

Characteristics of new particle formation events and their effect on cloud condensation nuclei, in a mountain semi-rural location in India

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# **OBJECTIVE**

A semi-continuous measurements of atmospheric ion and particle number size distributions at High-Altitude Cloud Physics Laboratory (HAPCL) in a mountain semirural location, Mahabaleshwar, in the Western Ghats to comprehensively characterize New Particle Formation.

Our main aim was to address the following with respect to the Indian context:

what is the frequency of occurrence of the regional NPF events at mountain semi-1) rural site and its association with long-range transported air masses?

Do atmospheric new particle formation affect the cloud condensation nuclei at 2) our site? What is the chemical variation during new particle formation ?

## **Chemical characterisation during New Particle Formation (NPF)**

• The growth of freshly nucleated particles that persisted for ~ 6-7 hours has led to the significant enhancement in mass concentration of aerosol (OOA, sulphate and nitrate).



#### **DATA AND METHODOLOGY**

- NAIS measures air ion concentration in the mobility range of 3.16 0.00133 cm<sup>2</sup>  $V^{-1} S^{-1}$ )
- Particle number size distributions in the diameter range from 5 nm to 32  $\mu$ m (72) size bins) were measured using a wide range aerosol spectrometer (WRAS) with a time resolution of 5 minutes.
- The aerosol chemical composition, particle number concentration were measured by using Time of Flight - Aerosol Chemical Speciation Monitor (ToF-ACSM),
- Cloud condensation nuclei (CCN) number was measured using CCN counter (CCNC).

**Classification and Frequency of occurrence of NPF** events





Fig. 2. Pie chart of non refractory particulate matter during 1) Event, 2) nonevent and 3) Variation of Black carbon, Organic Carbon and Elemental Carbon during event and nonevent and Undefined

## **NPF and Cloud Condensation Nuclei (CCN)**

During this particular event day the enhancement in CCN concentration at 0.5 % SS was found to be 23.4 % (Direct CCN measurement whereas during undefined day it was only <4% for N100 (CCN-proxy)





Fig. 1. Typical examples of a) Event, (b) Nonevent and c) Undefined d) The percentage of occurrence of different types of events during each season

- Events were classified into three different types: NPF, nonevents, and undefined originally adopted from **Dal Maso et al.** (2005) methodology.
- NPF occurred on (14.6%) days and non-events were observed on (65.4%) days at HACPL. A (20%) days were categorized as the days which could not be classified as NPF or non-events days due to mixed features such as broken banana-shaped aerosol growth, ion/particle bursts without evidence for growth (volcano/apple), or Aitken mode growth.

Fig. 3. (a) Event day (b) Wind Speed and Wind Direction and (c) CCN Proxy calculations.

## CONCLUSIONS

- At HACPL in Mahabaleshwar, NPF generally occurred at higher temperature and lower relative humidity in all seasons, but the interplay between gas-phase chemistry and atmospheric conditions decides when the NPF will trigger in the atmosphere.
- The  $\Delta$ CCN (%) for other NPF days ranged from 5 to 40 % over Mahabaleshwar during strong new particle formation event days. The frequency of occurrence of NPF was the highest in MAM months (22.9%)
- The newly formed particles and their subsequent growth have an obvious effect on CCN number concentrations during the observed NPF event days. Overall, NPF occurred more frequently in air masses with low Primary Organic Aerosol (POA) concentrations (cleaner) than polluted air masses, with faster growth rates and formation rates during strong event days.

## **FURURE SCOPE AND REFERENCES**

