



La prévention des risques de catastrophes et changement climatique au Maghreb

Atelier en ligne à destination des journalistes du Maghreb

Introduction au changement climatique et à ses phénomènes

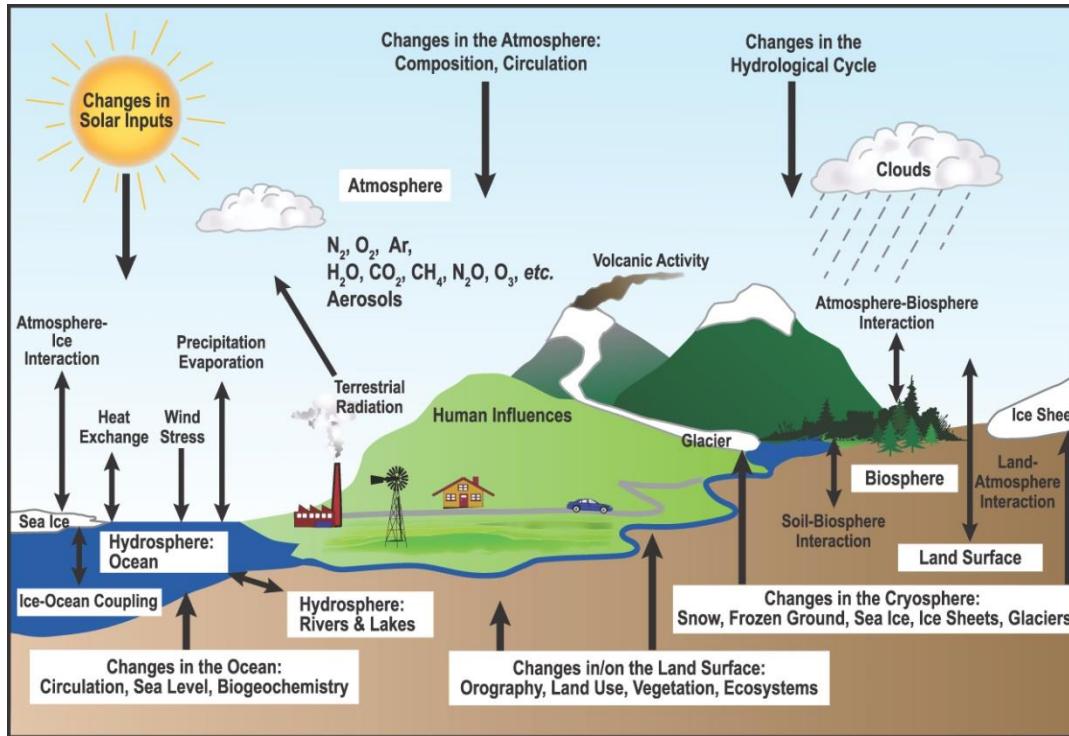


Fatima Driouech
UM6P
Vice-présidente Groupe I de travail GIEC



20/09/2020

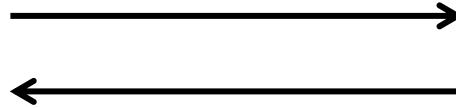
Le système climatique



Les interactions et échanges d'énergie et de matière entre les composantes du système climatique influe sur le climat et détermine son état et ses changements

Vue schématique des composantes du système climatique, leurs processus et interactions
Source: IPCC (2007): AR4

Temps



Climat

Global Warming of 1.5°C

An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial 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.



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INTERGOVERNMENTAL PANEL ON climate change

Climate Change and Land

An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems

[Summary for Policymakers](#)



- Human-induced global warming has already caused multiple observed changes in the climate system.
- The global climate has changed relative to the preindustrial period with multiple lines of evidence that these changes have had impacts on organisms and ecosystems, as well as human systems and wellbeing.
- Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems.
- Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.
- Past emissions alone do not commit the world to 1.5°C

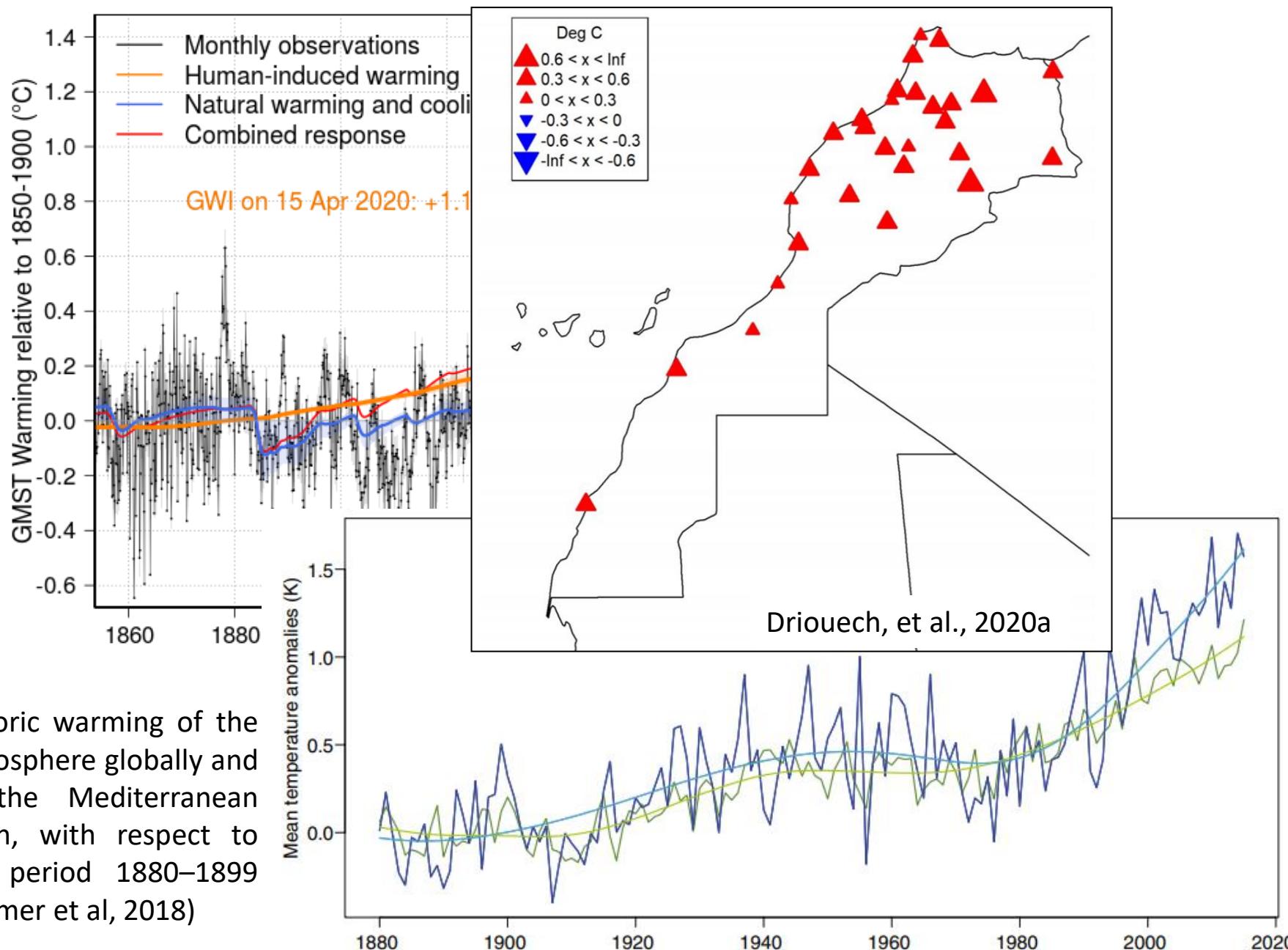


Where are we now?

Since pre-industrial times, human activities have caused approximately 1.0°C of global warming.

- Already seeing consequences for people, nature and livelihoods
- At current rate, would reach 1.5°C between 2030 and 2052
- Past emissions alone do not commit the world to 1.5°C

Global Warming Index (aggregate observations) - updated to Apr 2020



Trends of Observed temperature extremes in the Arab region

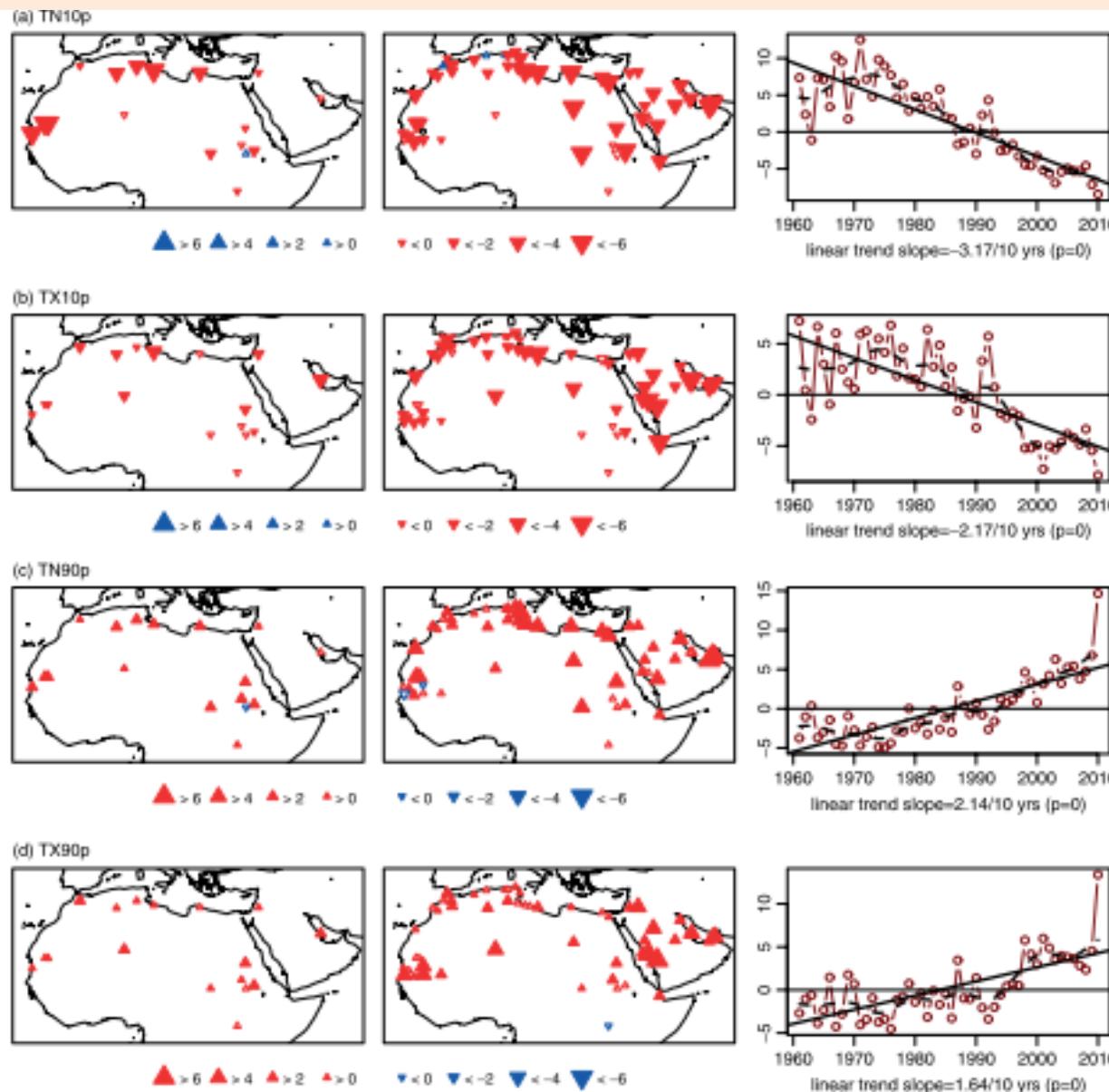
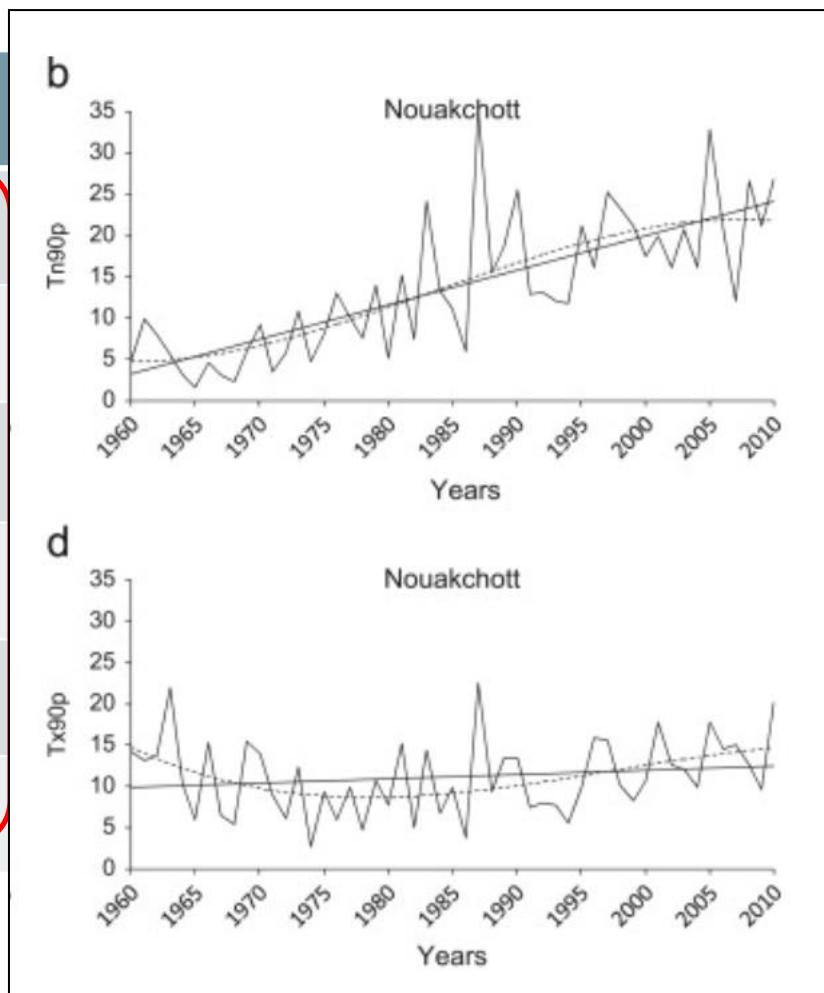


Figure 3. As Figure 2, but for frequency of cool nights (TN10p), cool days (TX10p), warm nights (TN90p), and warm days (TX90p). Upward pointing triangles show increasing trends, downward pointing triangles represent decreasing trends. Significant changes ($p \leq 0.05$) are indicated by filled symbols. Red colour coding indicates warming, blue indicates cooling trends (unit: % of days/10 years).

Changements observés des extrêmes de température

| | TX10p (j/d) | TX90p (j/d) | TN10p (j/d) | TN90p (j/d) | TXn (°C/d) | TNx (°C/d) |
|------------|--------------------|----------------|----------------|--------------------|--------------------|---------------|
| Saida | -2,12** | +1,59 | -3,22** | +0,7 | +0,61 | +0,19 |
| Mascara | -2,28** | +0,2 | -4,68*** | +1,12 | +0,89* | +0,35 |
| Tiaret | -2,75 ⁺ | +4,79*** | +0,94 | +1,24 | +0,44 | +0,36 |
| Maghnia | -2,12** | +0,13 | -9,22*** | +5,13*** | +0,14 | +0,7** |
| Tlemcen | -1,82* | +0,95 | -4** | +1,77 ⁺ | +0,08 | +0,54* |
| Mostaganem | -3,27*** | +0,77 | -4,79*** | 2,59** | +0,58 ⁺ | +0,99* |

Salah Sahabi (ONM Algeria)

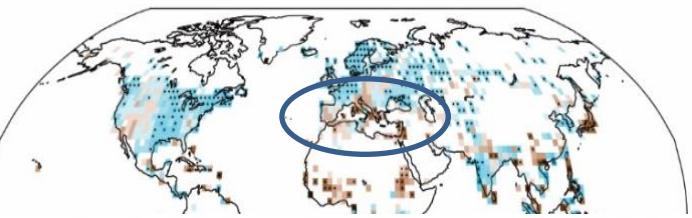


Ly et al. (2013)

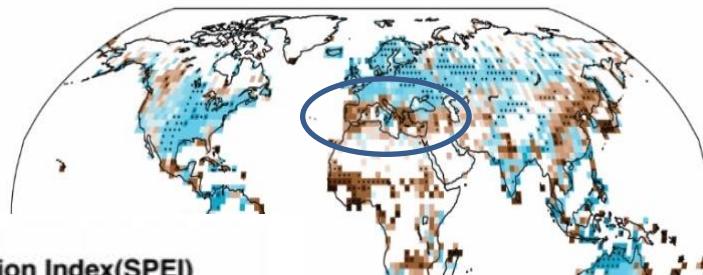
→ Une baisse des cumuls pluviométriques

Observed change in annual precipitation over land

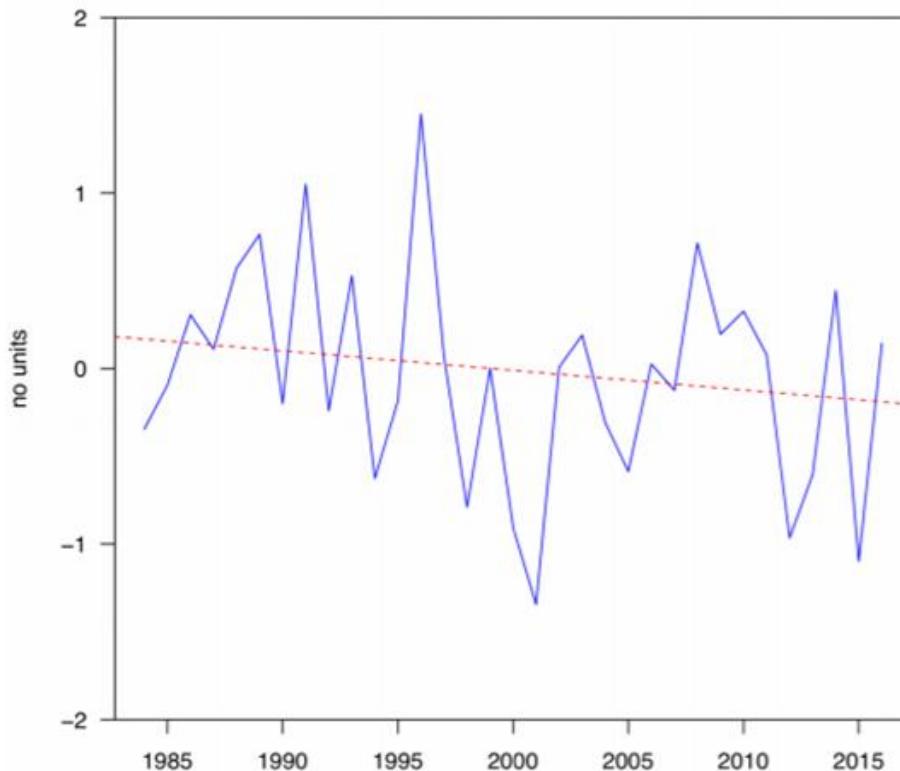
1901– 2010



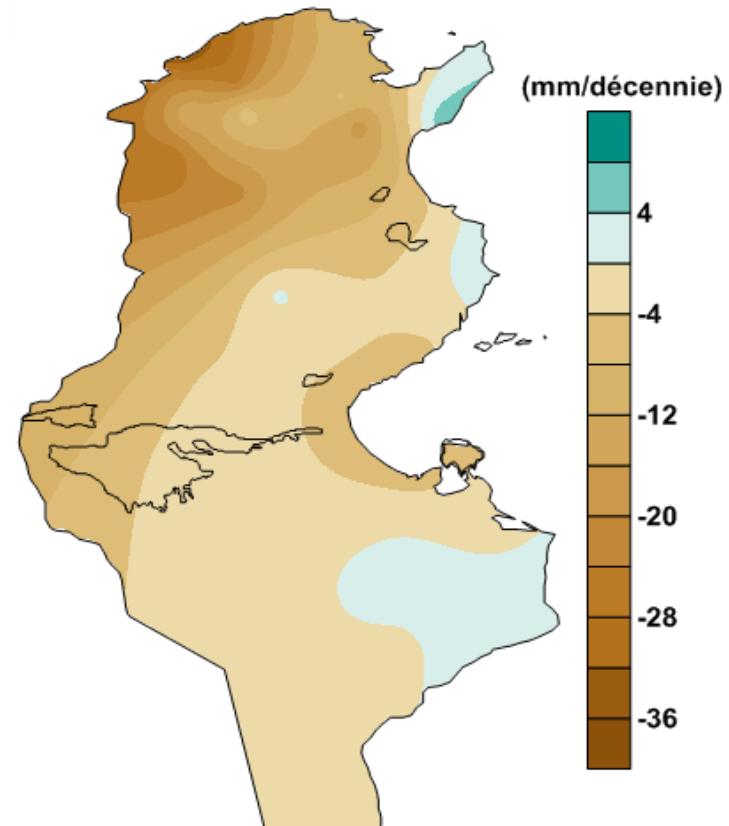
1951– 2010



Standardized Precipitation Evapotranspiration Index(SPEI)



Changement observé de sécheresse, Maroc
Driouech et al., 2020a



Trends of mean annual precipitation 1951-2010
Ben Rached Soumaya/Zammel Anis INM Tunisia

Average Annual Natural Hazard Occurrence for 1900–2018

Climat

Climat

Flood

Insect infestation

Earthquake

Lybie

Highcharts.com n

climateknowledgeportal.worldbank.org

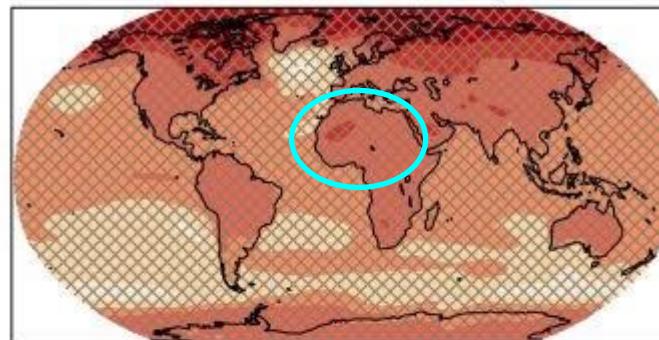
Les aléas climatiques
comptent pour plus
des 3/4 au Maroc et
plus de 50% en Lybie

Changements futurs selon le degré de réchauffement global

Mean temperature change
at 1.5°C GMST warming

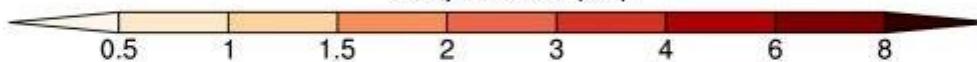


Mean temperature change
at 2.0°C GMST warming

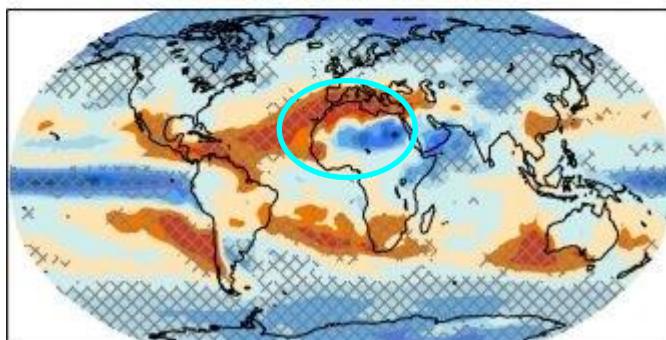


Changement de
température moyenne
annuelle

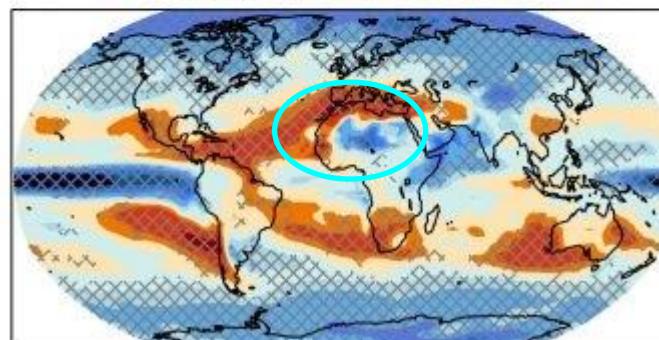
Temperature (°C)



Mean precipitation change
at 1.5°C GMST warming

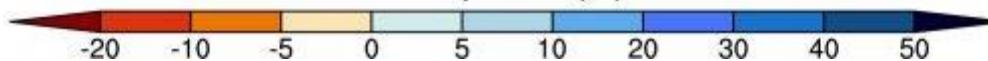


Mean precipitation change
at 2.0°C GMST warming



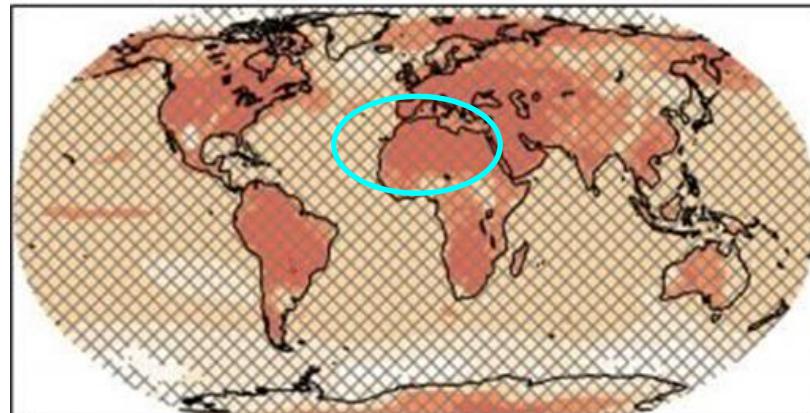
Changement de
précipitation annuelle

Precipitation (%)

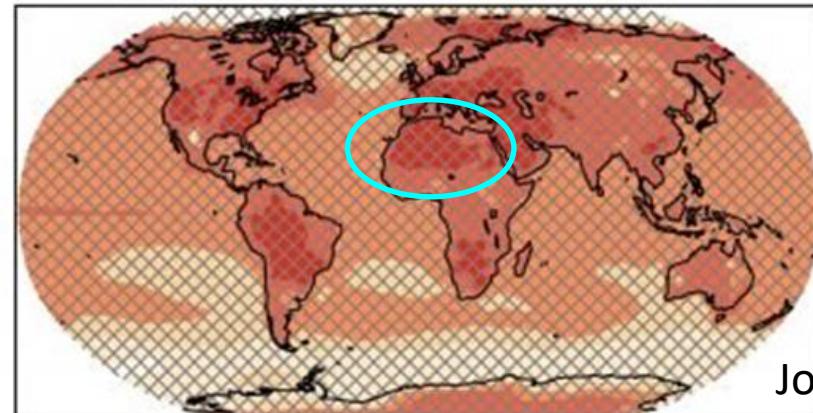


Changements futurs selon le degré de réchauffement global

Change in temperature of hottest days (TXx) at 1.5°C GMST warming

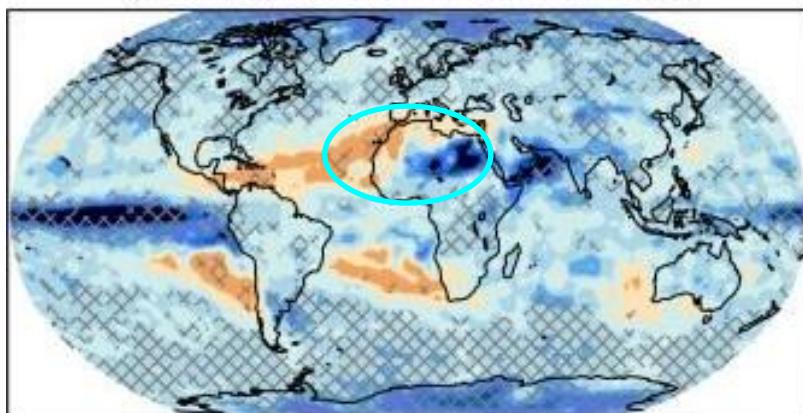


Change in temperature of hottest days (TXx) at 2.0°C GMST warming

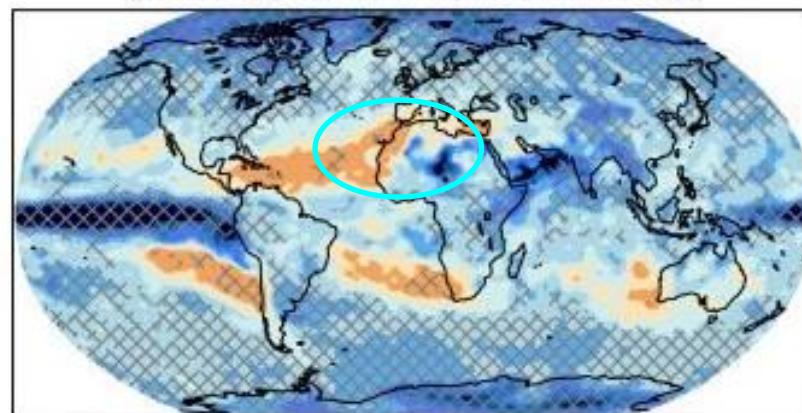


Jours très chauds

Change in extreme precipitation (Rx5day) at 1.5°C GMST warming



Change in extreme precipitation (Rx5day) at 2.0°C GMST warming



Pluies intenses

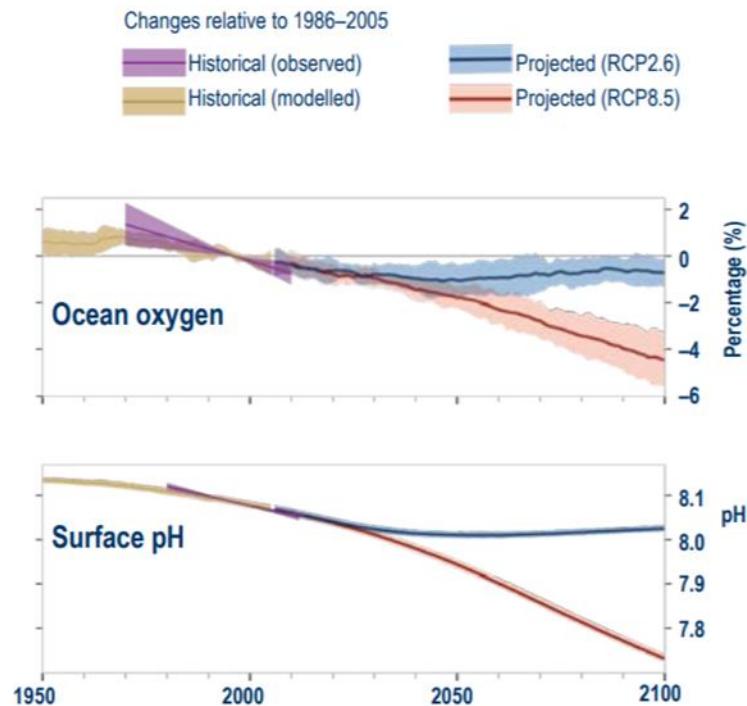
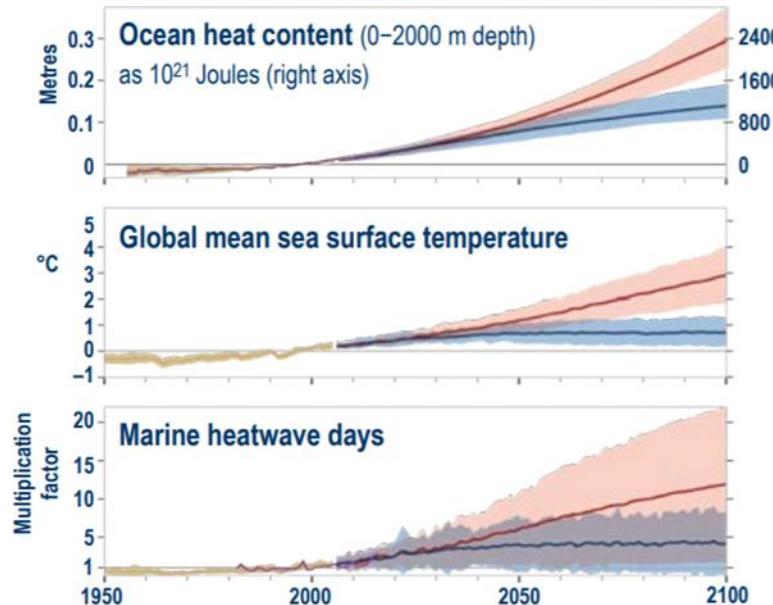
Precipitation (%)



IPCC-SR1.5



The ocean is projected to transition to unprecedented conditions



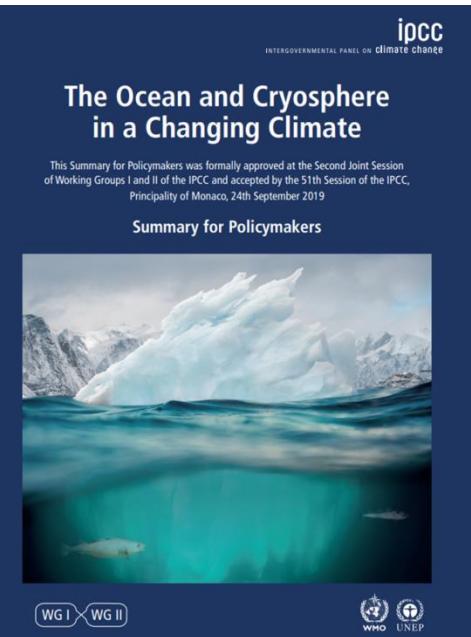
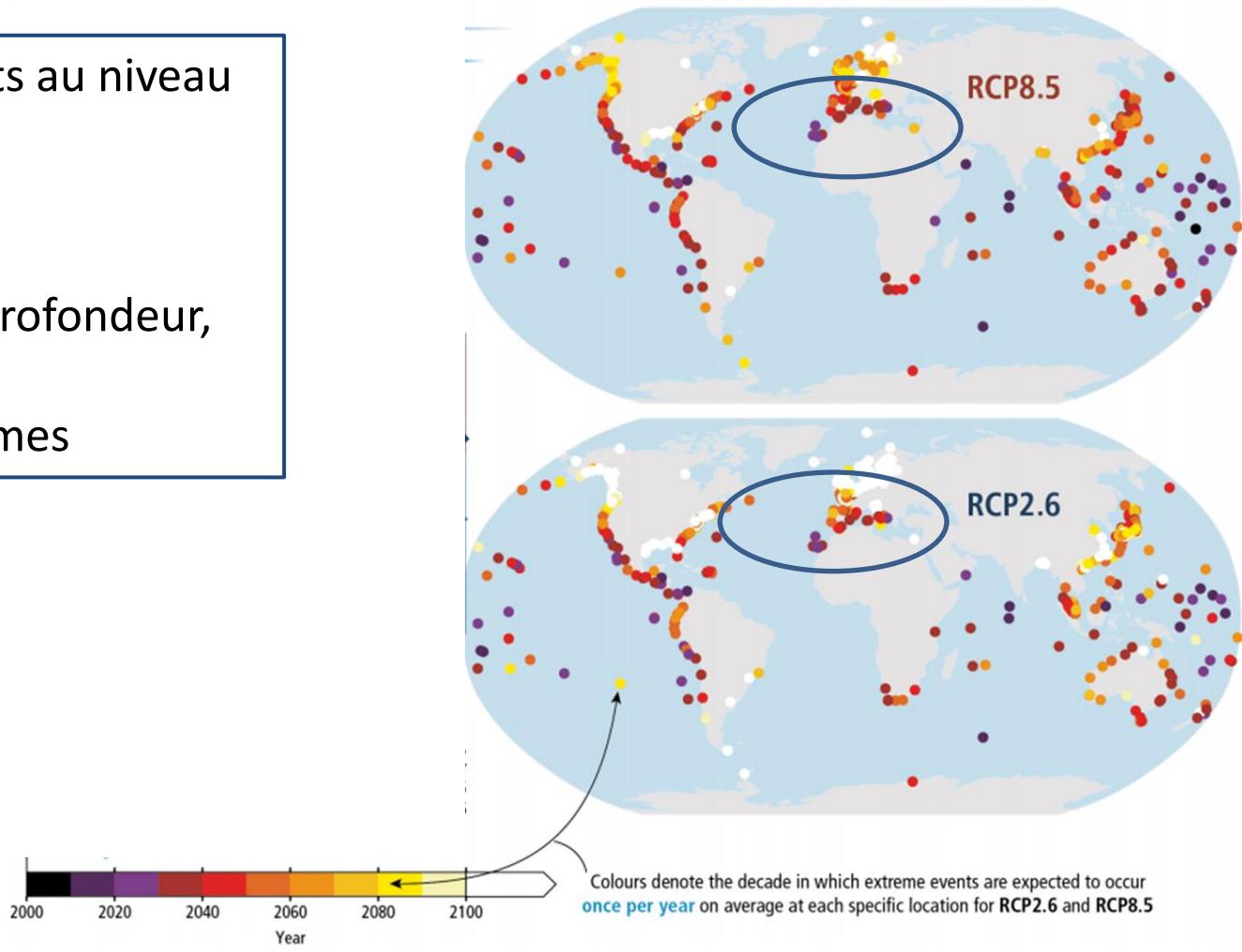
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INTERGOVERNMENTAL PANEL ON climate change



The ocean has absorbed 20 to 30% of CO₂ emissions and 93% of anthropogenic heat

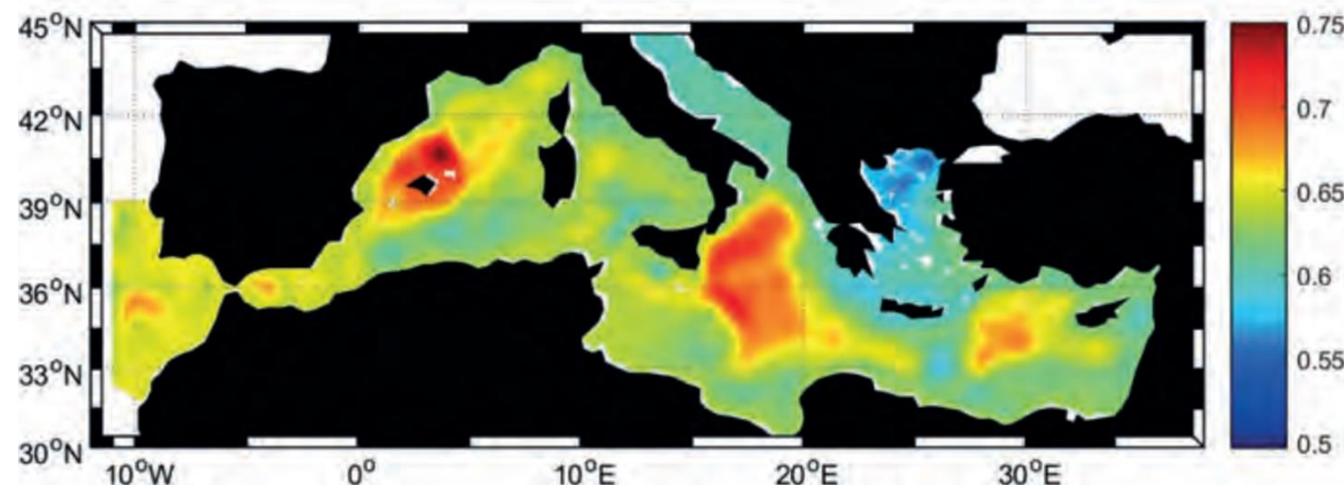
Les évènements de niveau de mer extrêmes (actuellement 1 fois par an) se produiront chaque année dans plusieurs régions dès 2030

Plusieurs changements au niveau de l'océan:
Baisse PH,
Peu de mélange,
Moins d'oxygène en profondeur,
Vague de chaleurs,
Risque pour écosystèmes



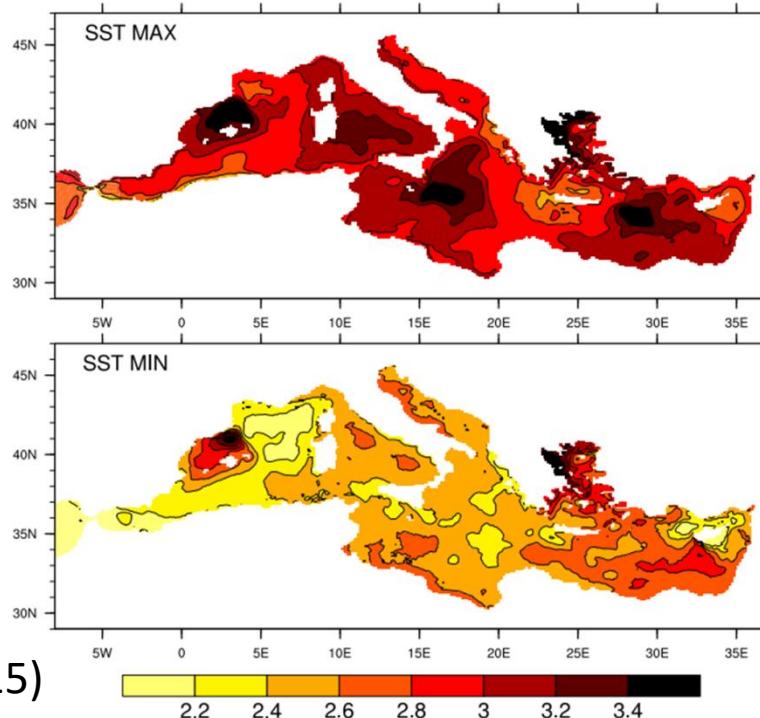
IPCC-SROC

Future projections: Sea changes



Projection of sea level change for the period 2080-2100 with respect to the period 1980-2000. Under moderate GHG emission scenarios (A1b and RCP6.0). Somot et al (2016)

Projected changes of sea surface temperature and salinity . Max and Min changes

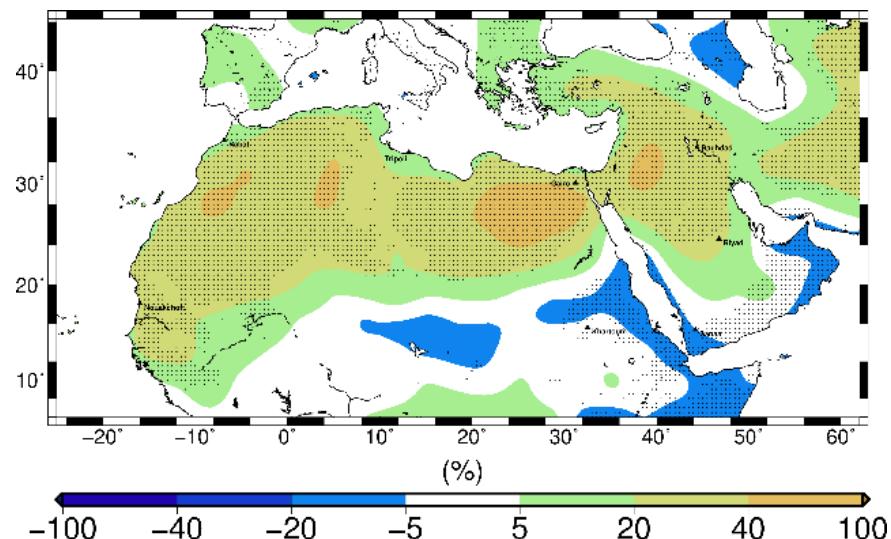


Adloff et al (2015)

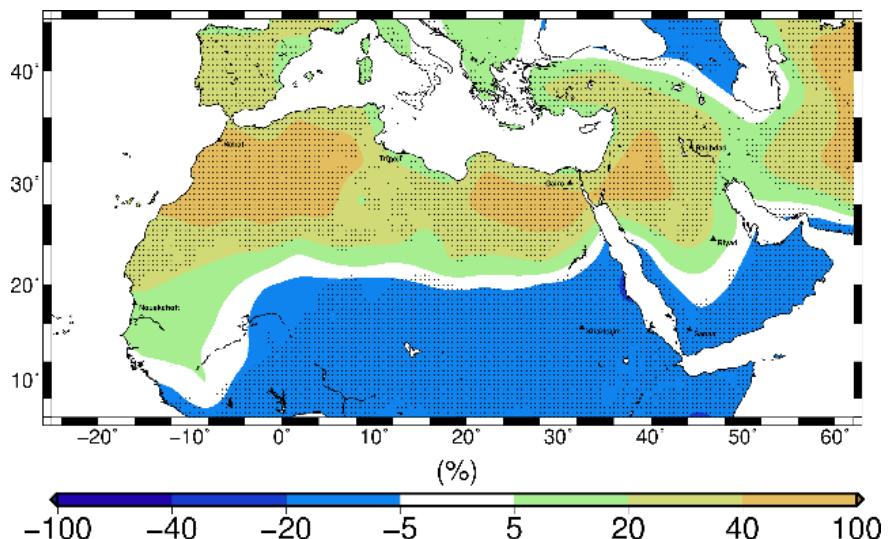
Changements projetés: phénomènes extrêmes

SPEI (sécheresse)

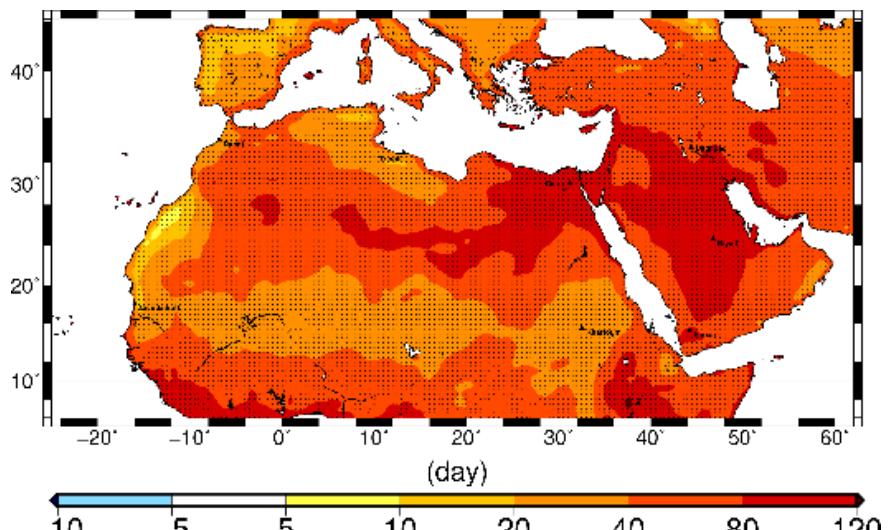
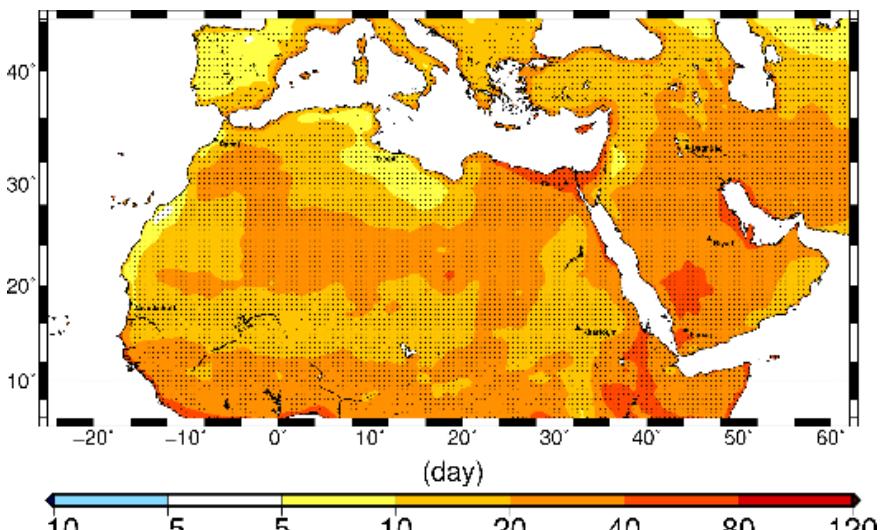
RCP4.5



RCP 8.5

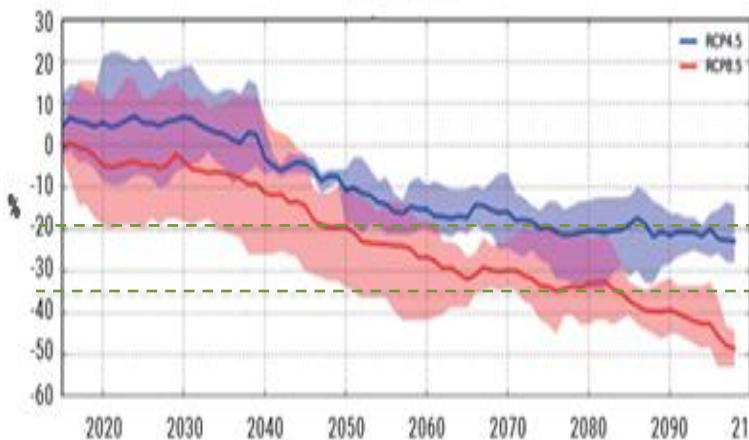


Durée des vagues de chaleur

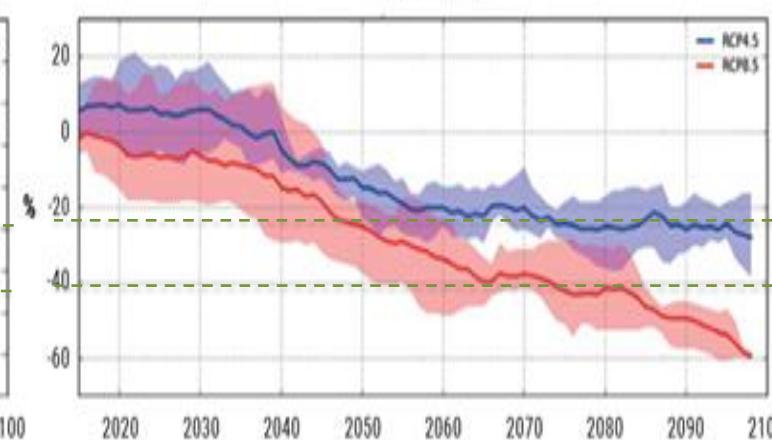


→ Baisse des débits annuels moyens au niveau des hauts plateaux

HYPE MODEL

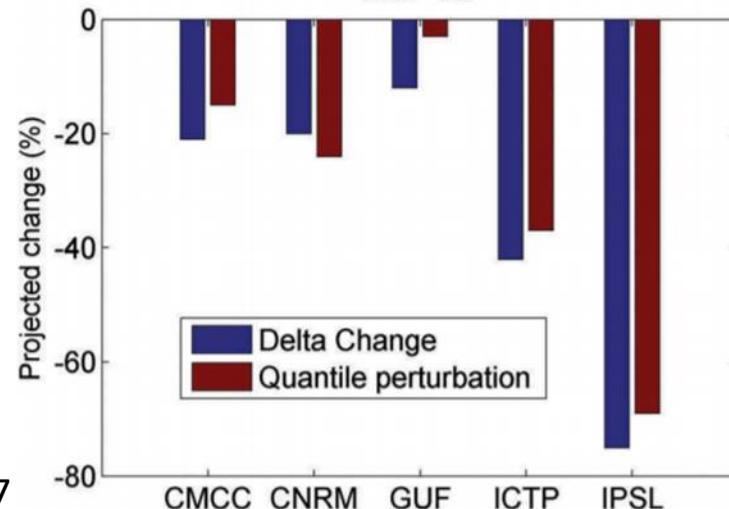


VIC MODEL

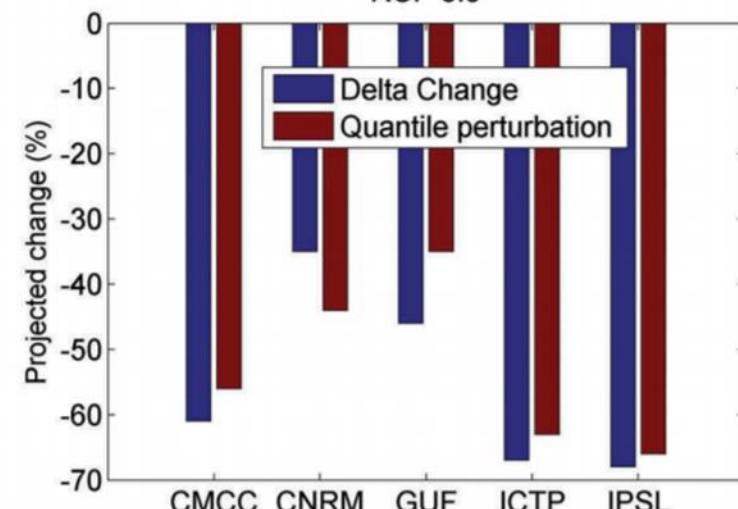


Changement futur de l'écoulement annuel moyen des hauts plateaux marocains (9W 1W 30N 35N) tels qu'issus de deux modèles hydrologiques HYPE (gauche) et VIC (droite) alimentés par différentes simulations climatiques sous les deux scénarios RCP4.5 et RCP8.5. Source : RICCAR (ESCWA et al., 2017)

RCP 4.5



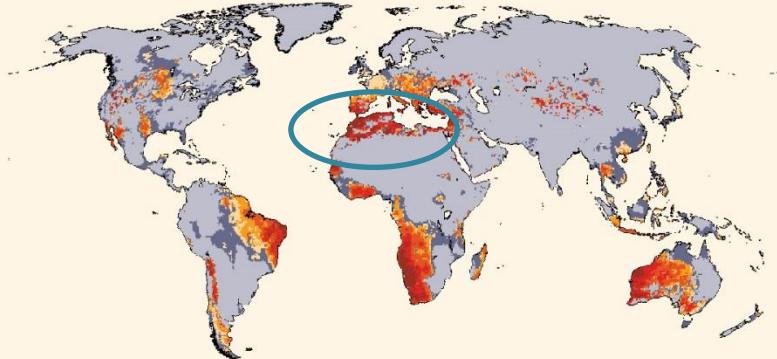
RCP 8.5



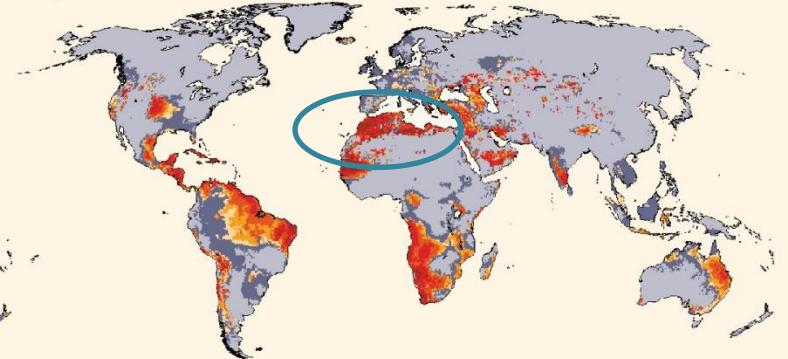
Marchane et al. 2017

Comparison of the projected changes in runoff with delta-change and quantile-perturbation methods.

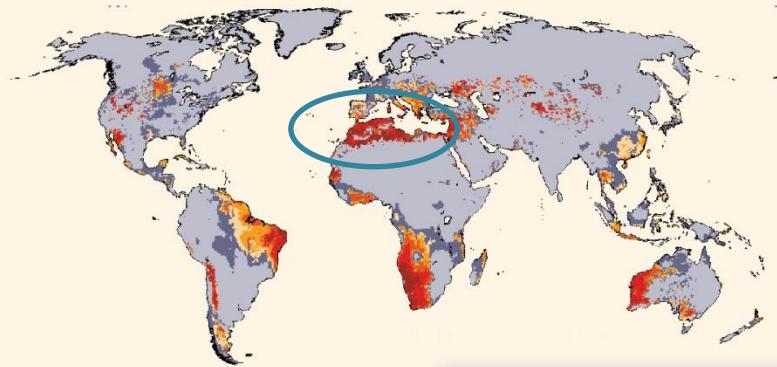
A2 - ECHAM4



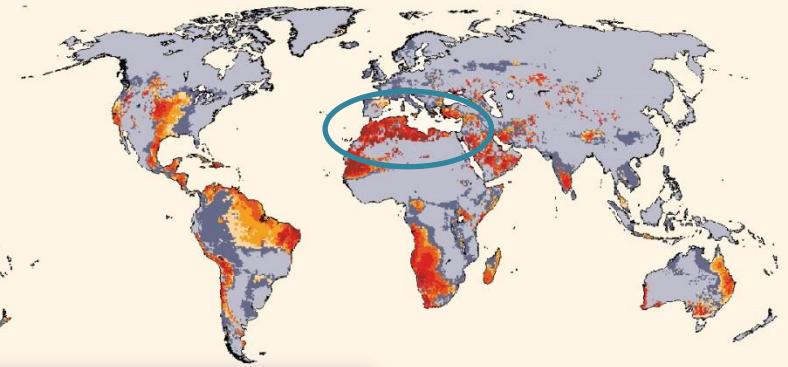
A2 - HadCM3



B2 - ECHAM4



B2 - HadCM3



Projected change in groundwater recharge

Small to no decrease

No decrease

< 10% decrease

> 10 % decrease

Vulnerability index

Low

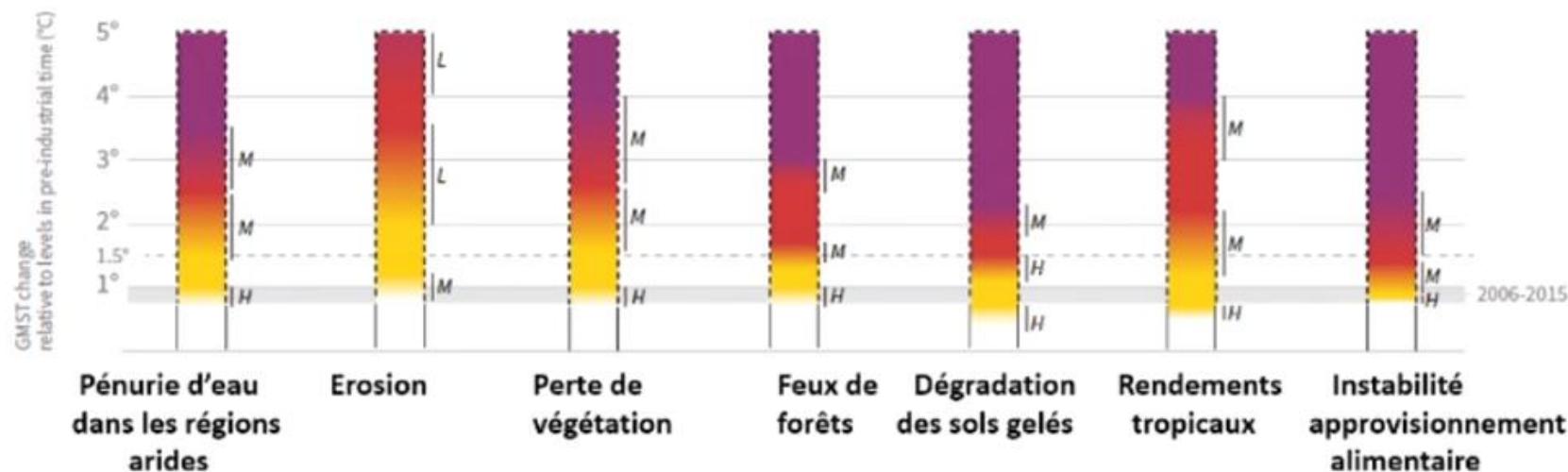
High

Vulérabilité

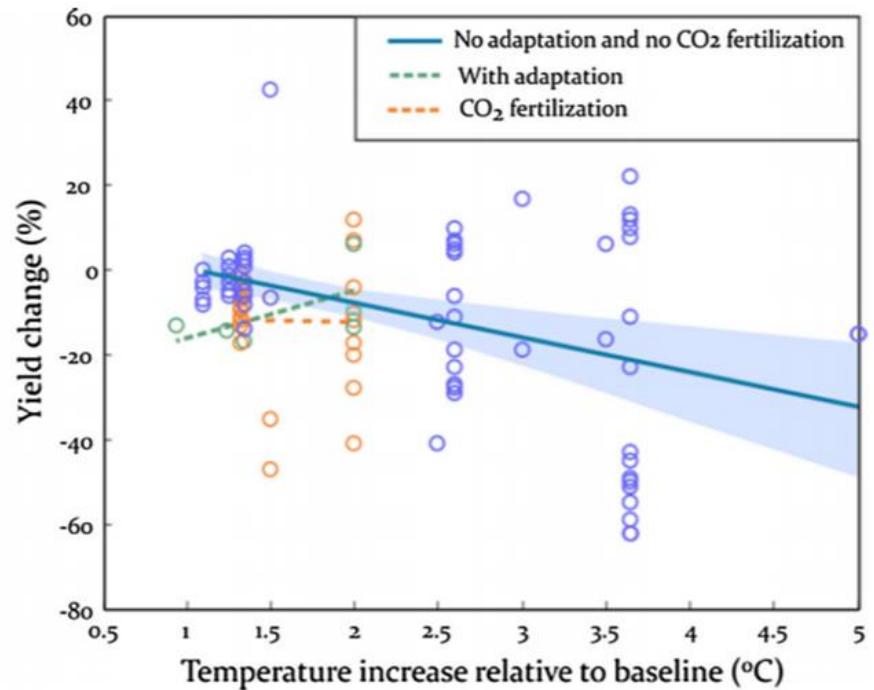
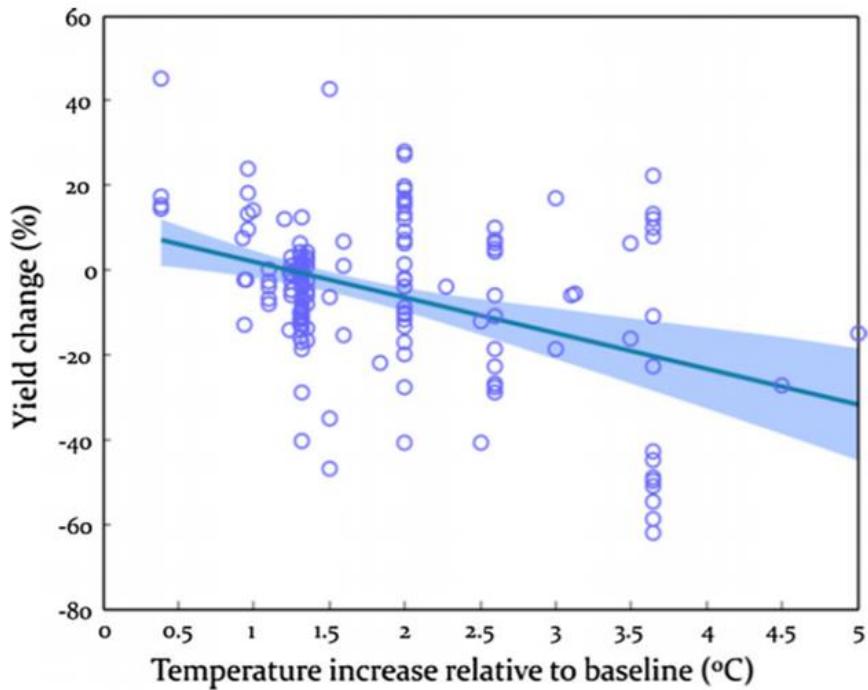
Human vulnerability to climate change-induced decreases of renewable groundwater resources by the 2050s. . The index is defined only for areas where groundwater recharge is projected to decrease by at least 10% relative to 1961–1990. IPCC- WGII AR5 (2014)



Risques liés aux processus terrestres du fait du changement climatique

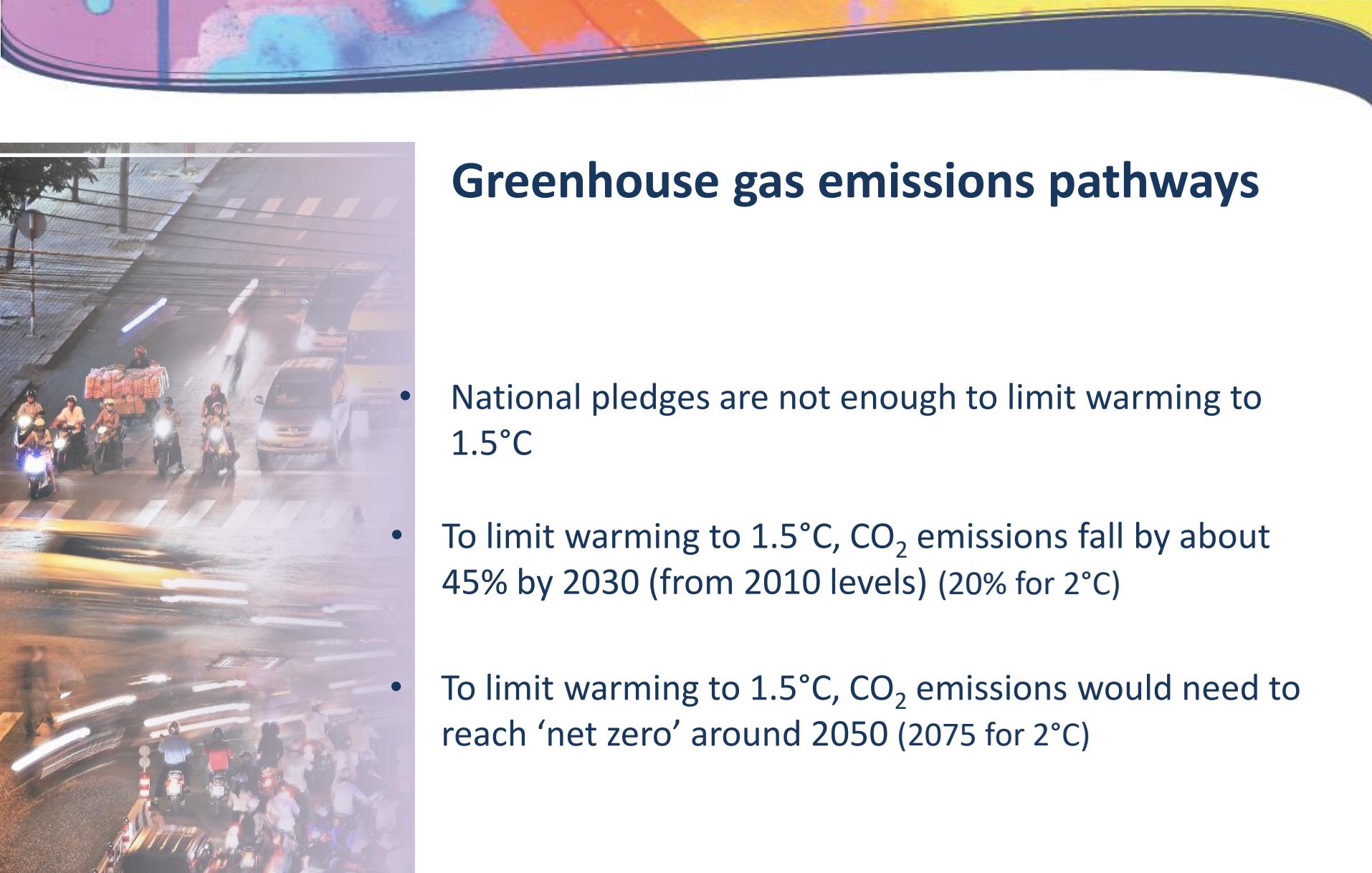


Examples of projected impacts



Crop yield changes with temperature increase in the MENA region over all studies (left) and for studies that take the effects of adaptation measures (green line) and CO₂ fertilization (orange line) into account.

Waha et al. 2017

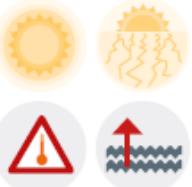
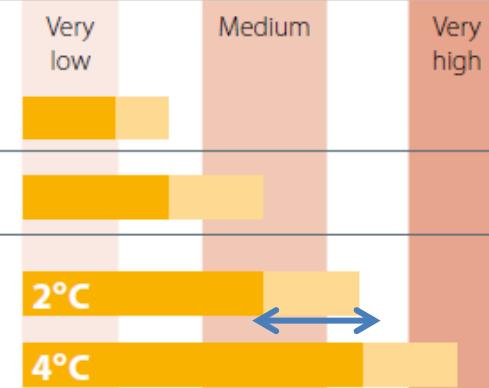
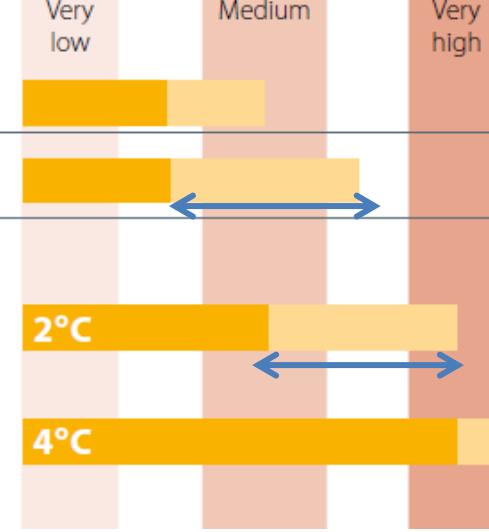


Greenhouse gas emissions pathways

- National pledges are not enough to limit warming to 1.5°C
- To limit warming to 1.5°C, CO₂ emissions fall by about 45% by 2030 (from 2010 levels) (20% for 2°C)
- To limit warming to 1.5°C, CO₂ emissions would need to reach 'net zero' around 2050 (2075 for 2°C)

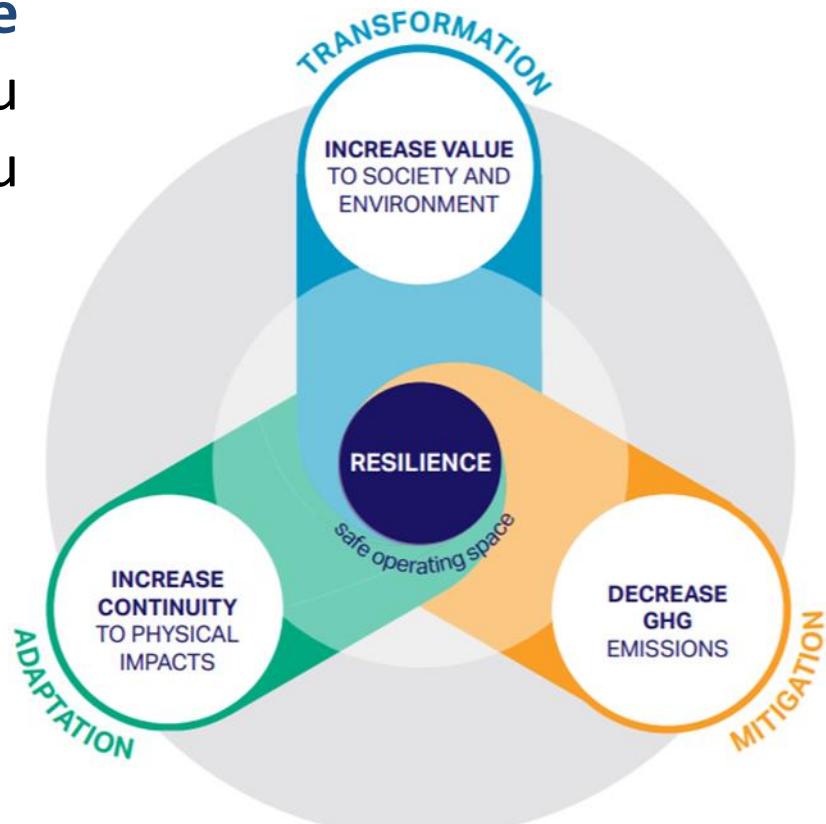
Gerhard Zwerger-Schoner / Aurora Photos

Examples of Main risks and role of adaptation and mitigation (Africa)

| Key risk | Adaption issues & prospects | Climate drivers | Time frame | Risk & potential for adaptation |
|--|---|---|---|---|
| Stress on water Compounded stress on water resources facing significant strain from overexploitation and degradation at present and increased demand in the future with drought stress exacerbated in drought-prone regions of Africa (<i>high confidence</i>) | <ul style="list-style-type: none"> Reducing non-climate stressors on water resources Strengthening institutional capacities for demand management, groundwater assessment, integrated water-wastewater planning, and integrated land and water governance Sustainable urban development |  | Present Near-term (2030–2040) Long-term (2080–2100) |  <p>Very low Medium Very high</p> <p>2°C 4°C</p> |
| Crop productivity Reduced crop productivity associated with heat and drought stress, with strong adverse effects on regional, national and household livelihood and food security, also given increased pest and disease damage and flood impacts on food system infrastructure (<i>high confidence</i>) | <ul style="list-style-type: none"> Technological adaptation responses (e.g., stress-tolerant crop varieties, irrigation, enhanced observation systems) Enhancing smallholder access to credit and other critical production resources, diversifying livelihoods Strengthening institutions at local, national and regional levels to support agriculture (including early warning systems) and gender-orientated policy Agronomic adaptation responses (e.g., agroforestry, conservation agriculture) |  | Present Near-term (2030–2040) Long-term (2080–2100) |  <p>Very low Medium Very high</p> <p>2°C 4°C</p> |

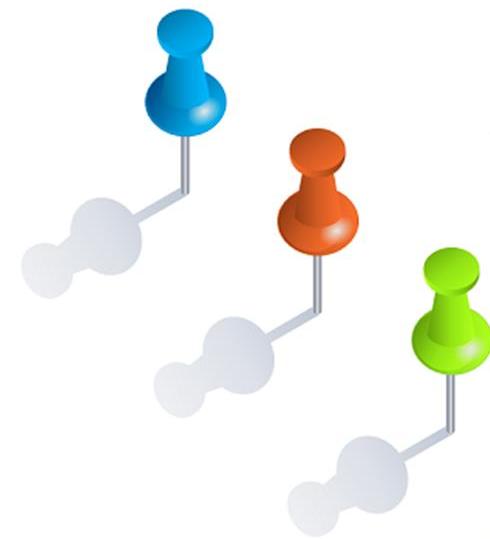
Besoin de meilleure résilience

- La résilience climatique est la capacité d'anticiper, de se préparer et de réagir aux événements, tendances ou perturbations dangereux liés au climat.



La résilience climatique part de la conviction que

- les systèmes humains et naturels sont fortement interconnectés aux variations et changements du climat
- L'action non correctement réfléchie de l'homme a des répercussions néfastes sur le climat et le système climatiques entier
- la capacité « d'innovation » qui nous a mis dans la situation/fragilité climatique actuelle peut également être utilisée pour nous en sortir



- 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

The report in numbers

133 Contributing authors

6000 Studies

91 Authors from 40 Countries

1 113 Reviewers

42 001 Comments

An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial 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.



**7000 studies
28275 comments**

An IPCC Special Report on climate change,
desertification, land degradation, sustainable
land management, food security, and
greenhouse gas fluxes in terrestrial ecosystems

Human use directly affects more than 70% of the global, ice free land surface



Special Report on the Ocean and Cryosphere in a Changing Climate

- S Summary for Policymakers
- T Technical Summary
- 1 Framing and Context of the Report
- 2 High Mountain Areas
- 3 Polar regions
- 4 Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities
- 5 Changing Ocean, Marine Ecosystems, and Dependent Communities
- 6 Extremes, Abrupt Changes and Managing Risks
- CB9 Integrative Cross-Chapter Box on Low-lying Islands and Coasts
- G Glossary

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INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

The Ocean and Cryosphere in a Changing Climate

This Summary for Policymakers was formally approved at the Second Joint Session of Working Groups I and II of the IPCC and accepted by the 51st Session of the IPCC, Principality of Monaco, 24th September 2019

Summary for Policymakers



WG I WG II

WHO UNEP



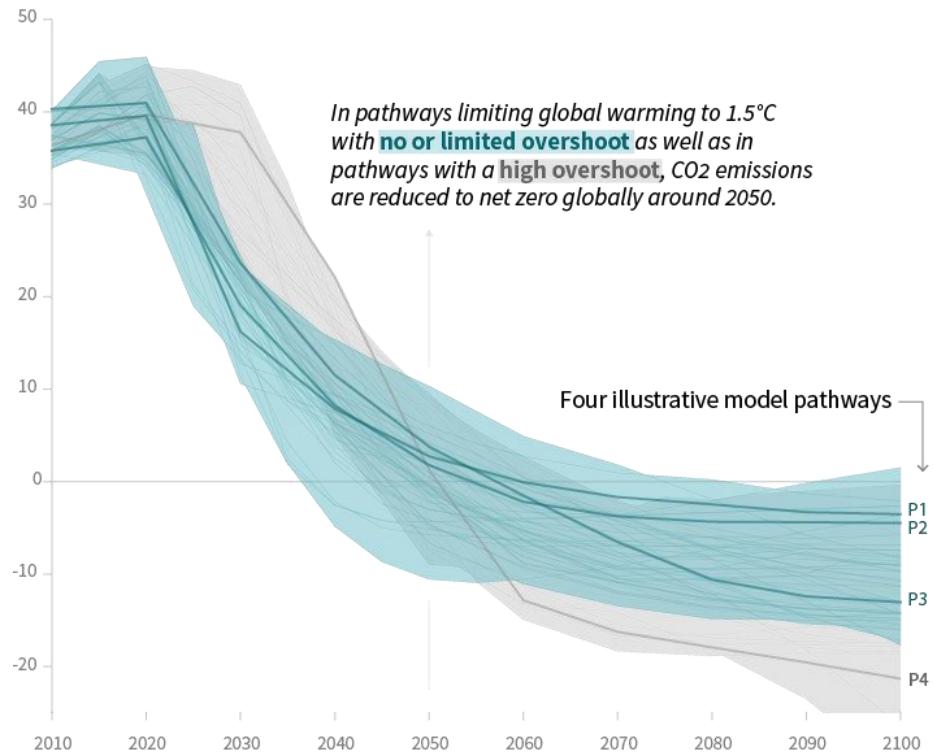


Merci de Votre Attention

Global emissions pathway characteristics

Global total net CO₂ emissions

Billion tonnes of CO₂/yr



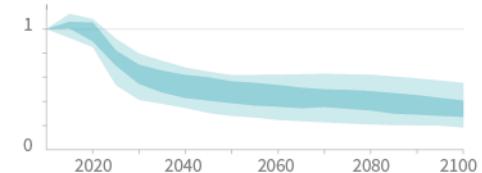
Timing of net zero CO₂
Line widths depict the 5-95th percentile and the 25-75th percentile of scenarios

Pathways limiting global warming to 1.5°C with no or low overshoot
Pathways with high overshoot
Pathways limiting global warming below 2°C (Not shown above)

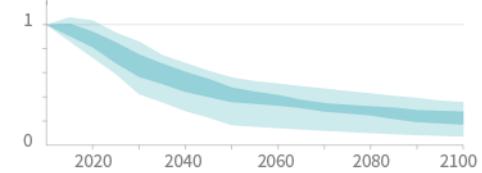
Non-CO₂ emissions relative to 2010

Emissions of non-CO₂ forcers are also reduced or limited in pathways limiting global warming to 1.5°C with no or limited overshoot, but they do not reach zero globally.

Methane emissions



Black carbon emissions



Nitrous oxide emissions

