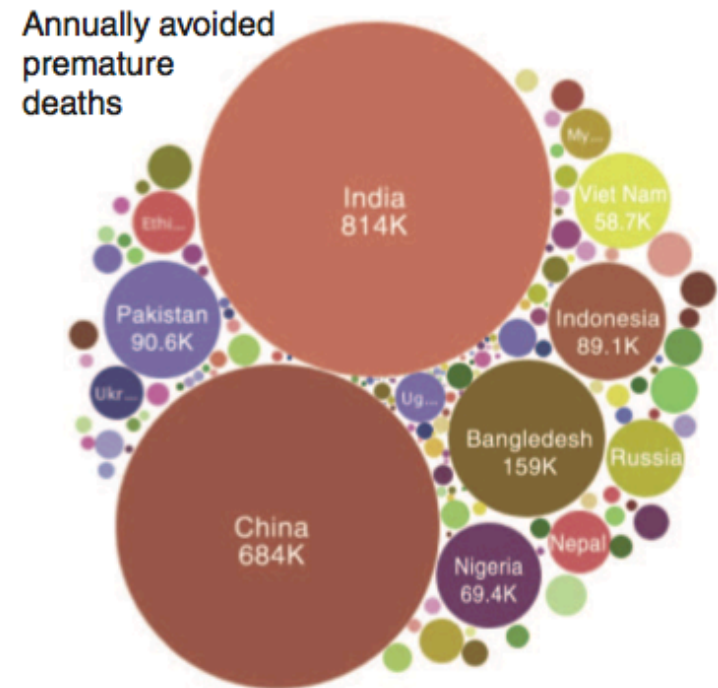
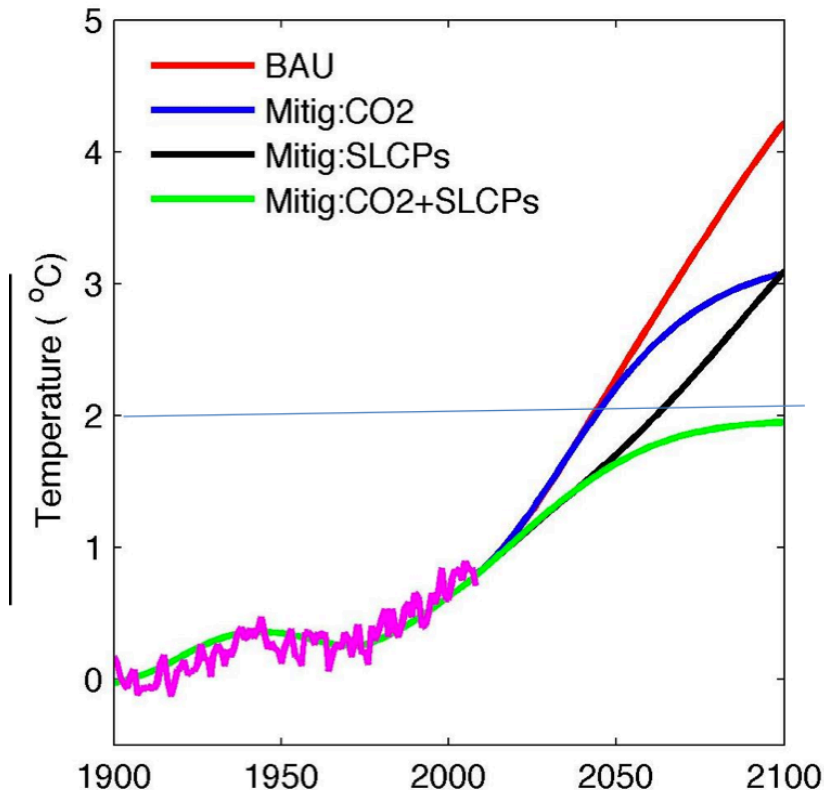


# Supporting health impact assessment tools using remote sensing and earth system models

SLCPs = **CH<sub>4</sub>**, **BC**, OC, CO, VOCs, NO<sub>x</sub>, SO<sub>2</sub>, NH<sub>3</sub>, (HFCs)



UNEP 2011; Shindell et al., 2012  
Ramanathan and Xu, 2010; Hu et al., 2013  
Ramanathan and Carmichael, 2008

**Daven K. Henze**, CU Boulder

**Susan Anenberg**, Environmental Health Analytics

**Patrick Kinney**, Environmental Health Analytics, Columbia University

Randall Martin and Aaron van Donkelaar, Dalhousie University

# Climate and Clean Air Coalition (CCAC)

- Initiated Feb 2012
- Bangladesh, Colombia, Ghana, Mexico, Sweden, US, and UNEP
- now 109 members (50 countries, numerous IGOs and NGOs).

Cross-cutting efforts:

- Financing SLCP mitigation
- **SLCP National Action Plans**



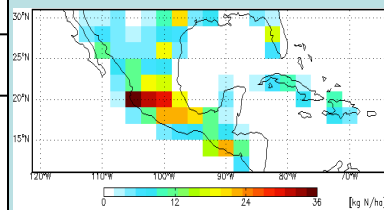
[www.unep.org/ccac](http://www.unep.org/ccac)

LEAP-IBC: rapid emission and scenario assessment toolkit

## Mitigation



## $\Delta$ Emissions



## Response

$\Delta O_3$ ,  
 $\Delta PM_{2.5}$ ,  
 $\Delta CH_4$

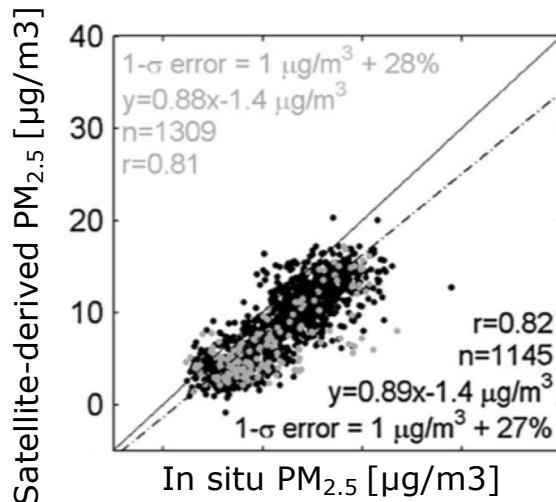
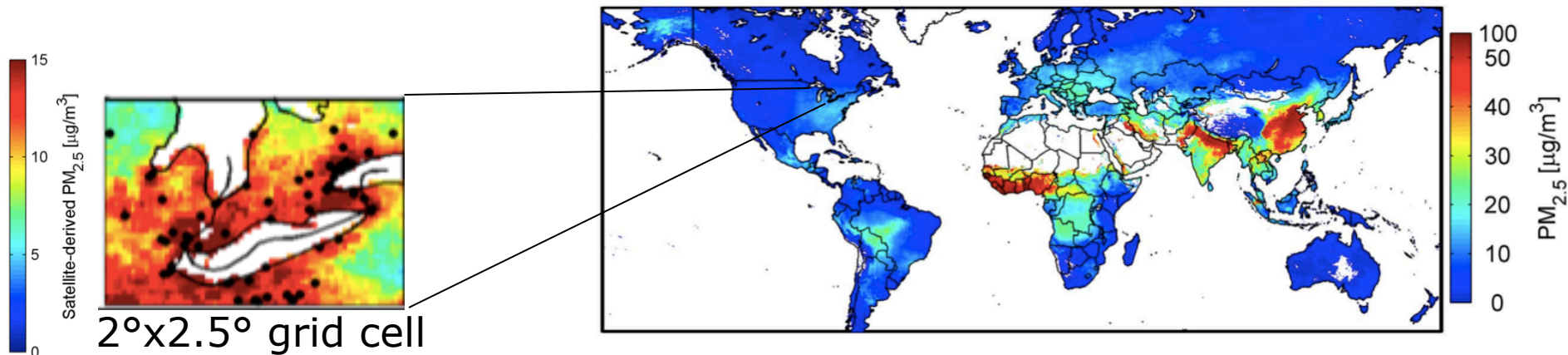
## Impacts

- health
- climate
- ecosystem

Country-specific responses for arbitrary  $\Delta$ emissions from GEOS-Chem adjoint

# NASA Earth Observations used in LEAP-IBC

PM<sub>2.5</sub> subgrid variability (0.1° x 0.1°) resolved using MODIS AOD and CALIOP vertical profile (van Donkelaar et al., 2013):



Satellite-derived PM<sub>2.5</sub> instrumental for global health studies.

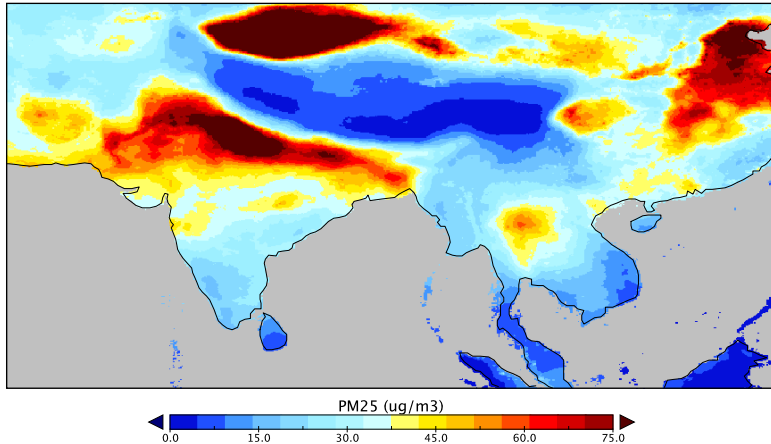
Approaches and instrumentation evolve (e.g., VIIRS, TROP-OMI,...).

Also use TES IRK and GISS climate model parameterization to estimate climate response.

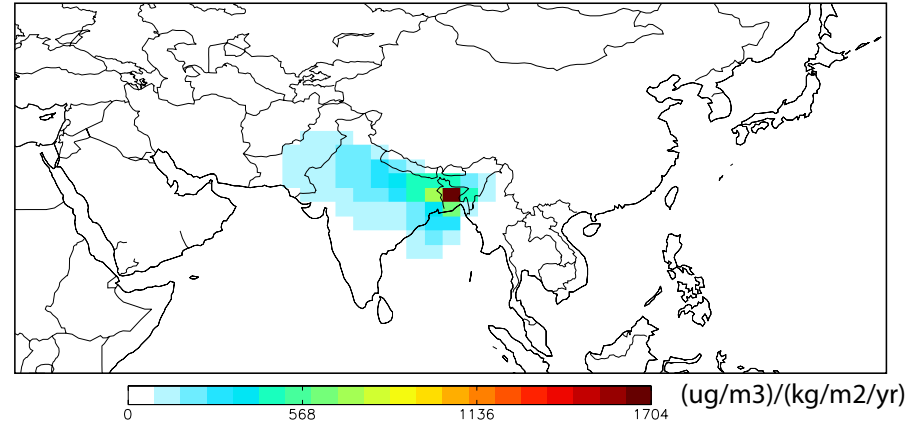
# LEAP- Integrated Benefits Calculator (IBC)

## Application: Bangladesh

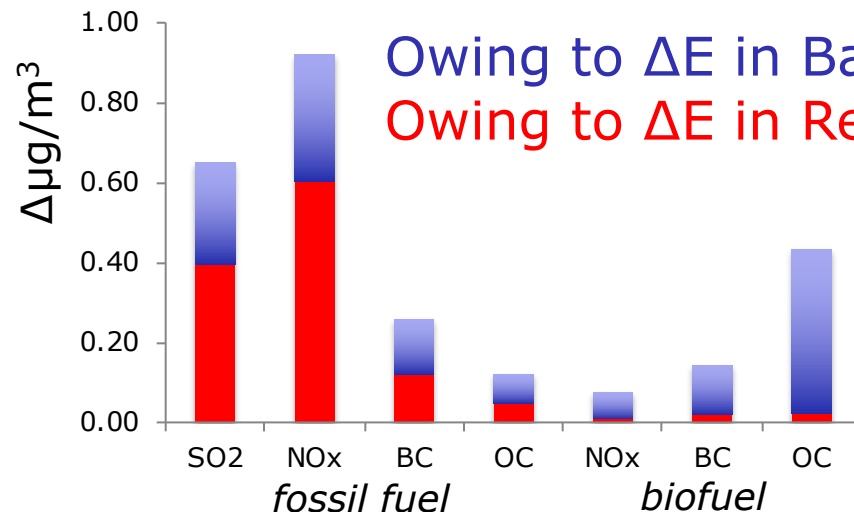
Satellite-derived surface PM<sub>2.5</sub>



SO<sub>2</sub> impact on exposure in Bangladesh



Response to 2030 – 2005 global emissions scenario ( $\Delta E$ ) from LEAP:



Owing to  $\Delta E$  in Bangladesh (81,686 deaths)

Owing to  $\Delta E$  in Rest of World (92,830 deaths)

Also estimate:

- changes in global  $\Delta T$
- health impacts of  $\Delta O_3$
- suppressed yield of crops

# Project Overview

- **Core project goals:**

- Application of new and future multi-sensor satellite-derived PM<sub>2.5</sub> estimates (MISR, SeaWiFS, MODIS, VIIRS, and TROPOMI)
- Extension of the GEOS-Chem adjoint model to high-resolution simulations over key urban areas, for use with new high-resolution (0.01 x 0.01) satellite-derived PM<sub>2.5</sub>.
- Delivery of global and fine resolution PM<sub>2.5</sub> exposure response coefficients to the LEAP-IBC to support CCAC member nations and initiatives.

- **Team member interests and expertise:**

- Remote sensing of aerosols and trace-gases
- Regional-to-global air quality modeling
- Data assimilation and source-receptor modeling
- Domestic and international air quality management
- Environmental health and policy