The Impact of Climate Change on Water Resources availability

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CC-WaterS

Introduction

Extreme weather events, such as longer dry periods or strong rainfall, have impact on water resources. When the impact is reflected as a deteoration of groundwater quality or decrease of available groundwater quantity, it can be critical issue for the society and the economy. The extend of climate change and its impact on water resources was studied on twoo test sites, Ljubljana field and Mura valley's aquifers (**Fig.1**) These two aquifers differentiate by geometry, yield, land use and response to climate change. The first one lies beneath urbanised and agricultural areas and on the second one the agricultural land use prevails.

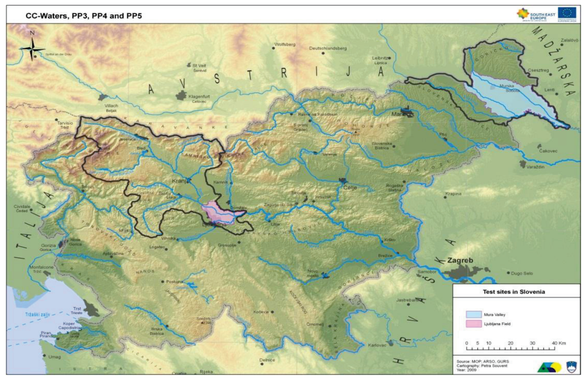


Figure 1. Slovenian test sites: Ljubljana field and Mura valley and their associated catchment areas

BASIC DATA	LJUBLJANA FIELD	MURA VALLEY
Size: Length/Width	20,14 km / 11,14 km	53,23 km / 20,25 km
Height (in m above sea level)	254,5 - 639,4	146,2 - 328,4
Average ann. precipitation (1961-1990)	1358 mm	817,42 mm
Mean ann. temperature (1961-1990)	9 °C	9,5 °C
Permeability (mean)	10-2 m/s - 3,7•10-3 m/s	10-4 m/s
Depth to groundwater (mean)	5 - 30 m	4 m

Conclusions

Water balance and groundwater modelling of worst case scenarios (max. values for T, P and min. values for river discharge) have shown decrease in future groundwater recharge in Mura valley, as well as in Ljubljana field. In the period 2021-2050 the groundwater recharge will decrease up to 10% and in the period 2071-2100 up to 15%.

Aknowledgement

Research work within CC-WaterS project is supported by means of the European Regional Development Fund.

Ljubljana field

Preliminary identification of the problems

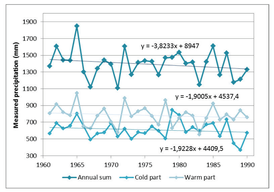


Figure 2: Measured precipitation

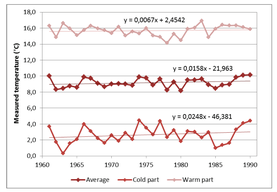


Figure 3: Measured temperature

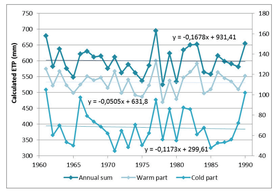


Figure 4: Calculated evapotranspiration

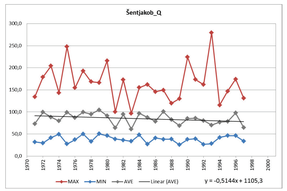


Figure 5: River discharge trends

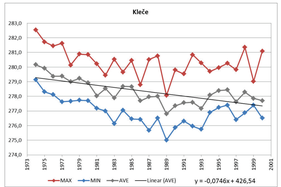


Figure 6: Groundwater levels trend

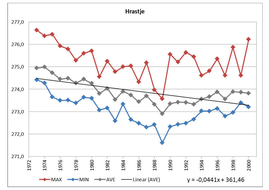


Figure 7: Groundwater levels trend

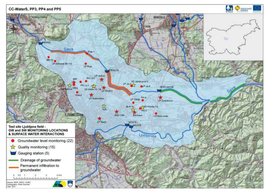


Figure 8: Monitoring stations

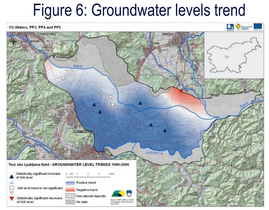


Figure 9: Groundwater level trends(1990-2006

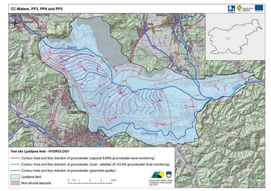


Figure 10: Hydrogeological map

Impact of the Climate Change

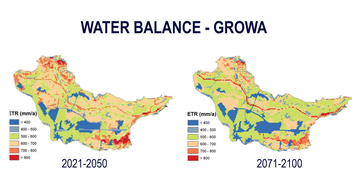


Fig.11a: Real ETP

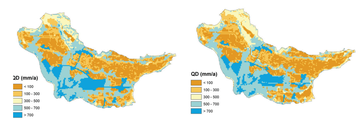


Fig.11b: Direct runoff

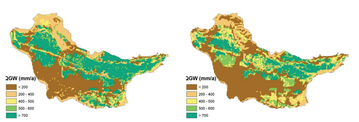


Fig.11c: Groundwater recharge

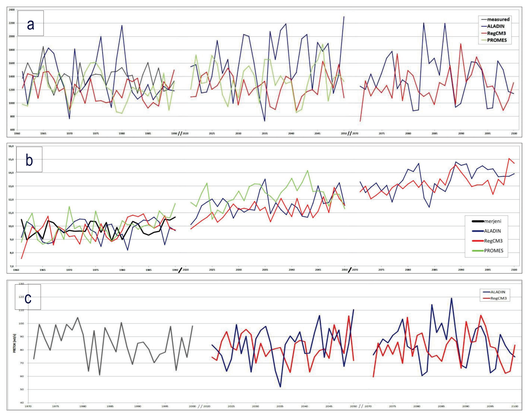
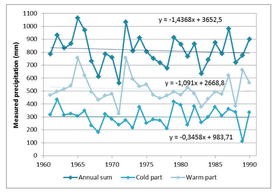


Fig.12: a – annual amount of measured and modelled precipitation (1961-1990 (left), 2021-2050 (middle), 2071-2100 (right)
b – annual measured and modelled temperature (1961-1990 (left), 2021-2050 (middle), 2071-2100 (right)
c - Sava river's discharge (1961-1990 (left), 2021-2050 (middle), 2071-2100 (right)

Mura valley

Preliminary identification of the problems



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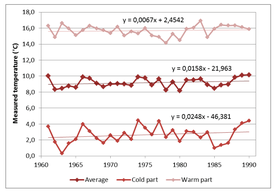


Figure.14: Measured temperature

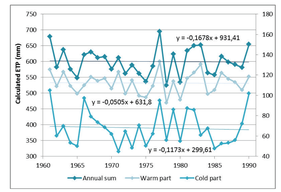


Figure.15: Calculated evapotranspiration

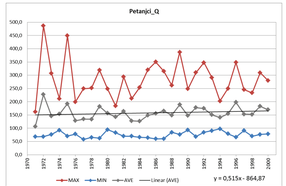


Figure 16: River discharge trends

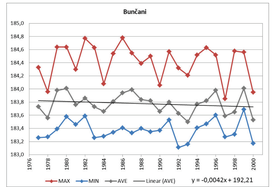
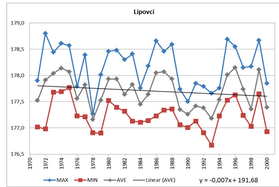


Figure 17. Groundwater levels trend



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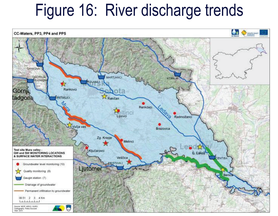


Figure 18: Monitoring stations

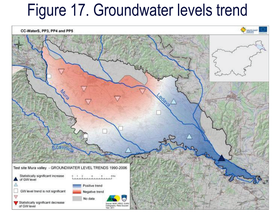
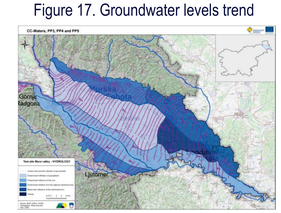


Figure 19: Groundwater level trends(1990-2006



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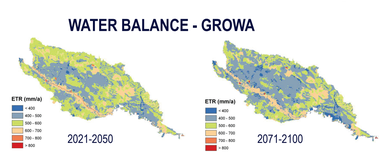


Fig.21a: Real ETP

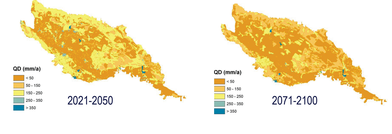


Fig.21b: Direct runoff

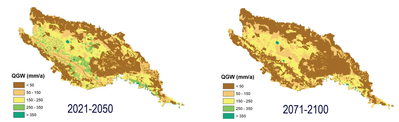
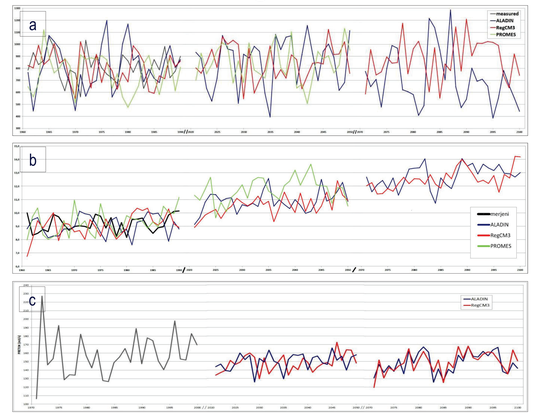


Fig.21c: Groundwater recharge



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