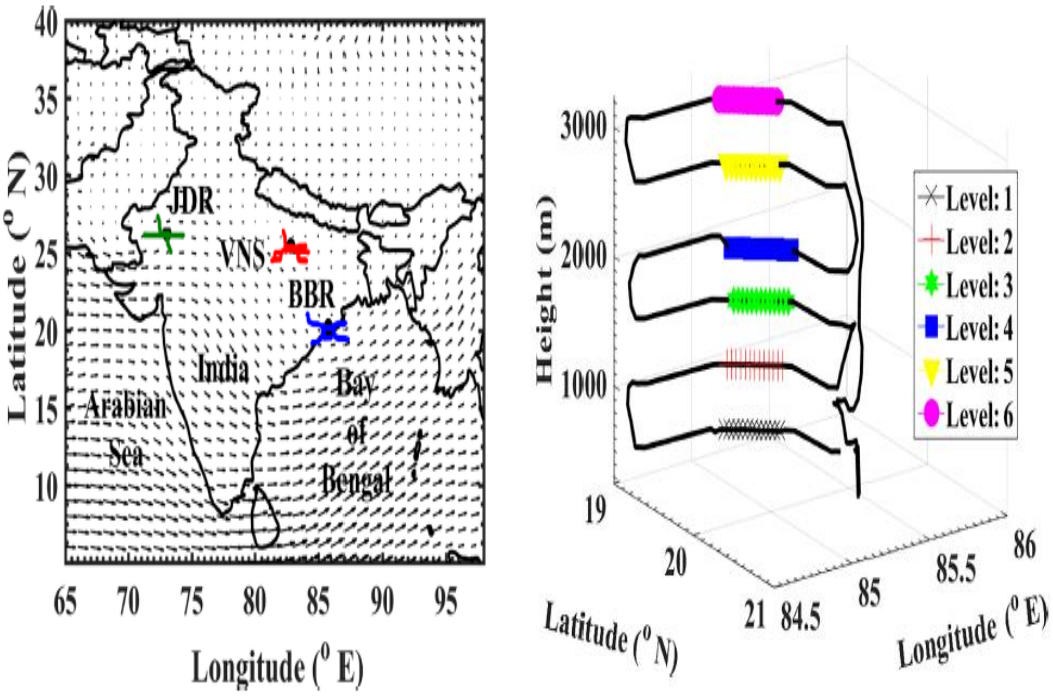
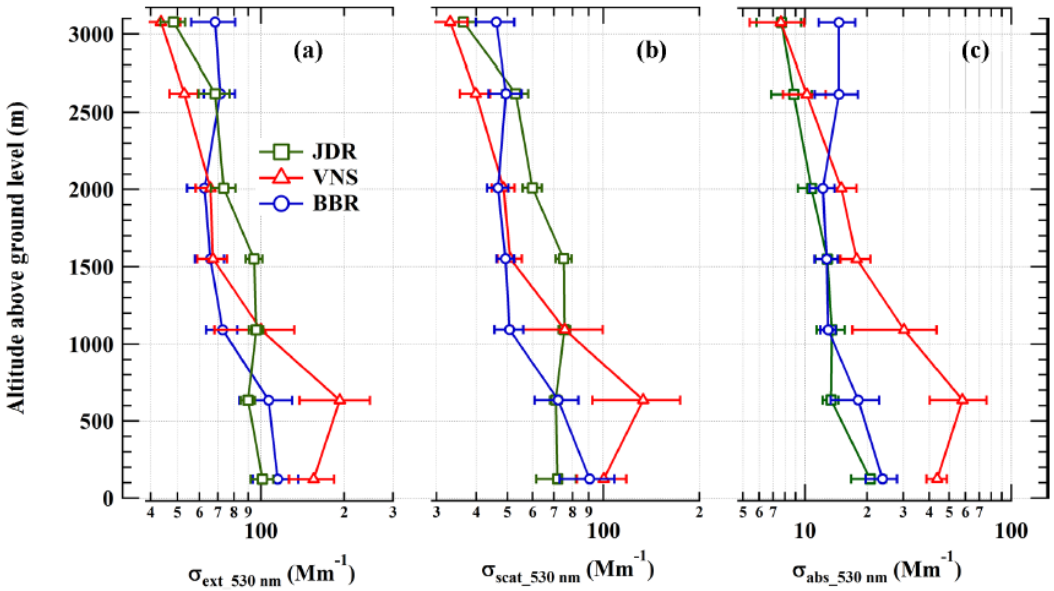
The vertical profile of aerosols across in north India prior to monsoon onset.

Natural and anthropogenic aerosols occur in significant amounts over the Indian region, especially over Indo-Gangetic Plains (IGP). They are known to strongly influence the Indian Summer Monsoon. A joint Indo- UK field campaign SWAAMI (South West Asian Aerosol Monsoon Interaction) was been carried out to characterize these aerosols. There were extensive measurements using Indian and UK aircrafts and data from ground-based observatories and satellites.

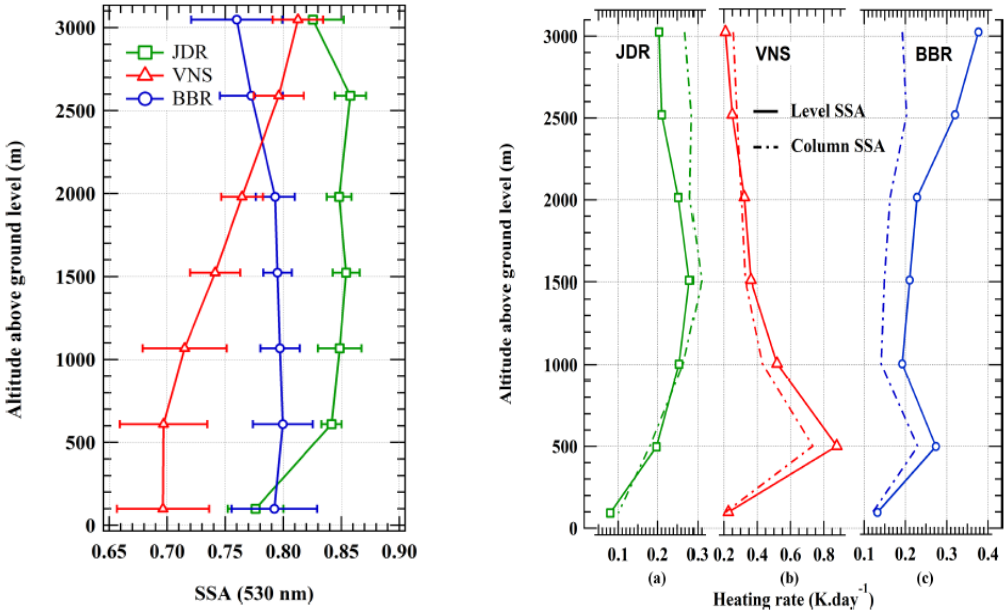
The altitude profiles aerosol extinction, absorption and single scattering albedo were measured in Jodhpur, Varanasi and Bhubaneshwar using a Beechcraft (B200) aircraft of the Indian Space research Organization, during June 2016.



The figure on the left shows the stations where measurements were made by aircraft. JDR=Jodhpur, VNS= Varanasi and BBR=Bhubaneshwar. The figure on the right shows how the aircraft traversed different layers of the atmosphere. Based on these measurements the vertical profile of extinction (sum of absorption and scattering) coefficient was calculated and SSA was derived. Jodhpur lies close to the arid region and is strongly under the influence of locally generated and long-range transported mineral dust during this season, Varanasi in the Central IGP represents regions with strong anthropogenic emissions and Bhubaneswar represents the aerosols at the outflow region, being modulated by the marine component.



The figure above shows the variation of extinction, scattering and absorption coefficient at different levels. Note that the absorption coefficient is much higher in Varanasi (Central IGP) than in the other two stations.



The figure on the left shows the vertical variation of single scattering albedo (SSA) which is the ratio of scattering to extinction coefficient. A low value of SSA indicates the presence of absorbing aerosols such as soot. Important points to note are (a) very low value of SSA at Varanasi close to the surface, (due to local anthropogenic activities) and a rather rapid increase in SSA above the local boundary layer showing the impacts of elevated dust aerosols (with SSA values going close to those over Jodhpur).

In contrast, at BBR, where the marine aerosols are significant in the lower altitudes, SSA remains fairly high, and surprisingly decrease above 2 km due to mixing of aerosols of different origins.
The figure on the right shows the heating rate of the clear atmosphere by these aerosols, estimated using the earlier data. Note the high heating over Varanasi on account of the presence of more soot in Varanasi when compared to Jodhpur which has more dust.

"Large contrast in the vertical distribution of aerosol optical properties and radiative effects across the Indo-Gangetic Plain during the SWAAMI–RAWEX campaign", Aditya Vaishya, Surendran Nair Suresh Babu, Venugopalan Jayachandran, Mukunda M. Gogoi, Naduparambil Bharathan Lakshmi, Krishnaswamy Krishna Moorthy, and Sreedharan Krishnakumari Satheesh, **Atmospheric Chemistry and Physics, 18, 17669–17685, 2018**