Funded by Israel ministry of science

Modeling a heterogeneous basin – the Lake Kinneret Watershed, Israel

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THE HEBREW UNIVERSITY OF JERUSALEM

חקר ימים ואגמים לישראל
Israel Oceanographic & Limnological Research

Lake Kinneret (Sea of Galilee)

- National freshwater reservoir
- Supply to Jordan Kingdom
- Tourism

Future (and current) trends:

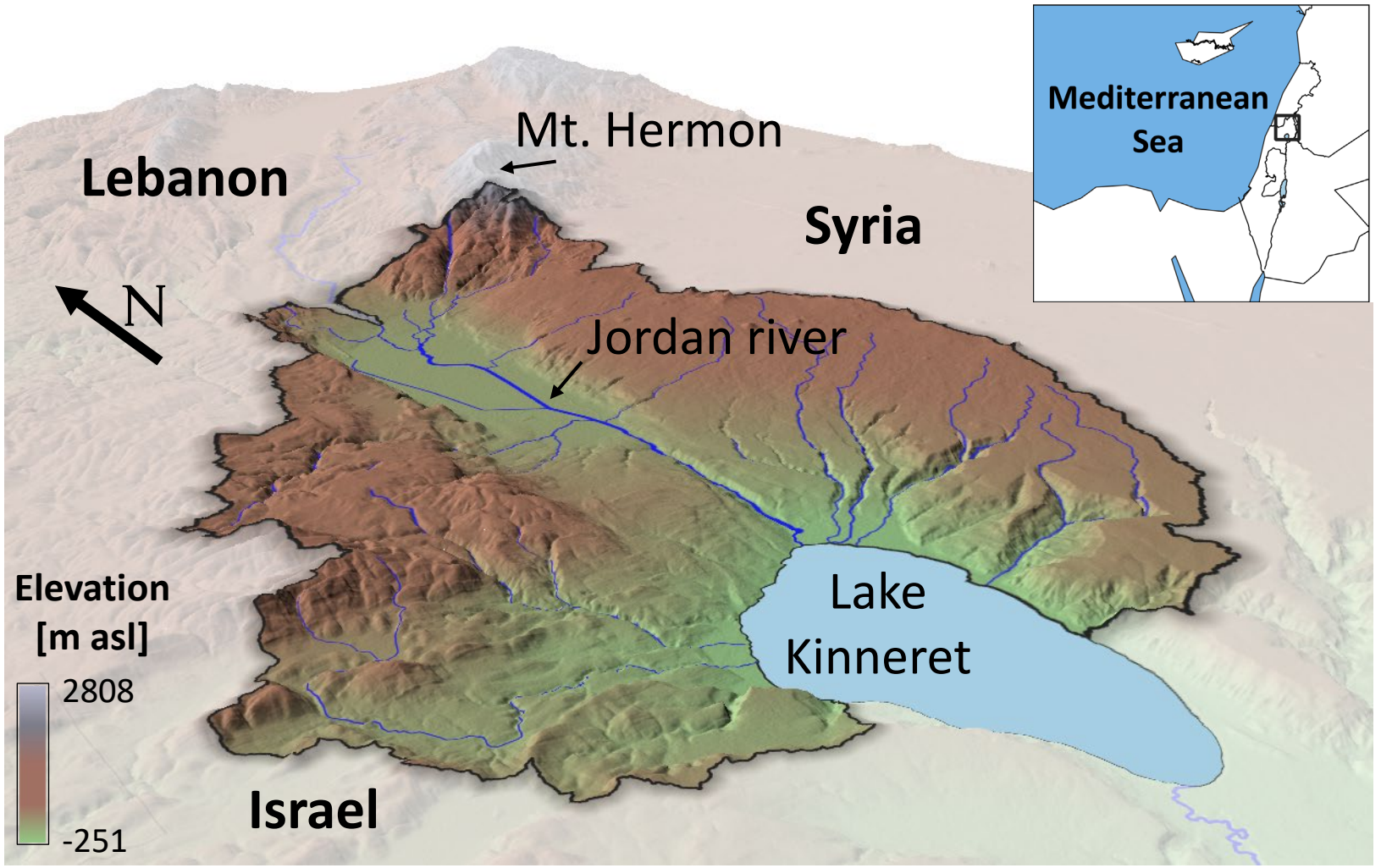
- Climate change
- Population growth

Photo by Natalie Kemper

The Lake Kinneret Watershed (LKW)

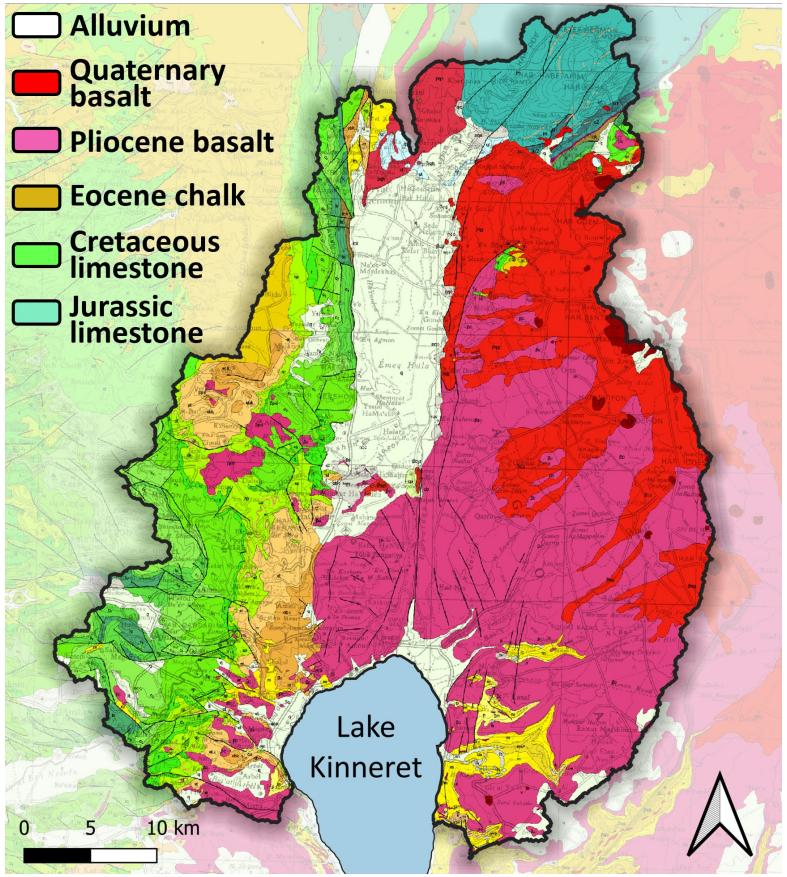
400-1500 mm/y

2730 km^2



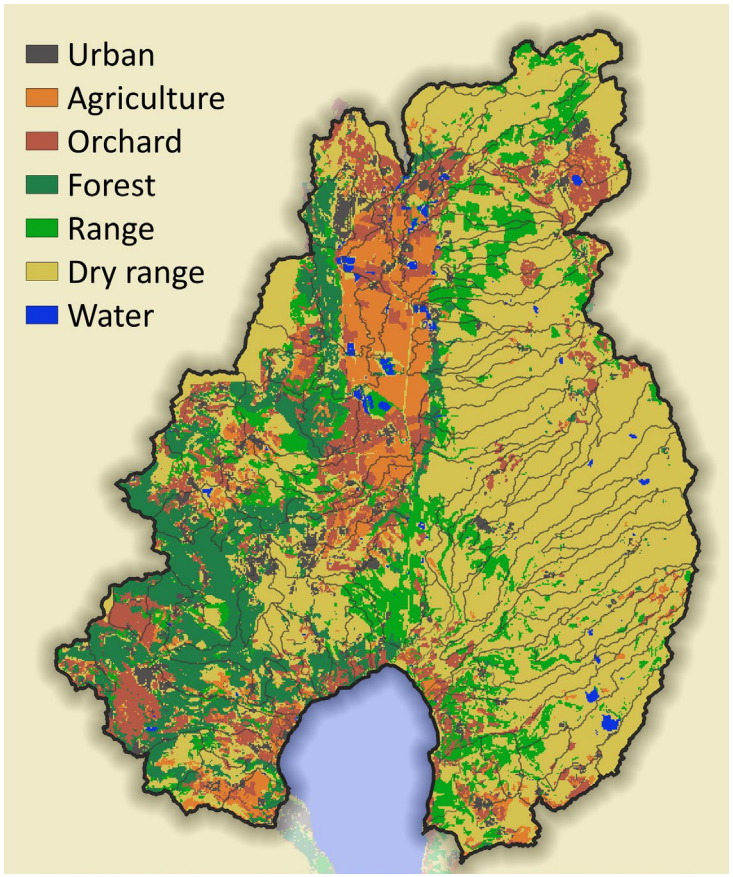
A heterogenous basin

Geology



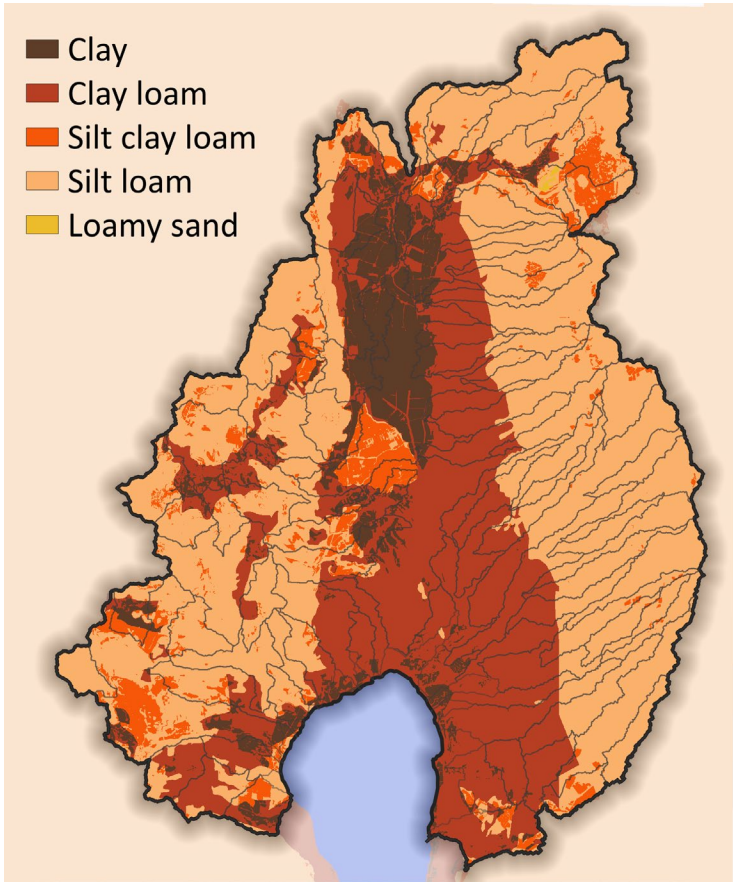
Modified after Sneh & Weinberger, (2003)

Land use



Data: Israel Central Bureau of Statistics

Soils



Data: Israel Water authority

Objectives

Hydrological processes

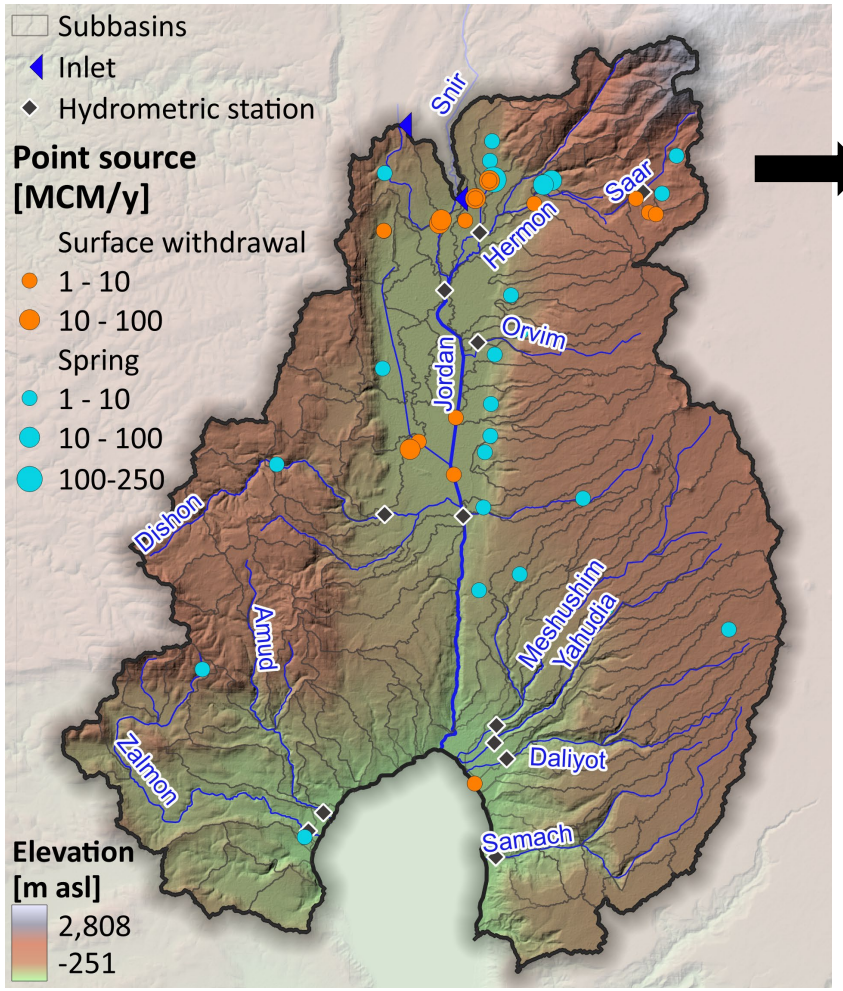
Climate change

Watershed management

Modeling surface- and groundwater flows of the LKW

Model settings

1. **SWAT+**



SWAT+ 60.5.4

- 101 subbasins
- 546 HRU
- No aquifers

Point source data:
Israel Water Authority

Climate data

COSMO model by IMS (Israel Meteorological Service)

Advantages:

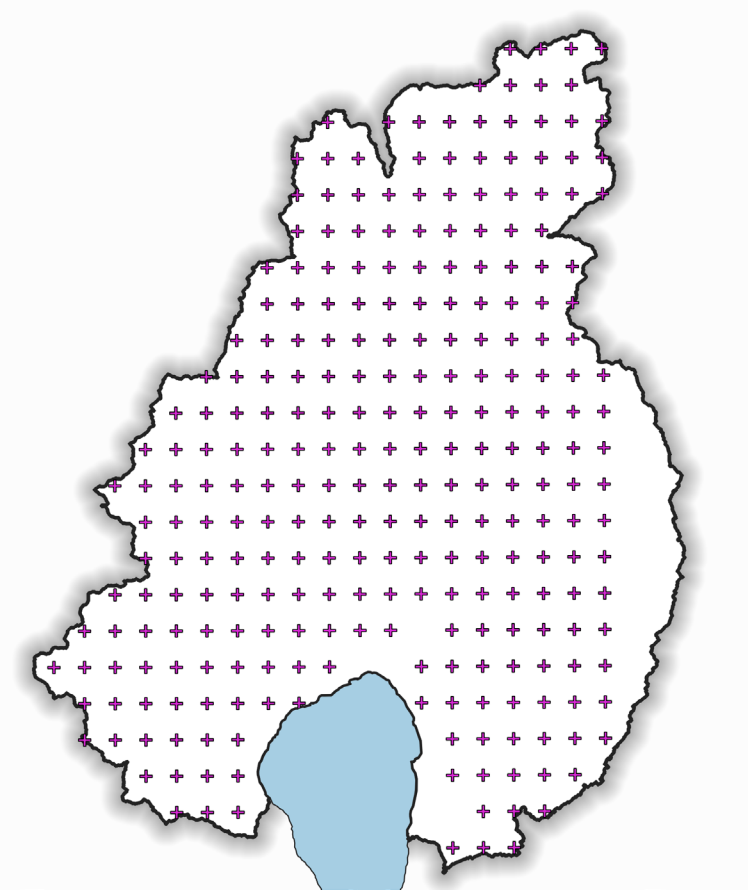
✓Covers ungauged areas

✓High resolution (~2.5 km)

Disadvantages:

X Daily accuracy

X Currently only for 2014-2020

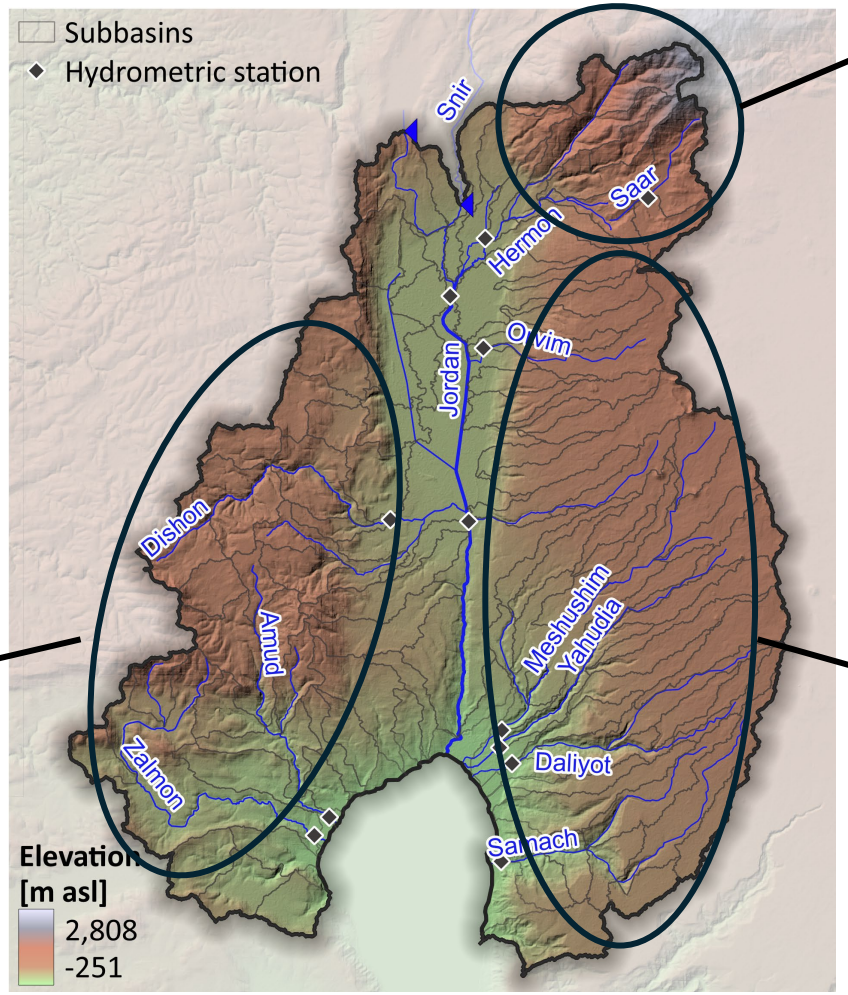


Climate data: Pavel Khain (IMS)

Main hydrological regions

Mt. Hermon

Galilee

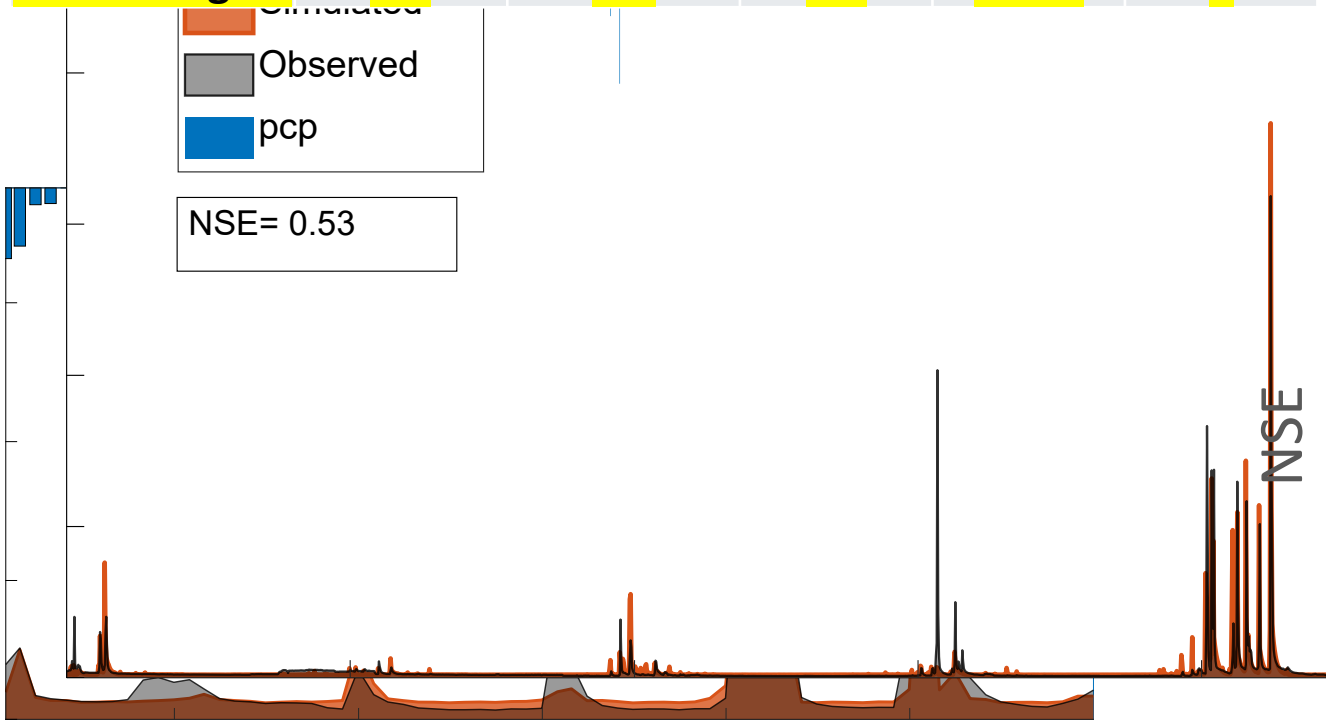


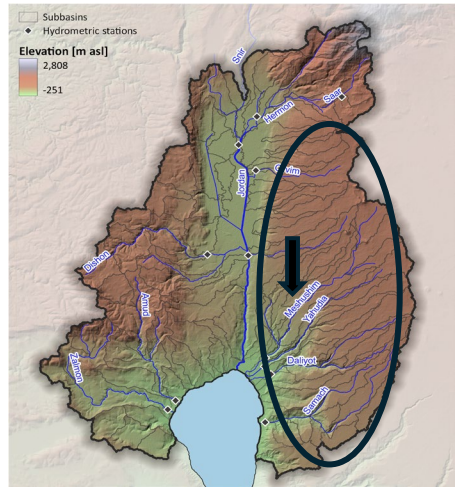
Golan Heights

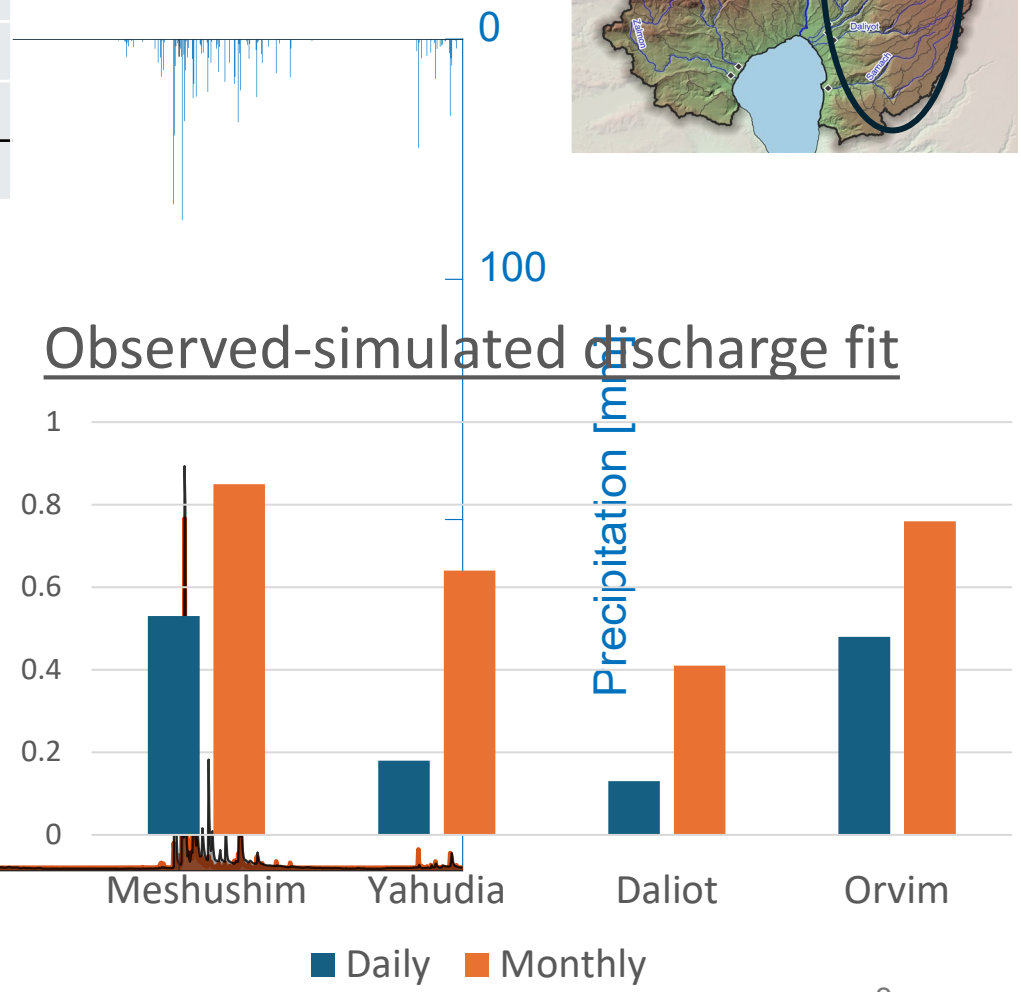
Photo by Natalie Kemper

Golan Heights

Name	crk	cn2	perco	cn3_swf	chk
Type	Absolute	Percentage	Absolute	Absolute	Absolute
Units		%			mm/d
Golan Heights	0.1	-30	0.5	0.995	1

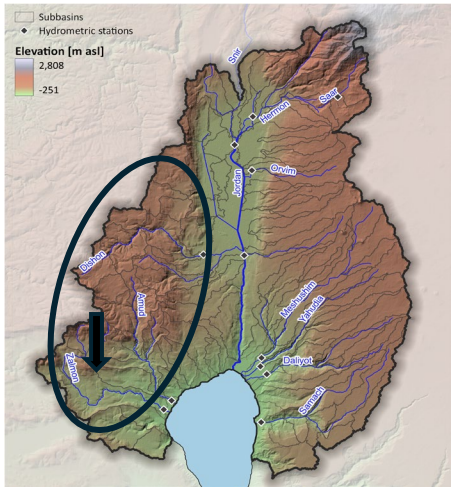


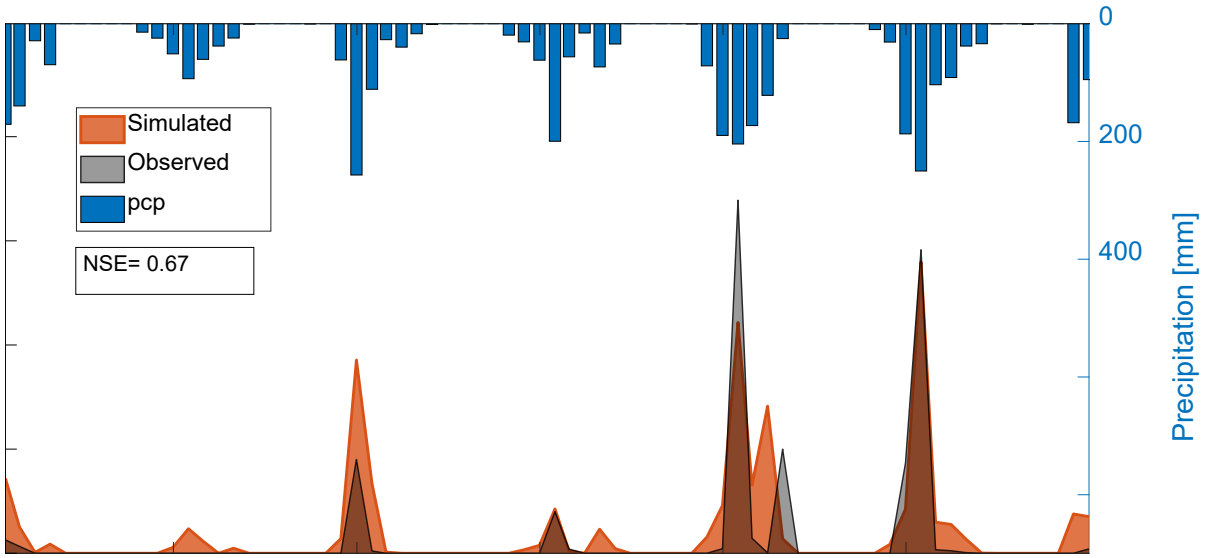




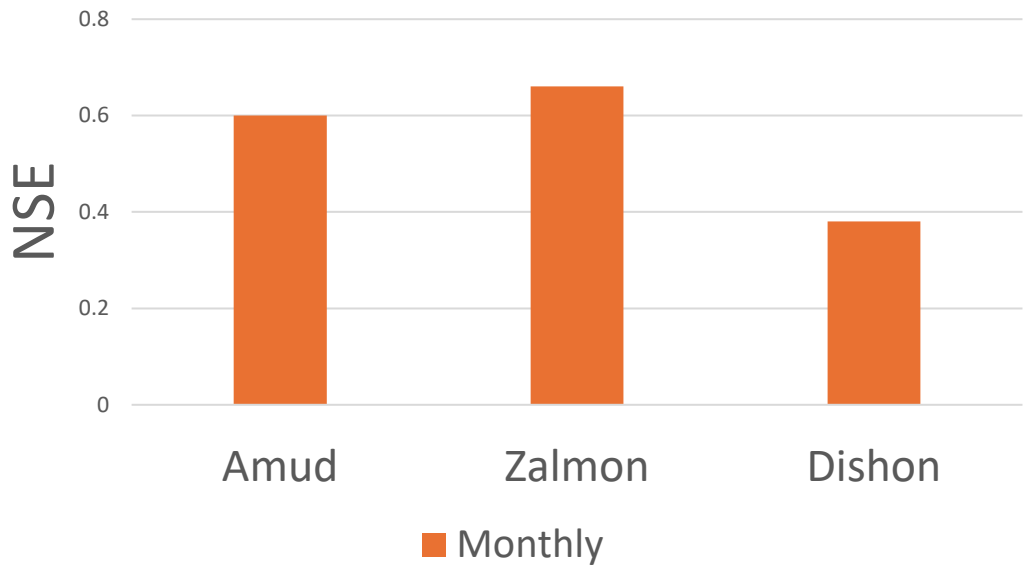
Galilee

Name	crk	cn2	perco	cn3_swf	chk
Type	Absolute	Percentage	Absolute	Absolute	Absolute
Units		%			mm/d
Golan Heights	0.1	-30	0.5	0.995	1
Galilee	0.7	-30	0.9	0.999	10



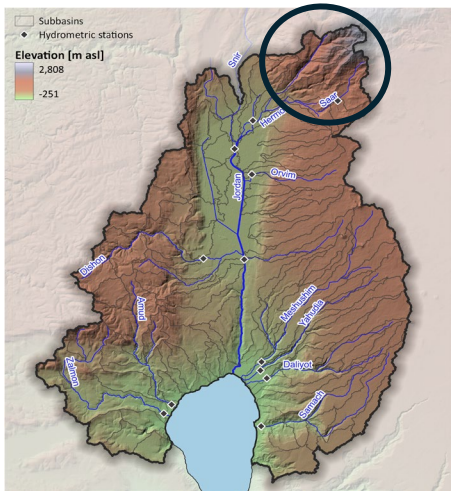


Observed-simulated discharge fit

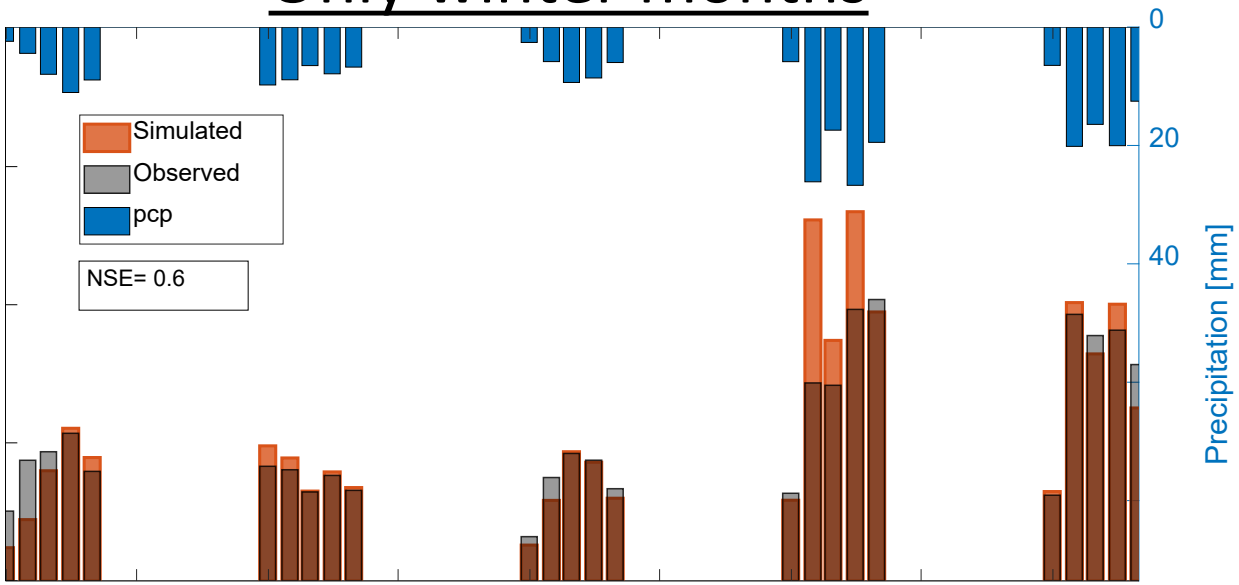


Hermon

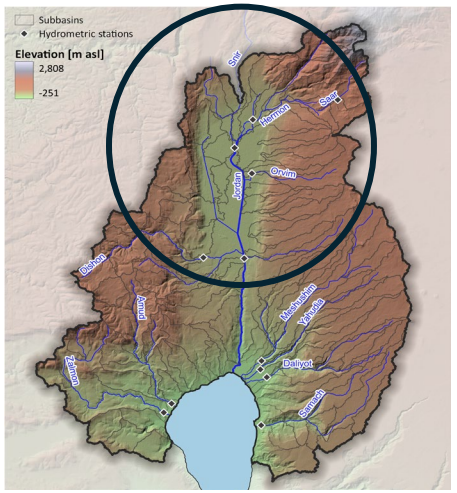
Name	crk	cn2	perco	cn3_swf	chk
Type	Absolute	Percentage	Absolute	Absolute	Absolute
Units		%			mm/d
Golan Heights	0.1	-30	0.5	0.995	1
Galilee	0.7	-30	0.9	0.999	10
Hermon	0.8	-30	0.9	0.995	1



Only winter months



Jordan catchment



Name	crk	cn2	perco	cn3_swf	chk
Type	Absolute	Percentage	Absolute	Absolute	Absolute
Units		%			mm/d
Golan Heights	0.1	-30	0.5	0.995	1
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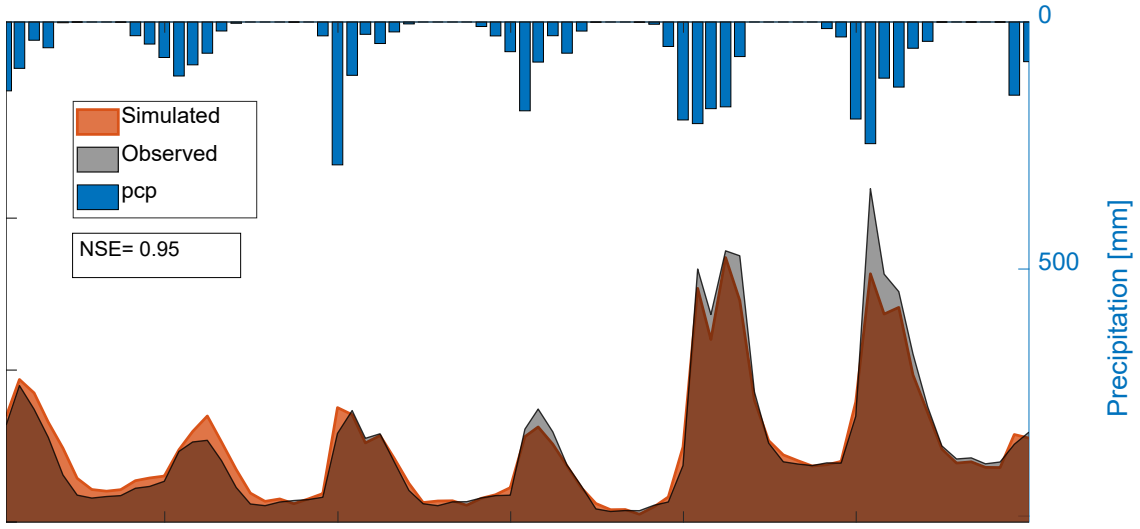
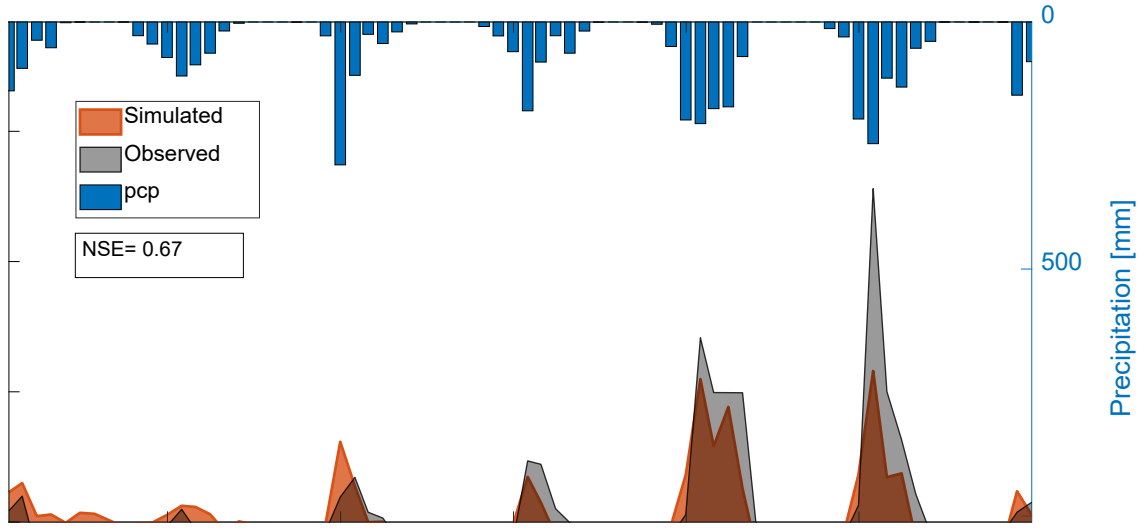
Hermon	0.8	-30	0.9	0.995	1

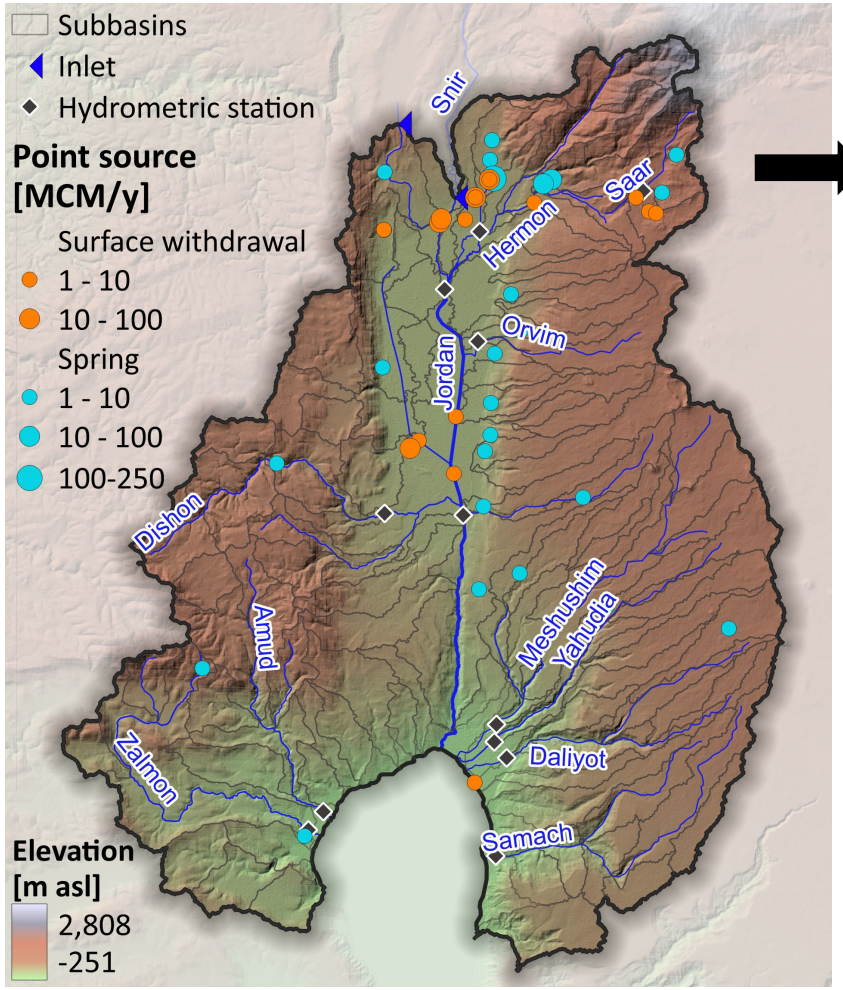


No Point source



Model settings

1. **SWAT+**

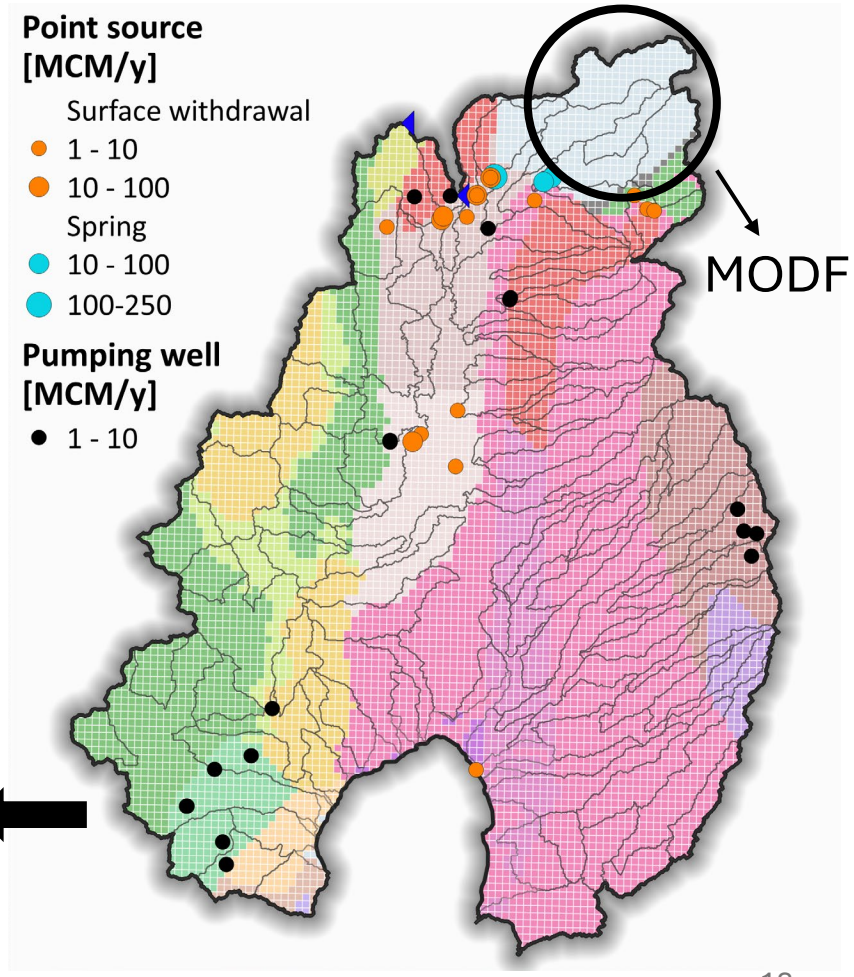


SWAT+ 60.5.4

- 101 subbasins
- 546 HRU
- No aquifers

- 7690 cells
- 500 m X 500 m
- 20 aquifer zones

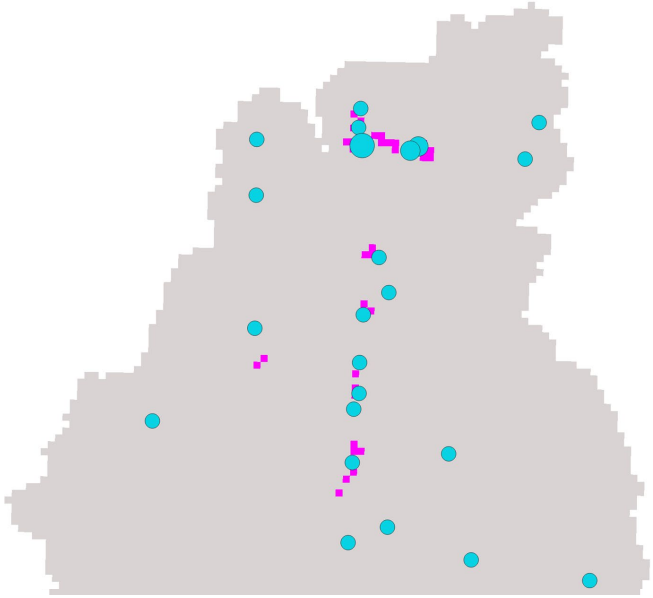
2. **SWAT+ gwflow**

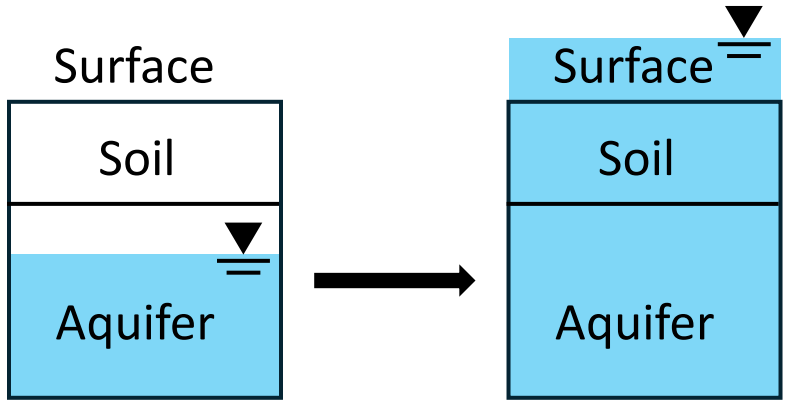


SWAT+gwflow_60.5.3

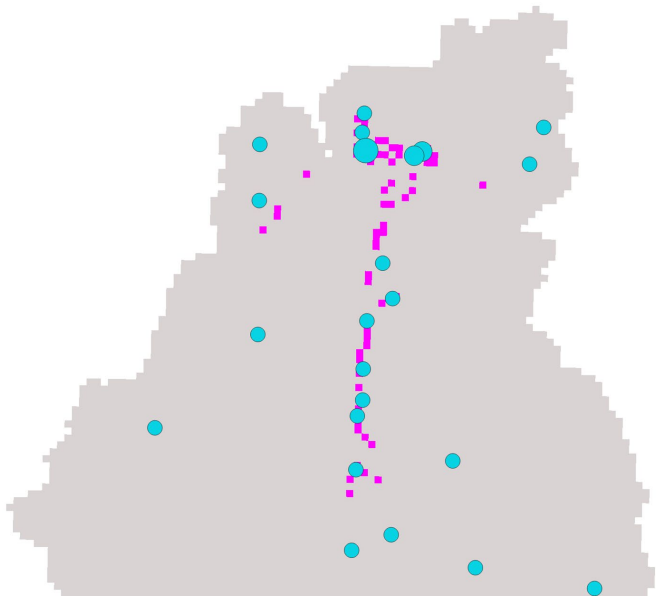
Saturation excess

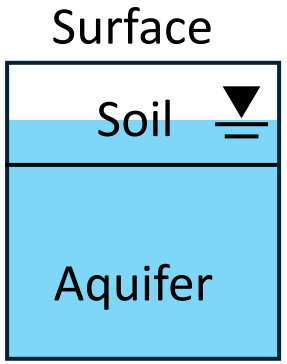
Groundwater → surface





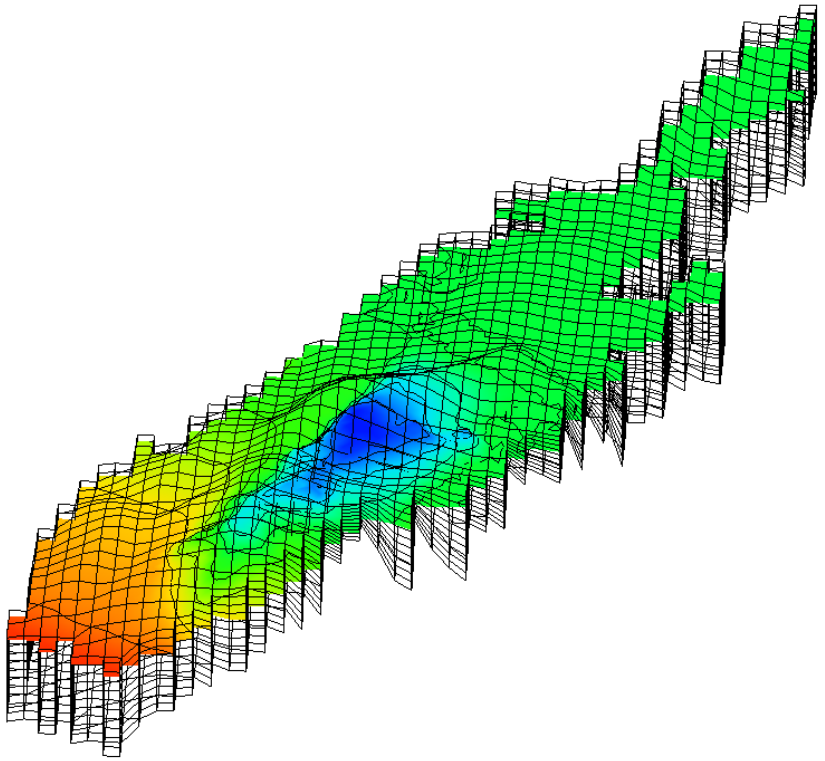
Groundwater → soil

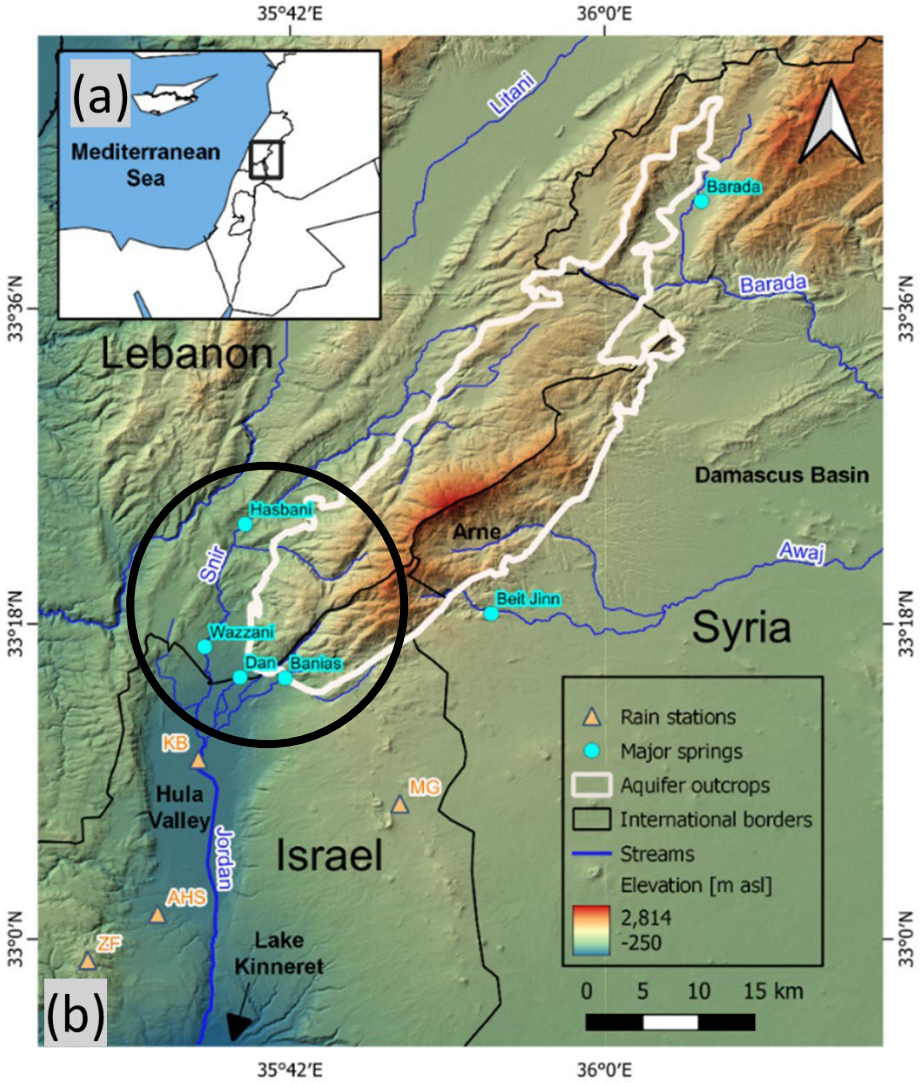




Hermon Jurassic aquifer

External MODFLOW model





Summary

1. Challenges: heterogeneity, groundwater contribution, data scarcity, management effect
2. The model's default parameters lead to extra runoff for the LKW
3. The observed-simulated monthly discharges of main streams show satisfactory correlation
4. gwflow simulations show good fit to the location of main springs
5. The coupled SWAT+gwflow model, together with an external MODFLOW model, will allow to simulate future scenarios for the LKW