



# **ADAPTATION TO CLIMATE CHANGE - relevant modelling studies**

**GEO-CRADLE Workshop & Project Meeting 16-  
17 November 2016  
Limassol, Cyprus**

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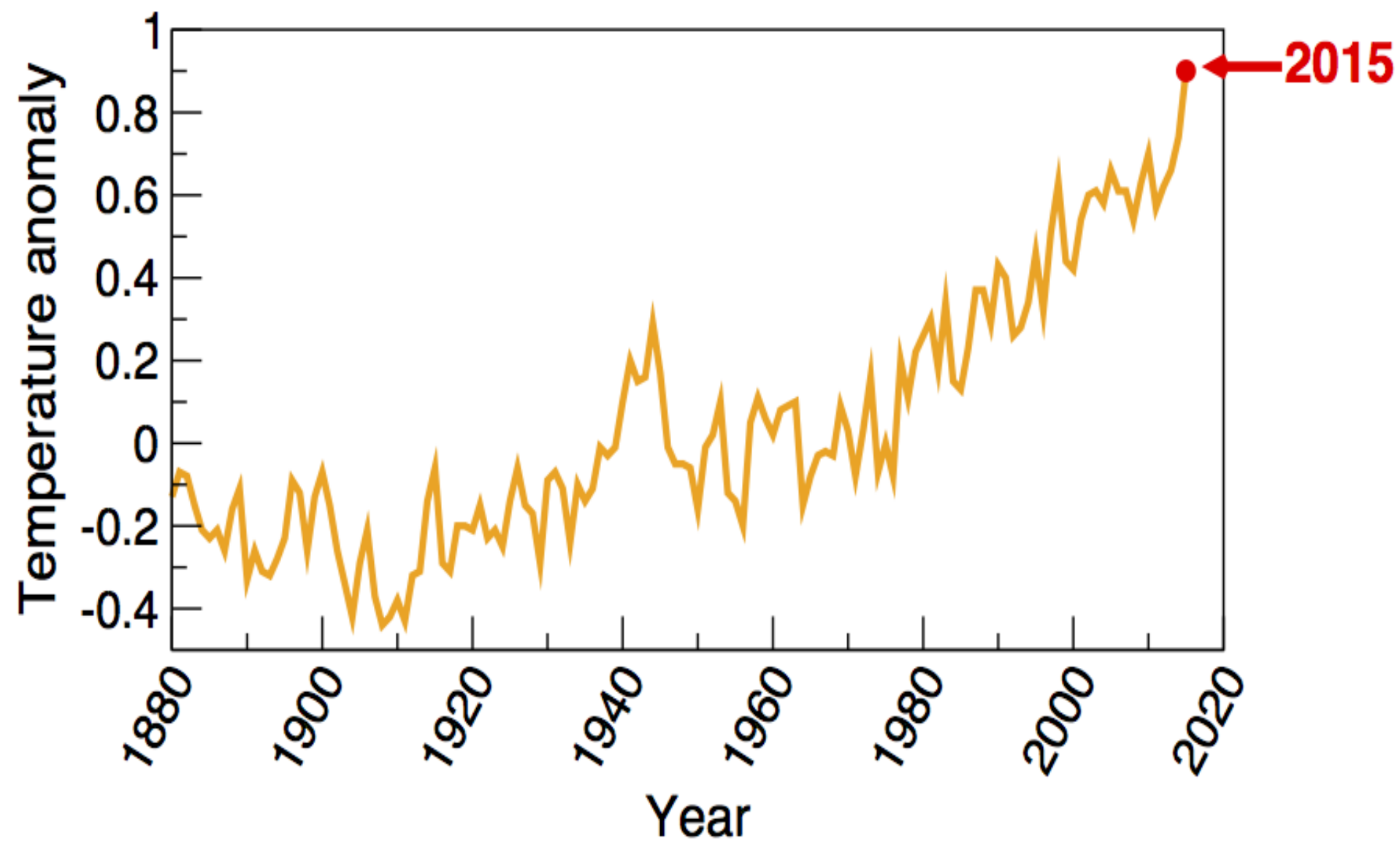
# L'OBJECTIF 2°C

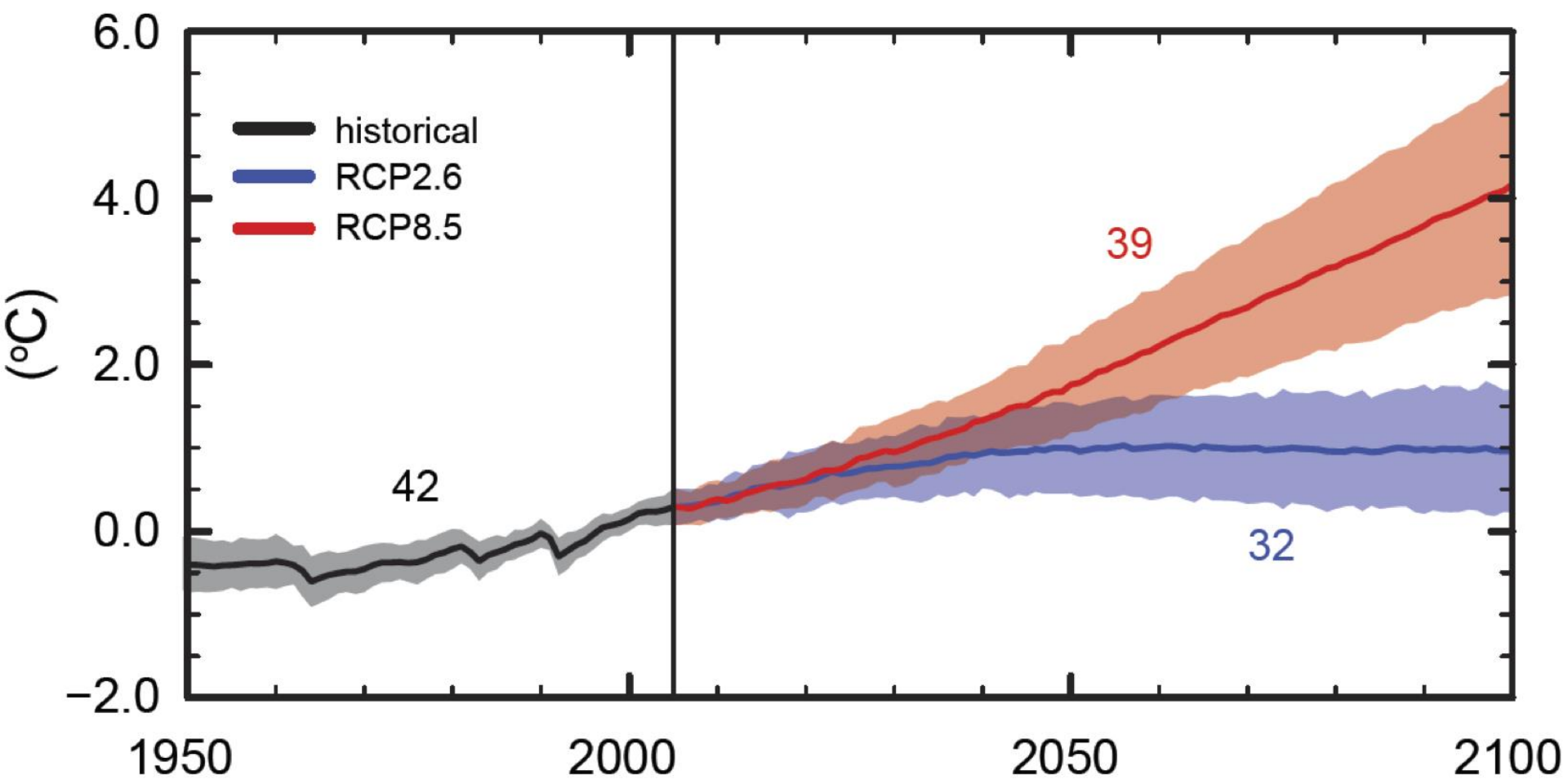




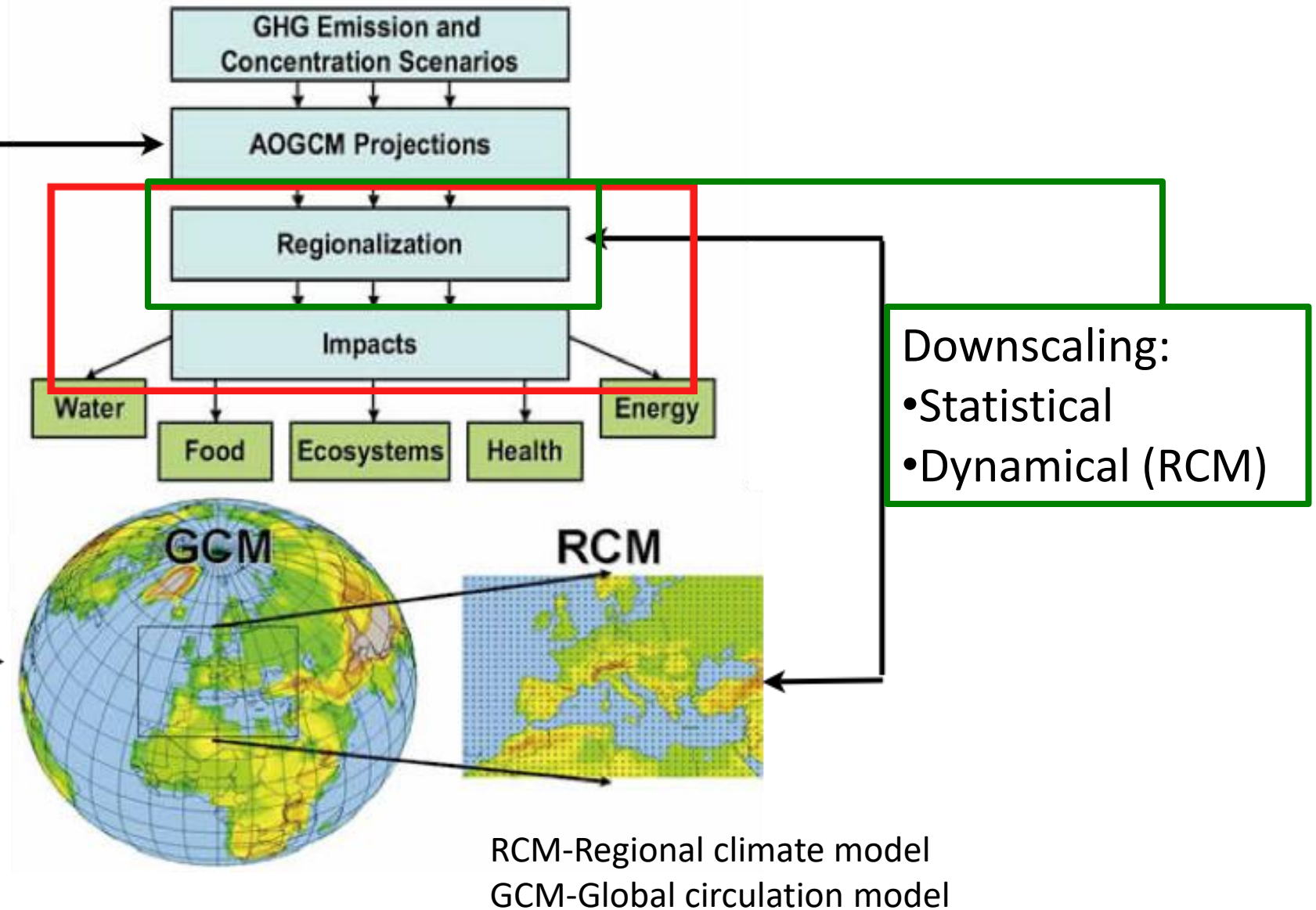
Paris Agreement: Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change





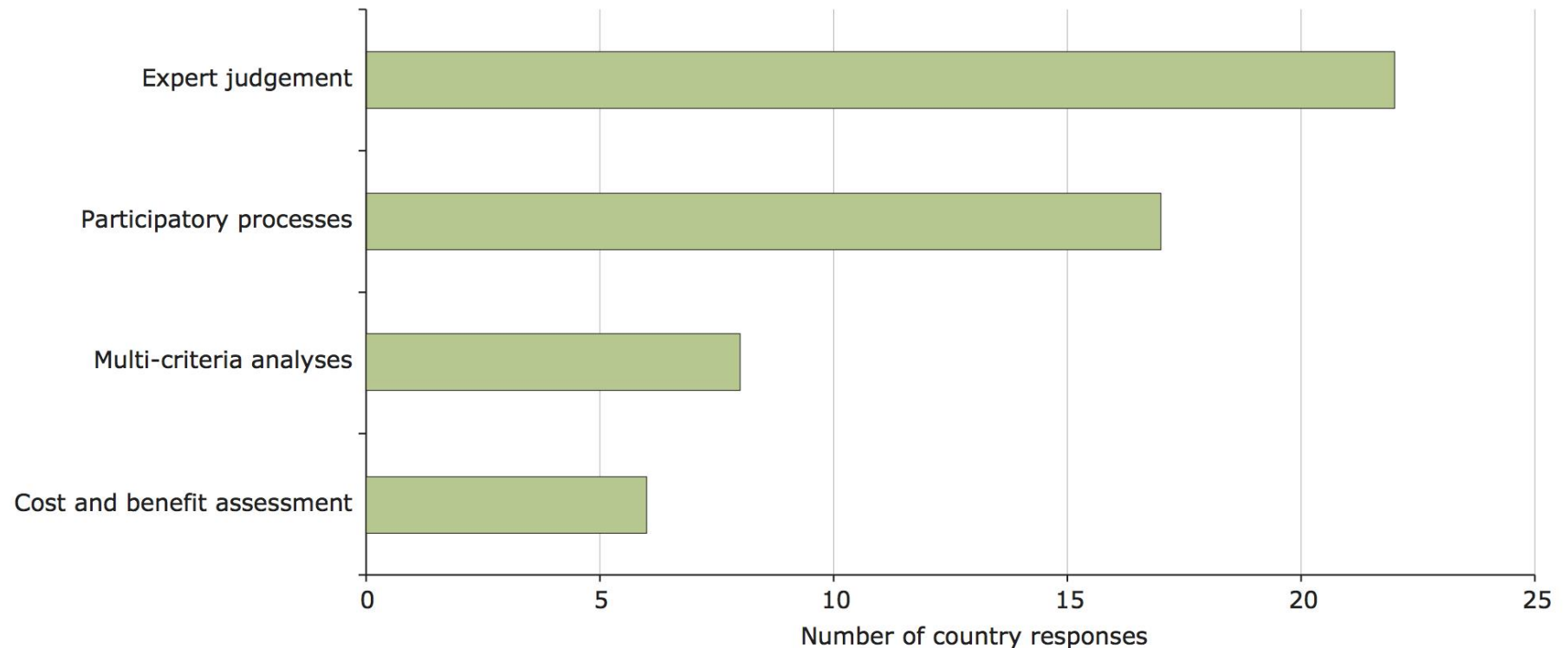


## Regionalization of climate change scenarios



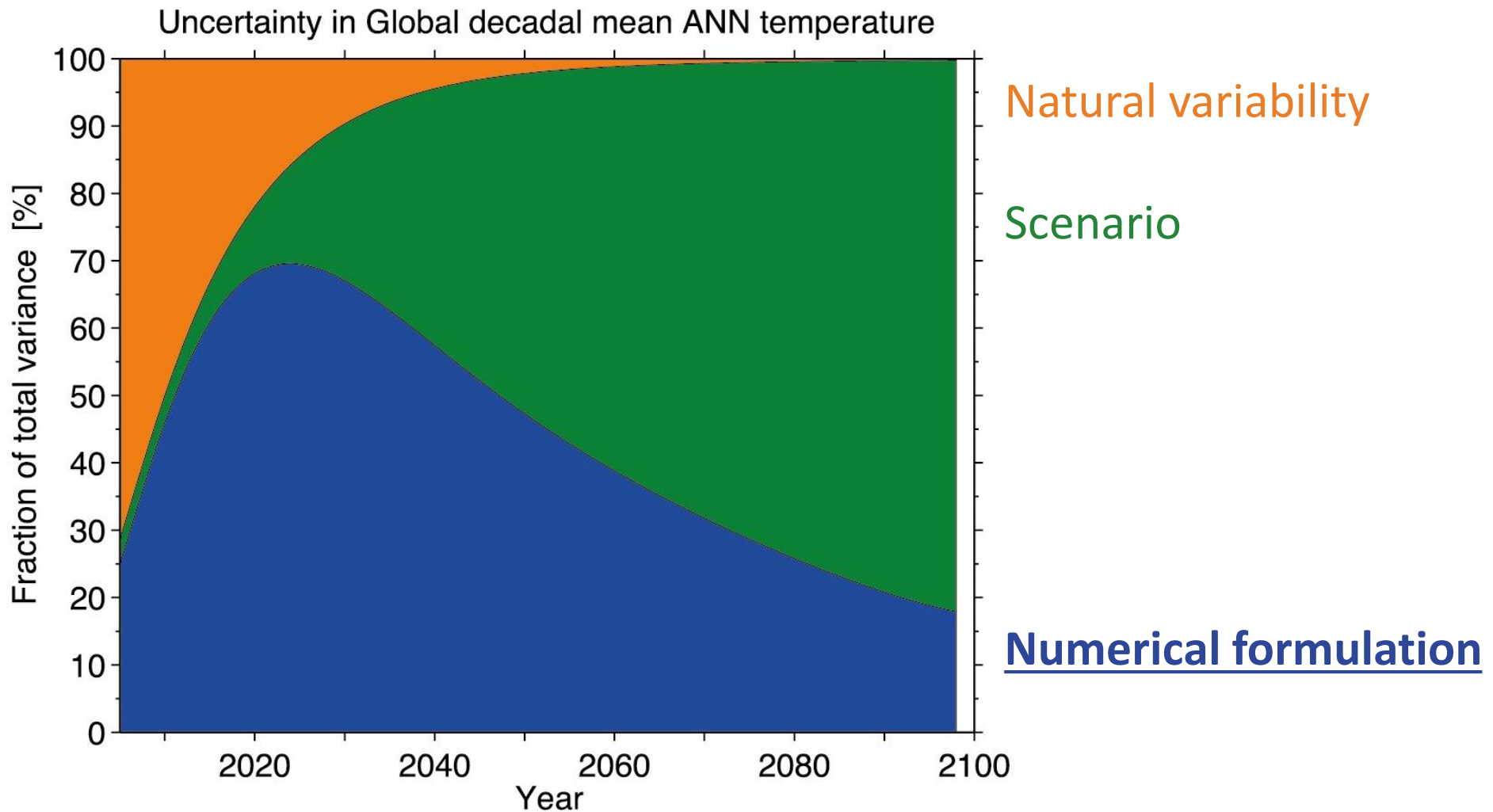
# EU National adaptation policy processes in European countries — EEA, 2014

**Figure 2.9 Methodological approaches for designing adaptation options (Question 23; 25 responding countries)**





# To access uncertainty in future changes and impacts we need multi-model ensemble





# Past projects - multi model ensemble



Prediction of Regional scenarios and  
Uncertainties for Defining European Climate  
change risks and Effects (FP5 - ended in 2004)



- Develop an ensemble prediction system for climate change based on the principal state-of-the-art, high resolution, global and regional Earth System models
- Quantify and reduce the uncertainty in the representation of physical, chemical, biological and human-related feedbacks in the Earth System
- Maximise the exploitation of the results by linking the outputs of the ensemble prediction system to a range of applications (FP6 – ended in 2009)



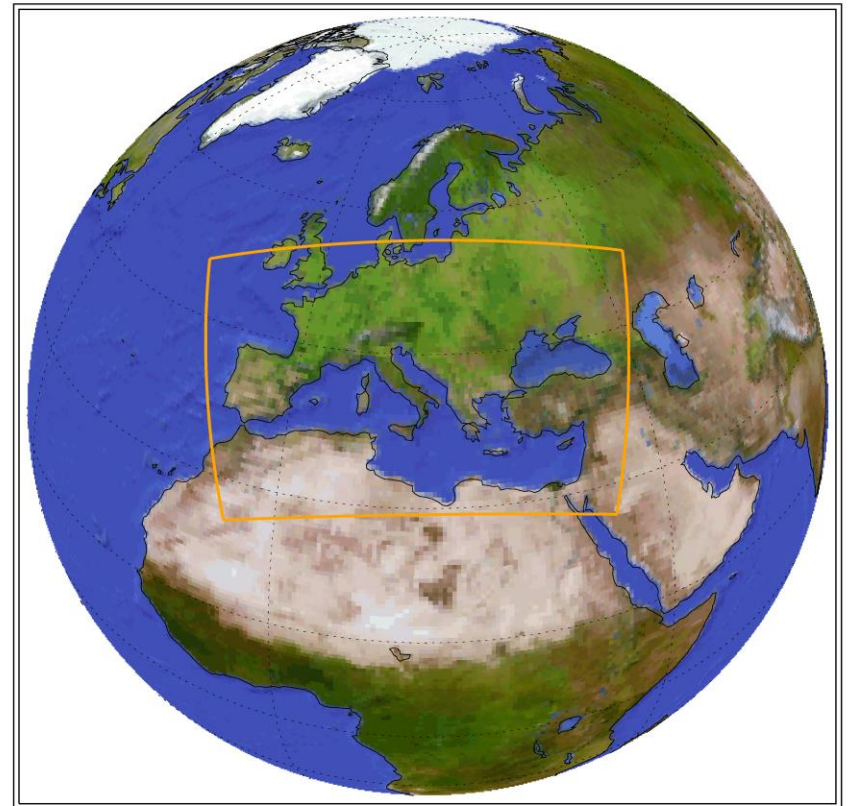
Coordinated Regional Climate Downscaling  
Experiment

Two domains over Europe

EURO-CORDEX



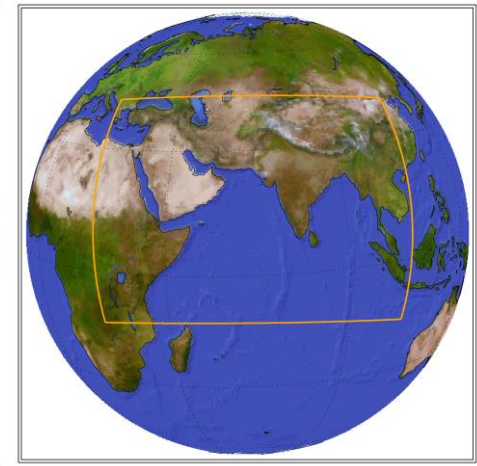
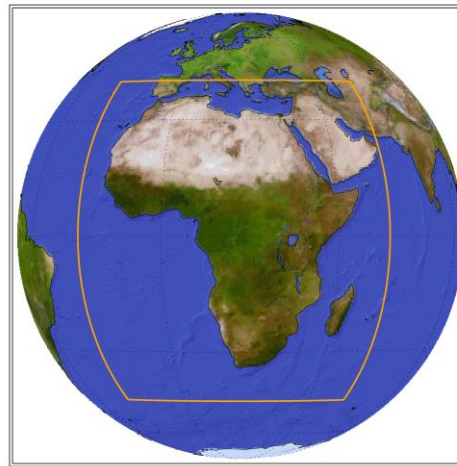
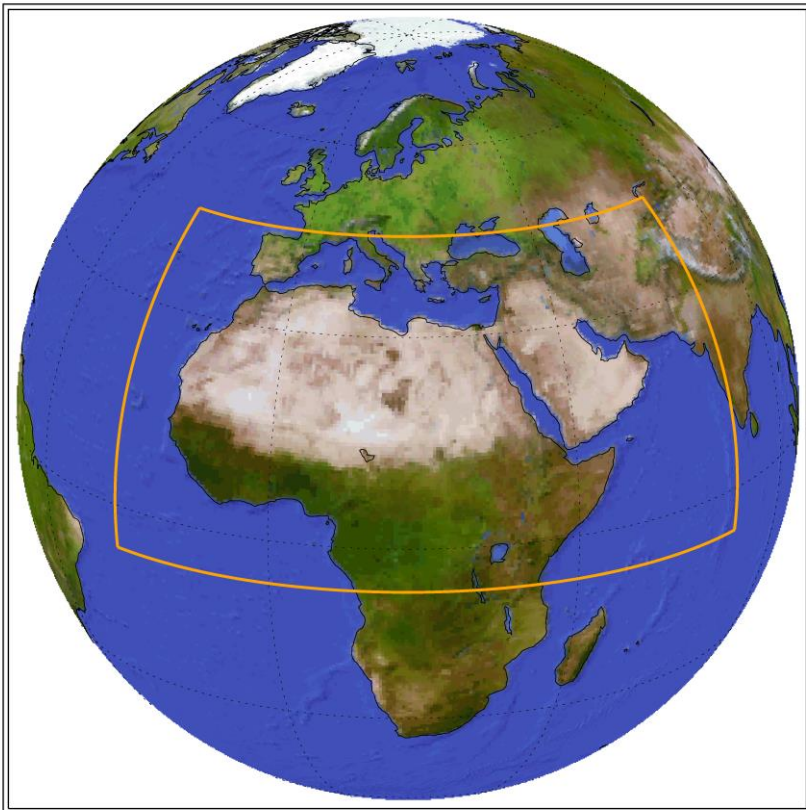
MED-CORDEX



One domain for  
Middle East and North Africa (MNA)

Domains for Africa and South Asia

MNA-CORDEX





Coordinated Regional Climate Downscaling Experiment

## EURO-CORDEX

Available thru ESFG (The Earth System Grid Federation)



EUR-44 & EUR-44i domains, ~50 km resolution

EUR-11 & EUR-11i domains, ~13 km resolution

For example current status for EUR-11 & EUR-11i domains

- 7 models (ALADIN53 (1) CCLM4-8-17 (4) HIRHAM5 (1) RACMO22E (2) RCA4 (5) REMO2009 (2) WRF331F (1) )
- 16 realizations for RCP8.5 and RCP4.5
- 6 realizations for RCP2.6

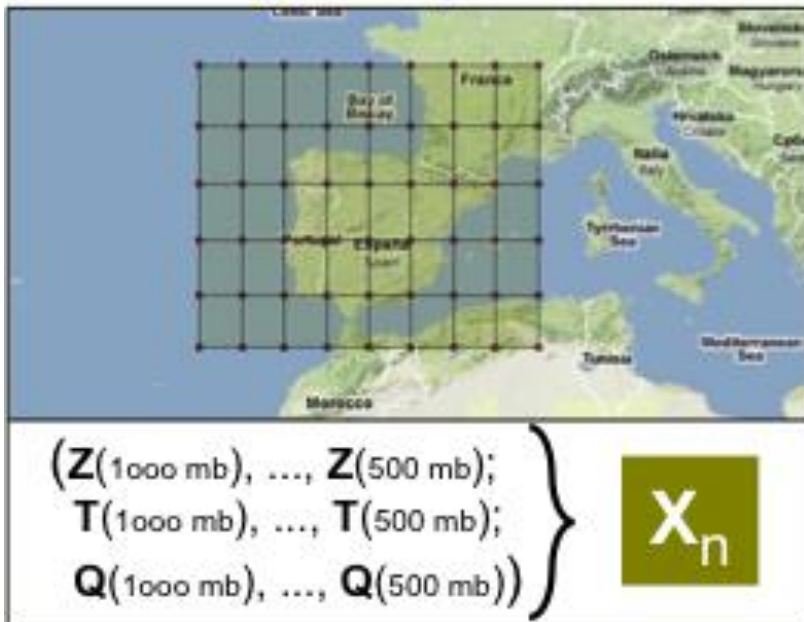
Also available 3h and 6h outputs, but for smaller number of models



# Experiment protocol - Empirical statistical downscaling

[http://www.cordex.org/index.php?option=com\\_content&view=article&id=222&Itemid=714](http://www.cordex.org/index.php?option=com_content&view=article&id=222&Itemid=714)

## Large scale predictors



## Downscaling Model

Analogs, reg., ...  

$$Y_n = f(X_n)$$

Statistical methods based on historical data to link large scale circulation to local climates.

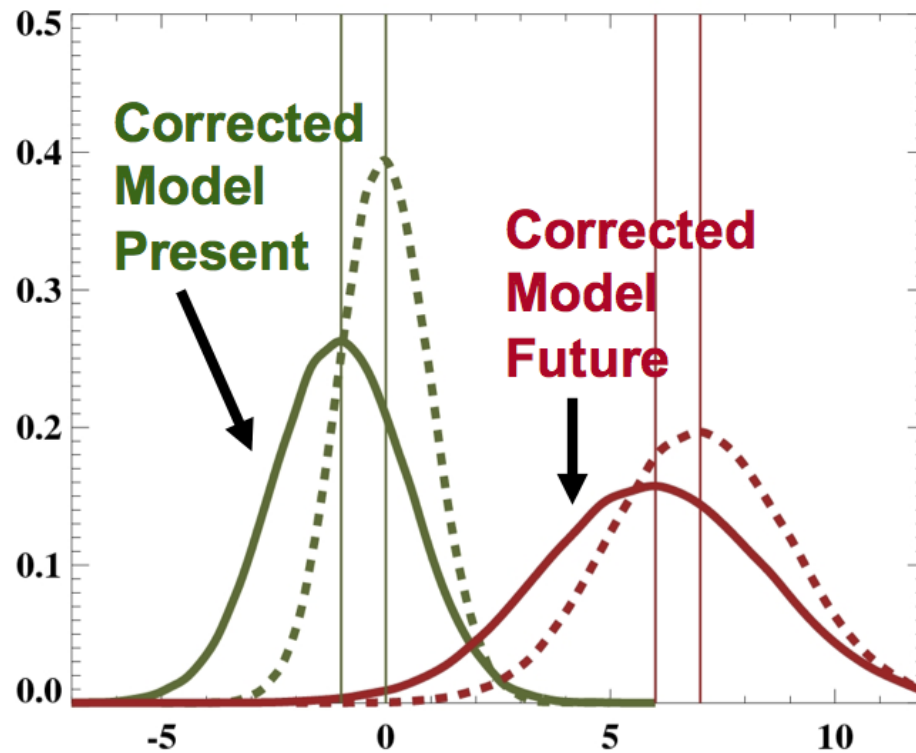
## Local predictands



**NEW!**

## Bias-adjusted CORDEX data

[http://www.cordex.org/index.php?option=com\\_content&view=article&id=280:bias-adjust-free&catid=117:cordex-news&Itemid=735](http://www.cordex.org/index.php?option=com_content&view=article&id=280:bias-adjust-free&catid=117:cordex-news&Itemid=735)



Probability Density Functions

## MED-CORDEX (Coupled regional climate models)

12 Fully coupled RCSM (at least ocean-atmosphere) ENEA, MPI, CNRM, LMD, Univ. Belgrade, MORCE-MED, UCLM/UPM, INSTM, COSMO-CLM, UAH, IC3, CMCC

Available thru [www.medcordex.eu](http://www.medcordex.eu)

**TIER1 simulations: Fully-coupled Regional Climate System Models (same atm as corresponding ARCM)**  
[table 6]

institute	RCM	comp.(*)	ERA-Interim 1979-now	HIST 1950-2005	RCP8.5 2006-2100	RCP4.5 2006-2100	RCP2.6 2006-2100
ENEA	PROTHEUS	ALRO	1982-2010	1971-2005		2006-2100	
MPI	REMO / MPI-OM	ALRO					
CNRM	RCSM 4	ALRO	1980-2013	1950-2005	2006-2100	2006-2100	2006-2100
LMD	LMDZ / NEMOMED 8	ALO	1979-2009	1950-2005	2006-2100	2006-2100	
U. Belgrade	EBU / POM	ALO	1989-2009	1950-2005	2006-2100		
IPSL	MORCE-MED-20Km	ALO	1989-2013				
UCLM UPM	PROMES / MOSLEF	ALO					
INSTM	LMDZ / ROMS-MED	ALO	1979-2009				
UAH AWI ROM	REMO / MITgcm	ALROB					
GUF	CCLM / NEMOMED	ALO	1980-2012				
CCMC U. Salento	COSMOMED	ALO	1980-2011	1950-2005 running	2006-2100	2006-2100	
ITU	RegCM4 / ROMS	ALO					

\* ALO: atmosphere, land, ocean (no river coupled) ALRO: atmosphere, land, river, ocean ALROB ALRO, Black Sea

In the following tables the colour of cells means:

PLANNED

DONE

ARCHIVED

UNKNOWN

# Data explorer – web pages

## Climate4impact (projects IS-ENES, IS-ENES2 and CLIPC)

<https://climate4impact.eu/impactportal/general/index.jsp>

The screenshot shows the Climate4impact web portal. At the top, there is a navigation bar with links: Home, Data discovery, Downscaling, Documentation, Help, About us, and Sign in. Below this is a search bar. The main content area is titled "Filters" and contains several filter categories: Project (1), Parameter (1), Frequency (1), Experiment (1), Domain (1), Date, Geobox, Free text, CF name (1), Data node (5), Driving model (5), Ensemble (4), Experiment family (2), Institute (7), Product (1), Rcm\_name (7), and Rcm\_version (3). There is also a "Variable long name (1)" section with a "show less filters" button. Below the filters, there is a "Quick select Experiment" section with two tabs: "Historical" and "RCP". The "RCP" tab is selected, showing a list of RCP scenarios: Radiative forcing of 2.6 W m<sup>-2</sup> (rcp26), Radiative forcing of 4.5 W m<sup>-2</sup> (rcp45), Radiative forcing of 6.0 W m<sup>-2</sup> (rcp60), and Radiative forcing of 8.5 W m<sup>-2</sup> (rcp85). The "Selected filters" section shows: Project : CORDEX, Parameter : tas, Frequency : day, Experiment : rcp85, and Domain : EUR-11. Below this, it says "Found 18 datasets. Displaying page 1 of 1." and provides navigation links: « Previous, 1, Next » and an "Export to CSV" button. The list of datasets includes: cordex.output.EUR-11.CLMcom.MOHC-HadGEM2-ES.rcp85.r11p1.CCLM4-8-17.v1.day.tas.v20150320, cordex.output.EUR-11.CLMcom.ICHEC-EC-EARTH.rcp85.r12i1p1.CCLM4-8-17.v1.day.tas.v20140515, cordex.output.EUR-11.CLMcom.CNRM-CERFACS-CNRM-CM5.rcp85.r11p1.CCLM4-8-17.v1.day.tas.v20140515, and cordex.output.EUR-11.CLMcom.MOHC-HadGEM2-ES.rcp85.r11p1.CCLM4-8-17.v1.day.tas.v20140515.

## KNMI Climate Explorer

[https://climexp.knmi.nl/plot\\_atlas\\_form.py?id=someone@somewhere](https://climexp.knmi.nl/plot_atlas_form.py?id=someone@somewhere)

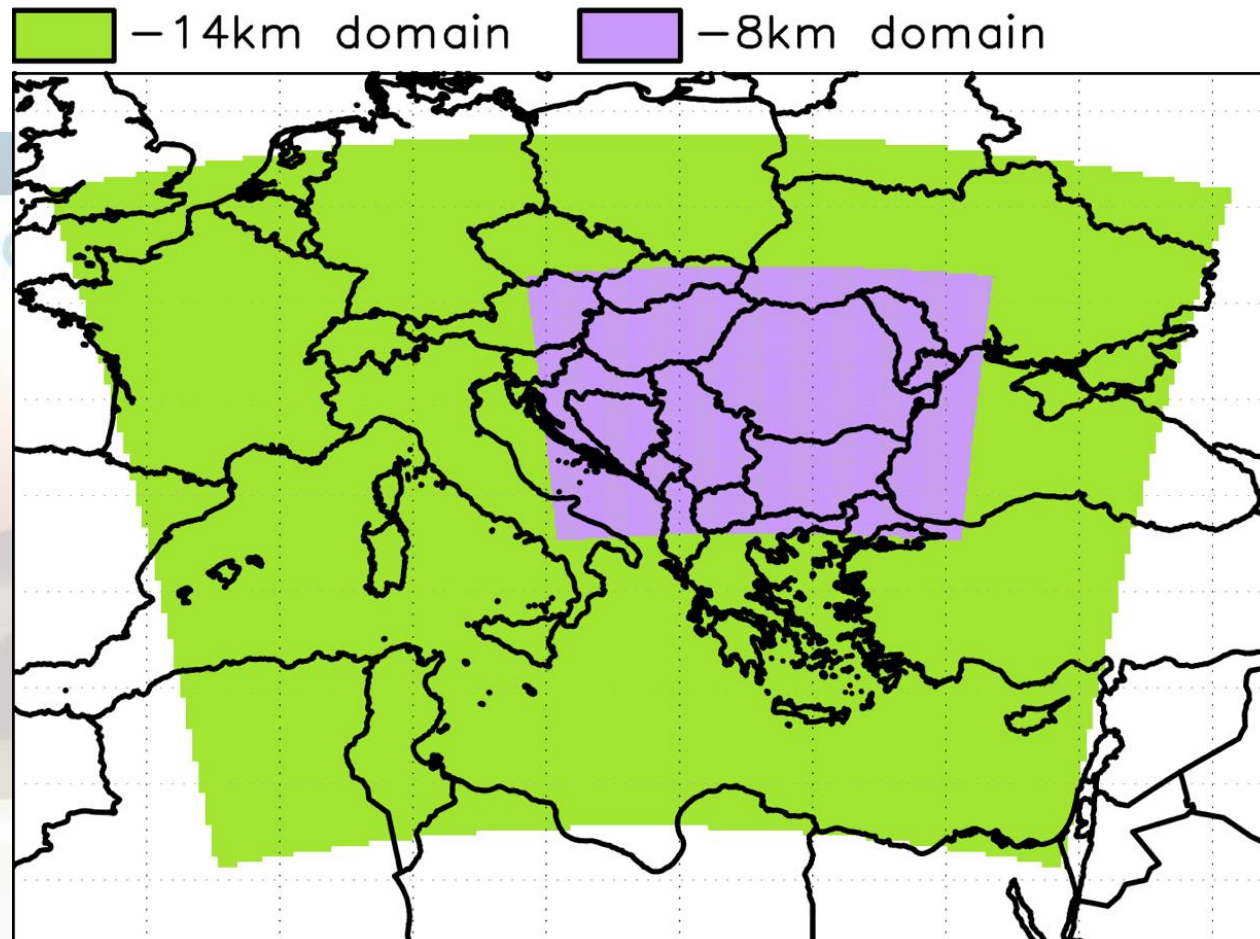
The screenshot shows the KNMI Climate Explorer web portal. At the top, there is a navigation bar with links: Home, Data discovery, Downscaling, Documentation, Help, About us, and Sign in. Below this is a search bar. The main content area is titled "KNMI Climate Explorer" and contains several sections: "Climate Explorer", "European Climate Assessment & Data", "KNMI", and a search bar. Below this is a navigation bar with links: Help, News, About, Contact, World weather, Effects of El Niño, Seasonal forecasts, and Climate Change Atlas. The "Climate Change Atlas" section is selected, showing a "Select a region" section with a "Type" dropdown (IPCC WG1, IPBES, countries, place, box) and an "IPCC WG1" dropdown (World). Below this is a "Select a season" section with a "Season" dropdown (First month, Jan, length, 12 months). Below this is a "Select a dataset and variable" section with a "Dataset" dropdown (GCM: CMIP5 (IPCC AR5 Atlas subset)) and a "Variable" dropdown (near-surface temperature). Below this is a "Map options" section with a "Scenario" dropdown (Historical + RCP4.5), a "Measure" dropdown (Difference of two periods), a "Reference period" dropdown (1986 - 2005), a "Future period" dropdown (2081 - 2100), and a "Mean/percentiles" dropdown (mean). Below this is a "Make map" button and a note: "May take up to 15 minutes the first time a season / measure is selected". On the right side, there is a "Further information" section with links: > Short introduction, > IPCC WG1 AR5 report, notably Annex I "Atlas", > CMIP5 co-ordinated climate model experiments, and > RCP scenario's. Below this is a "Funding" section with links: > KNMI, > SPECS, > Red Cross / Red Crescent Climate Centre, and > Dutch Ministry of Infrastructure and Environment, DGMI.



# Databases developed by other projects

## Example: ORIENTGATE PROJECT (RHMSS partner from Serbia)

HI-RESOLUTION 14 and 8 km runs with NMMB



Enter keywords...

Urban Adaptation & Health

Home

Events

Value of OrientGate climate scenarios recognised  
by Adriatic Ionian Cooperation Programme  
Jul 7, 2014

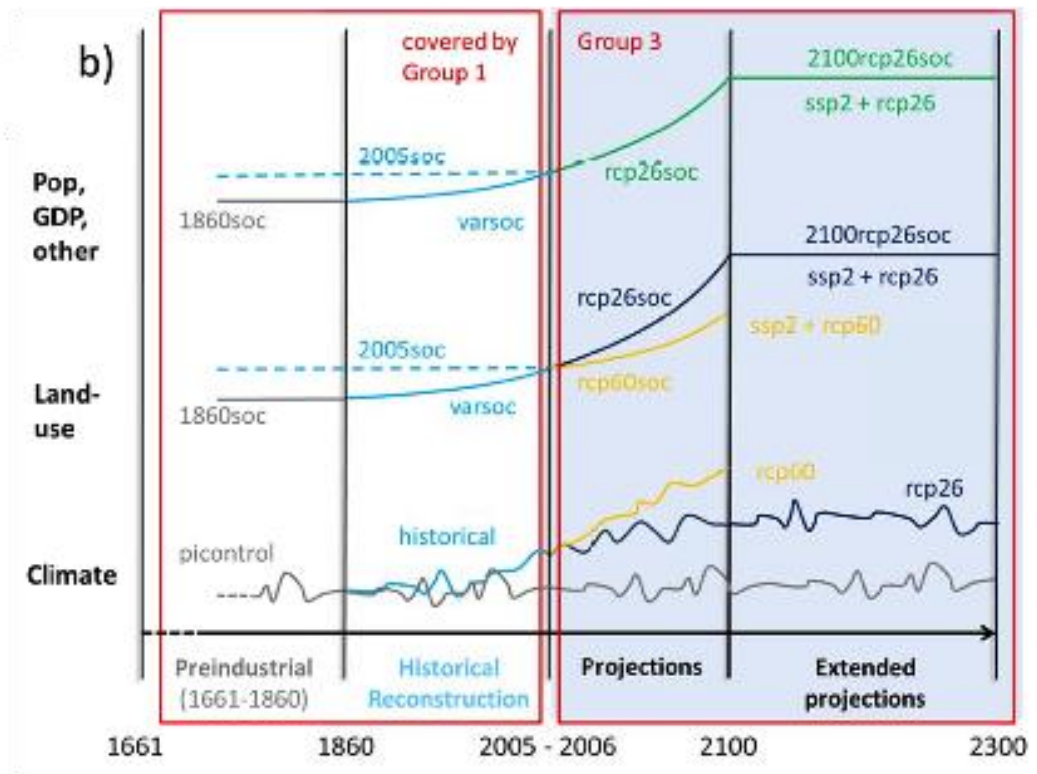
A network for the integration of climate knowledge into policy and planning

The OrientGate project aims to implement concerted and coordinated climate adaptation actions across South Eastern Europe (SEE). The partnership comprises 19 financing partners, 11 associates and three observers, covering 13 countries, that

The Inter-Sectoral Impact Model Intercomparison Project (<https://www.isimip.org/>)

Available thru ESFG (The Earth System Grid Federation) 

- Agriculture
- Water
- Forests
- Marine ecosystems  
& fisheries
- Biomes
- Permafrost



**Figure 2** Schematic representation of the scenario design for **Group 3** runs. Group 3 consists of model runs to quantify the effects of the land use (and irrigation) changes, and changes in population, GDP, and management from 2005 onwards associated with RCP6.0 (no mitigation scenario under SSP2) and RCP2.6 (strong mitigation scenario under SSP2). Forcing factors for which no future scenarios exist (e.g. dams/reservoirs) are held constant after 2005.

## About CLIMATE-ADAPT

# CLIMATE-ADAPT

The European Climate Adaptation Platform (CLIMATE-ADAPT) is a partnership between the European Commission (DG CLIMA, DG Joint Research Centre and other DGs) and the European Environment Agency.

CLIMATE-ADAPT aims to support Europe in adapting to climate change. It is an initiative of the European Commission and helps users to access and share data and information on:

- Expected climate change in Europe
- Current and future vulnerability of regions and sectors
- EU, national and transnational adaptation strategies and actions
- [Adaptation case studies and potential adaptation options](#)
- [Tools that support adaptation planning](#)

**T H A N K   Y O U !**