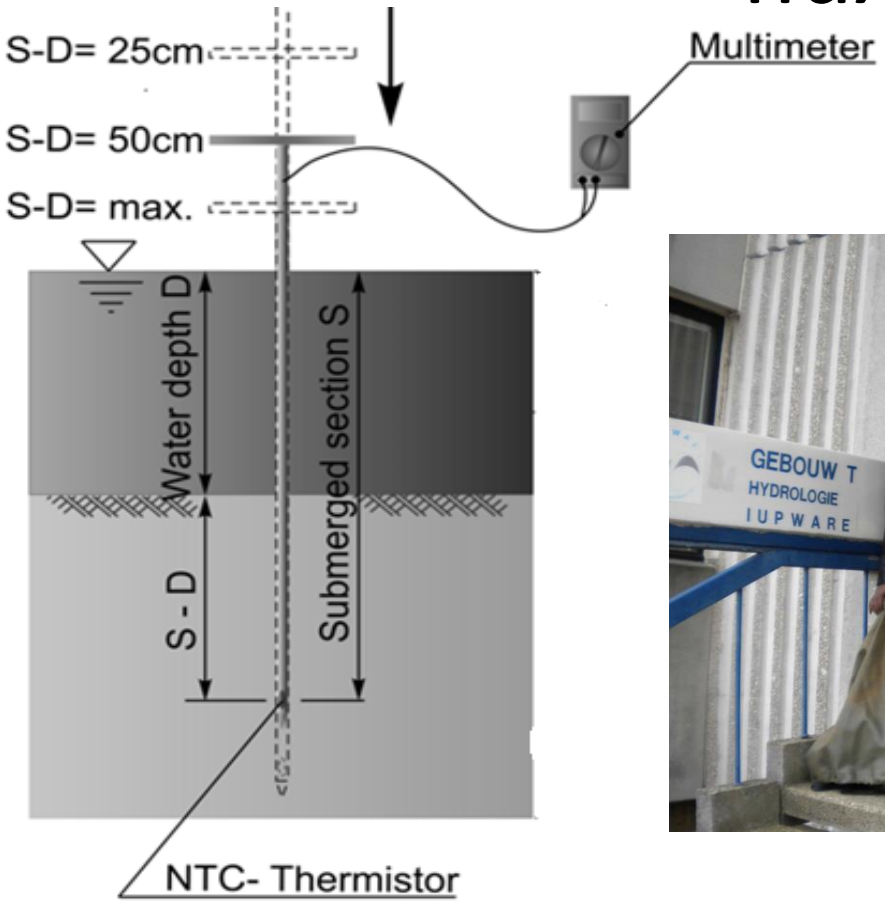
Losing Streams



- When gw_sub(i) = 0

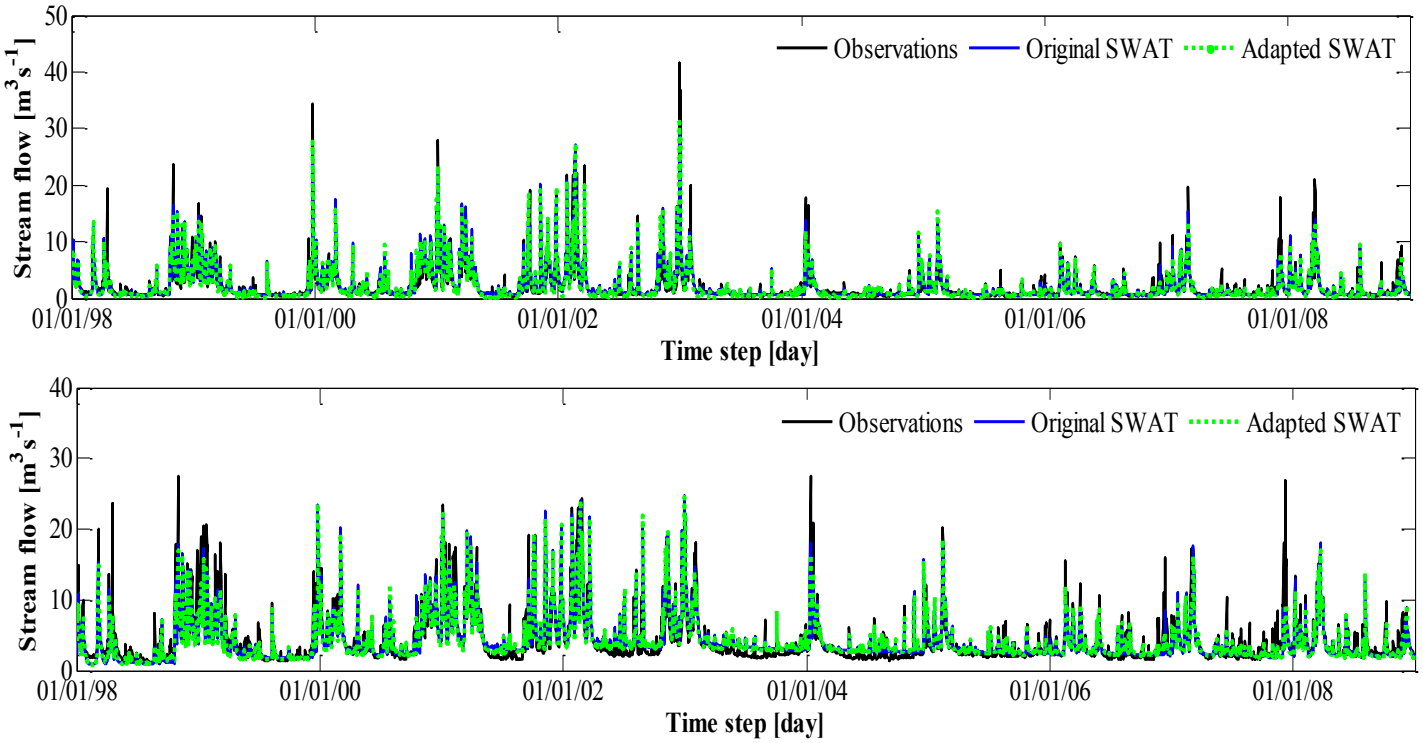
RTTLC =0 or positive (=losses)

T-stick measurements to measure fluxes



Anibas, C., Fleckenstein, J.H., Volze, N., Buis, K., Verhoeven, R., Meire, P., and Batelaan, O., 2009, Transient or steady state? Using vertical temperature profiles to quantify groundwater–surface water exchange: Hydrological Processes, v. 23, p. 2165-2177.

Calibration results



Calibration results

	Station	Calibration (1998-2008)			
		RMSE (m^3/s)	RSR	PBIAS (%)	NSE
Original SWAT	Tubize	1.29	0.46	5.8	0.78
Adapted SWAT		1.28	0.46	0.12	0.80
Original SWAT	Lot	1.57	0.46	-1.6	0.79
Adapted SWAT		1.52	0.44	-1.93	0.82

* inside bracket NSE for 1994-1997 from validation period

Conclusions

- SWAT simulations compared to Remote Sensing
  - ET from Forest/urban areas OK?
- SWAT simulations compared to flux observations in river bed
  - Conceptually not correctly simulation gaining/loosing river concepts
- Improvements have overall small influence on the calibration results