Multi-year Measurements of Aerosols at Jaipur, a site in Northwestern India

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Abstract

During the period from April 2011 to March 2015, in-situ measurements of aerosol optical properties were conducted at an urban site in Jaipur, Northwestern, India as a part of research initiative at BIT Mesra, Jaipur campus with support from Department of Science and Technology (DST), Govt of India over Jaipur (26.9°N, 75.8°E, 450m asl), located near to Thar Desert in the state of Rajasthan, India.

In this study, the variations in Aerosol Optical Thickness (AOT) and its spectral properties especially in summer and winter seasons from year 2011 to 2014 are analyzed. The AERONET Level 2 quality controlled data is also used in the present study. The seasonal trends in AOT together with particle sizes are evaluated with respect to the two primary contrasting seasons in the present study. The mean AOT is greater in the summer (>0.5) with a corresponding low angstrom exponent (AE) values due to dust episodes. A high AOT is also observed in winter but with high AE value denoting the contribution of secondary particle due to local pollution. The inter-comparison of the results from other monitoring networks across Indo Gangetic Plains (IGP) will also be presented.

Keywords: Aerosols, AOT, Size distribution

Site Description

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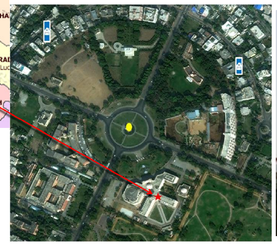
Site Coordinates and Elevation:
Latitude: 26.90582° North
Longitude: 75.80622° East
Elevation: 450.0 Meters



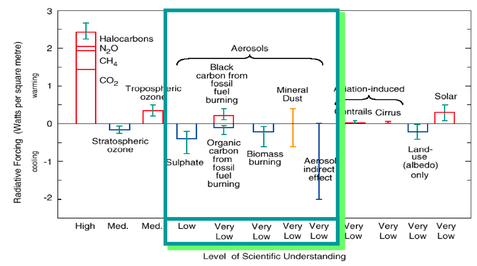
The site is at the heart of Jaipur , Birla Institute of Technology Extension Center.

Rationale

Atmospheric aerosol concentrations and their optical properties are one of the largest sources of uncertainty in current assessments and predictions of global climatic change (Intergovernmental Panel on Climate Change (IPCC) Hansen et al., 2000).

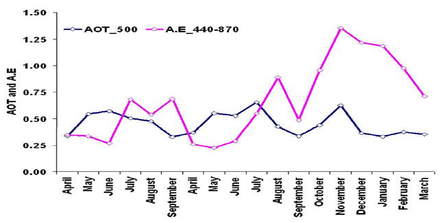
Aerosols are much more uncertain than greenhouse gases. Satellite remote sensing techniques are beginning to provide more detailed information on the global distribution and dynamics of aerosol optical depth and also an estimate of the relative magnitude of fine mode versus coarse mode particles (Kaufman et al., 2002; King et al., 1999)..

The Thar Desert centered in western India and eastern Pakistan is the primary potential source of dusts in the Indian subcontinent (Pease et al., 1998; Le ´on and Legrand, 2003).

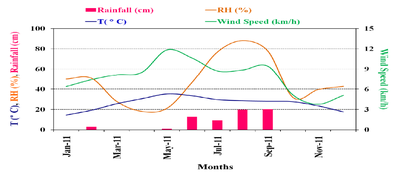


Results

1. Seasonal Variations in AOT and AE

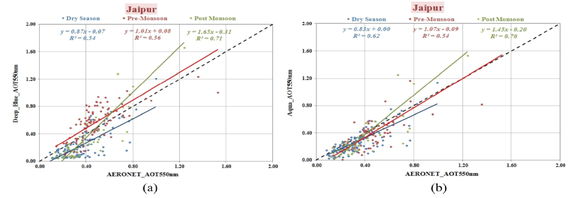


2. Synoptic Meteorology



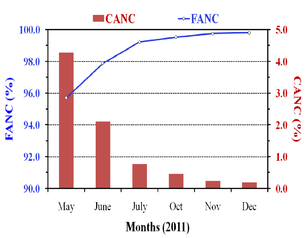
Jaipur experiences the semi arid climate. The average temperature remains higher during the summer season throughout April to June ranging from 31°C to 37°C.

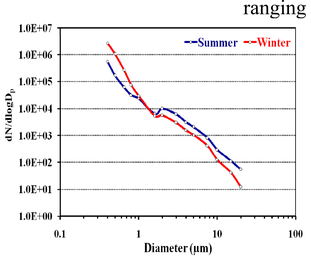
3. Comparison between **MICROTOP** and **MODIS** AOT

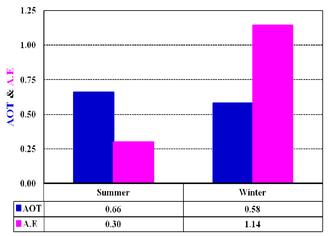


		τ AERONET Vs τ DBAOT550				τ AERONET Vs τ AQUAAOT550			
		CORRELATION	FB	FA2	NMSE	CORRELATION	FB	FA2	NMSE
JAIPUR	DRY SEASON	0.74	0.43	52.14	0.45	0.79	0.18	87.18	0.17
	PRE-MONSOON	0.75	-0.17	93.88	0.17	0.74	0.13	86.76	0.22
	POST MONSOON	0.85	0.09	62.22	0.60	0.83	0.04	77.78	0.42

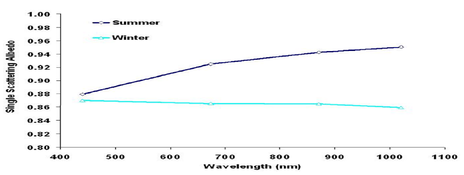
4. Fine and Coarse Mode during Summer/Winter



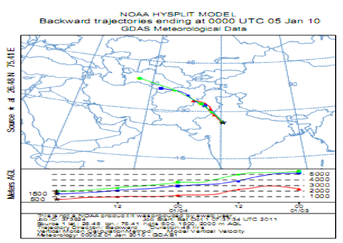


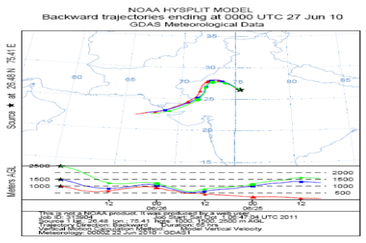


5. Spectral Variation of SSA and AOT

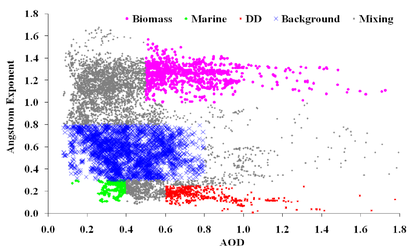


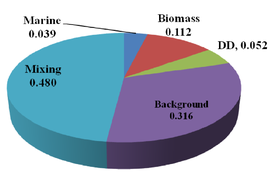
Back Trajectory Analyses





6. Aerosols types and sources over study region





The log normal size distribution curves reveals that the particle size less than 0.8 µm has key contributor in winter for higher ANC. The aerosols optical thickness shows nearly similar AOT values during summer and winter however corresponding AE values differs during summer (<0.3) than winter (>1.0), respectively

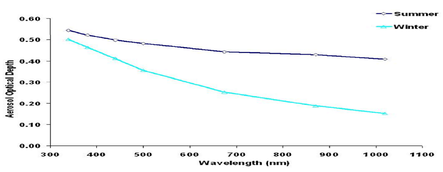


Table Comparison of aerosol parameters at Jaipur to two other sites over IGP region

Months (2009)	Locations	Mean aerosol parameter			
	$AOT_{500\ nm}$		$AE_{440-870\ nm}$	$SSA_{675\ nm}$	$AP_{675\ nm}$
May	Jaipur	0.56 (±0.16)	0.32 (±0.15)	0.93 (±0.02)	0.71 (±0.02)
	Kanpur	0.65 (±0.12)	0.74 (±0.27)	0.91 (±0.03)	0.68 (±0.02)
	Gandhi College	0.67 (±0.20)	0.91 (±0.34)	0.89 (±0.02)	0.67 (±0.02)
June	Jaipur	0.59 (±0.21)	0.29 (±0.19)	0.95 (±0.01)	0.72 (±0.01)
	Kanpur	0.69 (±0.24)	0.45 (±0.27)	0.94 (±0.03)	0.70 (±0.02)
	Gandhi College	0.77 (±0.34)	0.71 (±0.33)	0.92 (±0.03)	0.69 (±0.02)

Conclusions

- ***N***ew observations on the optical properties of aerosols over Jaipur , Northwestern India.
- The aerosol properties possesses clear seasonal variability's with maximum aerosol loading associated with mostly coarse particles (AE<0.25) during pre-monsoon season with occurrence of the highest AOD value compared to all other seasons.
- Five different aerosol types have been classified from the relation between AOD_{500} and AE, applying appropriate threshold values. The percentage contribution of each type varies seasonally. In winter, local production contribute to observed. An appreciable biomass burning (BB) type is attributed to mostly local and site specific aerosols.
- The HYSPLIT back trajectory analysis identifies the Thar Desert as the dominant potential source regions in pre-monsoon carrying primarily the coarse mode aerosols. On the other hand, in post-monsoon and winter seasons the main contribution to different aerosol types is from local sources which arises from north-west

Acknowledgements

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Poster Number: P-53