

Comment from the perspective of Management of Negative Emission Technologies (MaGNET)

Yoshiki Yamagata

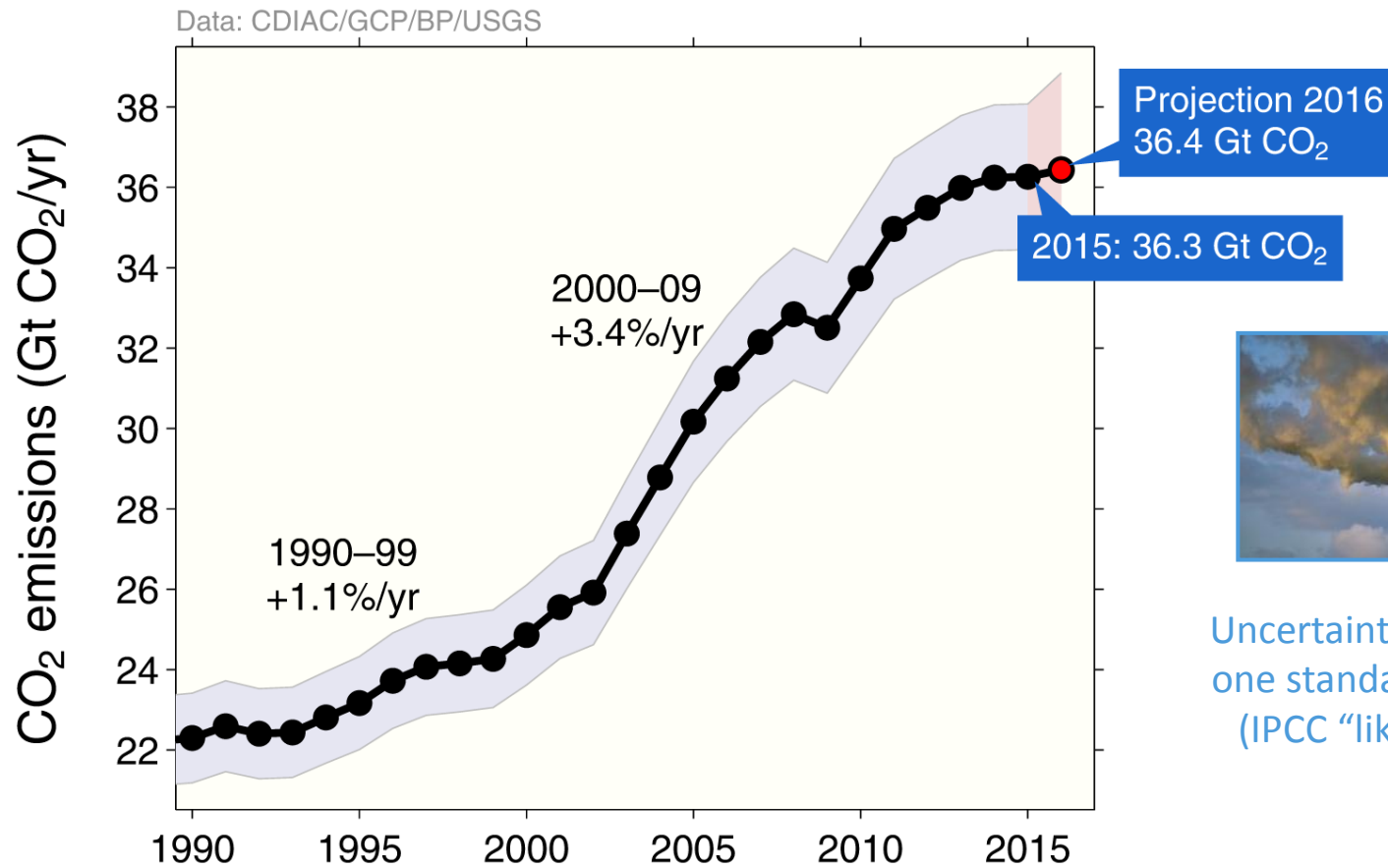
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Emissions from fossil fuel use and industry

Global emissions from fossil fuel and industry: 36.3 ± 1.8 GtCO₂ in 2015, 63% over 1990

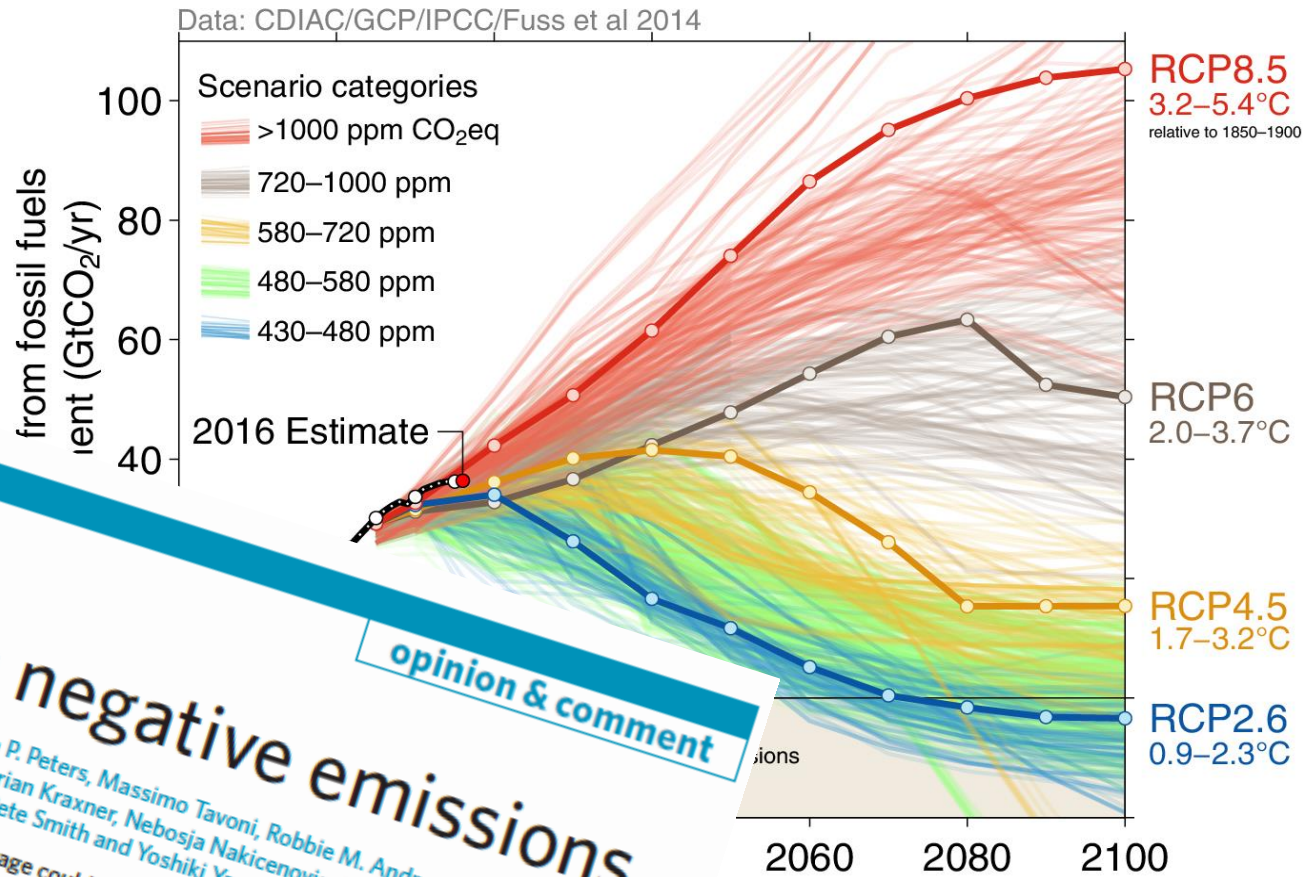
- Projection for 2016: 36.4 ± 2.3 GtCO₂, 0.2% higher than 2015



Uncertainty is $\pm 5\%$ for one standard deviation (IPCC “likely” range)

Observed emissions and emissions scenarios

The emission pledges to the Paris Agreement avoid the worst effects of climate change (4-5°C)
 Most studies suggest the pledges give a likely temperature increase of about 3°C in 2100



opinion & comment

COMMENTARY: Betting on negative emissions

Sabine Fuss, Josep G. Canadell, Glen P. Peters, Massimo Tavoni, Robbie M. Andrew, Philippe Ciais, Robert B. Jackson, Chris D. Jones, Florian Kraxner, Nebojsa Nakicenovic, Corinne Le Quéré, Michael R. Raupach, Ayyoob Sharifi, Pete Smith and Yoshiki Yamagata

Bioenergy with carbon capture and storage could be used to remove carbon dioxide from the atmosphere. However, its credibility as a climate change mitigation option is unproven and its widespread deployment in climate stabilization scenarios might become a dangerous distraction.

Future warming will depend strongly on the cumulative CO₂ emissions released through to the end of this century^{1,2}. A finite quota of cumulative CO₂ emissions, no more than 1,200 Gt CO₂, during energy generation, combined with capture of CO₂ produced by combustion and its subsequent storage in geological or ocean repositories. In other words, a net transfer of CO₂ from the atmosphere to the ground.

NE impacts on land

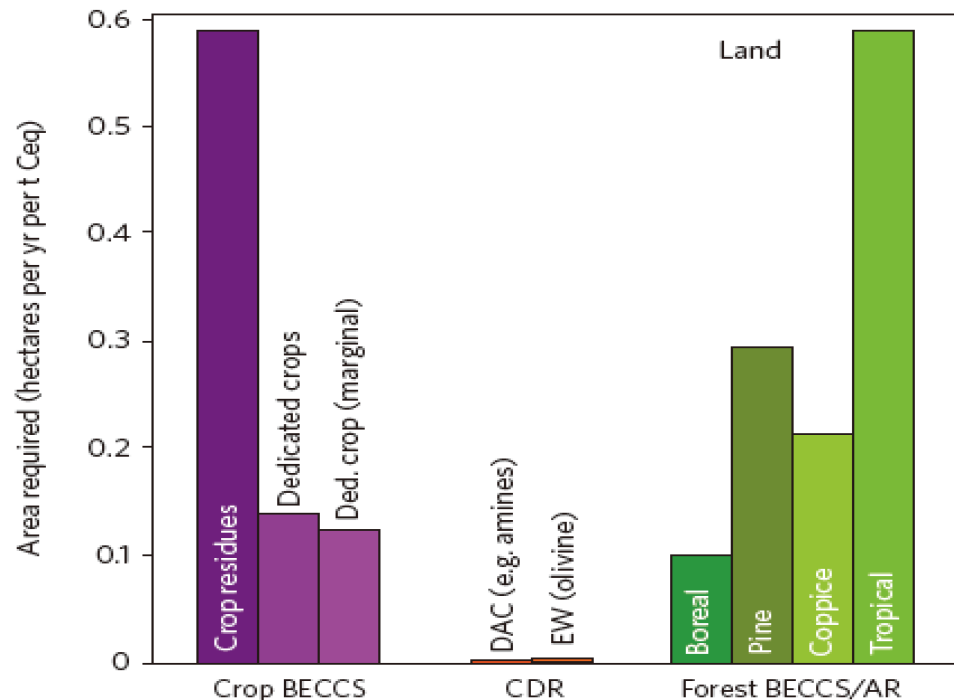
REVIEW ARTICLE

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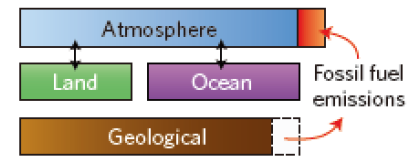
nature
climate change

Biophysical and economic limits to negative CO₂ emissions

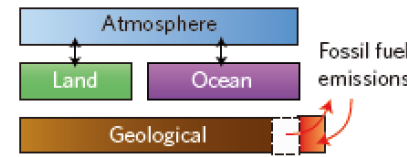
Pete Smith^{1*}, Steven J. Davis², Felix Creutzig^{3,4}, Sabine Fuss³, Jan Minx^{3,5,6}, Benoit Gabrielle^{7,8}, Etsushi Kato⁹, Robert B. Jackson¹⁰, Annette Cowie¹¹, Elmar Kriegler⁵, Detlef P. van Vuuren^{12,13}, Joeri Rogelj^{14,15}, Philippe Ciais¹⁶, Jennifer Milne¹⁷, Josep G. Canadell¹⁸, David McCollum¹⁵, Glen Peters¹⁹, Robbie Andrew¹⁹, Volker Krey¹⁵, Gyami Shrestha²⁰, Pierre Friedlingstein²¹, Thomas Gasser^{16,22}, Arnulf Grübler¹⁵, Wolfgang K. Heidug²³, Matthias Jonas¹⁵, Chris D. Jones²⁴, Florian Kraxner¹⁵, Emma Littleton²⁵, Jason Lowe²⁴, José Roberto Moreira²⁶, Nebojsa Nakicenovic¹⁵, Michael Obersteiner¹⁵, Anand Patwardhan²⁷, Mathis Rogner¹⁵, Ed Rubin²⁸, Ayyoob Sharifi²⁹, Asbjørn Torvanger¹⁹, Yoshiki Yamagata³⁰, Jae Edmonds³¹ and Cho Yongsung³²



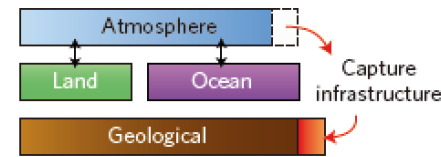
a Fossil fuel energy



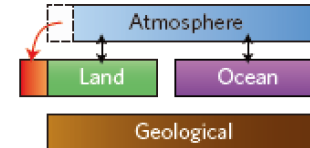
c Carbon capture and storage (CCS)



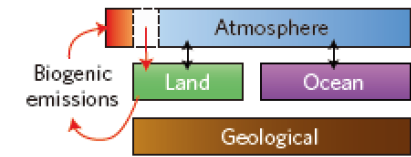
e Direct air capture (DAC)



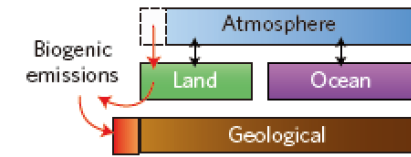
g Afforestation/changed agricultural practices



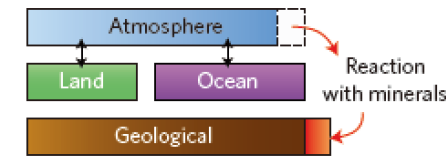
b Bioenergy



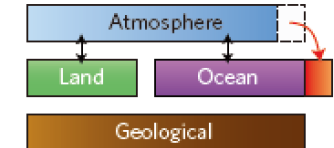
d Bioenergy + CCS (BECCS)



f Enhanced weathering



h Ocean fertilization/alkalinization



NE impacts on land

