ESF Project „*Establishment of interdisciplinary scientist group and modelling system for groundwater research*"

Mathematical estimation of shallow groundwater fluctuations under different aquifer characteristics

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Objective

To investigate shallow groundwater fluctuations and fix the main parameters that influence the groundwater levels in long term

Study area

Latvia

•Relief-flat with small knolls. 73...90 m AMSL, average ≈82 m AMSL.
•3 shallow groundwater wells in river catchment Mellupīte
•Observations from 2006-2010

•Relief-particularly hilly for Latvian conditions, Average 250 m AMSL
•30 shallow groundwater wells in 3 river catchments-Ezerupīte, Vienziemīte and Tūlija
•Observations 1976-1984

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Materials and Methods

Way of working by using:

- measurements from 33 shallow groundwater wells
  - Groundwater depth
  - Topography

Observed groundwater depth + 1D modelling=characteristic parameters of groundwater aquifer for each well

Find the most relevant parameters that affects the maximal minimal and average groundwater depth

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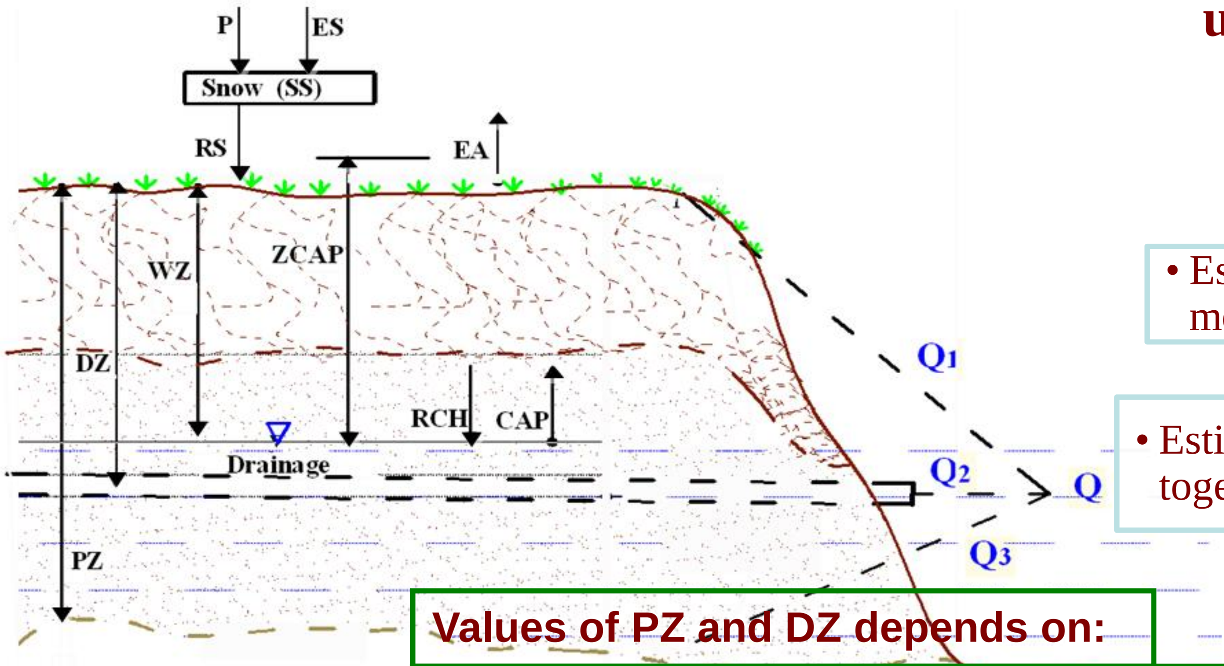
Mathematical groundwater model METUL

1D groundwater level model

Principal scheme



PARAMETERS
Wmax
ALFA
ZCAP
DZ and A2
PZ and A3
Ku, Kl and Ks
T1, T2, CFR and WHC
RCHR, RCHR2, RCHRZ, RCHRZ2, ROBK

Calculations in 3 blocs by using meteorological data

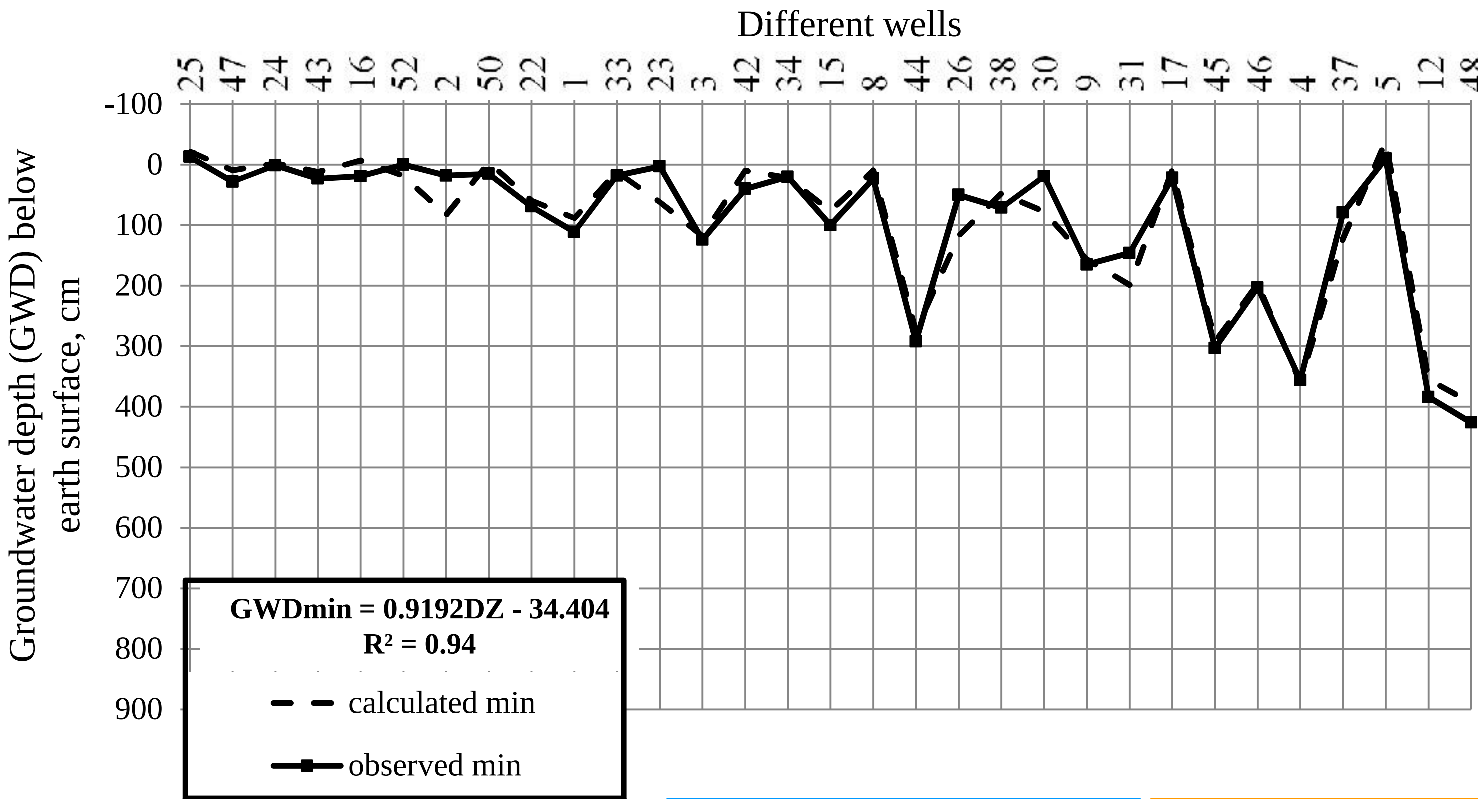
- Estimation of **snow cover**
- Estimation of the **active soil zone** moisture balance
- Estimation of the **groundwater balance** together with capillary fringe

Values of PZ and DZ depends on:	
Soil hydrofisical conditions, drainage pipes depth, local relief	Most important parameters that regulates the groundwater fluctuations **in long term:**
Aquitard depth, artesian pressure, local relief	

Data source: Krams M., Zīverts A. 1993

Results

Zosēni GWD-observed and calculated



GWD min
influenced by DZ

GWD average
influenced by PZ

GWD max
influenced by PZ

Although DZ mainly influence min GWD, there are PZ influences to all: max, average and min GWD

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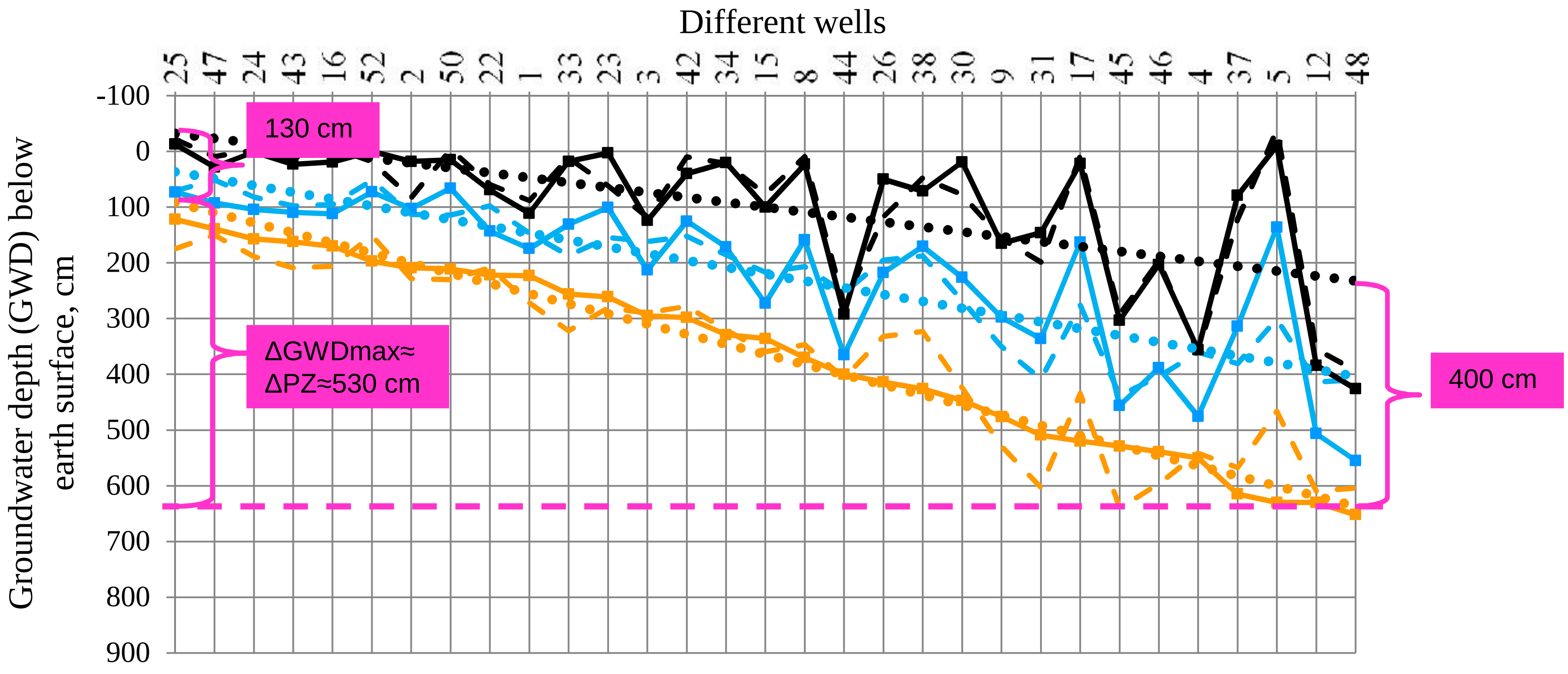
Zosēni GWD-observed and calculated



PZ increase provoke increases of:

- GWD min=0.5 cm/cm
- GWD average0.7 cm/cm
- GWD max=1 cm/cm
- GWD amplitude=0.5 cm/cm

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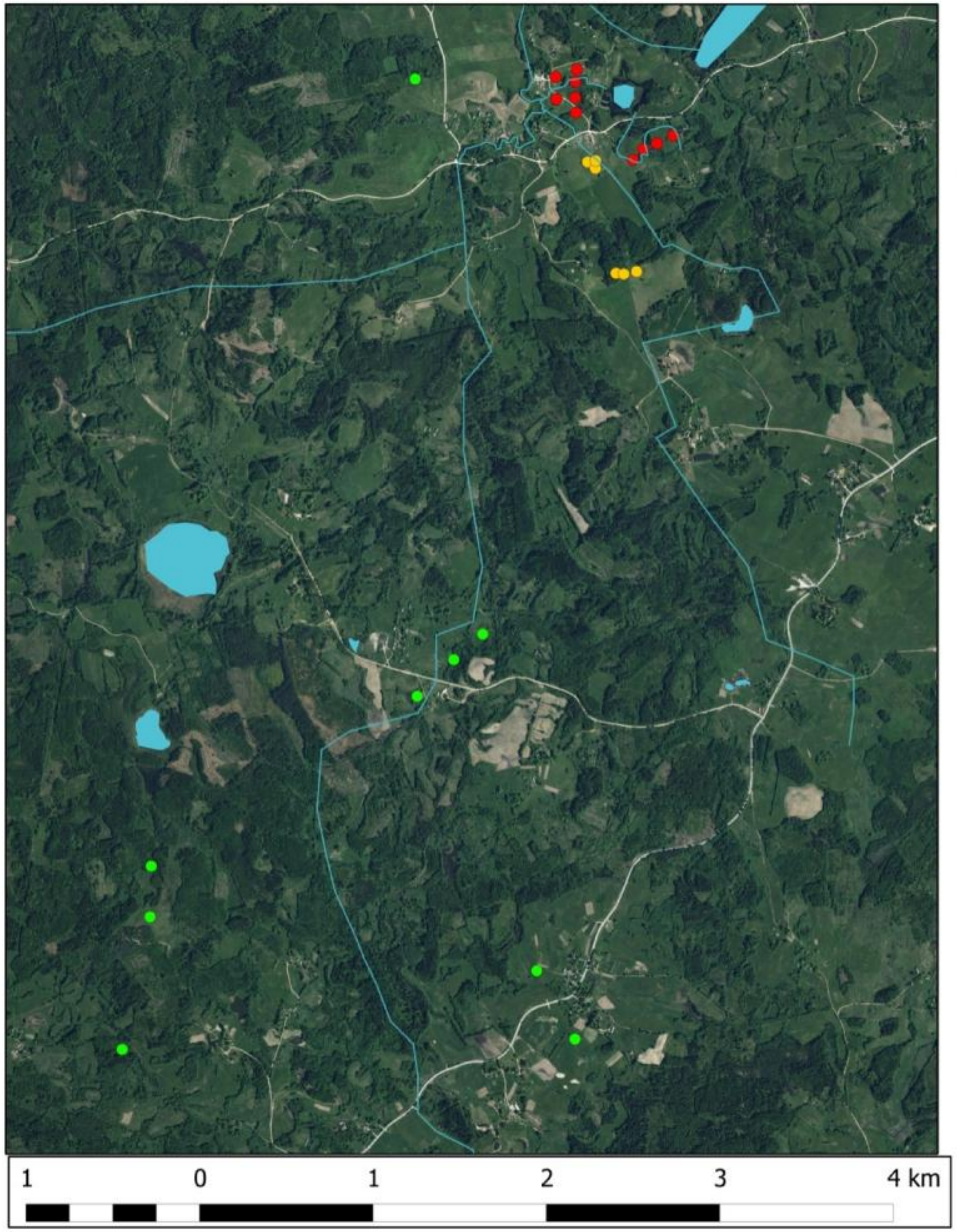
Before the next results the placement of analyzed wells of Zoseni site



The wells in 3 different river catchments

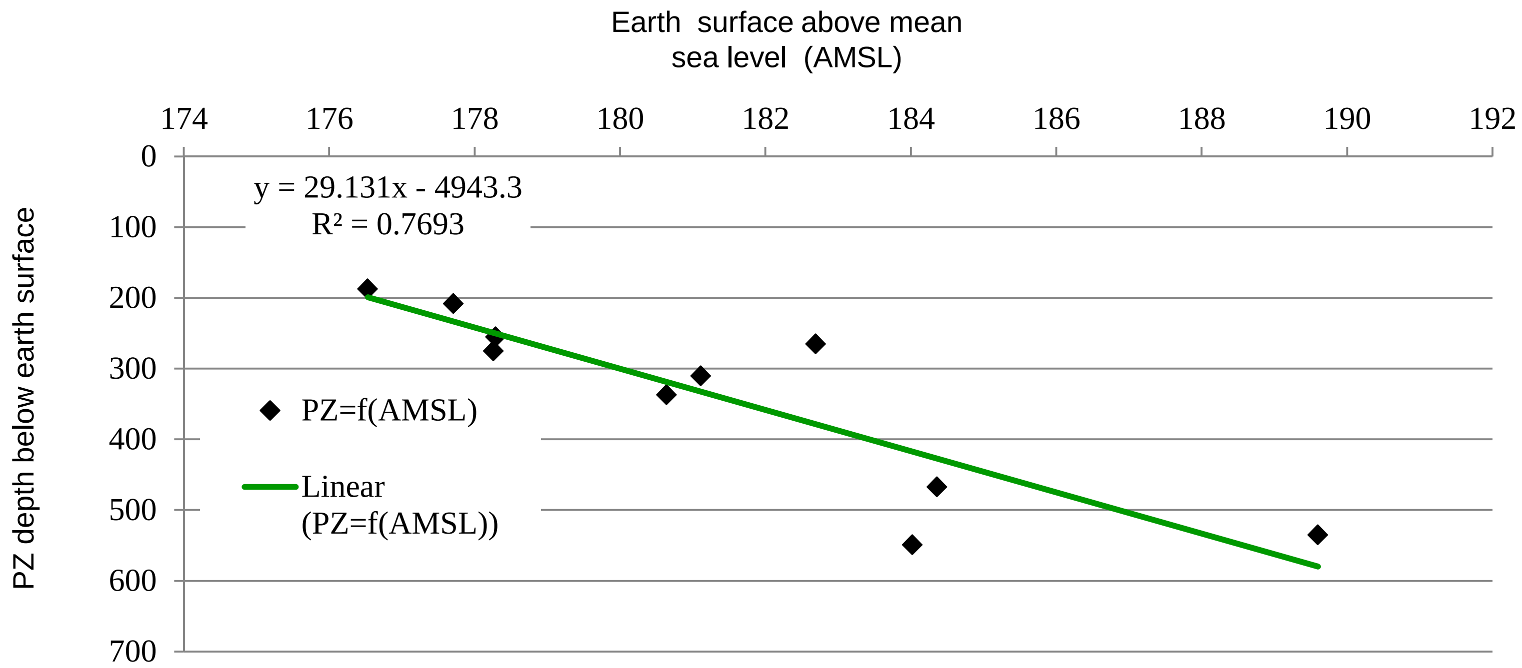
- The wells in catchment of river Tūlija
  Wells in wide area
  mainly depth <10 m

- The wells in catchment of river Vienziemīte
  Wellss close to each other
  3 wells are deeper than 10 m
  3 wells are less than 10 m deep

- The catchment of river Ezerupīte
  wells close to each other
  depth <10 m

Zosēni

PZ=f(AMSL)



In local theritory (Ezerupīte with10 wells) PZ depth is proportional to earth surface elevation AMSL

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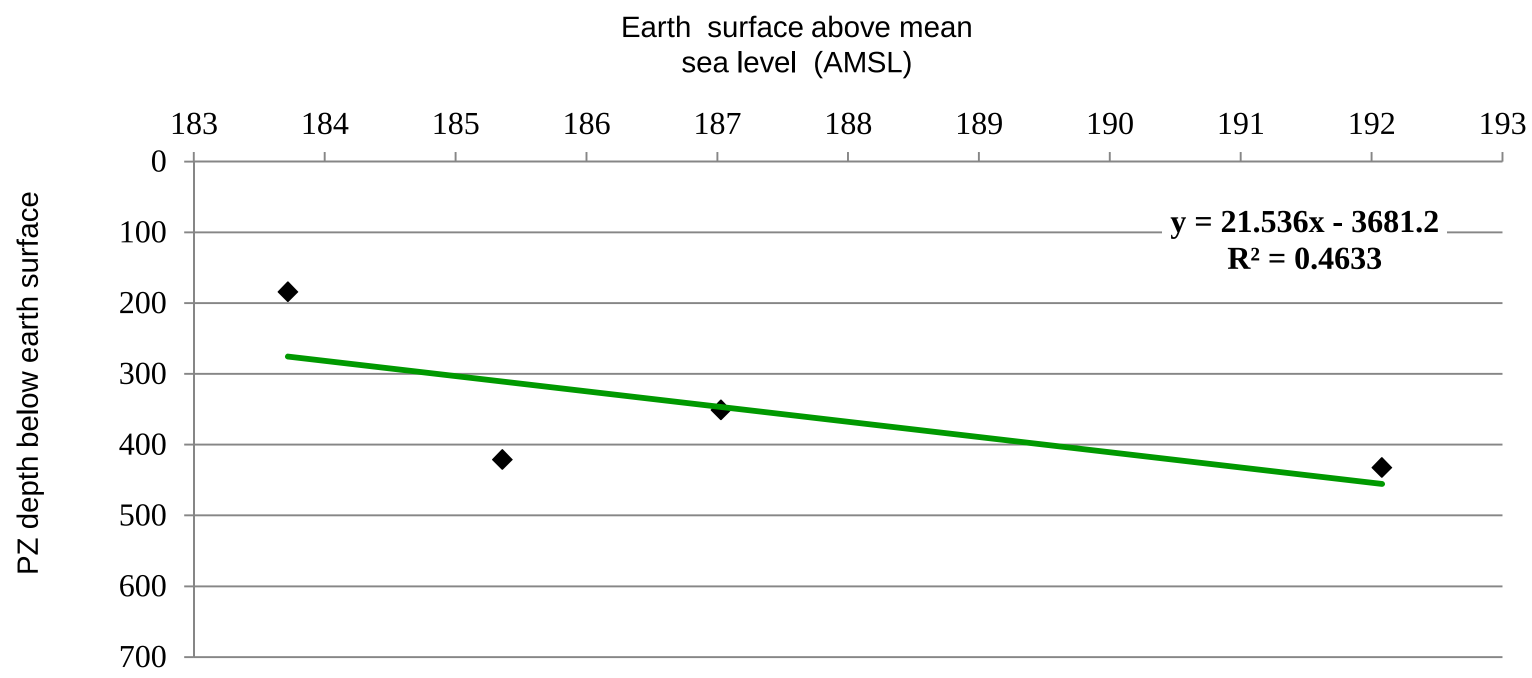
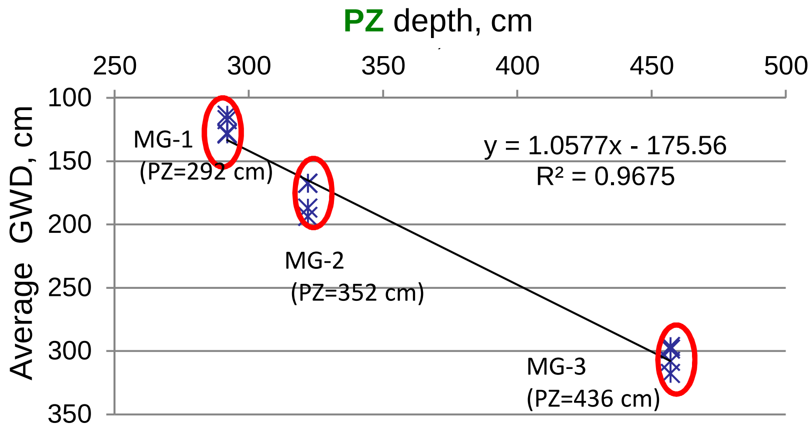
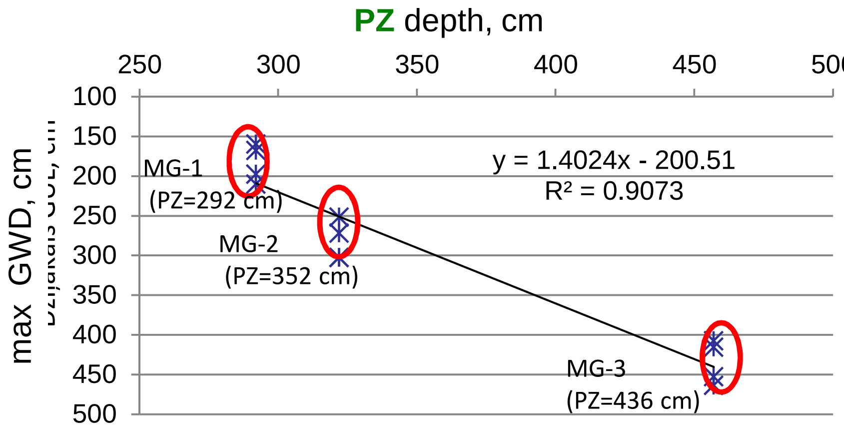


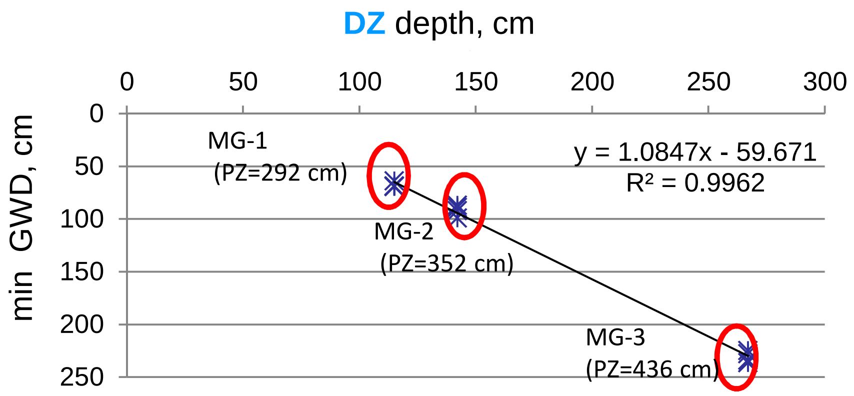
Wells in river catchment Vienziemīte Shows the corelation if the well depth is <10 m

Ezerupītē PZ dziļums korelē ar zem virsas augstuma izmaiņām.

GWD=f(PZ, DZ) and yearly variability (Mellupīte)







GWD results in 4 hidrologycal years (2006-2007; 2007-2008; 2008-2009; 2009-2010)

GWD uncarntainty

- GWDaverage=15...26 cm;
- GWDmaxļ=50...55 cm;
- GWDmin=5...12 cm;
- GWDampl=50...64 cm.

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Conclusion

•Long term groundwater depth is mainly affected by combinations of PZ; DZ and elevation of earth surface
•Minimal shallow groundwater depth is regulated mainly by subsurface drainage (characterized by DZ)
•Maximal shallow groundwater depth is regulated mainly by pesiometric head level (characterized by PZ)
•Long term average groundwater depth shows the good correlation with pesiometric head level
•Yearly groundwater depth variability could be higher than 60 cm

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Thank you!

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