Emerging research findings:
Global and regional climate patterns

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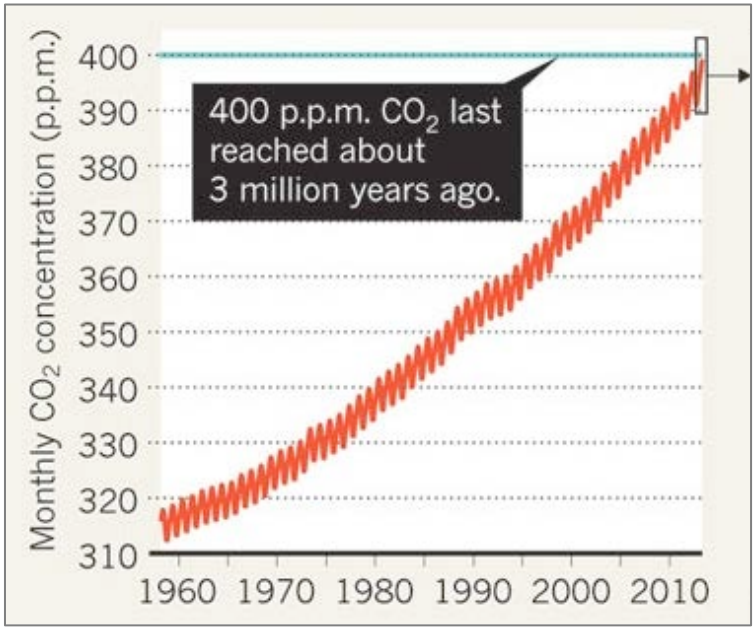
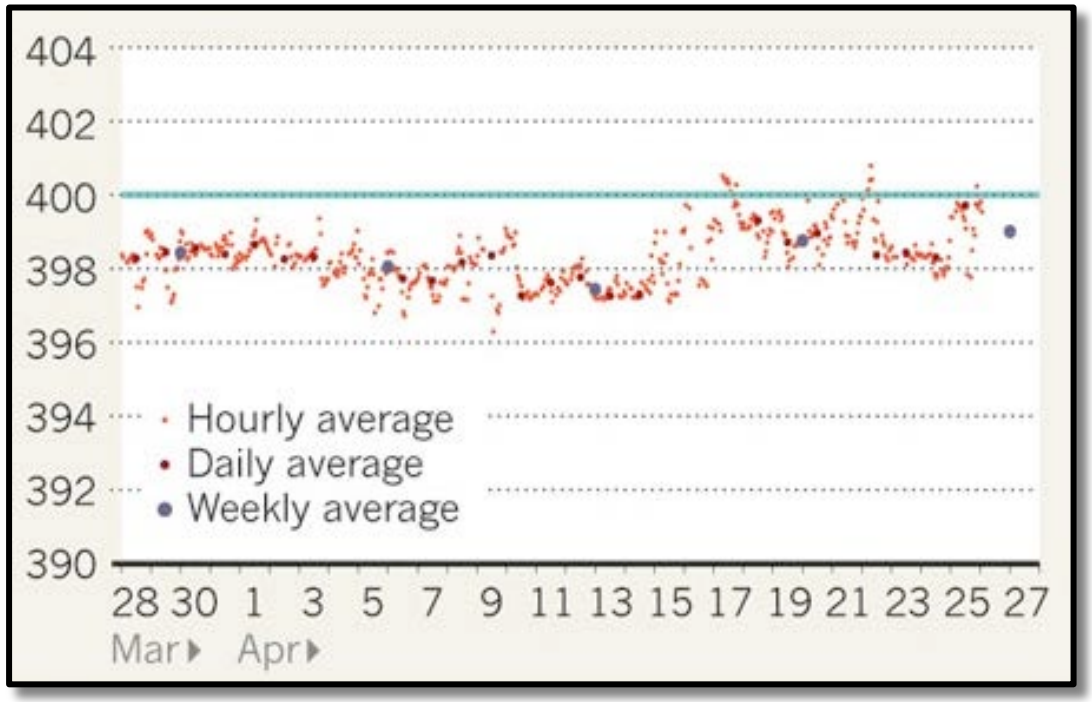
UNFCCC-SBSTA meeting Bonn
4 June 2013

Atmospheric CO_2 reached 400 ppm

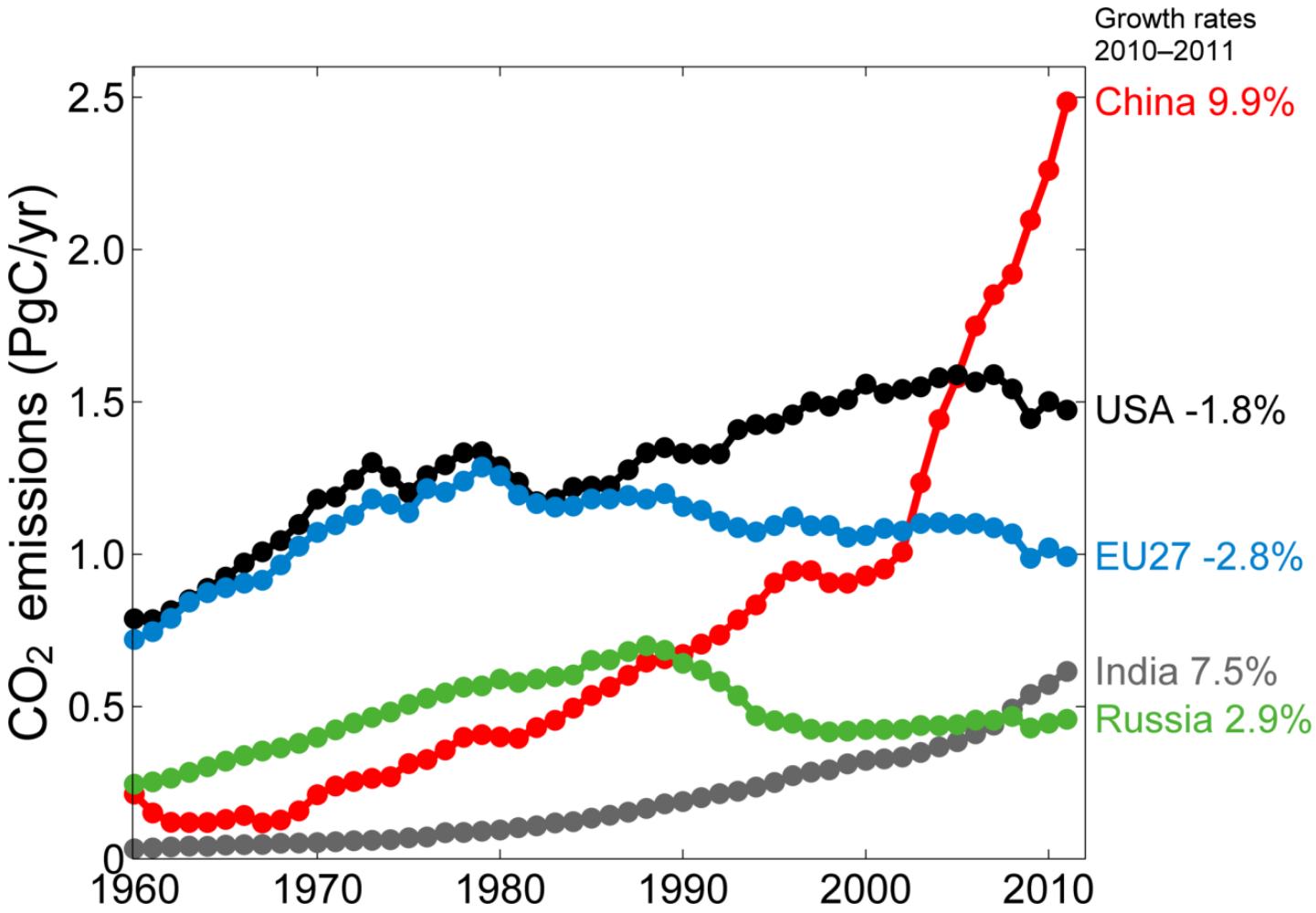




Richard Monastersky April vol 497
No. 7447, *Nature* 2013

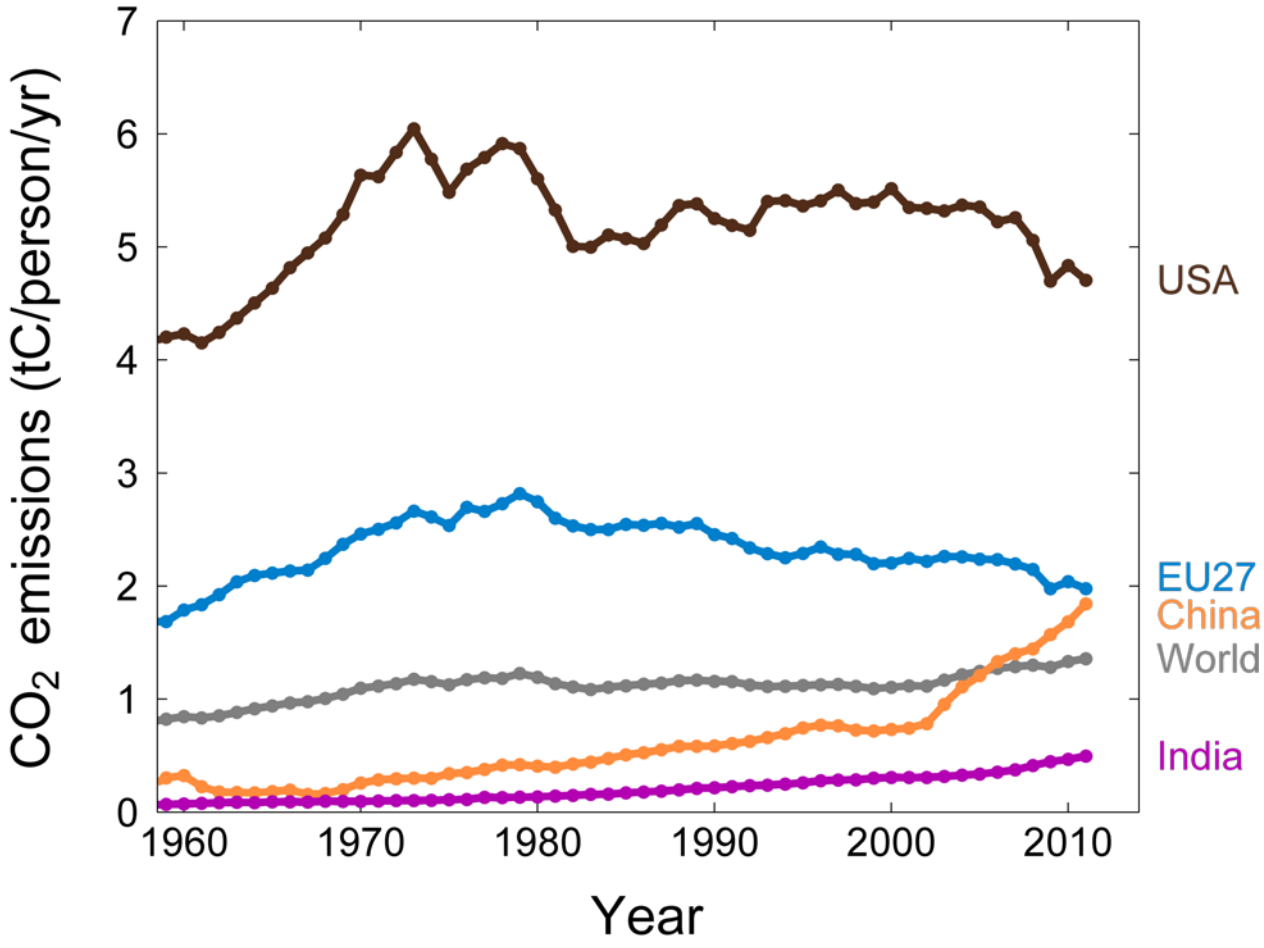
CO_2 emission trends by country

fossil fuel + cement + gas flaring



Le Quere *et al.* 2012;
Global Carbon Project 2012

Top fossil fuel emitters
(Per Capita)



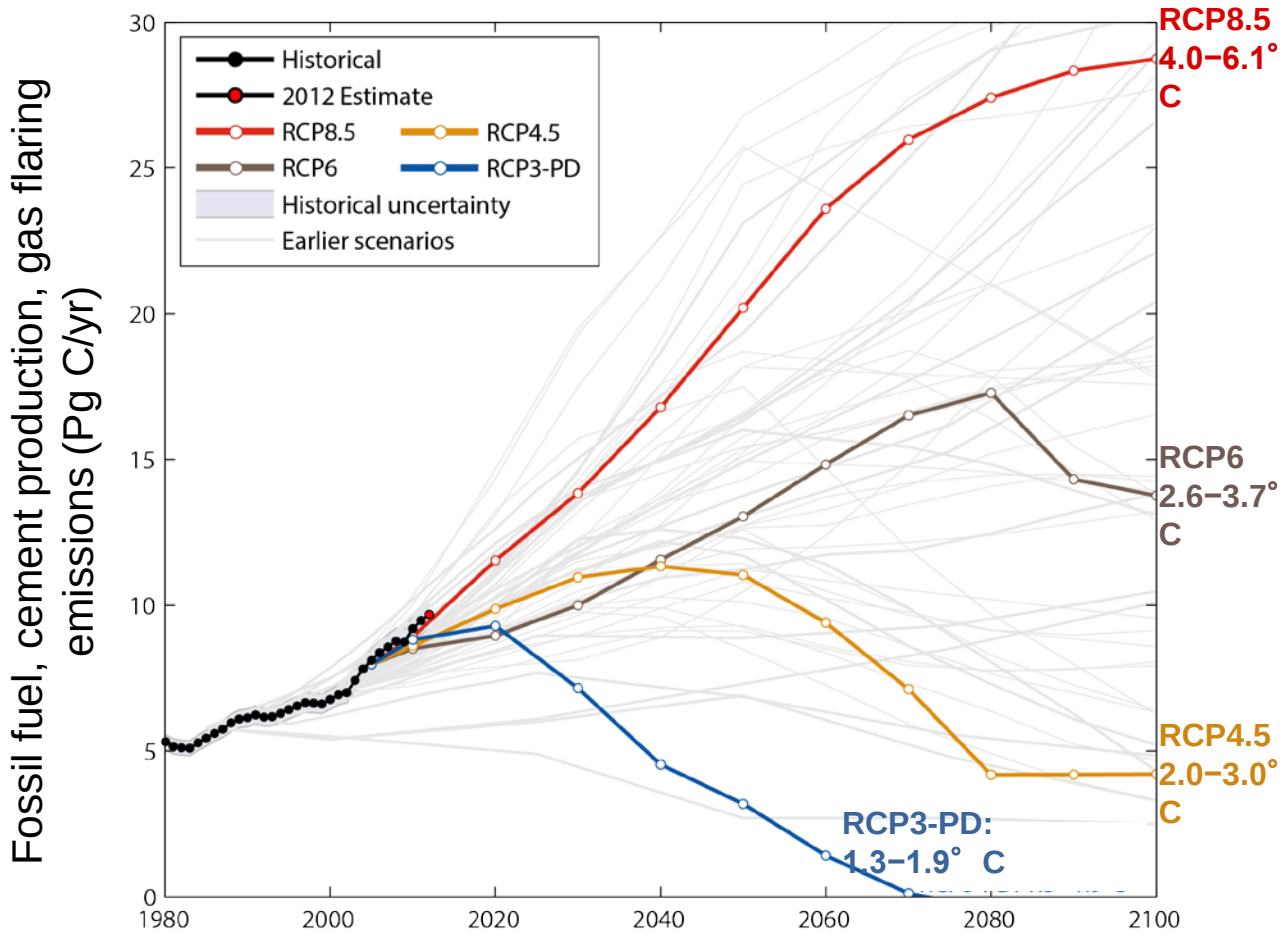
USA highest

China ≈ EU27

CDIAC Data; Le Quere *et al.* 2012;
Global Carbon Project 2012

CO_2 emissions follow worst case scenario

Emissions are heading to a 4.0-6.1ºC “likely” increase in temperature
Large and sustained mitigation is required to keep below 2ºC



Peters *et al.* 2012a;
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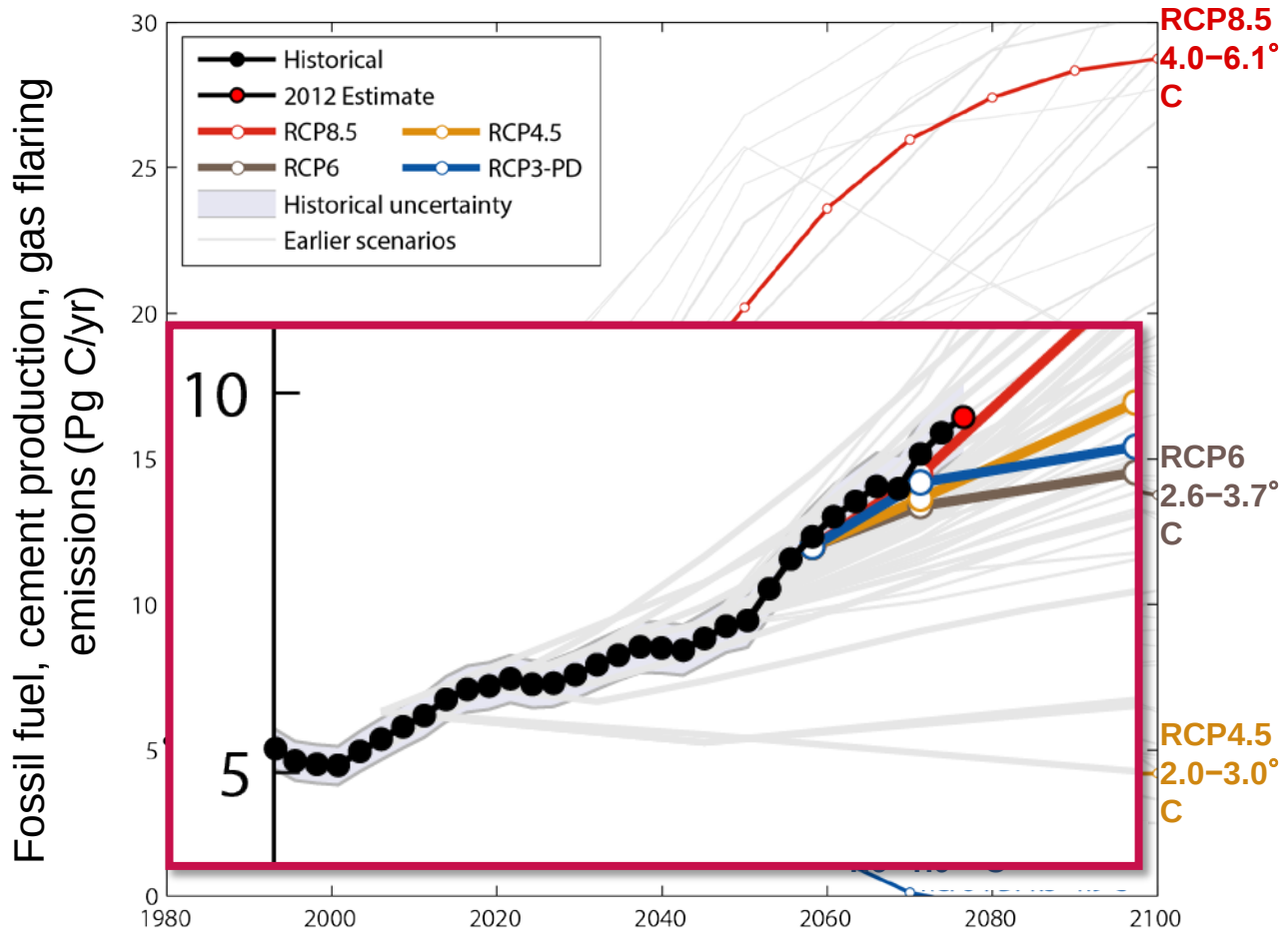
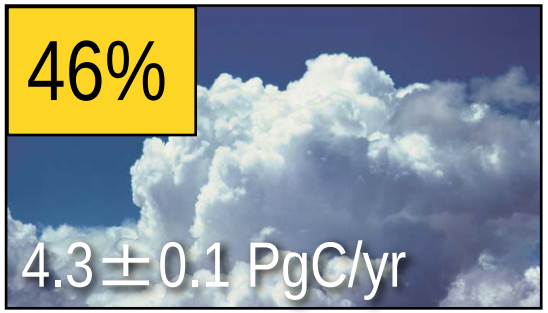


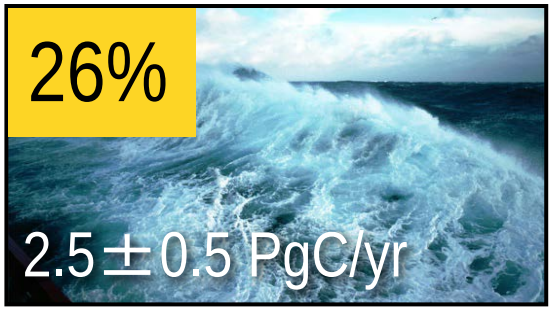
Peters *et al.* 2012a;
Global Carbon Project 2012;

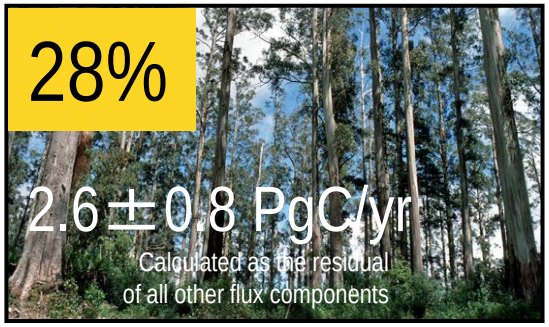
Fate of anthropogenic CO_2 emissions

(2002-2011 average)

+



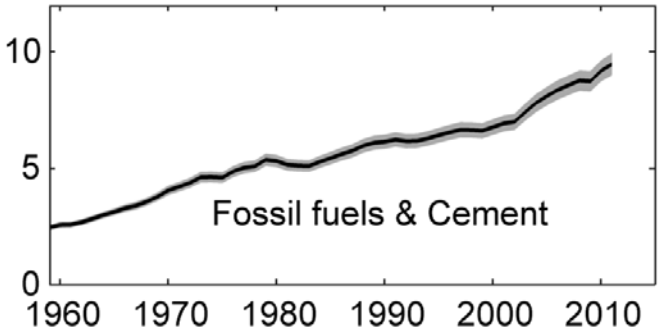


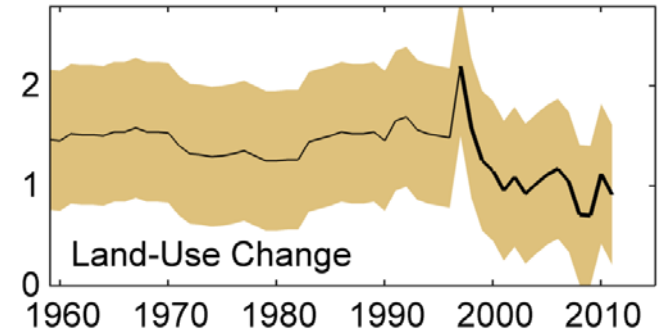


Le Quere *et al.* 2012;
Global Carbon Project 2012

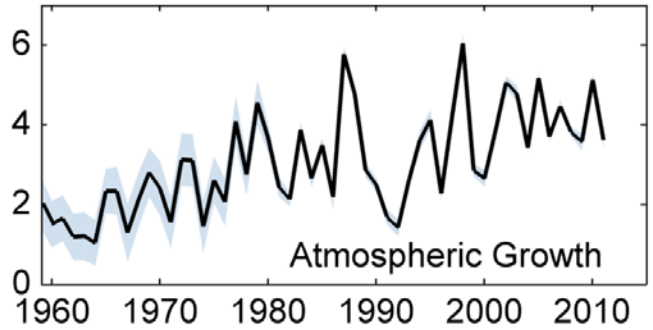
Changes in the Global Carbon Budget over time

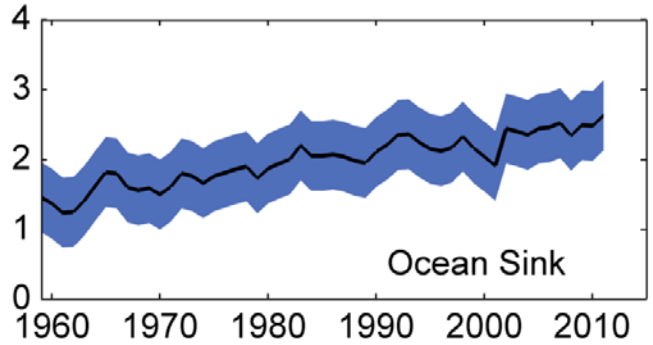
- The sinks have continued to grow with increasing emissions
- It is uncertain how efficient the sinks will be in the future

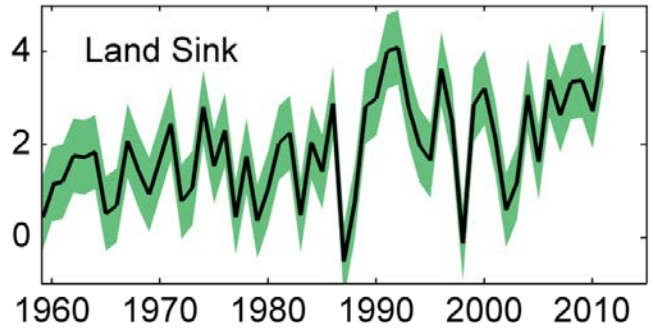




All fluxes in Pg C y^{-1}







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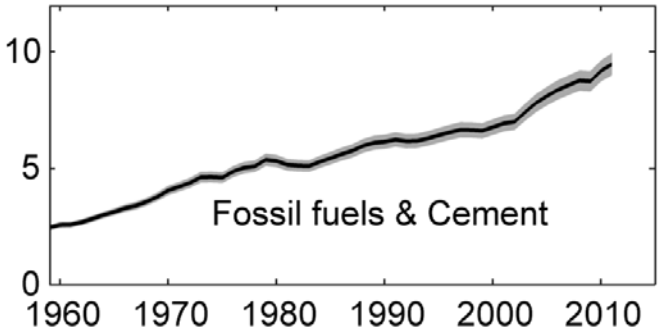

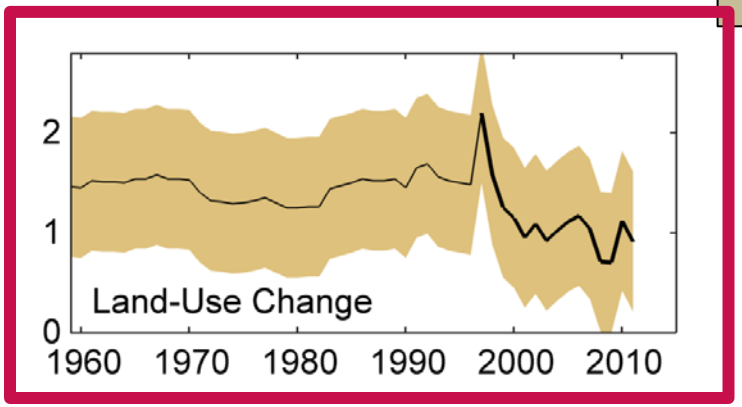

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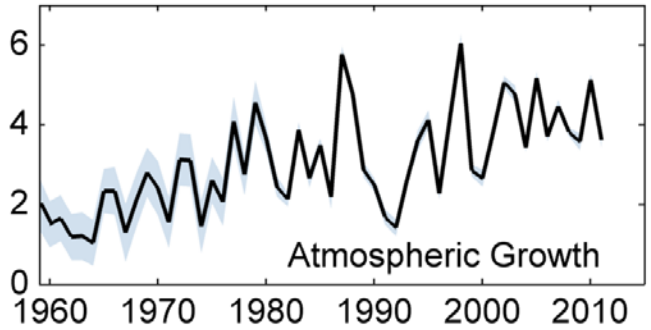
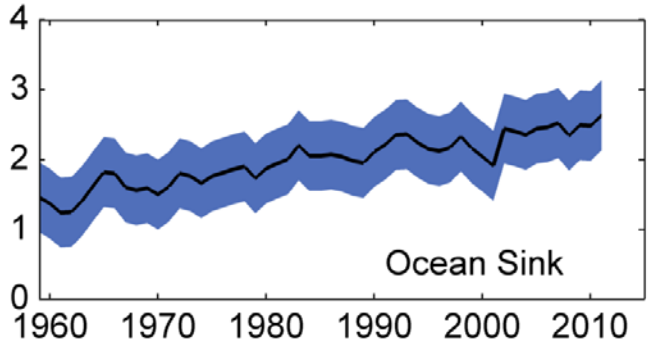
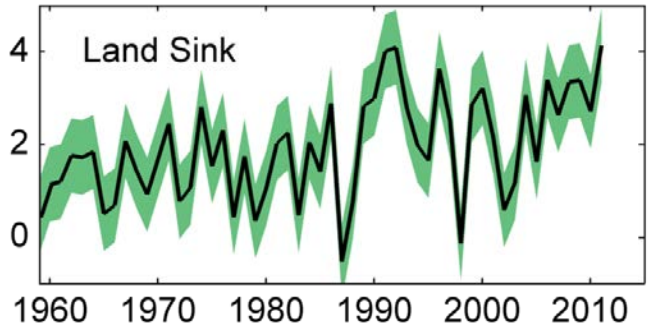
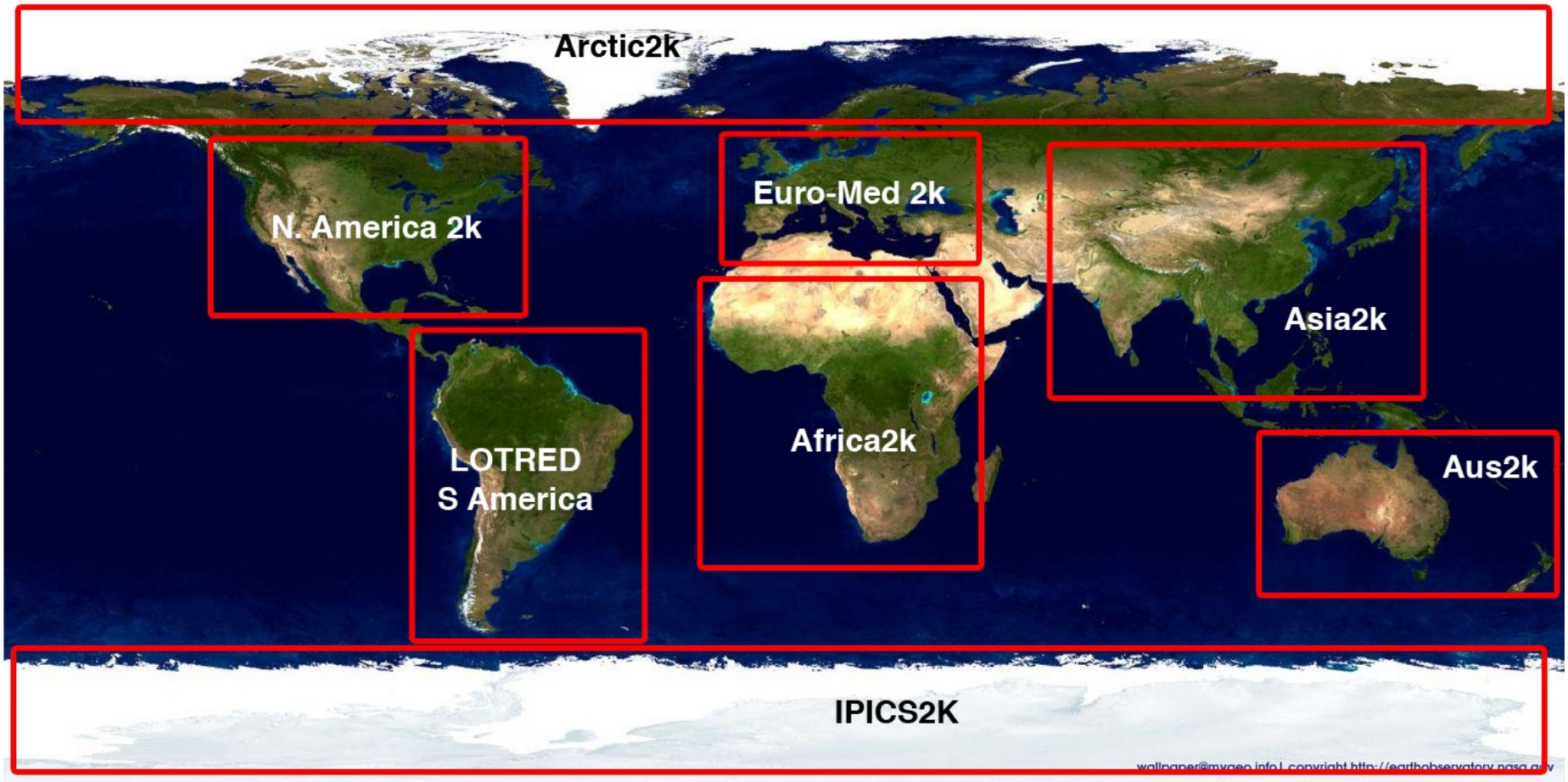






Le Quere *et al.* 2012;
Global Carbon Project 2012

2000 year regional climate reconstruction



PAGES 2k Consortium,
Nature Geoscience 2013

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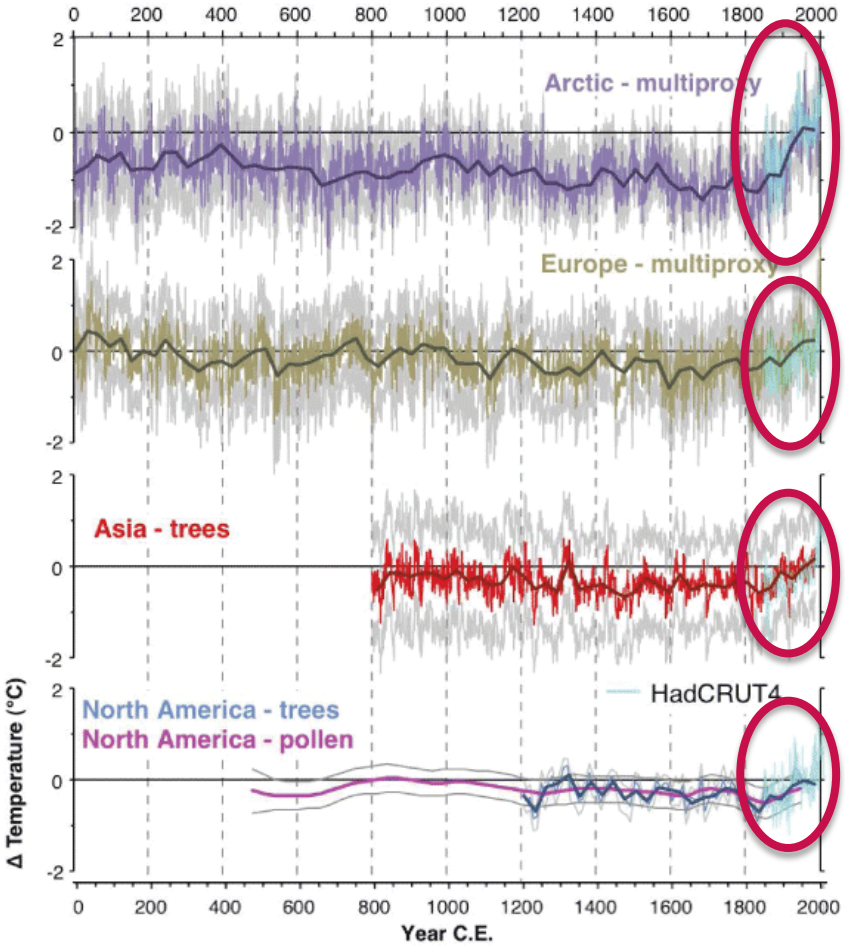
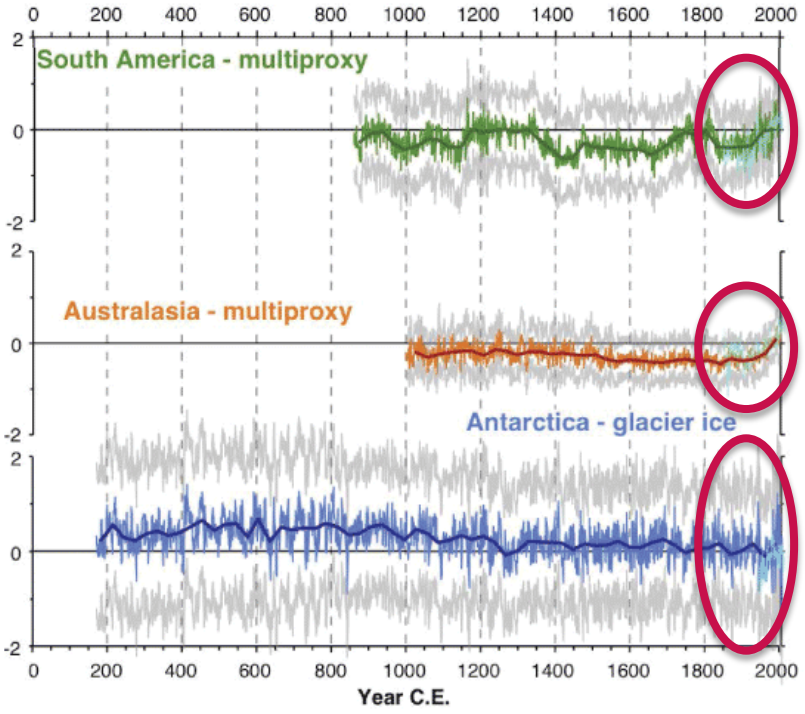
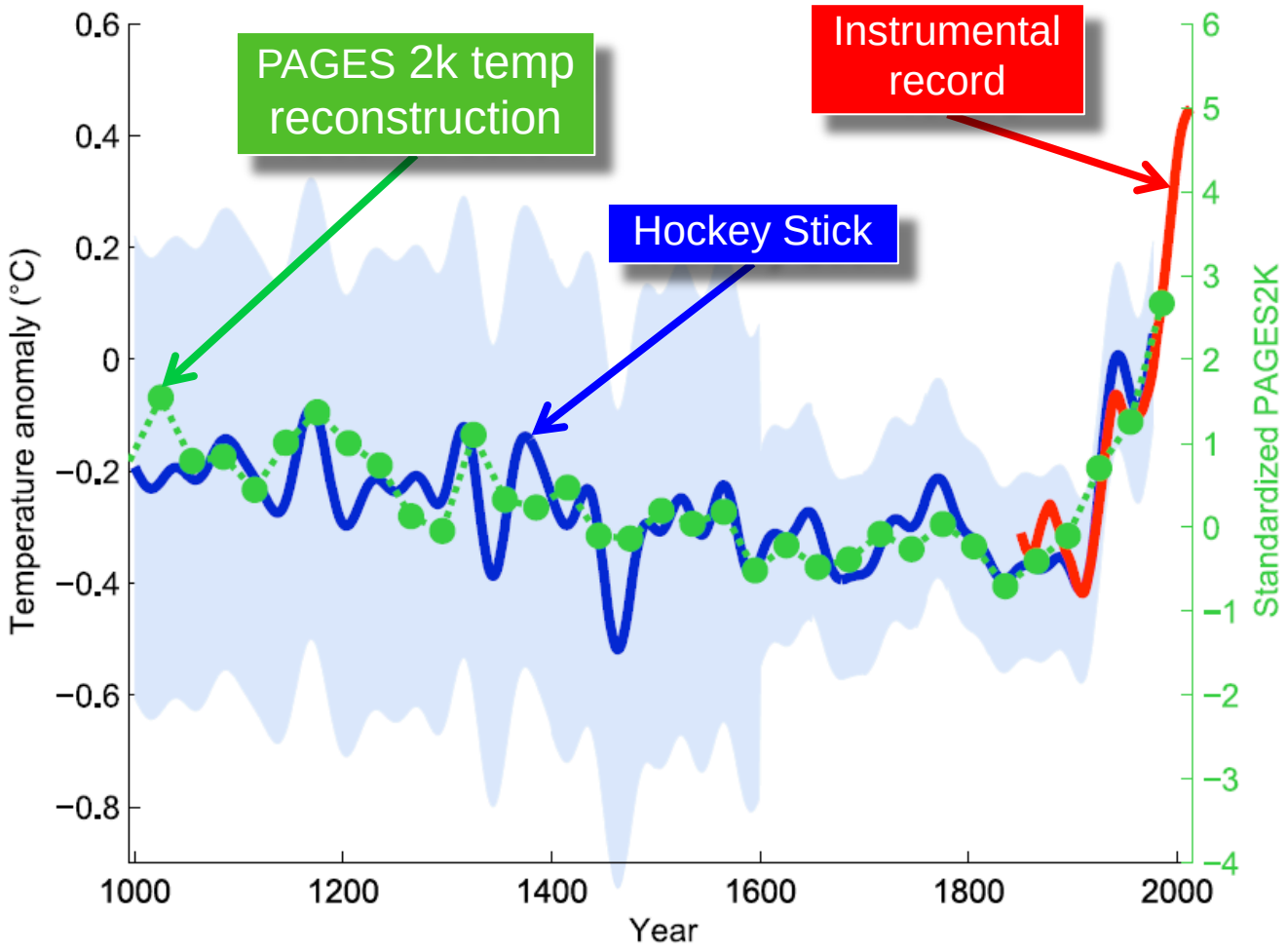




PAGES 2k Consortium,
Nature Geoscience 2013

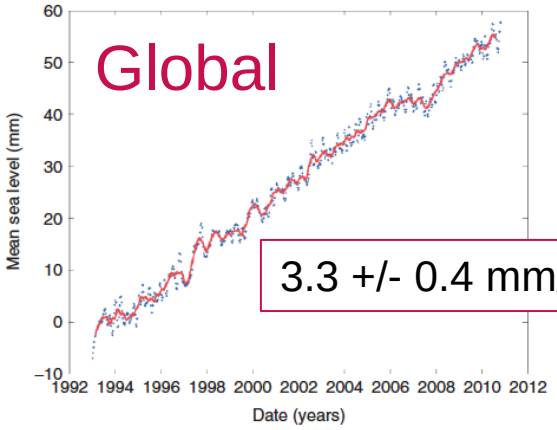
Extensive regional data confirms original trend



M. Mann 2013
PAGES 2k Consortium, *Nature Geoscience* 2013

Sea level change

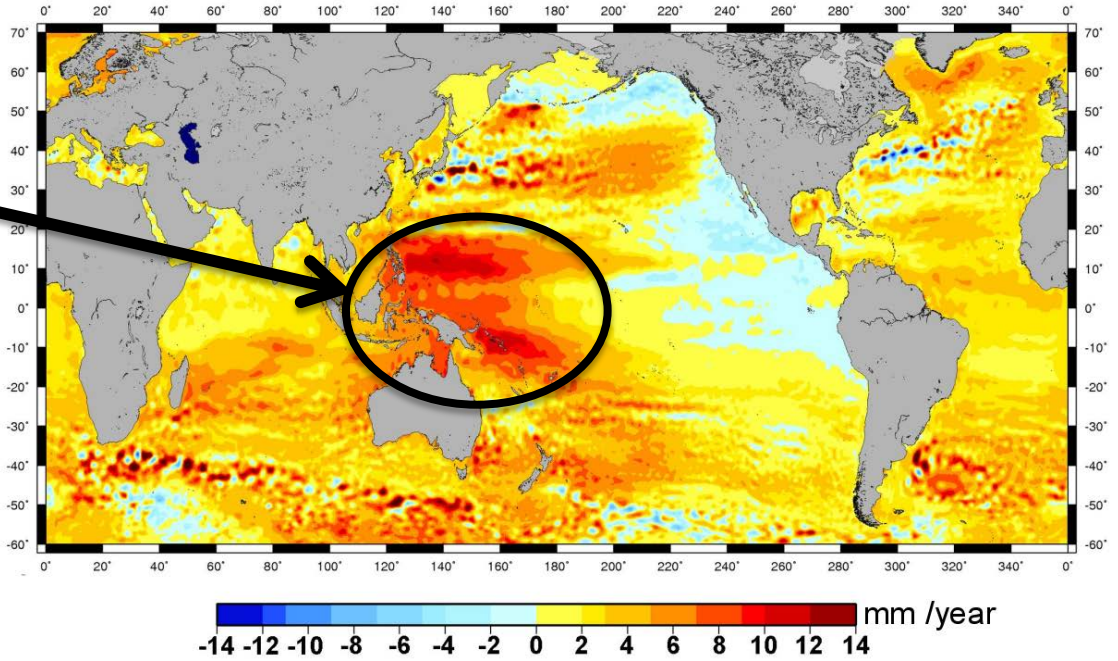
Jan 1993 to Oct 2010



1/3 thermal expansion
2/3 land ice mass loss

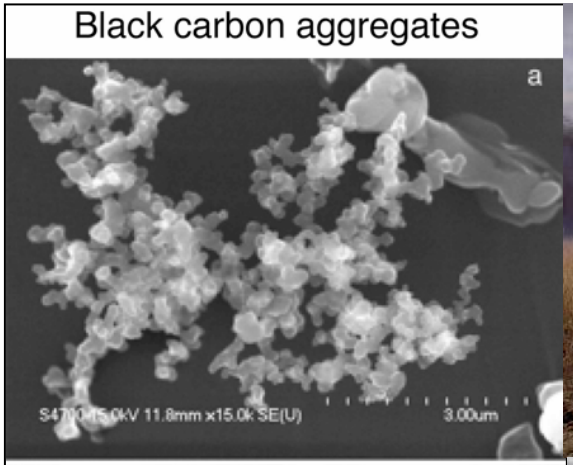
Regional

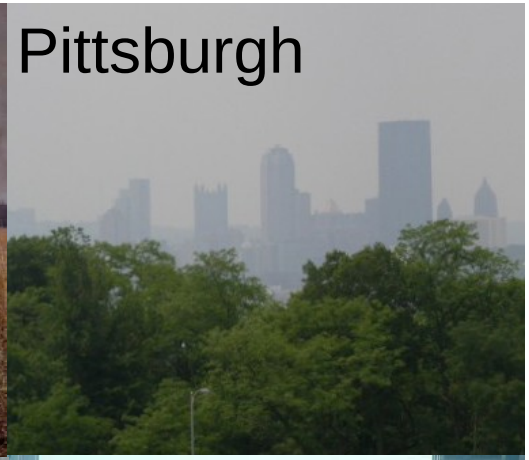
- **Spatial variation**
  - Tropical W.Pac 3-4x
  - Changing circulation patterns
- **Coastal zone assessments**
  - Multiple factors SLR
  - Climate-adaptation
  - Risk management

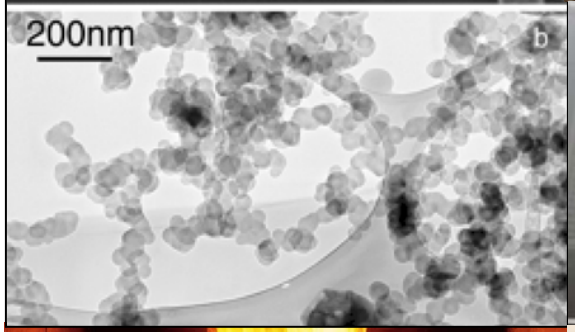


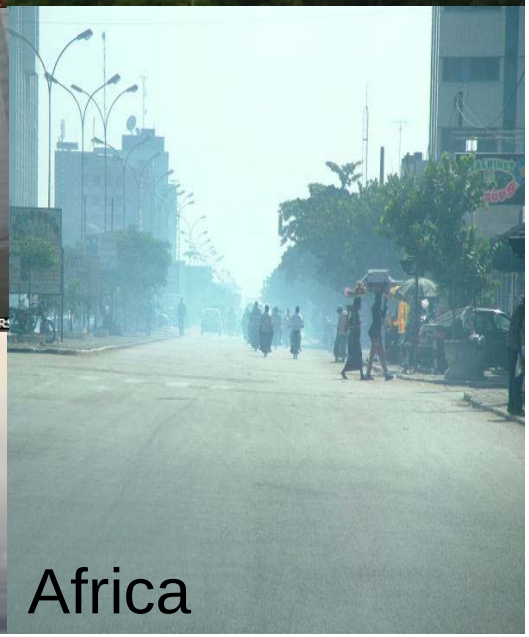
Cazenave and Remy, 2011

Black Carbon





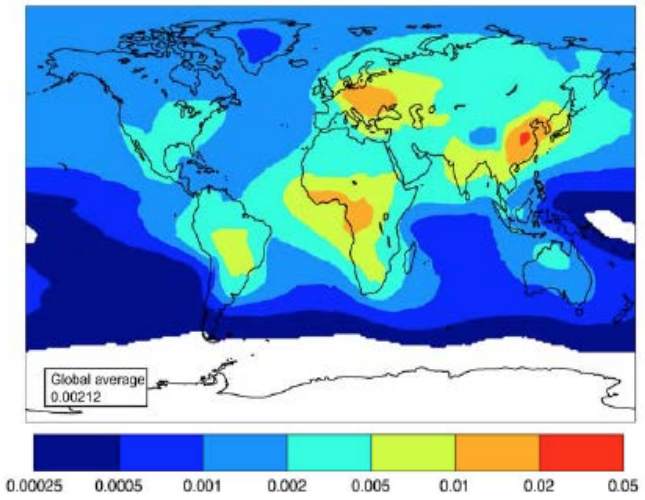




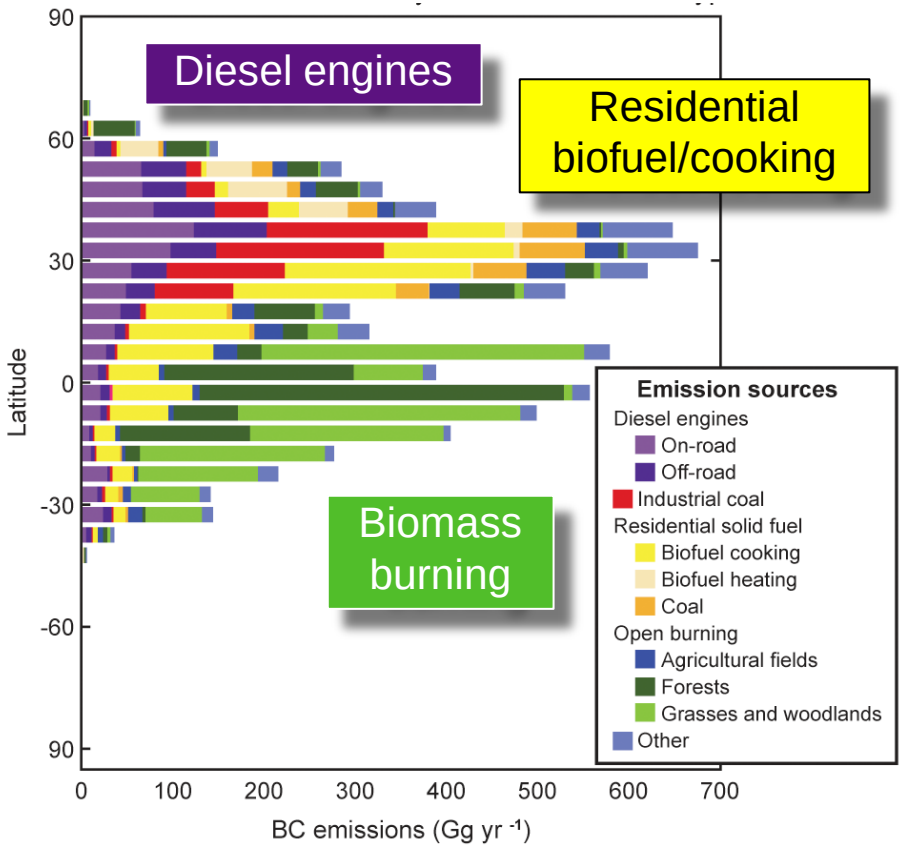
Black Carbon – distribution and sources

- 2nd only to CO_2 as warming agent
  1.7 vs 1.1 W/m^2
- Climate and health impacts
- Short atmos life-time
- Co-emitted species
- **MUST** still reduce CO_2

BC aerosol absorption optical depth



BC sources by latitude

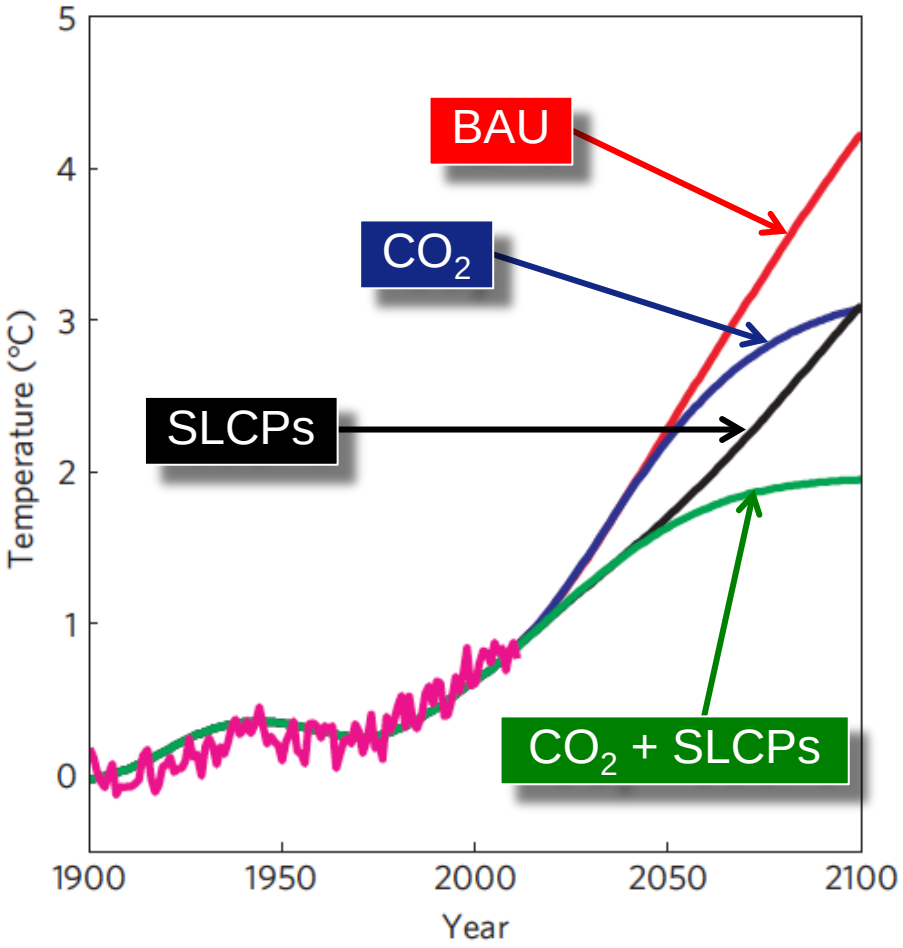


Bond *et al.* 2013 JGR Atmospheres

Benefit of short-lived pollutant reduction

SLCPs = BC + CH_4 + ozone + HFCs

- Reducing SLCP
  - faster response than CO_2 alone
  - reduce warming trend by about 50%
- Reducing CO_2 plus SLCP
  - Warming ≤ 2 C 2100



Hu *et al.* 2013

Valuing capital assets beyond GDP

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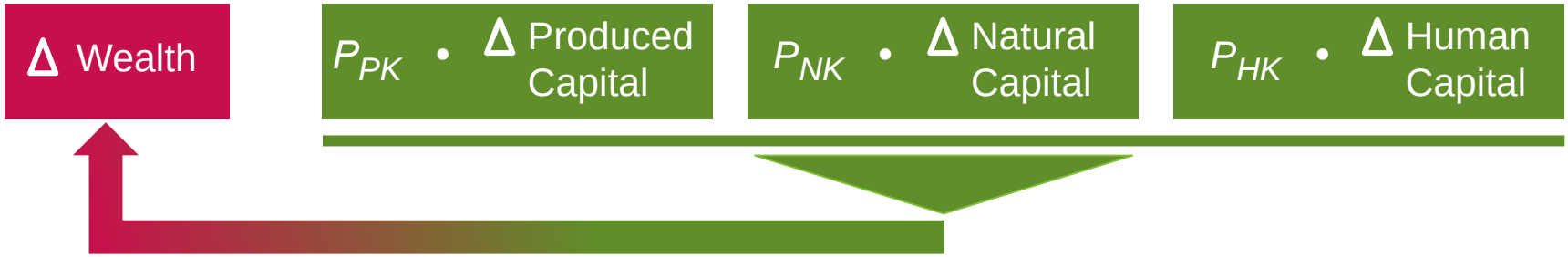
Inclusive wealth index

Inclusive Wealth = Value of Assets



Impact of climate change on:

- produced capital (e.g., industry, housing…)
- natural capital (e.g., C sequestration, water availability, ecosystems…)
- human capital (e.g., health, governance…)

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