Short Lived Forcers:
A Response to a Warming Arctic

Rafe Pomerance
Senior Fellow
Clean Air - Cool Planet

www.cleanair-coolplanet.org

Ny Alesund Symposium

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The Arctic Platform

The drama and clarity of climate change in the Arctic provide a powerful platform to bring attention to the magnitude of impacts and the urgent need for response.

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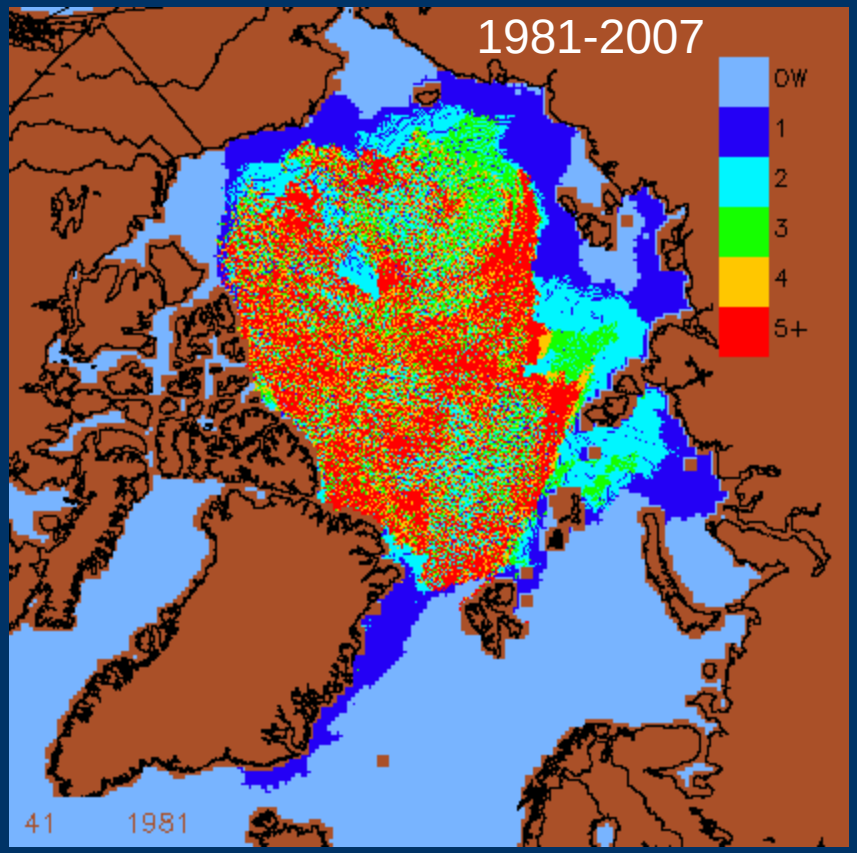
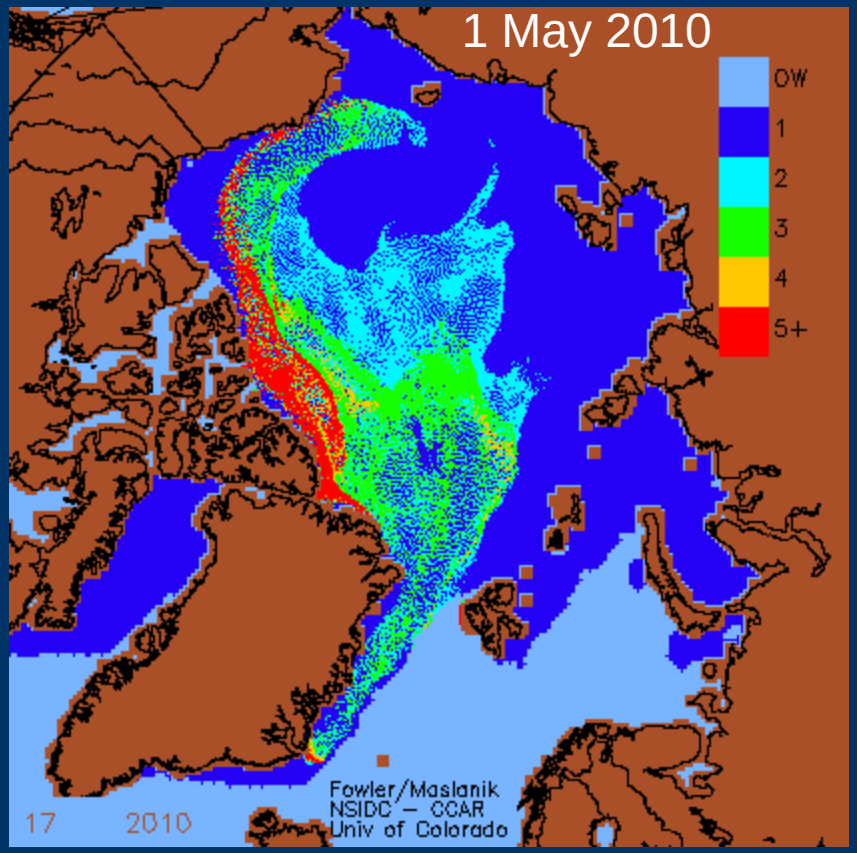
Call to Action

- The response to change in the Arctic must be urgent, immediate and build momentum
- The response must be part of a comprehensive approach to climate change
- A global methane initiative should be launched at the COP in Mexico later this year

Ice is getting younger and thinner

Old, ice used to covered most of central Arctic
Now it is limited to narrow band along Greenland and Canadian Archipelago





From J. Maslanik, C. Fowler, Univ. Colorado (Presentation of Dr. Walt Meier, NSDIC)

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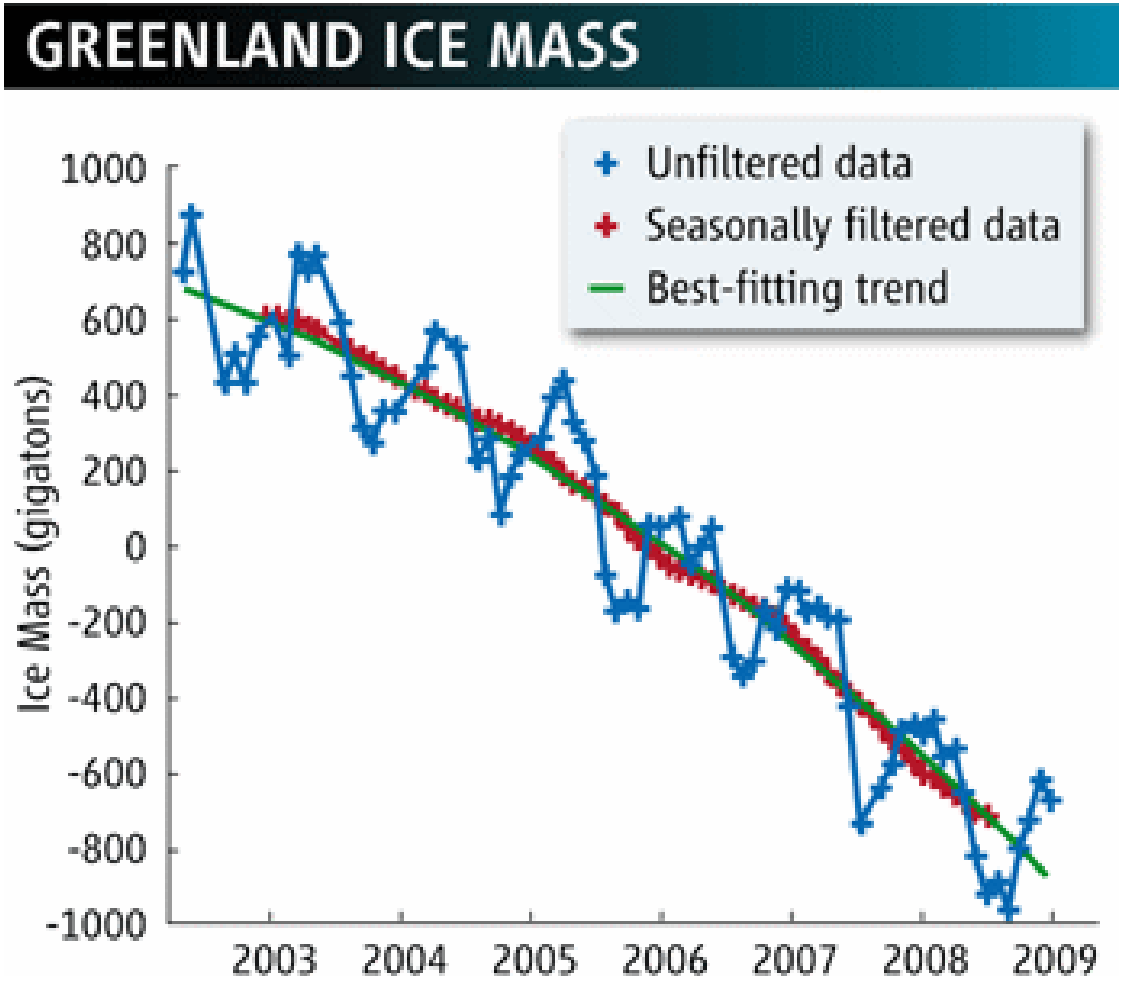

R. A. Kerr Science 326, 217-a (2009) (2009)

Science October 2009, adapted from Isabella Velicogna, Geophysical Research Letters.

Science AAAS

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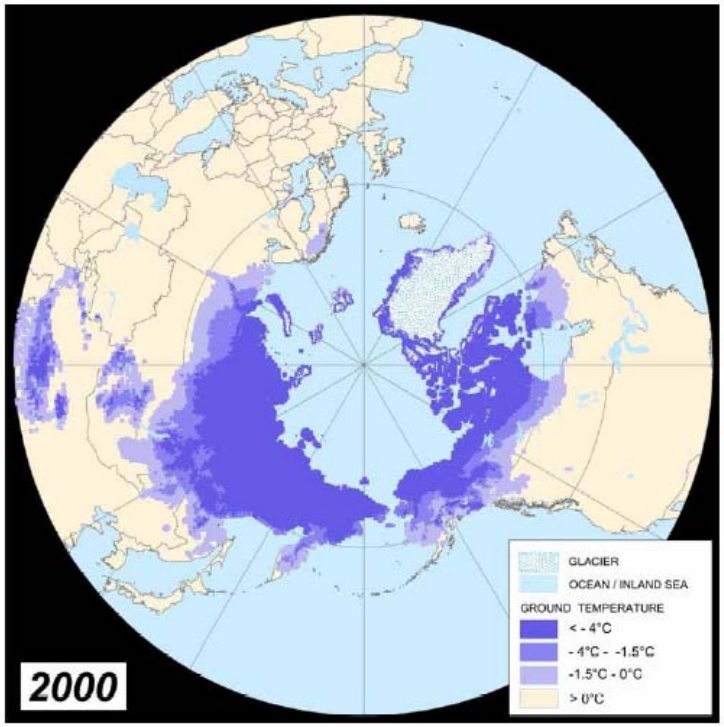
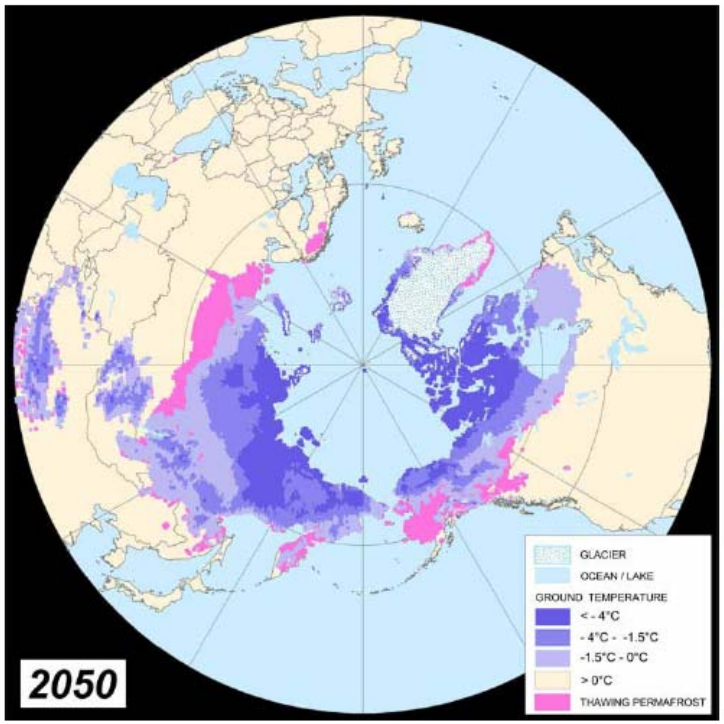
Circumpolar Permafrost





http://www.ametsoc.org/atmospolicy/documents/2008ESSS/ESSS92608/WDC_08%20Romanovsky2.pdf

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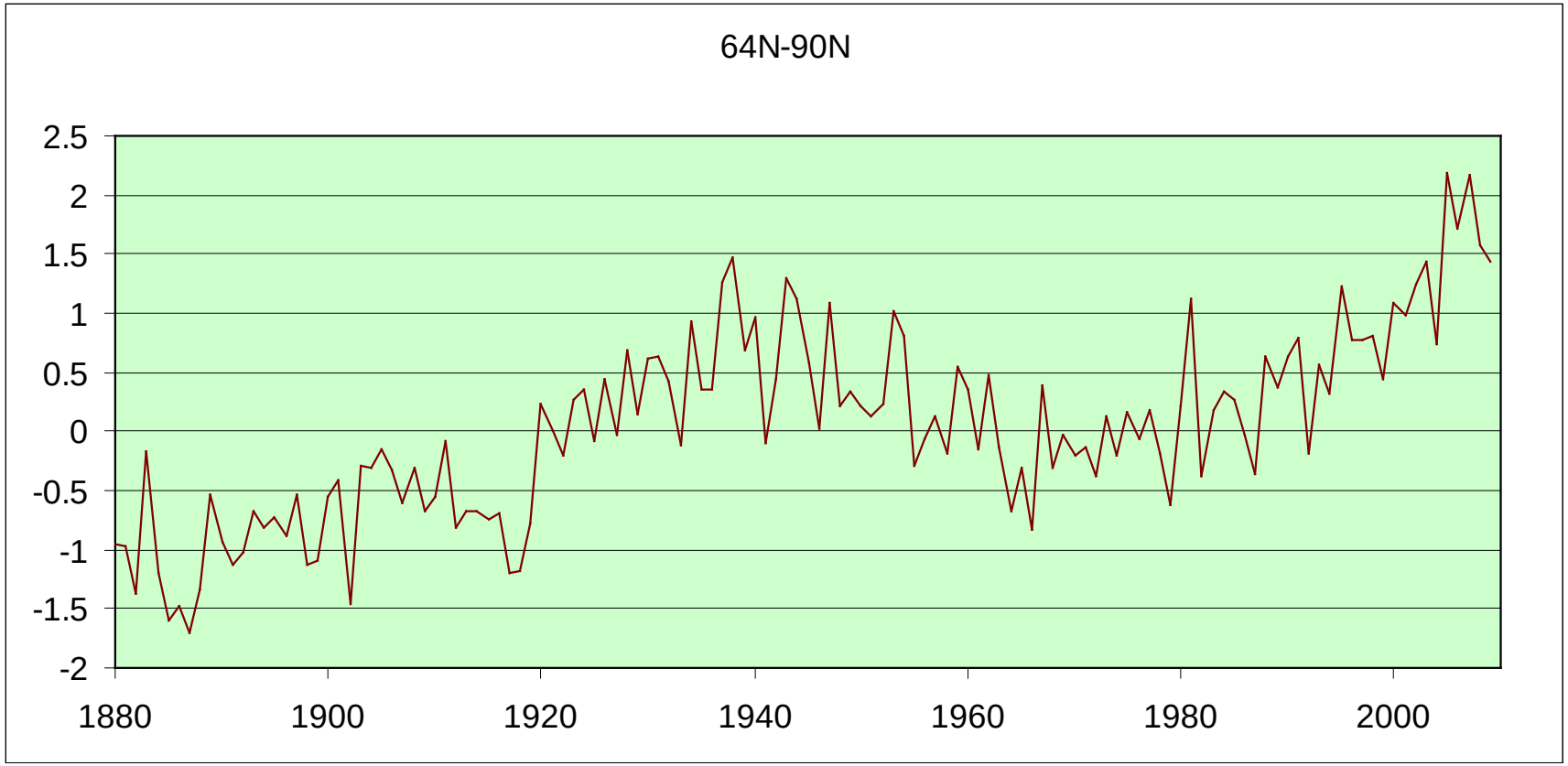
Annual Mean Temperature Anomalies



http://data.giss.nasa.gov/gistemp/tabledata/ZonAnn.Ts.txt

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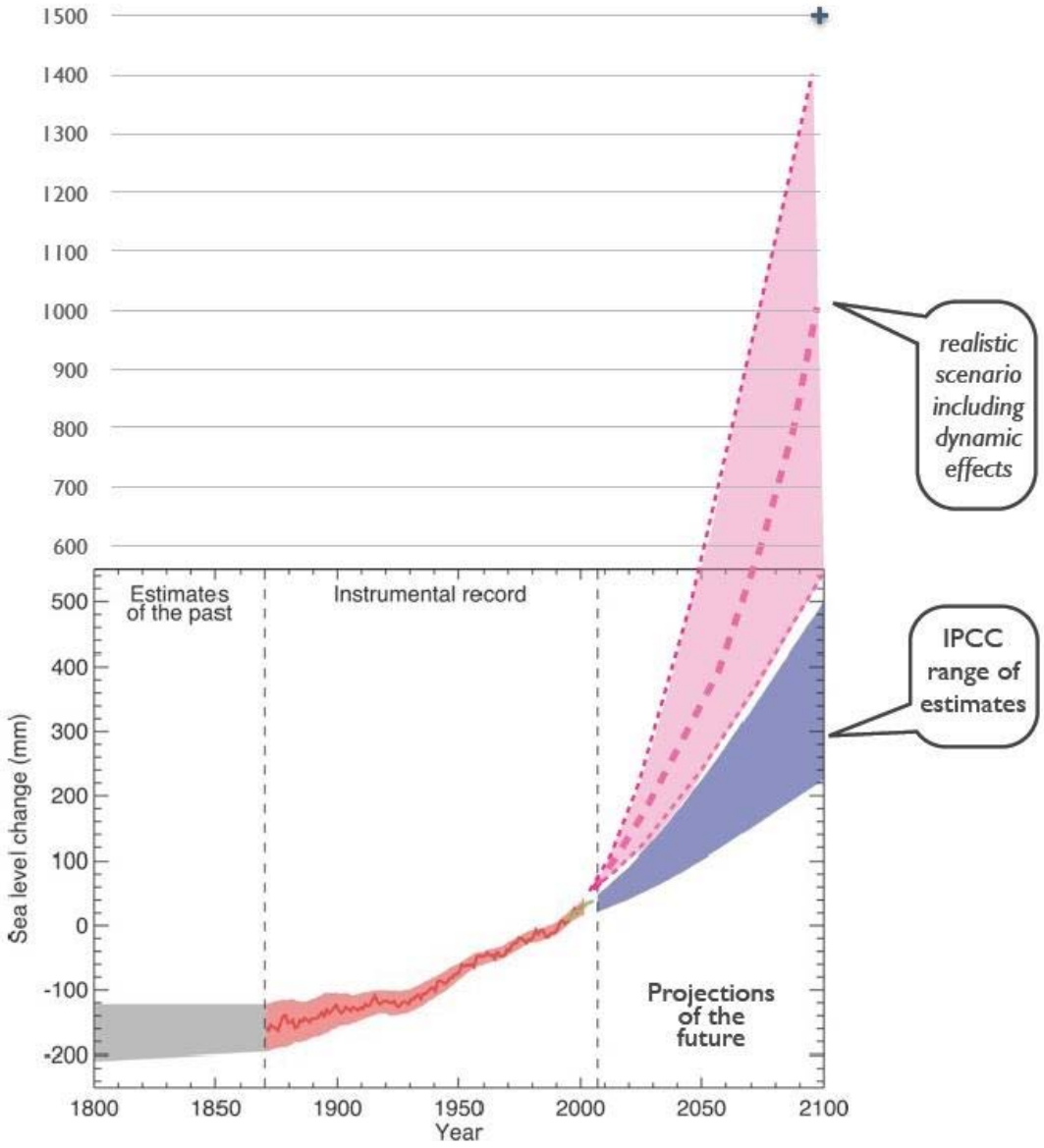
Adapted and modified from Figure 5.1 (IPCC, 2007)

Sea Level Rise Estimates



Source: Personal Communication from Dr. Gordon Hamilton


Clearwater
Courtney Campbell Causeway
Tampa International Airport
Tampa
Old Tampa Bay
Howard Frankland Bridge
Largo
St. Petersburg - Clearwater Int'l Airport
Candy Bridge
Hillsborough Bay
Pinellas Park
MacDill Air Force Base
Westrand East Lealman
Tampa Bay
Gulf of Mexico
St. Petersburg
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Downtown
Convention Center
Florida Aquarium
St. Petersburg
Bayfront Arena
Albert Whitted Airport
University of Southern Florida - St. Petersburg Campus
Sunshine Skyway Bridge
2 Miles
Area at risk of inundation from 1-meter (3.3 ft.) rise in sea level
Current sea level
Low estimate
Central estimate
Elevations based on computer models, not actual surveys. High, central, and low estimates indicate amount of land potentially inundated. Range in estimates reflects uncertainty in underlying elevation model. Inundation shown does not reflect coastal protection efforts that may prevent some low-lying areas from being flooded as sea level rises. Map does not depict inland areas below modeled sea level where not connected directly to the sea. Some hydraulically isolated areas that are below the predicted rise in sea level may become inundated as water tables rise.
Prepared by Stratus Consulting Inc.

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SLF Strategy:

- Is led by Arctic nations.
- Is part of a comprehensive response to global warming.
- Responds to the need to slow warming.
- Demonstrates the urgency of the climate problem
- Builds global momentum.
- Lowers concentrations of methane, ozone and BC quickly; their short lifetimes make this effective

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Some Other Elements of a Comprehensive Approach

- Carbon Pricing
- Transformational Technology R&D
- Forest Protection
- Climate Crisis Intervention Technology/ Geoengineering R&D

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Methane – a potent greenhouse gas

- Methane is 72 times more powerful as a greenhouse gas than CO_2 over a 20 year period
- Reductions have a direct impact on warming.
- Mitigation of methane emissions can have economic benefit
- Technologies for methane reduction are tested and available

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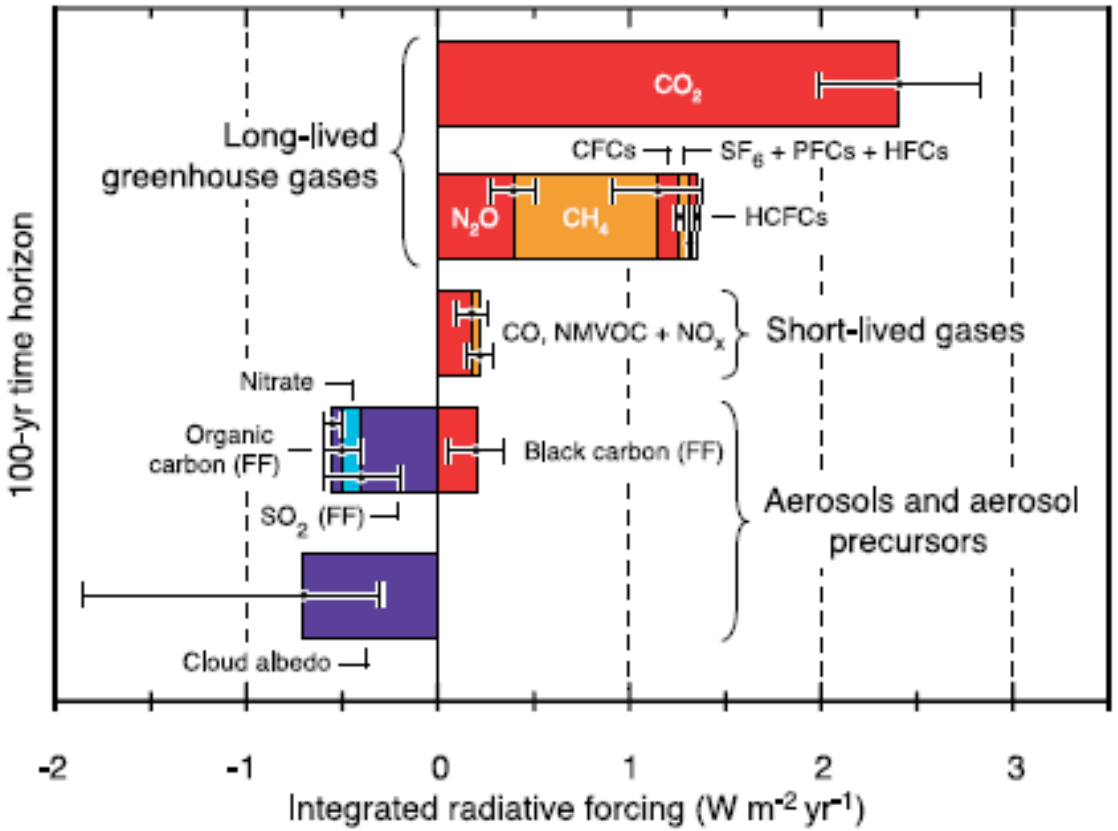
Integrated Radiative Forcing for Year 2000 Global Emissions 100-year time horizon



IPCC

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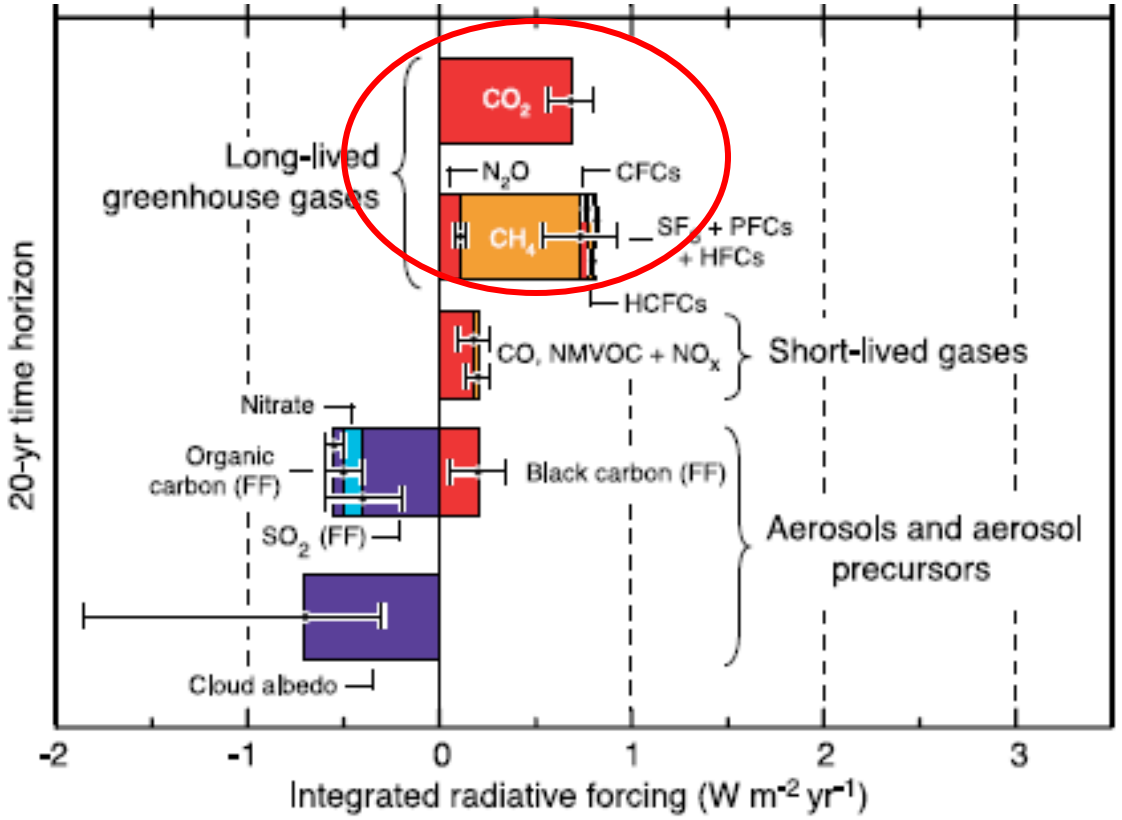
Integrated Radiative Forcing for Year 2000 Global Emissions 20-year time horizon:



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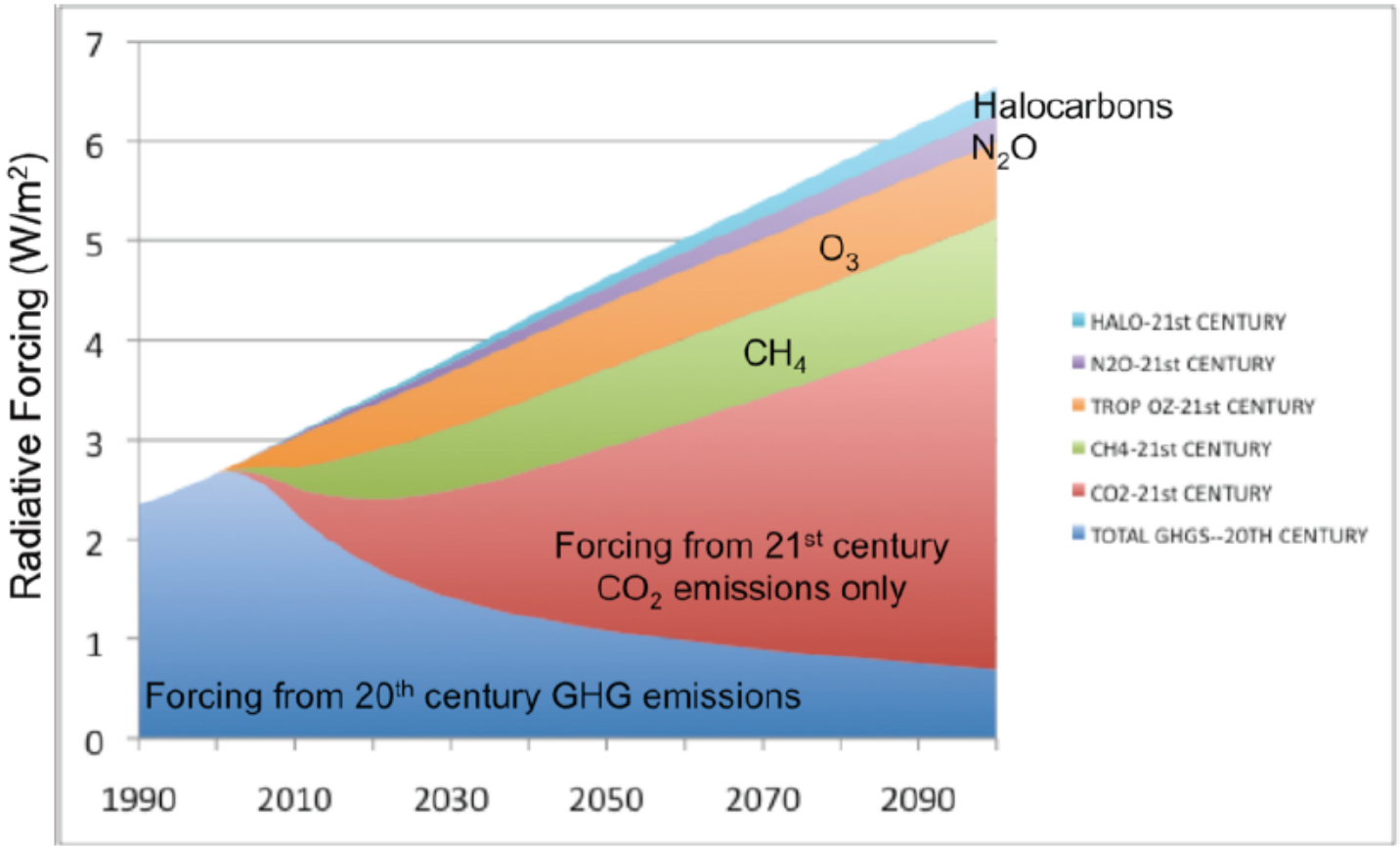

Figure 2: Projection of radiative forcing at the tropopause due to emissions of greenhouse gases prior to the 21st century (lower section) and from the emission of various greenhouse gases during the 21st century (five upper sections). For reference, a radiative forcing of approximately 2-3 W/m^2 is estimated, at equilibrium, to be associated with an increase in global average temperature of 2ºC above preindustrial conditions. Derived from simulation using MAGICC model of Wigley (2008).

Source: Michael C. MacCracken, Climate Institute, *Moderating Climate Change by Limiting Emissions of Both Short- and Long-Lived Greenhouse Gases*

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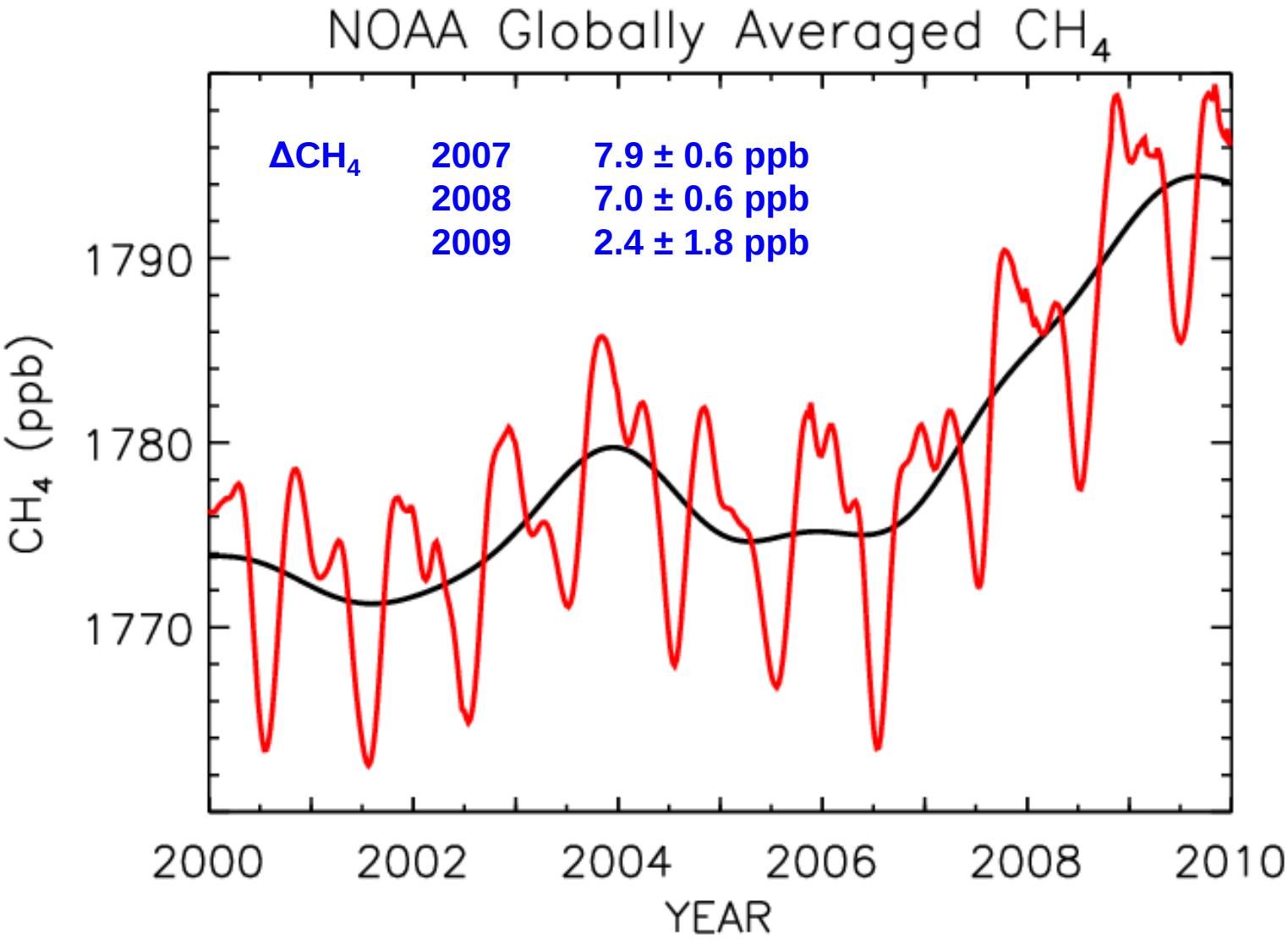

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Key Immediate Targets for Methane

- Waste management
- Coal mines
- Oil gas systems
- Wastewater treatment
- Livestock waste

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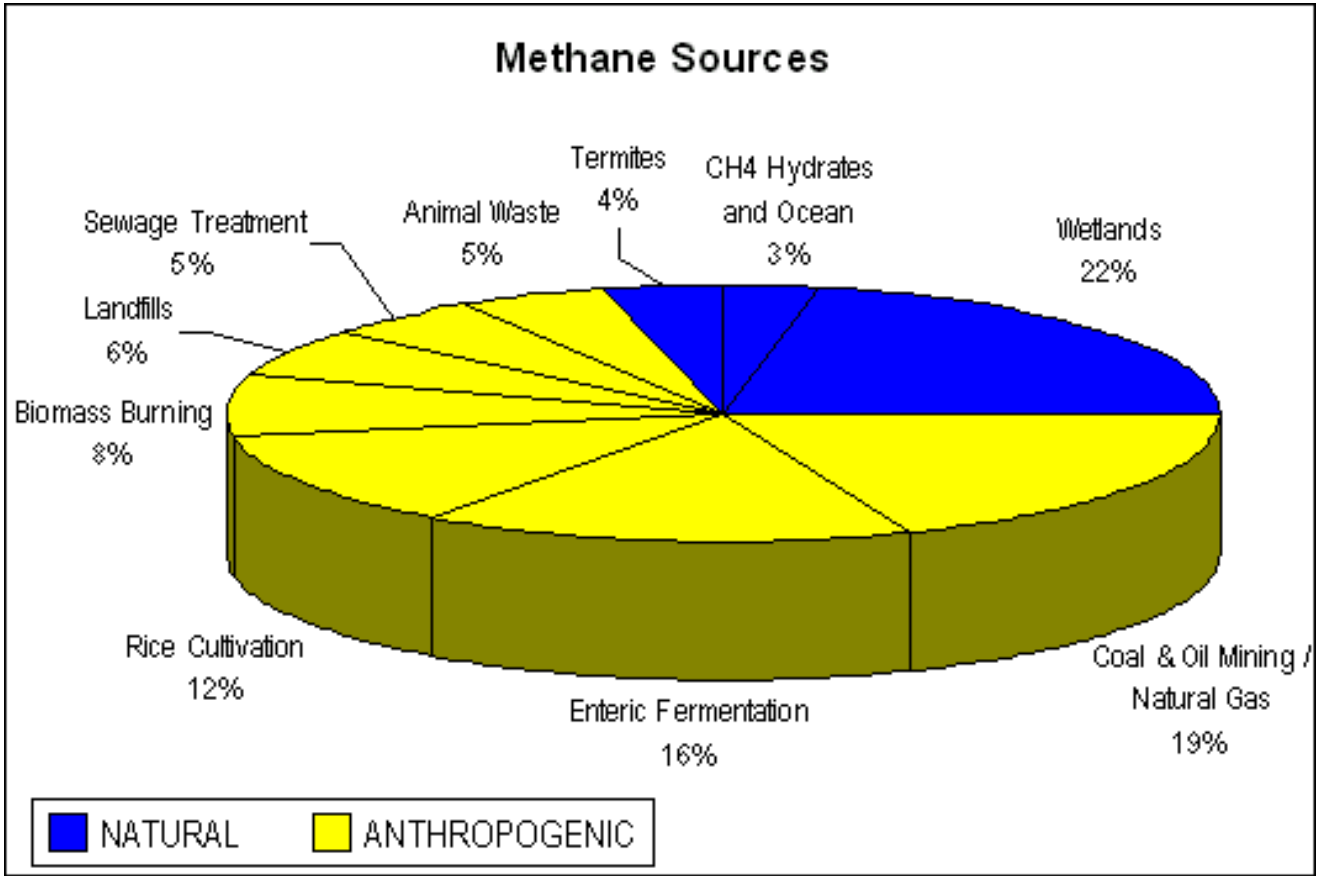
Global Sources of Methane



http://icp.giss.nasa.gov/education/methane/intro/cycle.html

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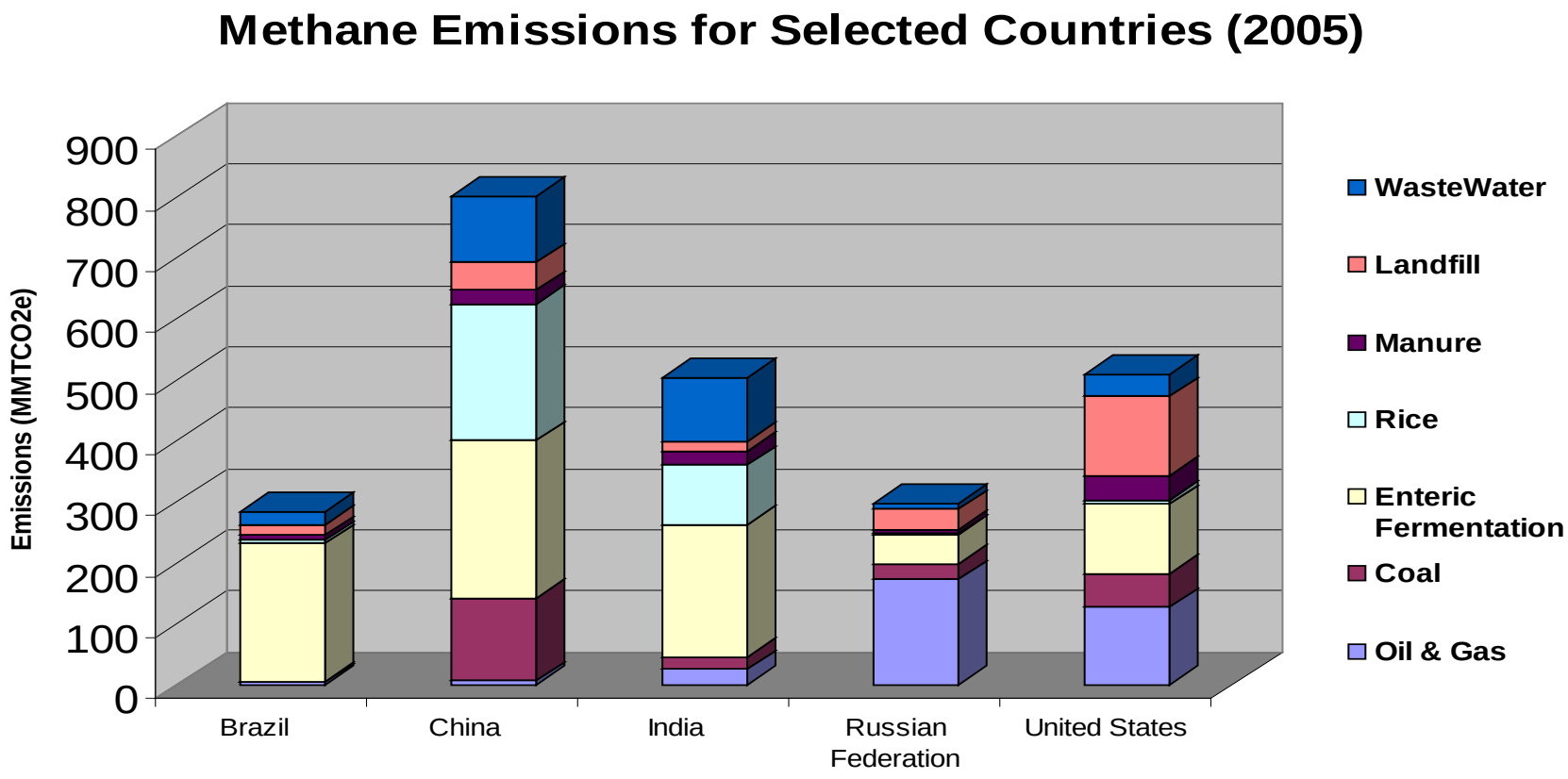
CH4 Sources and Strategies are Country-specific



EPA, Office of Atmospheric Programs, 2009

Methane to Markets

What is Methane to Markets?

- International public-private partnership to reduce methane emissions through deployment of *cost-effective* recovery and use projects
  - Landfills, coal mines, agricultural, and oil and gas systems
- Since 2004 - grown from 14 to 33 countries and nearly 1000 public and private organizations – covers **62% global methane emissions**

Methane to Markets

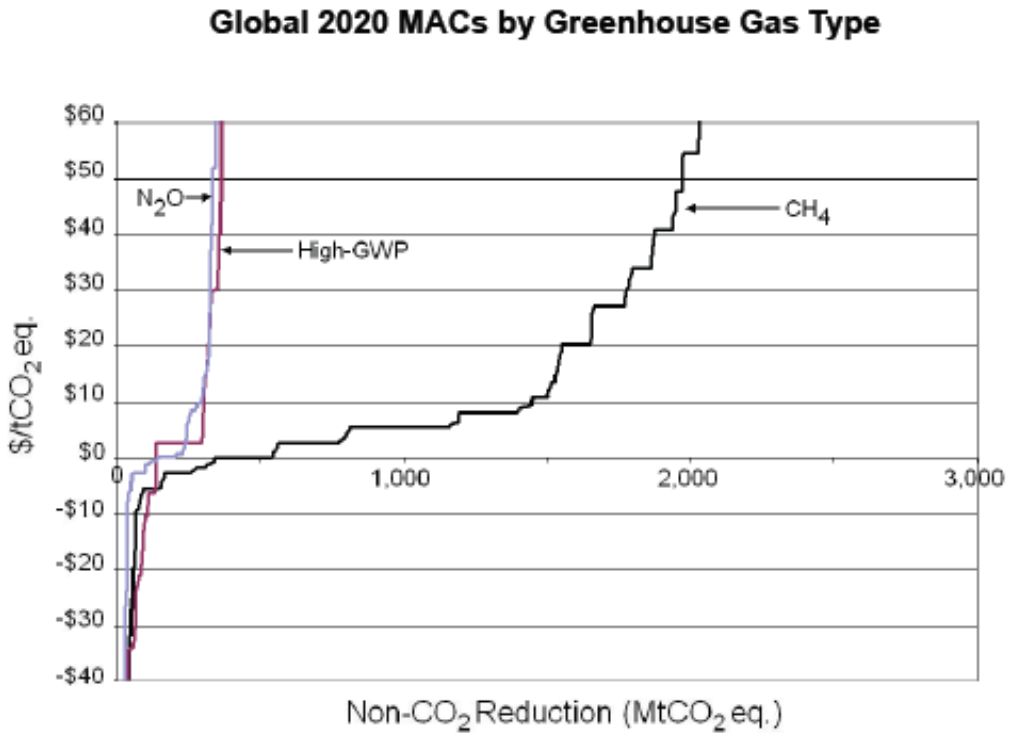
M2M Overcomes Barriers to Project Development

- Lack of awareness of emissions, reduction opportunities and value of lost fuel
- Lack of information on and training in technologies and practices
- Finance and investment
- Traditional industry practices
- Regulatory and legal issues
- Limited markets and infrastructure
- Lack of institutional capacity

Methane to Markets

Methane Projects Offer Low Cost Mitigation Potential

- At a cost-effective level, the potential for methane mitigation is greater than 500 MtCO2eq.
- The potential for reducing methane emissions grows three-fold as the breakeven price rises from $0 to $20/tCO2eq.
- At a breakeven price of $30/tCO2eq, reduction potential reaches nearly 1,800 MtCO2eq



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Global Methane Initiative

- Build on Methane to Markets (M2M)
- Provide Leadership at September/October Ministerial
- Devote Resources (staff, funding)
- Develop financial Instrument (Blue Ribbon Panel)
- Create visionary goal for global emission reduction
- Establish national plans to enable global action

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Global Methane Fund

- Recommended by Blue-Ribbon Panel (Watson, El Ashry, Newcombe, Molina, Cravero)
- Supports CDM through floor price guarantee for carbon, gives more confidence in CDM
- Concrete goal: 1 GT CO_2e by 2020 (50% IIASA)

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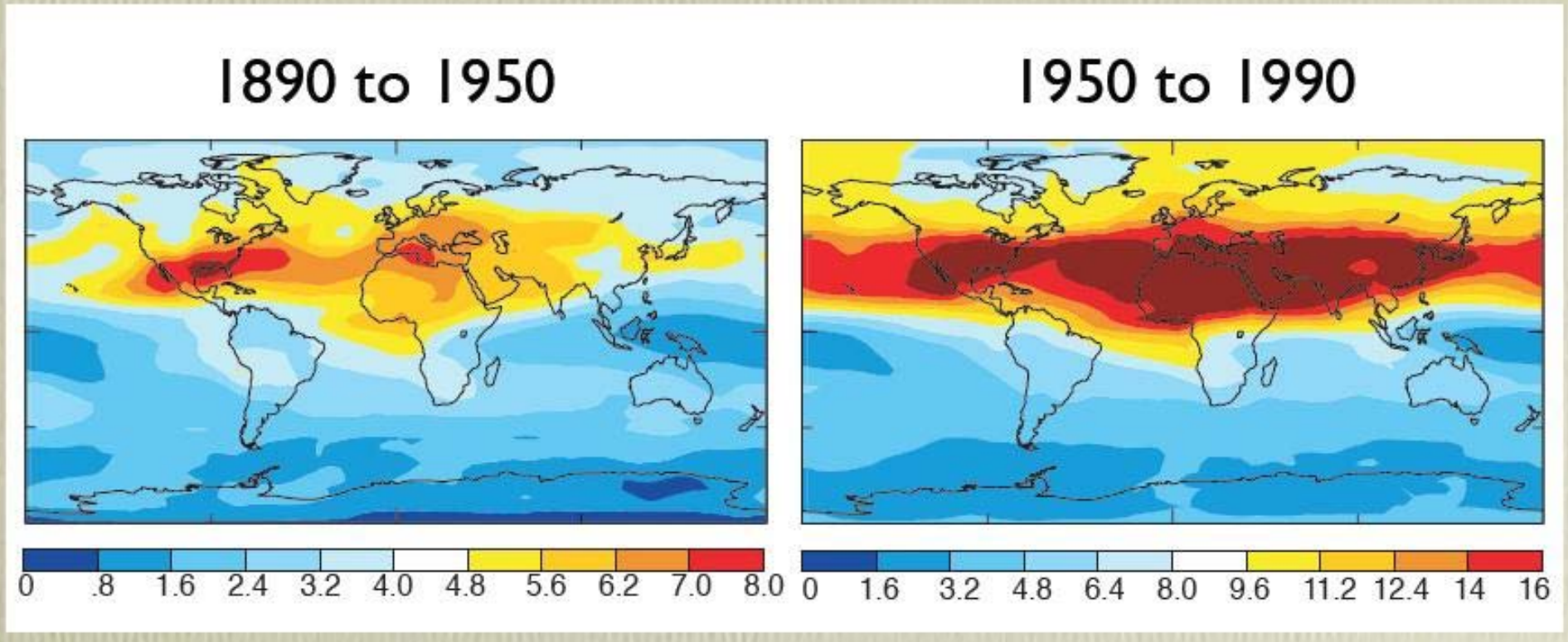
Methane Fund Proposal

- Establishes a “methane CER price guarantee” mechanism, providing a “price floor”
- Combines with country-level development plans (especially wastewater)
- Steers funding to small-scale, grass roots projects (stoves, household-based manure capture with Heifer International)
- Collaborates with UN Foundation

20th Century Ozone Increases



Values are for the tropospheric ozone column (in Dobson Units)

All values are positive. Scale x2 on right.

AMS congressional briefing, D. Shindell, May 31, 2006

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Tropospheric ozone

- Lifetime: days to weeks
- Ozone concentrations will follow methane changes (in the absence of other changes), and provide additional climate benefits plus health and agricultural benefits (avoided damages).
- Ozone reductions will come as a result of methane reductions

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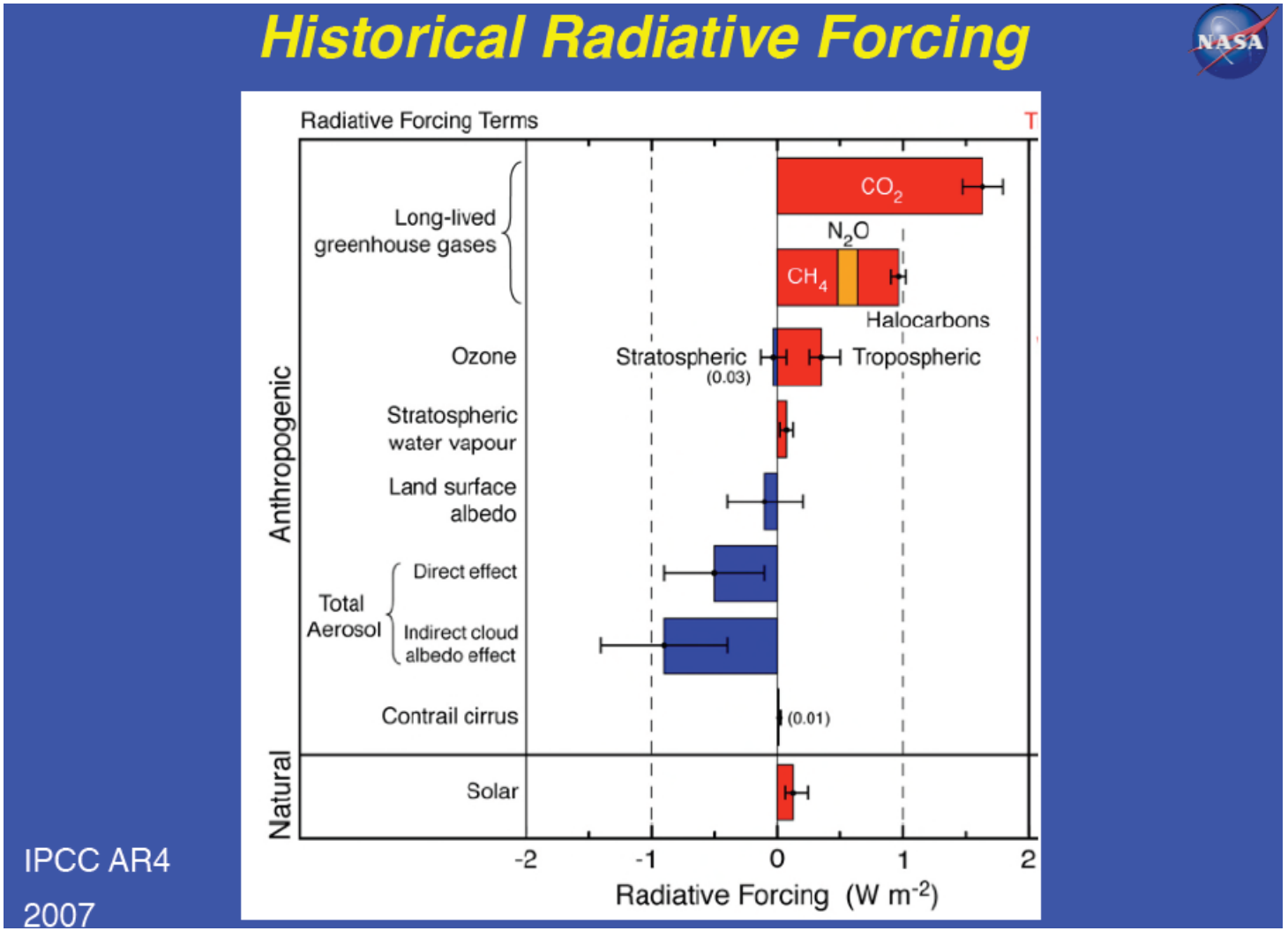
Forcing for present (~2005) relative to 1750



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Black Carbon (1)

- Black carbon, a major component of soot, has been estimated to be responsible for significant portion of anthropogenic warming experienced to date.
- Short lifetime (days to weeks), so near-immediate effect from reductions
- Direct effects:
  - darker ice → more melting
  - Directly absorbs solar heat

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Black Carbon (2)

- Targeted sources of black carbon:
  - Diesel engines
  - Cooking and heating stoves
  - Shipping
  - Agricultural burning
- Control of Black Carbon can provide major health benefits

2. Wilkinson, P. et al. Public health benefits of strategies to reduce greenhouse-gas emissions: household energy. The Lancet 374, 1917-1929 (2009).

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Sources of Black Carbon

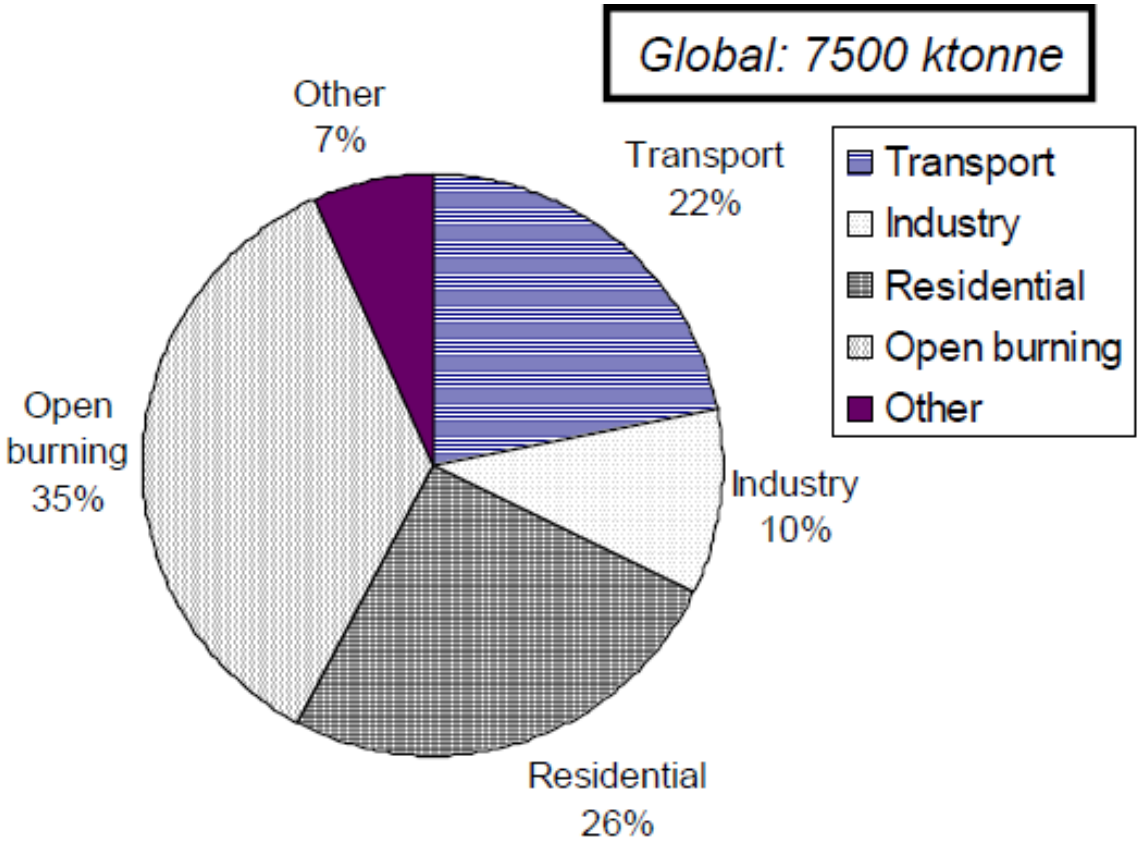
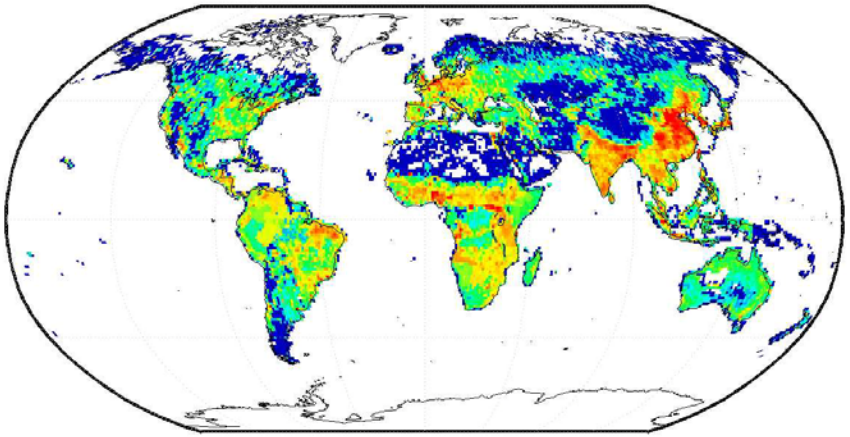


Figure 1. Global and North American sources of black carbon. Open burning is largely in the forests of Canada. 1 ktonne (metric)= 1100 tons. http://legislative.nasa.gov/hearings/3-16-10%20BOND.pdf Testimony for "Clearing the Smoke: Black Carbon Pollution" House Committee on Energy Independence and Global Warming, United States House of Representatives, March 16, 2010

Both emission and impact have “hot spots”

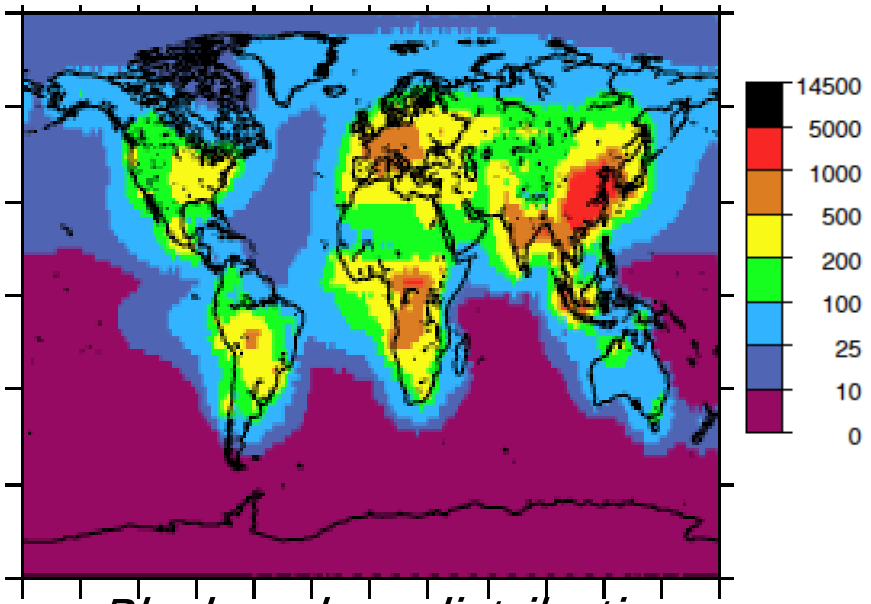


Black carbon emission, year 2000

Includes energy-related & open

Bond et al., Glob Biogeochem Cyc, 21, GB2018

Units: ng/m³/sec



Black carbon distribution

Koch et al., Atmos Chem Phys, 9, 9026

Units: ng/m3

Slide from Tami Bond’s presentation at the
Black Carbon, Climate, and Air Quality Lunch Briefing
Washington, DC
April 29, 2010

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Key Factors Regarding Black Carbon's Warming Effect:

- Indirect effect on clouds and radiative forcing
- Offsetting Organic Carbon (OC) emissions
- Extent of interaction with snow and ice (in Arctic, Himalayas and other regions)
- Co-emissions of trace gases

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Upcoming BC Reports (Role of the Arctic Council)

- "Bounding of forcing" scientific paper (Bond et. al.)
- Arctic Council Task Force
- UNEP Assessment
- EPA Report to United States Congress

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Arctic Council Ministerial Commitments – April 2009

- "… recognize that reductions in emissions [of SLFs] have the potential to slow the rate of Arctic snow, sea ice, and sheet ice melting in the near term;…
- Urges implementation of early actions where possible on methane and other [SLFs], and encourage collaboration with the Methane to Markets Partnership…

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IMO

- Norway, U.S., Sweden submission to explore in-Arctic SLF measures
- Arctic-specific regional measures
- Proposed study, simple measures such as slower speeds
- May become joint Arctic Council approach

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CLRTAP/Gothenburg Protocol

- Air pollution approach to BC: placing near-term climate impacts on table alongside health and agriculture benefits – especially Arctic impacts
- Covers North America/Europe
- New BC Expert Group with rapid 1-year mandate

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Conclusions

- A global methane initiative should be launched at the COP in Mexico later this year
- The response to change in the Arctic must be urgent, immediate and build momentum
- The response must be part of a comprehensive approach to climate change