

A new method for operating a continuous flow diffusion chamber to study Immersion freezing

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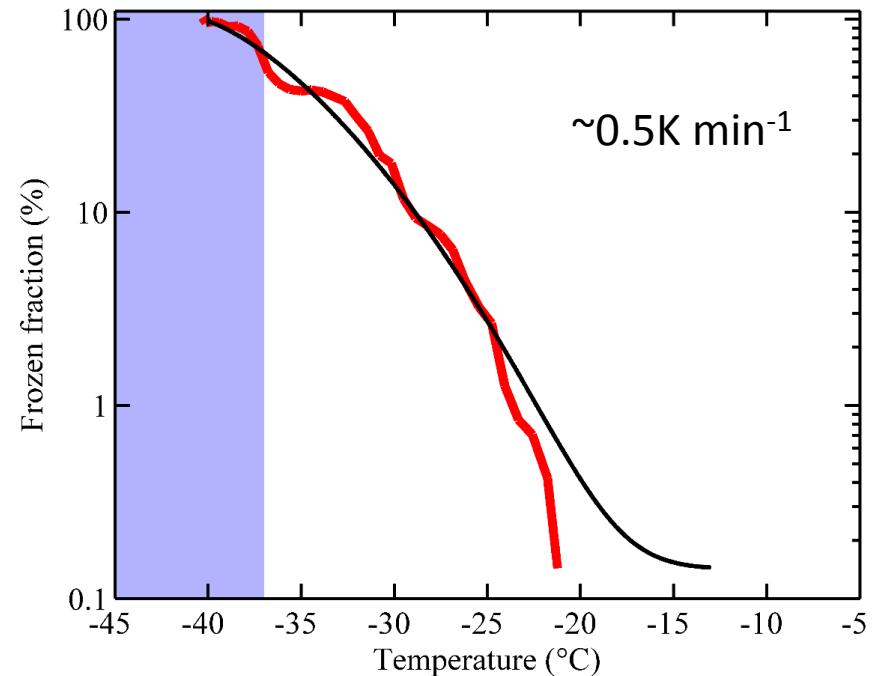
Benefits:

- Full immersion freezing continuous spectra in real-time under desired cooling rates;
- Approach allows to study only immersion freezing;
- Higher confidence in INP measurements particularly at low ambient particle concentrations.

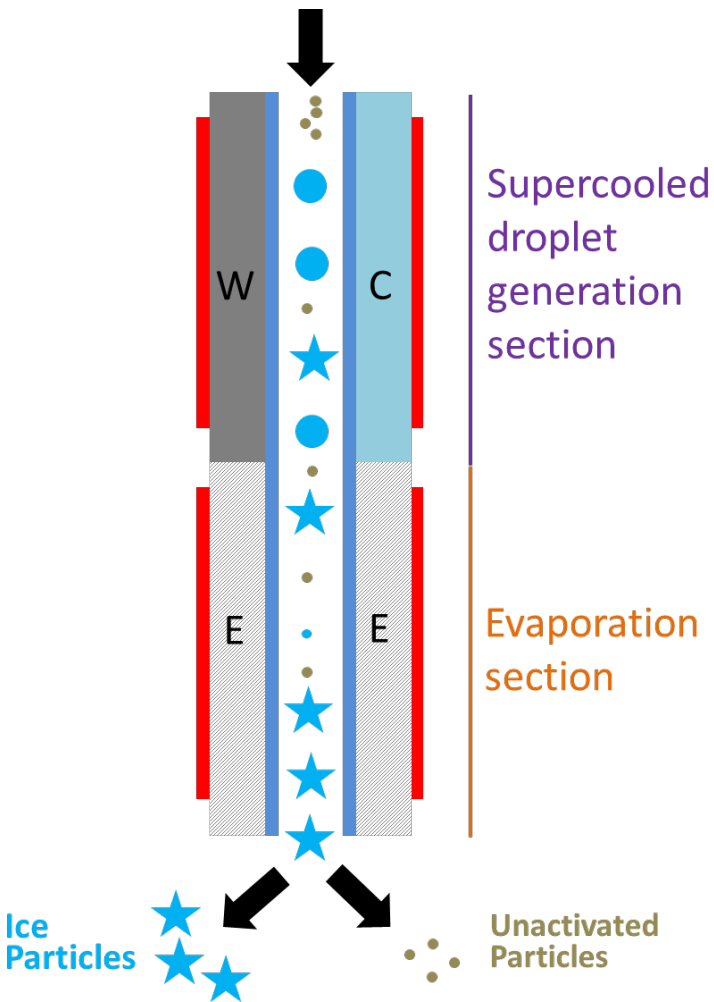
Present study (new approach)

(red) immersion freezing continuous spectra;
(black) CNT parameterization for models;

Kulkarni et al 2017 (in-preparation)



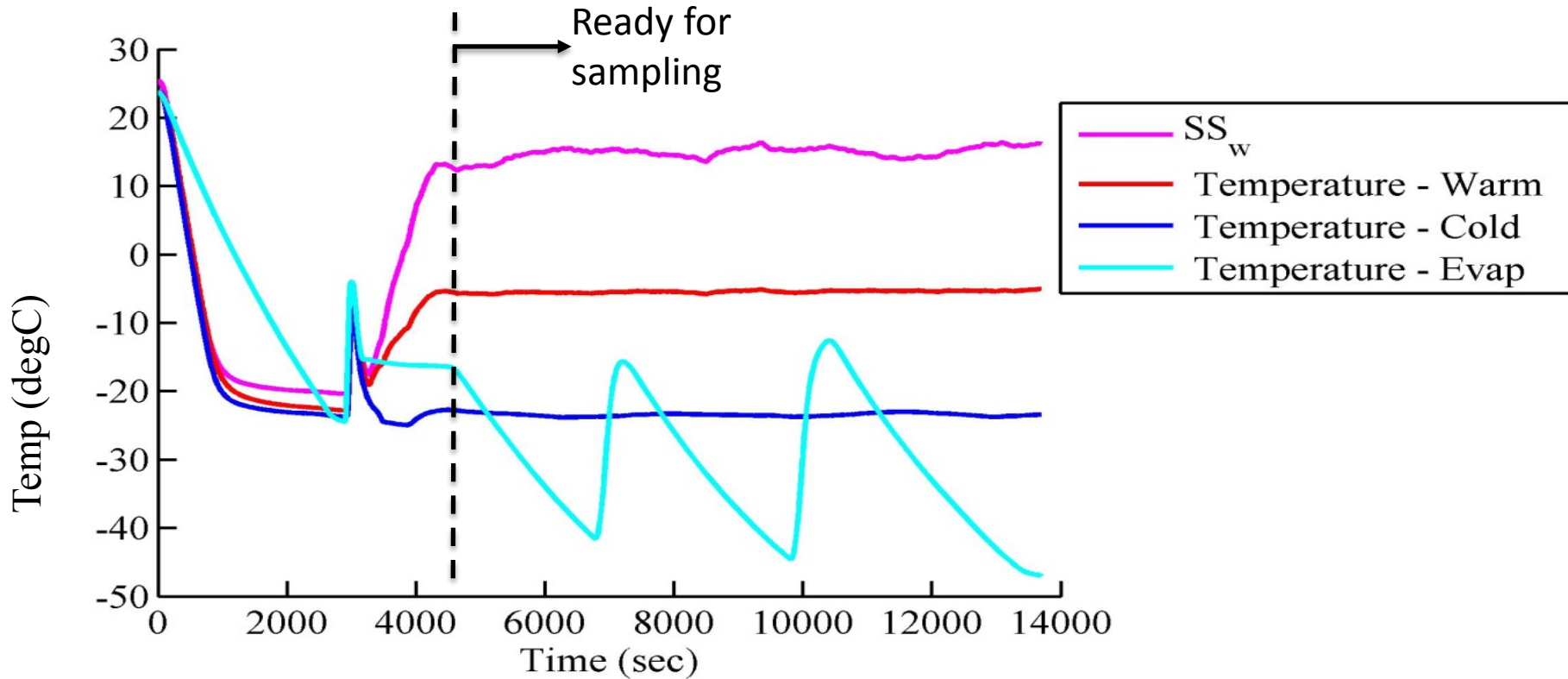
Chamber operation



Function: To activate the aerosol particle to the supercooled droplet;
 $SS_w = 10 - 15\%$ and $T = -15 \text{ degC}$;
Residence time = 6 seconds;

Function: To evaporate the supercooled droplets and expose them to varying supercooled temperatures (-15 to -40 degC);
 $RH_{ice} = 100\%$;
Residence time = 6 seconds

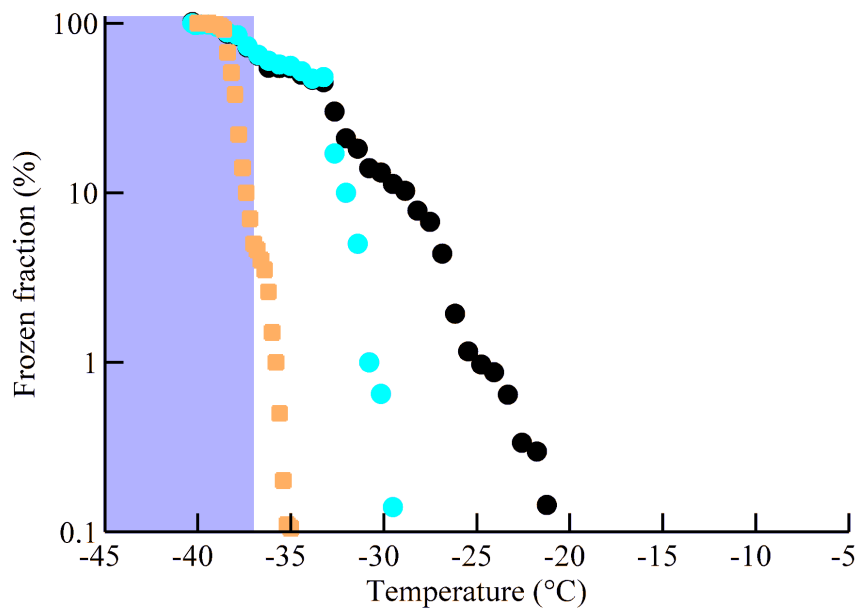
Time series of temperature and SS



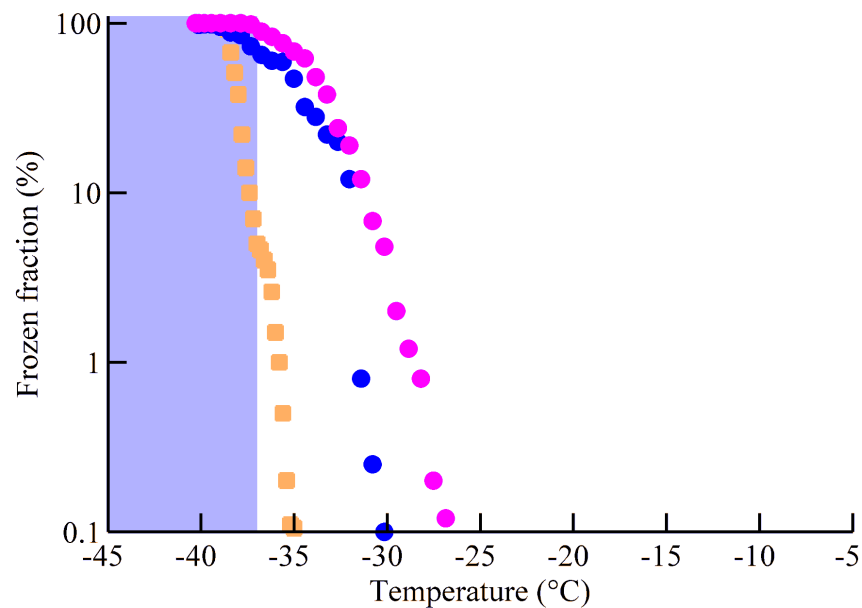
SS_w is held constant and evaporation section temperature is varied continuously.

Some results

Immersion freezing spectra averaged over ~1 degC temperature



Columbia valley soil dust



Mineral dust

✓ Chamber is sensitive towards the different aerosol species

Acknowledgements:

DOE ASR and ARM
EMSL user facility
Many collaborators

Thank you