

# CLIMATE CHANGE AND ADAPTATION: GREEK COASTAL AREAS and TRANSPORT INFRASTRUCTURE

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- Greece:
  - Geomorphology: rich diversity and spatial fragmentation
  - Limited size and available resources
  - Economic and environmental vulnerability
  - Capacity to manage risks and change
- Critical development/environment issues:
  - Diversity
  - Risks
  - Fragility
- Coastal areas are of special importance and interest

# Climate change impacts

## Climate change in the Mediterranean countries



Source :: UNEP GRID-Arendal / Zoi from IPCC, 2007 ; World Resources Institute, 2007 ; Rogers and Randolph in : Sciences, 2000 ; Fischer et al, 2005.

1: At a global scale, the overall Mediterranean basin is considered a hotspot. 2: Ratio between withdrawal and availability (2002). 3: Africa only.

Climate change



Environmental problem

- Increase in air temperature
- Precipitation reduction
- Sea level rise
- More frequent occurrence of extreme phenomena



Development model: Productive sectors and areas of interest are directly or indirectly affected by climate change and must adapt to maintain their momentum.

- Agriculture
- Aquaculture
- Tourism

***Need to integrate climate change - development model relationships in adaptation plans***

***As production will adapt in new spatial arrangements...so will transport patterns***



*...but...*

**climate change should not only be seen as a risk but as an opportunity as well**

*A valid analysis of climate change features allows:*

Protection of production sectors and the labour market

Identification and development of new production sectors

Highlighting the comparative advantages per production sector

Highlighting the importance of national and regional policy planning

"Educating" the state in long-term planning



## *Basic elements of the study*

The assessments of A1B (SRES) scenarios (and the equivalent of RCP 4.5) of the United Nations International Intergovernmental Panel on Climate Change (IPCC) were used.

What does the A1B suppose?

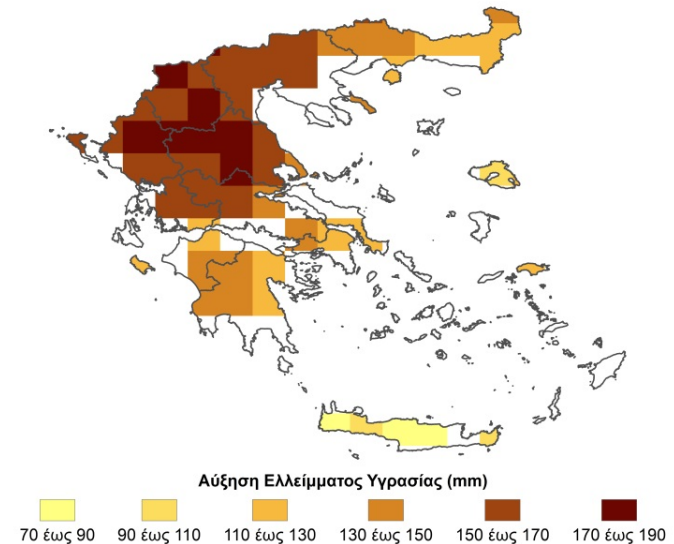
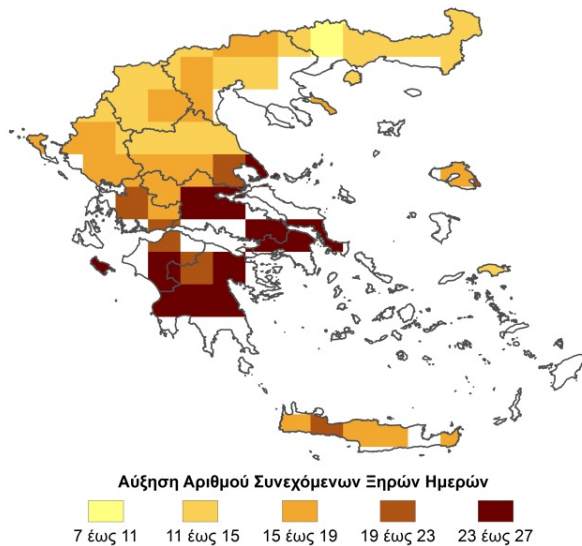
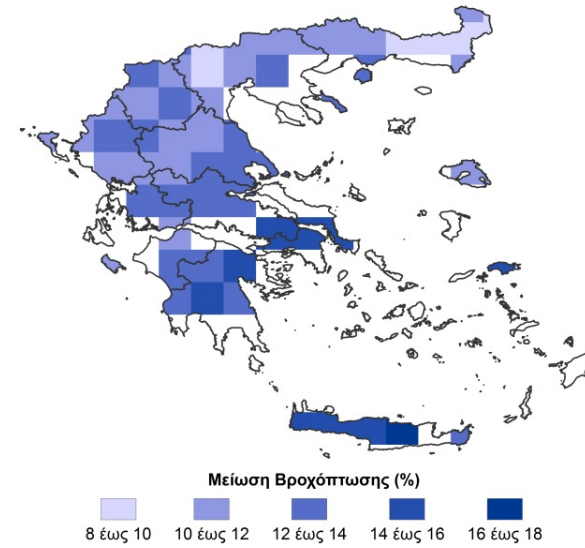
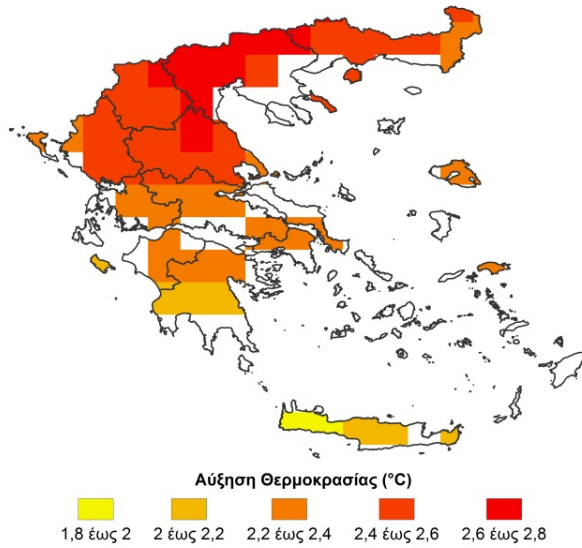
Rapid economic growth, particularly intensive energy consumption but also the dissemination of new technologies. Use of both fossil fuels and alternative energy sources. Small changes in land uses. Rapidly increasing the world's population by the year 2050 (9 billion) and gradually reducing it thereafter. A strong increase in the concentration of CO<sub>2</sub> in the atmosphere, which will reach 720 ppm in 2100.

Time period studied: **2046-2065**, in order to simulate the future climatic conditions for the mid-21st century.

The climatic data of the period 1961-1990 were used as initial climate model conditions.

Pilot examples focusing on climate change impacts in special interest areas like urban centers, coastal waterfronts, gulfs, islands, etc.

## Changes in the period 2046-2065 compared to 1961-1990

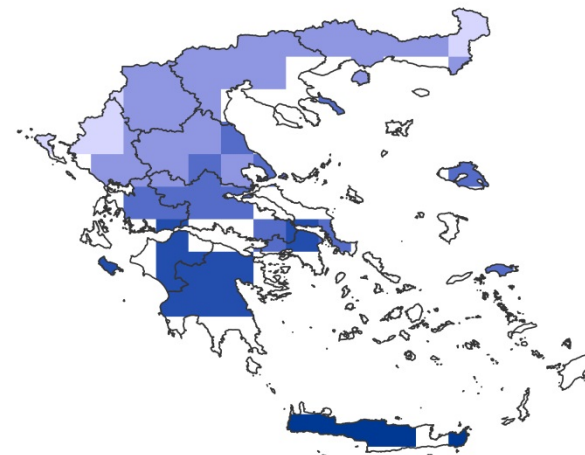
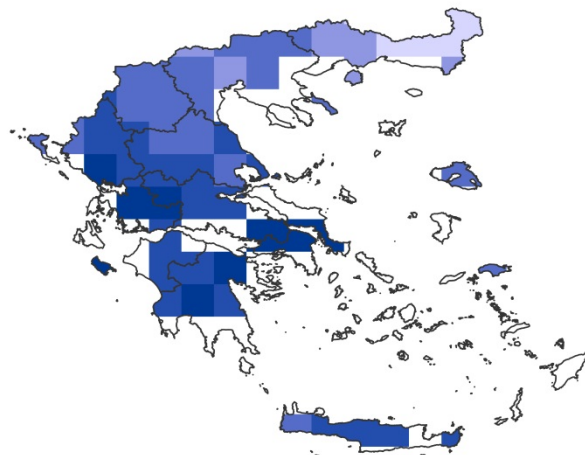
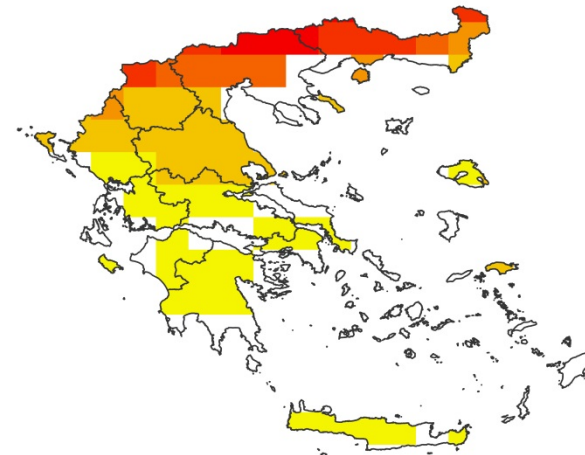
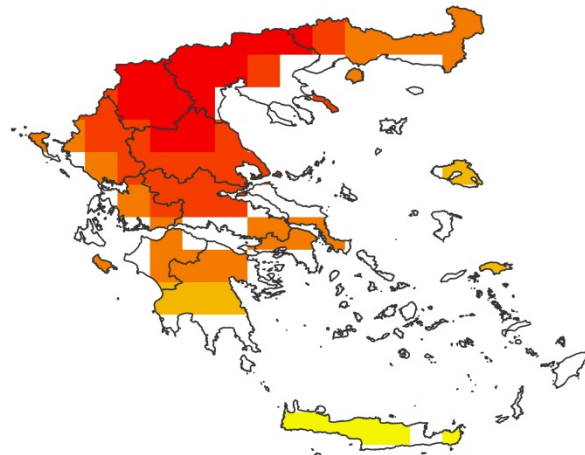






## Summer months

## Winter months







## Agricultural production

The climatic changes identified are:

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- A significant increase in temperature especially during the summer months and especially in agricultural areas in central and northern Greece.
- A significant increase in hot days mainly in the region of Thessaly and Eastern Macedonia.
- Reduction of rainfall by approximately 30% and 10% in the summer and winter months respectively.
- Reduction of the drought index (i.e. tendency to convert soils to dry) in western Thessaly and western Peloponnese.
- A significant increase in the humidity deficit mainly in western Thessaly and in spatial units in northern Greece and
- Reduction in the number of days of frost.



## Marine Aquaculture

The impacts on aquaculture depend on the level rise of the sea (half a meter up to 2050) but also from parameters such as surface sea temperature and carbon sequestration in marine waters, whose change in the future is difficult to assess accurately.

It is therefore necessary to assess whether there is a need to redefine the location of areas of organised aquaculture development in order to avoid adverse effects due to climate change.



## Tourism

- Increase of "hot days" especially in southern Greece.
- A significant increase in graded cooling days, which will affect the operating costs of tourist enterprises in the summer, as well as a reduction in the graded heating days which will limit the costs of tourist units in winter Tourist destinations
- Reduction of rainfall in all study areas, which will affect water availability
- Tourist areas in central and northern Greece will experience prolongation of the tourist season due to the increase in temperature

Climate change impacts in coastal areas affect:

- Resource availability i.e. land, water and energy
- Coastal development (beaches, infrastructure, etc.)
- Environmental risks (floods, fires)
- Landscape changes
- Coastal ecosystem functions

## Climate change impacts and development patterns

- Impacts on the competitiveness of areas and regions
- Urbanization patterns, especially in coastal zones
- Diversified impacts-geographic variation and diversity

Area specific dynamism and risks : special adaptation issues

*Need to prioritize support systems*

*For example in terms of **transport infrastructure***

- *Redevelopment/renovation priorities*
- *New specifications and guidelines for new development*
- *Emergency response mechanisms*

- Governance:
  - Spatial development and Planning
    - especially ICZM
  - Regulation
  - Incentives
  - Infrastructure Investments
  - Monitoring and Evaluation
  - Education/awareness/capacity building
  - Stakeholder consultation
- Need to introduce special interest on adaptation in planning and

## CHALLENGES

- Integrated approach (development – environment)
- Multidimensional interface (local, supra-local)
- Flexibility-adaptability (planning – management)
- Participation (consultation-governance)
- Monitoring and Evaluation (key indicators)
- Capacity building for action





*Thank you for your attention*

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