Please note that this presentation was given during the United Nations Climate Change Conference (COP-15) in Copenhagen, December 7-18, 2009 for more information please visit http://www.cop15.state.gov/ .

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CLEAN AIR TASK FORCE

NATUR VÅRDS VERKET
SWEDISH ENVIRONMENTAL PROTECTION AGENCY

How Improving Air Pollution Control Can Help Address Climate Change

UNFCCC COP-15 Side Event
December 8, 2009
Copenhagen
U.S. Center Meeting Room C5

U.S. CENTER 09 COPENHAGEN

The Climate-Air Quality Link:
Searching for Win-Win Solutions

Erika Sasser
Senior Policy Advisor
Office of Air & Radiation
U.S. EPA
sasser.erika@epa.gov

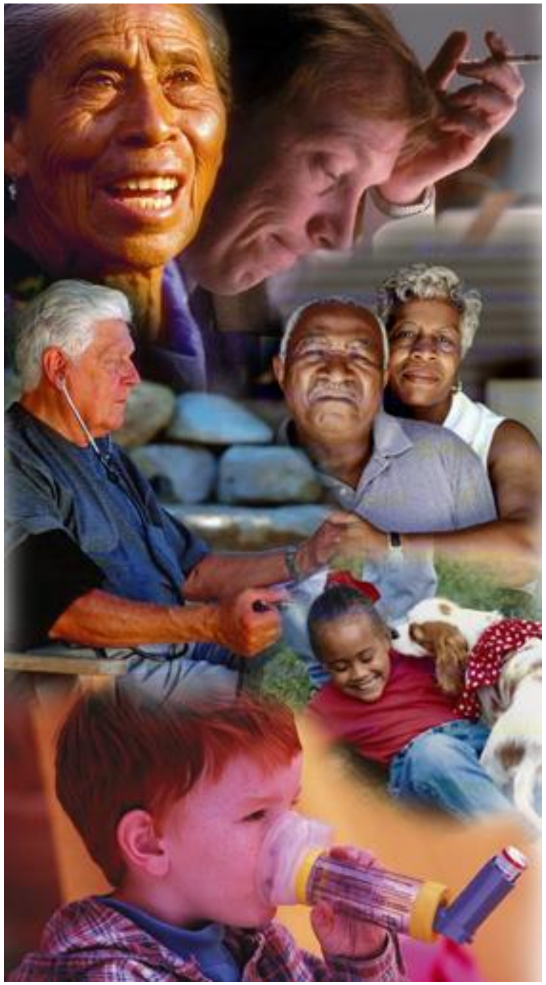
The Air Quality – Climate Link

- Carefully designed strategies to integrate air quality and climate can lead to more efficient solutions and faster results

Clean Industry Clean Energy Clean Transport	=	Clean Air Healthy Communities Stable Climate

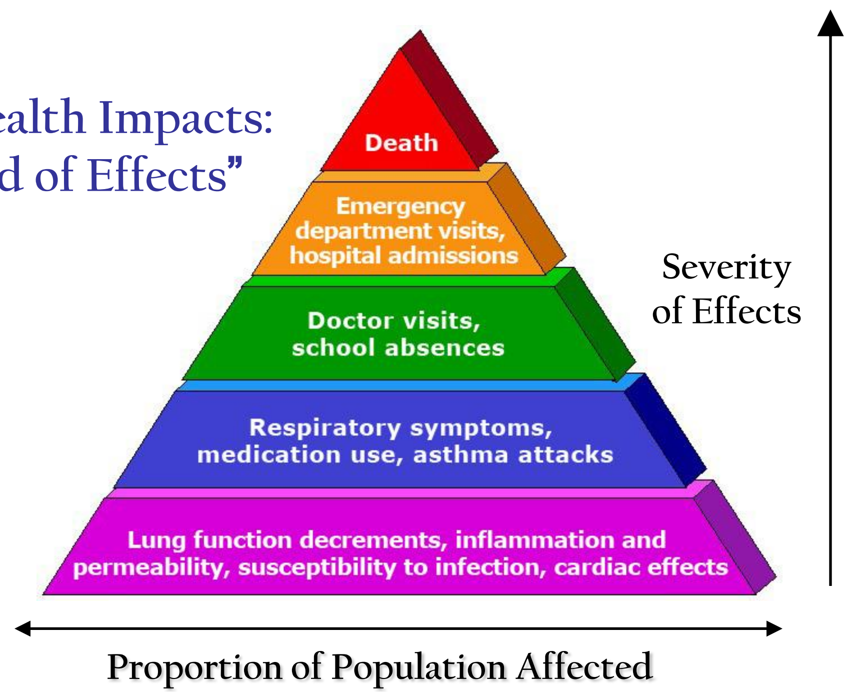
- Climate co-benefits of air quality programs come from:
  - Simultaneous reductions in GHGs and conventional air pollutants
  - Reductions in short-lived climate forcers (PM, ozone, methane)

Addressing the Public Health Impacts of Air Pollution is an Urgent Challenge



- WHO estimates air pollution causes ~ 2 million premature deaths worldwide each year
- Effects felt disproportionately by at-risk populations such as children, the elderly, and those in poor health status

Ozone Health Impacts:
"Pyramid of Effects"



Air Pollution and Climate:

Shared sources offer potential for integrated solutions

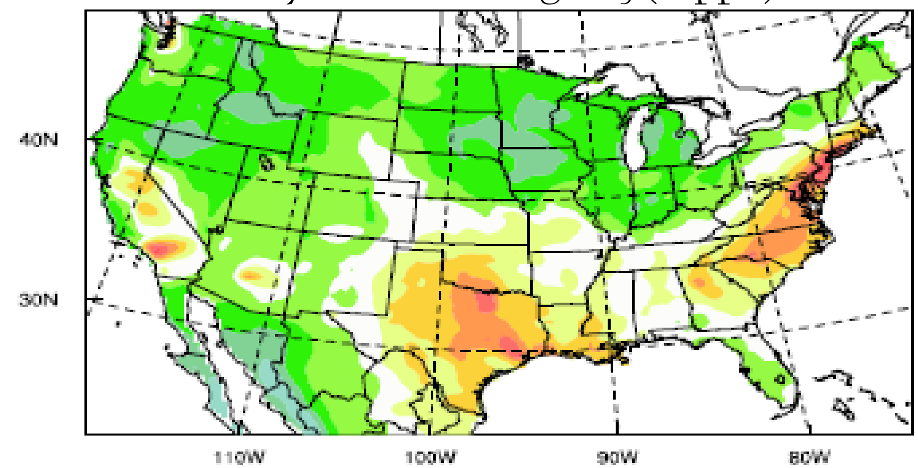
Impacts of Climate on Future Air Quality

Figures: Changes in summer ozone concentrations in 2050s due to climate change

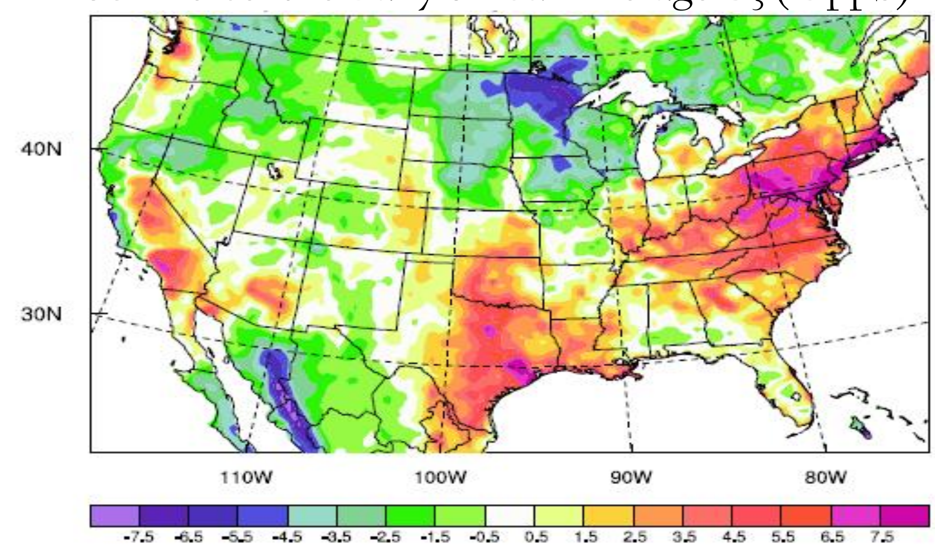
- Top: Average O_3 concentrations may change by several ppb under future climate conditions, with strong inter-regional variation
- Bottom: The sensitivity of O_3 to climate change is substantially larger during the highest-O_3 periods of the summer

Reference: U.S. Environmental Protection Agency, 2009: *Assessment of the Impacts of Global Change on Regional U.S. Air Quality: A Synthesis of Climate Change Impacts on Ground-Level Ozone*. Washington, DC; EPA/600/R-07/094F. http://cfpub.epa.gov/ncea/CFM/recordisplay.cfm?deid=203459#Download

Mean Daily 8-hour Average O_3 (Δ ppb)



95th Percentile Daily 8-hour Average O_3 (Δ ppb)



Source: Nolte et al., J. Geophys. Res. 2008

Opportunities to Achieve Climate/Air-Quality Co-Benefits

- Comprehensive energy strategies applied at industrial facilities (e.g. cement, petroleum refining, pulp and paper, and iron and steel plants) can reduce energy demand and the pollution generated by energy production
- New energy generation technologies can significantly reduce air pollution while improving efficiency
- Clean energy approaches lead to significant annual health benefits:

- Estimated annual health benefits (in million $US) associated with pollution reduction in U.S.:
  - Power plants:
    - ↓1,000 tons of SOx: $33M-$82M/year
    - ↓1,000 tons of NOx: $6-$15M/year
  - Industrial sources:
    - ↓1,000 tons of direct $PM_{2.5}$: $190M - $460M/year
  - Mobile sources:
    - ↓1,000 tons of direct $PM_{2.5}$: $230M - $560M/year

U.S. Air Quality Management:

Moving toward Integrated, Sector-based Strategies

Sector-based strategy:

1. Comprehensive evaluation of all emissions and processes
2. Integrated planning for control requirements

Process Emissions
Storage
Engines

Heaters
Waste
Furnaces

Advantages of a holistic, multipollutant approach:

1. Greater environmental benefits and public health protection;
2. Greater regulatory stability and clarity for industry;
3. Reduced regulatory and administrative burdens;
4. More efficient and effective use of resources; and
5. Explicit consideration of tradeoffs

Today's Speakers

Dr. Syed Hasnain
The Energy and Resources Institute (TERI)

"Disappearing Himalayan Ice: Impact by Long-Lived and Short-Lived Climate Forcing Agents"

Dr. Johan Kuylenstierna
Global Atmospheric Pollution Forum/SEI-York

"Air Pollution and Climate Change: Opportunities for Integrated Strategies in Developing Countries"

Dr. Peringe Grennfelt,
Swedish Environmental Research Institute (IVL)

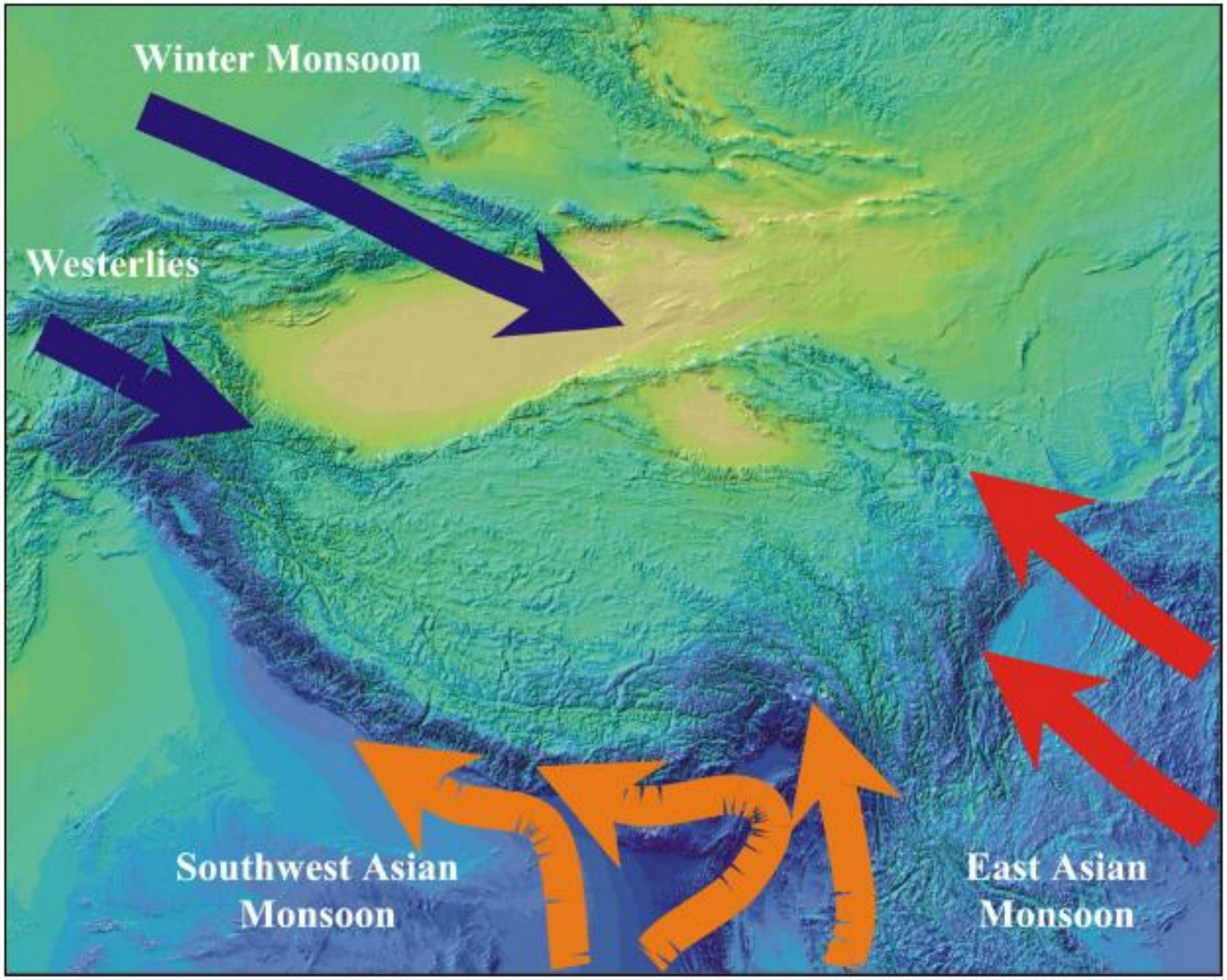
"Potential Avenues for Integrating Air Pollution and Climate"

DISAPPEARING HIMALAYAN ICE:

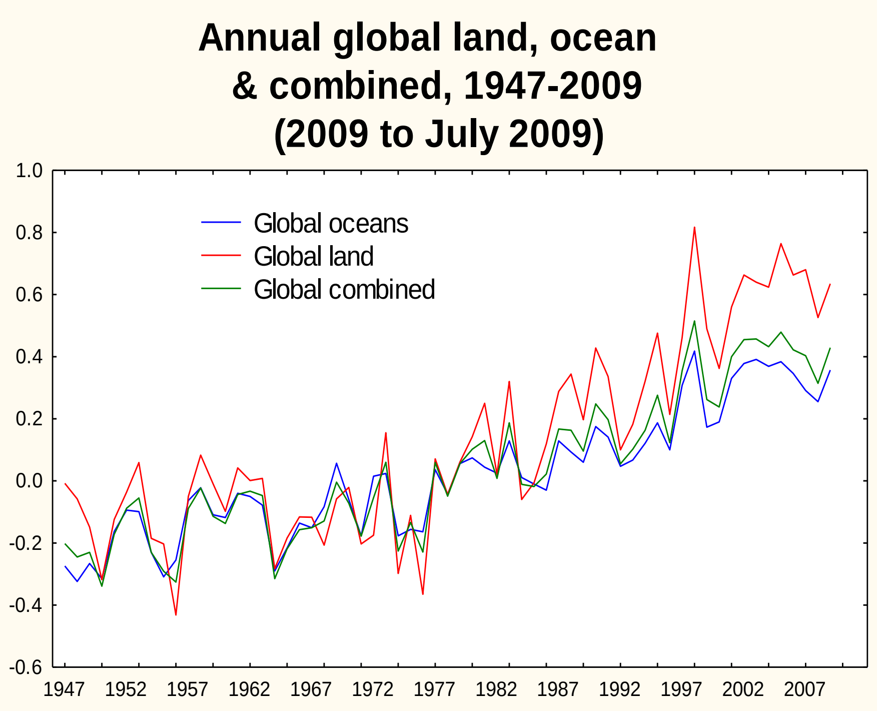
Impact by Long-Lived and Short-Lived Climate Forcing Agents

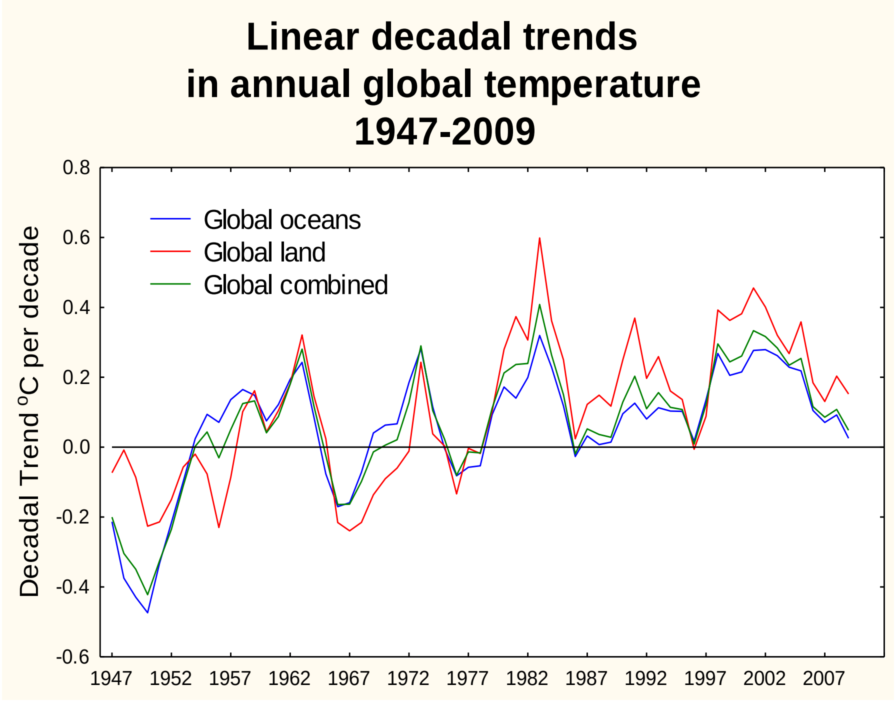
Syed Iqbal Hasnain
Senior Fellow
The Energy and Resources Institute, New Delhi
shasnain@teri.res.in

Major weather system of Himalaya – South West Monsoon & Westerly Jet stream



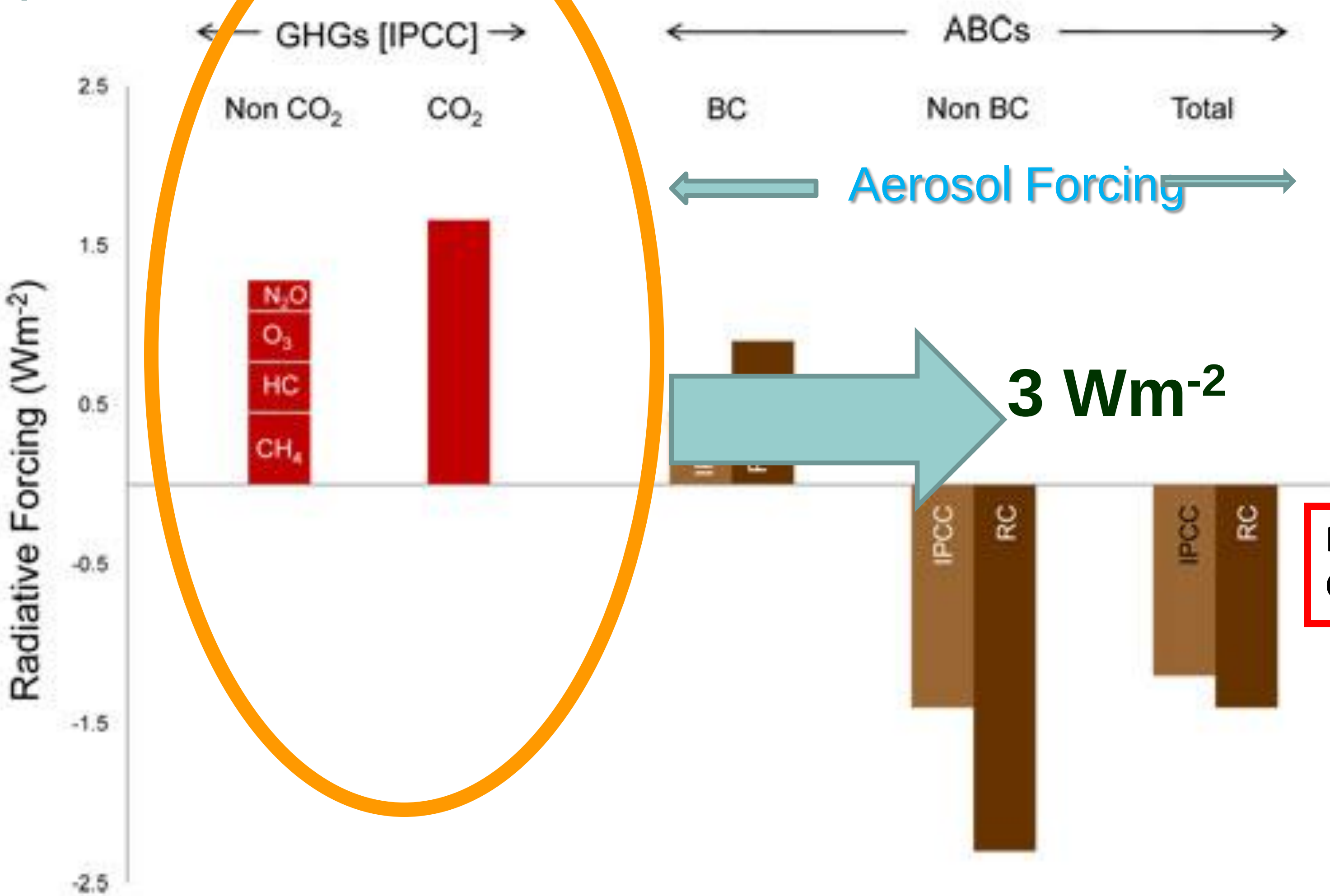
Global land, ocean & combined temperature time series, 1947-2009





Global Radiative Forcing due to GHGs (IPCC-AR4 Forcing)

Ramanathan and Feng, 2008



RC: Ramanathan & Carmichael, 2008

Black carbon – playing a major role in Himalaya

The main contributors are ….

Transport sector

Cement Factories

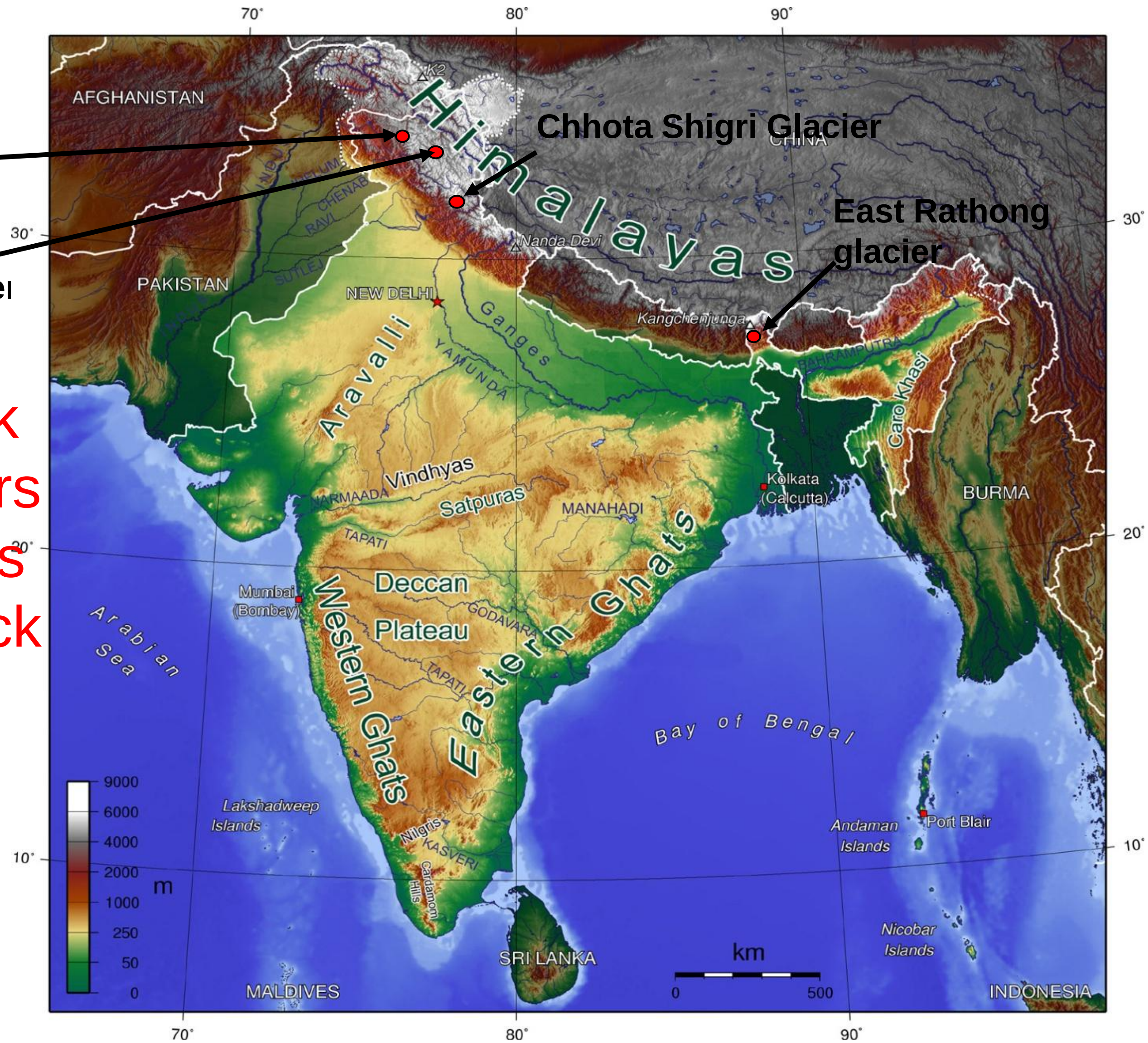
Research Questions

The study aims to address the following scientific questions:

- How much of the melt is attributable to the regional temperature trend, and how much is attributable to black carbon deposition ?
- What is the regional rate of glacier melt over the last decade?
- What is the portion of the flow in the major Himalayan rivers supplied by glacier melt ?
- How will the fresh water resources of Himalaya will be impacted in the future based on climate model projection of regional climate change in Asia ?

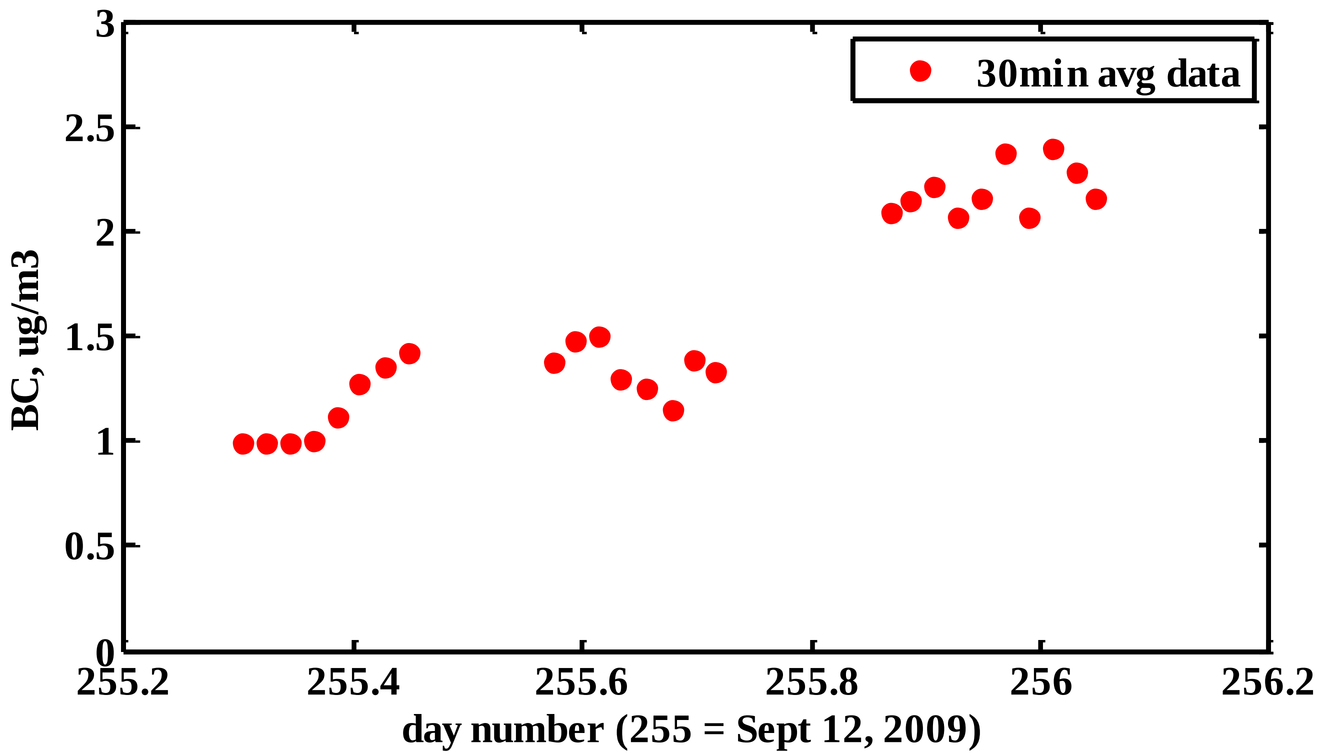
TERI's initiative to address the Climate change and Glacier melt concern

Setting up of network of benchmark glaciers and to identify drivers of glacier melt – Black carbon and Green House Gases

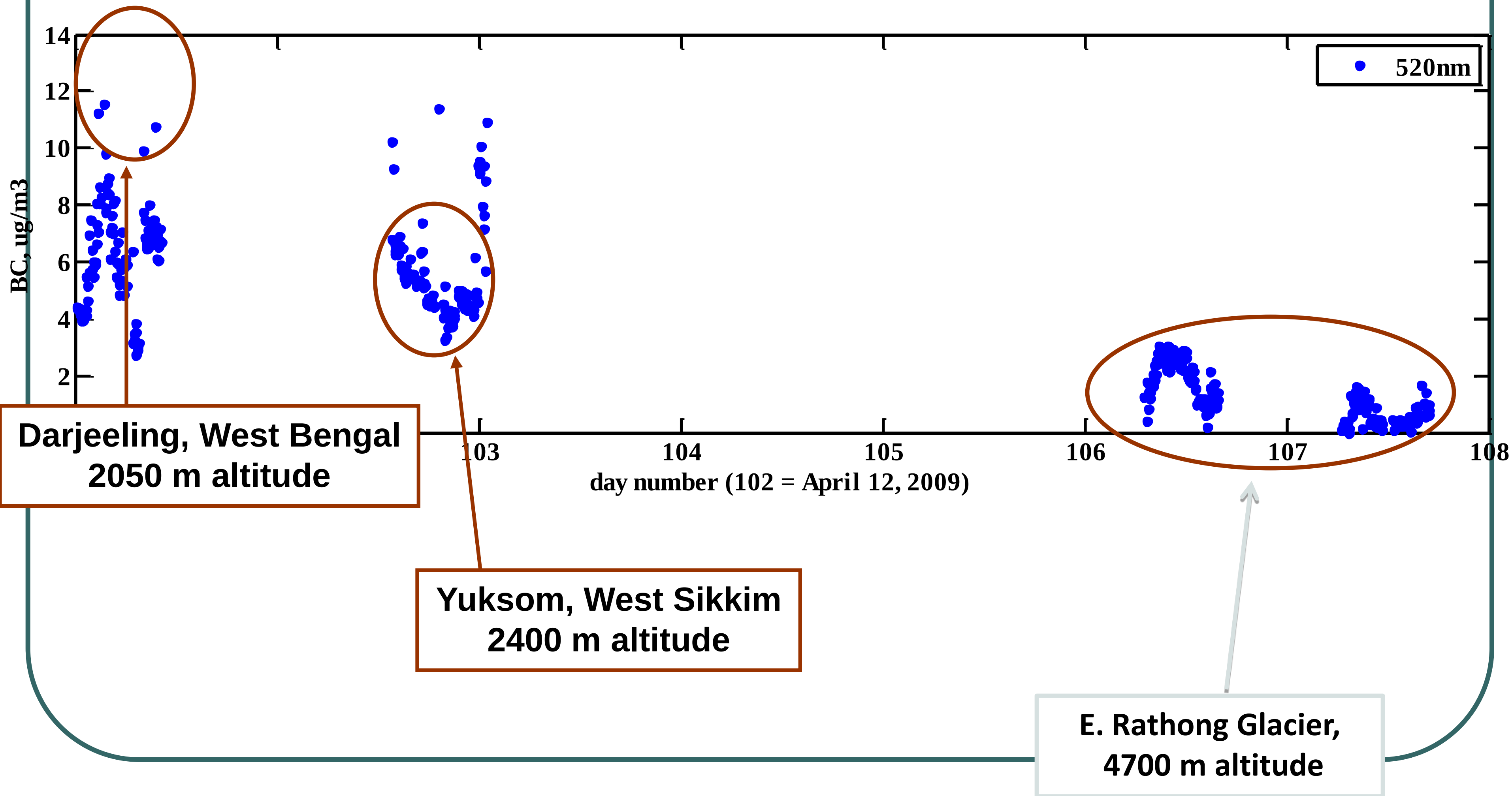


Monitoring result

Concentration of Black carbon in Western Himalayan region



Concentration of Black carbon in Eastern Himalayan region



Way forward

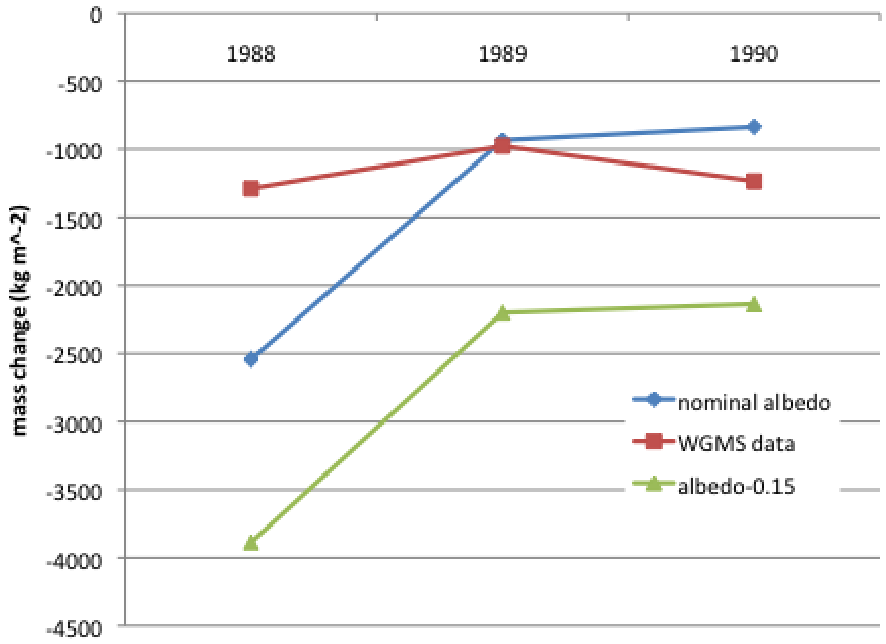
TERI's real time data

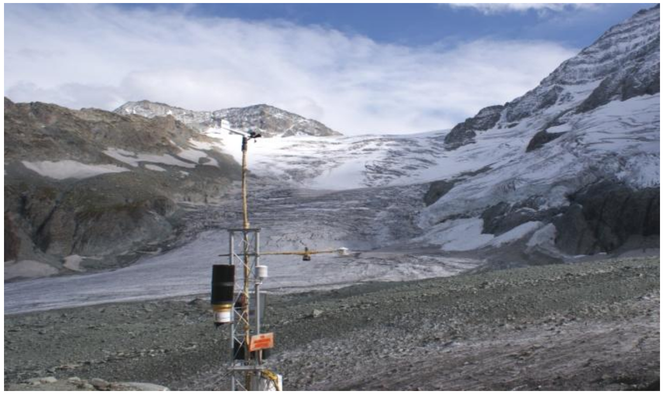
- Surface radiation balance
- Precipitation/Temperature
- Ambient aerosol and black carbon concentration
- Spectral snow reflectance for black carbon signature
- Black carbon concentration in snow
- Glacier mass balance
- Glacier discharge

Satellite data (NASA)

- TRMM: precipitation rate, 0.25 deg
- CERES: radiation budget, 10-50 km2
- SRTM: surface topography, 90 m)
- MODIS: snow cover, sweq, surface melt signature, land cover, 1km
- MSU: Tropospheric Temperature, 40 km
- GRACE: Cryospheric and terrestrial water storage, 400 km

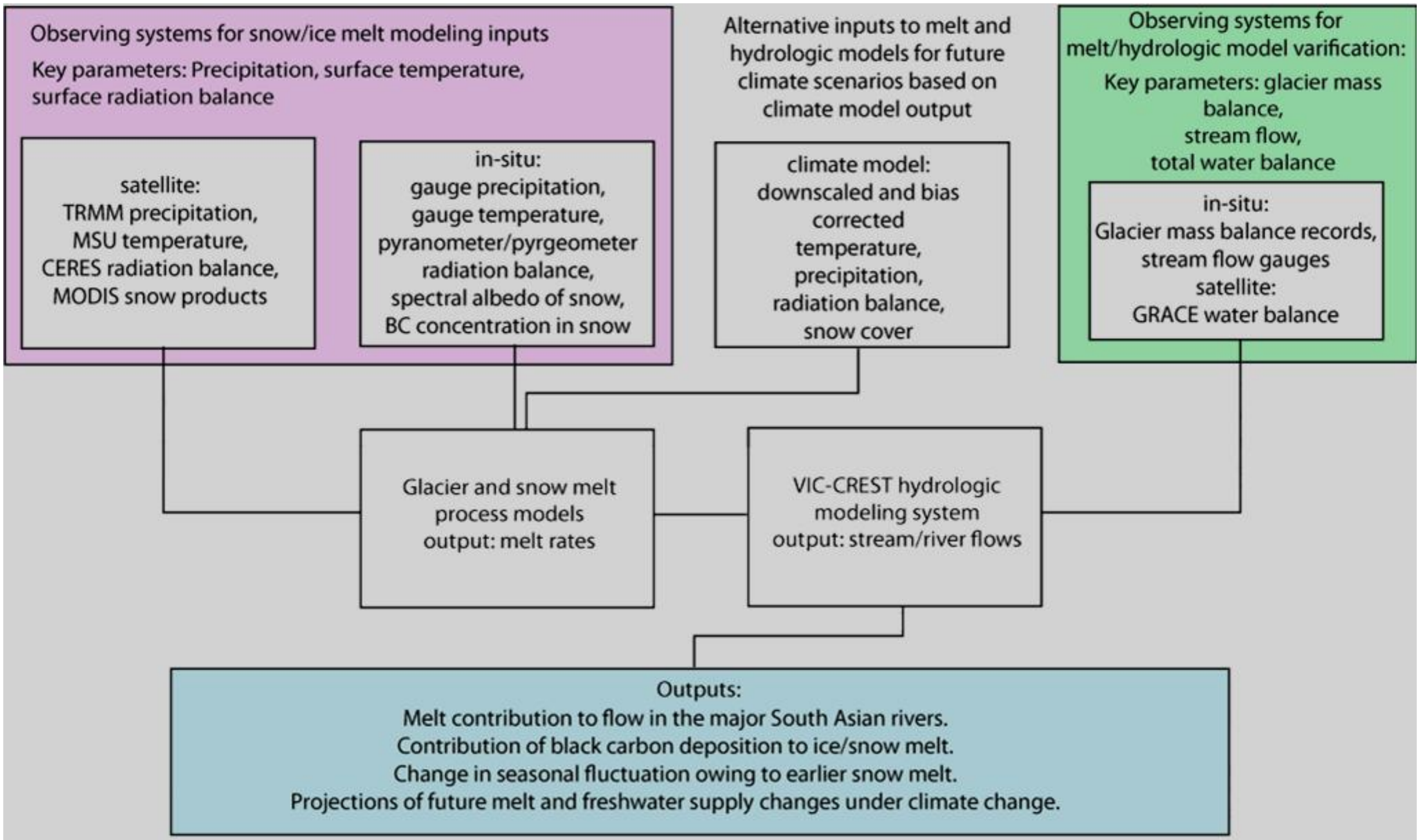
Glacier Mass Balance modeling





Kolahoi Glacier (34° 10'N 75° 18'E) tower at 3925m elevation

Climate Warming and Black Carbon Aerosol Impacts on Water Resources for South Asian Regions fed by Snow and Glacier Melt



Potential impact on vulnerable communities in Himalayan region - Food, Water & Livelihood security

Eric Wilcox, NASA

Global Atmospheric Pollution Forum

Air Pollution and Climate Change: Opportunities for Integrated Co-benefits Strategies in Developing Countries

Johan Kuylenstierna (SEI), Richard Mills (IUAPPA)
Kevin Hicks (SEI)

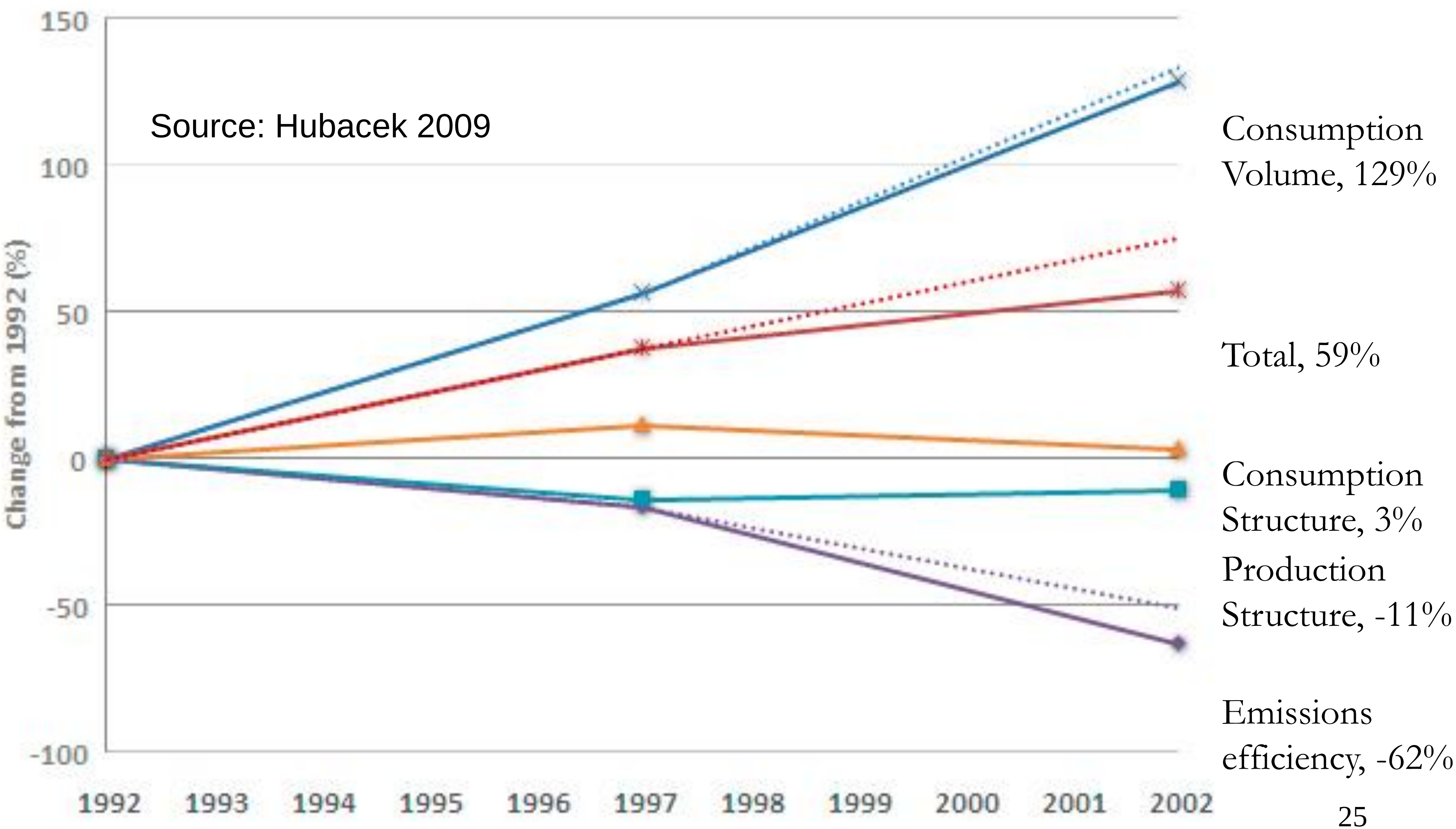
COP-15 Side Event
December 8, 2009

Effects of Emission Control Measures on Emissions (Amman, 2009)

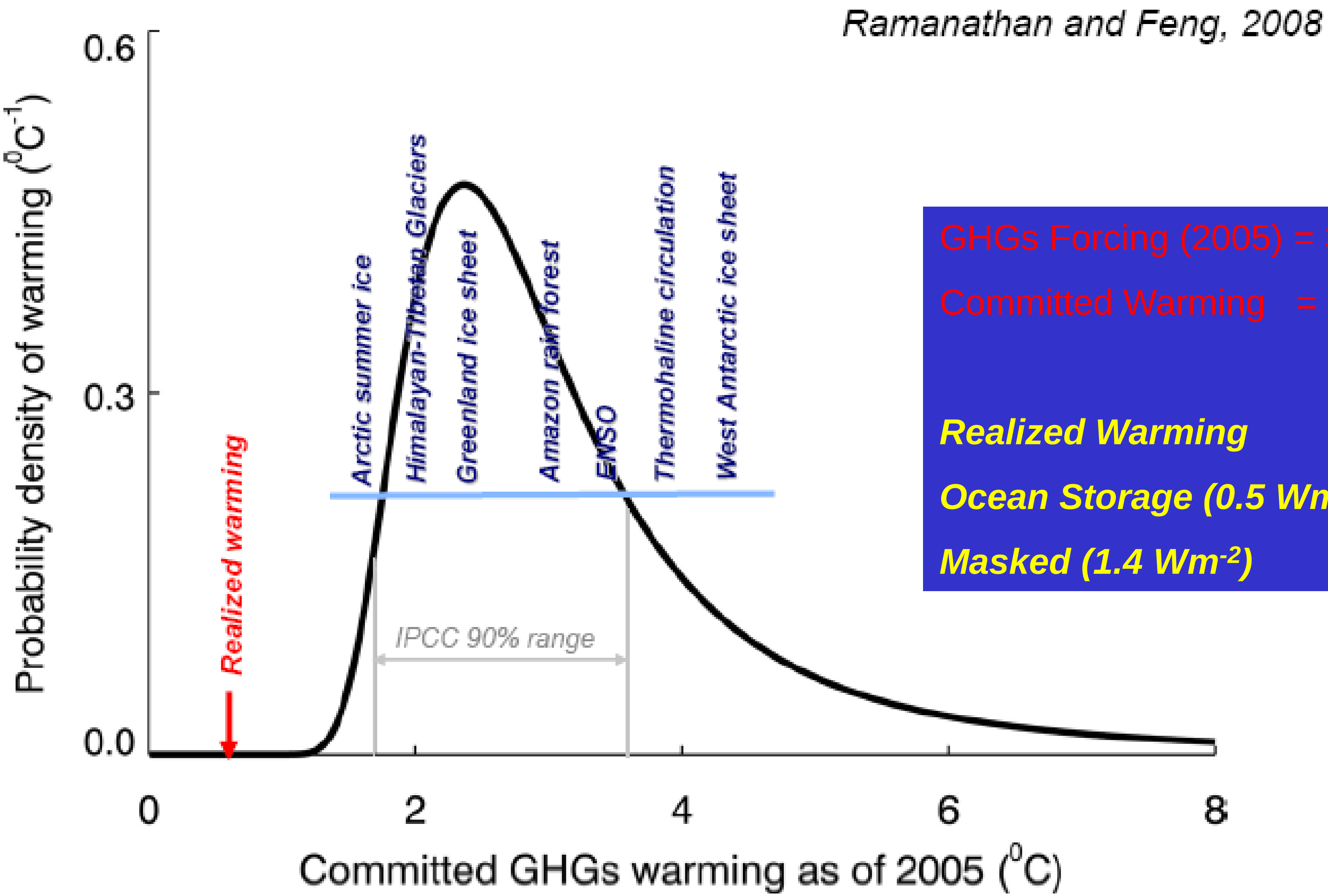
	Reduced emissions	Increased emissions
Structural Measures		
Energy savings, efficiency improvements, banning of activities	All pollutants	
Increased use of natural gas	CO_2, SO_2, VOC, NO_2, PM	CH_4
Biomass	CO_2	VOC, PM, CH_4, N_2O
Stationary Sources		
Advanced residential combustion	VOC, PM, CO, CH_4	
Fluidised bed combustion	SO_2, NO_X	N_2O
Combined heat and power	All pollutants	
Selective/non-selective catalytic reduction	NO_X, CO	NH_3, N_2O
FGD	SO_2, PM	CO_2
Mobile Sources		
Low sulfur fuels	SO_2, PM	
EURO Emission standards	NO_X, VOC, PM, CO	NH_3, N_2O
More diesel	CO_2, VOC	PM, NOx, SO_2

China: Structural Decomposition Analysis – efficiency versus emissions

- From 1992 to 2002, 59% increase in CO_2 emissions



Committed Warming as of 2005



GHGs Forcing (2005) = 3 Wm^{-2}

Committed Warming = 2.4 C

Realized Warming = 0.6 C

Ocean Storage (0.5 Wm^{-2}) = 0.5 C

Masked (1.4 Wm^{-2}) = 1.2 C

Committed warming derived from IPCC Forcing & IPCC climate sensitivity

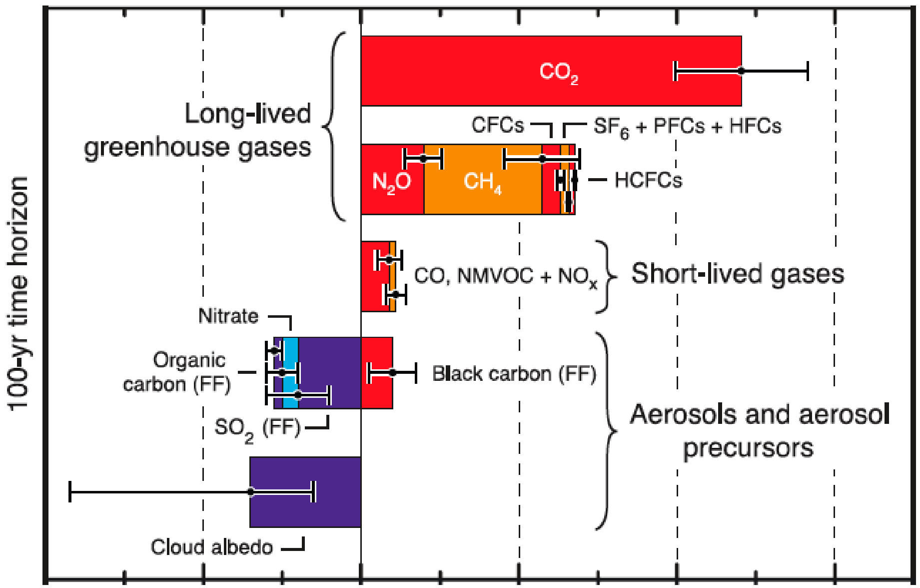
Global Forum Stockholm Conference

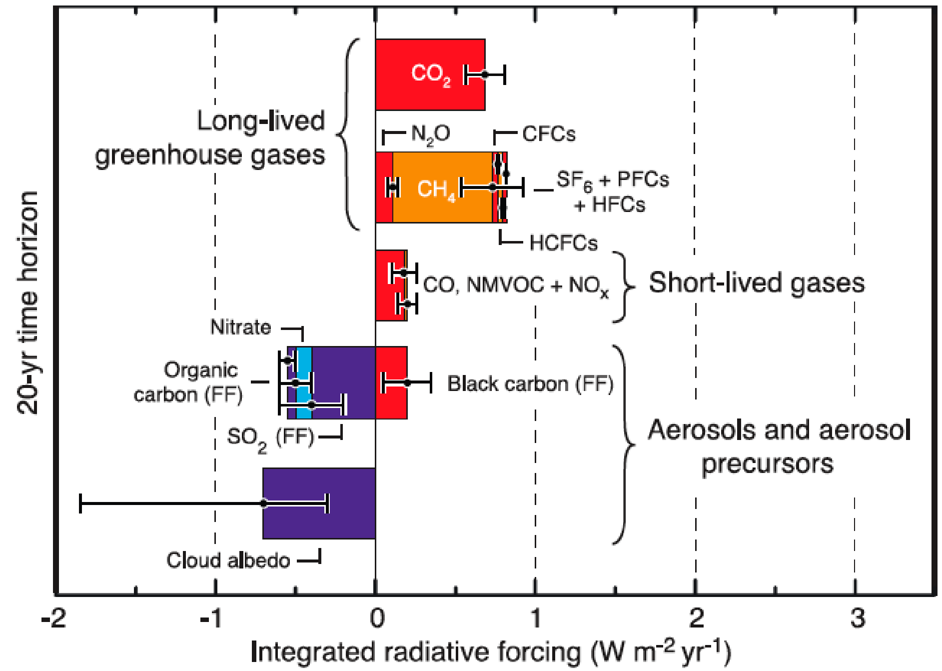
‘Air Pollution and Climate Change: Developing a Framework for Integrated Co-benefits Strategies’

<u>A Focus on Short term forcers</u>

- **SO_4 will go down – warming will be realised**
- **Focus on BC, O_3 and Methane**
- **Short-term forcing agents that also have air pollutant effects**

Integrated Radiative Forcing for Year 2000 Global Emissions





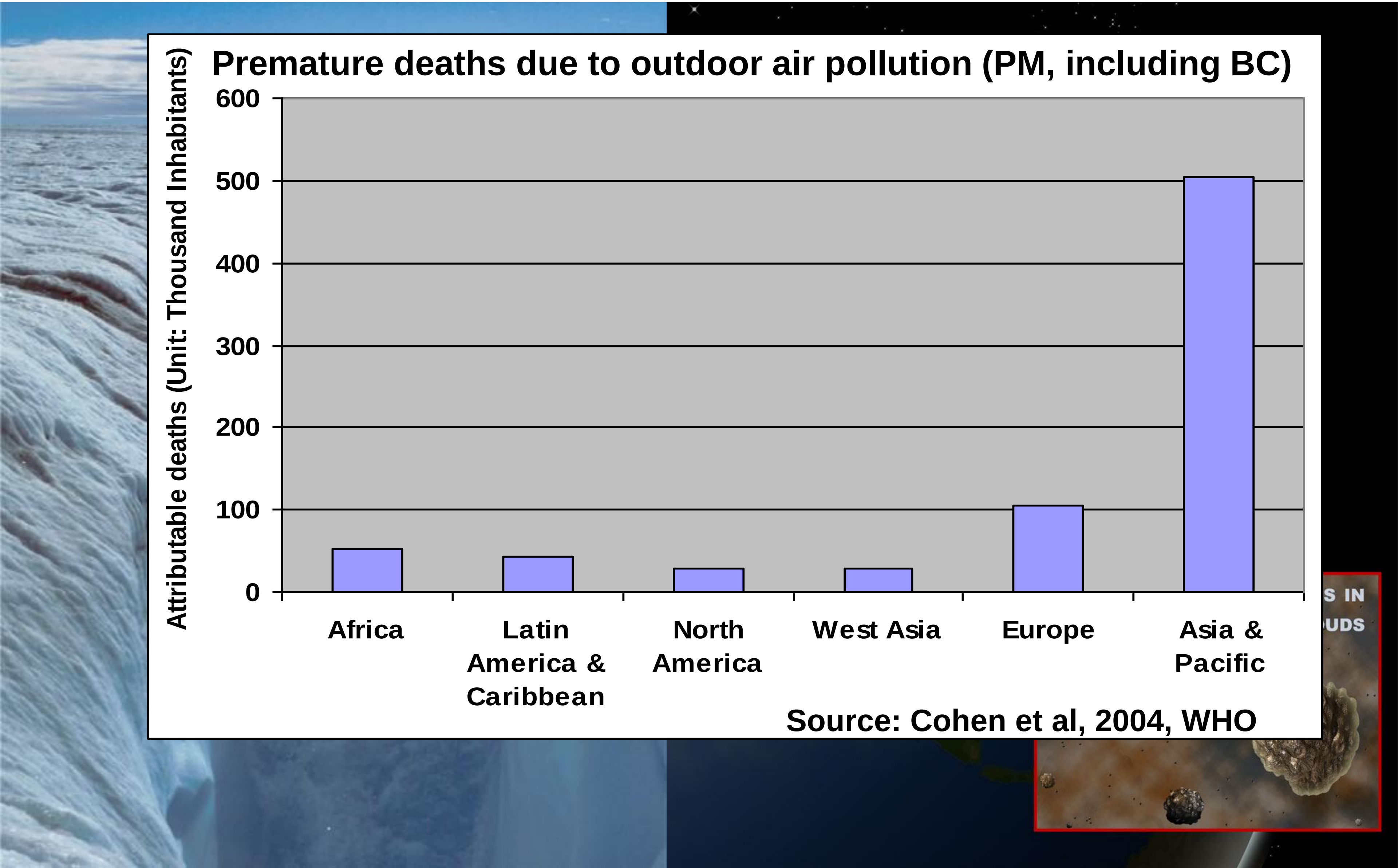
100-yr integrated radiative forcing

20-yr integrated radiative forcing

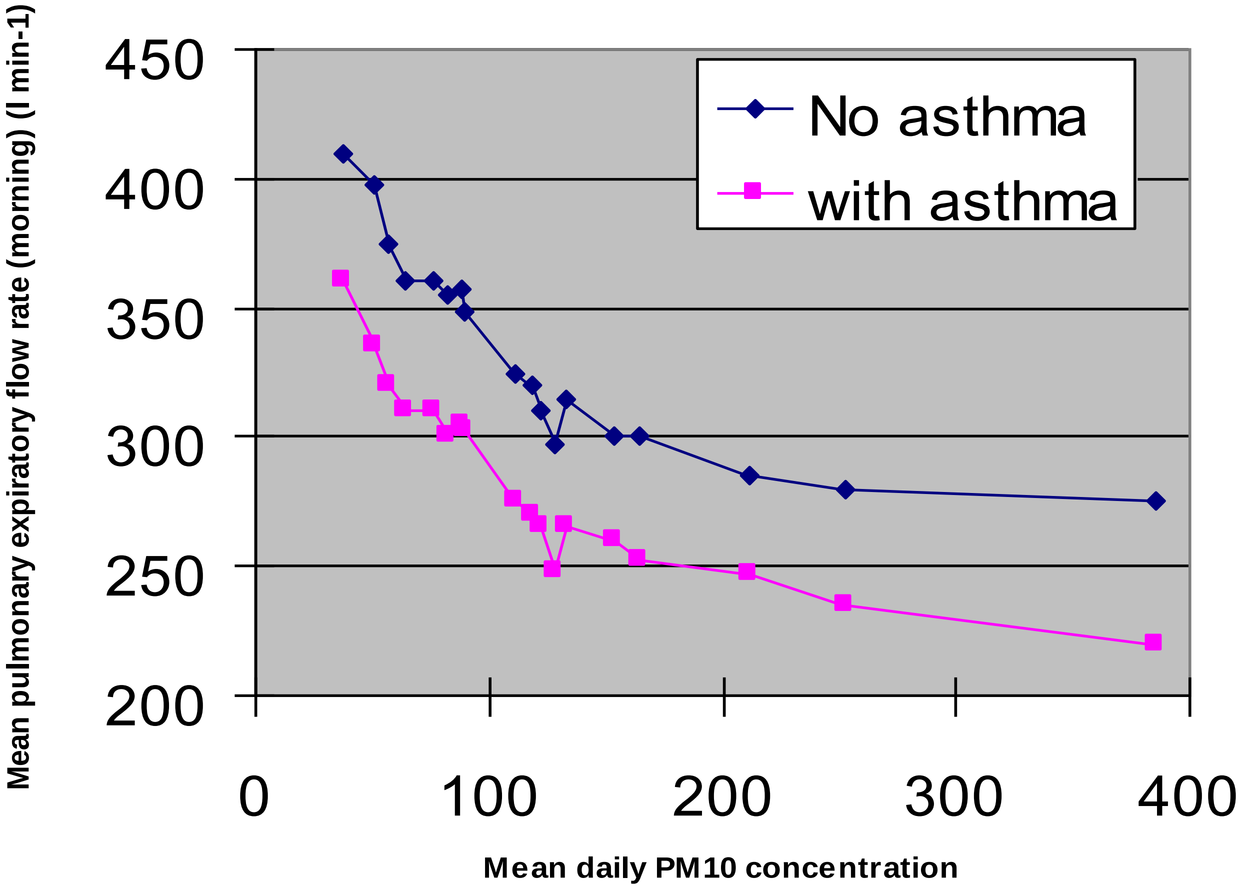
STOCKHOLM ENVIRONMENT INSTITUTE

Impacts on Himalayan-Tibetan Glaciers, Arctic and Health

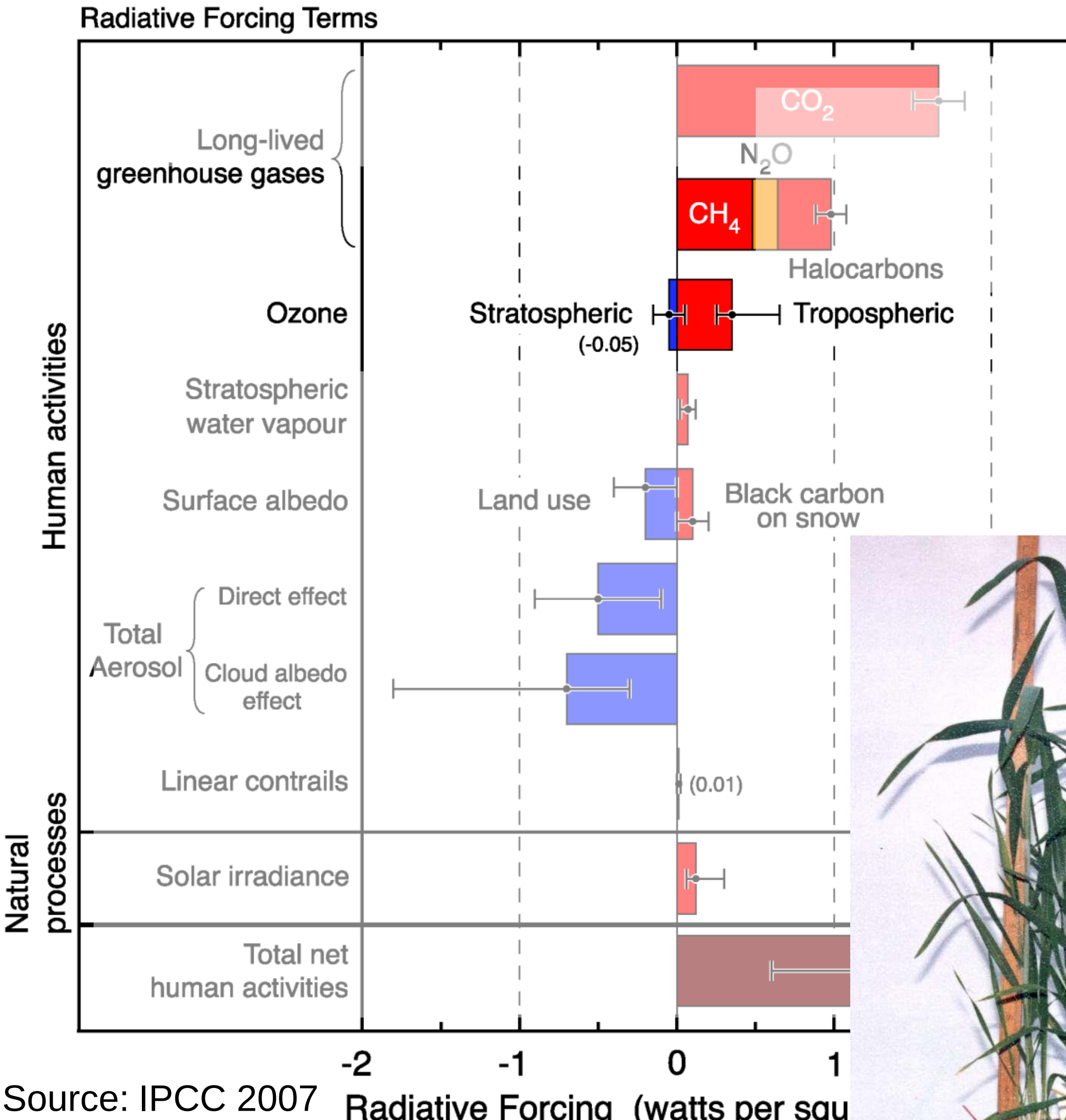
Black Carbon has an important local effect melting glaciers



Health Study Dhaka – the influence of PM on lung function



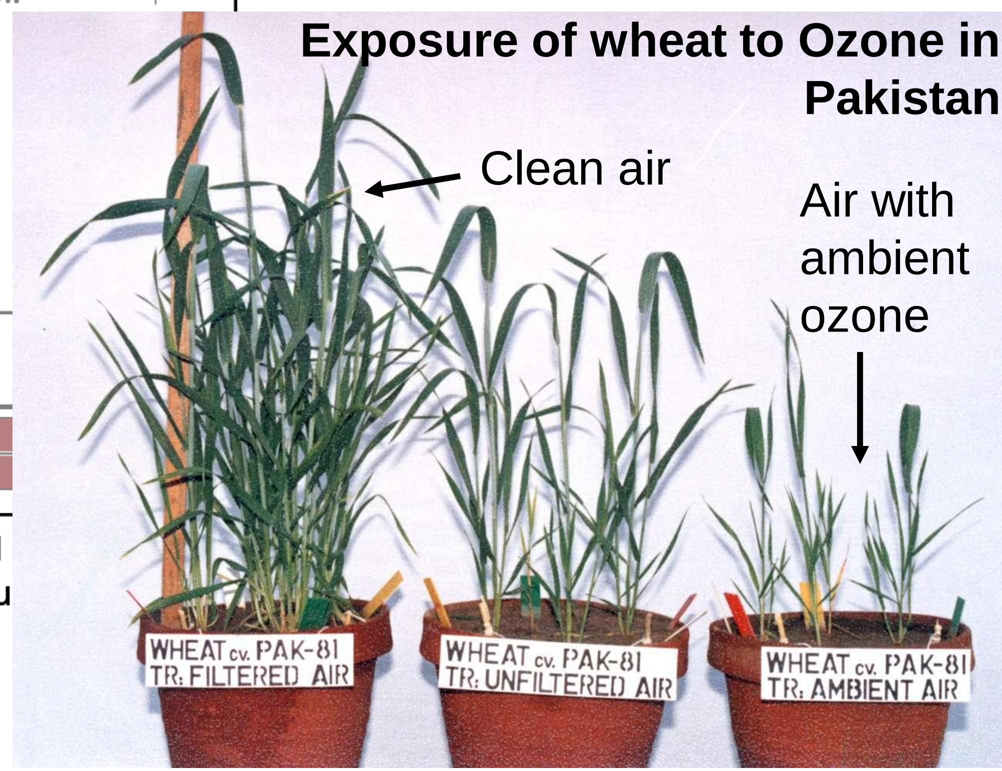
Multiple benefit of reducing ground-level / tropospheric ozone



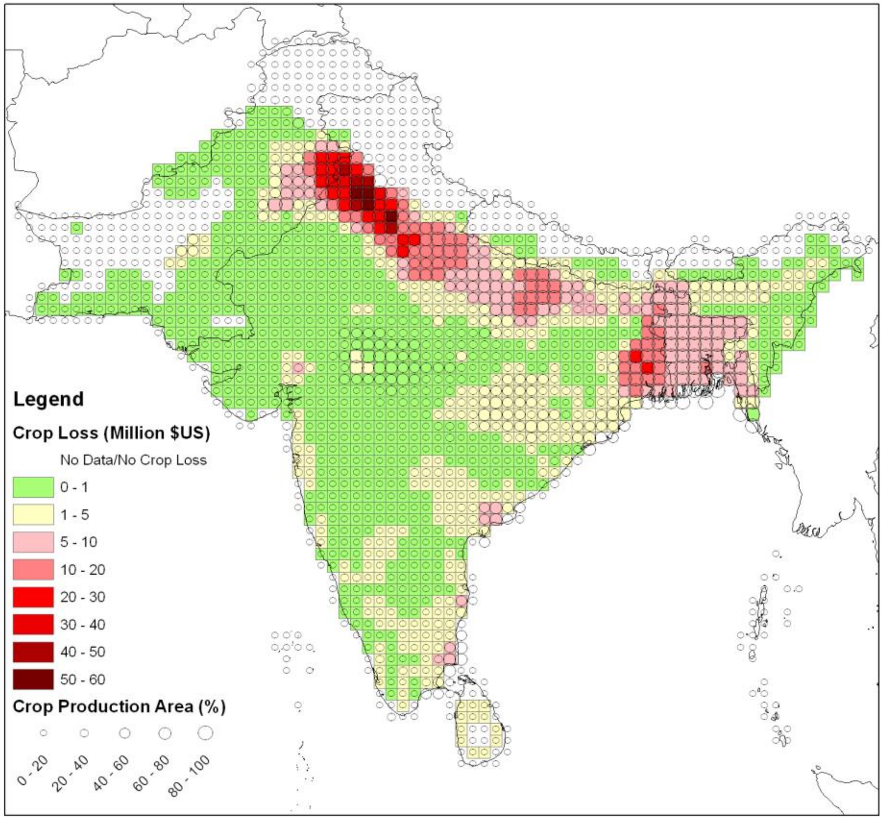
Source: IPCC 2007

i. Ozone – an important GHG; short residence time – immediate climate benefits from reductions

ii. Ozone – reduces crop yields in Asia by up to 40%



Provisional economic loss estimates for crops in South Asia



Wheat, Rice, Soybean, Potato

European AOT40 dose-response relationships

FAO crop production, distribution and producer price data for 2000

MATCH modelled O_3 concentrations for 2000

Loss estimated at US$ 3.9 Billion
India (US$ 3.1), Pakistan (US$ 0.35) and Bangladesh (US$ 0.4)

STOCKHOLM ENVIRONMENT INSTITUTE

Insights from the Stockholm Co-Benefits Conference and Göteborg Conference side event

- Development is the major priority of developing countries

- Air pollution is often seen in developing countries as a more relevant and immediate entry point to atmospheric issues than climate change

- Some Asian countries are starting to encompass co-benefits approaches in policy making as they develop their air quality and climate policy.

Need for an Integrated Approach

Win- win solutions:

- Efficiency gains will affect all emissions (win-win) – but only if these are not offset by greater overall consumption

- Tackling BC, O_3 and Methane will have multiple benefits,

Win-lose:

- Some measures reduce sulphate but leave BC – worst possible result for climate

Thank you

Potential Avenues for Integrating Air Pollution And Climate

Peringe Grennfelt

Swedish Environmental Research Institute

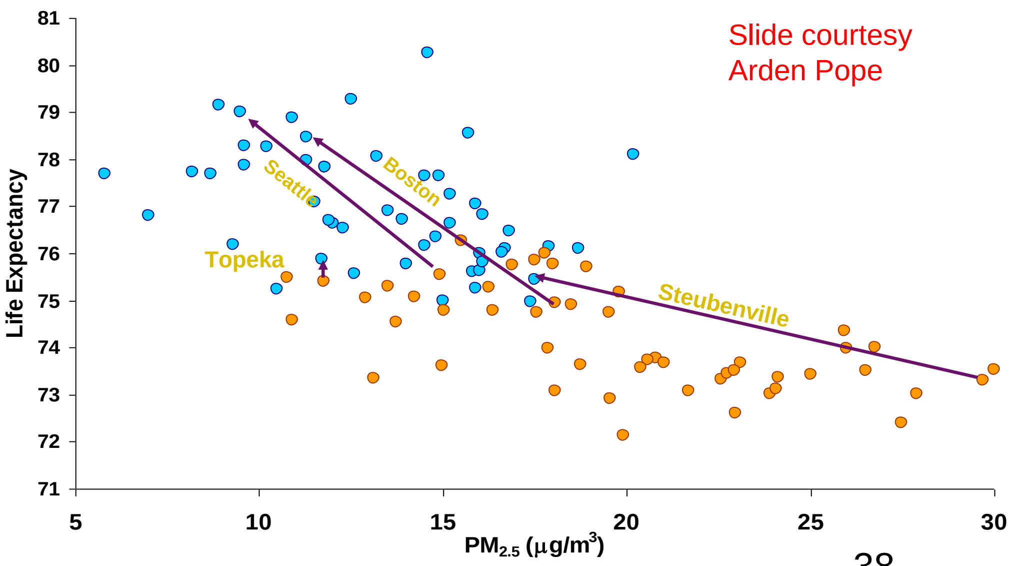
IPCC AR4 concludes:

"..in all analyzed world regions near-term health co-benefits from reduced air pollution as a result of actions to reduce GHG emissions can be substantial and may offset a substantial fraction of mitigation costs *(high agreement, much evidence)"*

- In many countries, air pollution is a stronger policy driver than climate change.
- Air pollution control will continue independent of climate change policies. (e.g. through regulations on large combustion plants, motor vehicles etc.)

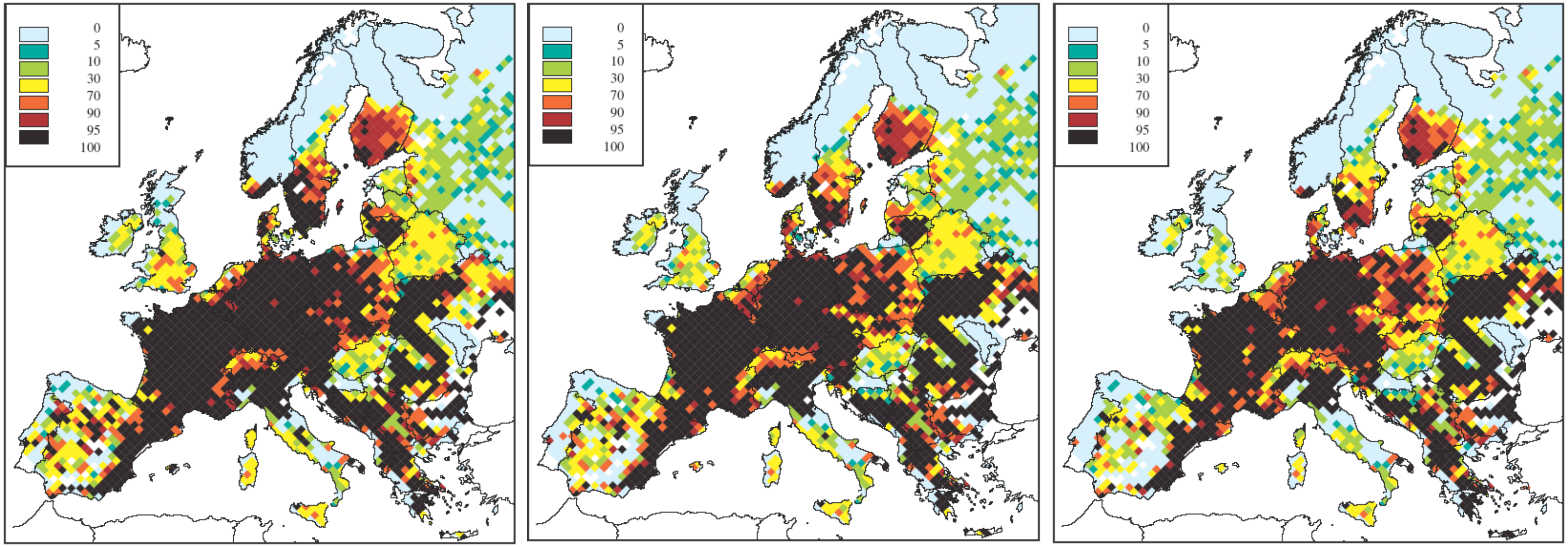
Life Expectancy vs $PM_{2.5}$ 1980-2000

- Health impacts:
- EU 2000: 370000 premature deaths every year (CAFE strategy 2005)
- Globally: ~2 million premature deaths every year (WHO 2005)



Ecosystem Effects Also Important Driver for Air Pollution Control

Exceedance of critical loads for eutrophication



2000 2010 2020

Proportion of ecosystems above the critical loads
(EU CAFE strategy. Baseline emissions)

Co-benefits in Developing and Industrial Countries are Well Documented

- US-EPA IES program:
  - Co-control options accounting for health co-benefits (Argentina, Brazil, Chile, China, India, Mexico, Phillippines, South Korea..)
- IGES (Institute for Global Env. Strategies):
  - Research on co-benefits of climate actions in the Asia-Pacific region
- Clean Air Initiative: Asia
- Europe: IIASA (Gains model Europe, Asia etc.)
- Academic scholars/publications:
  - Health and environmental co-benefits of GHG mitigation often exceed the costs
  - Air pollutants as a climate forcing (trade-offs!)

Control Measures Mostly Influence More than One Compound Examples:

Effects of Emission Control Measures on Emissions (Amman, 2009)

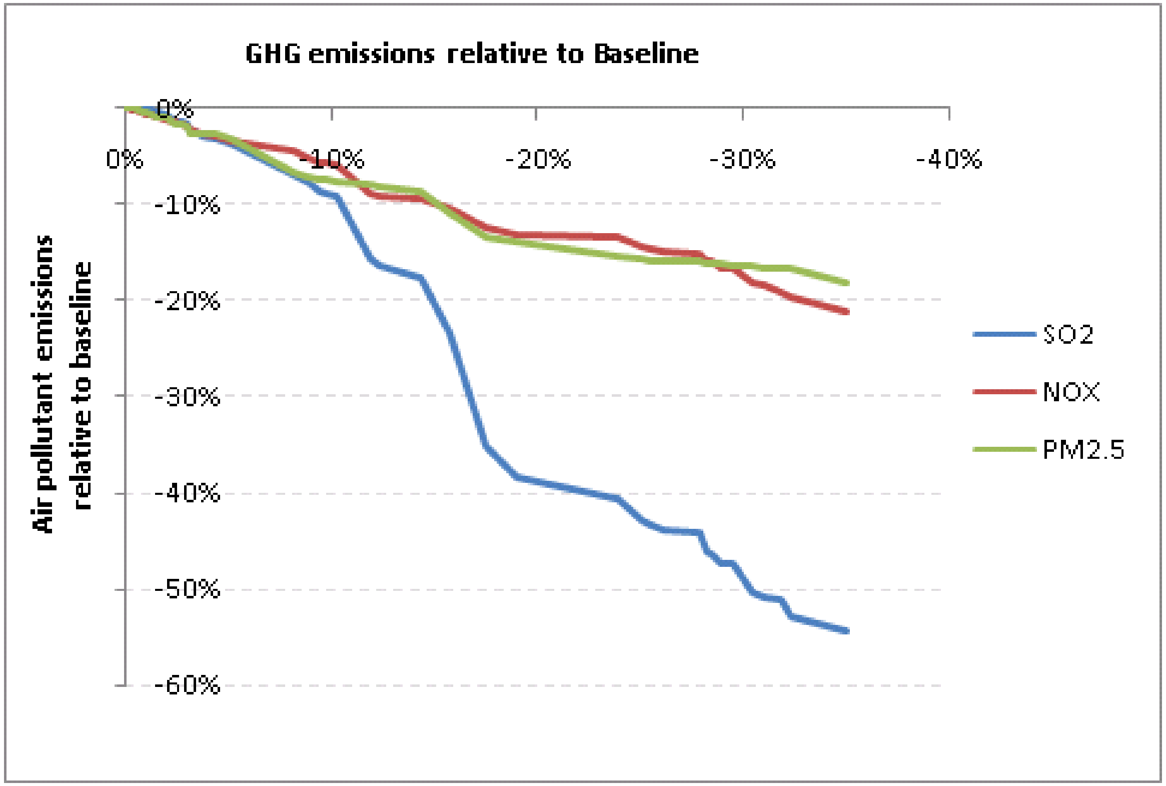
	Reduced emissions	Increased emissions
Structural Measures		
Energy savings, efficiency improvements, banning of activities	All pollutants	
Increased use of natural gas	CO_2, SO_2, VOC, NO_2, PM	CH_4
Biomass	CO_2	VOC, PM, CH_4, N_2O
Stationary Sources		
Advanced residential combustion	VOC, PM, CO, CH_4	
Fluidised bed combustion	SO_2, NO_X	N_2O
Combined heat and power	All pollutants	
Selective/non-selective catalytic reduction	NO_X, CO	NH_3, N_2O
FGD	SO_2, PM	CO_2
Mobile Sources		
Low sulfur fuels	SO_2, PM	
EURO Emission standards	NO_X, VOC, PM, CO	NH_3, N_2O
More diesel	CO_2, VOC	PM, NOx, SO_2

Co-control of GHGs and air pollutants

Annex I parties of UNFCCC, 2020.

Source: IIASA GAINS

30% GHG control may reduce NOx and $PM_{2.5}$ emissions by 15-20% and SO_2 emissions by 45-50%.



http://gains.iiasa.ac.at

- Thus, large evidence of benefits of co-control, but ...

- There is a need to:
  - further improve scientific understanding
  - further develop tools to quantify costs and benefits
  - establish platforms and (new) mechanisms for facilitating climate change and air pollution control in developing countries
  - improve capabilities for co-control in developing countries

"Air pollution community ready to offer support"

- Conclusions from workshop in Gothenburg 19-21 October organised by the Swedish EU presidency in collaboration with the Convention on Long-Range Transboundary Air Pollution (CLRTAP), USEPA, EU Global Atmospheric Pollution Forum (GAP) and other organisations.

- The workshop had the aim to highlight the possibilities for the air pollution community to design air pollution control strategies to offer climate benfits.

Main Conclusions

- CLRTAP and subsidiary bodies should consider to:
  - Include climate change mitigation in the revision of the Gothenburg Protocol
  - Establish a Task Force in support of combined policies (together with UNFCCC, IPCC)
  - Work together with relevant CC bodies (UNFCCC, IPCC etc.)
  - Particular issues
    - Explore the need for a protocol for background ozone
    - Evaluate the interrelations between nitrogen and climate change

Conclusions with Respect to Developing Countries

- Global Atmospheric Pollution Forum
  - will lead a UNEP assessment on climate and air pollution effects from black carbon and ozone '
- CLRTAP, UNEP and GAP should
    - Improve capacity building
    - Consider needs for financial support (possibilities for using existing CC policy mechanisms and forming new)
    - Facilitate technology transfer

End

www.swedishepa.se/airclimconf