Hydro Predict'2012

CC-WaterS

University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

Impacts of climate change on spring water availability of the city of Vienna

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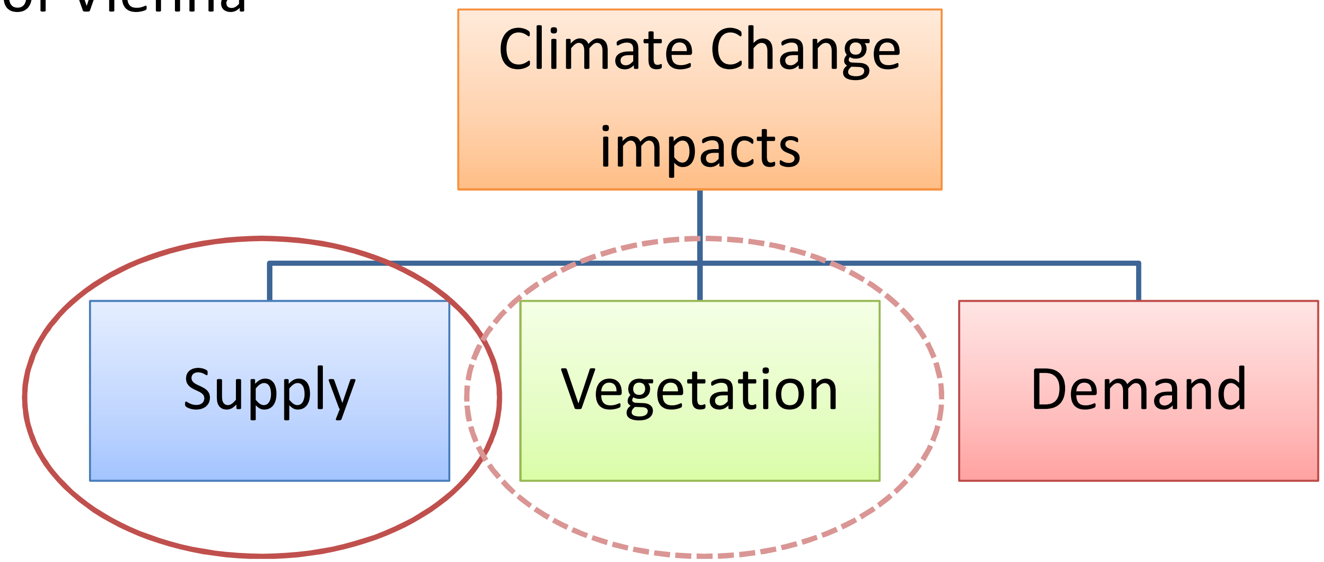
Organisation of the presentation

- Introduction
- Objectives
- Water Supply of the City of Vienna
- Methodology
- Results
- Summary

Objectives

Jointly for our common future

- The work presented is part of a larger project called CC-WaterS.
- The objective of this project is to analyse the possible impacts of climate change (CC) on water resources
- Special focus is on potential impacts on drinking water supply of the City of Vienna



Water Supply of the City of Vienna

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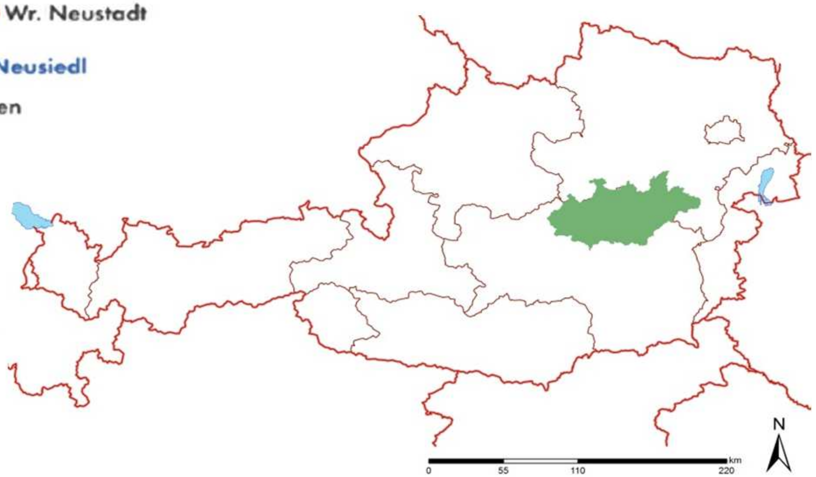
- 1st Vienna Mountain Spring Pipeline comprises the mountains Schneeberg, Rax and Schneealpe
- 2nd Vienna Mountain Spring Pipeline encompasses the Hochschwab Massif.

- In 15 locations, karstic spring water is tapped
- Max. supply capacity: 589.000 m³/d
- Around 400.000 m³ are diverted to Vienna per day
- The two spring zones cover more than 600 km²
- Spring water: 97,5 %
  - Pipeline 1: 43,9 %
  - Pipeline 2: 53,6 %



Methodology

- A water balance model was established for the intake areas of the Viennese water supply
- The main components of the water balance were analysed to assess changes of spring discharge, which is the main source for drinking water
- The water balance model is run under different climatic conditions - recent conditions for calibration and validation and the outputs from two RCM: Aladin-Arpege and RegCM-ECHAM5-r3, A1B emission scenario
- In the framework of the CC-WaterS project, precipitation and temperature fields with a spatial resolution of 0.25° were bias corrected using a quantile mapping approach
- The RCM outputs had to be downscaled to a higher spatial resolution (1x1 km^2) to reflect the climatic conditions in an alpine environment appropriately

Methodology: Water balance model, Spring catchments

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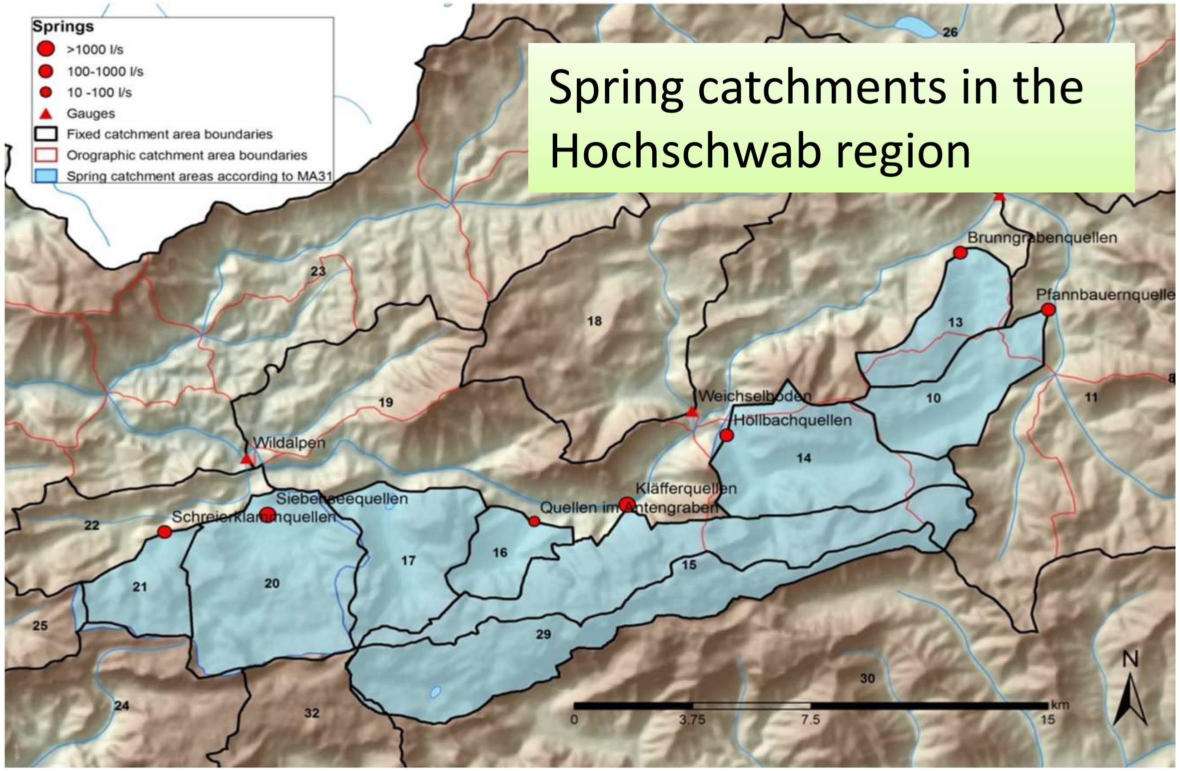
- The hydrological model was calibrated for the baseline period from 1971 to 1990
- Under the assumption that the hydrological parameters remain unchanged over the next decades, the outputs from the RCMs provide the input to the hydrological model.



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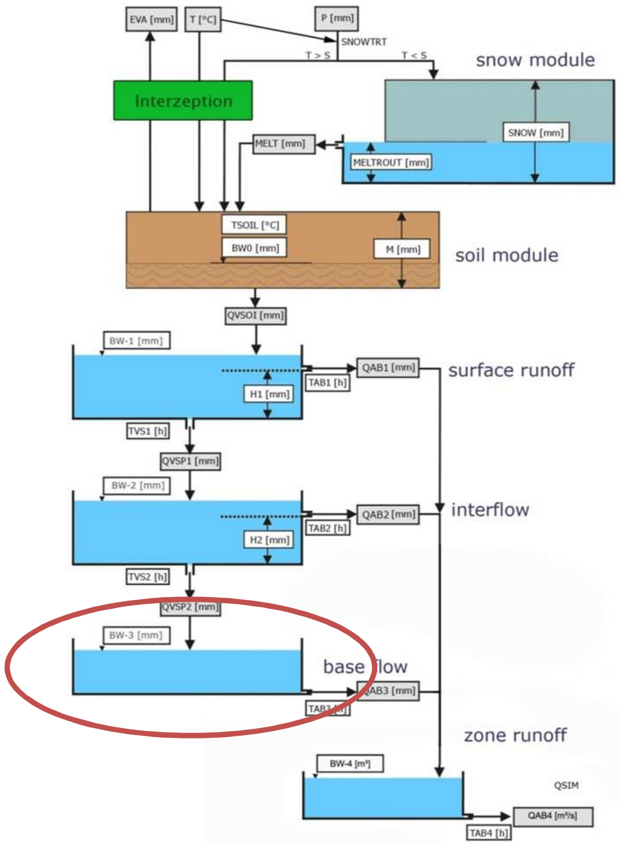
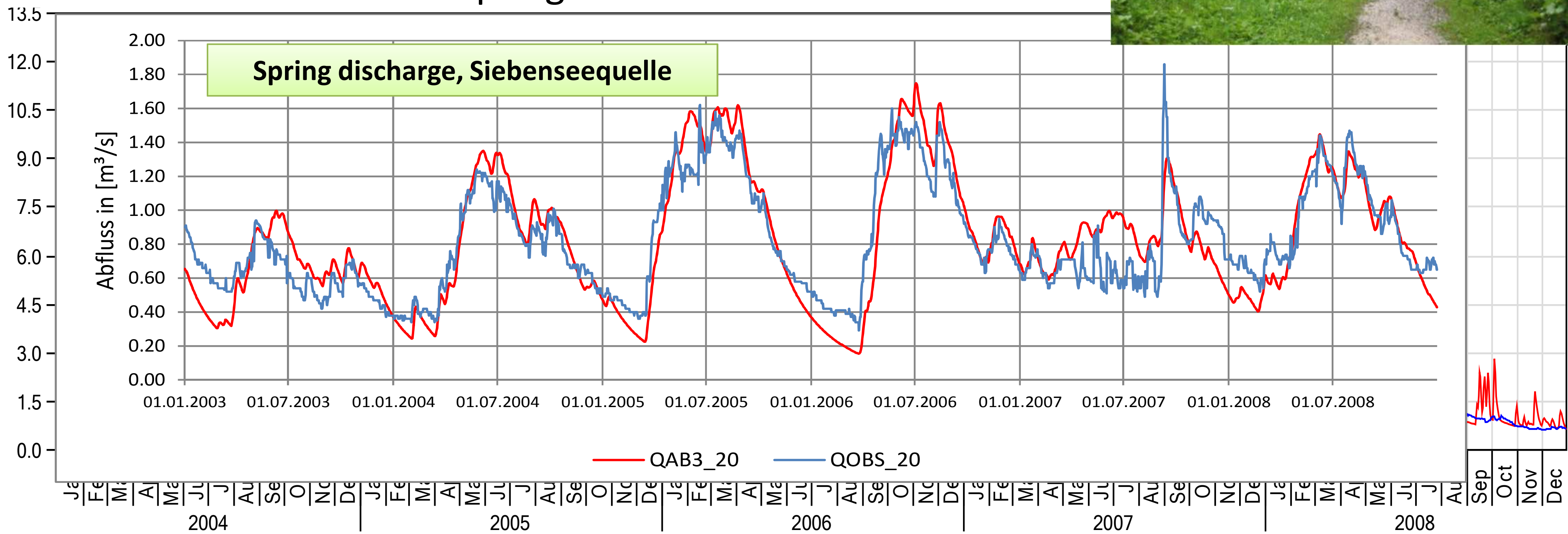


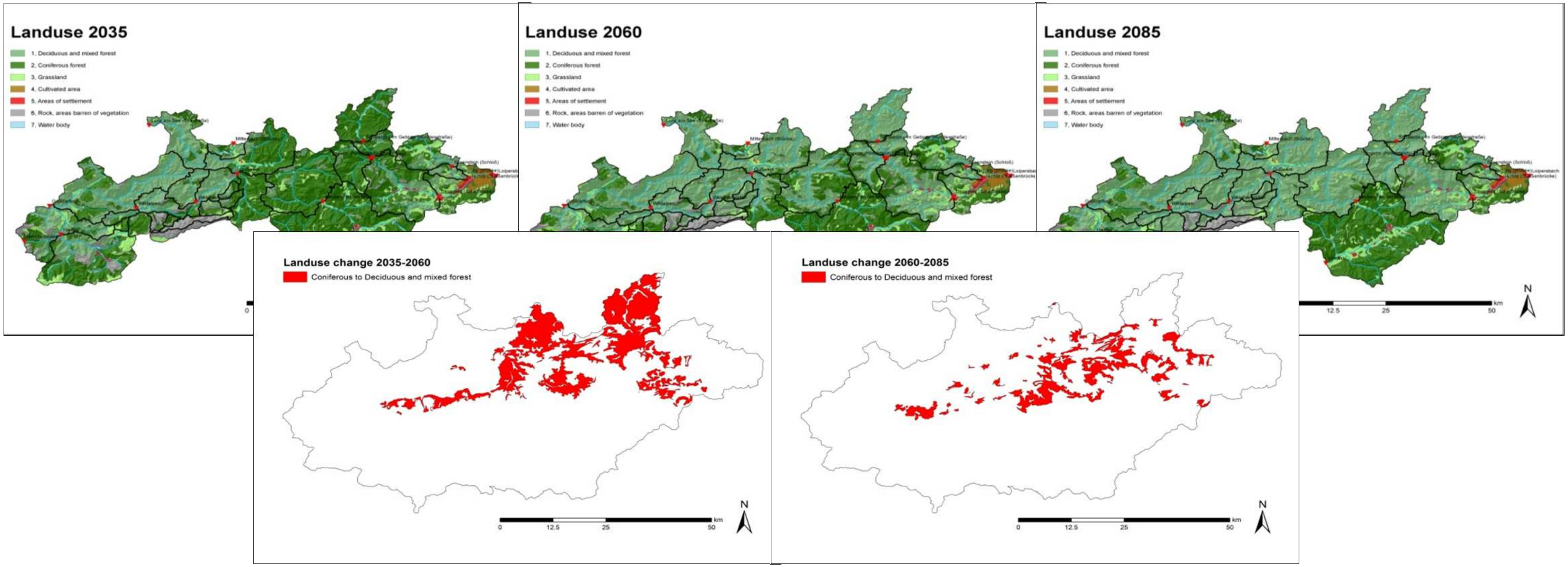
Calibration and validation of the spring catchments

- Spring catchments are part of the water balance model
- WB-model is calibrated with recent input data for the period from 1971-1990, validated from 1991-1999
- Baseflow-component of the simulated source runoff is compared with the spring discharge
- Observation data for 6 springs available



Climate change and CC-related land use changes

The outputs from two Regional Climate Models (Aladin-Arpege and RegCM-ECHAM5-r3) are used to drive the water balance model under different climate conditions



Application of scenario data – annual and seasonal values

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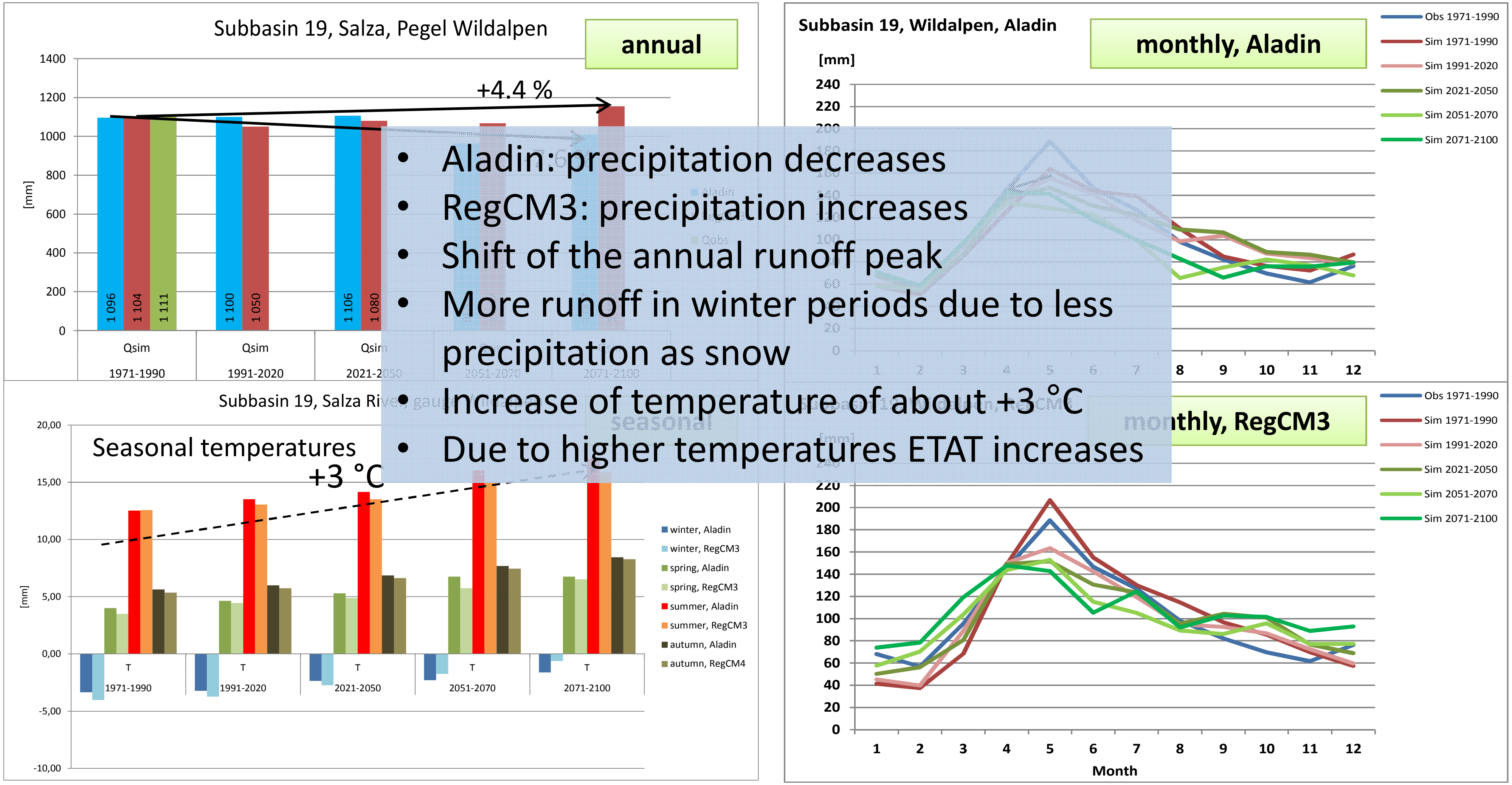

- Aladin: precipitation decreases
- RegCM3: precipitation increases
- Shift of the annual runoff peak
- More runoff in winter periods due to less precipitation as snow
- Increase of temperature of about +3 °C
- Due to higher temperatures ETAT increases

Spring discharge: uncertainty due to RCM data

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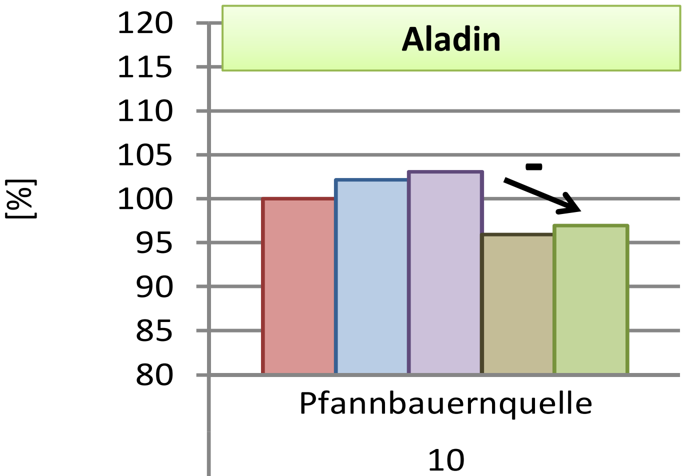
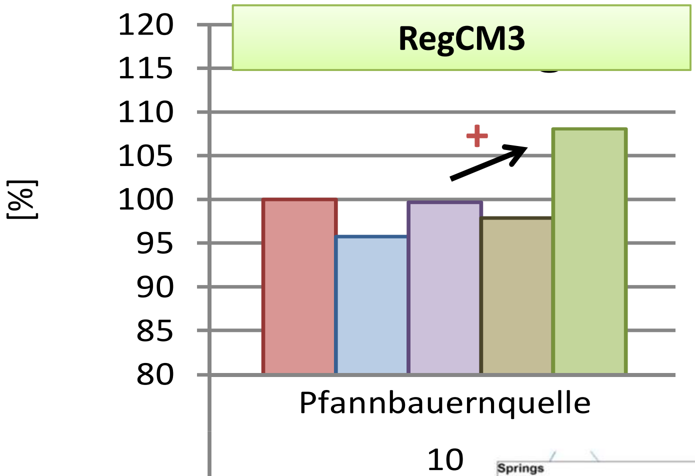
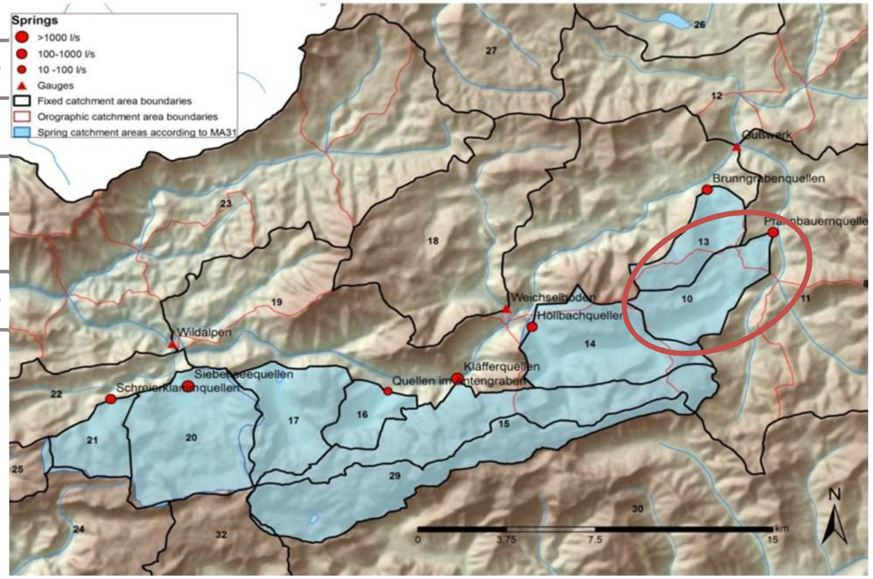


	10
1971-1990	100.0
1991-2020	102.1
2021-2050	103.1
2051-2070	96.0
2071-2100	97.0



	10
1971-1990	100.0
1991-2020	95.7
2021-2050	99.7
2051-2070	97.9
2071-2100	108.0



Spring discharge: uncertainty due to RCM data

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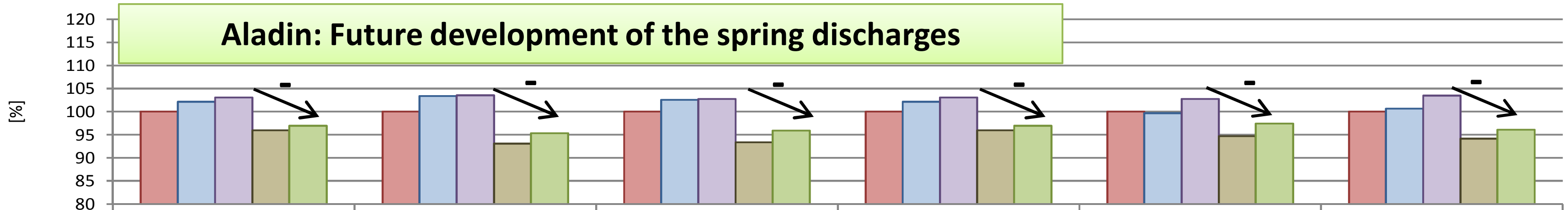


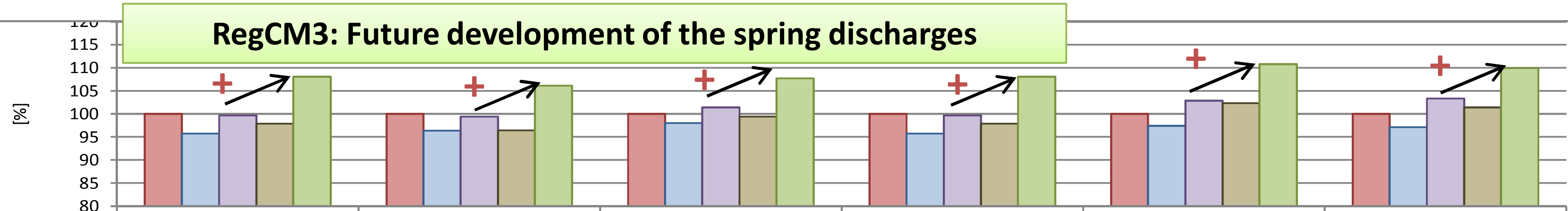
	Pfannbauernquelle 10	Brunngrabenquelle 13	Höllbachquelle 14	Kläfferquelle 15	Siebenseequelle 20	Schreierklammquelle 21
1971-1990	100.0	[illegible]	[illegible]	[illegible]	100.0	100.0
1991-2020	102.1	103.4	102.6	102.1	99.7	100.7
2021-2050	103.1	103.6	[illegible]	[illegible]	102.7	103.5
2051-2070	96.0	93.1	93.3	96.0	94.7	94.2
2071-2100	97.0	[illegible]	[illegible]	[illegible]	97.4	96.1

Future development of spring discharges

Aladin: decrease -3 % to -7 % after 2050

RegCM3: increase +6 % to +10 %

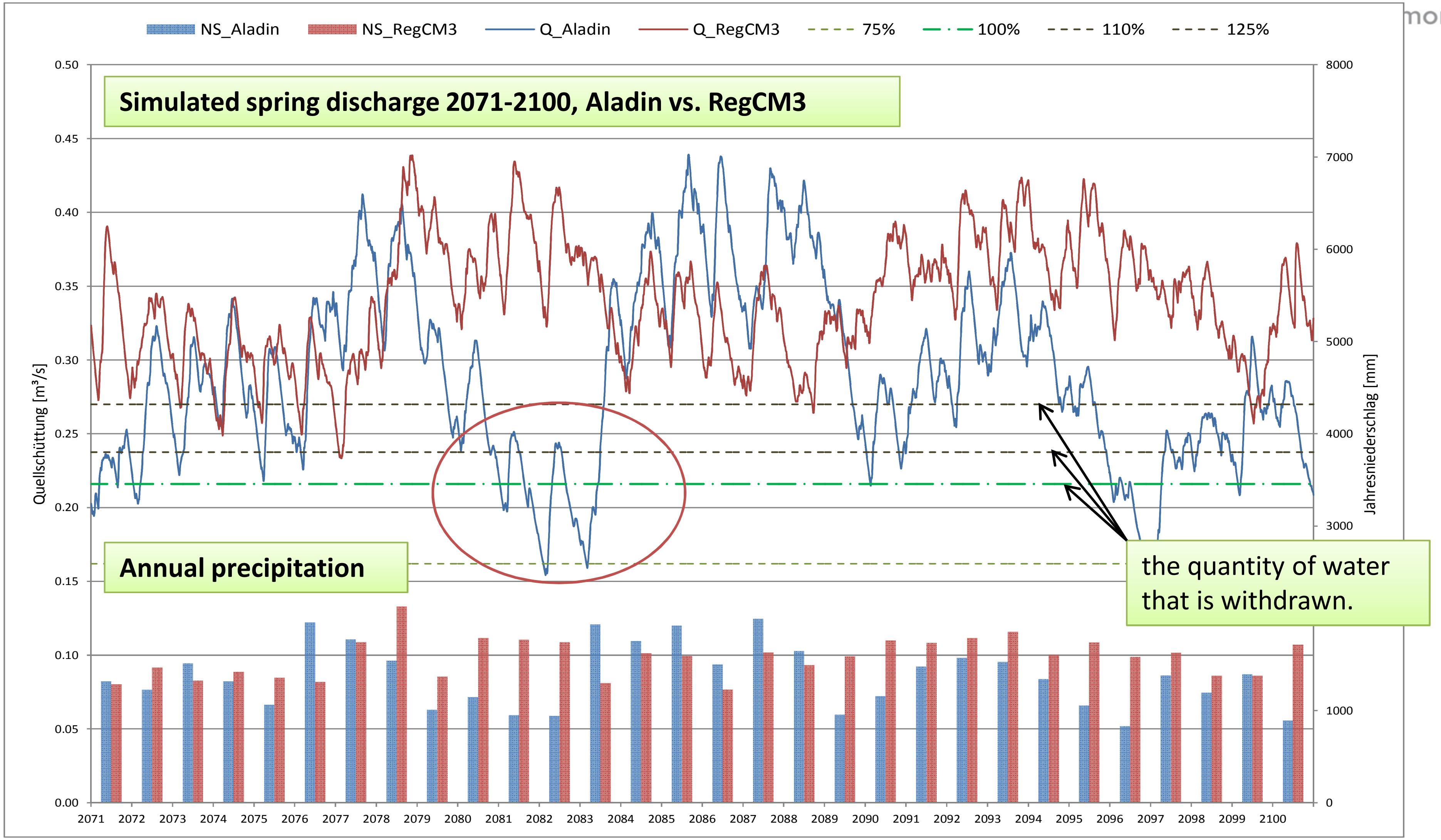
1971-1990 1991-2020 2021-2050 2051-2070 2071-2100



	Pfannbauernquelle 10	Brunngrabenquelle 13	Höllbachquelle 14	Kläfferquelle 15	Siebenseequelle 20	Schreierklammquelle 21
1971-1990	100.0	100.0	100.0	100.0	100.0	100.0
1991-2020	95.7	96.4	98.0	95.7	97.4	97.2
2021-2050	99.7	99.4	101.4	99.7	102.8	103.4
2051-2070	97.9	96.4	99.4	97.9	102.3	101.4
2071-2100	108.0	106.1	107.7	108.0	110.8	109.9

1971-1990 1991-2020 2021-2050 2051-2070 2071-2100

Spring discharge: uncertainty due to RCM data



Summary

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- A Water balance model covering the intake areas of the Viennese water supply was set up, to analyse the impacts of climate change on water resources in an alpine environment
- WB and seasonality agree well for the calibration and validation period
- To estimate CC it is driven by the outputs from two RCM
- Hydrological parameters remain unchanged for the future periods
- CC-related landuse changes are considered
- In terms of future water availability the outcomes are contrary: Aladin shows a decrease of the runoff and spring discharges whereas RegCM3 shows an increase
- Temperature increase of about +3 °C; due to higher temperatures ETAT increases; more runoff in winter periods and a shift of the annual runoff peak
- Possibly longer periods with less spring water availability
- The data do not show increase in extreme events

Acknowledgements

- The city of Vienna, Vienna waterworks
- ERDF - Sponsor in the course of the CC-WaterS project

Project website:
http://www.ccwaters.eu


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Thank you for your attention!
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