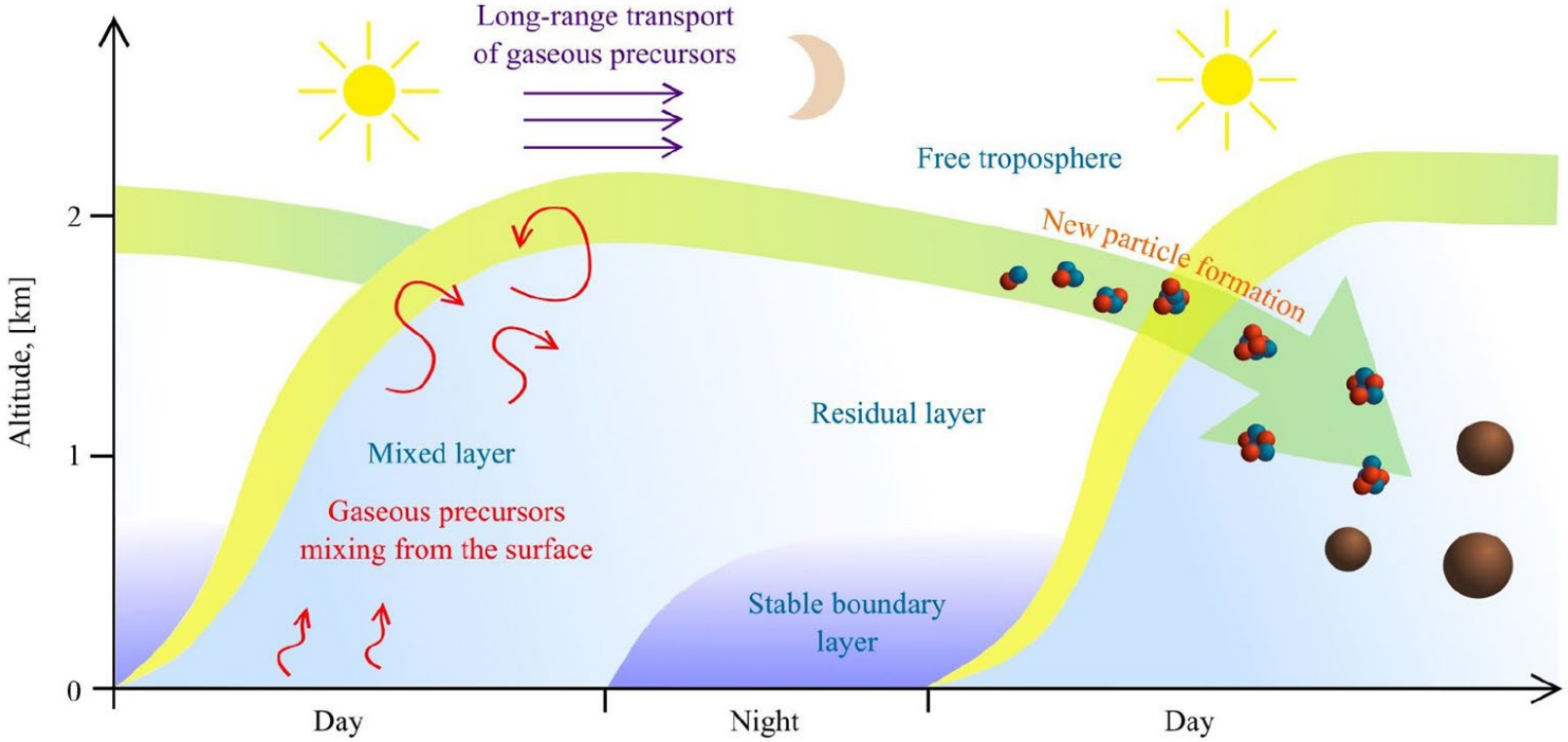
Vertically Resolved NPF and Boundary Layer Dynamics

Motivation

- NPF aloft followed by transport to the surface could be an important source of CCN.
- NPF model parameterizations based on surface observations ➔ missing initial NPF?
- There are limited vertical NPF observations ➔ challenging measurement.
- The spatial distribution and timing of NPF could be strongly controlled by boundary layer processes and meteorology.

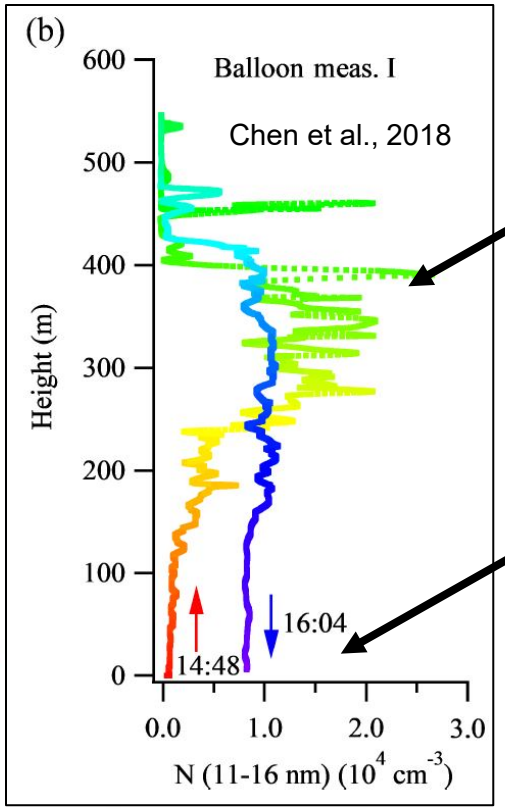


Brookhaven National Laboratory

Lampilahti et al., (2020)

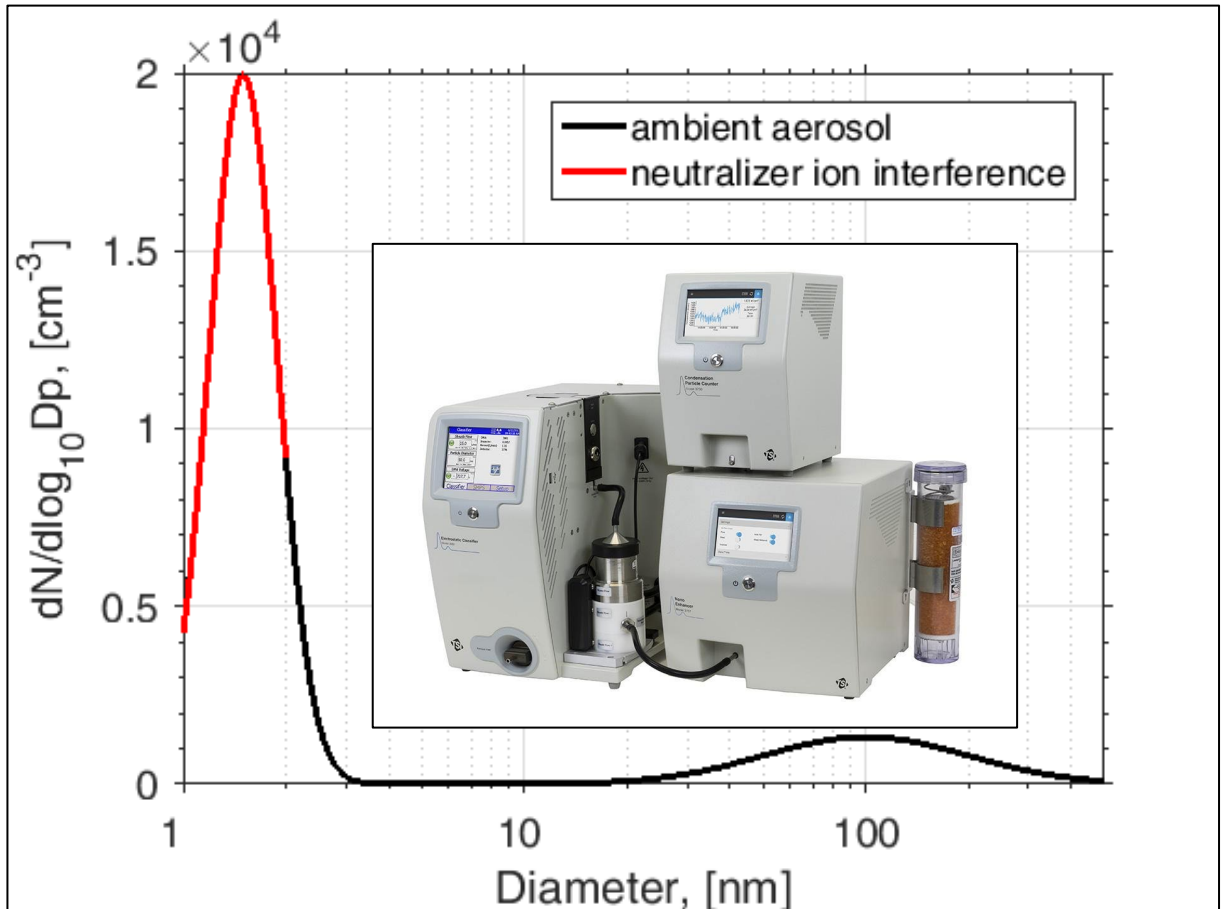
Goal: Reducing Uncertainties in the NPF Contribution to the CCN Budget

- Accurate model representation of NPF contribution to CCN is limited by:
  - **Large vertical gradients** in the distribution of newly formed clusters
  - **Large measurement uncertainties** in NPF detection via SMPS ➔ **use CPC instead**

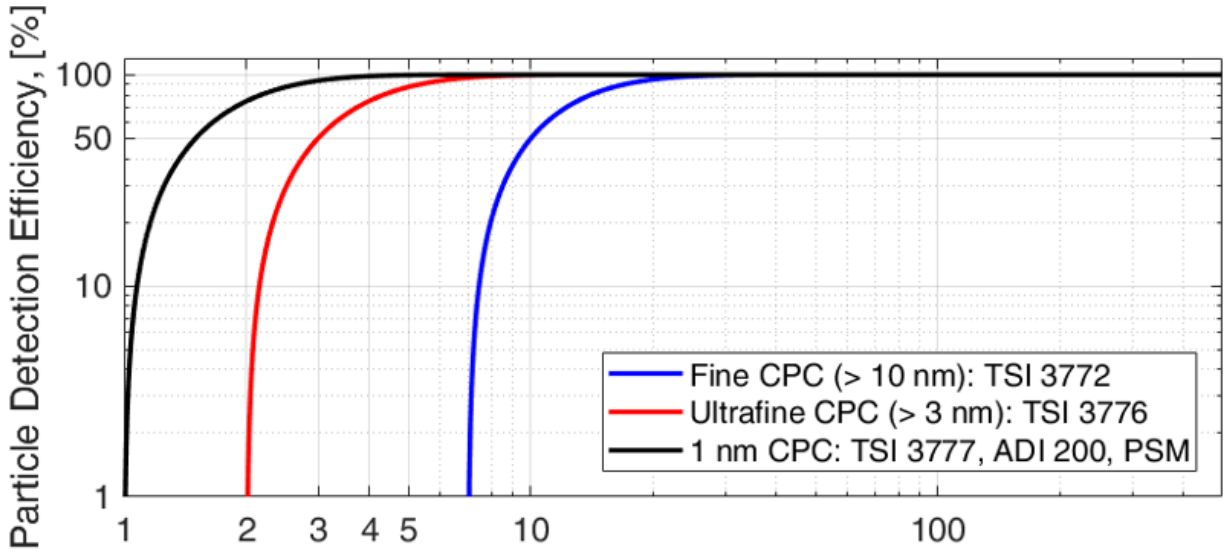


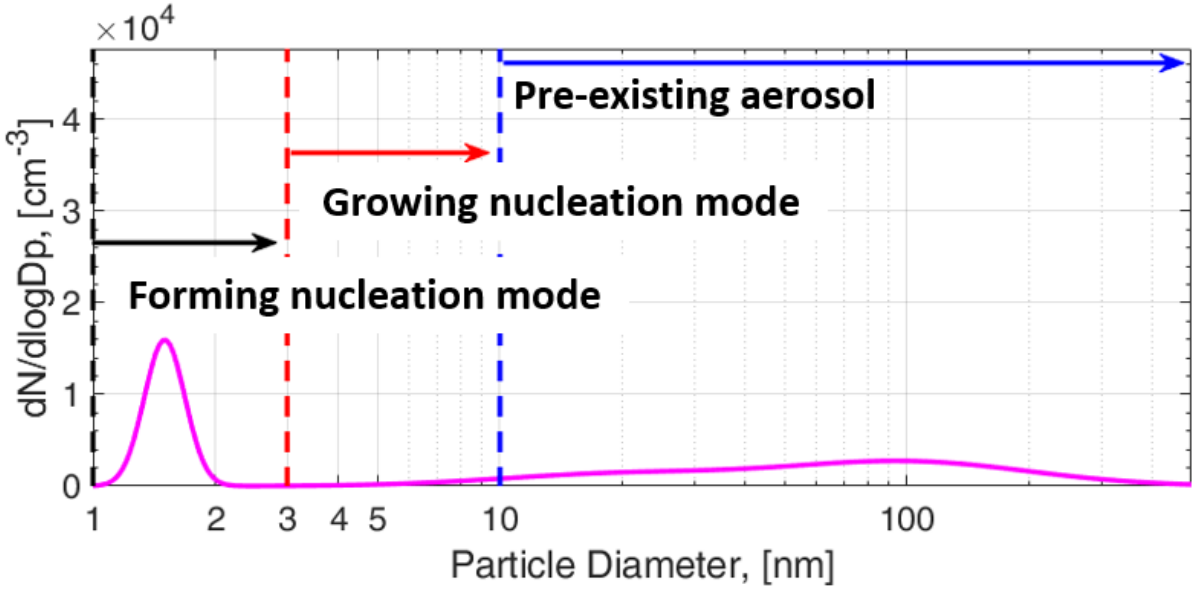
NPF aloft

Surface measurements miss NPF?



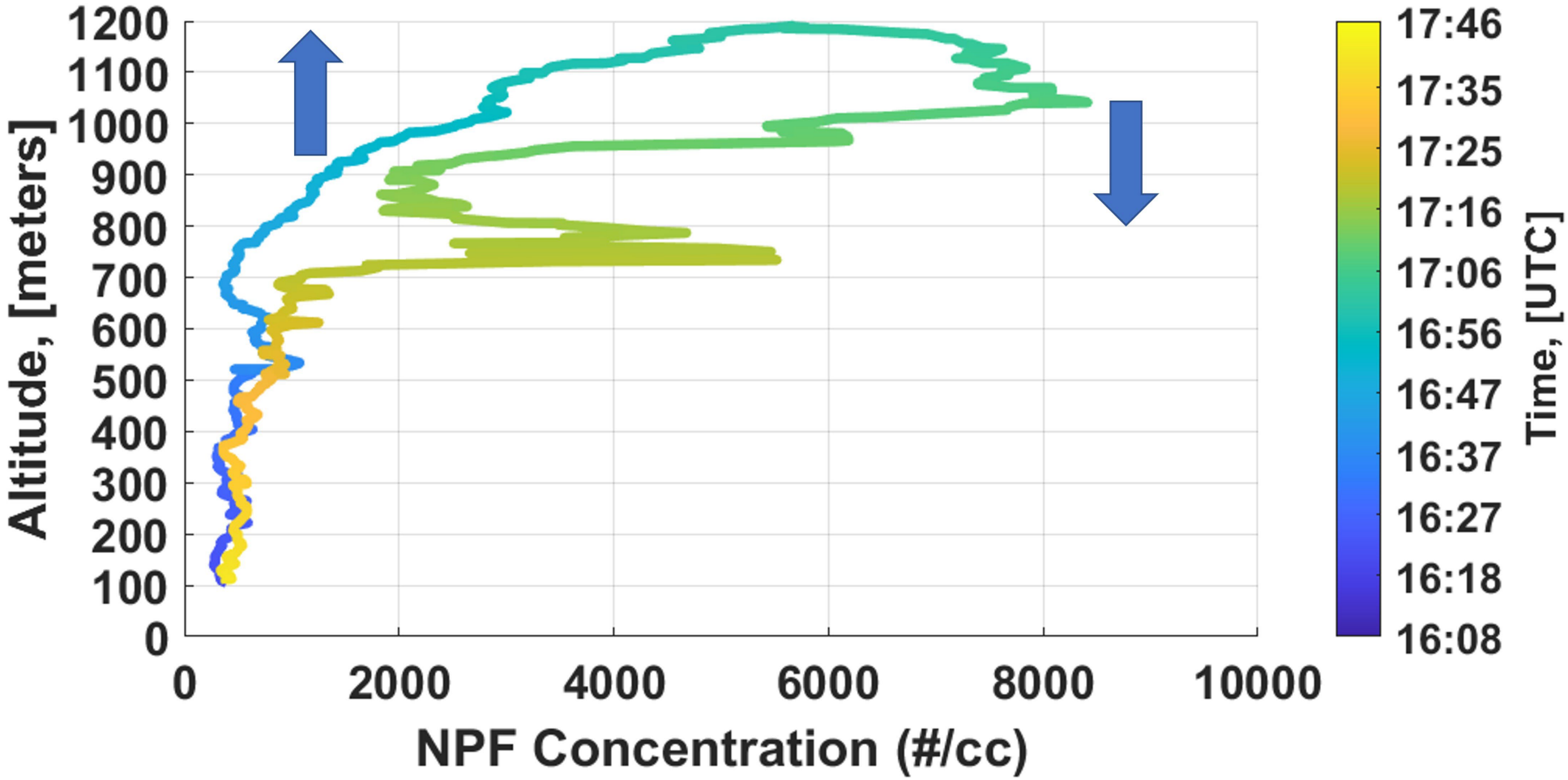
Aerosol Process Informs Appropriate CPC Platform





Prototype ADI DEG-MAGIC CPC*

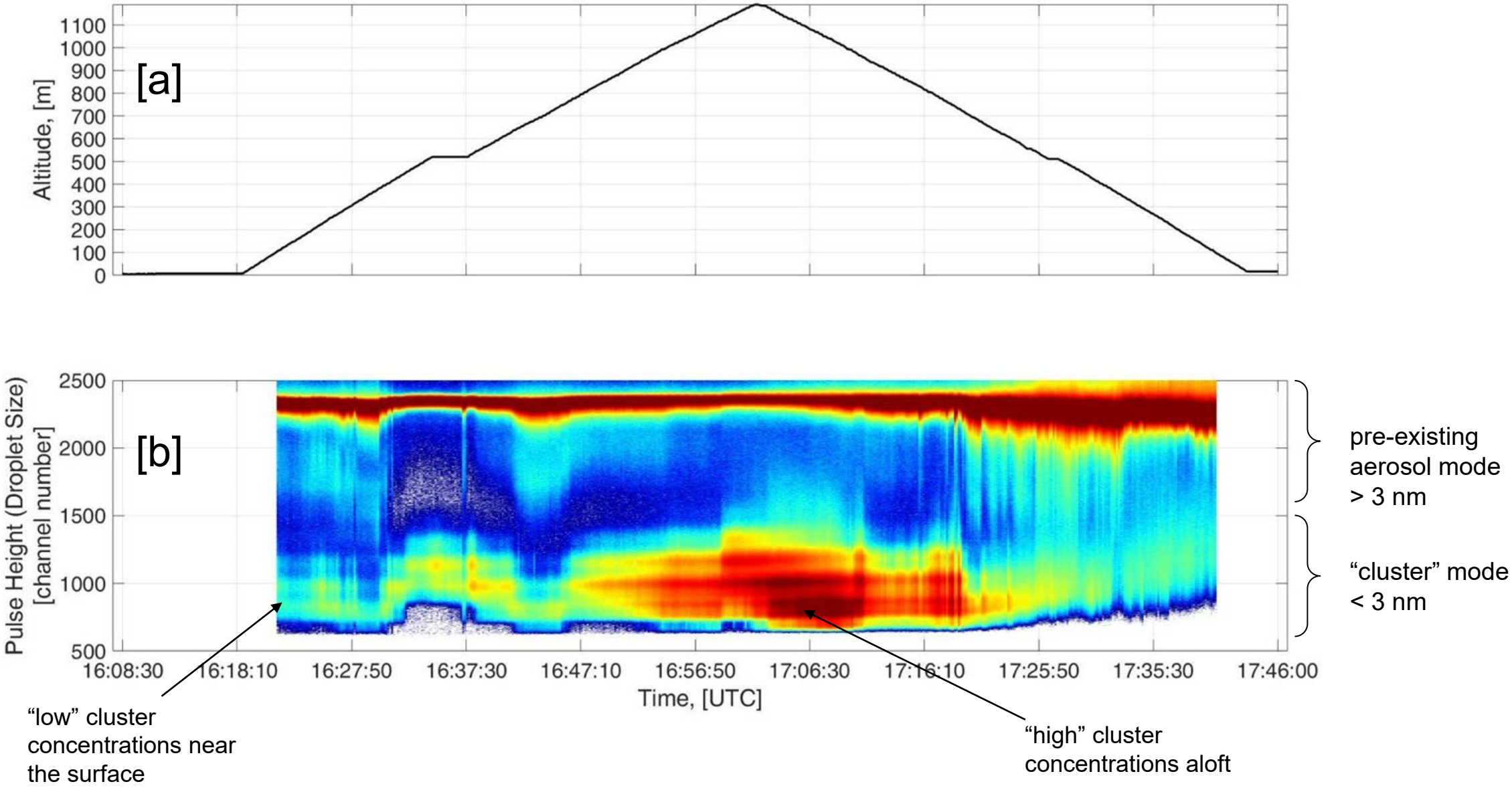
SGP October 5th, 2021: Profile 2, 16:08 - 17:46 UTC



- TBS-based 1 nm CPC (right) provided vertically-resolved aerosol concentrations indicating that **NPF initiates aloft** (> ~1200 m) followed by downward transport to the surface where particle growth continues.

Brookhaven National Laboratory

SGP October 5th, 2021: Profile 2, 16:08 - 17:46 UTC



[a] TBS profile altitude as a function of profile time. [b] pulse height contour plot as a function of profile time with pre-existing aerosol mode (> 3 nm, > 1500 channel number) and “cluster” mode (< 3 nm, < 1500 channel number).