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

Jean-Pascal van Ypersele

Climatologue à l'Université catholique de Louvain (UCL),

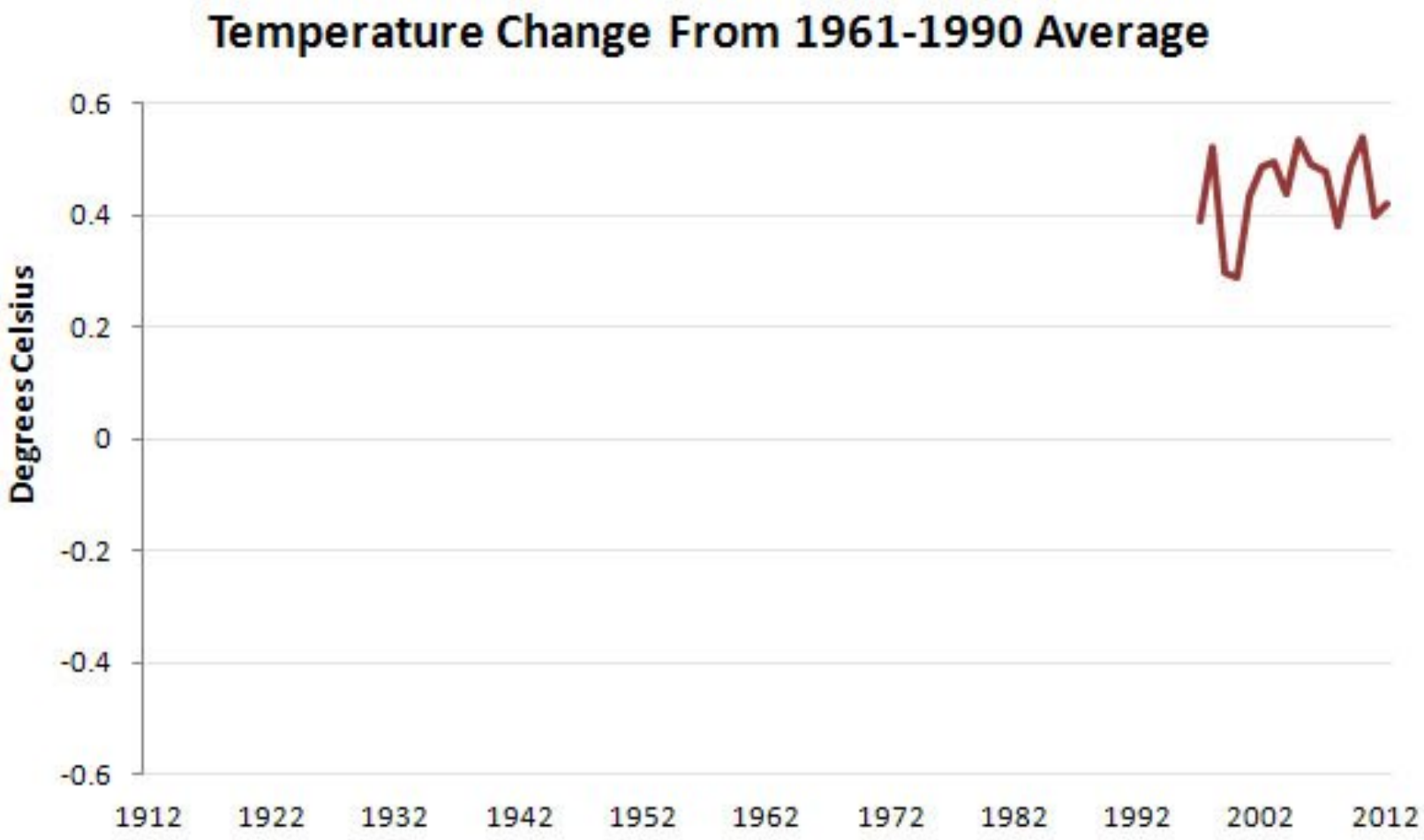
Vice-président du GIEC de 2008 à 2015

Twitter: @JPvanYpersele

École Énergies et Recherches 2018, Roscoff (France), 19-3-2018

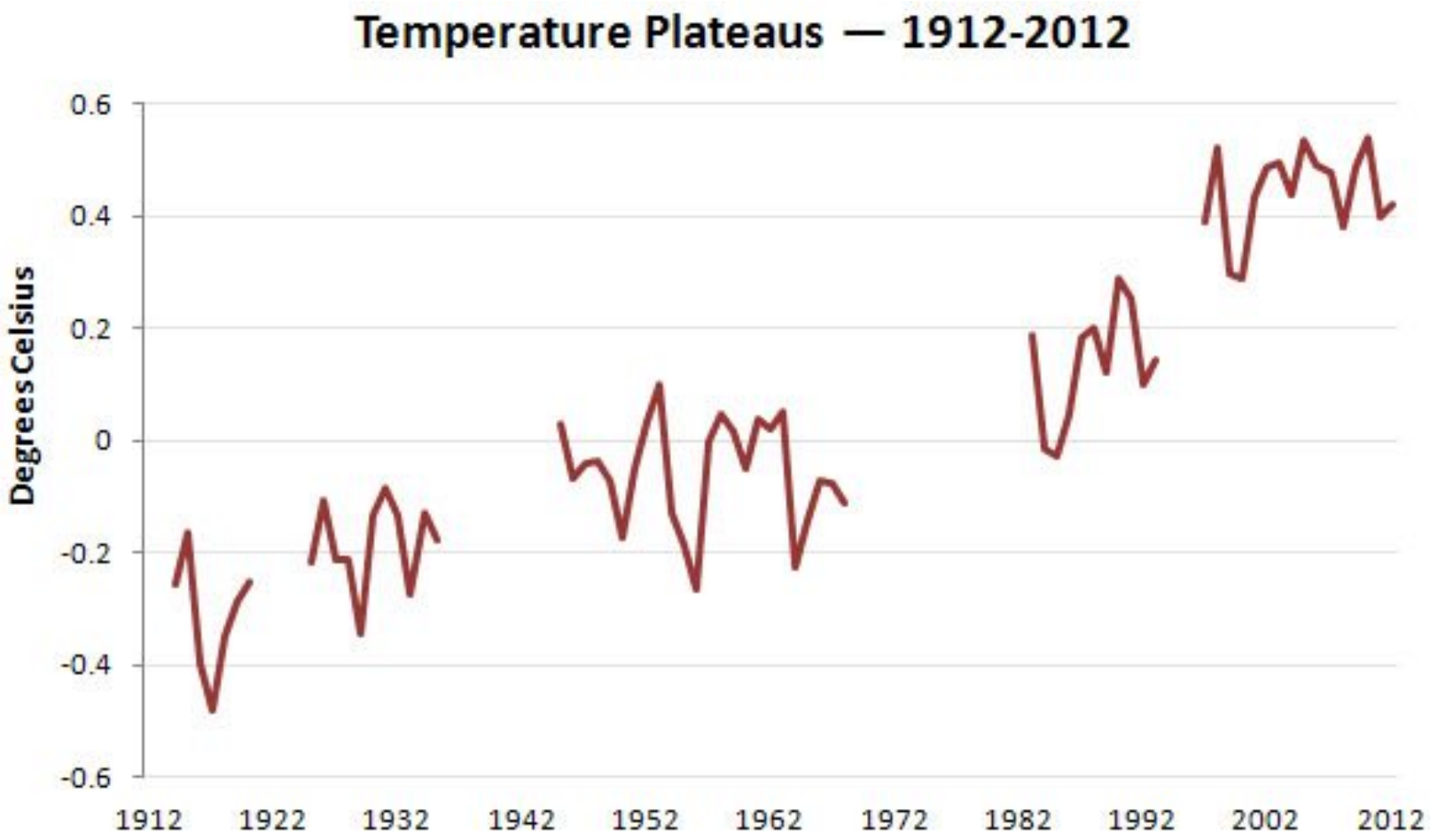
Merci aux Gouvernement wallon qui finance la Plateforme wallonne pour le GIEC et à mon équipe à l'Université catholique de Louvain pour leur soutien

Lying With Statistics, Global Warming Edition



http://www.motherjones.com/kevin-drum/2012/10/lying-statistics-global-warming-edition

Lying With Statistics, Global Warming Edition



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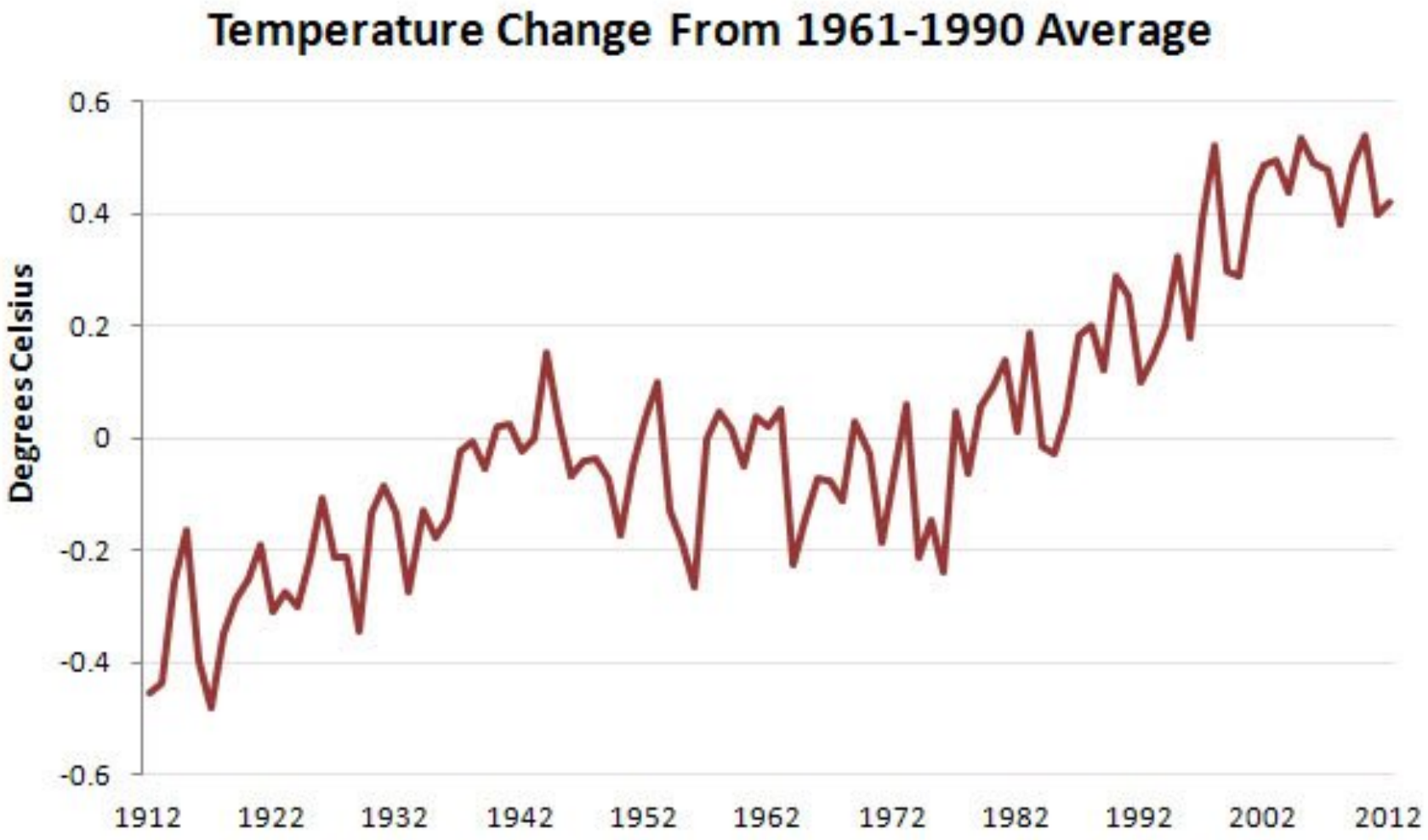
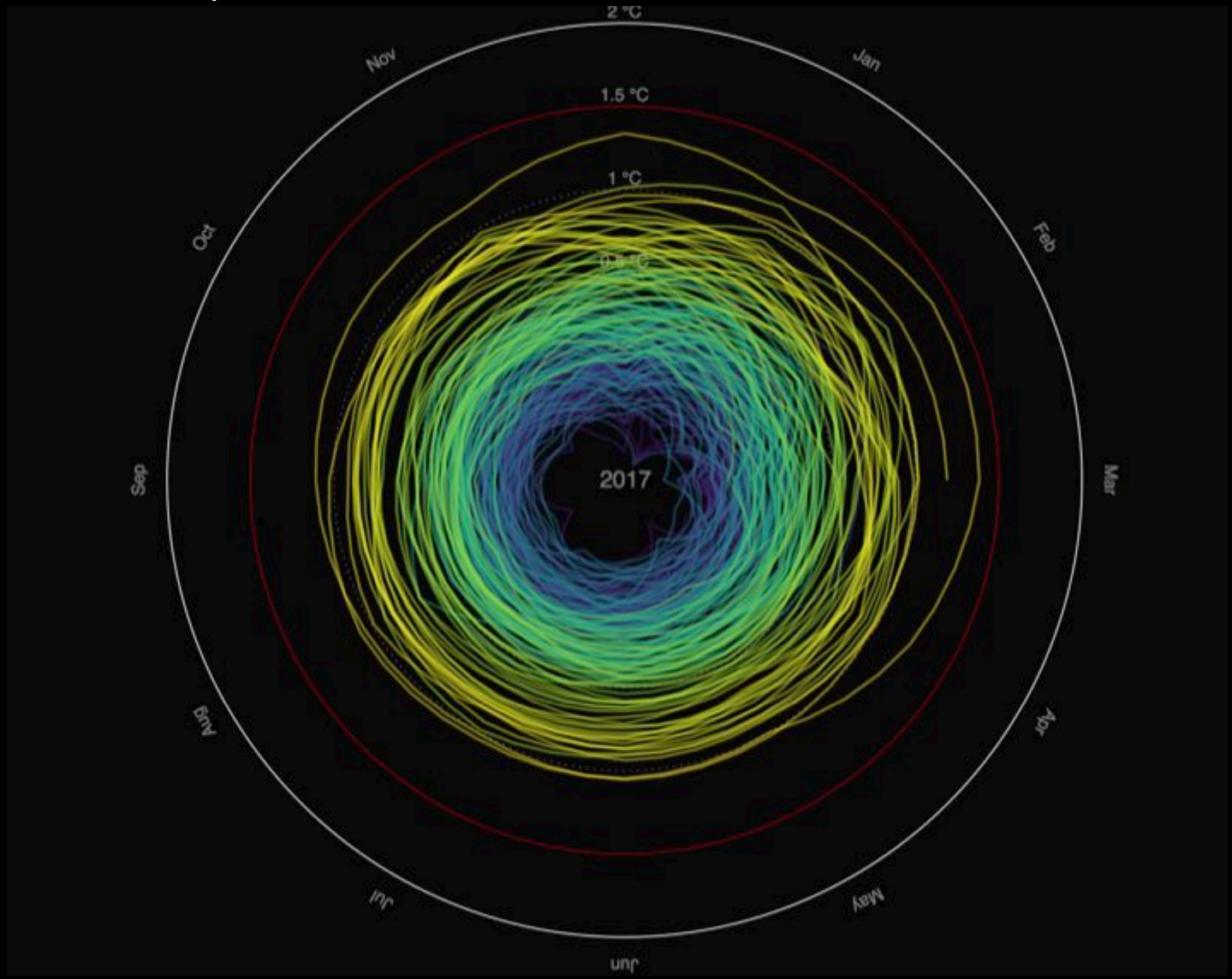
Lying With Statistics, Global Warming Edition



http://www.motherjones.com/kevin-drum/2012/10/lying-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
Animated version available on http://openclimatedata.net/climate-spirals/temperature

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

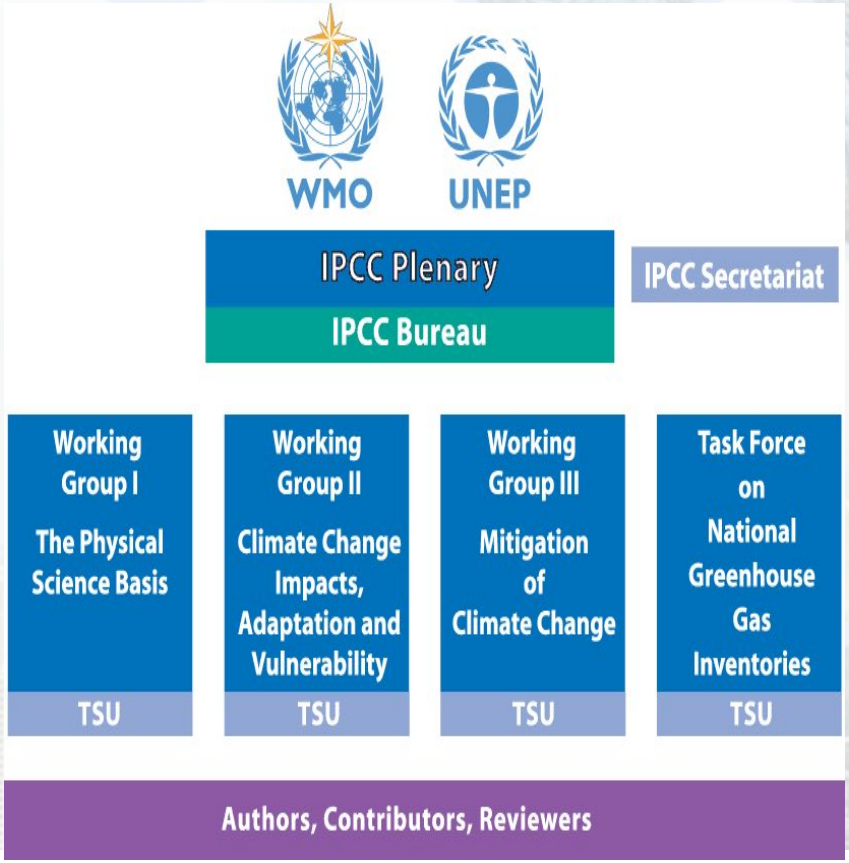
- To **assess** on a **comprehensive, objective, open and transparent** basis the scientific, technical and socio-economic information relevant to understanding the **scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation.**
- IPCC reports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

Source : http://www.ipcc.ch/organization/organization_procedures.shtml (last update 2013)

IPCC Reports are policy-relevant, NOT policy-prescriptive

Jean-Pascal van Ypersele
(vanypersele@astr.ucl.ac.be)

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!***

Jean-Pascal van Ypersele
(vanyp@climate.be)

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:

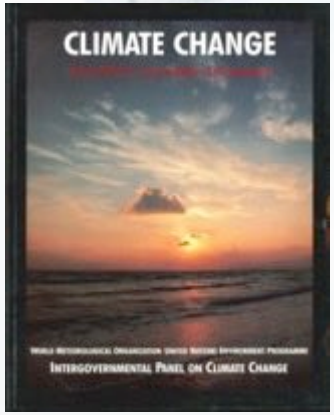
- By teams consisting of **Coordinating Lead Authors (CLA)**, **Lead Authors (LA), Contributing Authors (CA),** and **Review Editors (RE)**.
- **Coordinating Lead Authors** and **Lead Authors** have collective responsibility for the contents of a chapter.
- **Contributing Authors** assist the work of 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.

Jean-Pascal van Ypersele
(vanyp@climate.be)

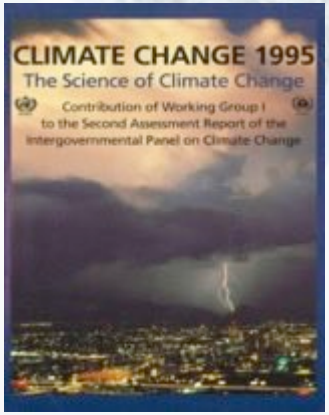
Appointment of the chapter teams:

- 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.

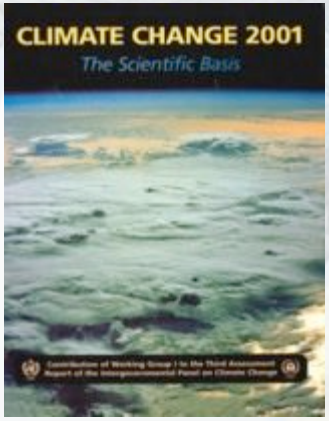
IPCC Assessment Reports



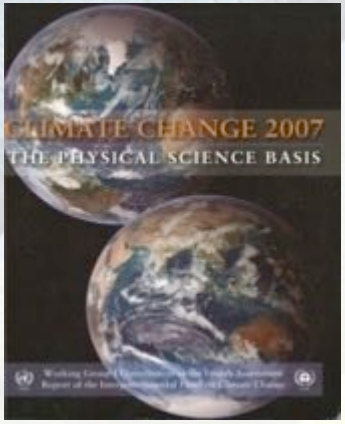
FAR 1990



SAR 1995



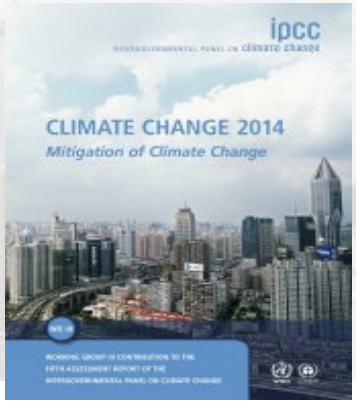
TAR 2001



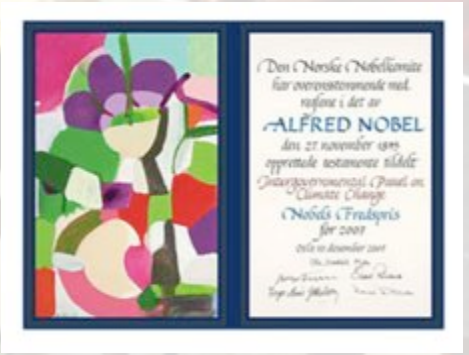
AR4 2007

AR5 WGI 2013

AR5 WGII 2014



AR5 WGIII 2014



IPCC AR5 Synthesis Report

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Completed IPCC Reports

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

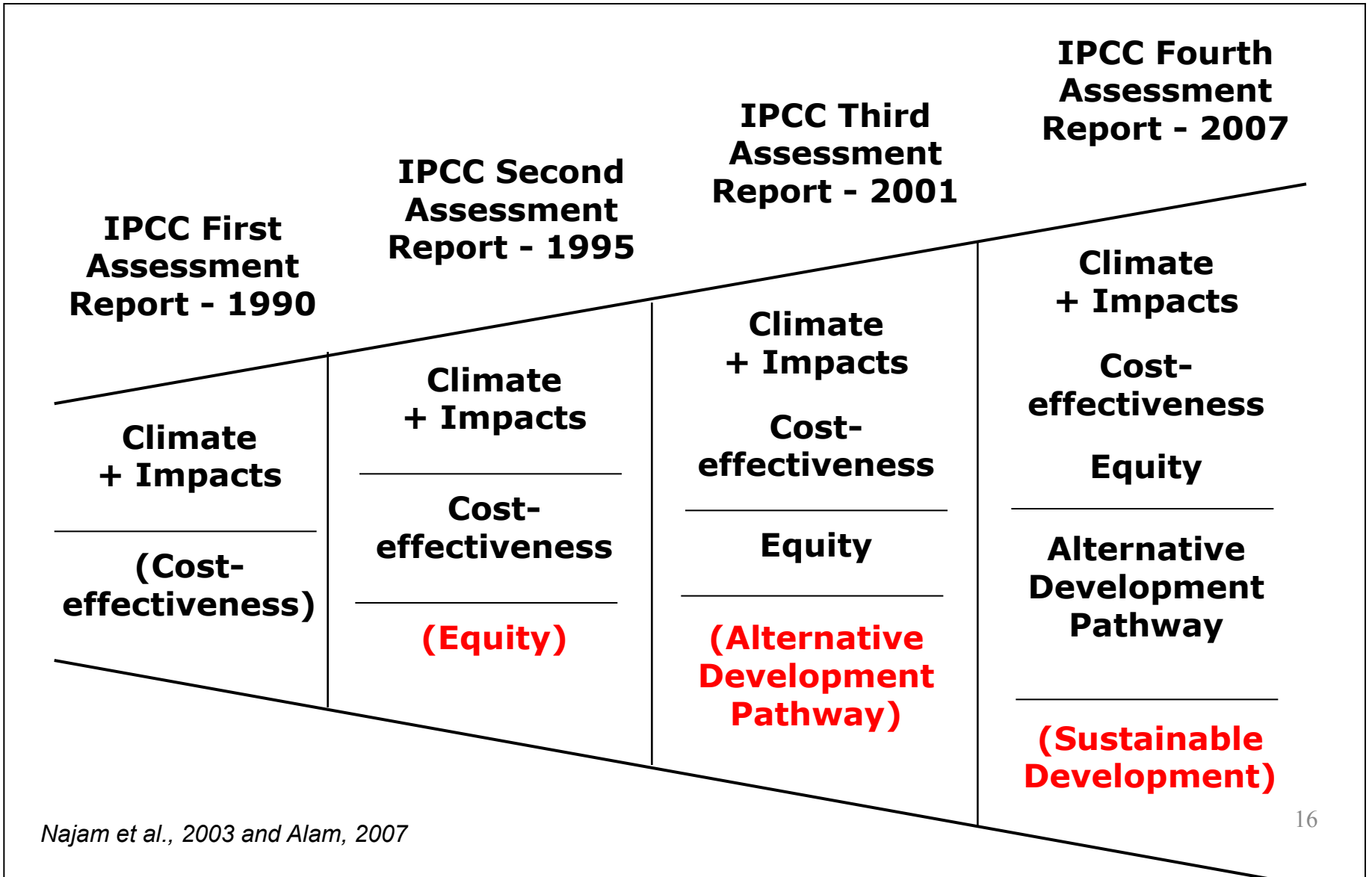
1992 Supplementary Report and *1994* Special Report

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

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

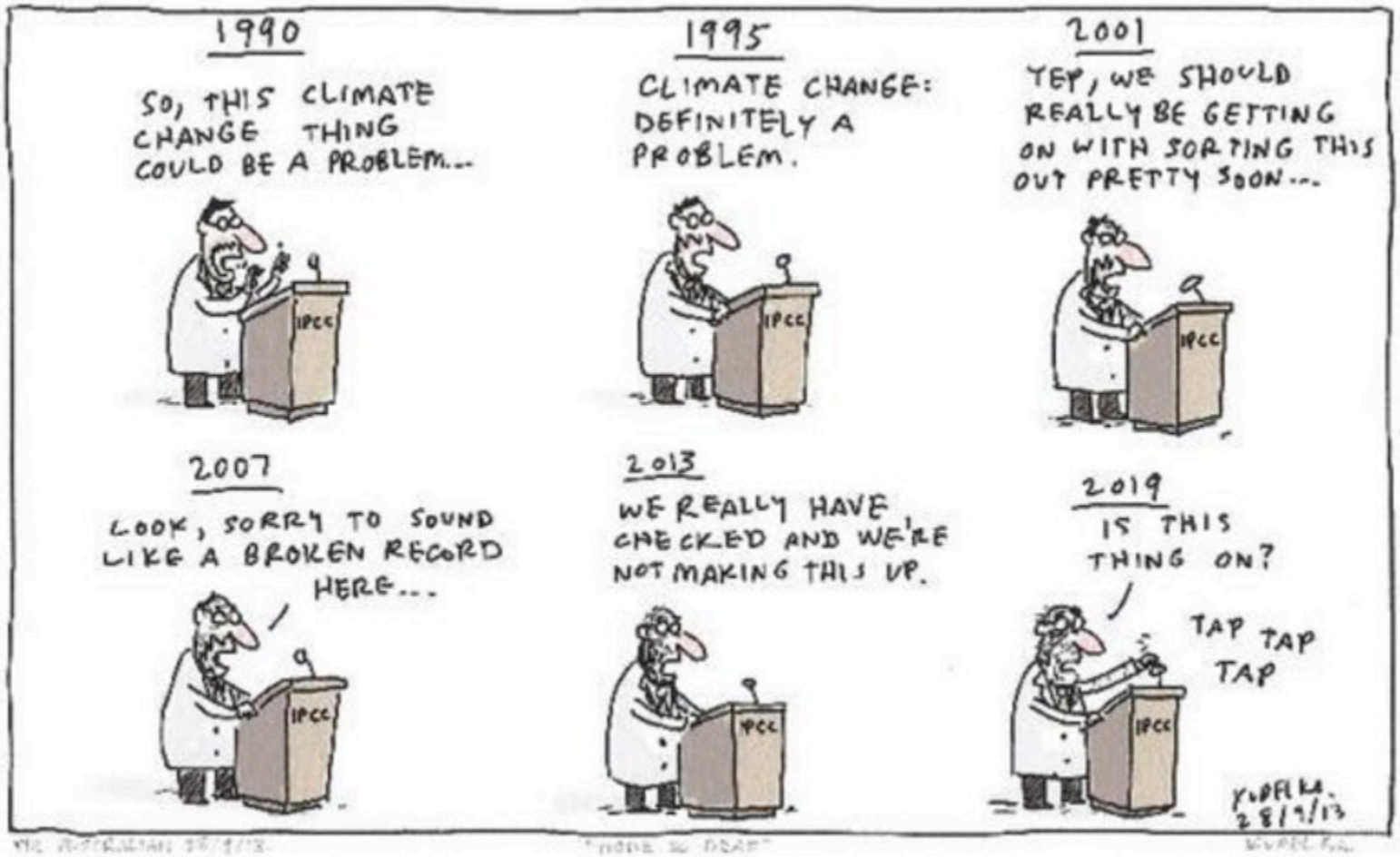
6 Technical Papers *(1996-2008)*

Background



Najam et al., 2003 and Alam, 2007

None So Deaf



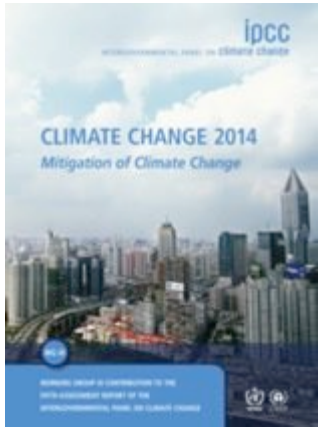
Auteur: @JohnKudelka

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) will inform the review of the 2°C objective, and be the context for preparing the Paris 2015 agreement

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

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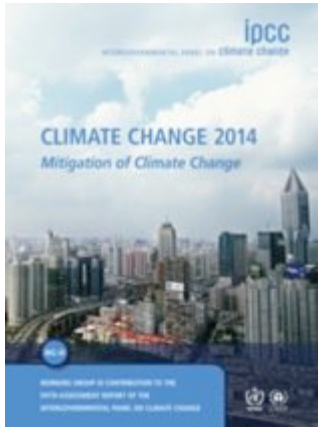

Que se passe-t-il dans le système climatique ?

Quels sont les risques ?

Que peut-on faire ?

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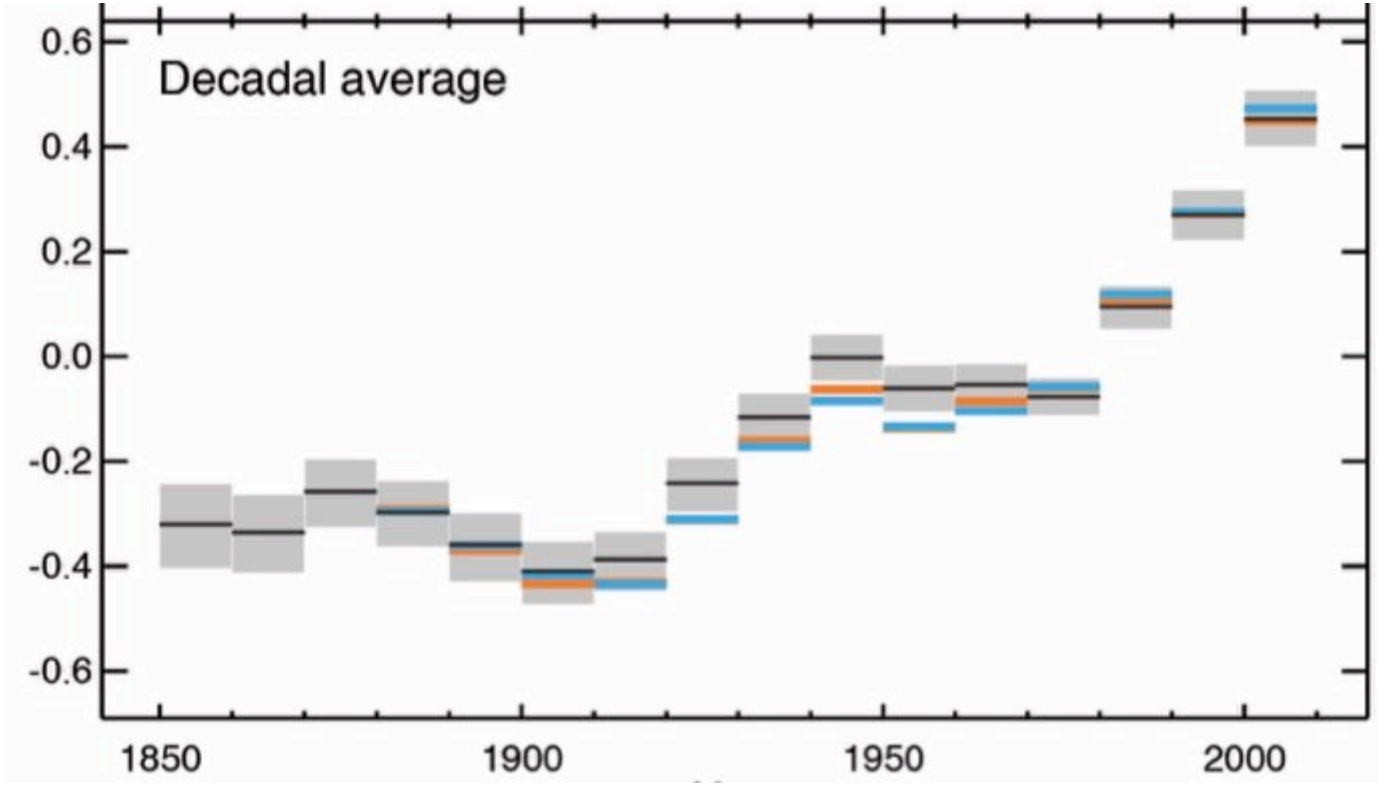
Messages clés

- **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

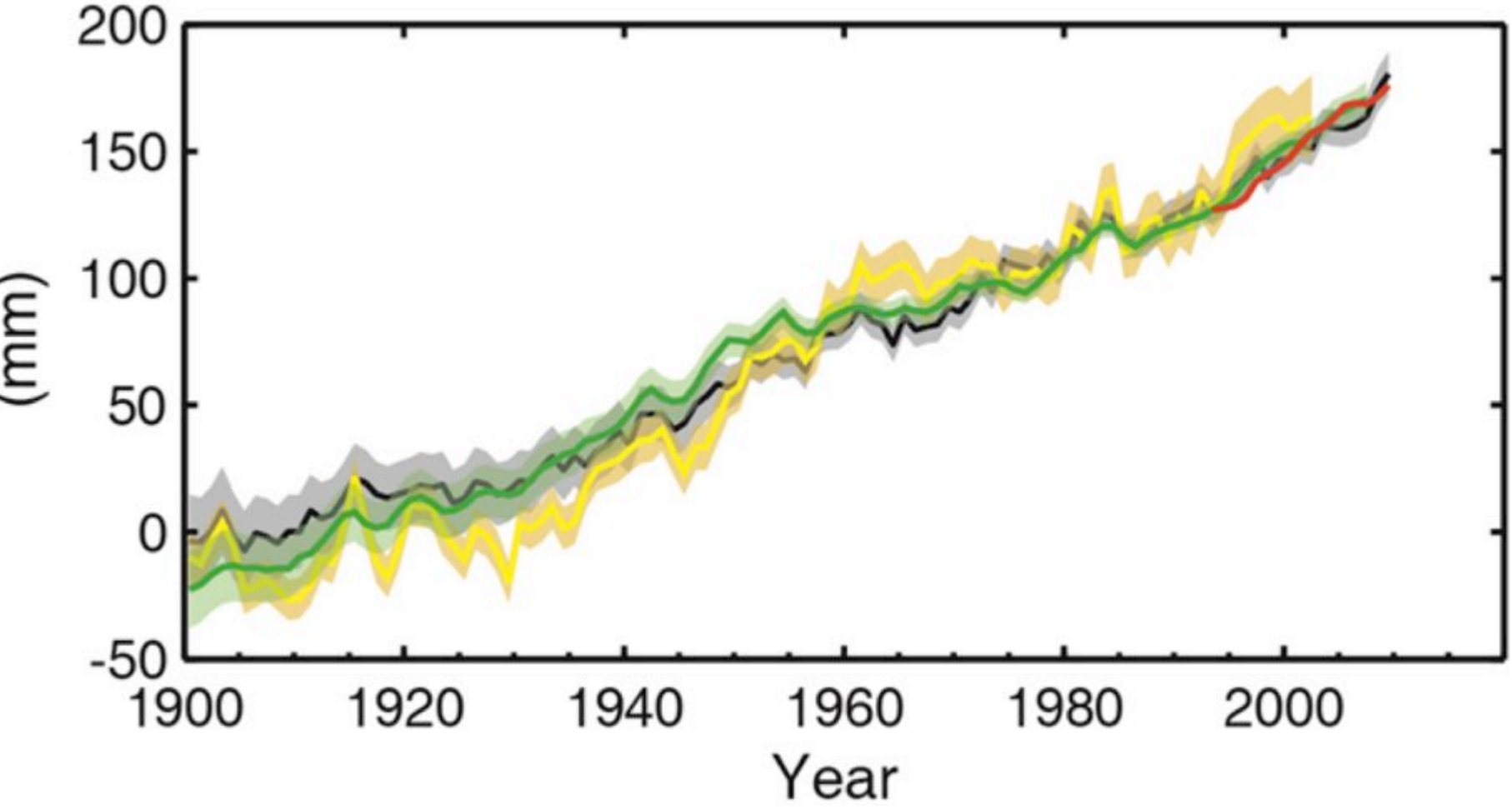
Plateau Glacier (1961)
(Alaska)

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)

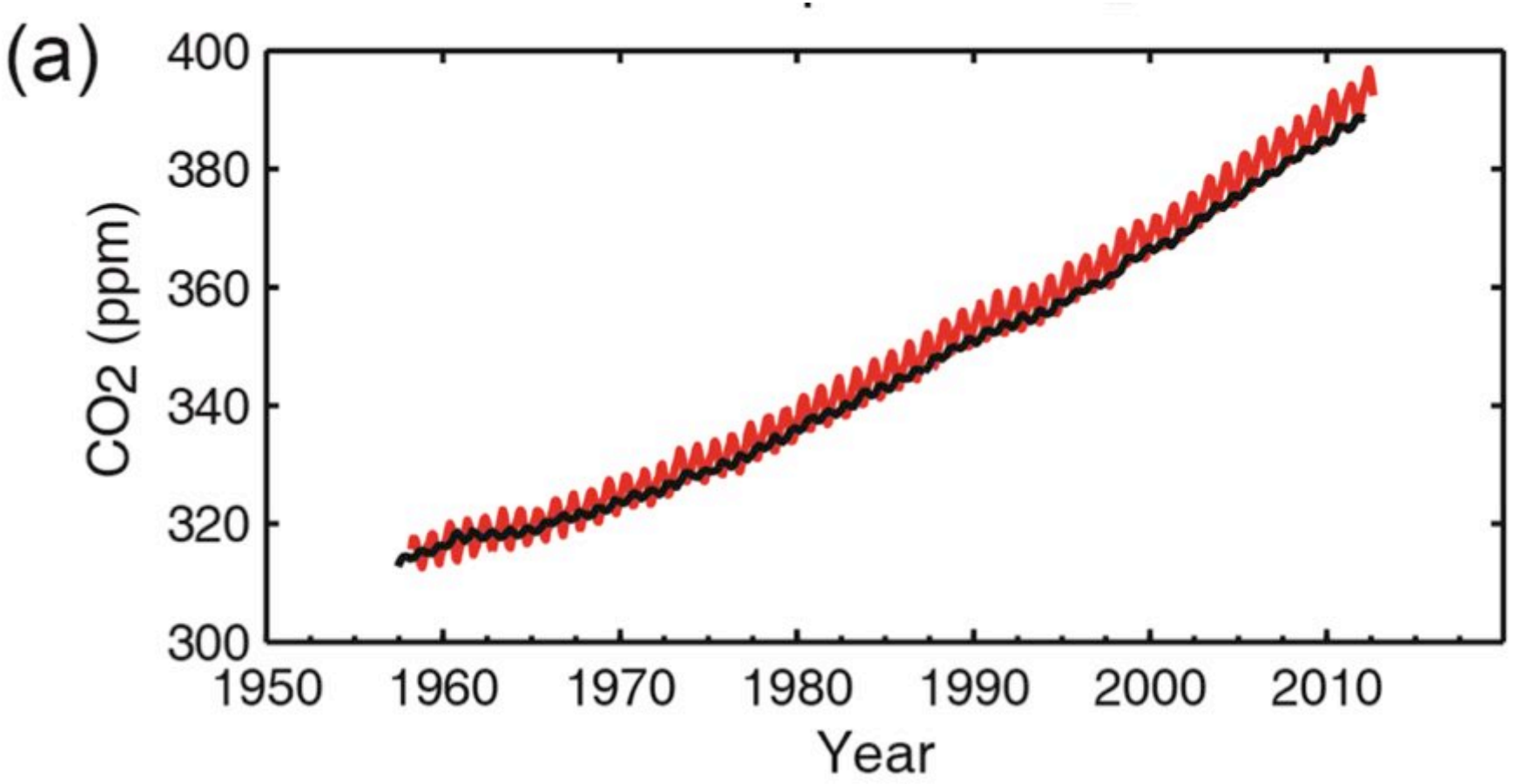
http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Evolution du niveau moyen des mers



AR5 WGI SPM - Approved version / subject to final copyedit

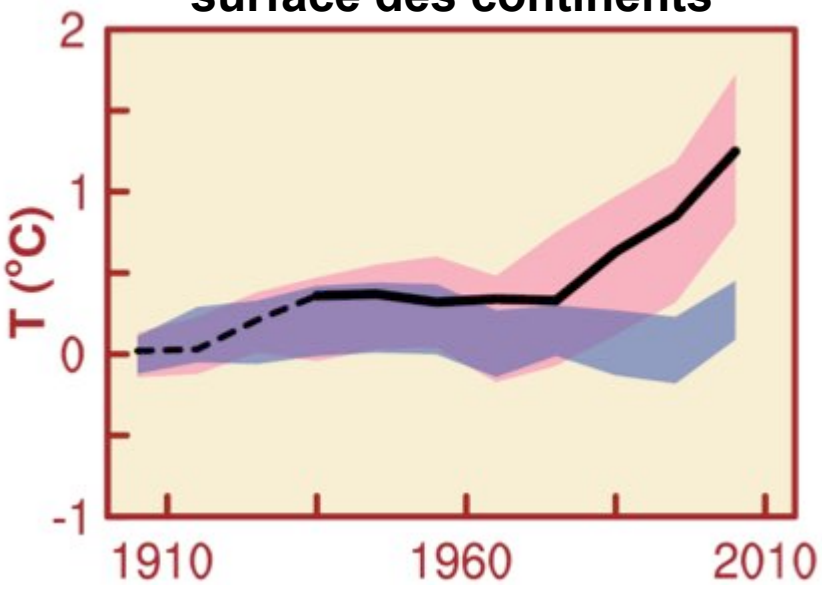
Concentration atmosphérique en CO_2



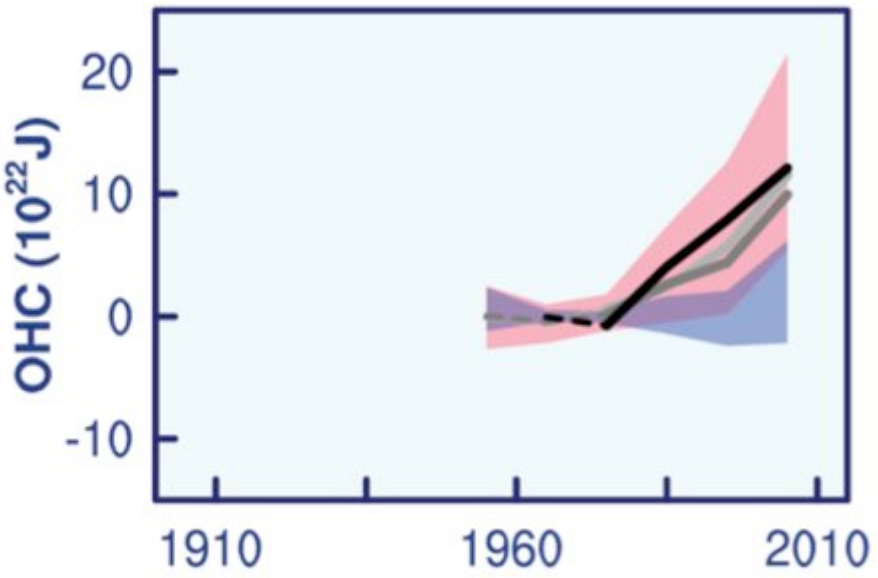
(Lüthi et al.,2008, NOAA)

Les concentrations atmosphériques en dioxyde de carbone (CO_2) ont augmenté jusqu'à des niveaux sans précédent au cours des 800 000 dernières années

Température moyenne surface des continents



Contenu thermique des océans



(IPCC 2013, Fig. SPM.6)

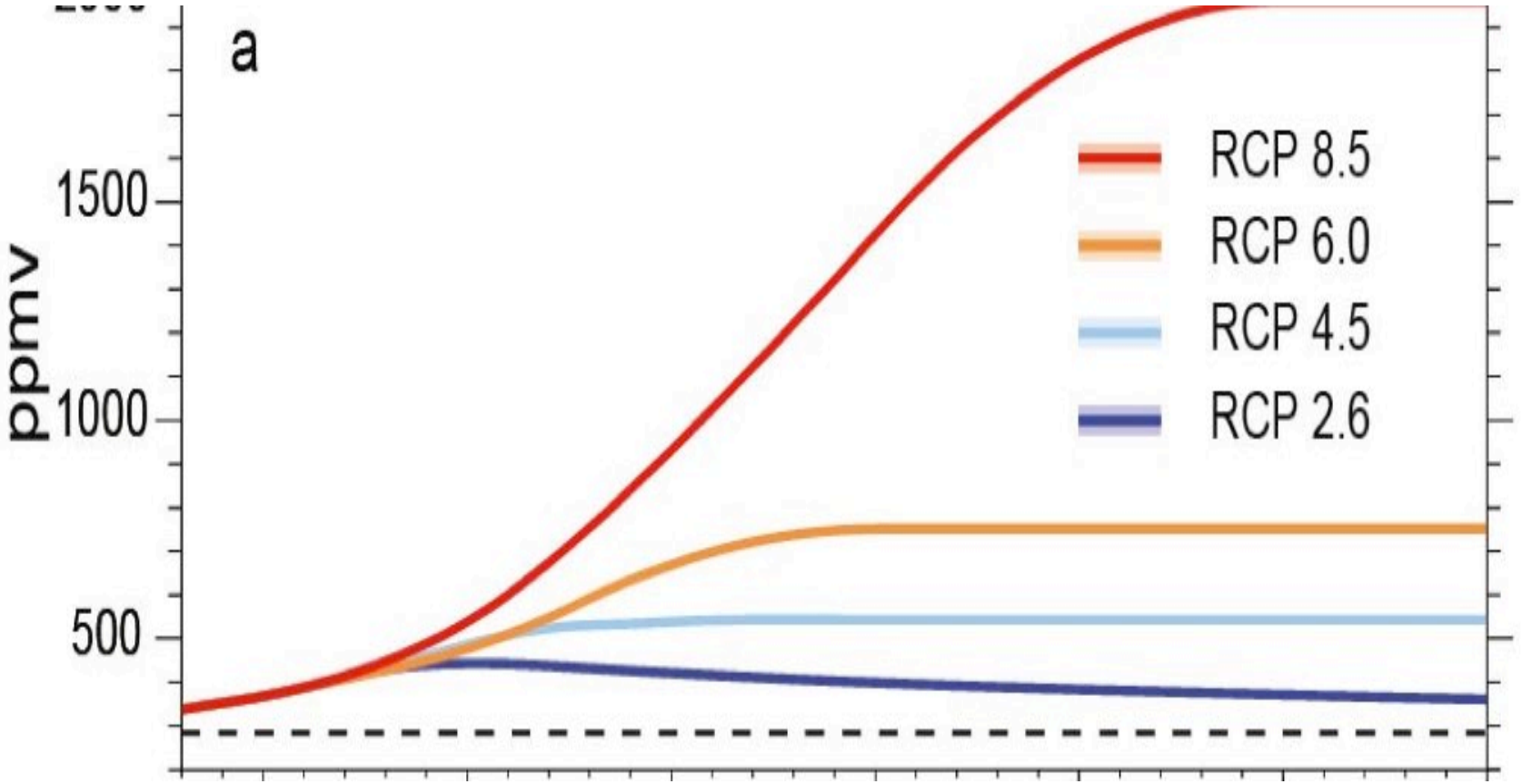
Noir: observations

Bleu: simulations avec seuls facteurs naturels

Rose: simulations avec facteurs naturels & humains

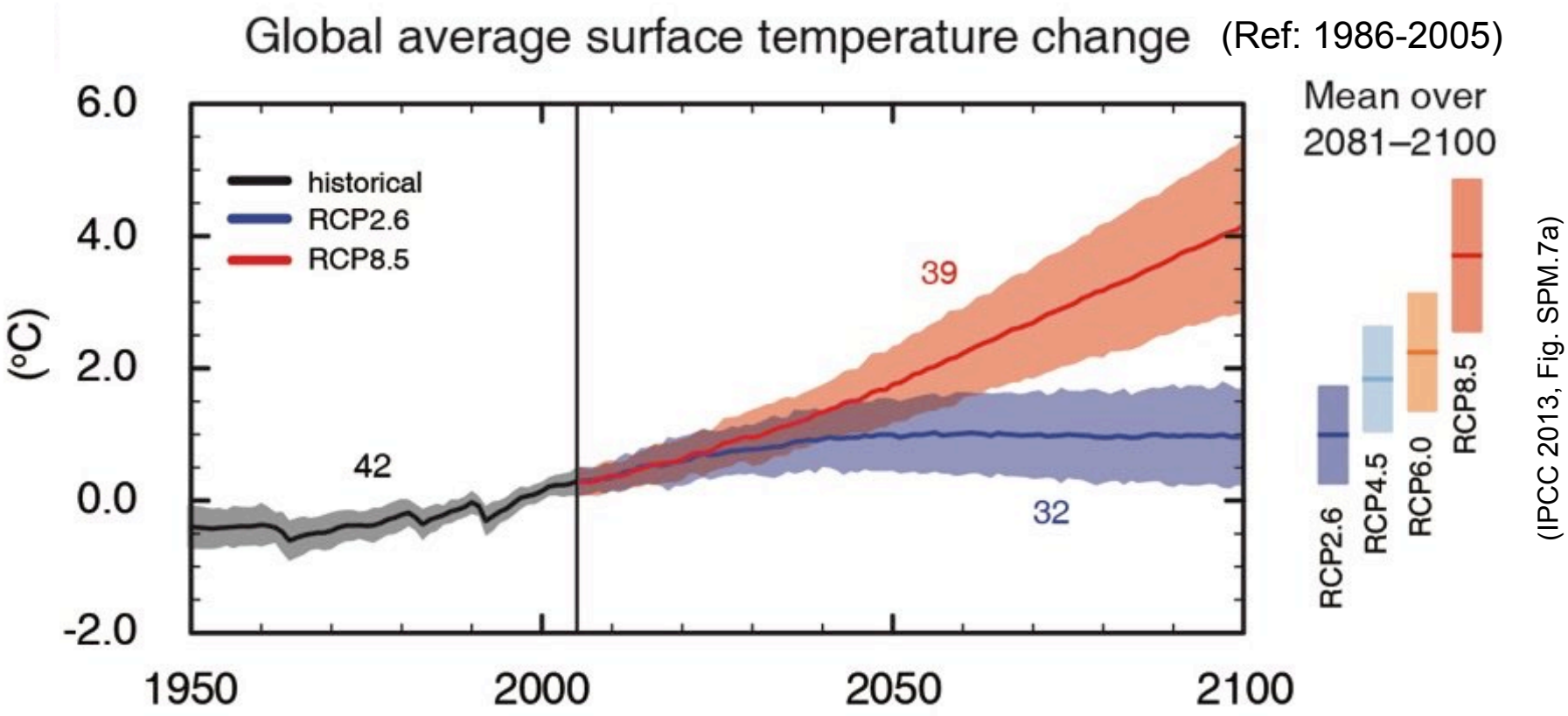
L'influence humaine sur le système climatique est sans équivoque; Il est *extrêmement probable* (95%) que l'influence humaine a été la cause principale du réchauffement depuis le milieu du 20ème siècle

RCP Scenarios: Atmospheric CO_2 concentration



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

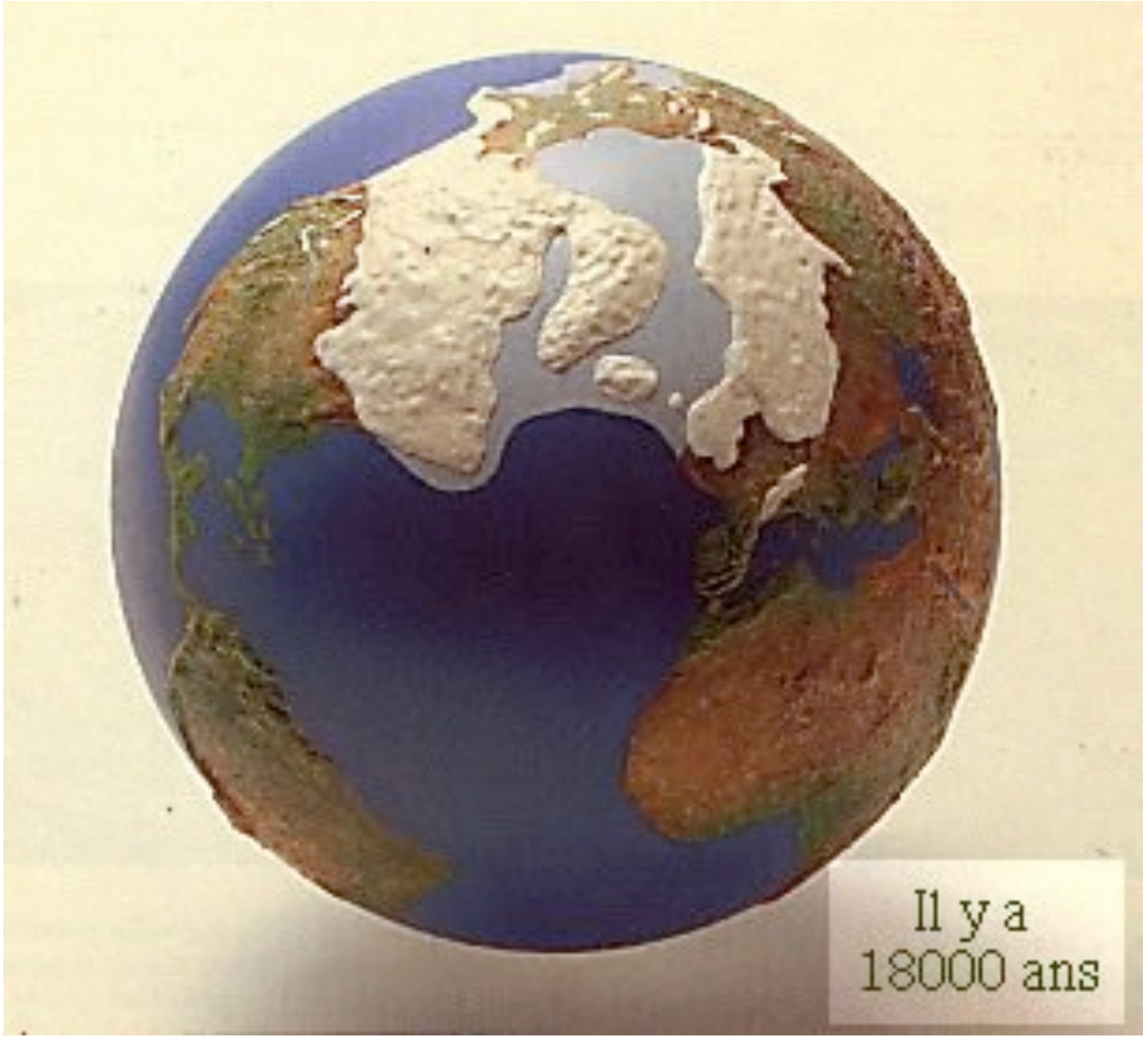
AR5, chapter 12. WGI- Adopted version / subject to final copyedit



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%.

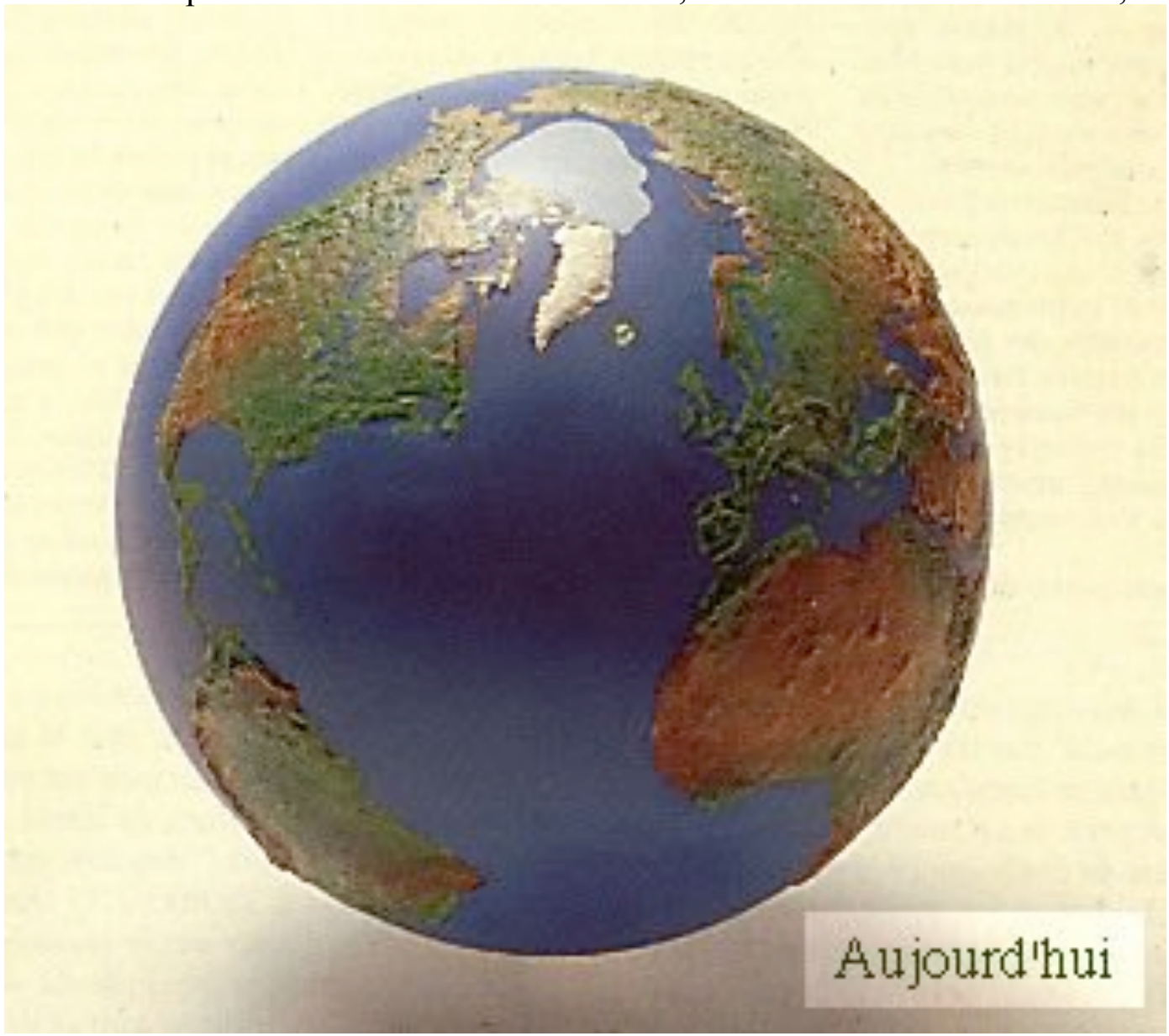
18-20000 years ago (Last Glacial Maximum)

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.

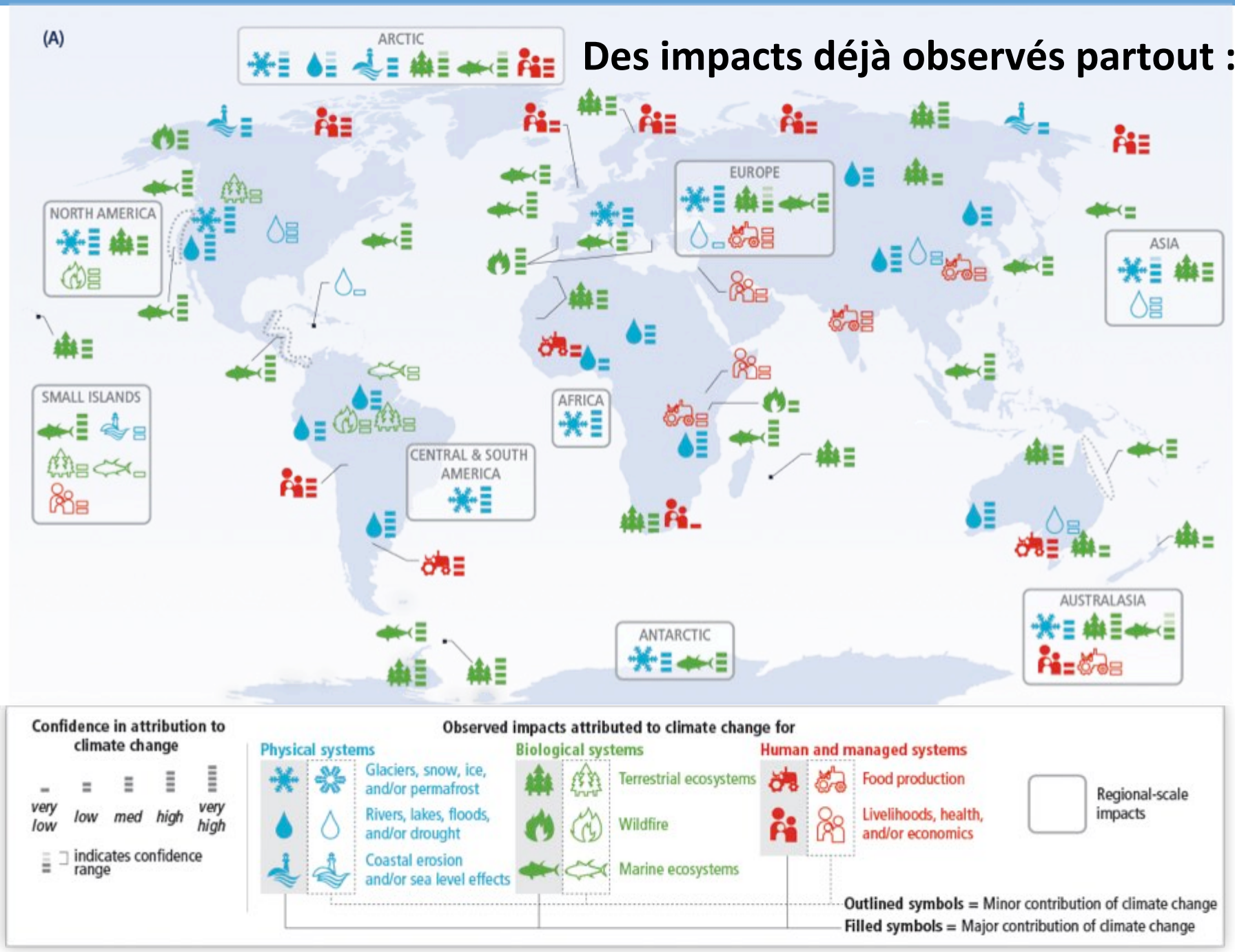


Quels sont les risques ?

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

AP Photo - Lisa Krantz (http://lisakrantz.com/hurricane-katrina/zspbn1k4cn17phidupe4f9x5t1mzdr)

Des impacts déjà observés partout :



Impacts Potentiels des Changements Climatiques

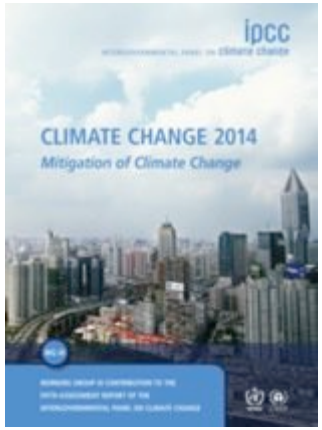
Pénurie de nourriture et d'eau

Migrations humaines accrues

Pauvreté accrue

Inondations régions côtières

AR5 WGII SPM



Que peut-on faire ?

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WMO UNEP

DE L'ADAPTATION

SE MET DEJA EN PLACE

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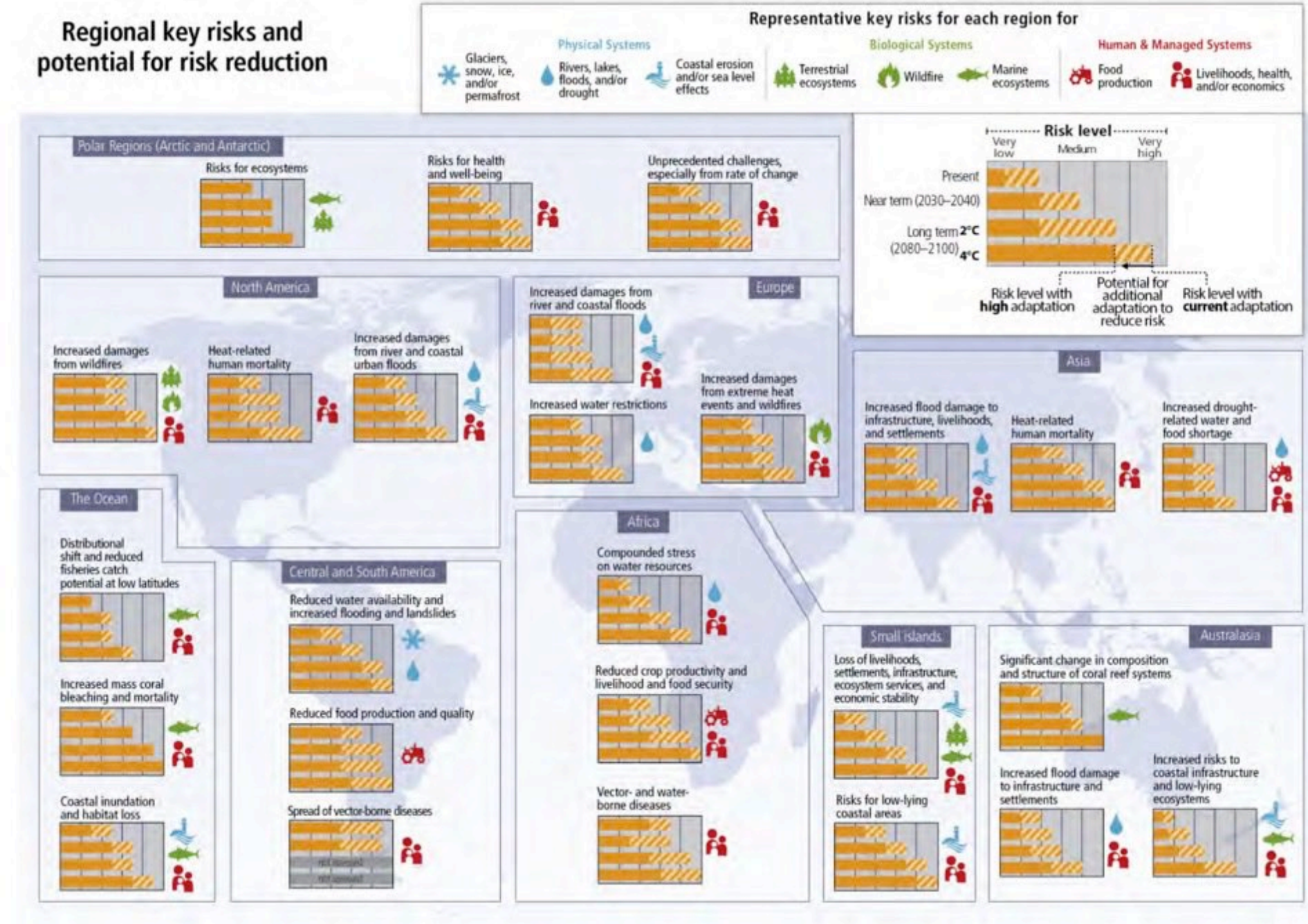
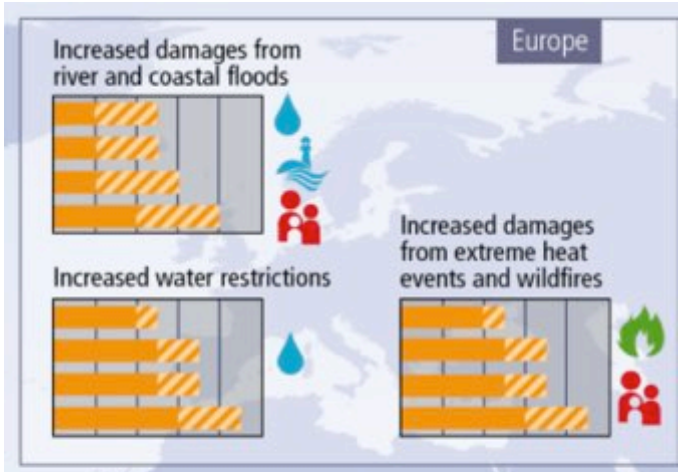
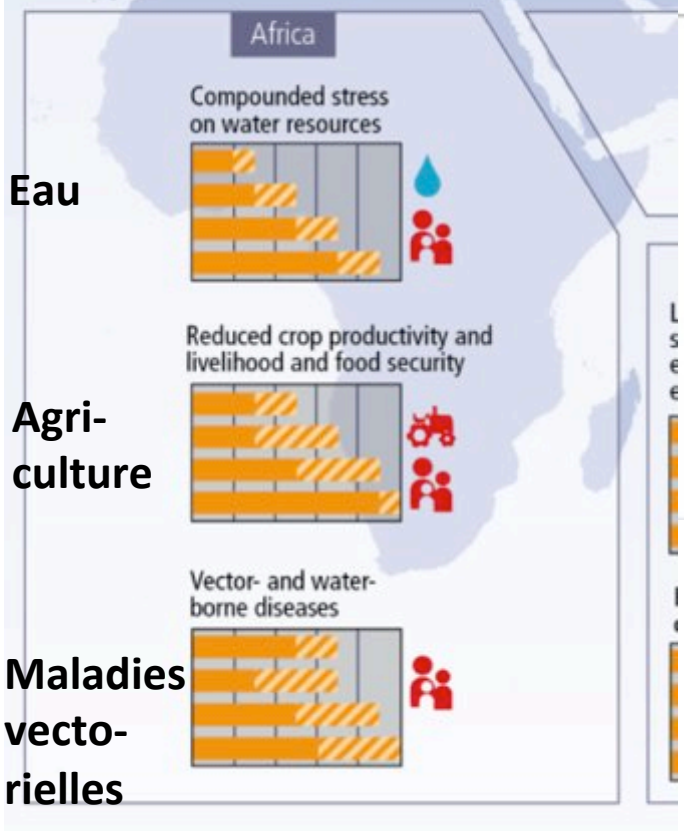


IPCC, AR5, SPM, Figure SPM.8

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

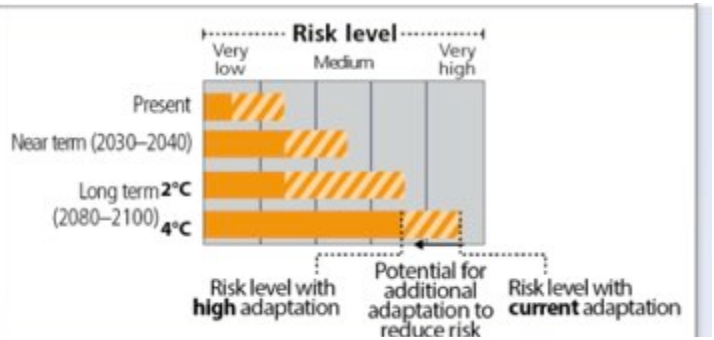


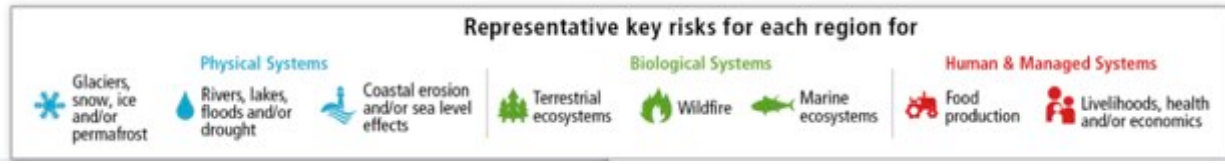


Eau

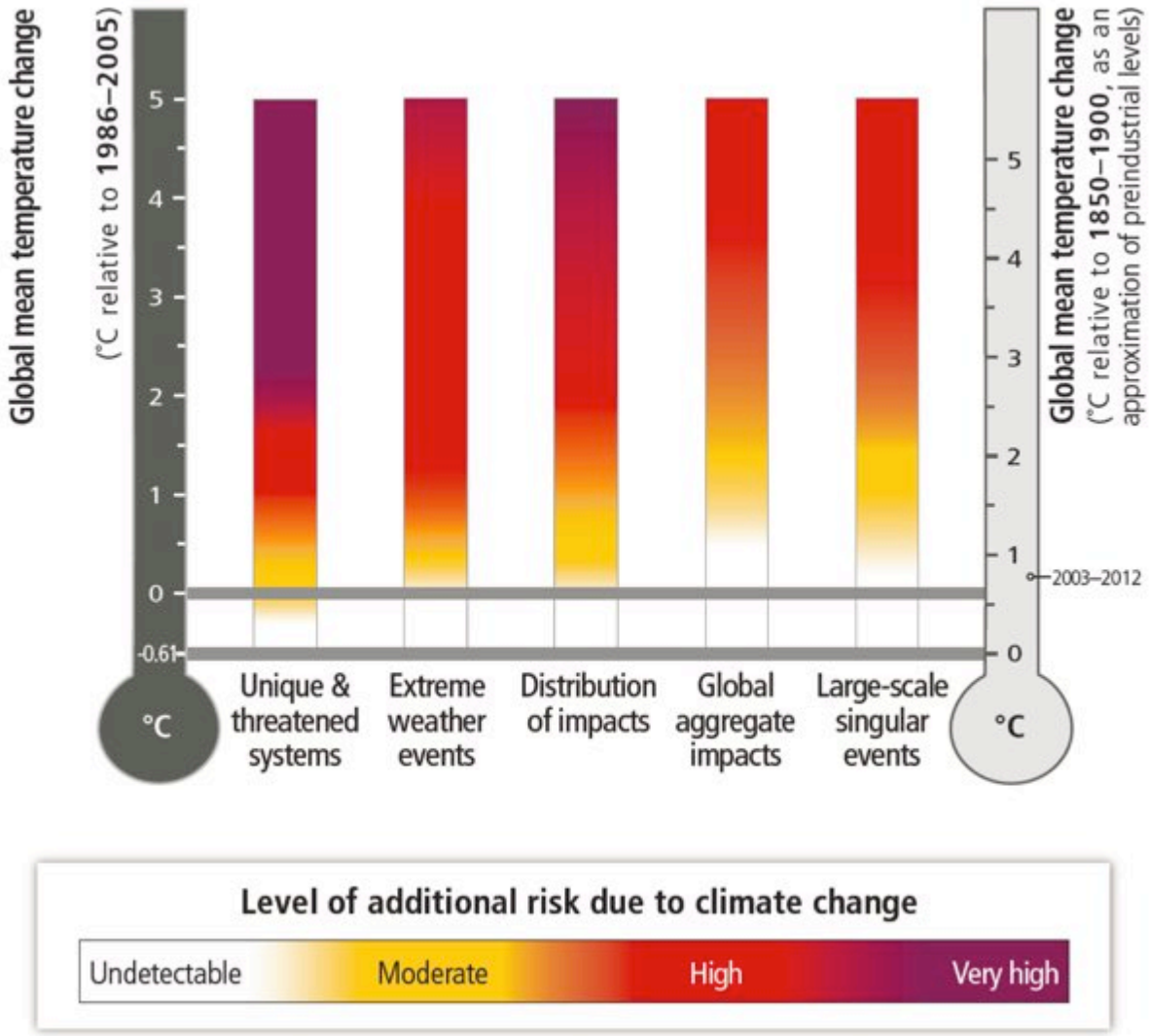
Agri-culture

Maladies vecto-rielles

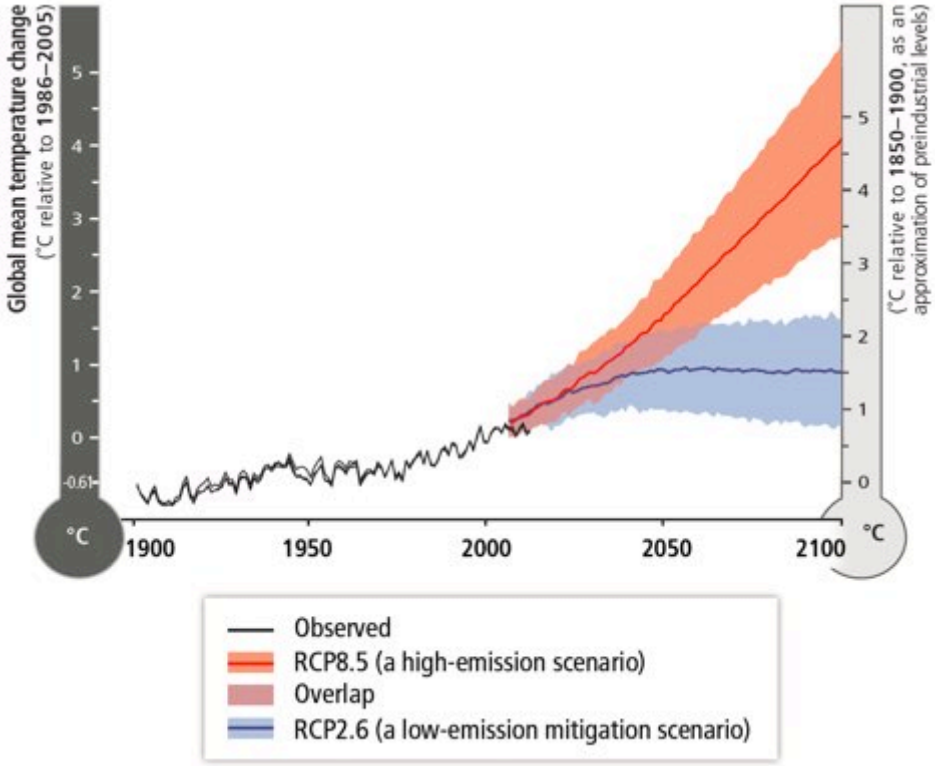


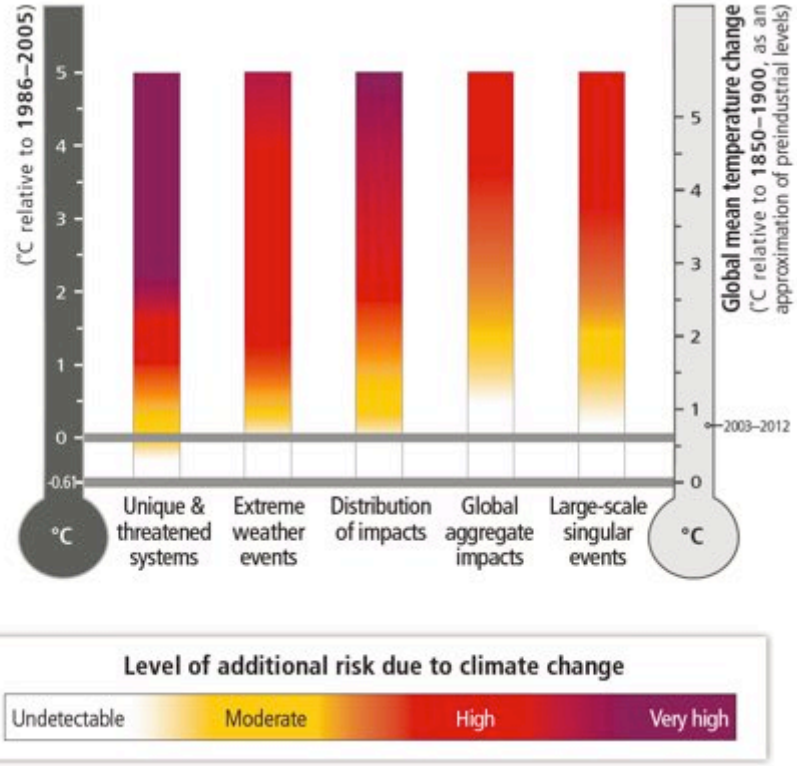


IPCC, AR5, SYR, SPM.8

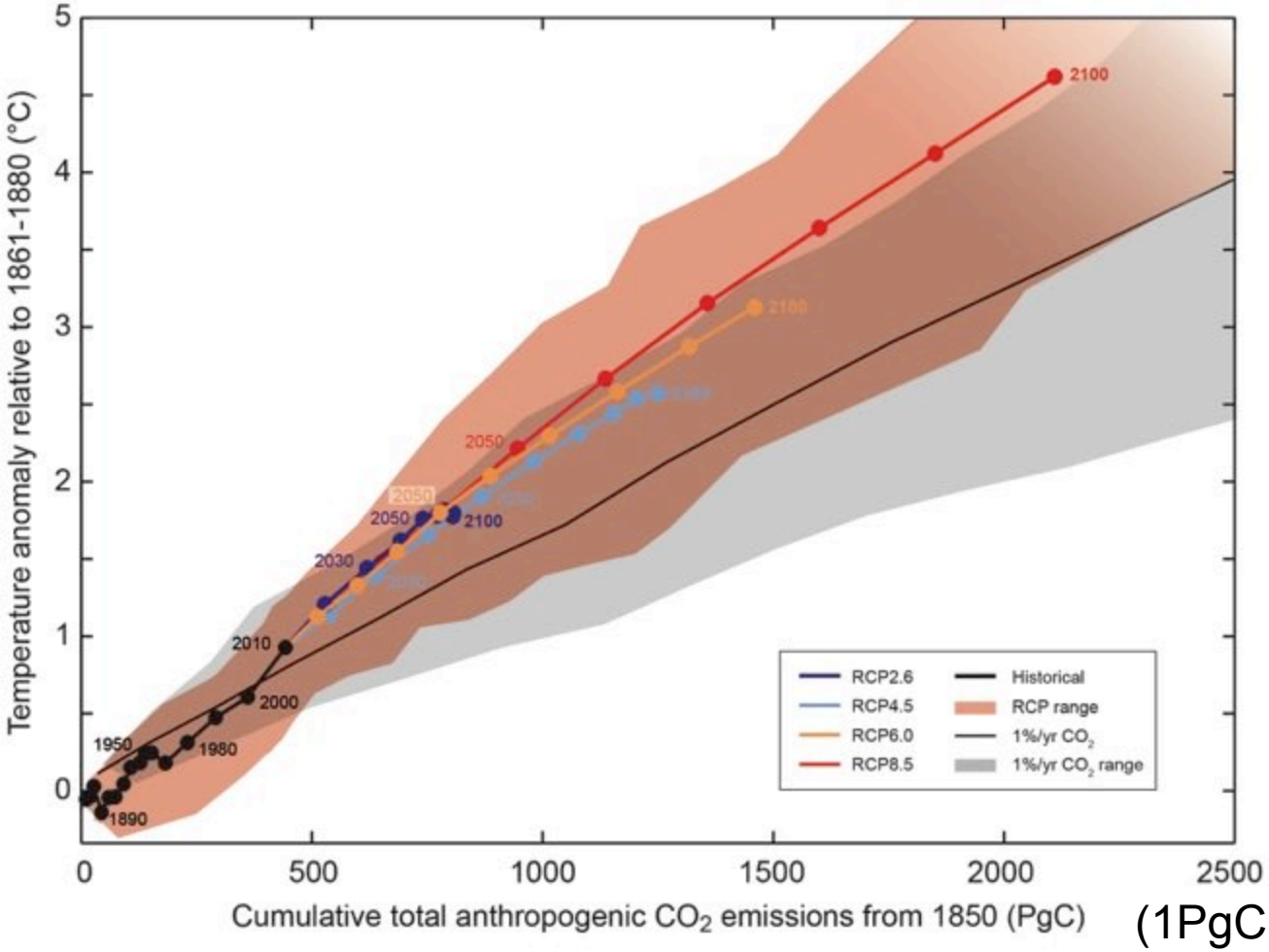


AR5, WGII, Box SPM.1 Figure 1





ipcc
INTERGOVERNMENTAL PANEL ON climate change



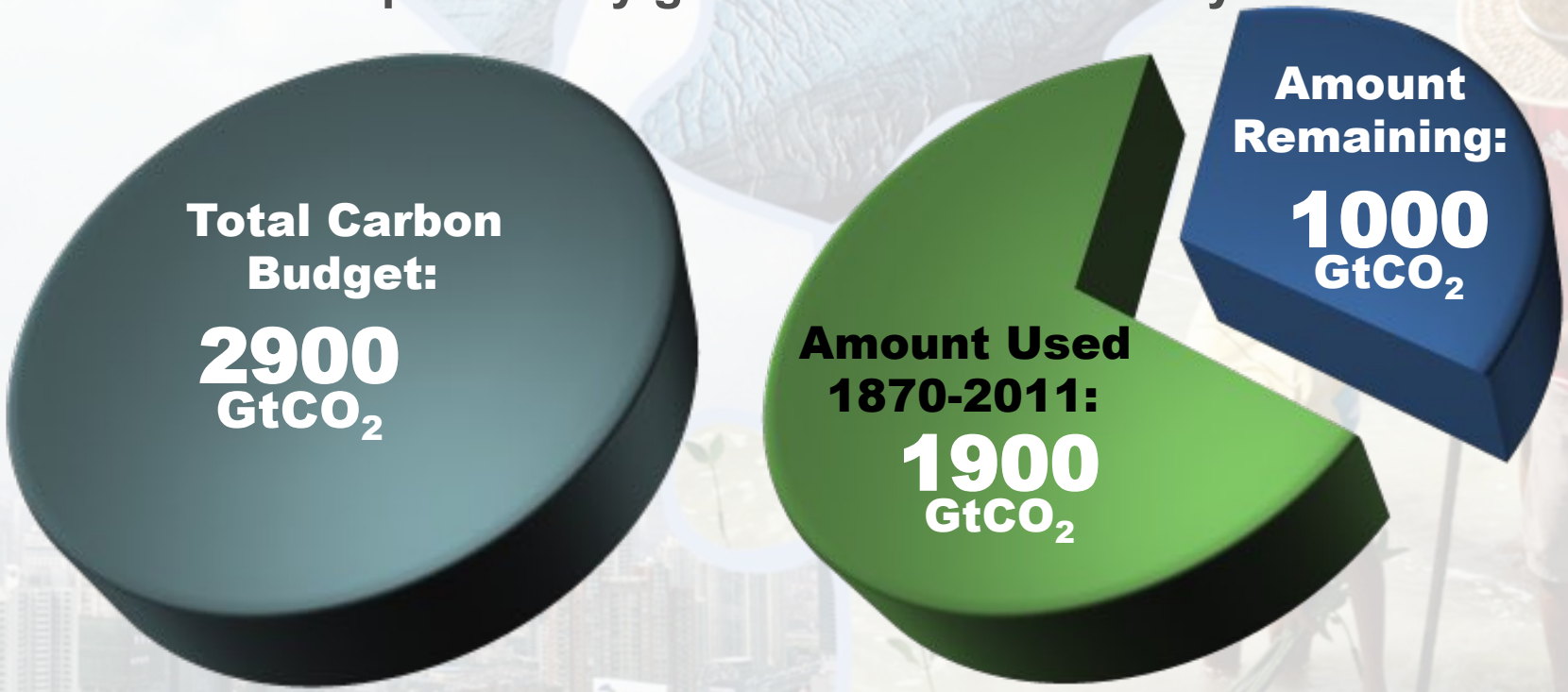
(IPCC 2013, Fig. SPM.10)

(1PgC = 1GtC)

Le total des émissions de CO_2 cumulées détermine dans une large mesure la moyenne globale du réchauffement en surface vers la fin du XXIème siècle et au delà

The window for action is rapidly closing

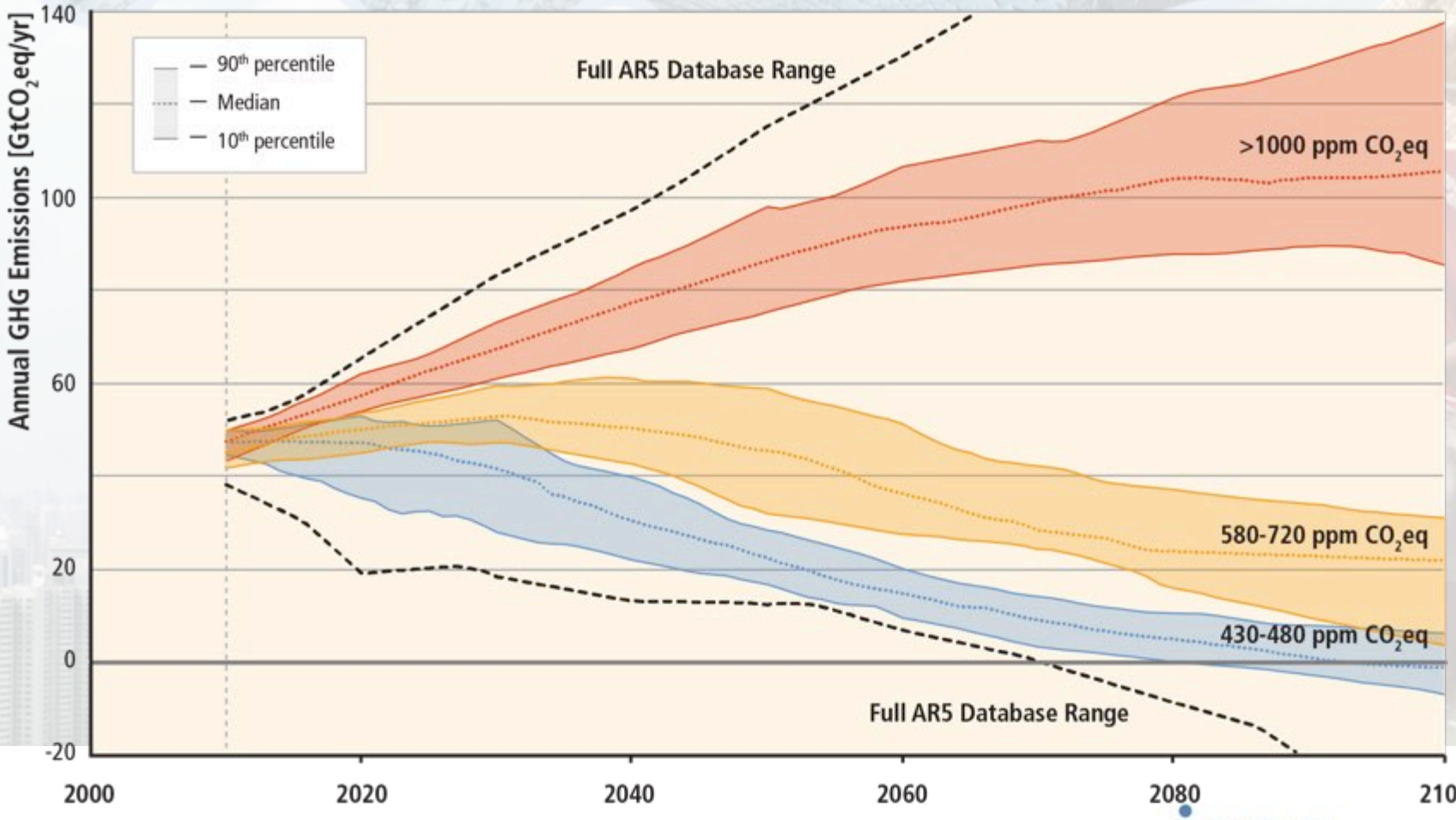
65% of the carbon budget compatible with a 2°C goal is already used
NB: this is with a probability greater than 66% to stay below 2°C



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

AR5 WGIII SPM

IPCC AR5 Synthesis Report

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WMO UNEP

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 atmospherique à moins de 450 ppm CO_2-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 ?

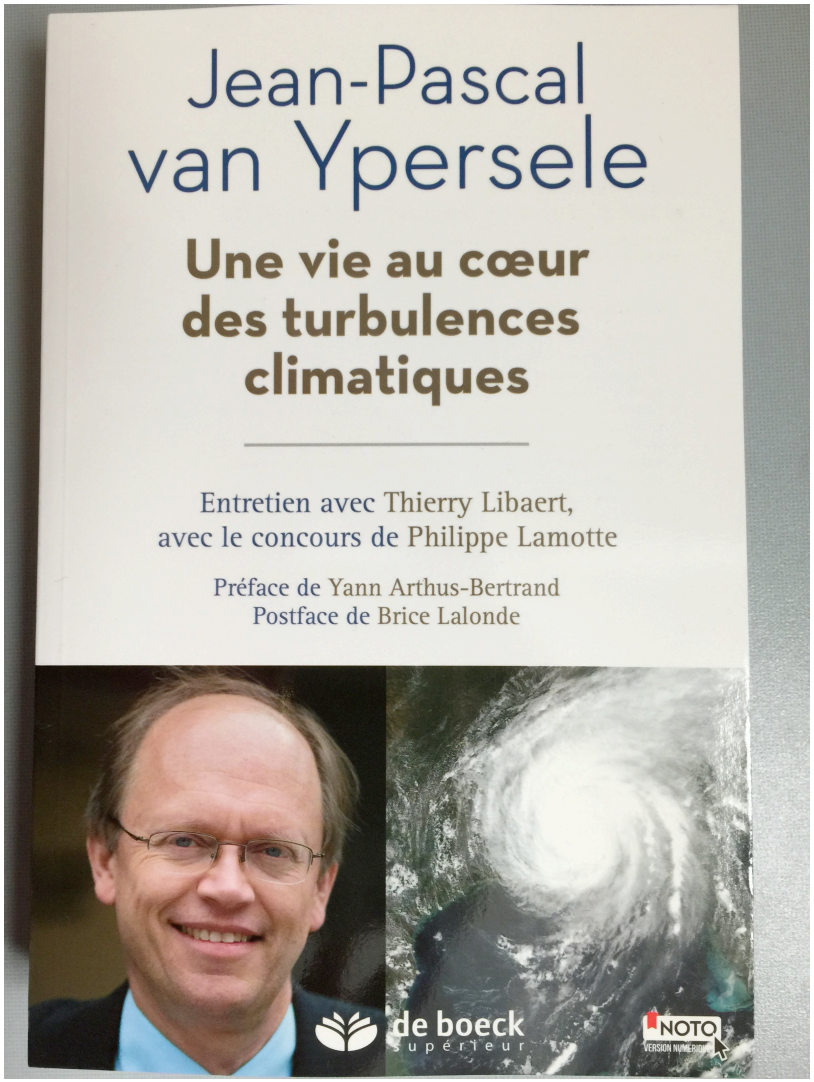
- **Ces scénarios sont caractérisés par une amélioration rapide de l'efficacité énergétique et un quasi-quadruplement de la part des sources d'énergie bas-carbone (renouvelables, nucléaire, capture et stockage du carbone provenant de combustibles fossiles ou de bio-énergie), pour que cette part atteigne 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.**

Publié chez De Boeck supérieur, octobre 2015



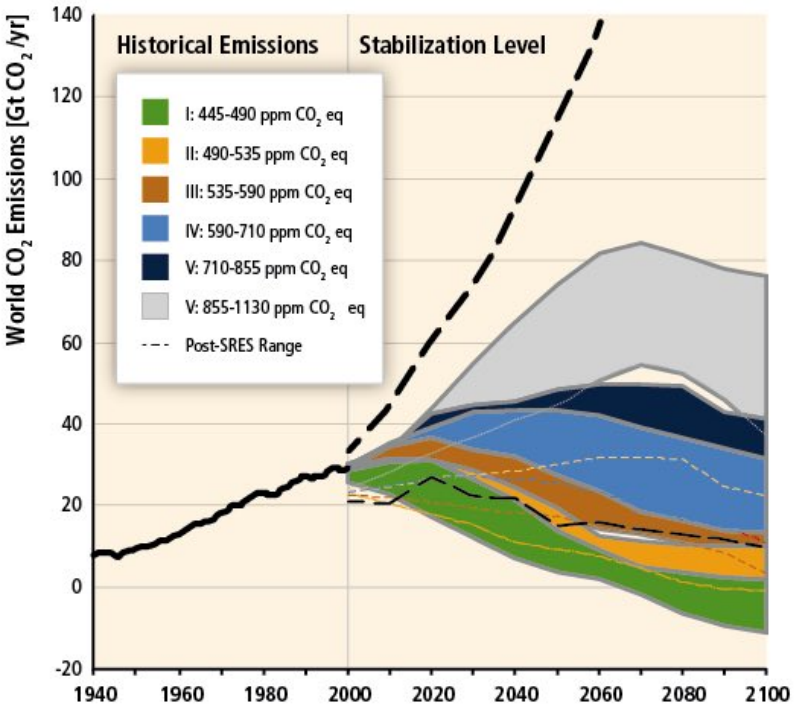
Useful links:

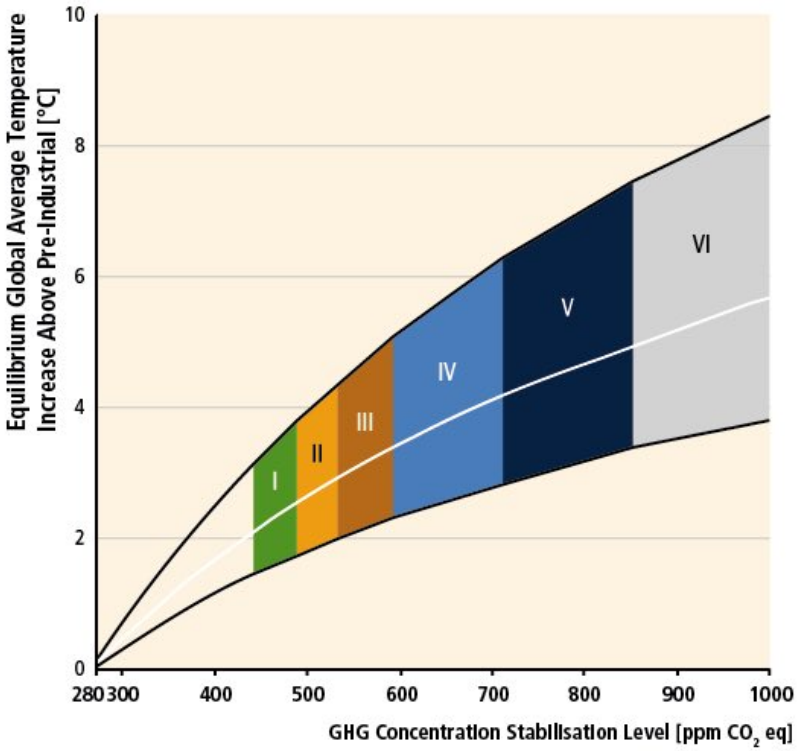
- www.ipcc.ch : IPCC (reports and videos)
- www.climate.be/vanyp : my slides and other documents
- www.skepticalscience.com: excellent responses to contrarians arguments
- www.plateforme-wallonne-giec.be (informations climatiques liées au GIEC)
- **On Twitter: @JPvanYpersele and @IPCC_CH**

The IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation (2011)

WMO UNEP

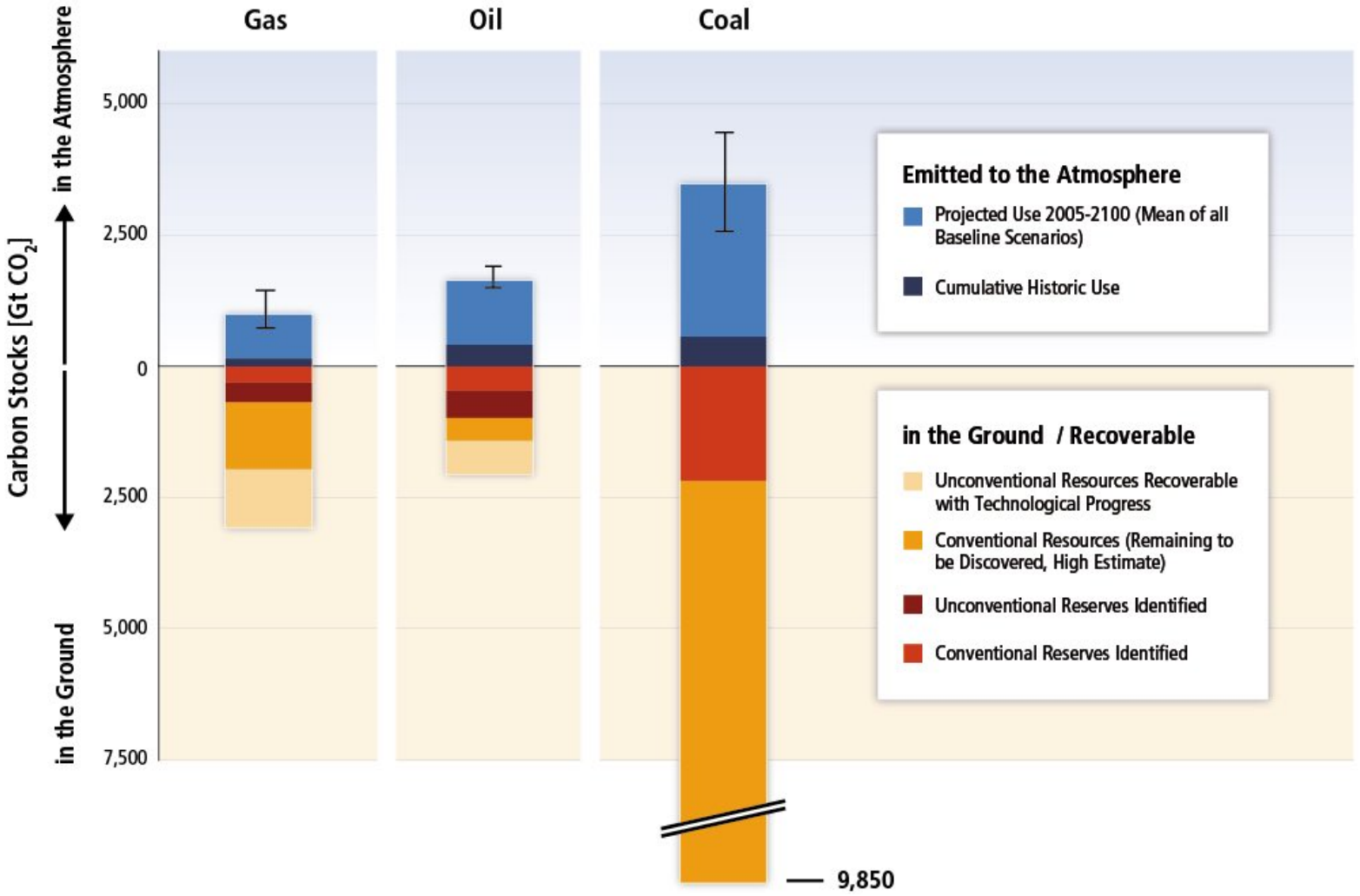
Demand for energy services is increasing.



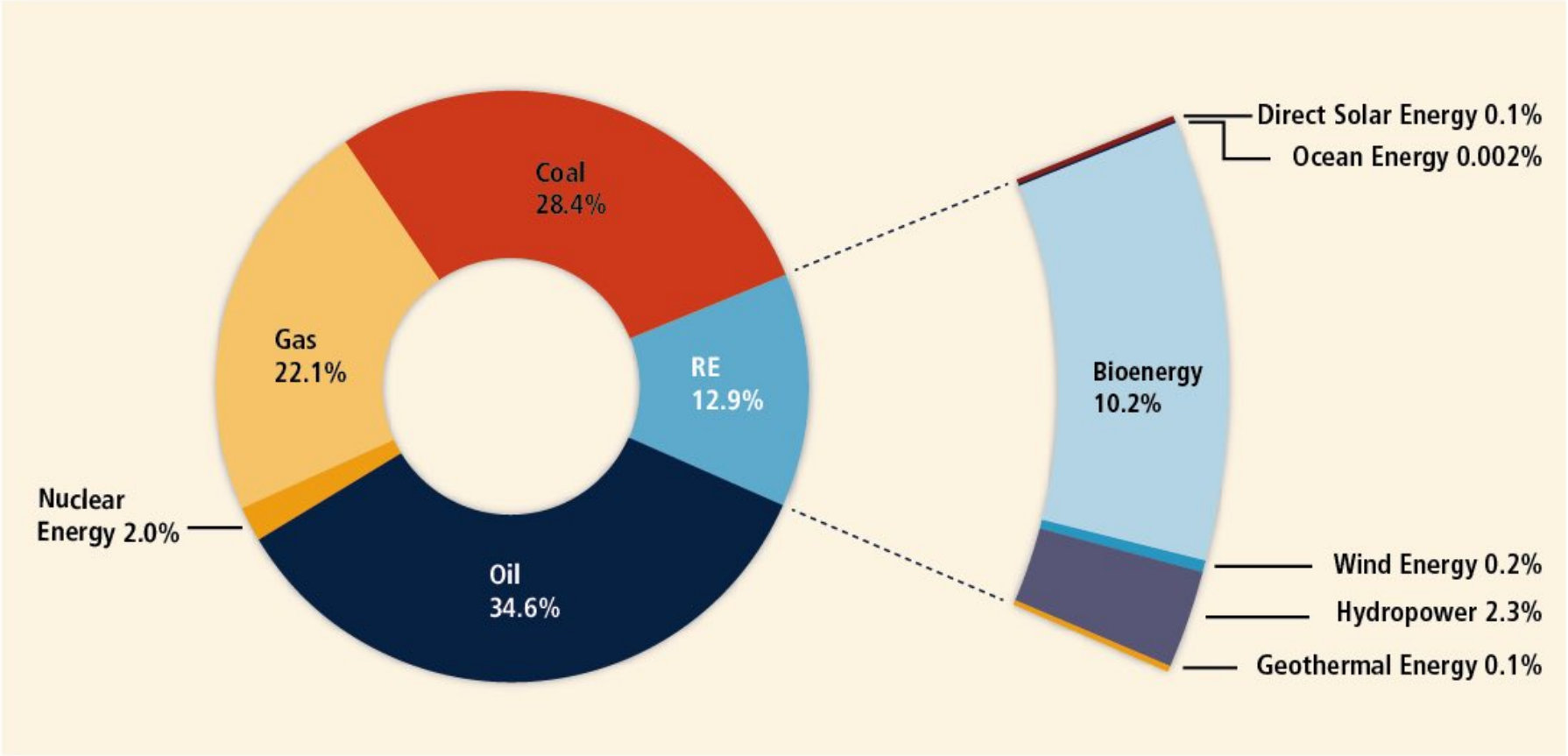


GHG emissions resulting from the provision of energy services contribute significantly to the increase in atmospheric GHG concentrations.

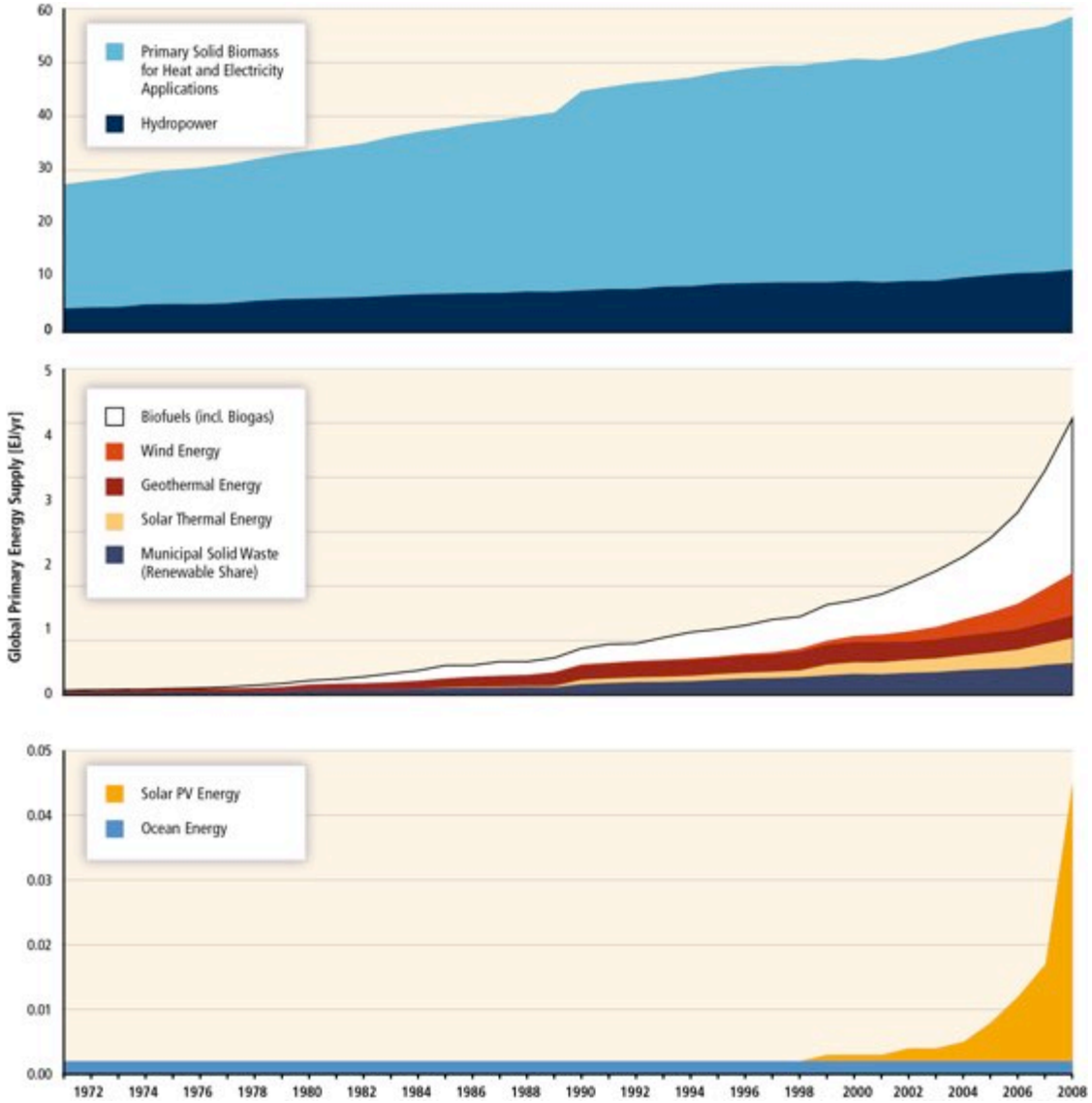
Potential emissions from remaining fossil resources could result in GHG concentration levels far above 600ppm.



The current global energy system is dominated by fossil fuels.



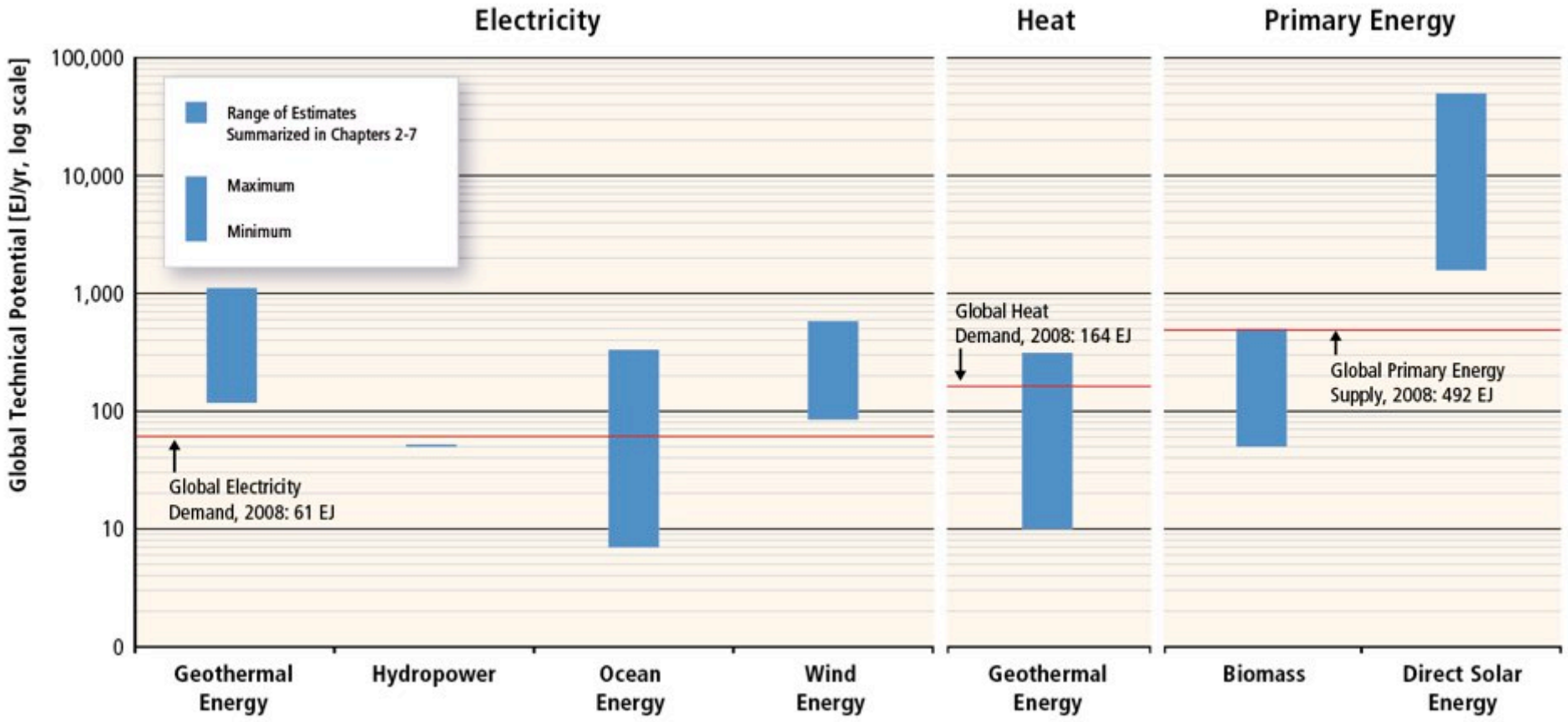
RE growth has been increasing rapidly in recent years.



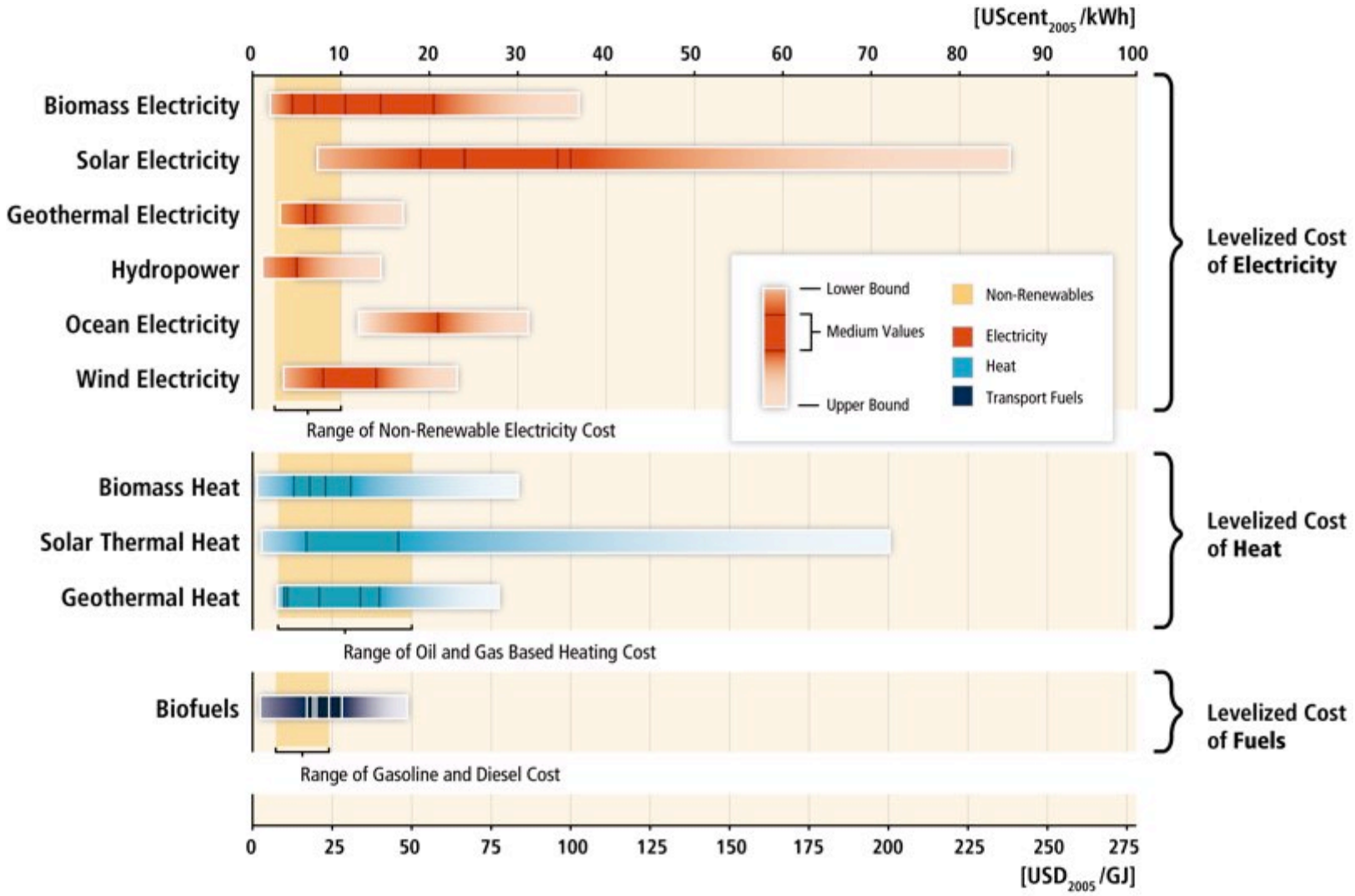
140 GW of new RE power plant capacity was built in 2008-2009.

This equals 47% of all power plants built during that period.

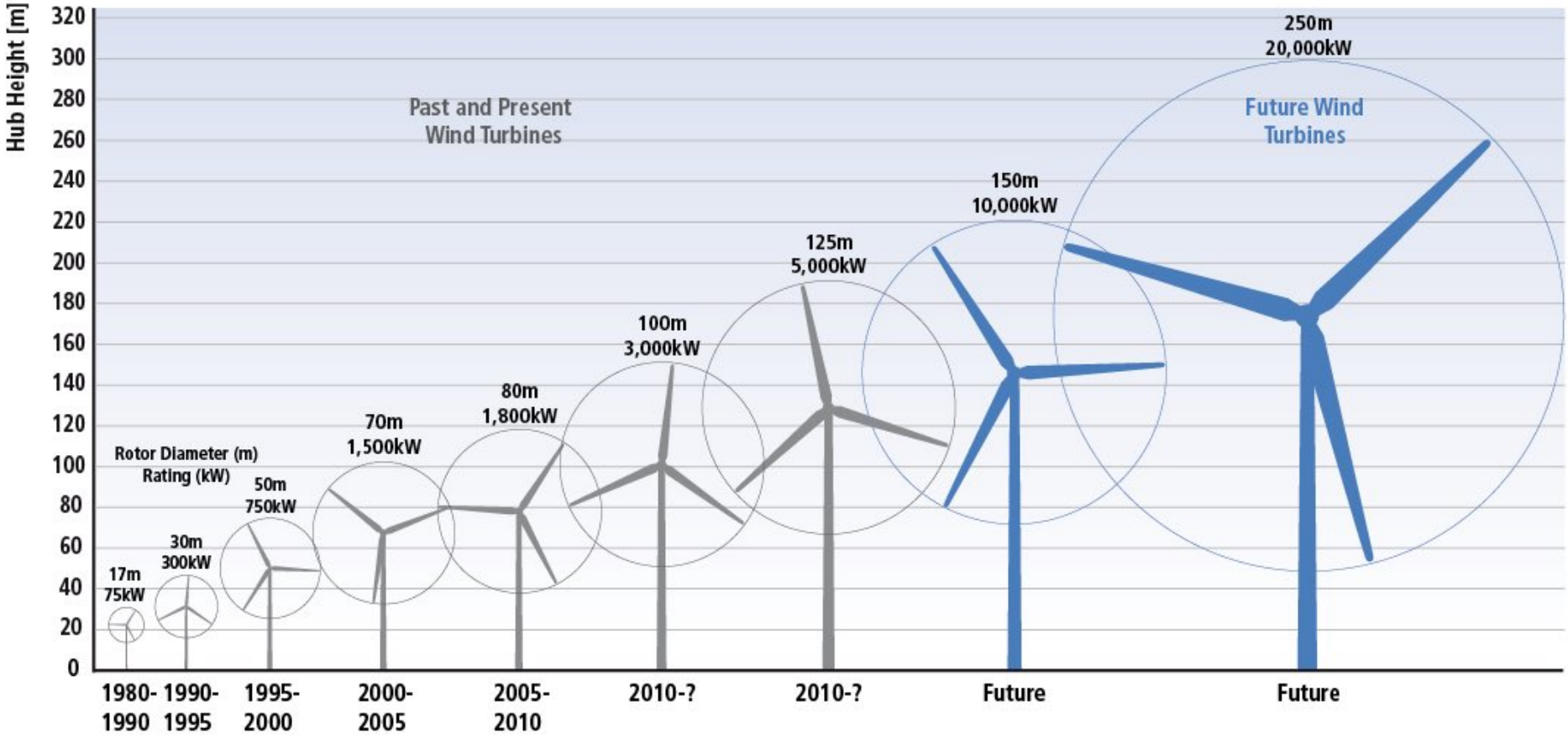
The technical potential of renewable energy technologies to supply energy services exceeds current demands.



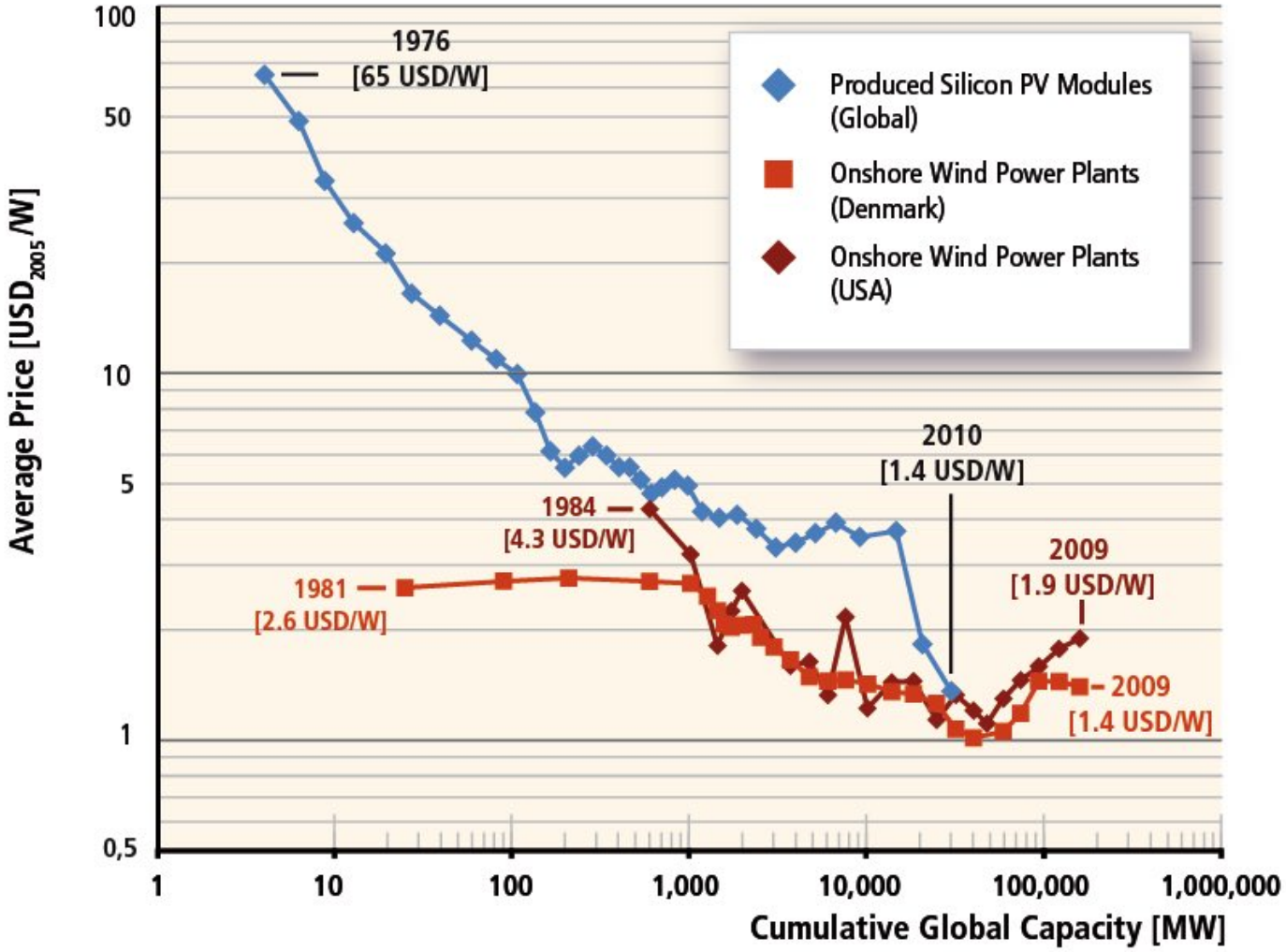
RE costs are still higher than existing energy prices, but in various settings RE is already competitive.



Technical Advancements: For instance growth in size of typical commercial wind turbines.



RE costs have declined in the past and further declines can be expected in the future.



Integration characteristics for a selection of RE electricity generation technologies

		Plant size range	Variability: Characteristic time scales for power system operation	Dispatchability	Geo-graphical diversity potential	Predictability	Capacity factor range	Capacity credit range	Active power, frequency control	Voltage, reactive power control
		(MW)	Time scale	Quality ranking			%	%	Quality ranking	
Bioenergy		0.1 - 100	Seasons (depending on biomass availability)	+++	+	++	50 - 90	Similar to conventional thermal and CHP	++	++
Direct solar energy	PV	0.004 – 100 modular	Minutes - years	+	++	+	12 –27	25-75%	+	+
	CSP with thermal storage *	50 - 250	Hours – years	++	+ **	++	35-42	90%	++	++
Geothermal energy		2 - 100	Years	+++	N/A	++	60 – 90	Similar to conventional thermal	++	++
Hydro power	Run of river	0.1 - 1500	Hours – years	++	+	++	20 – 95	0 – 90	++	++
	Reservoir	1 – 20000	Days – years	+++	+	++	30 - 60	Similar to conventional thermal	++	++
Ocean Energy	Tidal range	0.1- 300	Hours – days	+	+	++	22.5 - 28.5	<10%	++	++
	Tidal current	1-200	Hours – days	+	+	++	19-60	10-20	+	++
	Wave	1- 200	Minutes - years	+	++	+	22-31	16	+	+
Wind energy		5– 300	Minutes - years	+	++	+	20 – 40 on-shore, 30-45 off-shore	5-40	+	++

Capacity credit is an indicator for the reliability of a generation type to be available during peak demand hours.

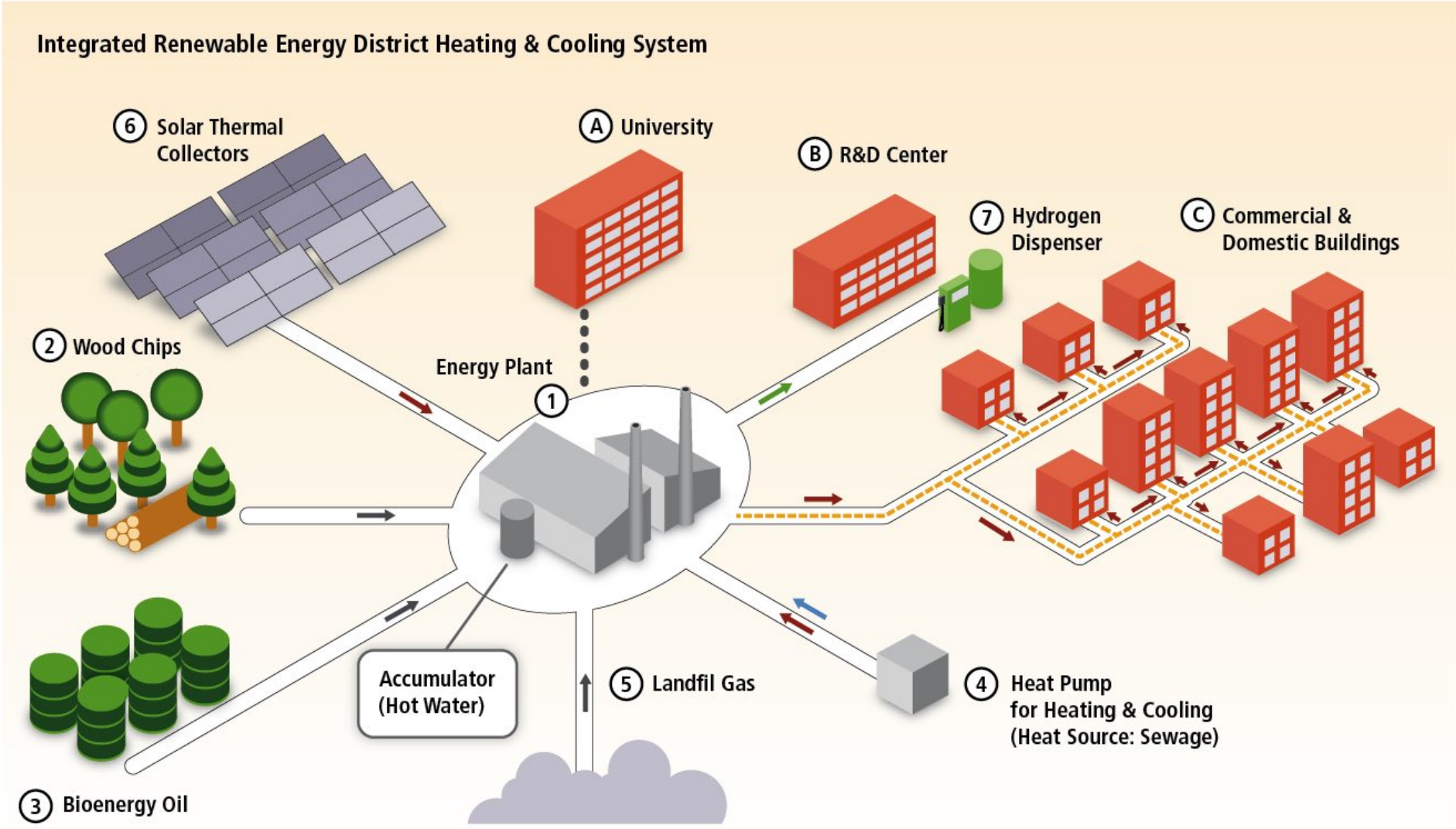
		[…]	Capacity credit range
		[…]	%
Bioenergy		[…]	Similar to conventional thermal and CHP
Direct solar energy	PV	[…]	25-75%
	CSP with thermal storage *	[…]	90%
Geothermal energy		[…]	Similar to conventional thermal
Hydro power	Run of river	[…]	0 – 90
	Reservoir	[…]	Similar to conventional thermal
Ocean Energy	Tidal range	[…]	<10%
	Tidal current	[…]	10-20
	Wave	[…]	16
Wind energy		[…]	5-40

If a type of generation has a low capacity credit,
the available output tends to be low during high demand periods.

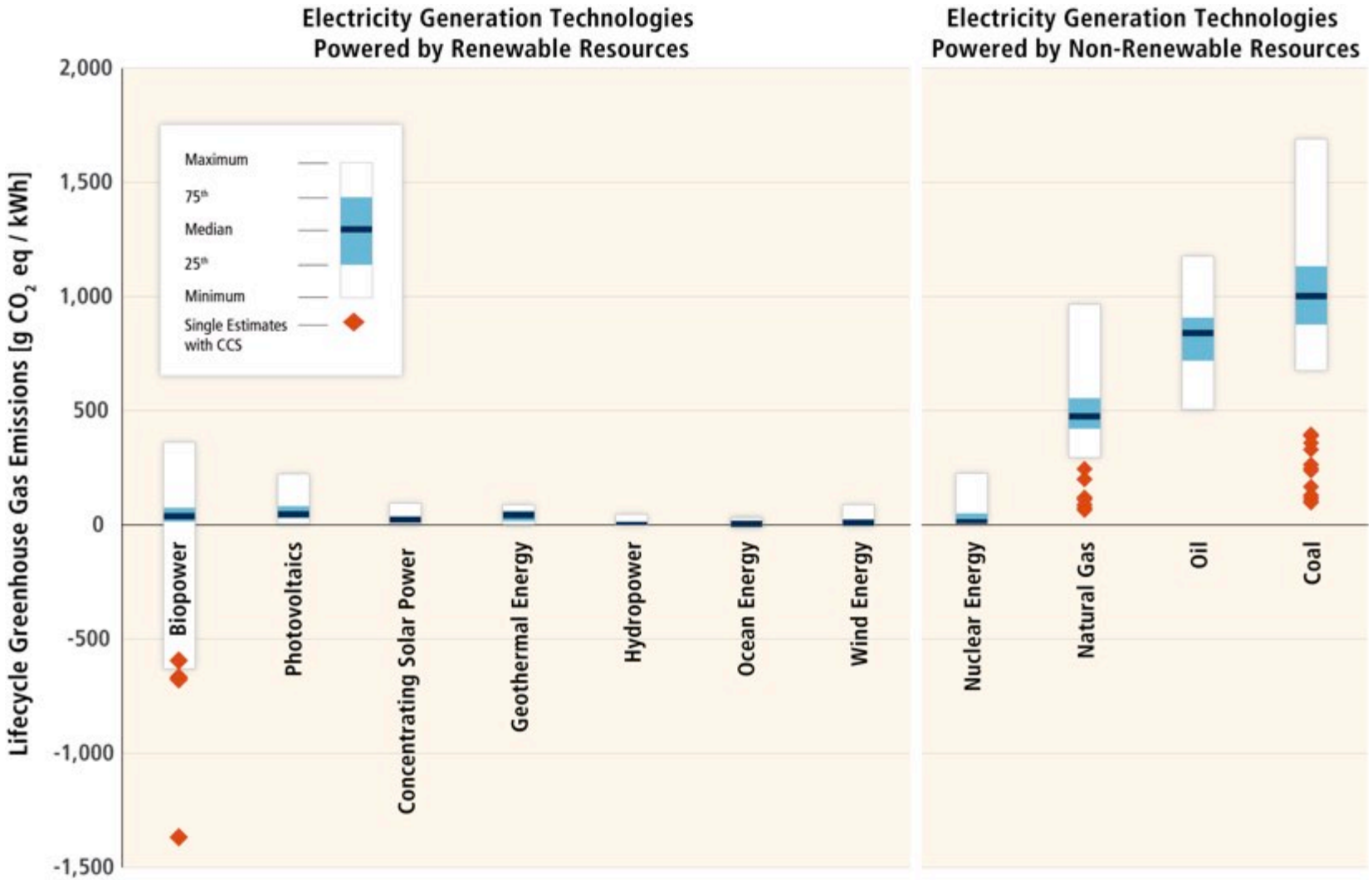
Few, if any, fundamental technical limits exist to the integration of a majority share of RE, but advancements in several areas are needed.

- Transmission and distribution infrastructure
- Generation flexibility
- Energy storage technologies
- Demand side management
- Improved forecasting and operational planning methods

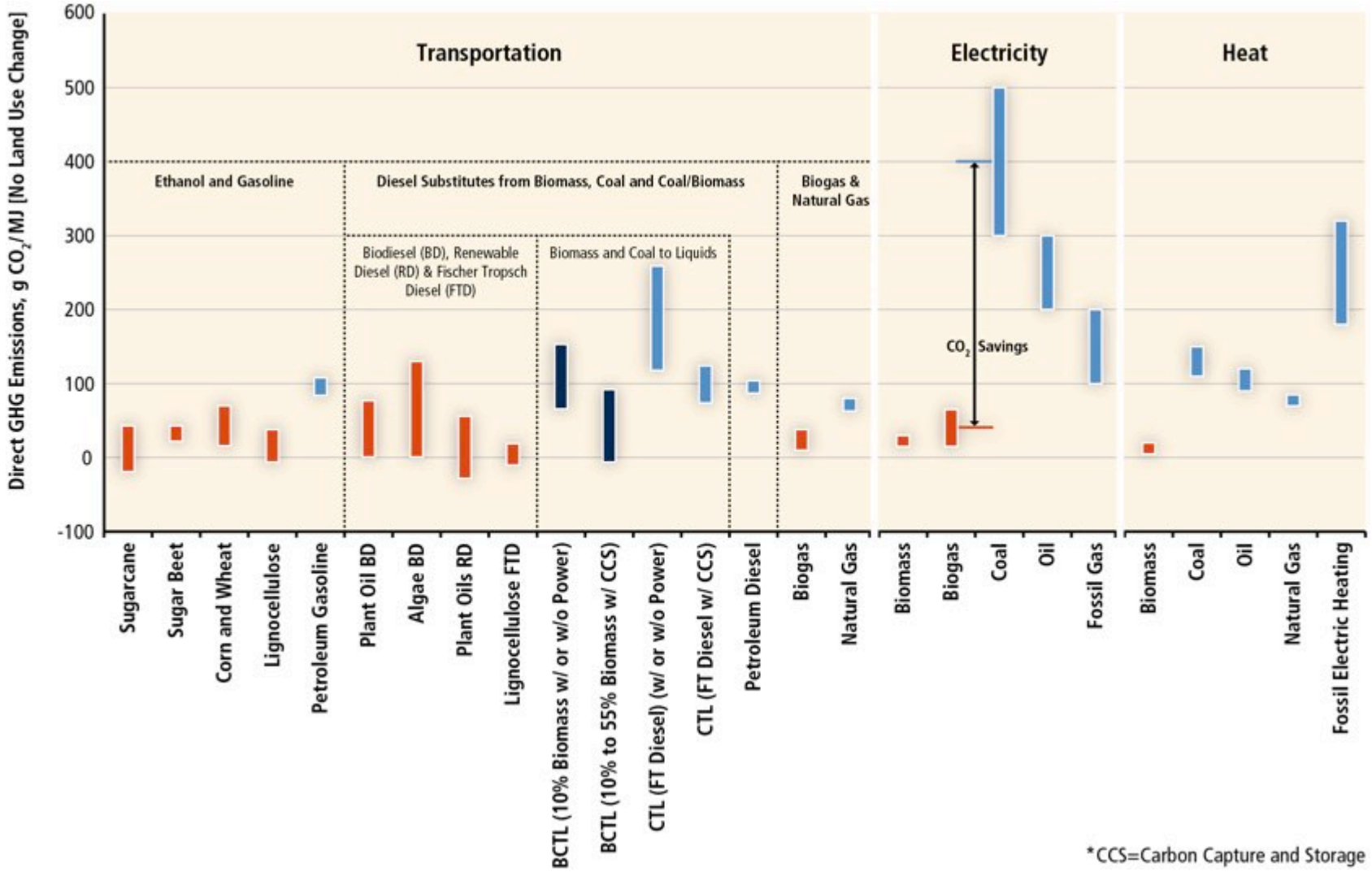
An integrated RE-based energy plant in Lillestrøm, Norway, supplying commercial and domestic buildings



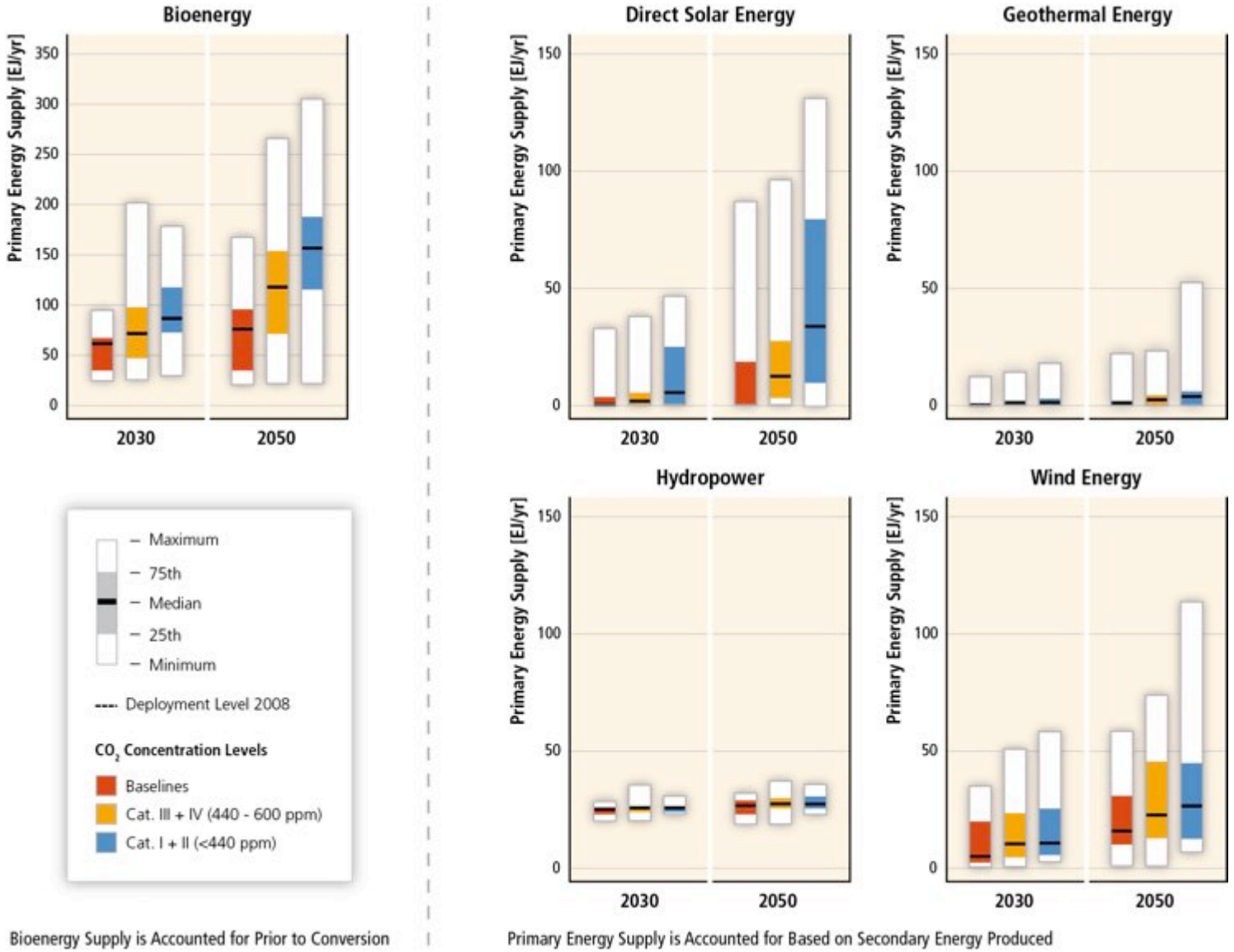
Lifecycle GHG emissions of RE technologies are, in general, considerably lower than those of fossil fuel options.



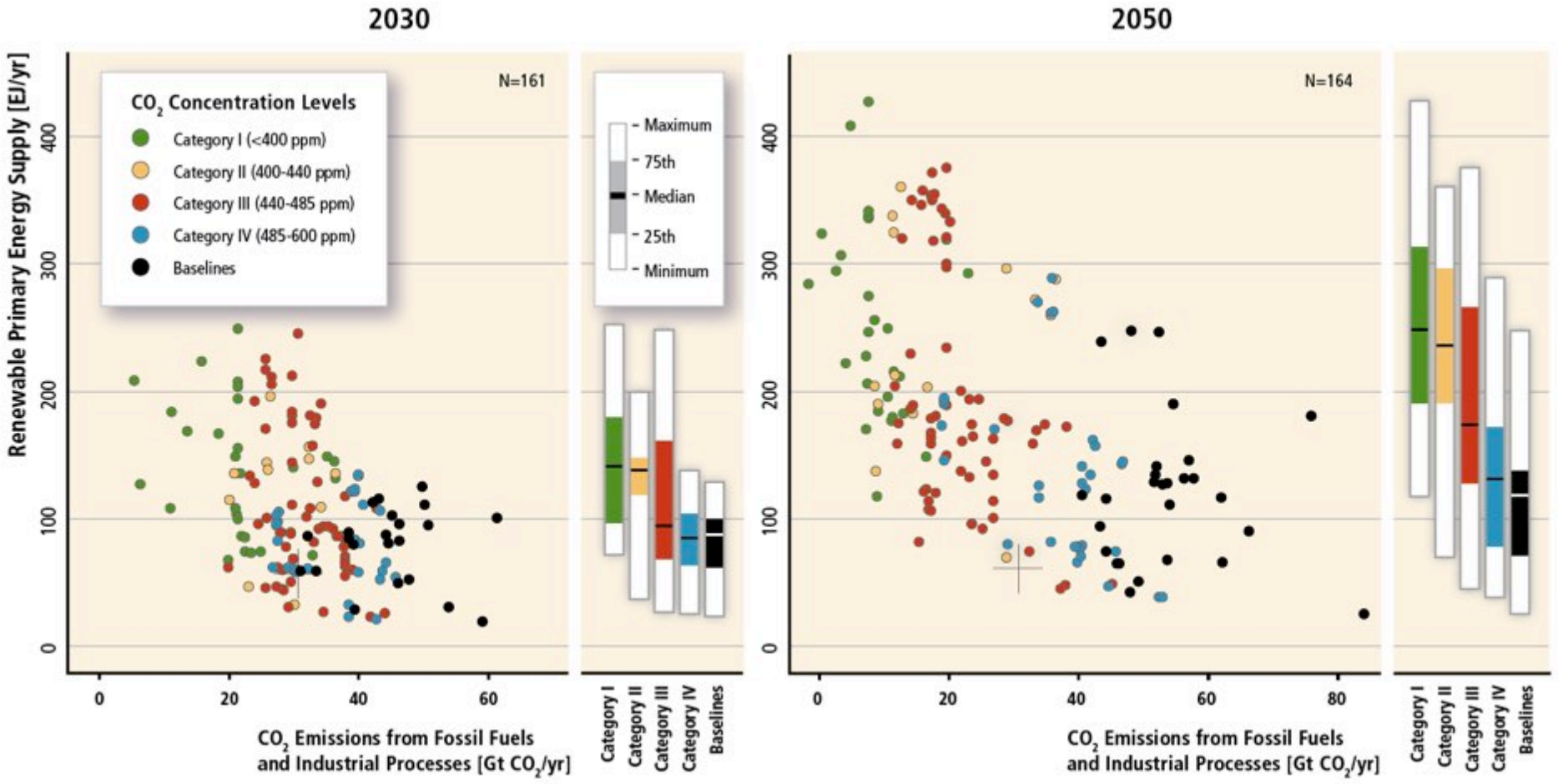
GHG emissions from modern bioenergy chains compared to fossil fuel energy systems, excluding land-use change effects.



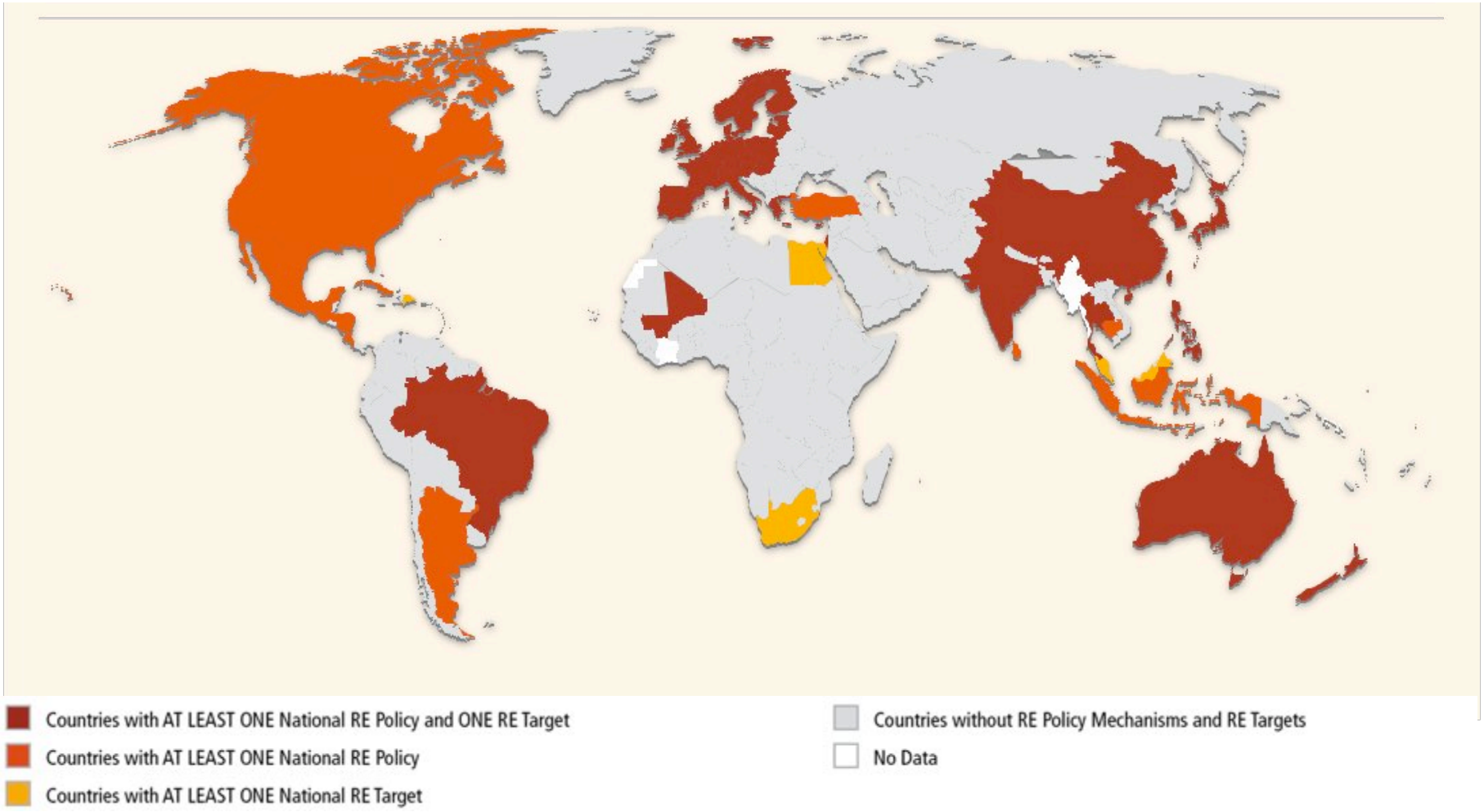
RE deployment increases in scenarios with lower greenhouse gas concentration stabilization levels.



Global RE primary energy supply from 164 long-term scenarios versus fossil and industrial CO_2 emissions.



RE and Climate Change Mitigation Policies 2004



RE and Climate Change Mitigation Policies 2011