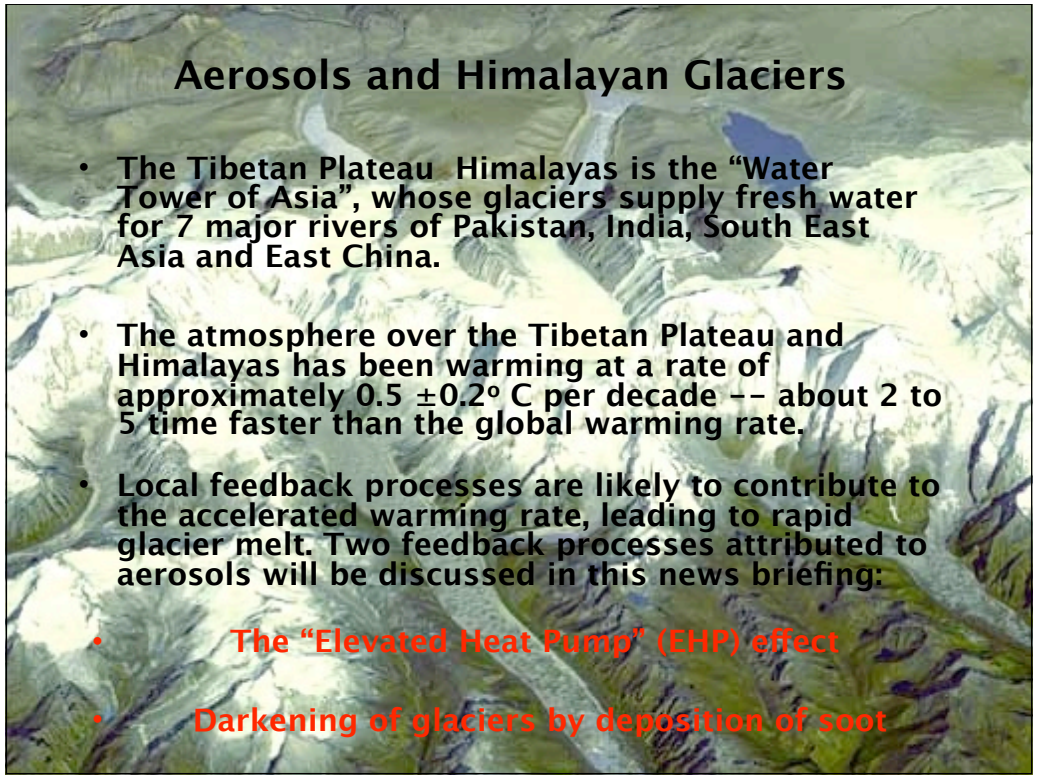
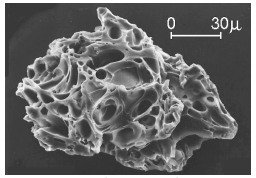

Aerosols and Himalayan Glaciers
• The Tibetan Plateau Himalayas is the "Water Tower of Asia", whose glaciers supply fresh water for 7 major rivers of Pakistan, India, South East Asia and East China.
• The atmosphere over the Tibetan Plateau and Himalayas has been warming at a rate of approximately 0.5 ±0.2° C per decade -- about 2 to 5 time faster than the global warming rate.
• Local feedback processes are likely to contribute to the accelerated warming rate, leading to rapid glacier melt. Two feedback processes attributed to aerosols will be discussed in this news briefing:
• The "Elevated Heat Pump" (EHP) effect
• Darkening of glaciers by deposition of soot

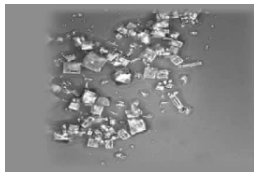
Definition of aerosol

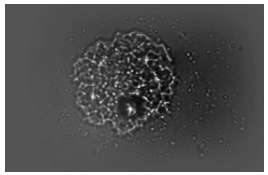
An **aerosol** is a suspension of fine solid particles or liquid droplets in a gas. Aerosols come from both man-made (industry, motor vehicles), and natural sources (forest fires, oceanic haze, deserts). Examples are: sulfate, soot (black carbon), organic carbon, dust, sea salt.

- **Soot** is impure carbon particles resulting from incomplete combustion of a hydrocarbon e.g., from internal combustion engines, power plants, heat boilers, waste incinerators, furnaces, fireplaces, slash and burn agriculture, forest fires.



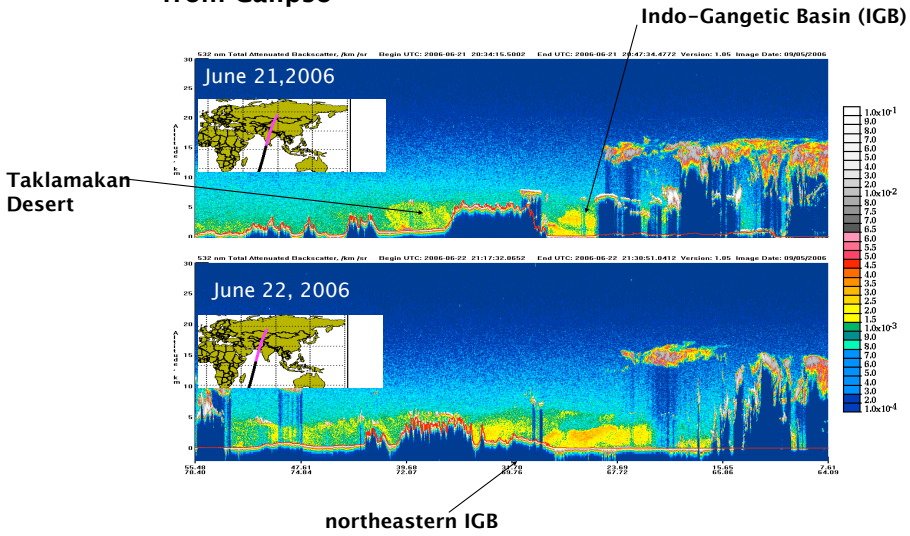
Volcanic ash


Sea Salt


Tractor soot

Space shuttle view of hazy aerosol cloud over Indo-Gangetic Plain, swept in from the Tibetan Plateau

Along-track satellite cross-sections of aerosol concentration over the Himalayas and Tibetan Plateau from Calipso

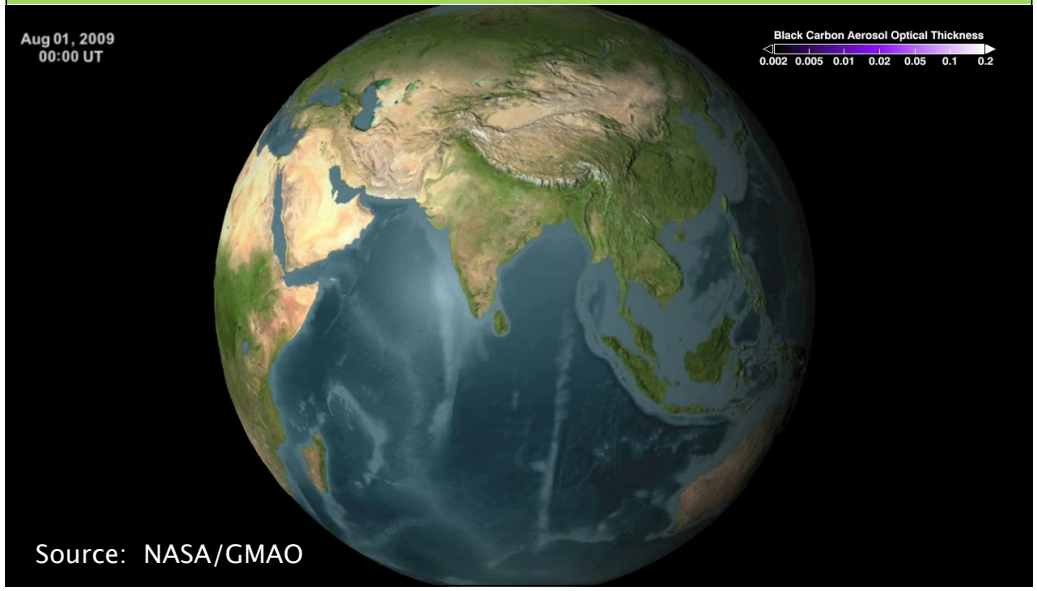


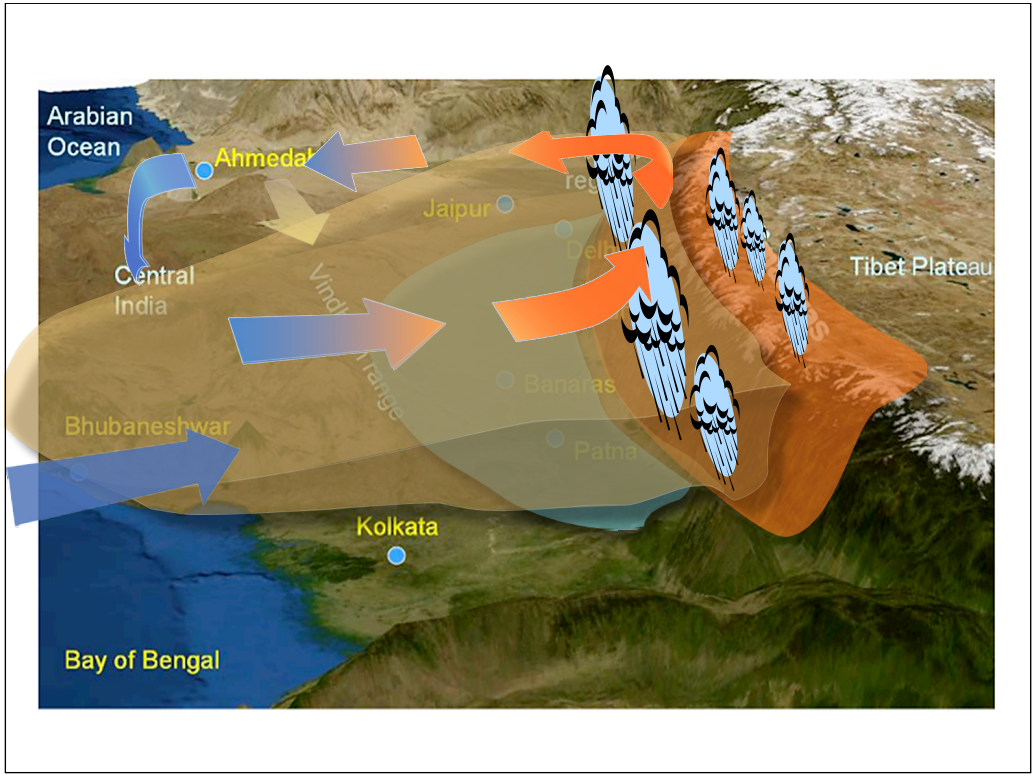
Reference

Lau, K.-M., K.-M. Kim (2008), Absorbing aerosols enhance Indian summer monsoon rainfall. iLEAPS Newsletter, No. 5, 22-24.

Caption: Color-coded near-meridional vertical cross-sections of CALIPSO satellite's lidar backscatter signal (532 nm), showing a deep and widespread layer of aerosols accumulating over northern India and the Himalayas foothills against the steep slopes of the Tibetan Plateau during June 21 (upper panel) and June 22 (lower panel) 2006. The green, yellow and red color shows low, medium and high aerosol concentrations of aerosols respectively. Some aerosols are seen over the top of the Himalayas (lower panel). Deep convection and high cirrus are shown from yellow to grey showing increasing concentration due to ice-scattering. Aerosols under high clouds cannot be detected by CALIPSO.

NASA global climate model simulation of emission and transport of
soot over the Indo-Gangetic Plain, the Himalayas and

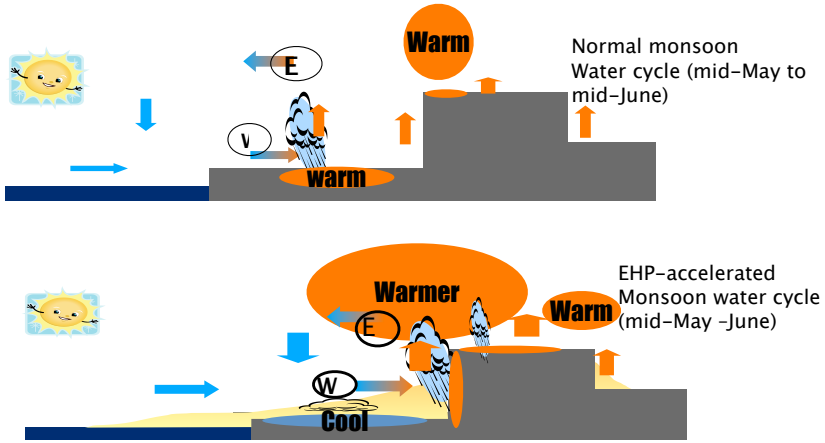




You can test this in Slide Show mode, using the button below left. Use your mouse to click through the sequence:

1-Click for brown cloud, 2-Click for Westerlies off desert, 3-Click for cool layer, 4-Click for warm air mass against slope, 5-Click for air flow off ocean, 6-Click once only for animated cycle, plays 3 times, then appears with all arrows at the end.

The Elevated Heat Pump (EHP) hypothesis



EHP postulates:

a) Warming and moistening of the upper troposphere over the Tibetan Plateau

b) An advance of the rainy season in northern India/Nepal region in May-June

c) The increased convection spreads from the foothills of the Himalayas to central India, resulting in an intensification of the Indian monsoon. in June-July

d) Enhanced snowmelt and rapid retreat of Himalayas glacier via

- transfer of heat from Indo-Gangetic Plain to the TP atmosphere-land system

- transfer of atmospheric pollutant from IGP to the TP, increase deposition, and snow-darkening effect