

Le travail du GIEC
(Groupe d'experts Intergouvernemental sur
l'Évolution du Climat)

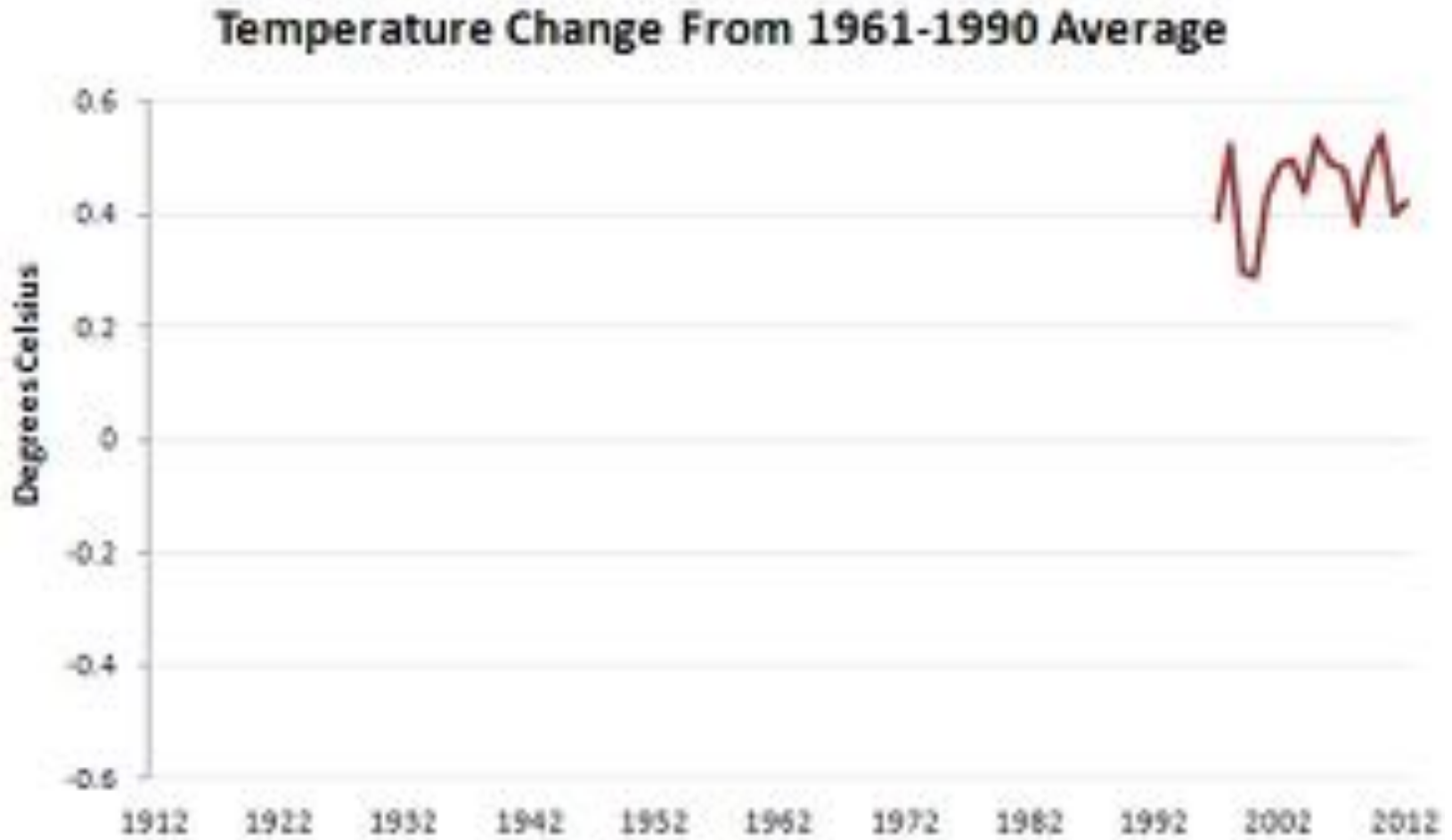
Jean-Pascal van Ypersele (UCL)
Vice-président du GIEC de 2008 à 2015

Twitter: @JPvanYpersele

Séminaire GRICE (Groupe de Recherche
Interdisciplinaire sur la Crise Ecologique), UCL,
Louvain-la-Neuve, 28-3-2018

Merci aux Gouvernement wallon qui finance la Plateforme wallonne pour le GIEC
et à mon équipe à l'Université catholique de Louvain pour leur soutien

Lying With Statistics, Global Warming Edition

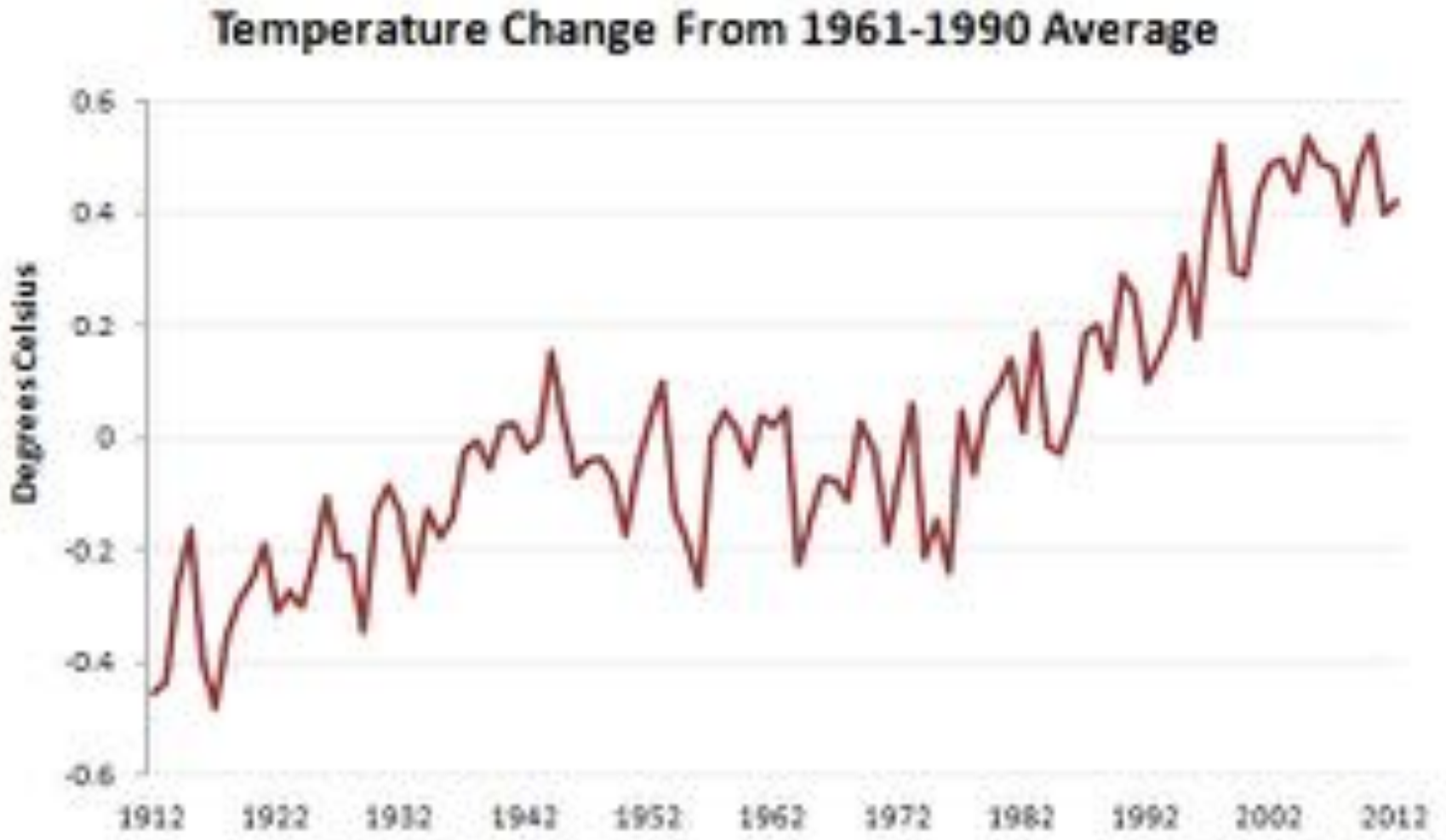


Lying With Statistics, Global Warming Edition

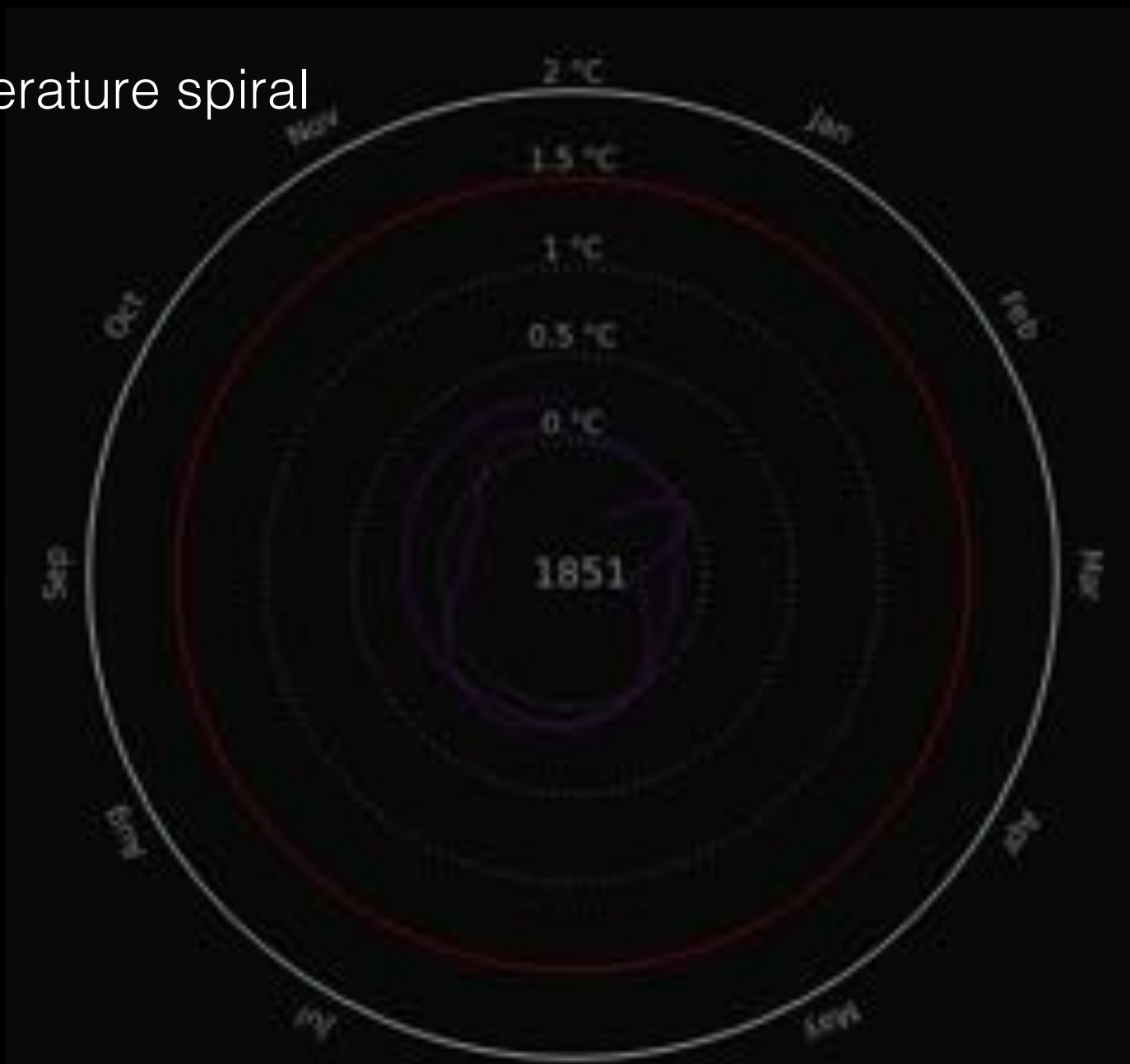
Temperature Plateaus — 1912-2012



Lying With Statistics, Global Warming Edition



Temperature spiral



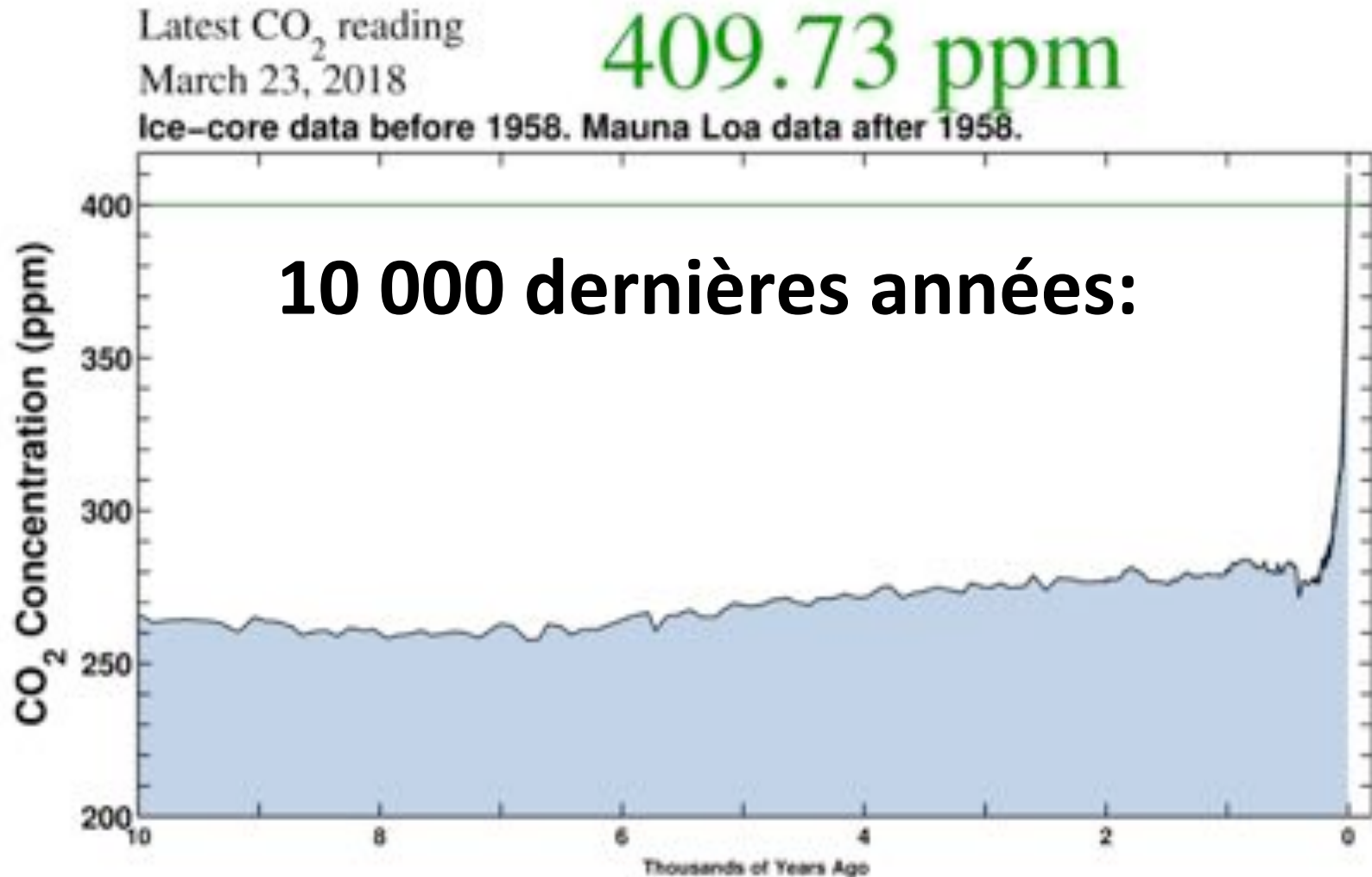
Global Mean Temperature in °C relative to 1850 – 1900

Graph: Ed Hawkins (Climate Lab Book) – Data: HadCRUT4 global temperature dataset

Available on <http://openclimatedata.net/climate-spirals/temperature>

Concentration en CO₂

23 mars 2018 (Courbe de Keeling)



Source: scripps.ucsd.edu/programs/keelingcurve/

Pourquoi le GIEC (Groupe d'experts

Intergouvernemental sur l'Evolution du Climat) ?

Etabli par l'OMM et le PNUE en 1988

Mandat: fournir aux décideurs une **source objective d'information** à propos:

- des causes des changements climatiques
- des scénarios possibles d'évolution
- des conséquences observées ou futures pour l'environnement et les activités humaines
- les options de réponse possibles (adaptation & atténuation = réduction des émissions).

OMM = Organisation Météorologique Mondiale
PNUE = Programme des Nations Unies pour l'Environnement

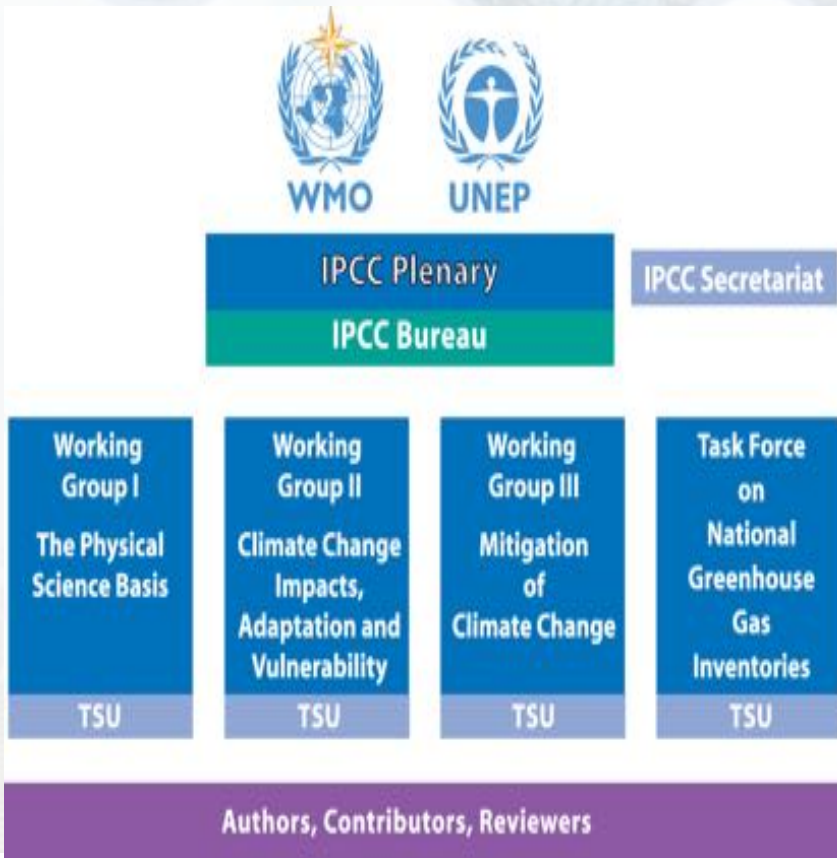


Mandate of the IPCC

- 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

IPCC Reports are
policy-relevant,
NOT
policy-prescriptive

Inter-governmental Panel on Climate Change (IPCC): Organization Structure



- IPCC plenary comprises of all countries in the world
- IPCC Bureau comprises of 34 elected members; IPCC elects its Bureau every 6-7 years
- 3 Working Groups & a Task Force on National Greenhouse Gas Inventories
- Authors, Contributors, Reviewers, Review Editors

IPCC writing cycle (4 years, 831 Lead authors for AR5)

- Plenary decides table of content of reports
- Bureau appoints world-class scientists as authors, based on publication record
- Authors assess all scientific literature
- *Draft* – Expert review (+ Review editors)
- *Draft 2 (+ Draft 1 Summary for Policy Makers (SPM))* – Combined expert/government review
- *Draft 3 (+ Draft 2 SPM)* – Government review of SPM
- Approval Plenary (interaction authors – governments) – *SPM and full report*
- ***NB: the scientists have the last word!***

Previous schedules

	Special Reports			AR4		
	LULUCF	SROC	SRCCS	WGI	WGII	WGIII
LA1	11-13/01/99	Aug 03	2-4/07/03	26-29/09/04	20-23/09/04	19-21/10/04
writing	8 weeks g	9 weeks	12 weeks	19 weeks	12 weeks	19 weeks
informal review	4 weeks	8 weeks	8 weeks	8 weeks	7 weeks	8 weeks
consideration of comments	3 weeks	4 weeks	3 weeks	4 weeks	5 weeks	5 weeks
LA2	28-30/04/99	Jan 04	16-18/12/03	10-12/05/05	14-17/03/05	6-9/06/05
preparation of 1st draft	8 weeks	11 weeks	21 weeks	18 weeks	25 weeks	25 weeks
Expert review	~ 5 weeks	8 weeks	8 weeks	8 weeks	8 weeks	9 weeks
consideration of comments	~ 2 weeks	4 weeks	6 weeks	5 weeks	10 weeks	3 weeks
LA3	23-25/08/99	June 04	17-19/08/04	11-16/12/05	16-19/01/06	14-18/02/06
preparation of 2nd draft	8 weeks	10 weeks	20 weeks	17 weeks	18 weeks	22 weeks
Exp/gov review	~ 7 weeks	8 weeks	8 weeks	8 weeks	8 weeks	8 weeks
consideration of comments	5 weeks	3 weeks	7 weeks	3 weeks	6 weeks	3 weeks
LA4	11-13/01/00	Dec 04	25-29/04/05	26-28/06/06	10-15/09/06	10-13/10/06
preparation of final draft	~ 6 weeks	9 weeks	11 weeks	18 weeks	14 weeks	18 weeks
final gov. distribution	4/8 weeks	8 weeks	7 weeks	9 weeks	8 weeks	7 weeks
consideration SPM comments			2 weeks	6 weeks	6 weeks	3 weeks
Approval/acceptance	May-00	April 05	Sept 05	Feb.07	Apr. 07	May.07

How are IPCC report chapters prepared:

- By teams consisting of **Coordinating Lead Authors (CLA)**, **Lead Authors (LA)**, **Contributing Authors (CA)**, and **Review Editors (RE)**.
- **Coordinating Lead Authors** and **Lead Authors** have collective responsibility for the contents of a chapter.
- **Contributing Authors** assist the work of the author teams by providing specific knowledge or expertise in a given area.
- The **Review Editors** ensure that all substantive comments received during review are given appropriate consideration by the author teams, ensure that genuine diversity in perspectives in the literature is reflected adequately in the report, and advise Lead Authors on how to handle contentious or controversial issues.

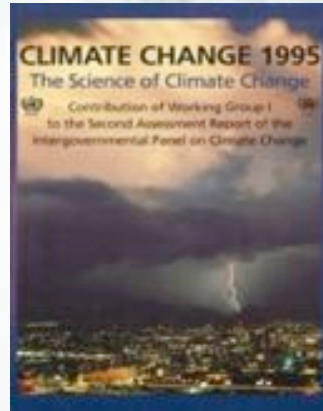
Appointment of the chapter teams:

- The Coordinating Lead Authors, Lead Authors, and Review Editors are selected by the Bureau of the respective Working Group or of the Task Force on National Greenhouse Gas Inventories.
- Criteria used: expertise (CV), geographical and gender balance, mix of new authors and authors with previous IPCC experience
- Typically, a chapter has a CLA from a developed country, and a CLA from a developing country, and between 5 and 10 LAs
- Up to three Review editors, senior scientists with IPCC experience, accompany the review process.

IPCC Assessment Reports



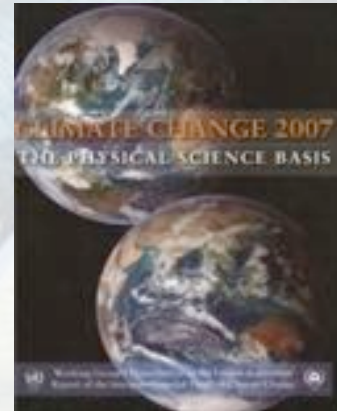
FAR 1990



SAR 1995



TAR 2001



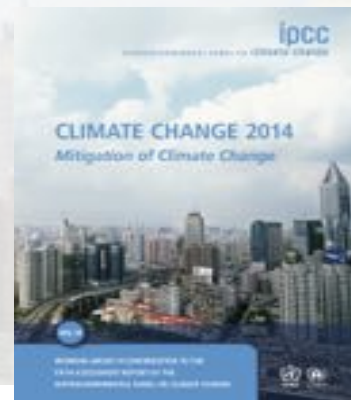
AR4 2007



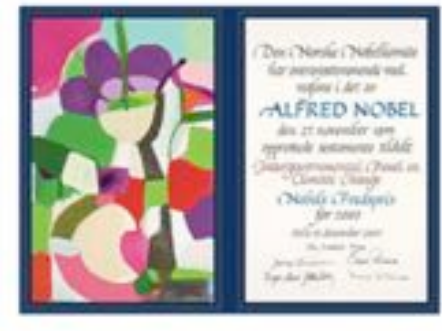
AR5 WGI 2013



AR5 WGII 2014



AR5 WGIII 2014



IPCC AR5 Synthesis Report

Completed IPCC Reports

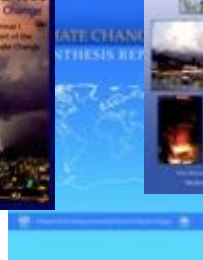
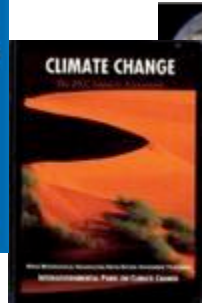
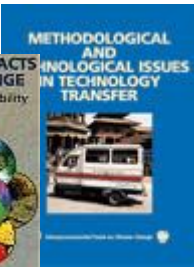
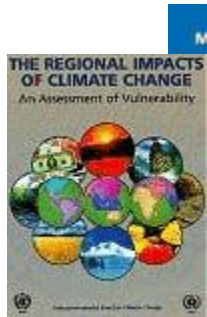
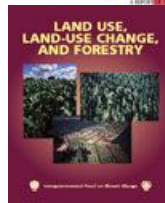
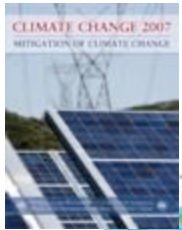
5 Assessment Reports (1990, 1995, 2001, 2007, 2013-14)

1992 Supplementary Report and 1994 Special Report

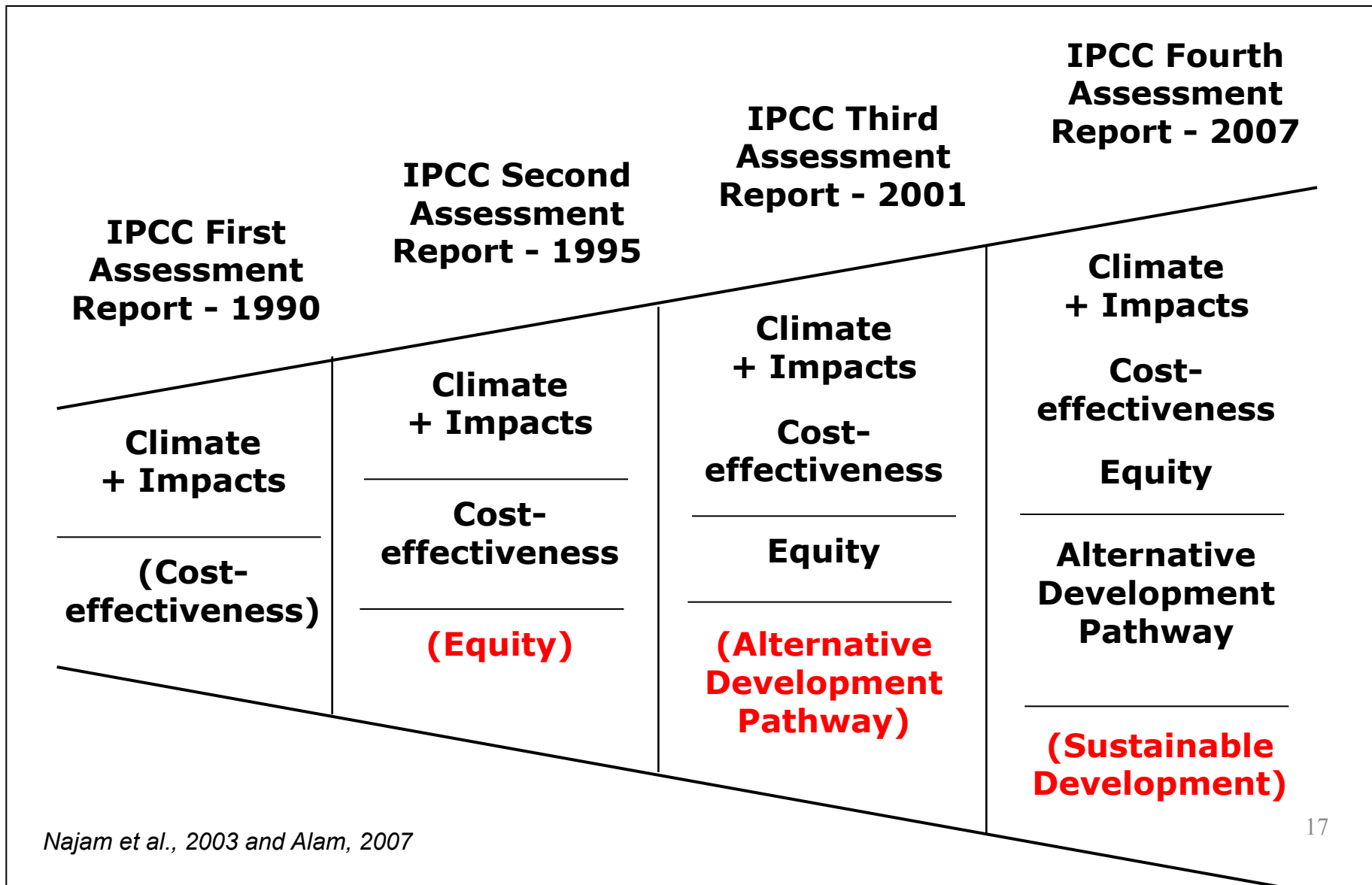
8 Special Reports (1997, 1999, 2000, 2005, 2011)

Guidelines for National GHG Inventories, Good Practice Guidance
(1995-2006)

6 Technical Papers (1996-2008)



Background



Confidence

Validity of Finding

Confidence synthesizes evaluation of evidence and agreement into a judgment about the validity of a finding.

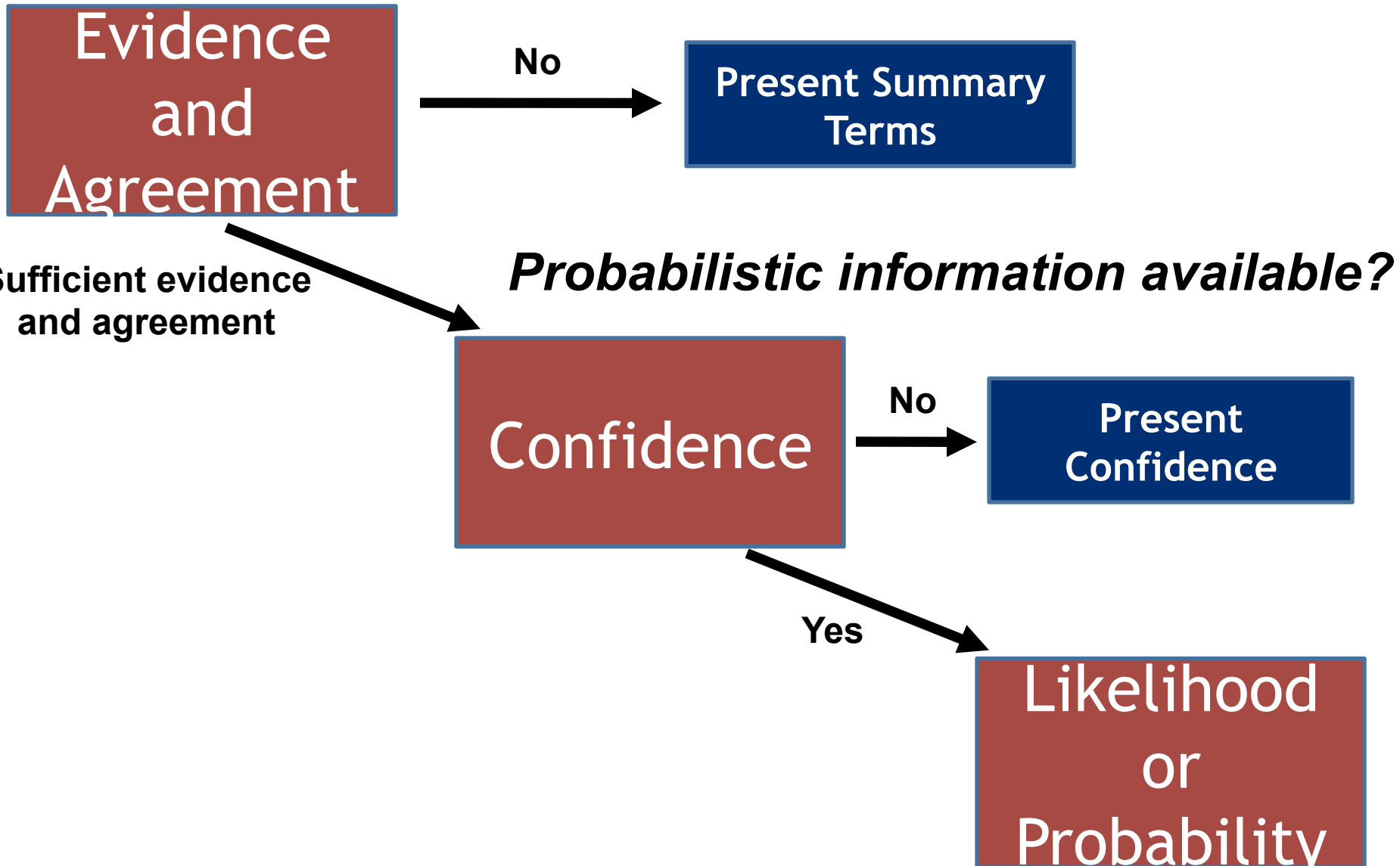
<i>High agreement Limited evidence</i>	<i>High agreement Medium evidence</i>	<i>High agreement Robust evidence</i>
<i>Medium agreement Limited evidence</i>	<i>Medium agreement Medium evidence</i>	<i>Medium agreement Robust evidence</i>
<i>Low agreement Limited evidence</i>	<i>Low agreement Medium evidence</i>	<i>Low agreement Robust evidence</i>

Agreement ↑

Evidence (type, amount, quality, consistency) →

Confidence Scale

Degree of Certainty for Findings: Process



Confidence

Levels of Confidence

Confidence synthesizes evaluation of evidence and agreement into a judgment about the validity of a finding.

“Very high”

“High”

“Medium”

“Low”

“Very low”

Likelihood or Probability

Probabilistic estimate

Likelihood expresses a probabilistic estimate of the occurrence of a single event or of an outcome lying in a given range.

Term	Likelihood of the outcome
<i>Virtually certain</i>	99-100% probability
<i>Very likely</i>	90-100% probability
<i>Likely</i>	66-100% probability
<i>About as likely as not</i>	33 to 66% probability
<i>Unlikely</i>	0-33% probability
<i>Very unlikely</i>	0-10% probability
<i>Exceptionally unlikely</i>	0-1% probability

Use more precise probability ranges when appropriate.

None So Deaf



The IPCC assessments have influenced global action on an unprecedented scale

- 1. The First Assessment Report (FAR, 1990) had a major impact in defining the content of the **UNFCCC****
- 2. The Second Assessment Report (SAR, 1996) was largely influential in defining the provisions of the **Kyoto Protocol****
- 3. The Third Assessment Report (TAR, 2001) focused attention on the **impacts** of climate change and the need for **adaptation****
- 4. The Fourth Assessment Report (AR4, 2007) informed the decision on the ultimate objective (**2°C**) and is creating a strong basis for a **post Kyoto Protocol** agreement**
- 5. The Fifth Assessment Report (AR5, 2013-14) informed the **review of the 2°C objective**, and was the **context for preparing the Paris 2015 agreement****

Nobel Peace Prize for 2007

- Shared, in two equal parts, between the Intergovernmental Panel on Climate Change (IPCC) and Albert Arnold (Al) Gore Jr. , for:

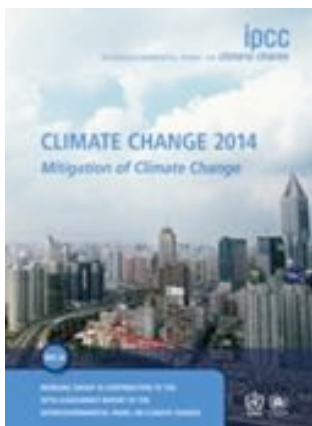
« their efforts to build up and disseminate greater knowledge about manmade climate change, and to lay the foundations for the measures that are needed to counteract such change. »



WG I (Physical science basis): 209 lead authors, 2014 pages, 54.677 review comments



WG II (Impacts, Adaptation, and Vulnerability): 243 lead authors, 2500 pages, 50.492 review comments



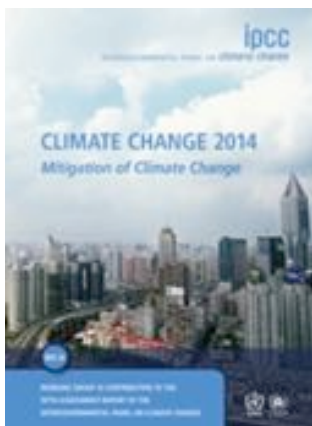
WG III (Mitigation of Climate Change): 235 coordinating and lead authors, 2000 pages, 38.315 review comments



Que se passe-t-il dans le système climatique ?



Quels sont les risques ?



Que peut-on faire ?

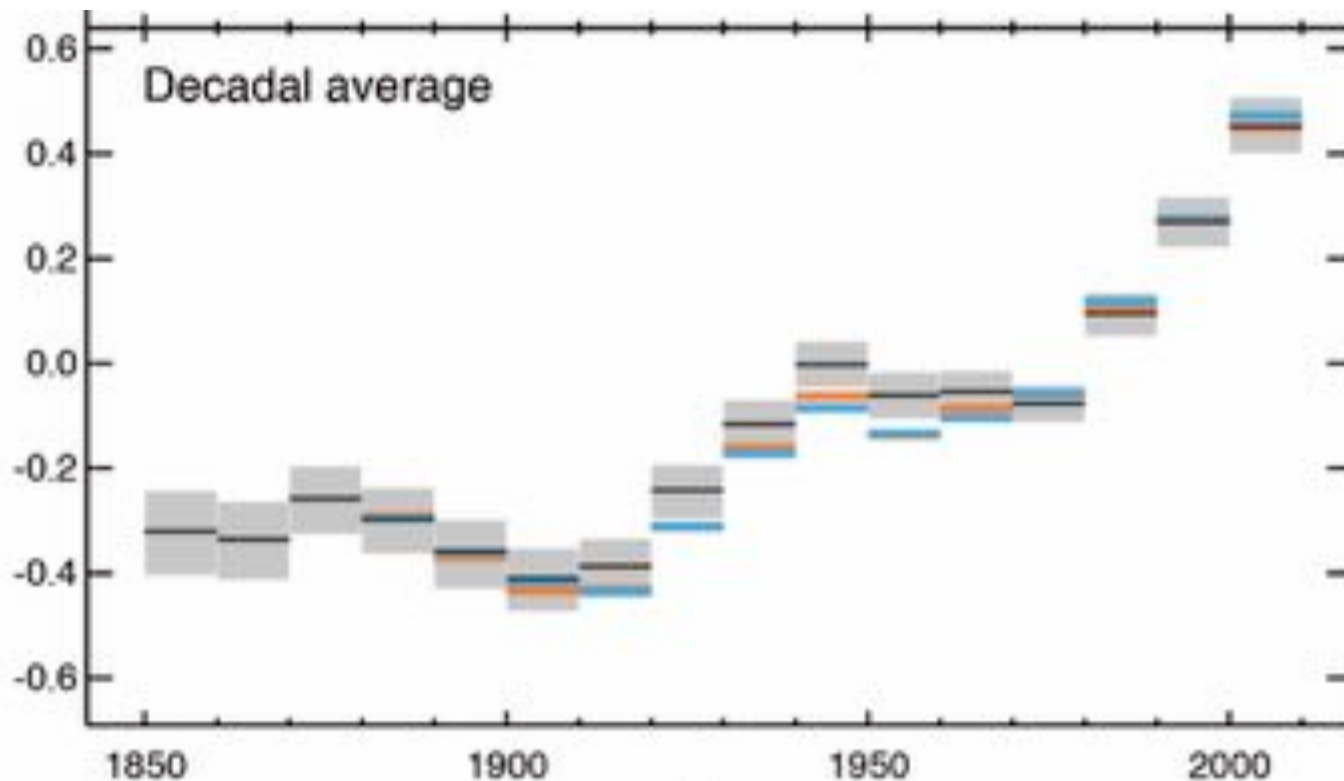
Messages clés

- **L'influence humaine sur le système climatique est claire**
- **La poursuite des émissions de gaz à effet de serre augmentera le risque d'impacts graves, répandus et irréversibles pour les populations et les écosystèmes**
- **Alors que les changements climatiques représentent une menace pour le développement durable, il existe de nombreuses opportunités pour intégrer l'atténuation, l'adaptation, et la poursuite d'autres objectifs sociétaux**
- **L'Humanité a les moyens de limiter les changements climatiques et de construire un avenir plus durable et plus résilient**

AR5 WGI SPM, AR5 WGII SPM, AR5 WGIII SPM



Que se passe-t-il dans le système climatique ?



(IPCC 2013, Fig. SPM.1a)

Chacune des trois dernières décennies a été successivement plus chaude à la surface de la Terre que toutes les décennies précédentes depuis 1850

Dans l'hémisphère nord, la période 1983–2012 a probablement été la période de 30 ans la plus chaude des 1400 dernières années (degré de confiance moyen).

Depuis 1950, les **jours extrêmement chauds** and les **pluies intenses** sont devenues plus courants



There is evidence that anthropogenic influences, including increasing atmospheric **greenhouse gas concentrations**, have changed these extremes

Plateau Glacier (1961) (Alaska)



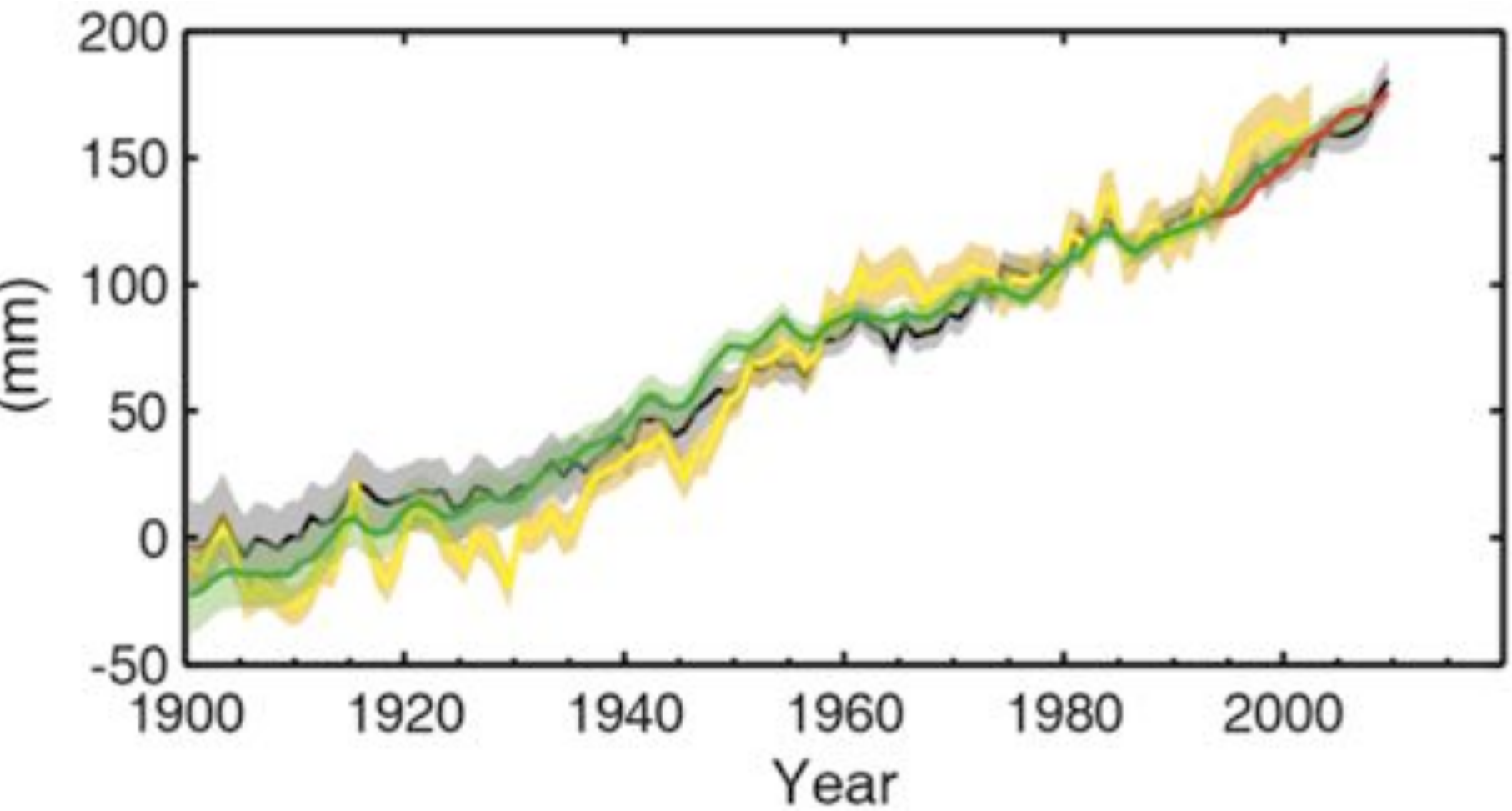
http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Plateau Glacier (2003) (Alaska)

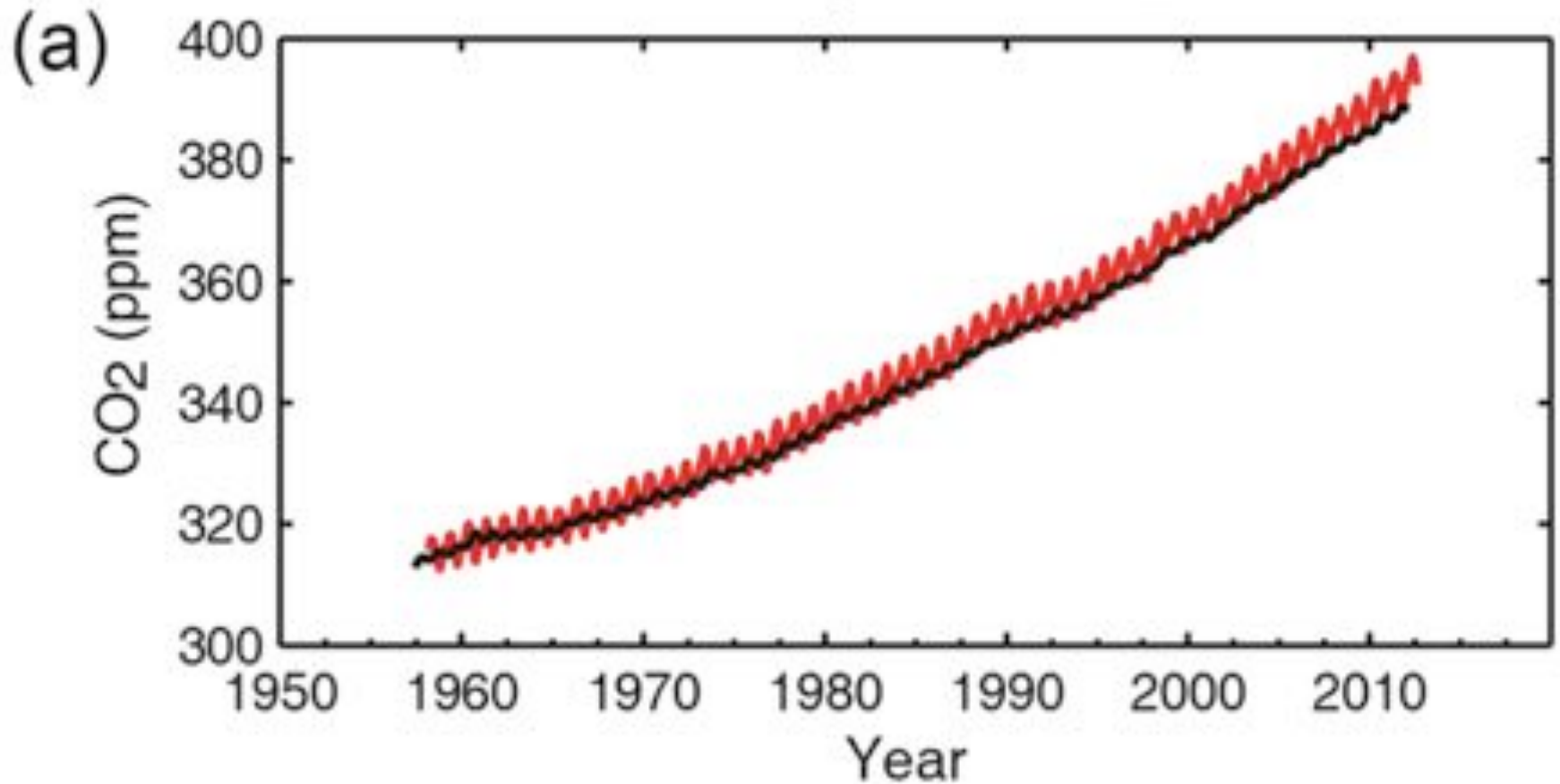


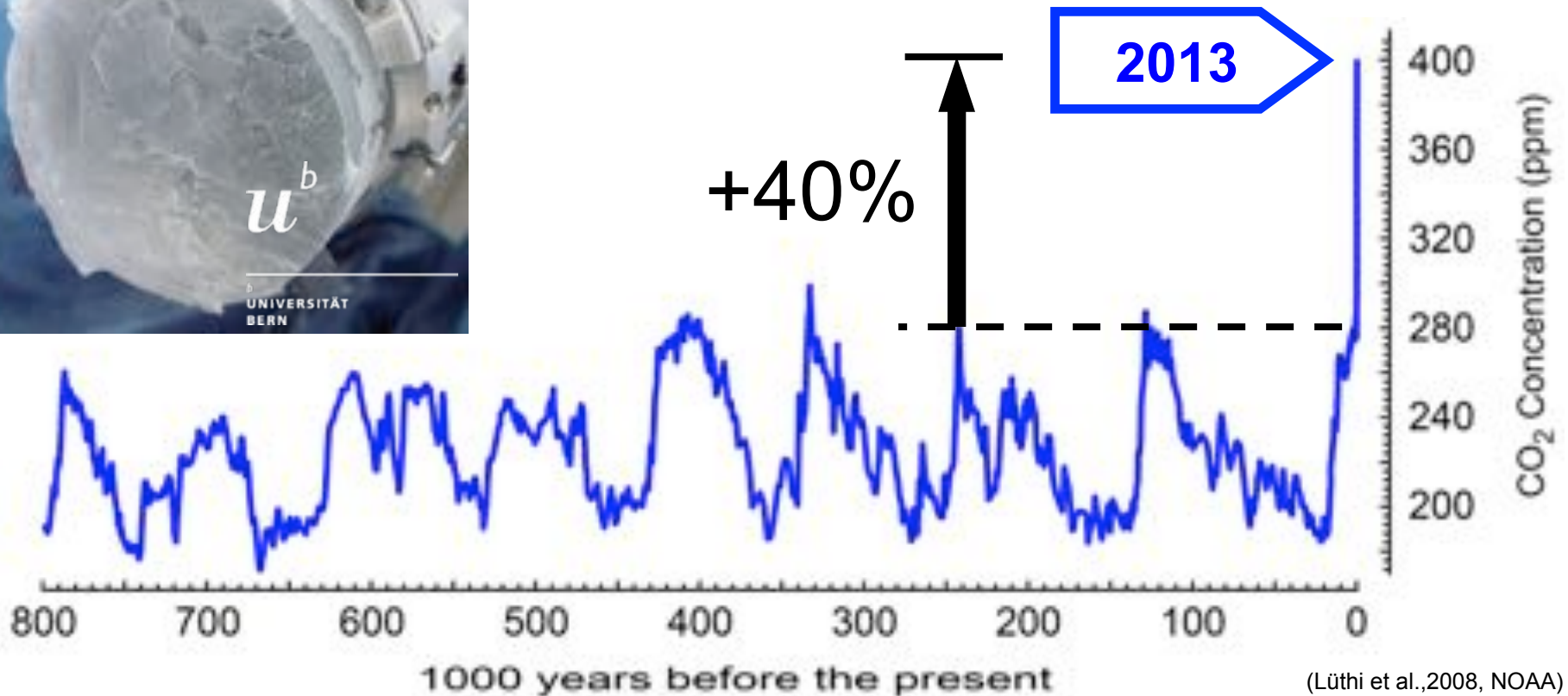
http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Evolution du niveau moyen des mers



Concentration atmosphérique en CO₂



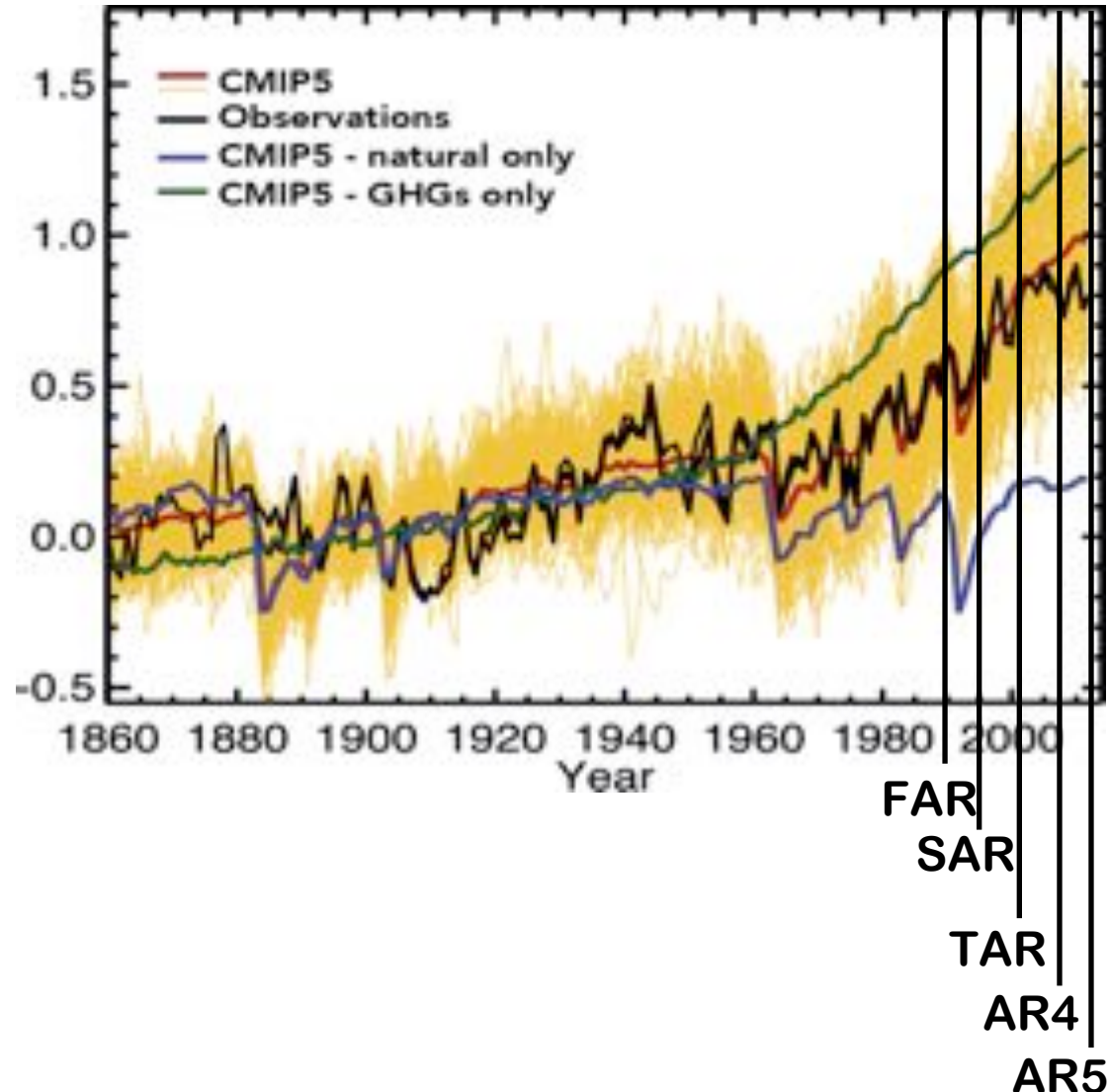


(Lüthi et al., 2008, NOAA)

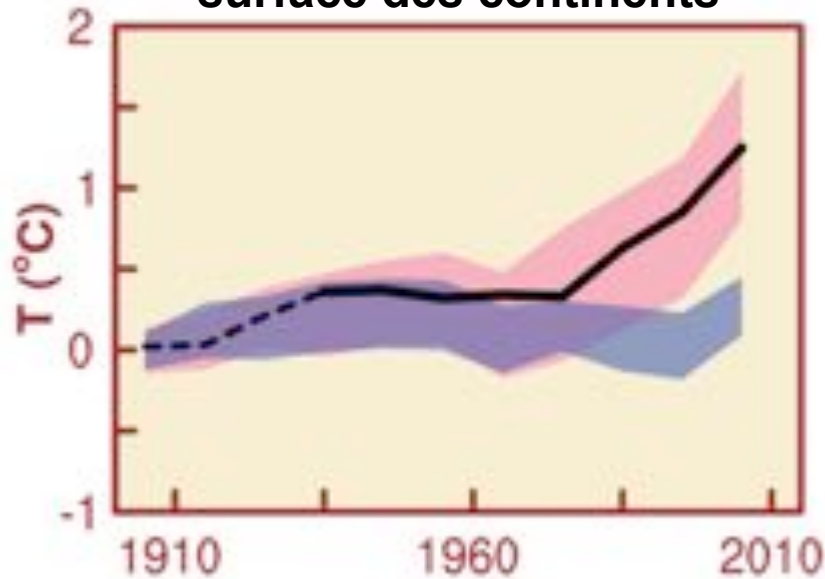
Les concentrations atmosphériques en dioxyde de carbone (CO₂) ont augmenté jusqu'à des niveaux sans précédent au cours des 800 000 dernières années

A Progression of Understanding: Greater and Greater Certainty in Attribution

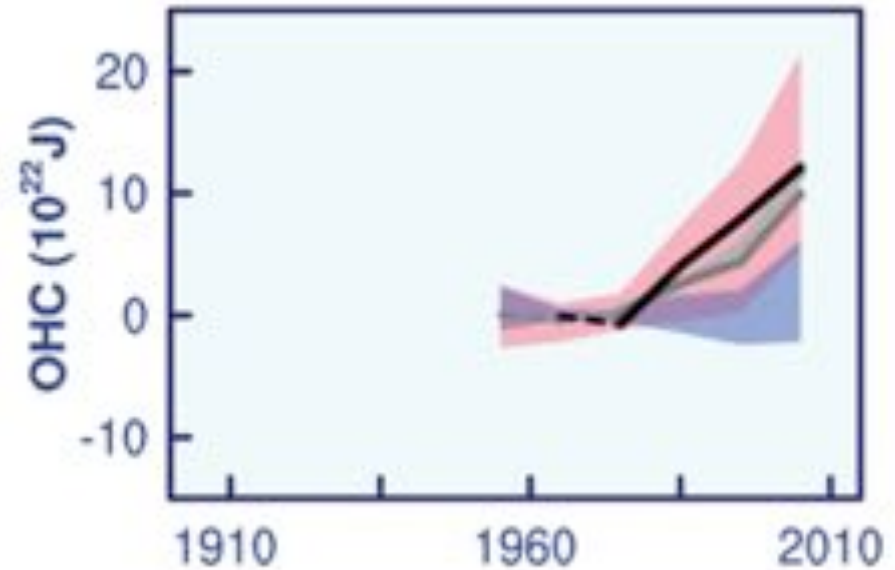
- FAR (1990): “unequivocal detection not likely for a decade”
- SAR (1995): “balance of evidence suggests discernible human influence”
- TAR (2001): “most of the warming of the past 50 years is *likely* (odds 2 out of 3) due to human activities”
- AR4 (2007): “most of the warming is *very likely* (odds 9 out of 10) due to greenhouse gases”
- AR5 (2013) «It is *extremely likely* (odds 95 out of 100) that human influence has been the dominant cause... »



Température moyenne surface des continents



Contenu thermique des océans



(IPCC 2013, Fig. SPM.6)

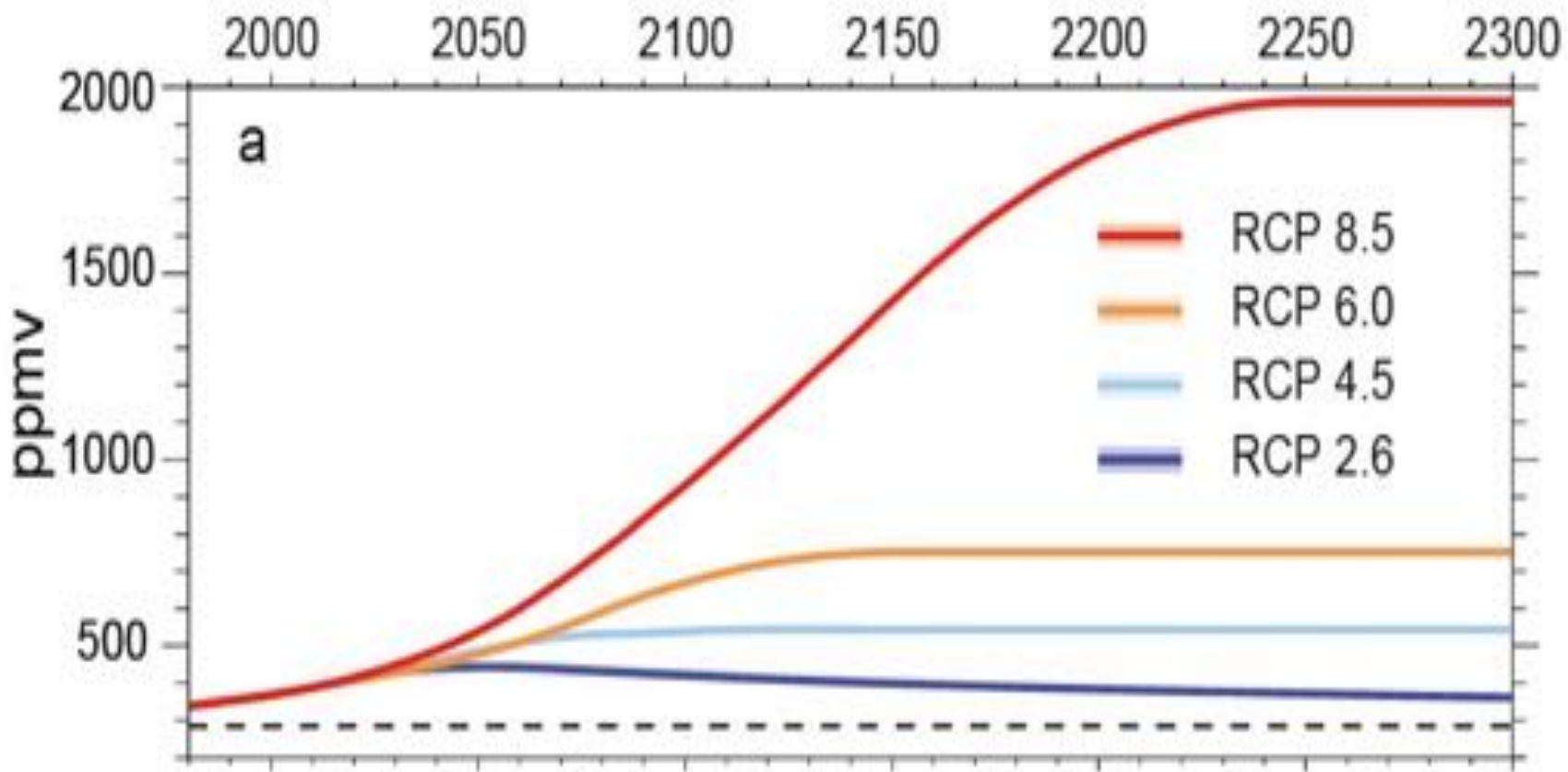
Noir: observations

Bleu: simulations avec seuls facteurs naturels

Rose: simulations avec facteurs naturels & humains

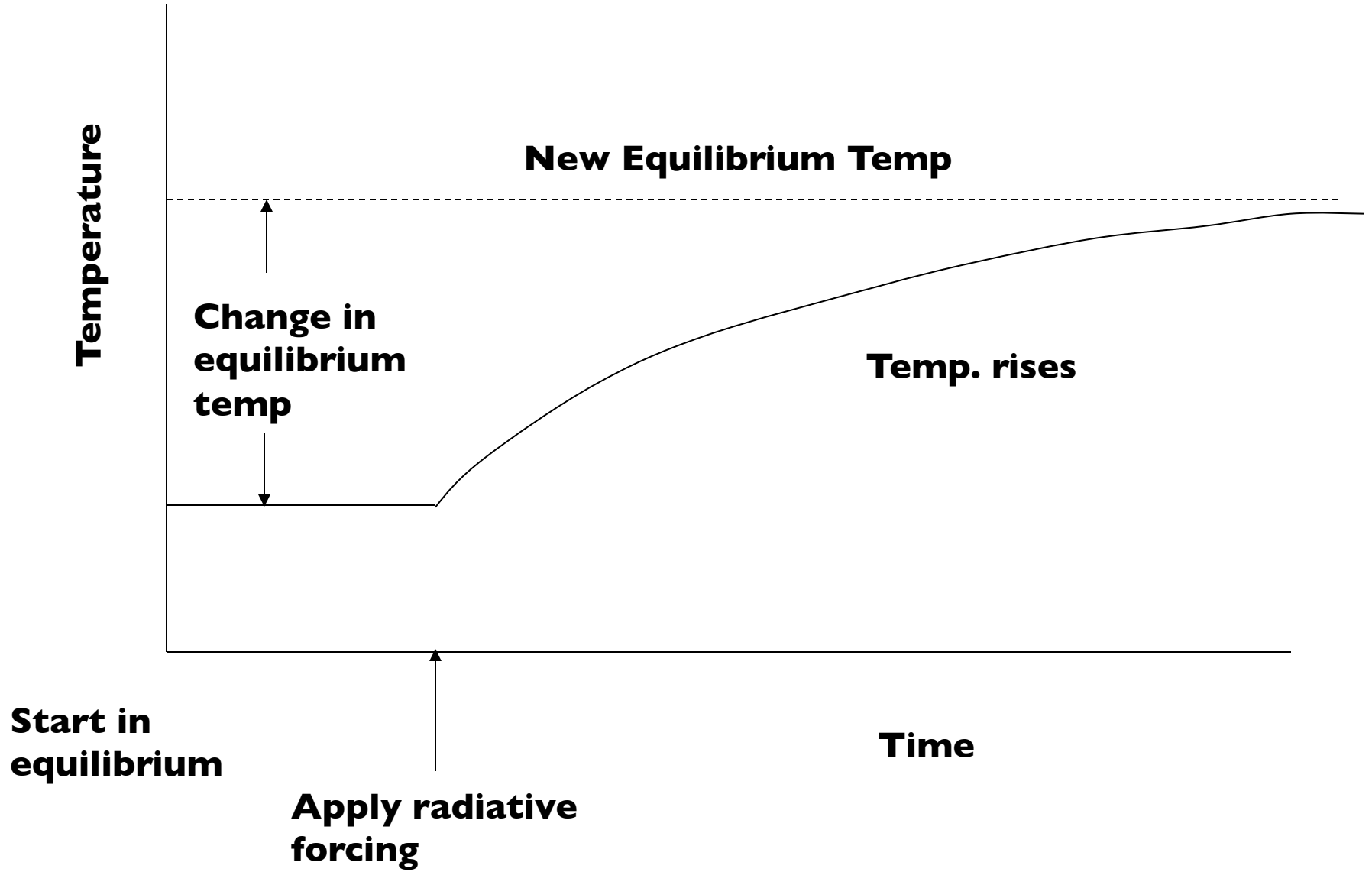
L'influence humaine sur le système climatique est sans équivoque; Il est *extrêmement probable* (95%) que l'influence humaine a été la cause principale du réchauffement depuis le milieu du 20^{ème} siècle

RCP Scenarios: Atmospheric CO₂ concentration



Three stabilisation scenarios: RCP 2.6 to 6
One Business-as-usual scenario: RCP 8.5

Climate sensitivity: change in equilibrium global temperature for a radiative forcing corresponding to a doubling in CO₂ concentration



Sensibilité de la température globale à l'équilibre à un doublement instantané de la concentration en CO₂

Depuis 1975, la littérature scientifique la situe entre 1.5 et 4.5°C, un facteur 3 d'incertitude !

Source majeure: la difficulté de représenter les nuages en détail dans les modèles climatiques

Stabilisation levels and equilibrium global mean temperatures

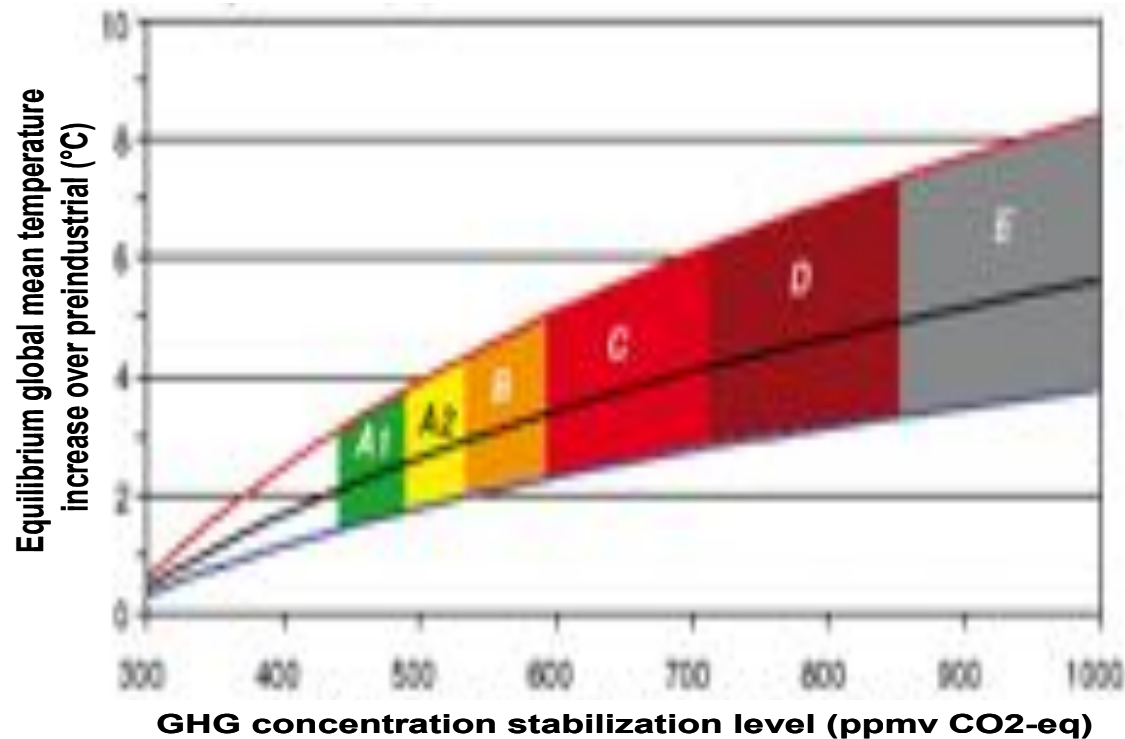
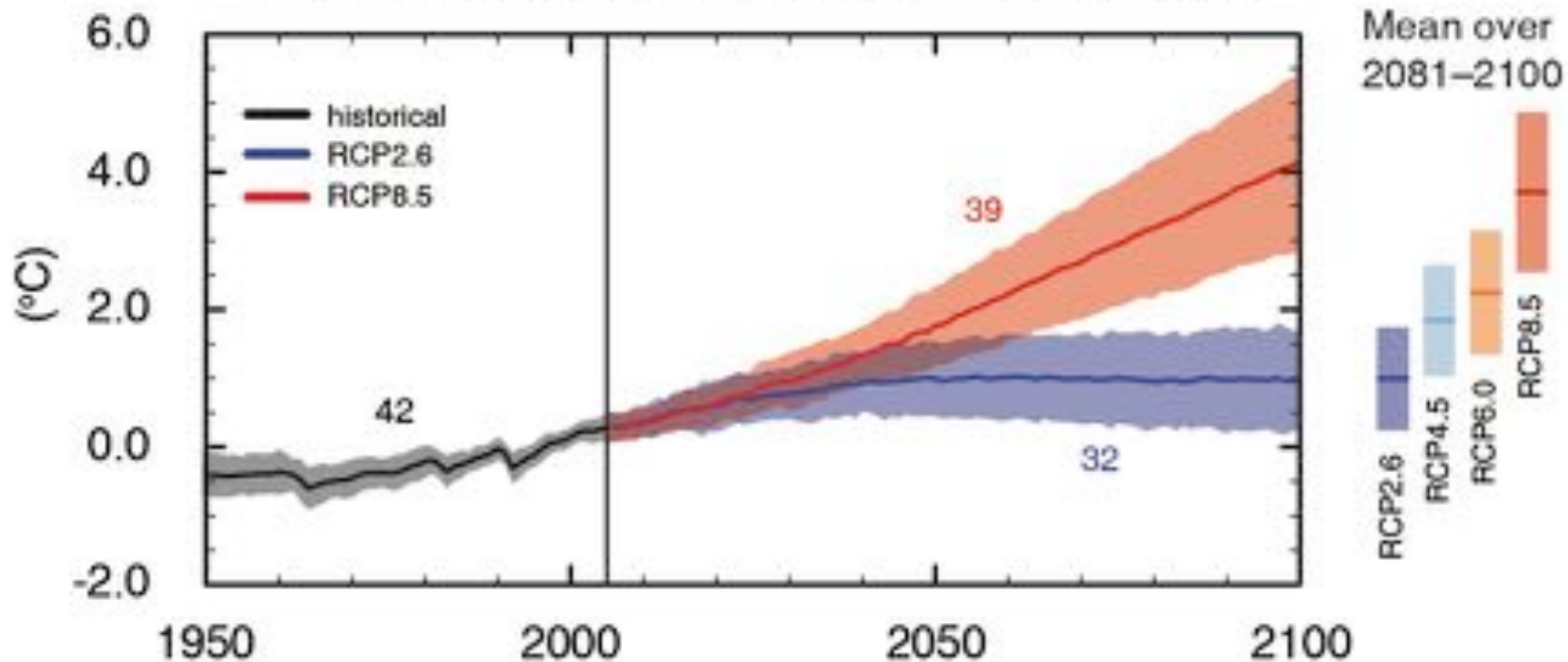


Figure SPM 8: Stabilization scenario categories as reported in Figure SPM.7 (coloured bands) and their relationship to equilibrium global mean temperature change above pre-industrial, using (i) “best estimate” climate sensitivity of 3°C (black line in middle of shaded area), (ii) upper bound of likely range of climate sensitivity of 4.5°C (red line at top of shaded area) (iii) lower bound of likely range of climate sensitivity of 2°C (blue line at bottom of shaded area). Coloured shading shows the concentration bands for stabilization of greenhouse gases in the atmosphere corresponding to the stabilization scenario categories. The data are drawn from AR4 WGI, Chapter 10.8.

Global average surface temperature change (Ref: 1986-2005)



(IPCC 2013, Fig. SPM.7a)

Seul le scénario d'émissions le plus bas (RCP2.6) permet de maintenir l'augmentation de la température moyenne du globe en surface en-dessous de 2°C (relativement à 1850-1900) avec une probabilité d'au moins 66%.

18-20000 years ago (Last Glacial Maximum)

With permission from Dr. S. Joussaume, in « Climat d'hier à demain », CNRS éditions.

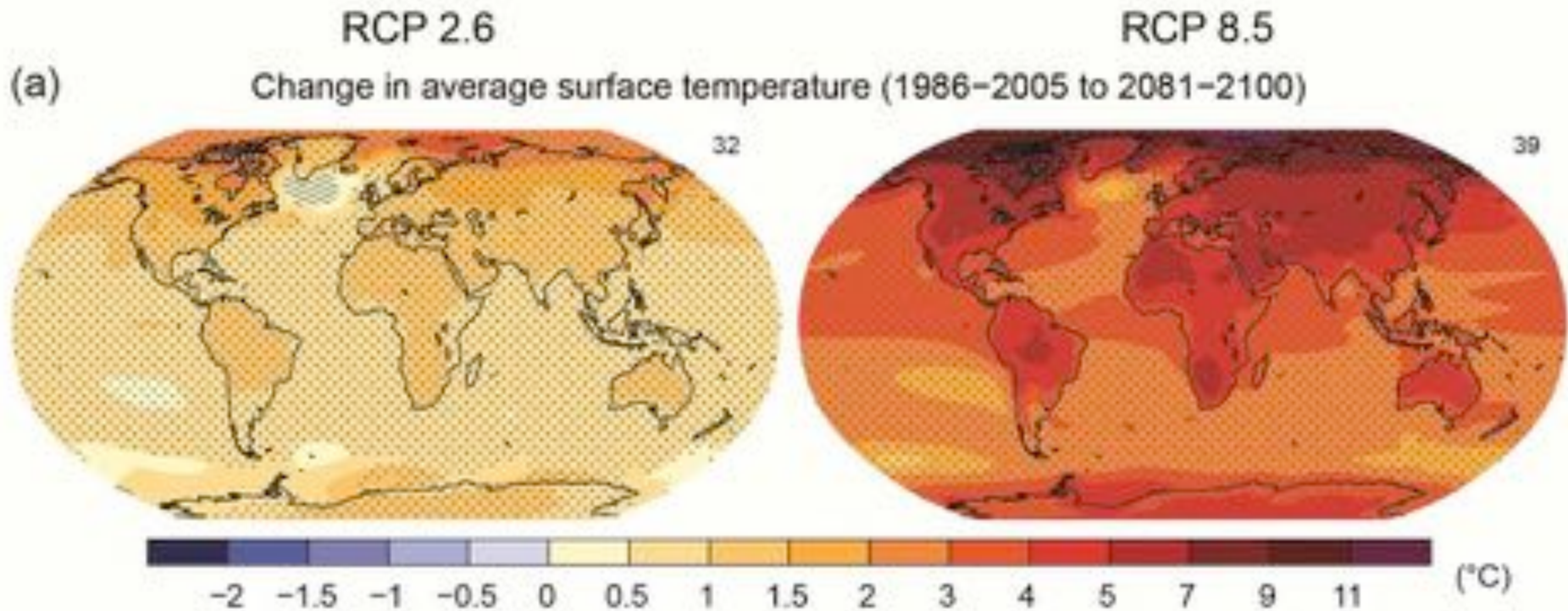


Today, with +4-5°C globally

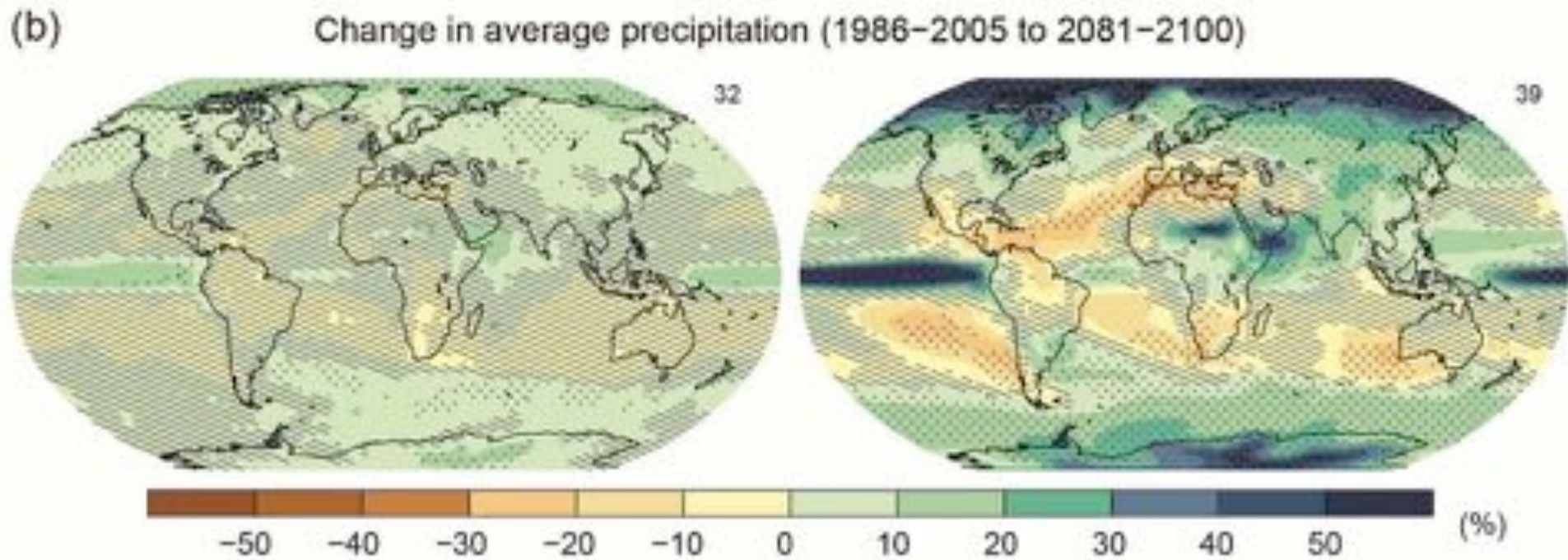
With permission from Dr. S. Joussaume, in « Climat d'hier à demain », CNRS éditions.



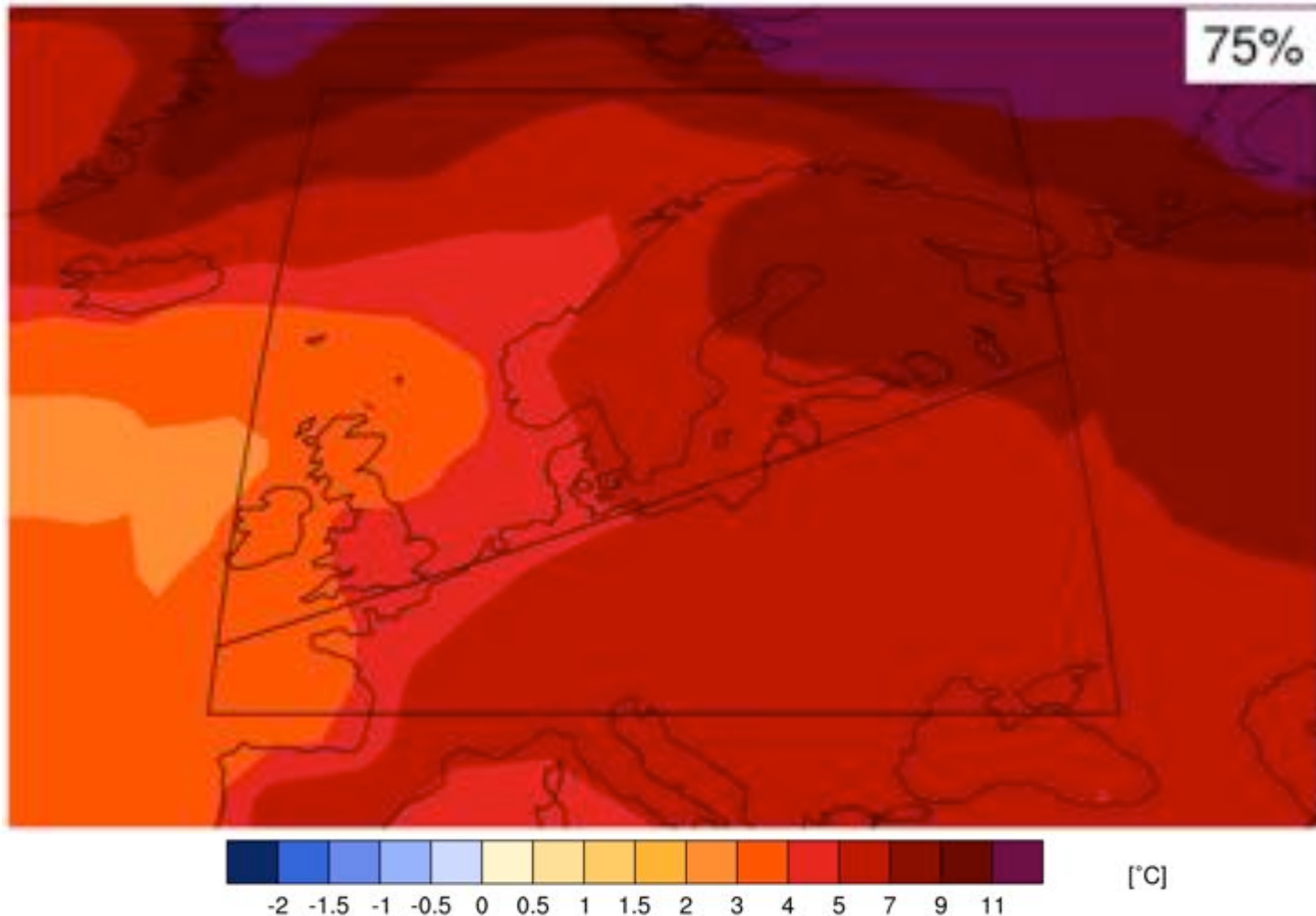
Surface temperature projections



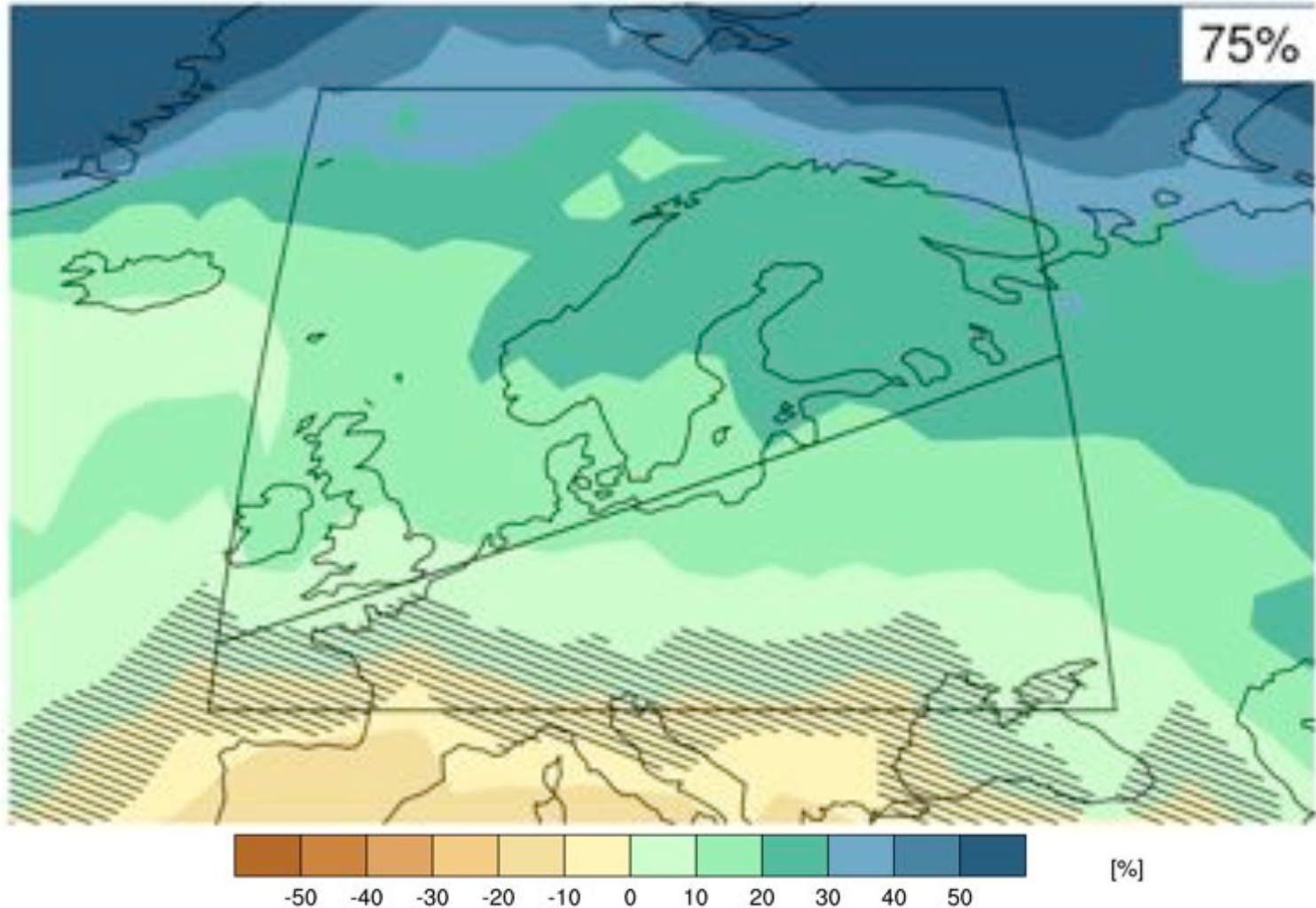
Precipitation projections

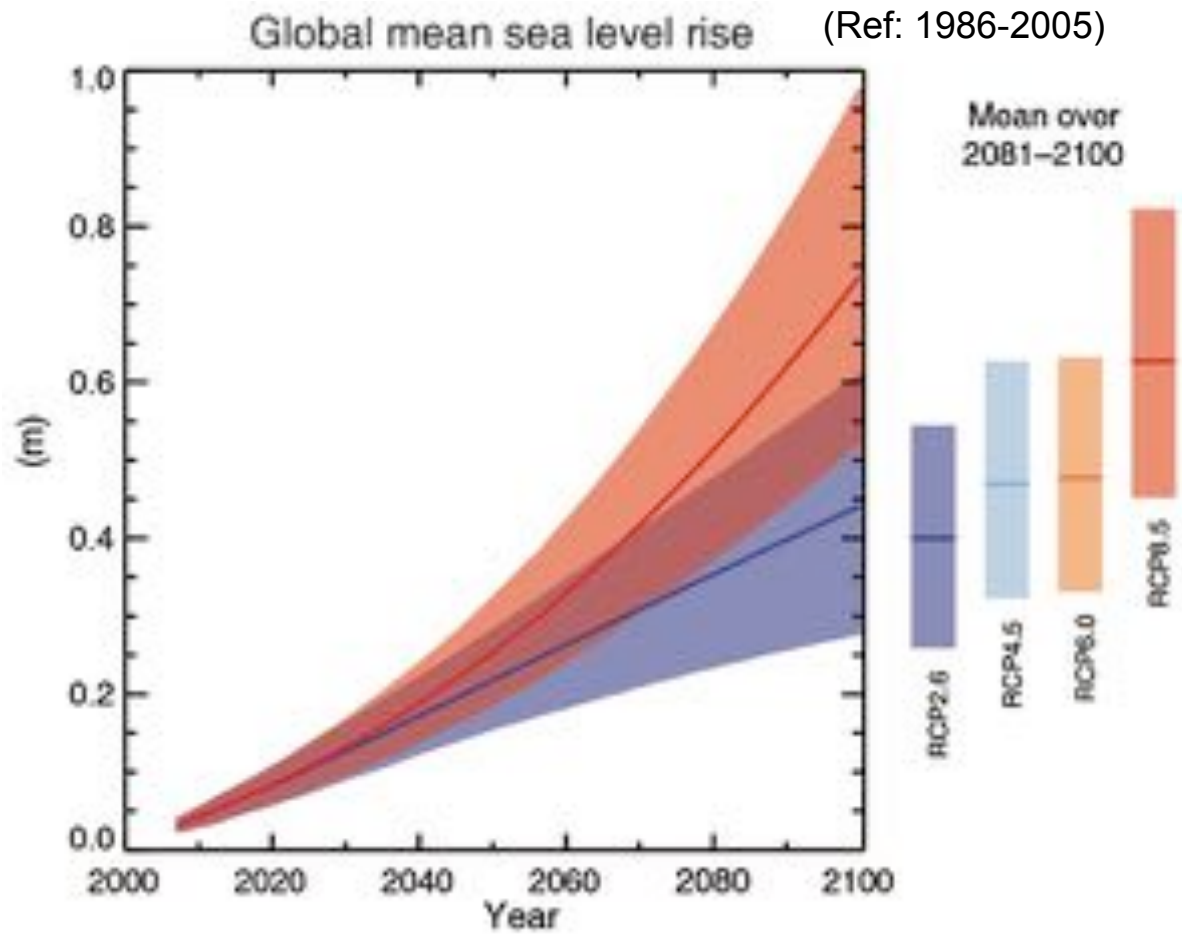


North Europe - Map of temperature changes: 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)



North Europe - Map of precipitation changes in 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)





(IPCC 2013, Fig. SPM.9)

Le niveau moyen des mers continuera à s'élever au cours du XXIe siècle

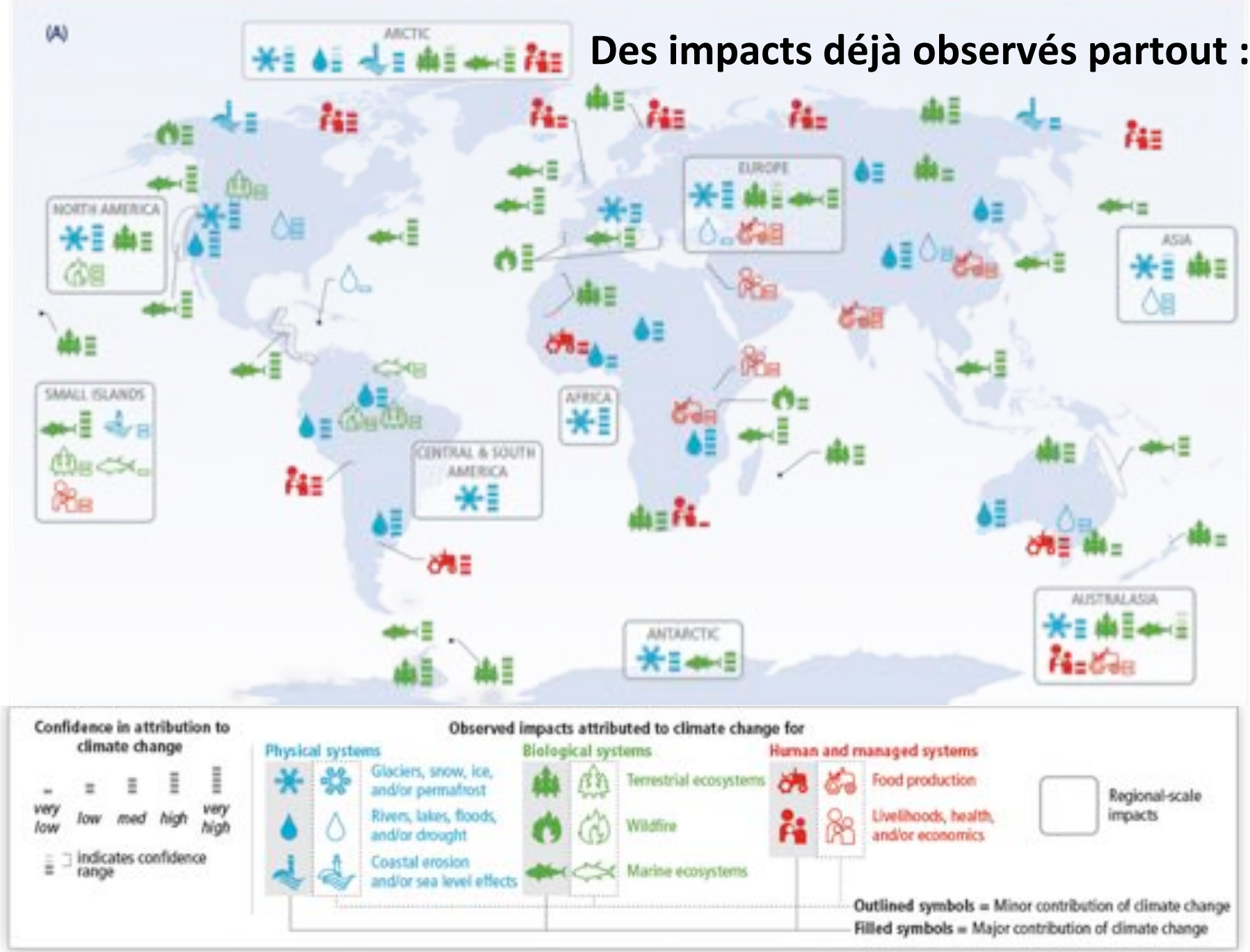


Quels sont les risques ?

Risque = Aléa x Vulnérabilité x Exposition (Victimes des inondations après Katrina)



Des impacts déjà observés partout :



Impacts Potentiels des Changements Climatiques



Pénurie de nourriture
et d'eau



Migrations humaines
accrues



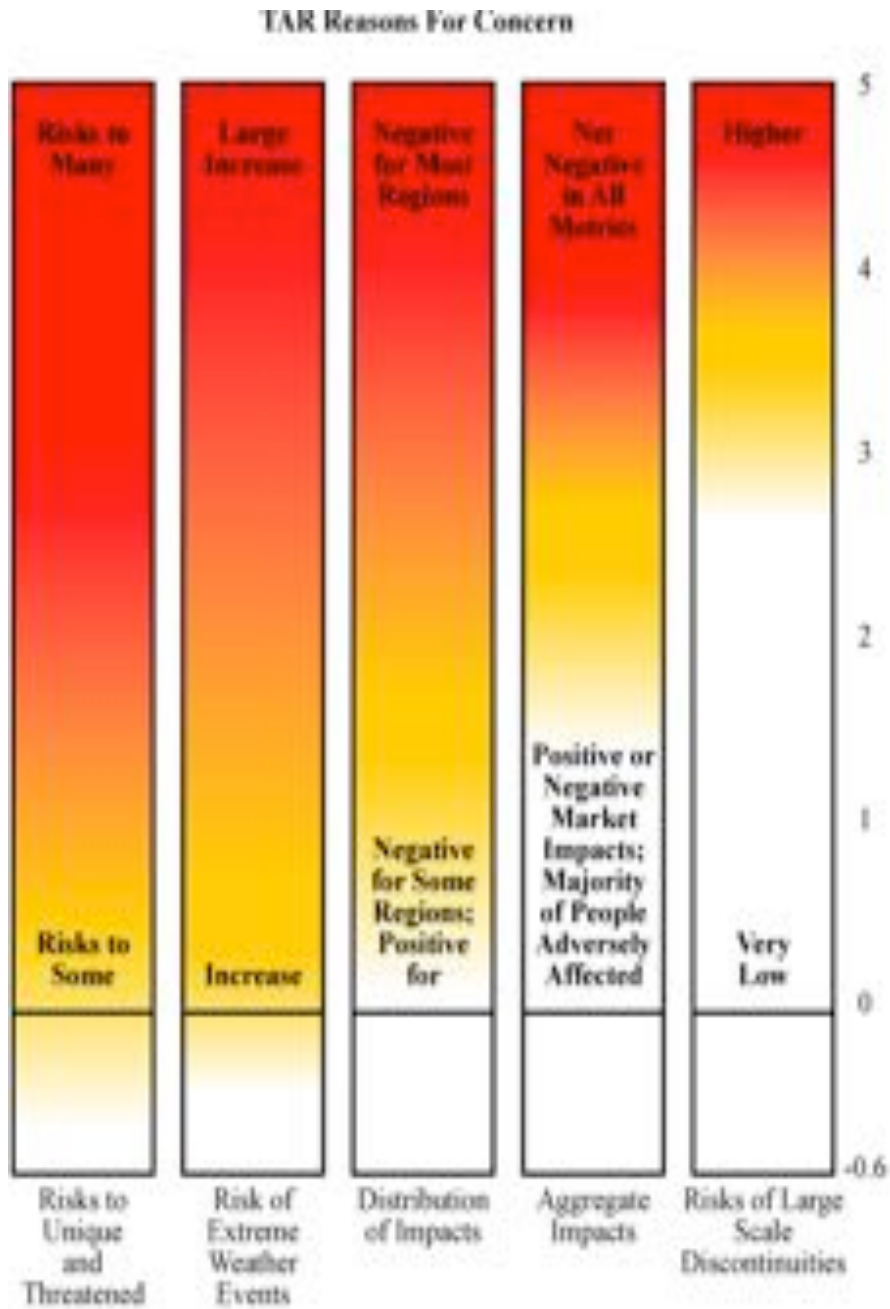
Pauvreté accrue



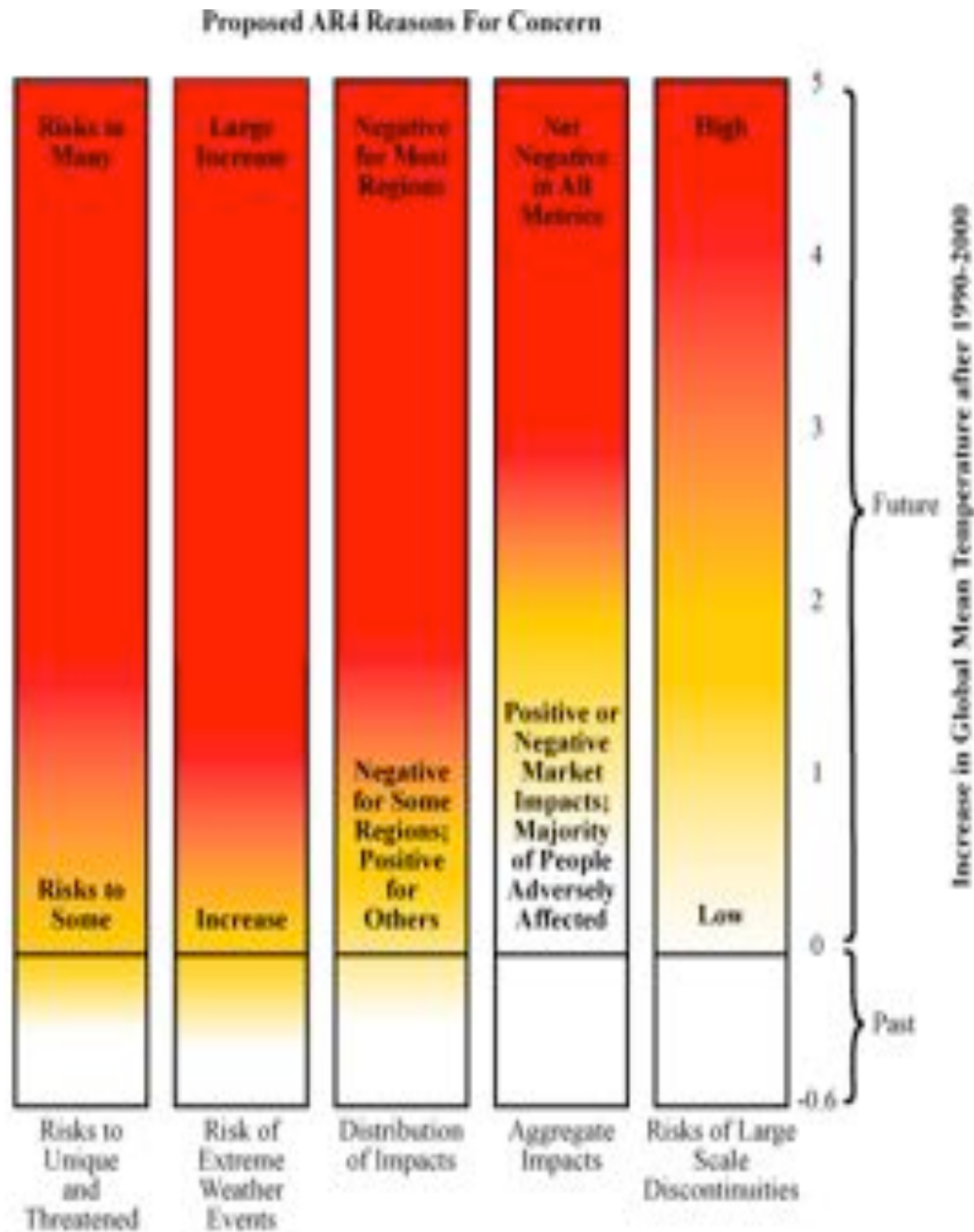
Inondations régions
côtières

AR5 WGII SPM

IPCC TAR, 2001



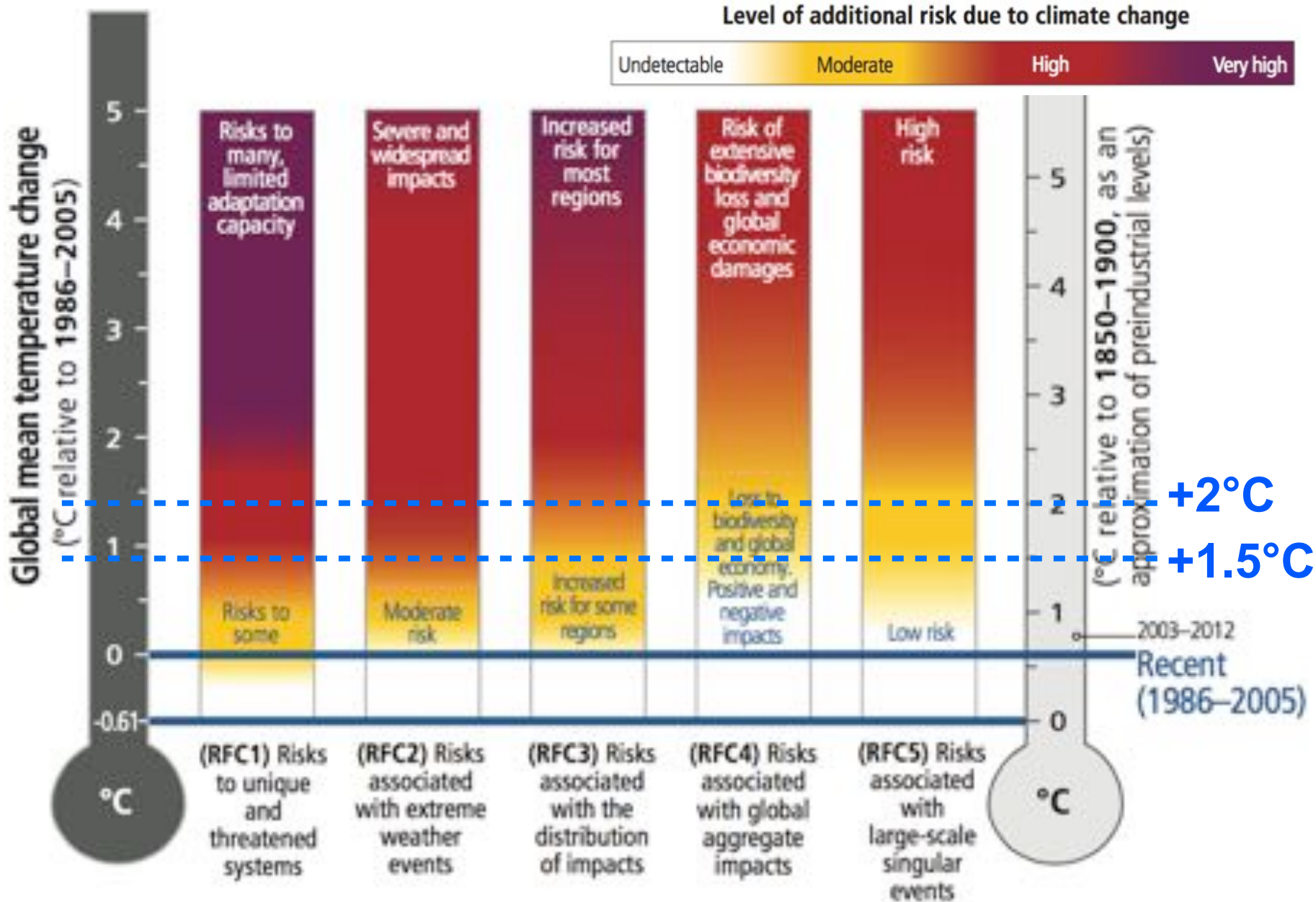
Smith et al, 2009, PNAS, based on IPCC AR4, 2007

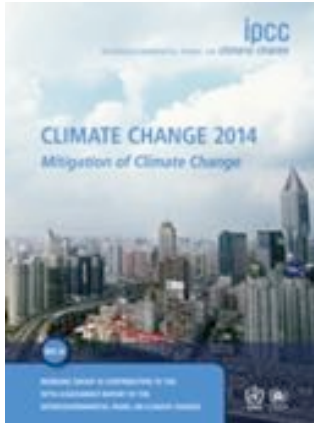


Objectif ultime de la Convention cadre sur les changements climatiques, Rio, juin 1992

- **"stabiliser [...] les concentrations de gaz à effet de serre dans l'atmosphère à un niveau qui empêche toute perturbation anthropique dangereuse du système climatique"**
- **"Il conviendra d'atteindre ce niveau dans un délai suffisant pour**
 - **que les écosystèmes puissent s'adapter naturellement aux changements climatiques,**
 - **que la production alimentaire ne soit pas menacée et**
 - **que le développement économique puisse se poursuivre de manière durable » (Art. 2)**

AR5 WGII: Reasons for Concern





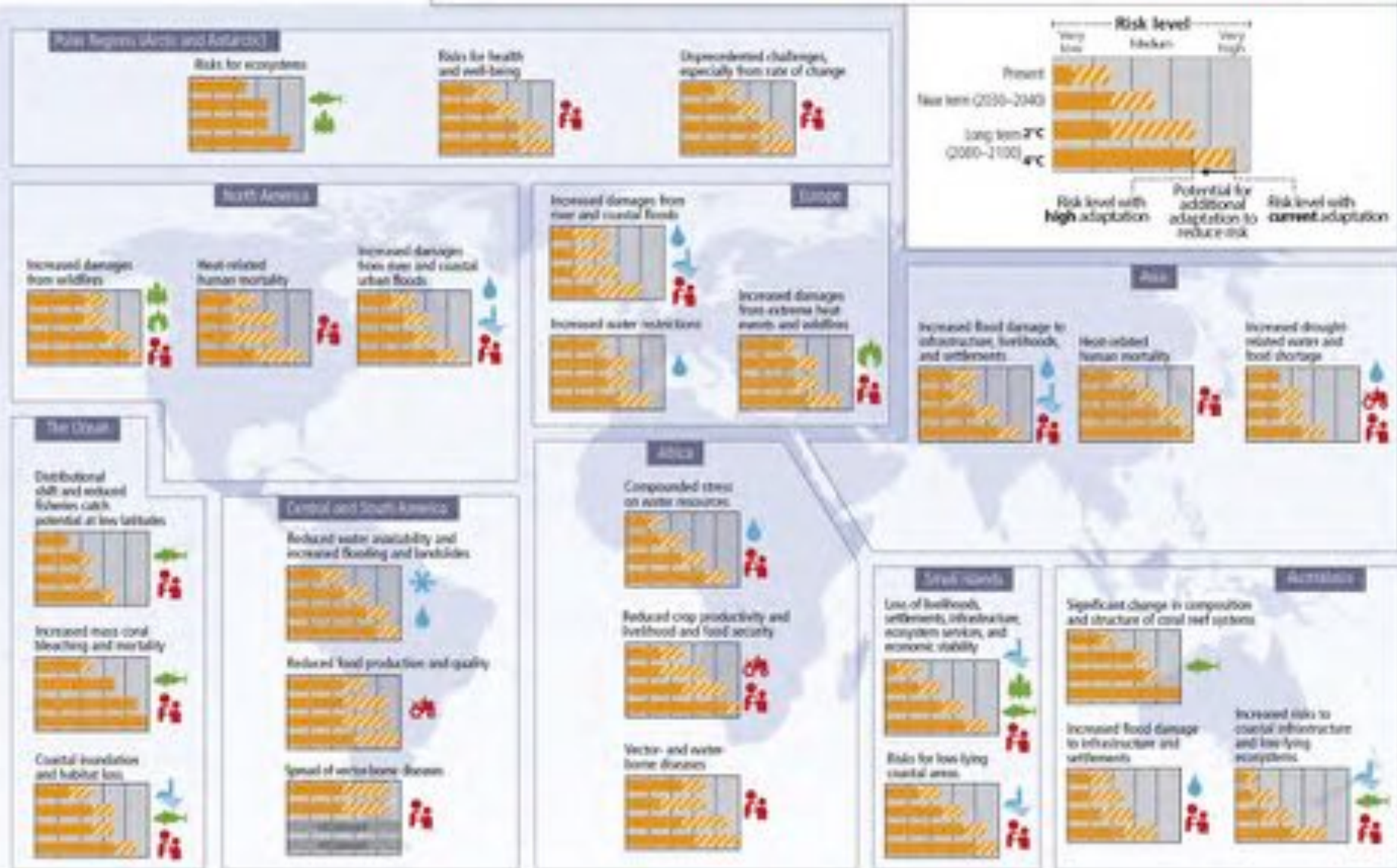
Que peut-on faire ?



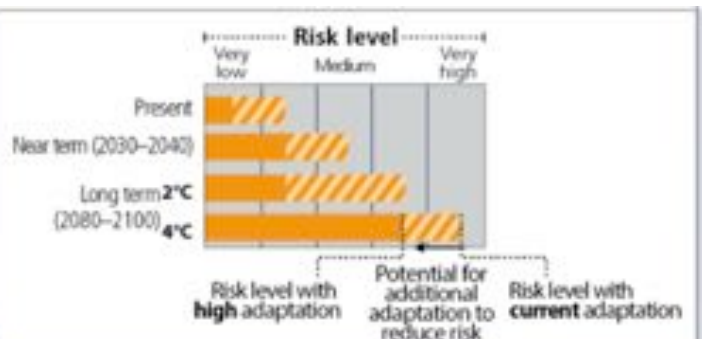
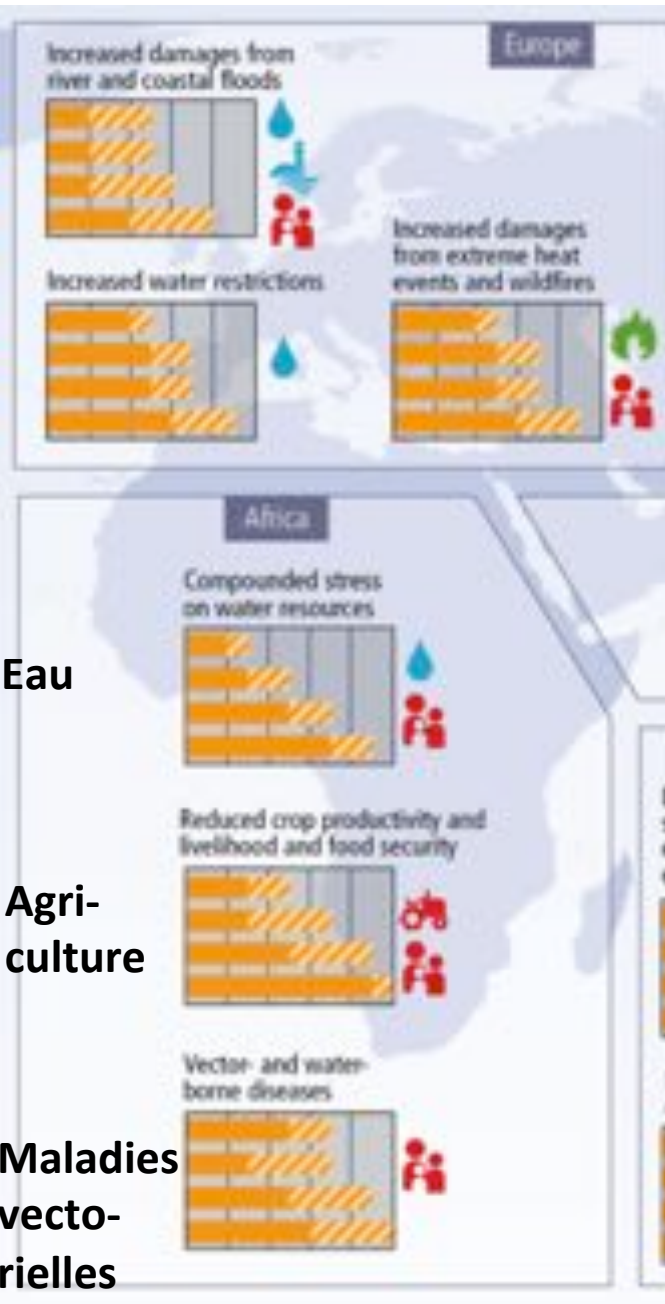
DE L'ADAPTATION

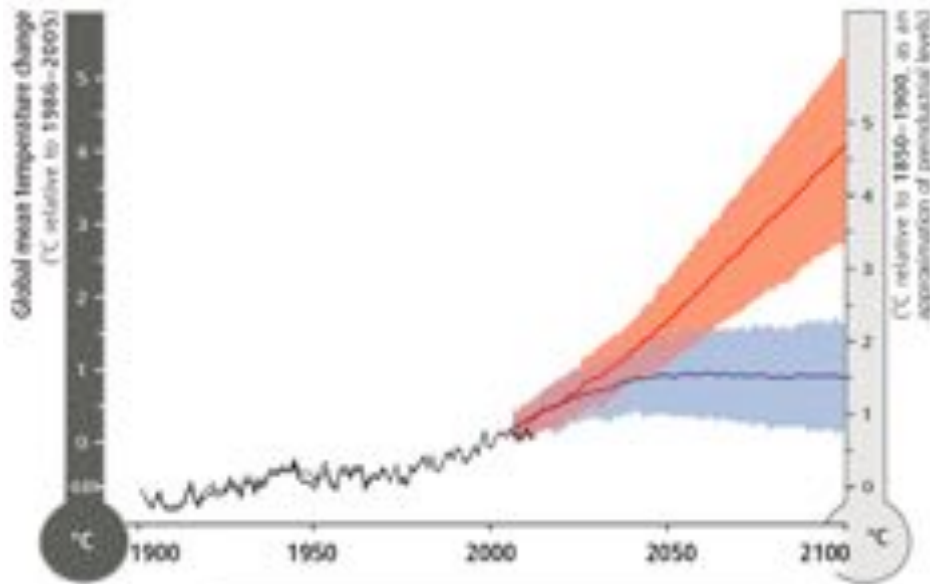
SE MET DEJA EN PLACE

Regional key risks and potential for risk reduction

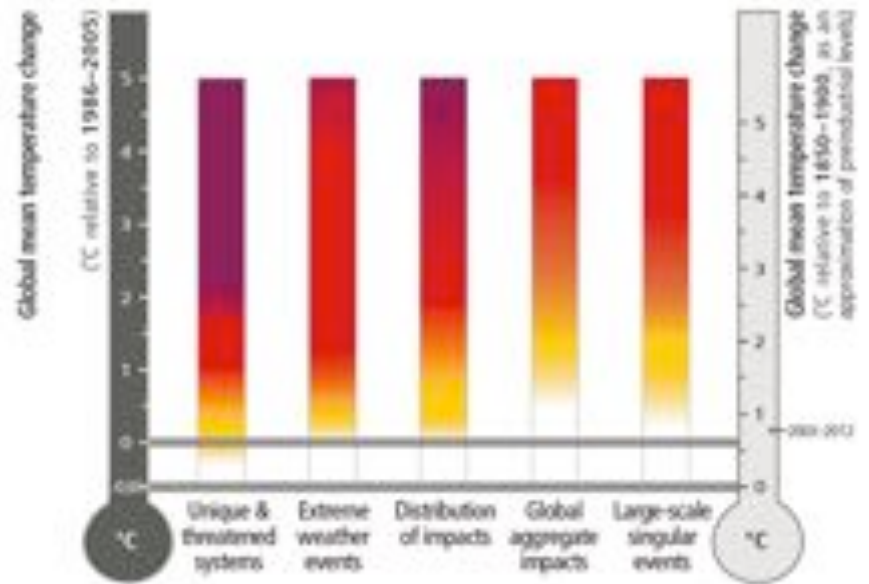


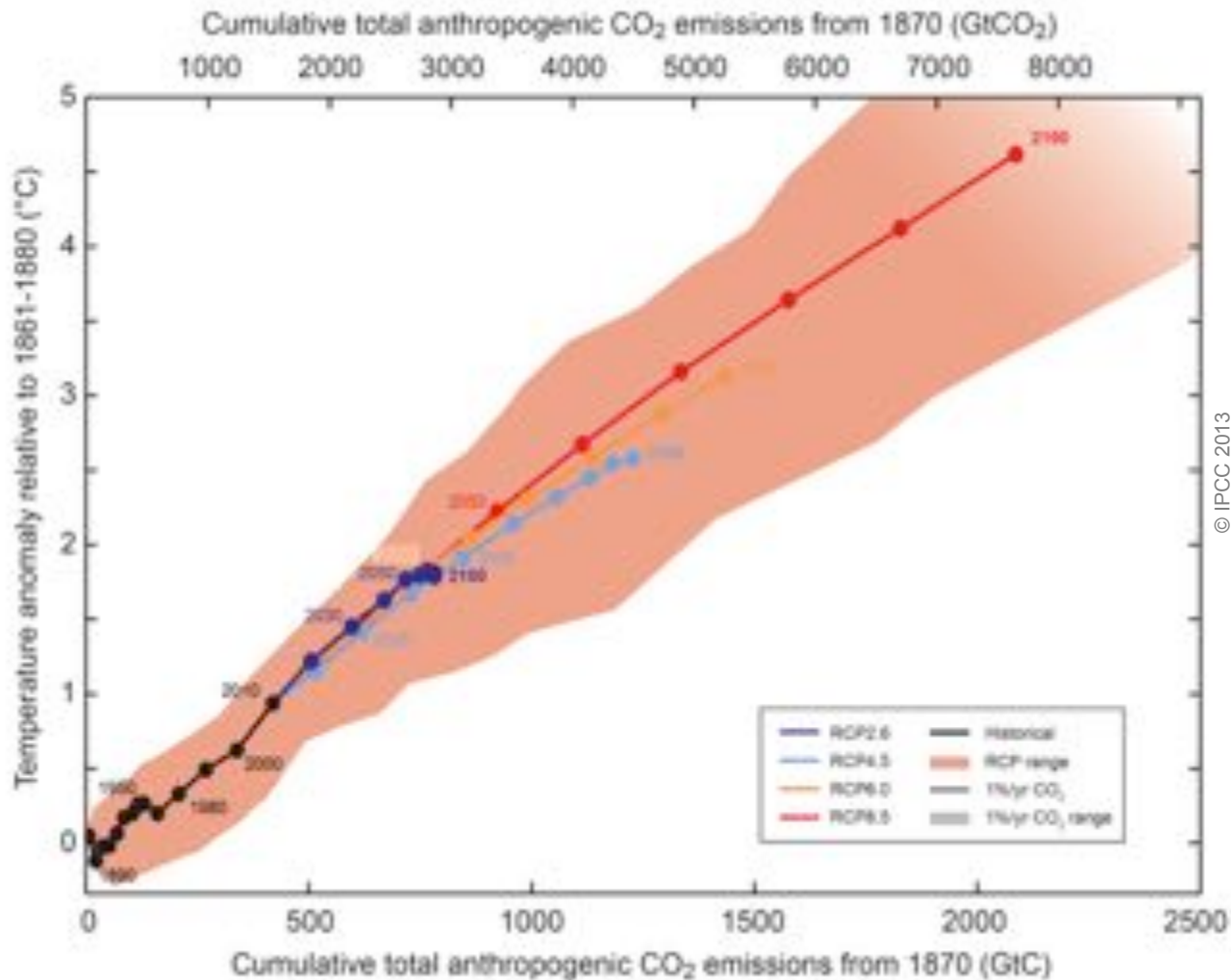
Risques clés à l'échelle régionale et potentiel de réduction du risque par l'adaptation: Afrique





- Observed
- RCP8.5 (a high-emission scenario)
- Overlap
- RCP2.6 (a low-emission mitigation scenario)





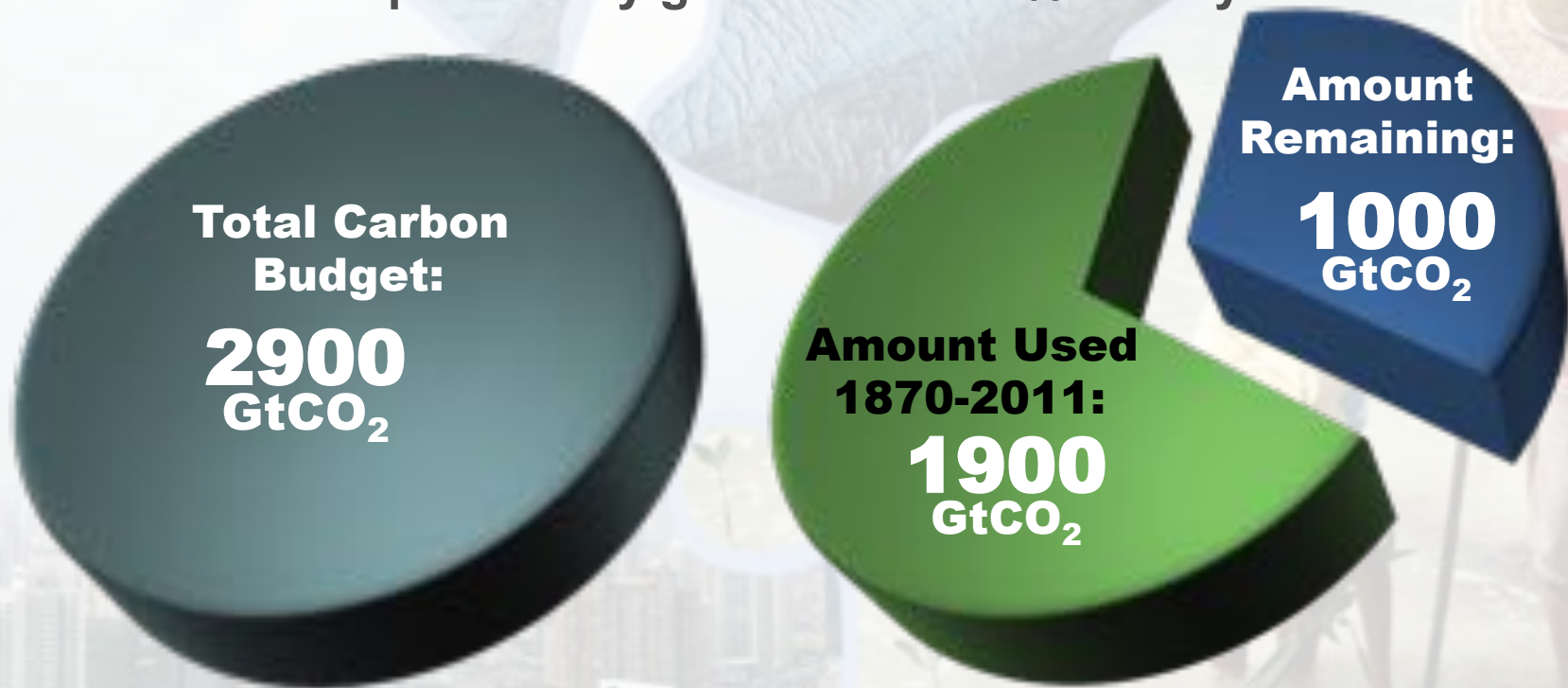
© IPCC 2013

Fig. SPM.10

Le total des émissions de CO₂ cumulées détermine dans une large mesure la moyenne globale du réchauffement en surface vers la fin du XXI^{ème} siècle et au delà

The window for action is rapidly closing

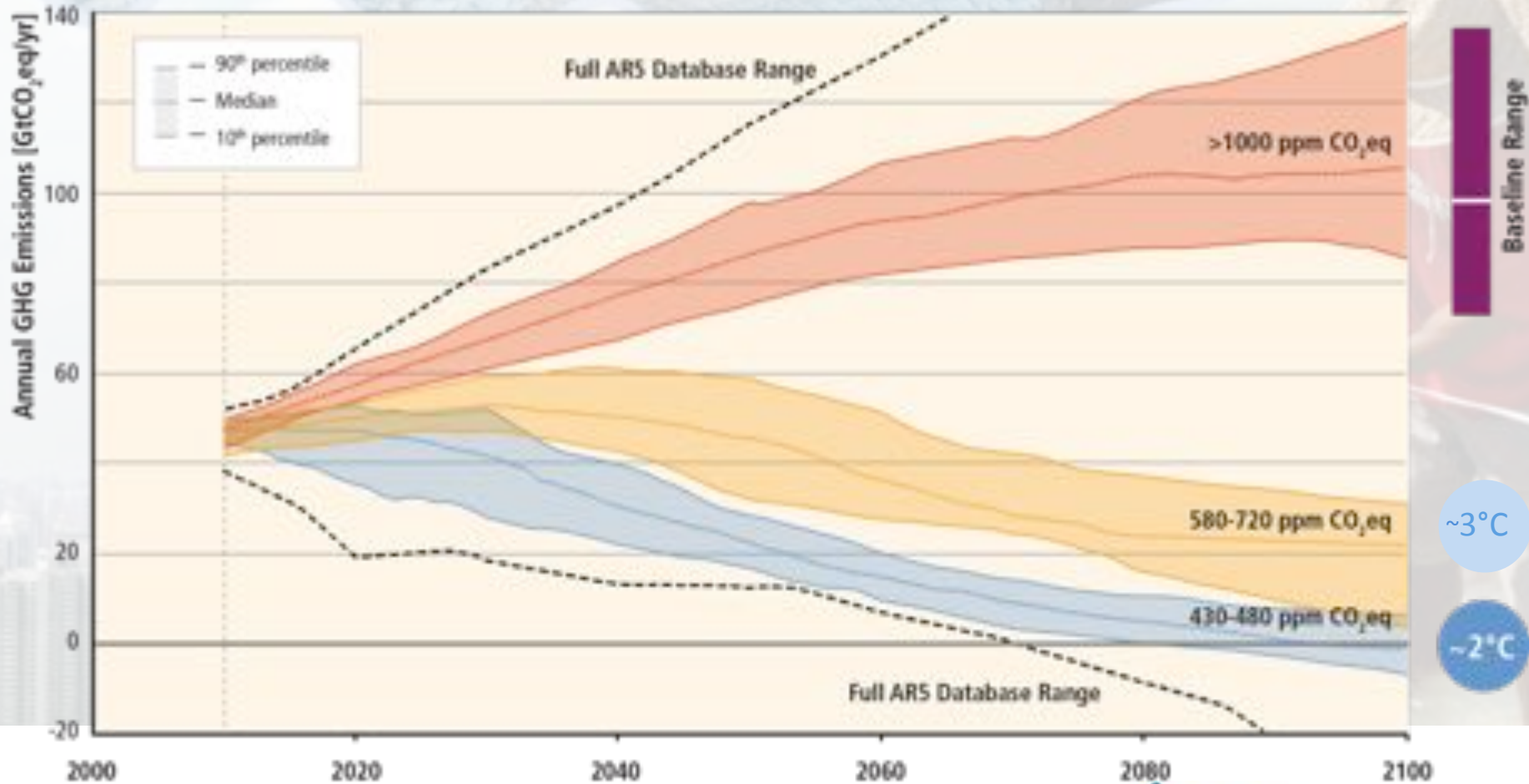
65% of the carbon budget compatible with a 2°C goal is already used
NB: this is with a probability greater than 66% to stay below 2°C



NB: Emissions in 2011: 38 GtCO₂/yr

AR5 WGI SPM

Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.



Based on Figure 6.7

L'élévation de température peut-elle encore être limitée à 1.5 ou 2°C (au cours du 21ème siècle) comparée au niveau pré-industriel ?

- De nombreuses études basées sur des scénarios confirment qu'il est techniquement et économiquement faisable de garder le réchauffement sous la barre des 2°C, avec une probabilité supérieure à 66%. Ceci impliquerait de limiter la concentration atmosphérique à moins de 450 ppm CO₂-eq d'ici 2100.**
- De tels scénarios impliquent de réduire de 40 to 70% les émissions globales de GES de 2010 à 2050, et d'atteindre des émissions globales nulles ou négatives avant 2100.**

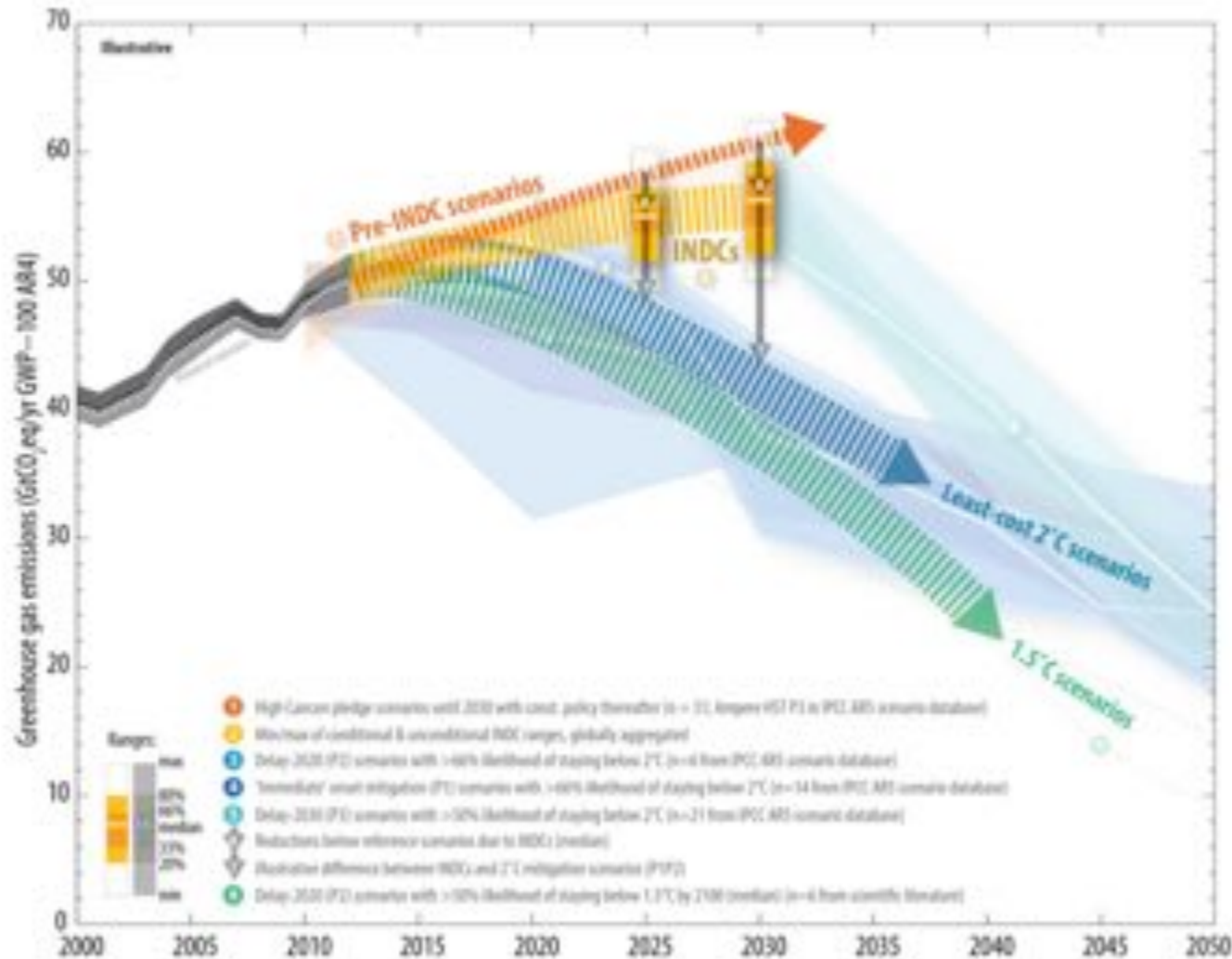
L'élévation de température peut-elle encore être limitée à 1.5 ou 2°C (au cours du 21ème siècle) comparée au niveau pré-industriel ?

- **Ces scénarios sont caractérisés par une amélioration rapide de l'efficacité énergétique et un quasi-quadruplement de la part des sources d'énergie bas-carbone (renouvelables, nucléaire, capture et stockage du carbone provenant de combustibles fossiles ou de bio-énergie), pour que cette part atteigne 60% en 2050.**
- **Maintenir le réchauffement global sous la limite de 1.5°C demanderait de rester sous des concentrations encore plus basses, et des réductions d'émissions encore plus rapides [...]**

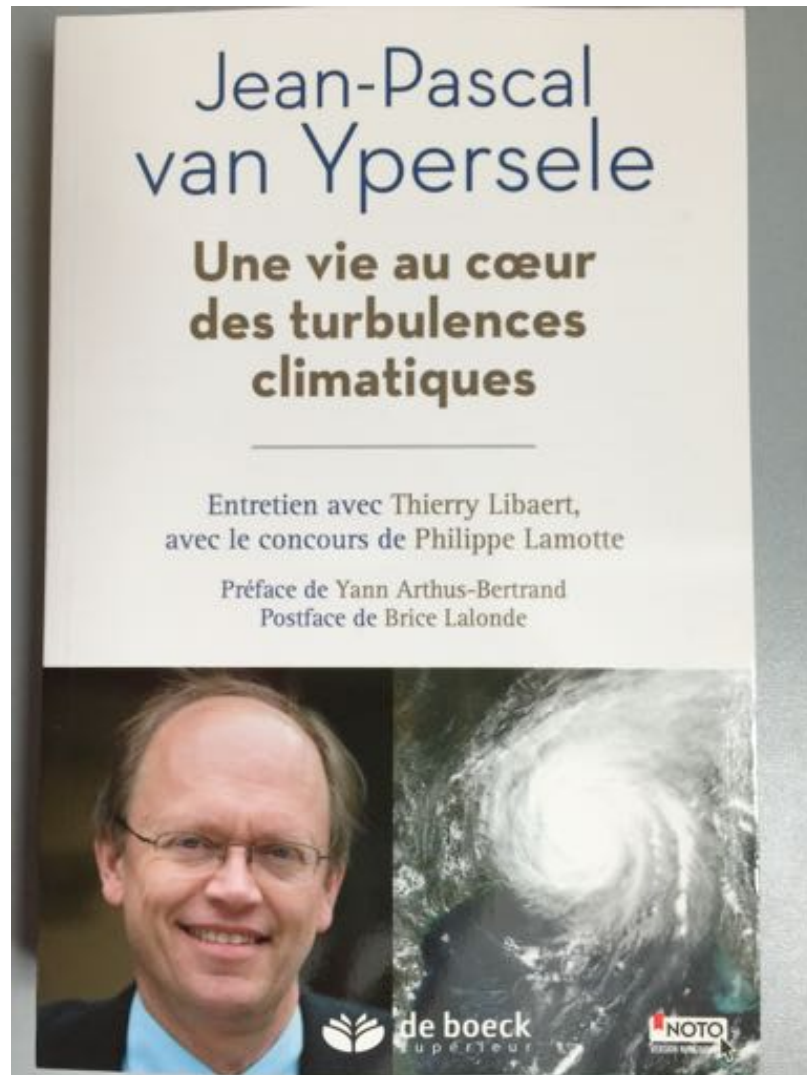
L'élévation de température peut-elle encore être limitée à 1.5 ou 2°C (au cours du 21ème siècle) comparée au niveau pré-industriel ?

- **Il y a aussi des bénéfices qui viennent des impacts évités des changements climatiques, et des co-bénéfices dans d'autres domaines, comme une réduction des dommages (santé, écosystèmes) dus à la pollution atmosphérique, une sécurité énergétique et alimentaire améliorée, ou une amélioration de l'emploi.**

Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the intended nationally determined contributions



**Publié chez De Boeck
supérieur,
octobre 2015
Broché: 16 euros
E-book: 13 euros**



Useful links:

- www.ipcc.ch : IPCC (reports and videos)
- www.climate.be/vanyp : my slides and other documents
- www.skepticalscience.com: excellent responses to contrarians arguments
- www.plateforme-wallonne-giec.be
- **On Twitter: @JPvanYpersele
and @IPCC_CH**