Research BRIEFS

NCAP-COALESCE

CarbOnaceous AerosoL Emissions, Source apportionment & ClimatE impacts

Understanding scientific complexities related to carbonaceous aerosols focussing on issues underlying their origin and fate, and their role as drivers of regional climate change over India.

Influence of dust and sea-salt sandwich effect on precipitation chemistry over the Western Ghats during summer monsoon

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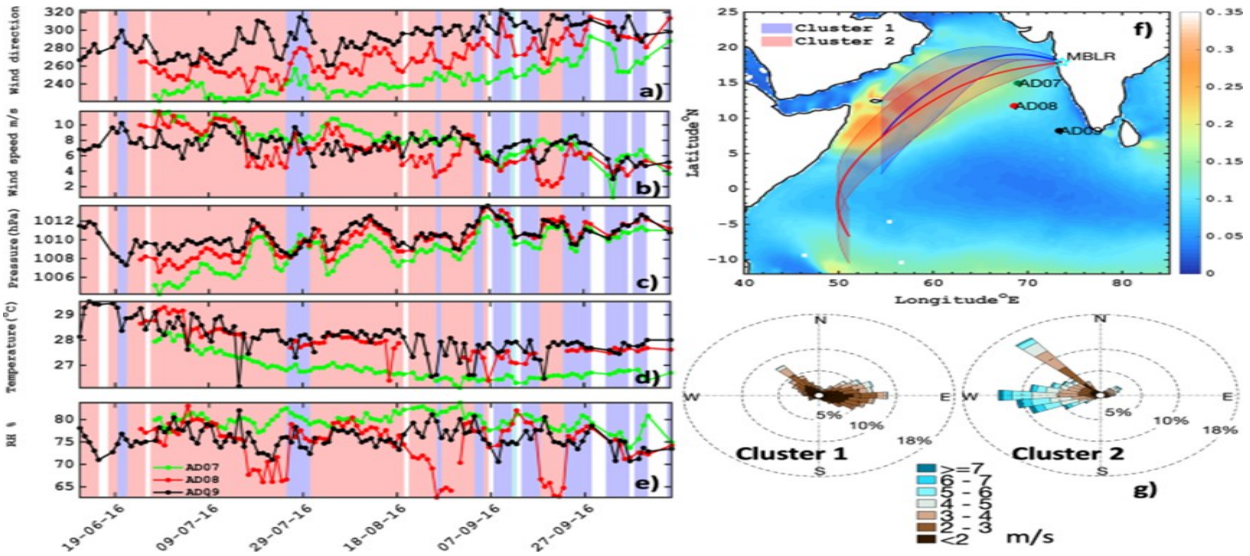

Key highlights:

- Two definite clusters: cluster1- with slow wind speed & Easterly flows and cluster2- with fast wind speed & south westerly flow pre-dominant during SW-monsoon period 2016.
- High columnar aerosols loading in rainwater over the Arabian Sea viewed in cluster-2 dominated days during 2016 summer monsoon from different satellite and reanalysis platforms.
- PMF (positive matrix factorization) source factor profiles for summer monsoon rainwater composition over the Western Ghats showed high dust (Ca2+) interception alongside sea salt (NaCl) in rainwater.

Summary:

The present study utilizes rainwater composition data from June to October 2016 at Mahabaleshwar, a high altitude site in Western Ghats, to assess the impact of different sources of major inorganic water -soluble constituents in rainwater. Th k-mean clustering algorithm was applied to discrete air mass back trajectories to segregate the observation as well as satellite and model reanalysis datasets. Cluster analysis revealed site to be mostly influenced by two types of clusters during south-west monsoon, one with more of continental influence (cluster 1) and another with oceanic influence (cluster 2). The cluster wise calculated sea salt source function unveiled higher sea salt genera-

generation in cluster 2 as compared to cluster 1. Similarly, the presence of dust in cluster 2 was dominant as also evident from MERRA2 and CAMS reanalysis products. Similar signatures were also visualized from the rainwater composition with higher volume-weighted average concentrations of Na+, Cl−, and Ca2+ in cluster 2 as compared to cluster 1. Dust aloft and sea salt beneath over the measurement site depicted a perfect sandwich like condition, hence, providing a continuous source for the rainwater constituents limiting of the seawater ratio signatures far from standard marine values. In contrast, the secondary species like SO_4^{2-} and NO_3^- showed reverse trend indicating the possible influence of anthropogenic emissions in cluster 1 as it air mass travelled toward inland. This studies further enlightens the limitation of using seawater ratios for calculating sea salt and non-sea salt concentration; as it may overestimate the non-sea salt fractions. The present study outlines extensively how different sources add up to the rainwater chemistry and showed us an alternative way of better representation of sources using k-mean clustering and positive matrix factorization analysis.

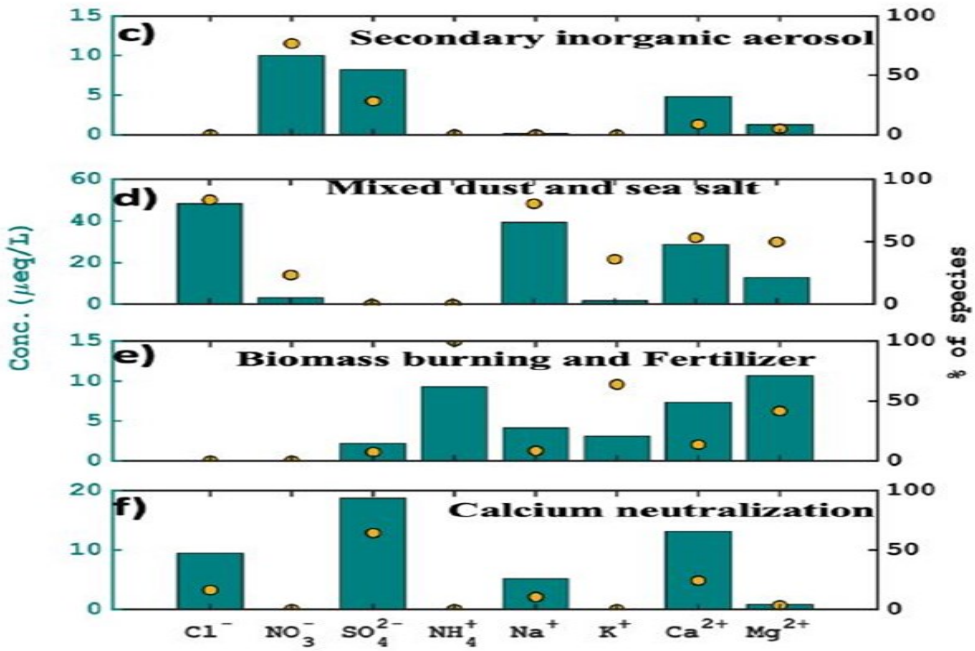

Figure1. The PMF factor profiles of 4 factors and their respective rainwater ionic concentration and percentage contribution to each factor (c–f) for Mahabaleshwar south-west monsoon period.

Major findings :

- Cluster analysis reveals that Western Ghats to be mostly influenced by two types of clusters during south-west monsoon, one with more of continental influence (cluster 1) and another with oceanic influence (cluster 2).
- The cluster wise calculated sea salt source function unveils the higher sea salt generation associated with cluster 2 as compared to cluster 1. Dust aloft and sea salt beneath over the Western Ghats depicted a perfect sandwich like condition which provided a continuous source for the rain-water constituents limiting the seawater ratio signatures far from standard marine signatures

Research Article

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