

# Climate Change in Central Asia

## Preliminary results from the CAWa project

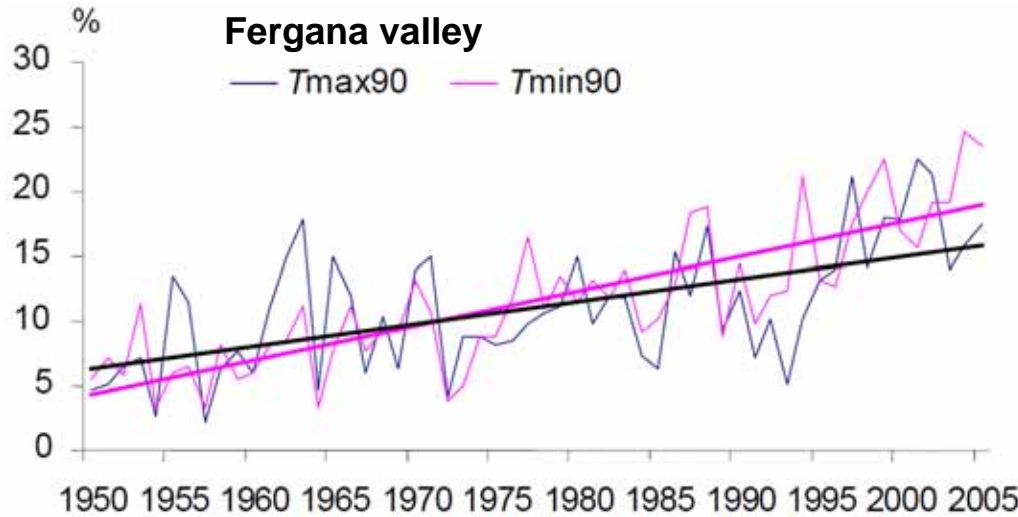
K. Unger-Shayesteh, M. Müller, D. DÜthmann, W.  
Hagg

& CAWa Project Team

[www.cawa-project.net](http://www.cawa-project.net)

# A hotspot for climate change

Observed changes

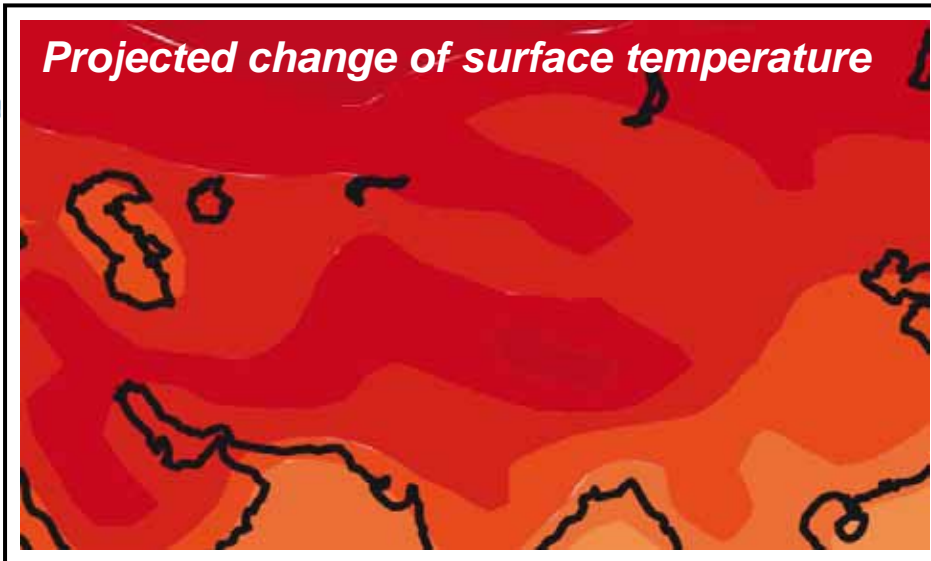


From: SNC of Rep. Uzbekistan to UNFCCC, 2008



From: SNC of Tajikistan to UNFCCC, 2008

Modeled changes



From: IPCC 2007 WG1-AR4

Precipitation?

Seasonal snow pack?

Glacier mass balances?

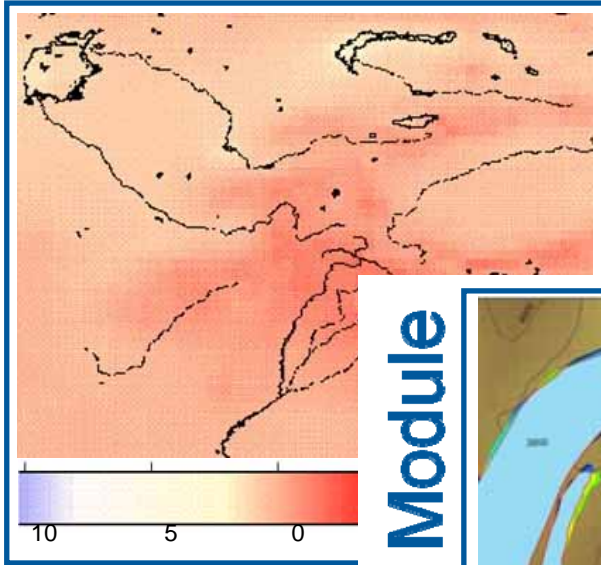
Spatial extent?

Extreme events?

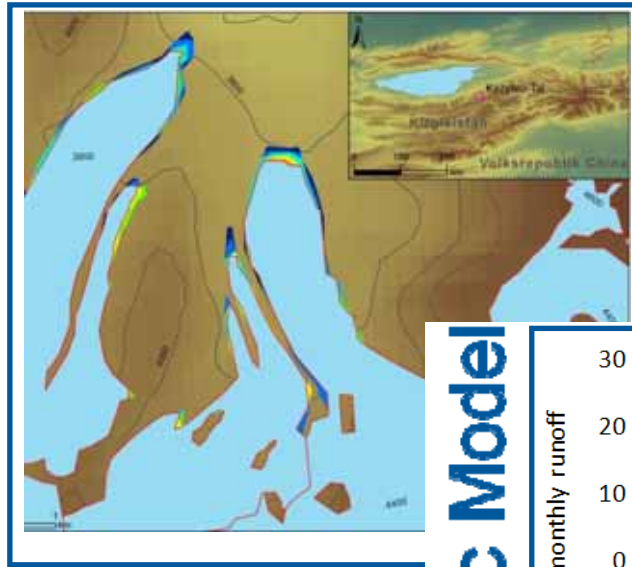


# CAWa approach: Model chain

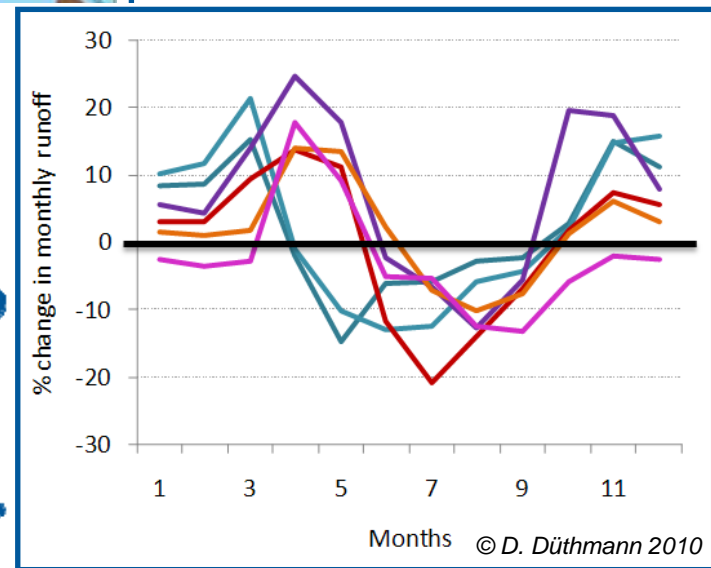
**Climate Model**



**Glacier Module**



**Hydrologic Model**

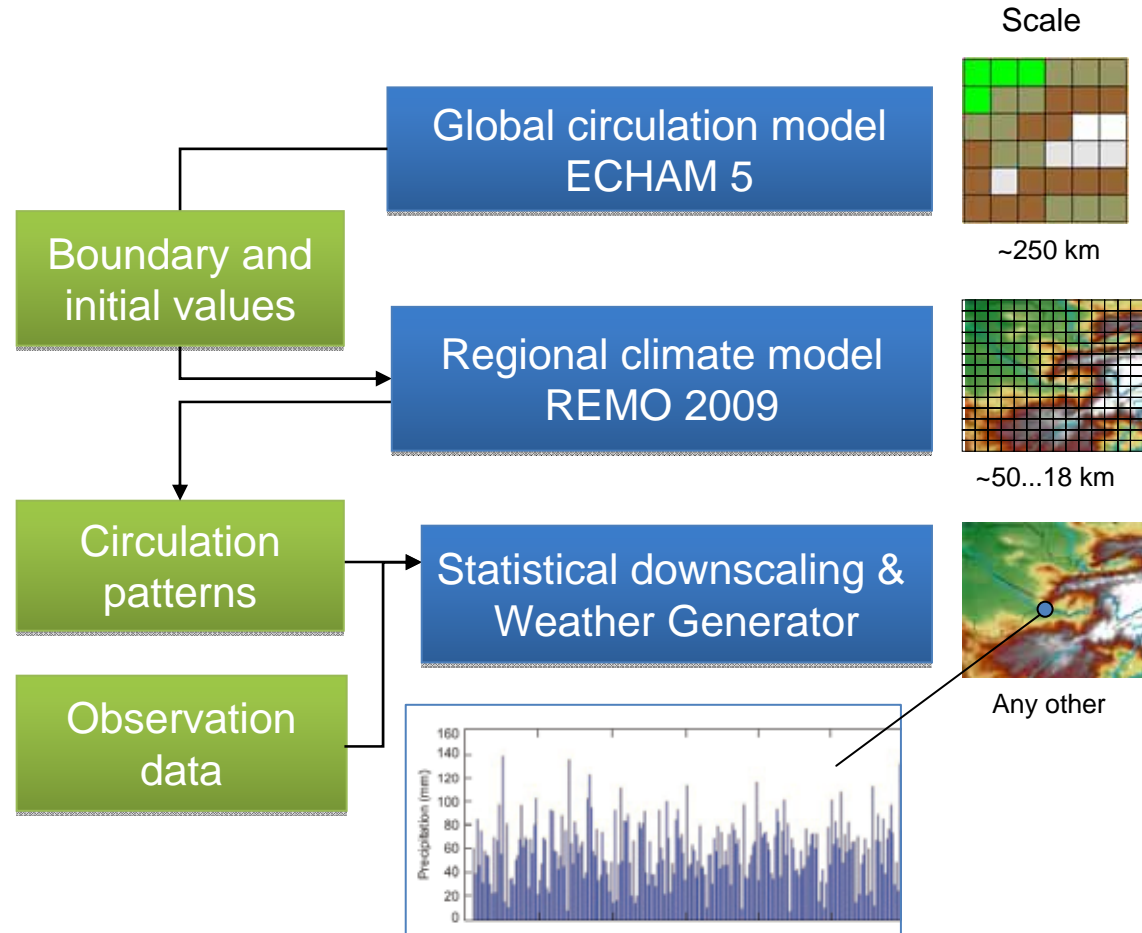
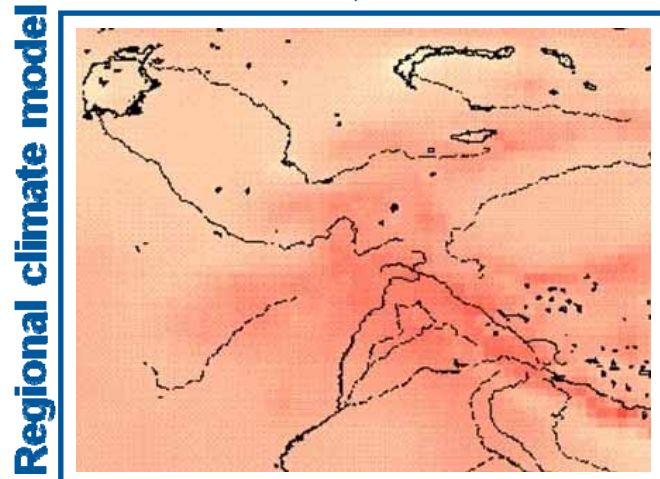
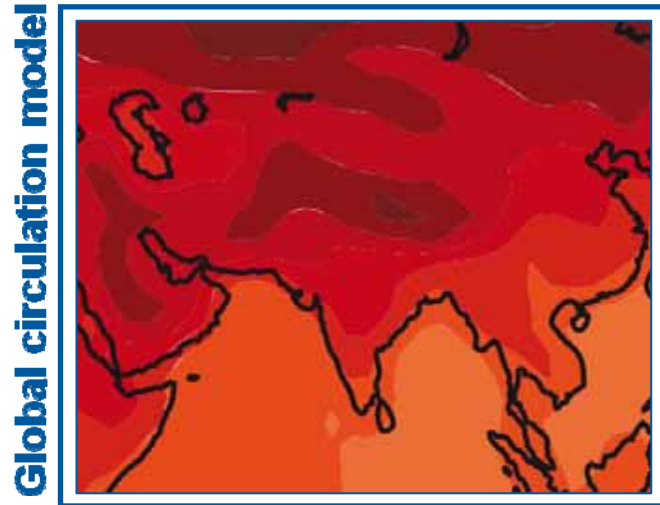


Assessment of future water availability using a model chain approach

M. Müller, H. Paeth, B. Mannig, C. Merckenschlager

# REGIONAL CLIMATE MODELING

# Regional Climate Model REMO



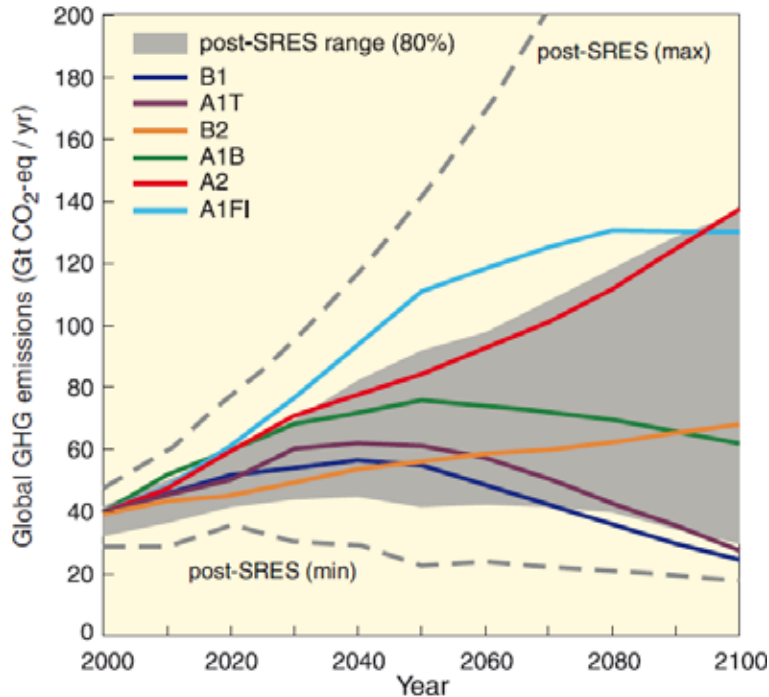
Source: adapted from PIK

# Emission Scenario A1B

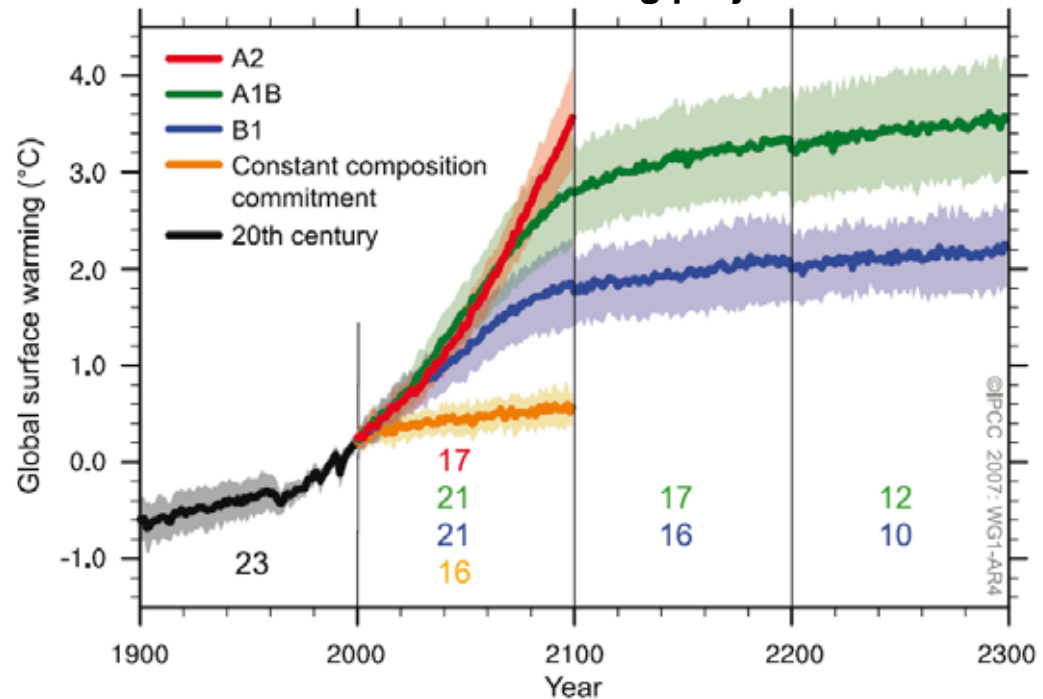
## Assumptions **A1B** scenario:

- very rapid economic growth
- global population that peaks in mid-century
- rapid introduction of new and more efficient technologies
- technological change based on balance across all energy sources

Scenarios for GHG emissions



SRES Mean surface warming projections



# Regional Climate Model Area

CAWa

REMO  
modelling areas

— 1/2 deg run

extreme coordinates:

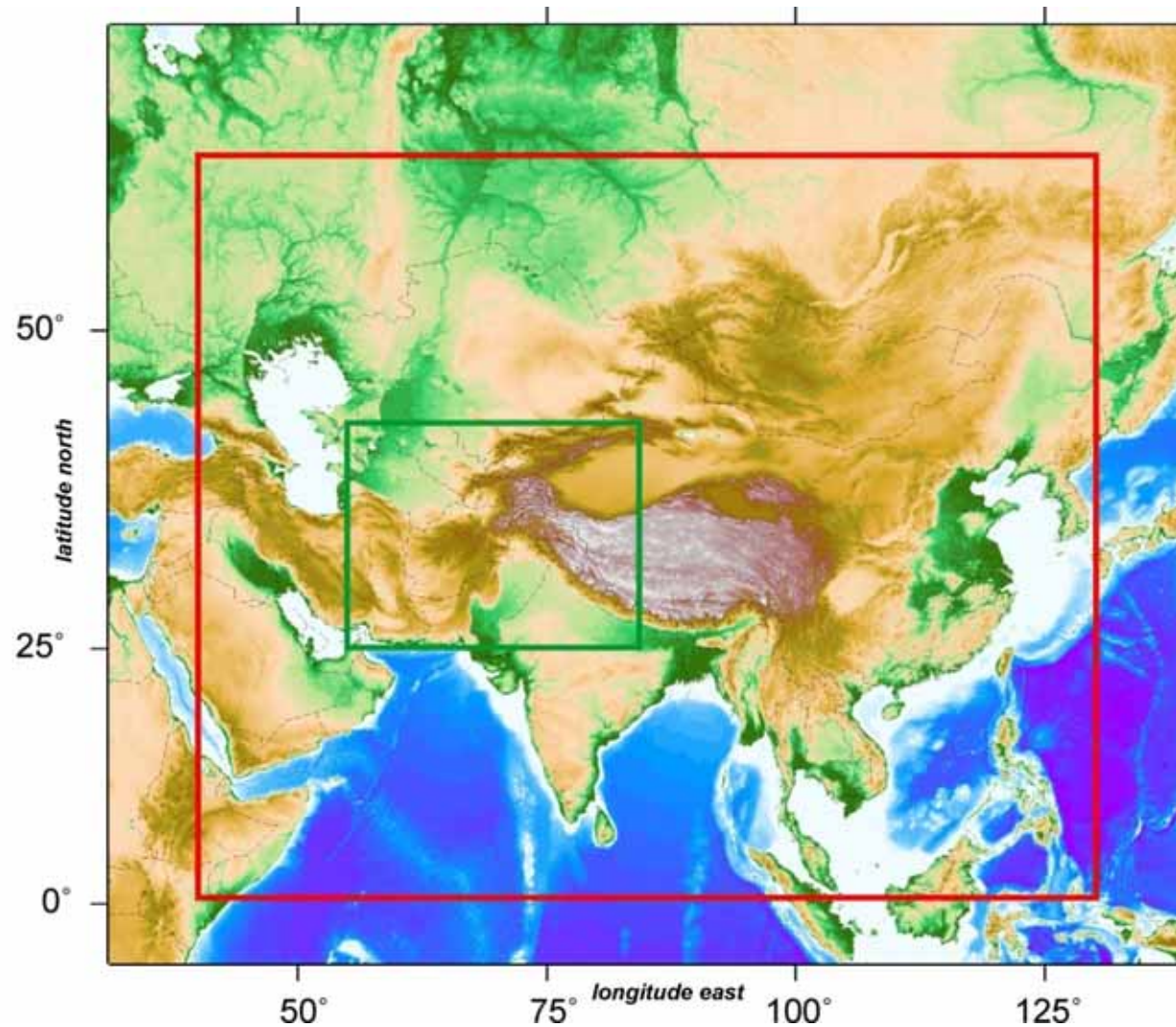
40°E/60°N	130°E/60°N
40°E/ 0°N	130°E/ 0°N

— 1/6 deg run

extreme coordinates:

55°E/45°N	85°E/45°N
55°E/25°N	85°E/25°N

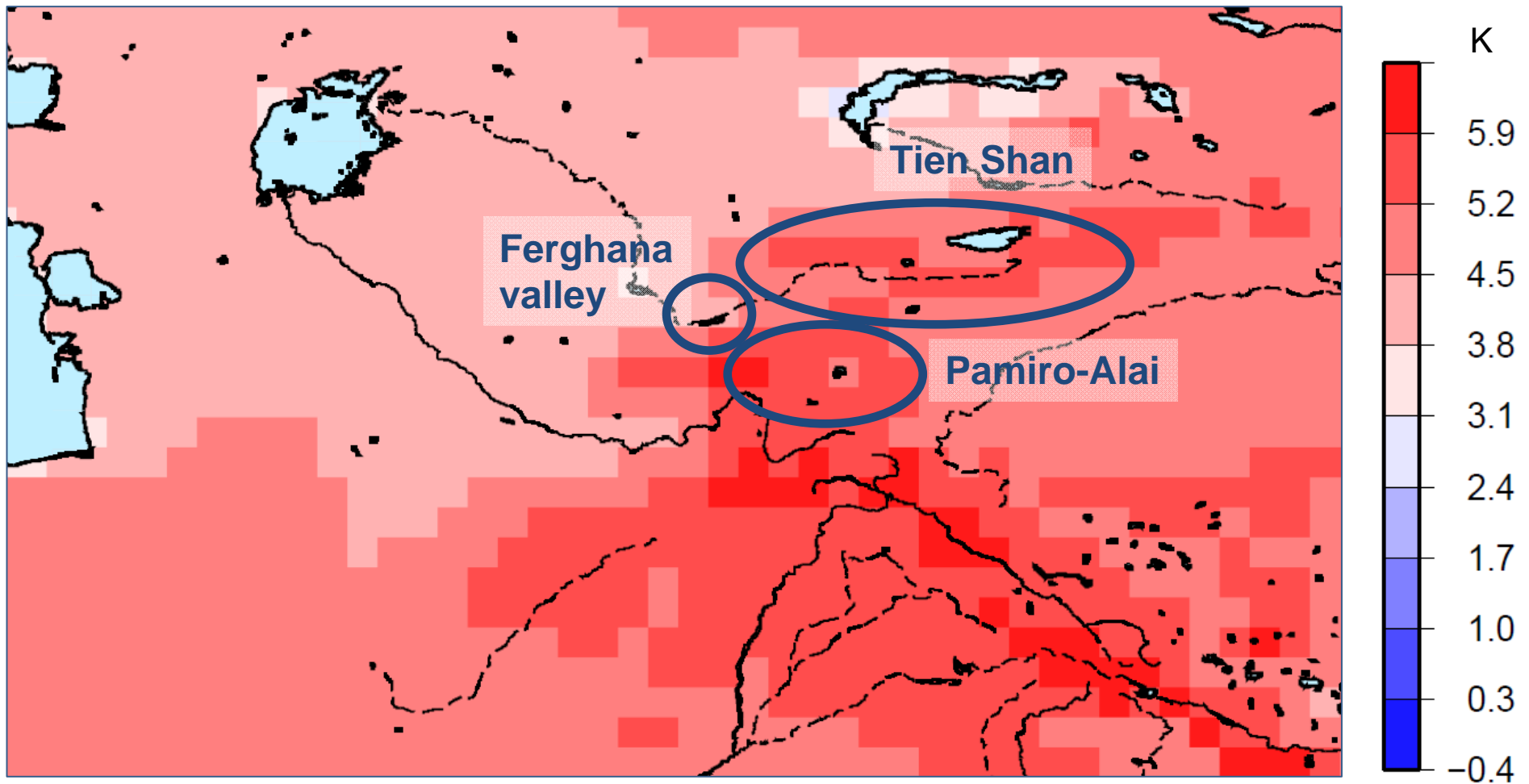
km  
0 500 1000  
base map: USGS



REMO 1961-2100, A1B scenario, hourly time steps

# Changes in mean annual T

Period 2071-2100 compared to 1961-1990 for A1B scenario

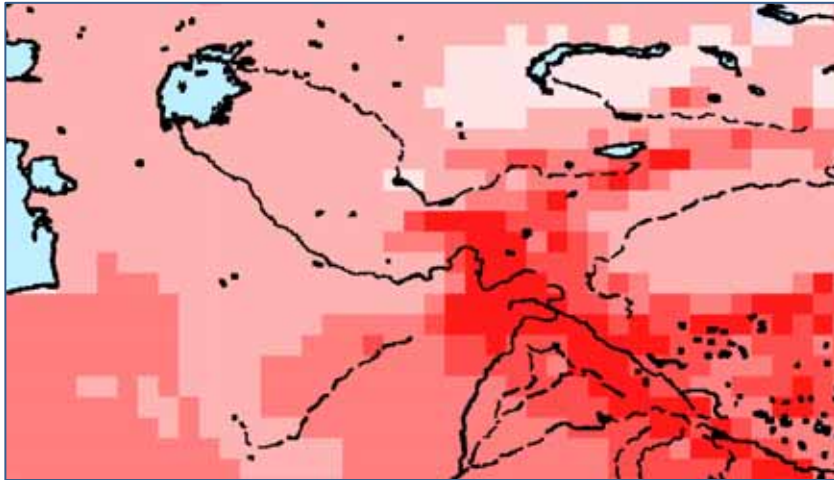


A1B scenario, 0.5 °, changes in 2 m air temperature in K in 2071-2100 compared to the period 1961-90

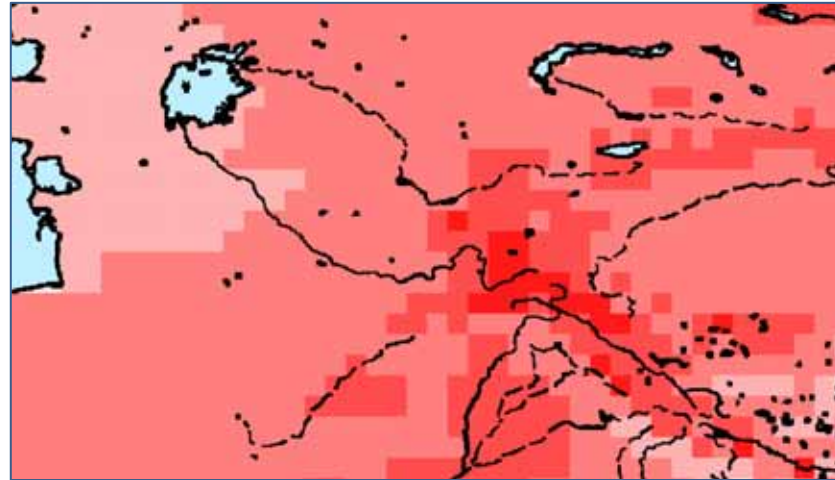


# Seasonal Changes in T

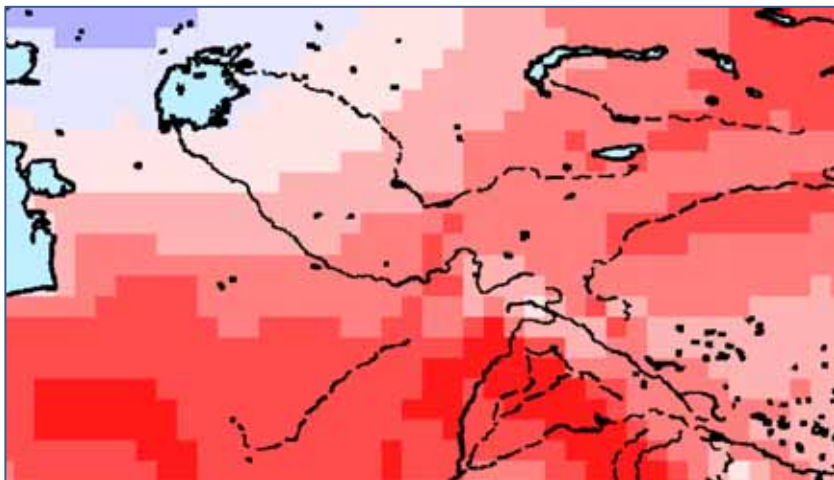
Spring



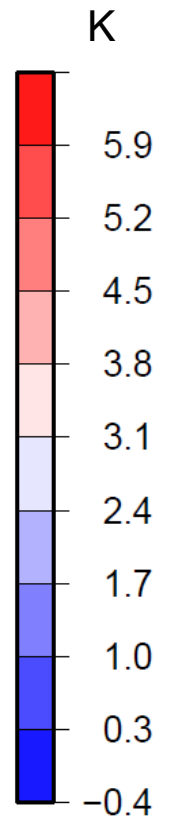
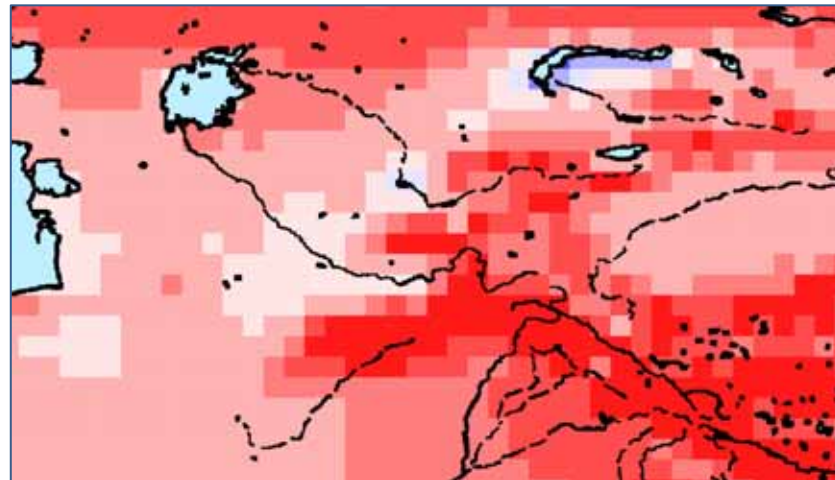
Autumn



Summer



Winter

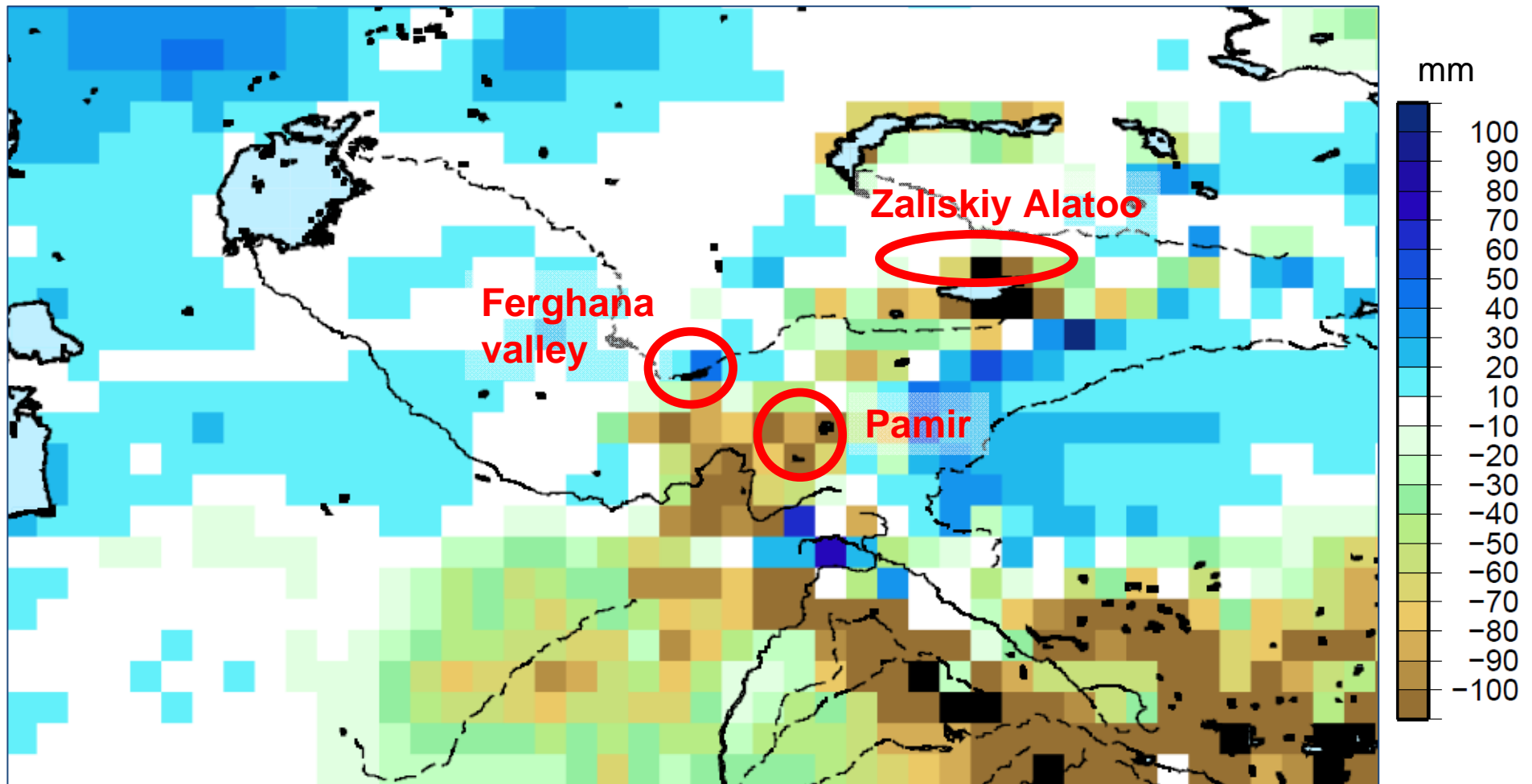


A1B scenario, 0.5 °, changes in 2 m air temperature in °C in 2071-2100 compared to the period 1961-90

20.05.2011

# Changes in annual precipitation

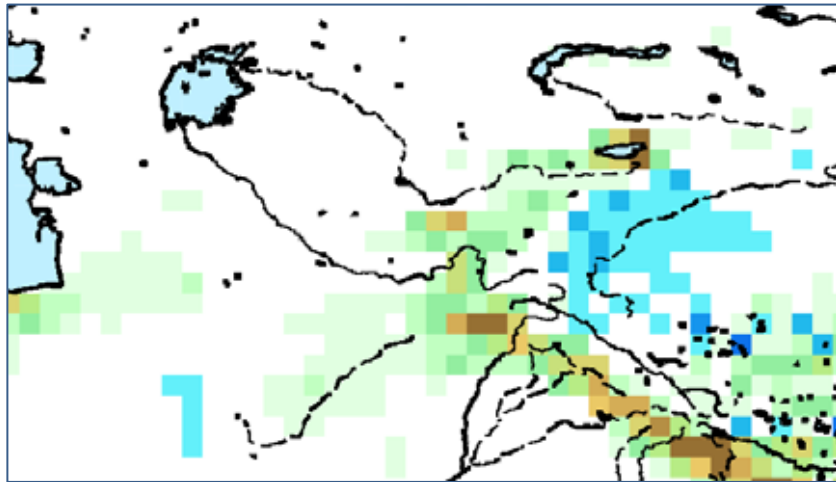
Period 2071-2100 compared to 1961-1990 for A1B scenario



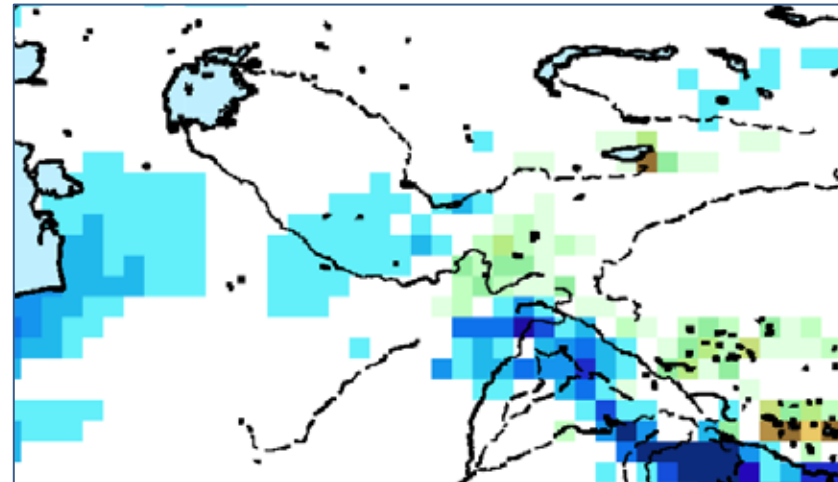
A1B scenario, 0.5 °, changes in precipitation in mm in 2071-2100 compared to the period 1961-90

# Seasonal changes in precipitation

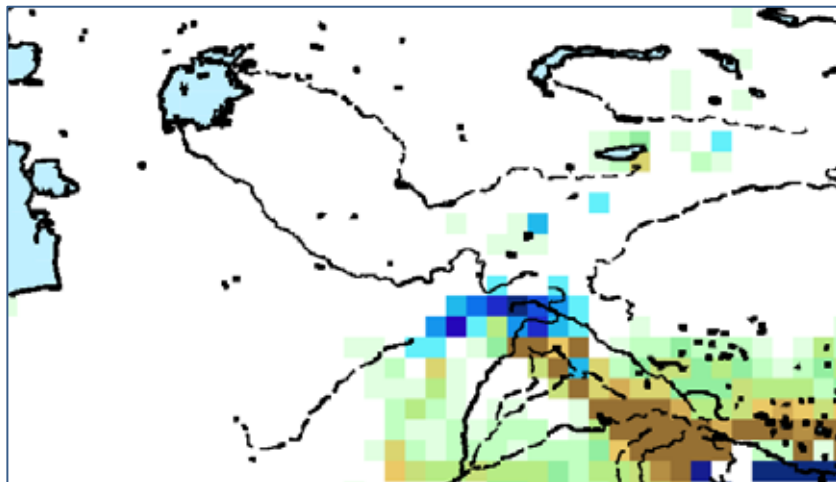
Spring



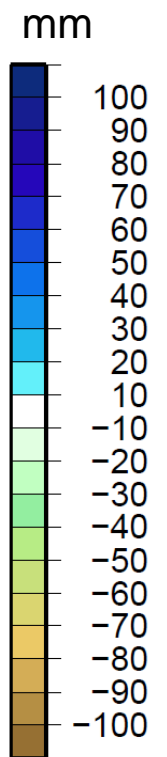
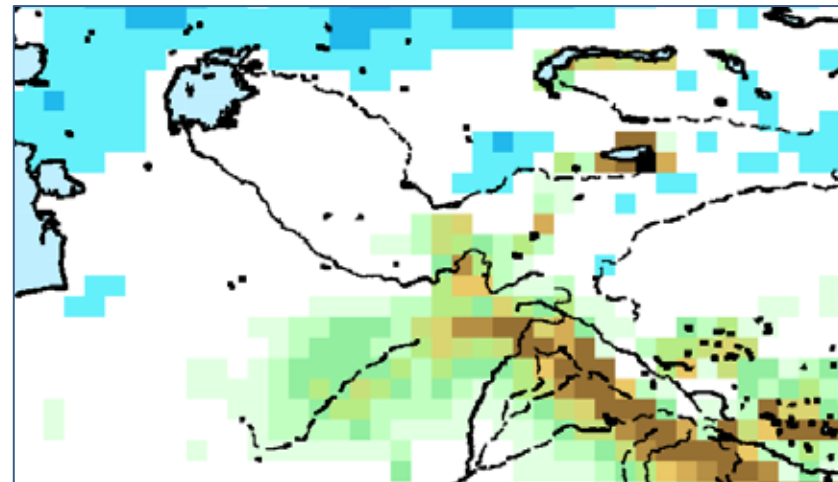
Autumn



Summer



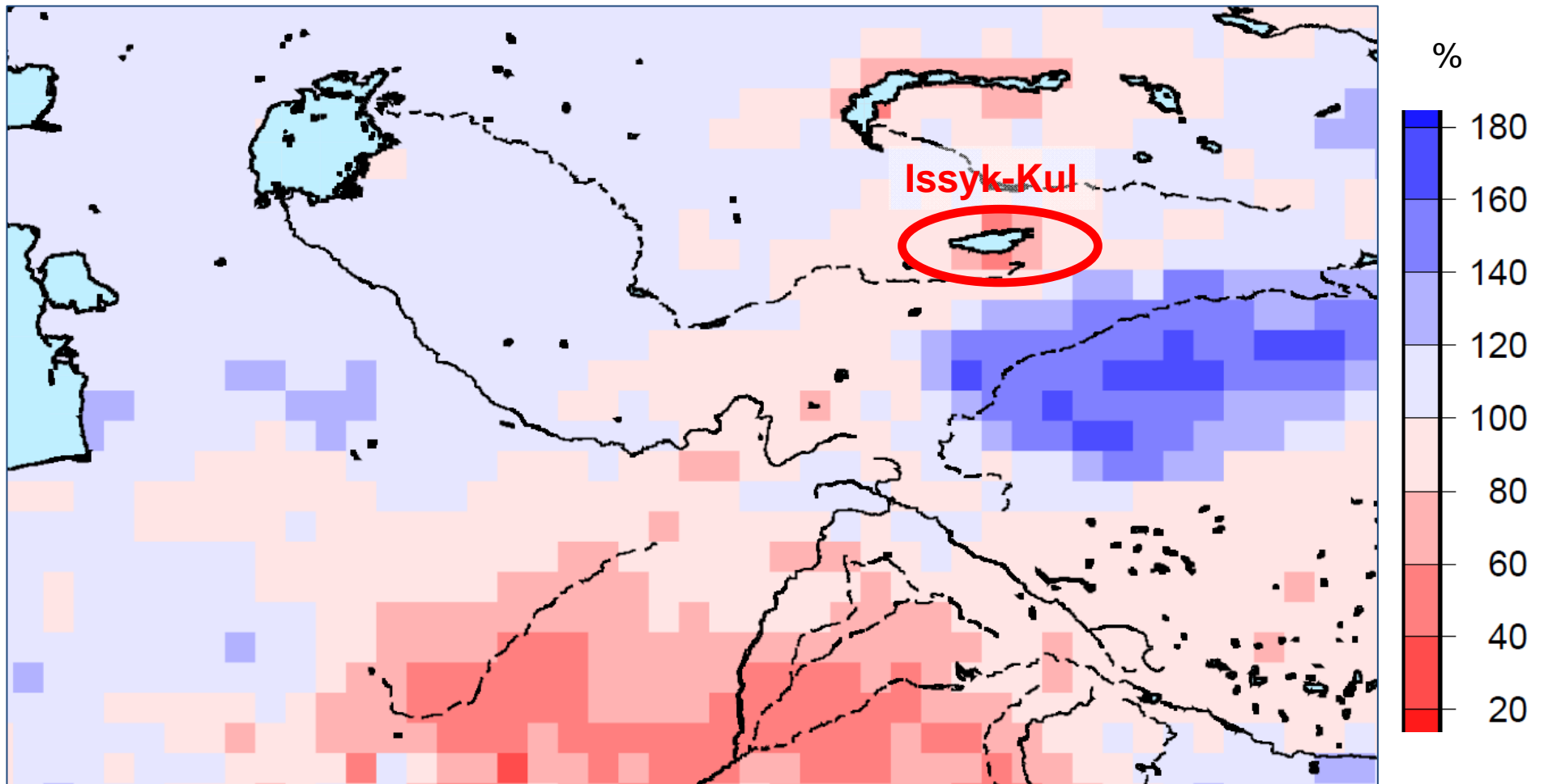
Winter



A1B scenario, 0.5 °, changes in precipitation in mm in 2071-2100 compared to the period 1961-90

# Changes in annual precipitation

Period 2071-2100 compared to 1961-1990 for A1B scenario



A1B scenario, 0.5 °, changes in precipitation in % in 2071-2100 compared to the period 1961-90

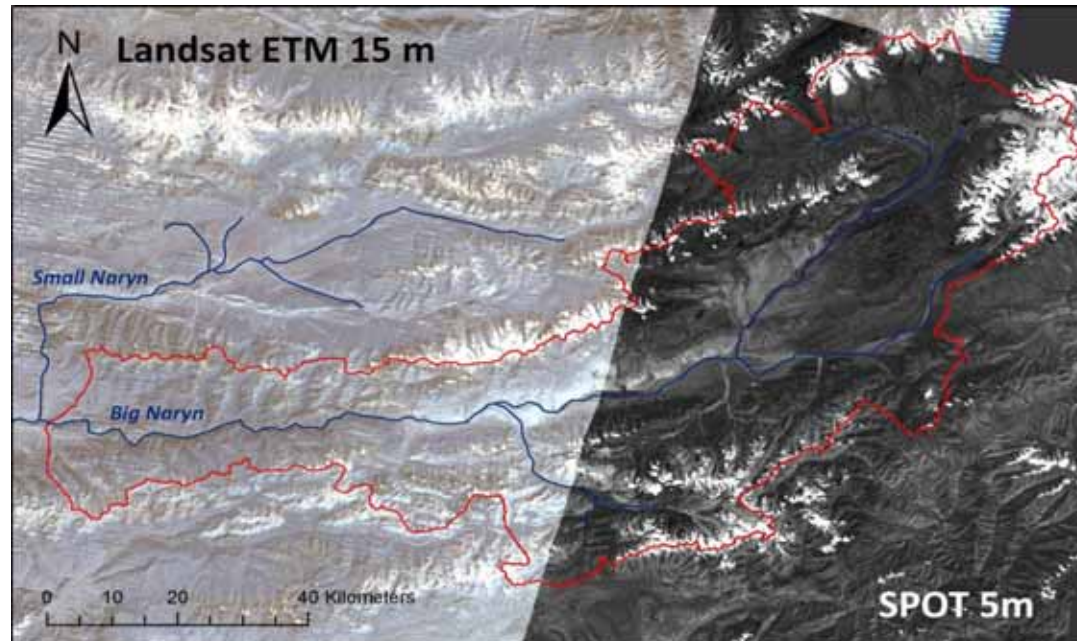
W. Hagg, C. Mayer, D. Kriegel, S. Vorogushyn, R. Usubaliev, A. Mandychev

# CHANGES IN GLACIER COVERED AREAS IN THE NARYN BASIN



# Data & objectives

2007



2006

## Glacier inventory:

Digital glacier map and GIS for the Big Naryn Basin in 2006

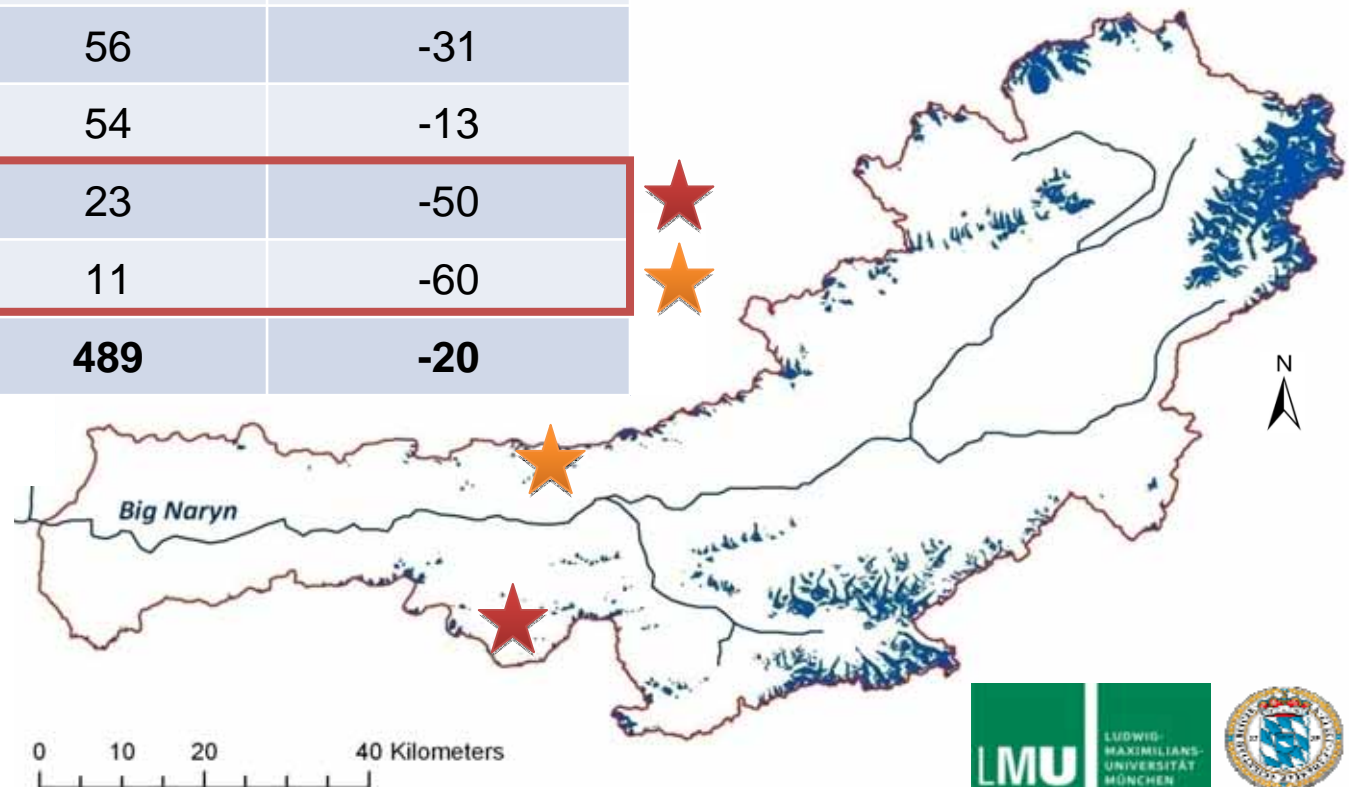
Assessment of changes in glaciated area compared to data from Katalog Lednikov (mid 1950ies)

Assessment of glacier mass balances

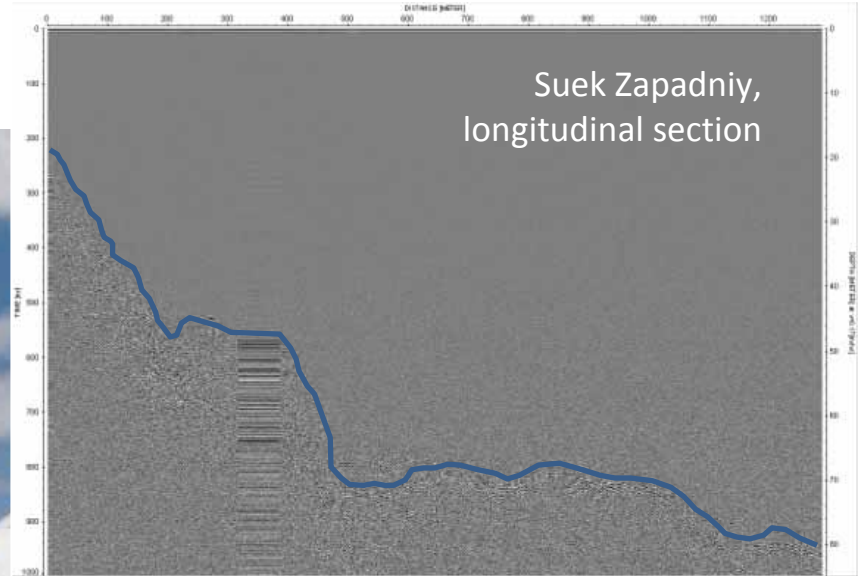
# Shrinking glaciers

Glacier area in the upper Naryn basin in 2006 compared to

Mountain range	Area in 2006 [km <sup>2</sup> ]	Relative loss [%]
Ak-Shiirak	186	-12
Borkoldoy	159	-14
Terskey	56	-31
Dzhetimbell-Suek	54	-13
Naryntau	23	-50
Dzhetim	11	-60
<b>Total Big Naryn basin</b>	<b>489</b>	<b>-20</b>



# Glacier dynamics: Measurements





K. Unger-Shayesteh, B. Merz, S. Vorogushyn, B. Moldobekov

# CONCLUSIONS

# Conclusions

## **Hydrometeorological monitoring :**

- improve monitoring network in the flow formation zone
- (re-)establish glacier monitoring

## **Climate change assessment:**

- high resolution regional climate modeling is an appropriate and necessary approach in CA, esp. with regard to projections for future precipitation changes
- for CC impact studies glacier mass balances should be measured and glacier changes should be modeled explicitly

## **CC adaptation:**

- improvement of water use efficiency