

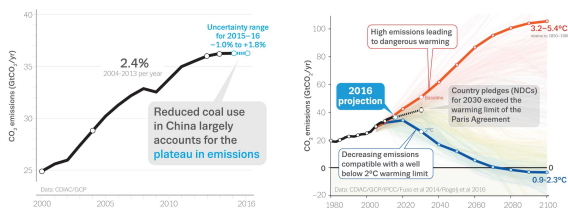
Carbon budgets, historic baselines, and agricultural contribution to climate mitigation

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On what trajectories are we with carbon dioxide and methane emissions?



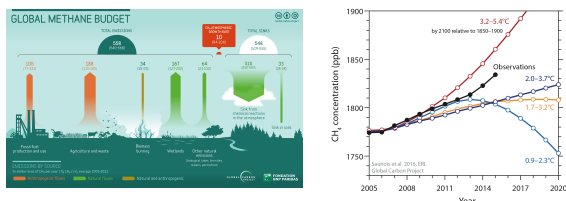
Carbon dioxide concentrations in the atmosphere have now crossed the 400 ppm threshold.



- Carbon dioxide emissions are almost flat since 3 years. They barely increased in 2016, despite large economic growth in parts of the globe.
- Decreased use of coal in China is the main reason behind the three-year slowdown.

Le Quéré et al. (2016): Global Carbon Budget 2016. Earth System Science Data 8, 605-649.

Methane is responsible for 20% of the global warming produced by all greenhouse gases so far.



Messages:

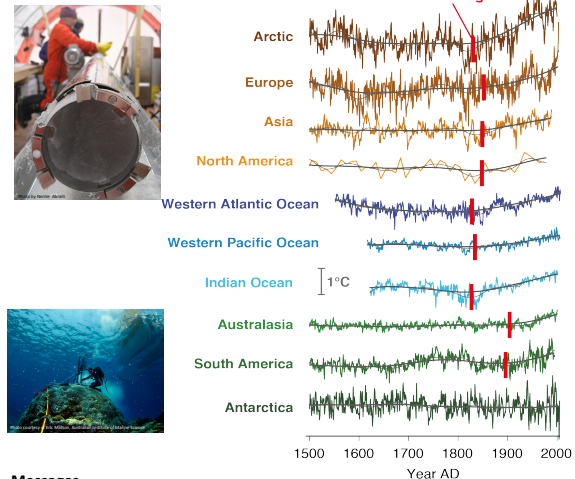
- Atmospheric CH4 concentrations are rising faster than at any time in the past two decades, probably dominantly due to increased biogenic emissions mostly from agriculture.
- Methane mitigation offers rapid climate benefits and economic, health and agricultural co-benefits that are highly complementary to CO2 mitigation.

Saunois et al. (2016): The Global Methane Budget 2000-2012, Earth System Science Data, 8, 1-54.

What is the temperature baseline for "pre-industrial"?



Natural recorders of Earth's climate, such as corals, tree-rings and ice cores, revealed that **human-induced climate warming** commenced in many parts of the world as early as the 1830s.



Messages

- The early warming since the 1830s moved the climate of many regions above the range of normal pre-industrial variability.
- This shows that Earth's climate responded rapidly to even small increases in atmospheric greenhouse gas levels during the early parts of the Industrial Revolution.
- It raises the question for future climate change mitigation efforts to discover if efforts to reduce or reverse greenhouse gas emissions could similarly result in rapid climate "paybacks" in some regions.
- Finding a relatively stable temperature baseline thus requires to go back to before the 1830s.

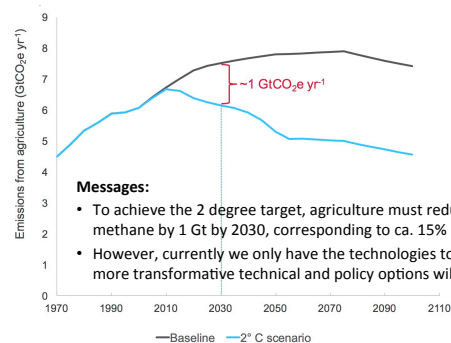
Abram et al. (2016): Early onset of industrial-era warming across the oceans and continents. Nature, 411-418.

What is the mitigation contribution and potential of agriculture?



Current agriculture practices can only deliver 21-40% of even the 2°C mitigation target.

Future agriculture will need to limit its greenhouse gas emissions to only 6-8 Gt of CO2 eq by 2030 while also increasing



Messages:

- To achieve the 2 degree target, agriculture must reduce emissions of nitrous oxide and methane by 1 Gt by 2030, corresponding to ca. 15% reduction from business as usual
- However, currently we only have the technologies to achieve ca. 30% of that target. Hence, more transformative technical and policy options will be needed.

Wollenberg et al. (2016): Reducing emissions from agriculture to meet the 2 °C target. Global Change Biology 22, 3859-3864.



Rice production in Eastern Uruguay. Photo by Neil Palmer/CGIAR.
Alternative wetting and drying in rice production can reduce emissions by up to 45% - we need more such technologies and the policies to support them

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