

Dust and Anthropogenic Emissions - Threat to Environment and Human Health

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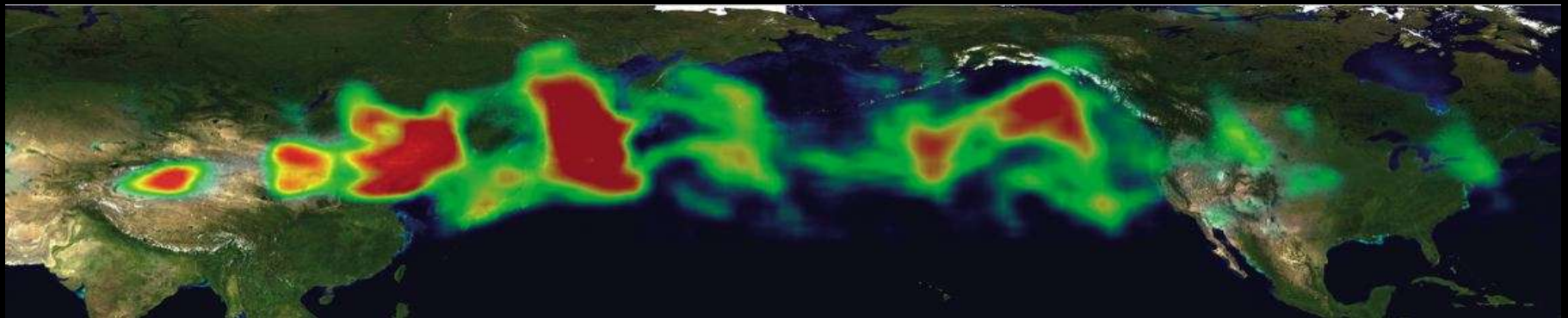
Dust and Anthropogenic Emissions Impact Atmosphere and Air Quality

Atmosphere has no boundary but
other Earth's spheres have boundaries

Dust is slow poison, especially in India,
Dust impacts Human Health of 700
million people living in the IGB
(Northern parts of India)

Dust also impacts Plants, Vegetation and
Hydrological cycle

- Droughts and Dust events are inter-related
- Droughts accelerate Dust events



MODIS image, April 2001



Sand & Dust Storms

Asian and North African/Middle East dust storms form a very important environmental phenomenon, has worsened in the last decades due to deforestation and prolonged droughts



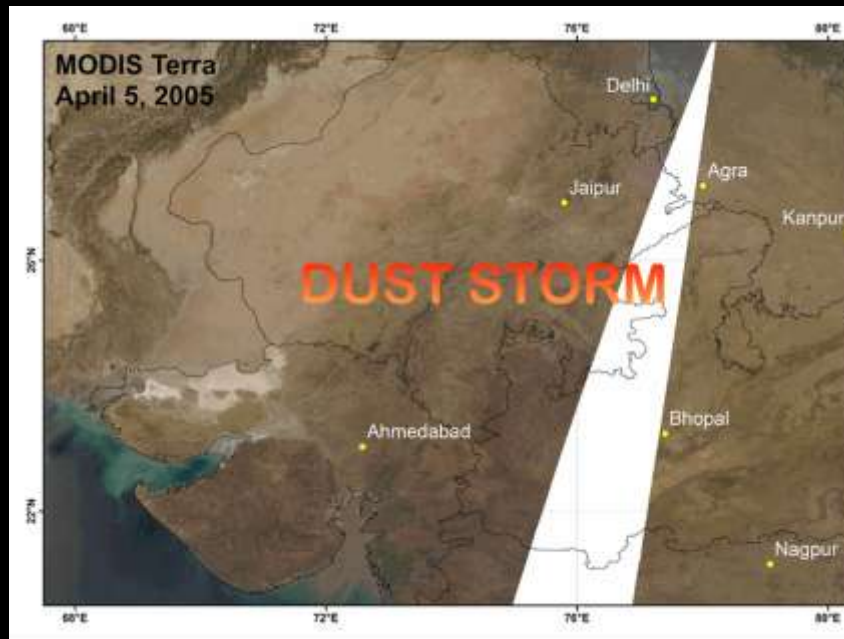
Dust in Beijing at 10:30AM March 20, 2002 (Picture courtesy China News Agency)



Phoenix Dust storm event

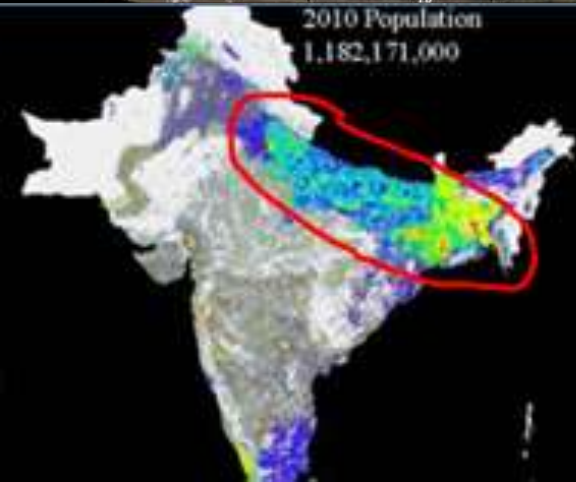
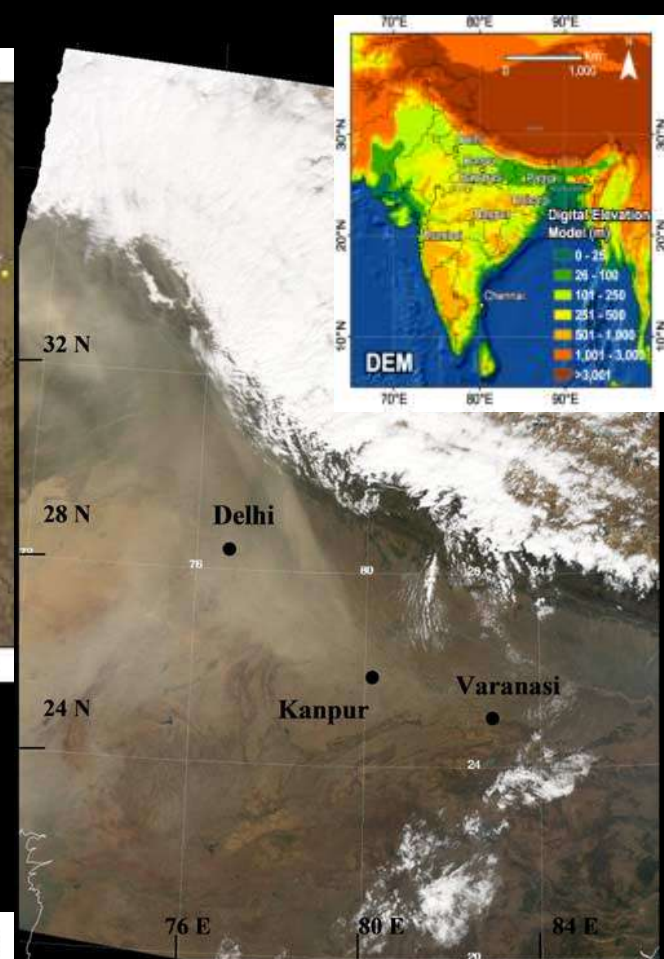
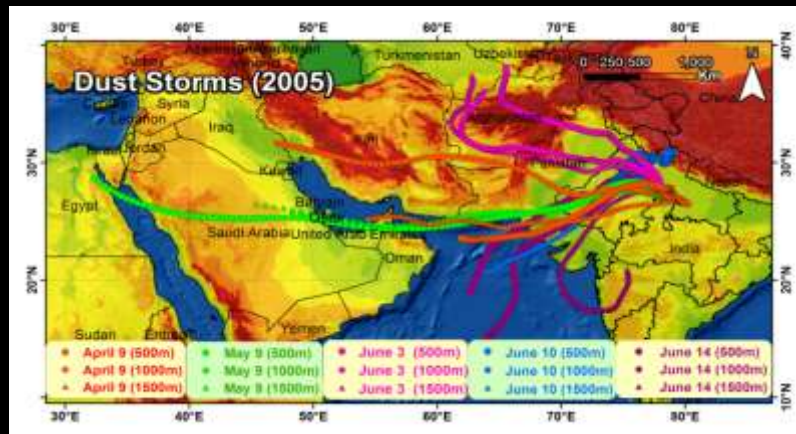
Dust Storms

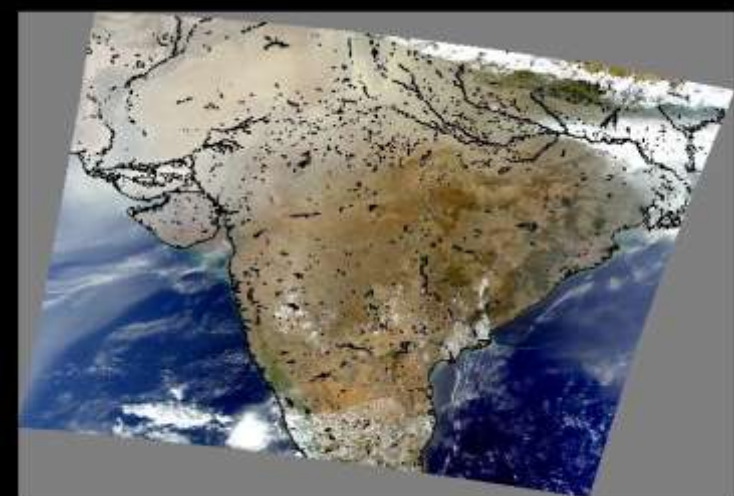
Satellite (daily)
MODIS Terra
and Aqua)



Ground based
CIMEL
Sun-photometer

(April 3-12, 2005,
MODIS Terra images)

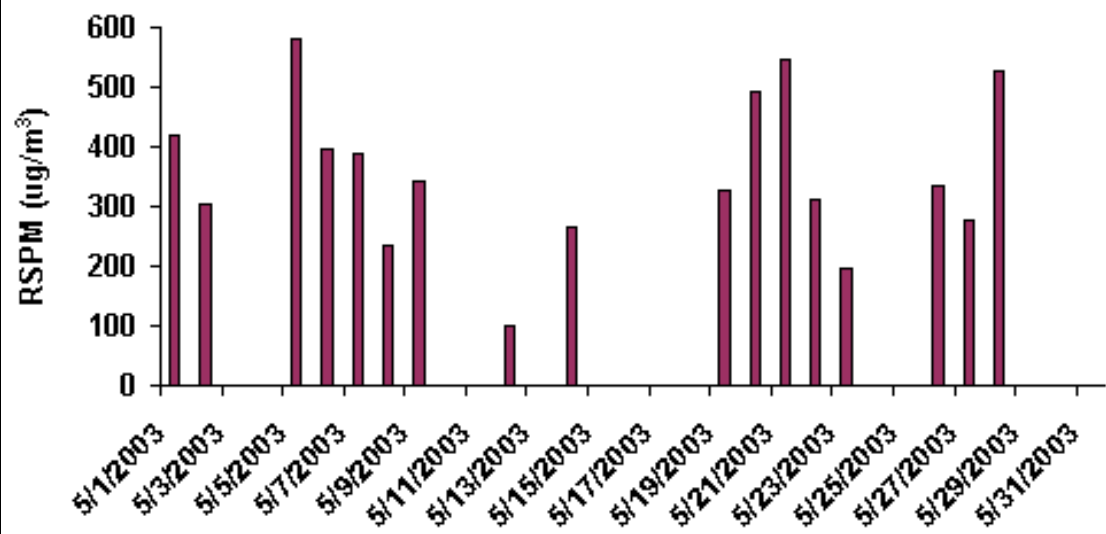




Commuters are caught in a dust storm in Bharatpur district

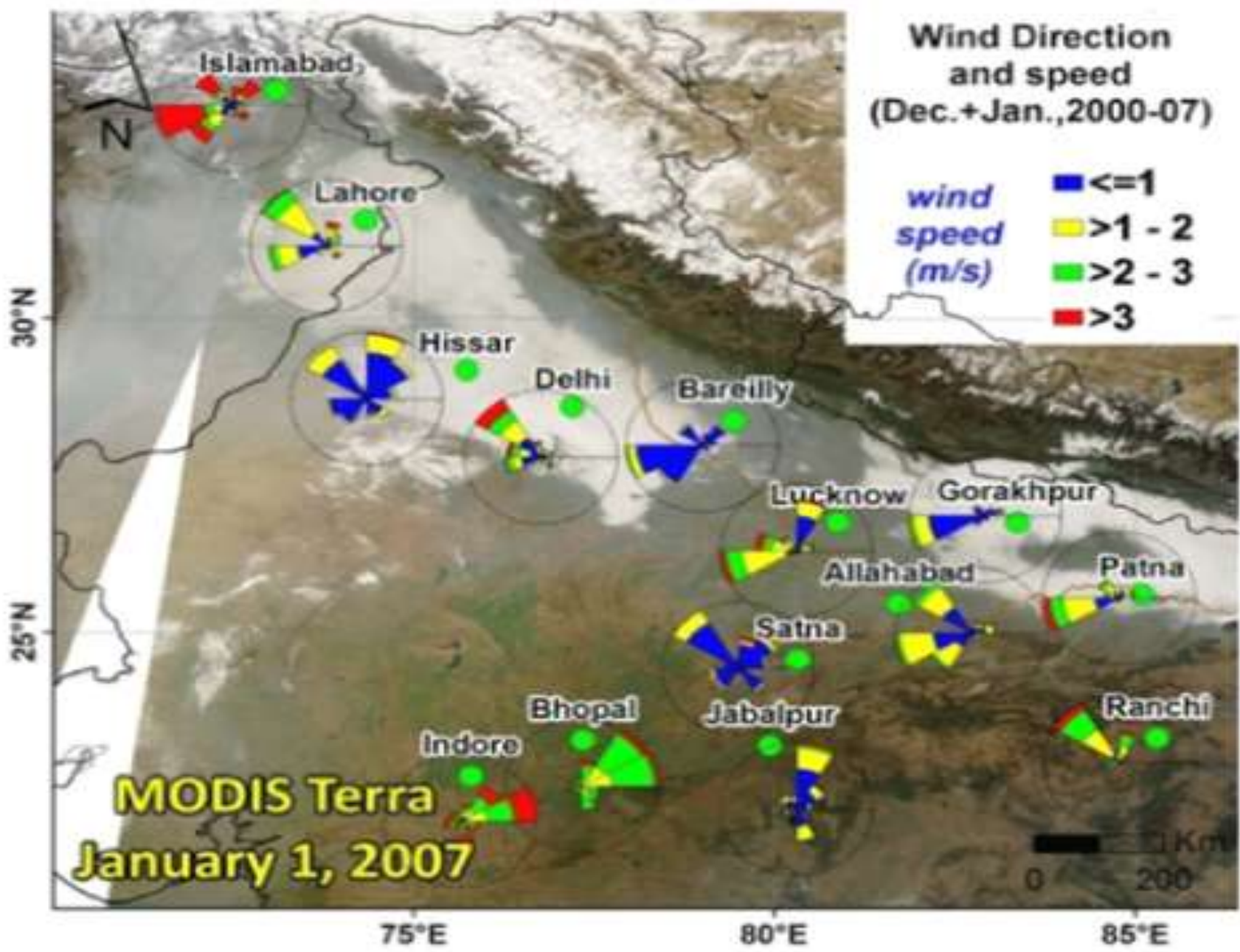


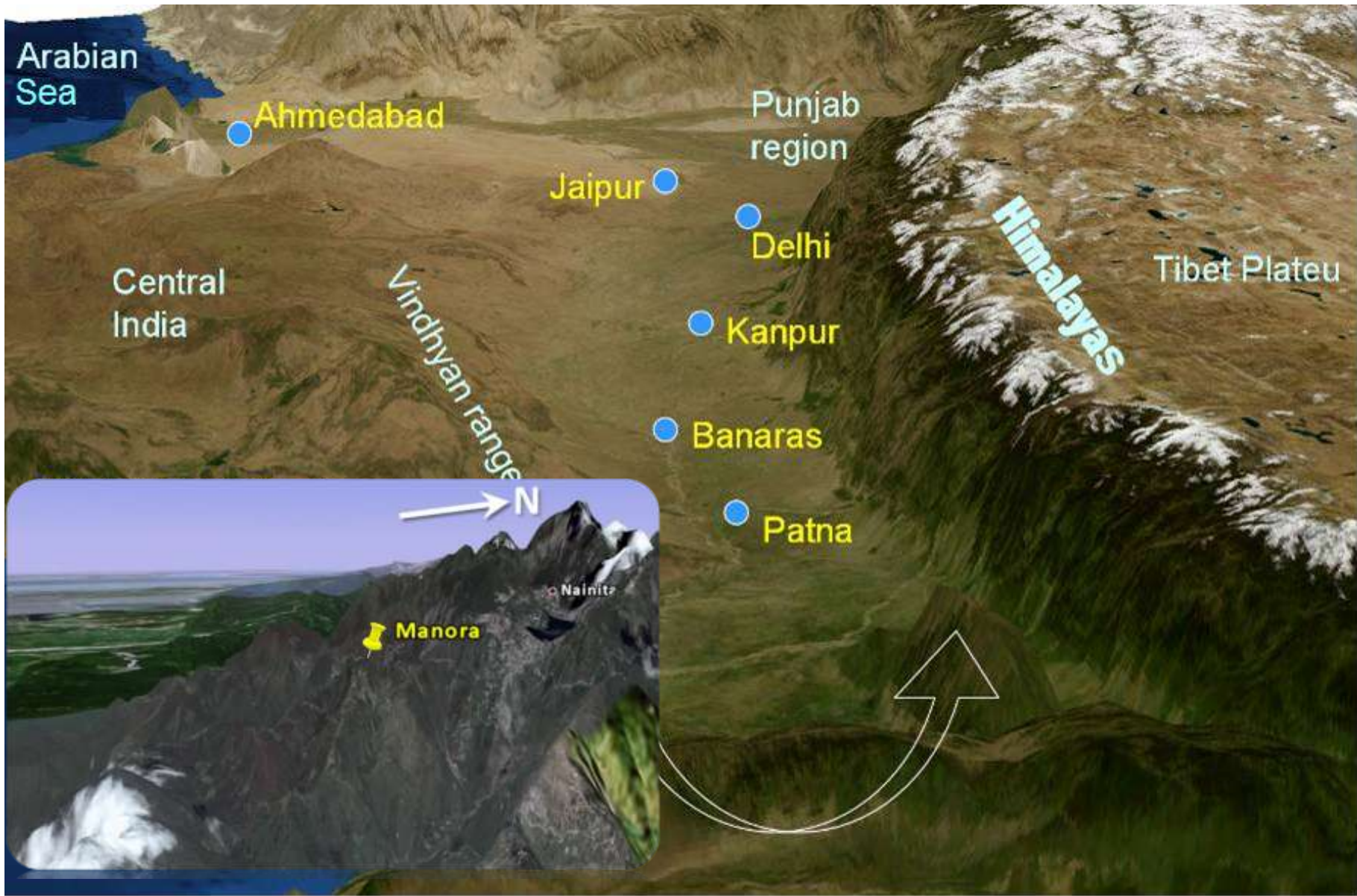
Caption: Commuters are caught in a dust storm in Bharatpur district of India's desert state of Rajasthan May 28, 2008. REUTERS/Vinay Joshi (INDIA)

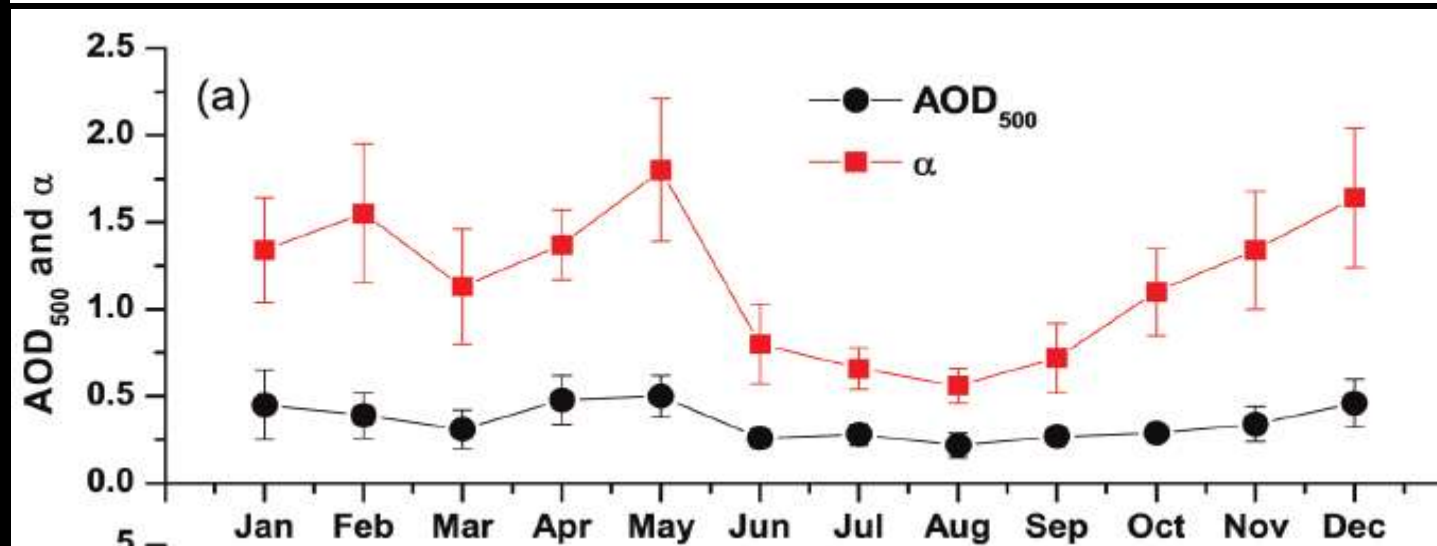
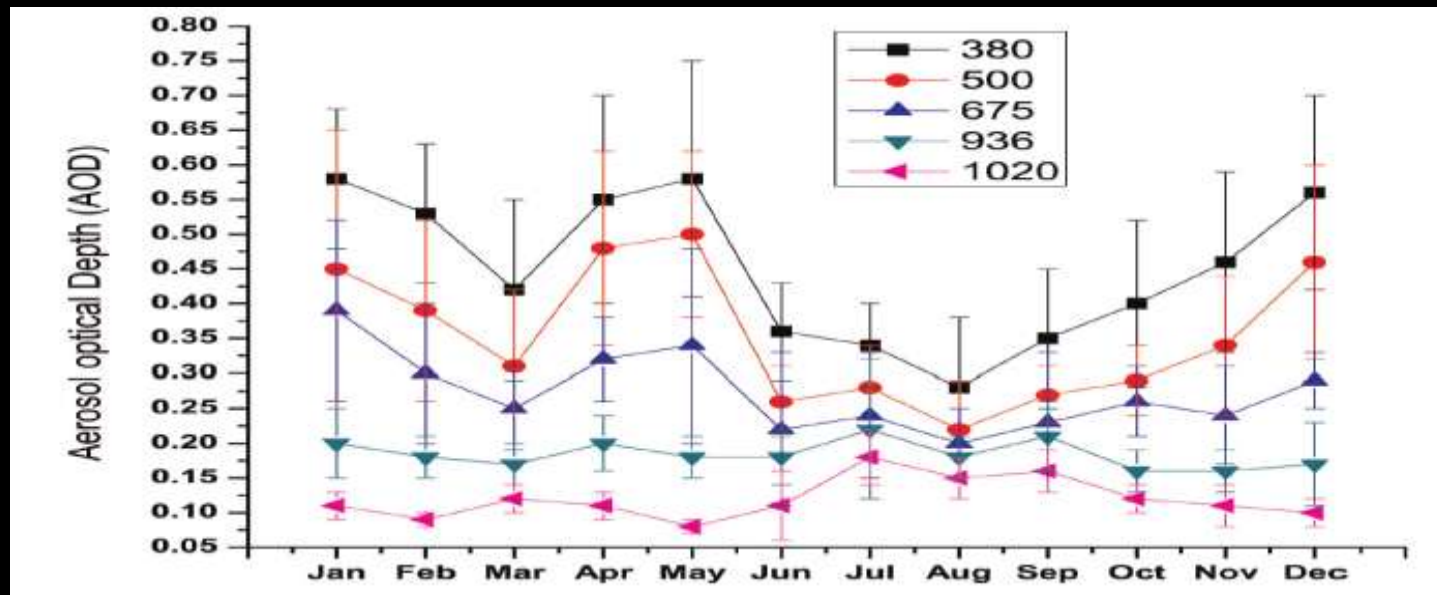


Commuters wait at a traffic signal amidst a dust storm in New Delhi, India, Wednesday, May 14, 2008. Heavy dust storm followed by torrential rains lashed the Indian capital on Wednesday throwing normal life out of gear with reports of many trees being uprooted.

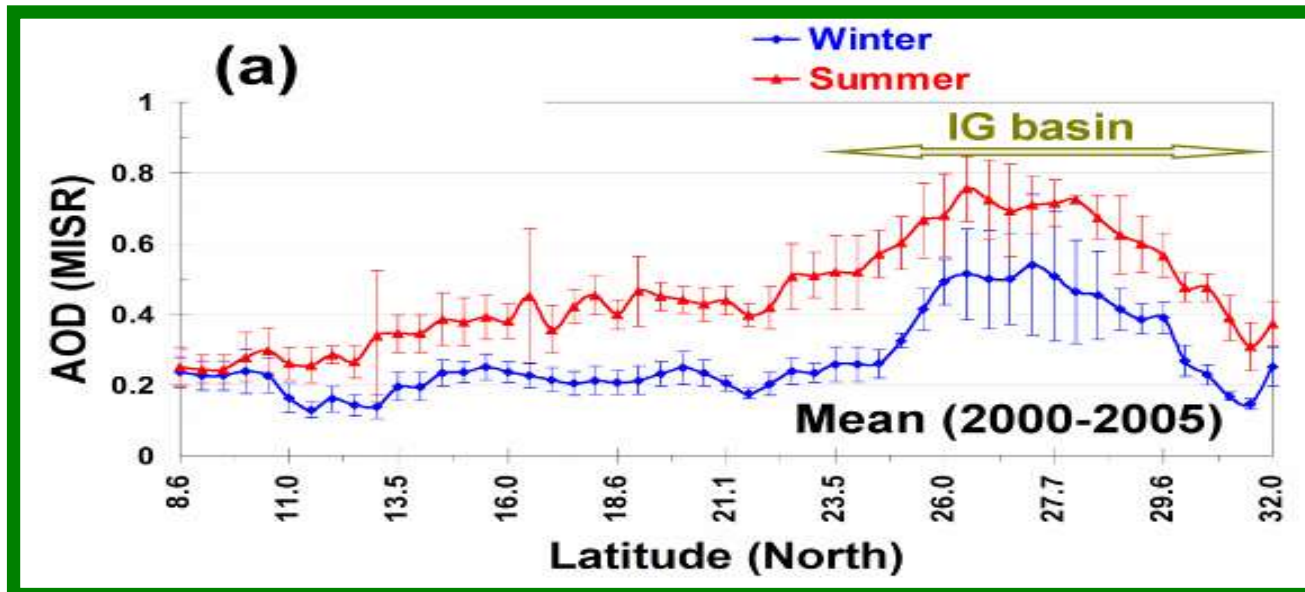
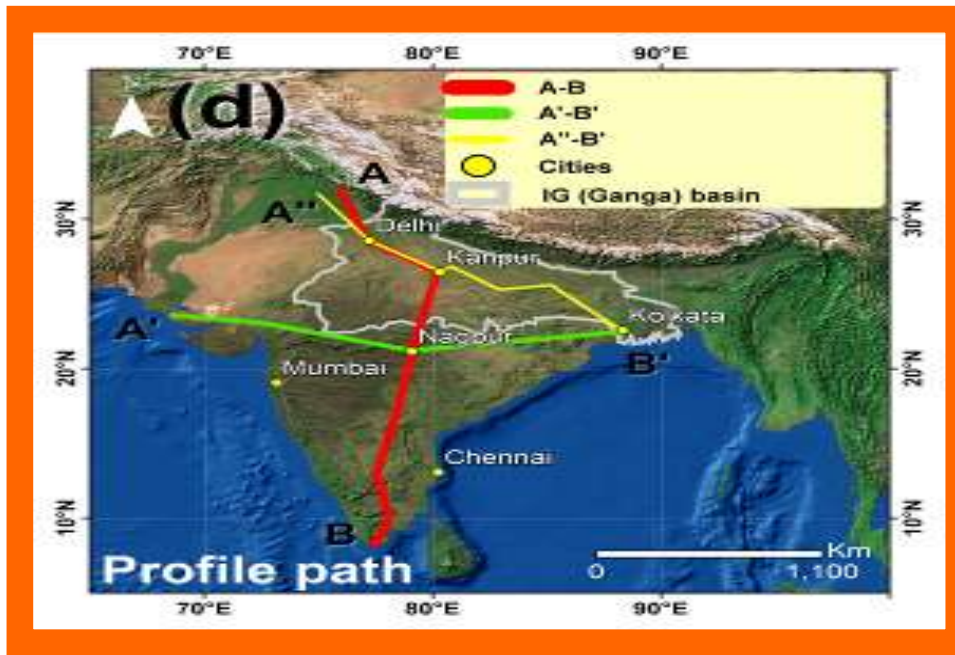


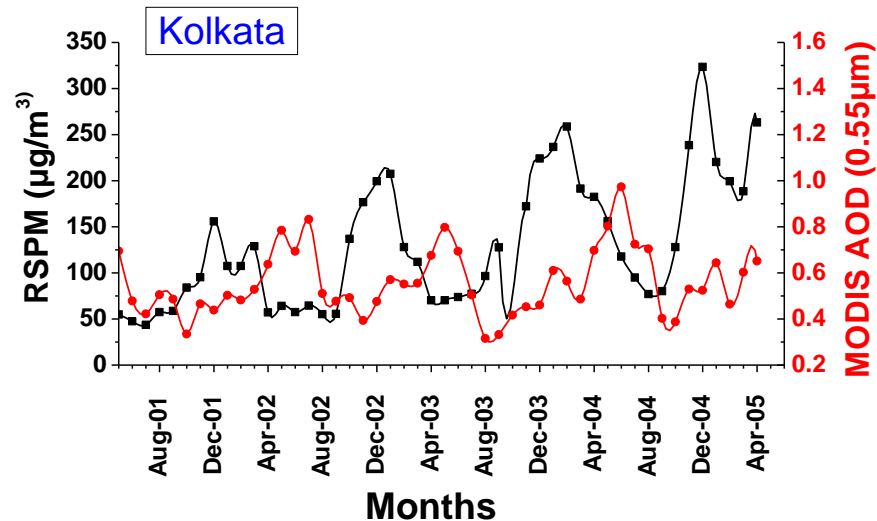
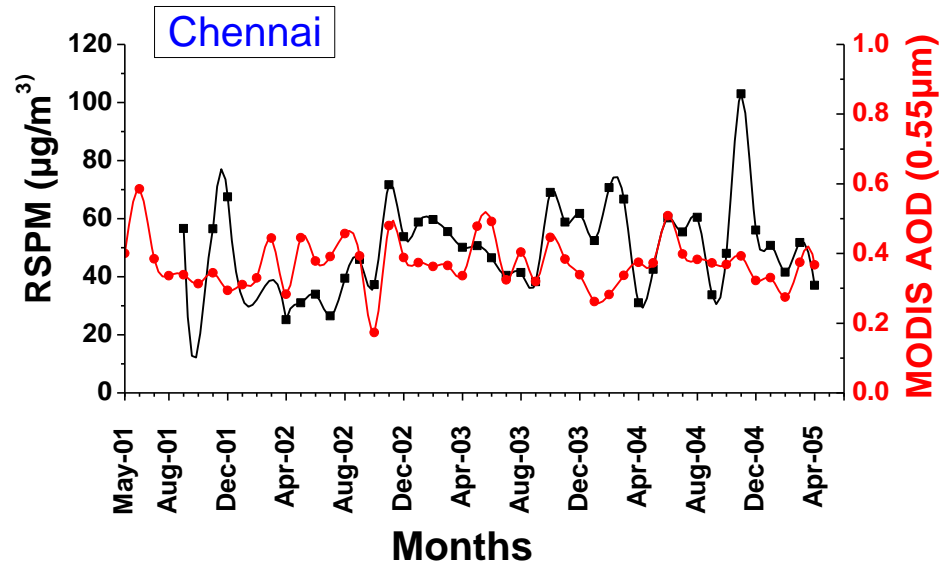
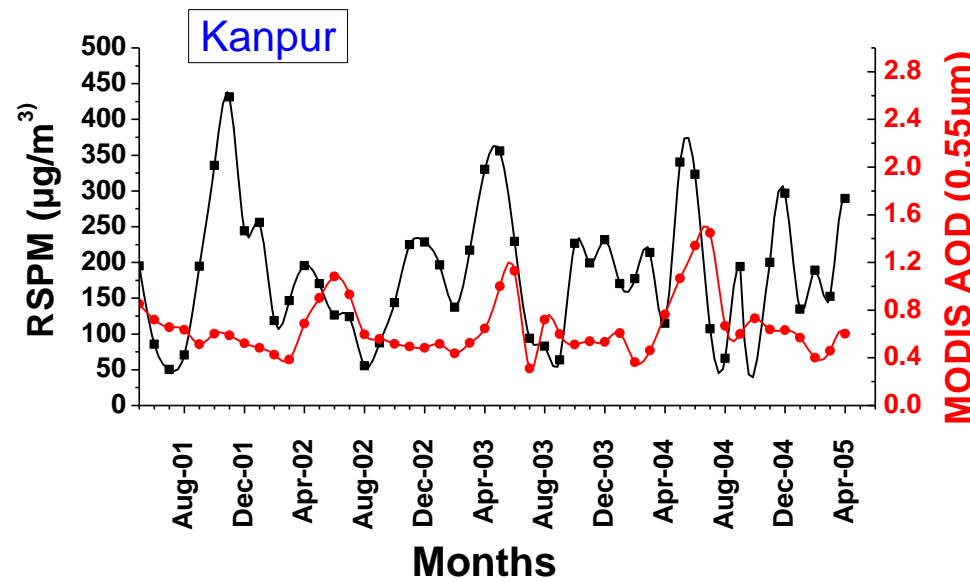
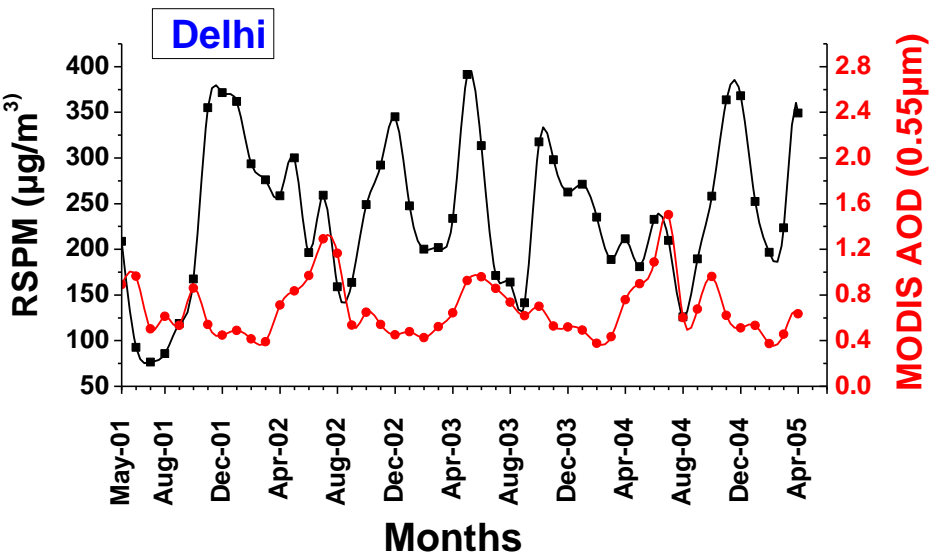




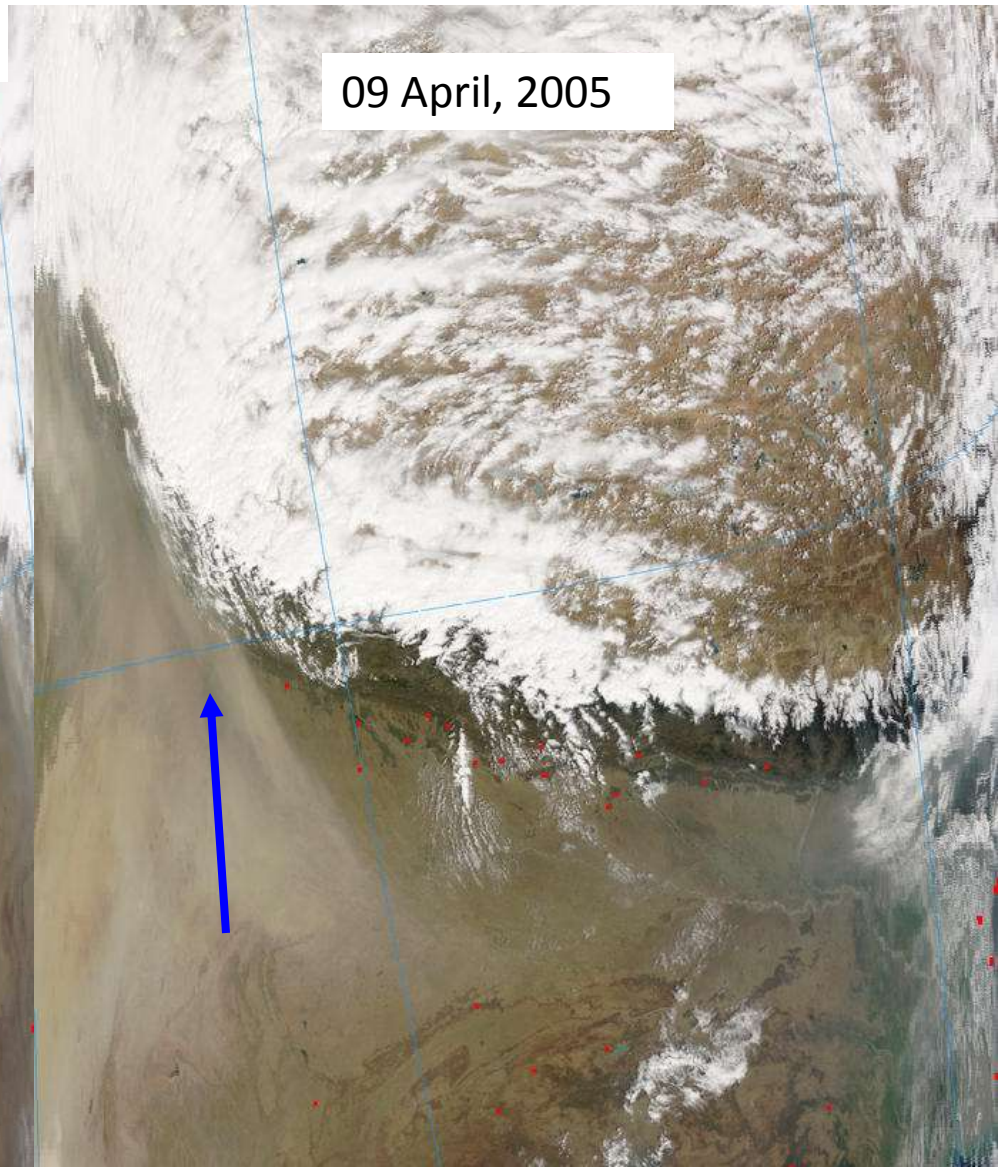
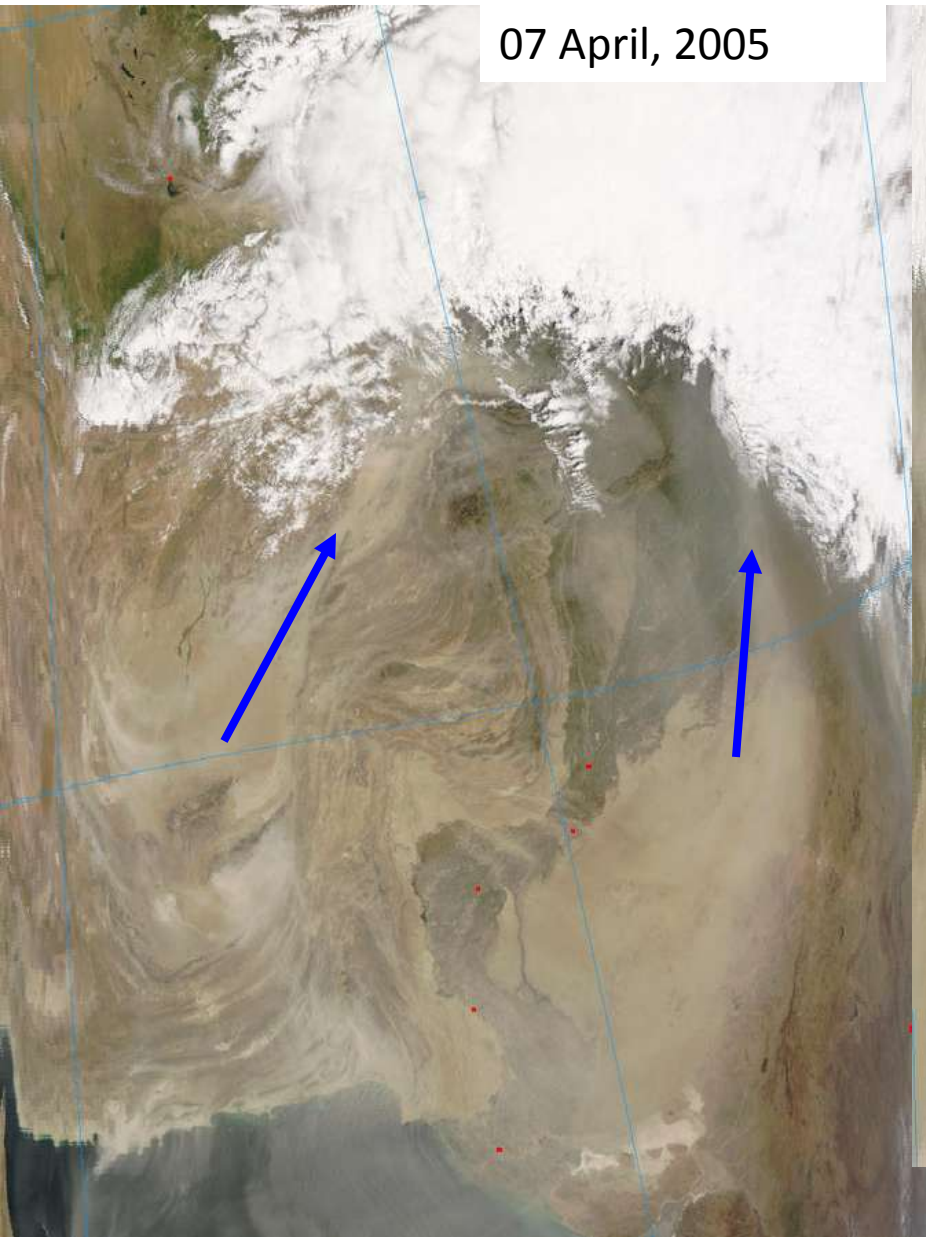


Darjeeling, Chatterjee et al. 2012





Higher RSPM level over Northern cities compared to southern cities



Dust Storm approaching the Himalayan snow cover region

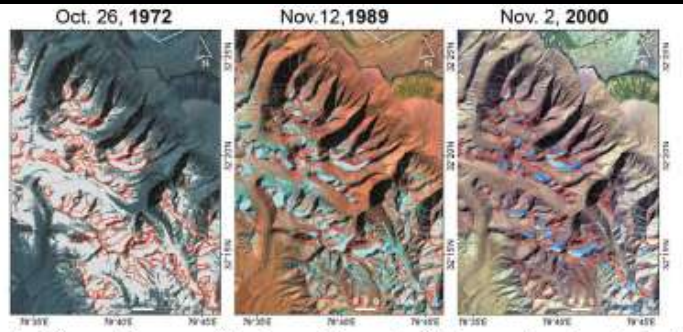


Fig. 1. Change in the snow and glacier cover in the western Himalayan region as shown in Landsat multispectral scanner (1972), thematic mapper (1989), and Enhanced Thematic Mapper Plus (2000) images. Areas outlined in red indicate information from the GLIMS database.

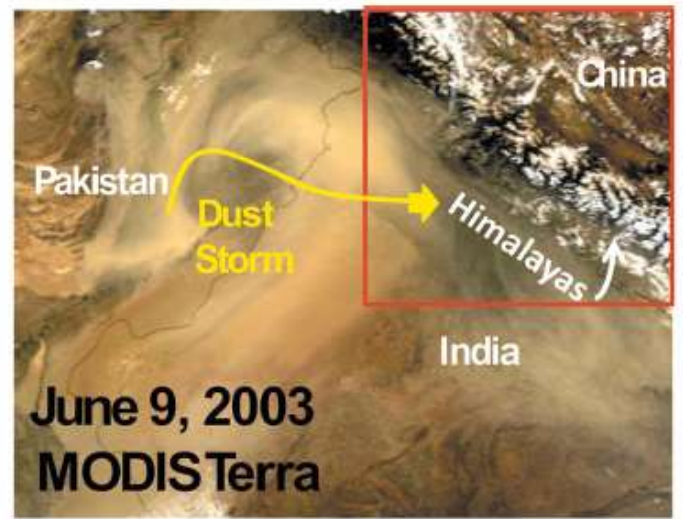
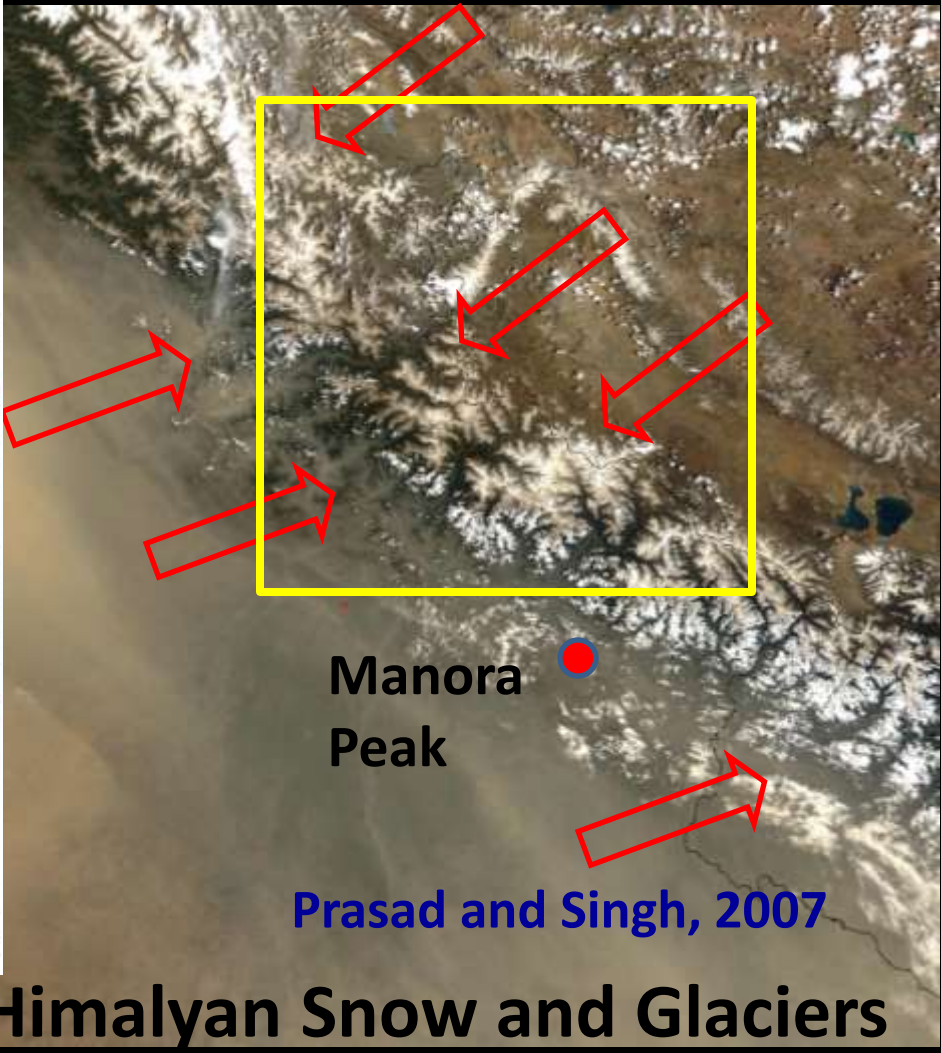
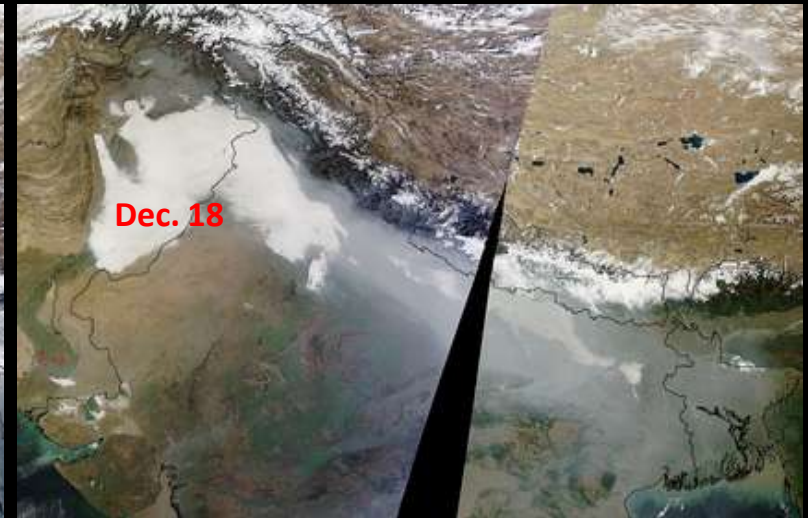
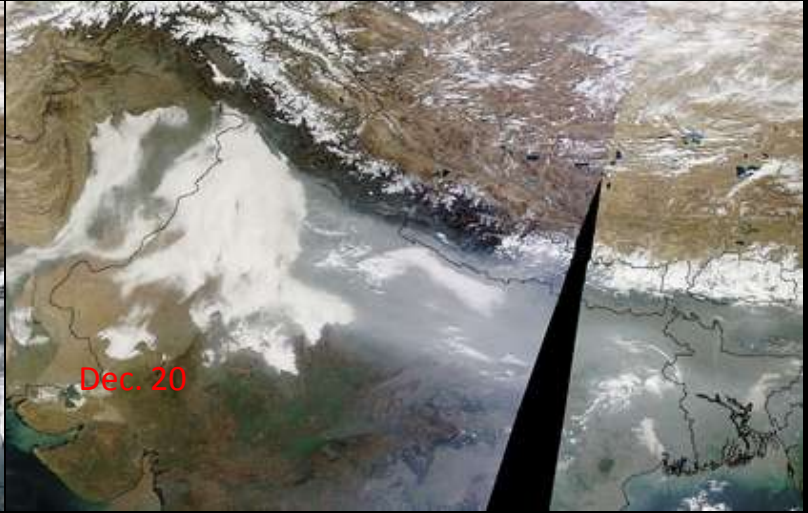
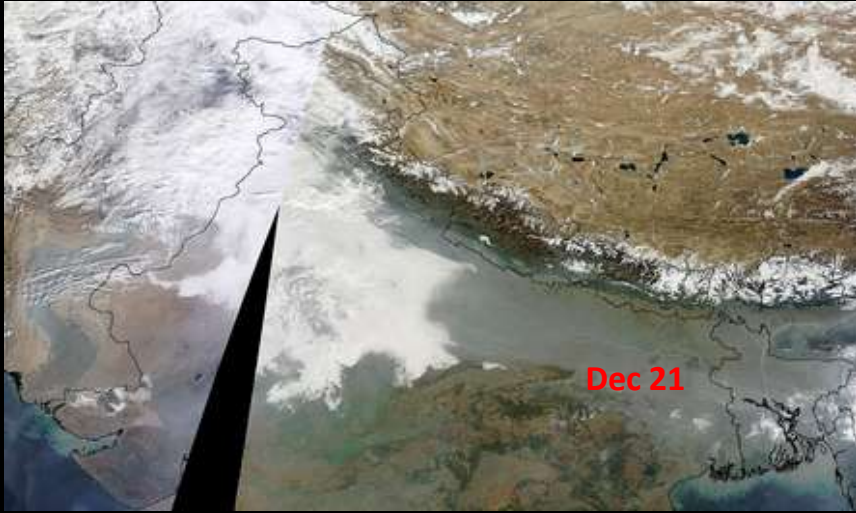
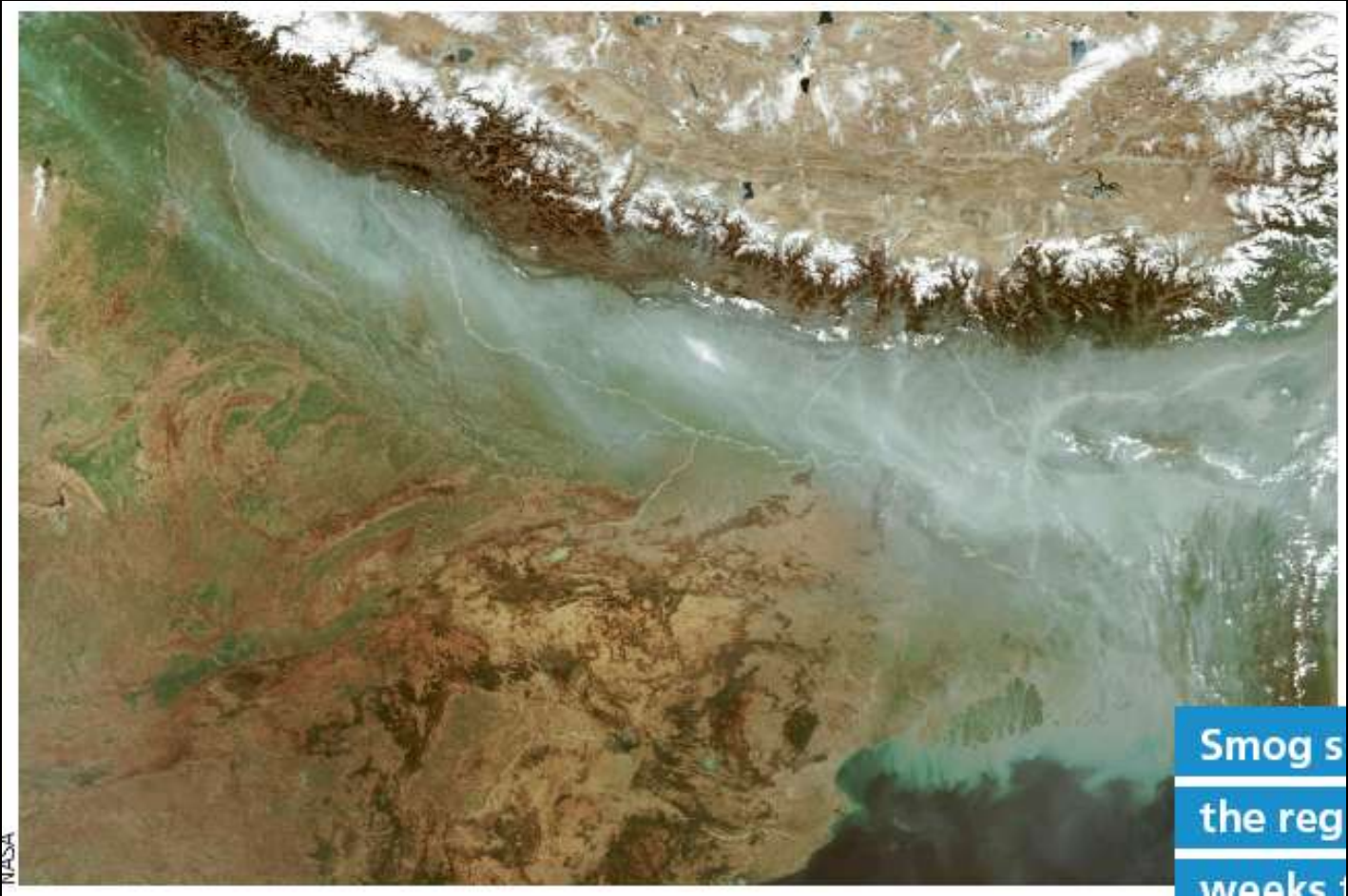


Fig. 2. Dust storms reach up to snow and glacier of Himalayas (box outlined in red) as visible in this 9 June 2003 MODIS Terra image obtained from the MODIS Web site (<http://modis.gsfc.nasa.gov/>).



Himalayan Snow and Glaciers



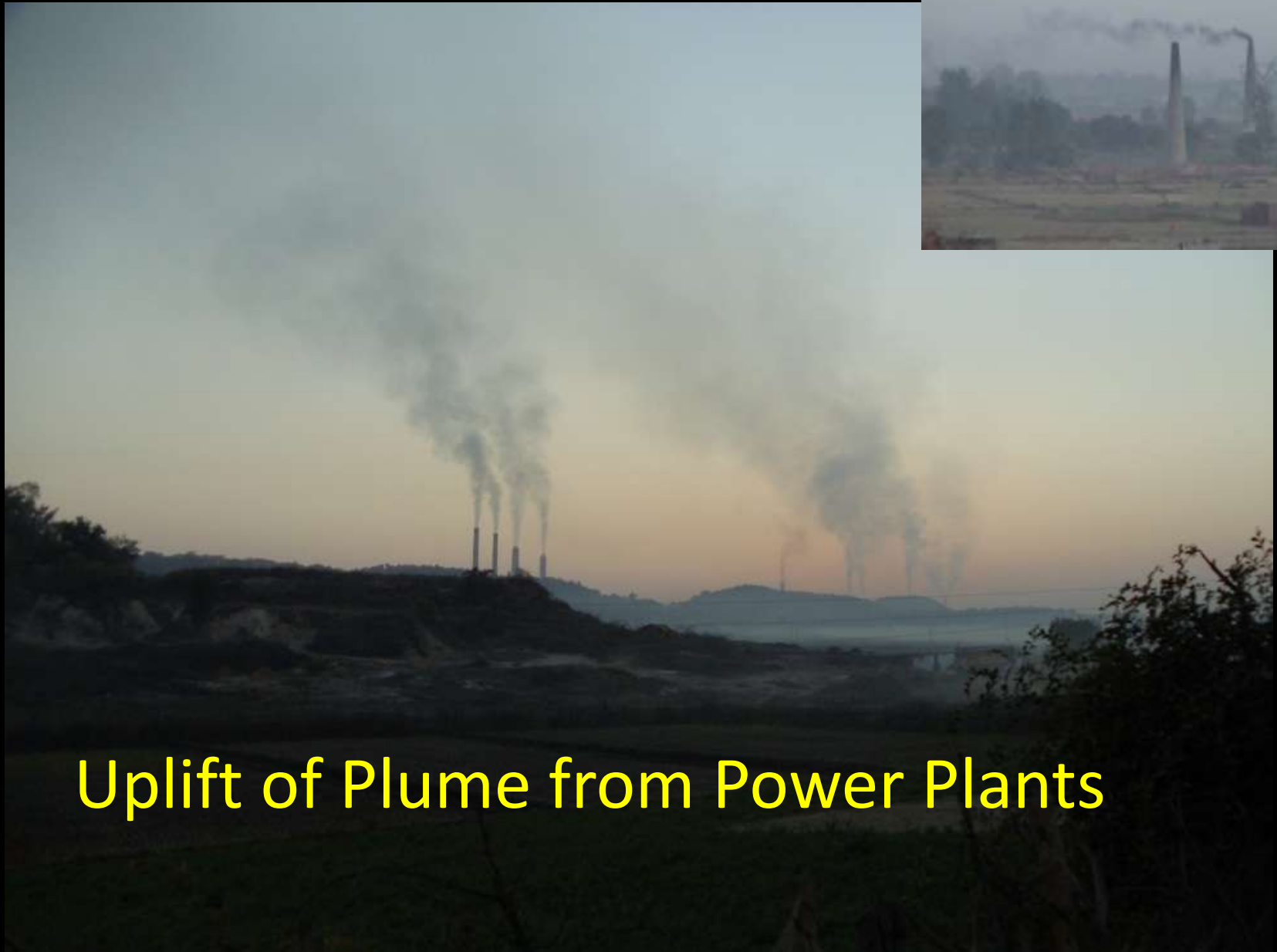


NASA

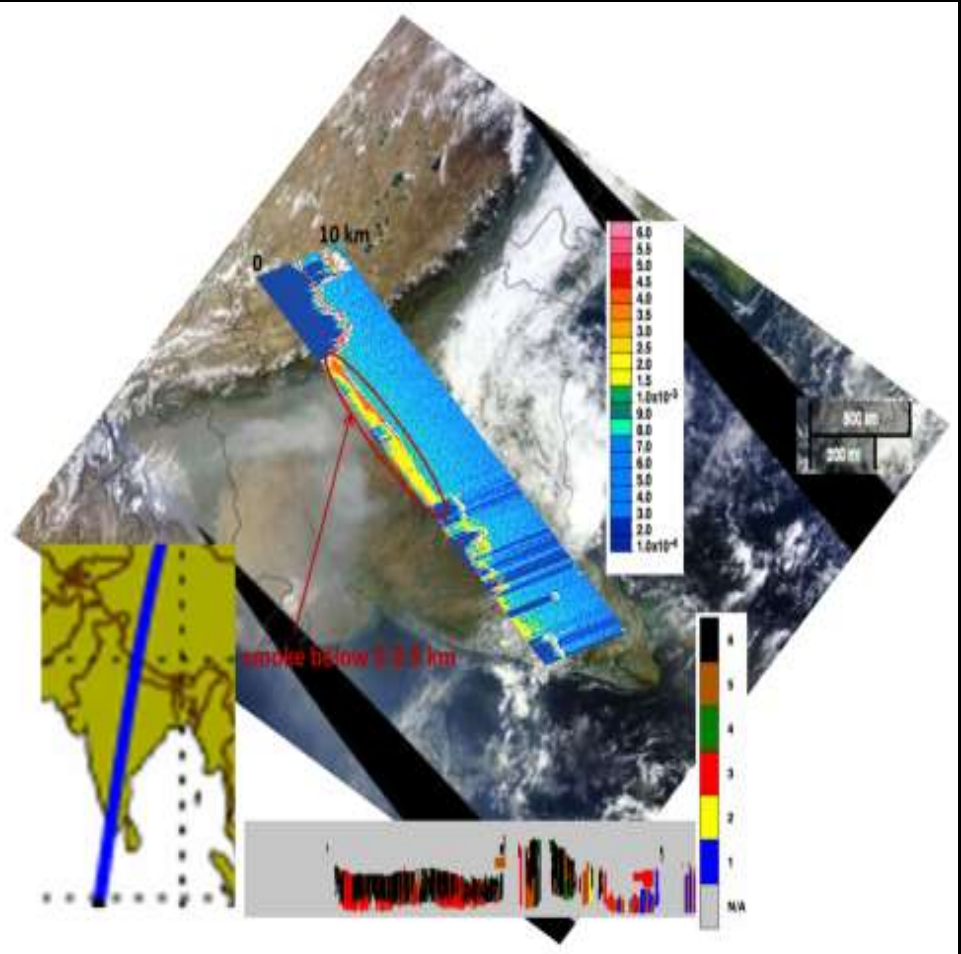
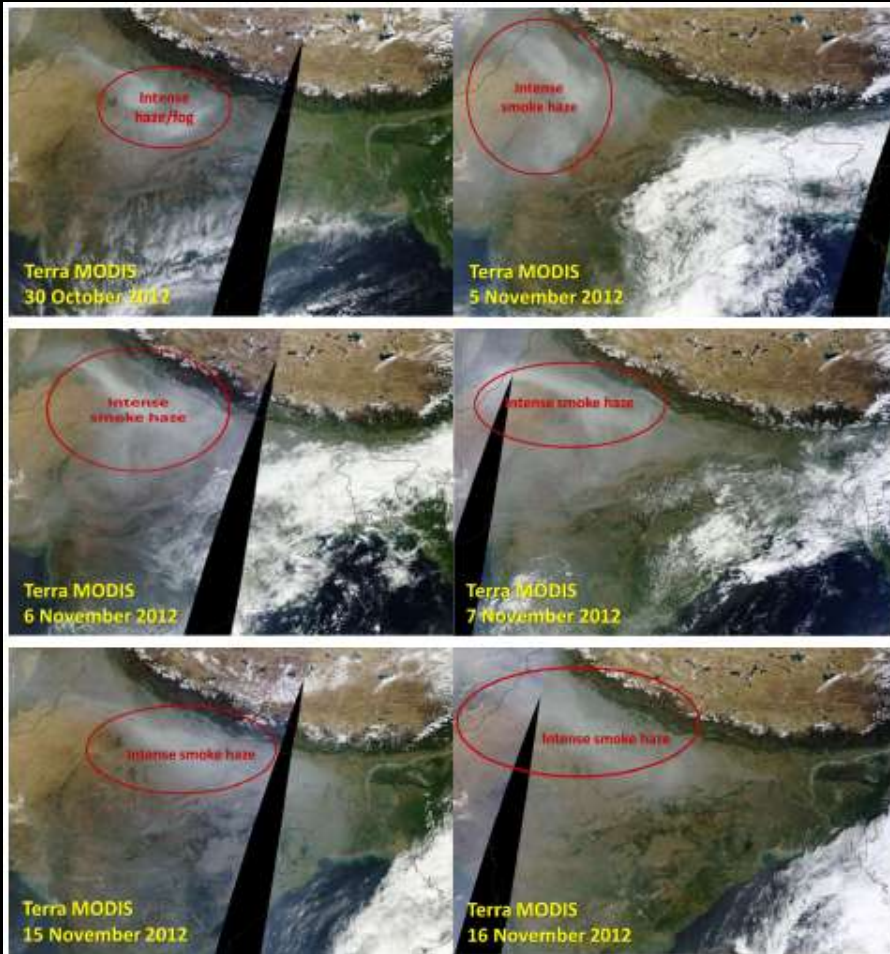
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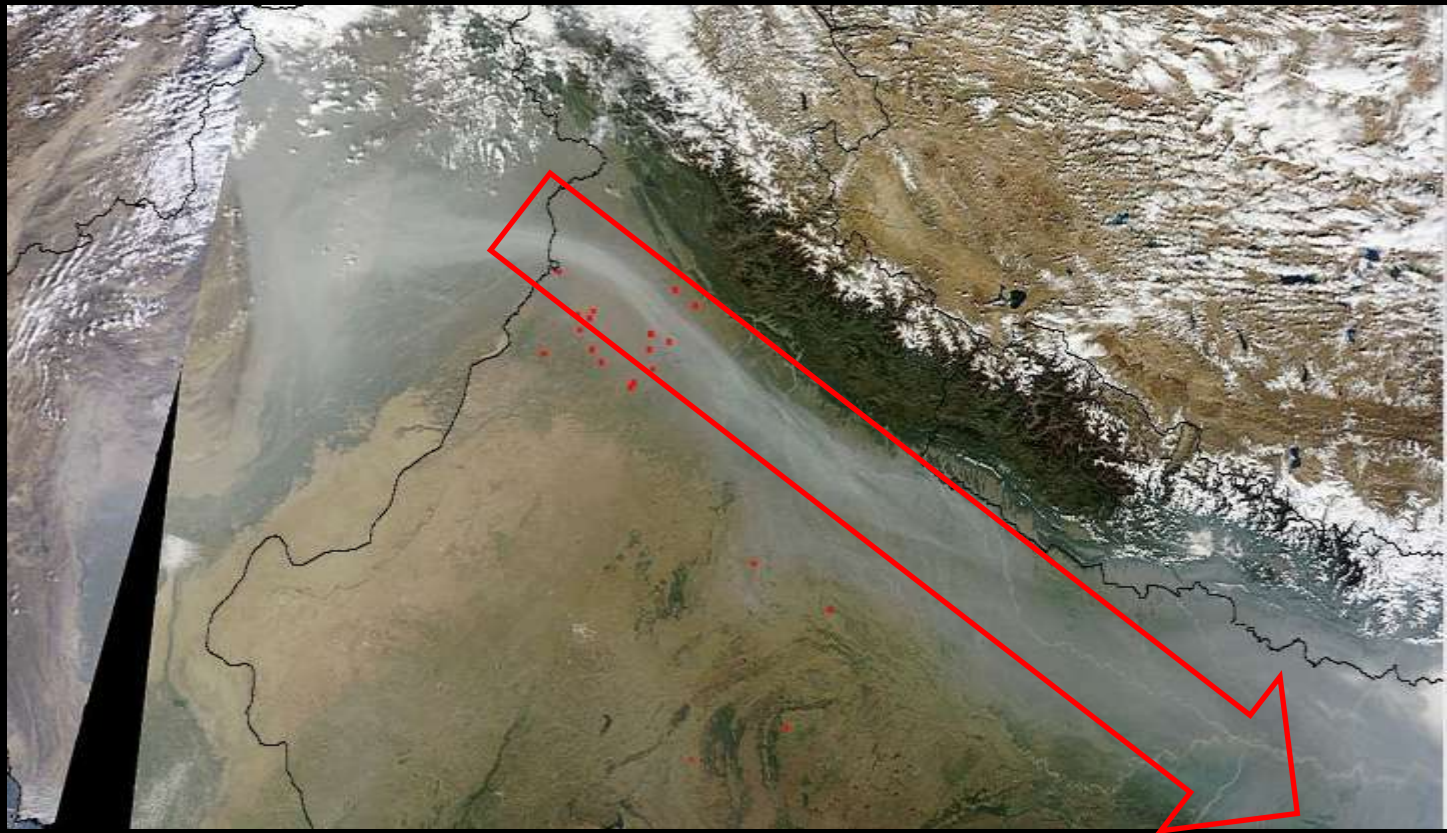
Crop burning

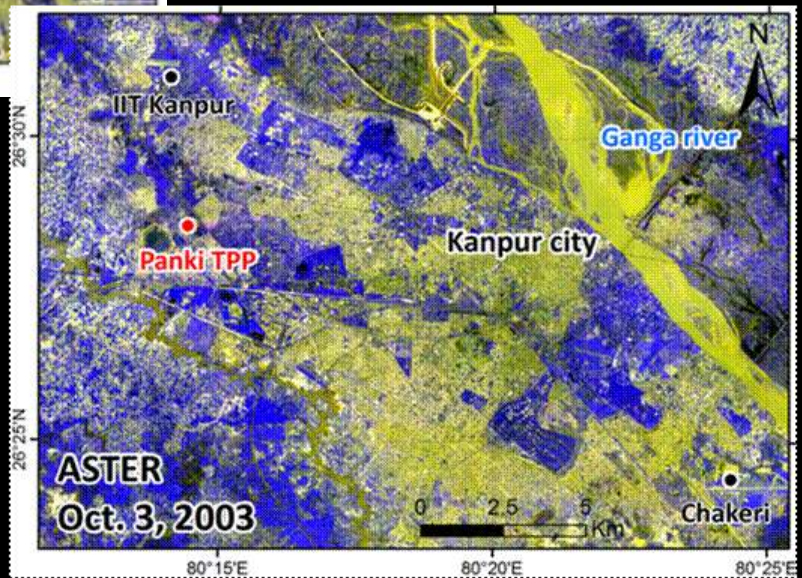
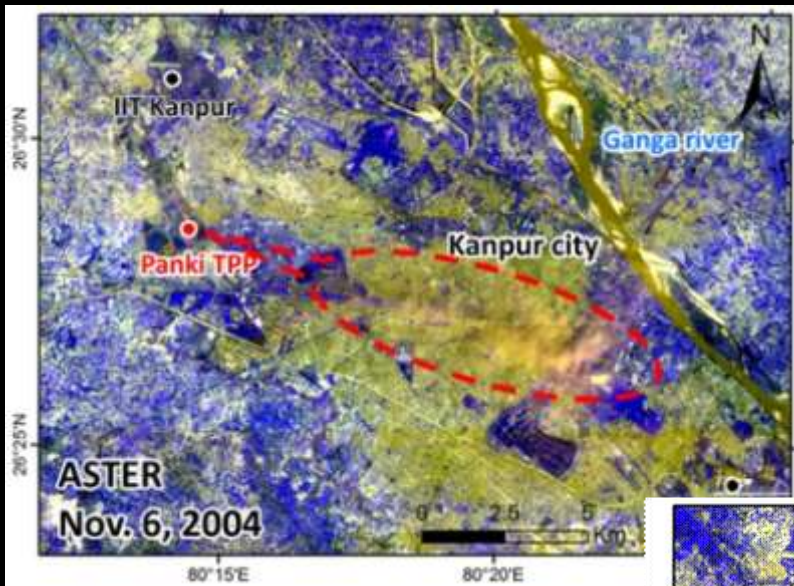


Uplift of Plume from Power Plants

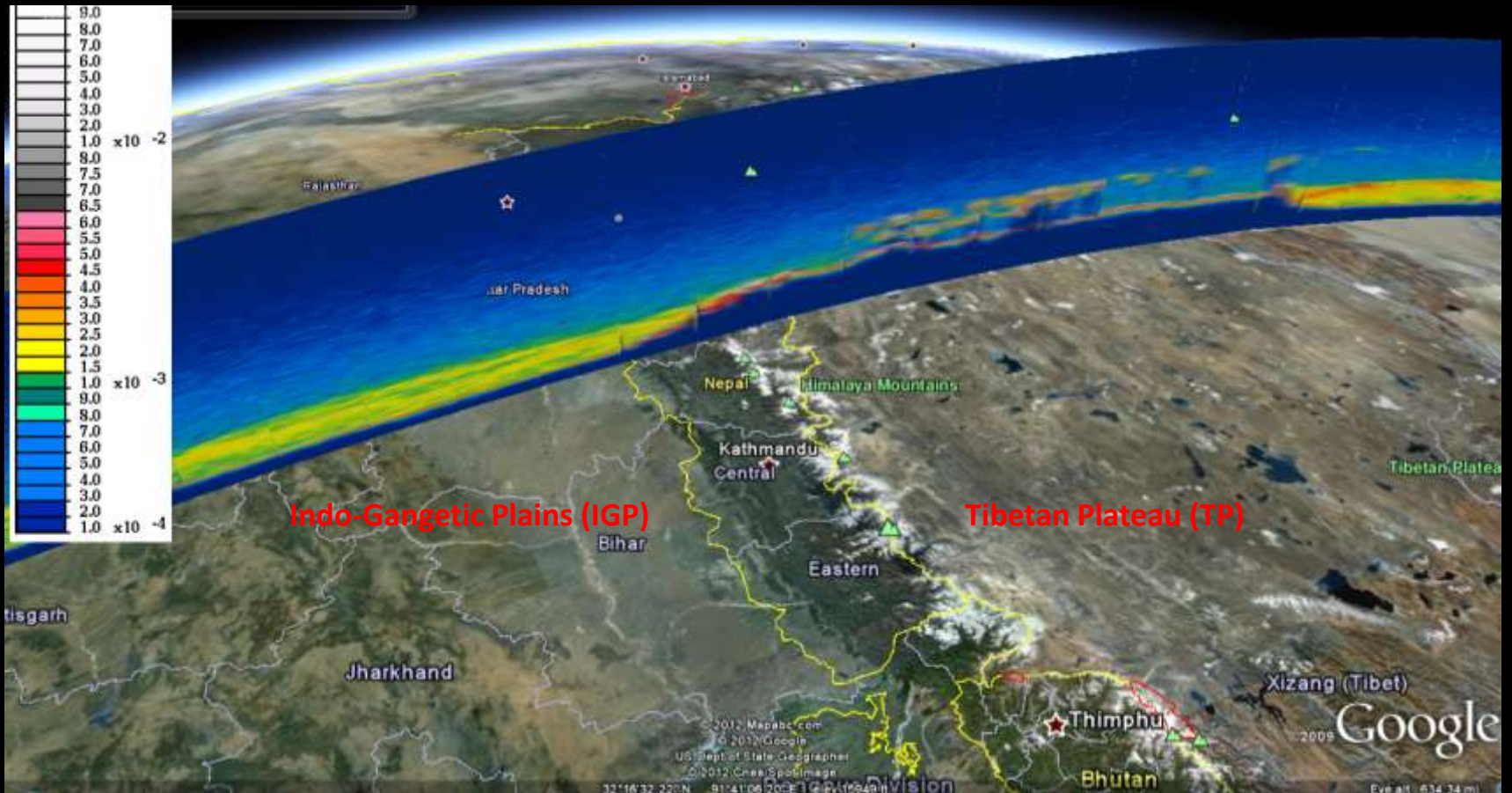


Transport of smoke plume crossing towering Himalaya

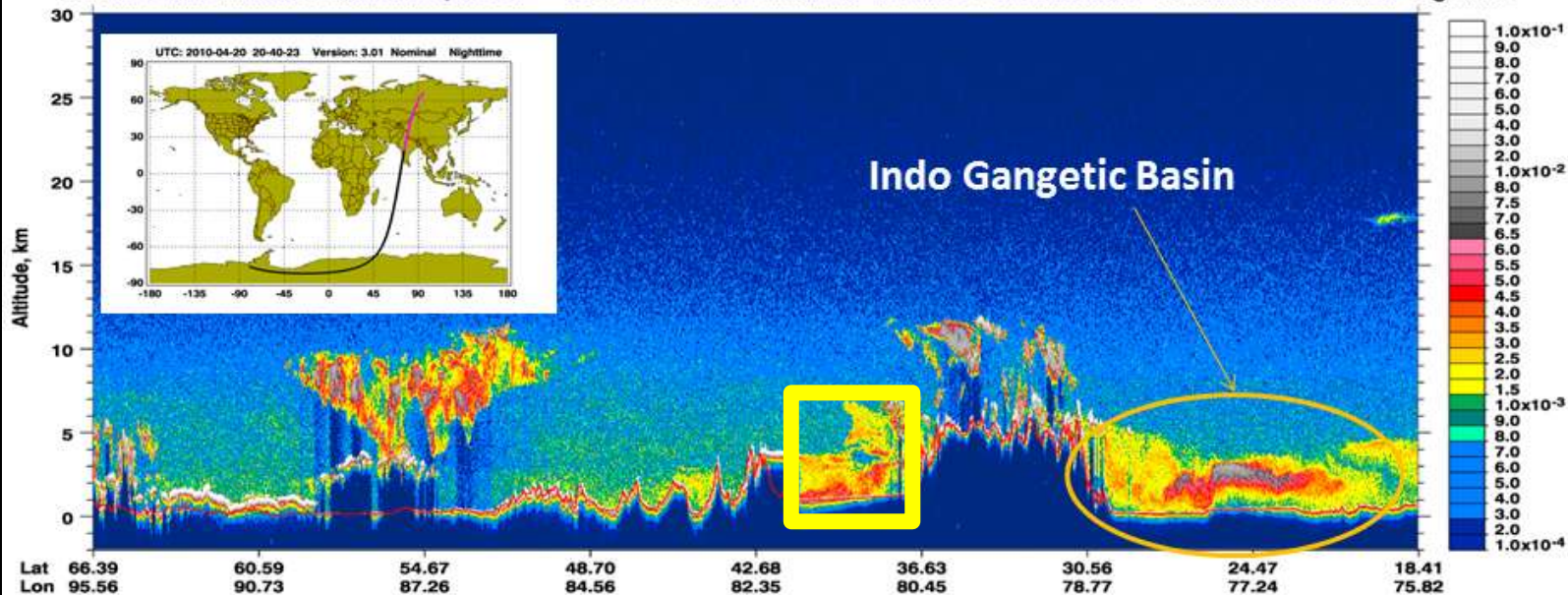




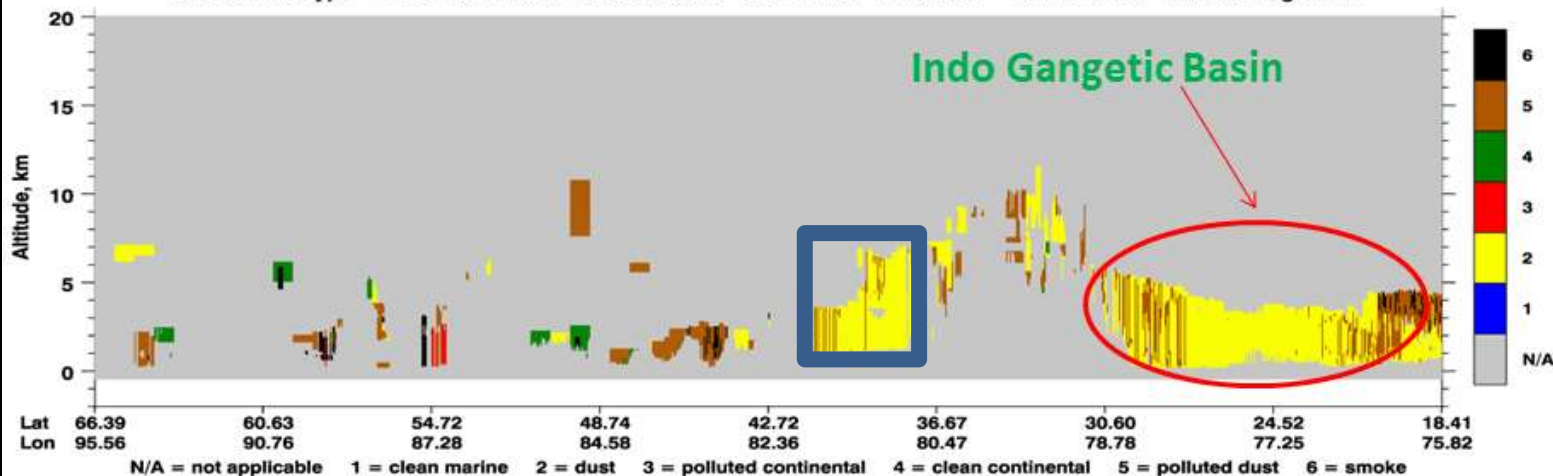
A vertical profile of the atmosphere on 6 May 2012 CALIPSO backscatter LIDAR image:

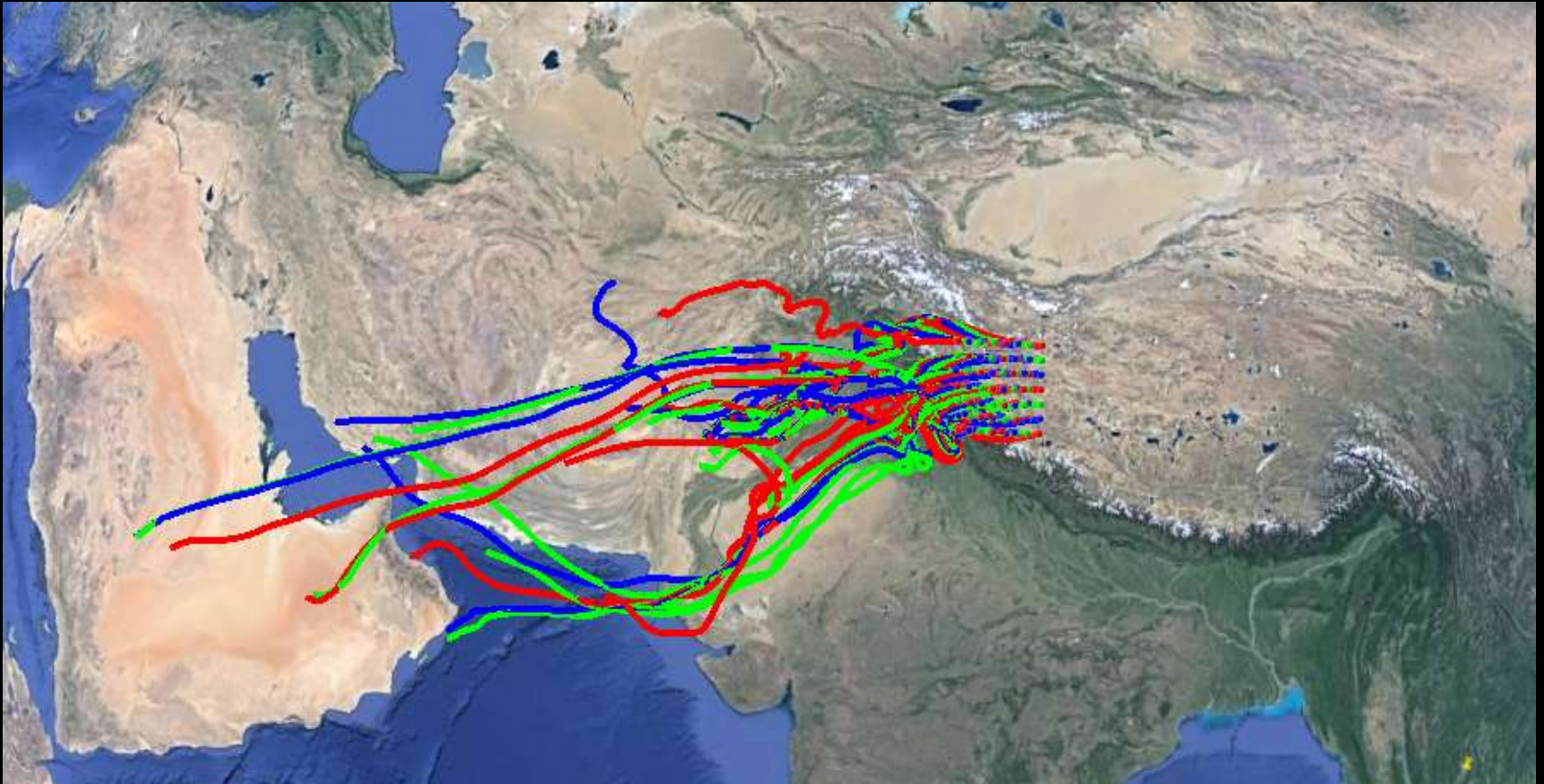


532 nm Total Attenuated Backscatter, $\text{km}^{-1} \text{sr}^{-1}$ UTC: 2010-04-20 20:40:22.0 to 2010-04-20 20:53:50.7 Version: 3.01 Nominal Nighttime



Aerosol Subtype UTC: 2010-04-20 20:40:22.0 to 2010-04-20 20:53:50.7 Version: 3.01 Nominal Nighttime





Air pollution has become a major problem. WHO estimates 700,000 deaths each year attributed to air pollution.



MOZAIC – INSTRUMENTATION (on commercial aircraft)



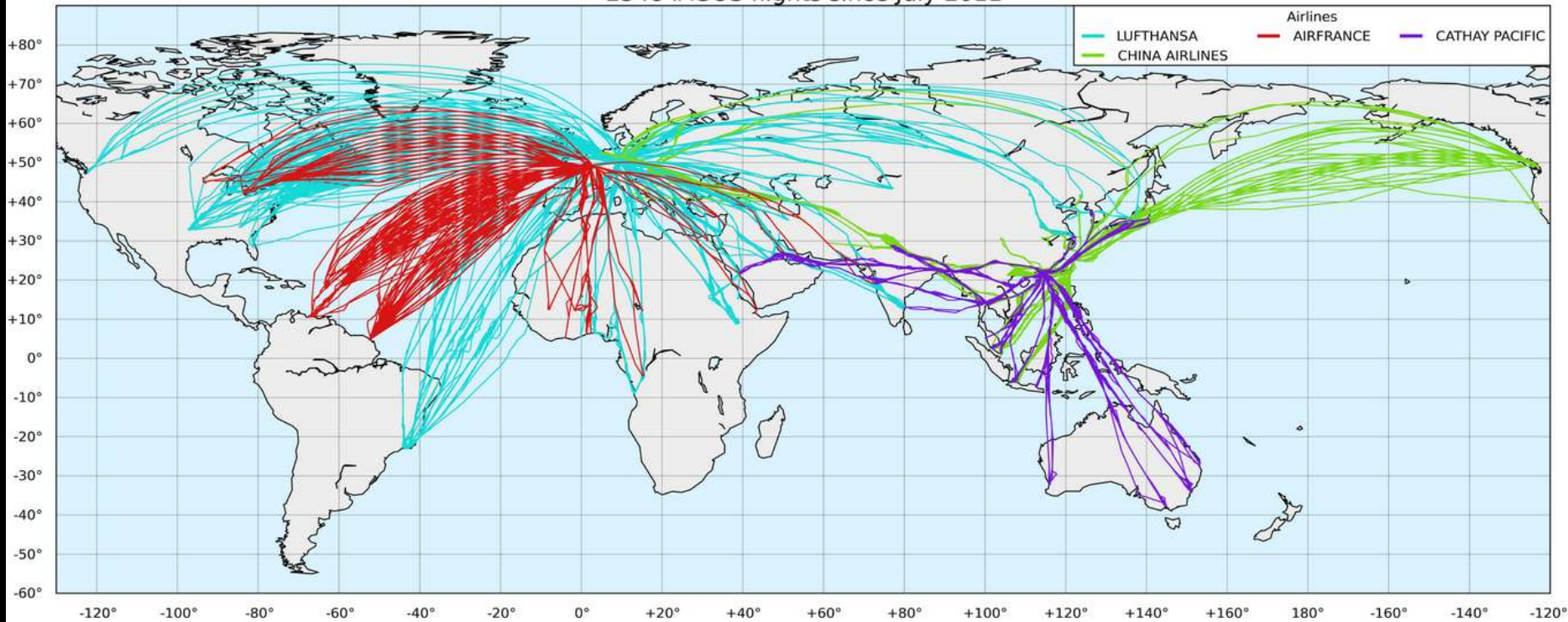


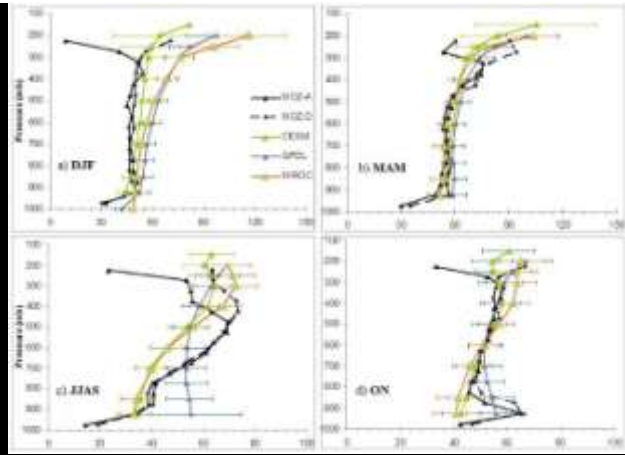
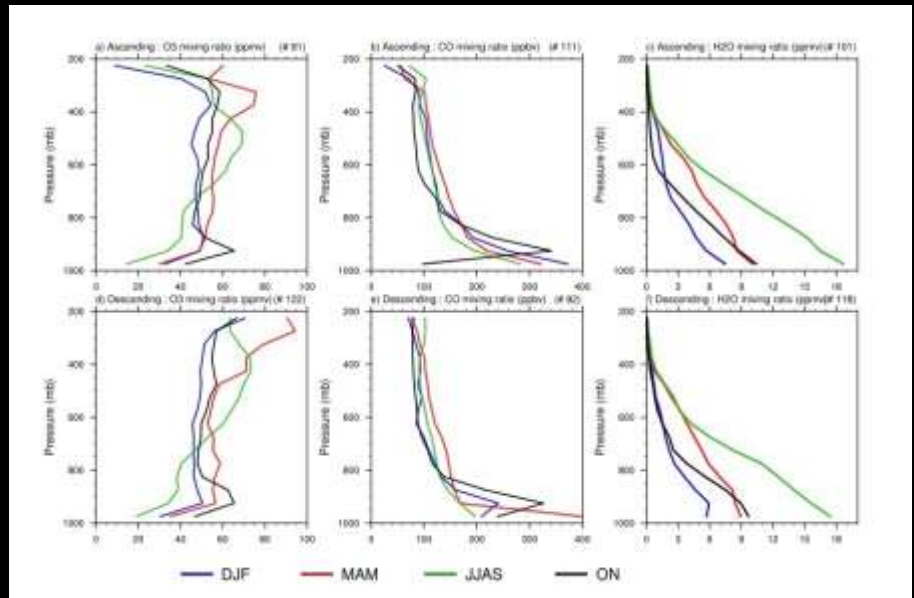
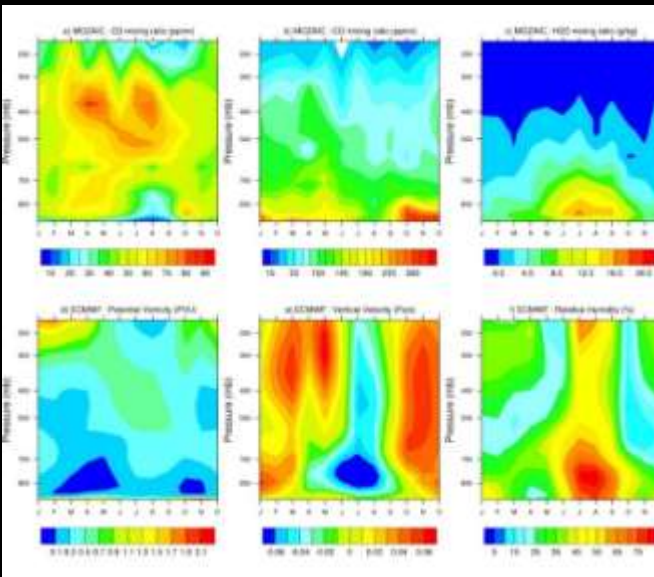
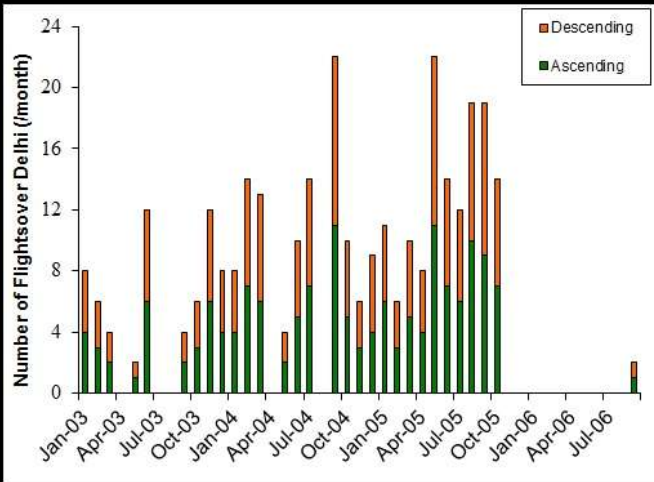
MOZAIC Consortium



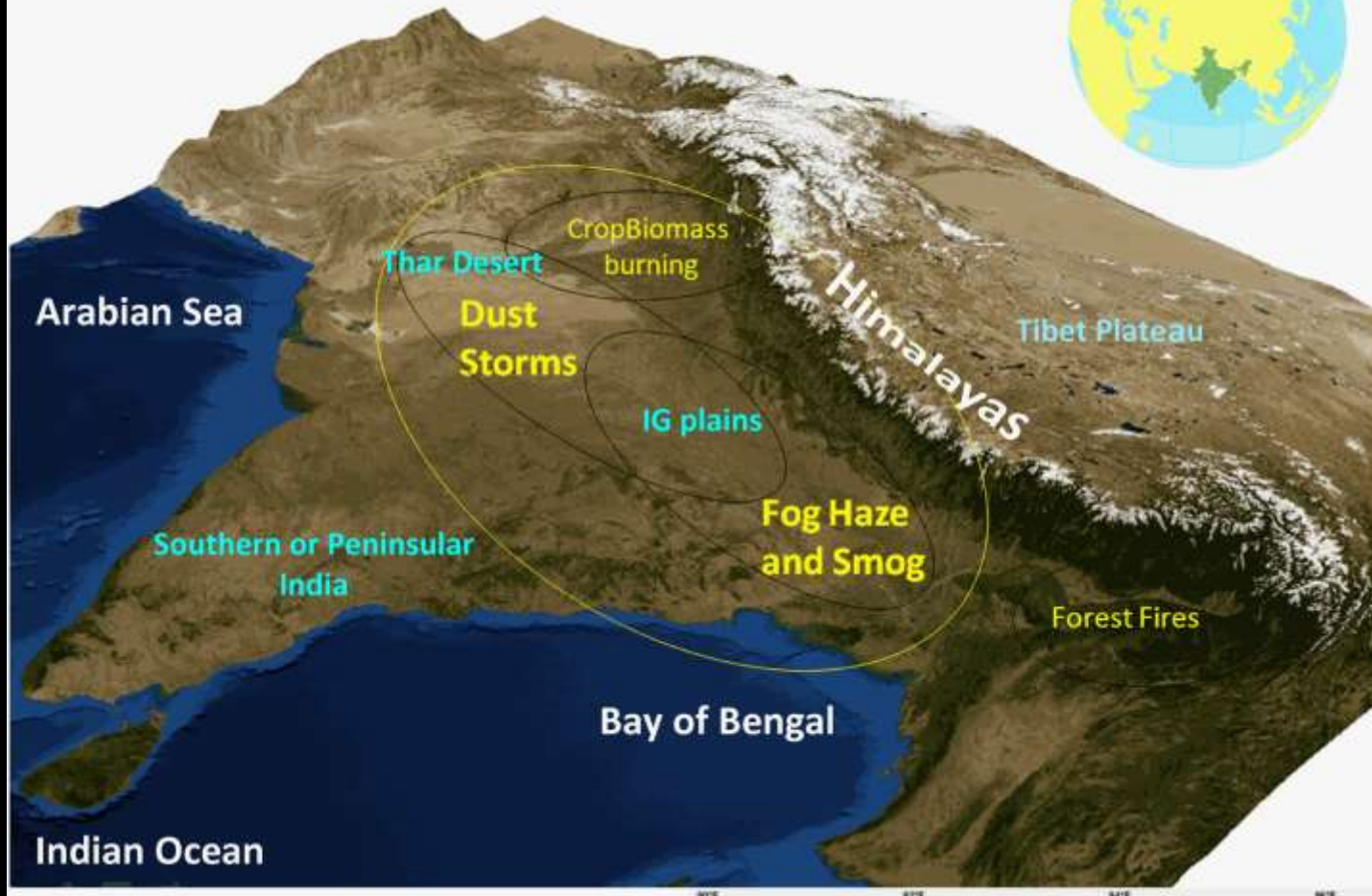
😊 The transport is free of charge !!

2548 IAGOS flights since July 2011





Indian sub-continent



Conclusions

Small satellites are needed to have detailed spatial and temporal information about the dust and anthropogenic emissions to alert people living in the Indo-Gangetic basin.

Thank You