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Fossil fuel CO₂ emissions up by 29 per cent since 2000

The strongest evidence yet that the rise in atmospheric CO₂ emissions continues to outstrip the ability of the world's natural 'sinks' to absorb carbon is published this week in the journal *Nature Geoscience*.

An international team of researchers under the umbrella of the Global Carbon Project reports that over the last 50 years the average fraction of global CO₂ emissions that remained in the atmosphere each year was around 43 per cent - the rest was absorbed by the Earth's carbon sinks on land and in the oceans. During this time this fraction has likely increased from 40 per cent to 45 per cent, suggesting a decrease in the efficiency of the natural sinks. The team brings evidence that the sinks are responding to climate change and variability.

The scientists report a 29 per cent increase in global CO₂ emissions from fossil fuel between 2000 and 2008 (the latest year for which figures are available), and that in spite of the global economic downturn emissions increased by 2 per cent during 2008. The use of coal as a fuel has now surpassed oil and developing countries now emit more greenhouse gases than developed countries – with a quarter of their growth in emissions accounted for by increased trade with the West.

Lead author Prof Corinne Le Quéré of the University of East Anglia (UEA) and the British Antarctic Survey said: "The only way to control climate change is through a drastic reduction in global CO₂ emissions. The Earth's carbon sinks are complex and there are some gaps in our understanding, particularly in our ability to link human-induced CO₂ emissions to atmospheric CO₂ concentrations on a year-to-year basis. But, if we can reduce the uncertainty about the carbon sinks, our data could be used to verify the effectiveness of climate mitigations policies."

The main findings of the study include:

- CO₂ emissions from the burning of fossil fuels increased by two per cent from 2007 to 2008, by 29 per cent between 2008 and 2000, and by 41 per cent between 2008 and 1990 – the reference year of the Kyoto Protocol.
- CO₂ emissions from the burning of fossil fuels have increased at an average annual rate of 3.4 per cent between 2000 and 2008, compared with one per cent per year in the 1990s.
- Emissions from land use change have remained almost constant since 2000, but now account for a significantly smaller proportion of total anthropogenic CO₂ emissions (20 per cent in 2000 to 12 per cent in 2008).

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- The fraction of total CO₂ emissions remaining in the atmosphere has likely increased from 40 to 45 per cent since 1959, models suggests this is due to the response of the natural CO₂ sinks to climate change and variability.
- Emissions from coal are now the dominant fossil fuel emission source, surpassing 40 years of oil emission prevalence.
- The financial crisis had a small but discernable impact on emissions growth in 2008 – with a two per cent increase compared with an average 3.6 per cent over the previous seven years. On the basis of projected changes in GDP, emissions for 2009 are expected to fall to their 2007 levels, before increasing again in 2010.
- Emissions from emerging economies such as China and India have more than doubled since 1990 and developing countries now emit more greenhouse gases than developed countries.
- A quarter of the growth in CO₂ emissions in developing countries can be accounted for by an increase in international trade of goods and services.

The researchers called for more work to be done to improve our understanding of the land and ocean CO₂ sinks, so that global action to control climate change can be independently monitored. The sinks have a major influence on climate change and are important in understanding the link between anthropogenic CO₂ emissions and atmospheric CO₂ concentration. But so far scientists have not been able to calculate the CO₂ uptake of the sinks with sufficient accuracy to explain all the annual changes in atmospheric CO₂ concentration, which hinders the scientists' ability to monitor the effectiveness of CO₂ mitigations policies.

Further information available on: www.globalcarbonproject.org

'Trends in the sources and sinks of carbon dioxide' by Corinne Le Quéré (University of East Anglia/British Antarctic Survey), Michael Raupach (CSIRO), Josep Canadell (CSIRO), Gregg Marland (Oak Ridge National Laboratory), Laurent Bopp (Laboratoire des Sciences du Climat et de Environnement), Philippe Ciais (Laboratoire des Sciences du Climat et de Environnement), Thomas Conway (NOAA), Scott Doney (Woods Hole Oceanographic Institution), Richard Feely (Pacific Marine Environmental Laboratory), Pru Foster (University of Bristol), Pierre Friedlingstein (Laboratoire des Sciences du Climat et de Environnement/University of Bristol), Kevin Gurney (Purdue University), Richard Houghton (Woods Hole Research Center), Johanna House (University of Bristol), Chris Huntingford (Centre for Ecology and Hydrology), Peter Levy (Centre for Ecology and Hydrology), Mark Lomas (University of Sheffield), Joseph Majkut (Princeton University), Nicolas Metzler (Université Pierre et Marie Curie), Jean Ometto (Instituto Nacional de Pesquisas Espaciais), Glen Peters (Center for International Climate and Environmental Research), Colin Prentice (University of Bristol), James Randerson (University of California), Steven Running (University of Montana), Jorge Sarmiento (University of Sheffield), Ute Shuster (University of East Anglia), Stephen Sitch (University of Leeds), Taro Takahashi (Columbia University), Nicolas Viovy (Laboratoire des Sciences du Climat

et de Environnement), Guido van der Werf (University of Amsterdam) and Ian Woodward (University of Sheffield) is published by Nature Geoscience on Tuesday November 17 2009.

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Notes to Editors

1. Issued on behalf of the international team by Simon Dunford at the University of East Anglia Communications Office: +44 (0)1603 592203 or s.dunford@uea.ac.uk.
2. The full report is available as a PDF on request.
3. The University of East Anglia has a longstanding reputation for its world-class environmental research. It is also well known for the energy efficiency of its newer buildings. Its new biomass plant is the biggest carbon-reducing project in the higher education sector and will reduce campus carbon emissions by at least 34 per cent.
4. British Antarctic Survey (BAS), a component of the Natural Environment Research Council, delivers world-leading interdisciplinary research in the Polar Regions. Its skilled science and support staff based in Cambridge, Antarctica and the Arctic, work together to deliver research that underpins a productive economy and contributes to a sustainable world. Its numerous national and international collaborations, leadership role in Antarctic affairs and excellent infrastructure help ensure that the UK maintains a world leading position. BAS has over 450 staff and operates five research stations, two Royal Research Ships and five aircraft in and around Antarctica.