

CLIMATE CHANGE AND CURRENT MEASURES TAKEN IN TURKEY AS A MEDITERRANEAN COUNTRY

Guleda ONKAL ENGIN

Yildiz Technical University

Dept. of Environmental Engineering

Meltem CELEN

Remzi Anil YAVUZ

Ahmet ADILLER







Outline

- Problem
- Impacts, Results and Reasons
- Action Plans taken in Turkey

- The EU Project CLIMB
- Last words…



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Motivation

- According to current climate projections, the Mediterranean countries are at high risk for an even pronounced susceptibility to changes in the hydrological budget and extremes.
- These changes are expected to have severe direct impacts on the management of
  - water resources,
  - agricultural productivity and
  - drinking water supply.
- The different regions of the Mediterranean landscape are already experiencing and expecting a broad range of natural and man-made threats to water security.


Glacier melting
Pollution
Heat waves
Droughts
Coastal erosion
Flash floods
Sea level rise
Environmental migration
Salinization
Source: http://www.shadedrelief.com/natural/images/italy.jpg





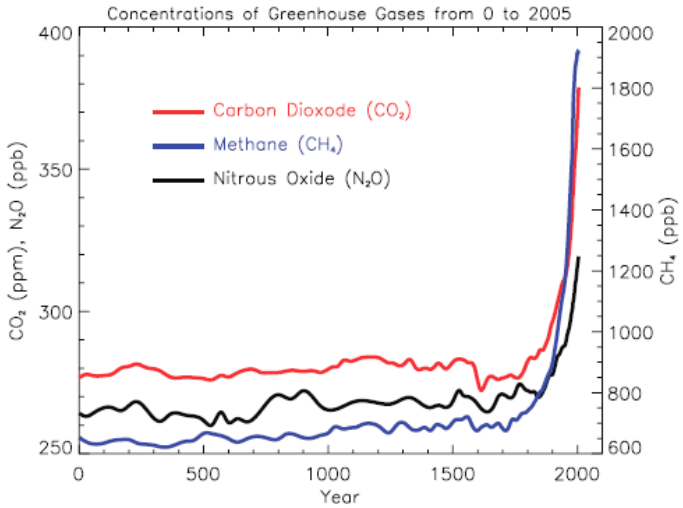


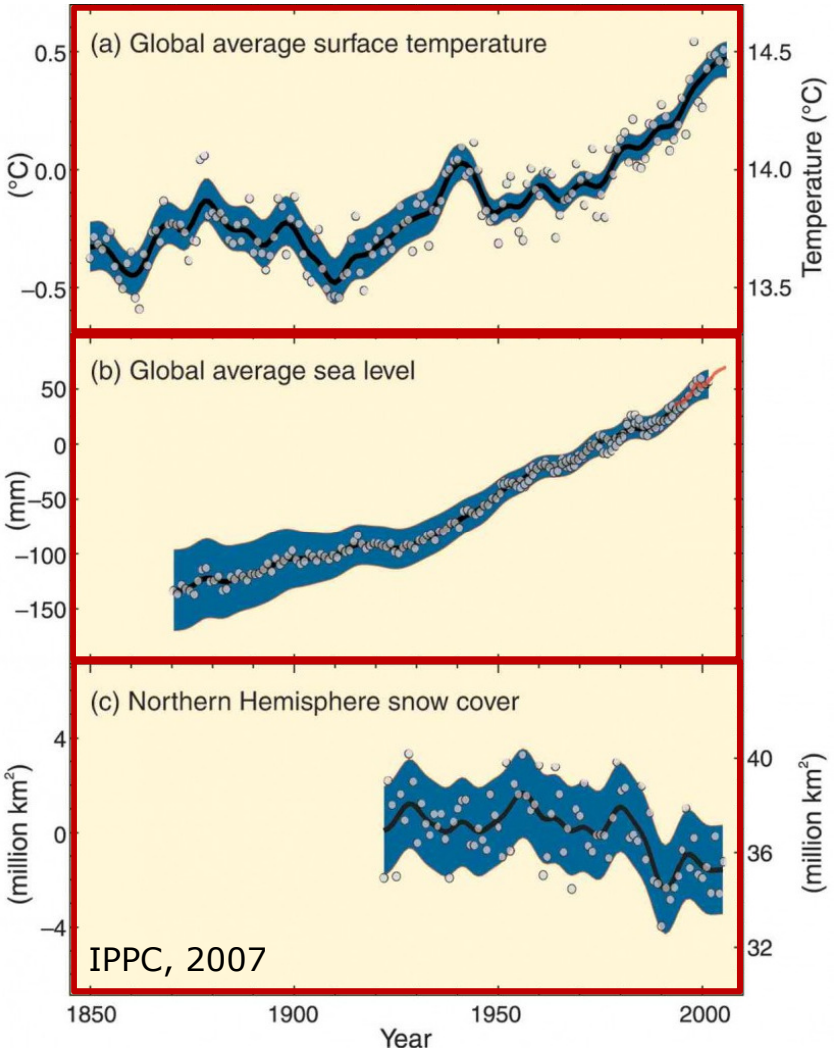




Impacts

- The surface temparature increased 0.8 ºC since 1950s.
- Global sea level rise was found to be 17.5 cm.
- Glacier decrease in the northern hemisphere was around 7.5%.
- Greenhouse emissions increased by 25-170%.





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Results

- Unexpected and destructive meteorological events
- Decrease in water resources
- Decline in food stocks and rise in food prices
- Adverse effects on human health
- …



Flooding



Storms



Overtemperature



Excessive precipitations



Droughts



Species extinction

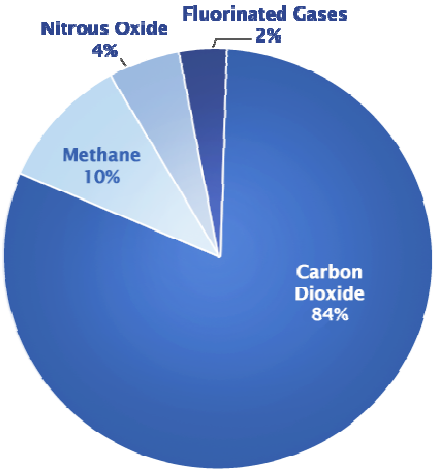


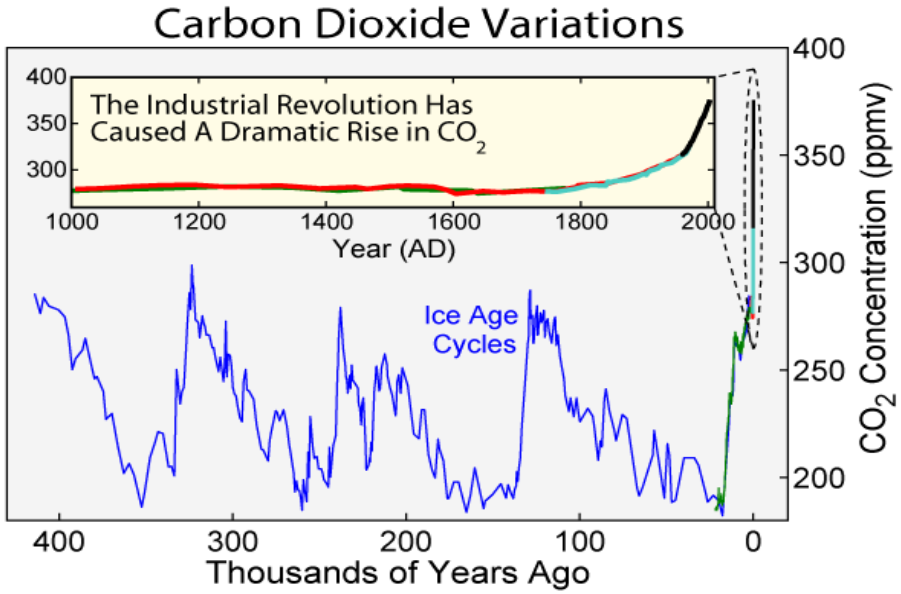


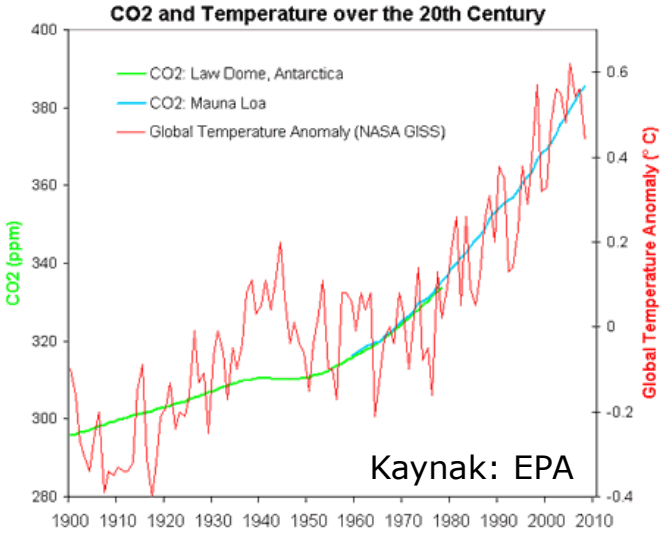


Reason: CO_2 conc. increase

- In the last century, the CO_2 concentration increased by 25%.
- A relationship was found between the CO_2 concentration increase and global warming.







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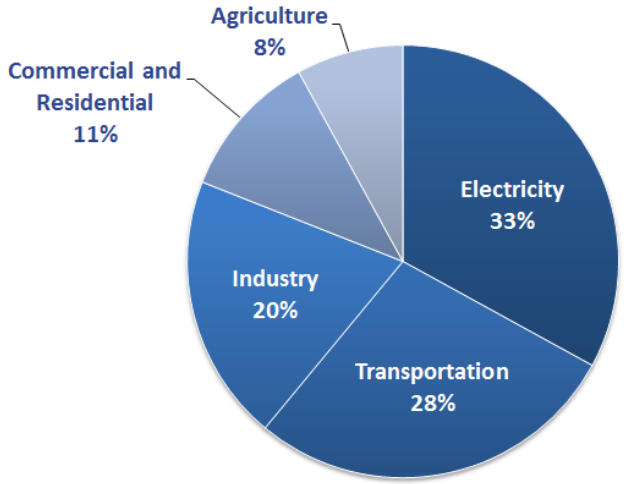




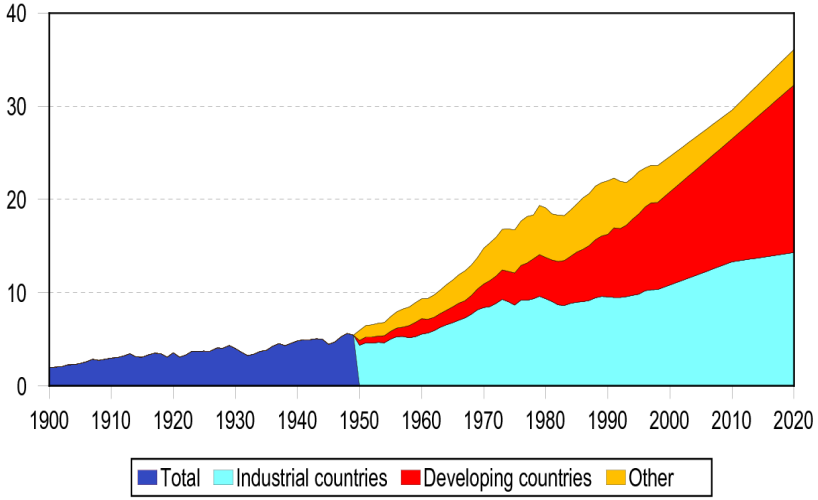


CO_2 emissions

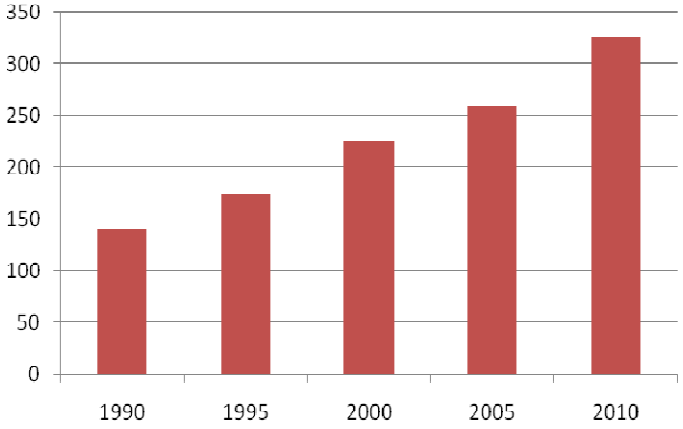
- Global CO_2 emissions increase by 2.1% each year (32 billion tonnes/year)
- The CO_2 emission of Turkey have increased by 130% in the last 20 years.
- Total CO_2 emission produced (%61) comes from energy-transportation sector.



Global CO_2 emissions and projection (billion tonnes)



Annual Total CO_2 Emissions - Turkey (million tonnes)



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Important issue: Uncertainty

The effects of climate change have **varying degrees of uncertainty.**

Therefore, a thorough and integrated investigation should be considered including

- **hydrological,**
- **climatological,**
- **socio-economical** dimensions

to determine

- **water scarcity,**
- **vulnerability of water resources,**
- **pronounced climatic variability**
- **social stress** caused by all these effects.











The situation in Turkey



- Being surrounded with water on three sides and having a **fragmented topographical structure**, different regions of Turkey will be affected in different ways and at different degrees.
- The increase in temperature would affect **semi-arid regions** more that are under the threat of desertification and sub-humid regions that do not have adequate water such as the Southeast Anatolia, Central Anatolia, Aegean and Mediterranean regions.
- These effects will be in the form of **reduced regional water supply** and **increased levels of water demand**.











The situation in Turkey



Metropolitan municipalities have an important mission within their territorial borders to ensure the protection of water basins in harmony with the principle of sustainable development.

Other important legal entities related are:

the Ministry of Forestry and Water Works
the Ministry of Environment and Urbanization
the Ministry of Food, Agriculture and Livestock

These Ministries are responsible for the protection and improvement of the resources of water, soil, plants, animals and fisheries.



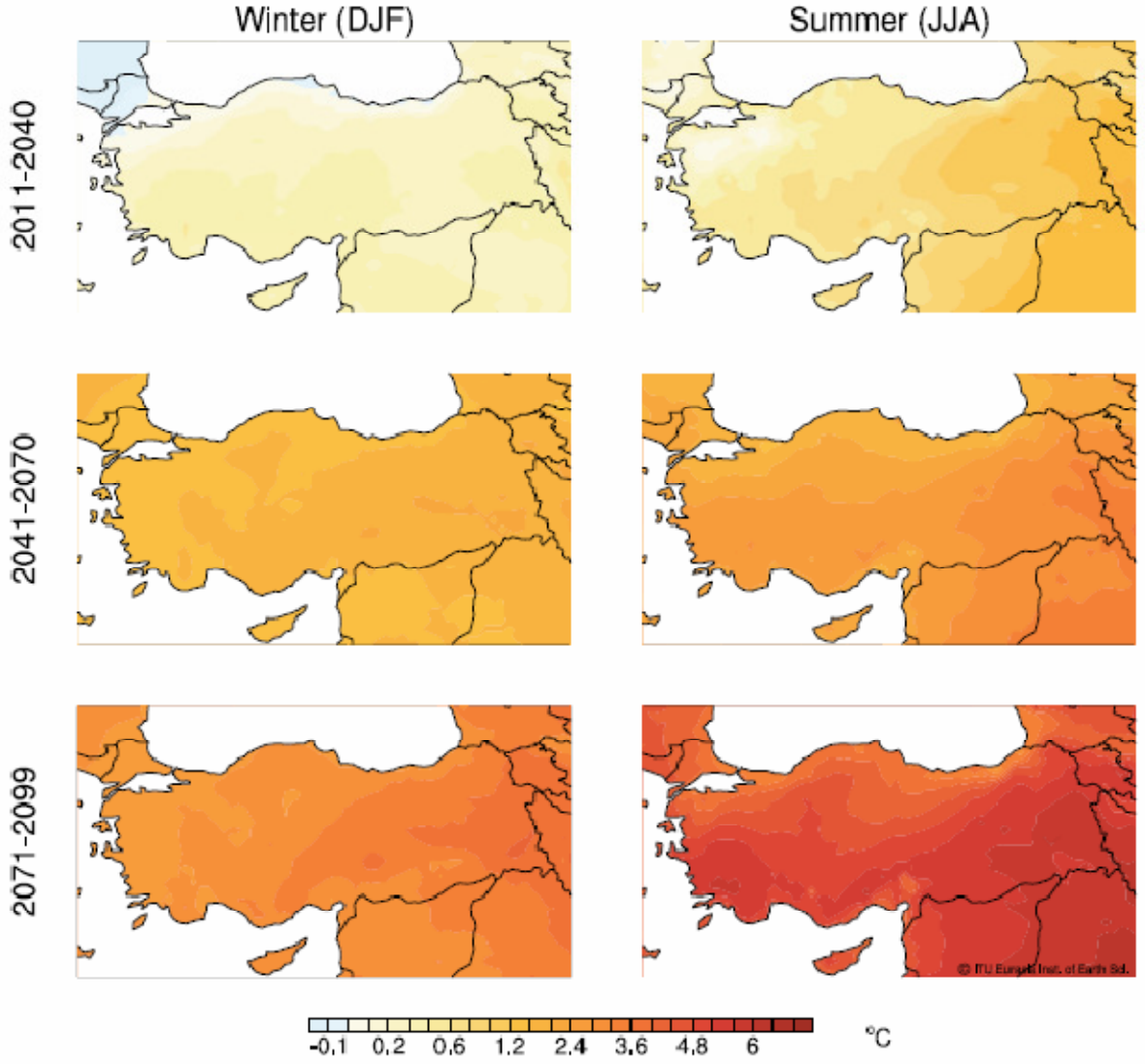








Climate Projections



Changes in Temperature

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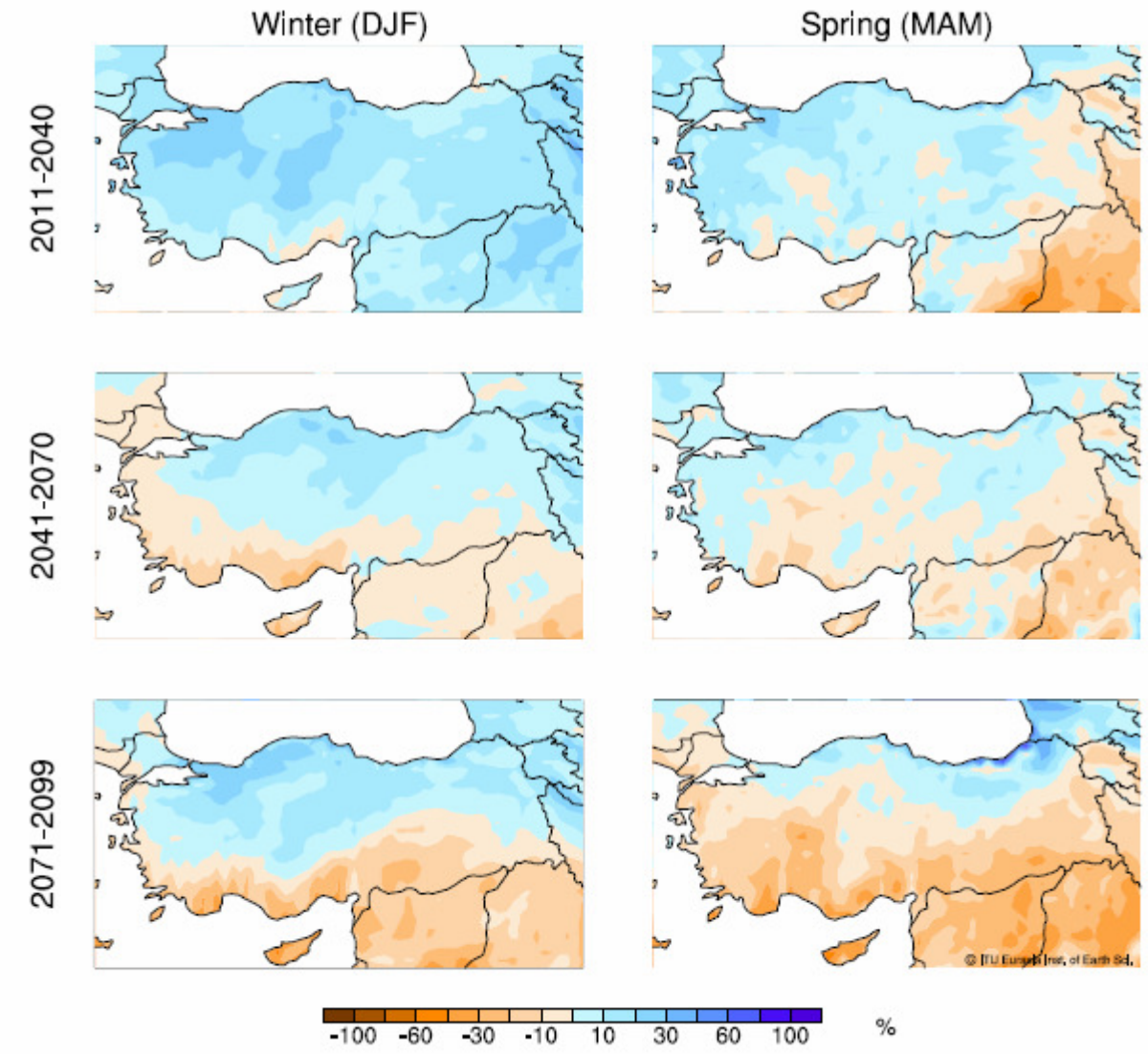








Climate Projections



Changes in Precipitation

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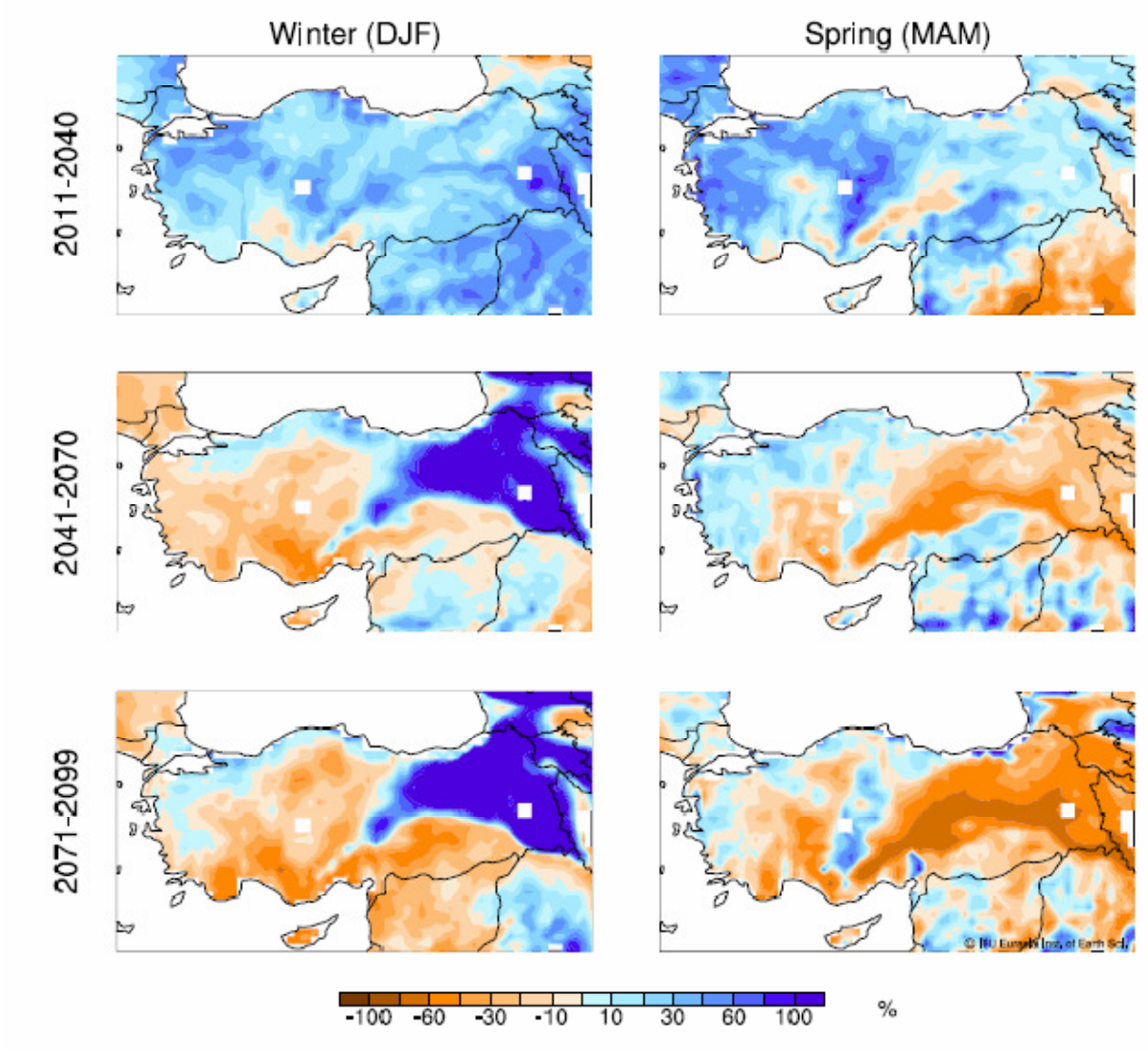








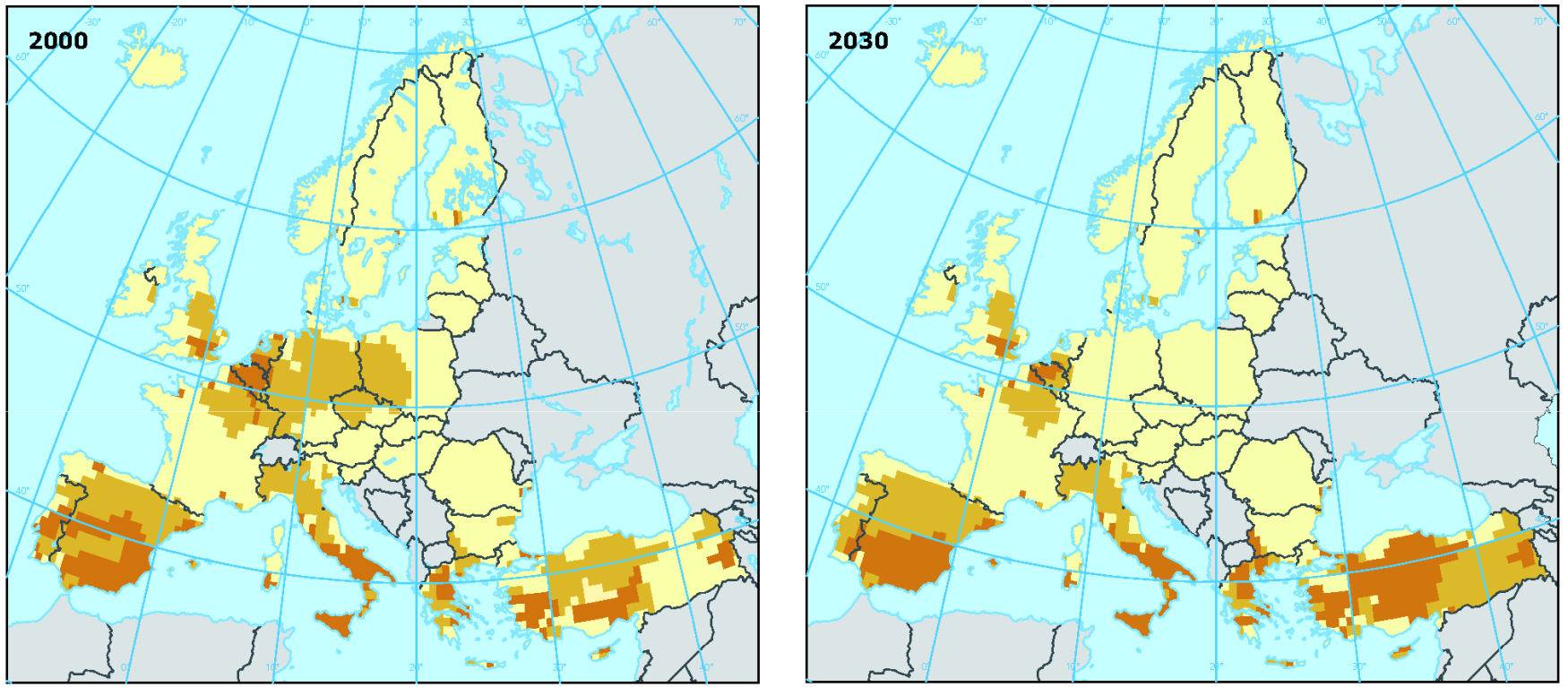
Climate Projections



Changes in surface runoff

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Water Stress in European River Basins



Water stress in European river basins in 2000 (left) and under the LREM-E scenario by 2030 (right)

Water exploitation index (%):

- 0–20 (low water stress)
- 20–40 (medium water stress)
- > 40 (severe water stress)
- Outside data coverage

Water stress due to existing growth rate and water consumption trends

(Source: EuPA, 2009)

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Studies Conducted in Turkey

- ***Water Scenarios for Neighbouring Countries*** - EU-FP6 project – Middle East Technical University
- ***The Effects of Climate Change on Euphrates Regimes*** – Turkish Research Council project – Istanbul Technical University
- ***The Effect of Climate Change on Supply Reliability of the Dam Reservoirs*** - Turkish Research Council project – Istanbul Technical University
- ***Climate Change Effects on Water Resources of Istanbul*** – Istanbul Water and Sewarage Administration project
- ***Climate Scenarios for Konya Closed Basin and East Mediteraanean Regions*** – WWF-Turkey project







Adaptation Studies – Water Resources

- *Adaptation to CC in Seyhan Basin*

  DSI (State Water Works) and UNDP

- *Anatolia Water Basins Rehabilitation*

  World Bank, and Global Eenvironmental Fund (carried out in 28 micro basins around Anatolia)

- *Capacity Building for Water Sector*

  EU – Establisment of Water Framework Directive







National climate change adaptation strategy & action plans

National Adaptation Strategy prepared under the coordination of the Ministry of Environment & Urbanization

5 main sectors:

- **Water Resources Management**
- **Agriculture and Food Security**
- **Ecosystem Services & Biodiversity**
- **Disaster Risk Management**
- **Health**

541 Action







National climate change adaptation strategy & action plans

- Integrating adaptation to the impacts of climate change into water resource management policies
- Strengthening water resources management capacity, interagency cooperation and coordination with regard to adaptation to climate change
- Develop and expand R&D and scientific studies to ensure adaptation to the impacts of climate change in water resources management
- Integrated management of water resources in water basins for adaptation to climate change



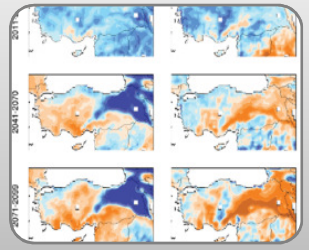








Climate change impacts on water resources project



Calculation of the water budget and budget deficits in river basins



Analysis of water impacts to sectors



Strategy documentation on adaptation activities tailored for each basin to support decision makers

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Strategy Development

- In the strategy establishment procedure, **the first challenge** is to collect information and data and to share the information systematically among stakeholders.



- For the developing countries, **collection of information** can be a complex process, as coordination among water sectors is most of the time is not well-established.
- **The second challenge** of strategy establishment is to develop policies that are specifically inclusive of all the water related issues.
- One of the most important problems within this second challenge is **financing of adaptive measures**.







EU Project: CLIMB

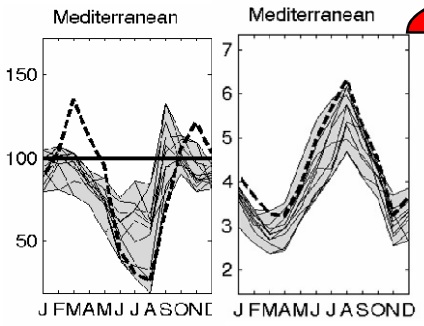
- **FP7-Topic:** ENV.2009.1.1.5.2
- **Funding period:** 01/2010 – 12/2013
- Project full title: Climate Induced Changes on the Hydrology of Mediterranean Basins – Reducing Uncertainty and Quantifying Risk through an Integrated Monitoring and Modeling System
- **Co-ordinator:** Ludwig-Maximilians-Universität München
- **Partner countries:** Germany, Italy, Austria, France, Tunisia, Turkey, Egypt, Palestinian administered areas, Canada. (9)
- **Partners:** 20
- **EC contribution:** 3.15 Mio €

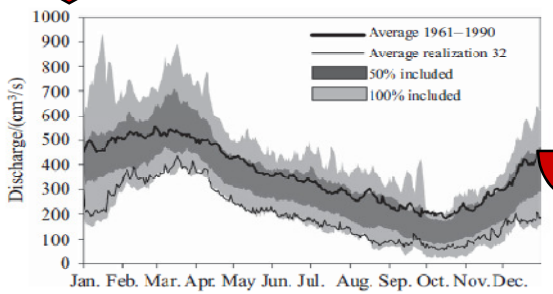
Climate Change Scenarios Uncertainty

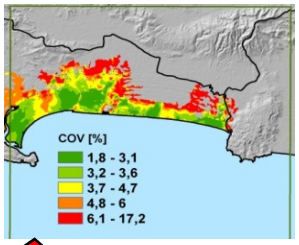
Hydrological Modelling Uncertainty

Risk & Vulnerability Assessment Uncertainty

propagation







propagation

- **Decision making under (quantified) uncertainty**
- **Uncertainty reduction**



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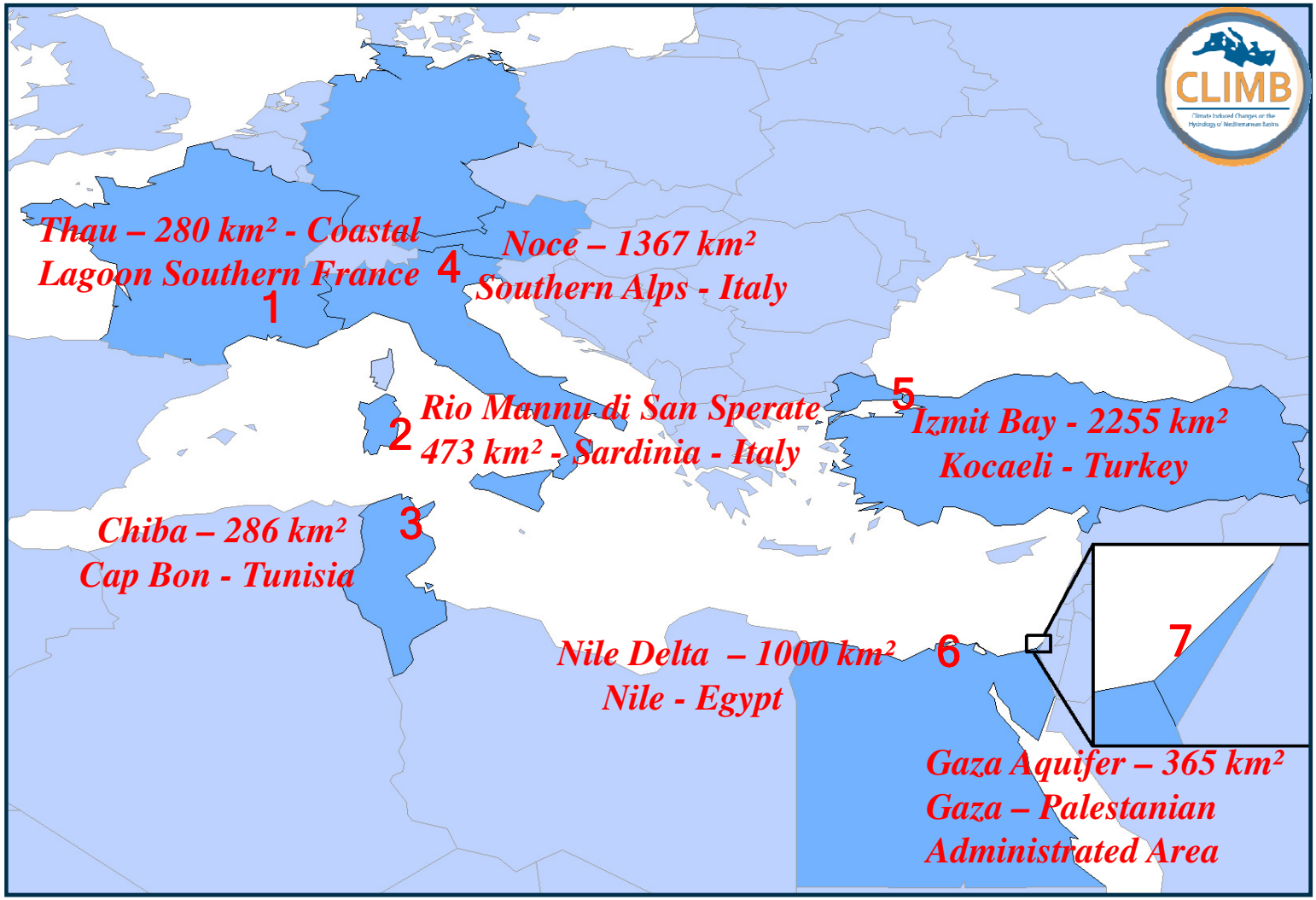








The EU Project CLIMB



The study sites, locations and surface areas

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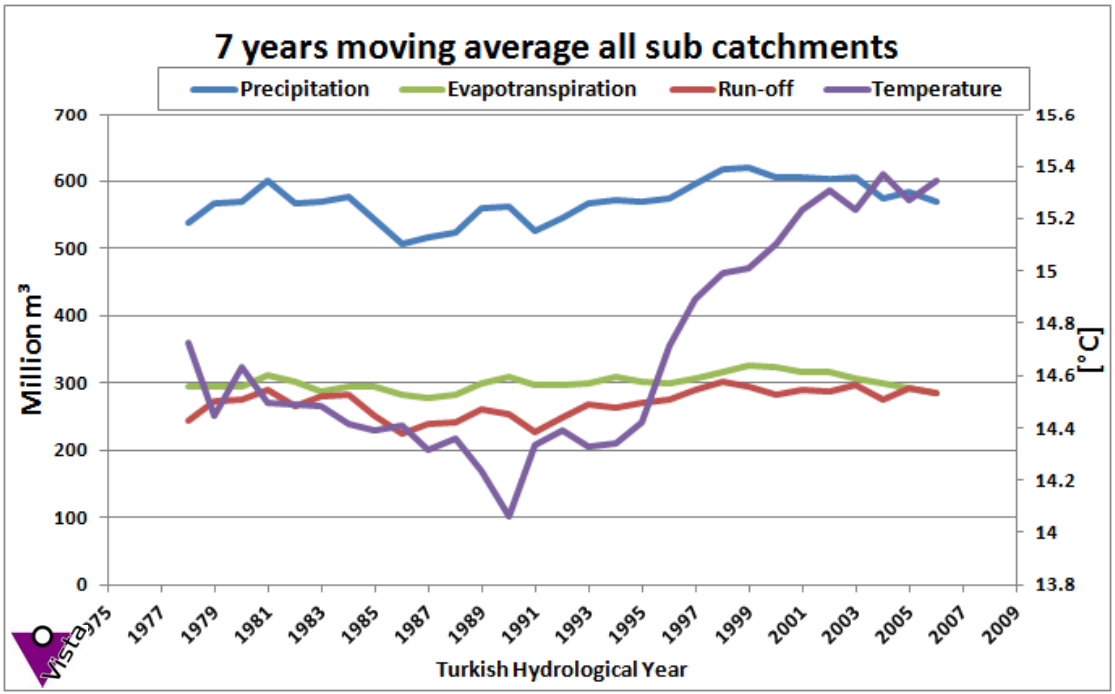




Climate Data

Meteorological data (1975-2010) shows that,

- Mean annual temperature is increasing,
- Mean annual precipitation in comparatively increasing,
- Runoff and Evapotranspiration have no significant change.



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Summary of results

- an ensemble of 4 regional climate models has been applied to drive the hydrological models PROMET and mGROWA.
- based on these simulation setups which comprise two hydrological periods from 1971-2000 (reference period) and 2041-2070 (future period) respectively, a bandwidth of possible future development paths of the regional water balance was determined.

- increasing precipitation during the winter months
- decreasing precipitation during the summer months
- groundwater recharge within the hydrological winter half year seems to remain stable
- extensive depletion of the soil water storage
- increasing irrigation demand on agricultural land
- pronounced change in sea level rise after year 2050.





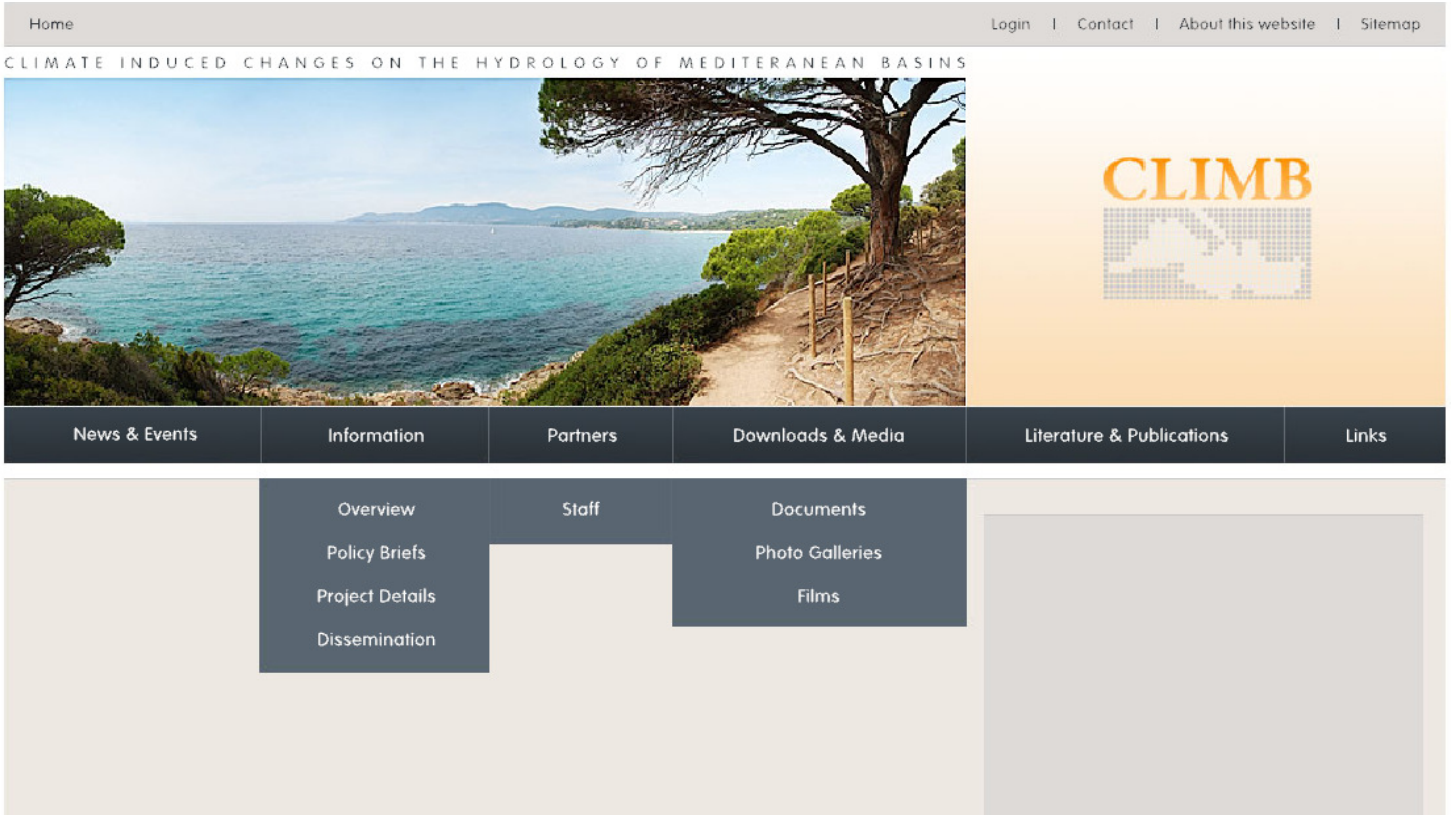






The EU Project CLIMB

www.climb-fp7.eu



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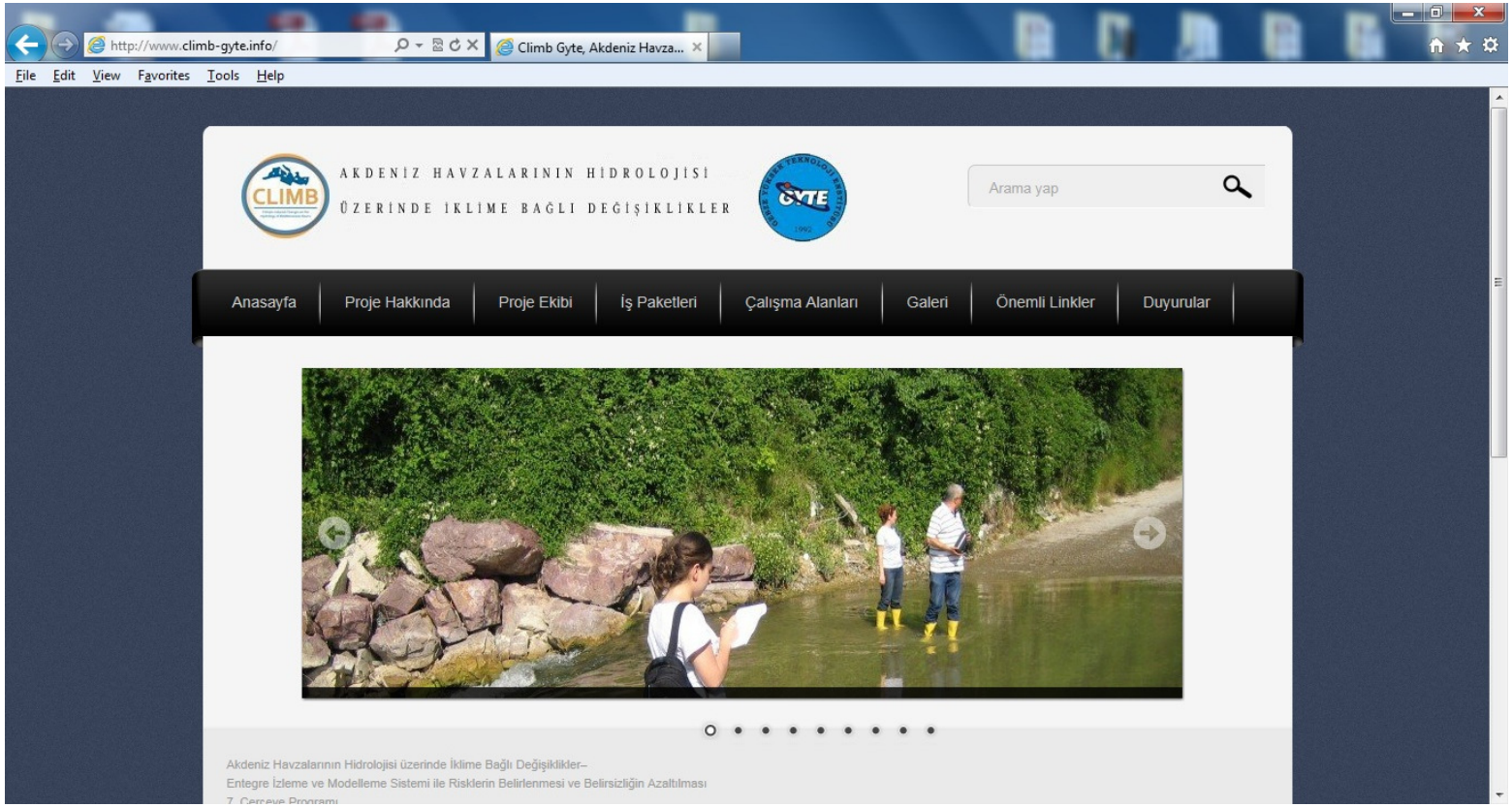








http://www.climb-gyte.info



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Last words…

- The pressure on water resources is ever increasing with overgrowing population and climate change, especially in the arid and semi arid regions. This calls for new approaches and strategies in water planning and management.
- Existing uncertainties in climate change impact analysis is another dimension that should be taken into consideration in IWRM strategy development.
- Integrated models (including climate and hydrology) should therefore be developed represent climate change conditions at catchment and sub-catchment level.
- Regional climate models must be run to reflect different levels of effects. Moreover, the outcome of these scenarios should be supported by accurate data.











Thank you…