EU Green Week

PARTNER EVENT

Climate Projection Study, Vulnerability & Risk Assessments – Water Management Sector

DIRECTORATE of CLIMATE CHANGE

Lisbon, Portugal
4 June 2024

#WaterWiseEU

UNECE

World Health Organization
REGIONAL OFFICE FOR Europe

PROTOCOL ON WATER AND HEALTH

REPÚBLICA PORTUGUESA
AMBIENTE E ENERGIA

SECRETARIA-GERAL DO AMBIENTE

ERSAR

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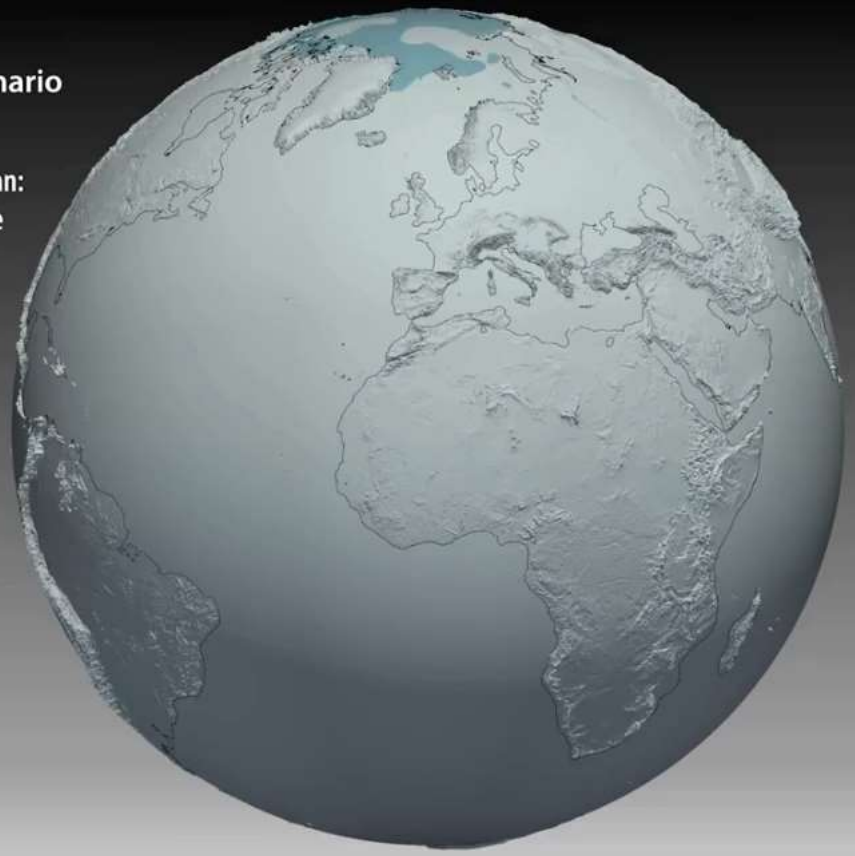
- Impacts of Climate Change on the Mediterranean Region
- Türkiye's Climate Projection Study
- Vulnerability and Sectoral Risk Assessment Methodology and Results – Water Management Sector

1

IMPACTS OF CLIMATE CHANGE ON THE MEDITERRANEAN REGION

Intermediate Scenario
(SSP2-4.5)

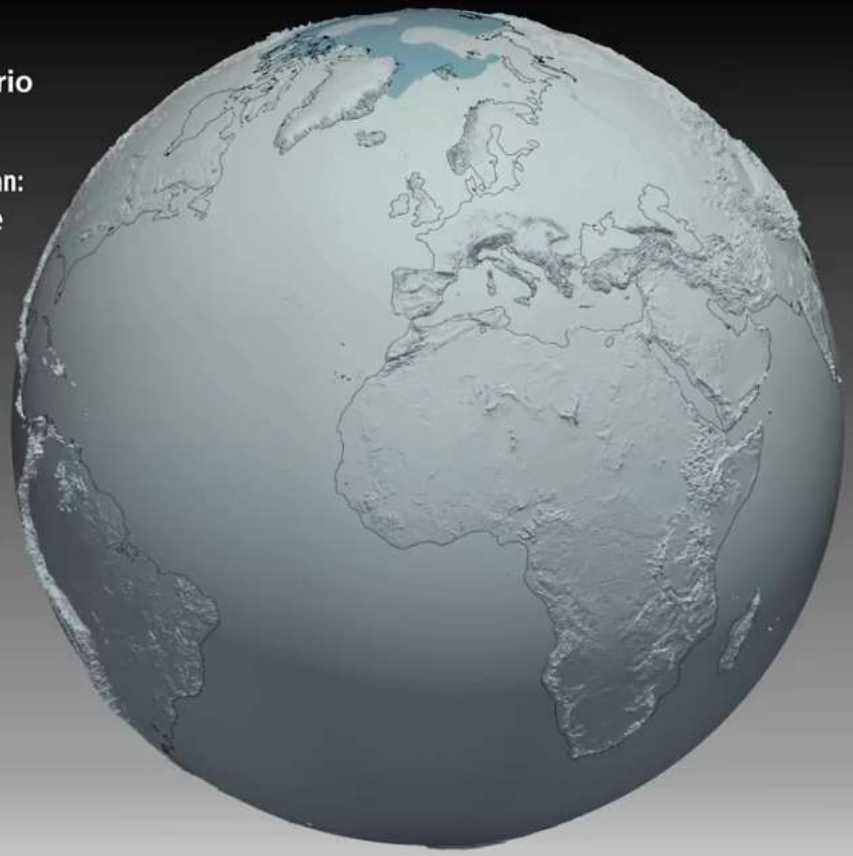
CMIP6 Multi Model Mean:
Projected Mean Surface
Temperature Change
relative to 1995-2014



1995

Pessimistic Scenario
(SSP5-8.5)

CMIP6 Multi Model Mean:
Projected Mean Surface
Temperature Change
relative to 1995-2014



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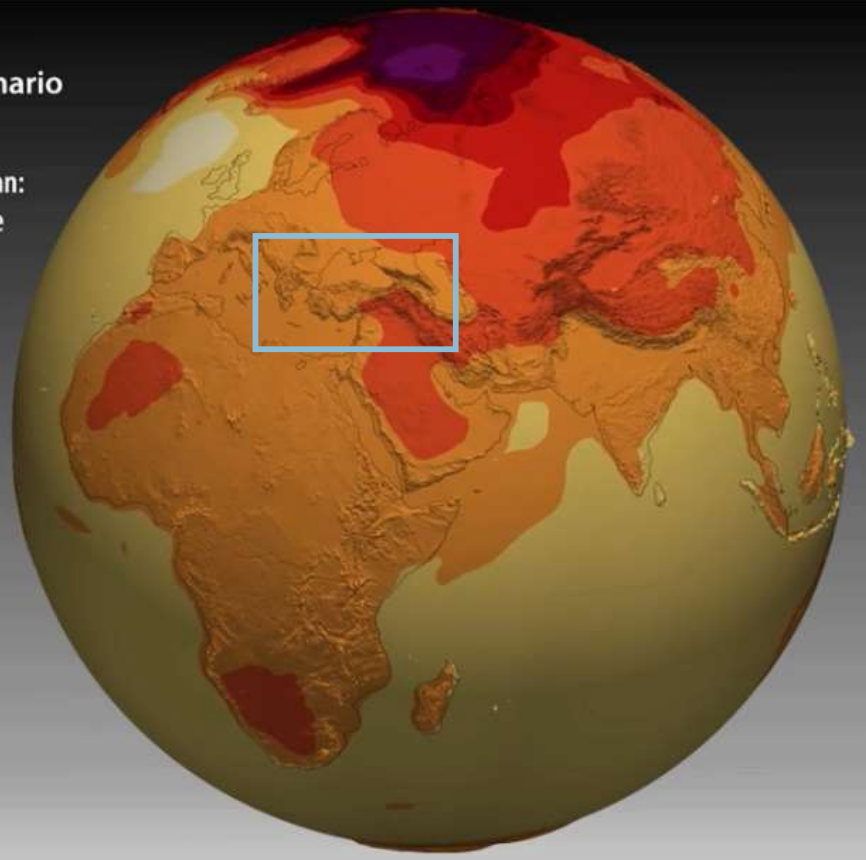
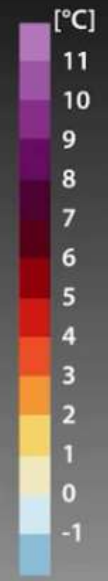
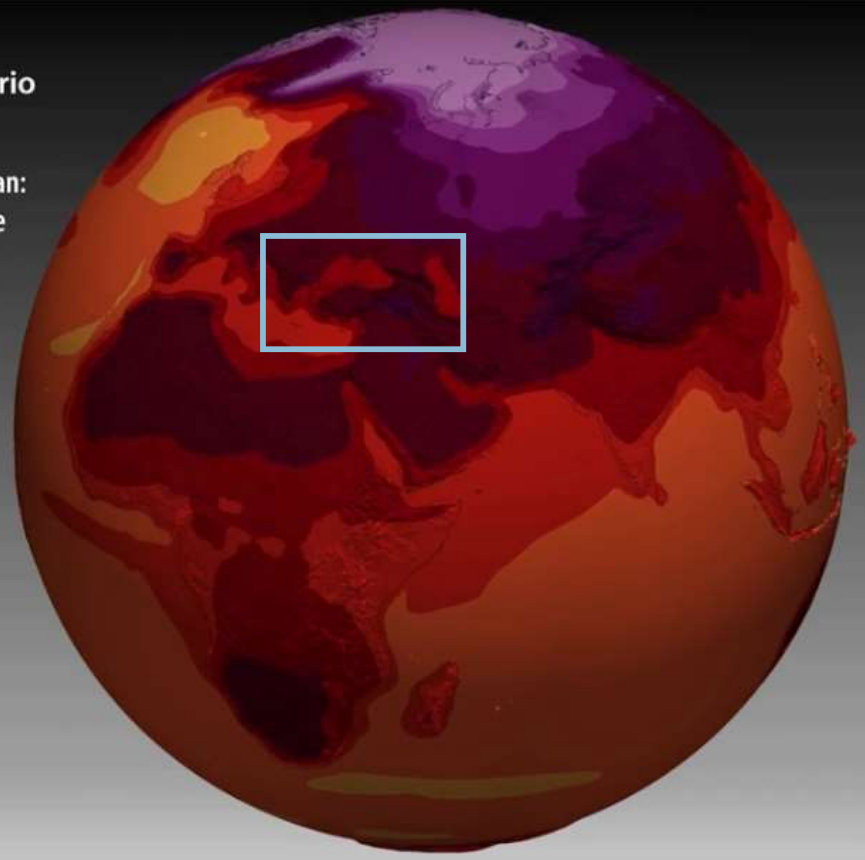




2100

Pessimistic Scenario
(SSP5-8.5)

CMIP6 Multi Model Mean:
Projected Mean Surface
Temperature Change
relative to 1995-2014



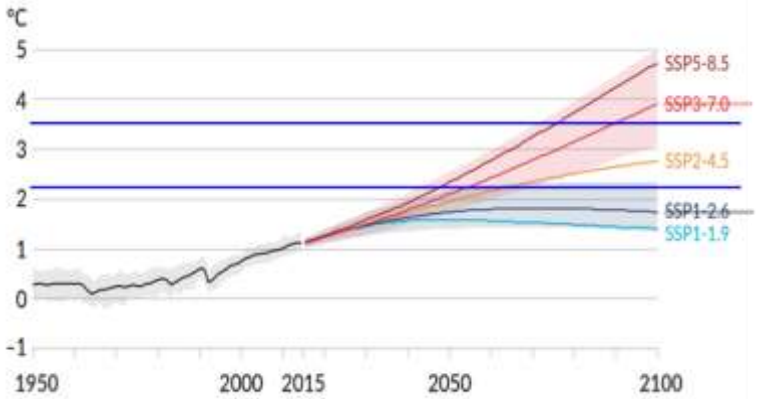
Vulnerability of Mediterranean Region and Europe Continent

Global earth temperatures have increased average of **1.45 °C** compared to the pre-industrial revolution period in 2023.

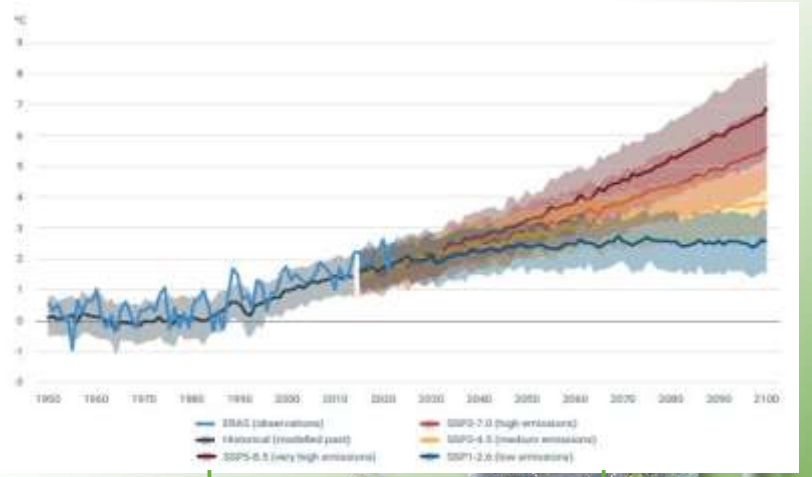
The temperature increase in the **Mediterranean Region is above the global increase**
IPCC Mediterranean Region Report, temperature has exceeded **1.5 °C**

European Environment Agency - Europe is the fastest-warming continent in the world.

The orange part represents the Mediterranean countries.



IPCC AR6 – SSP8.5 – 5oC – Global Scale

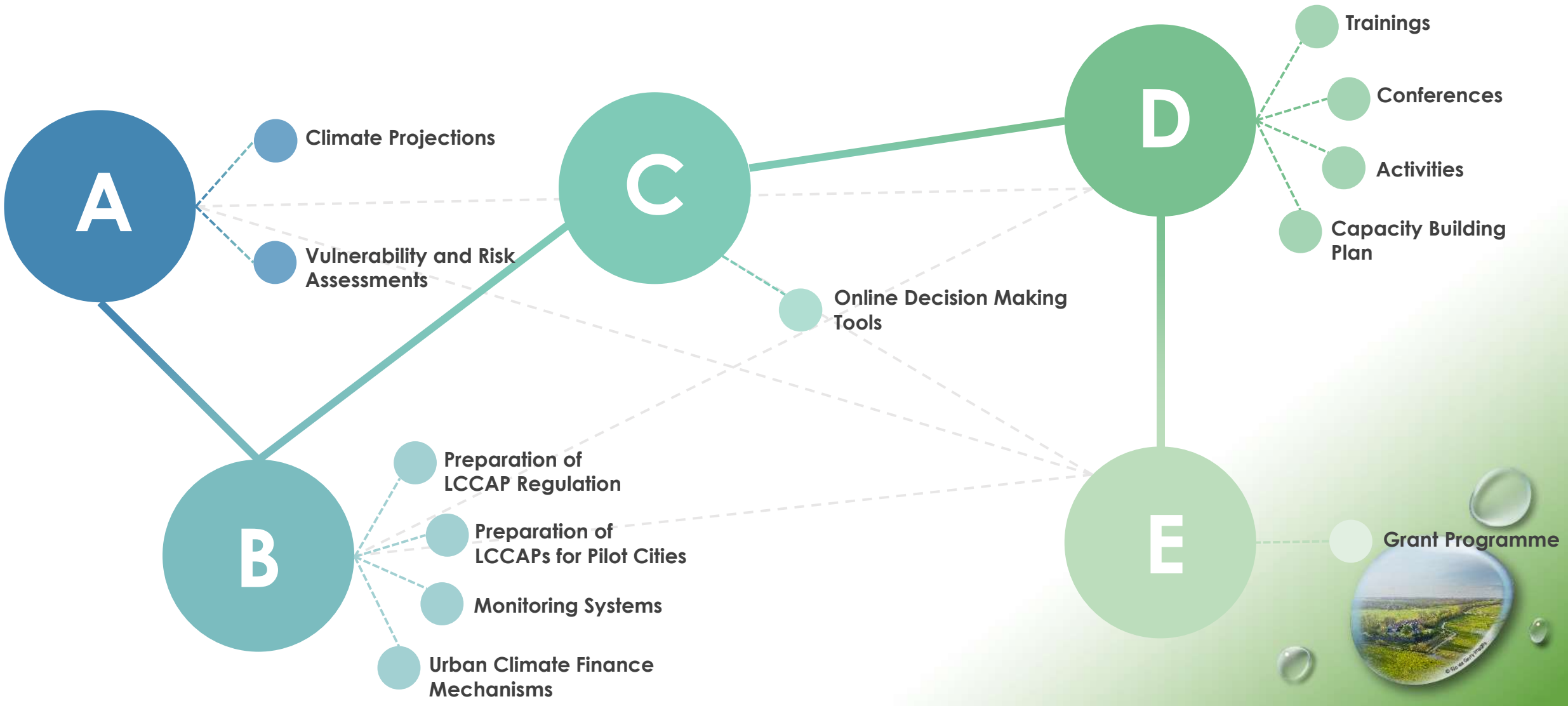


EEA– SSP8.5 – 7oC – Europe Scale

2

TÜRKİYE'S CLIMATE PROJECTION STUDY

Local Climate Actions for EU Partnership Project



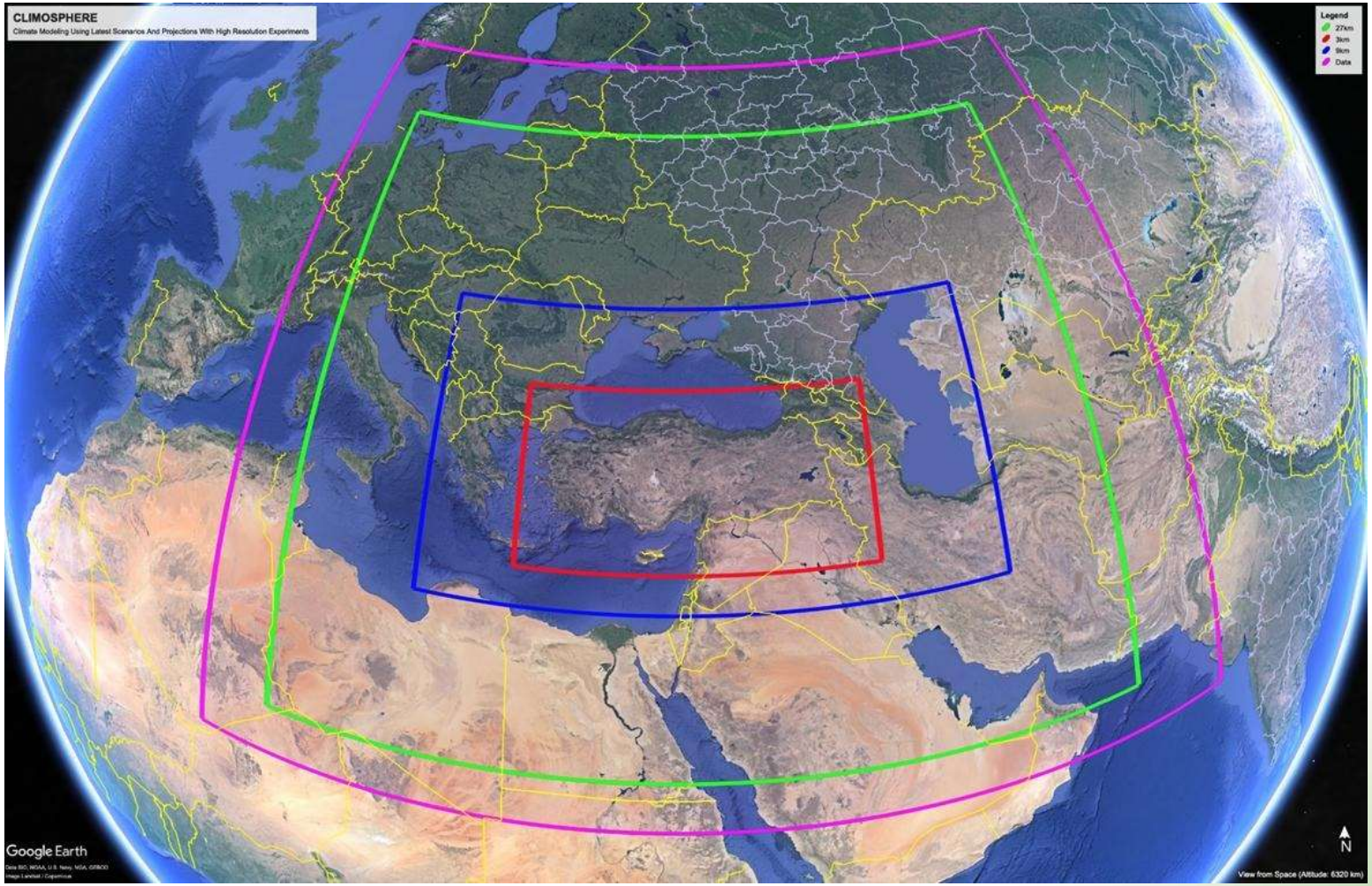
Climate Projections and Vulnerability – Risk Assessments

IPCC CMIP6

- Selection of 6 GCMs for Türkiye Domain
- 2 SSPs Scenarios (SSP 2-4.5 & SSP 5-8.5)
- 1950 – 2015 Historical – 2015 – 2100 Future
- 3 km resolution

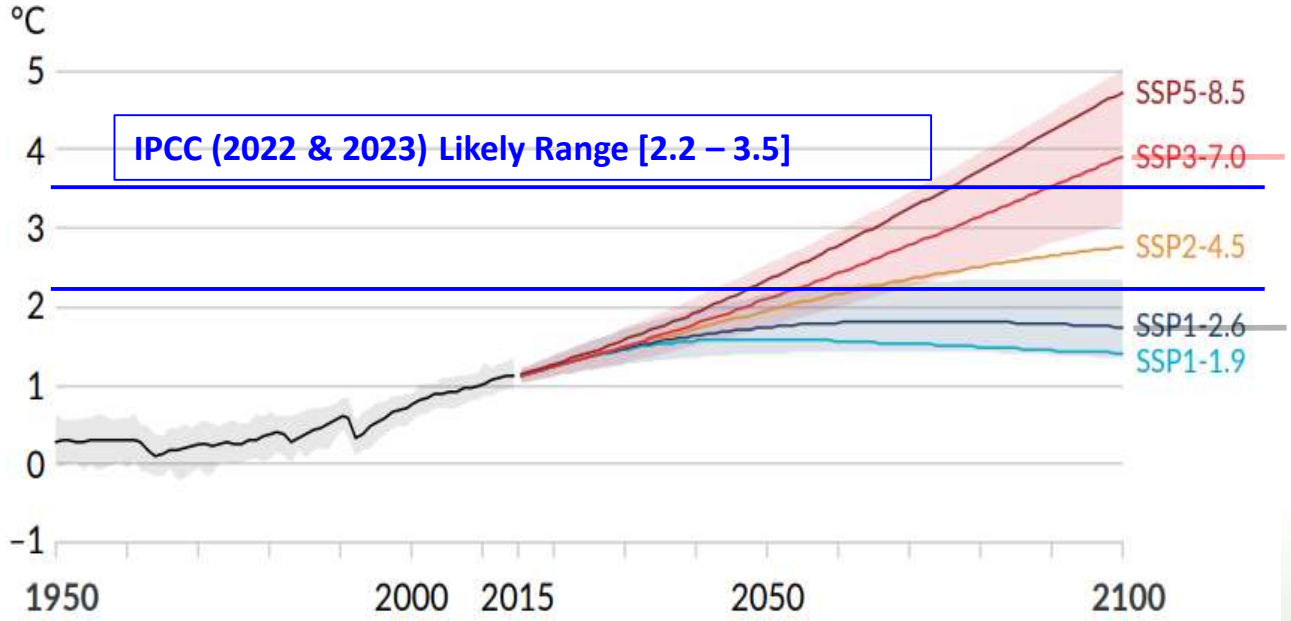
1. Selection of 6 GCMs representing the Türkiye domain and running models under up-to-date SSPs scenarios
2. Generation Regional Climate Models by dynamic downscaling of the selected GCMs to 3 km resolution
3. Assesing previous climate projections
4. Bias correction of the models
5. Calculating climate indices
6. Updating vulnerability and sectoral risk assesments

Climate Projections - Domain



Selection of GCMs and SSPs

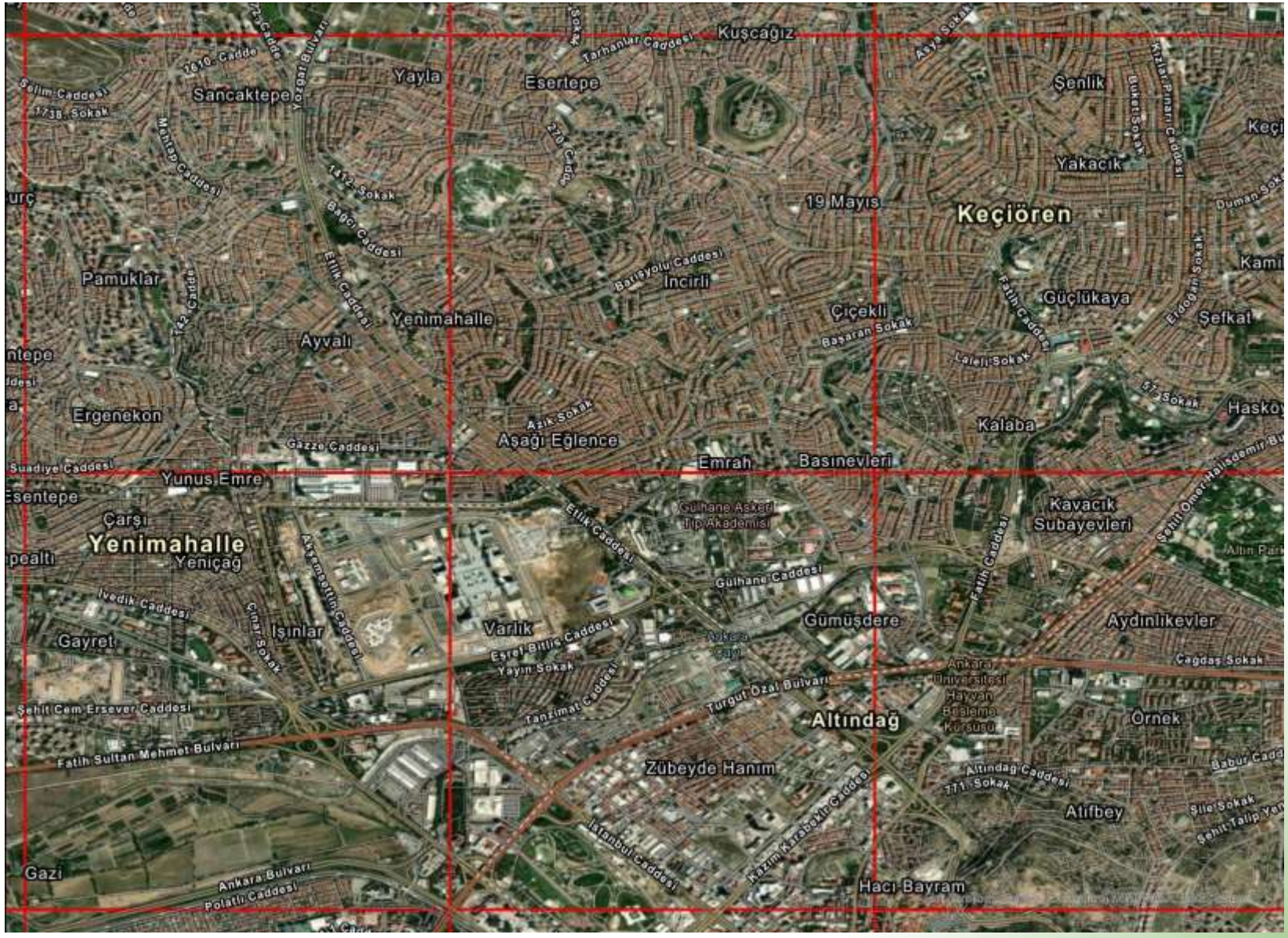
GCMs – Turkish State Meteorological Service (MGM)	GCMs – Directorate of Water Resources Management (SYGM)
HadGEM2 - ES	HadGEM2 - ES
MPI-ESM-MR	MPI-ESM-MR
GFDL-ESM-2M	CNRM-CM5.1



Institute	Regional Climate Model	Resolution	Scenarios
MGM	RegCM4.3	Outer Domain 50 km Inner Domain 20 km	RCP 4.5 & RCP 8.5
SYGM	RegCM4.3	Outer Domain 50 km Inner Domain 10 km	RCP 4.5 & RCP 8.5

GCMs (Country)	Historical	SSP2-4.5	SSP5-8.5
CMCC-ESM2 (Italy)	Hist	SSP2-4.5	SSP5-8.5
EC-Earth3-Veg (Europe)	Hist	SSP2-4.5	SSP5-8.5
HadGEM3 (UK)	Hist	SSP2-4.5	SSP5-8.5
MPI-ESM1-2-HR (Germany)	Hist	SSP2-4.5	SSP5-8.5
MRI-ESM2-0 (Japan)	Hist	SSP2-4.5	SSP5-8.5
NorESM2-MM (Norway)	Hist	SSP2-4.5	SSP5-8.5
TOTAL	12	6	6

Climate Projections - Resolution



Climate Projection Outputs

- 2m air temperature
- Precipitation,
- 10m and 100m horizontal wind components (U and V),
- Surface specific humidity,
- Surface pressure
- Incoming solar radiation,
- Incoming direct solar radiation,
- Incoming longwave radiation,
- Sea surface temperature,
- Surface runoff, subsurface flow,
- Snow water depth,
- Snow water equivalent, and actual evapotranspiration,
- Wind-u (850 hPa, 500 hPa, 250 hPa),
- Wind-v (850 hPa, 500 hPa, 250 hPa),
- Air temperature (850 hPa, 500 hPa, 250 hPa)
- Specific humidity (850 hPa, 500 hPa, 250 hPa),
- Geopotential height (850 hPa, 500 hPa, 250 hPa),
- Specific humidity (850 hPa, 500 hPa, 250 hPa),
- Albedo,
- Skin temperature,
- Soil temperature (at 4 depths),
- Soil moisture (at 4 depths),
- Cloud fraction,
- Rain water mixing ratio (1000 Hpa, 850 Hpa, 700 Hpa, 500 Hpa),
- Cloud water mixing ratio (1000 Hpa, 850 Hpa, 700 Hpa, 500 Hpa)

Climate Indices

- Standardized Precipitation Evapotranspiration Index (SPEI) Index 3, 6, 12, and 24 (SPEI3, SPEI6, SPEI12, and SPEI24)
- Annual total precipitation from daily precipitation > 95th percentile (R95P)
- Heat Wave Frequency (HWF)
- Fire Weather Index (FWI)
- Cold Wave Frequency (CWF)
- Extreme wind speed index (W98)
- Consecutive Dry Days (CDD)
- Consecutive Wet Days (CWD)
- Number of heavy rain days (R10mm)
- Number of very heavy rain days (R20mm)
- Mean daily maximum temperature (TXm)
- Mean daily minimum temperature (TNm)
- Total annual PR from very heavy rain days (R99p)
- Coldest daily minimum temperature (TNn)
- Warmest daily minimum temperature (TNx)
- Max 1-day PR (Rx1day)
- Max 5-day PR (Rx5day)
- Annual total wet-day PR (PRCPTOT)
- Contribution from very wet days (R95pTOT)
- Contribution from extremely wet days (R99pTOT)
- Daily PR intensity (SDII)
- Frost days (FD)
- Ice Days (ID)
- Summer days (SU)
- Tropical nights (TR)
- Warm spell duration indicator (WSDI)
- Cold spell duration indicator (CSDI)
- Warmest daily maximum temperature (TXx)
- Coldest daily maximum temperature (TXn)

3

VULNERABILITY AND SECTORAL RISK ASSESSMENTS

Methodology

- Vulnerability and Sectoral Risk Analyses Methodology Based On IPCC AR5

Formula	Source
$R = H * V$	Johnson et al. (2016); Life Sec Adapt (2017)
$R = H + E + V;\ V = S - AC$	Ortega-Gaucin et al., 2021
$R = H * (E + S)/AC$	Zarafshani et al., 2016
$R = H * E * S(1 - AC)$	Das et al., 2020
$R = H * E * S/AC$	Rana and Routray, 2016; Salam et al., 2021
$R = H * E * V$	Liu et al., 2016; Allen et al., 2018; Connelly et al. (2018); KC et al., 2021; Kim et al., 2021

R: Risk
H: Hazard
E: Exposure
V: Vulnaribility
S: Sensitivity
AC: Adaptive Capacity

Methodology

1	Preparing Sectoral Dataset & Impact Chain
2	Determining the Indicators
3	Collecting Sectoral Data
4	Normalization
5	PCA Analysis
6	Calculating Sectoral Climate Risk
7	Classification
8	Result

$$Xij = \frac{(Xi - Min\ Xj)}{(Max\ Xj - Min\ Xj)}$$ → Normalization

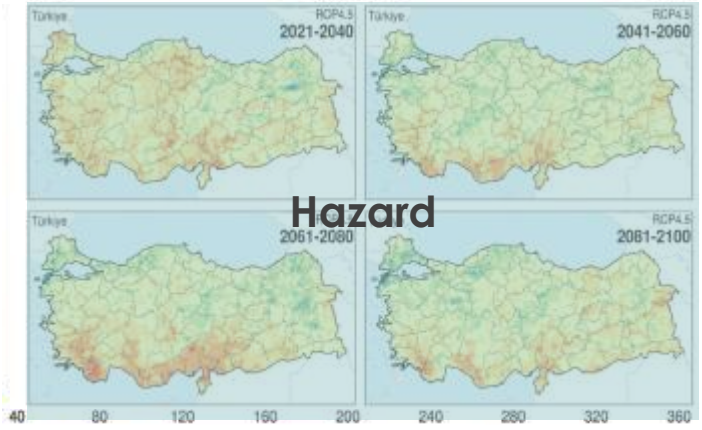
$$M, D, UK = \sum_{i=1}^{n} X_i \times A_i$$ → PCA Analysis

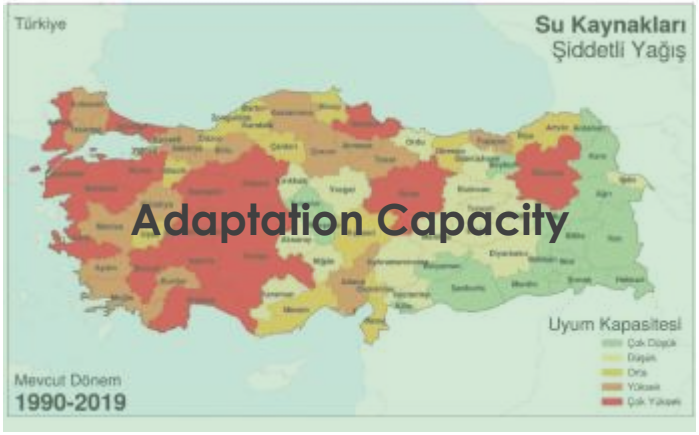
V = S (1-AC) → Vulnerability

V=vulnerability,
S=sensitivity,
AC=adaptation capacity

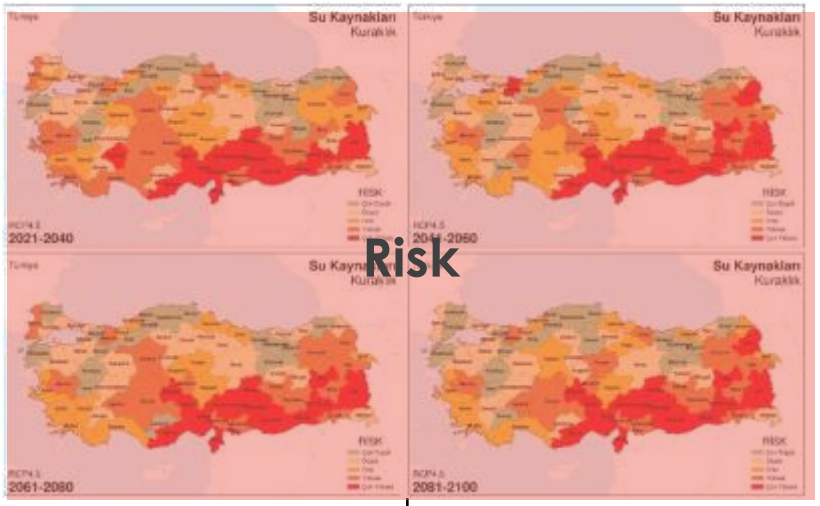
R = H × E × S (1-AC) → Risk

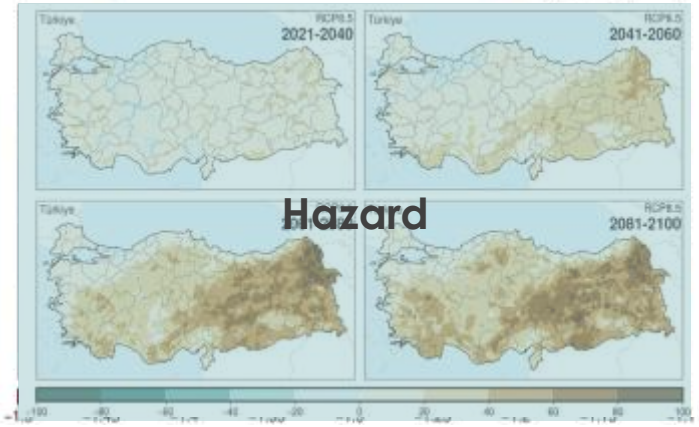
R= risk,
H= hazard,
E= exposure





Vulnerability and Sectoral Risk Analysis (İklime Uyum, 2022)





Vulnerability and Sectoral Risk Analysis (İklime Uyum, 2022)

Local Climate Action with EU Partnership Project

- Determining priority sectors for each NUTS
- Establishing the scope of an indicator-based climate change vulnerability and risk assessment for each Level 1 region of Türkiye, including a summary of selected sectors and discussing with key stakeholders
- Determining climate hazards an updating vulnerability and risk assessments accortding to IPCC's 6th Assessment Cycle
- Estimation of the economic impacts of climate change for each NUTS 1 region

Thank you for your attention!