

Three Decades of Climate Change Science: Focus on Mediterranean Region

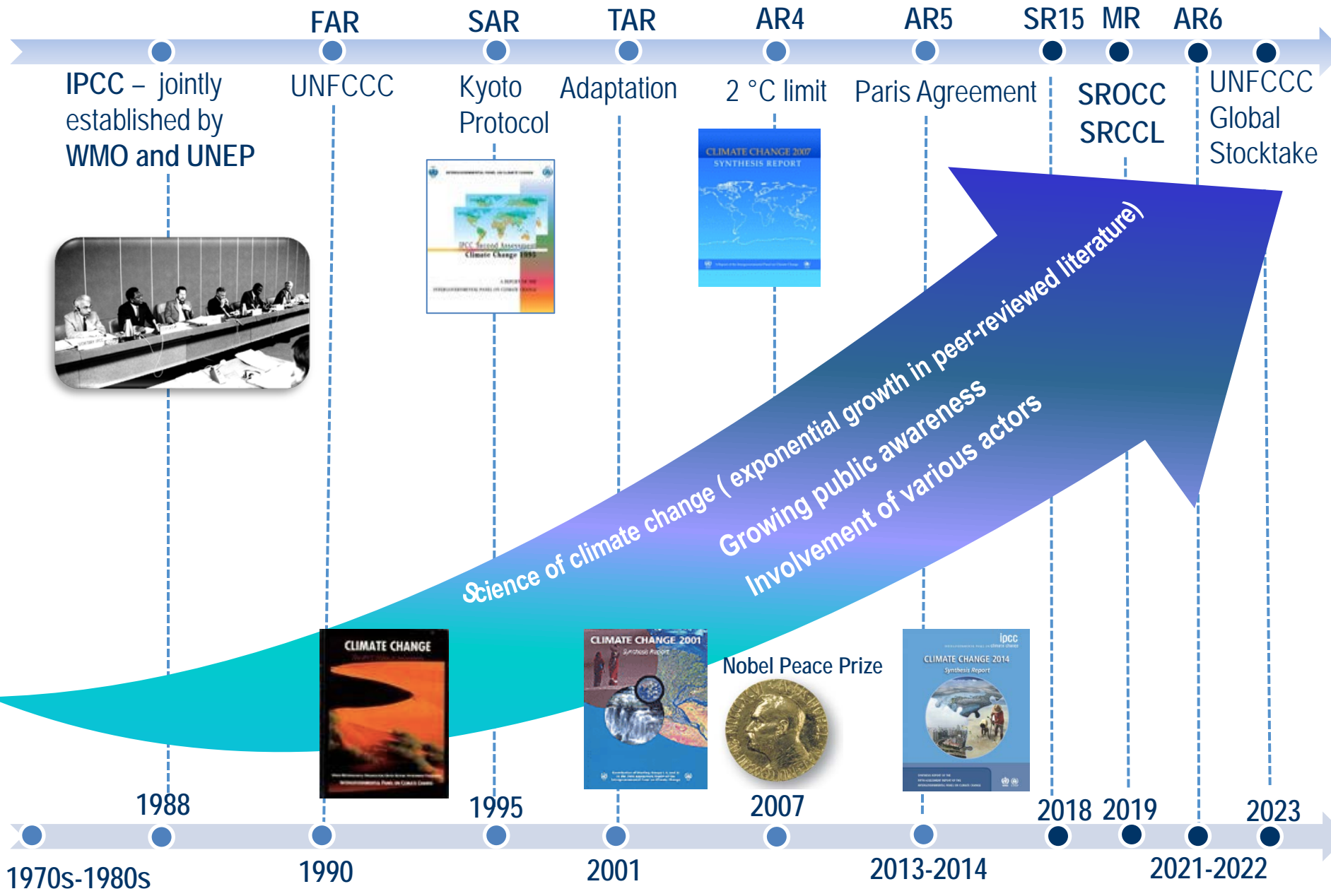
Abdalah Mokssit
Secretary of the IPCC

Climate Change in the Mediterranean and the Middle
East: Challenges and Solutions

International Conference Nicosia, Cyprus, 18-19 May 2018

IPCC History and Role





Science of climate change (exponential growth in peer-reviewed literature)
 Growing public awareness
 Involvement of various actors

IPCC – jointly established by WMO and UNEP



FAR
UNFCCC

SAR
Kyoto Protocol

TAR
Adaptation

AR4
2 °C limit

AR5
Paris Agreement

SR15
MR
SROCC
SRCCCL

AR6
UNFCCC
Global Stocktake

1988

1990

1995

2001

2007

Nobel Peace Prize

2013-2014

2018

2019

2023

2021-2022

1970s-1980s

IPCC Sixth Assessment (AR6)

Some overarching preliminary aspects for the Synthesis Report

- *Global Stocktake*
- *Interaction among emissions, climate, risks and development pathways*
- *Economic and social costs and benefits of mitigation and adaptation in the context of development pathways*
- *Adaptation and mitigation actions in the context of sustainable development*
- *Finance and means of support*

May 2019

Emission inventories

Oct. 2018

Global warming of 1.5 °C

Sept. 2019

Oceans and cryosphere

April 2021

The Physical Science Basis

October 2021

Climate Change Impacts, Adaptation and Vulnerability

April 2022

The Synthesis Report



Talanoa dialogue UNFCCC

Land

Aug. 2019

Mitigation of Climate Change

July 2021

Global stocktake 2023 UNFCCC

March 2018



Cities and Climate Change Science Conference

May 2018



Expert Meeting on Assessing Climate Information for Regions

May 2018



Expert Meeting on Short Lived Climate Forcers

** Dates are subject to change*

The role of the IPCC is ...

“ ... to **assess** on a comprehensive, objective, open and transparent basis the **scientific, technical and socio-economic information** relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation.”

“IPCC reports should be **neutral with respect to policy**, although they may need to **deal objectively with scientific, technical and socio-economic factors** relevant to the application of particular policies.”

Principles Governing IPCC Work, paragraph 2

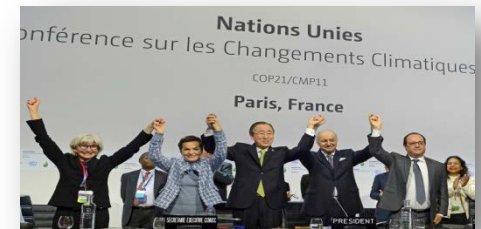
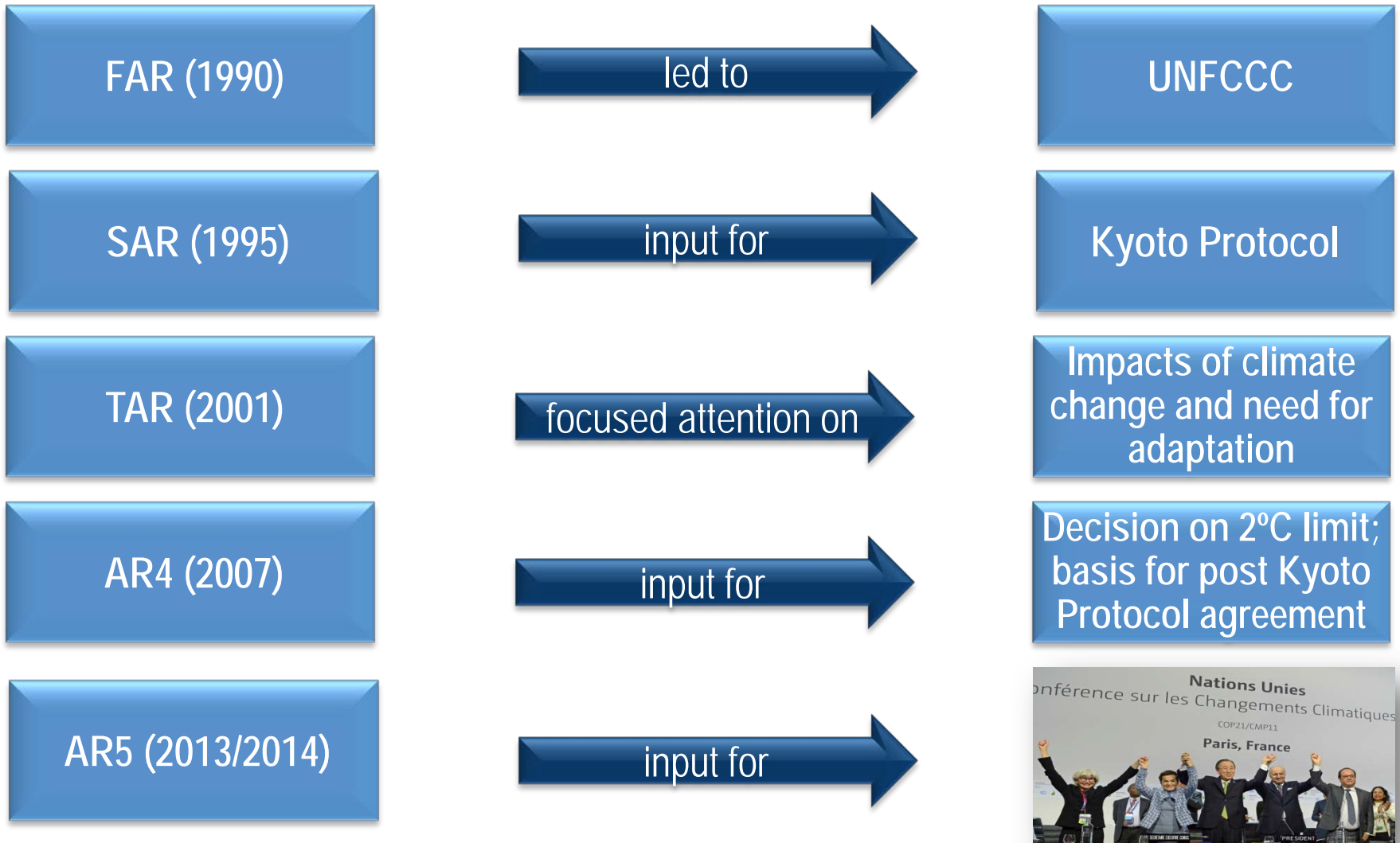
Source: <http://www.ipcc.ch/pdf/ipcc-principles/ipcc-principles.pdf>

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INTERGOVERNMENTAL PANEL ON climate change



...that has made an impact

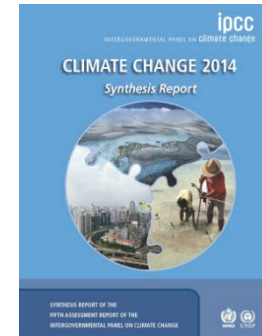
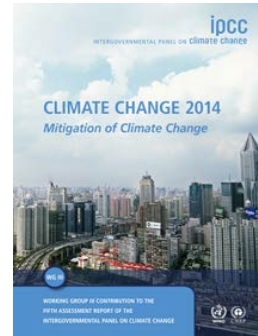


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INTERGOVERNMENTAL PANEL ON climate change



Achievements: 2013/2014 Fifth Assessment Report



Key messages

Human influence on the climate system is clear

The more we disrupt our climate, the more we risk severe, pervasive and irreversible impacts

We have the means to limit climate change and build a more prosperous, sustainable future

Figure SPM.1a

Observed globally averaged combined land and ocean surface temperature anomaly 1850-2012

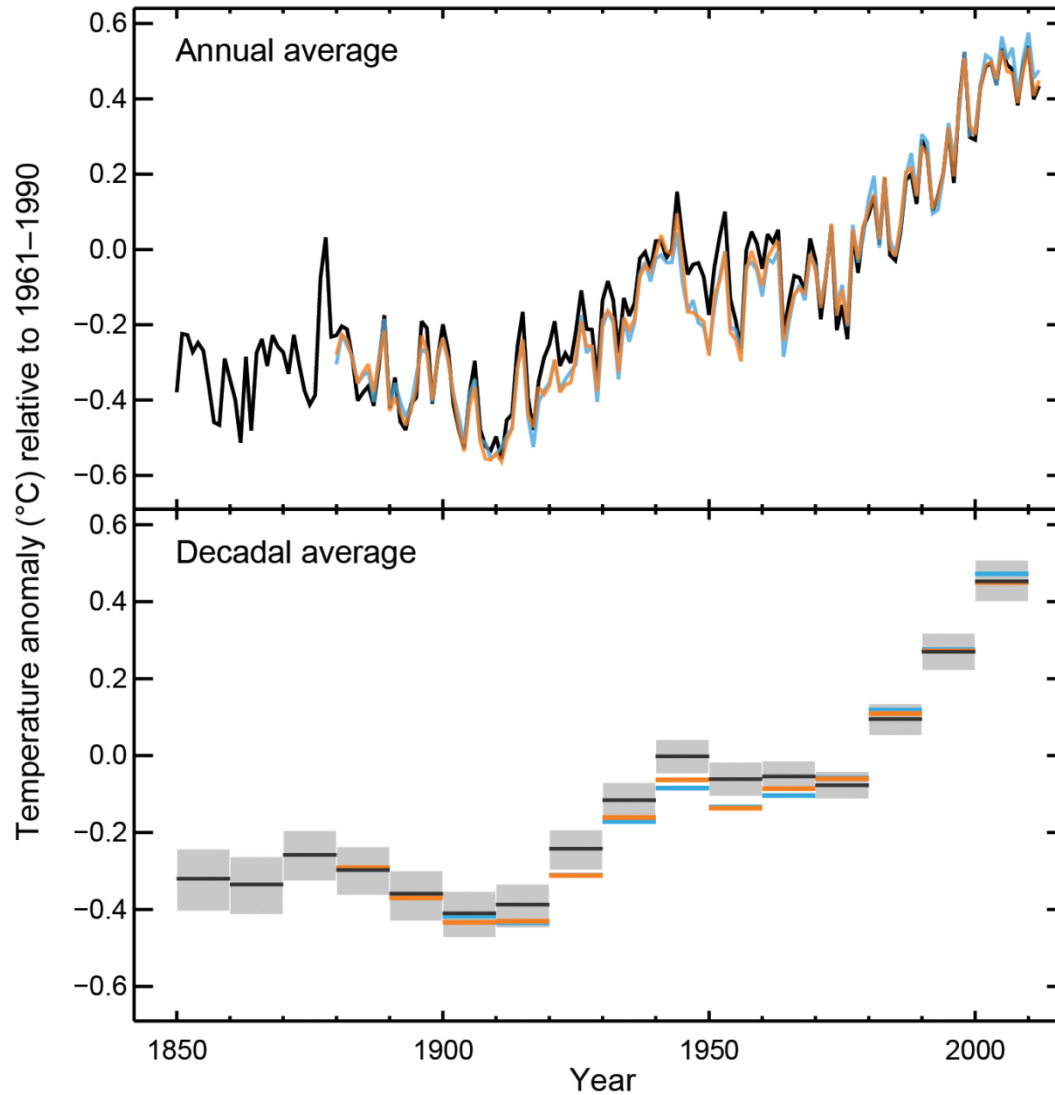


Figure SPM.1b

Observed change in surface temperature 1901-2012

All Figures © IPCC 2013

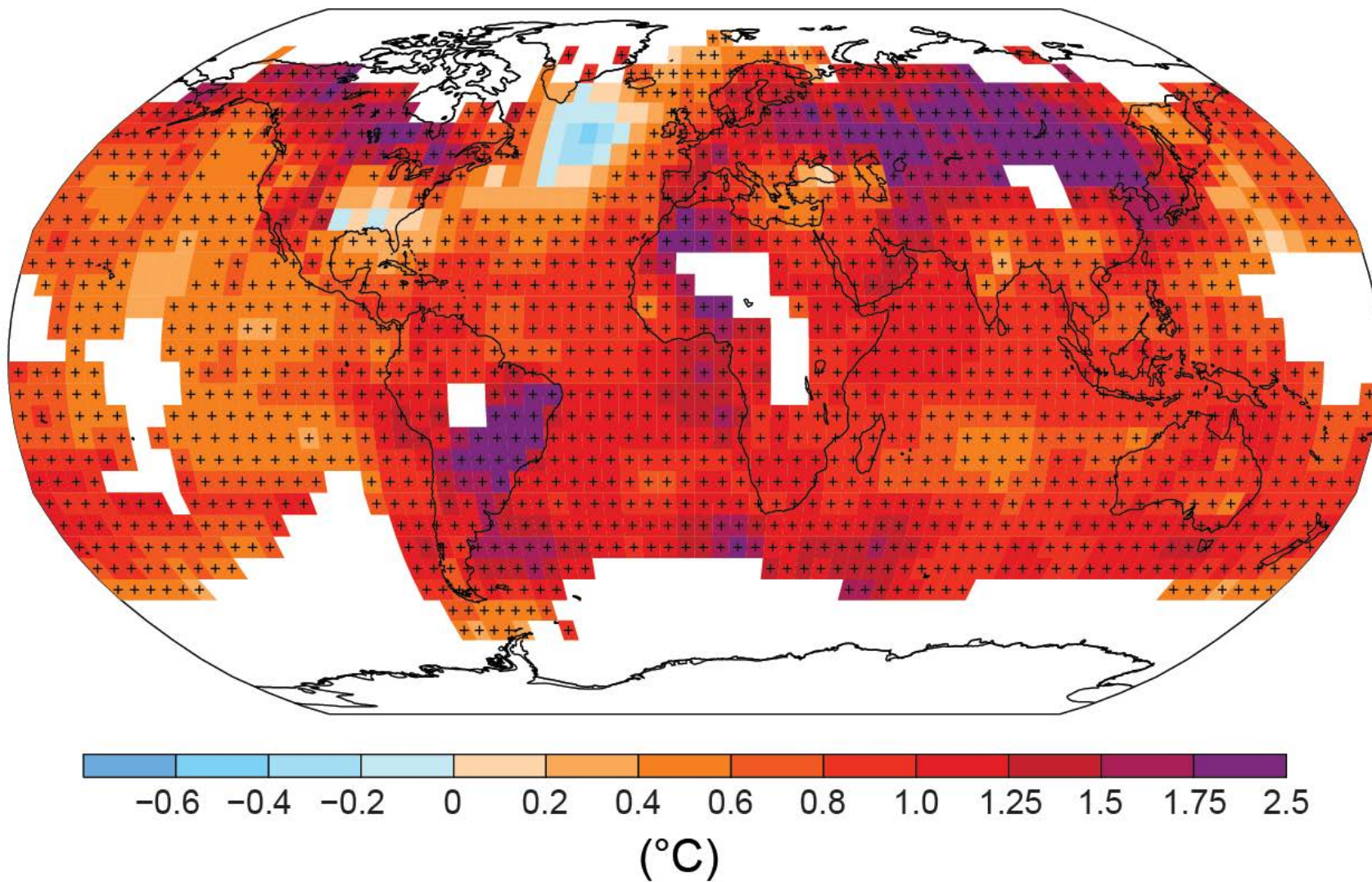
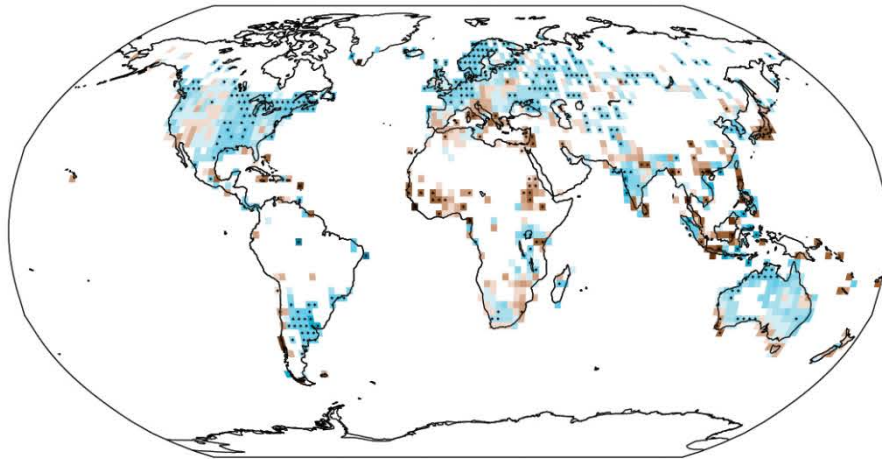


Figure SPM.2

Observed change in annual precipitation over land

All Figures © IPCC 2013

1901–2010



1951–2010

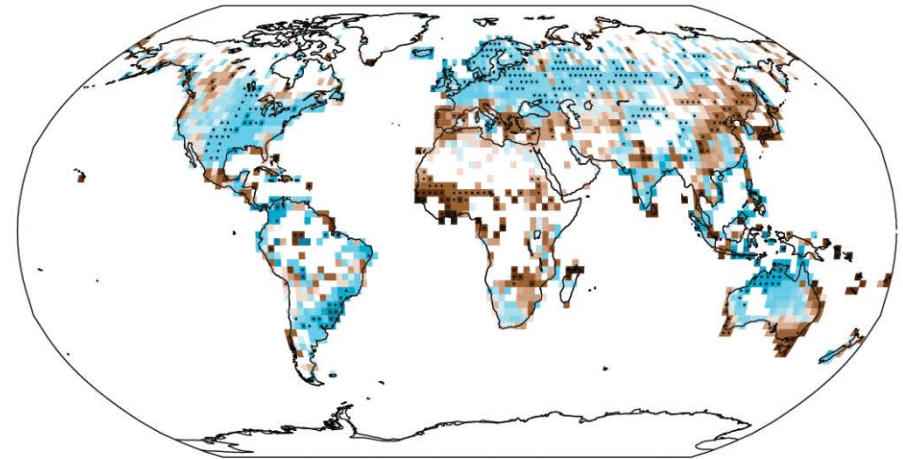
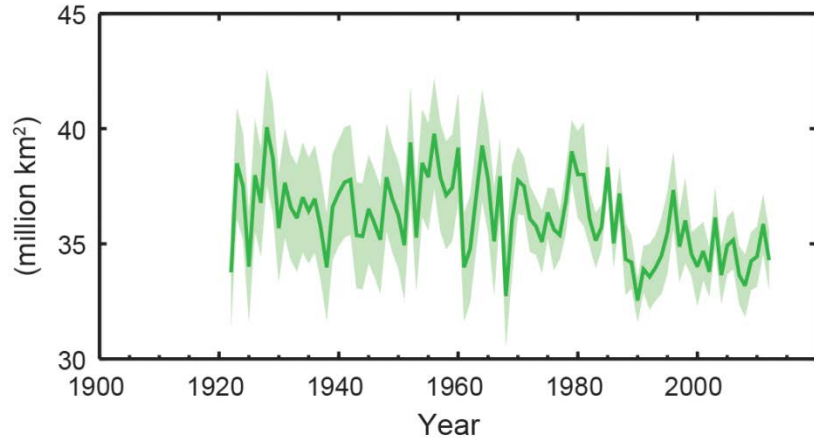


Figure SPM.3

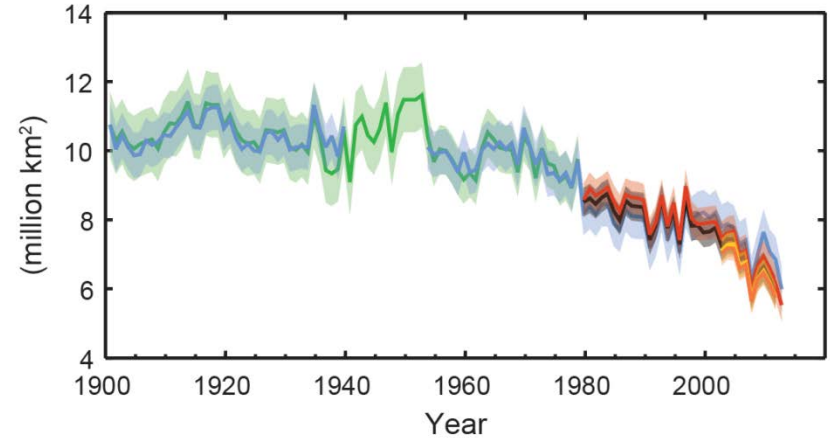
Multiple observed indicators of a changing global climate

All Figures © IPCC 2013

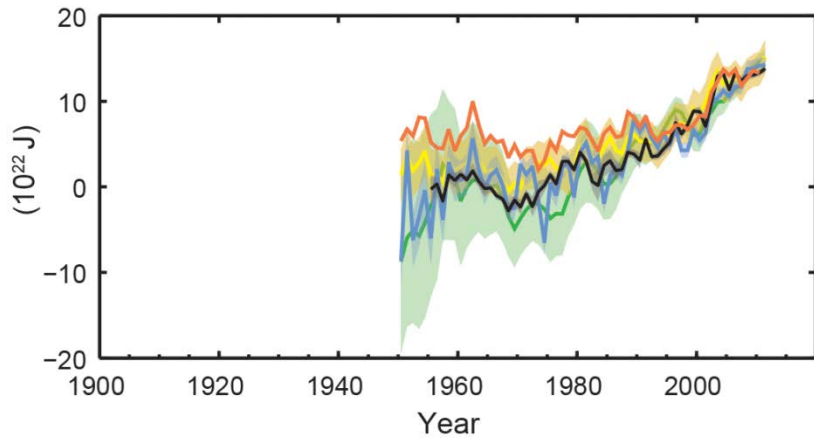
(a) Northern Hemisphere spring snow cover



(b) Arctic summer sea ice extent



(c) Change in global average upper ocean heat content



(d) Global average sea level change

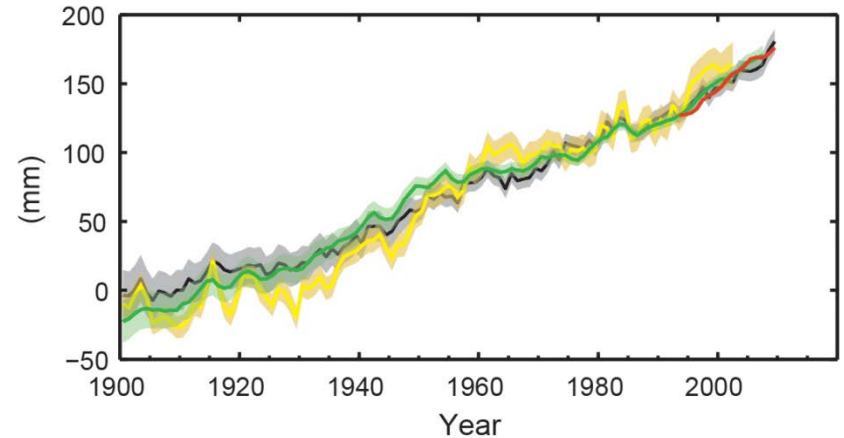


Figure SPM.6

Comparison of observed and simulated climate change

All Figures © IPCC 2013

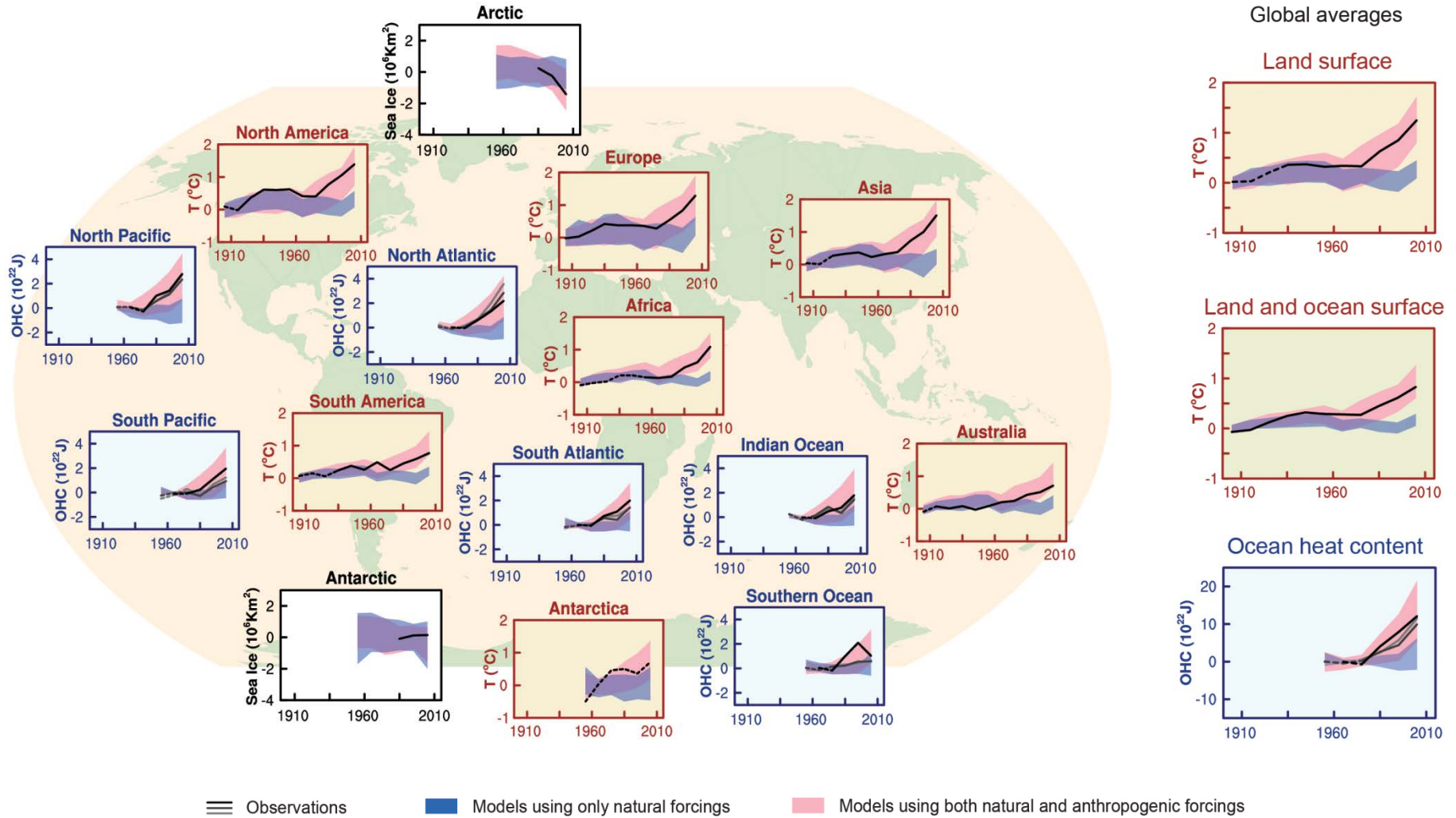


Figure SPM.8a,b

Maps of CMIP5 multi-model mean results

All Figures © IPCC 2013

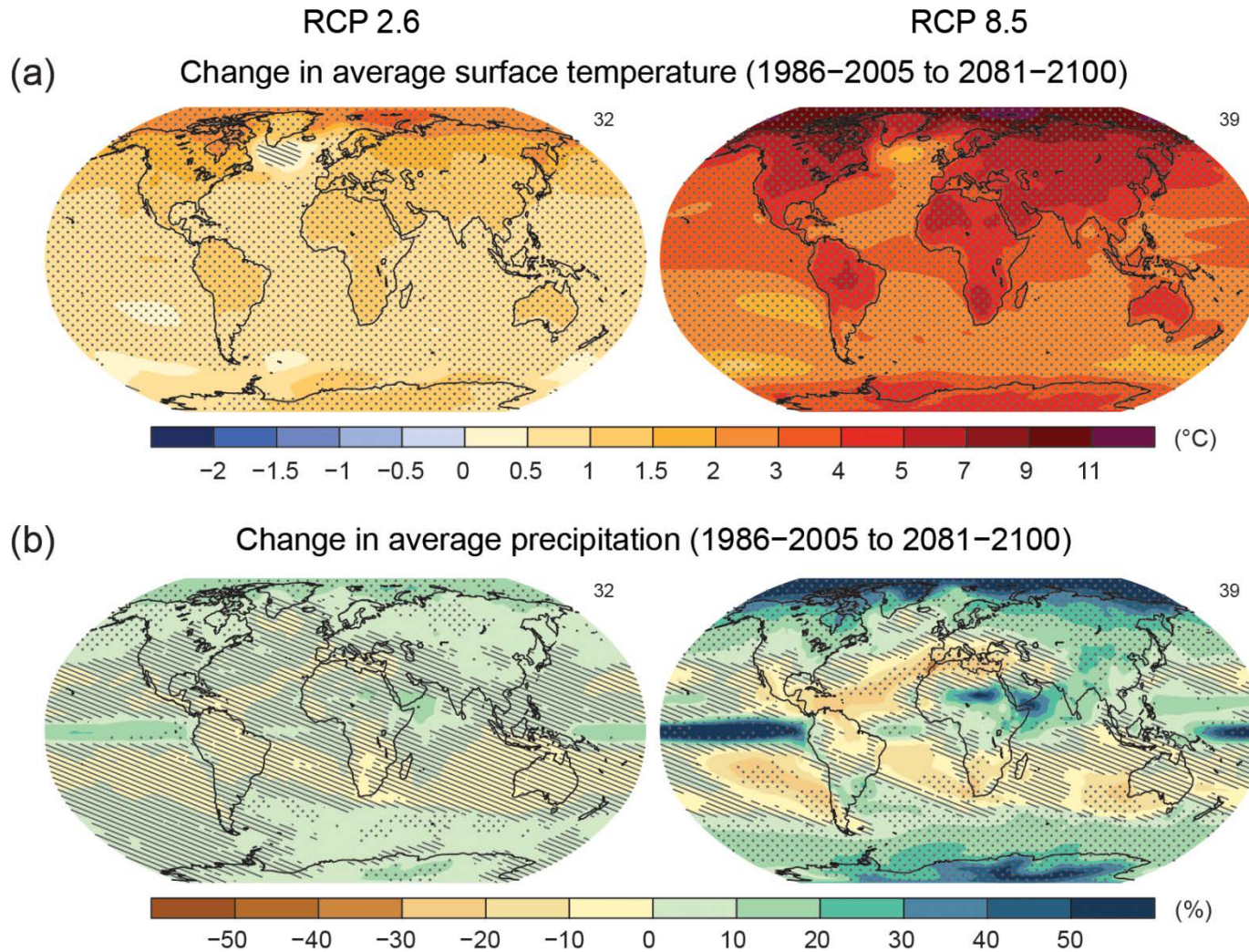
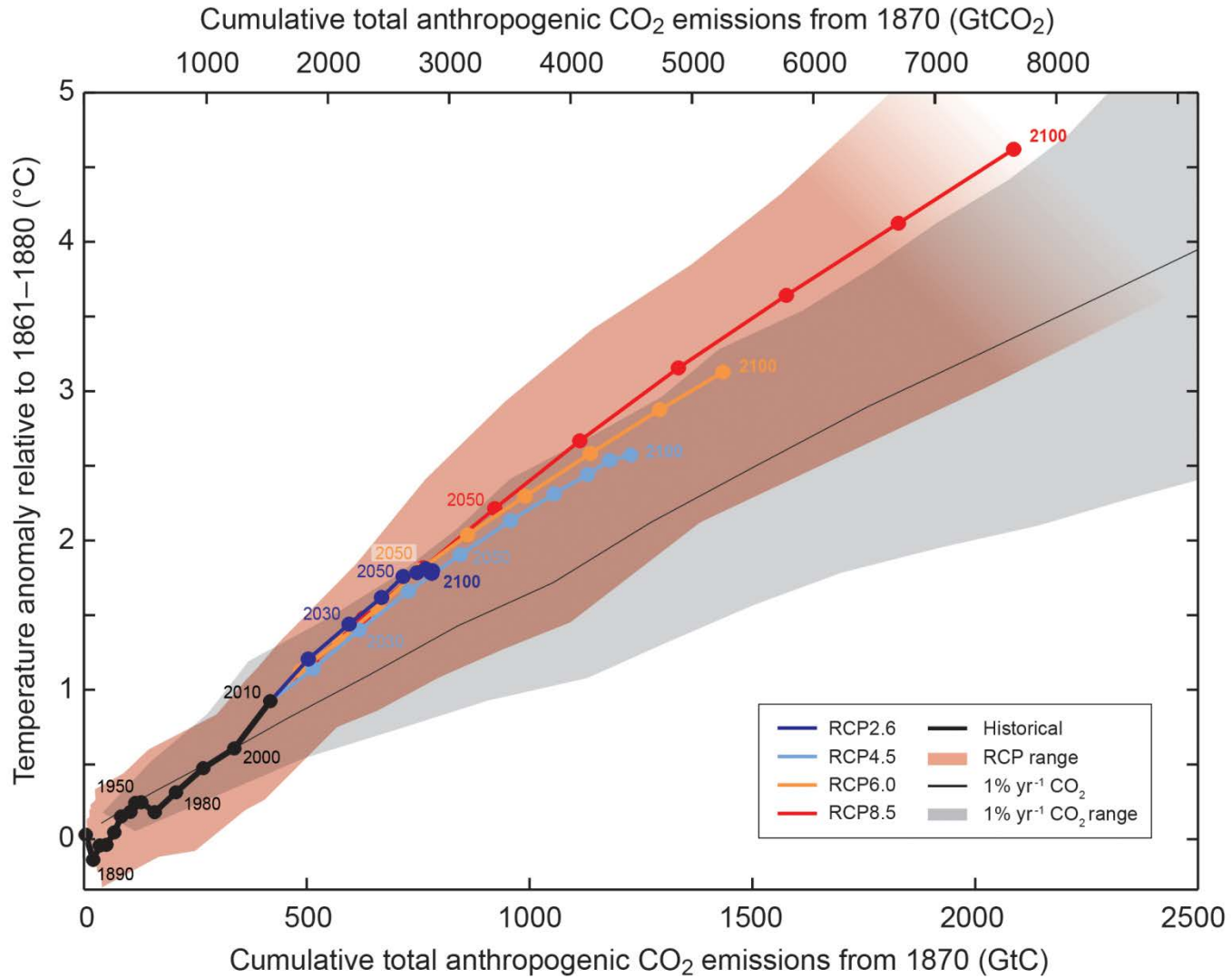


Figure SPM.10

Temperature increase and cumulative carbon emissions

All Figures © IPCC 2013





**WIDESPREAD
OBSERVED IMPACTS**

A CHANGING WORLD

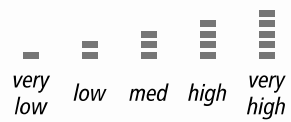
An underwater photograph of a coral reef. The water is a deep, murky green. The coral is mostly brown and white, indicating significant bleaching and mortality. A single, healthy-looking green coral polyp is visible in the center of the frame, standing out against the dead and dying coral. The overall scene conveys a sense of environmental degradation and the impact of climate change on marine ecosystems.


WIDESPREAD OBSERVED IMPACTS

A CHANGING WORLD



Confidence in attribution to climate change



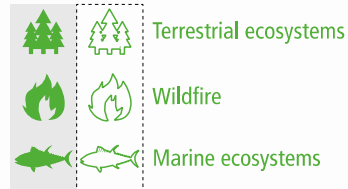
 indicates confidence range

Observed impacts attributed to climate change for

Physical systems



Biological systems

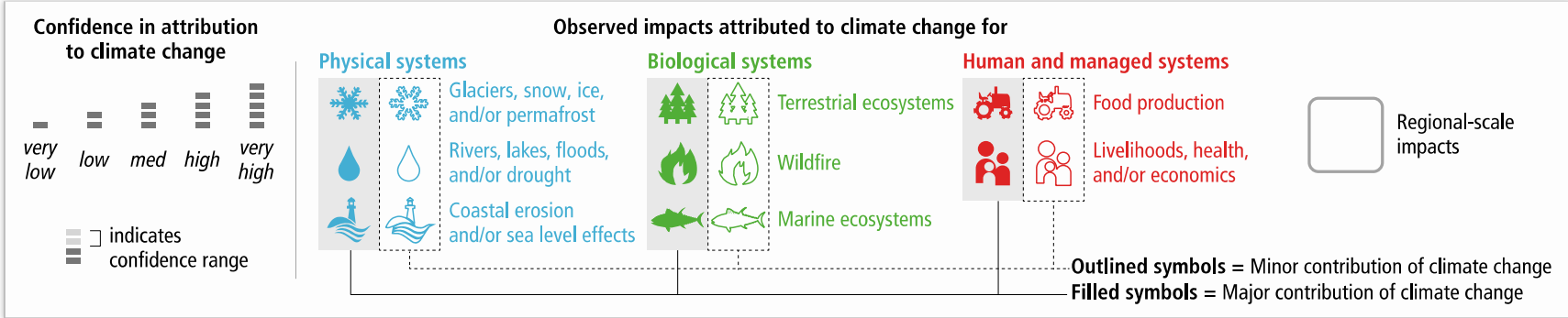


Human and managed systems



 Regional-scale impacts

Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change



A photograph of a city street completely flooded with water. The water is dark and reflects the overcast sky. Tall brick and concrete buildings line both sides of the street. In the distance, a person in a red jacket is wading through the water, and a dark car is partially submerged. The overall mood is somber and illustrates the impact of flooding.

VULNERABILITY AND EXPOSURE AROUND THE WORLD



**ADAPTATION IS
ALREADY OCCURRING**



INCREASING MAGNITUDES
OF WARMING INCREASE
THE LIKELIHOOD OF

**SEVERE AND
PERVASIVE IMPACTS**



RISKS OF
CLIMATE CHANGE
INCREASE
WITH CONTINUED
HIGH EMISSIONS

Regional key risks and potential for risk reduction

Representative key risks for each region for



Polar Regions (Arctic and Antarctic)

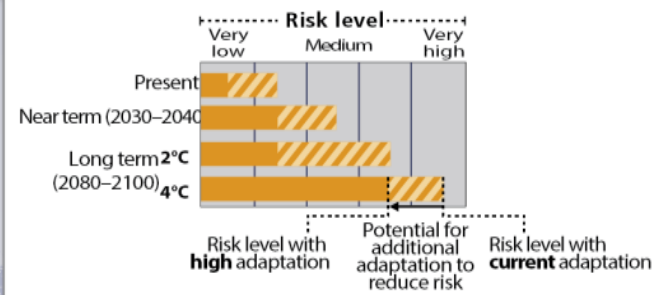
Risks for ecosystems



Risks for health and well-being



Unprecedented challenges, especially from rate of change



North America

Increased damages from wildfires



Heat-related human mortality



Increased damages from river and coastal urban floods



Europe

Increased damages from river and coastal floods



Increased water restrictions



Increased damages from extreme heat events and wildfires



Asia

Increased flood damage to infrastructure, livelihoods and settlements



Heat-related human mortality

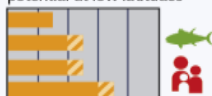


Increased drought-related water and food shortage



The Ocean

Distributional shift and reduced fisheries catch potential at low latitudes



Increased mass coral bleaching and mortality



Coastal inundation and habitat loss



Central and South America

Reduced water availability and increased flooding and landslides



Reduced food production and quality

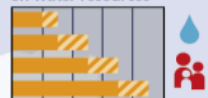


Spread of vector-borne diseases



Africa

Compounded stress on water resources



Reduced crop productivity and livelihood and food security



Vector- and water-borne diseases



Small islands

Loss of livelihoods, settlements, infrastructure, ecosystem services and economic stability



Risks for low-lying coastal areas



Australasia

Significant change in composition and structure of coral reef systems



Increased flood damage to infrastructure and settlements



Increased risks to coastal infrastructure and low-lying ecosystems





EFFECTIVE CLIMATE CHANGE ADAPTATION

A MORE VIBRANT WORLD

Adaptation options

- Adaptation options that focus on **strengthening existing delivery systems and institutions**, as well as **insurance and social protection** strategies, can improve health, security and livelihoods in the near term (high confidence).

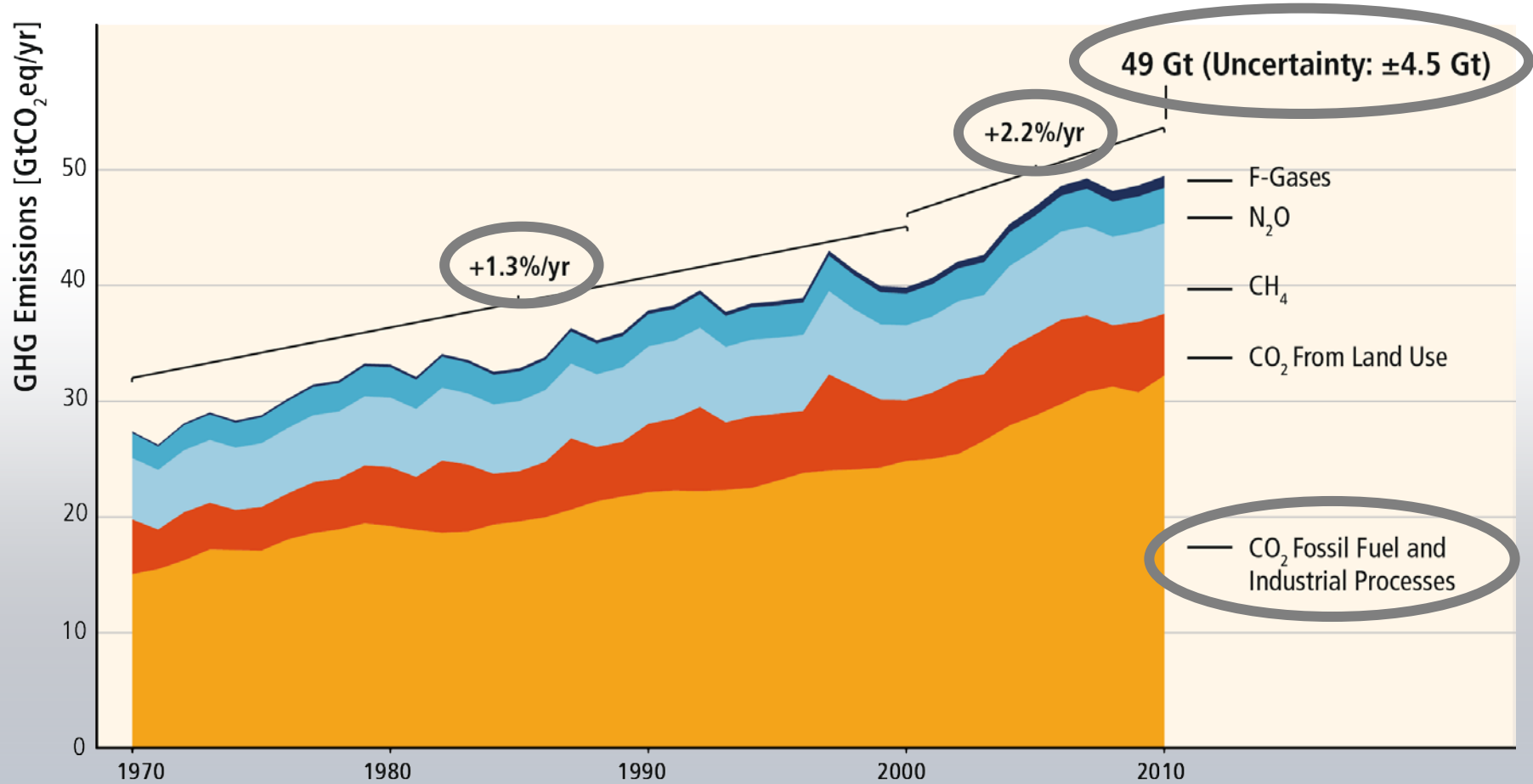


Climate change is a global commons problem that requires international cooperation and coordination across scales.

A yellow bulldozer is shown from a high-angle perspective, working on a construction site at night. The scene is illuminated with a strong blue light, creating a monochromatic atmosphere. The bulldozer is positioned in the upper right quadrant, facing towards the center. Its large front blade is visible. In the foreground, the wooden structure of a bridge or walkway is partially visible, with some cables and equipment. The ground is uneven and appears to be a mix of dirt and gravel. The overall mood is industrial and somewhat somber due to the blue lighting.

GHG emissions growth has accelerated despite reduction efforts.

GHG emissions growth between 2000 and 2010 has been larger than in the previous three decades.

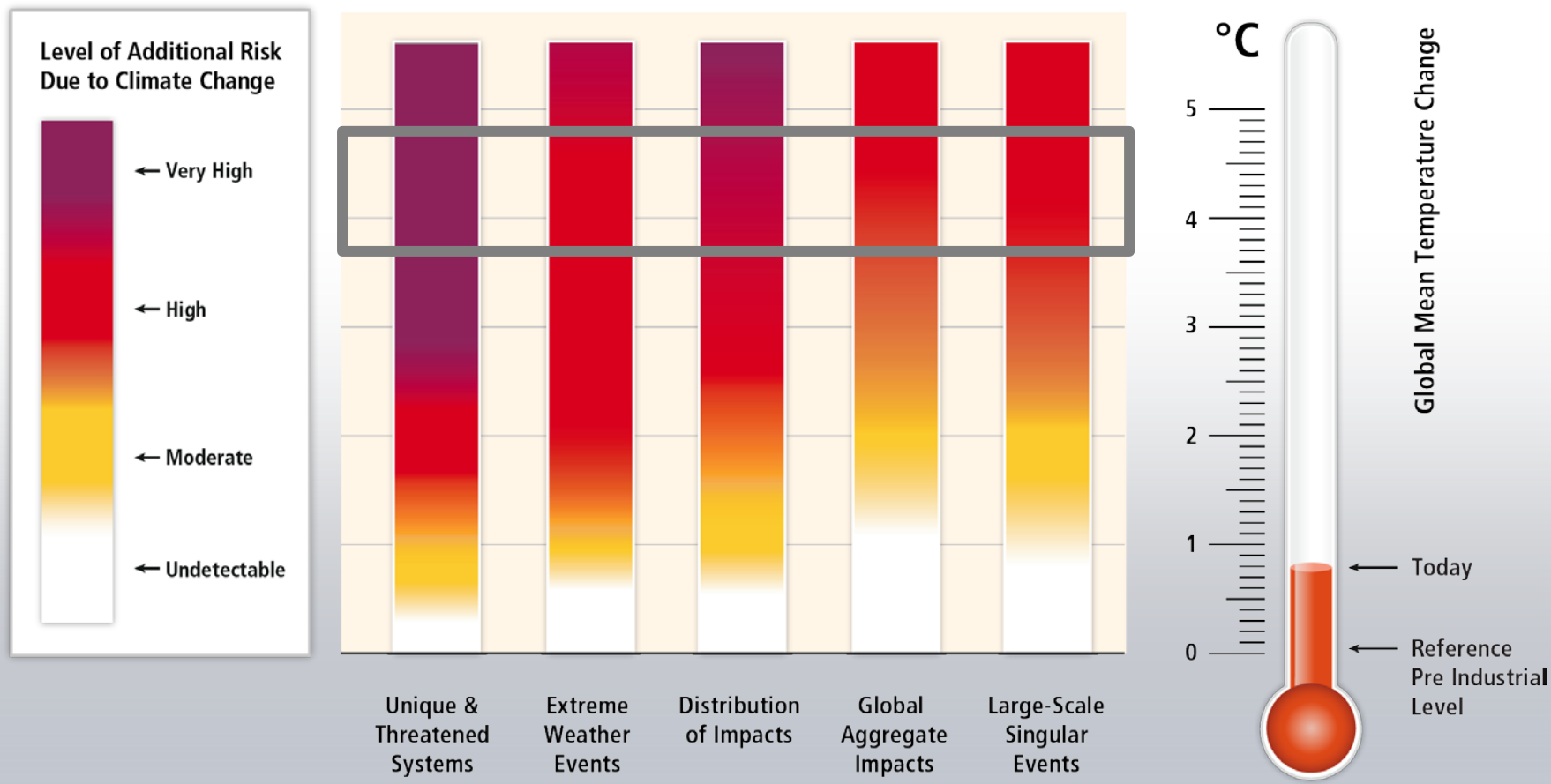


Based on Figure SPM.1

**Limiting warming involves substantial technological,
economic and institutional challenges.**

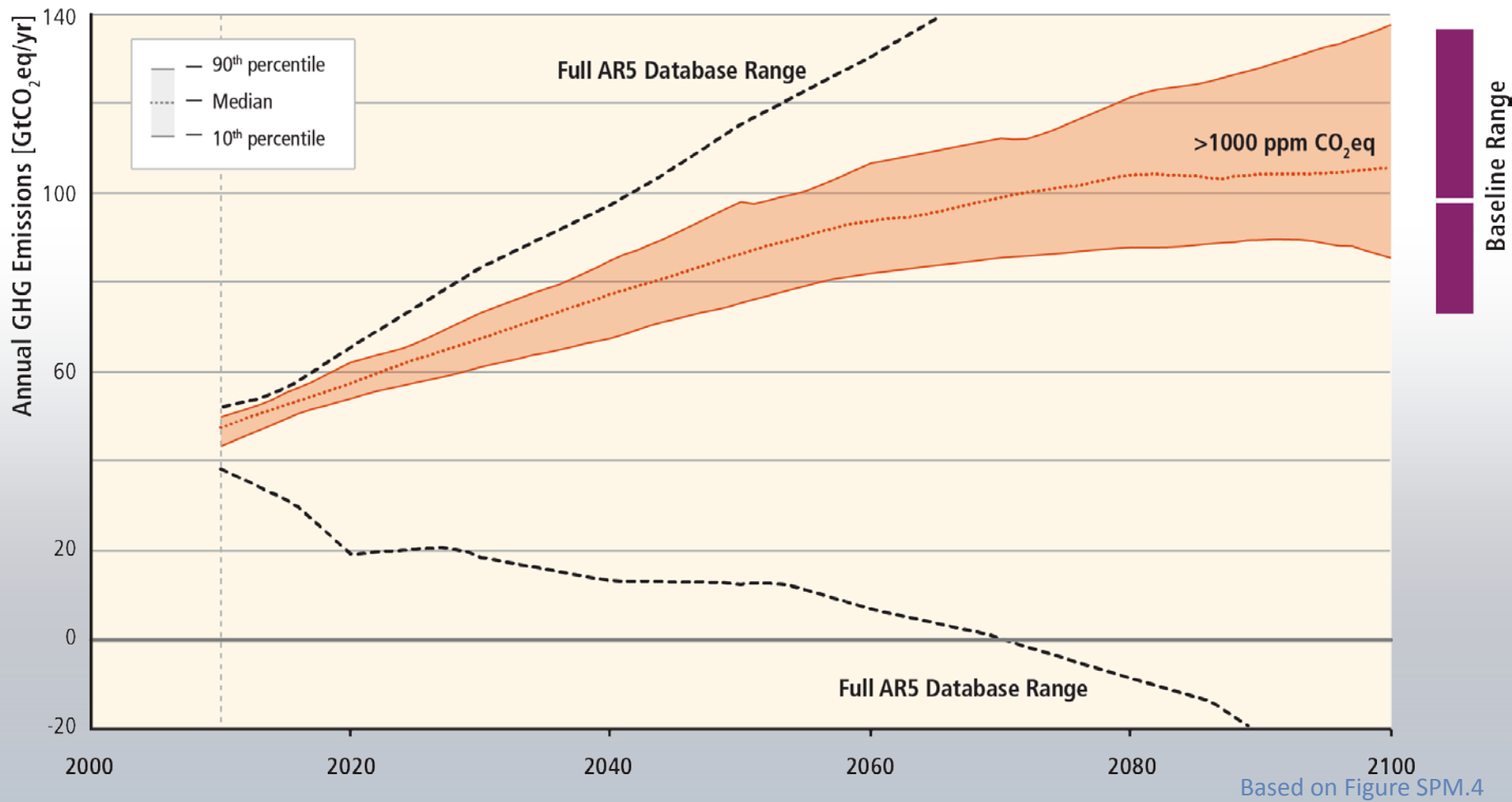


Without additional mitigation, global mean surface temperature is projected to increase by 3.7 to 4.8°C over the 21st century.



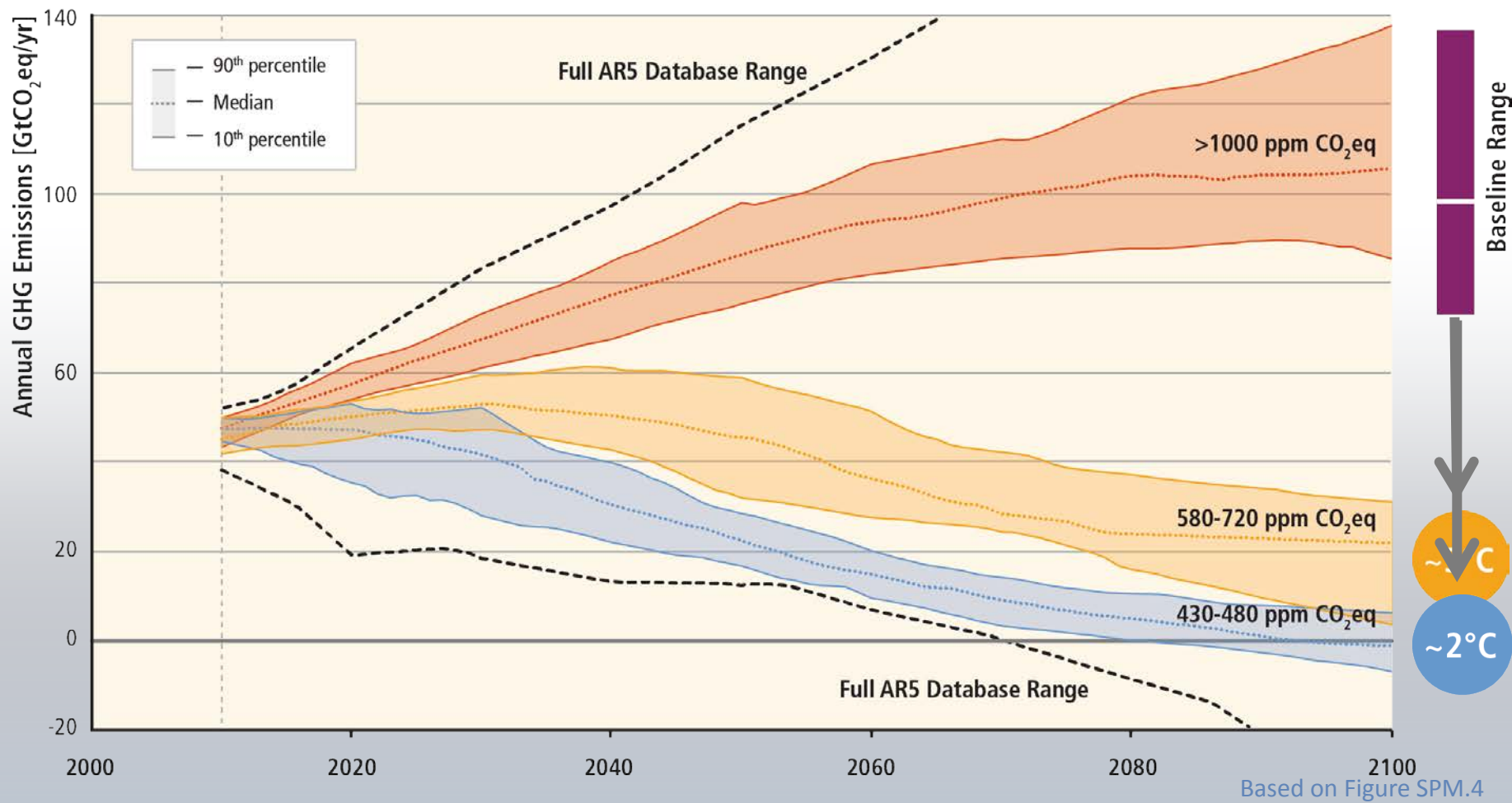
Based on WGII AR5 Figure 19.4

Stabilization of atmospheric GHG concentrations requires moving away from business as usual.

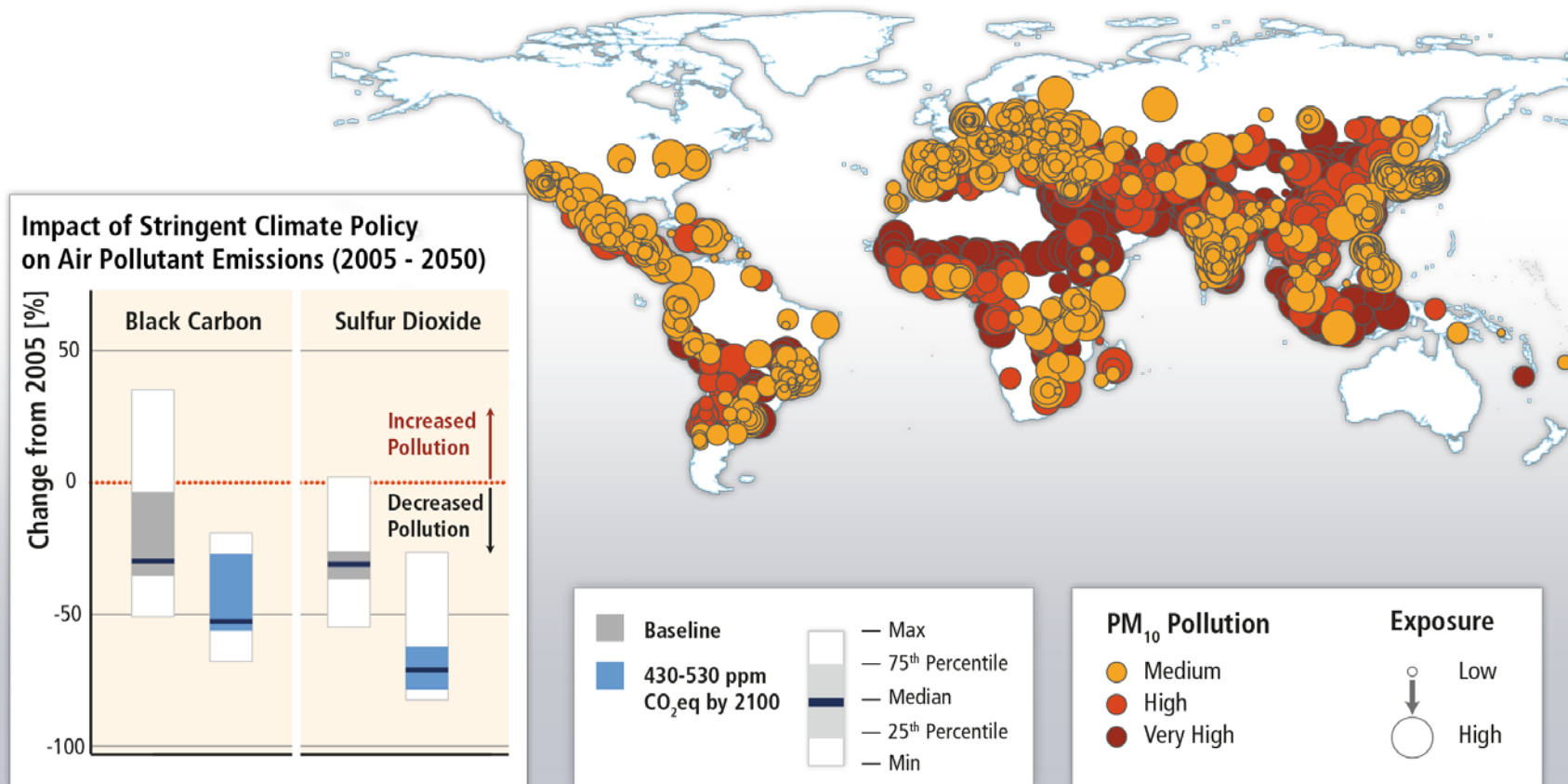


Based on Figure SPM.4

Lower ambition mitigation goals require similar reductions of GHG emissions.



Climate change mitigation can result in co-benefits for human health and other societal goals.

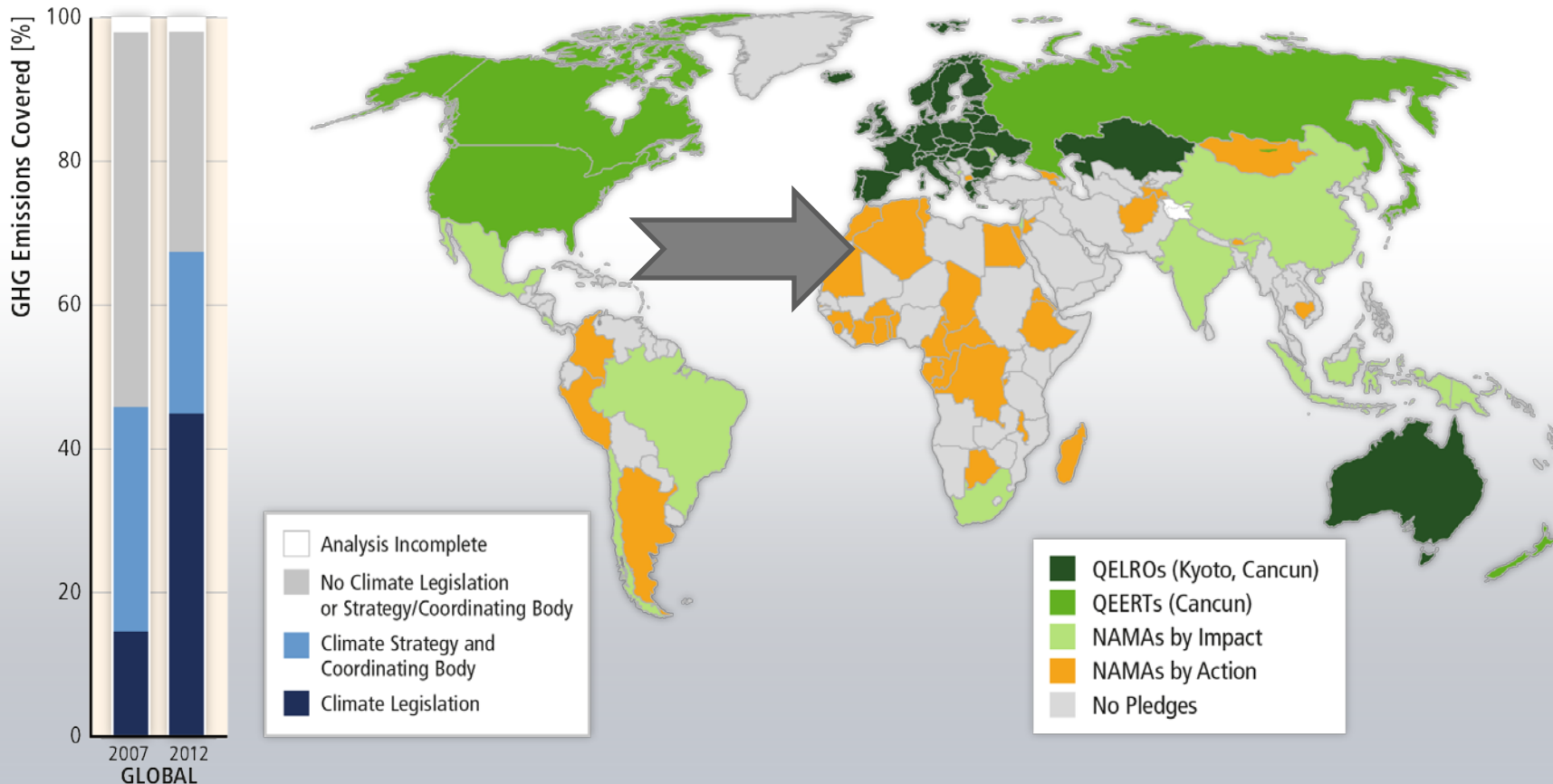


Based on Figures SPM.6 and 12.23

A large offshore wind turbine stands in the ocean at dusk. The sky is a deep blue, and the water is dark. In the foreground, a white service vessel with a red hull is moving towards the turbine, leaving a white wake. The turbine's three blades are visible against the sky. The overall scene is dimly lit, emphasizing the industrial nature of the renewable energy source.

The wide-scale application of best-practice low-GHG technologies could lead to substantial emission reductions.

There has been a considerable increase in national and sub-national mitigation policies since AR4.

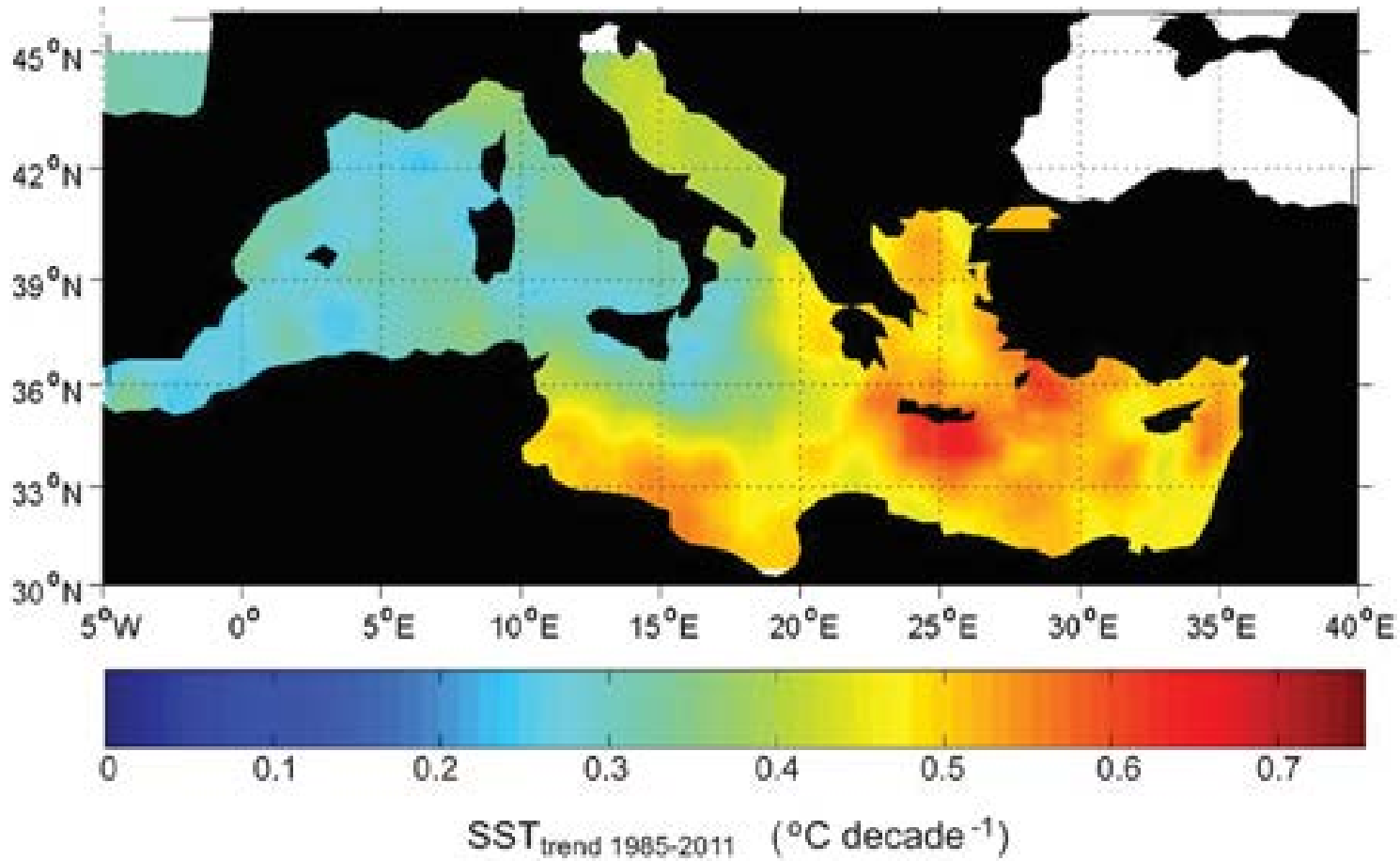


Based on Figures 15.1 and 13.3

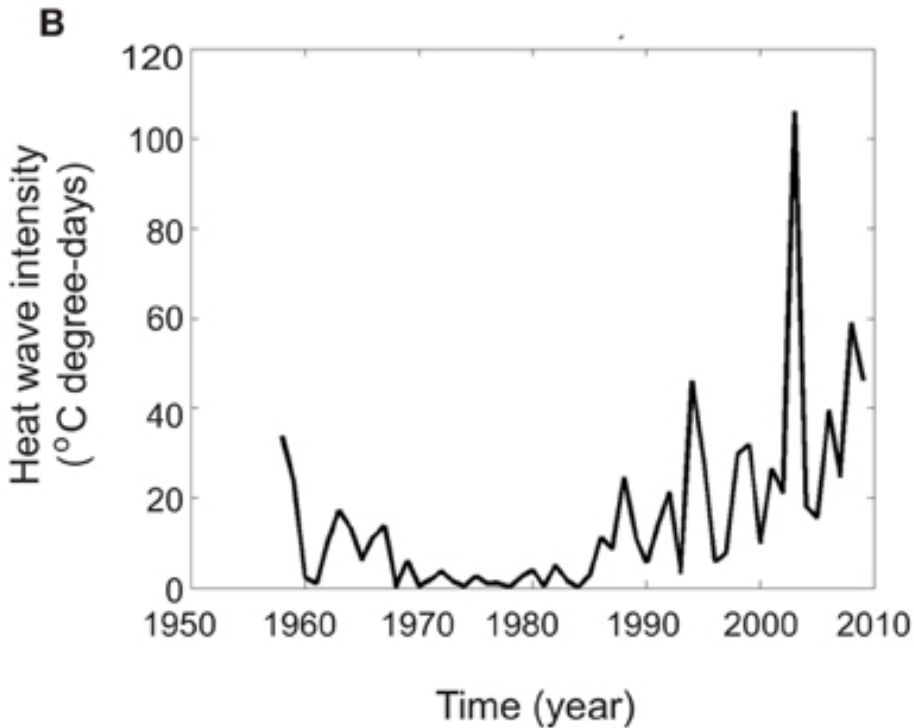
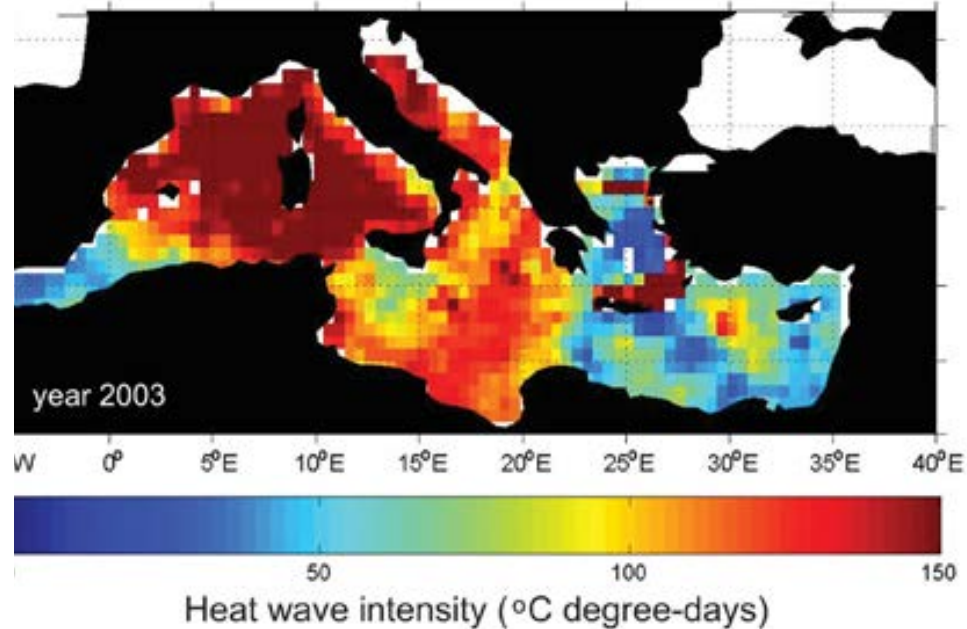
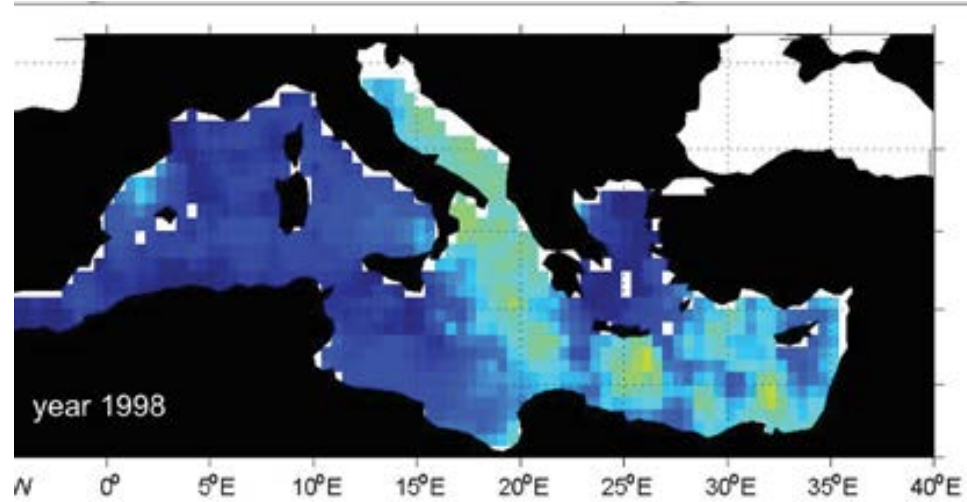
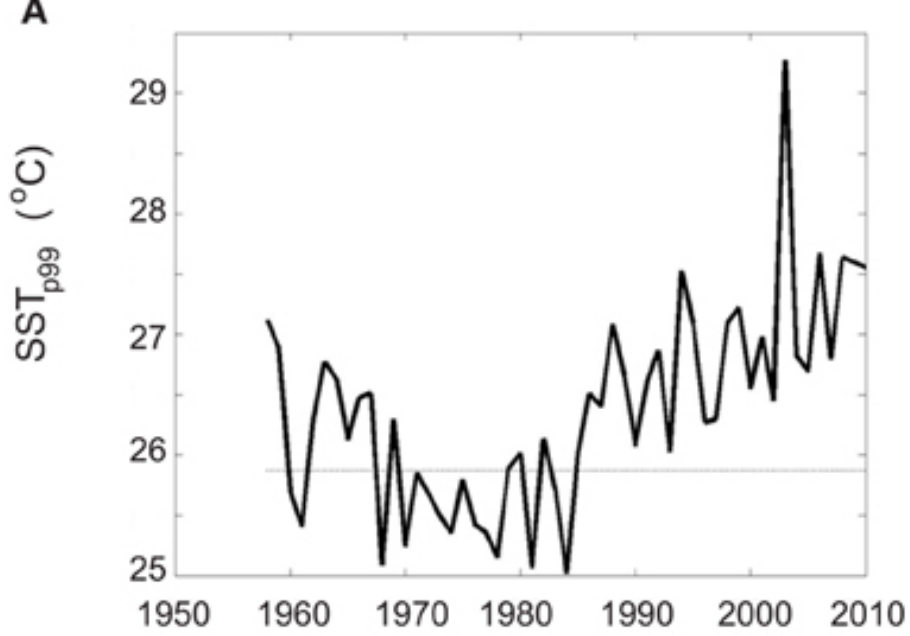
Regional Focus : Mediterranean

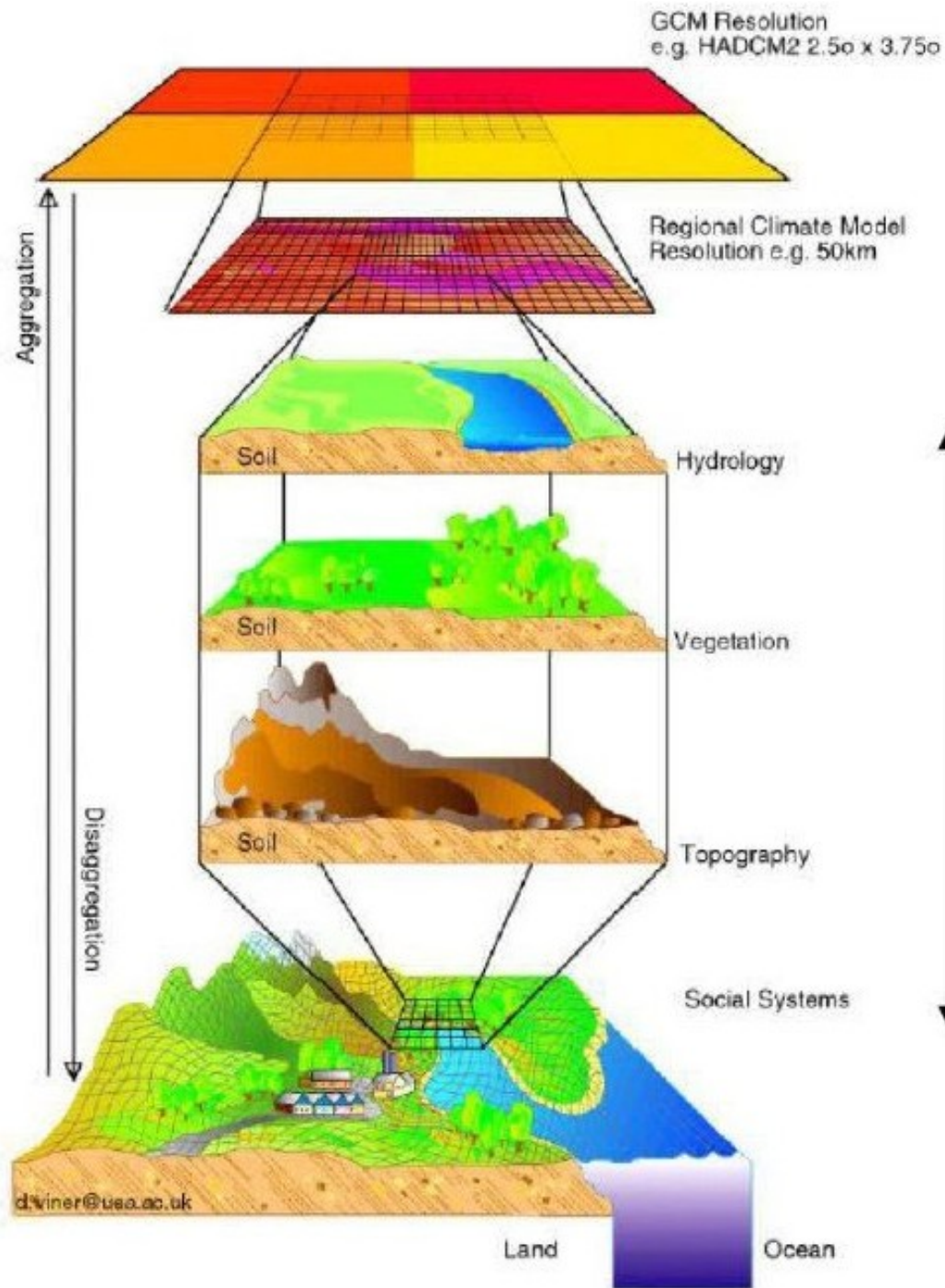


The Mediterranean Sea is rapidly warming



A predicted increase in heat wave intensity





Scénarios climatiques globaux

100 – 300 km

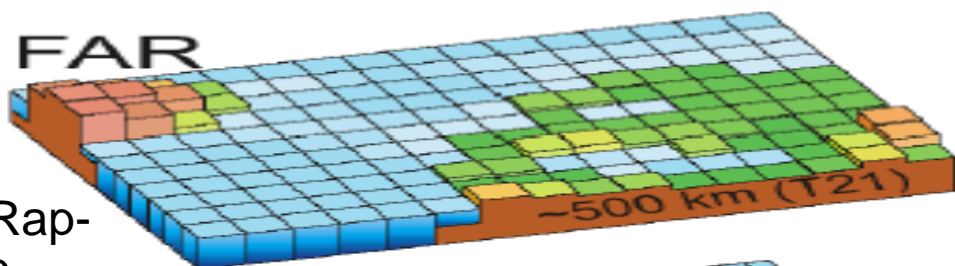
Scénarios climatiques régionaux

10 – 50 km

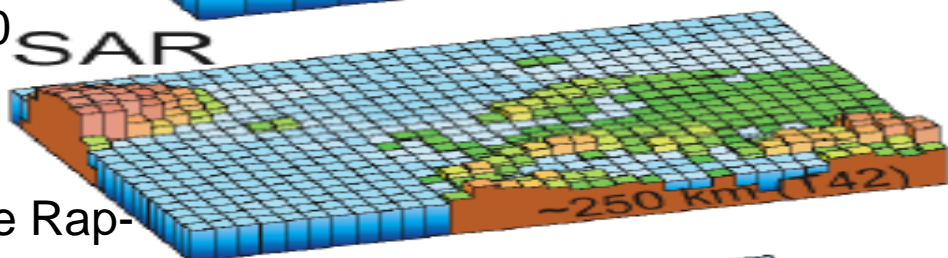
Modèles d'impacts

quelques km à quelques mètres

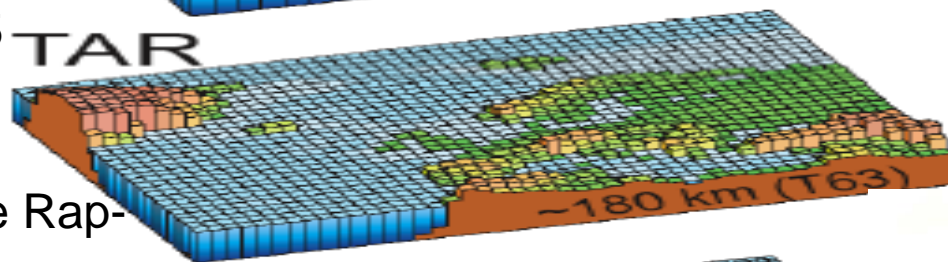
Résolution spatiale des modèles utilisés dans les rapports du GIEC



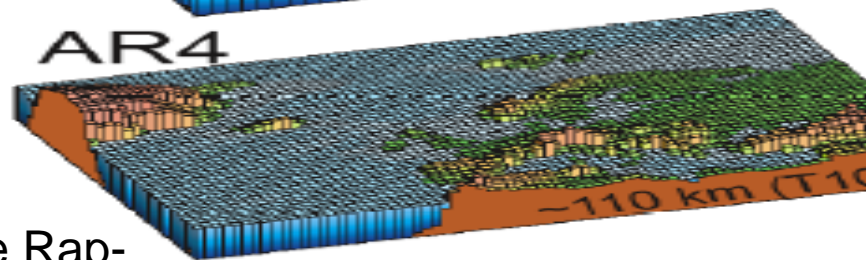
1er Rap-
1990



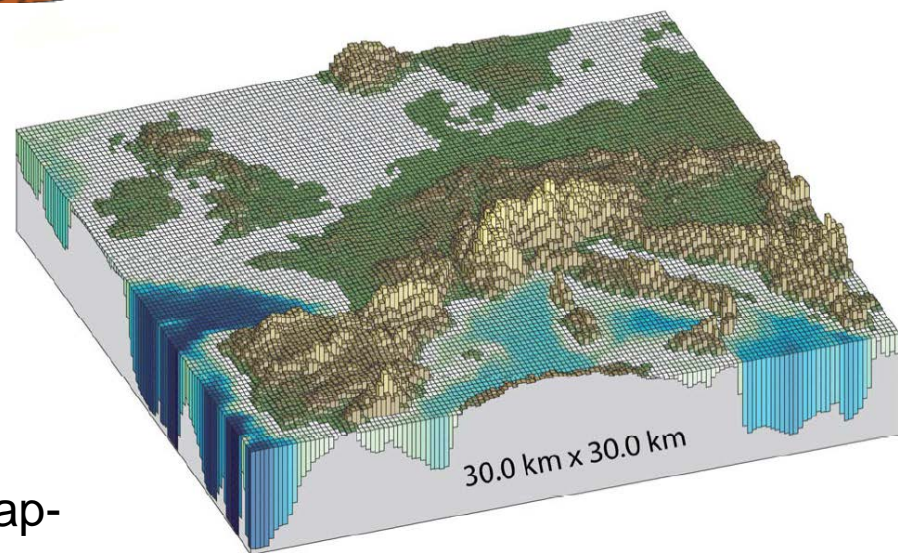
2ème Rap-
1995



3ème Rap-
2001

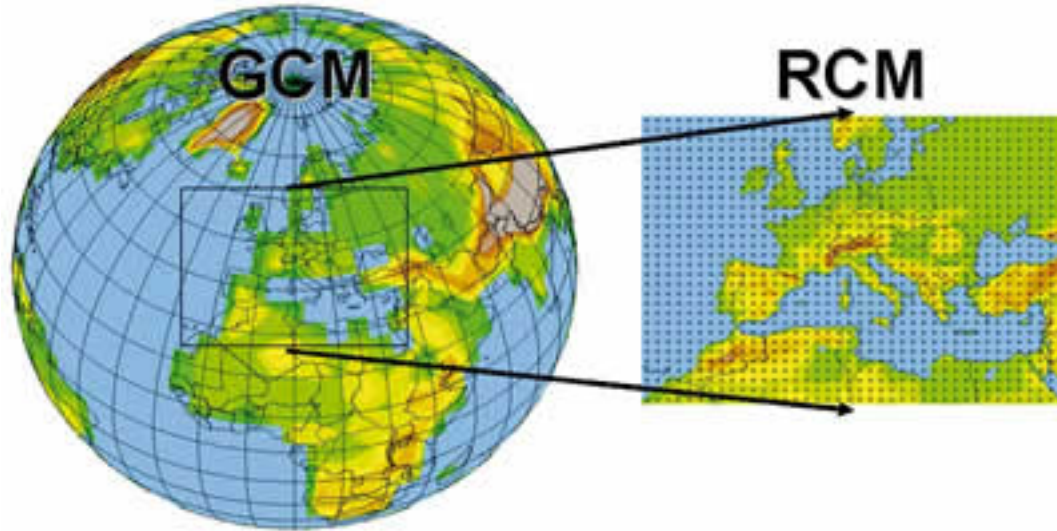


4ème Rap-
2007



5ème Rap-
2013

Techniques de réduction d'échelle Dynamiques (RCM)



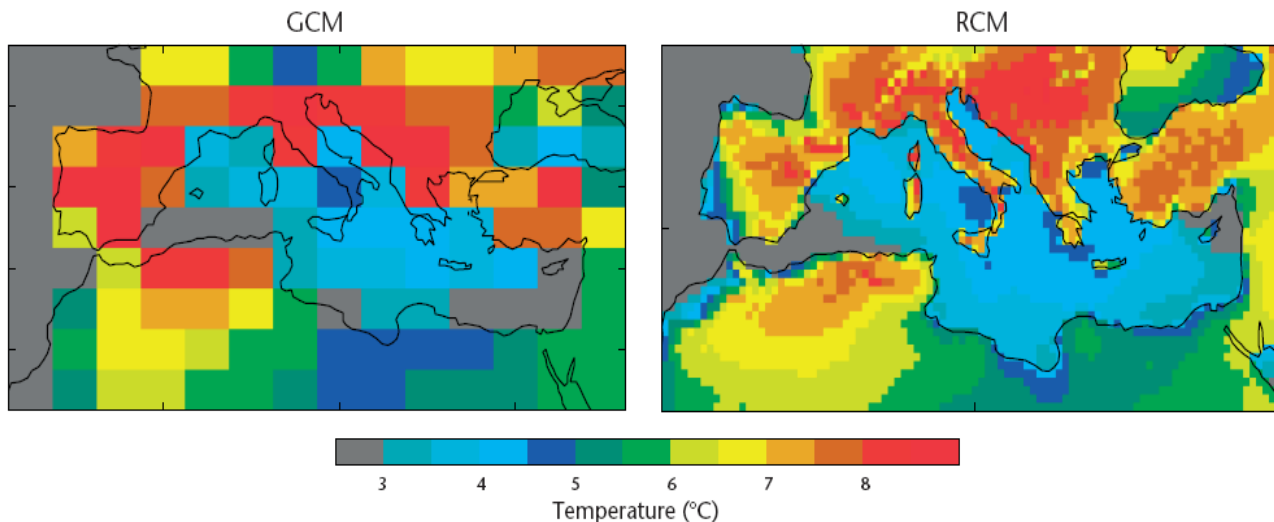
- Prise en compte des processus globaux

- Forcé aux frontières du domaine par un MCG

- Meilleure prise en compte des facteurs régionaux (topographie, végétation, ...)

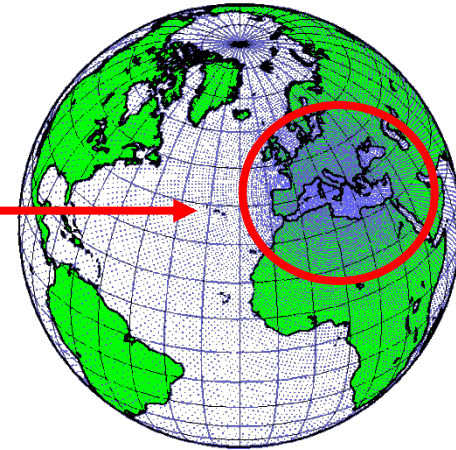
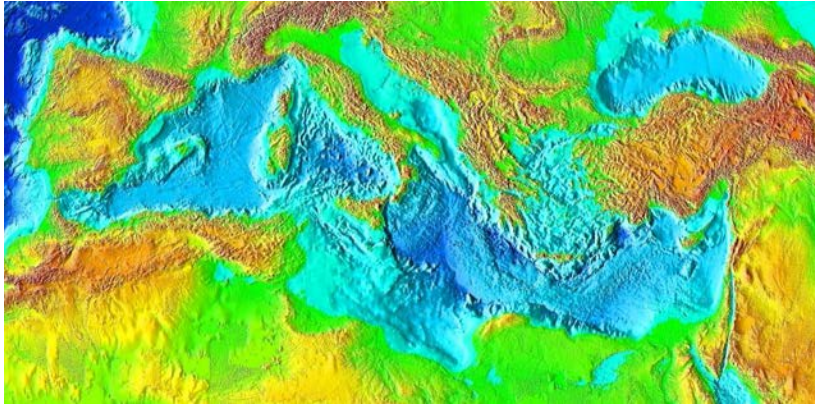
- 10km à 50km

- Mais des contraintes

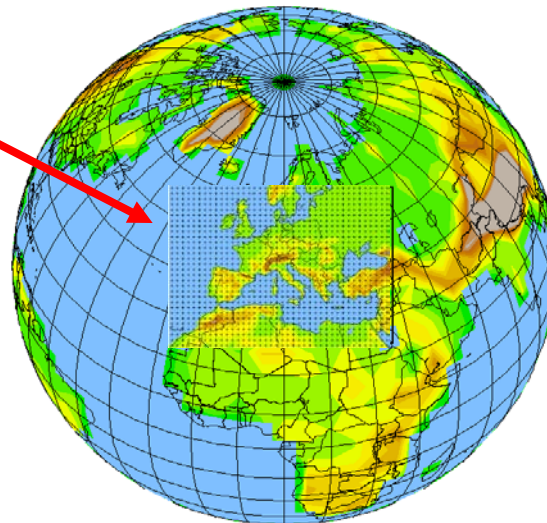


De nombreuses incertitudes liées à la complexité de la géographie des régions méditerranéennes

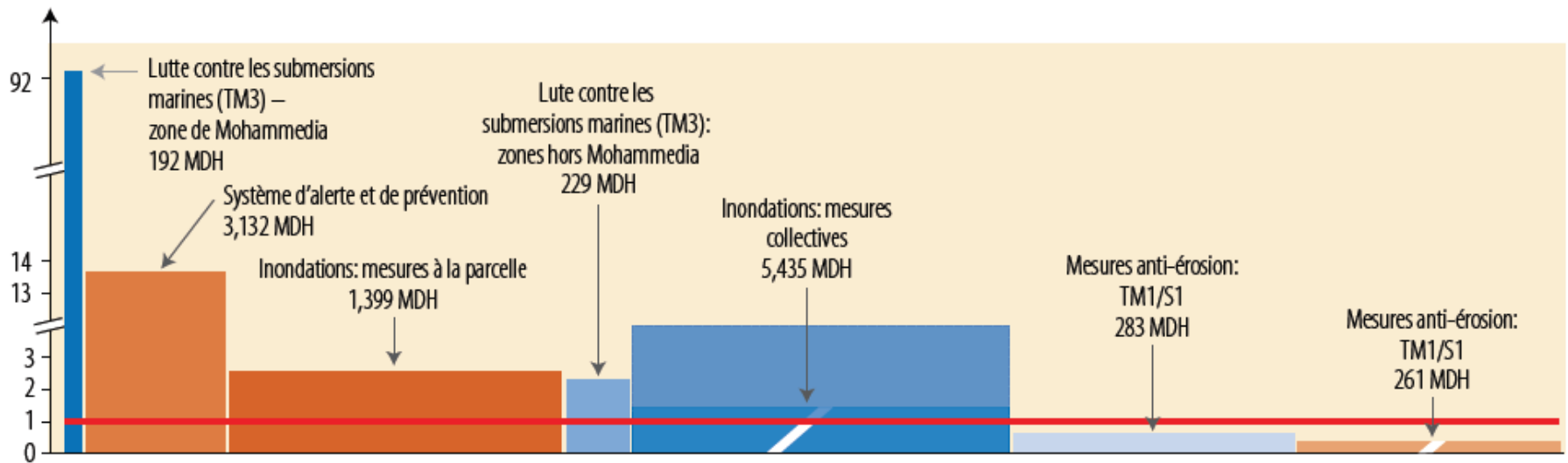
→ Besoin de recourir à des modèles climatiques régionaux



Modèle de climat régional ARPEGE étiré



Modèle de climat régional Aladin-Climat
(coopération Consortium Aladin dont Maroc-Météo)



Les courbes des coûts d’adaptation, comme celle de Casablanca, permettent aux villes d’évaluer les bénéfices des mesures proposées par les plans d’action. La colonne verticale présente le ratio bénéfices-coûts pour des investissements ponctuels, mesures institutionnelles et infrastructures. La ligne rouge montre le point d’équilibre, au-dessus duquel les bénéfices dépassent les coûts.

Une étude de la Banque Mondiale (*) sur la vulnérabilité des zones côtières urbaines réalisée dans trois pays (Egypte, Tunisie et Maroc) a mis en exergue les risques d’inondation et d’érosion du fait des fortes précipitations et de la surélévation du niveau marin. Selon cette étude, la région MENA serait la 2ème zone géographique la plus affectée par l’élévation accélérée du niveau de la mer.

* Banque Mondiale (2010) - Etude régionale sur la vulnérabilité des villes côtières d’Afrique du Nord au changement climatique et aux désastres naturels, à l’horizon 2030.

Les risques urbains augmentent dans toutes les localités urbaines examinées

Risques	Alexandrie	
	Actuel	2030
Séismes/instabilité des sols	Moyen	Moyen
Tsunamis/submersion marine	Moyen	Élevé
Érosion côtière	Moyen	Élevé
Inondations	Moyen	Moyen
Pénurie d'eau	Moyen	Élevé

Élevé Moyen Faible

Les risques urbains augmentent dans toutes les localités urbaines examinées

Risques	Casablanca	
	Actuel	2030
Séismes/instabilité des sols	Moyen	Moyen
Tsunamis/submersion marine	Moyen	Moyen
Érosion côtière	Élevé	Élevé
Inondations	Élevé	Élevé
Pénurie d'eau	Moyen	Moyen

Élevé Moyen Faible Très faible

Les risques urbains augmentent dans toutes les localités urbaines examinées

Risques	Tunis	
	Actuel	2030
Séismes/instabilité des sols	Moyen	Élevé
Tsunamis/submersion marine	Moyen	Élevé
Érosion côtière	Élevé	Élevé
Inondations	Élevé	Élevé
Pénurie d'eau	Moyen	Moyen

Très élevé Élevé Moyen Faible

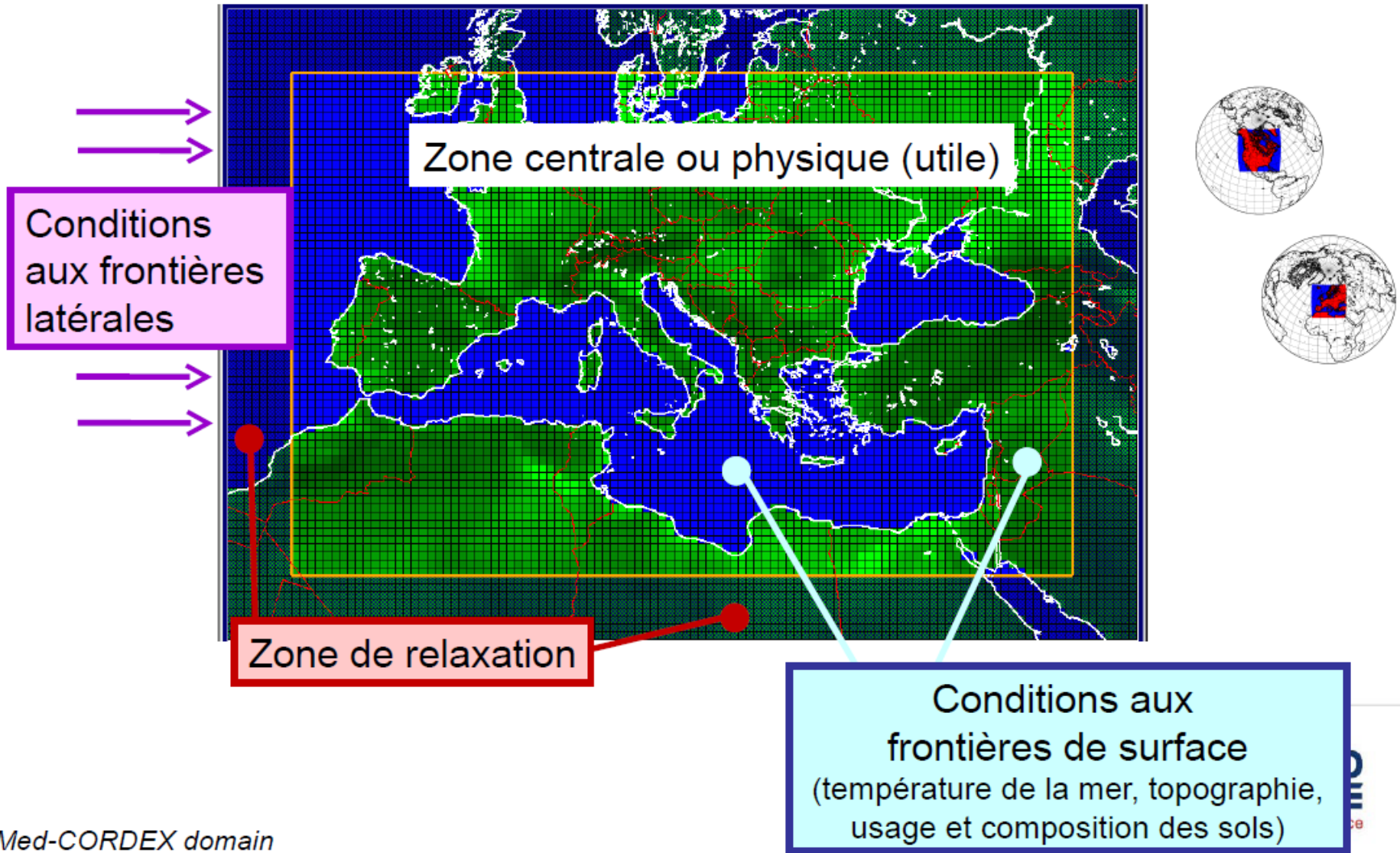
Les risques urbains augmentent dans toutes les localités urbaines examinées

Risques	Vallée du Bouregreg	
	Actuel	2030
Séismes/instabilité des sols	Moyen	Moyen
Tsunamis/submersion marine	Moyen	Élevé
Érosion côtière	Moyen	Moyen
Inondations	Moyen	Très élevé
Pénurie d'eau	Moyen	Moyen

Très élevé Élevé Moyen Faible

* Banque Mondiale (2010) - Etude régionale sur la vulnérabilité des villes côtières d'Afrique du Nord au changement climatique et aux désastres naturels, à l'horizon 2030.

Qu'est-ce qu'un modèle régional de climat ?

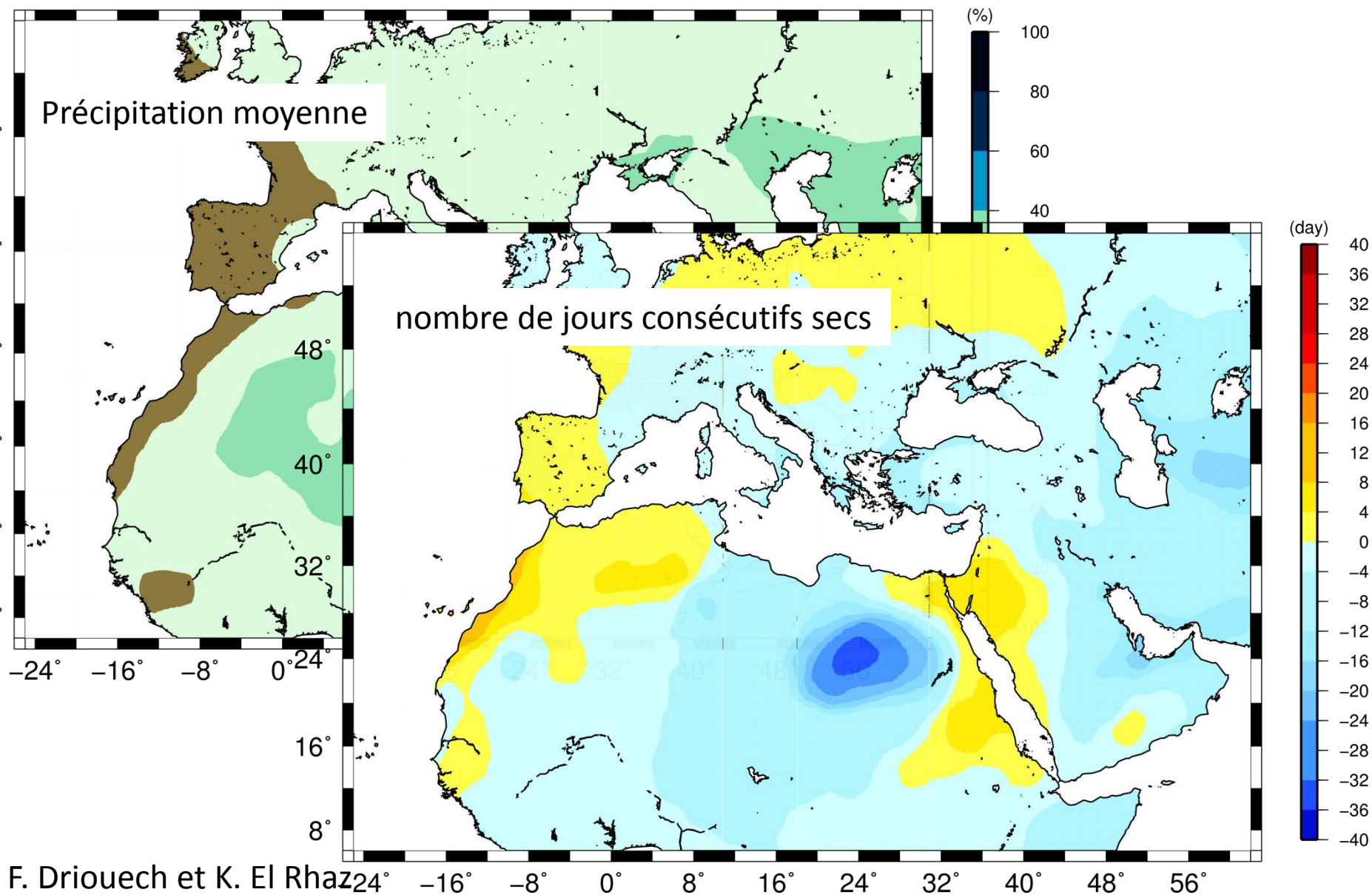


Med-CORDEX domain

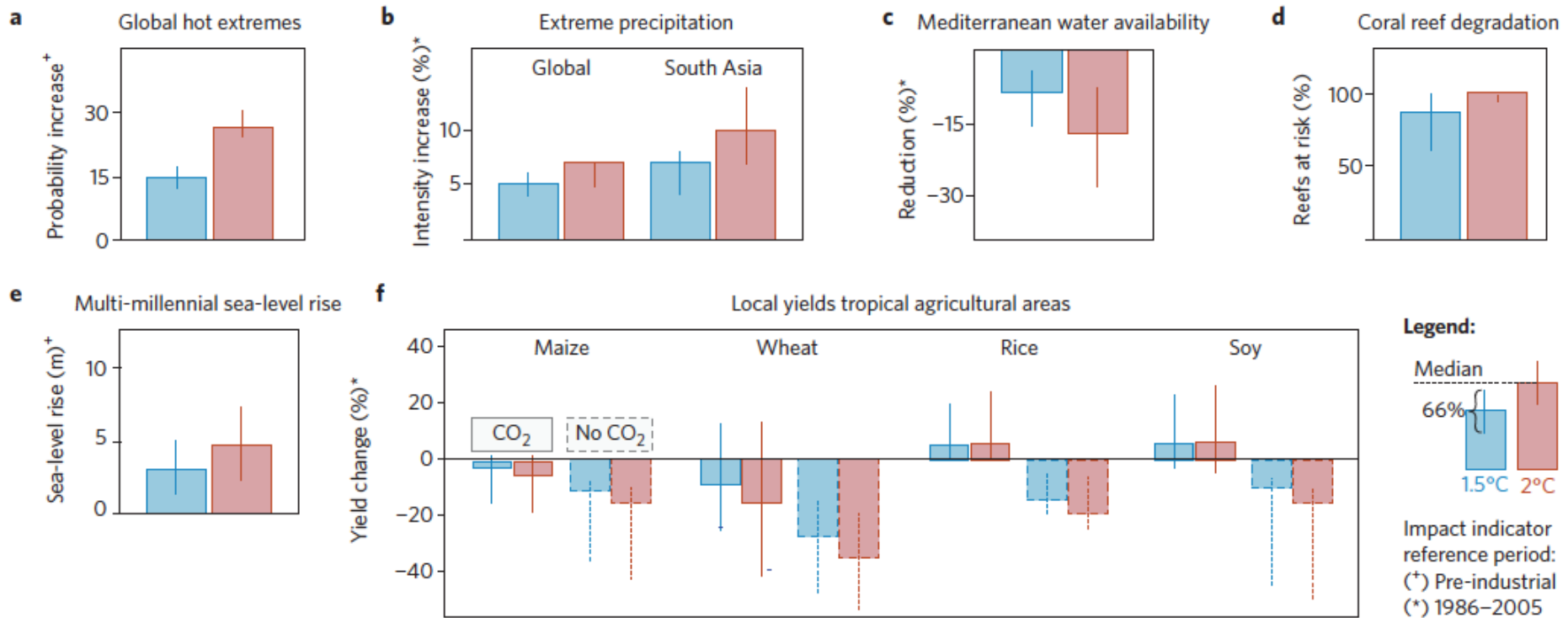
Projections futures du climat à l'horizon 2036-2065 /1971-2000

sous le scénario RCP4.5

Précipitation moyenne et nombre de jours consécutifs secs annuels



One study exploring impacts of 1.5-2°C global warming



Impacts of Climate change

Evaluating the impacts of climate change on crop yields in Morocco: rainfed wheat

Figures IVa et Figure IVb : Impacts des changements climatiques sur le rendement du blé dur pluvial au Maroc. IVa : impacts modérés jusqu'en 2030 et sévères au-delà, selon le scénario A2 ; IVb : impacts modérés jusqu'en 2030, et maîtrisés au-delà, selon le scénario B2.

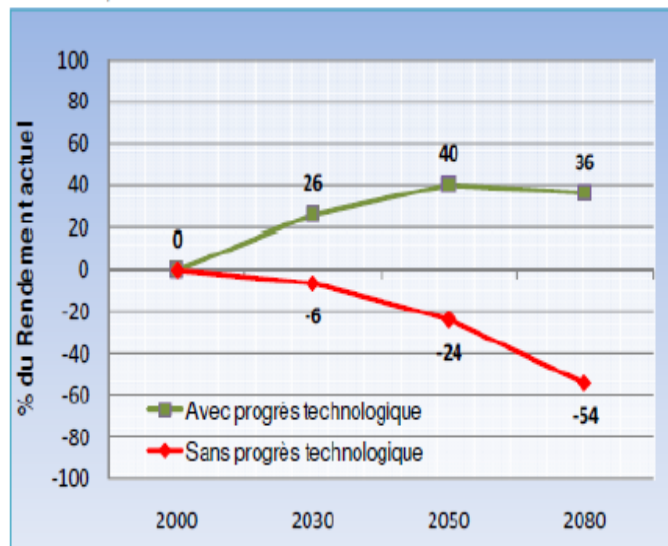


Figure IVa

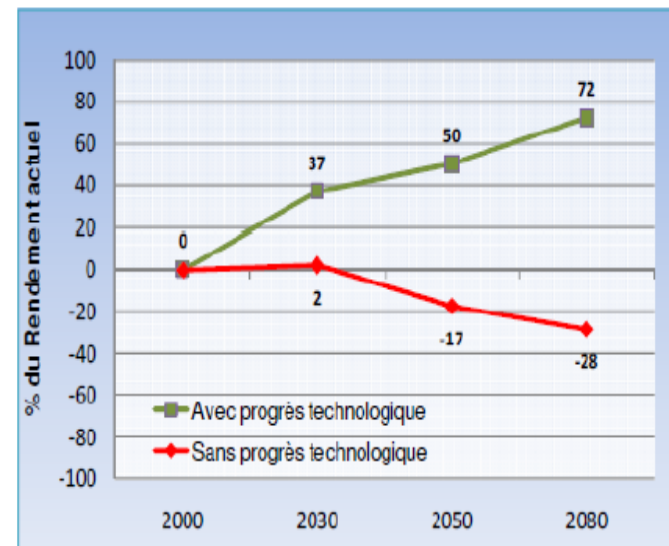


Figure IVb

Future changes with and without technological trends for the production of rainfed durum wheat in Morocco (for both A2 and B2 scenarios)



The Sixth Assessment Cycle

IPCC Sixth Assessment (AR6)

Some overarching preliminary aspects for the Synthesis Report

- *Global Stocktake*
- *Interaction among emissions, climate, risks and development pathways*
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Mitigation of Climate Change

July 2021

Global stocktake 2023 UNFCCC

March 2018



Cities and Climate Change Science Conference

May 2018



Expert Meeting on Assessing Climate Information for Regions

May 2018

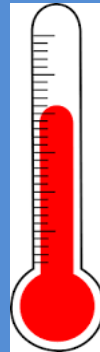


Expert Meeting on Short Lived Climate Forcers

** Dates are subject to change*

IPCC

Special Report on Global Warming of 1.5 °C (SR15)



Jan Fuglestedt
Vice Chair Working Group I
ZERO, 12 Januar 2018

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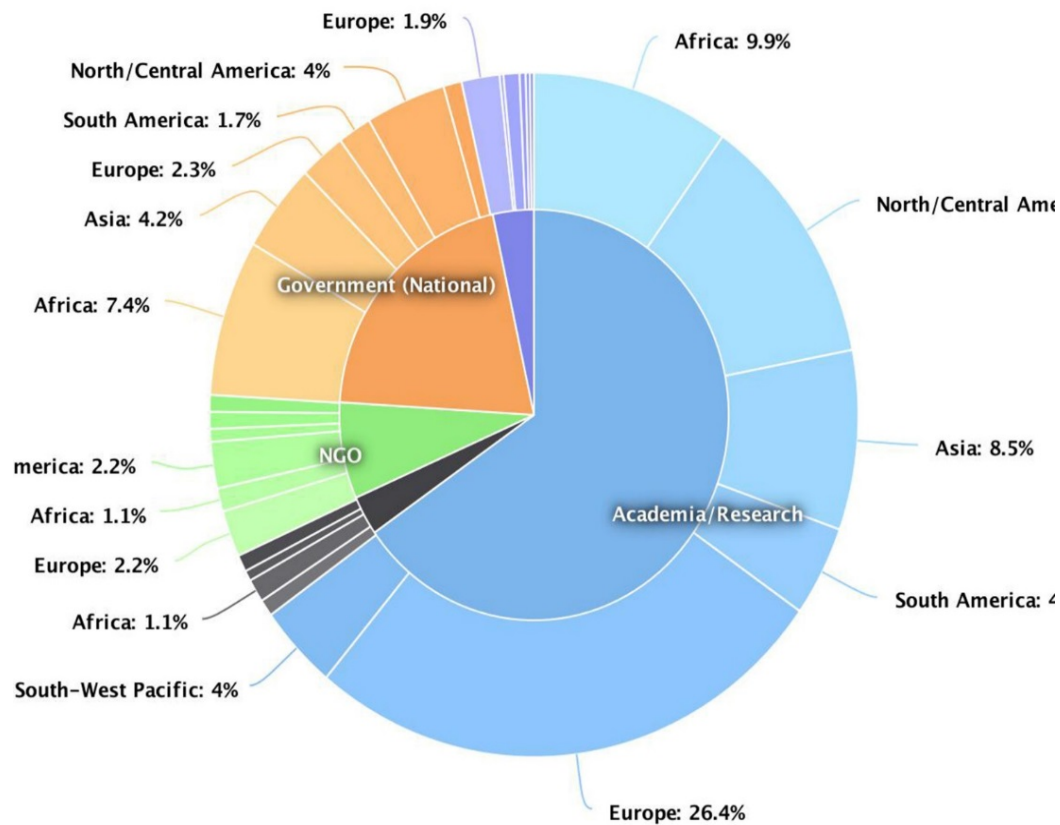




Scoping meeting for Special Report on 1.5 C

600 nominations for the scoping meeting
Selected: 86 participants + bureau members

Experts selected:
 33% female / 67% male
 51% developing / 49% developed countries



SR1.5 - Outline from Scoping Meeting

Submitted for consideration to the 44th Session of the IPCC, 17-20 October 2016

Front Matter	(2 pages)
Summary for Policy Makers	(15-20 pages)
1. Framing and context	(15 pages)
2. Mitigation pathways compatible with 1.5° C in the context of sustainable development	(40 pages)
3. Impacts of 1.5 ° C global warming on natural and human systems	(60 pages)
4. Strengthening the global response to the threat of climate change	(40 pages)
5. Approaches to implementing a strengthened global response to the threat of climate change	(20 pages)
6. Sustainable development, poverty eradication and reducing inequalities	(40 pages)
Up to 10 boxes integrated case studies/regional and cross-cutting themes	(20 pages)
FAQs	(10 pages)
TOTAL: (247/267 pages)	



Global warming of 1.5 °C

An IPCC special report on the impacts of global warming of 1.5° C above preindustrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty



Outline of special report
Global warming of 1.5 °C

Approved

Chapter 1: Framing and context (15 pages)

Chapter 2: Mitigation pathways compatible with 1.5°C in the context of sustainable development (40 pages)

Chapter 3: Impacts of 1.5°C global warming on natural and human systems (60 pages)

Chapter 4: Strengthening and implementing the global response to the threat of climate change (50 pages)

Chapter 5: Sustainable development, poverty eradication and reducing inequalities (20 pages)

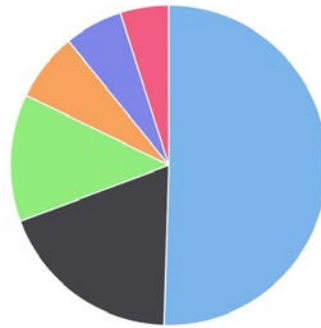
Expert Review:

12 895 comments

489 experts

61 countries

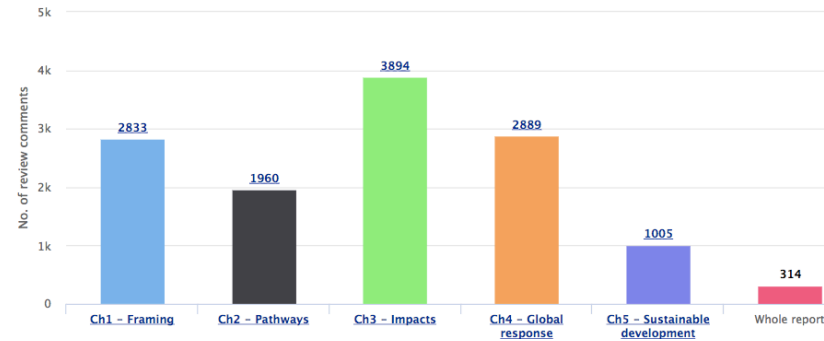
How well were different regions represented in the expert review?



● Europe ● North America, Central America & the Caribbean
● South America ● South West Pacific ● Africa ● Asia

Which chapters attracted most FOD review comments?

Click the columns to view reviewer expertise.



3rd Lead Author Meeting, Oct. '17.
Addressing review comments

Authors writing
Second Order Draft

1 November:
Literature submission
deadline



8 Jan – 25 Feb., 2018:
Expert and Government
Review of Second Order
Draft + First Order Draft of
Summary for Policy Makers

4th Lead Author
Meeting, 9-15 April

15 May: Literature
Acceptance deadline



COP24
Dec 2018

**1 – 7 October, 2018:
IPCC Plenary
Approval of SR1.5**

4 June – 29 July:
Final Government Review of
Summary for Policy Makers

Outlines

Sixth Assessment Cycle



Chapter 1: Framing, context, methods

Chapter 2: Changing state of the climate system

Chapter 3: Human influence on the climate system

Chapter 4: Future global climate: scenario-based projections and near-term information

Chapter 5: Global carbon and other biogeochemical cycles and feedbacks

Chapter 6: Short-lived climate forcers

Chapter 7: The Earth's energy budget, climate feedbacks, and climate sensitivity

Chapter 8: Water cycle changes

Chapter 9: Ocean, cryosphere, and sea level change

Chapter 10: Linking global to regional climate change

Chapter 11: Weather and climate extreme events in a changing climate

Chapter 12: Climate change information for regional impact and for risk assessment

Chapter 1: Point of departure and key concepts

SECTION 1: Risks, adaptation and sustainability for systems impacted by climate change

Chapter 2: Terrestrial and freshwater ecosystems and their services

Chapter 3: Ocean and coastal ecosystems and their services

Chapter 4: Water

Chapter 5: Food, fibre, and other ecosystem products

Chapter 6: Cities, settlements and key infrastructure

Chapter 7: Health, wellbeing and the changing structure of communities

Chapter 8: Poverty, livelihoods and sustainable development

SECTION 2: Regions

Chapter 9: Africa

Chapter 10: Asia

Chapter 11: Australasia

Chapter 12: Central and South America

Chapter 13: Europe

Chapter 14: North America

Chapter 15: Small Islands

SECTION 3: Sustainable development pathways: integrating adaptation and mitigation

Chapter 16: Key risks across sectors and regions

Chapter 17: Decision-making options for managing risk

Chapter 18: Climate resilient development pathways



Special Report on Global Warming of 1.5 °C (SR15) Outline

Chapter 1: Framing and Context

Chapter 2: Mitigation pathways compatible with 1.5°C in the context of sustainable development

Chapter 3: Impacts of 1.5°C global warming on natural and human systems

Chapter 4: Strengthening and implementing the global response to the threat of climate change

Chapter 5: Sustainable development, poverty eradication, and reducing inequalities

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Special Report on Climate Change and Land (SRCCL) Outline



Chapter 1: Framing and Context

Chapter 2: Land–Climate interactions

Chapter 3: Desertification

Chapter 4: Land Degradation

Chapter 5: Food Security

Chapter 6: Interlinkages between desertification, land degradation, food security and GHG fluxes: synergies, trade-offs and integrated response options

Chapter 7: Risk management and decision making in relation to sustainable development

Special Report on the Ocean and Cryosphere (SROCC) Outline



Chapter 1: Framing and Context of the Report

Chapter 2: High Mountain Areas

Chapter 3: Polar Regions

Chapter 4: Sea Level Rise and Implications for Low Lying Islands, Coasts and Communities

Chapter 5: Changing Ocean, Marine Ecosystems, and Dependent Communities

Chapter 6: Extremes, Abrupt Changes and Managing Risks

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2019 Refinement to the 2006 IPCC Guidelines



for National Greenhouse Gas Inventories Outline

Overview Chapter

Volume 1: General Guidance and Reporting

Volume 2: Energy

Volume 3: Industrial Processes and Product Use

Volume 4: Agriculture, Forestry and Other Land Use

Volume 5: Waste

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THANK YOU FOR YOUR ATTENTION!

For more information:

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IPCC Press Office: ipcc-media@wmo.int

Find us on:

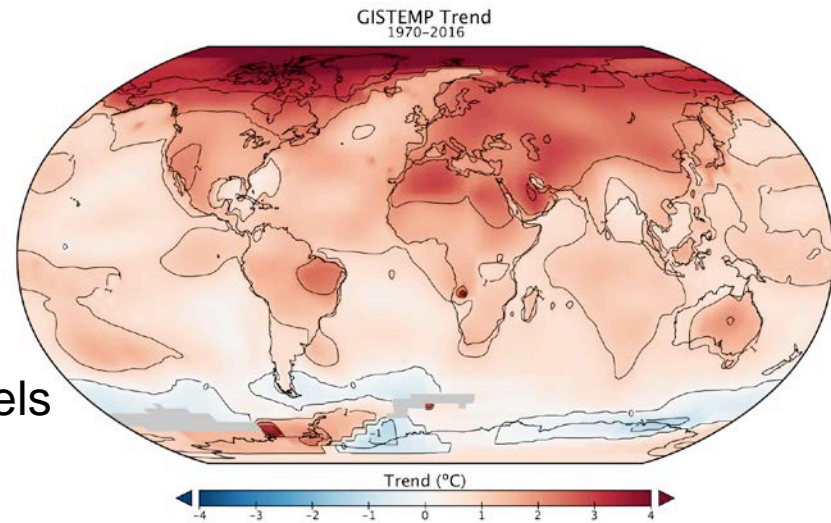
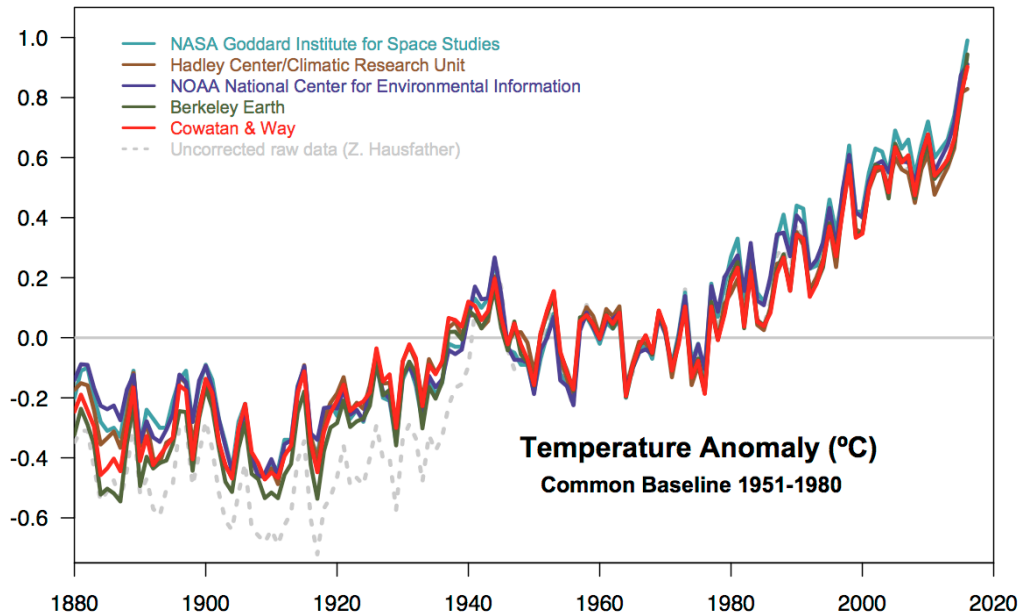


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How has temperature changed at the Earth's surface?



Ongoing trend : 0.18°C per decade

2015 and 2016 : $>1^{\circ}\text{C}$ above pre-industrial levels

One study of greenhouse gas emission pathways compatible with climate targets

