GLOBAL CARBON PROJECT

Observational constraints on the global carbon budget

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UNFCCC plenary, Paris, 4pm on December 12th 2015

IPCC plenary, Stockholm, 4am on Sept 27th 2013

futureearth | GLOBAL CHANGE | Tyndall Centre for Climate Change Research | UEA

Teams

The work presented here has been possible thanks to the enormous enthusiasm, and observational and modeling efforts of the institutions and networks below

Atmospheric CO_2 datasets
NOAA/ESRL (Dlugokencky et al. 2015)
Scripps (Keeling et al. 1976)

Fossil Fuels and Industry
CDIAC (Boden et al. 2015)
USGS, 2015
UNFCCC, 2015
BP, 2015

Consumption Emission
Peters et al. 2011

Land-Use Change
Houghton et al. 2012
van der Werf et al. 2010

Atmospheric inversions
CarbonTracker (Peters et al. 2010)
Jena CarboScope (Rödenbeck et al. 2003)
MACC (Chevallier et al. 2005)

Land models
CLM4-5BGC | ISAM | JSBACH | JULES | LPJ-GUESS | LPJ | LPJmL | OCNv1.r240 | ORCHIDEE | VEGAS | VISIT

Ocean models
NEMO-PlankTOM5 | NEMO-PISCES (IPSL) | CCSM-BEC | MICOM-HAMMOC | MPIOM-HAMMOC | NEMO-PISCES (CNRM) | CSIRO | MITgem-REcoM2

SOCAT
SOCATv3 (Bakker et al. 2014, 2015)

Ocean Data products
Jena CarboScope (Rödenbeck et al. 2014)
Landschützer et al. 2015

Full references provided in Le Quéré et al 2015

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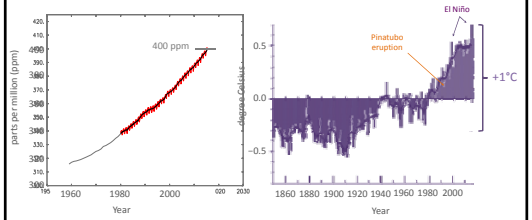
Latest trends on atmospheric CO_2 and temperature

atmospheric CO_2 concentration | global temperature

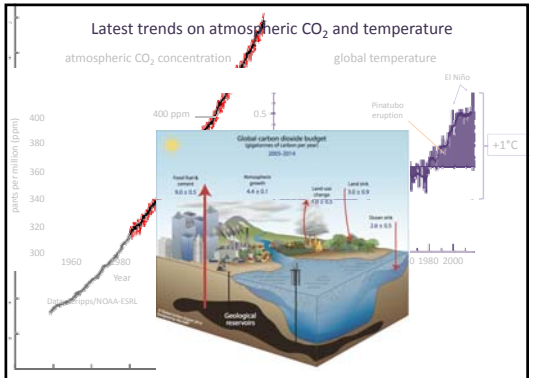


Data: Scripps/NOAA-ESRL | Data: HadCRUT4

UEA

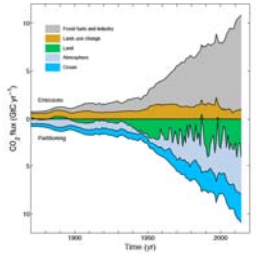
Latest trends on atmospheric CO_2 and temperature

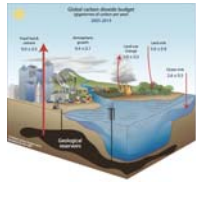
atmospheric CO_2 concentration | global temperature



Data: Scripps/NOAA-ESRL

the concept of global carbon budgets

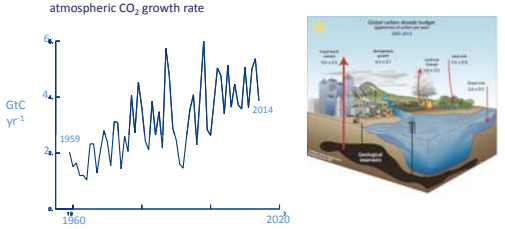




Source: Le Quéré et al ESSD 2015; Global Carbon Project 2015

information in the atmospheric CO_2 growth

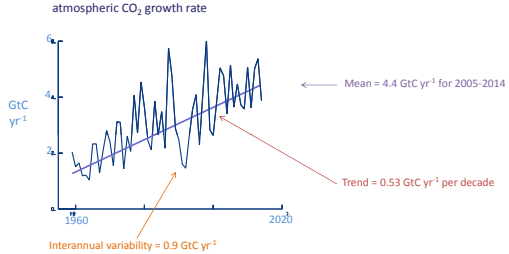
atmospheric CO_2 growth rate



Source: NOAA/ESRL Data; Le Quéré et al ESSD 2015; Global Carbon Project 2015

information in the atmospheric CO_2 growth

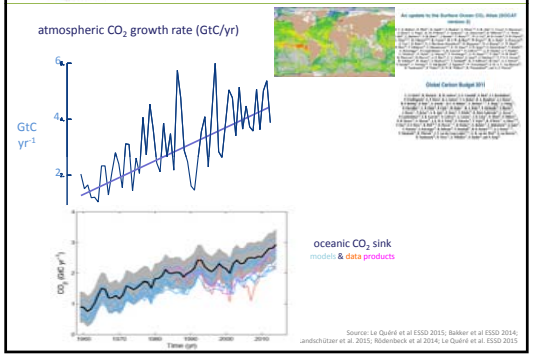
atmospheric CO_2 growth rate



Source: NOAA/ESRL Data; Le Quéré et al ESSD 2015; Global Carbon Project 2015

contributions of the ocean

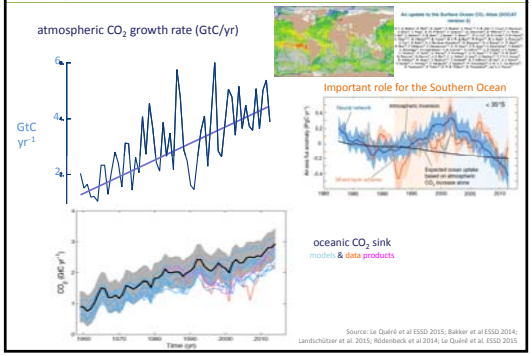
atmospheric CO_2 growth rate (GtC/yr)



Source: Le Quéré et al ESSD 2015; Bakker et al ESSD 2014; Landschützer et al. 2015; Rödenbeck et al 2014; Le Quéré et al. ESSD 2015

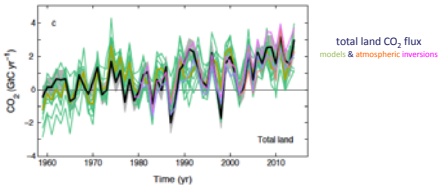
contributions of the ocean

atmospheric CO_2 growth rate (GtC/yr)



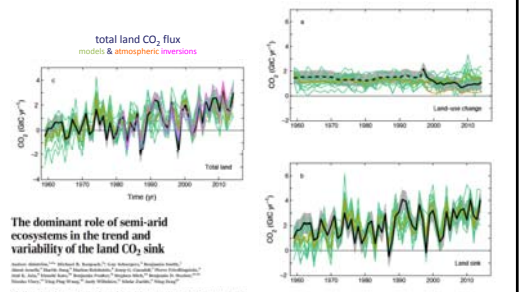
Source: Le Quéré et al ESSD 2015; Bakker et al ESSD 2014; Landschützer et al. 2015; Rödenbeck et al 2014; Le Quéré et al. ESSD 2015

contributions of the land



Source: Le Quéré et al ESSD 2015; Global Carbon Budget 2015; TRENDY model intercomparison

contributions of the land



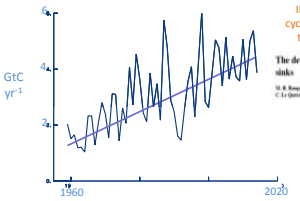
The dominant role of semi-arid ecosystems in the trend and variability of the land CO_2 sink

Contribution of semi-arid ecosystems to interannual variability of the global carbon cycle

Source: Le Quéré et al ESSD 2015; Global Carbon Budget 2015; TRENDY model intercomparison

role of climate change in past trends

atmospheric CO_2 growth rate (GtC/yr)



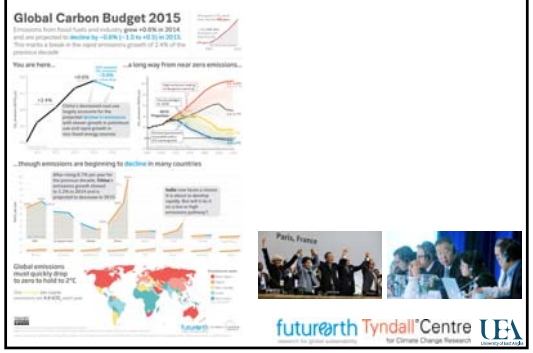
Role of climate change in past trends?

IPCC: "Climate change will affect carbon cycle processes in a way that will exacerbate the increase of CO_2 in the atmosphere"

The declining uptake rate of atmospheric CO_2 by land and ocean sinks

data access and reproducibility

contributions to the public understanding of science



summary of climate variables used

Atmospheric CO_2 datasets
distributed network

Fossil Fuels and Industry
energy statistics
conversion factors

Consumption Emission
trade statistics

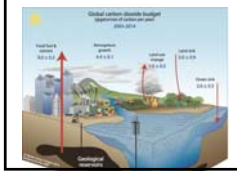
Land-Use Change
land-cover change
satellite products of biomass density & fires

Atmospheric inversions
atmospheric CO_2 distribution

Land models
observed precipitations, temperature, radiation
atmospheric CO_2 concentration

Ocean models
winds and buoyancy fluxes
atmospheric CO_2 concentration

Ocean Data products
surface pCO_2 data (SOCAT)
satellite products for SST, Chla, SSS, MLD (modelled)



Reduction of uncertainties and increased confidence in processes will need expansion of multiple key variables