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Characteristics of ice-nucleating particles in Beijing during Spring: a comparison study for the suburban and a nearby mountain area

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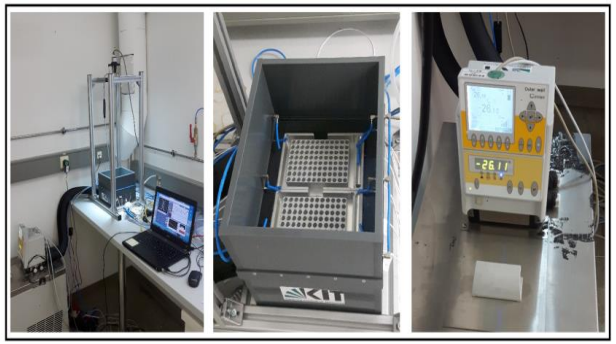


Motivation

@Chinese Weather

There is a significant difference in ice-nucleating particles (INPs) in different airmass types and different aerosol characteristics [e.g., Kanji et al., 2017; Murray et al., 2021].

A lack of data on the spatial and temporal variation of INPs around the globe limits our predictive capacity and understanding of clouds containing ice.

With the rapid economic development and large energy consumption, Beijing has experienced serious air pollution and became one of the hotspots for PM pollution in the world.

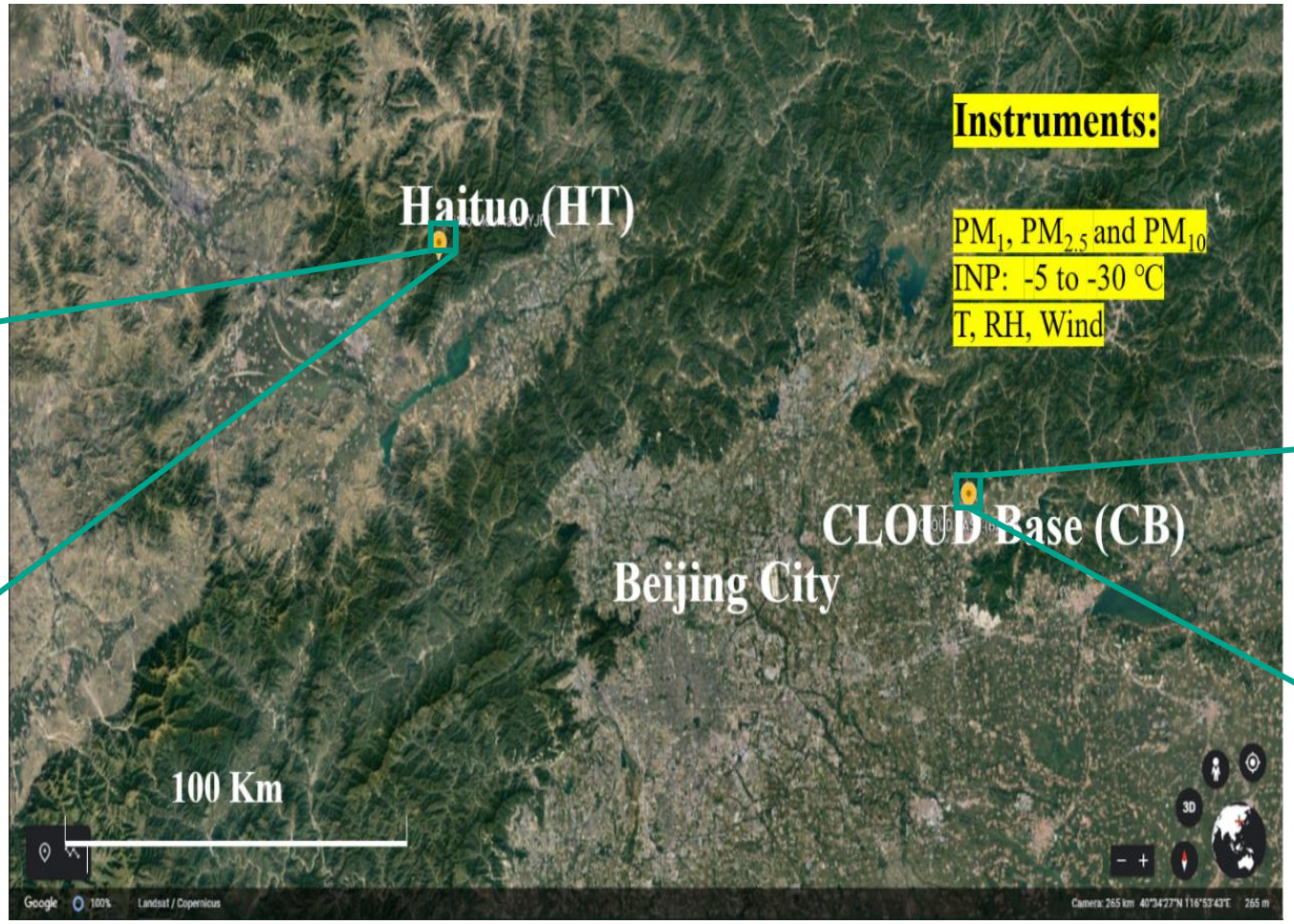
Sampling location

HT Mountain site

Altitude: 1344 m

mountain area

clean



[Google map]

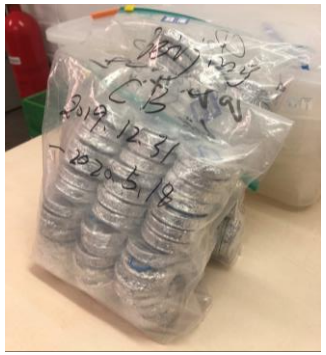
CB Suburban site

suburban

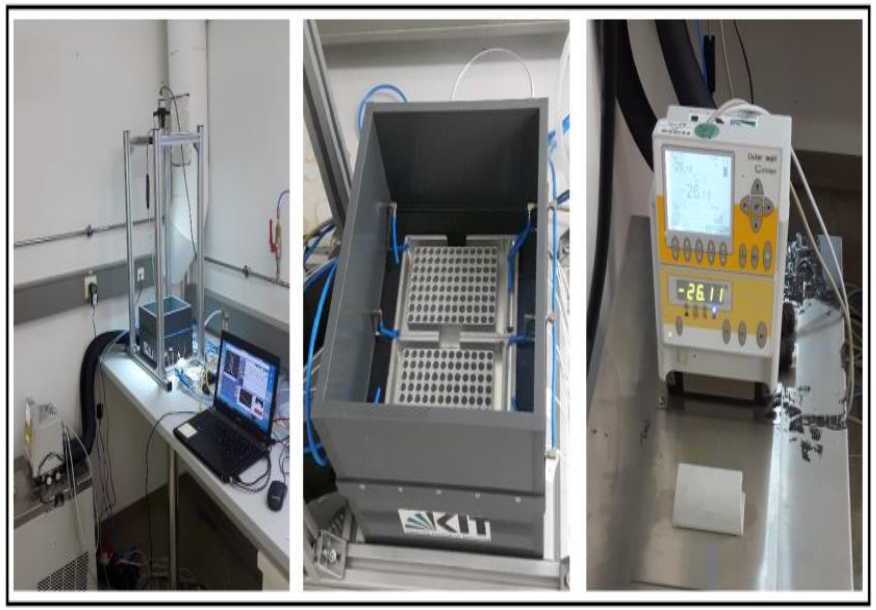
polluted

INPs filter sampling and analysis

24 hours aerosol samples, from 5th April to 2nd May 2019



The INP contents were measured with **Ice Nucleation Spectrometer of the Karlsruhe Institute of Technology (INSEKT)** , based on a cold-stage freezing method



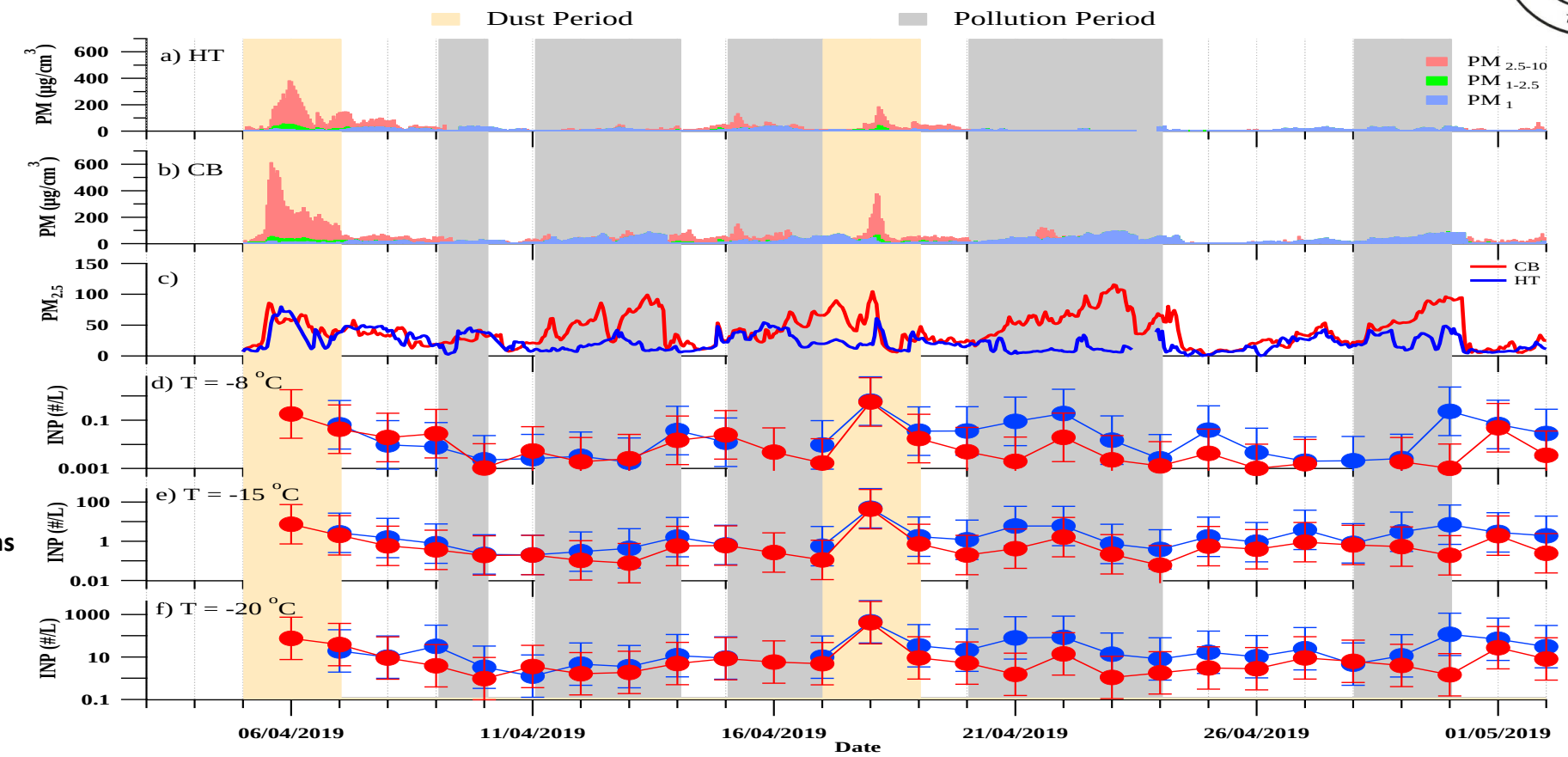
from -5 °C to about -30 °C in the immersion freezing mode

(Schneider et al., 2021)

Results: Time series of INP and PM concentrations at the HT and CB sites

Particulate Mass

INP concentrations



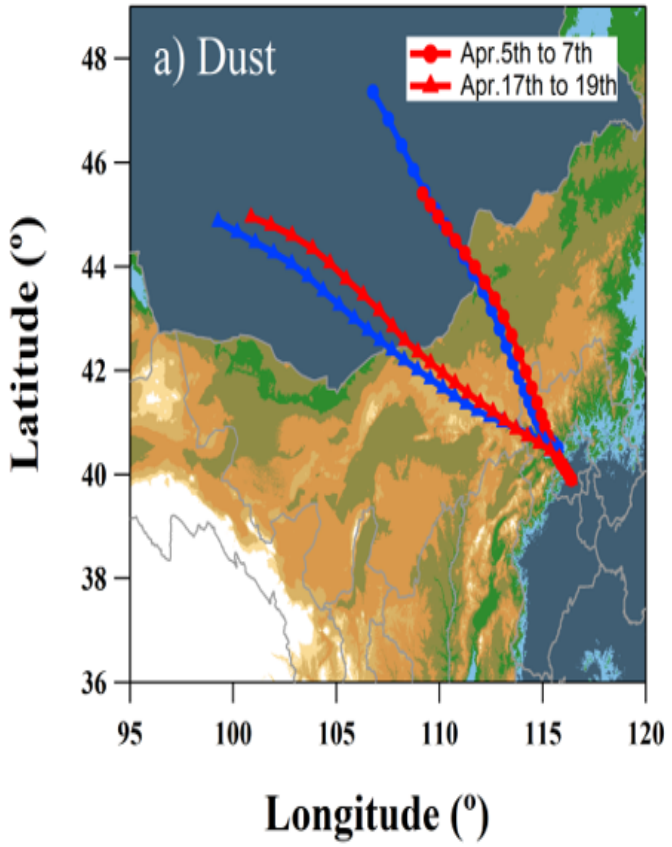
two significant dust events:
Apr. 5th to 7th
Apr. 17th to 19th

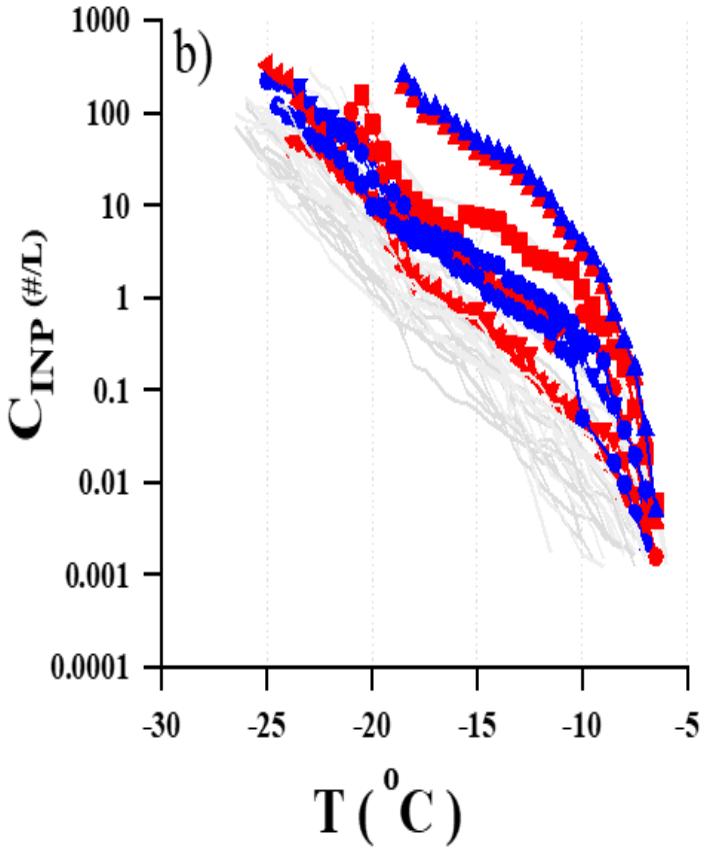
- PM2.5 mass concentration at the HT site was about 2-3 times lower
- INP show contrary results to the PM2.5
- INP span more than three orders of magnitude

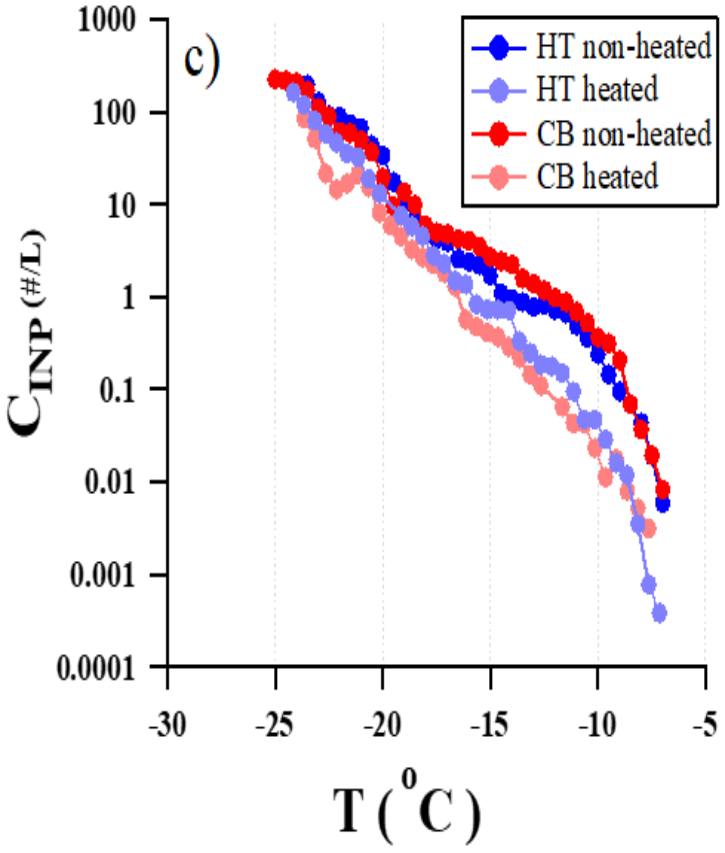
Results: The INP characteristics during Asian dust storm periods

24h backward trajectories

INP temperature spectra



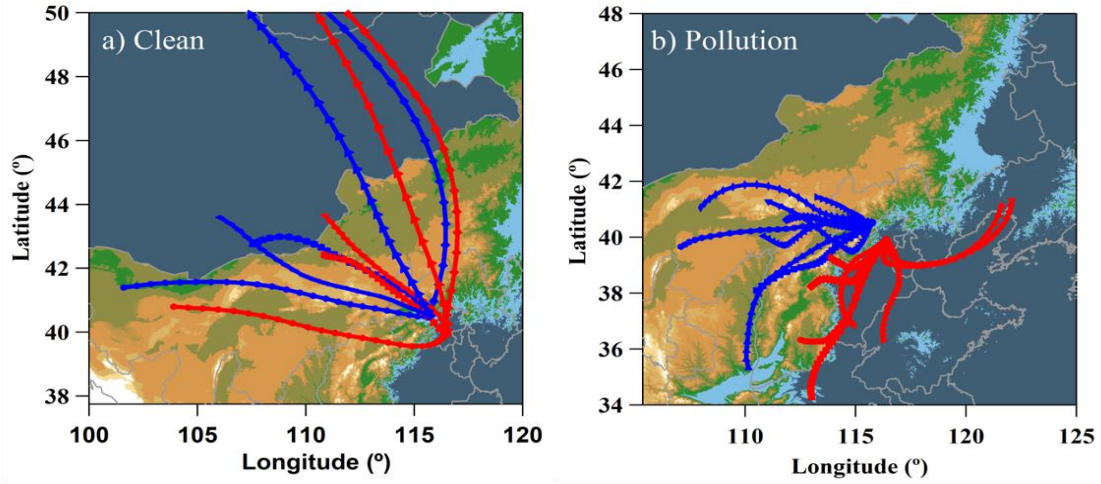




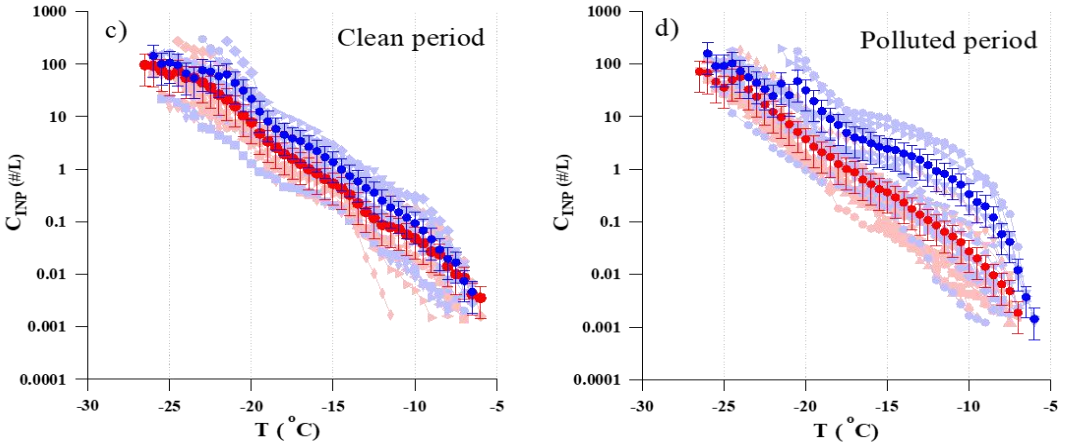
above -10 ℃ were shifted,
lower than -15 ℃ the heated effect was not pronounced.

Results: The contribution from anthropogenic pollution aerosols

24h backward trajectories



INP temperature spectra



During clean periods,
influenced by the **northwest clean air masses.**

The INP characteristics were similar.

the polluted periods:

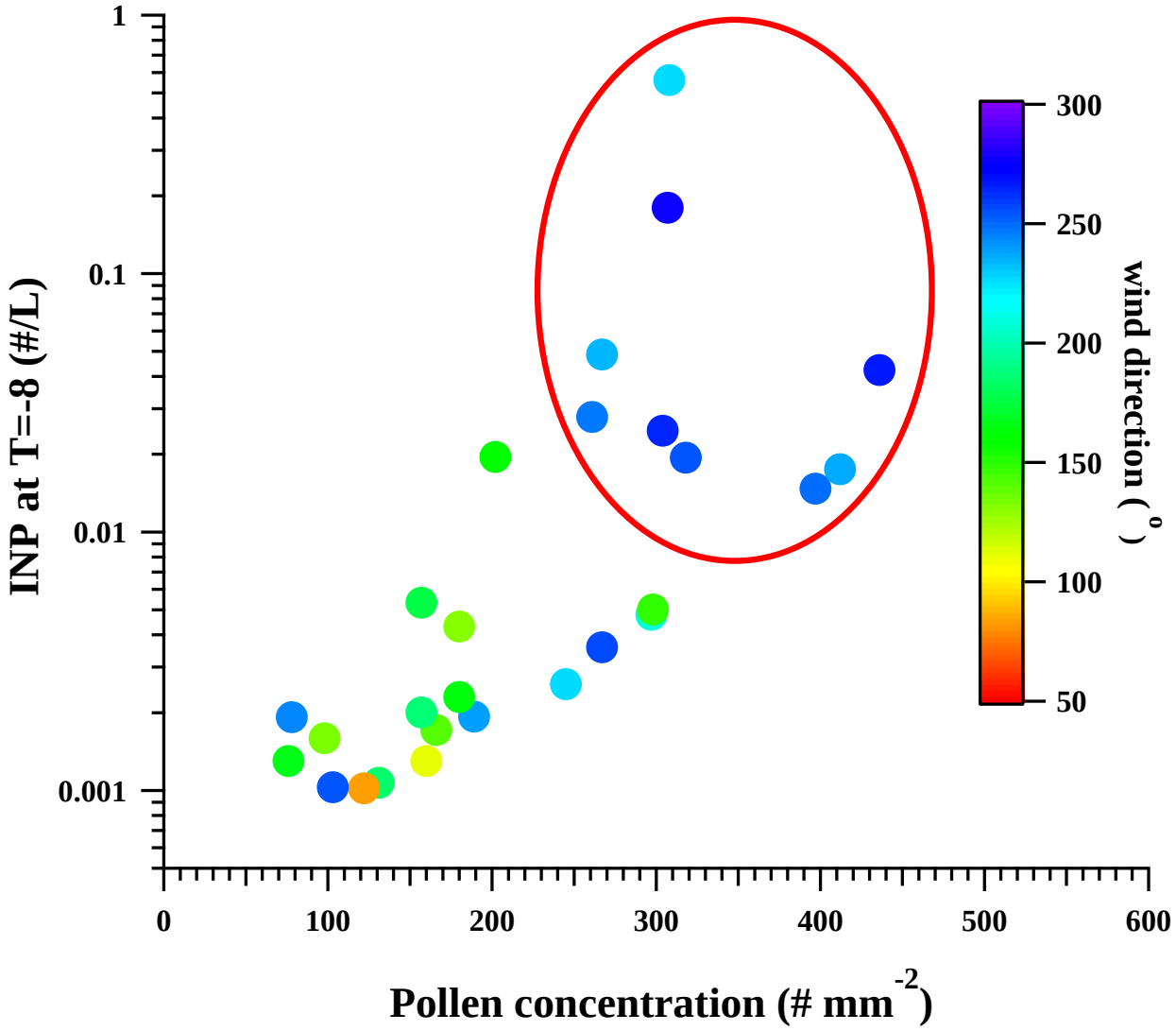
→ **the CB site** influenced by the **southeast regional pollution** air masses

one order magnitude lower

→ **the HT site** influenced by air from the **northwest**

almost the same

Results: Impact of primary biological particles at the HT site



Positive correlation

Northwest wind

Sharing not permitted

Conclusion

- The INP concentrations at both sites could vary 2 to 3 orders of magnitude during the one-month-long observation, which was influenced by the meteorological conditions together with local emission sources.

- For the first time, our studies found that the primary biological aerosol particles from the northwest boreal forest area of Beijing were INPs at temperatures between about -5 and -15°C, and could have influence on the urban area.

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Thank you for your attention!

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