

Provision of science based evidence on climate induced water quality challenges in Amu Darya basin

PEER Cycle 5

Project Information

- **Funding Agency: USAID- PEER**
- **Research Partnership with US: West Virginia University**
- **Project period: 24 month**
- **Implementing unit within CAREC: CO in Uzbekistan**

Background



Length	2,620 km (1,628 mi)
Basin	534,739 km ² (206,464 sq mi) Tajikistan, Afghanistan, Uzbekistan, Turkmenistan
Discharge	
- average	2,525 m ³ /s (89,170 cu ft/s) ^[1]
- max	5,900 m ³ /s (208,357 cu ft/s)
- min	420 m ³ /s (14,832 cu ft/s)

Research objective:

To assess the impact of climate change on surface water quality of the Amu Darya river, under plausible scenarios of:

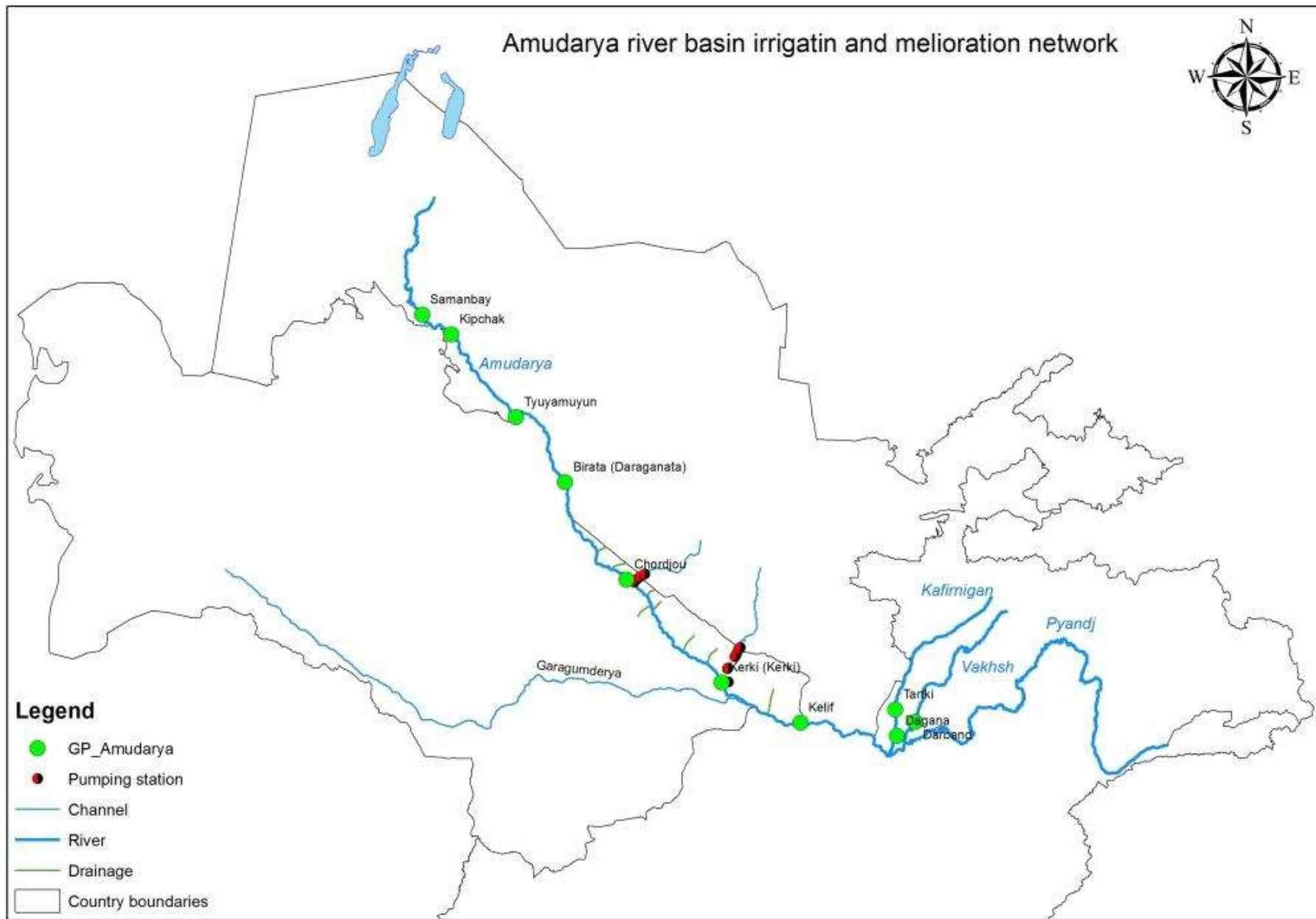
- climate change
- change in irrigation practices and water management

Project information

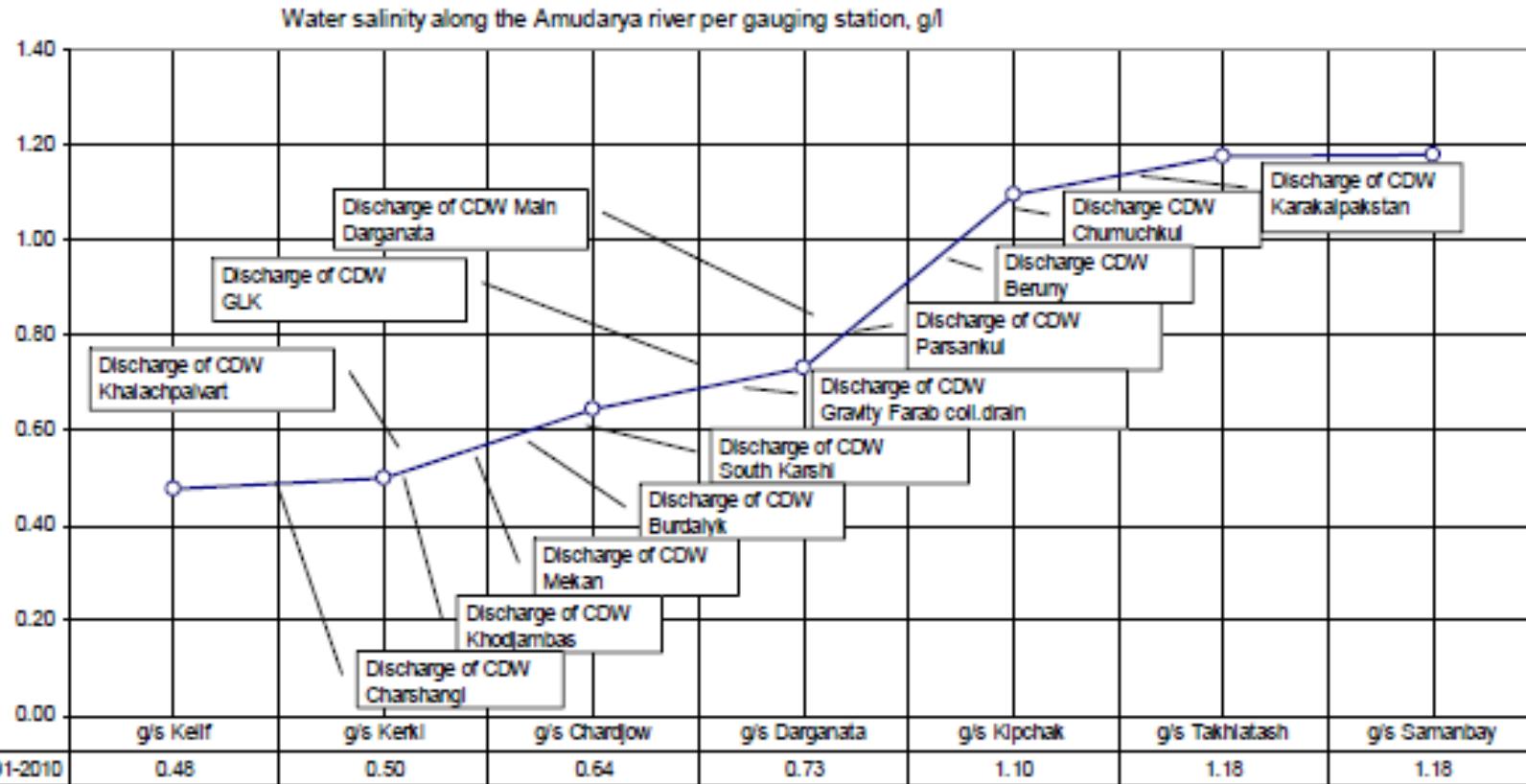
- **Specific objectives:**

- Understand **current state of the water quality** and water regime linkages in Amu Darya River and identify relationship;
- Develop different **climate-water scenarios** for Amy Darya River and identify water quality outcomes of different scenarios through **modelling** exercise;
- Identify major **changes in water quality indicators** under different **climate –water scenarios** and ‘hot spots’ in the river basin;

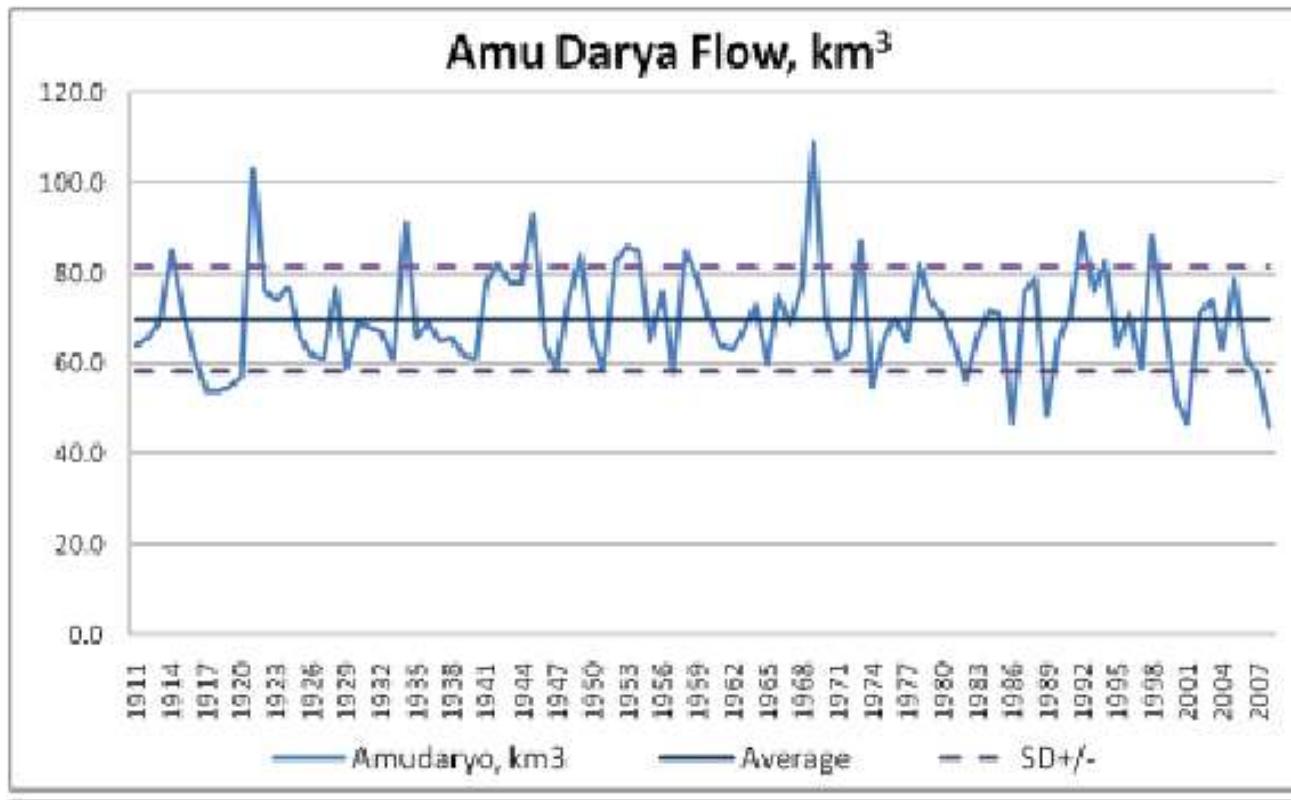
Background



Water salinity along the river

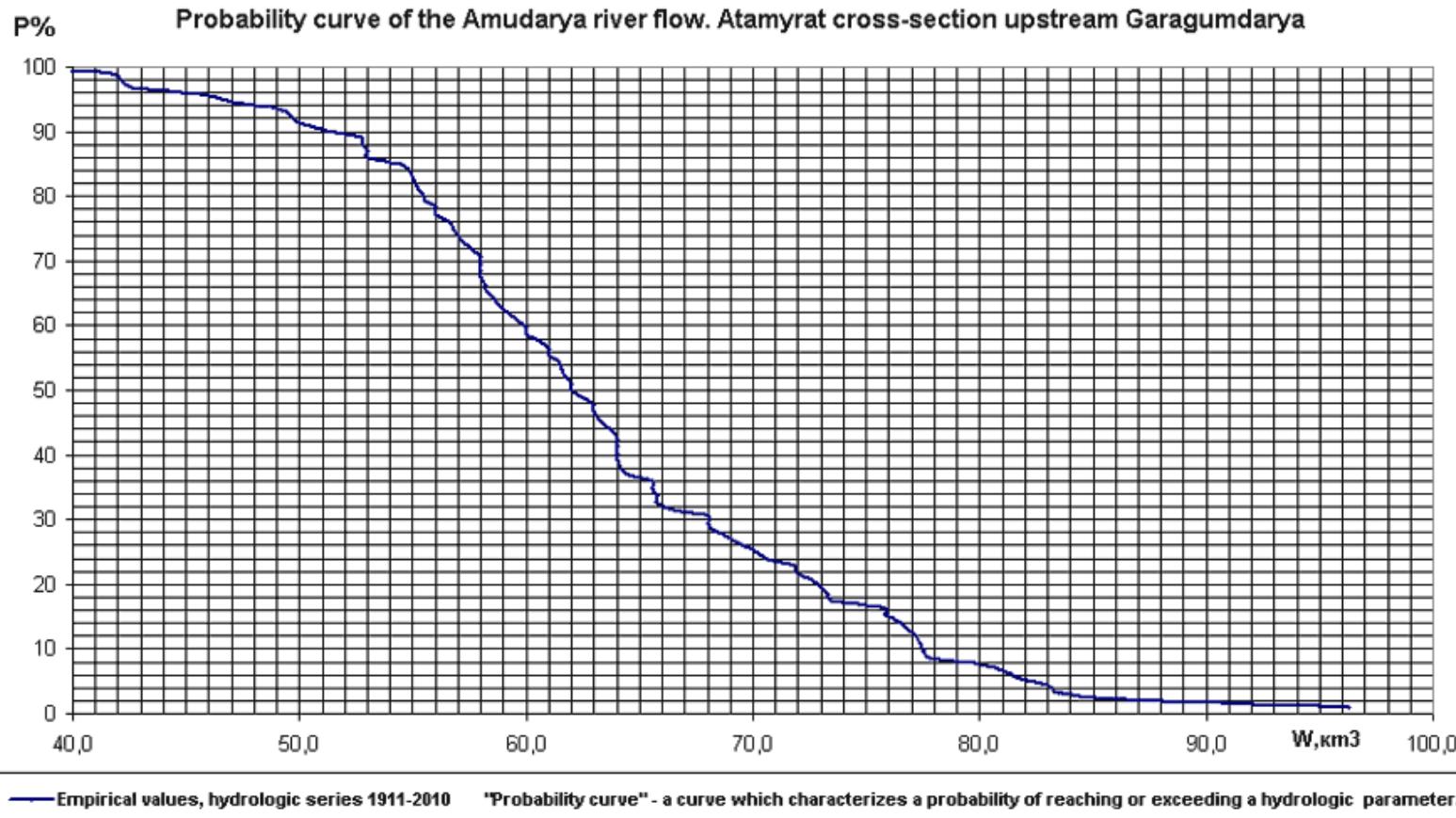


Volatility of the river flow



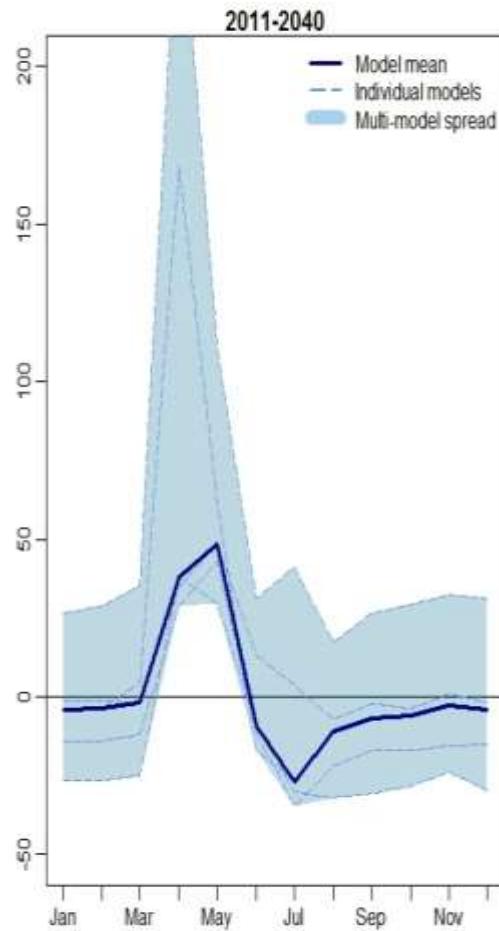
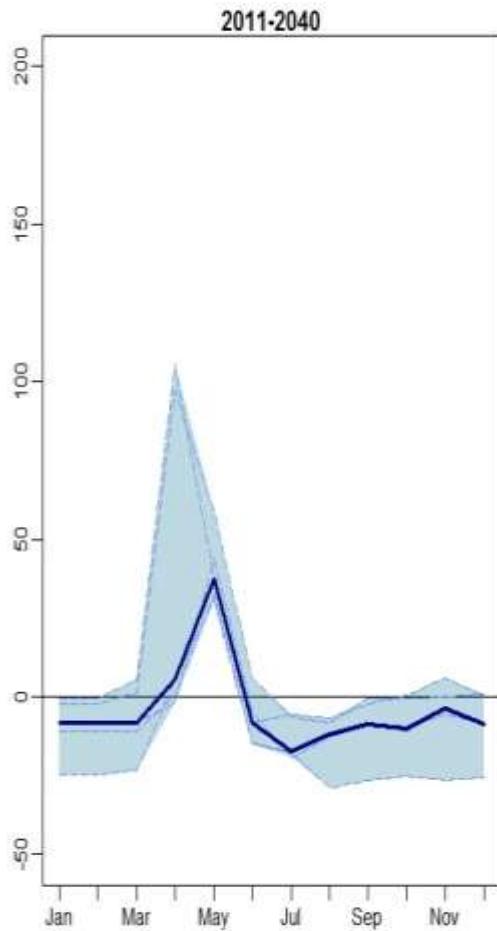
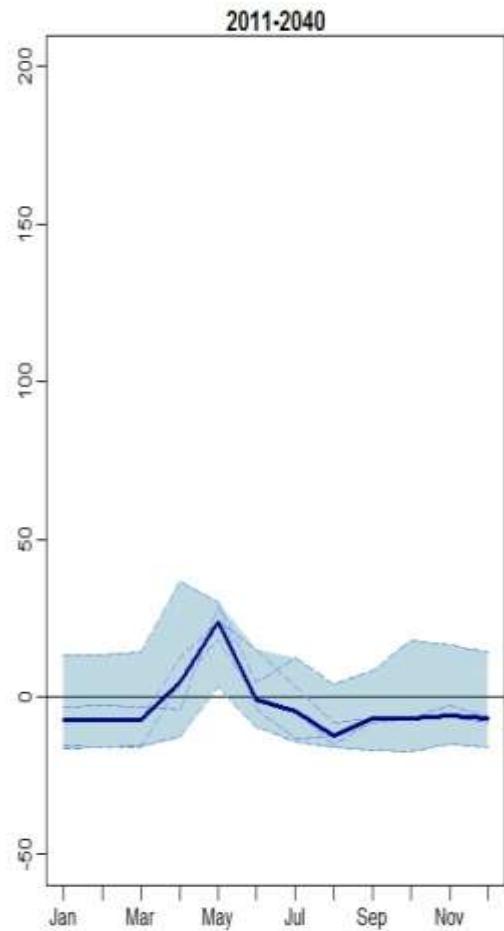
Source: Mirzabayev (2013) Climate Volatility and Change in Central Asia:
Economic Impacts and Adaptation

Water availability probability curve for the AM river



Source: CAWATER database

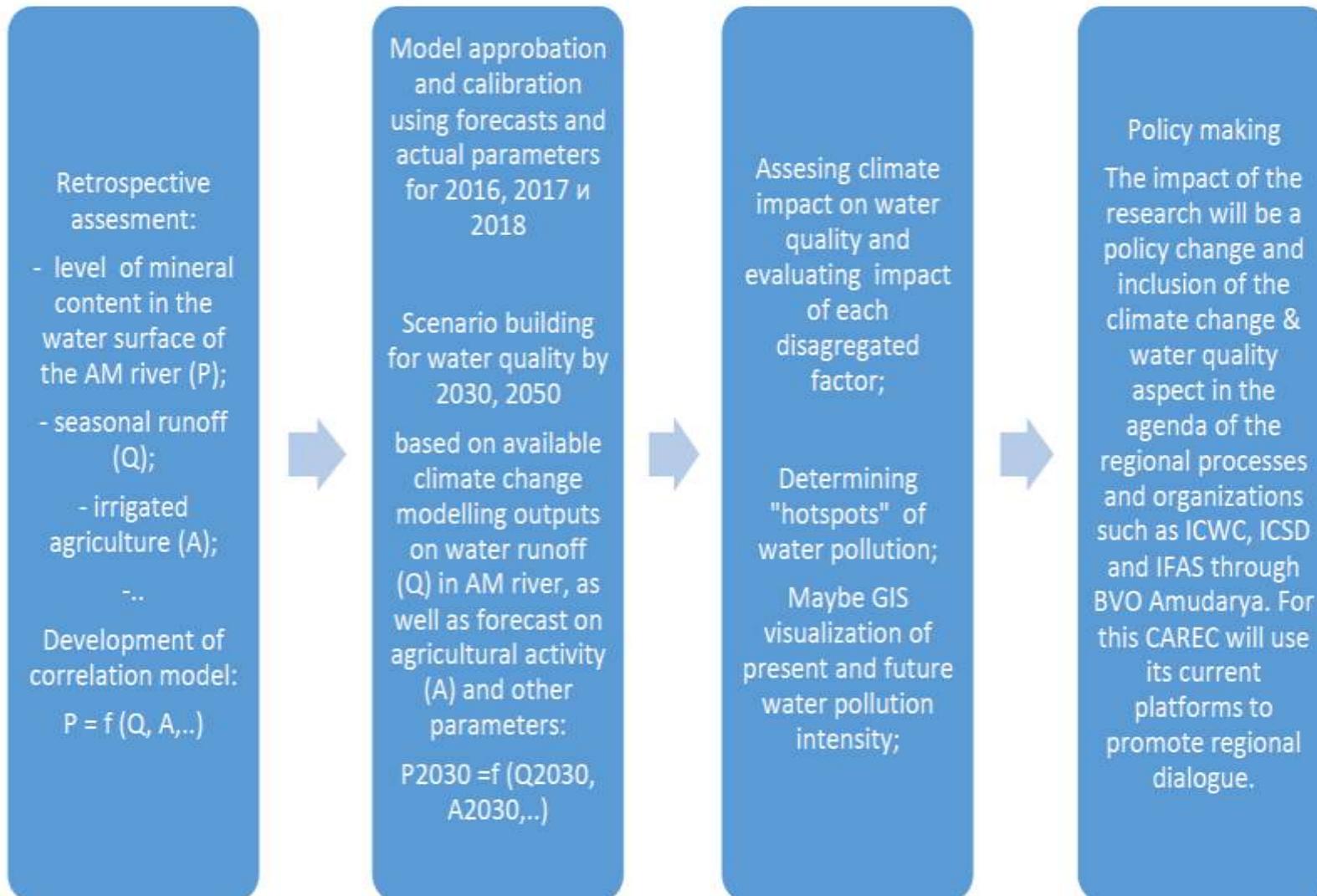
Shifts in the hydrological regime



A hypothesis

- Climate change (if all other factors remain unchanged) will act as an aggravating factor for water quality in the Amu Darya river because of:
 - overall reduction of the average annual flow of the river;
 - increase in the frequency of dry seasons;
 - increased demand for water due higher ET;
 - seasonal reduction of water flow during vegetation period

Research approach



DATA USED AND SOFTWARE

- DEM SRTM 90 m (<http://srtm.csi.cgiar.org>)
- Soil data (<http://www.fao.org>)
- Land use MODIS data
- Water Discharge hydroposts on Amudarya river

National sources and <http://cawater-info.net>

- Drainage Discharge

National sources and <http://cawater-info.net>

- Water quality data

- ArgGIS 10.3, ENVI 5.0, R programming language

ARC SWAT

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1:3 000 000

SWAT Project Setup • Watershed Delineator • HRU Analysis • Write Input Tables • Edit SWAT Input • SWAT Simulation

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Layers

- D:\Sherzod\Sherzod
- ArcHydro
- Monitoring
- <all other Type
- Linking

ArcSWAT

SWAT Project Setup • Watershed Delineator • HRU Analysis • Write Input Tables • Edit SWAT Input • SWAT Simulation

LongestPath

Basin

D:\Sherzod\Sherzod

- Land_use_SWA

D:\Sherzod\Sherzod

- Ik_all

D:\Sherzod\Sherzod

- LandSlope(Land Slope(%))
 - 0-9999

SwatSoilClass(L Classes

- WALLKILL
- RPOPOWAM
- BEACHES
- SACO
- PILLSBURY
- DEERFIELD

SwatLandUse(L Classes

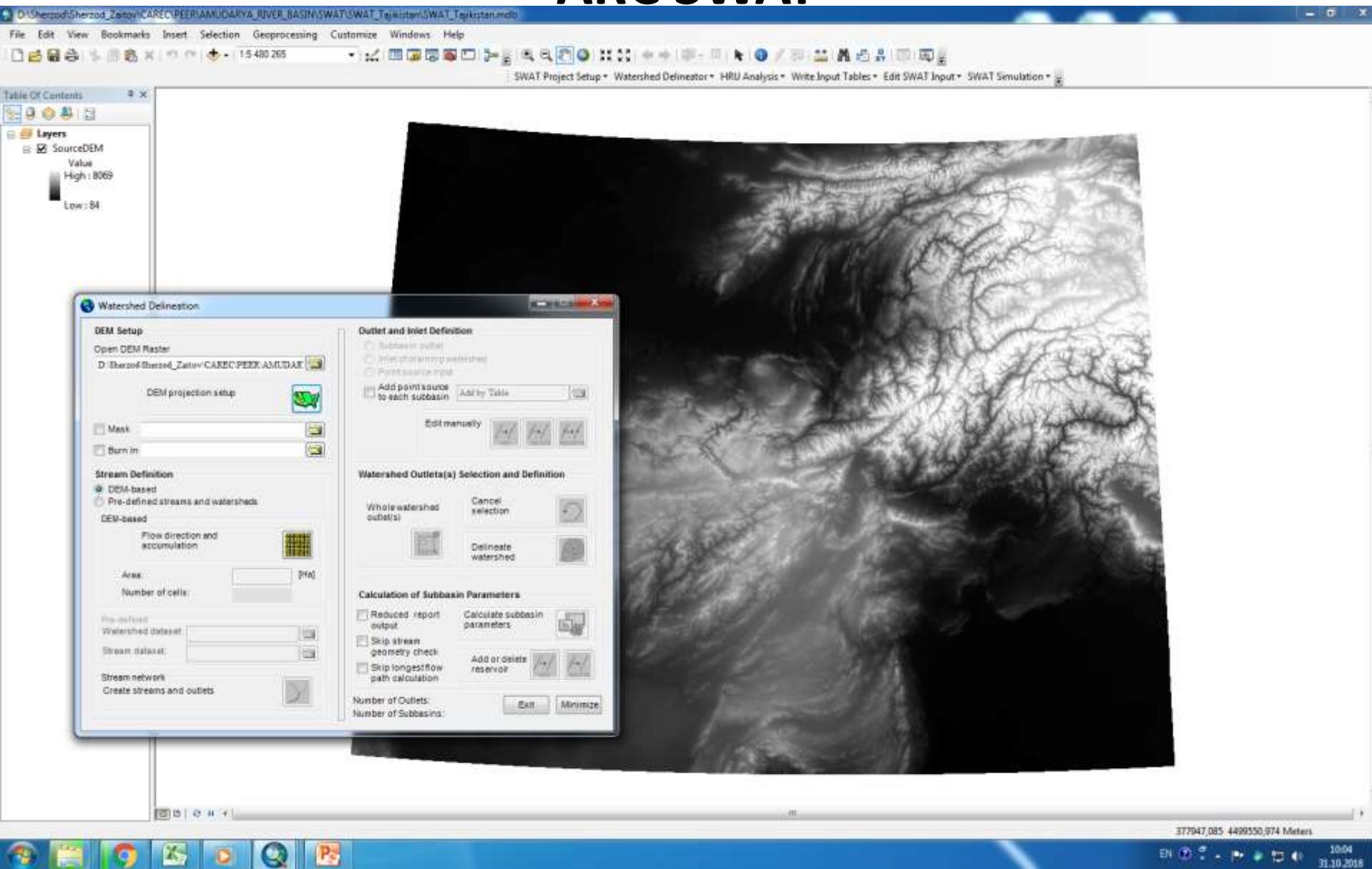
- ALMD
- BARR
- ORCD
- URLD
- AGRR



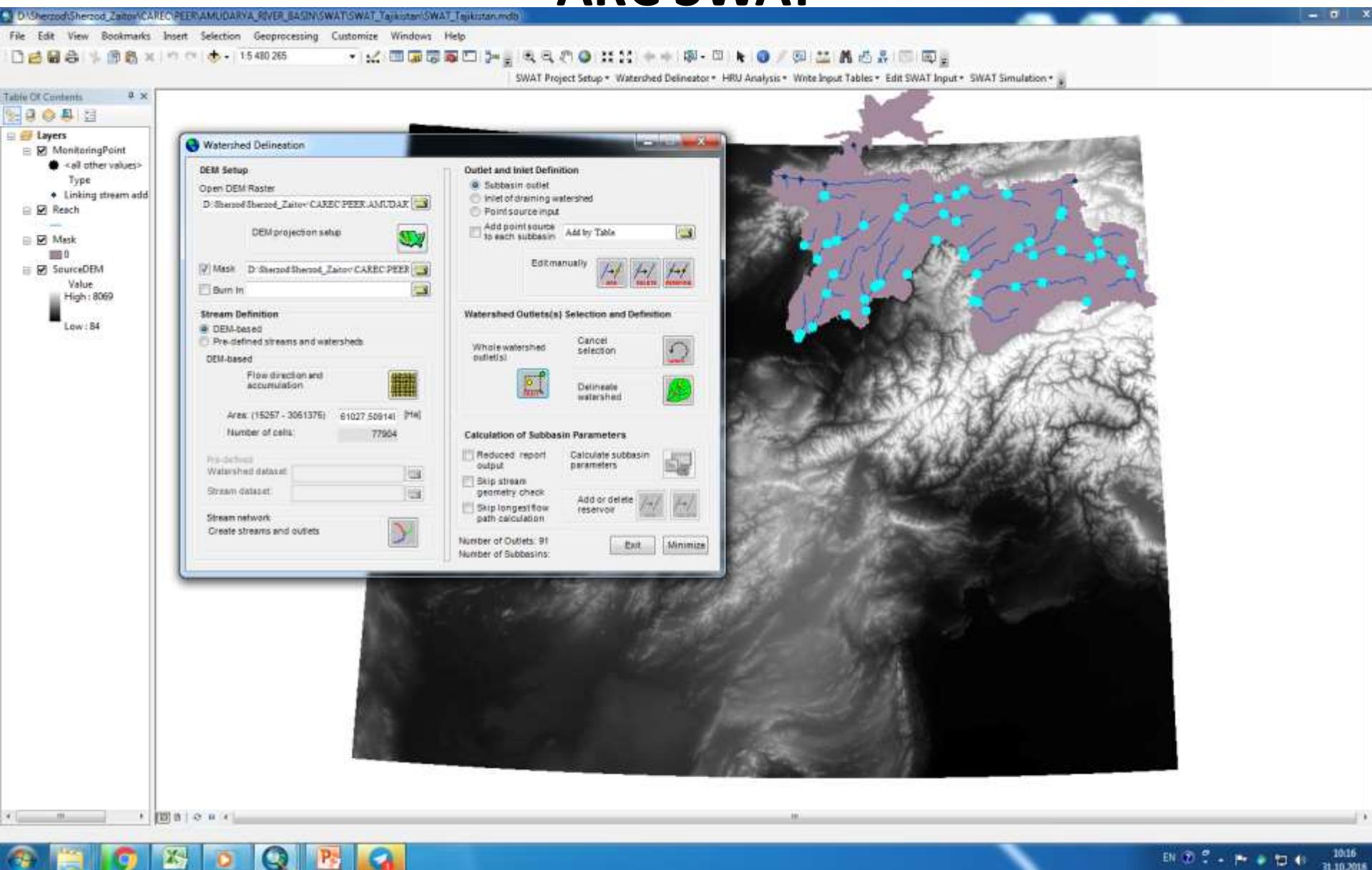
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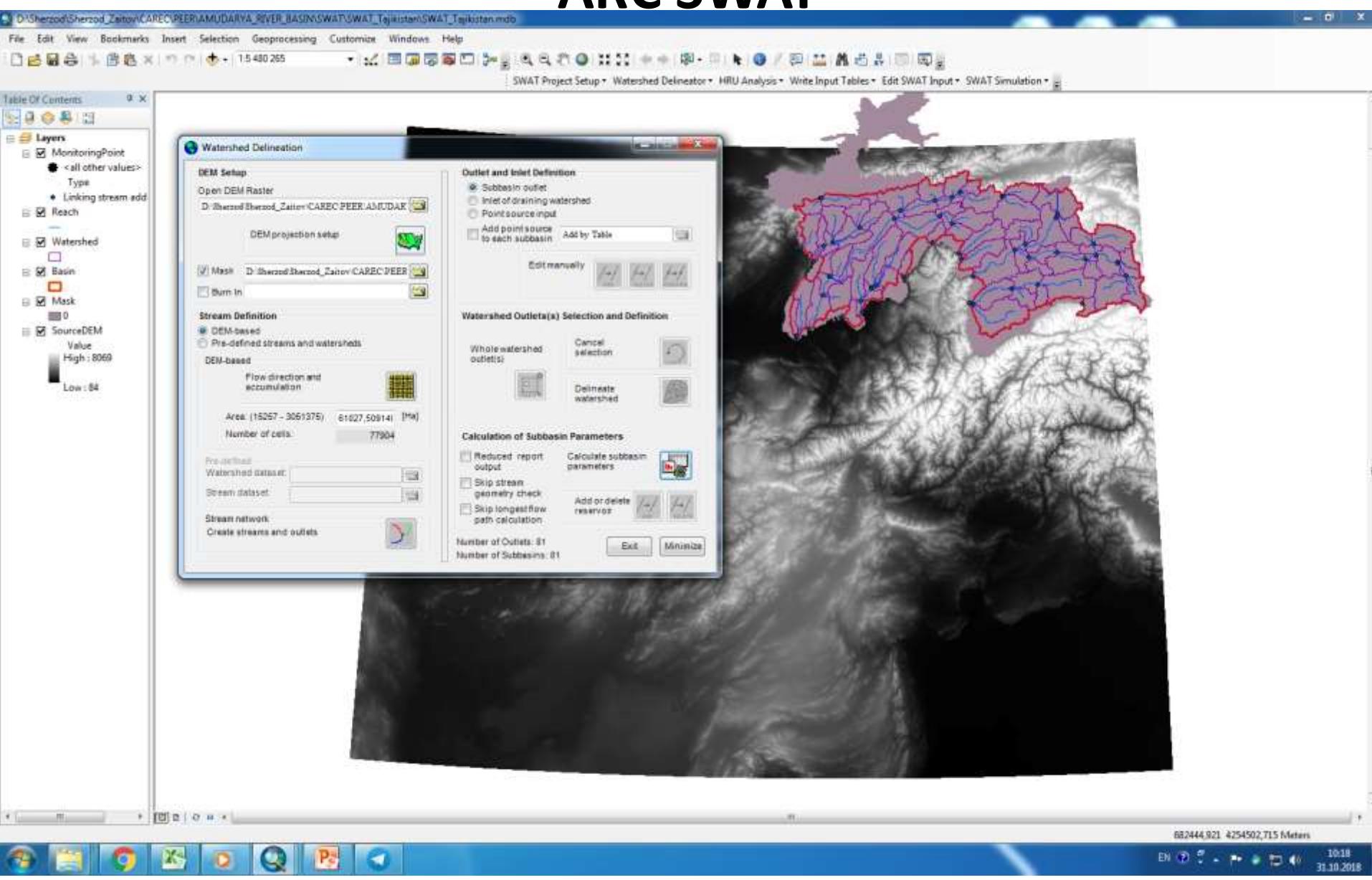
ARC SWAT



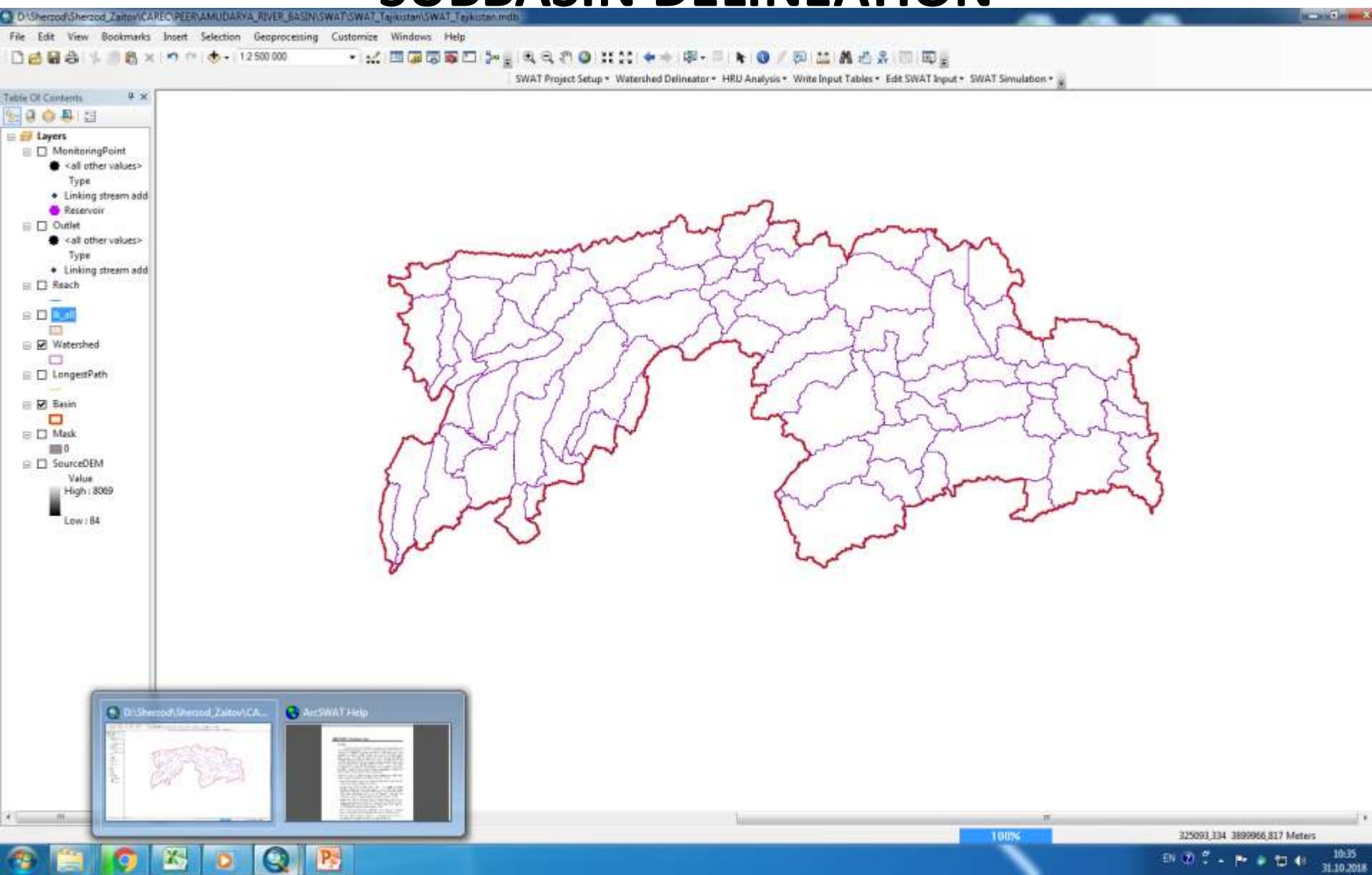
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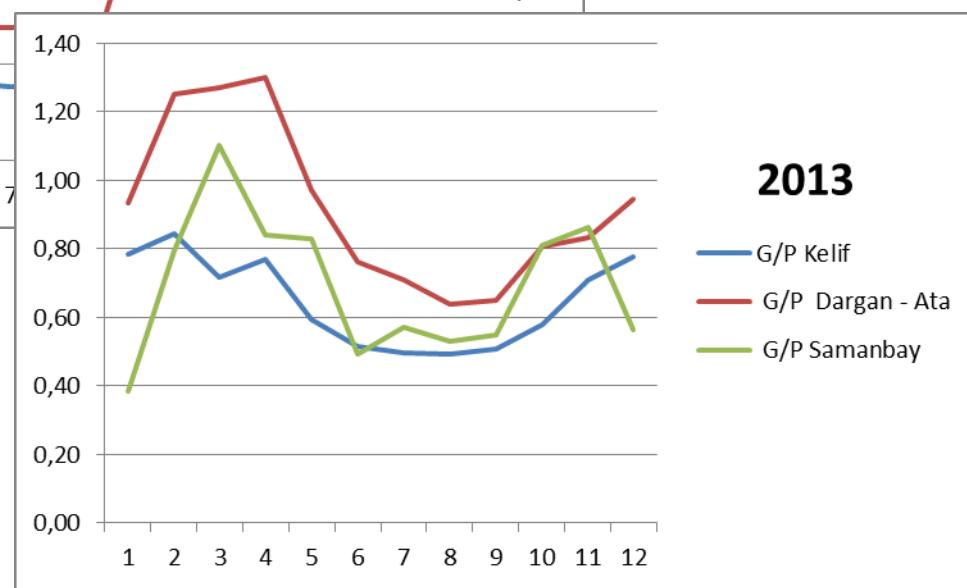
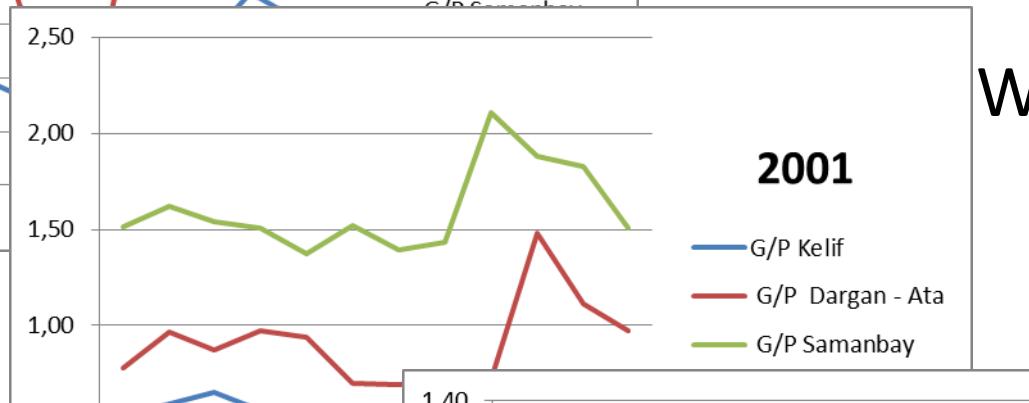
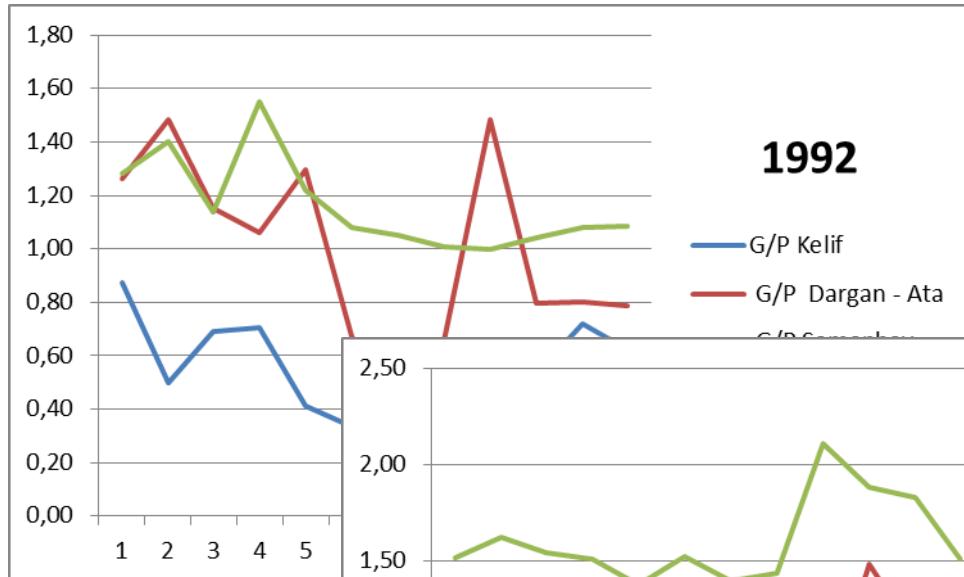
ARC SWAT



SUBBASIN DELINEATION



MINERALIZATION IN THREE HYDROPOSTS WITHIN WATERING YEAR



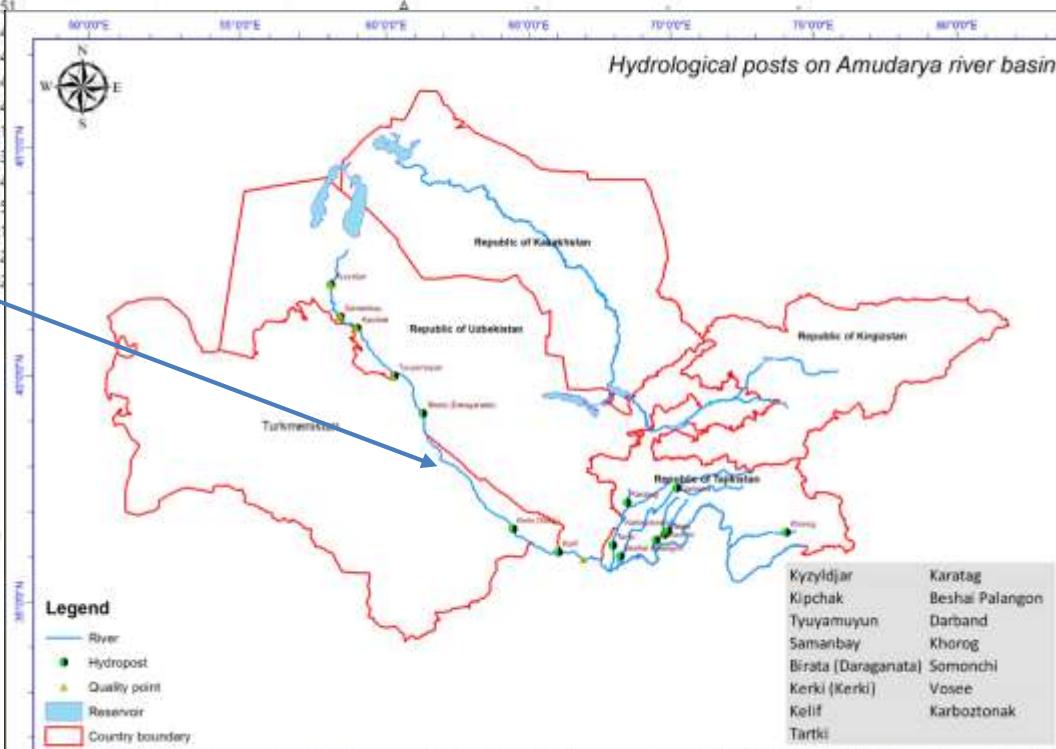
Database on WQ, WR and CC/ GIS/RS spatial analysis

Файл Правка Вид Избранное Сервис Справка

Добавить Извлечь Тестируть Копировать Переместить Удалить Информация

C:\Users\Jusip\Downloads\Input Data for WEAP modelling.rar\Input Data for WEAP modelling\

Имя	Размер	Сжатый	Изменен	Создан	Открыт	Атрибуты	Зашифрован	Непрерывный	Комментарий
ABMK_Return_2001-2005.xlsx	12 145	9 673	2018-02-06 11:21			A	-	-	-
ABMK_Transmission_2001-2005.xlsx	11 682	9 230	2018-03-30 10:14			A	-	-	-
ABMK_Transmission_2001-2005_Domestic.xlsx	11 538	9 062	2018-03-30 11:11			A	-	-	-
ABMK_Transmission_2001-2005_Industrial.xlsx	11 513	9 044	2018-03-30 11:16			A	-	-	-
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Industrial.xlsx	103 214	34 552	2018-03-30 09:51			A	-	-	-
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Kelif_DO_2001-2005.xlsx	11 376	8 925	2018-03-30 09:51			A	-	-	-
Kelif_NP_2001-2005.xlsx	12 075	9 605	2018-03-30 09:51			A	-	-	-
KMK_Return_2001_2005.xlsx	12 684	10 136	2018-02-06 09:49			A	-	-	-
KMK_Transmission_2001-2005.xlsx	12 714	10 014	2018-03-30 10:13			A	-	-	-
KMK_Transmission_2001-2005_Domestic.xlsx	12 315	9 735	2018-03-30 10:13			A	-	-	-
KMK_Transmission_2001-2005_Industrial.xlsx	11 758	9 289	2018-03-30 10:13			A	-	-	-
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Lebap_Transmission_2001-2005_Domestic.xlsx	11 841	9 533	2018-03-30 11:21			A	-	-	-
Lebap_Transmission_2001-2005_Industrial.xlsx	11 868	9 372	2018-03-30 11:21			A	-	-	-



Hydrological posts on Amudarya river basin

Legend:

- River
- Hydropost
- Quality point
- Reservoir
- Country boundary

Country boundary:

- Kyzyldjar
- Kipchak
- Tyuyamuyun
- Samanbay
- Birata (Daraganata)
- Kerki (Kerki)
- Kelif
- Tartki
- Karagtag
- Besha Palangon
- Darband
- Khorog
- Somonchi
- Vossee
- Karboztonak

Scenarios: Ag policies in Amudarya

Countries	Scenarios		
	Business as Usual (BaU)	Optimistic scenario (OS)	Pessimistic scenario (PS)
Afghanistan	<ul style="list-style-type: none"> i. More of food crops, rice ii. Application of high rates of chemicals and pesticides iii. Minimum of mechanization and state support iv. High levels of water application and drainage water v. Household and small farming with no or little processing capacities 	<ul style="list-style-type: none"> i. Increase in cropping area ii. Higher level of mechanization iii. Reduction of water losses through better water and agricultural technologies iv. Increased support to farming by state v. Commercialization of farming 	<ul style="list-style-type: none"> i. Reduction of cropping area ii. No or small mechanization iii. Increase in water losses due to degraded infrastructure iv. No support to farming by state v. Household/subsistence farming
Tajikistan	<ul style="list-style-type: none"> i. Trend in increase of other crops (none-cotton) ii. Increasing application of agrochemicals iii. Overirrigation/high water norms iv. Small and medium size farming v. Limited funding/support to agriculture 	<ul style="list-style-type: none"> i. Trend in increase of vegetables and orchards ii. Application of biological methods iii. Water saving technologies applied for major crops iv. Small and medium size farming v. Commercialization of agriculture 	<ul style="list-style-type: none"> i. Trend on monocropping ii. Further increase in application of agrochemicals iii. More overirrigation/high water norms and water intake due to degrading infrastructure iv. Small and medium size farming v. Reducing of funding/support to agriculture
Turkmenistan	<ul style="list-style-type: none"> i. State lead agriculture, state quotas for cotton, wheat ii. High agrochemical inputs iii. Over use of irrigation water and drainage iv. Medium scale agriculture v. Subsidies and support of state 	<ul style="list-style-type: none"> i. Reducing of state lead agriculture, state quotas for cotton, wheat are abolished ii. More of biological methods applied for crop protection iii. Systematic water saving in irrigated agriculture iv. Medium and large-scale agriculture v. Steady support of state to agriculture 	<ul style="list-style-type: none"> i. State lead agriculture, state quotas for cotton, wheat and other crops ii. High agrochemical inputs and deteriorated drainage system iii. Irrigation system leaks are increased iv. Medium scale agriculture v. Subsidies and support of state decline
Uzbekistan	<ul style="list-style-type: none"> i. State lead agriculture, state quotas for cotton, wheat ii. High agrochemical inputs iii. Over use of irrigation water and drainage iv. Medium and large-scale farming v. State support and subsidies 	<ul style="list-style-type: none"> i. State role in agriculture reduced, commercial agriculture is stronger ii. More of biological crop protection is applied iii. Water savings is applied in large scales iv. Medium and large-scale farming v. State support is still strong for agriculture 	<ul style="list-style-type: none"> i. State quotas for cotton, wheat and other crops ii. High agrochemical inputs iii. Irrigation system in decline and huge losses iv. Medium and large-scale farming v. State support and subsidies are in decline

Capacity building



The Regional Environmental Centre for Central Asia (CAREC)

June 19 at 10:03 AM

#CAREC_news Семинар «Иновационные инструменты для улучшения управления водными ресурсами в Ташкенте обобщил климатологов и специалистов по водным ресурсам. Подробнее <http://carecaco.org/en/main/news/GIS-summer-school>

Семинар в Ташкенте объединил климатологов и специалистов по водным ресурсам.

Ташкент: 15-19 июня 2018 года (место с проектом «Вода в Центральной Азии» (САВ). Актеры: Академия Форума. Несколько исследований: CAREC/САВ).

Brussels Environment, Environment and Climate

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REGIONAL HYDROLOGICAL MODELLING WORKSHOP

24 JUNE -JULY, 2018
KAZAKHSTAN, ALMATY

Regional hydrological workshop

The main aim is to provide introduction to the climate impact assessment on water resources by using the eco-hydrological model SWIM. The workshop will include the theoretical lectures and practical exercises. The practical part will be based on an example of the previously modelled pilot river basin of the Isfara. The previously done set up, calibration and validation of the SWIM model for the Isfara River basin will be used for training participants during the Regional hydrological workshop. Namely, all steps: model setup, calibration and validation, application of climate change scenarios as input to SWIM will be explained in detail and should be repeated by the participants for the Isfara basin during the workshop. After that participants will become familiar with the model operation on example of the Isfara, and after that they are expected to be able to set up, calibrate and validate the SWIM model and apply climate change scenarios independently for the selected catchments in each respective country.

June 25- July 6, 2018 (Almaty)

June 25- July 4, 2018 (Tashkent)

June 13 to June 19, 2018 (Tashkent)



Thank you for attention!