

Evaluation of Soil Water Assessment Tool for the simulation of preferential contaminant transport in the cultivated lands near Zarqa river

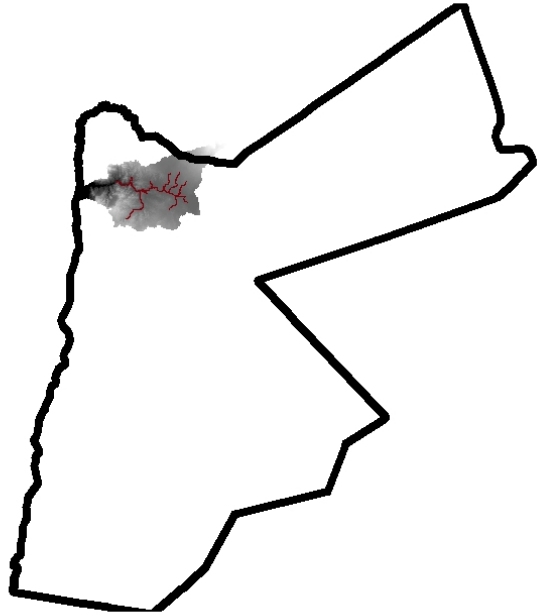
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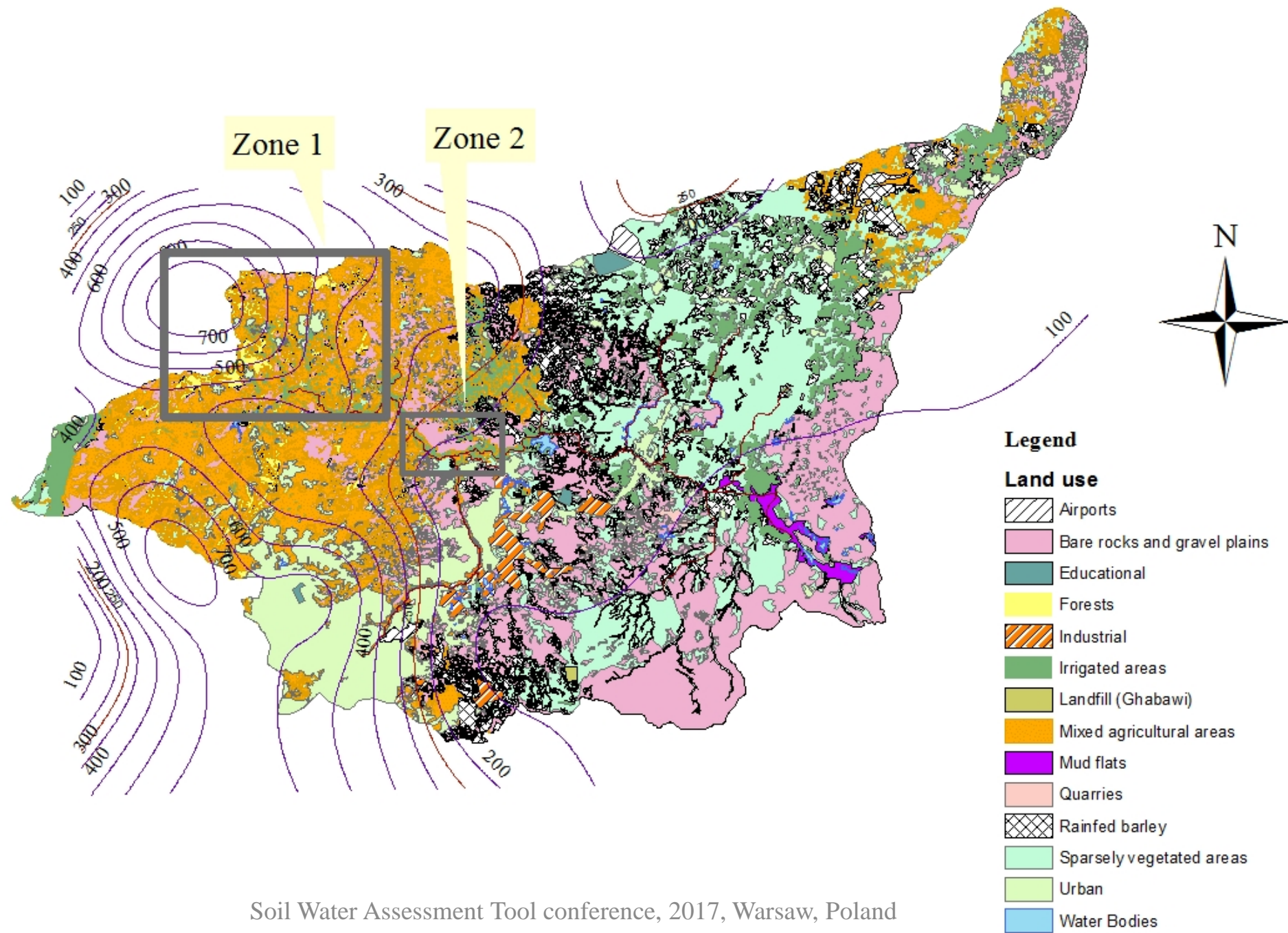
Department of Land, Water and Environment

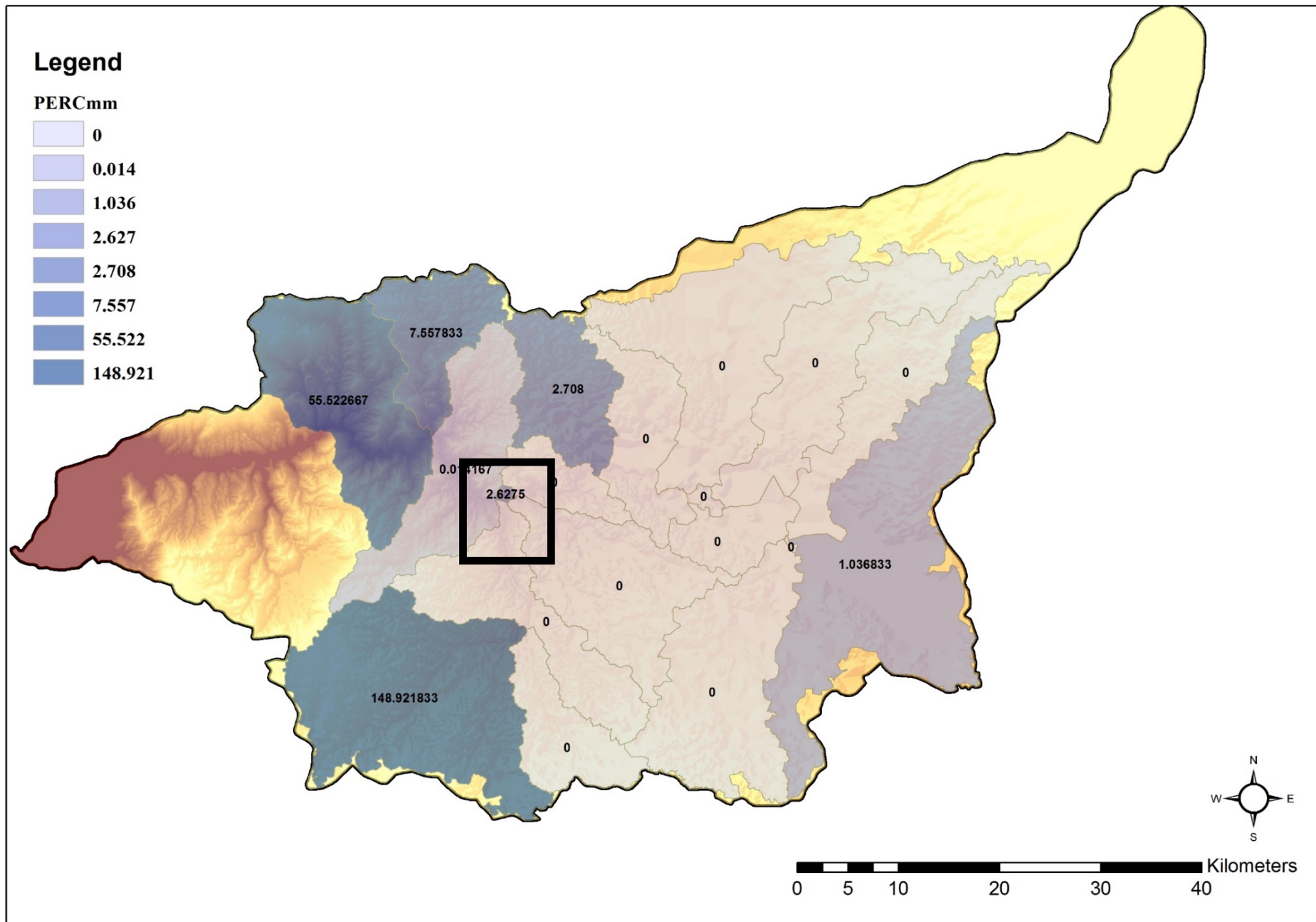
University of Jordan

Zarqa River Basin



- Zarqa river basin is one of most important surface water basins
- Home of major cities in Jordan (Amman, Zarqa)
- Drains an approximate area of 3900 km² .
- Drains in King Talal Dam
- Runoff Dilutes wastewater from Khirbat Es-Samra treatment station.

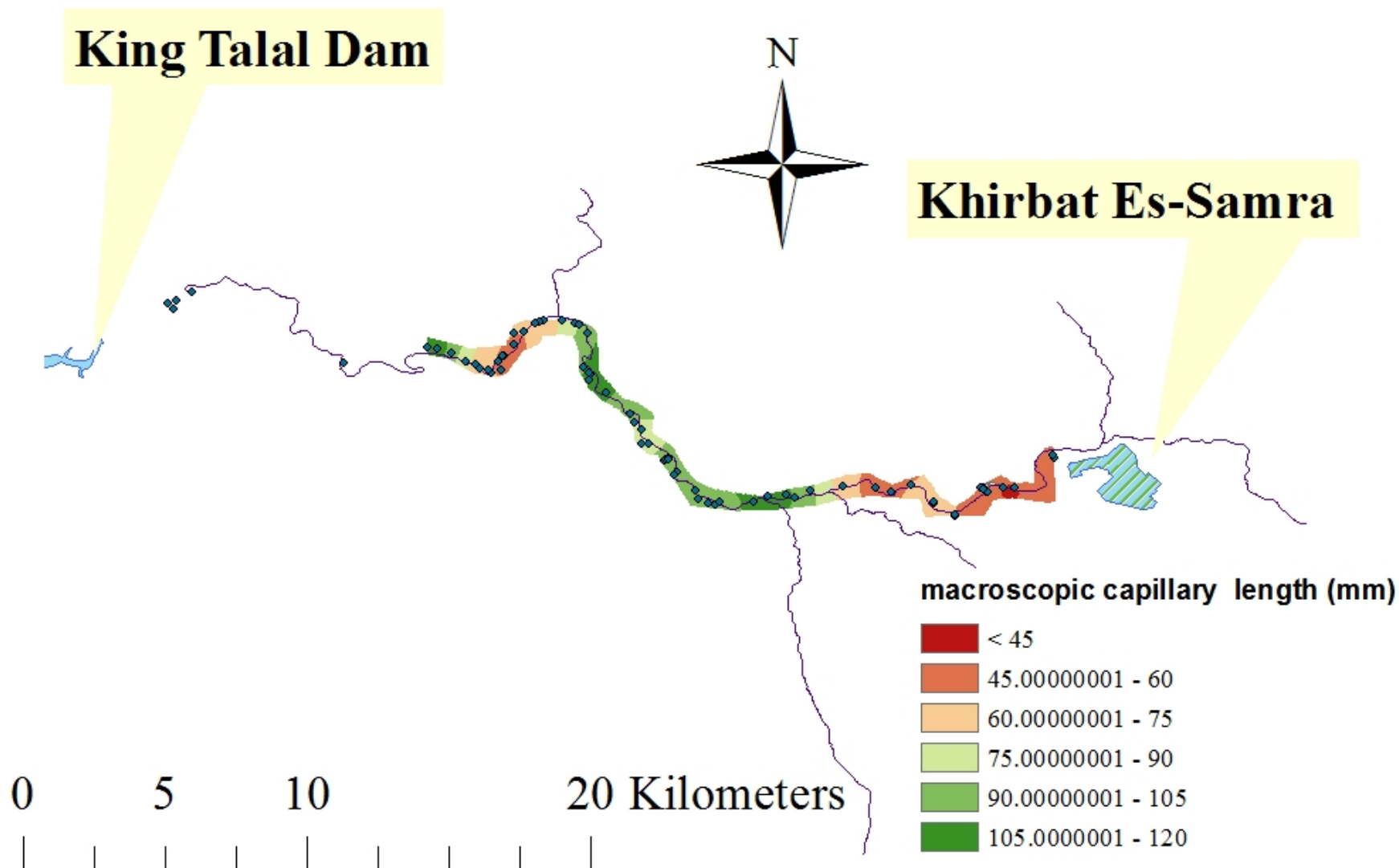


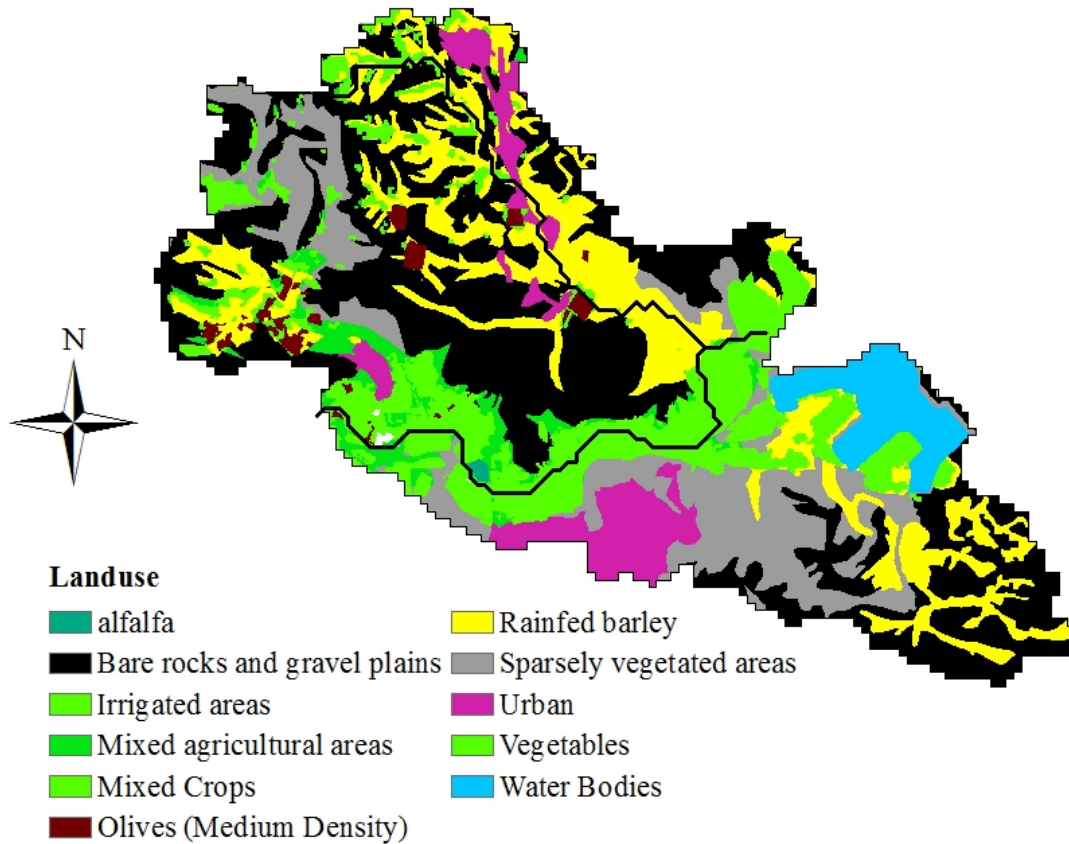


Preferential flow and transport investigation



- In-situ measurements using tension infiltrometer
- three tensions of -6, -3 and 0 cm
- Locations recorded using Etrex 30 GPS device
- $Q(h_i) = \pi r^2 K_s \exp(ah_i) \left(1 + \frac{4}{\pi r \alpha}\right)$
- a is inverse macroporosity capillary length (λ_C)
- $\lambda_C > 80$ mm indicates preferential flow

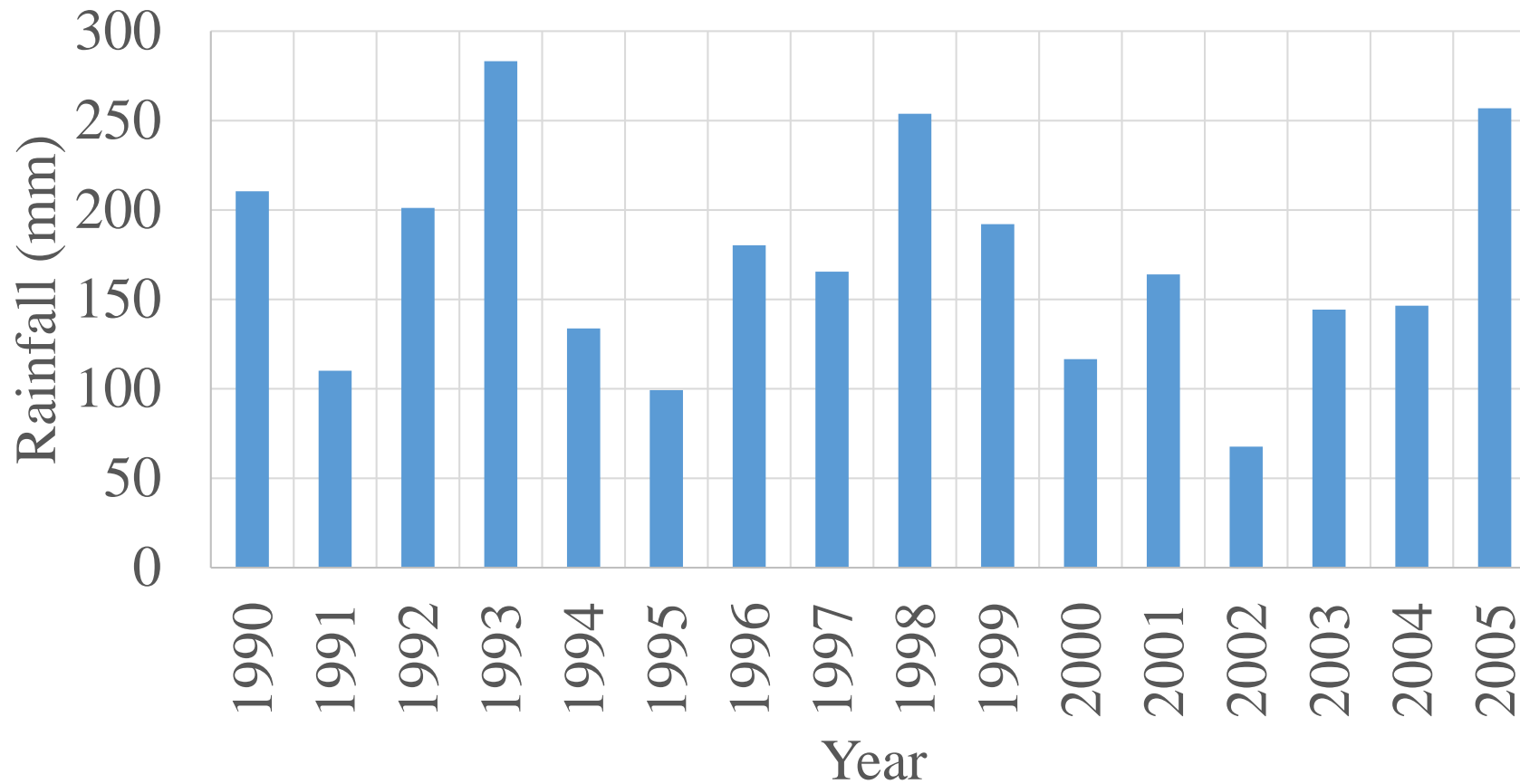




Landuse	Area (hectare)	Area%
Bare soil	2519	44.7
Sparse vegetation	1067	18.9
Rainfed barley	1341	23.8
Irrigated vegetables	707	12.6

Average Precipitation (mm)	170.4
Potential evapotranspiration (mm)	1537.0
Watershed area (Km²)	56.3

Annual Precipitation (1990 – 2005)



Management operations

Timing	Operation	Crop	Criteria	Type
30/1	Auto fertilization initialization		Plant stress > 0.95	Composite
30/1	Fertilizer application			Composite
30/1	Auto irrigation initialization		20 mm of field capacity	
5/2	Plant/begin. growing season	AGRC		
15/5	Harvest and kill operation			
1/6	Plant/begin. growing season	CAUF		
1/6	Fertilizer application			composite
23/9	Harvest and kill operation			
27/9	Plant/begin. growing season	AGRC		
20/12	Kill/end of growing season			

SWAT – Average annual output

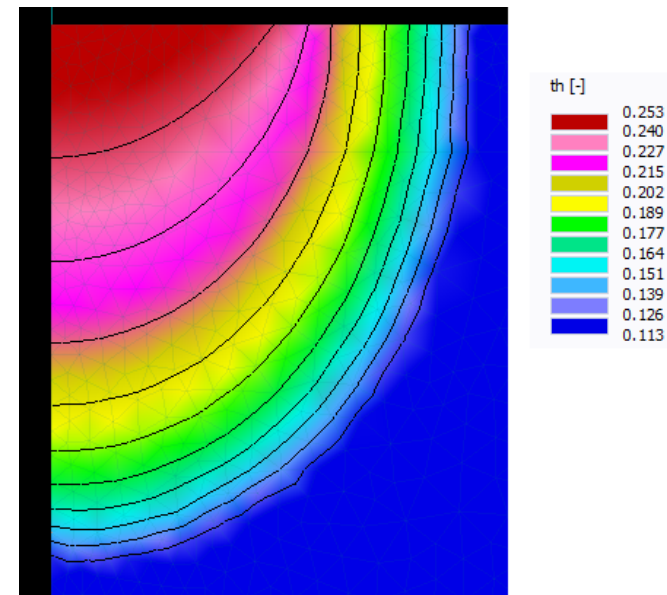
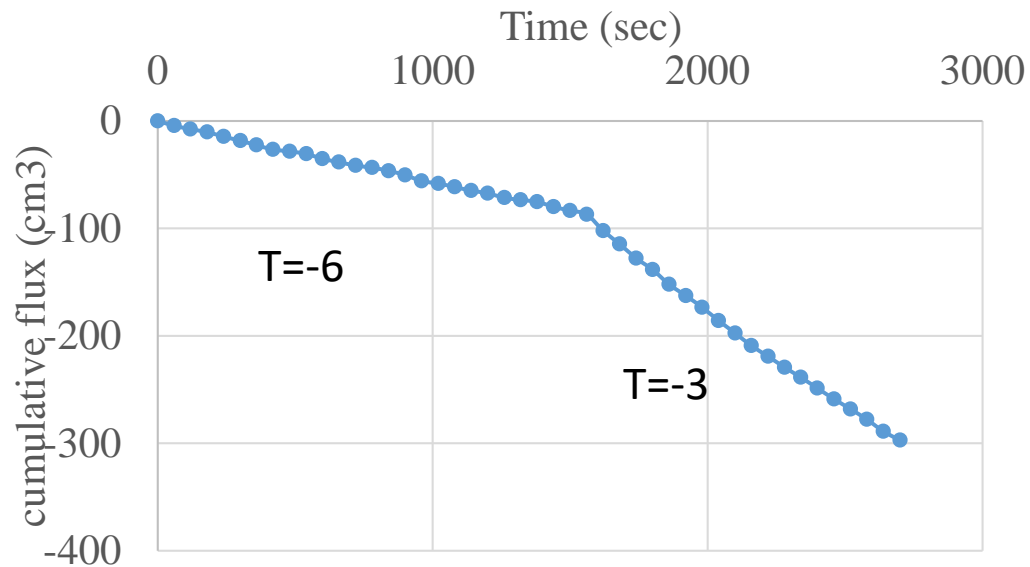
Parameter	Slope			
	0 – 5	5 -10	10 -15	> 15
Irrigation (mm)	867.5	861.2	870.0	900.0
Actual evapotranspiration (mm)	983.9	983.0	984.0	988.9
Percolation (mm)	47.2	44.3	40.9	37.1
Lateral discharge (mm)	5.9	3.4	14.9	43.8
Runoff generation (mm)	1.6	1.3	1.2	1.3

SWAT 2015 output

Parameter	Slope			
	0 – 5	5 -10	10 -15	> 15
Irrigation (mm)	880	880	880	920
Actual evapotranspiration (mm)	1012.4	1009.8	1001.6	1017.9
Percolation (mm)	109.5	114.3	97.3	94.8
Lateral discharge (mm)	7.5	4.0	17.1	51.0
Runoff generation (mm)	5.6	6.6	5.9	7.0
Rainfall (mm)	256.9	256.9	256.9	256.9
Potential evapotranspiration (mm)	1563.2	1563.2	1563.2	1563.2

Hydrus modeling

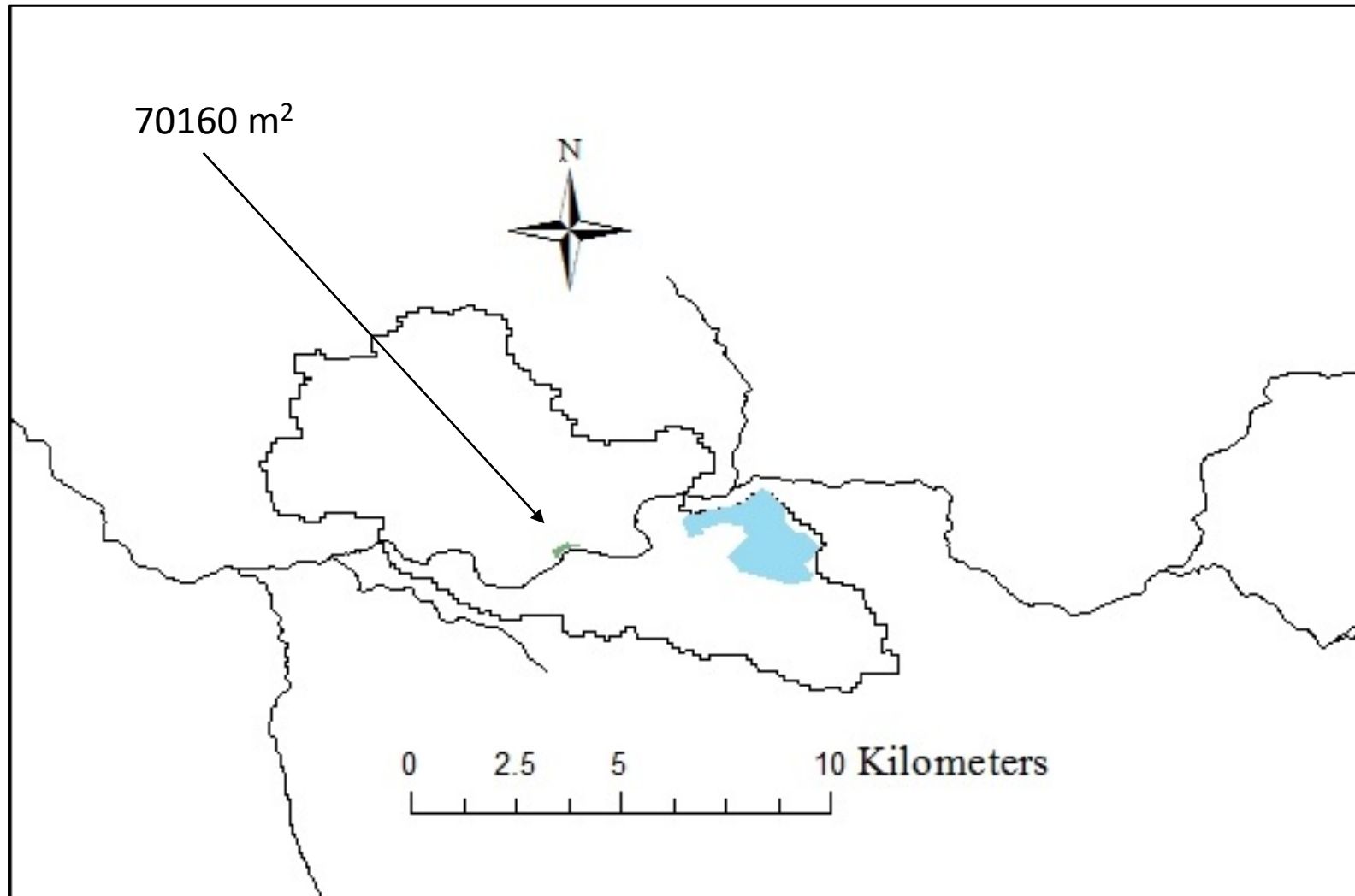
HYDRUS model was calibrated to match the steady boundary fluxes observed in the field.



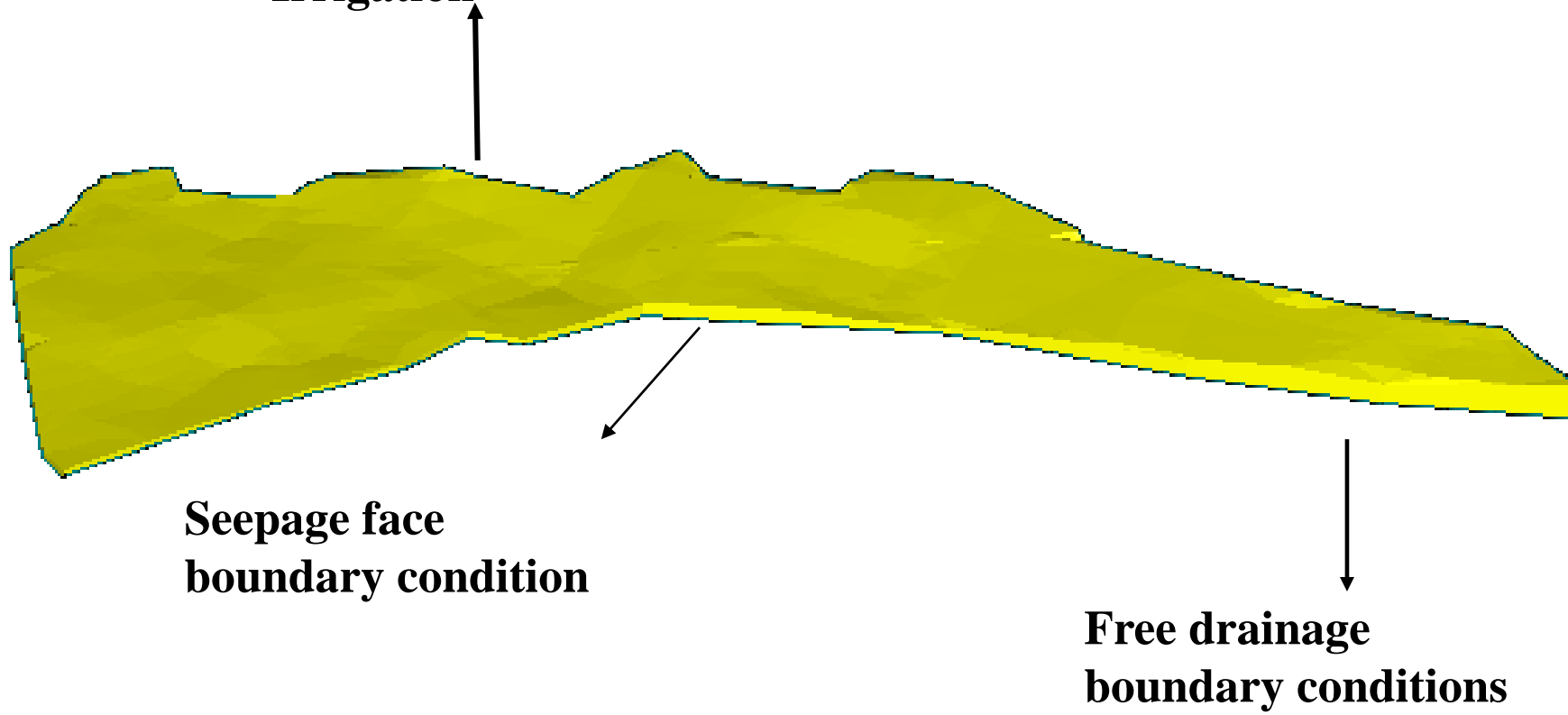
HYDRUS input

- Dual porosity model /Van Genuchten parameters

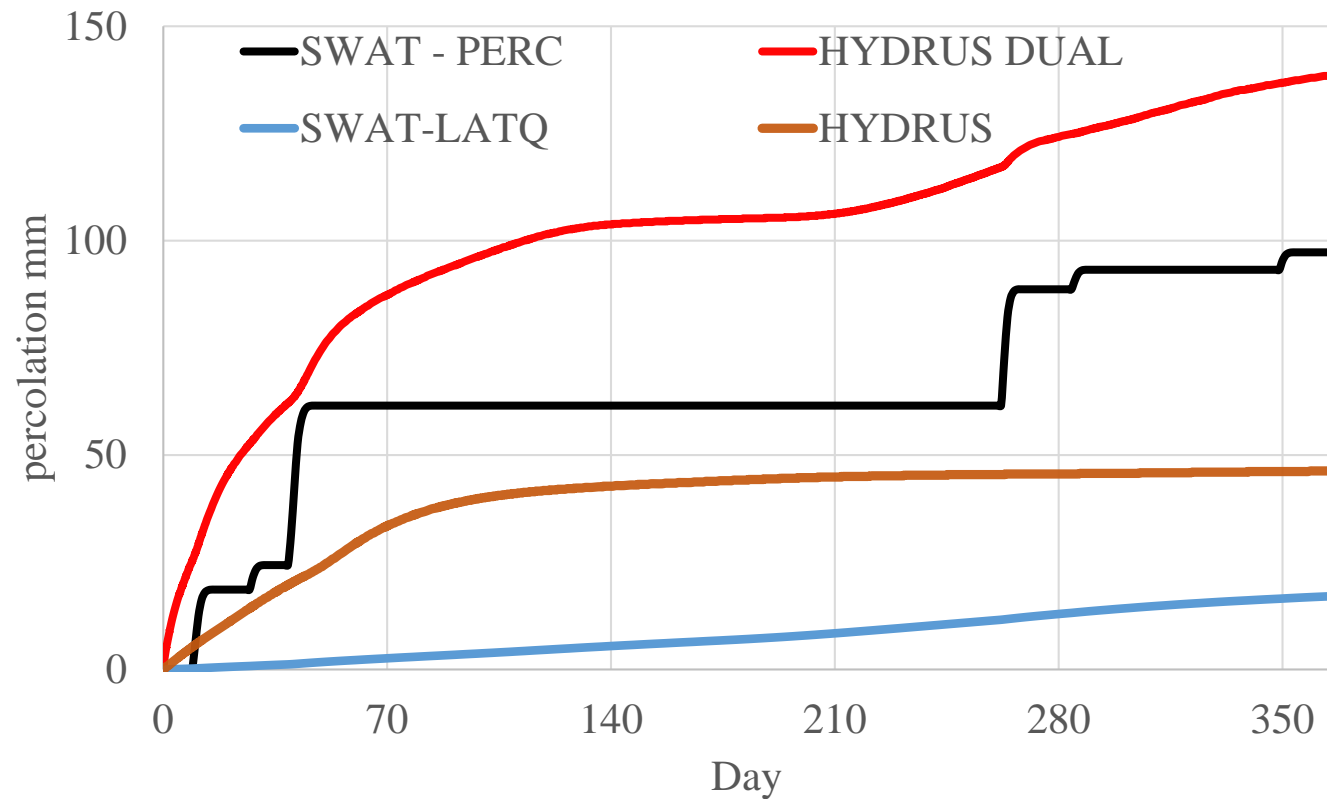
Depth (mm)	Q_r	Q_s	n	α (1/m)	Ks (m/day)	w	α_2	n2
470	0.0513	0.38	0.030	1.500	0.500	0.09	0.9	1.2
1420	0.0764	0.44	0.590	1.583	0.128			



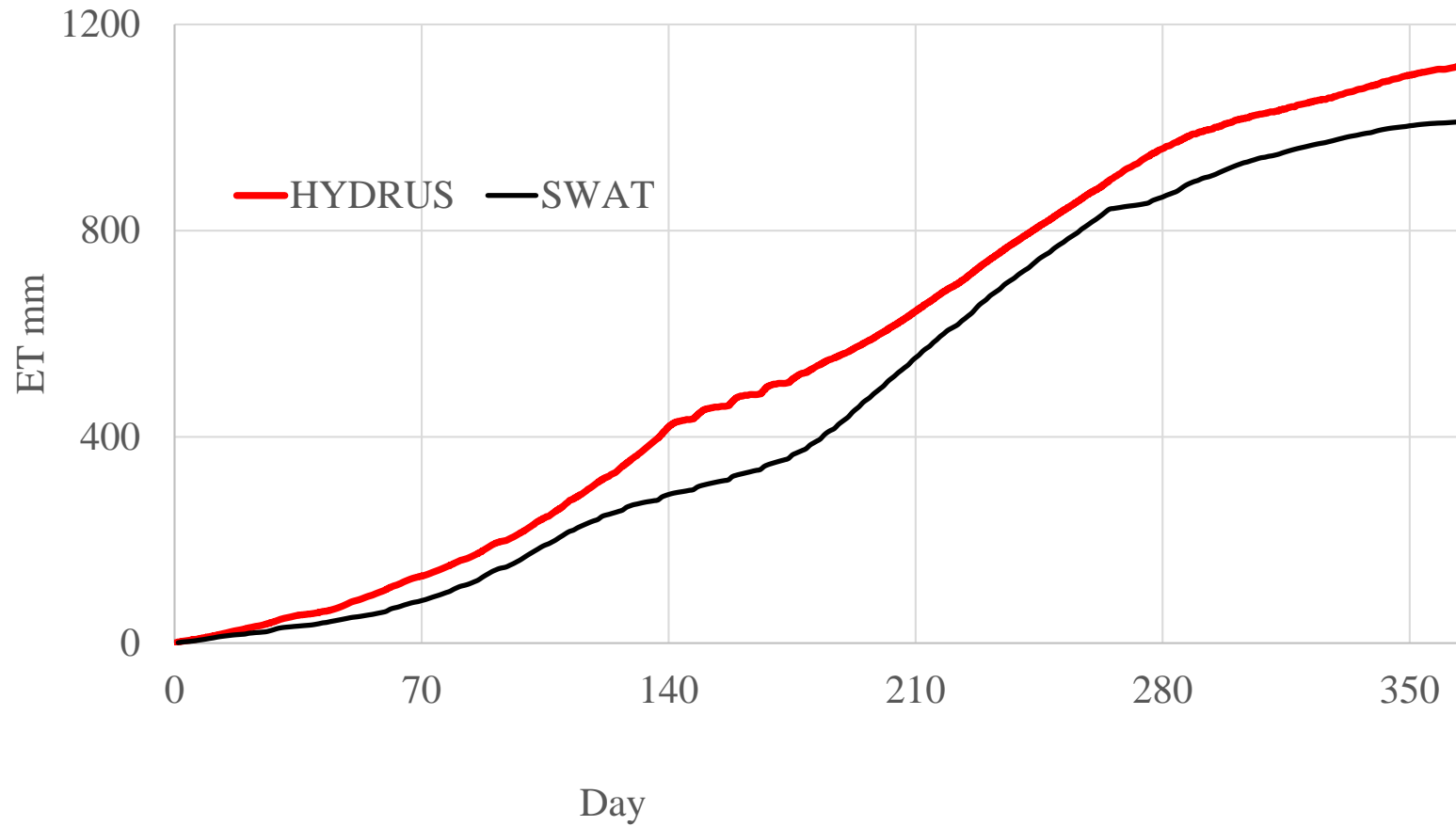
- **Atmospheric conditions**
 - **Potential transpiration**
 - **Potential evaporation**
 - **Irrigation**



HYDRUS –SWAT comparison -Percolation



HYDRUS –SWAT comparison -AET



Acknowledgement

This research was made possible by grant from USAID/Partnership for Enhanced Engagement in Research (PEER) program (Grant No. 2000006244)