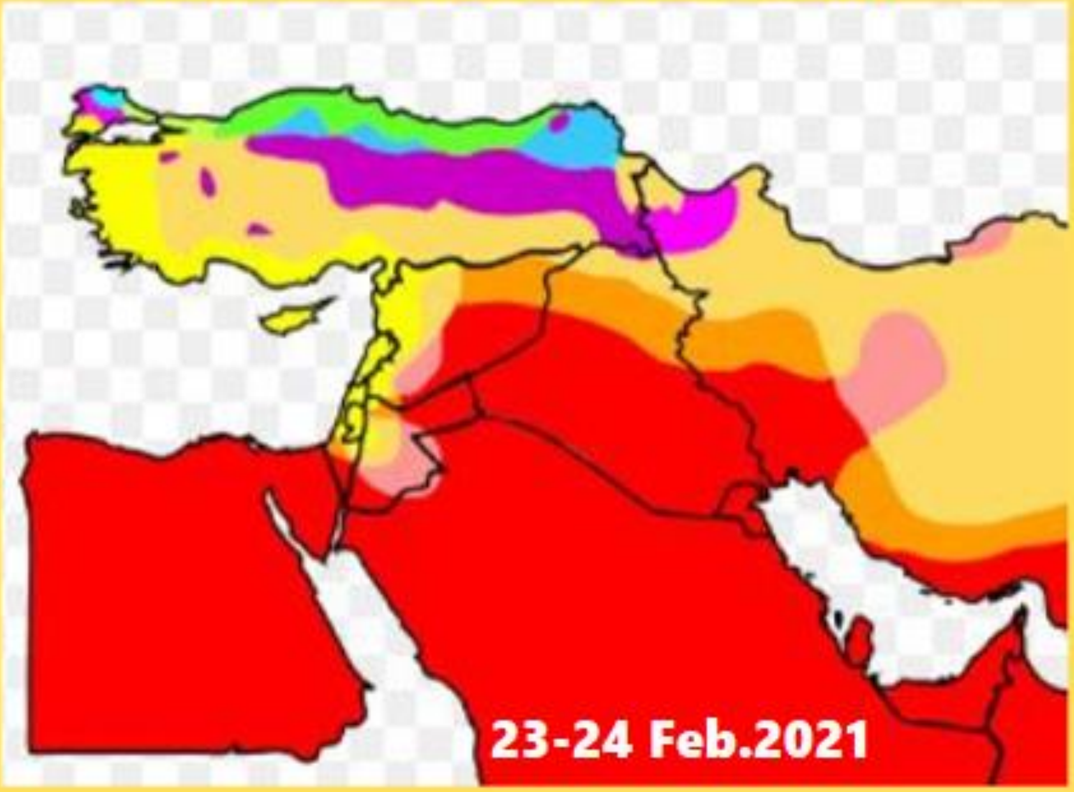
Zoom

WEBINAR

Water Scarcity in the Context of Climate Change

Projections for the Middle East

Euphrates -Tigris River Basin

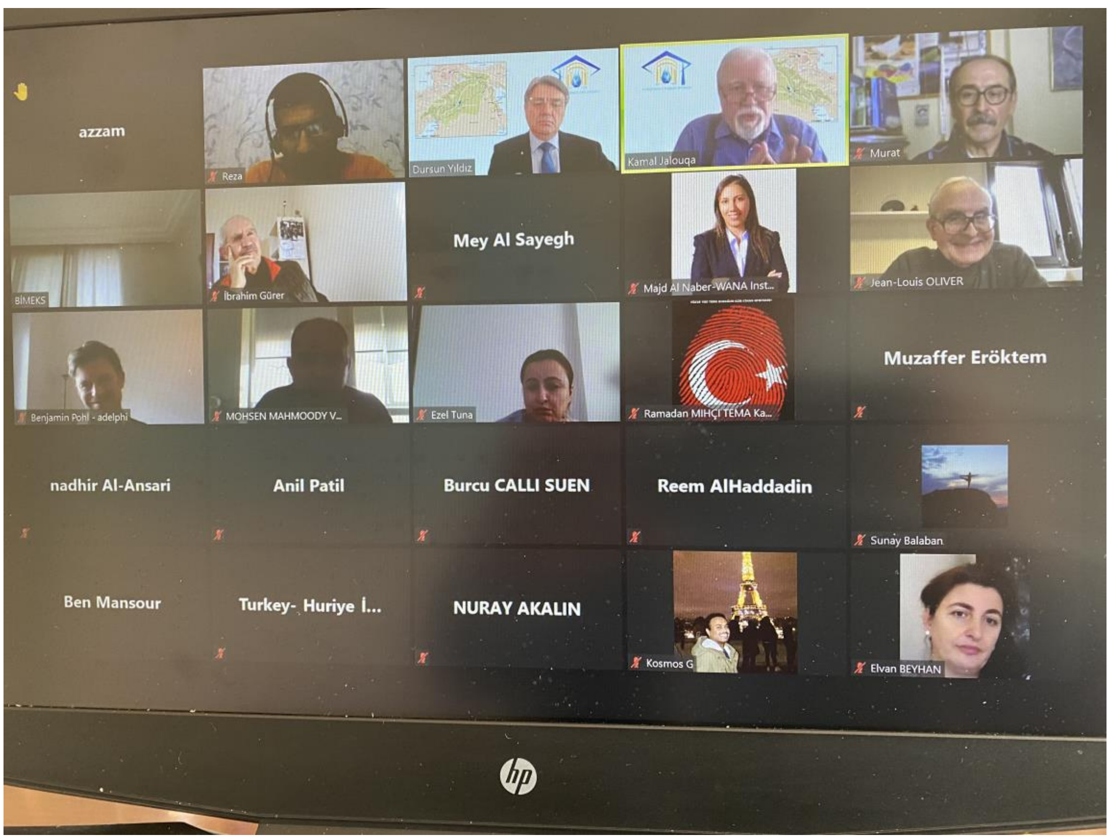


REPORT

Presentations

Hydropolitics Academy,Turkey

Hydropolitics Academy,Turkey would like to thank all of the speakers and atendees for their contrubution to the webinar



27 February 2021

CONCEPT NOTE :

The Euphrates-Tigris basin the north eastern part of the Middle East is estimated to be one of the most affected areas from climate change, and thereby is an area that should be prepared for the phenomenon by its countries, its research and development institutions, and by experts in the field. All possible tools available to researchers should be made ready for negotiating politicians in the region's countries. This Webinar is a step in the right direction, and many should follow before the situation of water resources scarcity becomes imminent.

We, in the region, are dealing with a situation with high levels of climate vulnerability, characterised by high population growth and density, high levels of urbanization, and scarce water resources, faltering agriculture and fisheries resources that may lead to substantial societal and economical transitions, and to unresolvable conflicts in some countries and throughout the region.

Objective:

The Hydropolitics Academy Center (HPA) leads on this Zoom-Webinar to highlight the climate change impact on water resources in Euphrates-Tigris River Basin and the potential impacts on the Middle East Future

The webinar addressed the following questions:

1. What are the results of Climate Change Projections Models and it's effects on Water Resources in the Basin.
2. What is Climate Change and security relations in the region
3. What policies and strategies are needed to respond climate change effects
4. What framework is needed to strengthen regional cross border collaboration against Climate Change Effects

__Hosted By:__ **Hydropolitics Academy Center of Turkey (HPA)**

Facilitated by:

- **Kamal Jalouqa**, *Project Coordinator, Climate change and Natural Resources Sustainability Cluster* –JORDAN (HPA Associate)

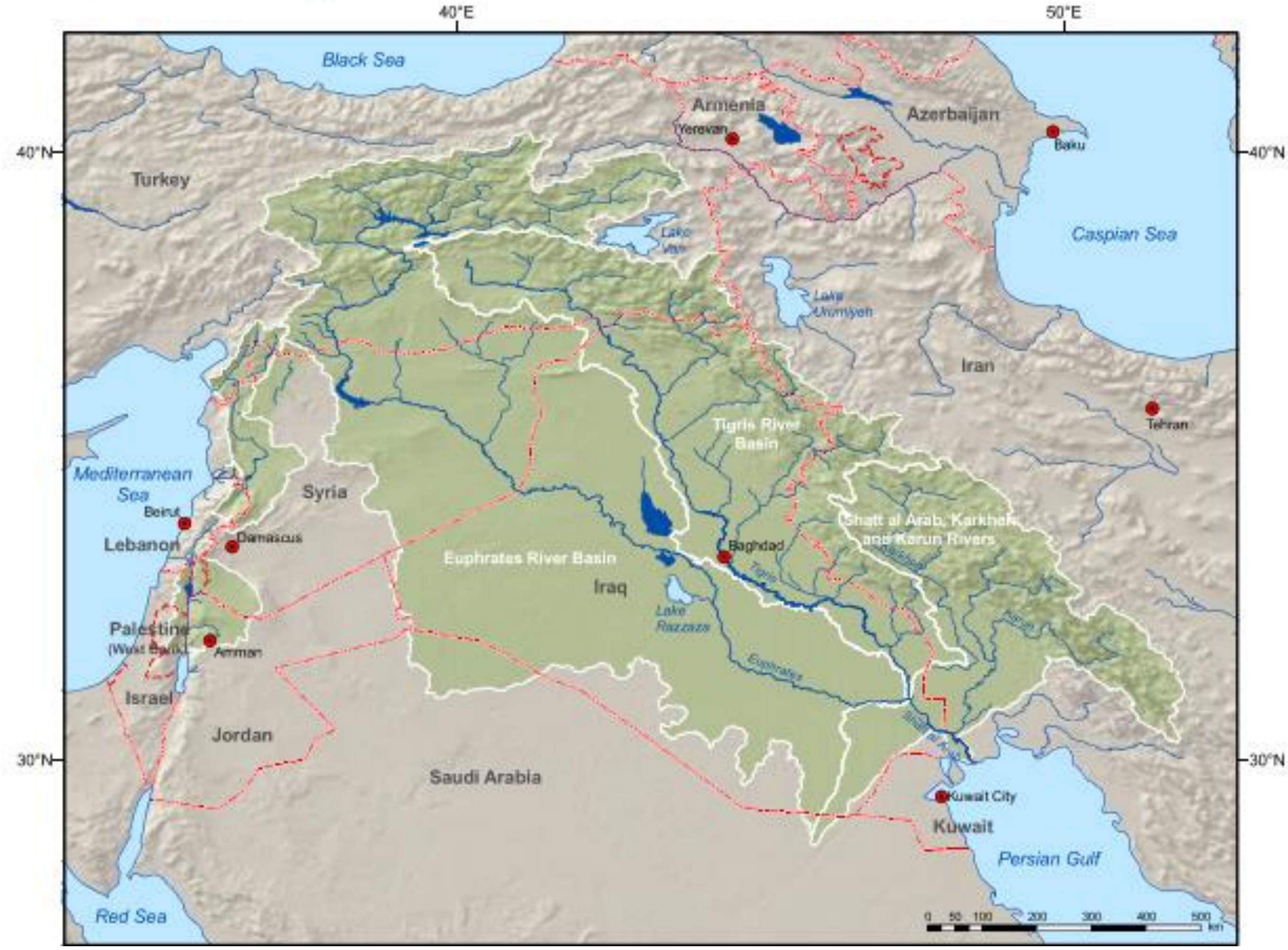
Speakers:

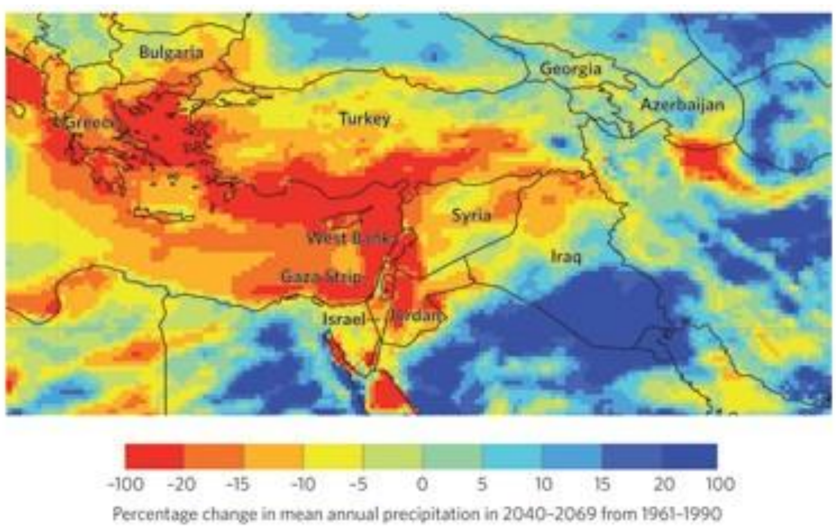
__23th Feb 2021__

- **Prof.Dr. Nadhir Al Ansari ,** *Lule University SWEEDEN*
- **Prof.Dr. Murat Türkeş** Member of Bogazici University Center for Climate Change and Policy Studies.TURKEY
- **Dr.Gholamreza Joodaki** Assistant Professor at __Satellite Geodesy__. University of Zanjan.IRAN

__24th Feb.2021__

- **Dr.Benjamin Pohl ,** Head of Programme Climate Diplomacy and Security .GERMANY
- **Dr.Azzam Alwash** Founder and CEO, Nature Iraq, Member of the Board of Trustees of the American University of Iraq – Sulaimani, and Goldman Environmental Prize Laureate IRAQ
- **Dursun Yıldız .**Head of Hydropolitics Academy.IZTECH International Water Resources Dept. TURKEY
- **Kamal Jalouqa**
- *Project Coordinator, Climate change and Natural Resources Sustainability Cluster* –JORDAN (HPA Associate)


40°E
50°E
40°N
30°N
Black Sea
Armenia
Yerevan
Azerbaijan
Baku
Turkey
Caspian Sea
Lake Van
Lake Urumiyeh
Iran
Tehran
Tigris River Basin
Mediterranean Sea
Beirut
Lebanon
Damascus
Syria
Shatt al Arab, Karkheh and Karun Rivers
Euphrates River Basin
Baghdad
Iraq
Palestine (West Bank)
Amman
Lake Razzaza
Euphrates
Israel
Jordan
Saudi Arabia
Kuwait City
Kuwait
Persian Gulf
Red Sea
0 50 100 200 300 400 500 km


Bulgaria
Georgia
Azerbaijan
Greece
Turkey
Syria
West Bank
Iraq
Gaza Strip
Israel
Jordan
-100 -20 -15 -10 -5 0 5 10 15 20 100
Percentage change in mean annual precipitation in 2040-2069 from 1961-1990


Zoom
WEBINAR
Water Scarcity in the Context of Climate Change
Projections for the Middle East
Euphrates -Tigris River Basin
14:00 - 16:15 PM (GMT + 3 Ankara)
23-24 February 2021
HYDROPOLITICS ACADEMY ,Turkey
Program and registration information are available at the link below:
https://www.hpacenter.org/
SESSION 1
PROGRAM 23 Feb.2021
14:00 -14:05 Openning Remark Kamal Jalouqa MA in Development Studies (Moderator)
14:05 -14:30 Prof.Dr. Murat Türkeş
Results of Climate Change Modeling Studies on the Euphrates and Tigris Basins
Emeritus Professor of Physical Geography and Geology & Climatology and Meteorology.Member of the Executive Committee for the "Bogazici University Center for Climate Change and Policy Studies", İstanbul, Turkey
14:30-14:50 Prof.Dr. Nadhir Al-Ansari
Consequences of Climate Change Effects in the Euphrates and Tigris Basin.
Luleå University of Technology, Department of Civil, Environmental and Natural Resources Engineering, Mining and Geotechnical Engineering.SWEDEN
14:50-15:10 Dr.Gholamreza Joodaki
Estimating the groundwater depletion in the Middle East, from GRACE data
Assistant Professor at Satellite Geodesy, University of Zanjan.IRAN
15:10 -15:30 Q&A and Closing Remark


Zoom
WEBINAR
Water Scarcity in the Context of Climate Change
Projections for the Middle East
Euphrates -Tigris River Basin
14:00 - 16:15 PM (GMT + 3 Ankara)
23-24 February 2021
HYDROPOLITICS ACADEMY ,Turkey
Program and registration information are available at the link below:
https://www.hpacenter.org/
SESSION 2
24 Feb.2021
14.00-14:20 Dr. Benjamin Pohl
What climate change will mean for the Middle East security and geopolitics
Head of Programme Climate Diplomacy and Security-adelpi GERMANY
14:20-14:40 Dr.Azzam Alwash
Water as a tool for economic cooperation instead of political tensions
Founder and CEO, Nature Iraq, Member of the Board of Trustees of the American University of Iraq – Sulaimani, and Goldman Environmental Prize Laureate IRAQ
14:40 -15-10 Dursun Yıldız C.E
Effects of Climate Change on Food Security in the Region
President of Hydropolitics Academy
Part Time Lecturer in International Water Resources Department of İzmir Institute of Technology .Turkey
15:10-15:30 Kamal Jalouqa Moderator
Technology as a tool in Water Diplomacy ,Euphrates and Tigris Basin
MA in Development Studies . Amman Jordan
15:30 -16:00 Q&A and Closing Remark

Webinar on: Climate Change Effects on the Euphrates-Tigris Basin

Organized by Hydropolitics Academy, Ankara, Turkey**,** on 23-24 February 2021

SUMMARY & PROPOSALS

The webinar was organized by the Ankara-based Hydropolitics Academy, to seek a joint understanding of the main symptoms of Climate Change and how they are affecting are in question, the Euphrates-Tigris basin, and its lateral states, Turkey, Syria, Iraq and Iran. The webinar was organized in two, two-hour sessions, and attended by experts representing the region, Europe, and International organizations.

Participating speakers gave an overall picture of Climate Change, and how the countries, their water resources, and related infrastructure, agriculture and urban centers are affected by the phenomenon. The speaker also gave a general framework of actions that need to be taken by the stakeholders, governments and international organizations, research and consultancy formations and the concerned individuals of the issues at stake.

the Webinar has come up with the following results:

1. Governments and their related political formations are overwhelmed by on-going security turmoil and resulting conditions, and little is being done of bilateral and multilateral readiness to confront the threats resulting from Climate Change and how it is affecting the environment, agricultural production, and resource technological needs to confront the resulting situation.
2. The private sector, consulting firms and research institutions, who have done research and assessment on the situation of Climate Change, are not in a better situation due to the region's governments' lack of work opportunities that will provide finance to their work. For that reason little is being done on technological advancement on tools. Programs and projects that, could be handed over to political circles for action, especially on multistate cooperation and joint projects.
3. This situation of two of the main stakeholders of the water resources management situation, namely politicians and technical people are lacking an effective institutional

framework for work progress that may lead to joint, and country-level, programs and projects needed to remedy the situation resulting from Climate Change.

4. The institutional framework needed may include and is not limited to, a joint high-level meeting of representatives of regional governments, international organizations, research institutes, and technology firms to draw an **immediate joint action plan** at the level of the region.

5. Participating experts reiterated the importance of agricultural production and food security in the region, and how it is affected by interruptions in water supply, and the need for a remake of the ways and methods of water usage in agriculture, and the immediate need for bilateral, institutional cooperation in this field.

6. The participating experts also mentioned the region is highly dependent on imported food, which may reach catastrophic dimensions due to climate change conditions. Which brings country-wide and region-wide cooperation to the table. This makes cooperation a major necessity on regional development projects to achieve food security

7. Migration due to security and political turbulences may also become difficult to solve problems for the region's governments as well as the international community and aid organizations, especially if the security of food and agricultural reforms were not implemented.
8. Joint teams, scientific teams from riparian countries within NGOs and universities are to be encouraged to work together to solve ongoing and expected problems in this context.
9. Projected warming and decrease in precipitation might powerfully affect the mostly drylands (arid and semi-arid environments) of the study area including the Middle East and make most of the large Asian continent vulnerable to climate change.
10. Some studies also focused on the demand for irrigation applications showed that water demands from irrigated agriculture tend to increase as a consequence of the simulated changes in temperature and precipitation.
11. Consequently, farmers need to adapt their production systems, switching crops, changing cultivars and sowing dates, increasing irrigation, etc.
12. The participants as well as the panelists agree that there are technical solutions possible that would lead to changing the situation from a threat to security to an opportunity for economic cooperation and co-dependence that will lead to stability in the region.
13. What is missing is mutual trust and having a common understanding of the positions of each of the stakeholders. But the most important missing ingredient is lack of political will by the decision-makers.
14. To that end, the participants agreed that there is a need for more frequent discussions on zoom or other means to further flesh out the ideas presented and to discuss the important issue of trust-building through a step-wise set of projects of mutual benefits.

15. . Groundwater is an indicator of climate variability and human impacts on the environment. Combining GRACE data with hydrologic modeling enables water managers to observe dynamic changes in groundwater over the region where well data are sparse.
16. There is a need to build political will & this requires building trust & the right incentive structures so that governments (and other stakeholders) feel they will be rewarded for good results rather than national grandstanding. And a regular exchange (perhaps with just one or two people asked for short ideas to present & discuss) would be great, especially if we could also bring in some policy-makers.

Panellist's Bios

Prof. Dr. Nadhir Al-Ansari

Professor at Lulea Technical University **Sweden**

Obtained his PhD degree from Dundee University in Water Resources Engineering in 1976. Now Professor at Lulea Technical University Sweden. Previously worked at Baghdad University 1976-1995 then at Al-Bayt University in Jordan (1995- 2007). Served several academic administrative post (Dean, Head of Department). Publications include more than 673 articles in journals and 21 books. He executed more than 60 major research projects in Iraq, Jordan and UK. Got several scientific Awards

Prof.Dr. Murat Türkeş

Emeritus Professor , Bogazici University Center for Climate Change and Policy Studies.**Turkey**

Obtained PhD degree in Climatology and Meteorology from İstanbul University, Institute of Marine Sciences and Geography in 1990 .He used to be Full time lecturer and Professor at the Department of Geography of the Faculty of Sciences and Arts, Çanakkale Onsekiz Mart University and Affiliated Faculty at the Department of Statistics Middle East Technical University (METU), Ankara, Turkey.He worked for nine years at Çanakkale Onsekiz Mart University. In the past about 23 years for the Turkish State Meteorological Service.

He is a Member of the Executive Committe of the Bogazici University Center for Climate Change and Policy Studies.His areas of expertise: Physical geography and geology, climatology and meteorology; climate change and variability; drought and desertification with respect to the climate and climatic variations; the United Nations Framework Convention on Climate Change and its Kyoto Protocol; energy policies and environmental protection; sustainable development and climate change. He executed several project in Turkey and abroad.

Dr. Gholamreza Joodaki

Assistant Professor at Geodesy, ZNU **Iran**

He is orginallly a Surveying Engineer .He got his B.Sc degree from the University of Tehran, Iran, Surveying Engineering in 1996. .He followed his M.Sc. degree in the same university on Satellite Geodesy field. His thesis title is Earth Mass Change Tracking Using GRACE Satellite Gravity Data. He follwed his PhD in the Norwegian University of Science and Technology between 2014-2019 on the subject of Satellite Geodesy After his PhD degree from the Norwegian University of Science and Technology he began to his carrier in the University of Zenjan, Iran.

He published several paper on Satellite Geodesy and Evaluation ground water storage using by GRACE.He also study on Mass loss of the Greenland ice sheet from GRACE time-variable gravity measurements ,Estimating the Human Contribution to Groundwater Depletion in the Middle East, from GRACE Data, Land Surface Models, and Well Observations and Steric Sea level changes from ENVISAT and GRACE in the Nordic Seas. Aside from teaching, He is a Professional Surveyor registered in Iran and do consultancy and advisory work in different aspects for both private and government agencies.

He used to be head of departmant of Surveying Engineering between 2002-2004 and Vice Chancellor for Reseach, Faculty of Engineering between 2004- 2005 in University of Zenjan .He is Head of Surveying Engineering Department in the University of Zenjan since 2017

Will Climate Change Lead to Conflict or Cooperation in the Middle East, Euphrates and Tigris Basin

WEBINAR | 24th February 2021 | 14:00h – 16:00h

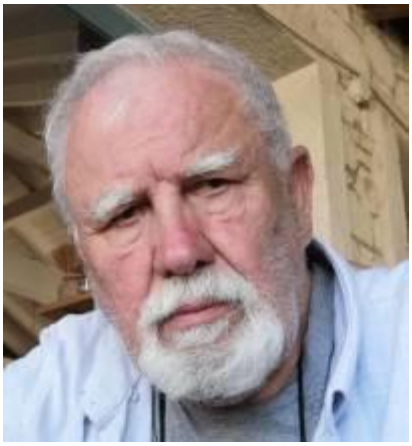
Dr. Benjamin Pohl

Head of Programme Climate Diplomacy and Security. **Germany**

Dr.Benjamin Pohl is Senior Project Manager at adelphi where he focuses on the impact of global environmental change on foreign, security and development policy. He is responsible for the topic areas foreign policy, diplomacy, and water cooperation and has been working for five years at the interface of peacebuilding and global sustainable development. The core challenge in his projects often comes down to the constructive management of conflicts of interest in the face of limited natural resources. Facilitating such constructive management frequently.

depends on fostering dialogue in which stakeholders can reflect their interests beyond established positions

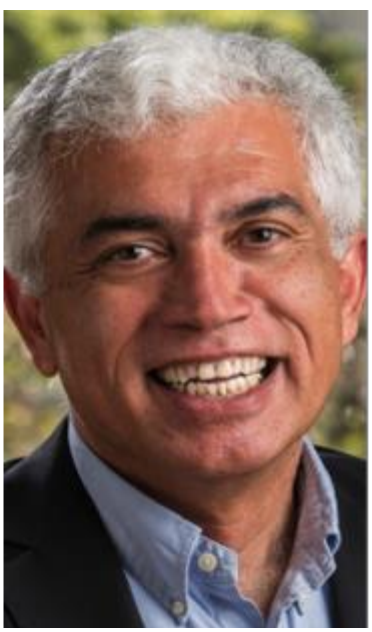
Kamal Jalouqa, MA in Development Studies, Jordan



Developmant Planning, 1983, BCP, City Planning, 1978. Worked on major regional, metropolitan and sector development studies and major projects like industrial estates, airports and infrastructure in Jordan, Palestine, Iraq, Saudi Arabia, UAE, Pakistan and Sudan. Former president of the Jordanian Planning Forum and active in non profit organisations. Former Industrial Professor at German Jordanian University and part-time lecturer at Jordan University.He is also member of Hydropolitics Association in Ankara, Turkey.

Dr.Azzam Alwash

Founder and CEO, Nature Iraq, Member of the Board of Trustees of the American University of Iraq – Sulaimani, and Goldman Environmental Prize Laureate **Iraq**



Dr. Azzam Alwash was born in Kut, Iraq in 1958 and left in 1978 for the United States, where he completed his graduate work, earning a Ph.D. in Civil Engineering from the University of Southern California in 1988. He has more than 20 years experience in the environmental and geotechnical fields. After the removal of Saddam Hussein, he moved back to Iraq to work on the restoration of the marshes and founded Nature Iraq, an Iraqi NGO focused on the preservation of Iraq's environment and cultural heritage — an effort that earned him the Takreem Award in 2011, The Goldman Environment Prize for 2013, as well as distinction as one of Foreign Policy's 100 forward-thinking leaders of the world in 2013.

Dr. Alwash became a founding member of the board of trustees of American University of Iraq, Sulaimani in 2006. Dr. Alwash is working now on issues of water and the environment through Nature Iraq and American University of Iraq, Sulaimani to promote the idea of cooperation on water management and making water an instrument of peace rather than the source of tension in the future Middle East.

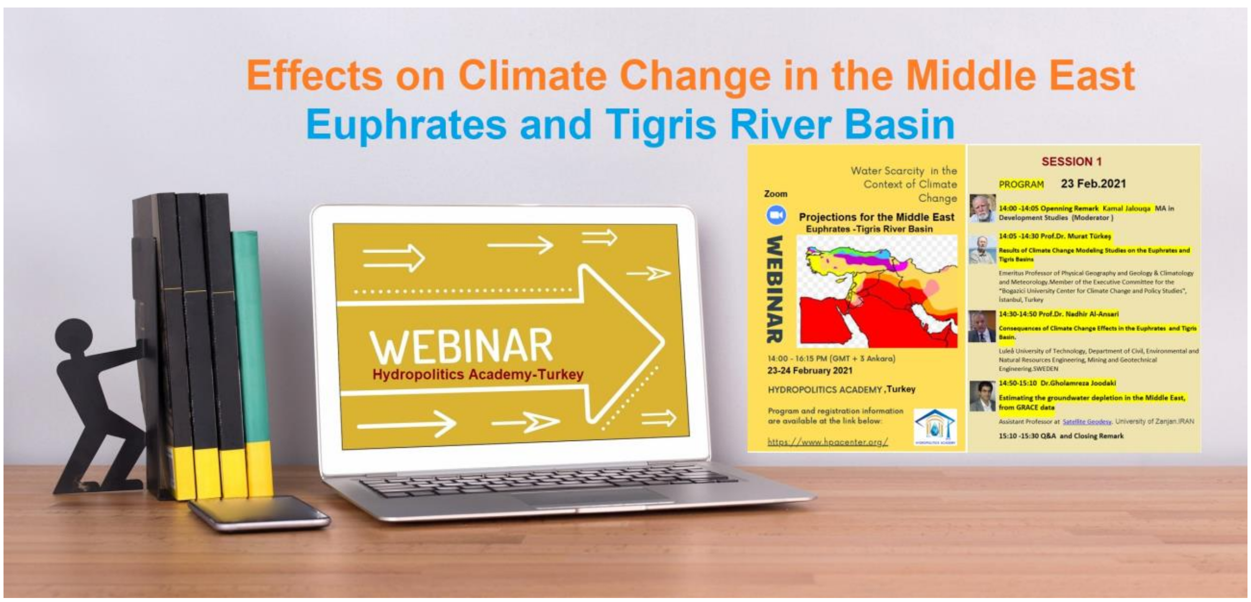
Dursun Yıldız CE Hydropolitics Expert

President of Hydropolitics Academy of Turkey
Part Time Lecturer in International Water Resources Department of İzmir Institute of Technology .Turkey

He is orginally a civil engineer.He began to work in State Hydraulic Works in 1983. During his DSİ carrier he participated in post graduate professional education and investigation programs in Holland-Delft, the USA Bureau of Reclamation and US Army Corps of Engineers. In 2000 he completed his MSc degree on the topic of water politics in Hacettepe University Hydropolitics and Strategy Research Center. He experienced in water, hydro energy management, and consultancy for 25 years, wrote seventeen books and besides published several papers and technical reports on the topics of hydraulic engineering,water management,hydropolitics,hydro diplomacy in national and international periodicals. He has awarded the Successful Water Researcher Prize of the Year of 2008 by Agriculturers Associations of Türkiye. He has also awarded Successful Water Expert Prize by Central Union of Irrigation Cooperatives in 2016 . He is founder of the Hydropolitics Association in 2015 and president of it. He is also managing his own Engineering and Consultancy Company since 2008.

He is a member of the Scientific Committee of the Turkish Foundation for Combating Soil Erosion (TEMA). He is editor of the **International Journal of Water Management and Diplomacy** published by Dergipark. Currently, he is a Part Time Lecturer **in International Water Resources Department of İzmir Institute of Technology, Turkey.**

PRESENTATIONS



Results of Climate Change Modeling Studies on the Euphrates and Tigris Basins

Prof.Dr. Murat Türkeş

(Physical Geography and Geology & Climatology and Meteorology)

Bogazici University Center for Climate Change and Policy Studies, İstanbul, Turkey

TEMA Foundation Member of the Science Committee, İstanbul, Turkey

with starting

Water scarcity can mean scarcity in availability due to physical shortage, or scarcity in access due to the failure of institutions to ensure a regular supply or due to a lack of adequate infrastructure.

Water scarcity already affects every continent.

Water use has been growing globally at more than twice the rate of population increase in the last century, and an increasing number of regions are reaching the limit at which water services can be sustainably delivered, especially in arid regions.

UN WATER, 2021

https://www.unwater.org/water-facts/scarcity/

with starting

Climate Change and Desertification Impacts on Water Scarcity and Use

- Reduced water retention capacity of degraded soils amplifies floods, reinforces degradation processes through soil erosion, and reduces annual intake of water to aquifers, exacerbating existing water scarcities.
- Reduced vegetation cover and more intense dust storms were found to intensify droughts.
- Moreover, secondary salinisation in the irrigated drylands often requires leaching with considerable amounts of water.
- Consequently, different types of soil degradation increase water scarcity both through lower water quantity and quality.
- All these processes reduce water availability for other needs.

IPCC SRCCL, Chapter 3 Desertification, 2018

with starting

Climate Change and Desertification Impacts on Water Scarcity and Use

- In this context, climate change will further intensify water scarcity in some dryland areas and increase the frequency of droughts.
- Higher water scarcity may imply growing use of wastewater effluents for irrigation, and the use of untreated wastewater increase soil degradation processes, in addition to negative human health impacts.
- Climate change, thus, will amplify the need for integrated land and water management for sustainable development.

IPCC SRCCL, Chapter 3 Desertification, 2018

motivation

-Aim of the presentation is to give a brief technical information on the present and future climate of the Euphrates and Tigris Basins and the Western Asia region

-and to make an evaluation of results of some of our climate change modeling studies on these regions.

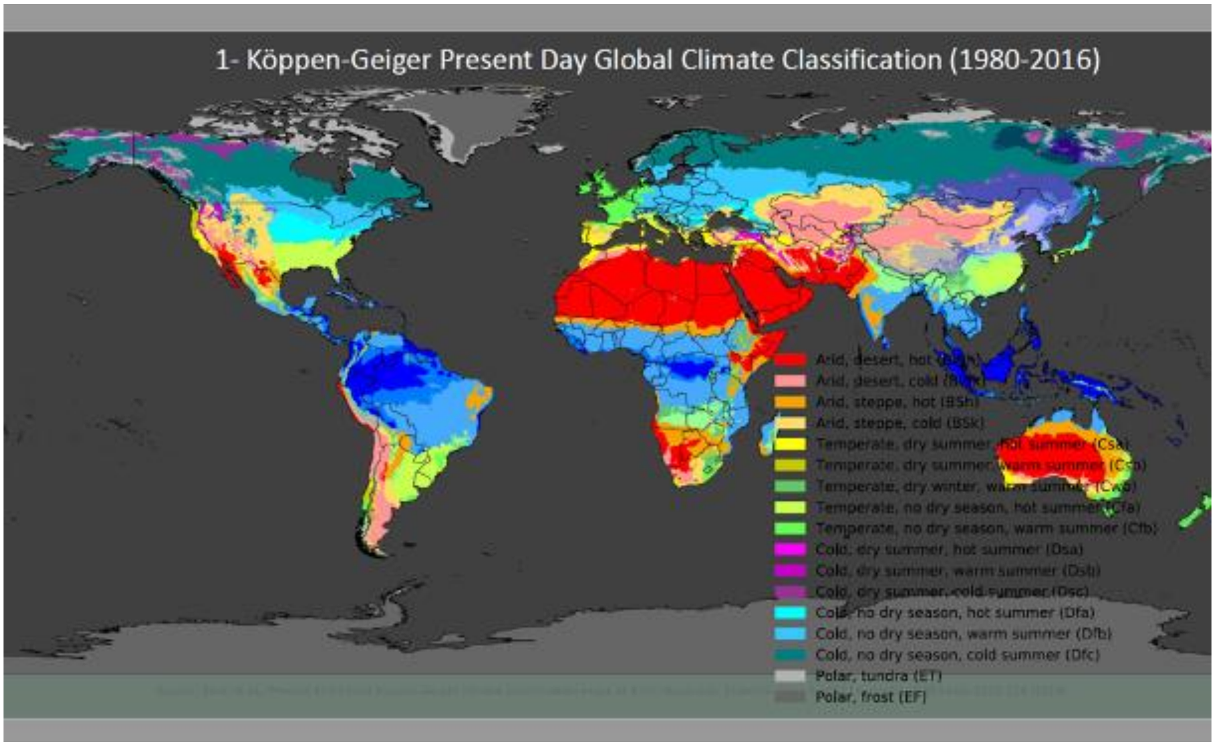
SCIENTIFIC DATA

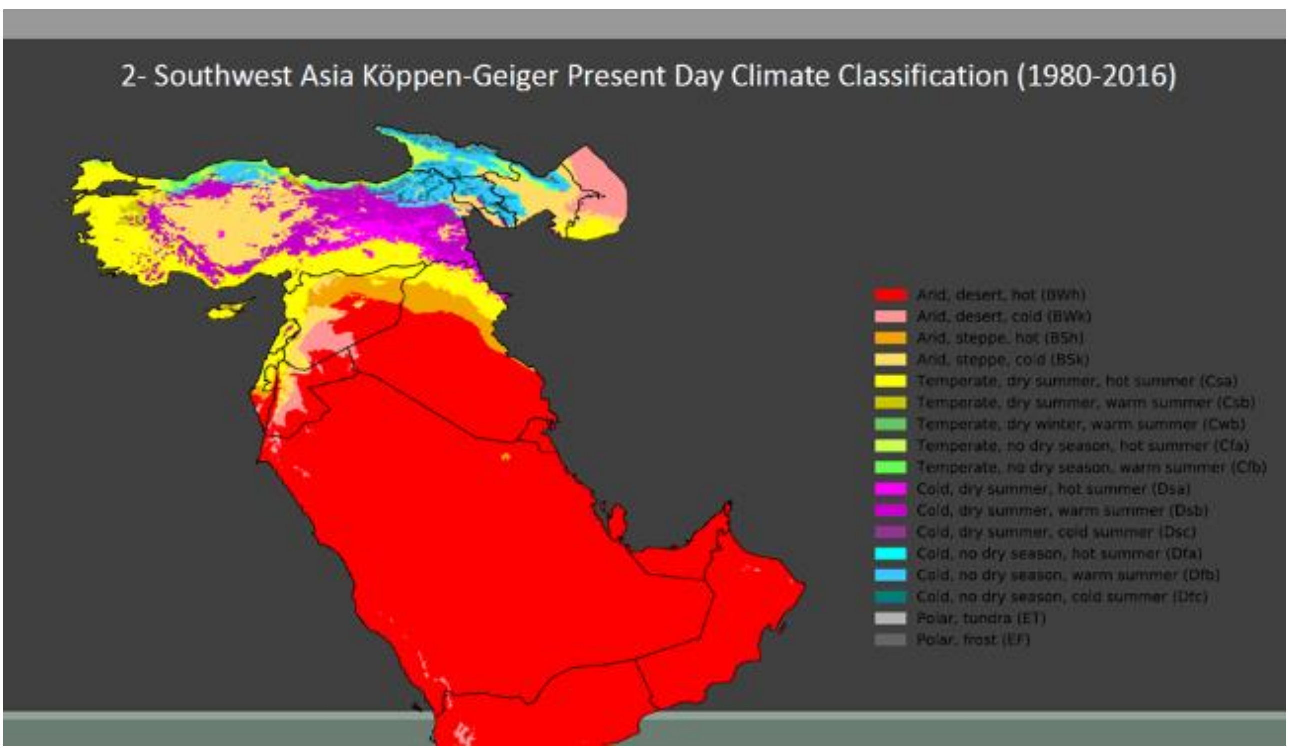
OPEN **Data Descriptor: Present and future Köppen-Geiger climate classification maps at 1-km resolution**

Hylke E. Beck[1], Niklaus E. Zimmermann[2,3], Tim R. McVicar[4,5], Noemi Vergopolan[1], Alexis Berg[1] & Eric F. Wood[1]

Received: 4 June 2018
Accepted: 21 August 2018
Published: 30 October 2018

We present new global maps of the Köppen-Geiger climate classification at an unprecedented 1-km resolution for the present-day (1980–2016) and for projected future conditions (2071–2100) under climate change. The present-day map is derived from an ensemble of four high-resolution, topographically-corrected climatic maps. The future map is derived from an ensemble of 32 climate model projections (scenario RCP8.5), by superimposing the projected climate change anomaly on the baseline high-resolution climatic maps. For both time periods we calculate confidence levels from the ensemble spread, providing valuable indications of the reliability of the classifications. The new maps exhibit a higher classification accuracy and substantially more detail than previous maps, particularly in regions with sharp spatial or elevation gradients. We anticipate the new maps will be useful for numerous applications, including species and vegetation distribution modeling. The new maps including the associated confidence maps are freely available via www.gloh2o.org/koppen.


1- Köppen-Geiger Present Day Global Climate Classification (1980-2016)
Arid, desert, hot (BWh)
Arid, desert, cold (BWk)
Arid, steppe, hot (BSh)
Arid, steppe, cold (BSk)
Temperate, dry summer, hot summer (Csa)
Temperate, dry summer, warm summer (Csb)
Temperate, dry winter, warm summer (Cwb)
Temperate, no dry season, hot summer (Cfa)
Temperate, no dry season, warm summer (Cfb)
Cold, dry summer, hot summer (Dsa)
Cold, dry summer, warm summer (Dsb)
Cold, dry summer, cold summer (Dsc)
Cold, no dry season, hot summer (Dfa)
Cold, no dry season, warm summer (Dfb)
Cold, no dry season, cold summer (Dfc)
Polar, tundra (ET)
Polar, frost (EF)


2- Southwest Asia Köppen-Geiger Present Day Climate Classification (1980-2016)
Arid, desert, hot (BWh)
Arid, desert, cold (BWk)
Arid, steppe, hot (BSh)
Arid, steppe, cold (BSk)
Temperate, dry summer, hot summer (Csa)
Temperate, dry summer, warm summer (Csb)
Temperate, dry winter, warm summer (Cwb)
Temperate, no dry season, hot summer (Cfa)
Temperate, no dry season, warm summer (Cfb)
Cold, dry summer, hot summer (Dsa)
Cold, dry summer, warm summer (Dsb)
Cold, dry summer, cold summer (Dsc)
Cold, no dry season, hot summer (Dfa)
Cold, no dry season, warm summer (Dfb)
Cold, no dry season, cold summer (Dfc)
Polar, tundra (ET)
Polar, frost (EF)

5th International Workshop on SDS, 23-25 Oct. 2017, Istanbul

Recent Spatiotemporal Variations of Synoptic Meteorological Sand and Dust Storm Events Observed over the Middle East and Surrounding Regions

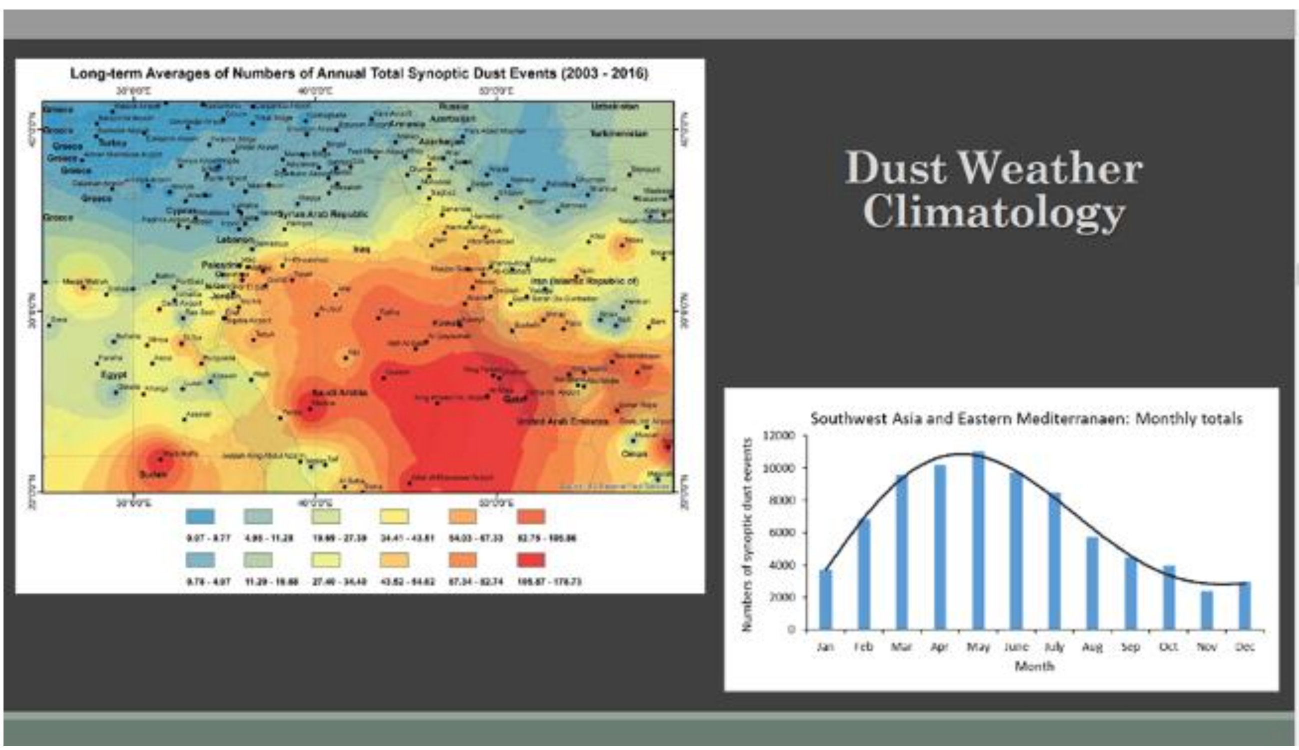
Murat Türkeş

The Center for Climate Change and Policy Studies and the Department of Physics, Boğaziçi University, Istanbul, Turkey

Abstract

The study investigated the climatology and spatiotemporal variations of synoptic meteorological sand and dust storms (SDS) observed over the Middle East and surrounding regions during 2003-2016 period. Time-series data from total 172 stations was used in station- and country-based climatological analysis, whereas 134 of 172 stations were used for the station-based and country-based time-series analysis. We also made use of the Aerosol Optical Depth/Optical Thickness (AOD) time-series data in addition to the station-based observational weather sand and dust events.

Statistically significant positive relations between inter-annual variations of numbers of the SDS weather events and the country-based AOD time-series revealed clearly that synoptic meteorological surface SDS weather events data and remotely-sensed atmospheric data are well correlated, proving that both data sets can be used for the observational SDS studies including temporal and spatial variability. According to the u(t) test statistics calculated for the Mann-Kendall rank correlation coefficient, annual number of synoptic SDS weather events in Turkey, Saudi Arabia, Iran and the regionally averaged annual totals of the Eastern Mediterranean and the Southwest Asia increased significantly at the 5 per cent level. Among the 11 countries selected for the study only Egypt's annual total SDS series indicated significant decreased trend at the 5 per cent level. Based on the resultant u(t) test statistics from the Mann-Kendall analysis, even though 94 (40) of all 134 stations used in the trend analysis is characterised with an increasing (a decreasing) trend, 34 (16) stations tended to increase significantly at the 5 (1) per cent level, while 12 stations indicated a decreasing trend at the 5 per cent level of significance.

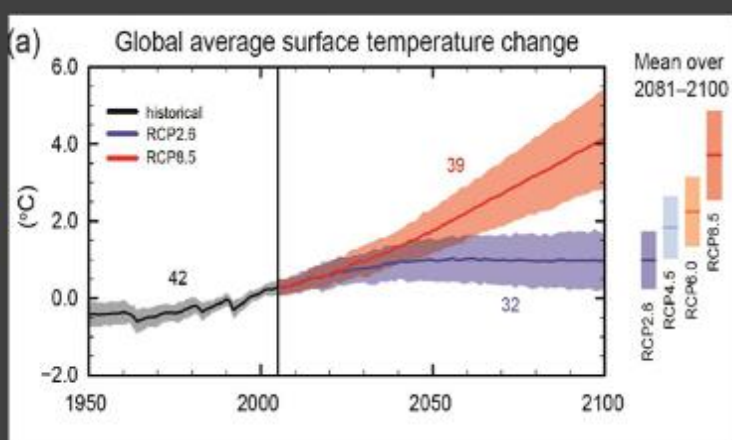


Spatial and Temporal Patterns of the Climate Model Simulations of Future Changes in Global and Asia Climate including Climates of Turkey and Midle East Regions

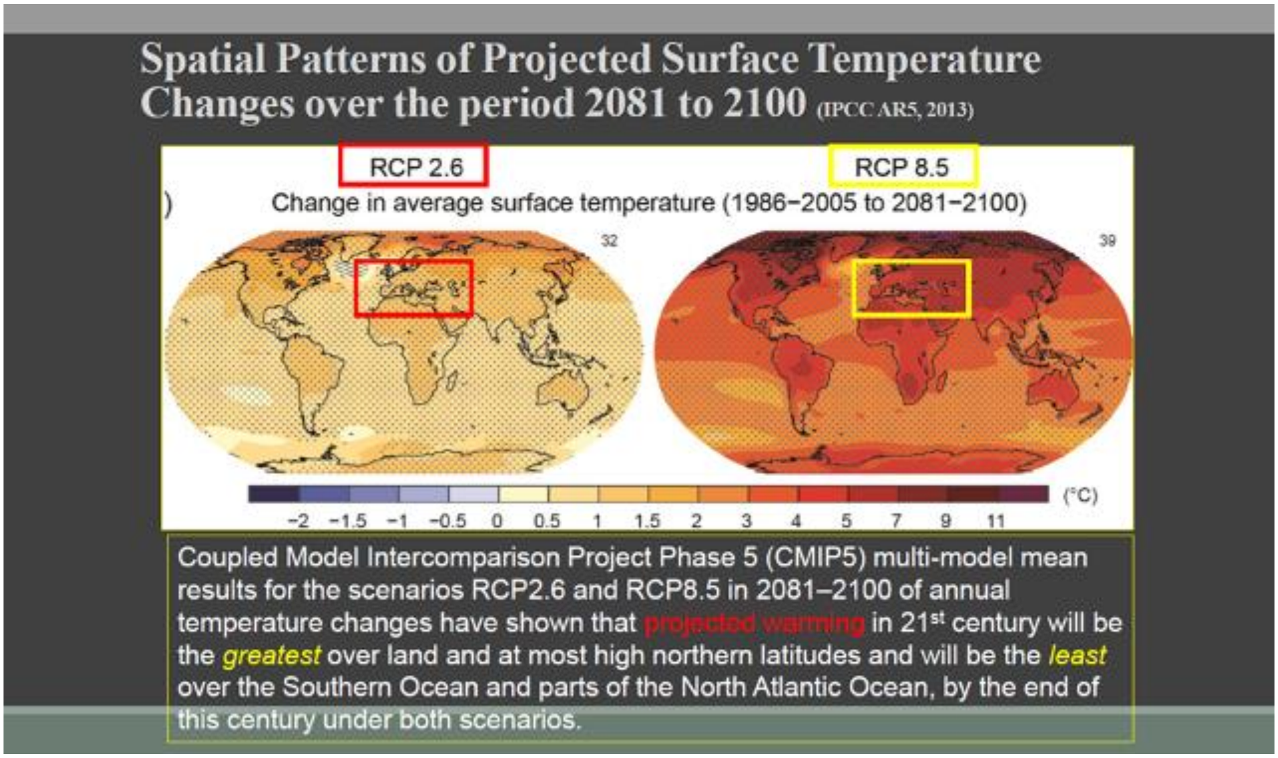
(IPCC AR5, 2013; Ozturk et al. 2013, 2014, 2015, 2017, 2018; Turp et al. 2013, 2014; Türkeş et al., 2020, etc.)

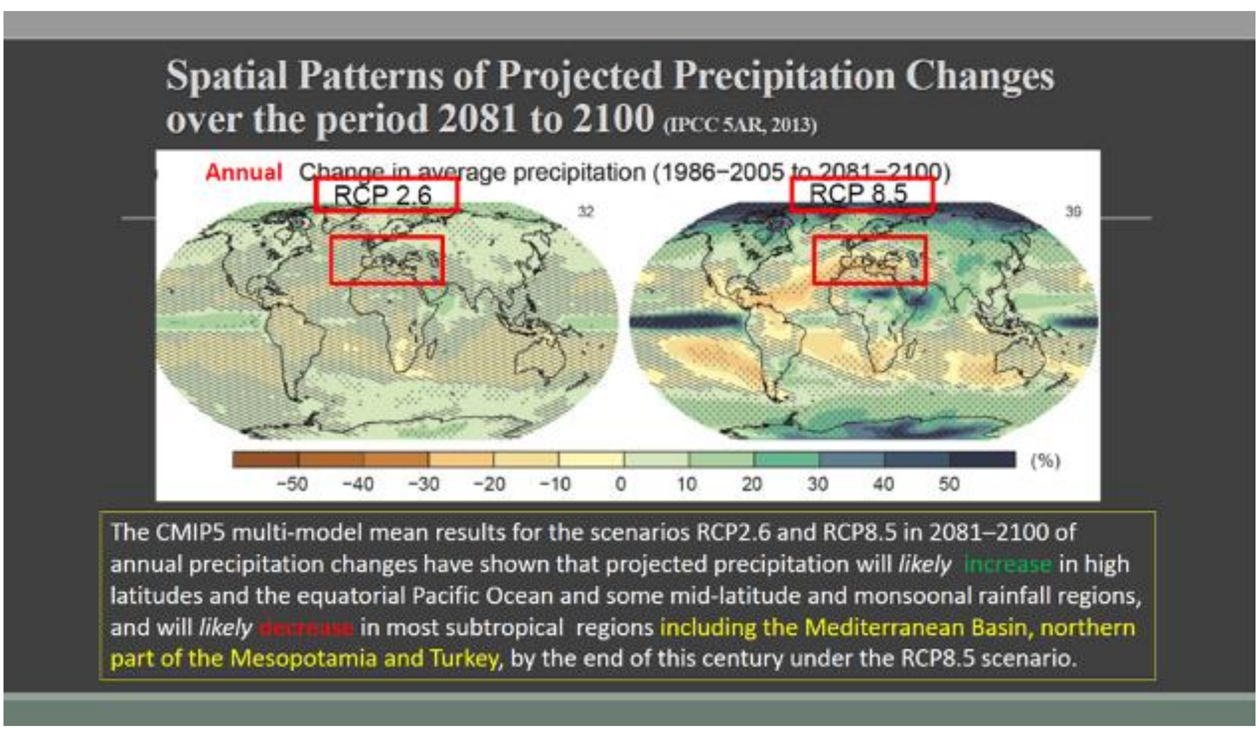
Multi-model simulated changes in global annual mean surface temperatures relative to 1986–2005 (IPCC AR5, 2013)

- Equilibrium climate sensitivity is *likely* in the range 1.5°C to 4.5°C (*high confidence*), *extremely unlikely* less than 1°C (*high confidence*), and *very unlikely* greater than 6°C (*medium confidence*).



Global surface temperature change for the end of the 21st century is *likely to exceed 1.5°C* relative to 1850 for all RCP scenarios


Spatial Patterns of Projected Surface Temperature Changes over the period 2081 to 2100 (IPCC AR5, 2013)
RCP 2.6
RCP 8.5
Change in average surface temperature (1986−2005 to 2081−2100)
32
39
(°C)
−2 −1.5 −1 −0.5 0 0.5 1 1.5 2 3 4 5 7 9 11
Coupled Model Intercomparison Project Phase 5 (CMIP5) multi-model mean results for the scenarios RCP2.6 and RCP8.5 in 2081–2100 of annual temperature changes have shown that projected warming in 21st century will be the greatest over land and at most high northern latitudes and will be the least over the Southern Ocean and parts of the North Atlantic Ocean, by the end of this century under both scenarios.


Spatial Patterns of Projected Precipitation Changes over the period 2081 to 2100 (IPCC 5AR, 2013)
Annual Change in average precipitation (1986−2005 to 2081−2100)
RCP 2.6
RCP 8.5
32
39
(%)
−50 −40 −30 −20 −10 0 10 20 30 40 50
The CMIP5 multi-model mean results for the scenarios RCP2.6 and RCP8.5 in 2081–2100 of annual precipitation changes have shown that projected precipitation will likely increase in high latitudes and the equatorial Pacific Ocean and some mid-latitude and monsoonal rainfall regions, and will likely decrease in most subtropical regions including the Mediterranean Basin, northern part of the Mesopotamia and Turkey, by the end of this century under the RCP8.5 scenario.

RMetS

Projections of climate change in the Mediterranean Basin by using downscaled global climate model outputs

OPEN ACCESS

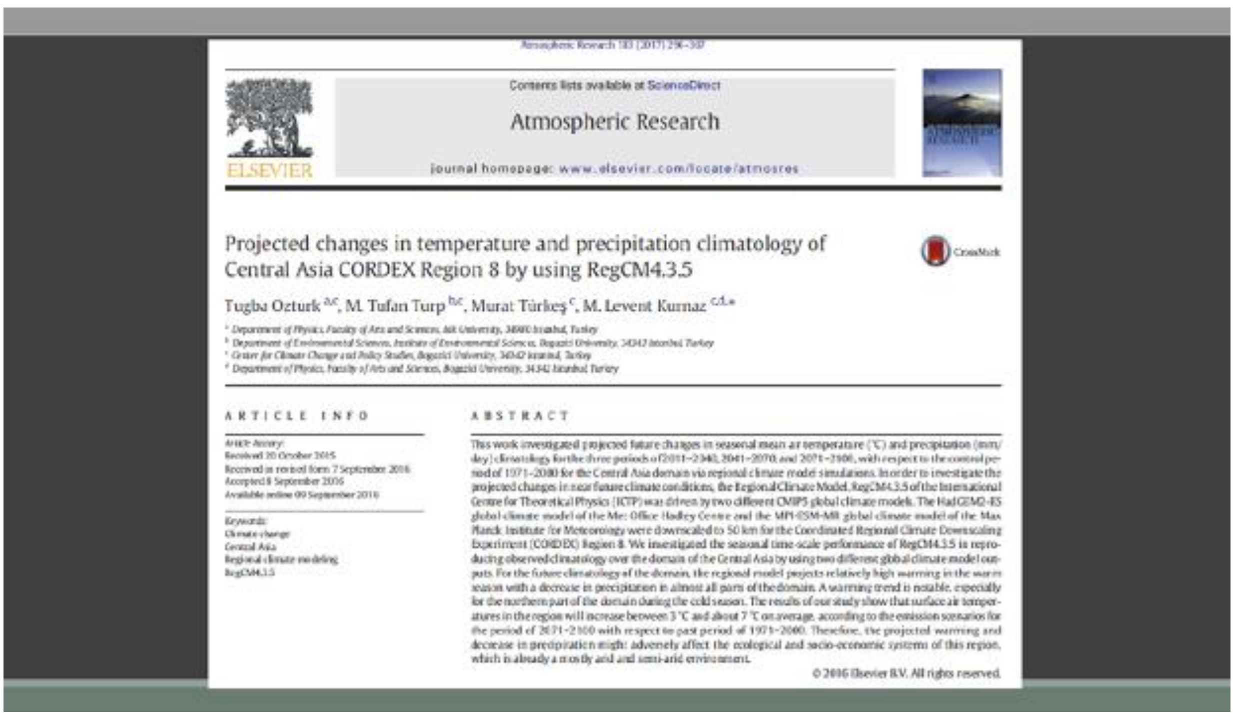
Simulation of temperature and precipitation climatology for the Central Asia CORDEX domain using RegCM 4.0

Atmospheric Research

Future projections of temperature and precipitation climatology for CORDEX-MENA domain using RegCM4.4

Atmospheric Research

Projected changes in temperature and precipitation climatology of Central Asia CORDEX Region 8 by using RegCM4.3.5



Atmospheric Research 183 (2017) 296–307

Contents lists available at ScienceDirect

Atmospheric Research

journal homepage: www.elsevier.com/locate/atmosres

Projected changes in temperature and precipitation climatology of Central Asia CORDEX Region 8 by using RegCM4.3.5

Tugba Ozturk [a,c], M. Tufan Turp [b,c], Murat Türkeş [c], M. Levent Kurnaz [c,d,*]

[a] Department of Physics, Faculty of Arts and Sciences, Isik University, 34980 Istanbul, Turkey
[b] Department of Environmental Sciences, Institute of Environmental Sciences, Bogazici University, 34342 Istanbul, Turkey
[c] Center for Climate Change and Policy Studies, Bogazici University, 34342 Istanbul, Turkey
[d] Department of Physics, Faculty of Arts and Sciences, Bogazici University, 34342 Istanbul, Turkey

ARTICLE INFO

Article history:
Received 20 October 2015
Received in revised form 7 September 2016
Accepted 8 September 2016
Available online 09 September 2016

Keywords:
Climate change
Central Asia
Regional climate modeling
RegCM4.3.5

ABSTRACT

This work investigated projected future changes in seasonal mean air temperature (°C) and precipitation (mm/day) climatology for the three periods of 2011–2040, 2041–2070, and 2071–2100, with respect to the control period of 1971–2000 for the Central Asia domain via regional climate model simulations. In order to investigate the projected changes in near future climate conditions, the Regional Climate Model, RegCM4.3.5 of the International Centre for Theoretical Physics (ICTP) was driven by two different CMIP5 global climate models. The HadGEM2-ES global climate model of the Met Office Hadley Centre and the MPI-ESM-MR global climate model of the Max Planck Institute for Meteorology were downscaled to 50 km for the Coordinated Regional Climate Downscaling Experiment (CORDEX) Region 8. We investigated the seasonal time-scale performance of RegCM4.3.5 in reproducing observed climatology over the domain of the Central Asia by using two different global climate model outputs. For the future climatology of the domain, the regional model projects relatively high warming in the warm season with a decrease in precipitation in almost all parts of the domain. A warming trend is notable, especially for the northern part of the domain during the cold season. The results of our study show that surface air temperatures in the region will increase between 3 °C and about 7 °C on average, according to the emission scenarios for the period of 2071–2100 with respect to past period of 1971–2000. Therefore, the projected warming and decrease in precipitation might adversely affect the ecological and socio-economic systems of this region, which is already a mostly arid and semi-arid environment.

Forcing Data and Experiment Design

- HadGEM2-ES global climate model of the Met Office Hadley Centre and MPI-ESM-MR global model of the Max Planck Institute for Meteorology were used as forcing data.
- RCP4.5 (mid-range mitigation) and RCP8.5 (high emission) scenario outputs of HadGEM2-ES and MPI-ESM-MR were given to regional climate model as an input.
- RCP4.5 Stabilization without overshoot pathway where total radiative forcing is stabilized at 4.5 W/m² post 2100, and RCP8.5 Rising radiative forcing pathway leading to 8.5 W/m² in 2100.
- In this study, RegCM4.3.5 version was used to downscale the global climate data to 50 km resolution. Grell scheme was used as a cumulus convection scheme with the Fritsch-Chappell type closure.
- Comparison of simulated air temperature and precipitation data of the RegCM4.3.5 regional climate model was made with the CRU observational dataset over the Central Asia for the period of 1980 – 2000.

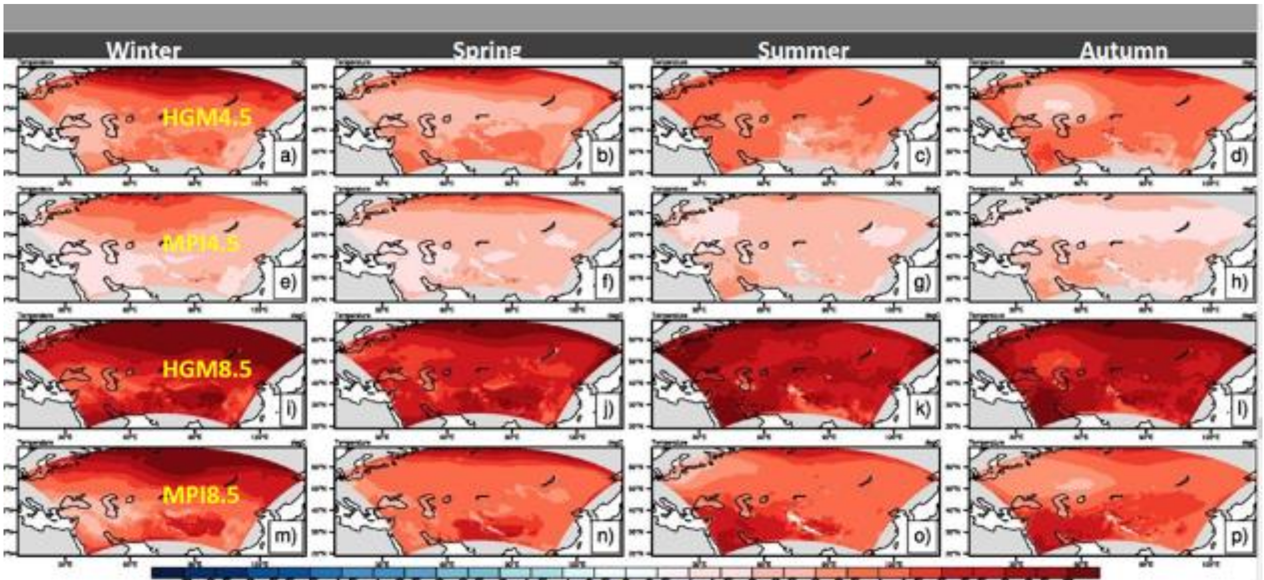


Fig. 3 Geographical distribution patterns of **changes in projected mean air temperatures (°C)** over Central Asia from the regional climate model (RegCM4.3.5), forced by HadGEM2-ES global climate model with RCP4.5 scenario and RCP8.5 scenario for the climatology of 2070-2100 future period, with respect to the reference period of 1970-2000: (a, i) winter, (b, j) spring, (c, k) summer and (d, l) autumn seasons, respectively. Same results but with the Max Planck Institute (MPI-ESM-MR) dataset are: (e, m) winter, (f, n) spring, (g, o) summer and (h, p) autumn seasons.

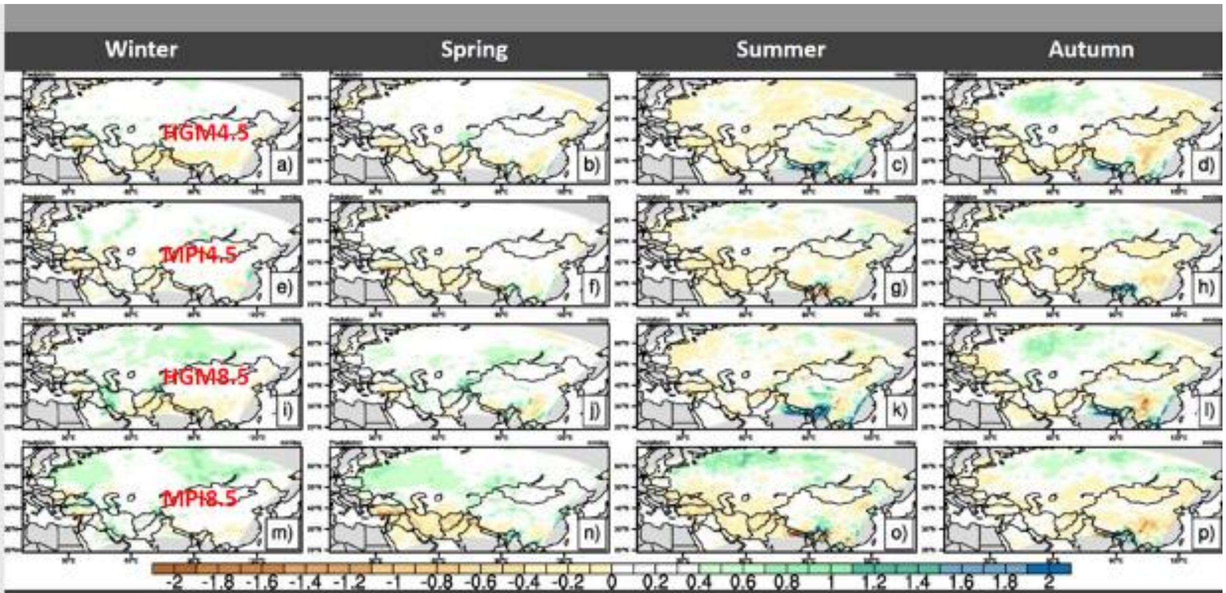


Fig. 4. Same as Fig. 3, but for changes in total precipitation (mm/day).

Ege Coğrafya Dergisi, 23/1 (2014), 1-24, İzmir
Aegean Geographical Journal, 23/1 (2014), 1-24, İzmir—TURKEY

RegCM4.3.5 BÖLGESEL İKLİM MODELİNİ KULLANARAK TÜRKİYE VE ÇEVRESİ BÖLGELERİN YAKIN GELECEKTEKİ HAVA SICAKLIĞI VE YAĞIŞ KLİMATOLOJİLERİ İÇİN ÖNGÖRÜLEN DEĞİŞİKLİKLERİN İNCELENMESİ

Investigation of Projected Changes for Near Future Air Temperature and Precipitation Climatology of Turkey and Surrounding Regions by Using the Regional Climate Model RegCM4.3.5

M. Tufan TURP[1], Tugba ÖZTÜRK[2,4], Murat TÜRKEŞ[3,*], M. Levent KURNAZ[2]

[1] *Boğaziçi Üniversitesi, Çevre Bilimleri Enstitüsü, Bilimleri Çevre Bölümü 34342, İstanbul, Türkiye*
[2] *Boğaziçi Üniversitesi, Fen-Edebiyat Fakültesi, Fizik Bölümü 34342, İstanbul, Türkiye*
[3] *Orta Doğu Teknik Üniversitesi, Fen-Edebiyat Fakültesi, İstatistik Bölümü Bağlantılı Ankara*
[4] *Fizik Bölümü, Fen-Edebiyat Fakültesi, Işık Üniversitesi, 34980, İstanbul, Türkiye*

Abstract

In this study, projected future changes for the period of 2020 – 2050 in mean air temperature and precipitation climatology and year-to-year variability with respect to the control period of 1970 – 2000 were investigated for the domain of Turkey via regional climate model simulations. In order to investigate the projected changes in near future climate conditions, Regional Climate Model (RegCM4.3.5) of ICTP (International Centre for Theoretical Physics) was driven by three different global climate models. HadGEM2 global climate model of the Met Office Hadley Centre, MPI-ESM-MR global climate model of the Max Planck Institute for Meteorology, GFDL-ESM2M global climate model of the National Oceanic and Atmospheric Administration Geophysical Fluid Dynamics Laboratory were dynamically downscaled to 50 km for Turkey and its surrounding region. The projections were performed based on the RCP4.5 and the RCP8.5 emission scenarios of the Intergovernmental Panel on Climate Change (IPCC). According to the model results, there will be an increase between 0.5 °C and 4 °C in mean air temperatures of Turkey for the period of 2020 – 2050 with respect to the period of 1970 – 2000. This warming will be more severe in warm seasons than cold seasons. Precipitation decreases varying from approximately 0.4 mm/day to 1.2 mm/day in precipitation climatology of Turkey are expected to occur in all seasons particularly over the southern and western regions of the country dominated by the Mediterranean climate, according to the regional climate model results.

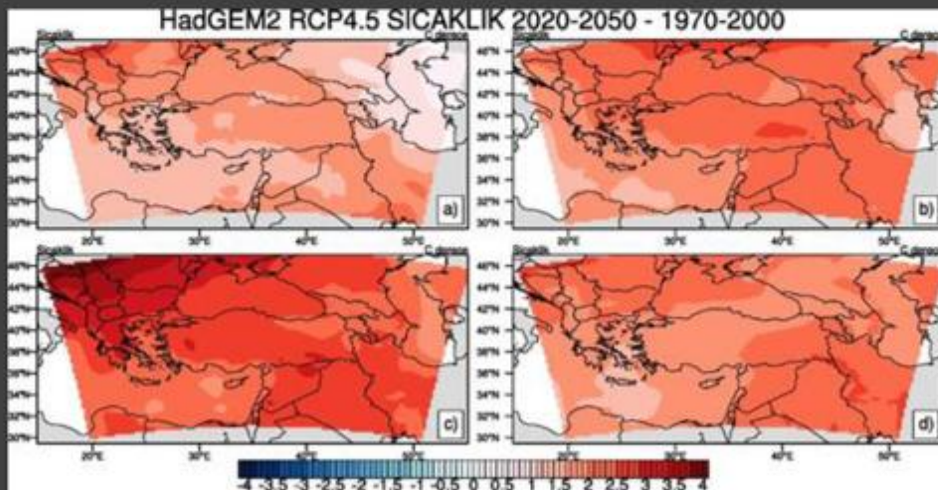


Fig. 5 Geographical distribution patterns **of changes in projected mean air temperatures** over Turkey and its nearby surroundings from the regional climate model (RegCM4.3.5), which is forced by the global climate model HadGEM2 with RCP4.5 emission scenario for the climatology of 2020 - 2050 future period with respect to the climatology of 1970 - 2000 reference period: (a) winter, (b) spring, (c) summer and (d) autumn seasons.

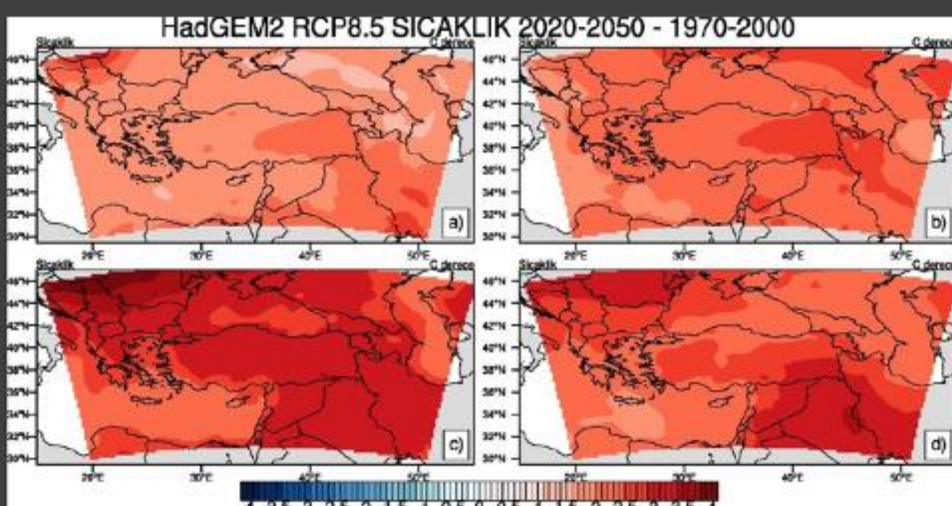


Fig. 6 Same as Fig. 5, but for **changes in projected mean air temperatures** with RCP8.5 emission scenario for the climatology of 2020 - 2050 future period with respect to the climatology of 1970 - 2000 reference period: (a) winter, (b) spring, (c) summer and (d) autumn seasons.

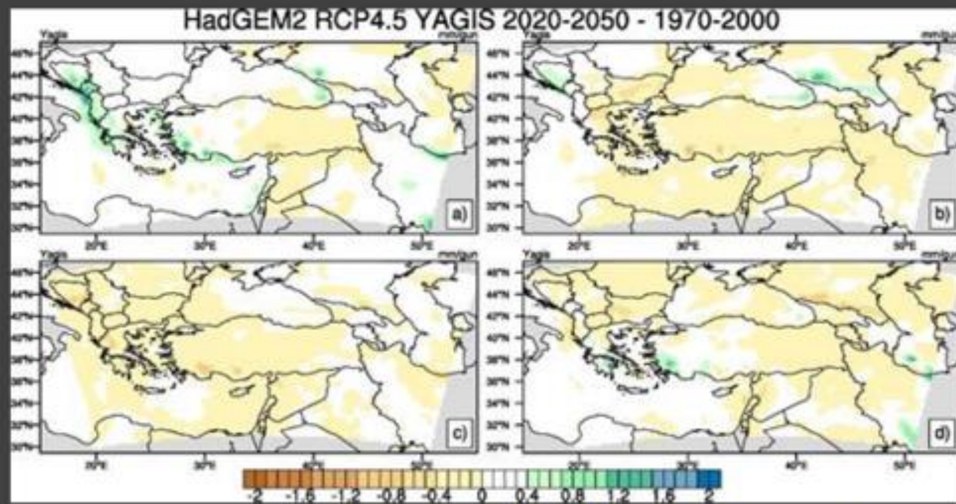


Fig. 7 Geographical distribution patterns of **changes in projected total precipitation amounts** over Turkey and its nearby surroundings from the regional climate model (RegCM4.3.5), which is forced by the global climate model HadGEM2 with RCP4.5 emission scenario for the climatology of 2020 - 2050 future period with respect to the climatology of 1970 - 2000 reference period: (a) winter, (b) spring, (c) summer and (d) autumn seasons.

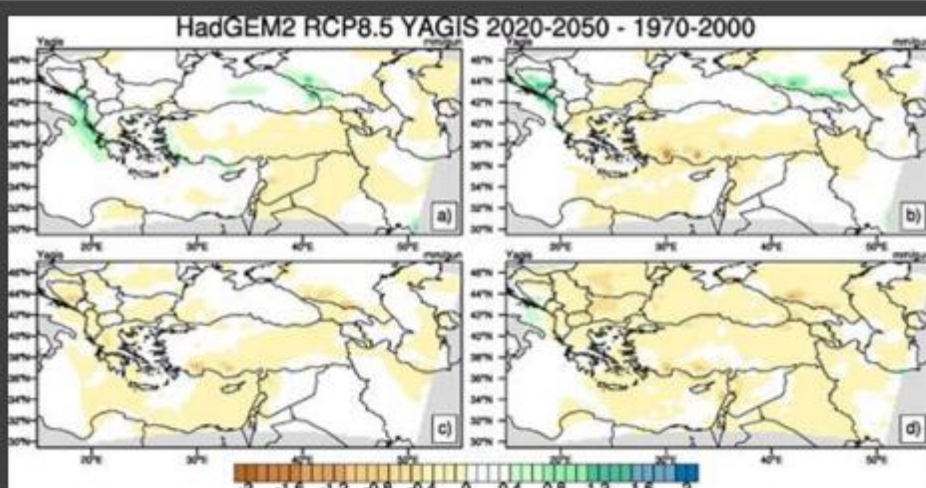
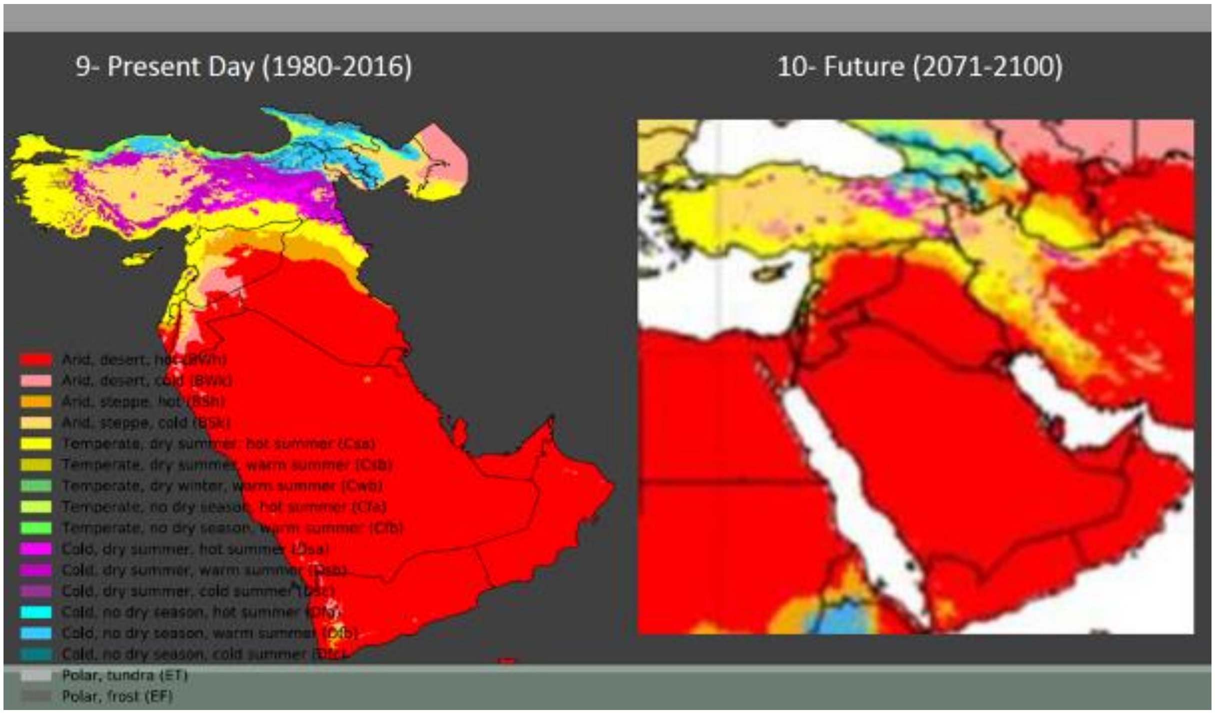
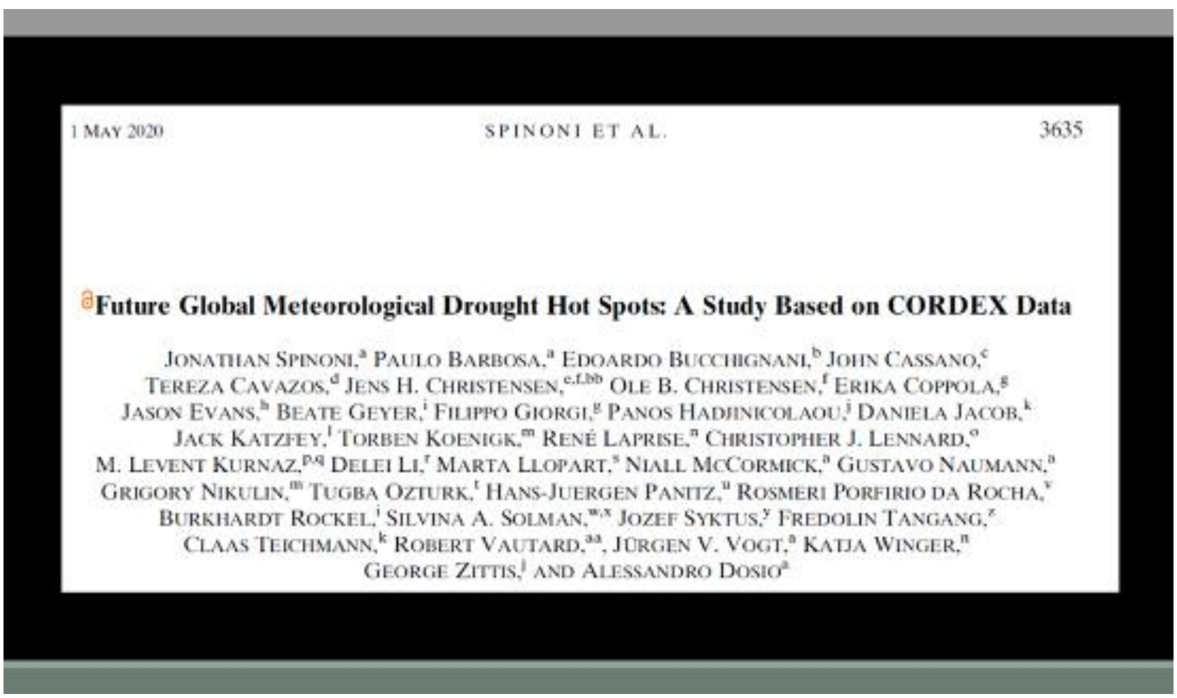


Fig. 8 Same as Fig. 7, but for **changes in projected total precipitation amounts** with RCP8.5 emission scenario for the climatology of 2020 - 2050 future period with respect to the climatology of 1970 - 2000 reference period: (a) winter, (b) spring, (c) summer and (d) autumn seasons.





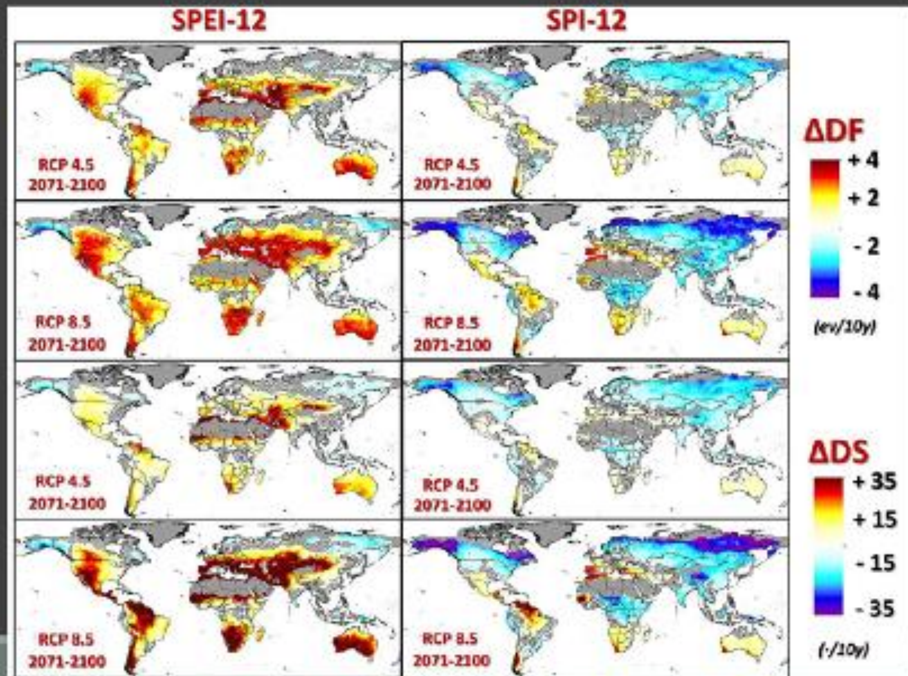
1 MAY 2020 SPINONI ET AL. 3635

Future Global Meteorological Drought Hot Spots: A Study Based on CORDEX Data

JONATHAN SPINONI,[a] PAULO BARBOSA,[a] EDOARDO BUCCHIGNANI,[b] JOHN CASSANO,[c] TEREZA CAVAZOS,[d] JENS H. CHRISTENSEN,[e,f,bb] OLE B. CHRISTENSEN,[f] ERIKA COPPOLA,[g] JASON EVANS,[h] BEATE GEYER,[i] FILIPPO GIORGI,[g] PANOS HADJINICOLAOU,[j] DANIELA JACOB,[k] JACK KATZFEY,[l] TORBEN KOENIGK,[m] RENÉ LAPRISE,[n] CHRISTOPHER J. LENNARD,[o] M. LEVENT KURNAZ,[p,q] DELEI LI,[r] MARTA LLOPART,[s] NIALL MCCORMICK,[a] GUSTAVO NAUMANN,[a] GRIGORY NIKULIN,[m] TUGBA OZTURK,[t] HANS-JUERGEN PANITZ,[u] ROSMERI PORFIRIO DA ROCHA,[v] BURKHARDT ROCKEL,[i] SILVINA A. SOLMAN,[w,x] JOZEF SYKTUS,[y] FREDOLIN TANGANG,[z] CLAAS TEICHMANN,[k] ROBERT VAUTARD,[aa], JÜRGEN V. VOGT,[a] KATJA WINGER,[n] GEORGE ZITTIS,[j] AND ALESSANDRO DOSIO[a]

Fig. 11 Differences in drought frequency (DF; events per decade) and average severity of events (DS; severity per decade) between 2071–2100 and reference period (1981–2010) under the RCP4.5 and the RCP8.5.

➢It is projected based on the SPEI drought index that drought frequency and average severity of drought events in the future will increase most parts of the semi-arid and dry subhumid subtropical and Mediterranean climate regions and semi-humid and humid temperate mid-latitude climate regions of the World.

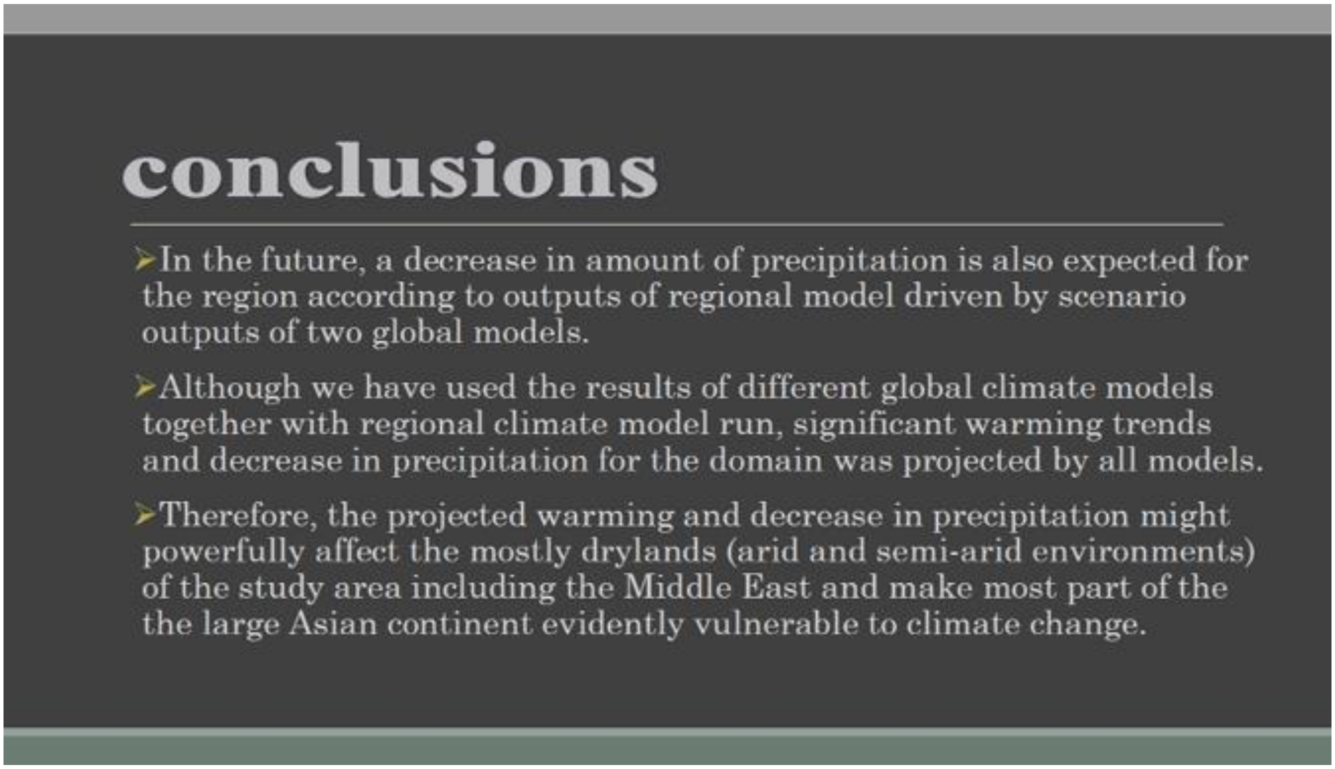


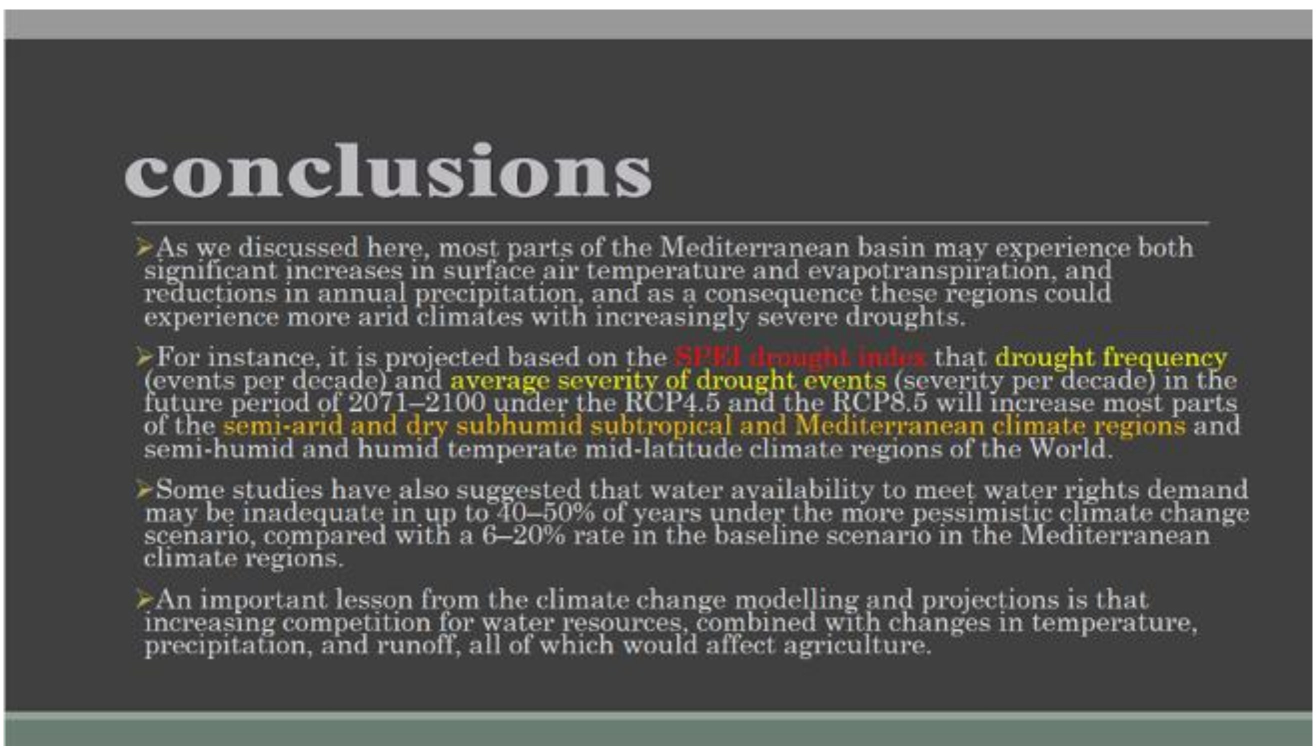
conclusions

➢Mean temperatures will increase more in the far future than it will be in mid future and near future periods. According to the worst-case scenario outputs (RCP 8.5), this increase will be stronger.

➢Results obtained from regional model which was driven by global model of the Max Planck Institute (MPI-ESM-MR global model) are milder than results of regional model driven by HadGEM2-ES global model.

➢The results show that air temperatures in the region will increase from 3 °C up to 7°C on average for period of 2070-2100.


conclusions
➢In the future, a decrease in amount of precipitation is also expected for the region according to outputs of regional model driven by scenario outputs of two global models.
➢Although we have used the results of different global climate models together with regional climate model run, significant warming trends and decrease in precipitation for the domain was projected by all models.
➢Therefore, the projected warming and decrease in precipitation might powerfully affect the mostly drylands (arid and semi-arid environments) of the study area including the Middle East and make most part of the the large Asian continent evidently vulnerable to climate change.

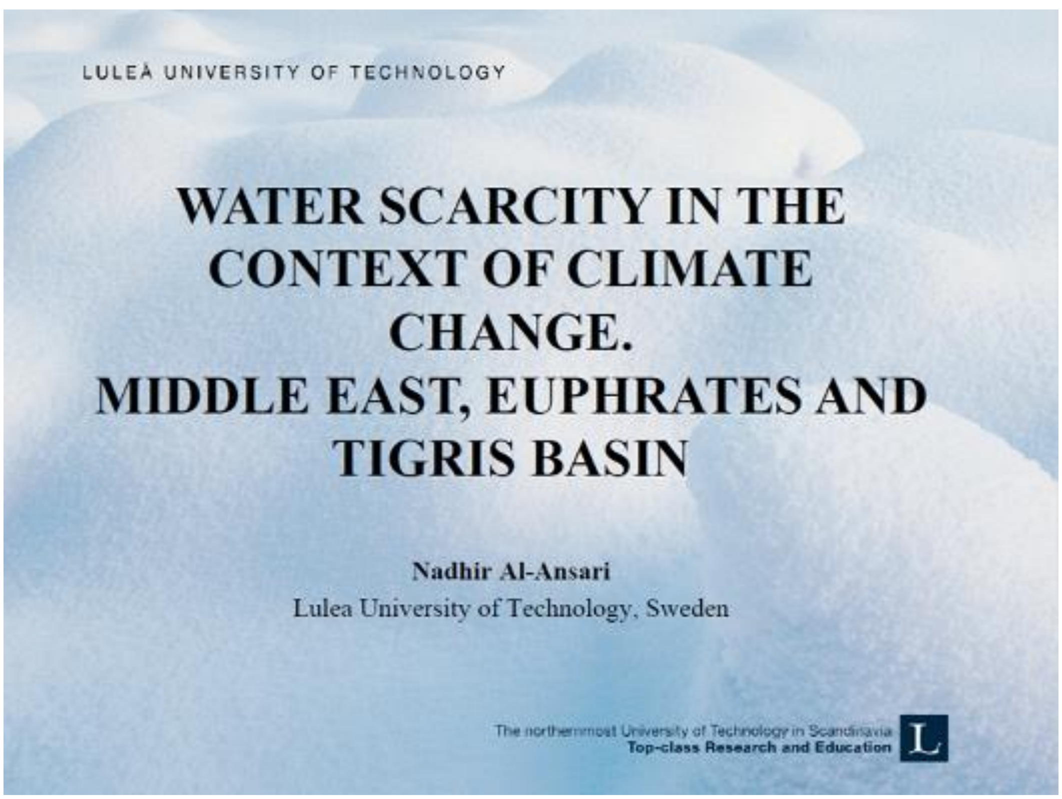

conclusions
➢As we discussed here, most parts of the Mediterranean basin may experience both significant increases in surface air temperature and evapotranspiration, and reductions in annual precipitation, and as a consequence these regions could experience more arid climates with increasingly severe droughts.
➢For instance, it is projected based on the SPEI drought index that drought frequency (events per decade) and average severity of drought events (severity per decade) in the future period of 2071–2100 under the RCP4.5 and the RCP8.5 will increase most parts of the semi-arid and dry subhumid subtropical and Mediterranean climate regions and semi-humid and humid temperate mid-latitude climate regions of the World.
➢Some studies have also suggested that water availability to meet water rights demand may be inadequate in up to 40–50% of years under the more pessimistic climate change scenario, compared with a 6–20% rate in the baseline scenario in the Mediterranean climate regions.
➢An important lesson from the climate change modelling and projections is that increasing competition for water resources, combined with changes in temperature, precipitation, and runoff, all of which would affect agriculture.

conclusions

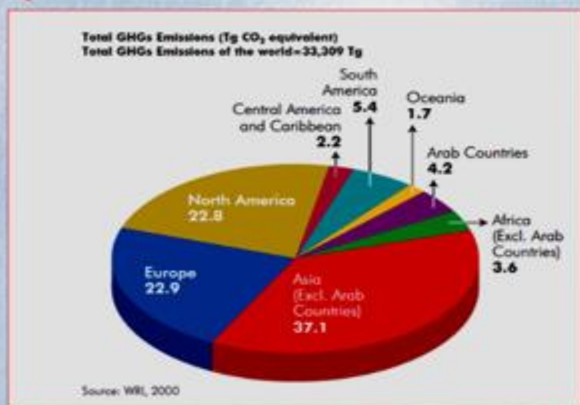
- Consequently, farmers need to adapt their production systems, switching crops, changing cultivars and sowing dates, increasing irrigation, etc.
- These decisions in turn reshape the process of change, may provide different opportunities for land-use management, and change irrigation and water management needs.
- Some studies also focused on demand for irrigation applications showed that water demands from irrigated agriculture tend to increase as a consequence of the simulated changes in temperature and precipitation.
- The magnitudes of these changes depend on crop types and their prevalence in the region.

thank you

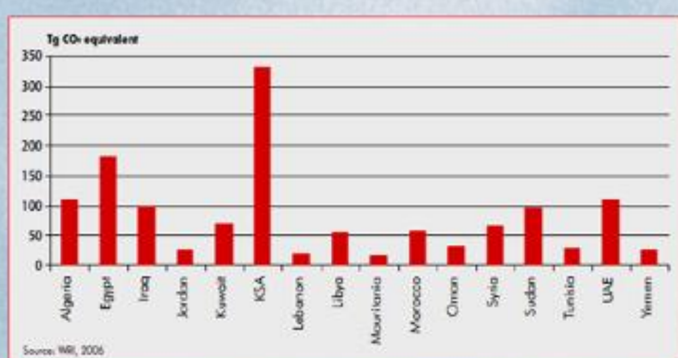
the Euphrates and Tigris Basins should never turn into a desert


LULEÅ UNIVERSITY OF TECHNOLOGY
WATER SCARCITY IN THE CONTEXT OF CLIMATE CHANGE.
MIDDLE EAST, EUPHRATES AND TIGRIS BASIN
Nadhir Al-Ansari
Lulea University of Technology, Sweden
The northernmost University of Technology in Scandinavia
Top-class Research and Education

- The world contribution was about 33 000 Tg (teragram) in year 2000 (WRI, 2005).
- WRI, 2005 reported that the total global emissions grew 12.7% between 2000 and 2005, an average of 2.4% a year.

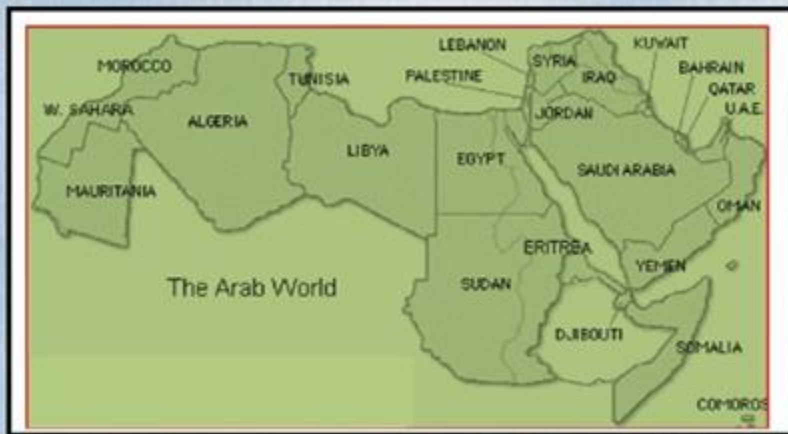


MENA countries contributions of greenhouse gas emissions



LULEÅ UNIVERSITY OF TECHNOLOGY

Impacts of Climate Change on the Middle East and North Africa (MENA)



The northernmost University of Technology in Scandinavia
Top-class Research and Education

LULEÅ UNIVERSITY OF TECHNOLOGY

Impacts of Climate Change on the Middle East and North Africa (MENA)

Climate Change is affecting (MENA) region in many ways:

1.Migration and changes in precipitation production systems and fragile water regime. The Majority of rivers are affected such as the Nile, the Euphrates, the Tigris, Jordan and Yarmuk rivers.

2.Consequently charging of ground water aquifers in the region is reduced.

3. Resulting in water shortages, droughts, loss of crops and increased desertification

4.Long term effects on coastal areas (Gaza, Iraq, Kuwait) and deltaic areas (Shatt Al Shatt Al Arab and the Nile Delta)

The northernmost University of Technology in Scandinavia
Top-class Research and Education

Impacts of sea level rise(SLR) as consequence of climate change

According to the (IPCC) studies:

Average global sea level rise: 1961- 2003 was 1.8 mm/year

Average global sea level rise : 1993- 2003 was 3.1 mm/year

This is showing an accelerated rate of SLR in (1993-2003)

The most future vulnerable areas are the Nile delta in Egypt and Tigris and Euphrates delta in Iraq in addition to their coast lines (2009)

The East Mediterranean and Middle East Climate Zone (EMME)

Modeling studies for the 21st century suggest continued gradual and strong warming:

Near Future Period (2010- 2039)----- (1-3°C)

Med century period (2040- 2069)---- (3-5°C)

End of Century Period (2070- 2099) ------ (3.5-7°C)

LULEÅ UNIVERSITY OF TECHNOLOGY

The East Mediterranean and Middle East Climate Zone

Analysis of annual precipitation data base for the period (1901- 2006)) and projecting till the end of the 21st century suggest sharp decline of water resources by (5- 30%) relative to (1961- 1990).

Other studies suggest that the Euphrates River flow will suffer reduction of (29%- 73%). Jordan River will suffer similarly and the whole "Fertile Crescent" might disappear by the end of the century

The northernmost University of Technology in Scandinavia
Top-class Research and Education

LULEÅ UNIVERSITY OF TECHNOLOGY

Global Warming Negative effects on NAO and its Impacts on MENA Region

NAO , or the North Atlantic Oscillation is the fluctuation of atmospheric pressure at sea level over the North Atlantic Ocean caused by the difference of this pressure between the Icelandic Low and the Azores' High.

This fluctuation normally controls the strength and direction of westerly winds and strength of storms across the North Atlantic, MENA region.

IPCC modeling studies show that precipitation over MENA will decrease by 15- 25% by the end of the century as a result of global warming which is negatively impacting NAO.

Tigris and Euphrates catchments will suffer from decline of their water resources accordingly being part of MENA

The northernmost University of Technology in Scandinavia
Top-class Research and Education

LULEÅ UNIVERSITY OF TECHNOLOGY

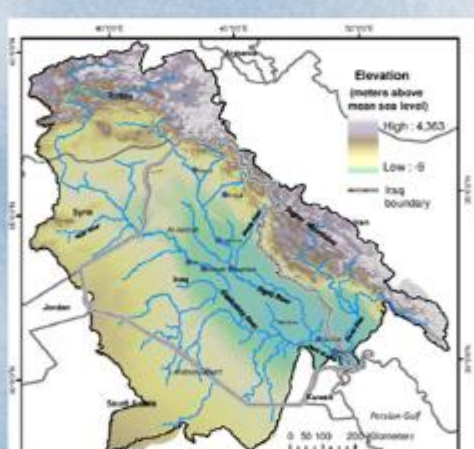
Global climate change with special reference to Iraq

The northernmost University of Technology in Scandinavia
Top-class Research and Education

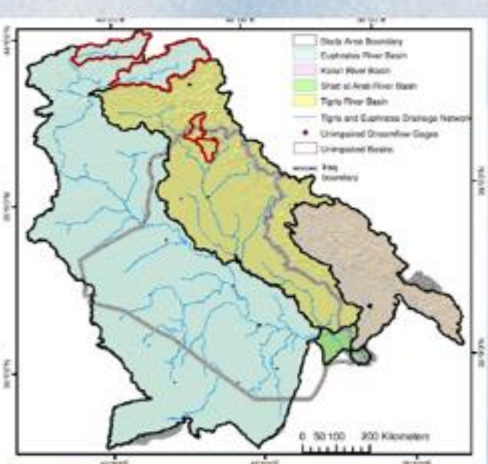
LULEÅ UNIVERSITY OF TECHNOLOGY

Tigris and Euphrates Catchments

Total Catchments in EMME



Sub-Catchments in Riparian Countries



LULEÅ UNIVERSITY OF TECHNOLOGY

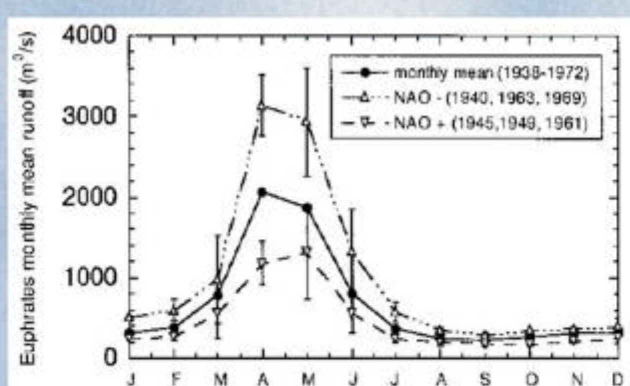
A Study Shows Tigris and Euphrates Water Resources Correlates well with NAO Changes

Cullen et al. (2000) analyzed climatic and stream flow data available from Turkey for discharge stations in the Euphrates and Tigris River basins in addition to Tigris stream flow at Baghdad. The results of this study confirmed that the stream flow of the Tigris and Euphrates Rivers are associated with the North Atlantic Oscillation (NAO), which governs the path of the Atlantic mid-latitude storm track and precipitation in the Eastern Mediterranean.

The northernmost University of Technology in Scandinavia
Top-class Research and Education

LULEÅ UNIVERSITY OF TECHNOLOGY

Monthly flow of the Euphrates River measured at Keban, Turkey (35-year mean). (solid line)
Monthly averages for the three lowest NAO years (1940, 1963, 1969; (Upper dashed line) and monthly averages of the highest NAO years (1945, 1949 and 1961; (Lower dashed line)



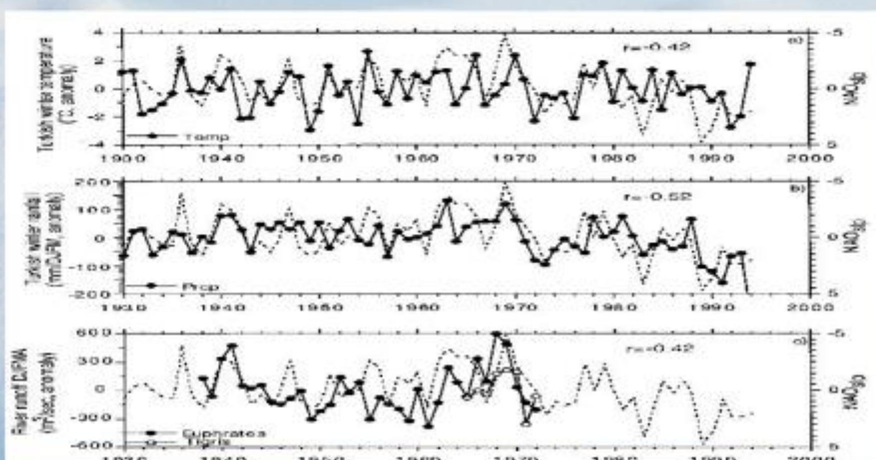
Top-class Research and Education

LULEÅ UNIVERSITY OF TECHNOLOGY

What is NAO_{slp}

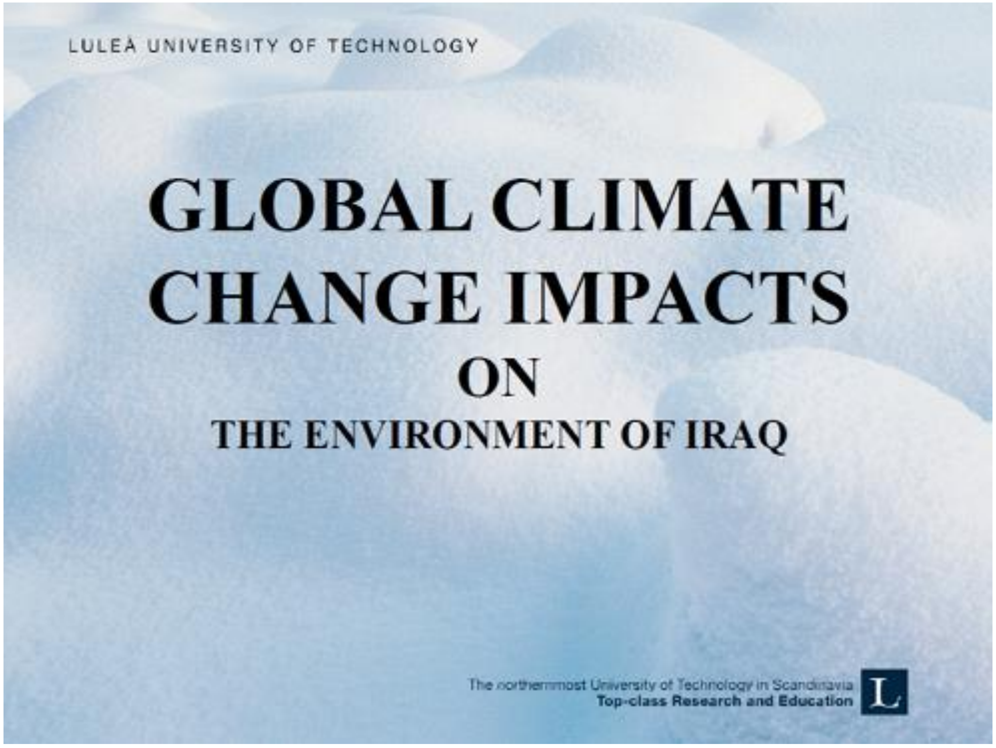
NAO_{slp} is a statistical index calculated from the differences between normalized mean- variance of NAO values at different locations, and it is used as the signature of NAO in these locations

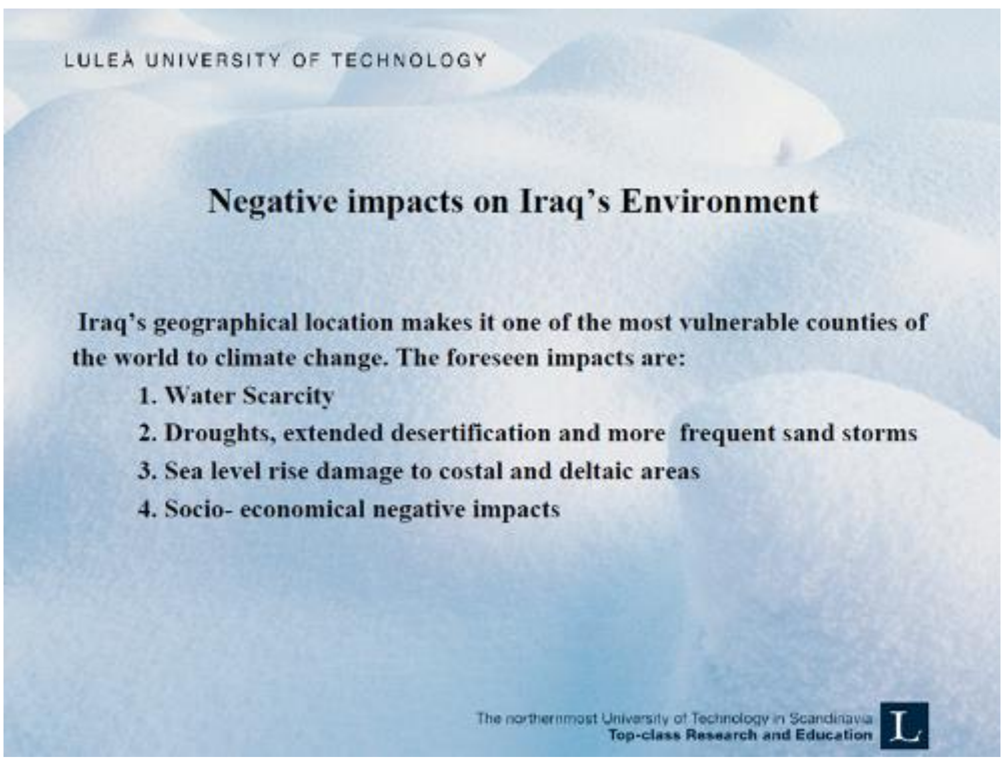
The northernmost University of Technology in Scandinavia
Top-class Research and Education



CORRELATION BETWEEN THE NAO_{SLP} INDEX, AND
(A) TURKISH WINTER TEMPERATURE INDEX,
(B) TURKISH WINTER PRECIPITATION INDEX
(C) DJFMA AVERAGE STREAM FLOW OF THE EUPHRATES (FILLED CIRCLES) AND THE TIGRIS RIVERS (OPEN CIRCLES) (NOTE: THE NAOSLP INDEX HAS BEEN MULTIPLIED BY _1

The northernmost University of Technology in Scandinavia
Top-class Research and Education


LULEÅ UNIVERSITY OF TECHNOLOGY
GLOBAL CLIMATE CHANGE IMPACTS
ON
THE ENVIRONMENT OF IRAQ
The northernmost University of Technology in Scandinavia
Top-class Research and Education
L


LULEÅ UNIVERSITY OF TECHNOLOGY
Negative impacts on Iraq's Environment
Iraq's geographical location makes it one of the most vulnerable counties of the world to climate change. The foreseen impacts are:
1. Water Scarcity
2. Droughts, extended desertification and more frequent sand storms
3. Sea level rise damage to costal and deltaic areas
4. Socio- economical negative impacts
The northernmost University of Technology in Scandinavia
Top-class Research and Education
L

LULEÅ UNIVERSITY OF TECHNOLOGY

Water Scarcity Due to Climate Change and its Impacts on Iraq

Water Scarcity will increase in Iraq by the end of the 21st century due to:

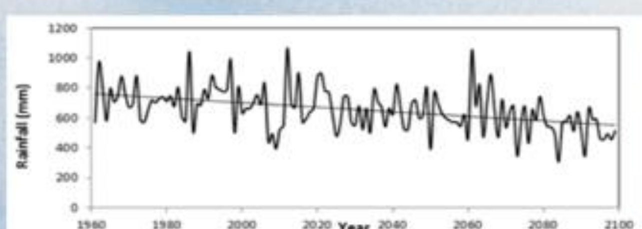
1. **(15-25%) reduction in precipitation quantities coupled with comparable increase in transpiration**
2. **(29- 73%) reduction in total surface water resources for the (Euphrates and Tigris and its tributaries)**
3. **Grave depletion of ground water resources due to heavy dependency and reduced replenishment**

Water Scarcity will impact Agriculture, Municipal water supply, Sanitation, Industry and life quality

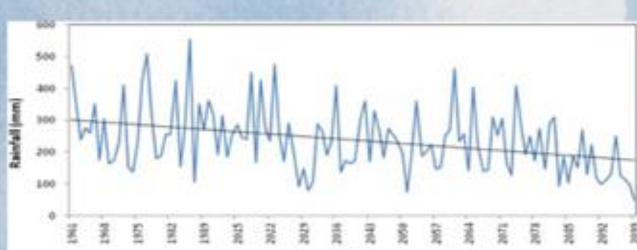
The northernmost University of Technology in Scandinavia
Top-class Research and Education

LULEÅ UNIVERSITY OF TECHNOLOGY

Decreasing Rainfall

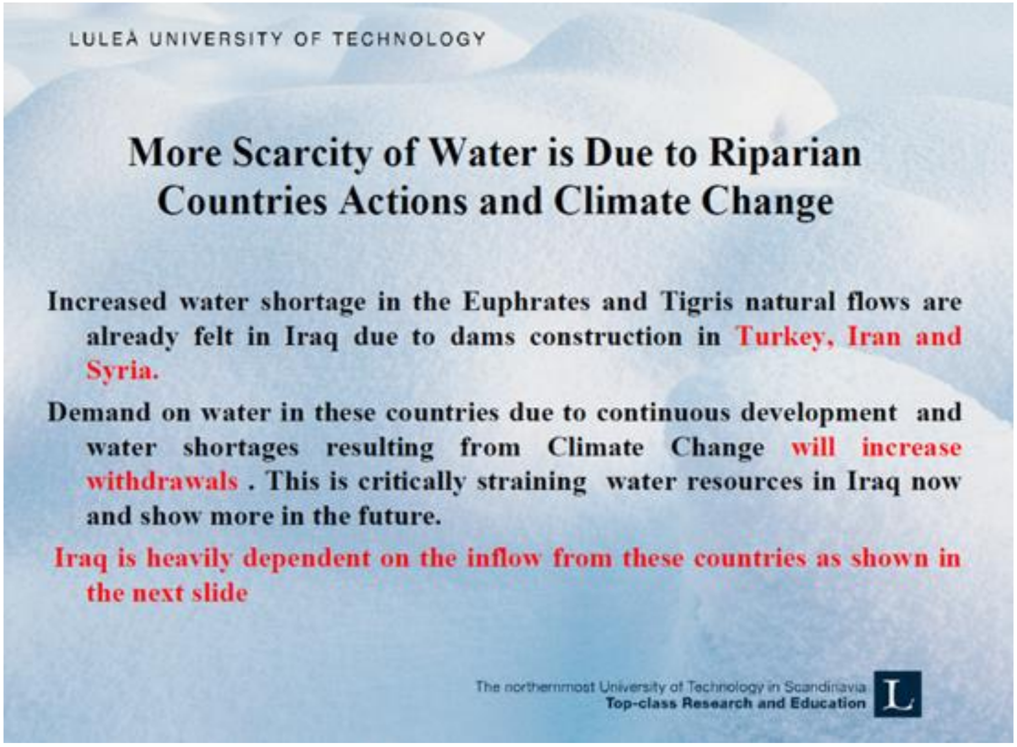


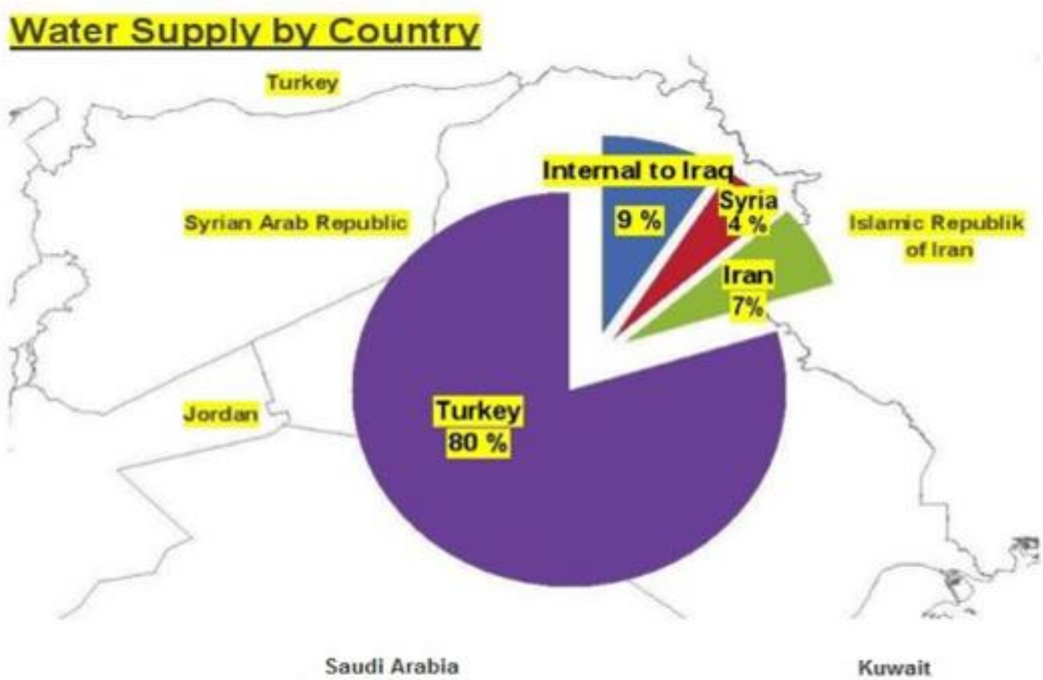
Sulaimaniyah



Sinjar

The northernmost University of Technology in Scandinavia
Top-class Research and Education





Source: Ministry of Water Resources Iraq 2010

LULEÅ UNIVERSITY OF TECHNOLOGY

Droughts, extended desertification and more frequent sand storms

Climate change impacts on Iraq as well as other Middle East Countries will lead to the disappearance of the " Historic Fertile Crescent) which we mentioned before .

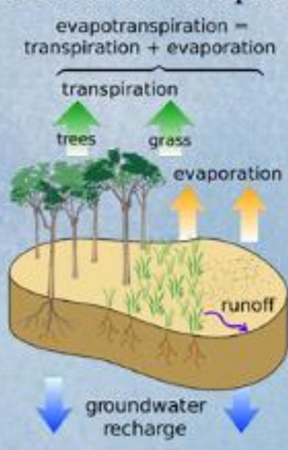
The northernmost University of Technology in Scandinavia
Top-class Research and Education

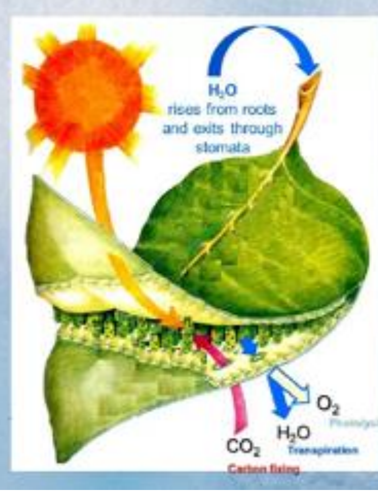
LULEÅ UNIVERSITY OF TECHNOLOGY

Droughts, extended desertification and more frequent sand storms

Decreased precipitation ,increased temperatures, reduced surface and ground water will result in:

1. Increased transpiration





LULEÅ UNIVERSITY OF TECHNOLOGY

2. Reduction of total arable land area and hit agriculture

The northernmost University of Technology in Scandinavia
Top-class Research and Education

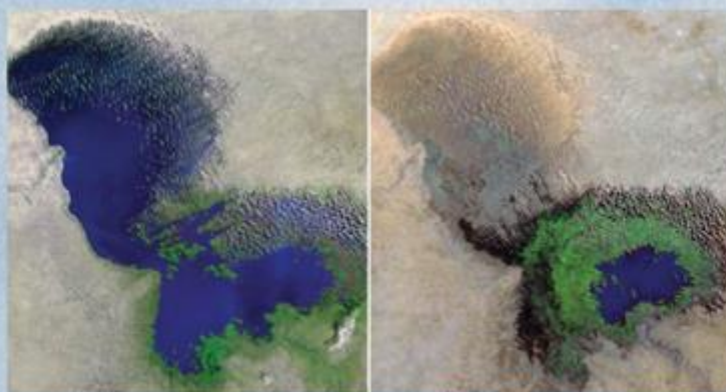
LULEÅ UNIVERSITY OF TECHNOLOGY

3. Decrease of the natural vegetative cover

The northernmost University of Technology in Scandinavia
Top-class Research and Education

LULEÅ UNIVERSITY OF TECHNOLOGY

4. Reduction of total area of lakes and other natural water bodies

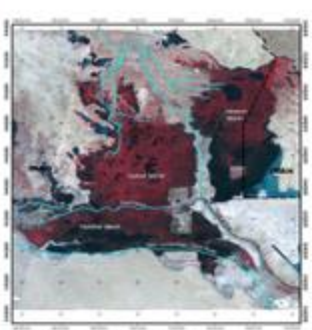


The northernmost University of Technology in Scandinavia
Top-class Research and Education

LULEÅ UNIVERSITY OF TECHNOLOGY

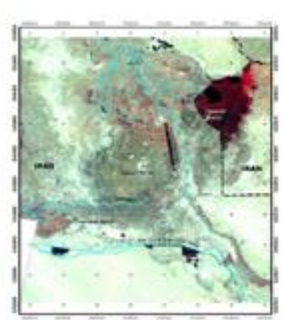
5. Hamper efforts to restore Iraq's Southern Marshes which may disappear all together

1985



The Mesopotamian Marshes in 1985

2000



The Mesopotamian Marshes in 2000

The northernmost University of Technology in Scandinavia
Top-class Research and Education

LULEÅ UNIVERSITY OF TECHNOLOGY

6. Extended Desertification due to above causes

LULEÅ UNIVERSITY OF TECHNOLOGY

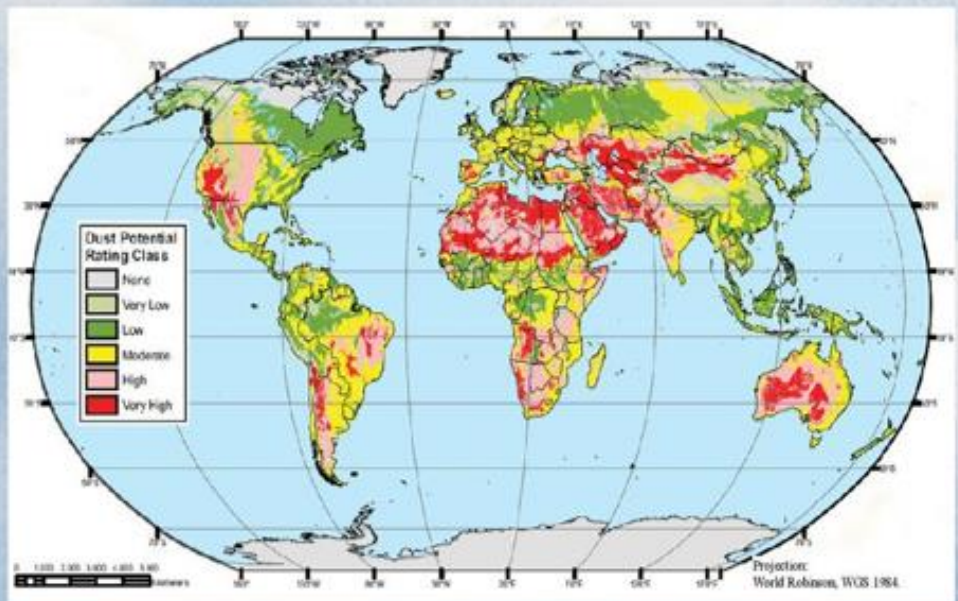
7. Reduction of soil moisture leading together with loss of vegetative cover to Chemical and Physical Destruction of soil structure leading to Intensive and Violent Dust Storms

- According to UN report based on Iraq's Ministry of Environment Information indicates Occurrence of 122 Dust Storms and 283 dusty days in 2012

- According to the report of the Desert Research Institute DRI (2013) Iraq is located in one of the Highest Dust Potential Parts of the World (see next two slides)

LULEA UNIVERSITY OF TECHNOLOGY

Global Dust Potential

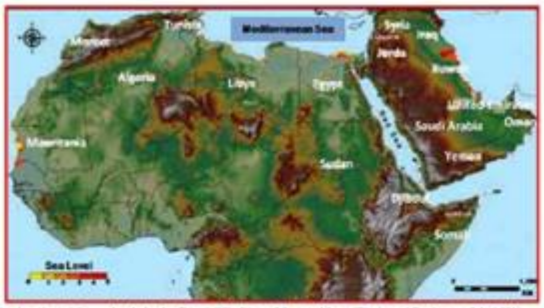


LULEA UNIVERSITY OF TECHNOLOGY

Impacts of Sea level Rise (SLR)

Sea level Rise due to North Pole ice melting is affecting numerous parts of the world including North Africa and the Middle East as indicated in the next slide

Modeled scenarios of future impacts of (SLR) due to Climate Change show severe impacts on the Coastal areas of Egypt and Iraq while the Nile Delta and the Euphrates and Tigris Deltas will suffer irreversible damages unless protective actions are taken



The situation of the sea level rise for Egypt (Nile River delta) and Iraq (Tigris and Euphrates delta) [33].

Simulated Sea Level Rise in North Africa and Middle East showing Mostly Affected Areas

Effect of sea level rise on Iraq and Kuwait [35].

Predicted Sea Level Rise Extent within Euphrates and Tigris Rivers Delta as predicted by (+1m) SLR Scenario

LULEÅ UNIVERSITY OF TECHNOLOGY

Predicted of Sea Level Rise Extent within Euphrates and Tigris Rivers Delta as predicted by (+3m) SLR Scenario

LULEÅ UNIVERSITY OF TECHNOLOGY

Iraq’s Coastline along the Arab Gulf

The northernmost University of Technology in Scandinavia
Top-class Research and Education

LULEÅ UNIVERSITY OF TECHNOLOGY

Necessary Actions Required From the Government of IRAQ

The northernmost University of Technology in Scandinavia
Top-class Research and Education

LULEÅ UNIVERSITY OF TECHNOLOGY

Apart from the National Responsibility of the Government to promote all actions to improve Sharing Common Water Resources with Riparian Countries(Turkey, Iran and Syria), This Government has also the National and Moral duty to mitigate the Negative Climate Change Impacts within IRAQ by:

A- Adopting New Water Management Policies

B- Development of New Sources of Water and improving existing water resources

C- Improving Agricultural Practices

D- Improving Land Use

E- Combating Sea Level Rise Expected Problems

F- Actions on the International Level

The northernmost University of Technology in Scandinavia
Top-class Research and Education


LULEA UNIVERSITY OF TECHNOLOGY
Thank you
The northernmost University of Technology in Scandinavia
Top-class Research and Education

Estimating the groundwater depletion in the Middle East from GRACE Data

Gholamreza Joodaki
Assistant Professor at Geodesy, ZNU, Iran
gh_reza@znu.ac.ir

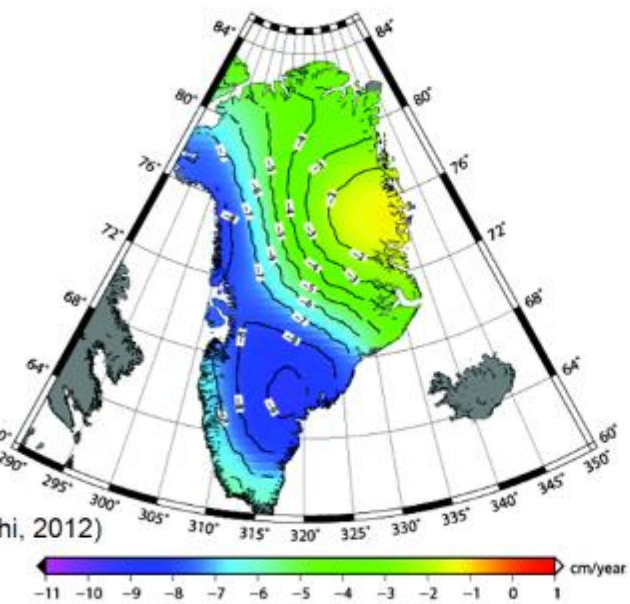
GRACE (Gravity Recovery and Climate Experiment) mission

- USA-German joint mission
- Launched in March 2002, end in October 2017
- Twin satellites, dedicated to the measurement of the time-variable gravity field
- Mapping the Earth's gravity field by accurate measurements of the distance between the two satellites
- GRACE Follow On satellite mission (lunched 2018 and is in the orbit now)

2

GRACE monthly gravity field solution

- Oceanography
- Hydrology
- Glaciology
- Solid Earth



(Joodaki and Nahavandchi, 2012)

3

GRACE Shows Change in Water from March 2010 to March 2011

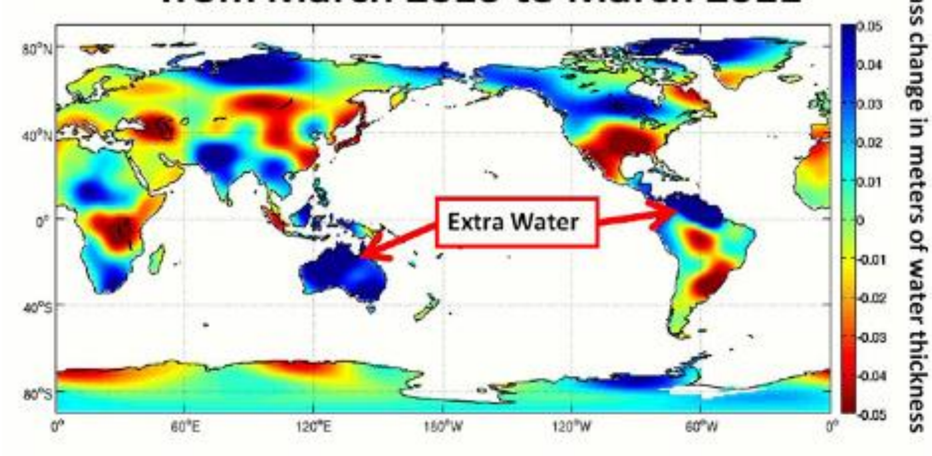


Image from NASA JPL.

4

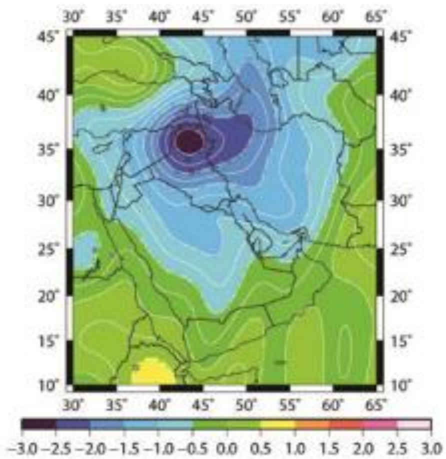
Estimating the human contribution to groundwater depletion in the Middle East, from GRACE data, land surface models, and well observations

Gholamreza Joodaki, John Wahr, and Sean Swenson

https://doi.org/10.1002/2013WR014633

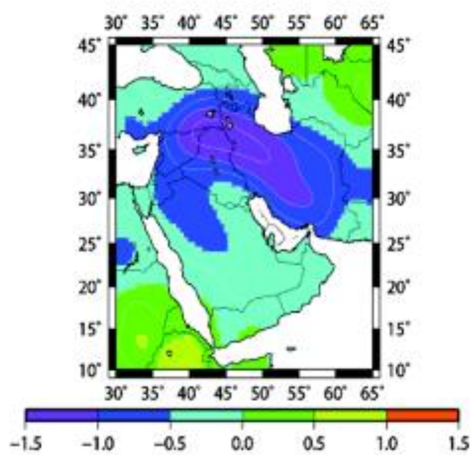
5

The 2003-2012 secular trend maps (cm/year) over the Middle East

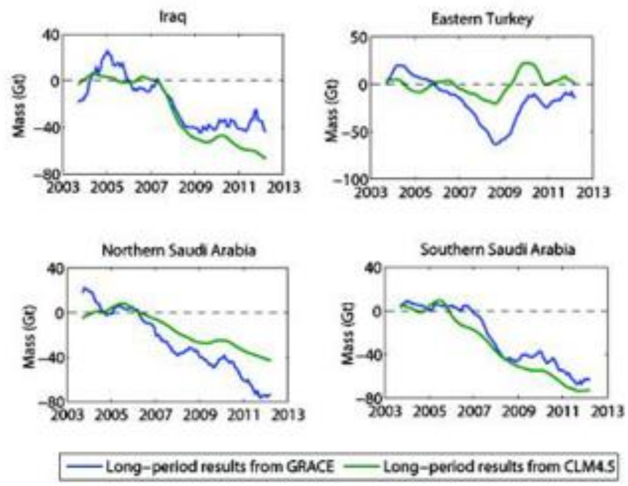


6

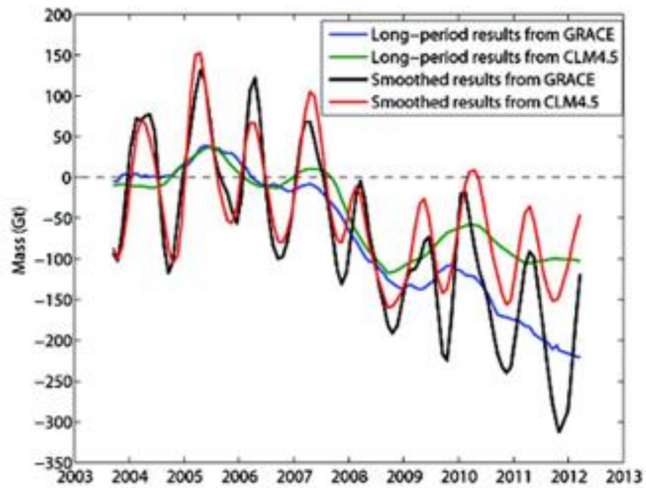
- **Secular trend in groundwater (cm/yr) during 2003-2012.**



- **Changes in water storage, in gton for Iraq, eastern Turkey, and northern and southern Saudi Arabia.**



- **Changes in water storage, in gton, for Iran**



Total groundwater storage

Region	Secular trend Gt/yr
Iran	-25±6
Iraq	-2±3
Eastern Turkey	-5±2
Northern Saudi Arabia	-6±5
Southern Saudi Arabia	-5±2

Remark

- GRACE offers a valuable and unique opportunity to understand hydrologic trends in data-inaccessible regions.

11

Thank you for your attention!

Any question?

12

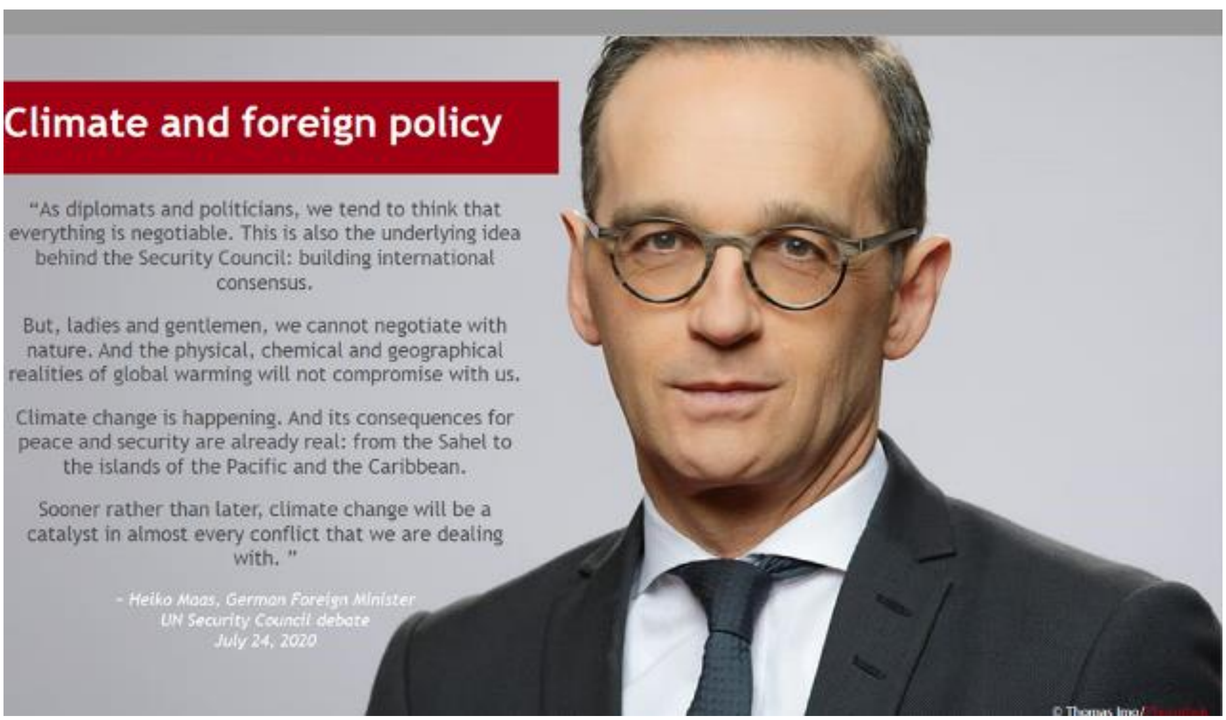

Climate Diplomacy
CLIMATE SECURITY EXPERT NETWORK
adelphi
Supported by:
Federal Foreign Office
Climate change impacts on security in the Middle East
Hydropolitics Academy Webinar
February 24, 2021
Benjamin Pohl, adelphi

Why would climate change matter to foreign policy?

- climate security matters because of the projected human security impacts, but also the geopolitical risks that derive from them

- addressing these risks proactively and preventatively can contribute to the global prevention and stabilization agendas

2



Climate security - what is it?

Climate change impacts

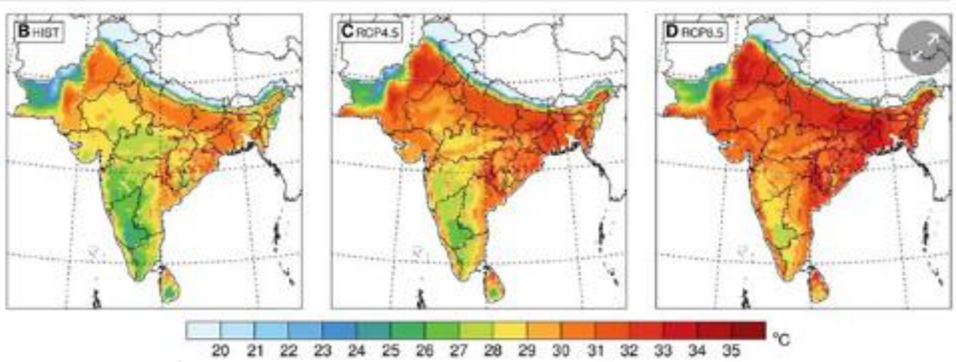
- **Temperature rise**: 1 or 2 degrees may not sound like much, but think of body temperature
- Changes in **water availability & reliability**: our food system is built on comparatively stable climatic conditions
- **Tipping elements**: during the past 50 years, we tipped 10.000 years of Holocene into Anthropocene; and due to tipping elements, the next 50 years will likely decide the next 10.000 years

4

Climate security - what is it?

Impacts:

temperature rise



Distribution of maximum wet bulb temperature (WBT) from 1976-2005 (B), from 2071-2100 with 2.25C of warming (C), from 2071-2100 with 4.5C of warming (D). WBT of more than 31C is considered extremely dangerous and over 35C is fatal within hours.

5

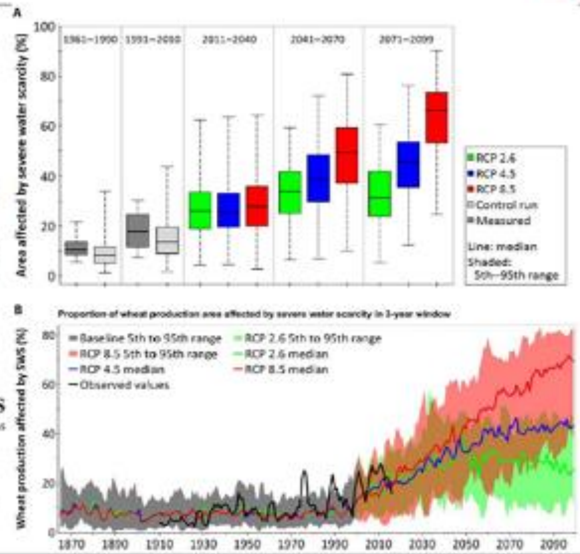
Climate security - what is it?

Impacts: water scarcity / reliability

Fig.: Estimated proportion of global wheat-growing area affected by Severe Water Scarcity between 1861 and 2100.

Source: Miroslav Trnka et al. Sci Adv 2019

ScienceAdvances



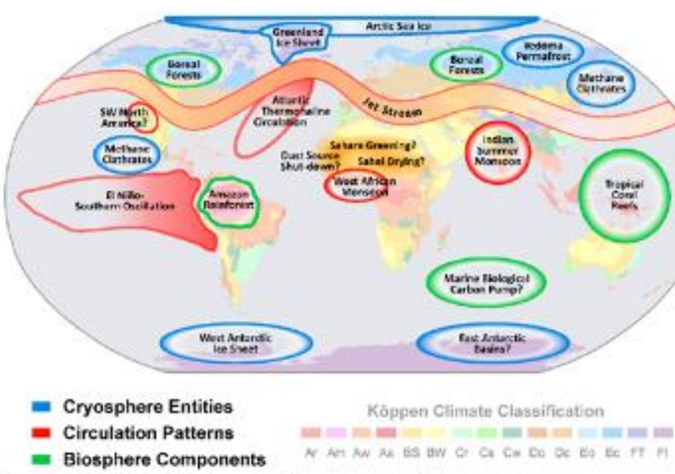
6

Climate security - what is it?

Impacts: tipping elements

Achilles heels of the Earth system

...



Source: PIK 2017 Creative Commons BY-ND 3.0 DE https://www.pik-potsdam.de/services/infodesk/tipping-elements

7

Compound climate-fragility risks

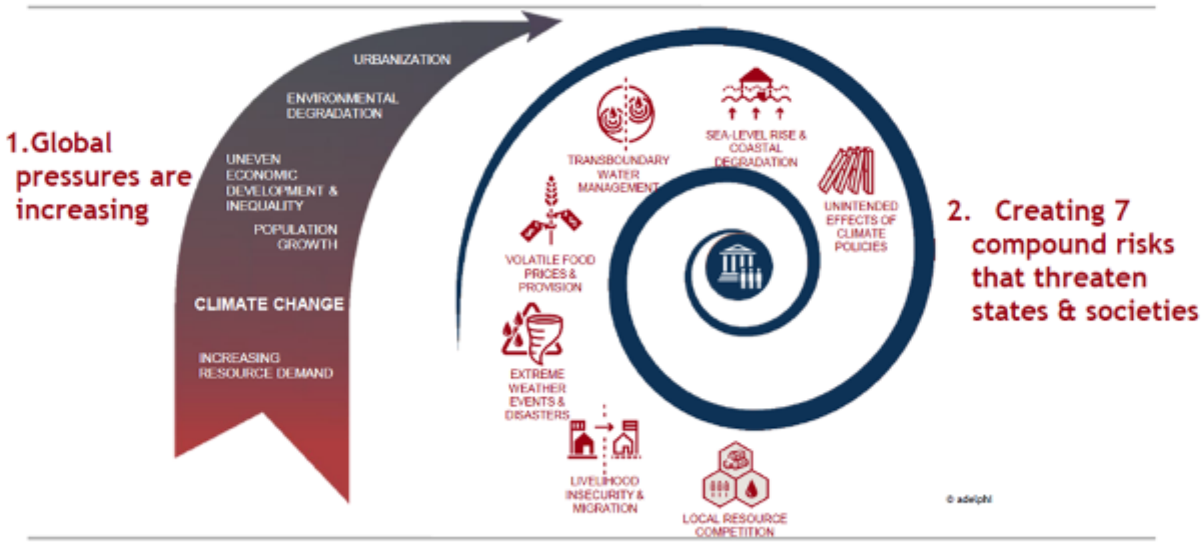
Climate change a global threat to security in the 21st century

- Risks and conflict dynamics are already observable today
- No simple causal link between climate change and fragility
- Climate change will converge with other pressures and shocks and increase the risks to the stability of states and societies

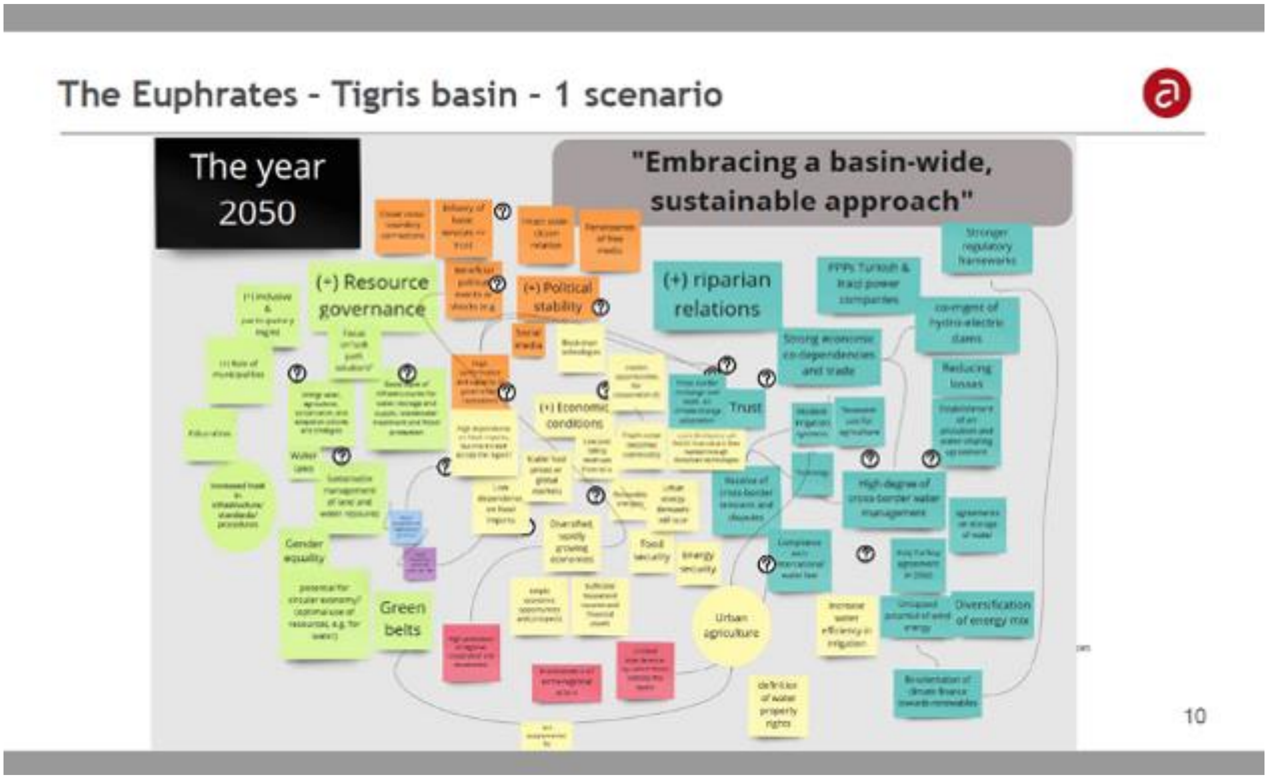
Photo credits: Asianet-Pakistan/ shutterstock.com

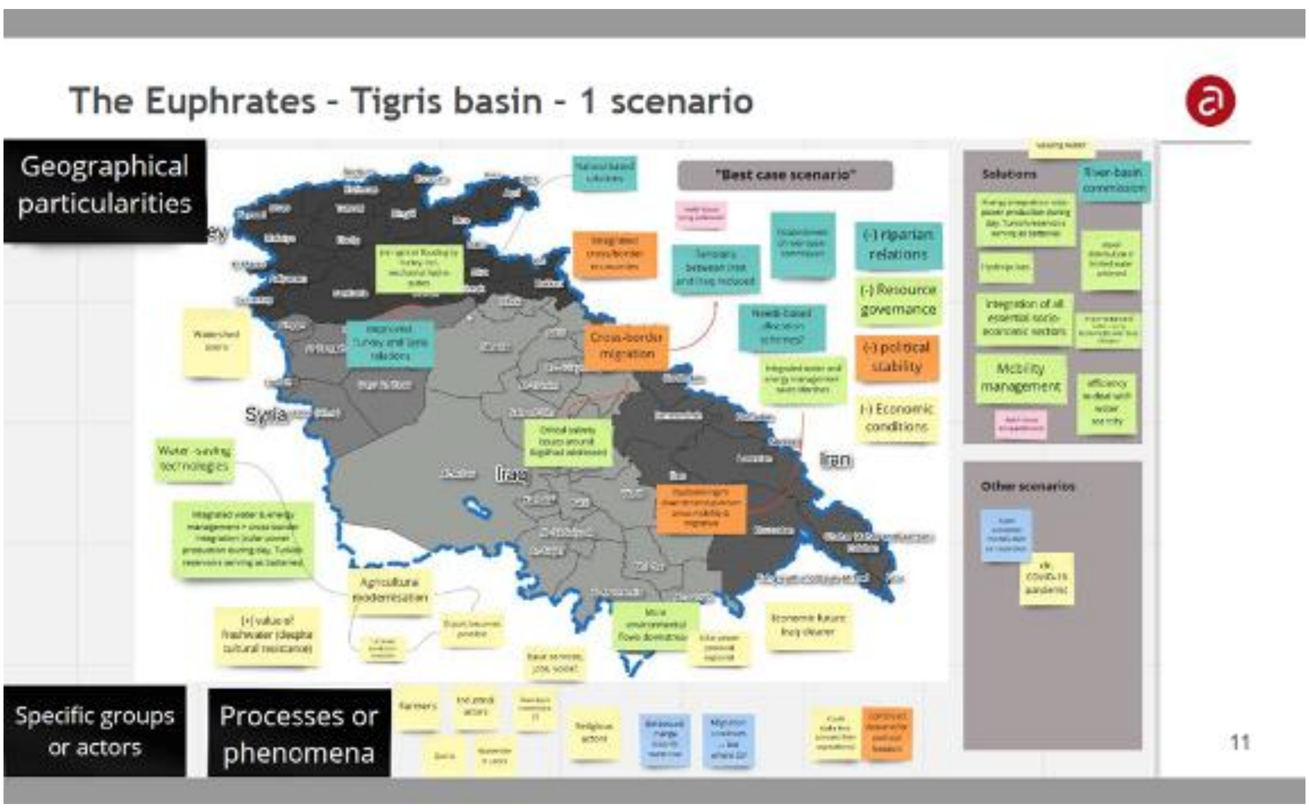
8

Seven compound climate-fragility risks

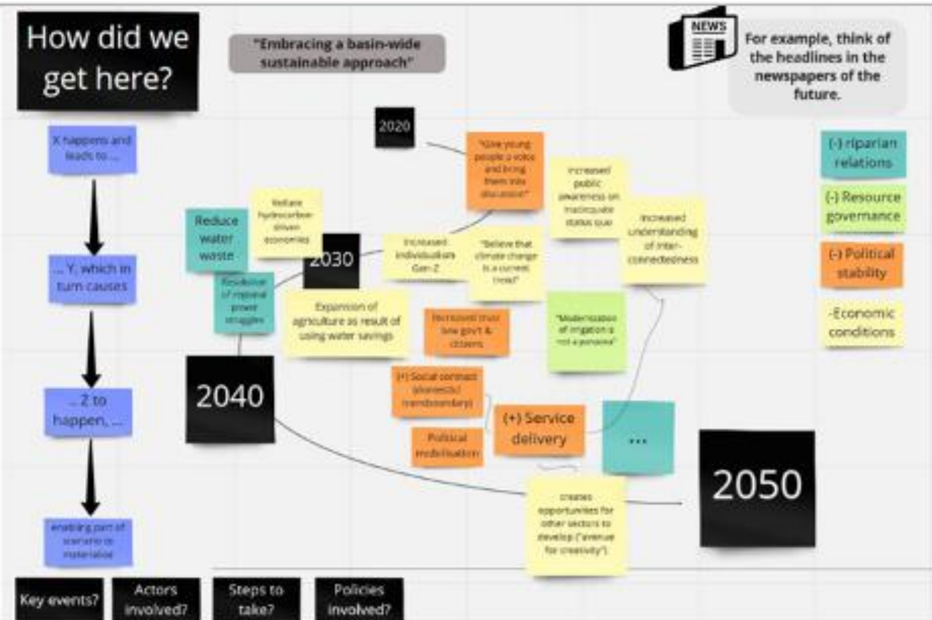


9


The Euphrates - Tigris basin - 1 scenario
The year 2050
"Embracing a basin-wide, sustainable approach"
(+) Resource governance
(+) Political stability
(+) riparian relations
Trust
(+) Economic conditions
Stronger regulatory frameworks
Strong economic co-dependencies and trade
Reducing losses
High degree of cross-border water management
Gender equality
Green belts
Food security
Energy security
Urban agriculture
Diversification of energy mix
10


The Euphrates - Tigris basin - 1 scenario
Geographical particularities
"Best case scenario"
Syria
Iraq
Iran
Cross-border migration
(-) riparian relations
(-) Resource governance
(-) political stability
(-) Economic conditions
Water-saving technologies
Agriculture modernisation
Solutions
River-basin commission
Mobility management
Other scenarios
Specific groups or actors
Processes or phenomena
11

The Euphrates - Tigris basin - 1 scenario



12

Climate security opportunities in the ET basin

Opportunities for cooperation

Cooperation around the nexus / water often has important net benefits & can help development goals:

- Economies of scale argue for integrated management (optimize hydropower generation, irrigation needs, flood control etc.)
- Avoided opportunity costs of conflict (violence, non-integration, duplication of efforts etc.)

Puzzle: Why is there not more cooperation??

- Answer: because of perceived political risks...

13

Climate security opportunities in the ET basin

Opportunities for cooperation

Opportunities for nexus & water cooperation are not always discussed in the right places:

- Need to cooperate & benefits of cooperation can create political space for addressing contentious issues
- But technical and development cooperation does not automatically translate into political collaboration

→ We have to <u>**reverse existing strategies**</u>: **not keep basin politics out - but better reflect & harness political realities in basins**

14

Climate Diplomacy

www.climate-diplomacy.org

CLIMATE SECURITY EXPERT NETWORK

www.climate-security-expert-network.org

Supported by:

Federal Foreign Office

www.auswaertiges-amt.de

adelphi

www.adelphi.de

Dr. Benjamin Pohl
Head of Climate Diplomacy and Security Programme
pohl@adelphi.de

adelphi

Alt-Moabit 91
10559 Berlin
Germany

T +49 (0)30-89 000 68-0
F +49 (0)30-89 000 68-10

www.adelphi.de
office@adelphi.de

The ECC Factbook

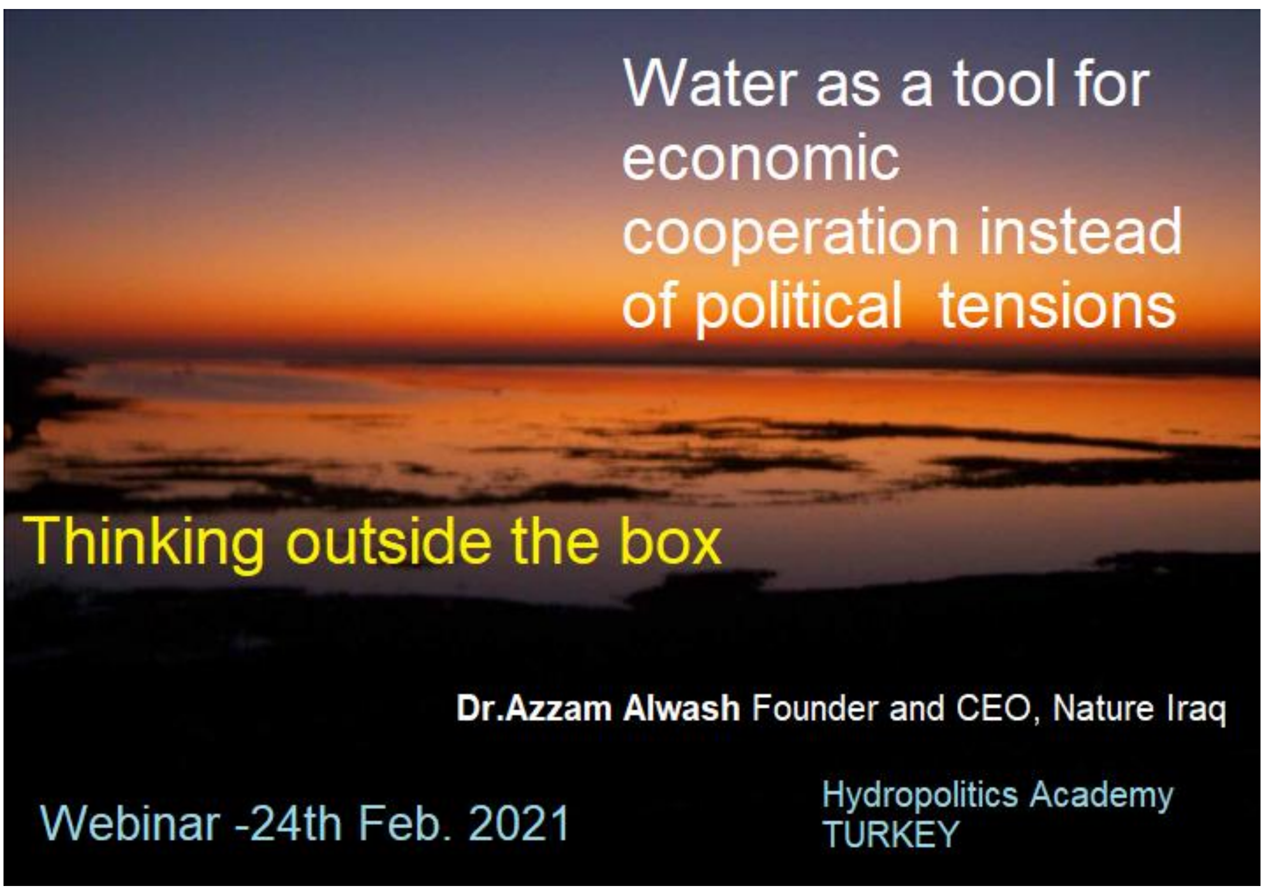
https://factbook.ecc-platform.org

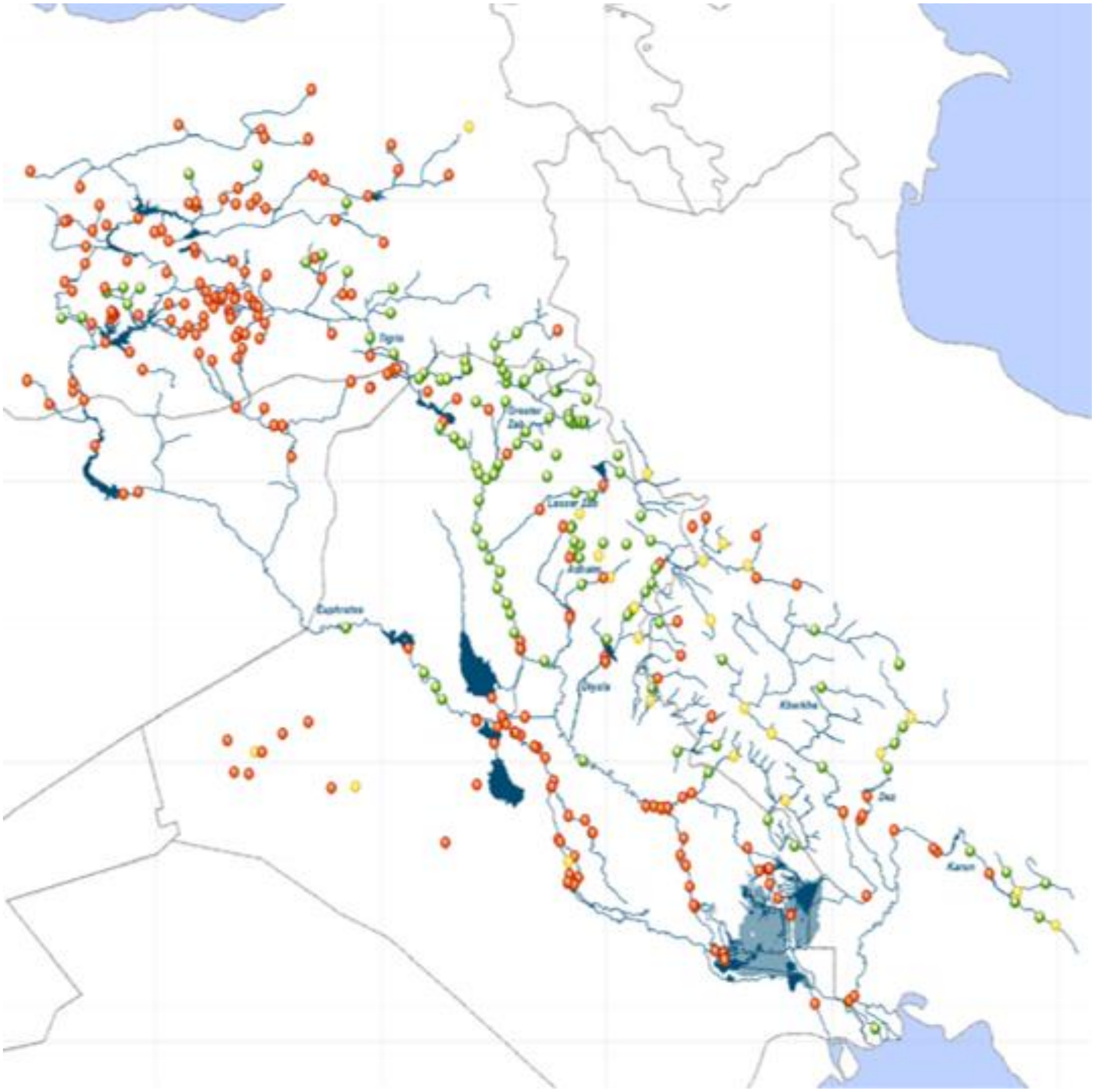
16

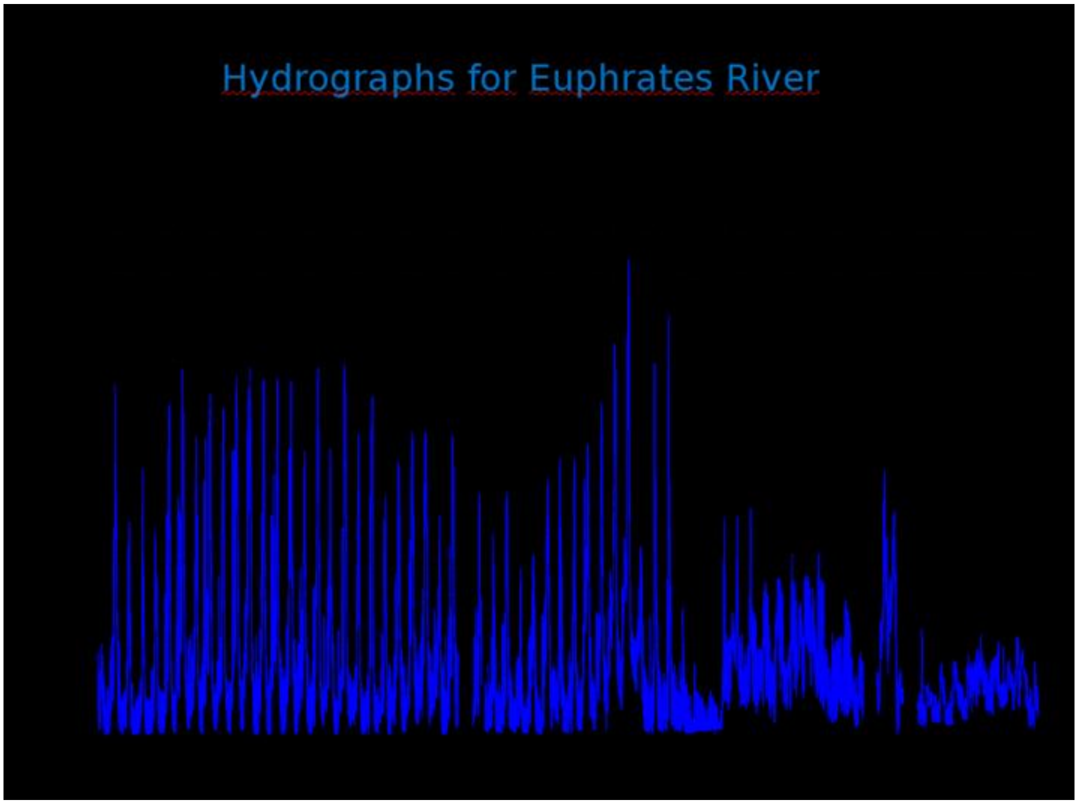
The ECC Factbook on Conflict and Cooperation

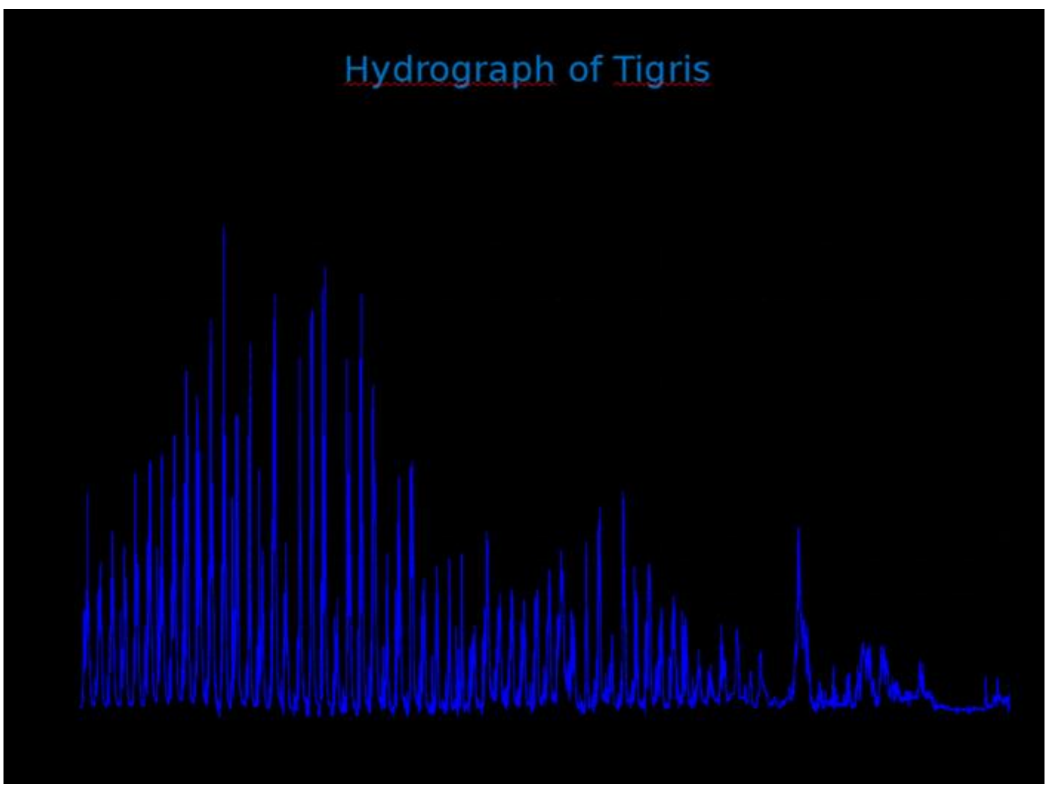
- is an interactive platform featuring more than 100 conflicts related to environmental change and security
- is an easy-to-access map and entry point for policy makers and practitioners to get into the links between environmental change and security, so people asking questions like:
  - Which role do climate fragility risks play in specific countries / regions?
  - How does environmental change contribute to fragility and conflict?
  - What has been done to address these risks?
  - What could & should be done to address them?
- provides synthesis on case specific climate fragility risks and the interplay between environmental change, conflict and cooperation
- supposed to help demonstrate relevance of environmental change to colleagues (educational material)
- provides entry points for research / background briefings etc.

17


Water as a tool for economic cooperation instead of political tensions
Thinking outside the box
Dr.Azzam Alwash Founder and CEO, Nature Iraq
Webinar -24th Feb. 2021
Hydropolitics Academy
TURKEY


Tigris
Greater Zab
Lesser Zab
Adhaim
Euphrates
Diyala
Dez
Karun


Hydrographs for Euphrates River


Hydrograph of Tigris

It is BANKRUPCY, not CRISIS

Floods washed the salts and added nutrient rich soils made irrigated agriculture sustainable in Iraq for over six millennia

2020	2030	2050
40 mm	53 mm	80 mm

OIL INCOME VANISHING

Thinking outside the box

We must change the dynamics of the dialogue between Turkey, Iraq, Syria and Iran from:

“whose water is it”

To:

“Water as the basis for economic ties”

Thinking outside the box

- Iraq’s evaporation rate is 3 m on average per annum - 10 billion m3
- Iraq’ predicted deficit in SWLRI is 11 billion in 2035
- Managing the headwaters together is THE solution. But HOW?
- STEP WISE CONFIDENCE BUILDING MEASURES - leading to integration.

Thinking outside the box
Trust Building

- Musil dam and Ilisu?
-
  - Grouting of foundation will be easier with empty reservoir.
  - Musil reservoir looses 1 billion m3 per year to evaporation and infiltration. Managing Ilisu together will save 1 billion m3
  - Buy electricity of Ilisu, reduction of losses of electricity to transportation means more income to Turkey
  - Price? Let’s talk?

Thinking outside the box

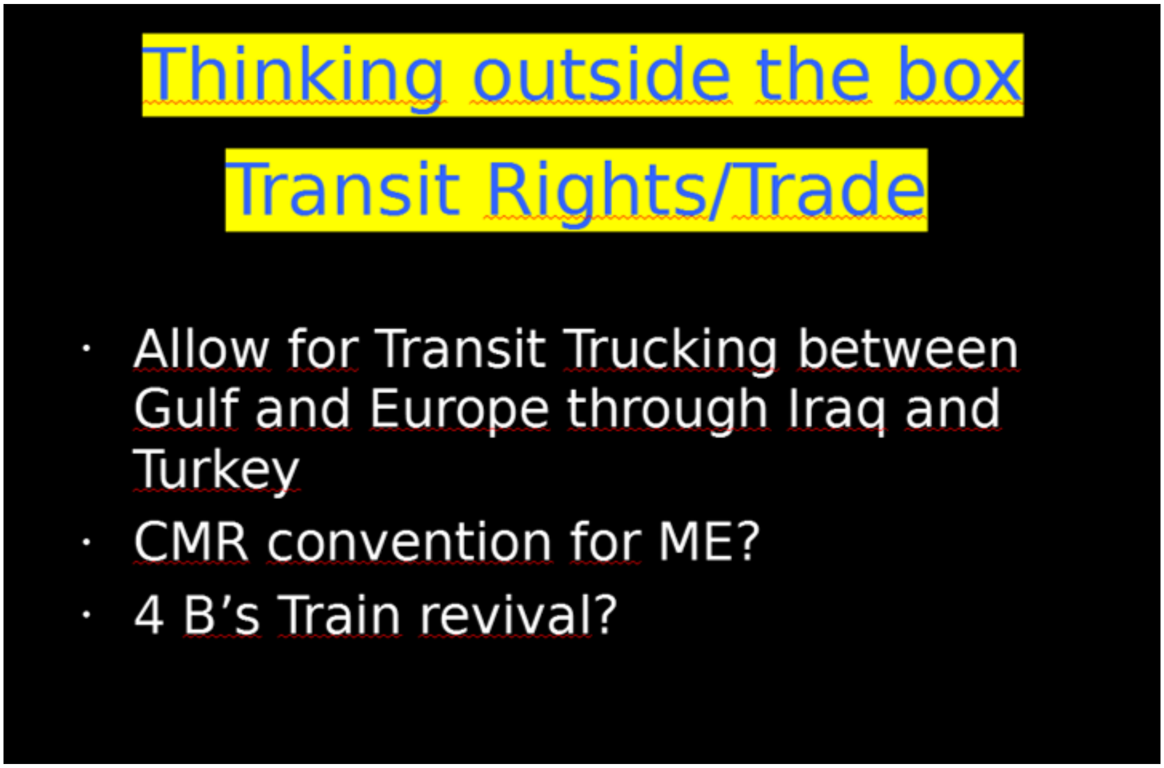
SUSTAINABLE ELECTRICTY

- PV in south Iraq, (save unsold in reservoirs)
- Hydropower in Turkey & Iraq and Iran,
- Turbines - where we can
- Thermal plants on grid
- Manage the grid through bidding process and smart meters with new transportation grid

Thinking outside the box

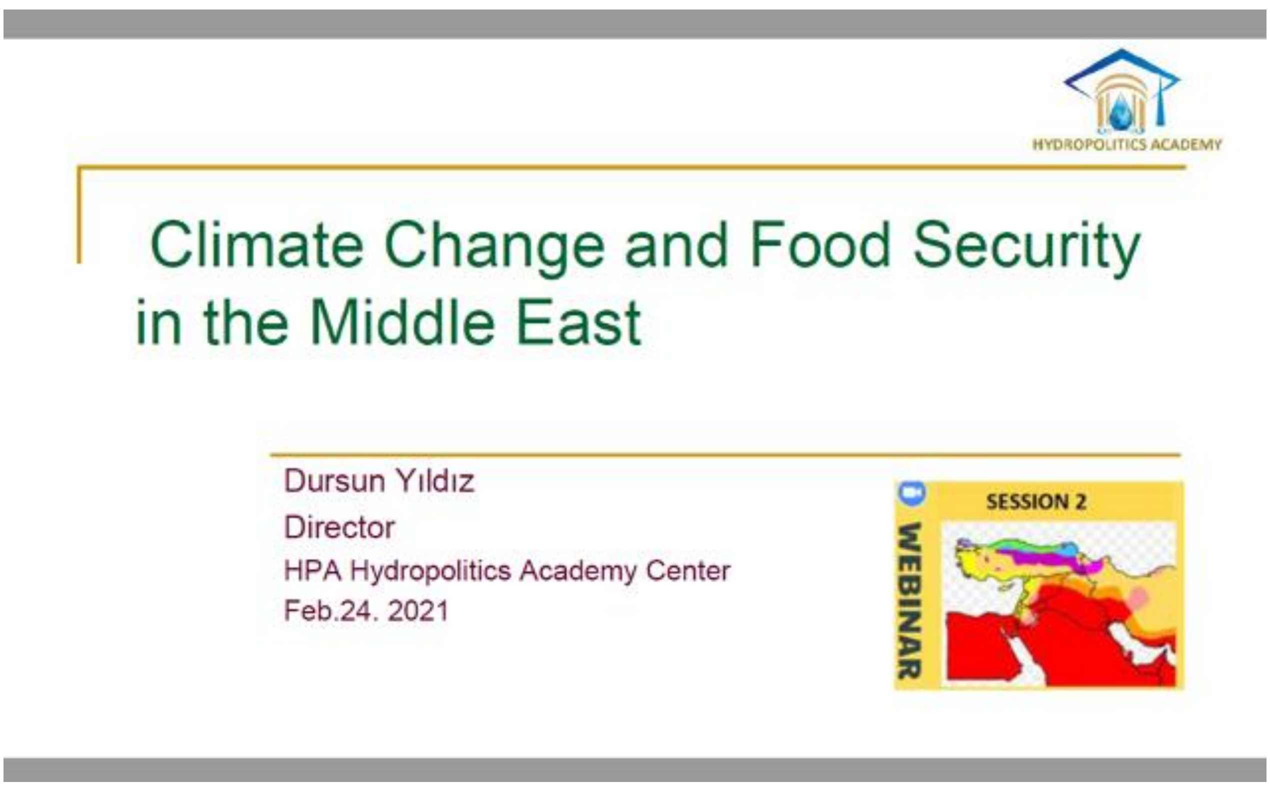
Agriculture

- Modernize irrigation region wide
    - Drip vs flood
    - Vegetables vs cereal crops
    - Less salinityModernize Irrigation region wide
- Hypotonic Agriculture Under PV Farms
- Harvesting the atmospheric moisture/Saline


Thinking outside the box
Transit Rights/Trade
• Allow for Transit Trucking between Gulf and Europe through Iraq and Turkey
• CMR convention for ME?
• 4 B’s Train revival?

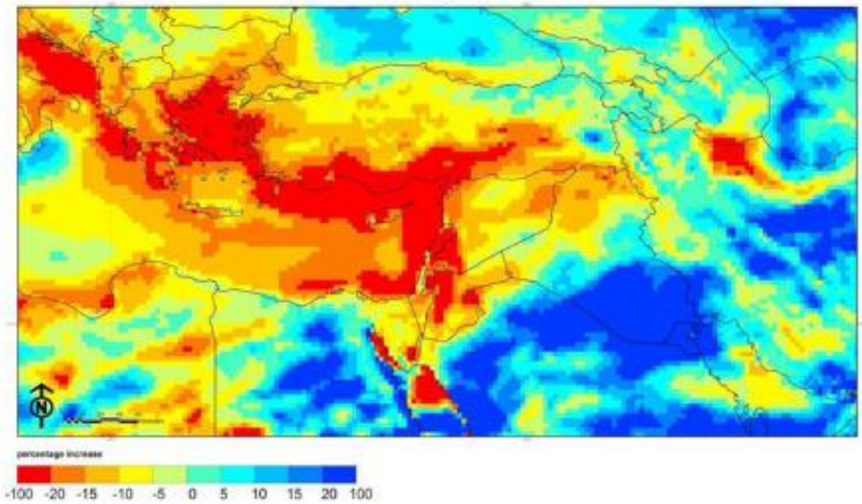

Thinking outside the box
EU started with a coordination agreement between France and Germany
on production of Coal and Steel
...... May 1950 !


Thank You
Dr. Azzam Alwash



HYDROPOLITICS ACADEMY
Climate Change and Food Security in the Middle East
Dursun Yıldız
Director
HPA Hydropolitics Academy Center
Feb.24. 2021
SESSION 2
WEBINAR

One of the most important risk for the region



Precipitation in 2040-2069

Figure 2: Percentage change in mean annual precipitation in 2040-2069 from 1961-1990 as simulated by PRECIS.

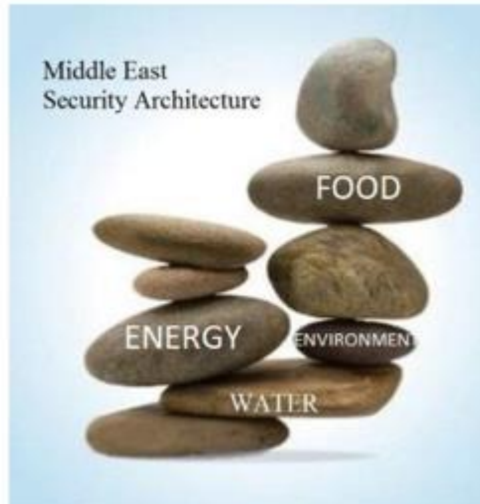
Water Resources Research
Volume 47, Issue 6, W06506, 10 JUN 2011 DOI: 10.1029/2010WR010269
http://onlinelibrary.wiley.com/doi/10.1029/2010WR010269/full#wrcr13018-fig-0002

Threats due to Climate Change

- Climate change may increase competition for scarce water resources, complicating peace agreements
- Climate change may intensify food insecurity,
- Climate change may hinder economic growth, thereby worsening poverty and social instability:
- Climate change may lead to destabilizing forced migration and increased tensions over existing refugee populations:
- Perceptions of resources shrinking as a result of climate change could increase the resecuritization of strategic natural resources
- Sea level rise will impact infrastructure, increase coastal erosion and increase saltwater intrusion into coastal aquifers

Question

- How can we get out of structure of conflicts between neighbours?
- Not easy
- Not impossible



Being aware of

- Risks
- Opportunities

Key Points

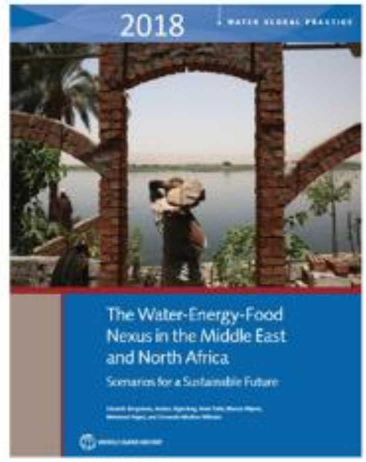
- We need to have a regional concept starting from bilateral relationship (Turkey and Iraq)
- Regionalization
- Institutinalisation
- Civil Society Interrelation
- Strategical Agricultural Investment

Why do we choose food security ?

- We need to seperate the conflicts and try to find the most applicable solution with high level community support
- These areas are relatively free from global actors involvement
- Easy to have shared vision, shared goal and unity of effort

Climate related water scarcity will

- affect the types of crops
- contribute to changes in the crop basket,
- decrease agricultural production

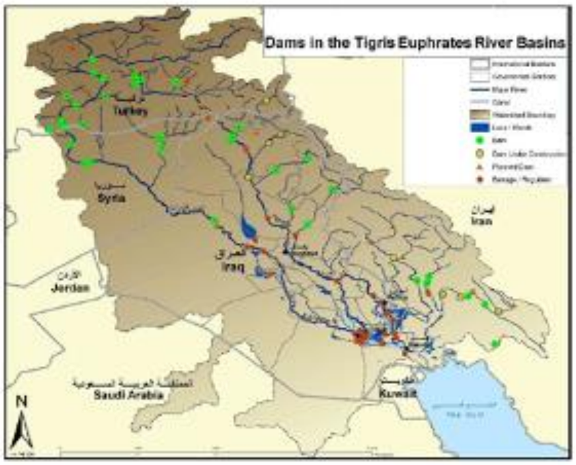


Achieving food security in the region is a demanding task

How the refugees will survive

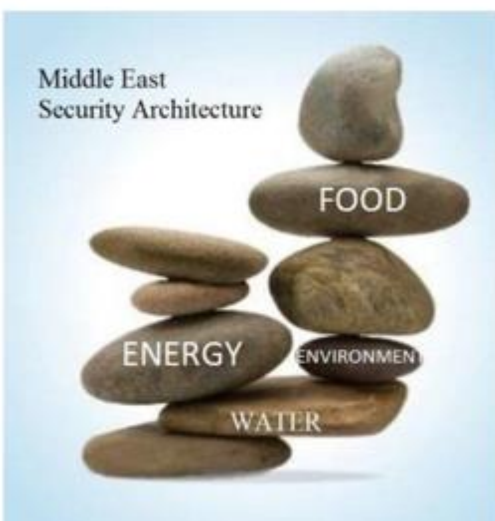
- UN identified 13.5 million **Syrians** requiring humanitarian assistance,
- How the refugees will survive when they return to home ?
- In short term ?
- In long term ?

Water conflicts dynamics turned into



- Operation of Dams,
- Irrigation of Lands,
- Less Water availability,
- Food Unsecurity

NEED TO INNOVATIVE HYDRO DIPLOMACY



- HYDRO-DIPLOMACY in the framework of the Nexus "Water, Energy, Food, Biodiversity" will increase to provide stability and security in the region

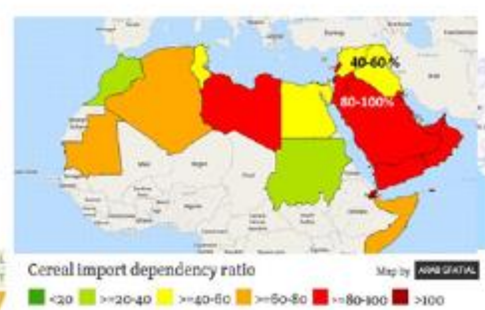
Losses in agricultural production by 2050

- Saudi Arabia has the largest projected losses in agricultural production by 2050 (*about 65 percent* reduction from current levels),
- Republic of Yemen (with a 35 percent reduction), and
- the Syrian Arab Republic (projected to lose 13 percent of its agricultural production).
- The Islamic Republic of Iran and Lebanon each stand to lose about 5 percent of their agricultural production under the moderate economic development scenario considered

GROWING FOOD IMPORT DEPENDENCY

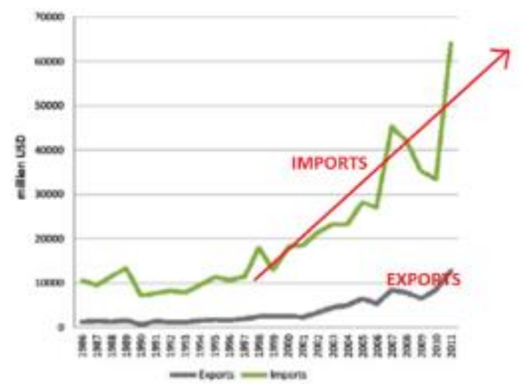
Regional developments: Middle East and North Africa

- Conflict remains key barrier
  - About ½ the population of Iraq, Libya, Syria, and Yemen require humanitarian assistance
- Food import dependency likely to rise as populations urbanize and grow
- Outlook for 2017
  - Tackling root causes of conflict
  - Preparing strategies to transform agrifood systems for growing food import dependency, urbanization

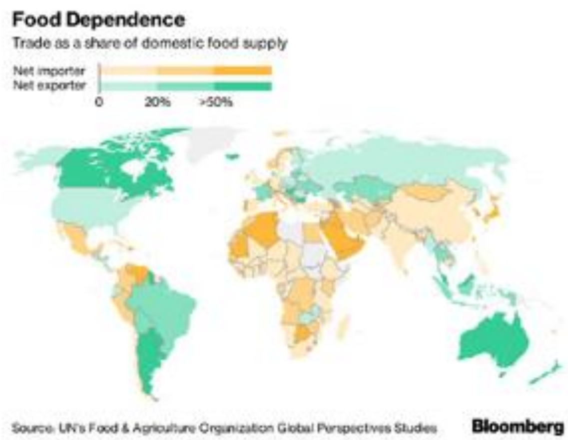


Food Dependence

: Food imports and exports (in million USD) in the Middle East and North Africa (1996-2011) (FAO, 2015)



Source: FAO



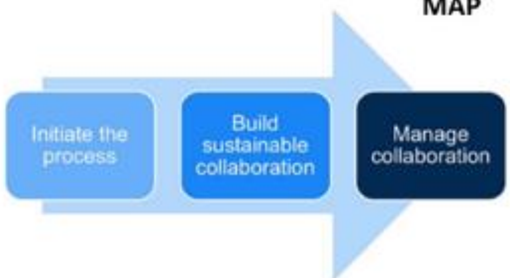
Five Main Imports Partners of the Countries

	Iran	Iraq	Syria 2010	Lebanon	Jordan
Vegetables	UAE Switzerland India Pakistan Malaysia	Canada China İran Australia İndia	USA Ukraine Egypt Russia Argentina	Ukraine Russia Egypt Brazil USA	Romania USA Russia Argentina Ukraine
Food Products	UAE Switzerland Netherland Germany Turkey	UAE Saudi Arabia Kuwait China Jordan	Brazil Argentina Switzerland France Netherland	Switzerland France England Turkey USA	Saudi Arabia Argentina Syria Egypt Irland
Agricultural Raw Materials	UAE Korea Germany Malaysia Russia	Russia Romania Syria China Iran	Russia Romania Germany India Egypt	Romania Russia USA Germany Italy	USA Brazil Germany Finland Romania

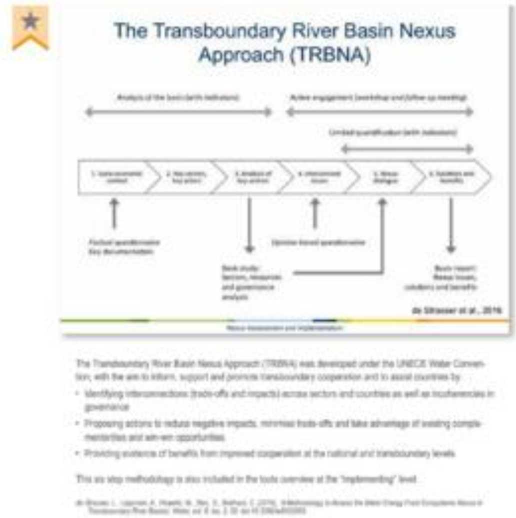
Can Food Security be a Common Objective

Bilateral or Multilateral Agreement Process

Three phases are recognised for setting up an **BAP** **MAP**



Adapted from FAO (n.d.)



We need a conceptual change to achieve food security

- ***Three magic words to move forwards***
- ***Mutually beneficial***
- ***interrelations.***

We need

- to reduce a tendency towards greater resecuritisation with innovative WEFB Security Nexus diplomacy
- **Moving forward to Regional Food Security Cooperation as an initial step**

PAST EXPERIENCES - Larger Scale experience (MENA Scale)

GAFTA

Greater Arab Free Trade Area

Governmental & Military

PAFTA

Pan-Arab Free Trade Agreement

Despite attempts to institutionalise intra-regional trade through initiatives such as the Pan-Arab Free Trade Agreement, political obstacles have hindered their development.

Smaller scale experience on mutually beneficial cooperation (2011)

- In June 2010, Jordan Lebanon, Syria and Turkey formed a Quadrilateral Free Trade Area.
- This covered cooperation in energy, trade, transit and industry.
- The experiment collapsed with the crises in Syria in 2011

Current Situation

Intra-regional trade in the Middle East only accounts for 5 to 10% of total trade

Food Insecurity

- Food security is already a core political concern in many countries in the region.
- A severe drought across the region in 2007/8 provided a taste of what could happen in future.
- Complete food self-sufficiency is an unrealistic goal
- Already the Middle East as a whole is the world's most dependent region on wheat imports.

Paradigm shift to nexus approach

Cooperation and partnerships around water, agriculture, and energy need to be essential

- Water Energy Food resources in the region already scarce in more than one coupled with an ever increasing variability in availability,
- An **integrated or nexus approach** to resources management and cooperation appears to be the evident way forward.
- The nexus approach, identifies water, energy, food and biodiversity as the central sectors and advocates for better physical as well as policy and governance integration.
- It is an approach that integrates management and governance across sectors and scales.
- 'A nexus approach can support a transition to sustainability at the regional level

The competetive advantages define the basis for nexus and cooperation

a few simple strategies for action.

- We need to reshape our visions
- We need to improve inter regional trade and food security on the base of regional strategical agricultural investments.
- We need to develope a WEF nexus approach and applicable integrated regional development projects
- We need to be aware of that we have several technical solutions to implement for Water and Food Security
- We need to have a multidisciplinary expert platform at least . Partnerships between institutions with an applicable road map ,can enhance muttualy trust

We Need a Vision for The Day After

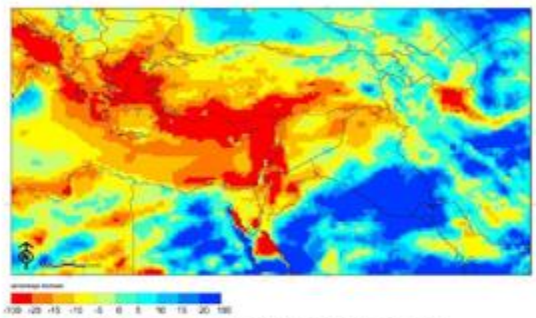


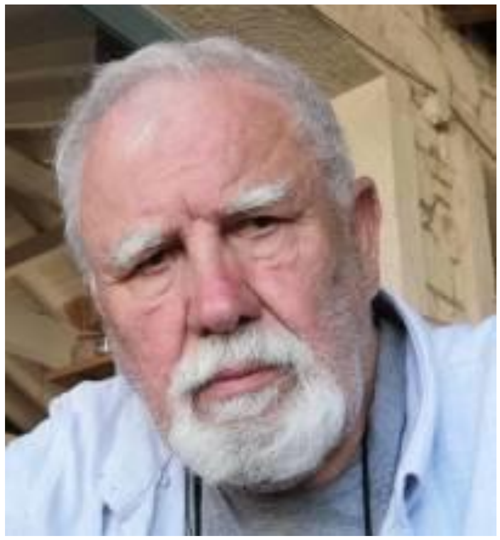
Figure 2: Percentage change in mean annual precipitation in 2040-2069 from 1961-1990 as simulated by PRECIS.

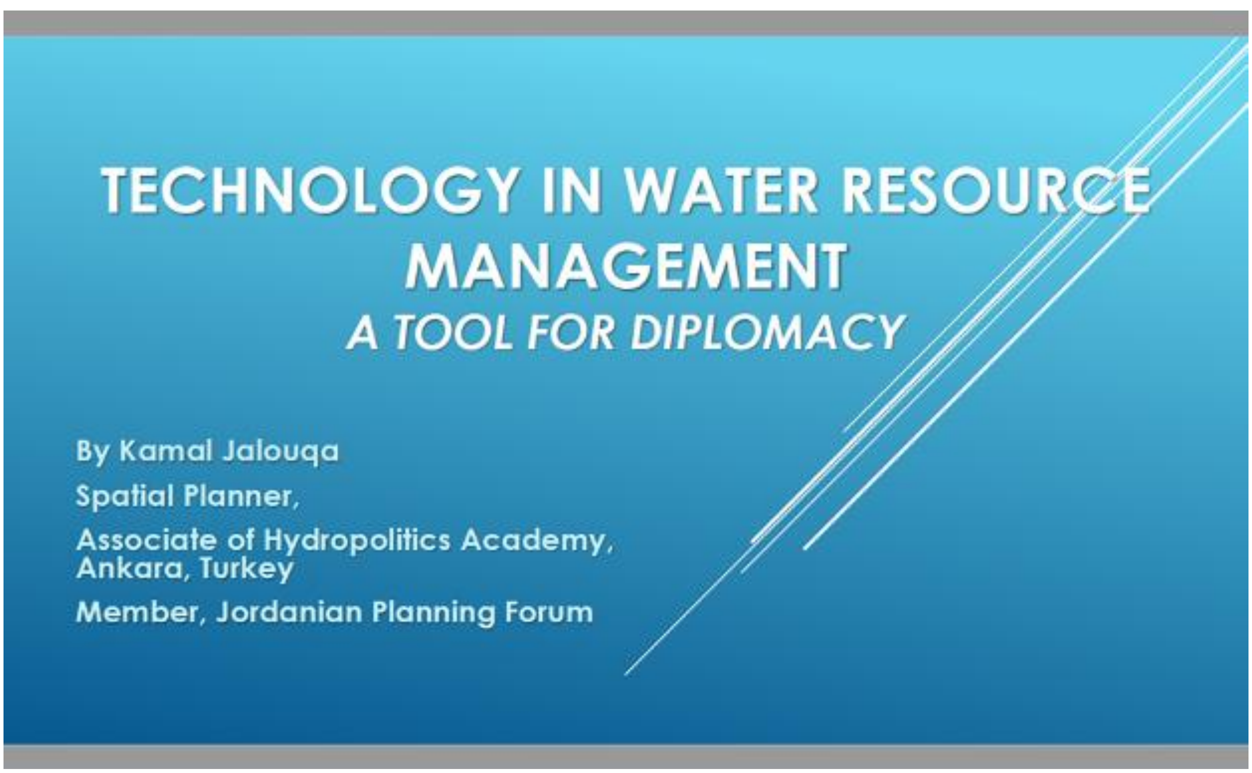
HYDROPOLITICS ASSOCIATION

Thank You

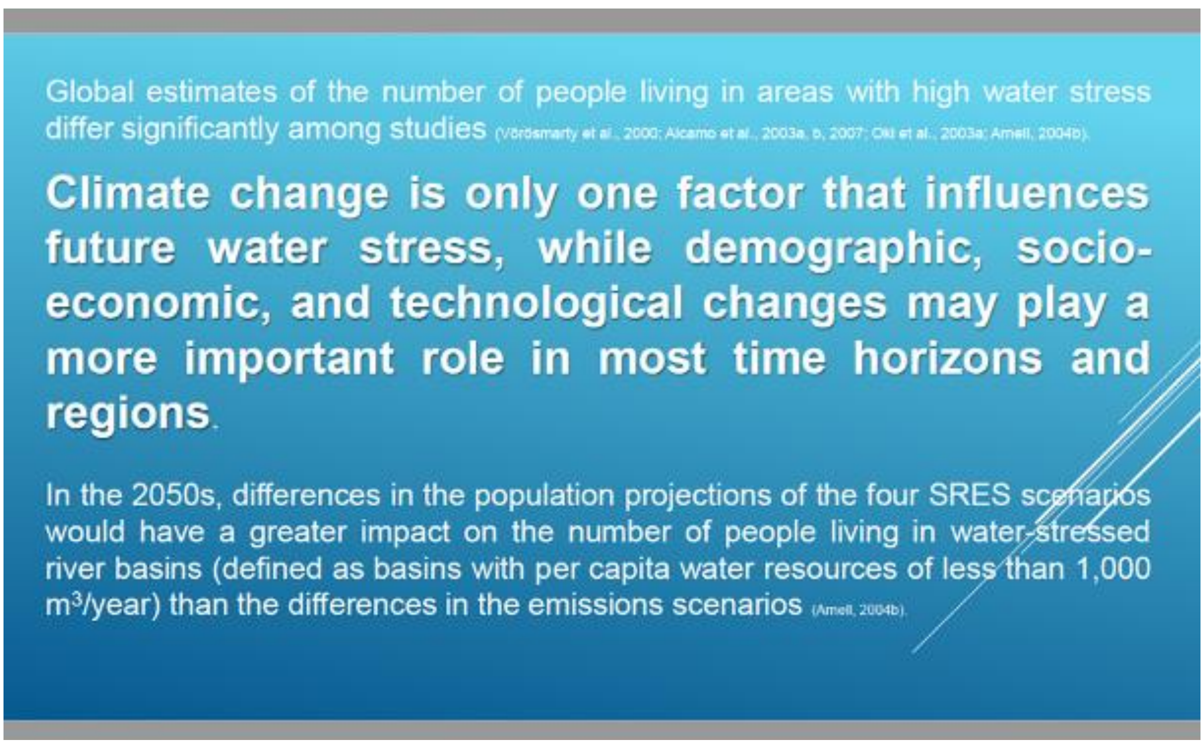
Dursun Yıldız

HYDROPOLITICS ACADEMY




TECHNOLOGY IN WATER RESOURCE MANAGEMENT
A TOOL FOR DIPLOMACY
By Kamal Jalouqa
Spatial Planner,
Associate of Hydropolitics Academy, Ankara, Turkey
Member, Jordanian Planning Forum


Water Sector-specific features
Water and sanitation are segmented sectors that involve multiple stakeholders (users, sector employees, different layers of government, and
public agencies, communities, donors, private sector, NGOs and environmental associations).
Water is a human need with important externalities. Its management is highly politicised.
The sector may involve the construction of particularly large physical infrastructure with potentially important impact on local communities (dams) and of facilities that may generate local controversies (treatment plants).
Labour intensive sector.
Important cross-jurisdictional and cross-country
dimension.
Important vertical and horizontal co-ordination
dimension across levels of government.


Global estimates of the number of people living in areas with high water stress differ significantly among studies (Vörösmarty et al., 2000; Alcamo et al., 2003a, b, 2007; Oki et al., 2003a; Arnell, 2004b).
Climate change is only one factor that influences future water stress, while demographic, socio-economic, and technological changes may play a more important role in most time horizons and regions.
In the 2050s, differences in the population projections of the four SRES scenarios would have a greater impact on the number of people living in water-stressed river basins (defined as basins with per capita water resources of less than 1,000 m3/year) than the differences in the emissions scenarios (Arnell, 2004b).

Managing Climate Change

In theory, the effects of climate change can be slowed down in many ways, including:

1.Increasing sinks of greenhouse gases

2.Decreasing sources of greenhouse gases

A sink is a process that removes greenhouse gases from the atmosphere. For example, growing a tree where one did not previously exist provides a sink for carbon dioxide, because the tree extracts carbon dioxide for photosynthesis. A source is a place or activity from which greenhouse gases are emitted such as coal burning.

3. Also Growing Algae, in solar-hydroponic ponds in sea water reduces CO2 and produces Oxygen and oily contents that can be used as fertilizer, animal feed and Bio Diesel

Considerations for governments

1. Facilitate clear understanding of roles and responsibilities of all stakeholders, notably through the creation of capacity and space for dialogue.
2. Develop co-ordination mechanisms. Consider ways of meaningfully involving weaker communities.
3. Involve the employees and their representatives in project development.
4. Develop consumer trust and awareness through information campaigns on public policies and disclosure on key project information and expected outcomes.
5. Communicate on the reasons for unpopular decisions or actions.
6. Public consultation should be developed according to the principles of clear focus, representation and transparency and follow published standard procedures.
7. It requires time and resources and should therefore be organised strategically at important stages of policy making and preferably start at the early stage of the projects.
8. Consultation should involve explicit feedback from the public authority.
9. Consider greater involvement of civil society (NGOs, consumer groups) in
10. protecting consumer rights, monitoring service provision and determining model of utility management.
11. Consider providing adequate training.

Reduction in groundwater depletion

Through :

- reduced over abstraction
- Reduced land degradation through flood and drought management and reduced nutrient loss in the soil
- Reductions in CO2 emissions through energy optimisation and reduced energy consumption
- Reduced water consumption through leak detection and reduced demand and increased reuse Governance benefits • Improved management and knowledge, as measurement is critical for effective management
- improved accuracy of data, as real-time data should also be SMART (specific, measurable, actionable, relevant and time-bound) data.

./..

Reduction in groundwater depletion cont.

- Increased community-led decision-making opportunities as water users can make decisions based on real-time water use and information
- Improved transparency as water users have access to water use and quality in realtime Technology benefits
- The opportunity to test and develop new and innovative tools for water management
- Innovative technologies created with the potential for commercialization • Identification of the remaining gaps in technology adoption (e.g. standardisation of software and tools to make it easier to adopt the 'right' mix of tools for each situation
- Showing the potential for SWM tools to deliver successful outcomes and in turn lead to significant social, environmental, governance and financial impacts

US Example

STRATEGIC OBJECTIVE 3: REDUCE CONFLICT BY PROMOTING COOPERATION ON SHARED WATERS

More than 260 river basins and 600 aquifers are shared between two or more countries. In many of these basins or aquifers, no formal agreement or institutional relationship exists between 6 the parties to govern use of these shared water resources. As these resources degrade or become scarce, competition is likely to increase, raising tensions and increasing the likelihood of conflict. These can be particularly challenging problems to solve, as there are often legitimate competing interests. Countries often view water as a strategic asset and a national security priority. Water disputes are often embedded within a broader context of social, economic, and political challenges or animosities, and the data on disputed water systems are often sparse or not publicly available. Many of these same challenges also exist at the local level as competition increases between different communities or water users, such as farmers and pastoralists. At the same time, water issues represent an important means of bringing communities and countries together, strengthening regional integration, and providing a stabilizing influence in regions of conflict. To reach this strategic objective, the U.S. government will work to strengthen the political will for cooperation, and promote the development of agreements and mechanisms that support the cooperative management of shared water resources in regions where water is, or may become, a source of conflict.

Agreements. United Nations Environment Programme (UNEP), Food and Agriculture Organization of the United Nations (FAO), and Oregon State University, 2002.

Example of Policy, Strategy, Objective, Means and Actions **hierarchy**

U.S. Government Global Water Strategy

STRATEGIC OBJECTIVE 4: STRENGTHEN WATER SECTOR GOVERNANCE, FINANCING, AND INSTITUTIONS.

Key outcomes of Strategic Objective 3 will include: • Increased number of cooperative events on water in priority regions; and, • Stable, adaptive, and responsive institutions that support the cooperative management of shared waters.

Promote science, technology, innovation, and information: Provide direct and in-kind support to improve science and technology capacity, water conservation and water use efficiency; promote common data exchange formats and access to data for decision-making; and build knowledge to monitor the quality and quantity of water resources, improve forecasting, and model water related systems. Provide support for the monitoring and evaluation of programs to identify the most effective interventions and activities to spur innovation and catalyze the deployment of new technologies — particularly those with U.S. export potential

Key outcomes of Strategic Objective 3

will include:

- Increased number of cooperative events on water in priority regions; and,
- Stable, adaptive, and responsive institutions that support the cooperative management of shared waters.

[5] UN World Water Development Report. United Nations, 2017. [6] Atlas of International Freshwater

Definition of Smart Water Management

Smart Water Management (SWM) is the use of Information and Communication Technology (ICT) to provide real-time, automated data for use in resolving water challenges through IWRM.
SWM can be used for planning and operational purposes, from daily use to organizational and policy planning at a range of scales, across contexts and regions.

Policy recommendations for Smart Water Management implementation Strategies Policy direction SWM for an improved quality of life (Society):

1. Facilitate adoption of SWM tools, especially in developing countries, to support access to basic services, and to support equality for poverty reduction, public health and quality of life. Include capacity development, technology sharing, collaborative business models and community governance and decision-making opportunities.
2. Build trust and community engagement using SWM tools in areas where the community feel unsafe using the local water sources.
3. Empower people in developing countries with smart tools to reduce the time spent on water management and increase farm income and time available for other activities (e.g. further schooling, and additional work opportunities). Investment in SWM for improved resilience and sustainable development (Economy)

../.

Policy recommendations for Smart Water Management /cont.

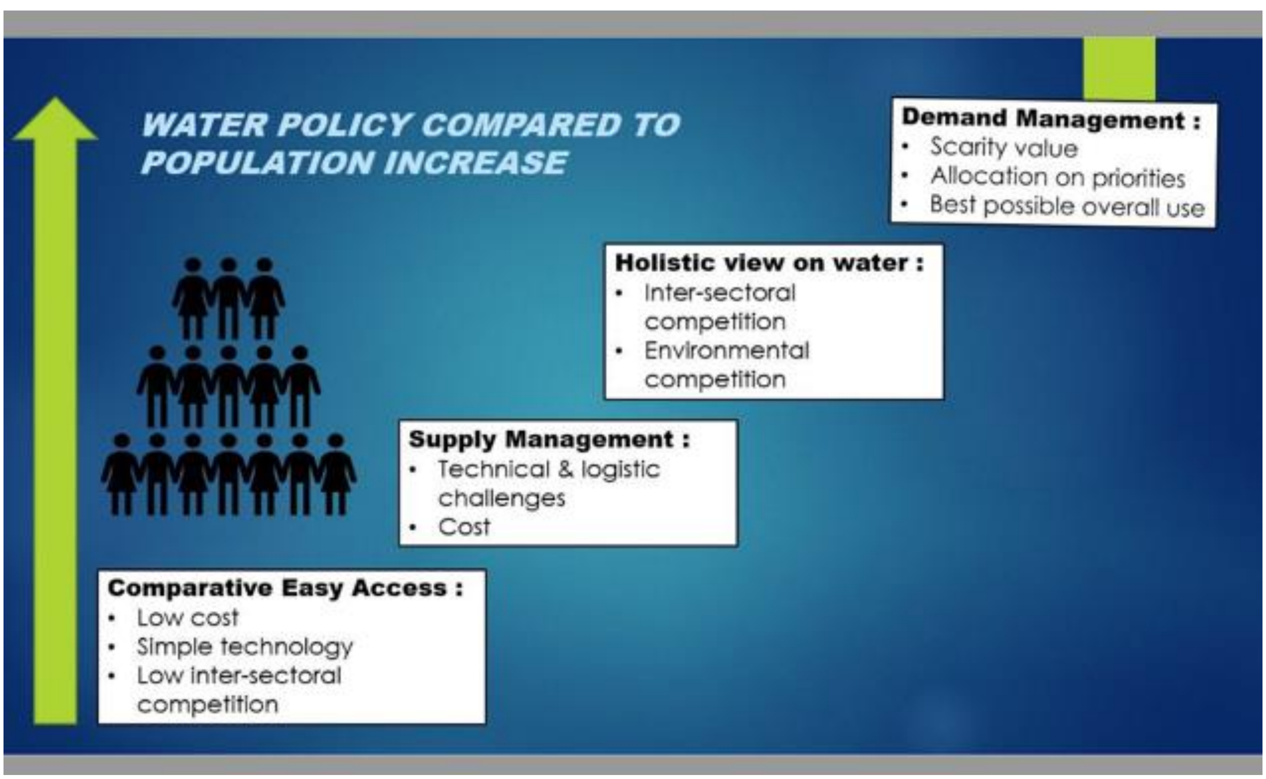
- Strengthen collaboration across and within sectors to provide opportunities for networks to share information and data to assist with effective and efficient water management. Value non-financial benefits (e.g. environmental, social, governance and technical benefits) as equally important as financial benefits for SWM implementation, as they contribute to building resilience to the effects of climate change and increasing populations.
- Support long-term investments for SWM implementation to enable adequate research, development and testing. SWM for protecting and conserving water resources and ecosystems (Environment)
- Introduce policies, regulations and incentives to drive environmental and ecosystem protection through use of SWM.
- Encourage SWM solutions to increase water quality, manage demand and use, water reuse, reducing groundwater depletion and increase energy efficiency, etc.
- Introduce SWM solutions for climate adaptation plans for flood and drought planning and management and major storm events

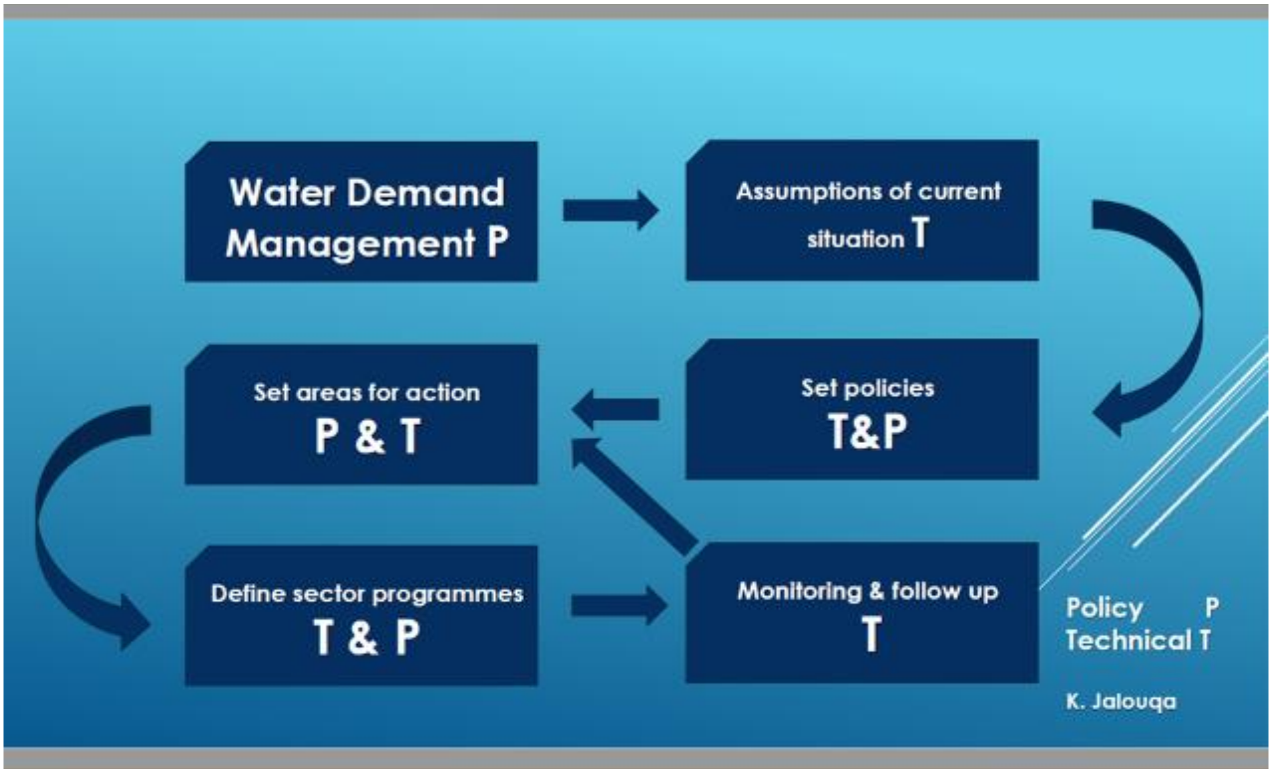
Water Demand Management

has long been acknowledged as a critical tool to cope with the pressures of growing populations and their demand for natural resources. Today, the growing evidence of climate change makes development and implementation of

Water Demand Management policies even more important for national institutions responsible for managing water.

Intensifying water scarcity, problems with deteriorating water quality, and the effects of more severe and frequent extreme climatic events (storms, floods and droughts) will almost certainly increase the need for Water Demand Management measures.

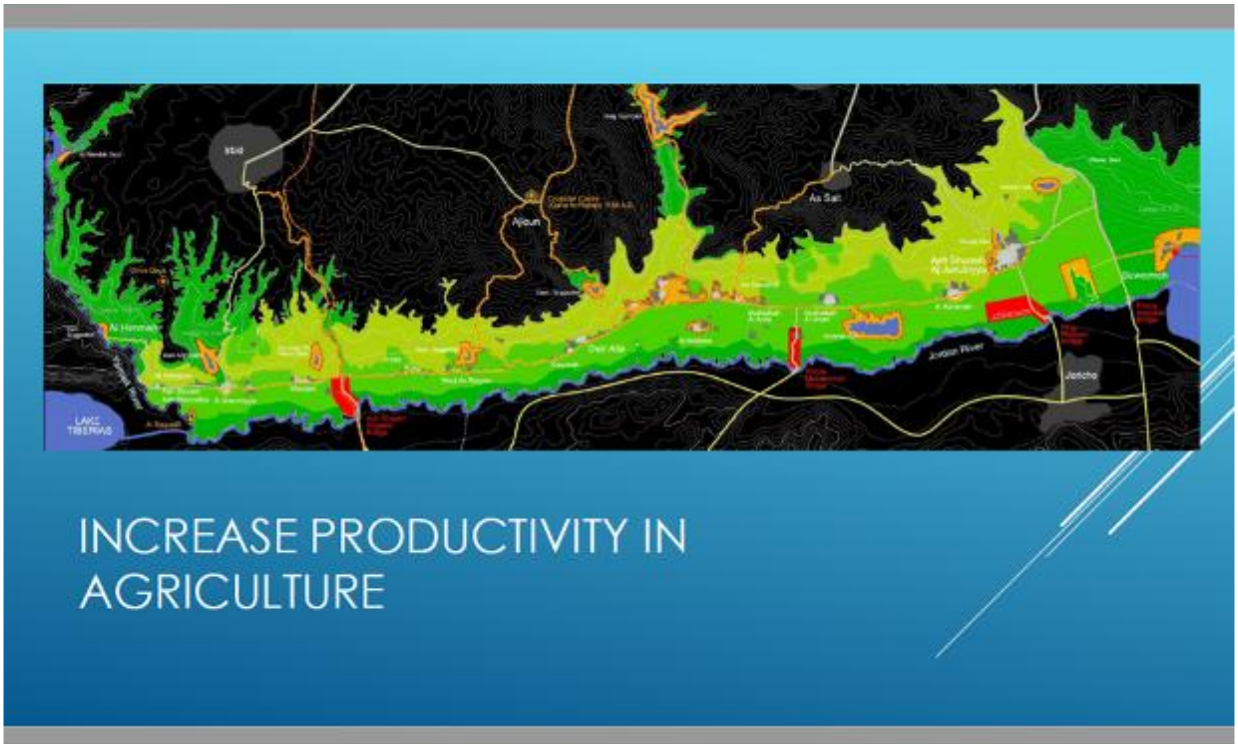


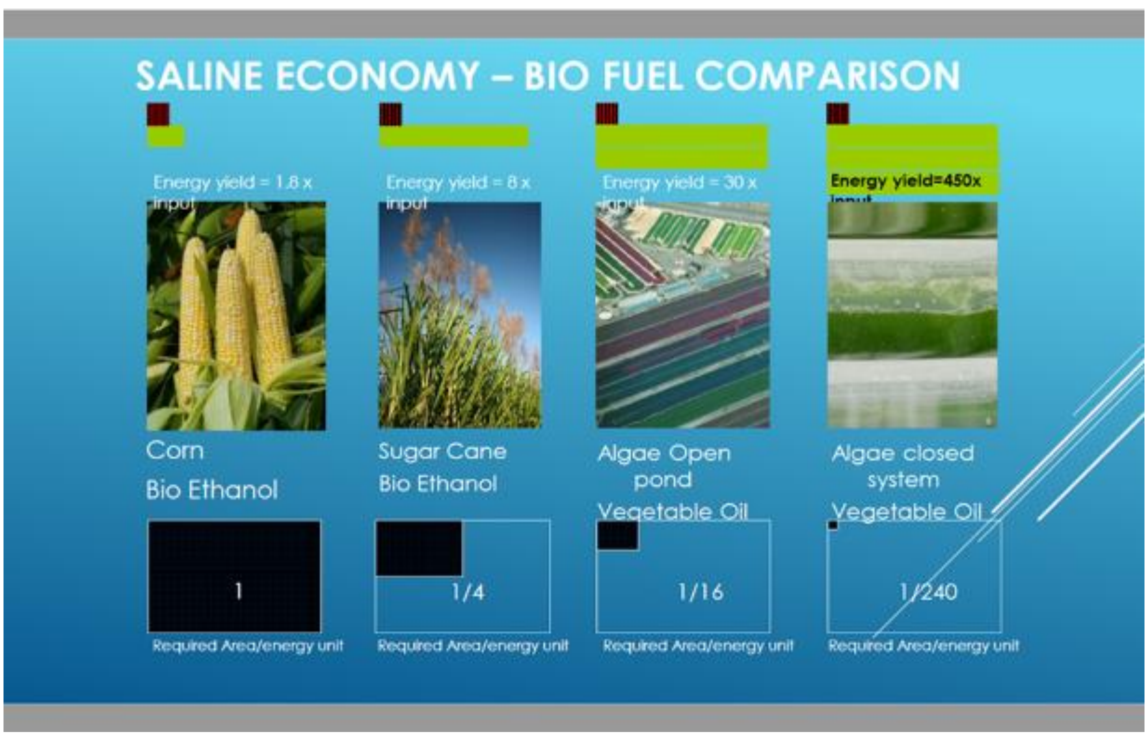

Water Demand Management P
Assumptions of current situation T
Set areas for action P & T
Set policies T&P
Define sector programmes T & P
Monitoring & follow up T
Policy P
Technical T
K. Jalouqa


Elon Musk is donating $100 million to fund a competition to find new ways to remove carbon from the air or water:
in a bid to help fight climate change. The race for the prize – the largest in the XPrize's history – will start on Earth Day and will run for four years, through 2025.
https://www.xprize.org/prizes/elonmusk?newtab=0#email

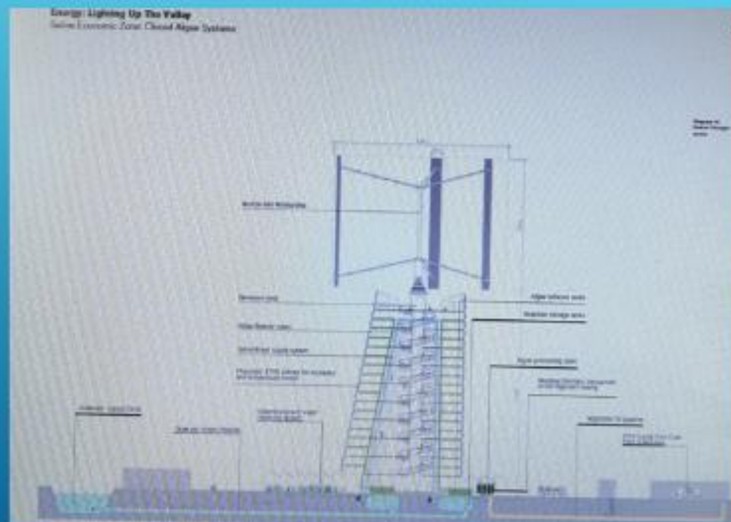
Numerous companies, researchers and institutions will definitely show interest in this offer, like the ones in the next slide:

Are we ?????


INCREASE PRODUCTIVITY IN AGRICULTURE

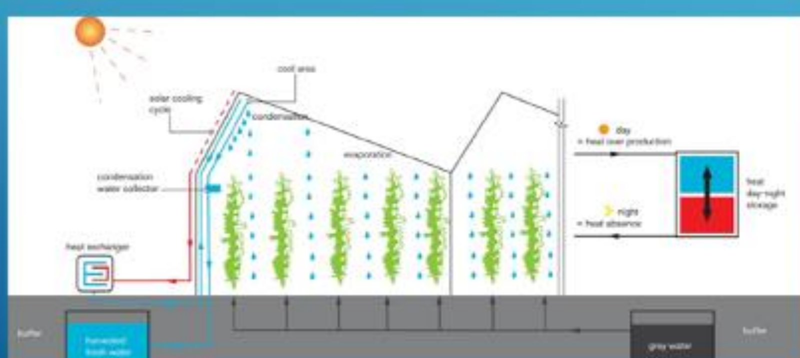

SALINE ECONOMY – BIO FUEL COMPARISON
Energy yield = 1.8 x input
Energy yield = 8 x input
Energy yield = 30 x input
Energy yield=450x input
Corn
Bio Ethanol
Sugar Cane
Bio Ethanol
Algae Open pond
Vegetable Oil
Algae closed system
Vegetable Oil
1
1/4
1/16
1/240
Required Area/energy unit
Required Area/energy unit
Required Area/energy unit
Required Area/energy unit

Multiple level Solar/sea water Algae plantation



CLOSED CONTROLLED GREENHOUSES

- The most significant changes introduced through closed controlled greenhouses is the water efficiency, achieved through hydroponic systems and computer controlled demand driven water supply and the shift in the labour market, towards more skilled jobs rather than unskilled workers.



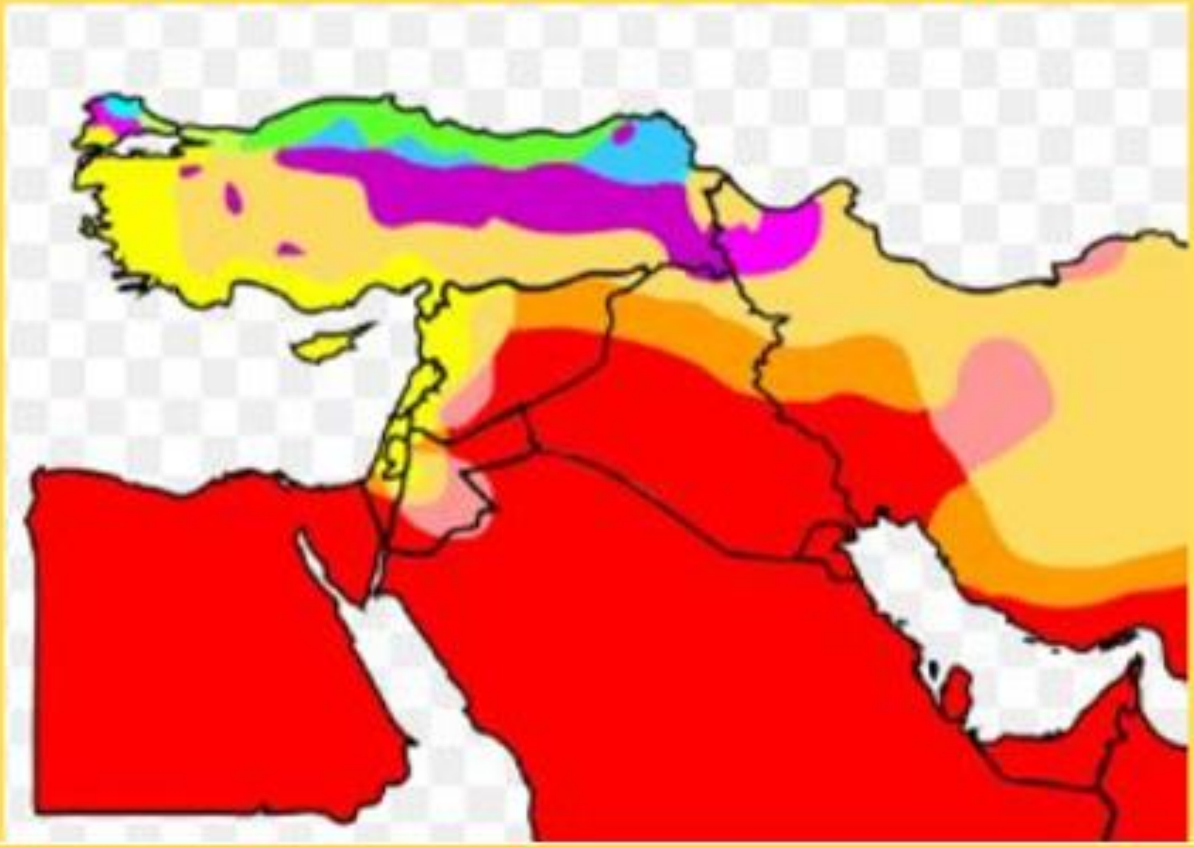

How can the stakeholders in Water Resource management – and CLIMATE CHANGE meet, at local, regional and multi-state, and global levels organise, create policy, work plans, and projects will be
OUR NEXT JOINT WORK FRAME
.
THANK YOU
K.J.

Context of Climate Change

Zoom

WEBINAR

Projections for the Middle East
Euphrates -Tigris River Basin



Hydropolitics Association

HPA Hydropolitics Association