

'Pollution cools monsoon days'

Study says aerosol emissions cause temperature drop of 1 degree Celsius

R. PRASAD
CHENNAI

Increased emissions of aerosols into the atmosphere due to pollution are beginning to have a definite cooling effect of 1 degree C during the Indian summer monsoon period, a study has found.

The increased cooling is seen during the day, while the night time temperature is increasing, thus shrinking the diurnal temperature difference. The diurnal temperature difference is what drives the convection process (where water evaporates and reaches the atmosphere as water vapour), and development of clouds.

Shape, characteristics

As diurnal temperature difference decreases, the lower layer of the atmosphere will reduce in height and come closer to the earth's surface.



This will cause more aerosols to get into the atmosphere, thus impacting the lower atmospheric turbulence, which may eventually affect the distribution of moisture and rainfall.

"The increased concentration of aerosols in the atmosphere also tends to change the shape and characteristics of rain-bearing clouds, leading to extreme rainfall events but weakened monsoon rainfall," says Professor Sachchida Tripathi

from the Indian Institute of Technology (IIT)-Kanpur.

Striking similarity

The study by a team of researchers led by Professor Tripathi, and Dr. Vijay Kanawade from the University of Hyderabad, found striking similarity between satellite data (2002-2016) and a global reanalysis modelled data that showed cloud structure being modified with increased aerosol emission.

Rain-bearing clouds were found to increase in number and height when aerosol emission is higher. The clouds also tend to have a far higher number of ice particles that are smaller in size when aerosol loading is higher, thus reducing the efficiency of water droplet growth, says the paper published in *Nature Communications* by Chandan Sarangi

of IIT-Kanpur. "We found that when there is high aerosol loading, there will be more water droplets in the atmosphere. Once the droplets reach above the freezing level, ice formation begins. Heat is given off when ice formation processes begin. This acts as a fuel to make the cloud grow taller and thicker," says Dr. Kanawade.

"When aerosol loading is higher, the anvil (cloud top) contains more number of smaller ice particles, which tend to reflect the shortwave radiation from the top of the cloud, leading to increased cooling of the earth's surface. Cooling by shortwave radiation surpasses warming by longwave radiation, leading to net reduction in daytime temperature during the summer monsoon," says Prof. Tripathi.