The role of Short Lived Climate Forcers in mitigation in the transport sector

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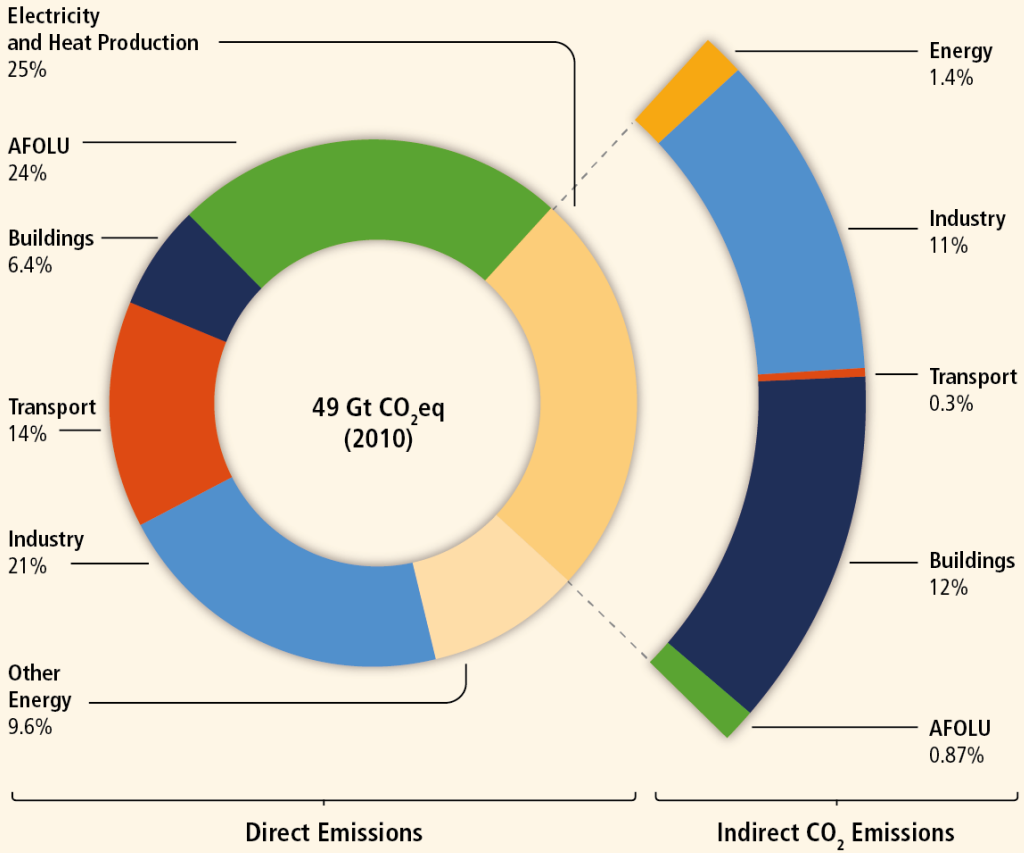
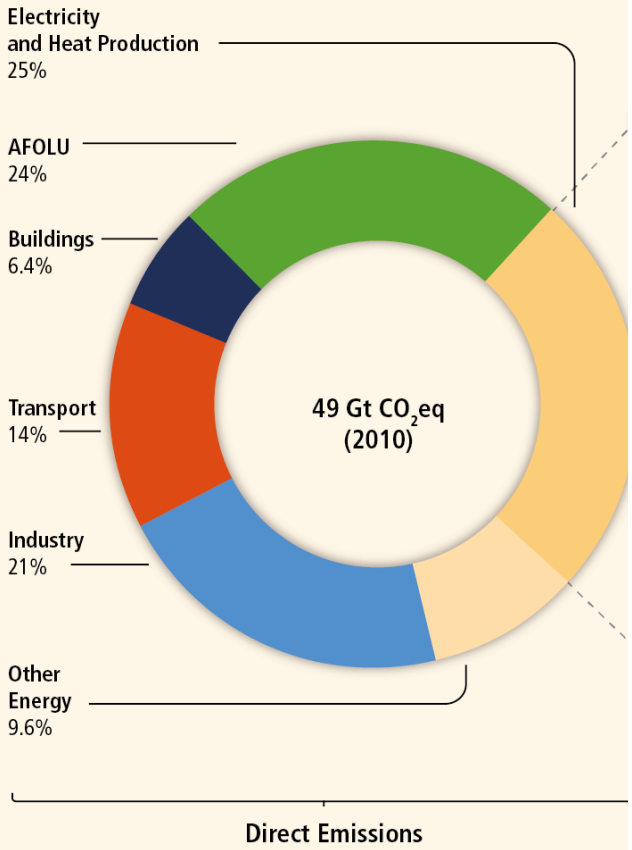
GHG emissions by economic sectors:

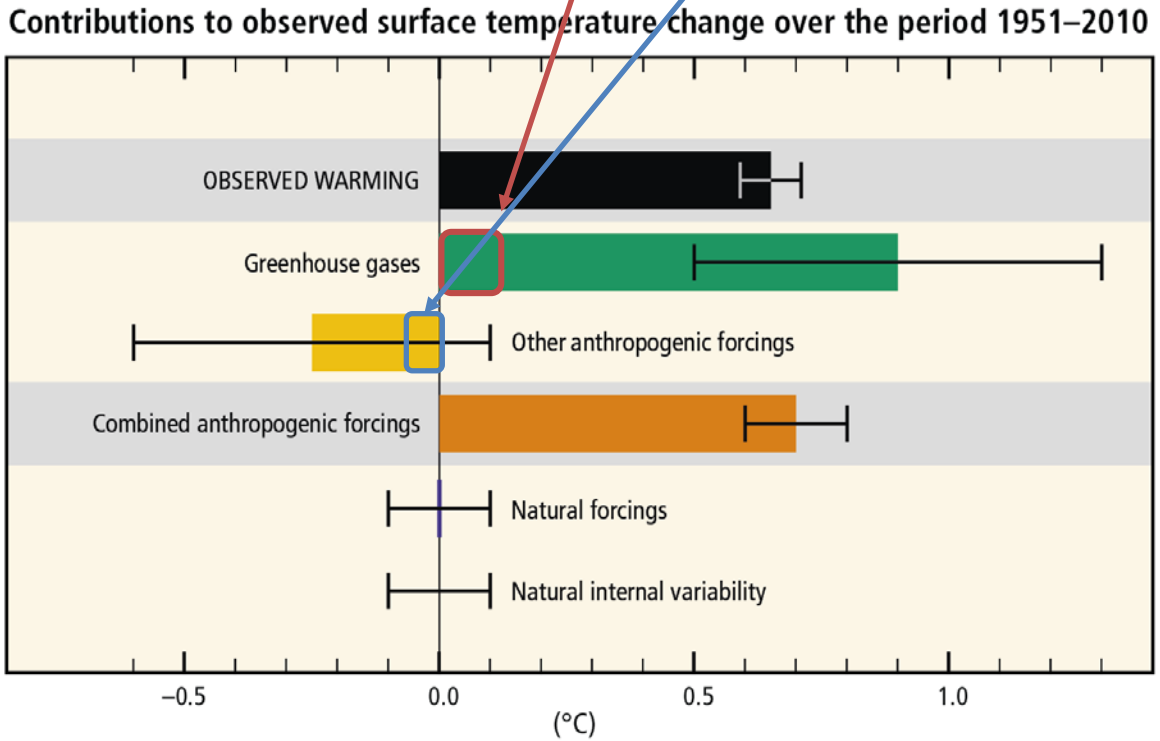


GHG emissions by economic sectors:



Cooling from transport SLCF

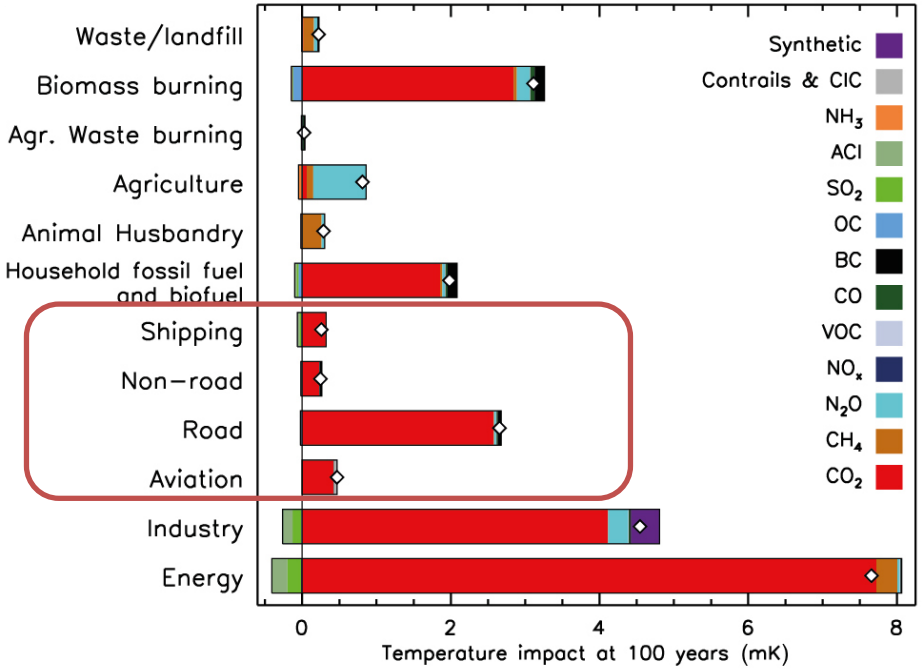
Warming from transport GHG emissions

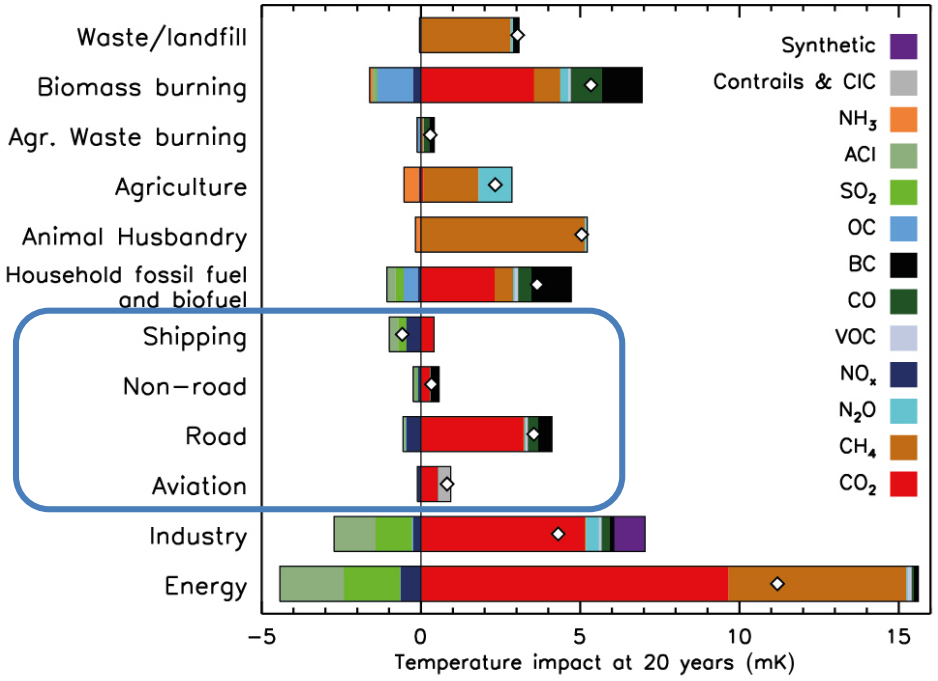


Trace gas or PM	Approximate lifetime in the free troposphere
NO_2	days
SO_2	days to weeks
CO	weeks to months
VOCs	hours to months
CH_4	8-9 years
NH_3	days
PM	days to weeks
ozone	weeks to months

SLCF atmospheric lifetimes of hours – weeks – months, depending on specie.

CO_2: decades – centuries, 20% remaining for millennia





Temperature impacts of transport dominated by CO_2 on the 100 year scale.

On shorter time scale (20 years) SLCF play larger role relatively.

Temperature impacts from a pulse emission, 2008 values

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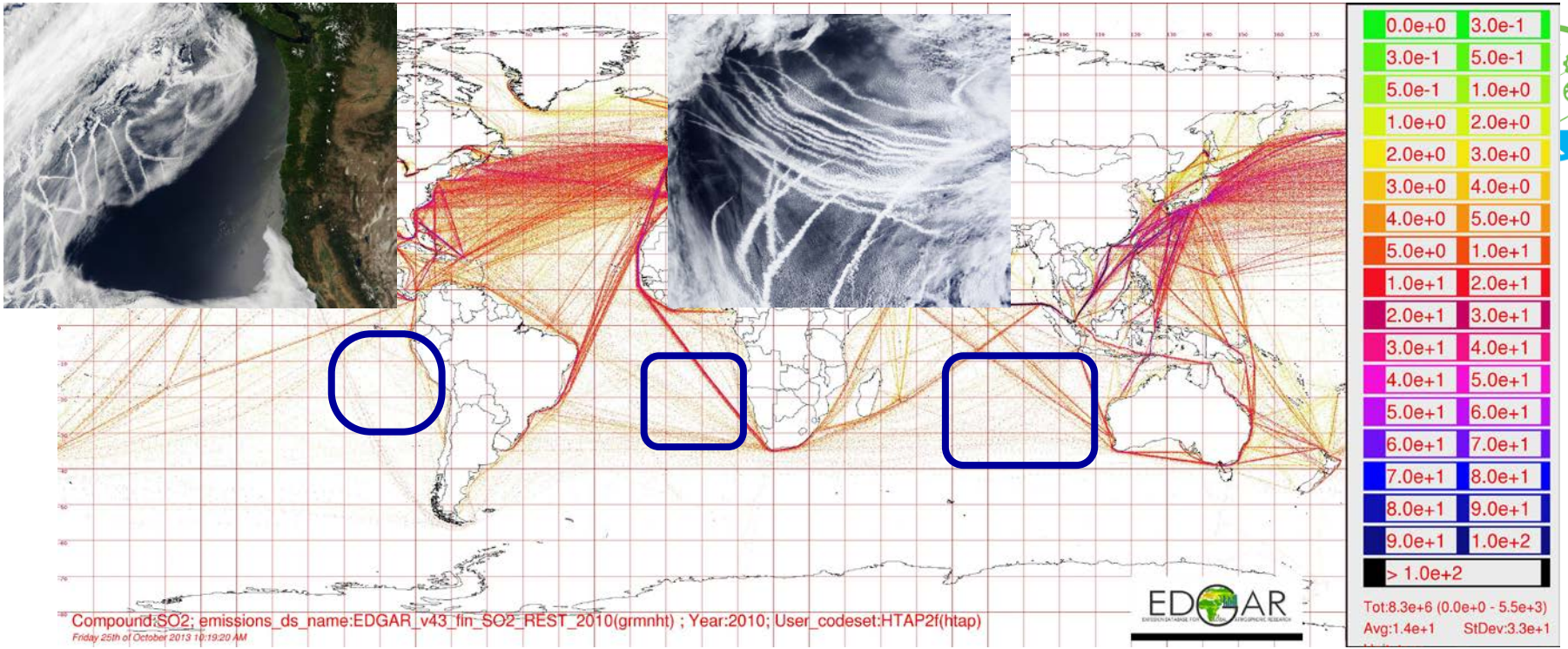
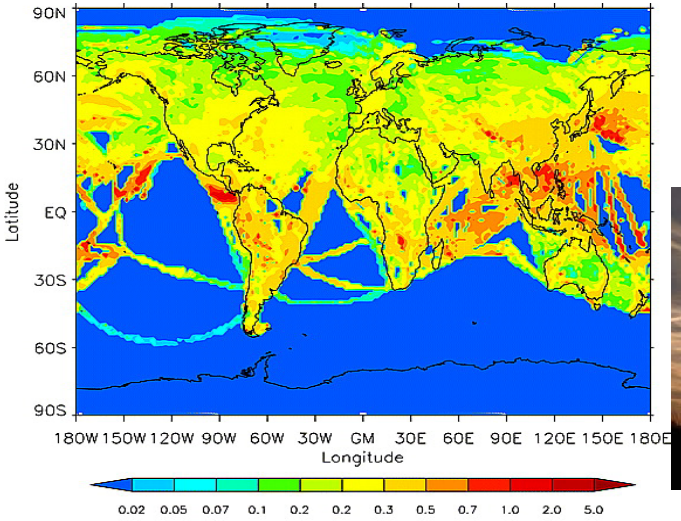


Shipping: SO_2 emissions (ton) in 2010

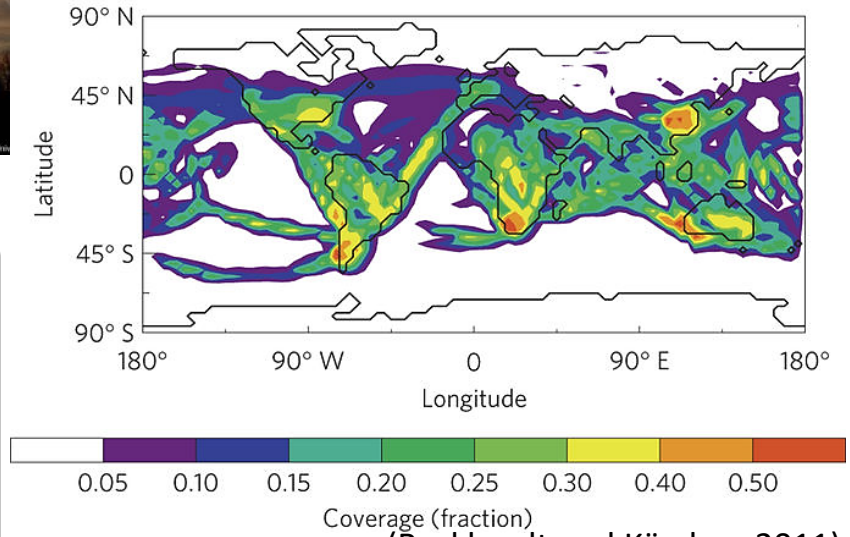
Aviation SLCF emissions cause formation of contrails and contrail-cirrus -> warming

Mean contrail optical depth, 2002



(Rap et al. 2010)

Mean cover of contrail-cirrus, 2002



(Burkhardt and Kärcher, 2011)

When assessing the climate impacts of transport and mitigation options, one needs to take aerosol - cloud interactions into account.

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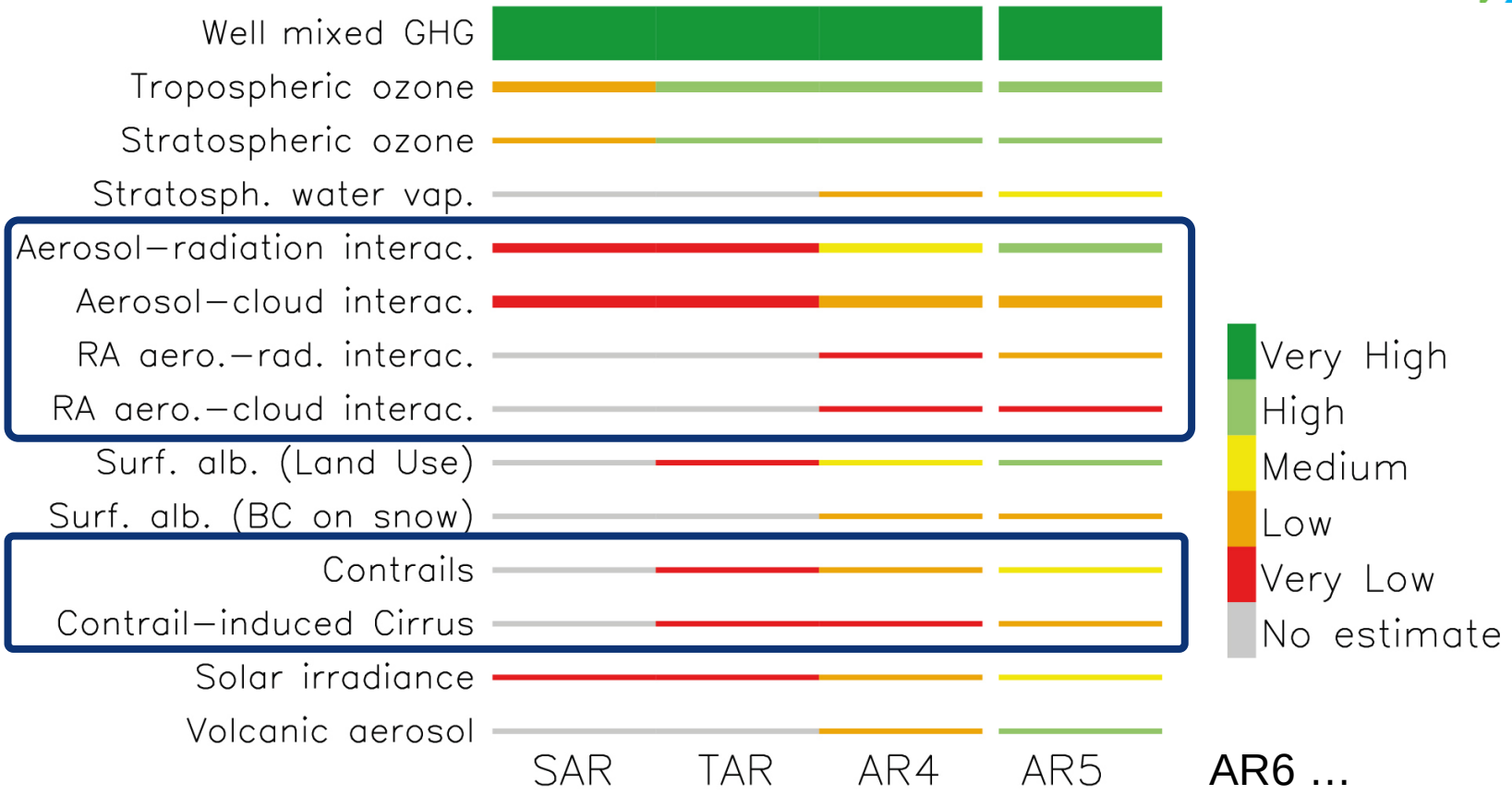
Confidence level of forcing estimates improving



Thanks for your attention!

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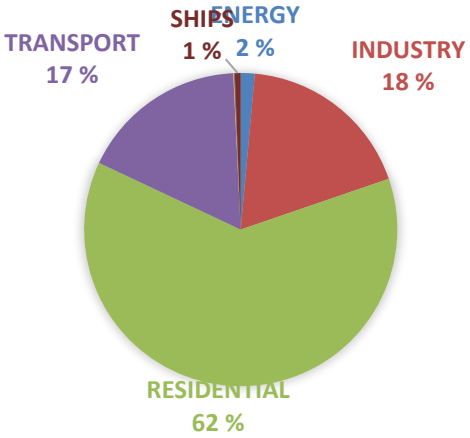
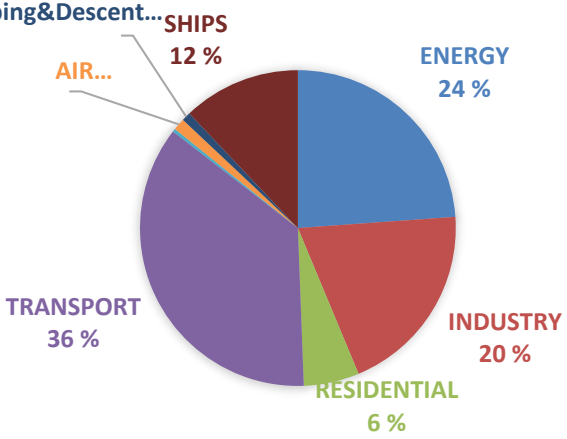
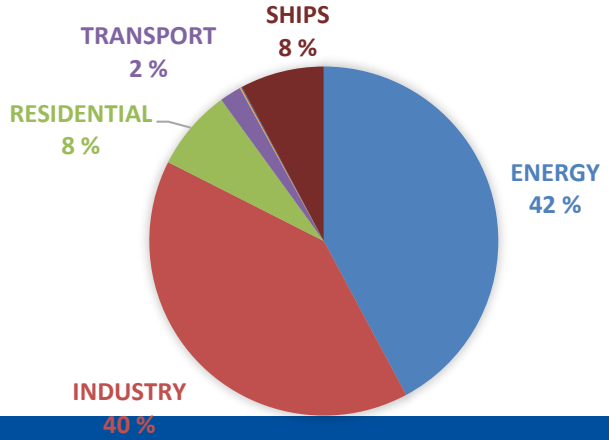


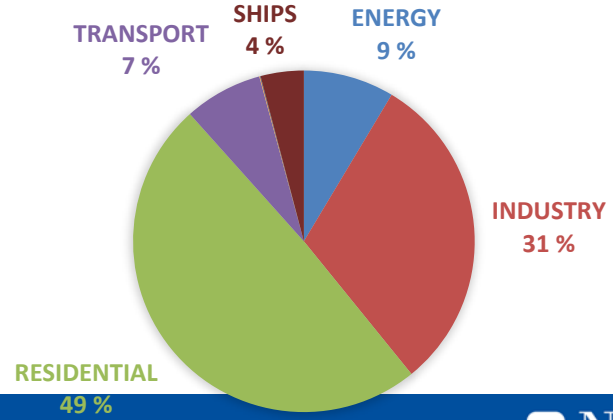
NOX

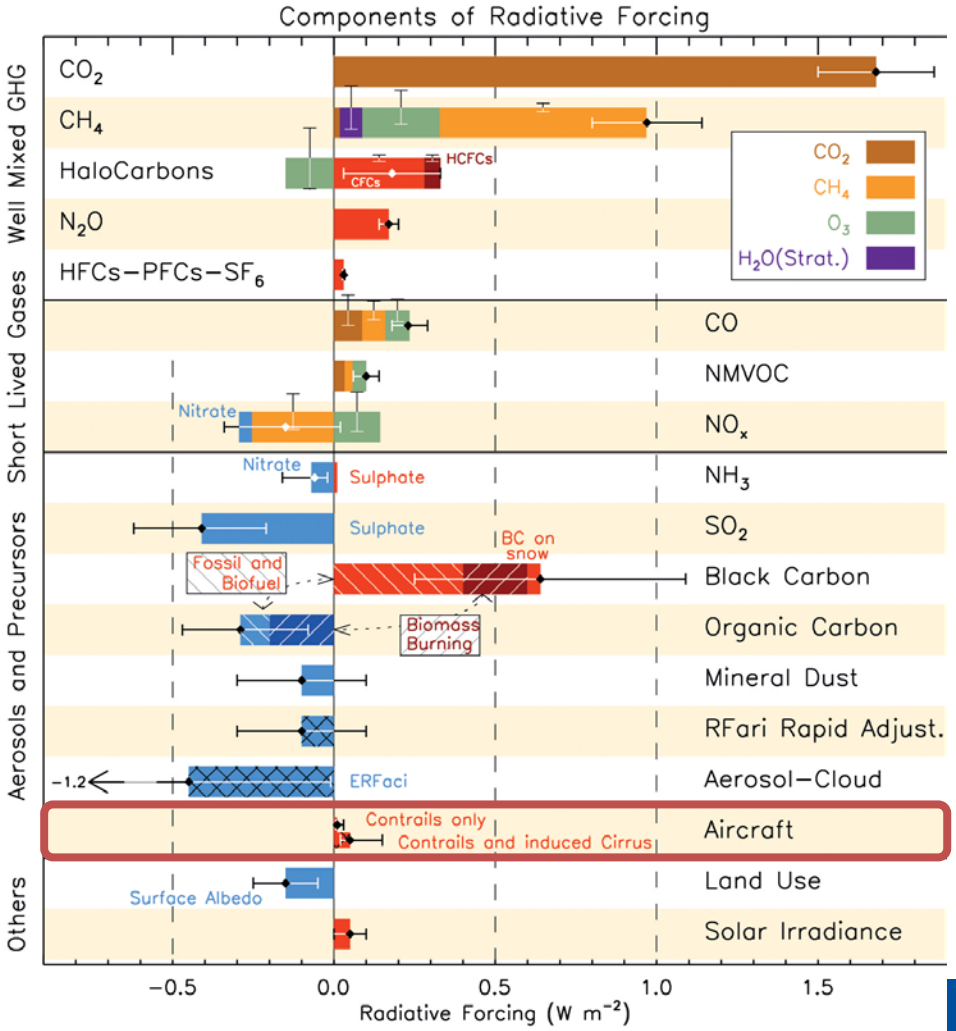


SO2 EMISSIONS



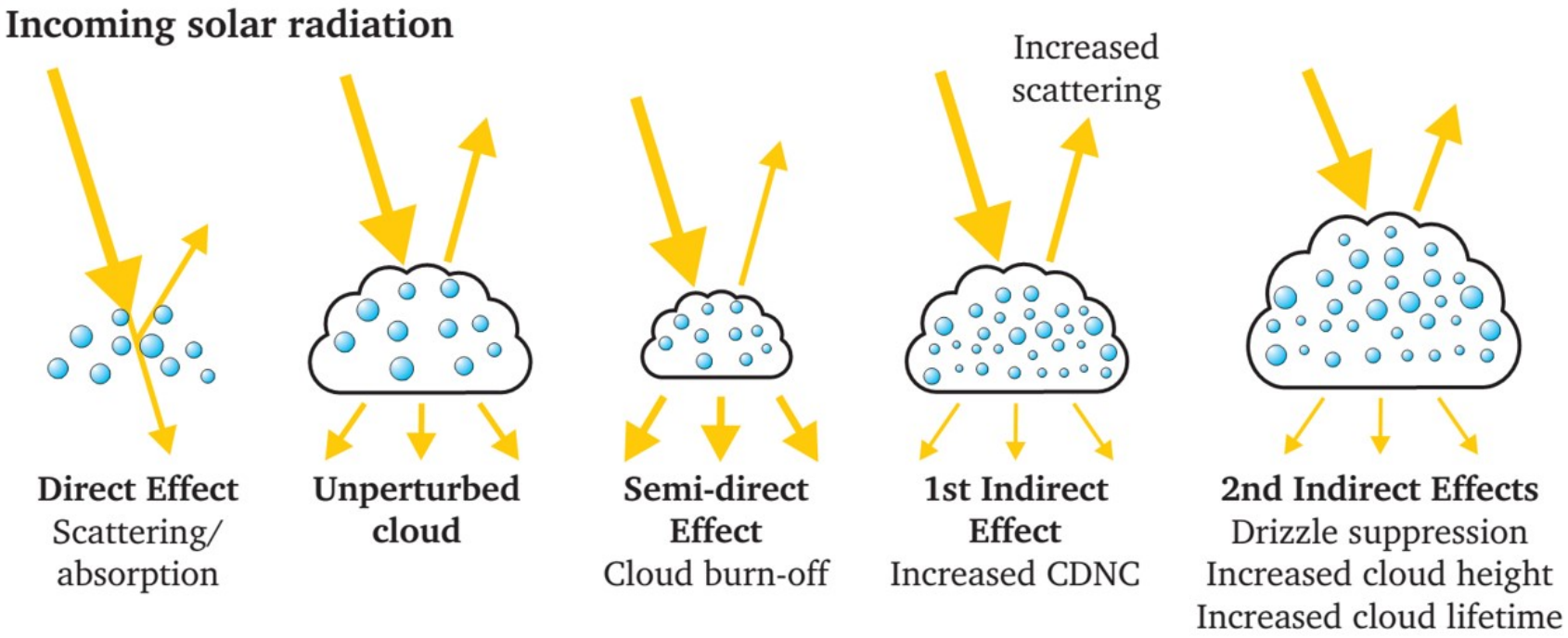
PM2.5




Components of Radiative Forcing
Well Mixed GHG
Short Lived Gases
Aerosols and Precursors
Others
CO2
CH4
HaloCarbons
N2O
HFCs−PFCs−SF6
HCFCs
CFCs
CO2
CH4
O3
H2O(Strat.)
CO
NMVOC
NOx
Nitrate
Nitrate
Sulphate
NH3
Sulphate
SO2
BC on snow
Fossil and Biofuel
Black Carbon
Biomass Burning
Organic Carbon
Mineral Dust
RFari Rapid Adjust.
−1.2
ERFaci
Aerosol−Cloud
Contrails only
Contrails and induced Cirrus
Aircraft
Surface Albedo
Land Use
Solar Irradiance
−0.5
0.0
0.5
1.0
1.5
Radiative Forcing (W m−2)

(IPCC, 2013)

Aerosol – cloud interactions



(Denman et al., 2007)

- Analysing climate change impacts by using the net effect of particular activities or sectors may—compared to other perspectives—provide more insight into how societal actions influence climate.
- Owing to large variations in mix of short- and long-lived components, as well as cooling and warming effects, the results will also in these cases depend strongly on choice of time horizon and climate impact parameter.
- Improved understanding of aerosol–cloud interactions, and how those are attributed to individual components is clearly necessary to refine estimates of sectoral or emitted component impacts.