

A Study on the Spatially and Temporally Varying Recharge Patterns in a Semi-arid Region with Shallow Groundwater

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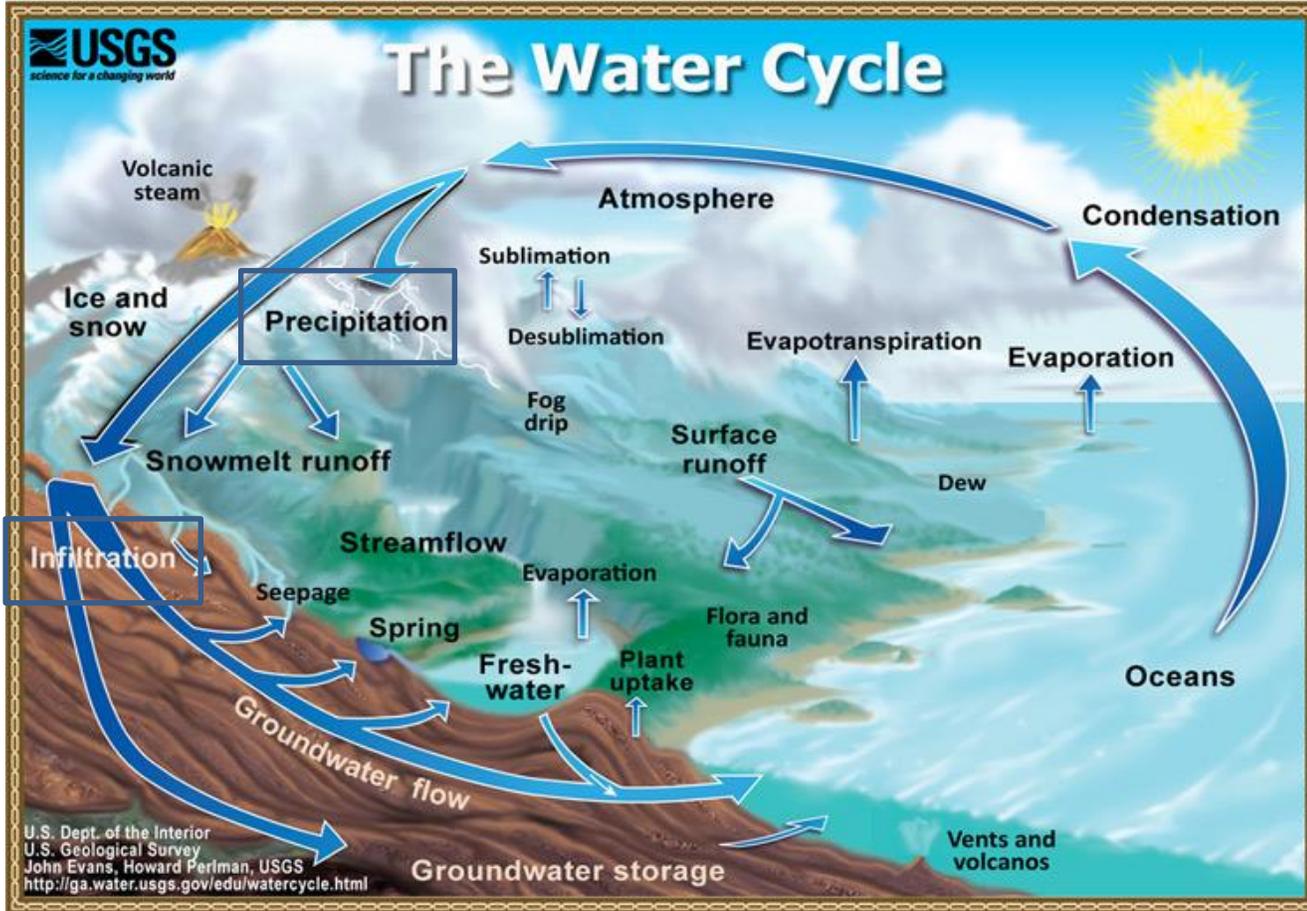
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Outline

- Introduction
- Study Area
- Processes of Groundwater Recharge
- Numerical Simulation
- Conclusion

Introduction



Groundwater recharge is an important part of the hydrologic cycle, in which water from the surface works its way into the subsurface, replenishing groundwater supplies.

! In the semiarid region

*What's the form of recharge (from precipitation)?

Discussion on the Origin of Groundwater on Ordos Basin

1) precipitation

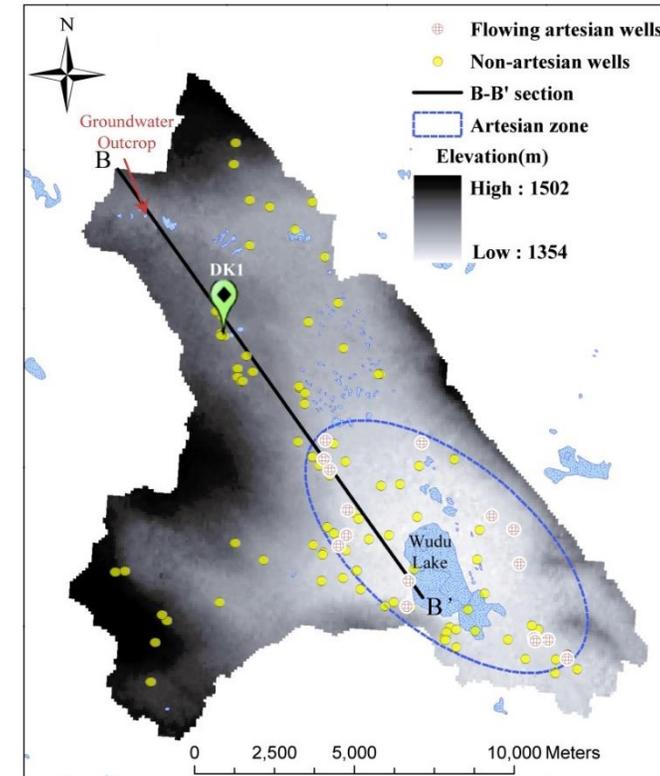
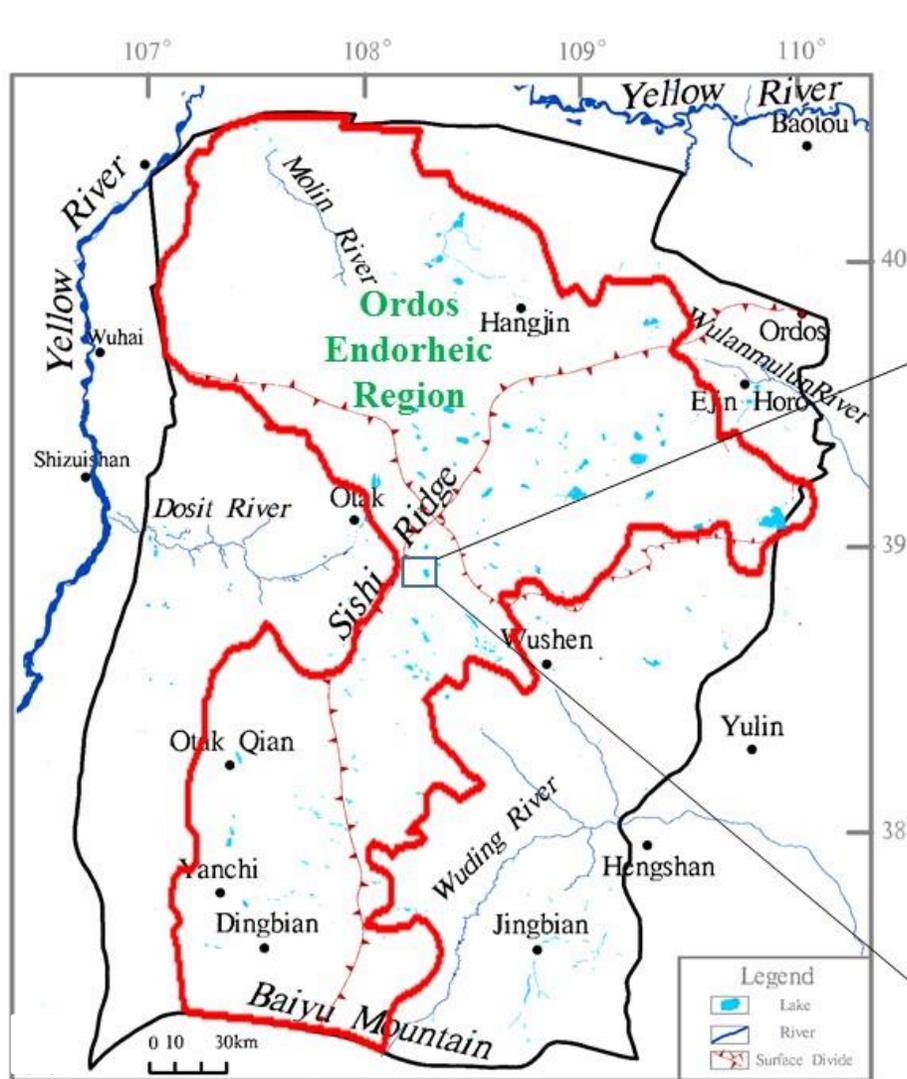
2) flows through basement faults

! The water movement through the shallow vadose zone

Outline

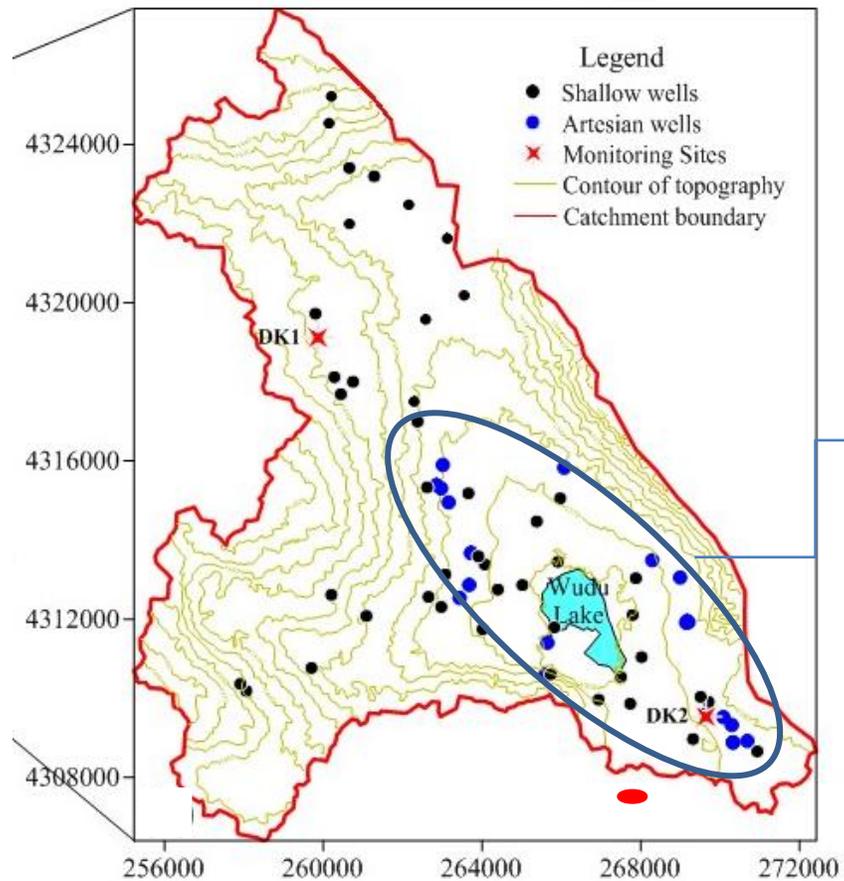
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The Ordos Plateau and the Wudu Catchment



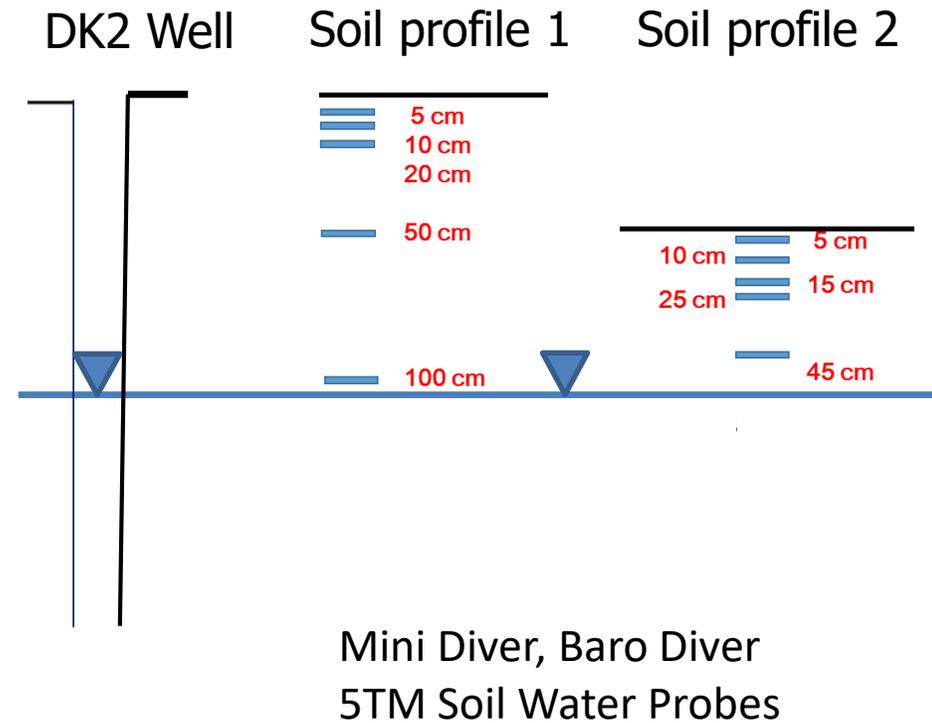
- Semi-arid Climate: Precipitation 260 mm/yr; Pan Evaporation 1300 mm/yr

Monitoring Water Table and Soil Moisture



Shallow groundwater

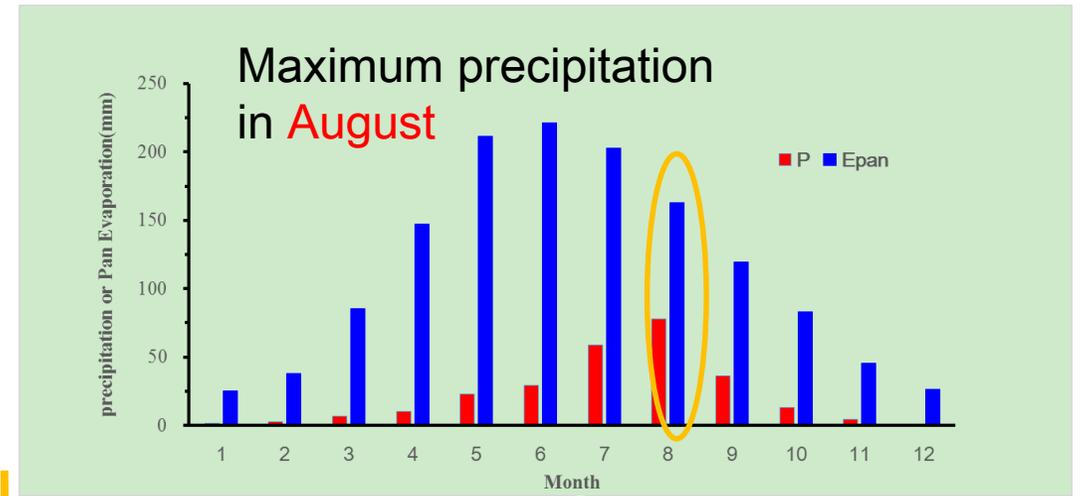
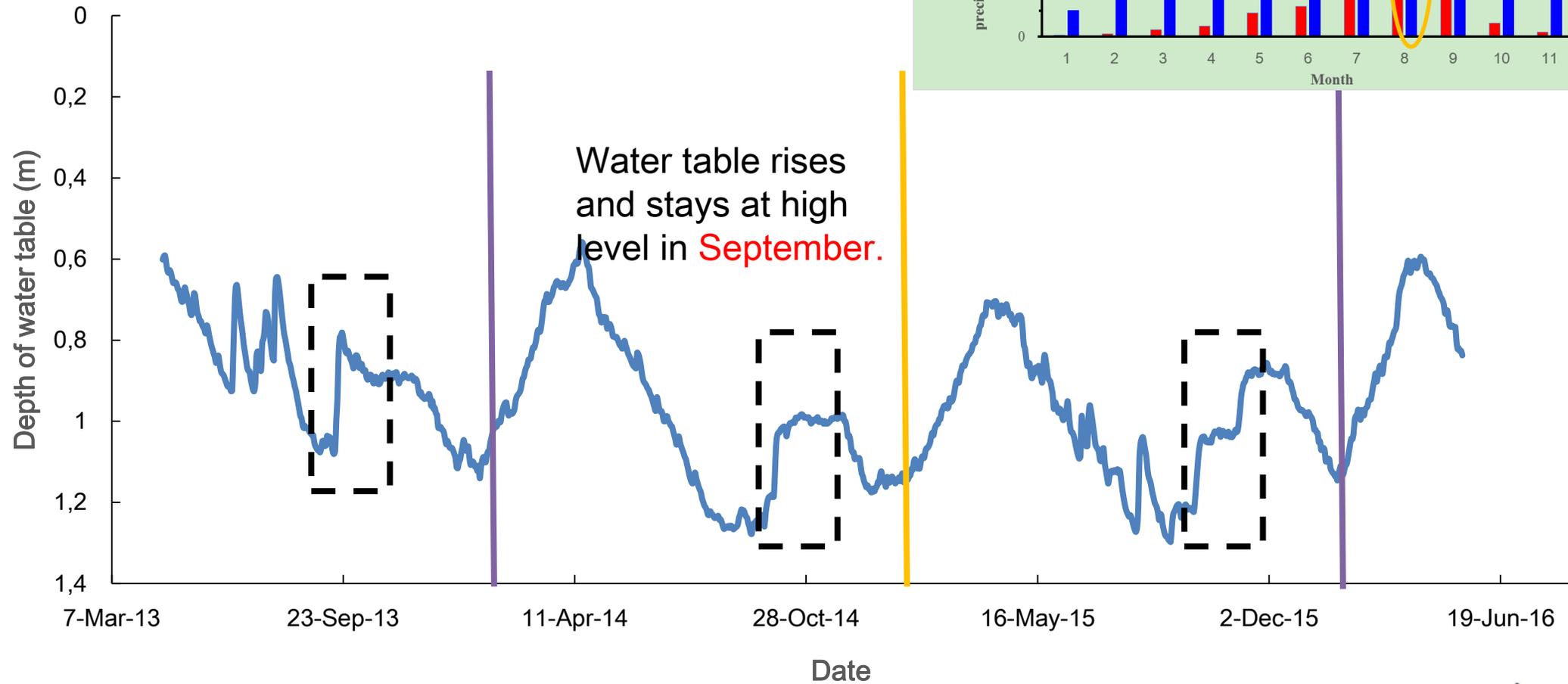
Discharge area



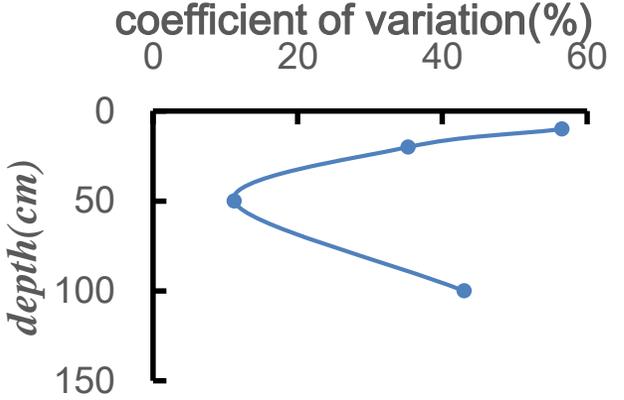
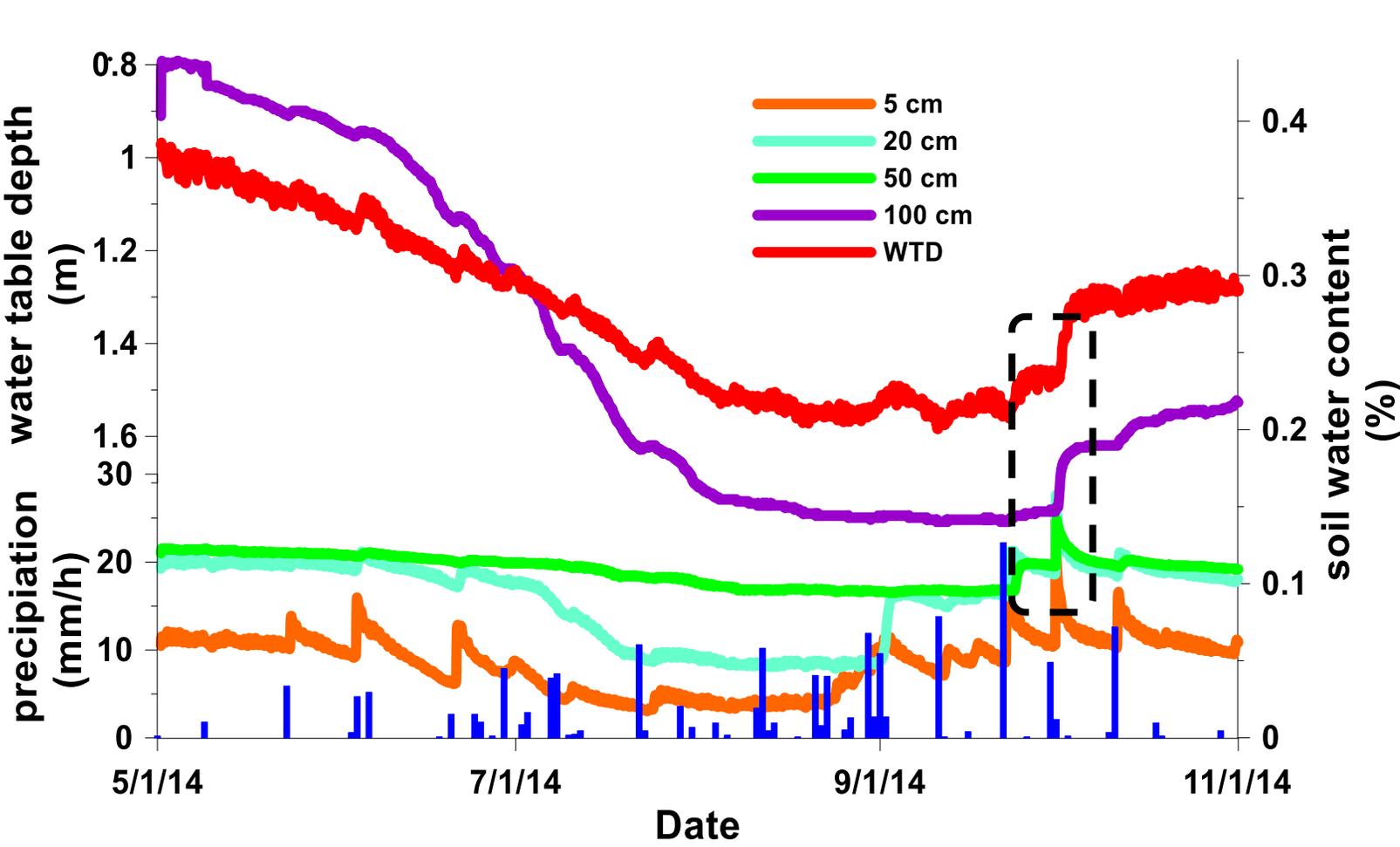
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The Fluctuating Water Table Depth (WTD)



Profile 1 (WTD₀=1 m)



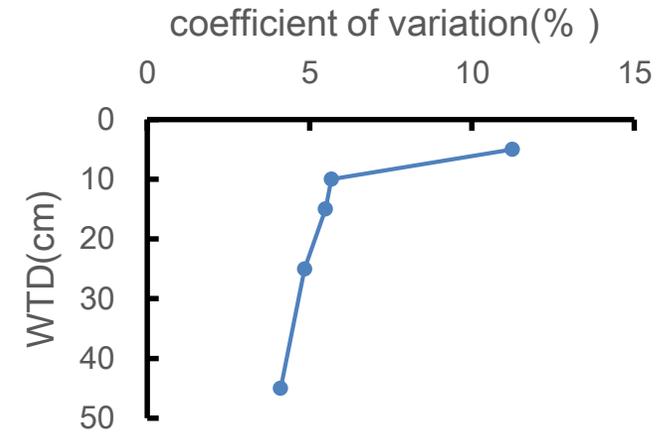
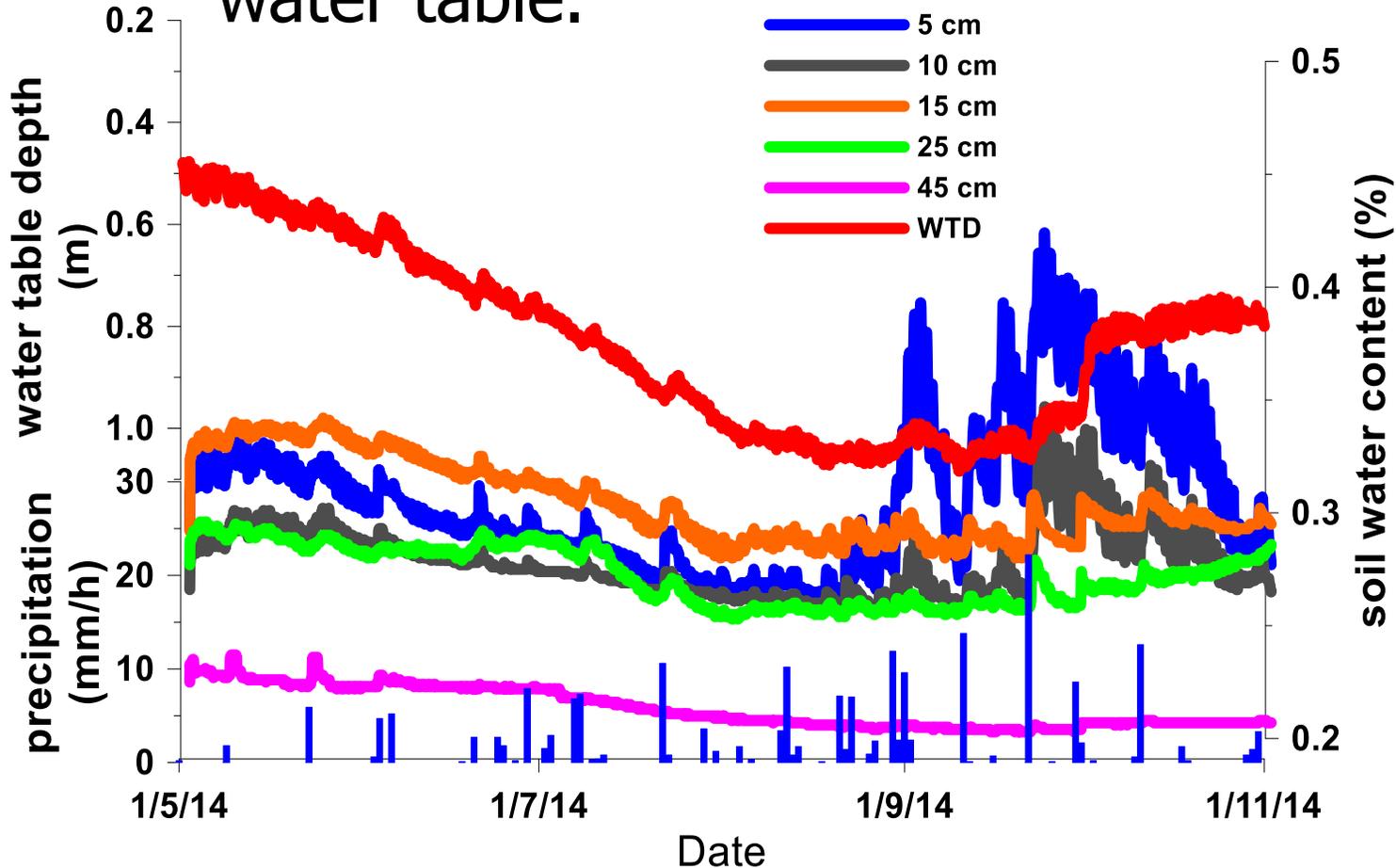
- the rise of water table and soil moisture in different depths
- cross-correlation function analysis

The rise of water table and soil moisture in different depths

2014 DK2-Profile1	May –Sept	After Sept.
5 cm-20 cm	<p data-bbox="624 735 1592 949">May –Sept, higher evaporation Soil moisture in depth of 50 cm is the final one responses to the rainfall</p> <p data-bbox="1656 813 2497 949">After Sept., rainfall can directly recharge groundwater</p>	
20 cm-50 cm		
50 cm-100 cm		
100 cm-WTD		

Profile 2 (WTD₀=0.5 m)

Precipitation could arrive at the water table.



2014 DK2-Profile2	May –Oct.
5 -10 cm	+1h
10 -15 cm	+2h
15 -25 cm	+1h
25 -45 cm	+2h
45 cm-WTD	+1h

Mechanisms of GW Recharge

Focused Recharge

From May to August
(low P/Ep)

Profile 2
(initial WTD=0.5 m)

Diffuse Recharge

In September
(high P/Ep)

Profile 1 & Profile 2

Outline

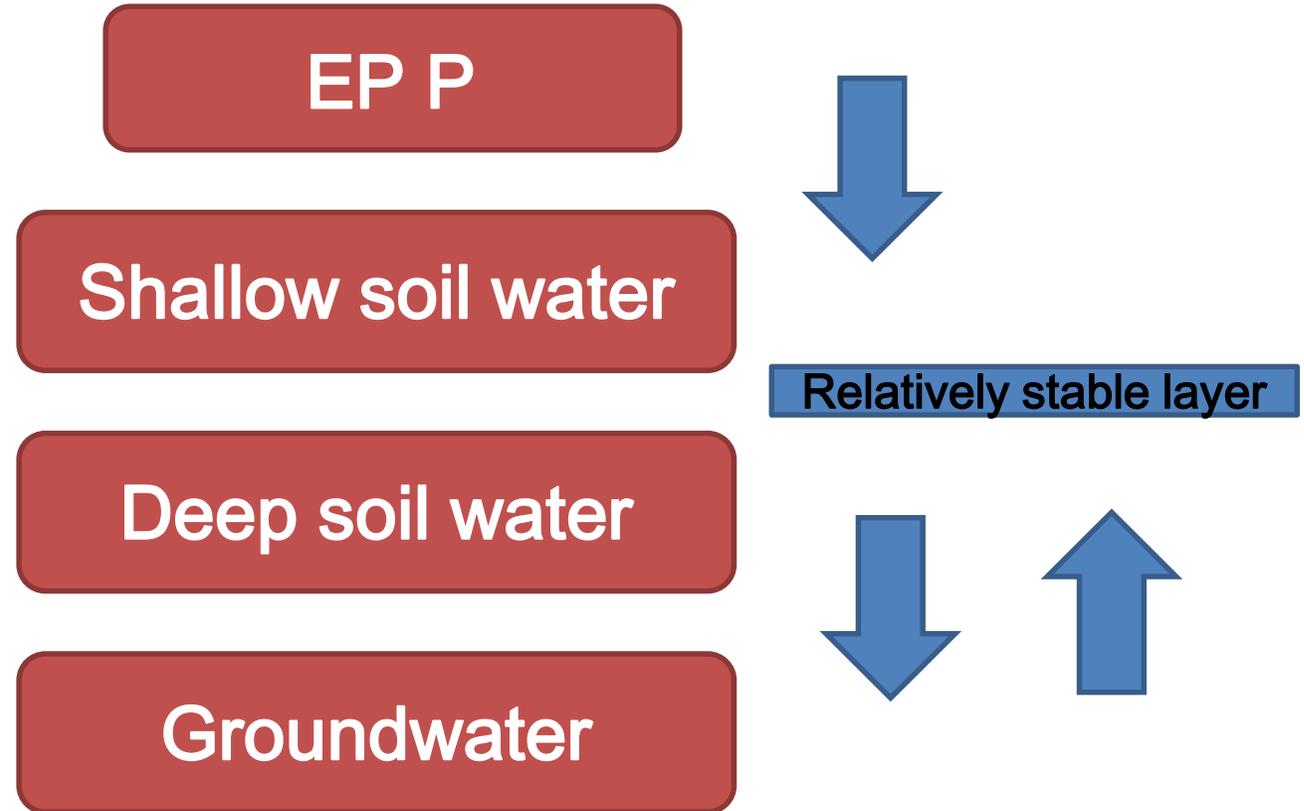
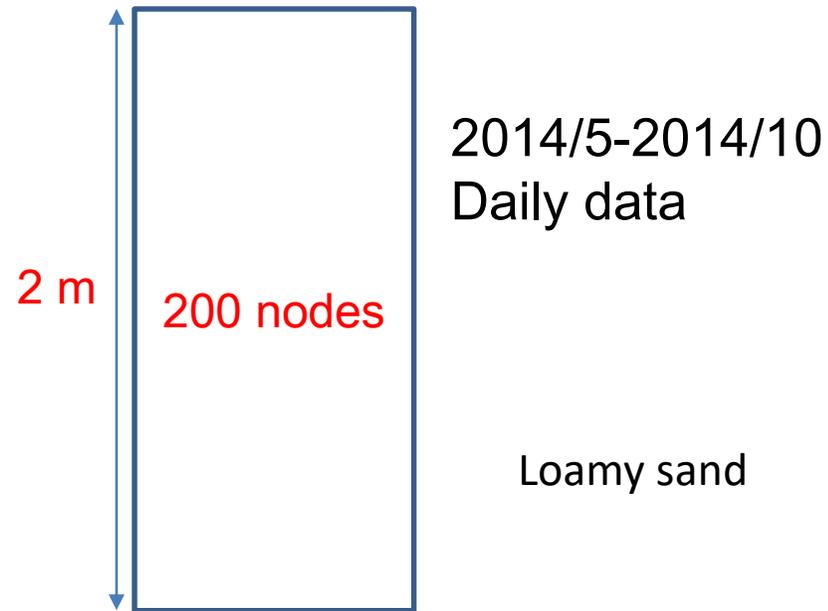
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The simulation by Hydrus-1D

Atmospheric boundary :

P from meteorological station

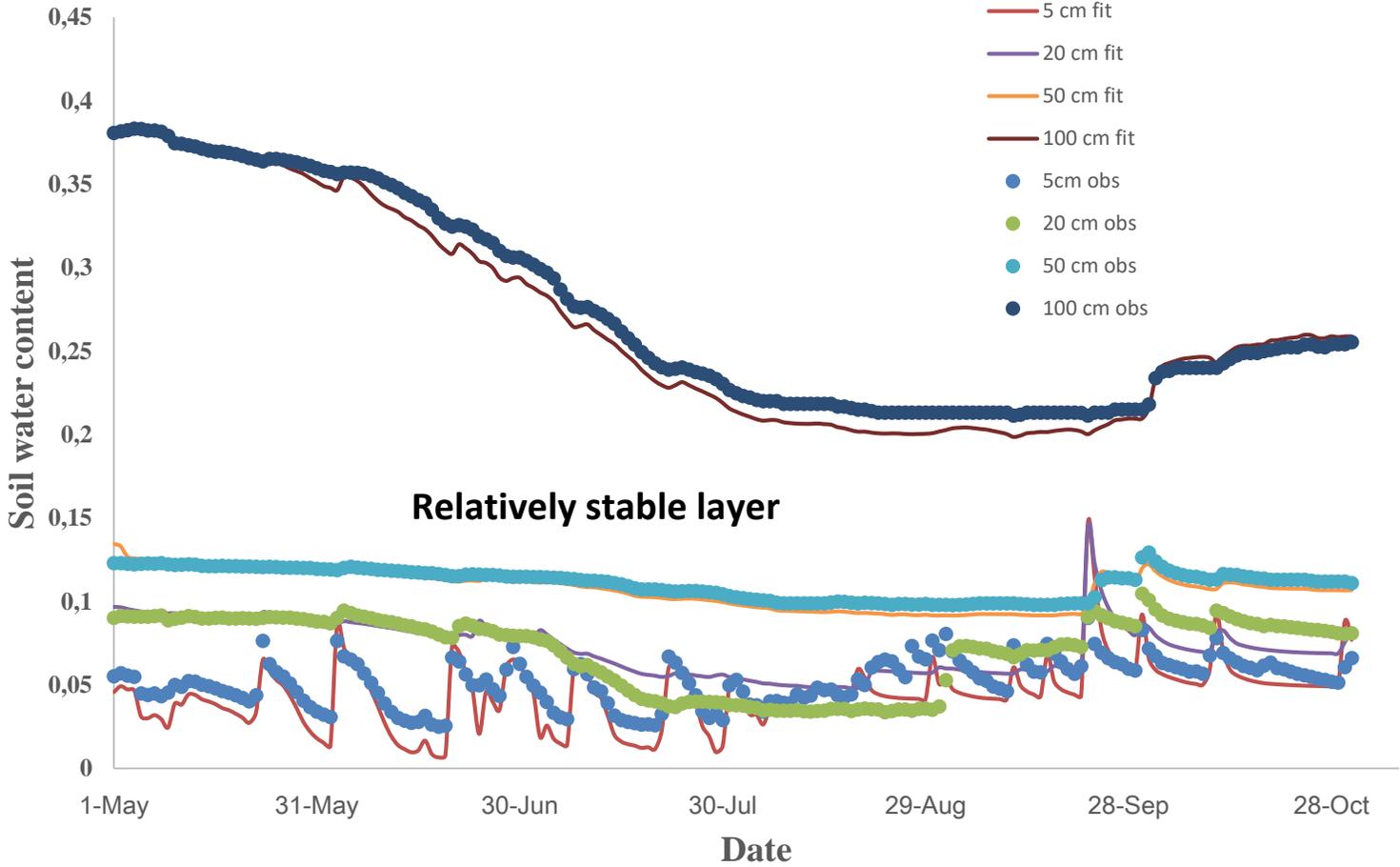
EP from Penman-Montheith Equation



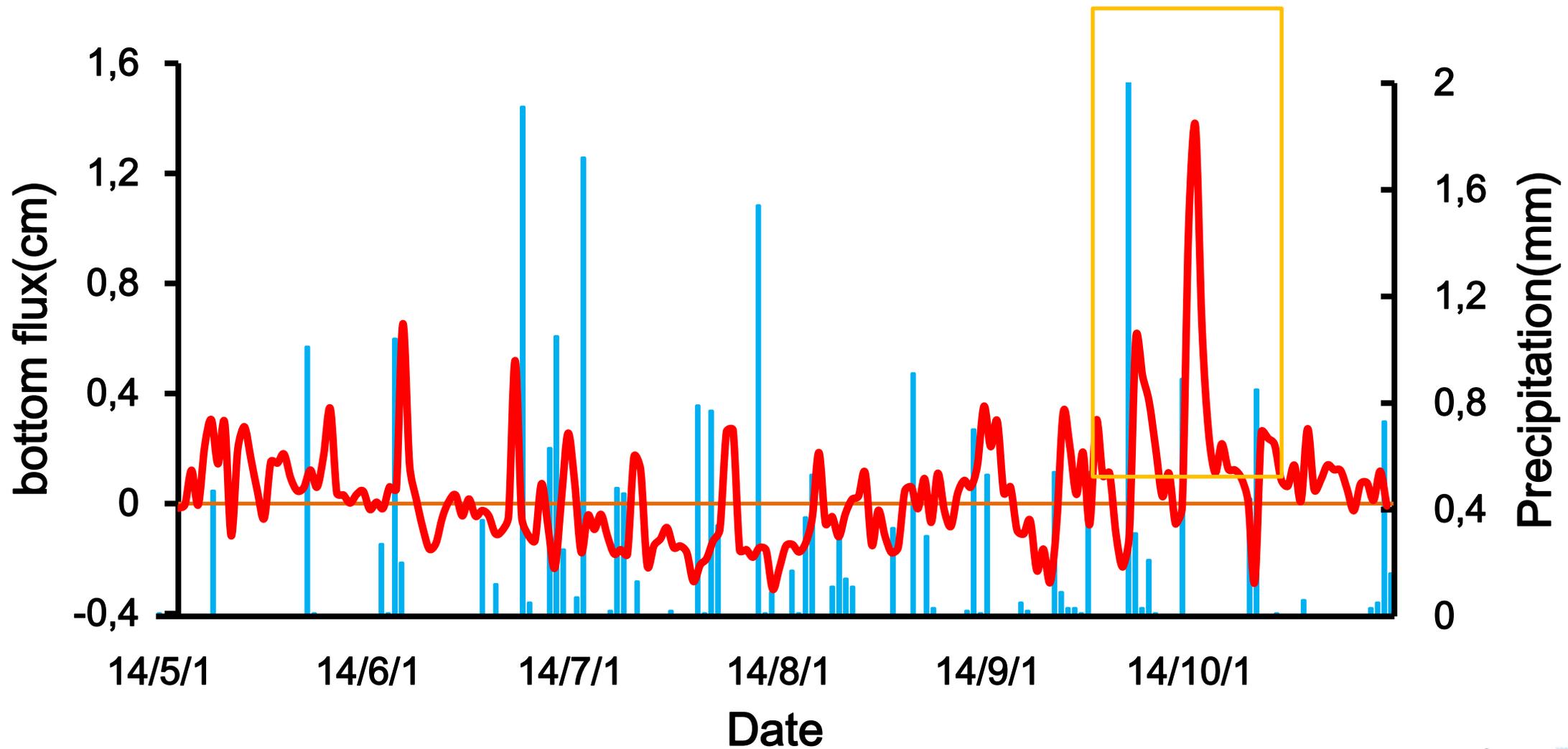
Variable head boundary:

Fluctuating water level

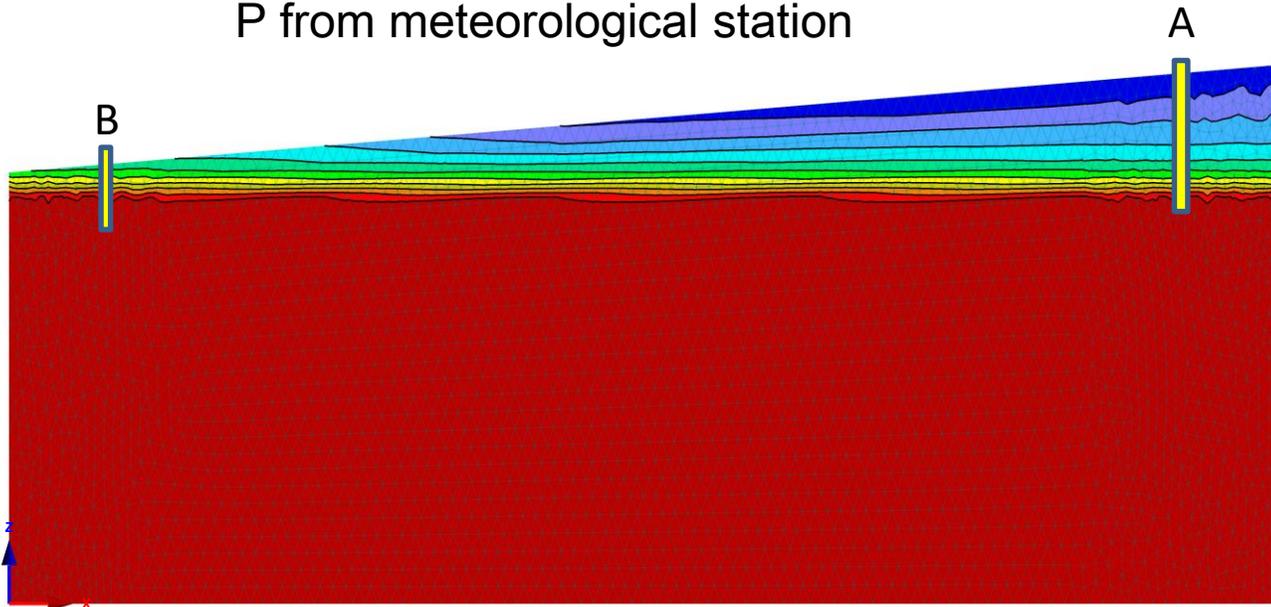
The simulation by Hydrus-1D



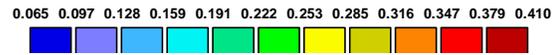
The bottom flux



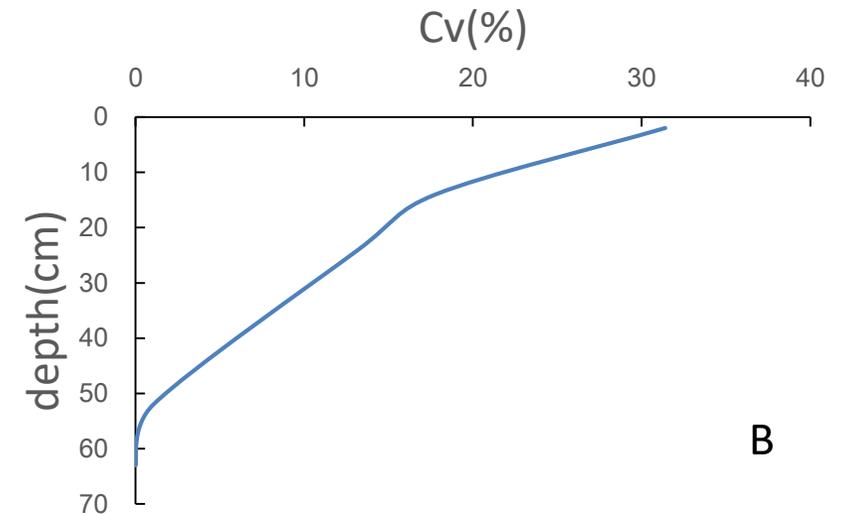
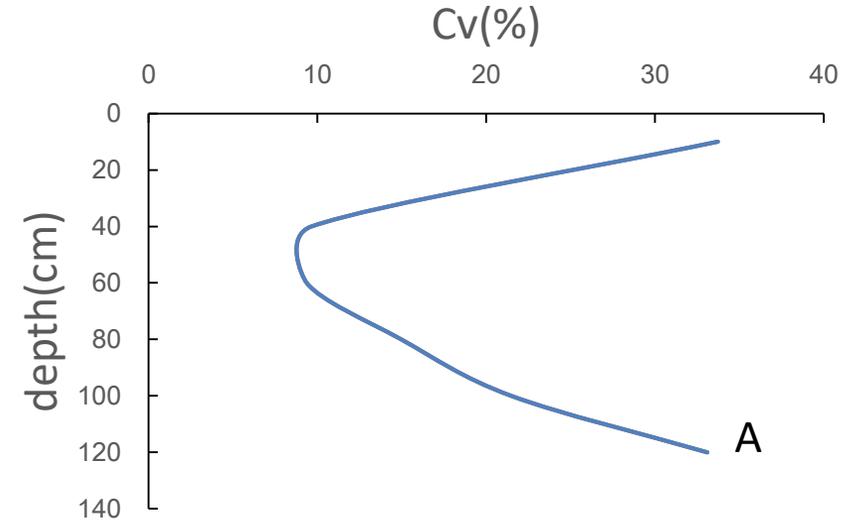
Atmospheric boundary:
 ET from Penman-Montheith Equation
 P from meteorological station



Variable head boundary :
 Fluctuating water table



Simulation by hydrus-2D

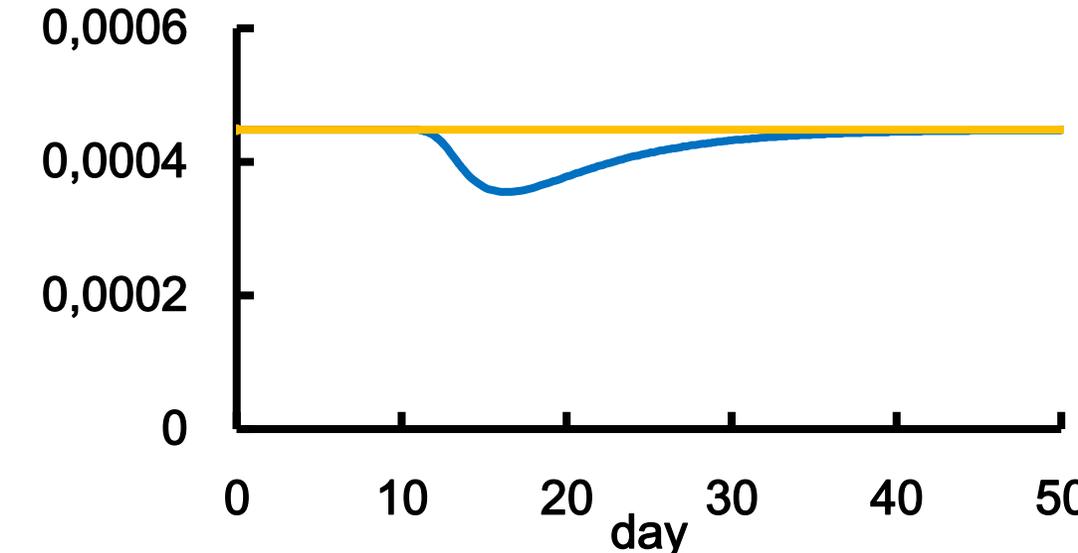
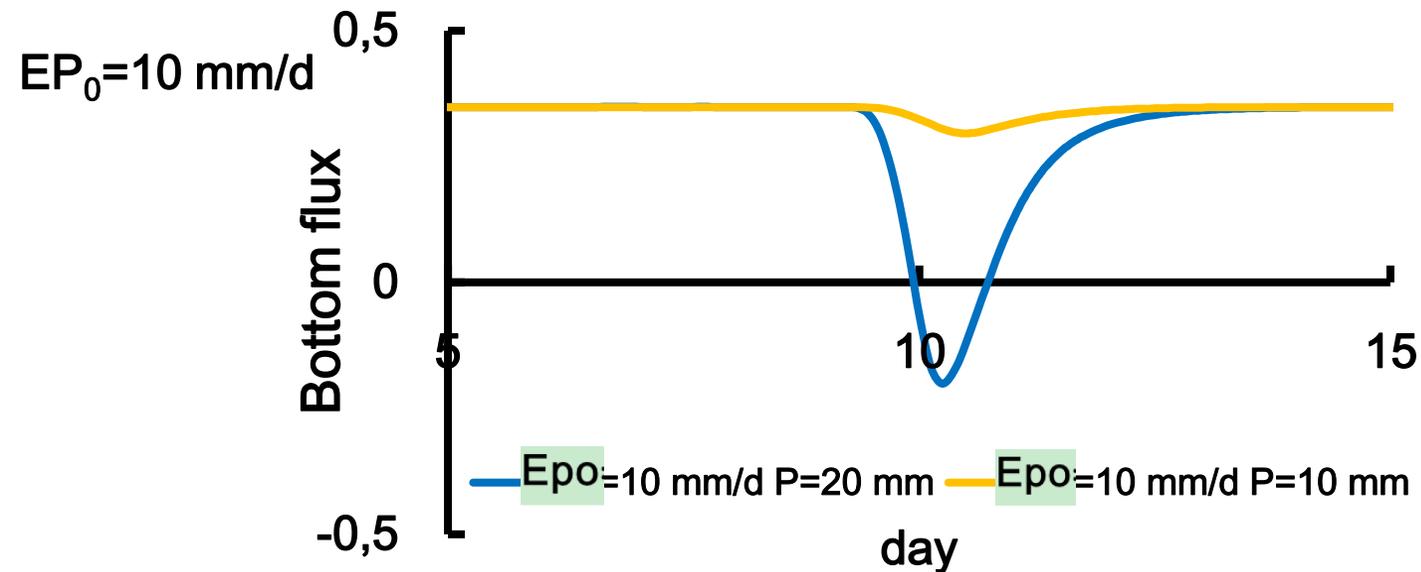
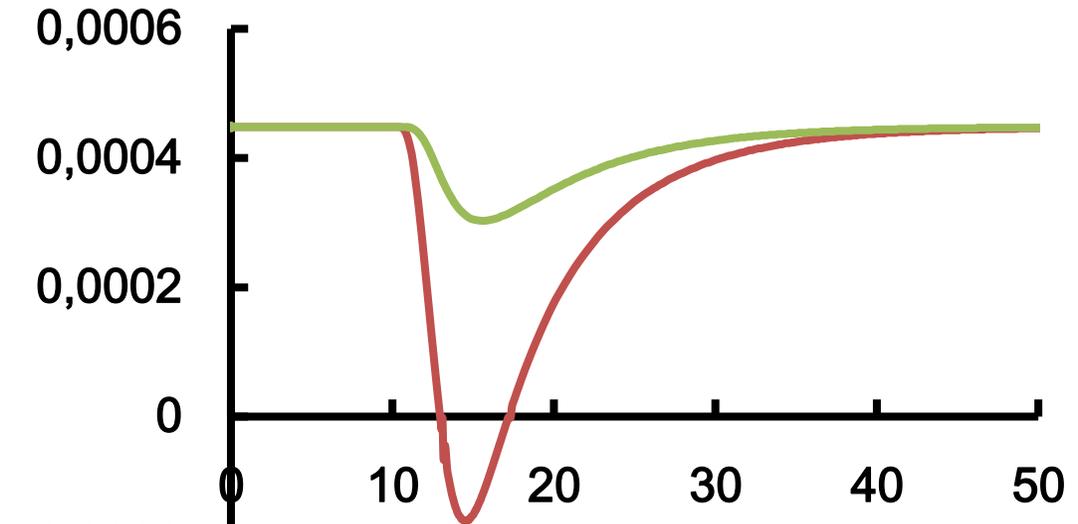
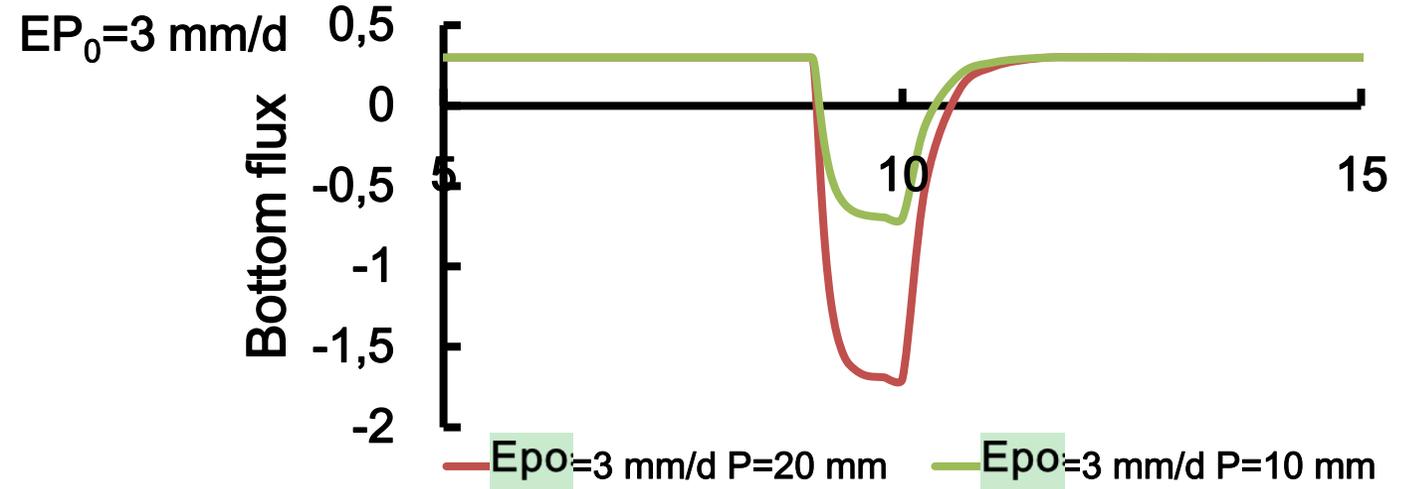


Influencing factors of recharge : WTD and EP_0

WTD:

0.5 m

1.5 m



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Conclusion:

In the semi-arid region

Infiltration of rainfall --- main source of recharge

Field observation and numerical simulation--- effect of WTD and P/EP on GW recharge

Monitoring of soil content --- a useful tool

Thank you for your attention!