# Climate Change: Key Messages in the IPCC 5<sup>th</sup> Assessment Report (AR5)

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#EIClimaEstaCambiando Conference, Buenos Aires, 2 July 2015

Thanks to the Belgian Federal Science Policy Office (BELSPO) and the Ministry of Foreign Affairs, and to my team at the Université catholique de Louvain for their support



### Why the IPCC?

#### **Established by WMO and UNEP in 1988**

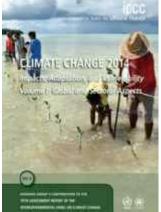
to provide policy-makers with an objective source of information about

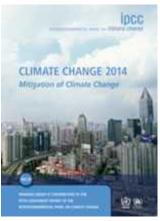
- causes of climate change,
- potential environmental and socio-economic impacts,
- possible response options (adaptation & mitigation).

WMO=World Meteorological Organization
UNEP= United Nations Environment
Programme









## What is happening in the climate system?

What are the risks?

What can be done?



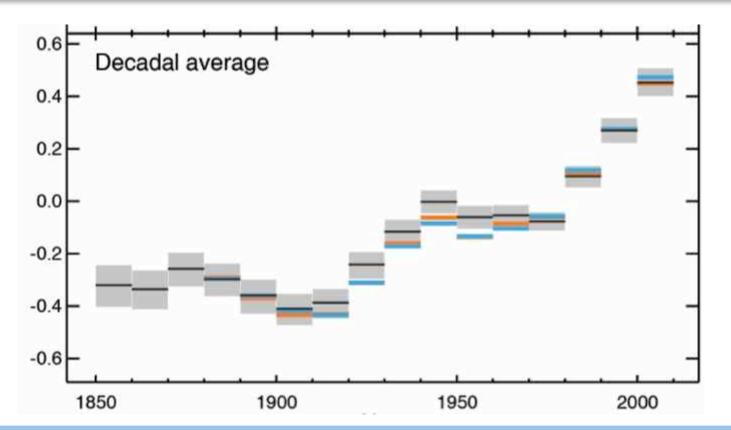


### **Key messages from IPCC AR5**

- → Human influence on the climate system is clear
- → Continued emissions of greenhouse gases will increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems
- → While climate change is a threat to sustainable development, there are many opportunities to integrate mitigation, adaptation, and the pursuit of other societal objectives
- → Humanity has the means to limit climate change and build a more sustainable and resilient future





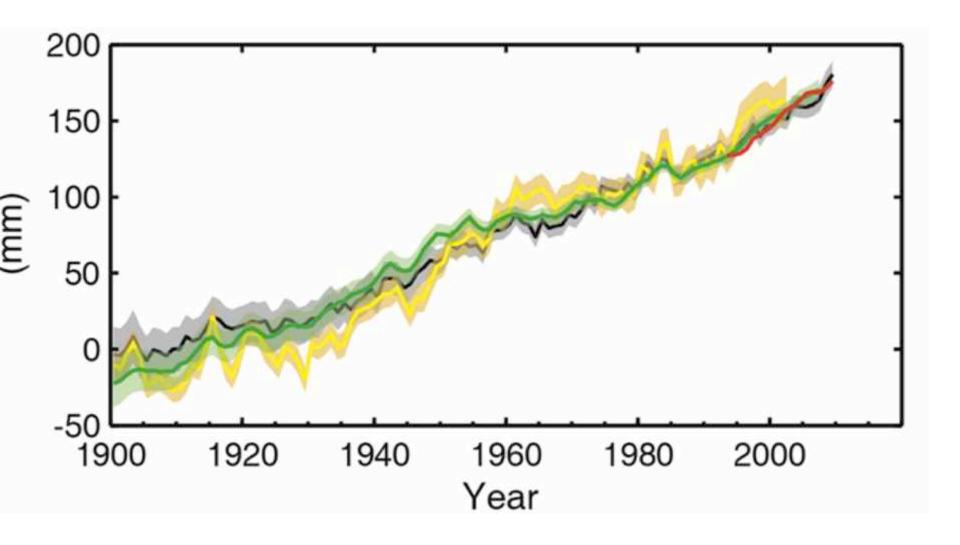


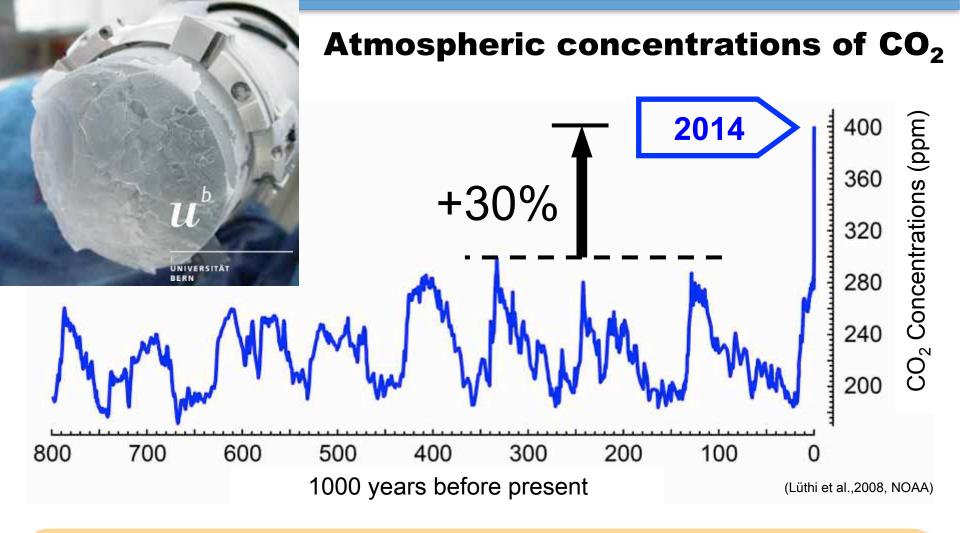
Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850.

In the Northern Hemisphere, 1983–2012 was likely the warmest 30-year period of the last 1400 years (medium confidence).



## Change in average sea-level change





The concentrations of  $CO_2$  have increased to levels unprecedented in at least the last 800,000 years.

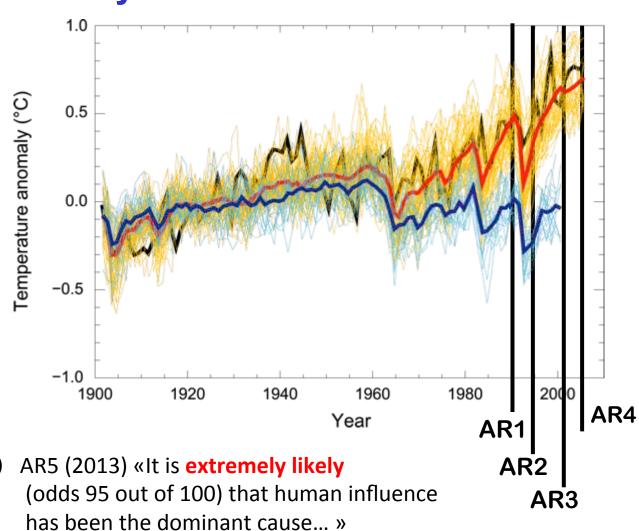
## A Progression of Understanding: Greater and Greater Certainty in Attribution

AR1 (1990): "unequivocal detection not likely for a decade"

AR2 (1995): "balance of evidence suggests discernible human influence"

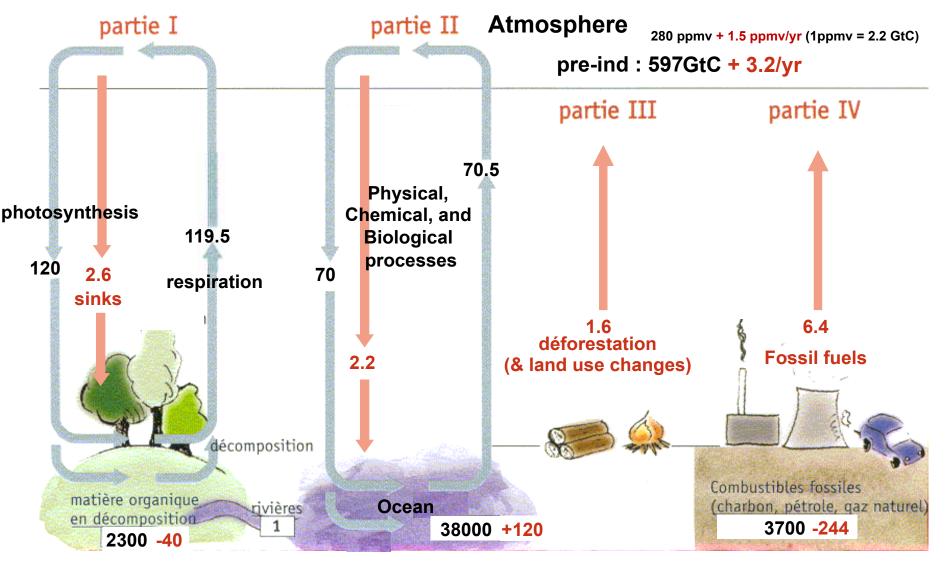
AR3 (2001): "most of the warming of the past 50 years is **likely** (odds 2 out of 3) due to human activities"

AR4 (2007): "most of the warming is **very likely** (odds 9 out of 10) due to greenhouse gases"



## Carbon cycle: perturbed by human activities

(numbers for the decade 1990-1999s, based on IPCC AR4)

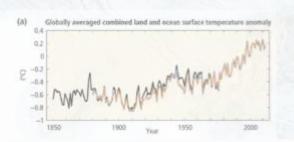


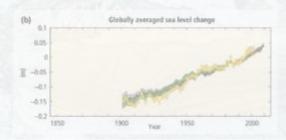
Units: GtC (billions tons of carbon) or GtC/year

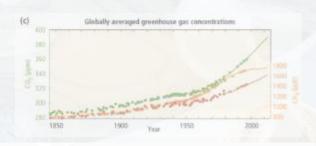
Stocks!

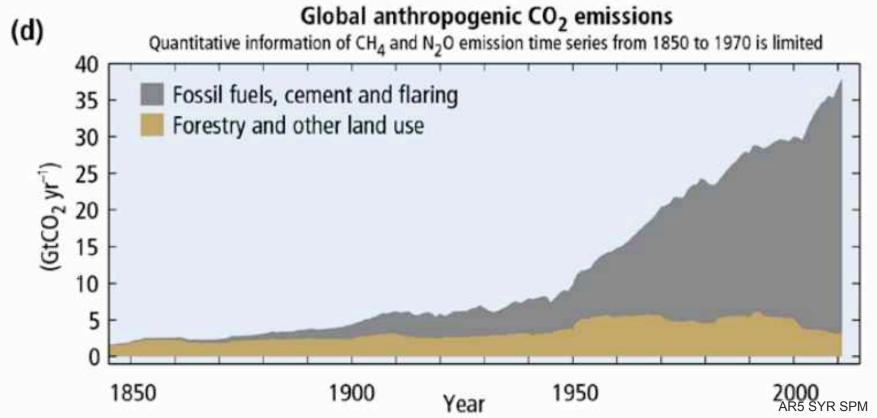
## The carbon cycle is policy-relevant

- CO<sub>2</sub> accumulates in the atmosphere as long as human emissions are larger than the natural absorption capacity
- Historical emissions from developed countries therefore matter for a long time
- As warming is function of cumulated emissions, the carbon « space » is narrowing fast (to stay under 1.5 or 2°C warming)









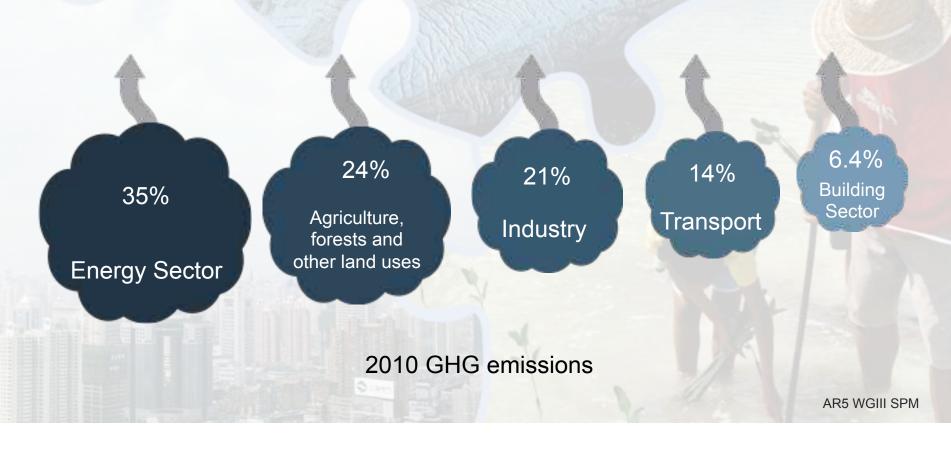






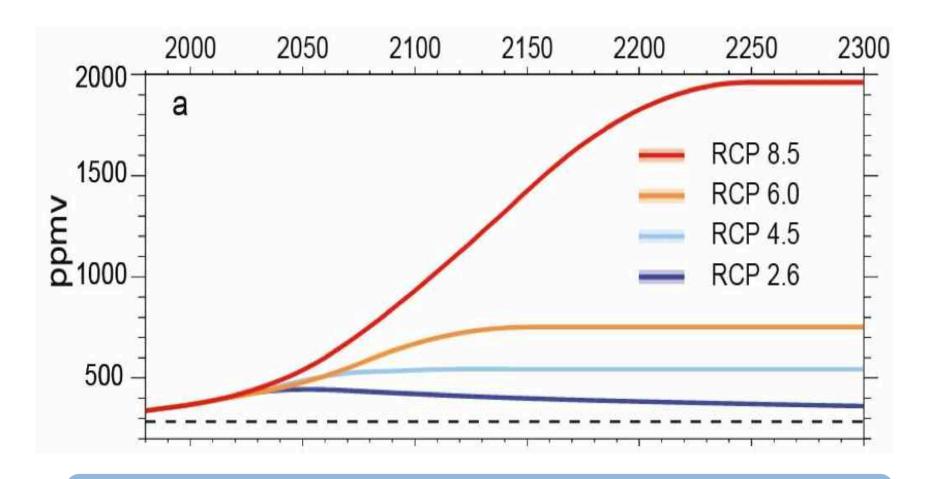
#### Sources of emissions

**Energy production remains the primary driver of GHG emissions** 

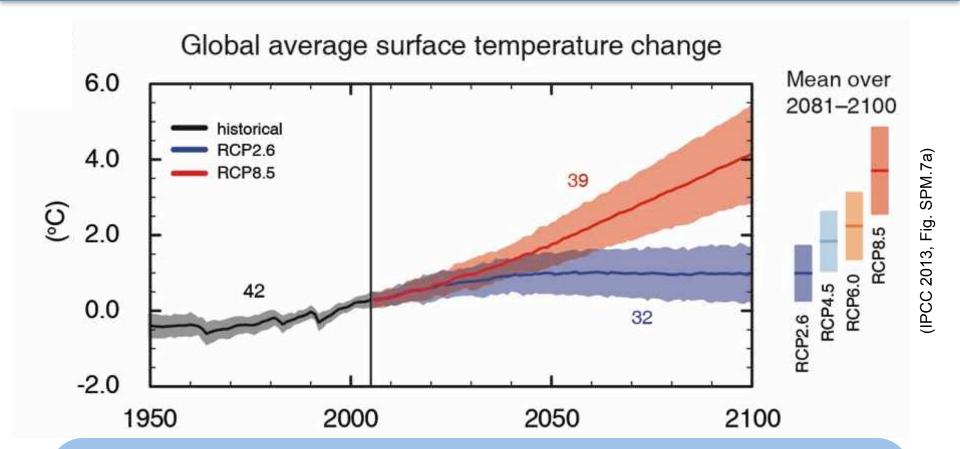




#### RCP Scenarios: Atmospheric CO<sub>2</sub> concentration

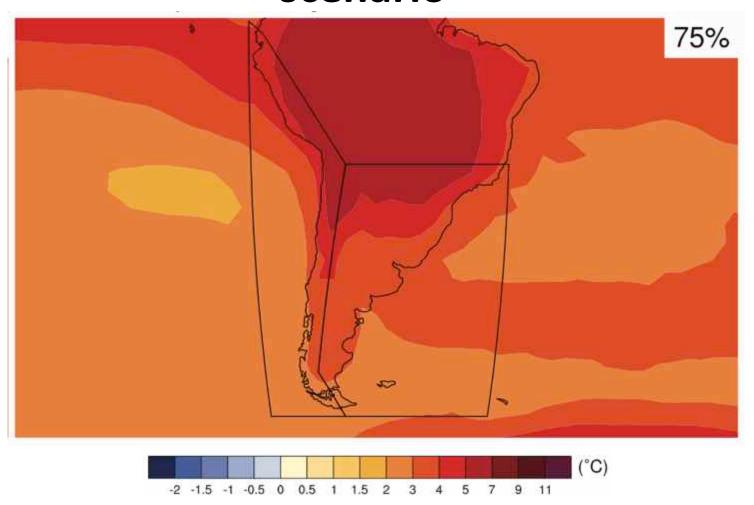


Three stabilisation scenarios: RCP 2.6 to 6 One Business-as-usual scenario: RCP 8.5

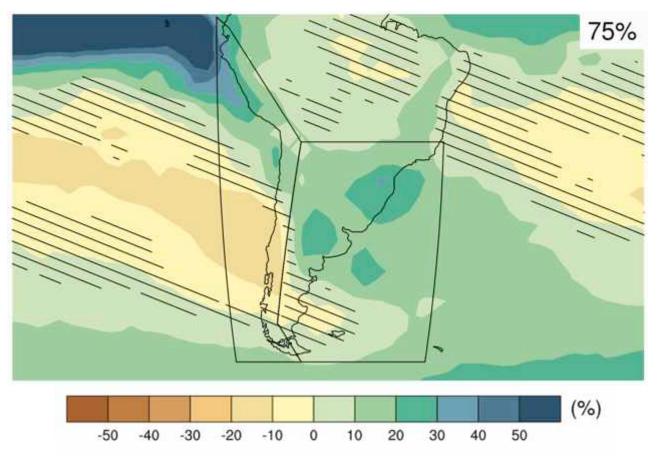


Only the lowest (RCP2.6) scenario maintains the global surface temperature increase above the pre-industrial level to less than 2°C with at least 66% probability

# Map of temperature changes in 2081–2100, with respect to 1986–2005 in the RCP8.5 scenario



## Map of precipitation changes in 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario

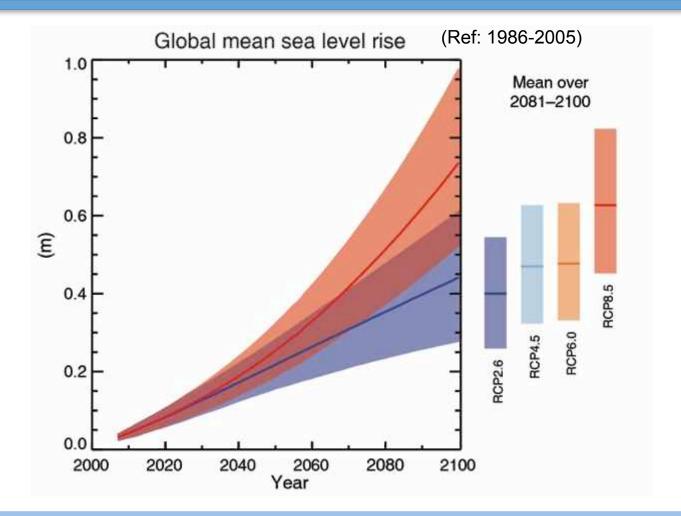




Regions where the projected change is less than one standard deviation of the natural internal variability



Regions where the projected change is large compared to natural internal variability, and where at least 90% of models agree on a sign of change



#### Sea level due to continue to increase







Current and predicted coastal impacts in response to climate change



## Since 1950, extreme hot days and heavy precipitation have become more common





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

### **Future Regional Climate Change**

An increase in heavy precipitation events over almost the entire continent, especially Amazonia, southern Brazil and northern Argentina, is projected by a high-resolution model ensemble (Kitoh et al., 2011) and in subtropical areas of South America by regional models (Marengo et al., 2009).





#### Impacts are already underway

- Tropics to the poles
- On all continents and in the ocean
- Affecting rich and poor countries (but the poor are more vulnerable everywhere)



**AR5 WGII SPM** 







## Risk = Hazard x Vulnerability x Exposure (Katrina flood victim)



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

#### **Potential Impacts of Climate Change**



Food and water shortages



Increased displacement of people



Increased poverty



**Coastal flooding** 

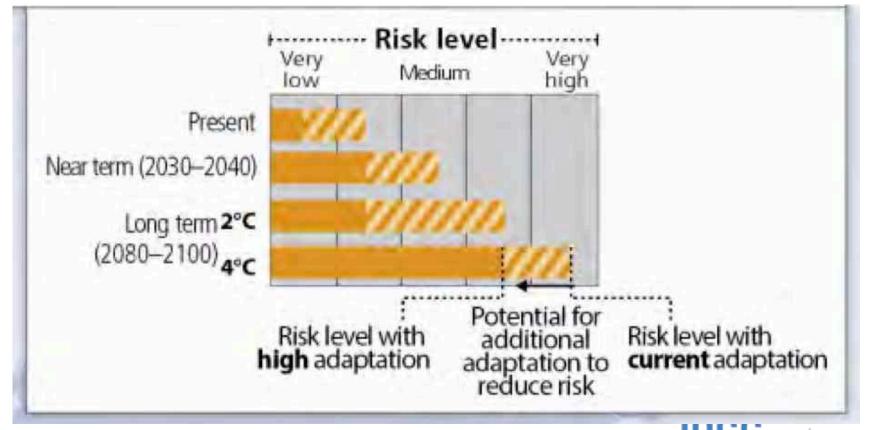
**AR5 WGII SPM** 





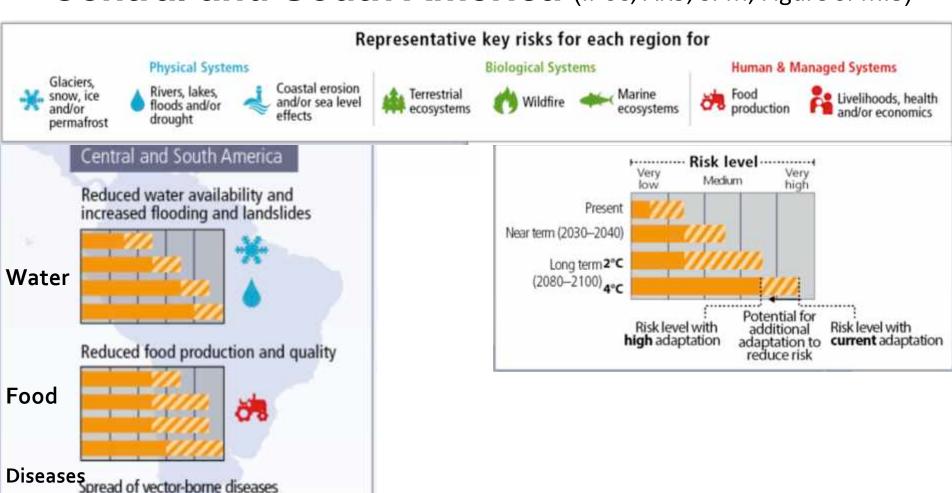
Regional key risks and potential for risk reduction through adaptation





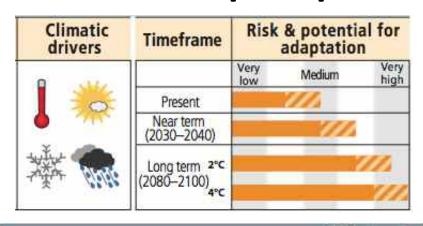


## Regional key risks and potential for risk reduction: Central and South America (IPCC, AR5, SPM, Figure SPM.8)

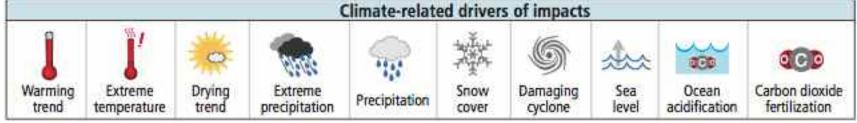


## Key risk for Central and South America

Water availability in semi-arid and glacier-melt-dependent regions and Central America; flooding and landslides in urban and rural areas due to extreme precipitation (high *confidence*)







### Adaptation issues and prospects

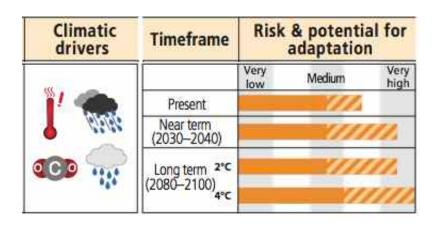
- 1. Integrated water resource management
- 2. Urban and rural flood management (including infrastructure), early warning systems, better weather and runoff forecasts, and infectious disease control



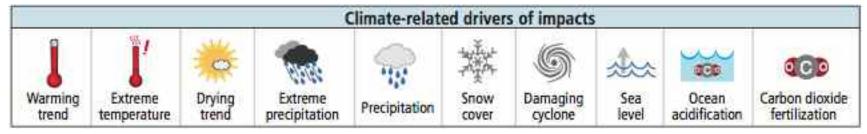


### Key risk for Central and South America

## Decreased food production and food quality (medium confidence)







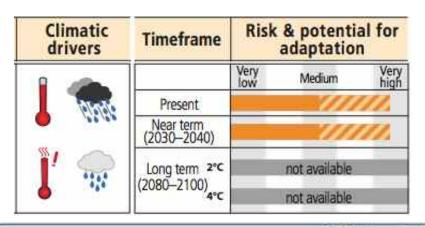
### Adaptation issues and prospects

- Development of new crop varieties more adapted to climate change (temperature and drought)
- 2. Offsetting of human and animal health impacts of reduced food quality
- 3. Offsetting of economic impacts of land-use change
- 4. Strengthening traditional indigenous knowledge systems and practices

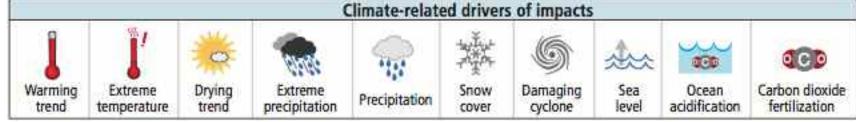


## Key risk for Central and South America

## Spread of vector-borne diseases in altitude and latitude (high confidence)







### Adaptation issues and prospects

- 1. Development of early warning systems for disease control and mitigation based on climatic and other relevant inputs. Many factors augment vulnerability
- 2. Establishing programs to extend basic public health services







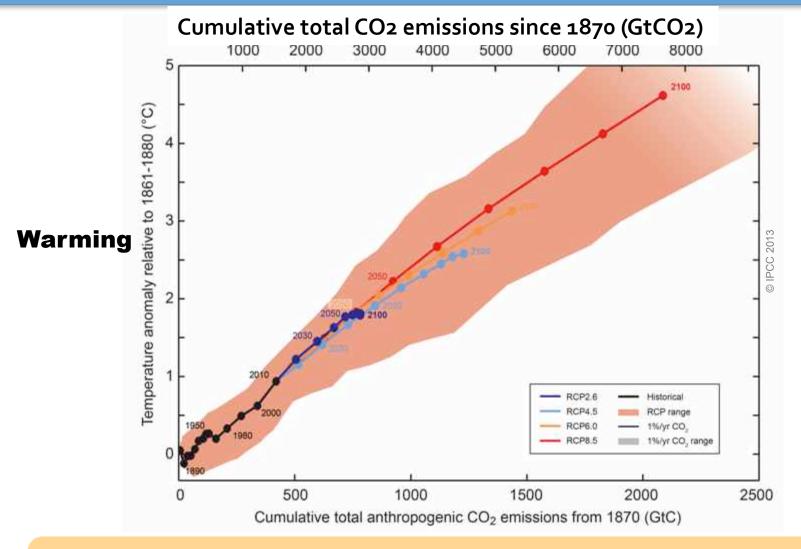


Fig. SPM.10

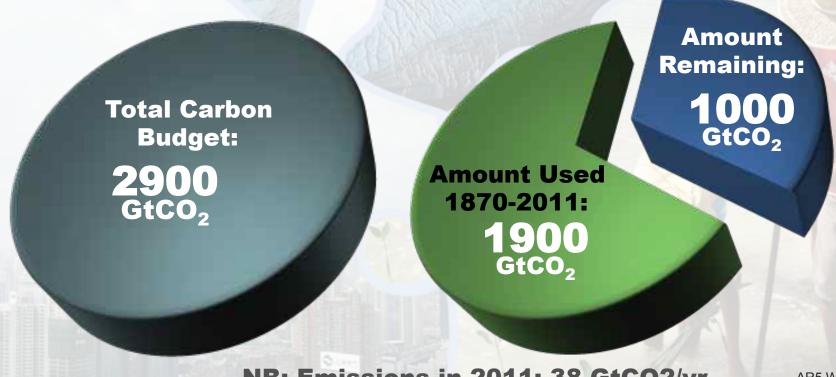
Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.





### 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



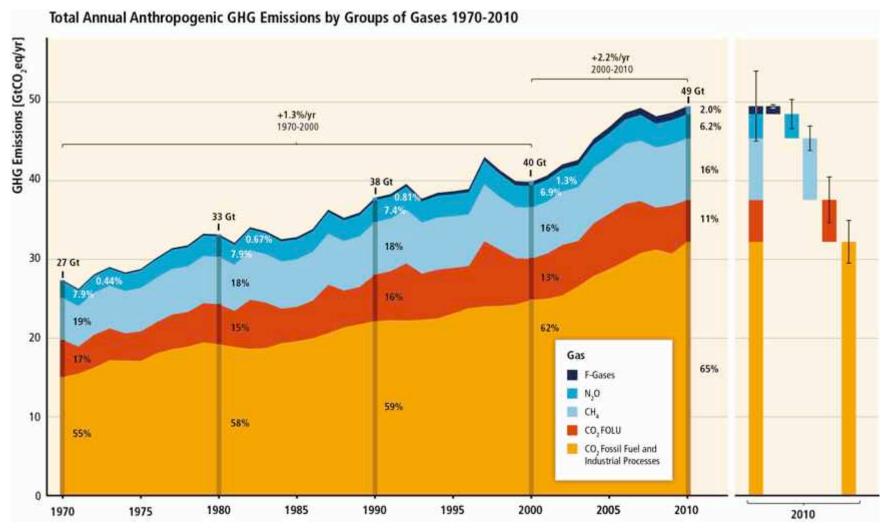
NB: Emissions in 2011: 38 GtCO2/yr







## GHG emissions accelerate despite reduction efforts. Most emission growth is CO<sub>2</sub> from fossil fuel combustion and industrial processes.







#### **Mitigation Measures**



#### More efficient use of energy



#### Greater use of low-carbon and no-carbon energy

- Many of these technologies exist today
- But worldwide investment in **research** in support of GHG mitigation is small...



#### Improved carbon sinks

- Reduced deforestation and improved forest management and planting of new forests
- Bio-energy with carbon capture and storage



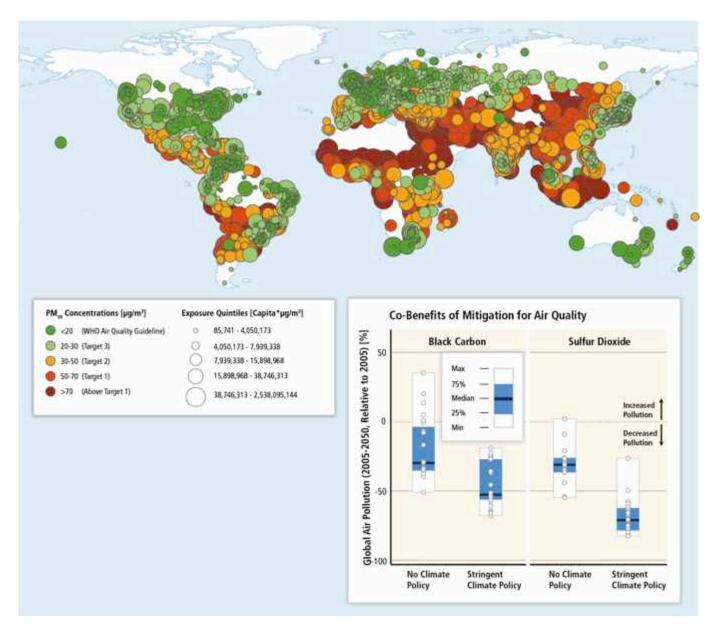
Lifestyle and behavioural changes

AR5 WGIII SPM





Delaying additional mitigation to 2030 will substantially increase the challenges associated with limiting warming over the 21st century to below 2°C relative to preindustrial levels.



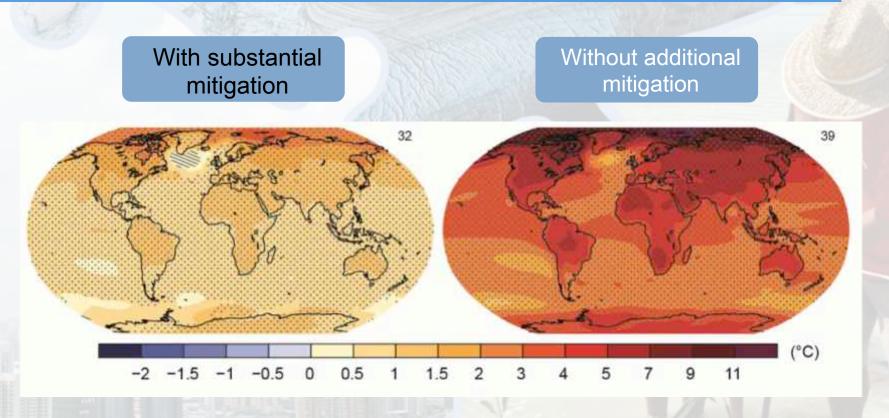
Mitigation can result in large co-benefits for human health and other societal goals.

- Sustainable development and equity provide a basis for assessing climate policies and highlight the need for addressing the risks of climate change
- Issues of equity, justice, and fairness arise with respect to mitigation and adaptation





#### The Choices we Make Will Create Different Outcomes (and affect prospects for effective adaptation)



Change in average surface temperature (1986–2005 to 2081–2100)

AR5 WGI SPM







#### Please...

- Participate to the next IPCC
  Assessment (as authors or expert
  reviewers)(Tip: know your IPCC Focal
  point)
- Think about the children and their future in a warm climate

#### **Useful links:**

- www.ipcc.ch : IPCC (reports and videos)
- www.climate.be/vanyp : my slides and my candidature for the IPCC Chair position
- www.skepticalscience.com: excellent responses to contrarians arguments
- On Twitter: @JPvanYpersele and @IPCC\_CH