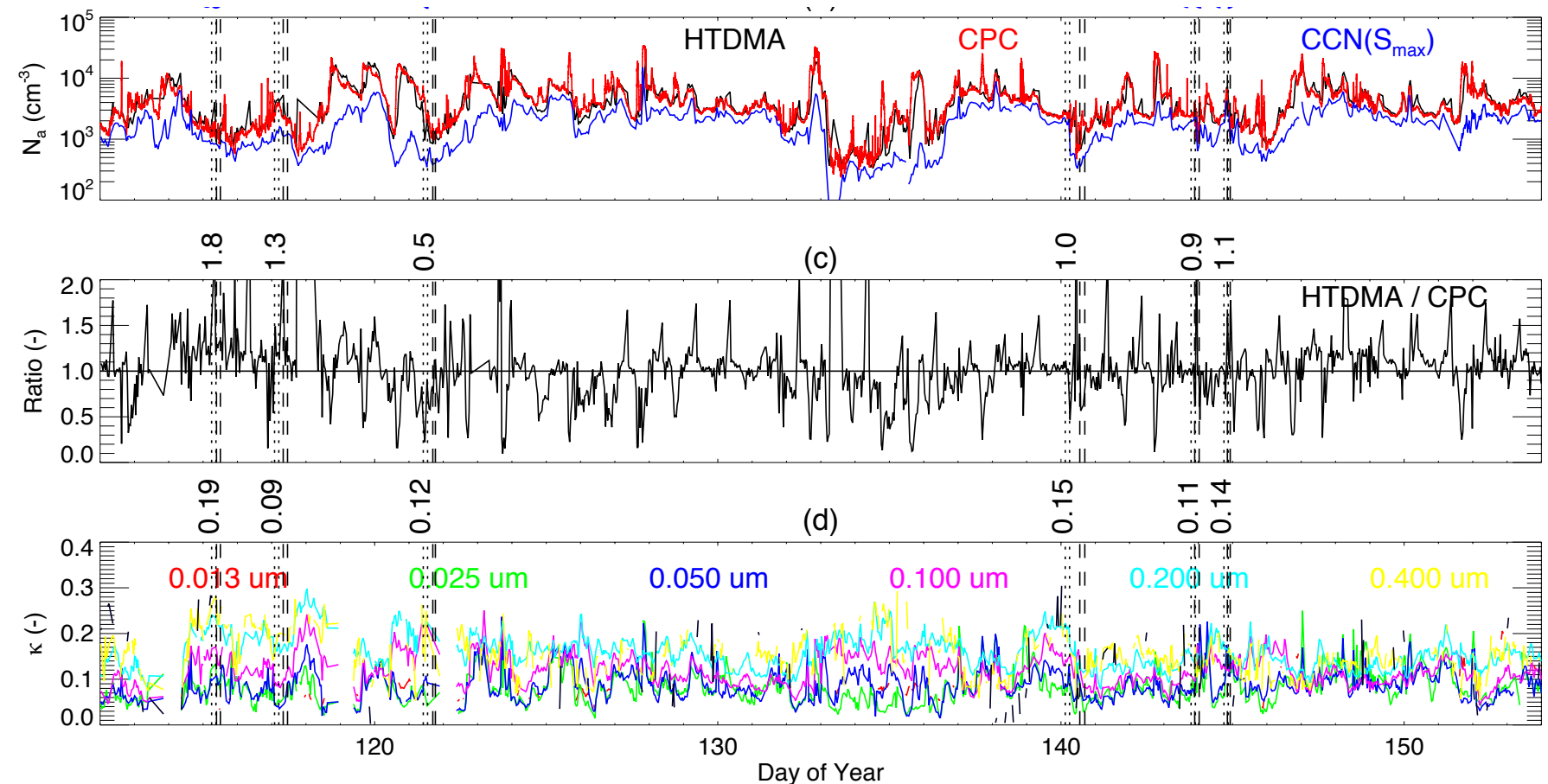


# INP field campaign design to constrain models?

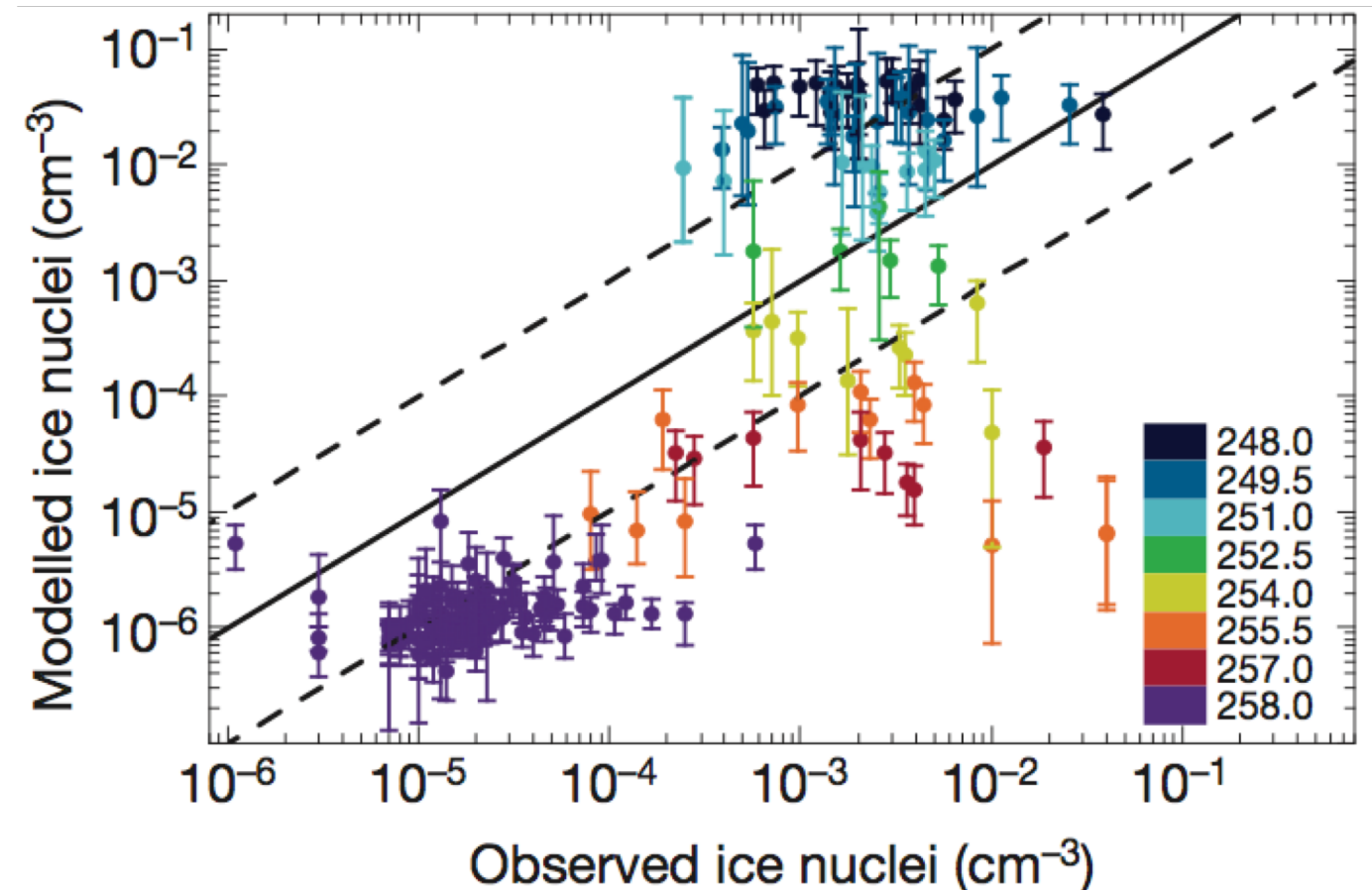
- aerosol-ice formation closure concept
  - limited analog to aerosol-CCN closure provided by HTDMA and CCN at SGP
  - model-predicted quantity  $\text{CCN}(T, S_w)$  and most relevant ambient aerosol properties (PSD and size-dependent kappa PDF) are simultaneously measured
  - colocated data more strongly constrains models (is kappa or PDF biasing CCN?)
  - greater range of  $S_w$  probed more strongly constrains models
  - limited version for INP a first step to better constraining models?



# INP field campaign design to constrain models?

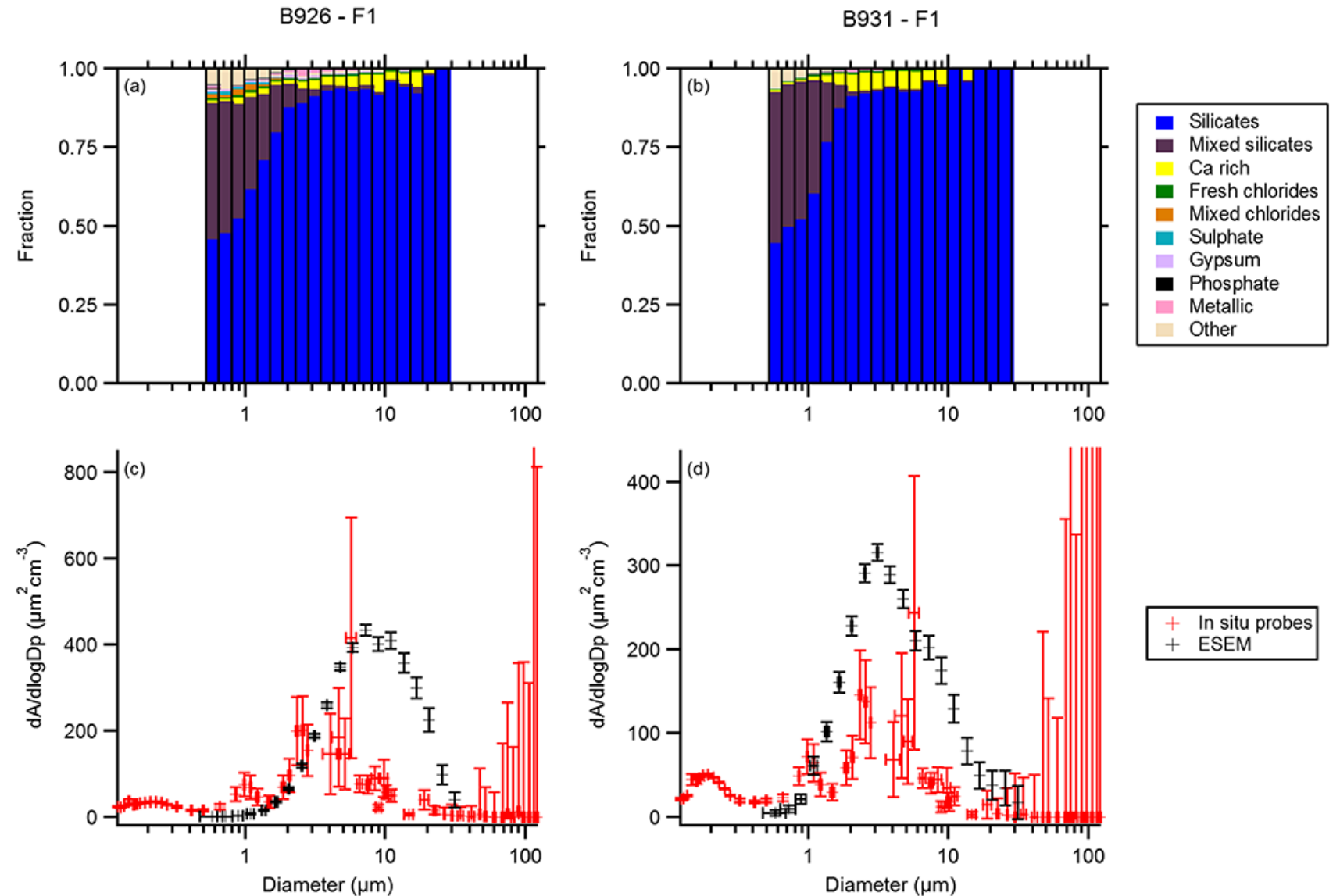
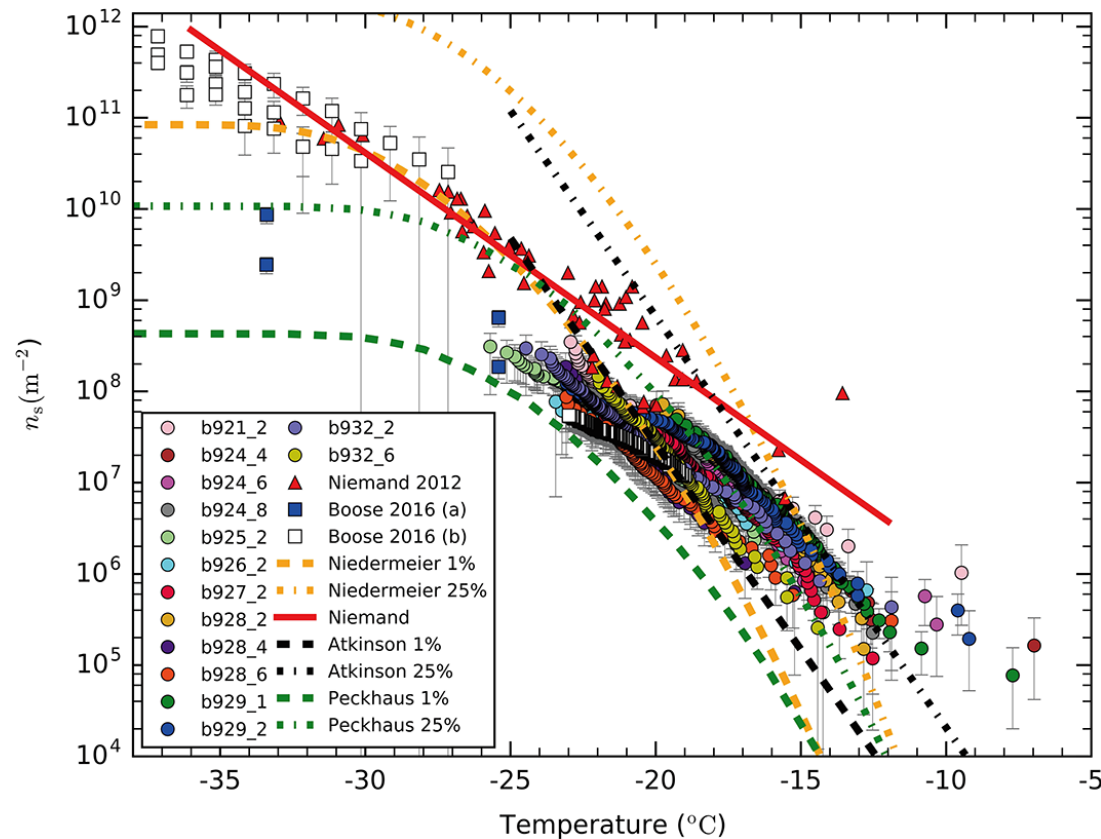
- aerosol-ice formation closure concept
  - analog to  $\text{CCN}(T, S_w)$  in immersion mode:  $\text{INP}_{\text{im}}(T)$  from CFDC
  - most relevant ambient aerosol properties: PSD and ...  $\text{INP}_{\text{im}}$  analog to kappa PDF
  - colocated data more strongly constrains models: is PSD or composition biasing  $\text{INP}_{\text{im}}$ ?
  - single-particle data not adequate to derive analog to kappa PDF ...
  - but is it possible to provide colocated data that can help constrain models significantly better than stand-alone CFDC data?
  - and if so, what?

Atkinson et al. [Nature 2013]



# INP field campaign design to constrain models?

- aerosol-ice formation closure concept
  - clues from field campaign analyses?
  - e.g., if  $n_s = \text{INP}_{\text{im}}(T)/\text{SA}$
  - closure assumed to derive  $n_s$



Price et al. from ICE-D [JGR 2018]

# INP field campaign design to constrain models?

- most useful measurements? possible list
  - aerosol size distribution, including coarse mode and impactor methods
  - aerosol composition, including refractory and non-refractory
  - aerosol mixing state, coatings and morphology
  - aerosol phase state including viscosity, size-dependence, and hygroscopicity
  - total aerosol projected area, including lidar or other open path
  - crystal nucleation rate in the deposition, immersion and contact modes (multiple methods required, including filter)
- general questions
  - relevant lessons from recent instrument intercomparison studies?
  - where and how to set up such a field campaign?
  - what are instrument and infrastructure requirements?
  - can we focus efforts at pre-identified points of model deficiency?