

Global Atmospheric Pollution Forum

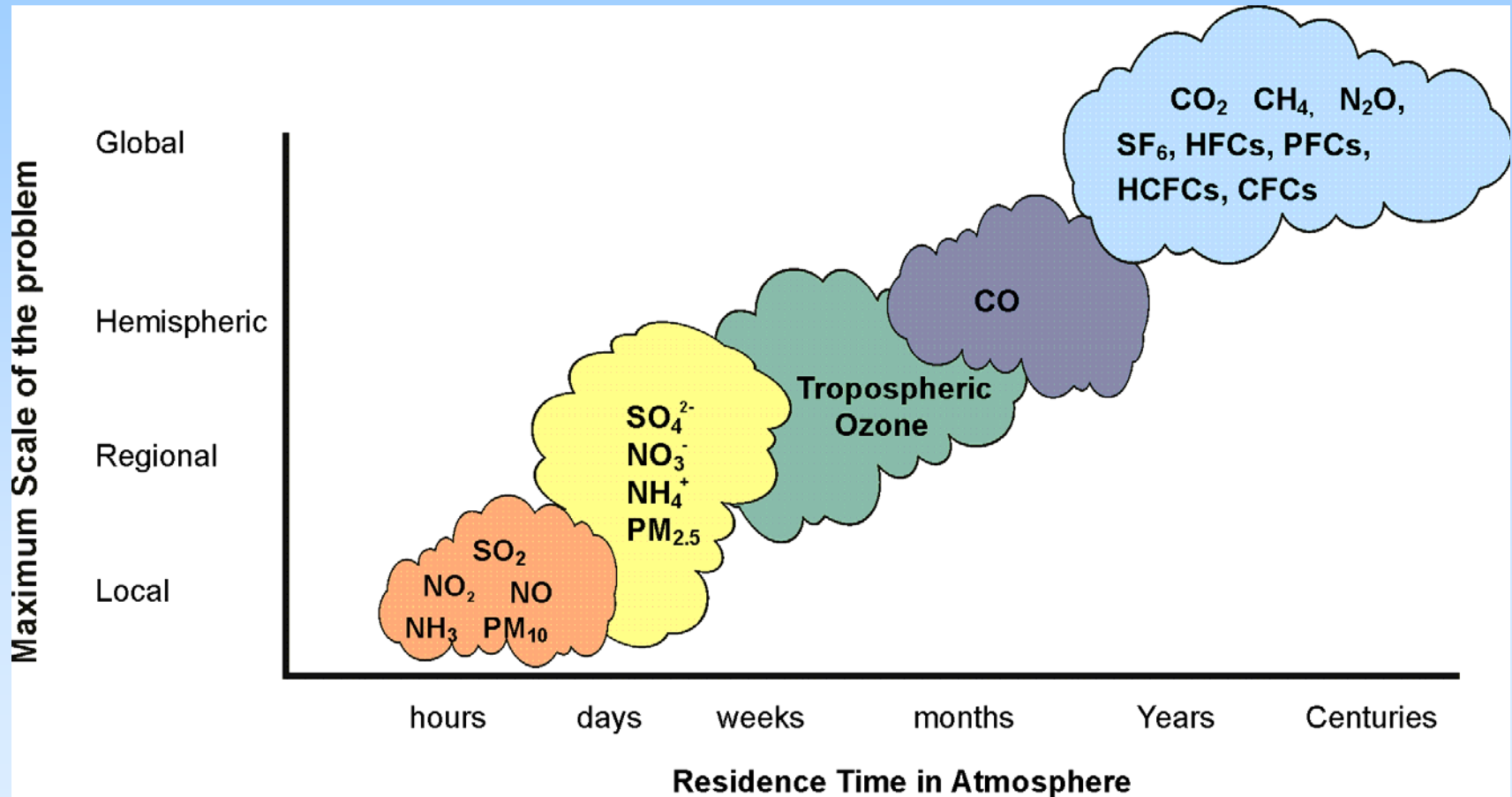


# Air Pollution at the Global and Hemispheric Scales - Emerging Trends

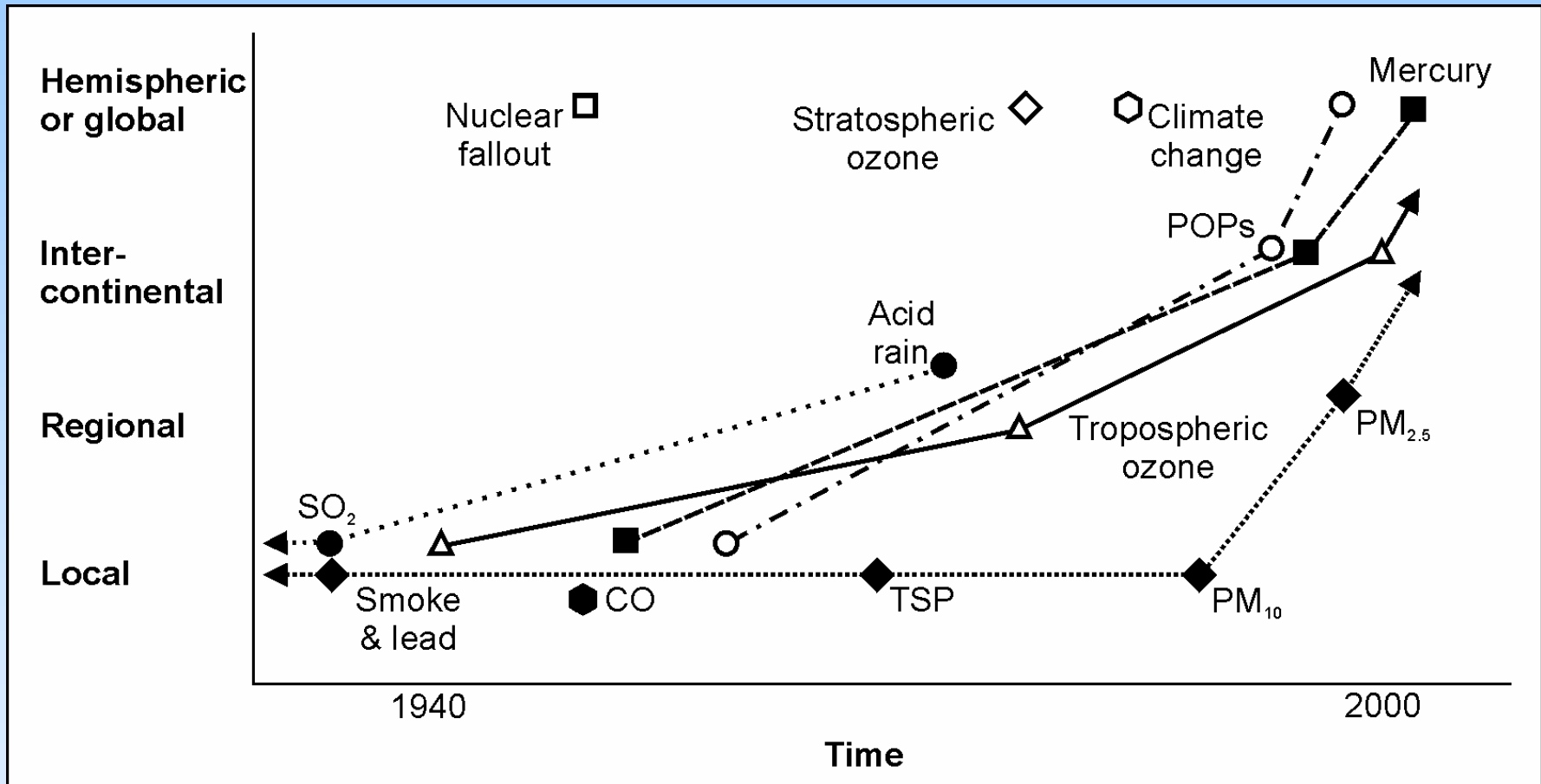
**Kevin Hicks (SEI),  
Johan Kuylenstierna (SEI), Richard Mills (IUAPPA)**

Sub-regional workshop: <<Better Air Quality in North Africa>>  
Hôtel Ramada Plaza, Tunis, 23-25 November 2009

# Air pollutants act at a range of scales



# Emerging challenges: evolution of the perceived spatial scale of air pollution

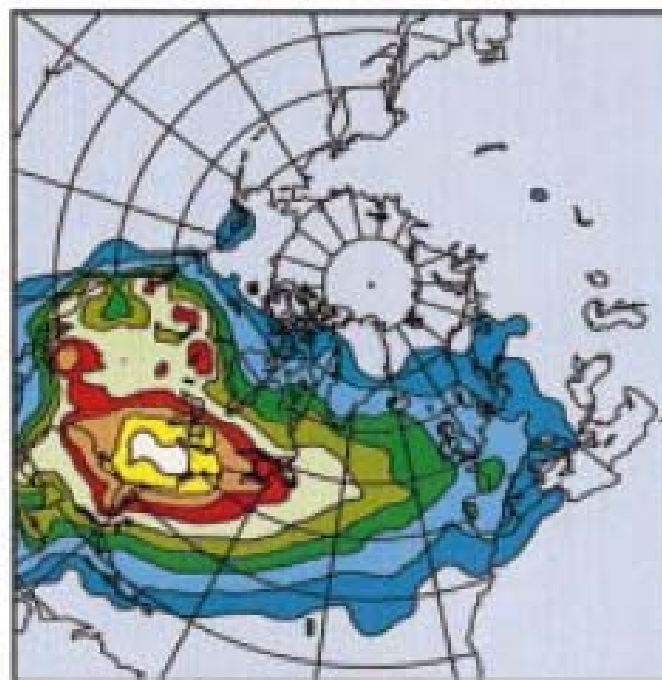
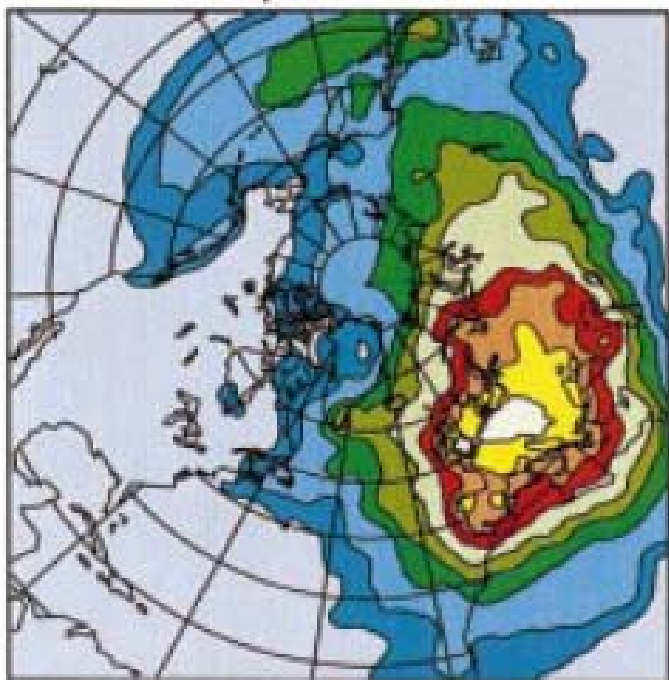


Keating *et al.*, 2004

# Continental scale transport of man-made sulphur

European Sources

North American Sources

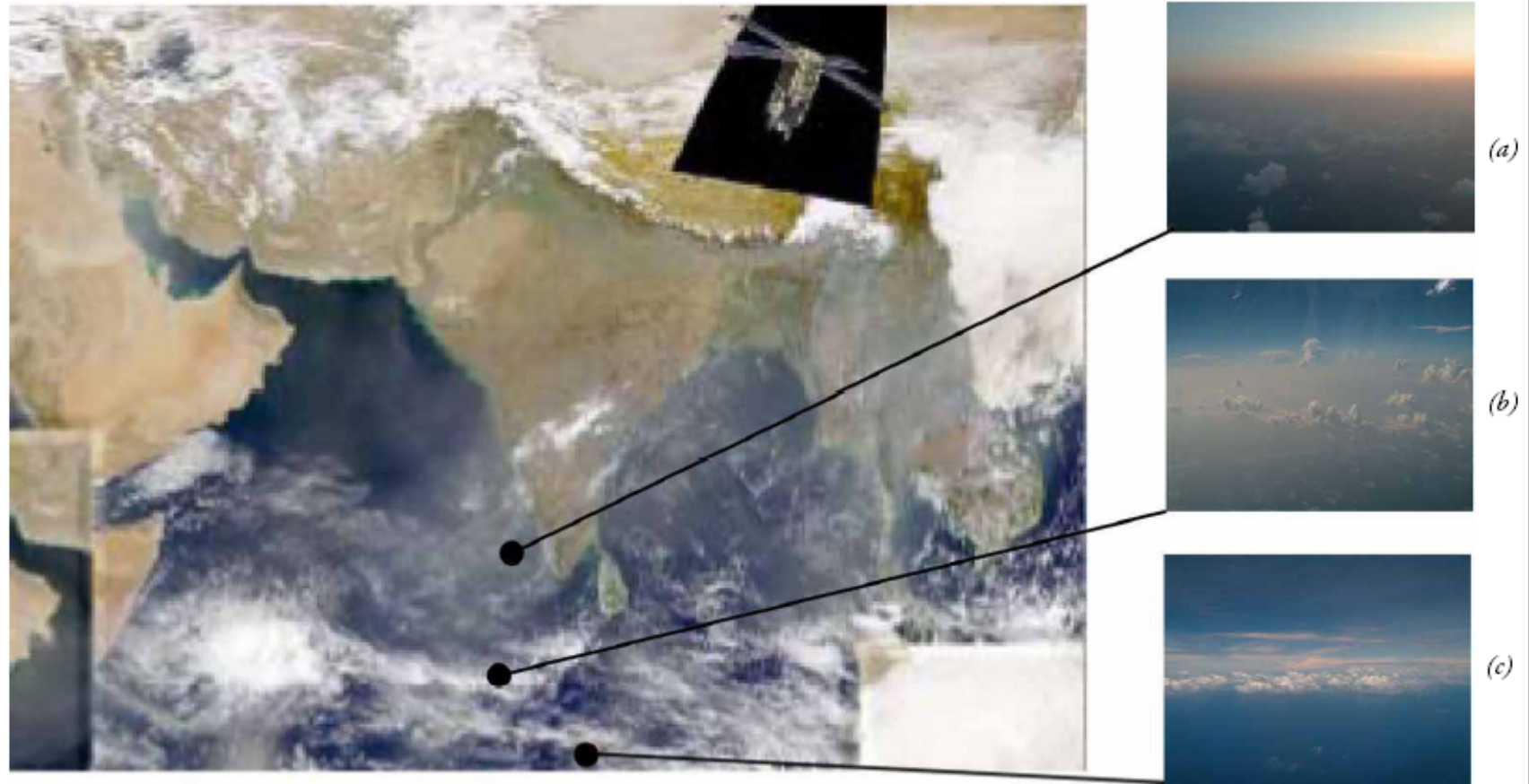


mg(S)/m<sup>3</sup>



Tarrason & Iversen, 1998

# Regional haze problem is increasing around the globe



(Courtesy of N. Kuring, NASA Goddard Space Flight Center)

Figure A: Synoptic view of the Asian during INDOEX, top left, from the SEAWiFS satellite. The three photographs on the right taken from the C-130 research aircraft show images of (a) the dense haze in the Arabian Sea, (b) the trade cumuli embedded in the haze and (c) the pristine southern Indian Ocean.

# Regional haze problem is increasing around the globe



Pollution haze over Bay of Bengal  
December 2004



© Archive



Haze over the lower Himalayas, south of Mt. Everest.

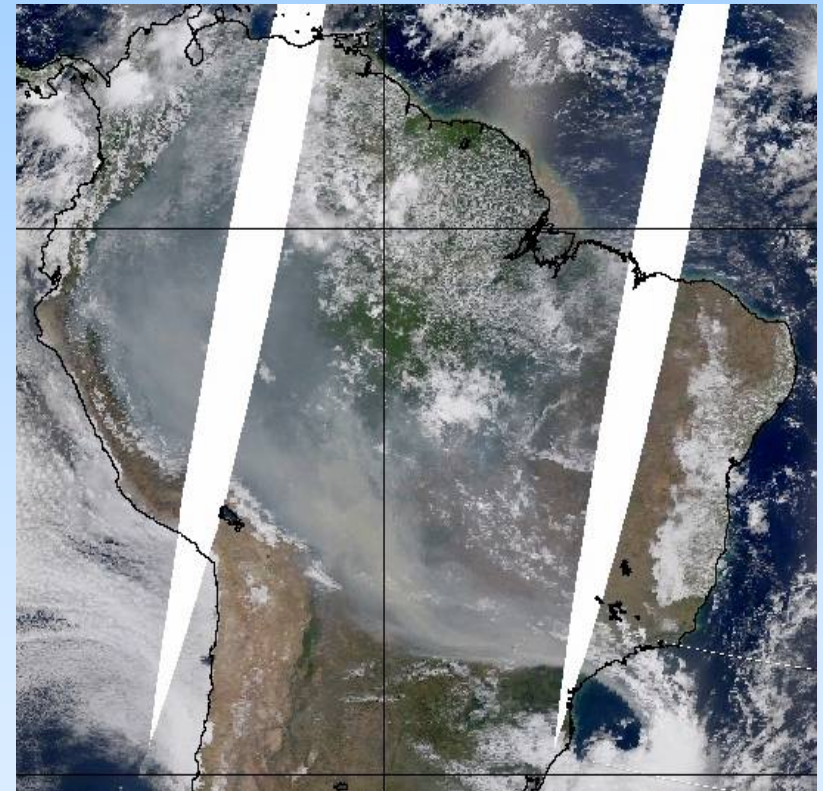
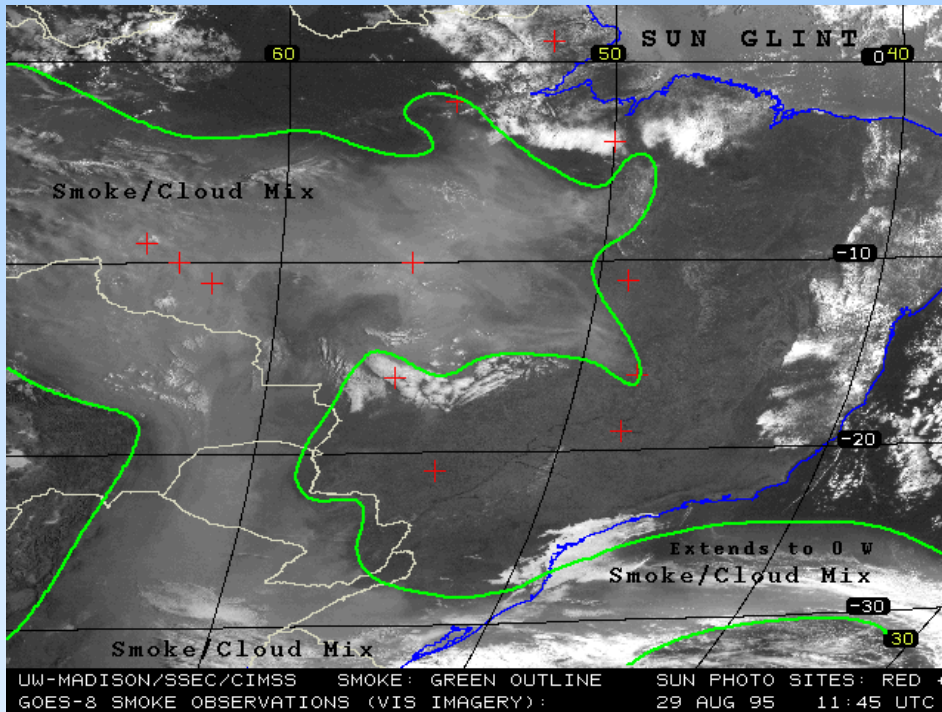
© Archive

1.3: Photograph of the South Asian Brown haze over the Nepalese town of Phaplu (bottom panel), taken on March 25, 2001, (approximately 30 km south of Mt. Everest (top panel), from a flight altitude of about 3 km. Both photographs were taken from the same location,

Brown haze over Nepal, UNEP  
ABC Assessment report 2002



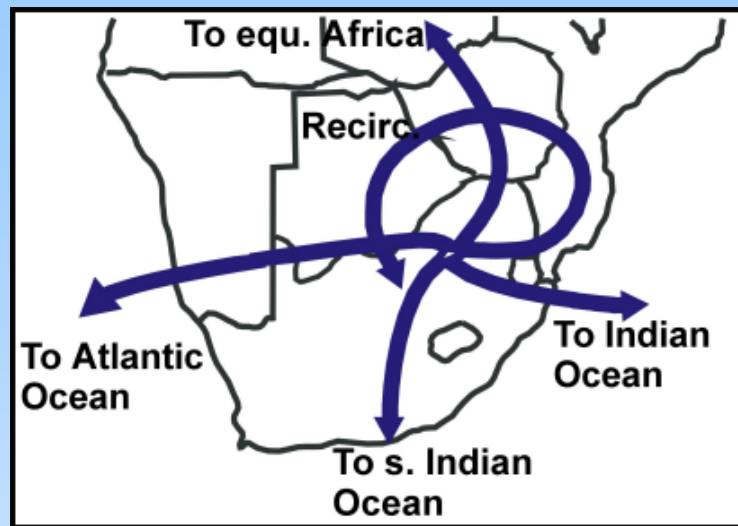
# Large scale distribution of heavy smoke from biomass burning in Amazonia all over South America



# Regional haze problem is increasing around the globe



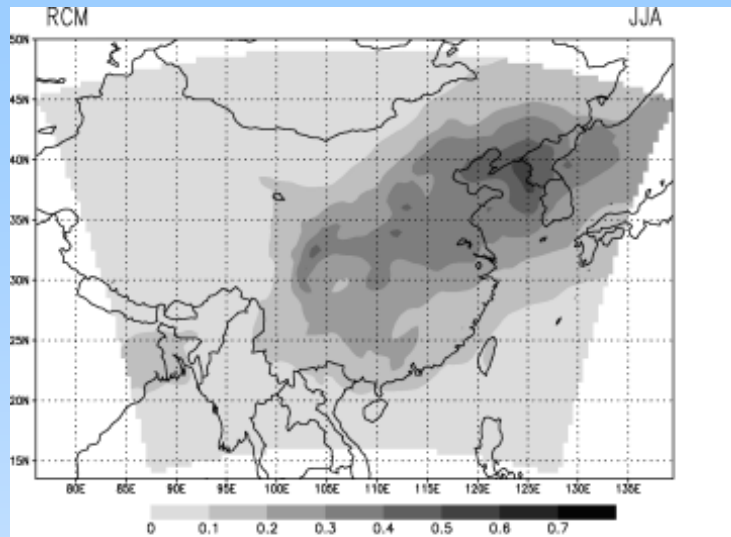
ROS events involve regional, long-range transport of huge quantities of aerosols and trace gases emitted from uncontrolled, man-made bushfires.



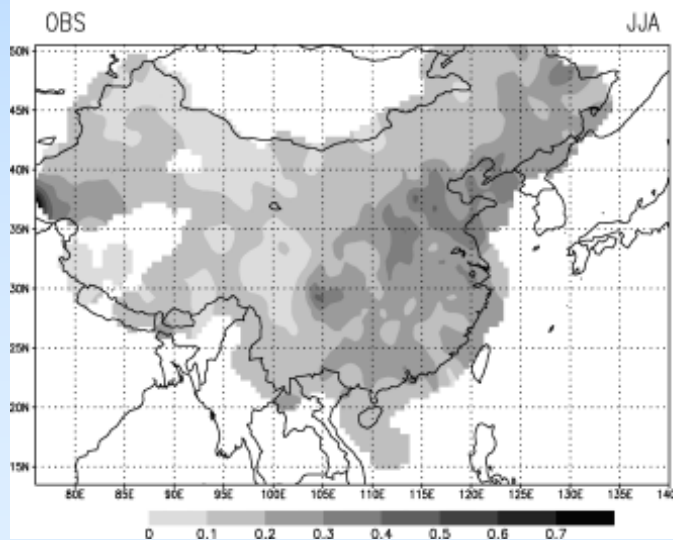
Southern African anticyclonic gyre — 5-year trajectory climatology displaying the main transport pathways of air out of the South African Highveld region.

# Implications of Hemispheric Transfer of Air Pollution

Modelled



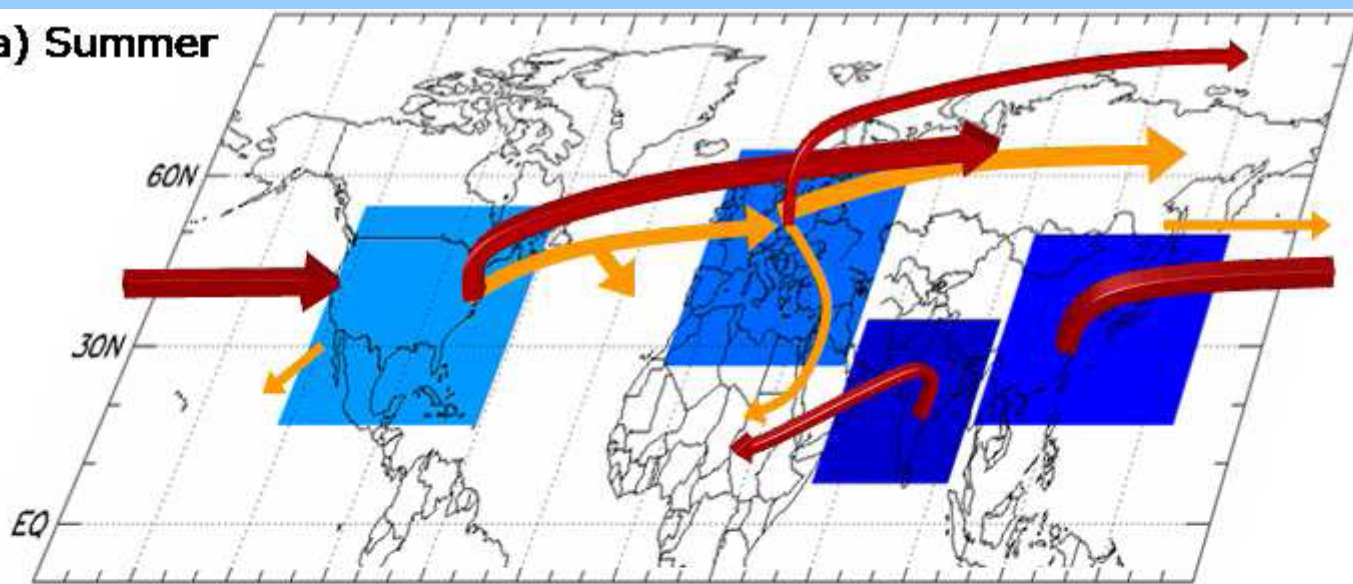
Observed



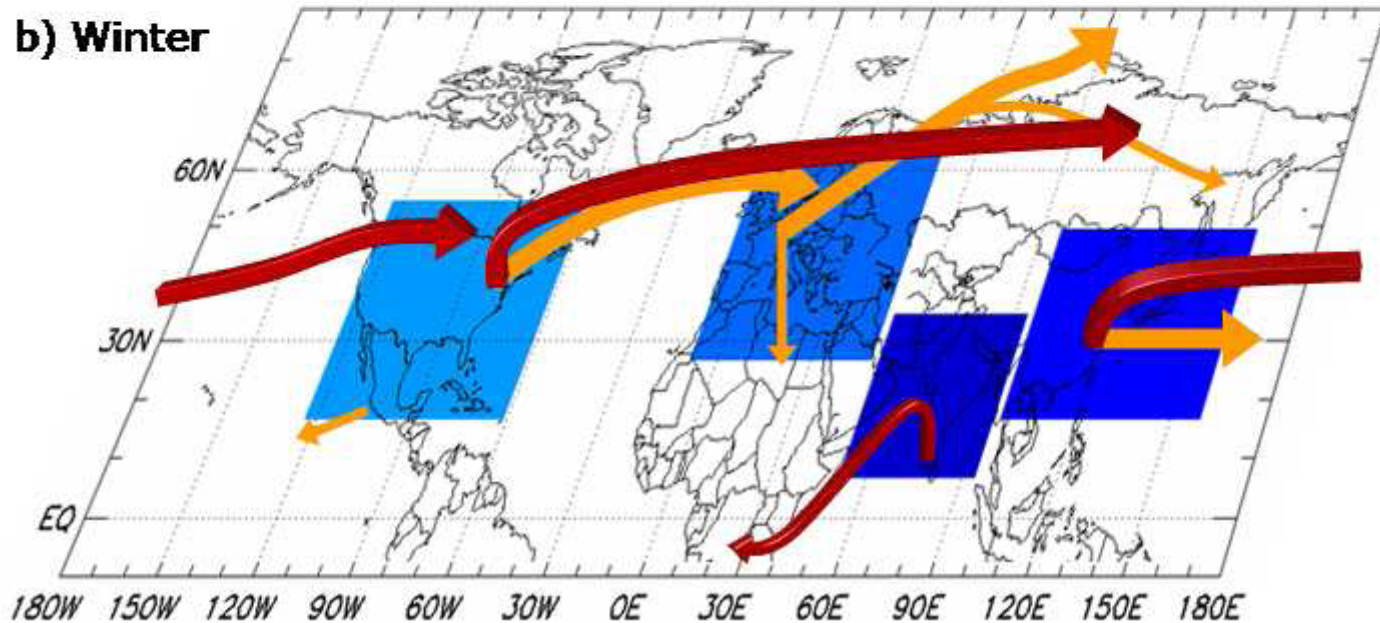
Extinction of sunlight due to aerosols in China  
Qian *et al.* *Tellus B* 2003

Particulate matter effects include health impacts, radiative forcing, extinction of sunlight, reduced visibility and alteration of rainfall patterns

a) Summer



b) Winter



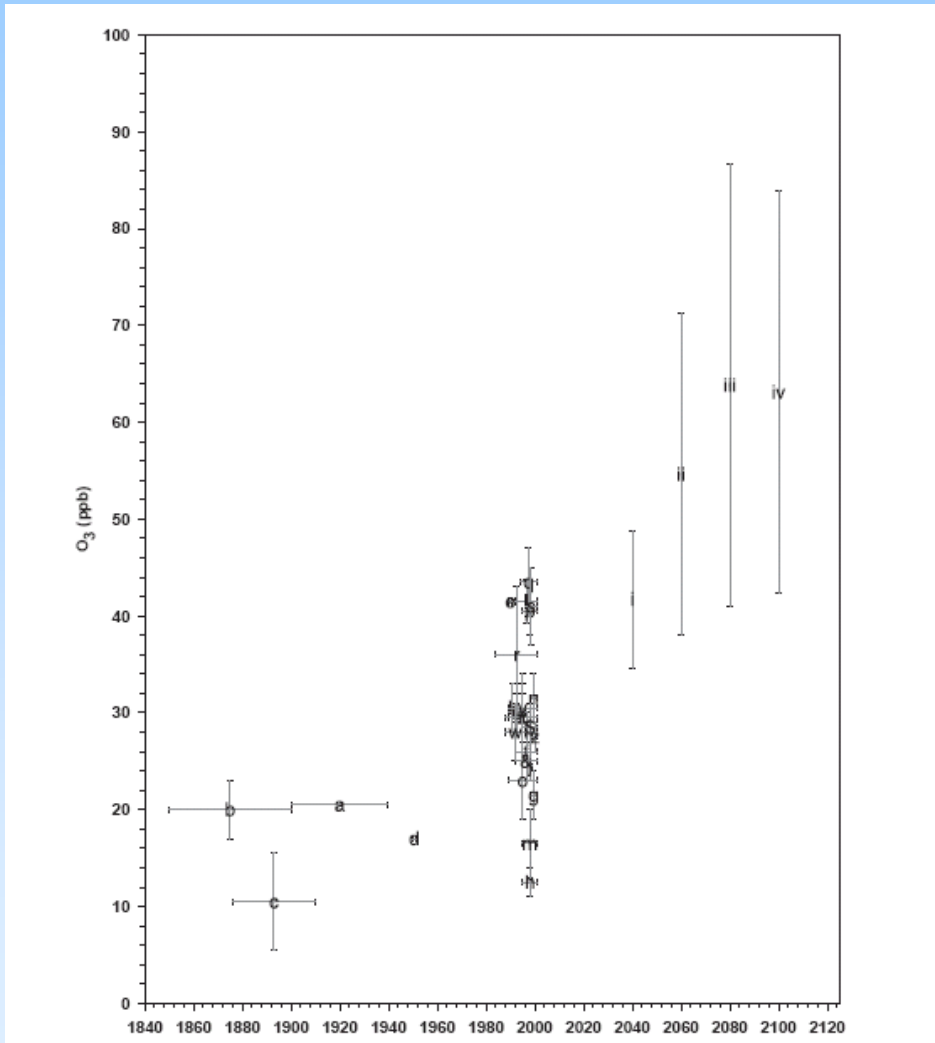
HTAP, 2007

Intercontinental transport pathways in the Northern Hemisphere

## e.g. North Africa and transboundary air pollution

- European pollution is also exported southwards in the lower troposphere across the Mediterranean Sea to North Africa all the year round, although the strongest events occur during summer (Lelieveld et al., 2002; Stohl et al., 2002)
- The transport of many species and PM from Europe to Africa during summer can be very efficient due to the diminished impact of wet removal processes (Kallos et al., 1998)
- A modelling study by Duncan and Bey (2004) indicates the exported European pollution is responsible for 5–40 per cent of the lower tropospheric ozone above North Africa during summer
- Dust transport from North Africa impacts a wide region of the Western Atlantic, the Caribbean, and the southern and eastern United States (Perry et al., 1997, ; Prospero, 1999)

# Background Ozone Concentrations from the literature and modelled



Model sensitivity studies indicate that the rise in NO<sub>x</sub> emissions account for the greatest increase in background ozone levels over the past three decades.

Model projections using IPCC emission scenarios for the 21<sup>st</sup> century indicate that background ozone may rise to levels that would exceed internationally accepted environmental criteria for human health and the environment.

*Vingarzan (2004)*

# International co-operation: progress so far

## Global:

Montreal Protocol for Ozone Depleting Substances

Stockholm Convention on POPs

## Intercontinental:

UNECE CLRTAP Task Force on Hemispheric Transport of Air Pollutants

## Regional:

Widespread emergence of regional co-operation, but variation in effectiveness and only limited co-operation between different regional initiatives

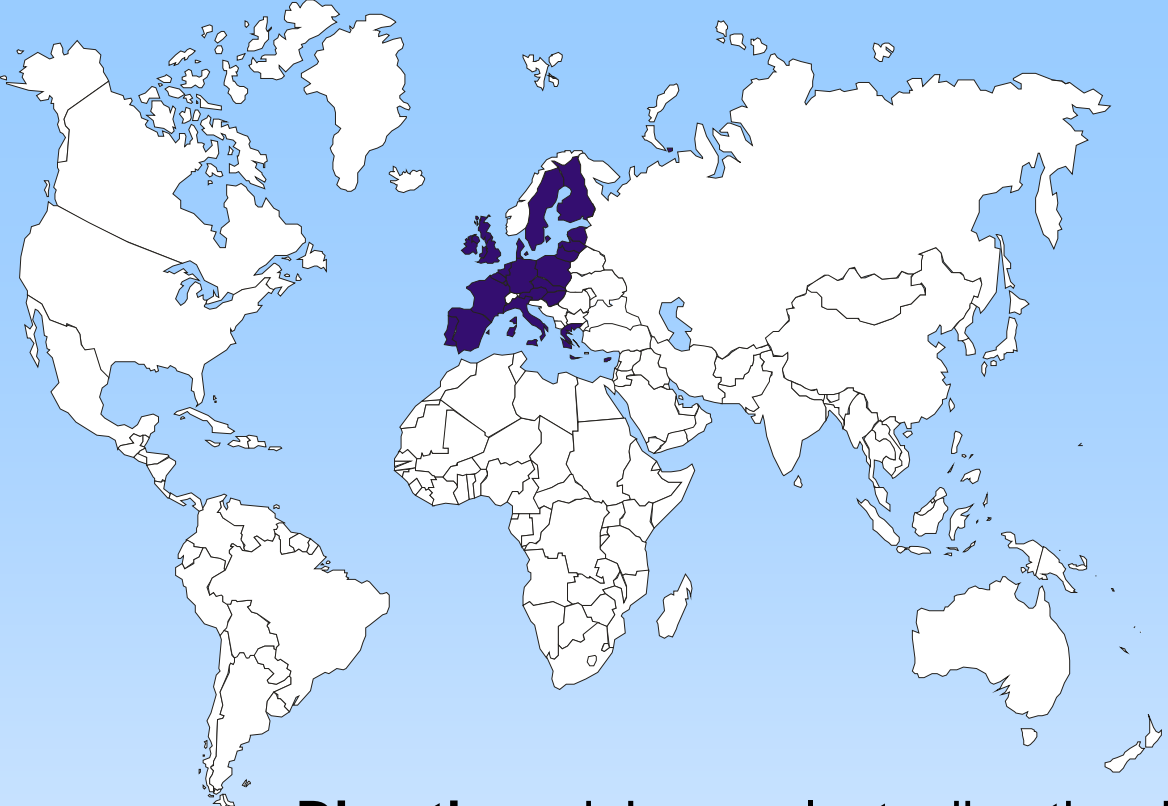


# UN Economic Commission for Europe (UN/ECE)

## Convention on Long-Range Transboundary Air Pollution (CLRTAP)

8 Protocols signed with commitments to reduce emissions of SO<sub>x</sub>, NO<sub>x</sub>, VOCs, HMs, POPs

Convention structure promotes efficient flow of science to policy and vice-versa: emissions officially reported using EMEP/CORINAIR manual, EMEP transfer model officially recognised, IIASA-Rains model used to develop strategies



## European Union Initiatives:

### Clean Air For Europe (CAFÉ)

Directives

Programmes

**Directives:** i. Large plants directive; ii. Air quality framework directive; iii. National emission ceilings (NEC) Directive

**Strategy** to combat acidification, ozone and eutrophication

**Auto-oil** programme

**CAFÉ programme:** review implementation of directives; improve monitoring; set priorities for further action

# Central Asian Republics

(Kazakhstan,  
Kyrgistan,  
Tajikistan,  
Turkmenistan,  
Uzbekistan)

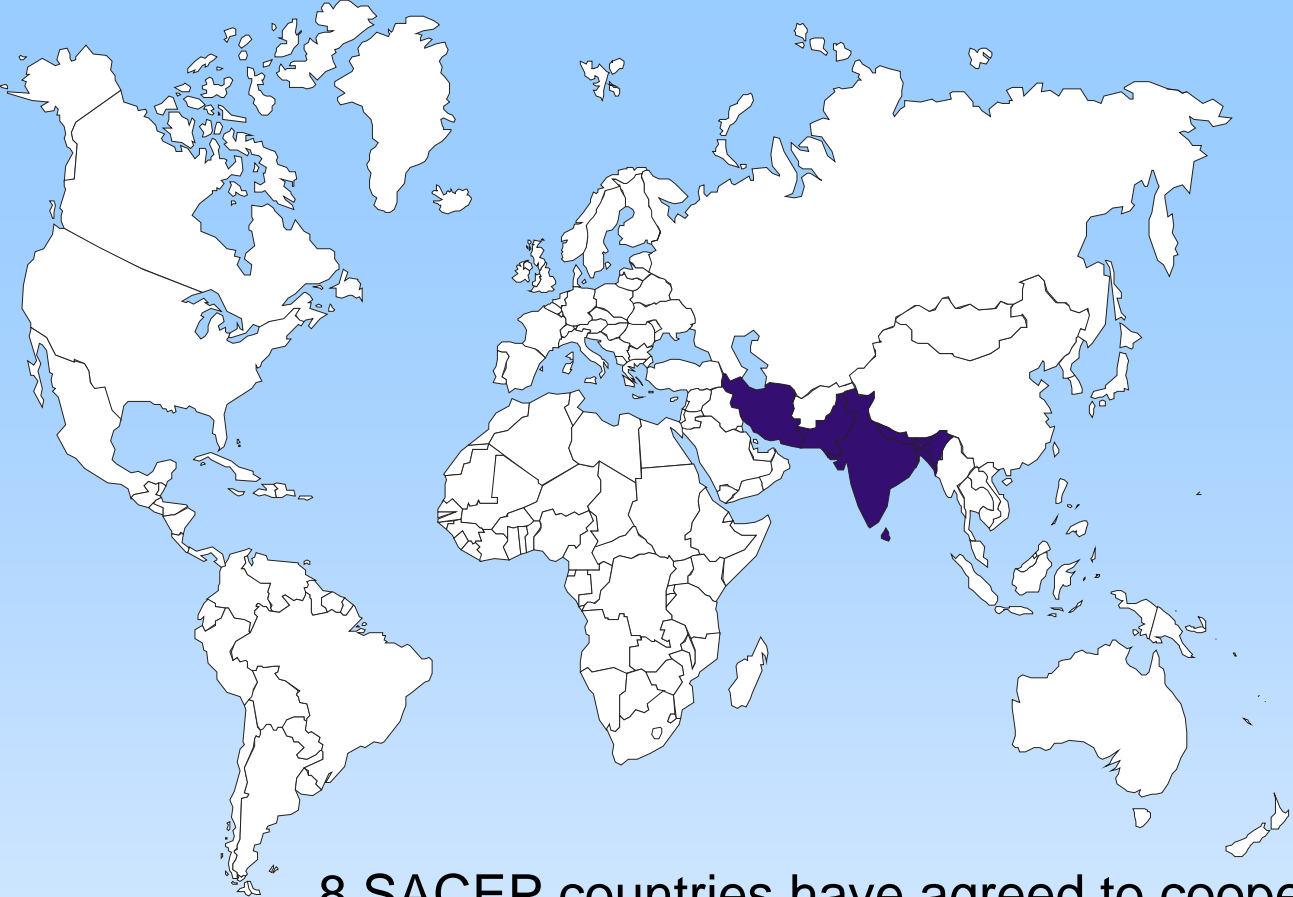


Activities initiated at regional level by UNEP and UN/ECE

UN/ECE Convention on LRTAP to help develop national programmes and implementation plans from 2004

EMEP model being extended

Case study in Kazakhstan main activity at the moment



# Malé Declaration on the Control and Prevention of Air Pollution and its Likely Transboundary Effects in South Asia

8 SACEP countries have agreed to cooperate

Network developed (annual meetings of FPs and NIAs)

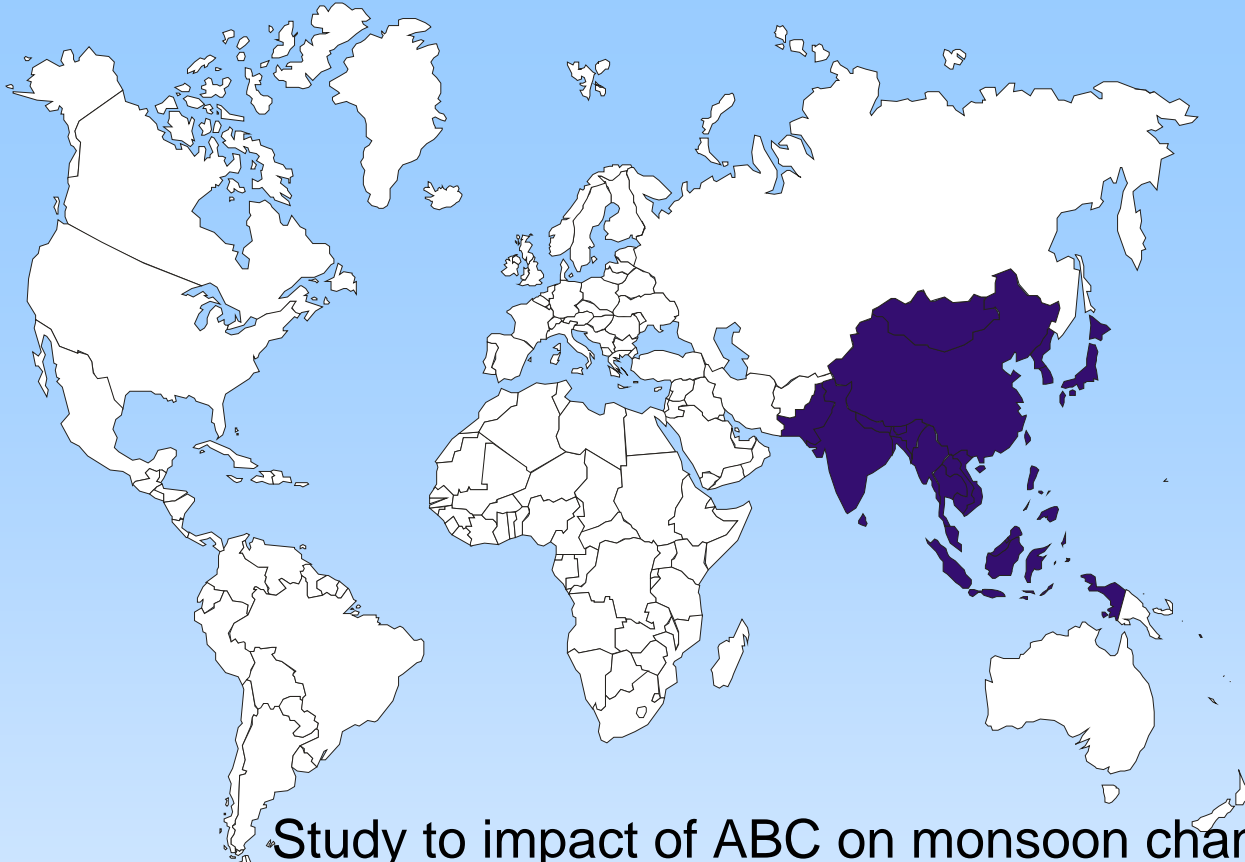
Scientific assessment has started (monitoring network set up in 2003/2004)

# Association of South East Asian Nations (ASEAN)



Regional agreement on haze entered into force in November 2003.

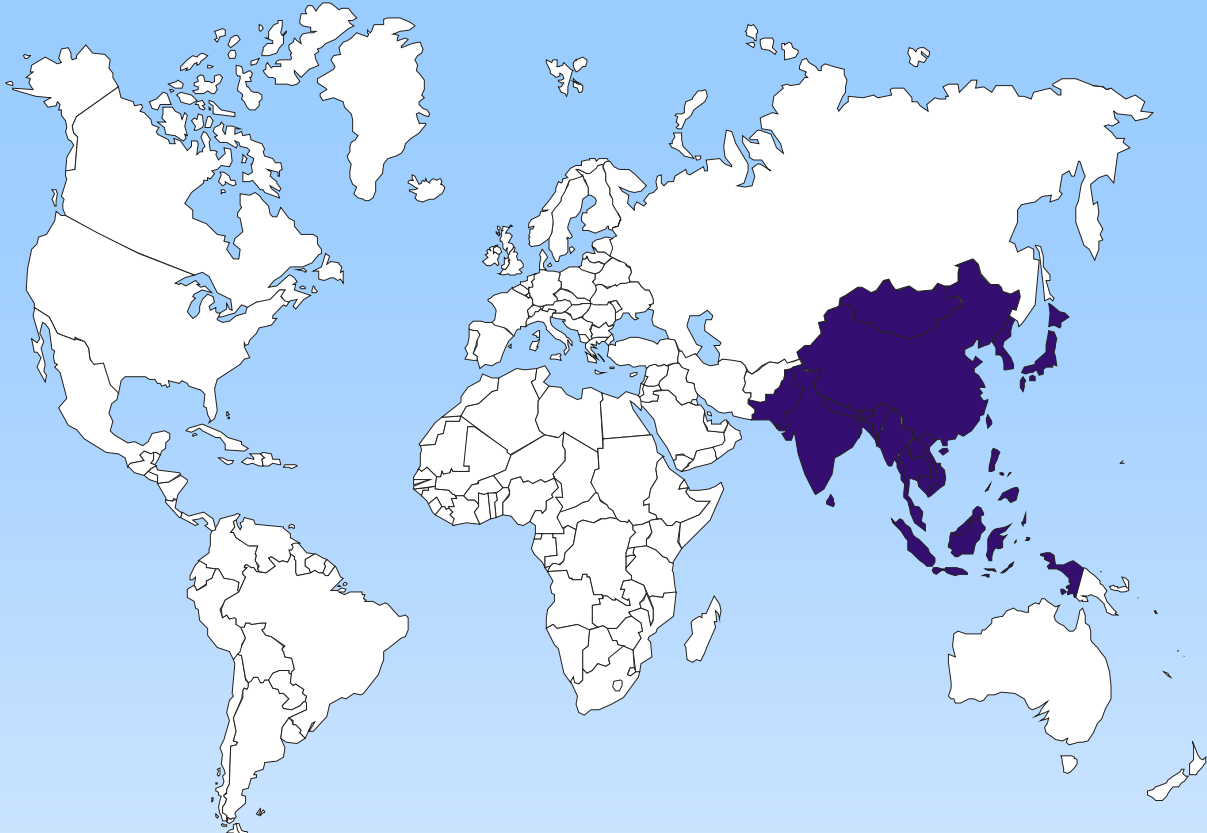
# Atmospheric Brown Cloud (ABC)



Study to impact of ABC on monsoon change, water balance, agriculture and health

Ground based monitoring stations (some common with Malé Declaration) plus periodic aircraft monitoring concentrating on aerosols

ABC plan to influence environmental policy and build capacity



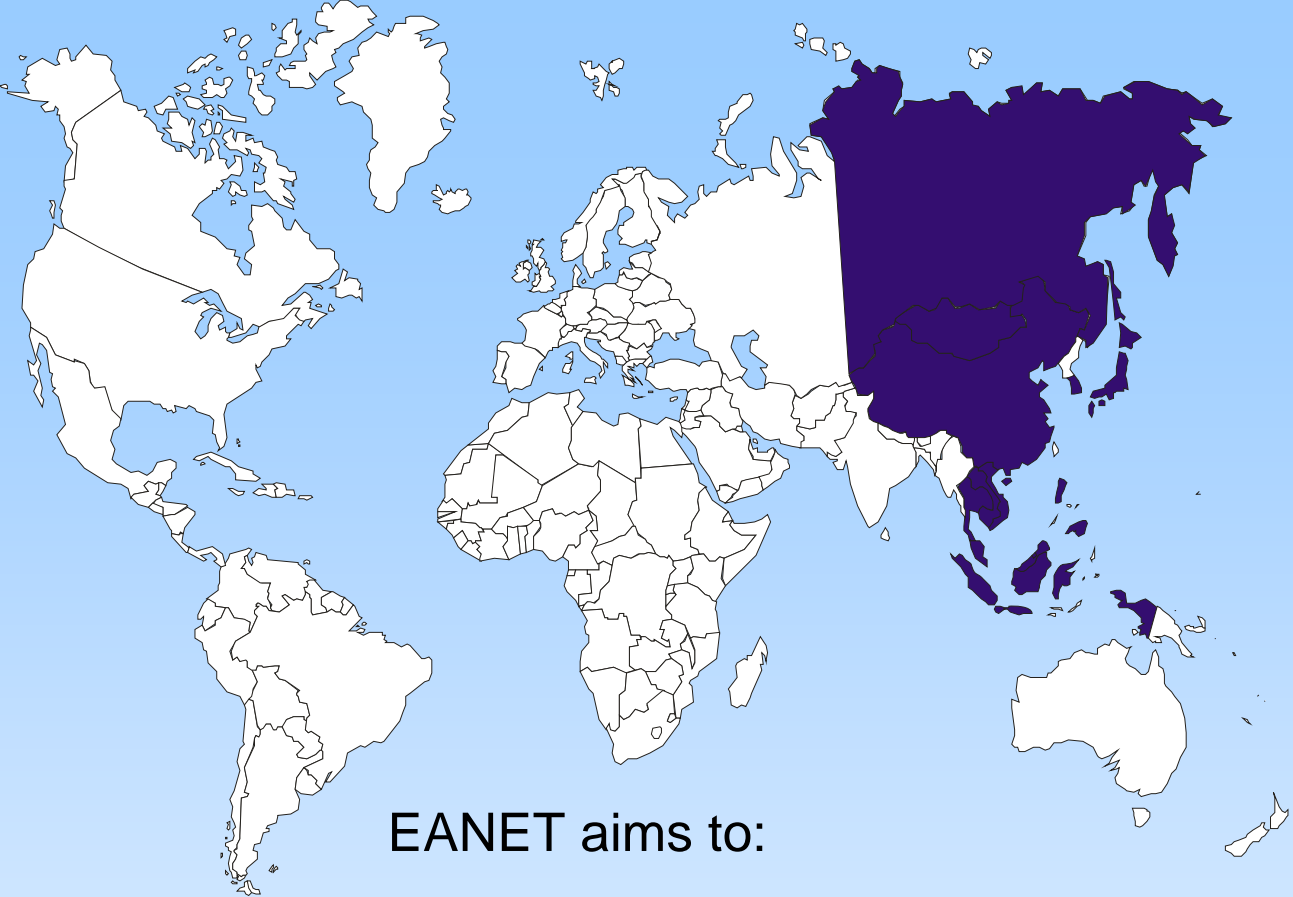
## **Clean Air Initiative – Asia (CAI-Asia)**

Promoting better air quality management in Asian cities through partnerships and sharing experience since 2001

28 cities, 19 government agencies, NGOs, academic institutions, development agencies and private sector

PAPA – Public Health and Air Pollution in Asia

Strategic framework and Benchmarking (by SEI's APMA project in collaboration with CAI-Asia)



## EANET

# Acid Deposition Monitoring Network in EAST ASIA

EANET aims to:

- Create common understanding about acid deposition in E Asia
- Provide inputs to decision making in the region
- Promote mutual cooperation on issues related to acid deposition
- Monitoring network is current focus



# APINA

**Air  
Pollution  
Information  
Network for  
Africa**

Developing science base


Maputo Draft Declaration developed that aims to formally link policy makers in SADC region

APINA helped organise the Regional Conference on Better Air Quality in Sub-Saharan Africa attended by 30 Ministers of Environment at UNEP HQ in 2006



# IANABIS

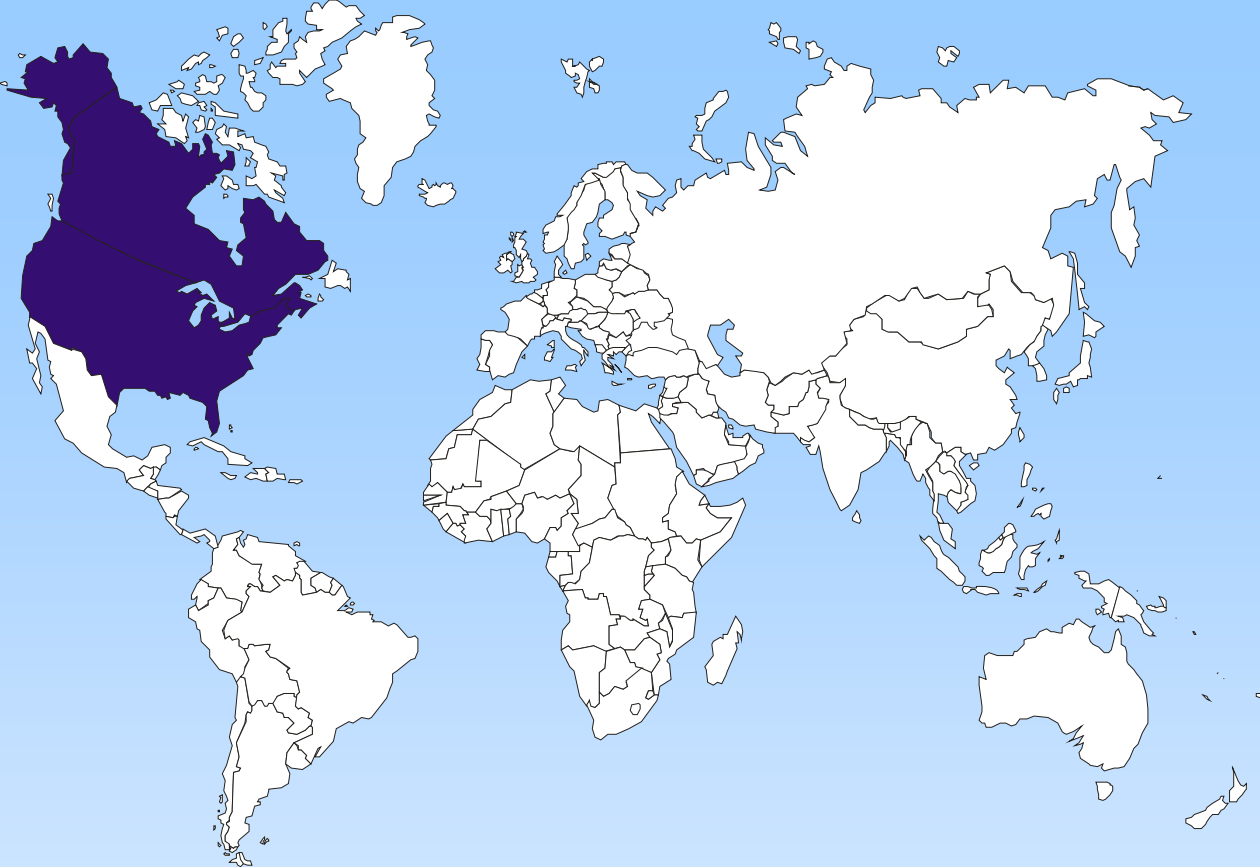
‘Inter-  
American  
Network for  
Atmospheric /  
Biospheric  
Studies’



Currently setting up state-of-art research centres for atmospheric/biospheric studies in countries shown

Aims to develop network to explain changes in regional and global climate, and

Develop regional policies to regulate emissions, air quality and protect the environment



## Canada-USA Air Quality Agreement (1991)

Mainly focussed on acid rain

Now includes ozone and particulate matter

Commitments made by USA and Canada to reduce emissions

Collaboration on scientific and technical activities

# Need for Global Cooperation on Air Pollution Control and Prevention

- Critical need to develop and harmonize high quality air pollution databases across the various regions
- Growing consensus on need for coordinated assessment and pollution control strategies at the hemispheric scale
- A comprehensive global atmospheric pollution convention is one possible outcome to address hemispheric and global pollution issues
- Until then, there are opportunities to build on the efforts of existing regional initiatives, networks, and institutions



# Role of the Global Atmospheric Pollution Forum

1. Support efforts of regional networks to tackle air pollution at the regional, hemispheric and global scales
2. Facilitate dialogue and promote coordination among regional networks to share experiences and identify opportunities for collaboration
3. Help regional networks link up to find effective frameworks to address regional, hemispheric or global air pollution
4. Encourage the establishment of new regional networks in areas where they do not currently exist, and encourage capacity-building in those regions where lack of resources poses severe constraints
5. Provide a forum for pursuing approaches to address issues of wider concern, such as the interaction of climate change and air pollution

**For More Information...**

Visit our website:

**[www.gapforum.org](http://www.gapforum.org)**



*...and finally...*

***Chinese proverb:***

***A clever person learns from their  
mistakes***

***A wise man learns from other  
people's***

***Thank you!***