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Fast Ice Nucleus Chamber FINCH

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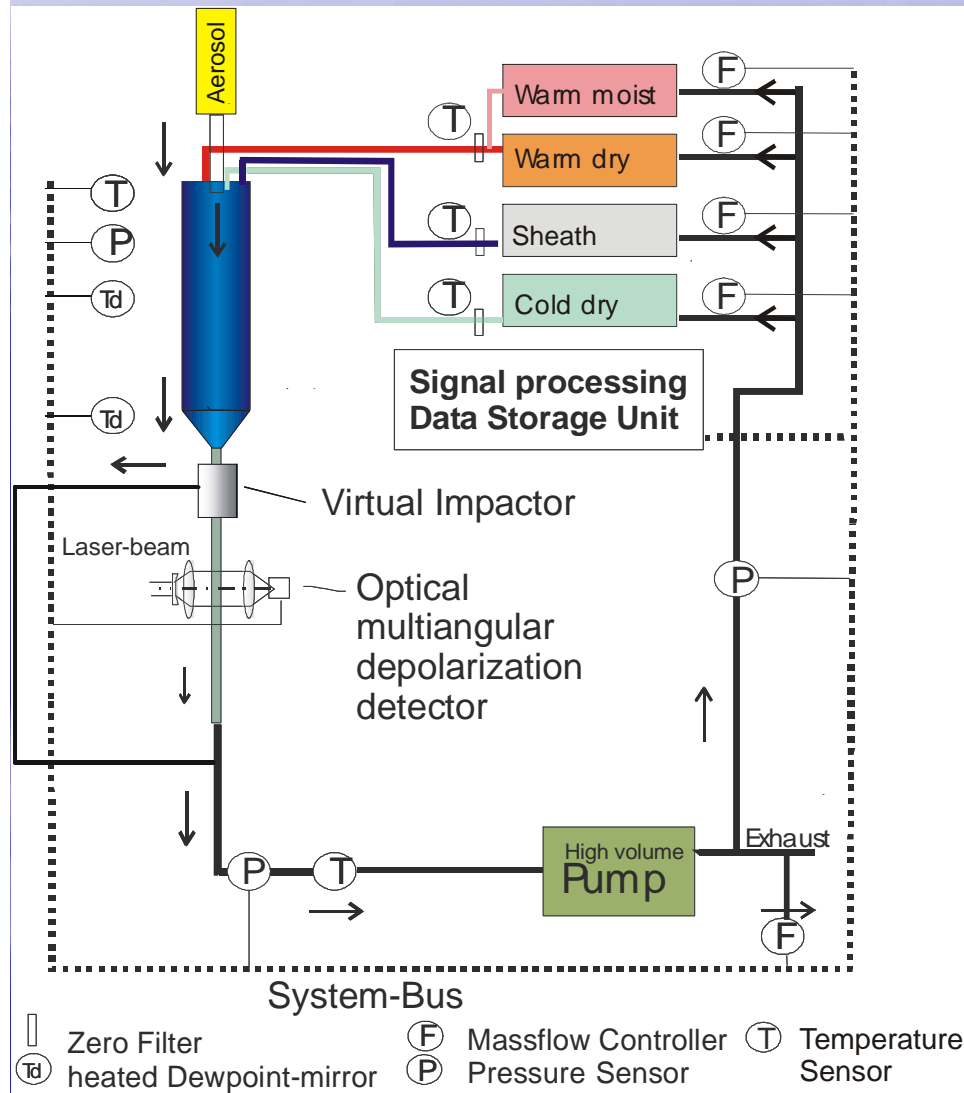
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FINCH



Bundke et al., Atmospheric Research, 2008

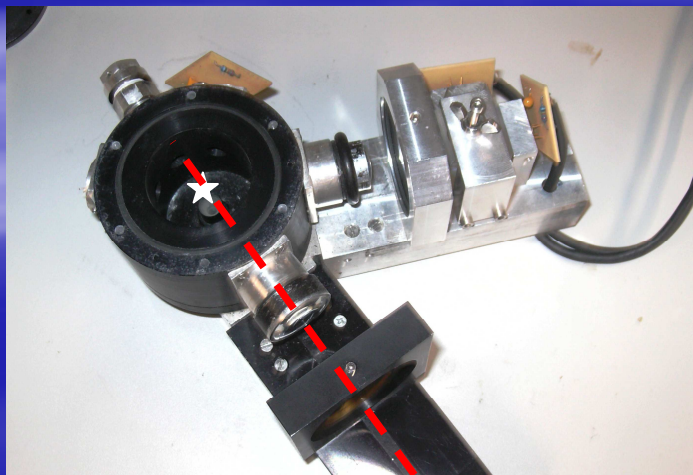
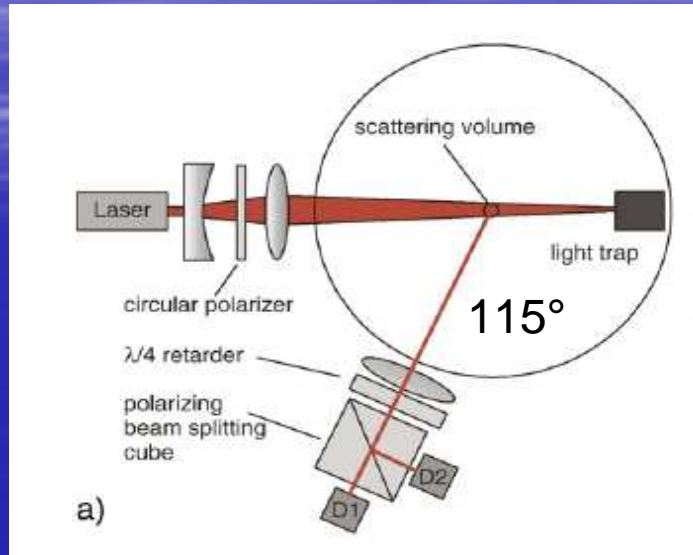
- Mixing of 3 gas flows
- Total flow 40-80 l/min
- Aerosol flow 1-10 l/min



Activation of IN and CCN at pre selected temperature and super-saturation

- cooled processing chamber of 1,3m
- virtual impactor
- distinguish between ice crystals and super cooled water droplets

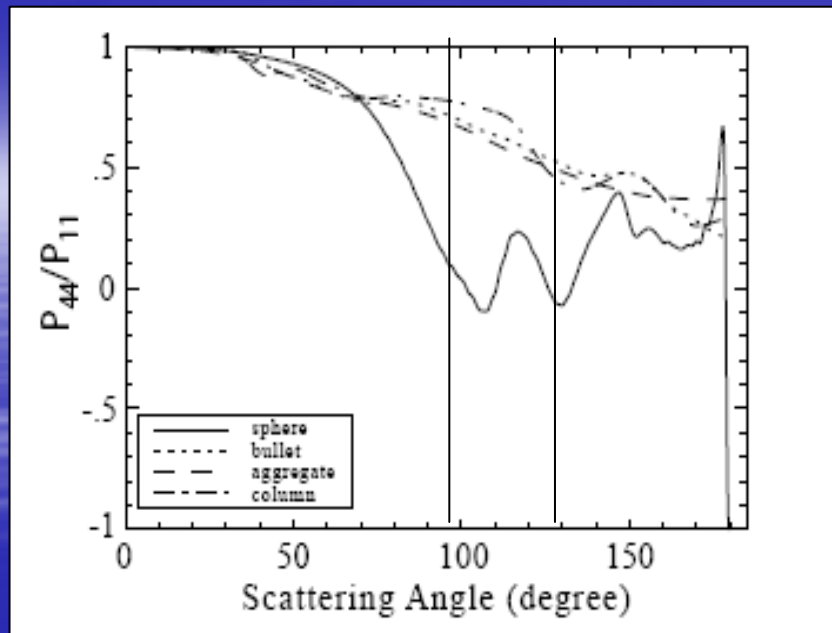
Optical detector (new development)



- circular polarized laser beam
- backscattered light is detected and analyzed for the circular polarization under an angle of 115°
- separate detectors measure the two perpendicular linear polarized beams

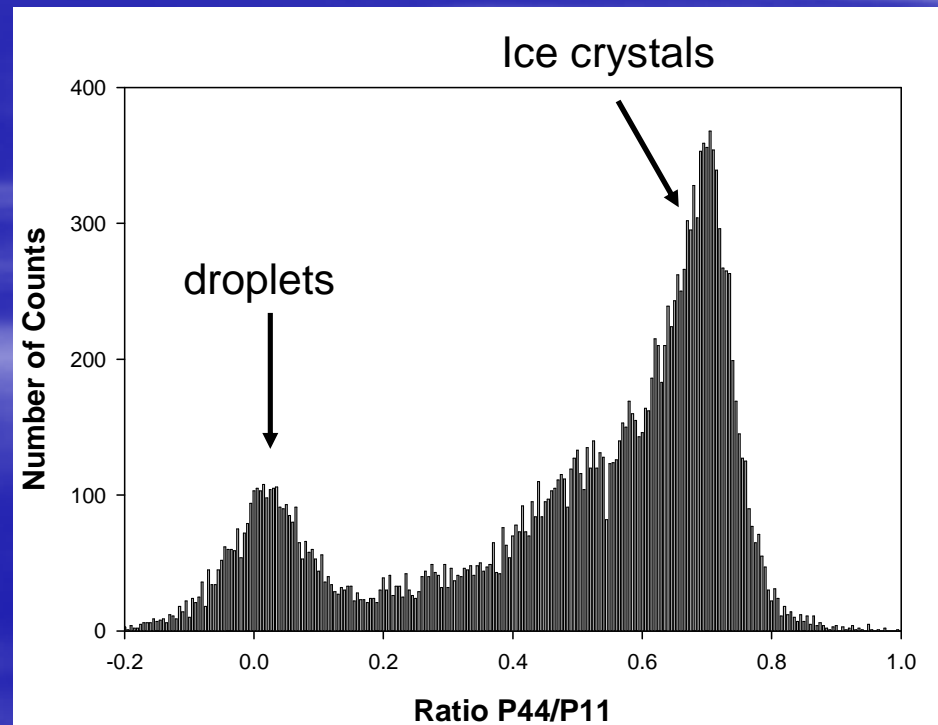


calculation of the ratio of P44 and P11 of the scattering matrix

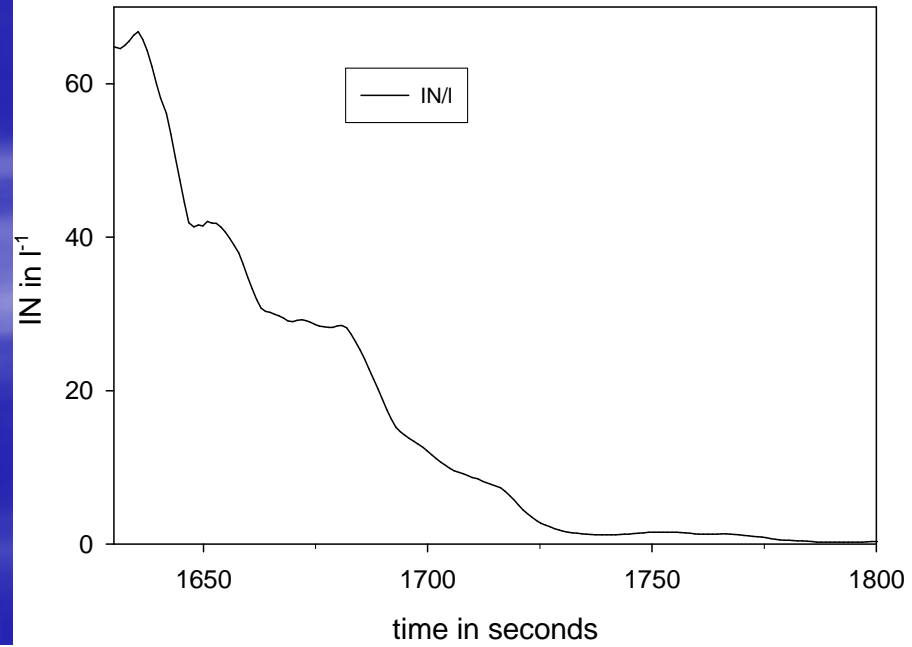
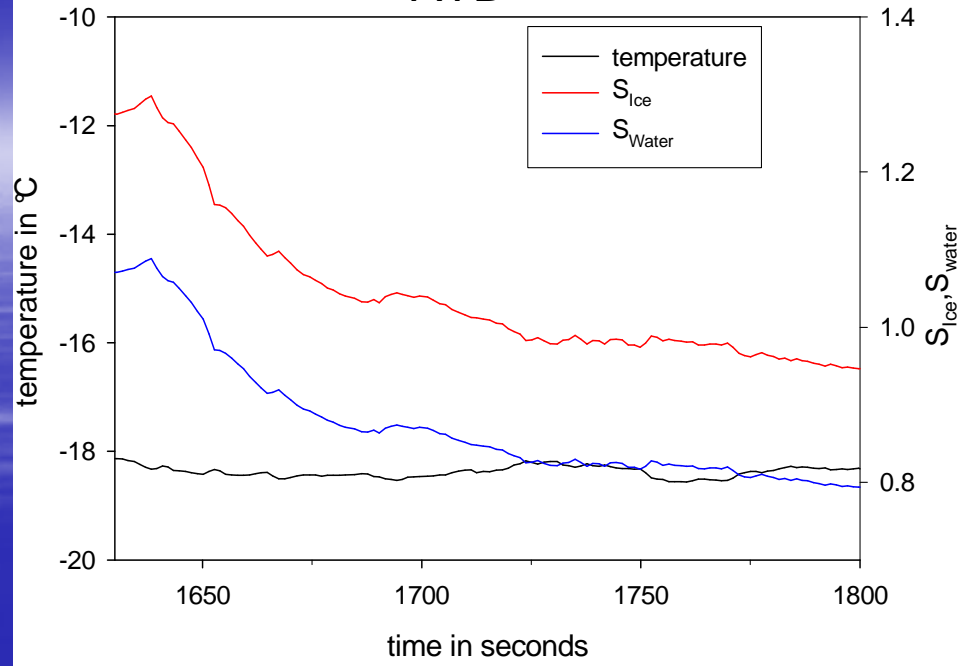


(Y.-X. Hu et al. / Journal of Quantitative Spectroscopy & Radiative Transfer 79–80 (2003) 757–764)

- Different ratio P_{44}/P_{11} for supercooled droplets and ice crystals



ATD

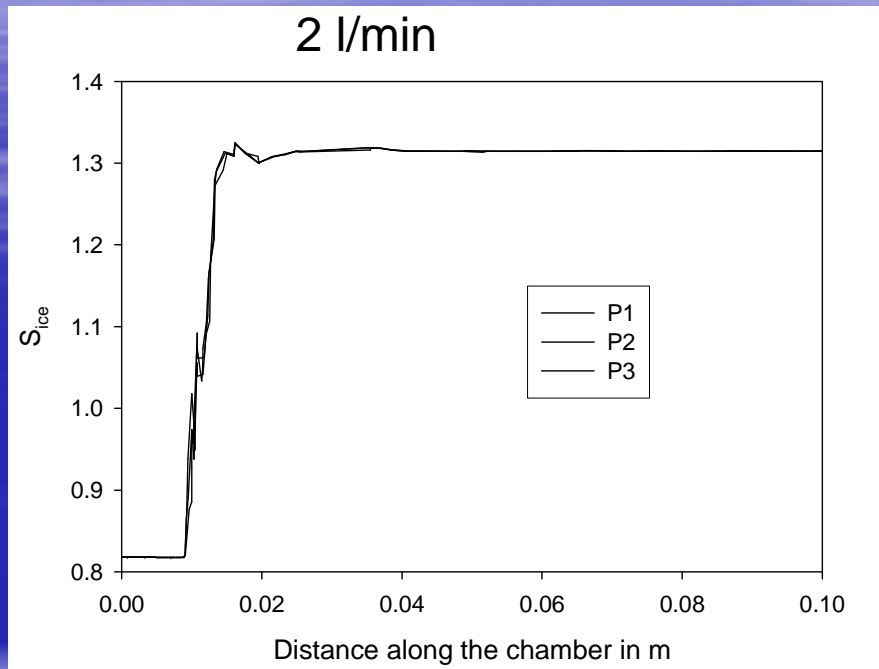


The International Workshop on Comparing Ice Nucleation Measuring Systems (ICIS 2007)

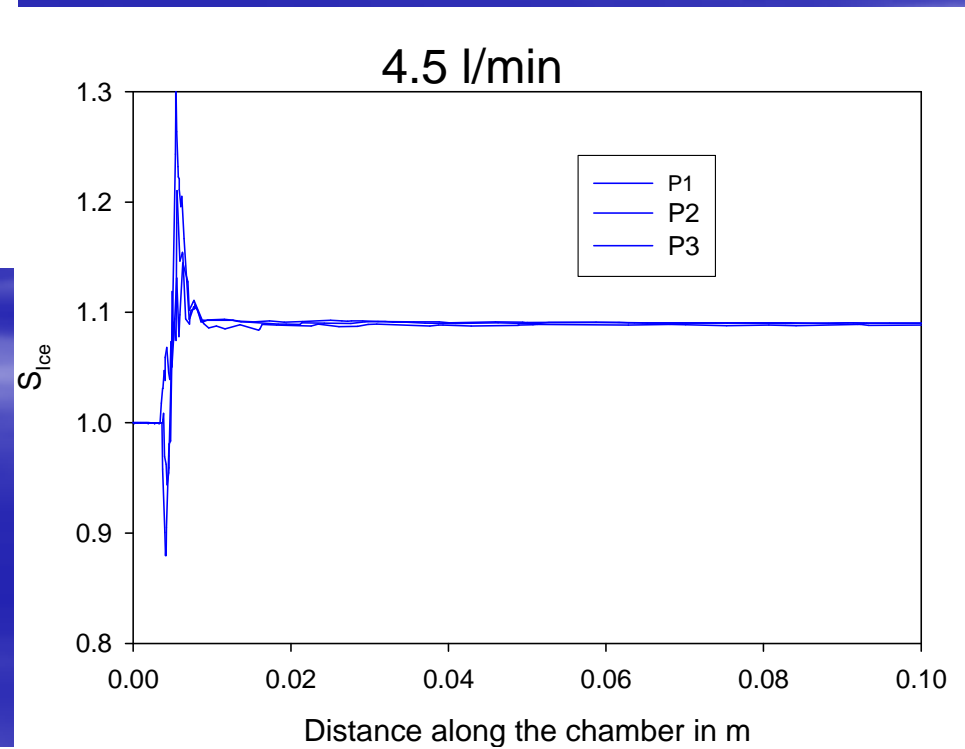
Problems:

- No supersaturation at the beginning (NAUA measurements)
 - Dry air from the NAUA
 - Humidified the sample flow
 - freezing of the inlet
(only short measurement periods possible)
 - Leak at high pressure side of the pump → 4.5 instead of 2 l/min sample flow
- activation at lower supersaturation, lower IN number concentration

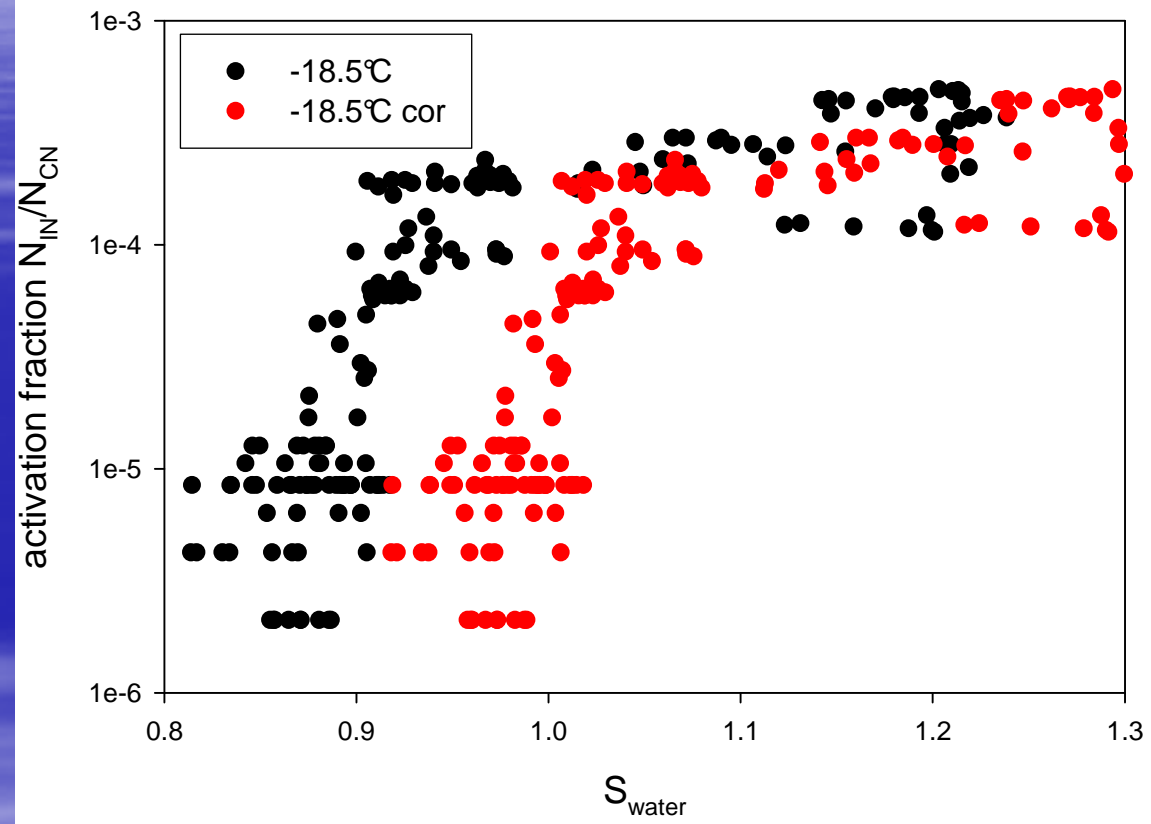
FLUENT-calculations



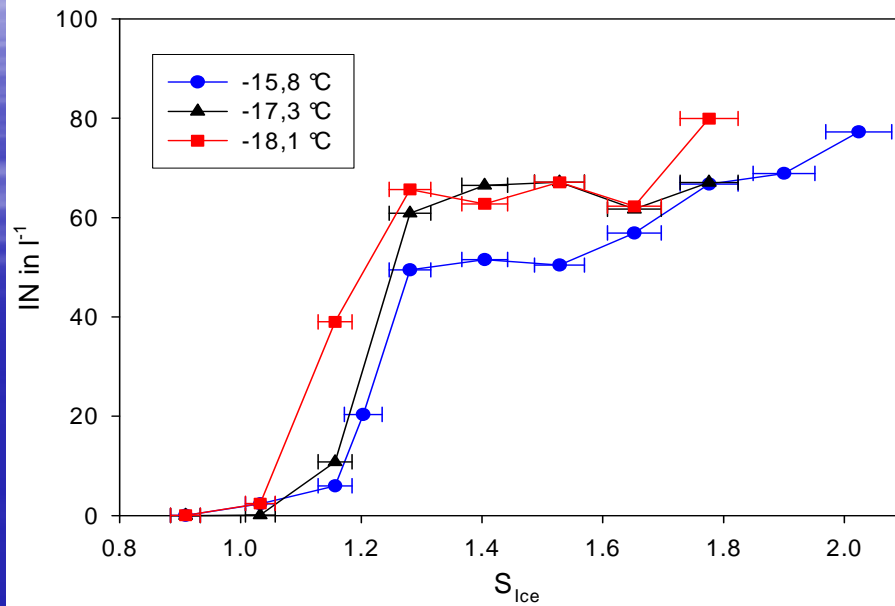
Very fast activation of IN
<1ms



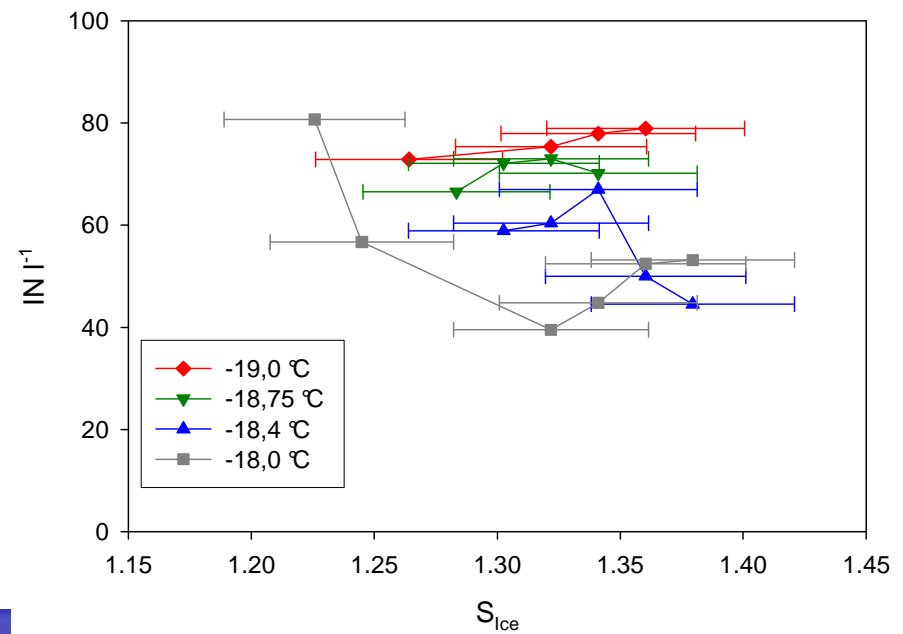
ATD



ATD

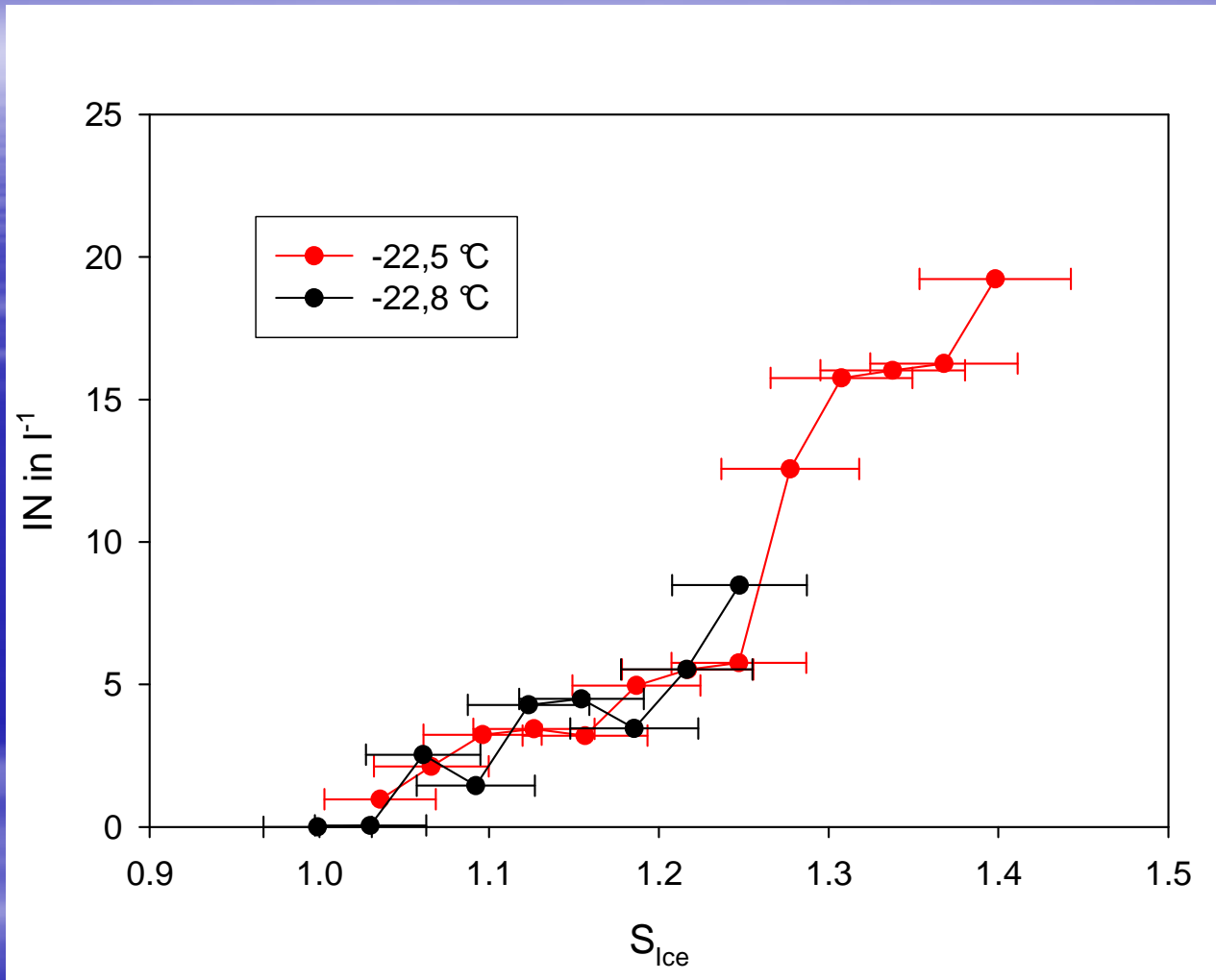


Start 18.9.
10:00 -10:20 AIDA
 $CN=280\text{ cm}^{-3}$



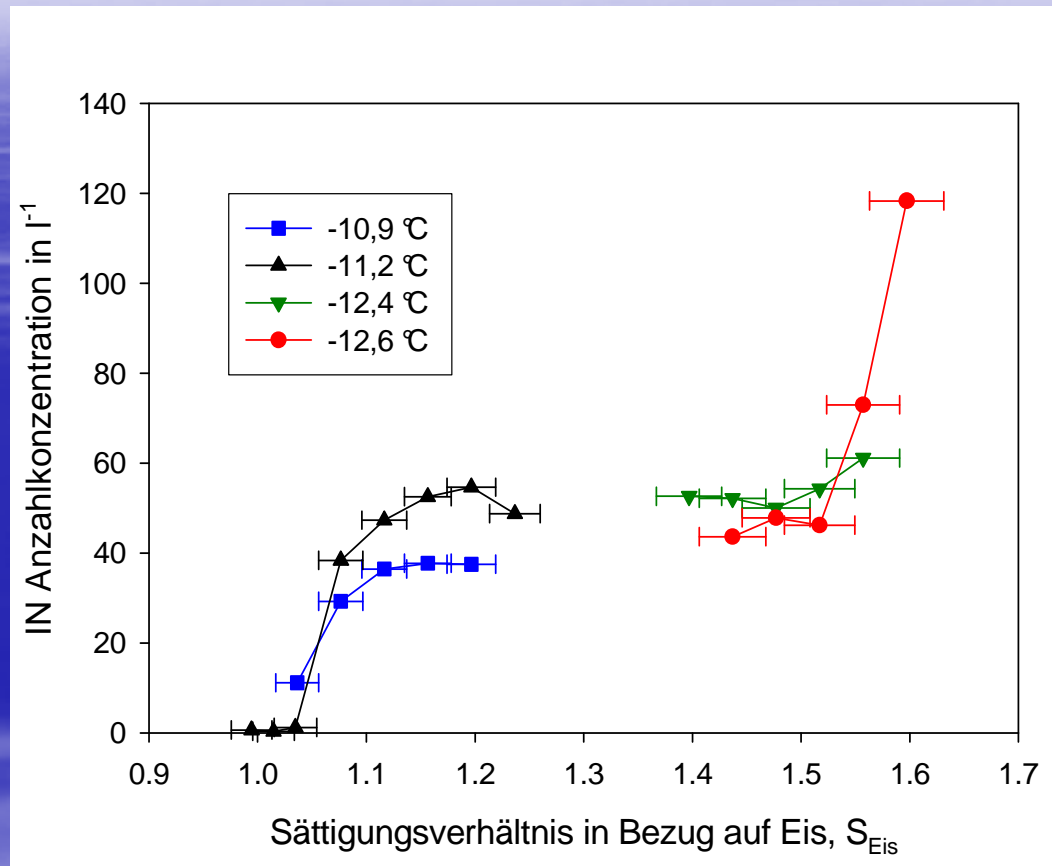
Start 18.9.
12:55 AIDA
 $CN=200\text{ cm}^{-3}$

GfG soot



Start 20.9.
10:08 NAUA
CN=35000-40000 cm^{-3}

Snowmax

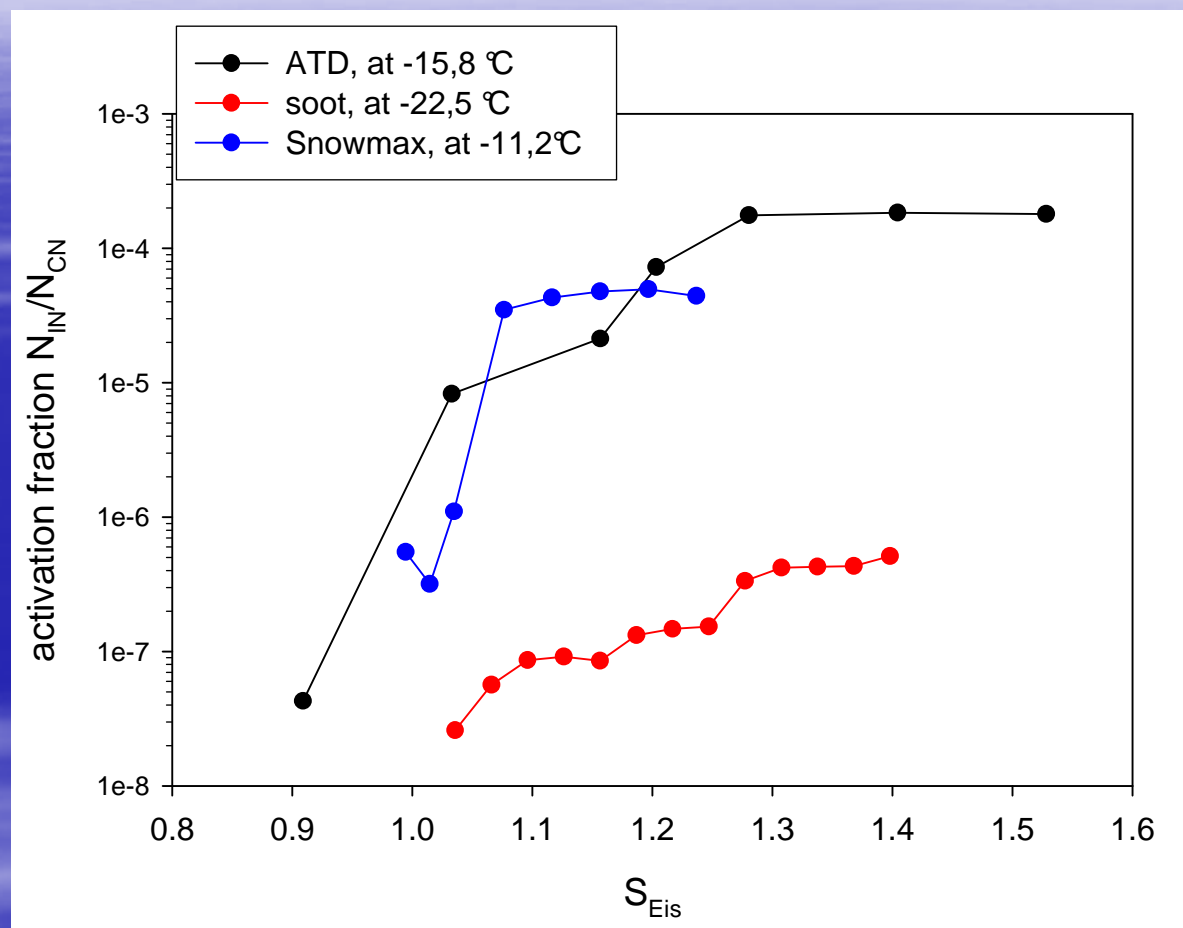


Start 26.9. 15:10

NAUA

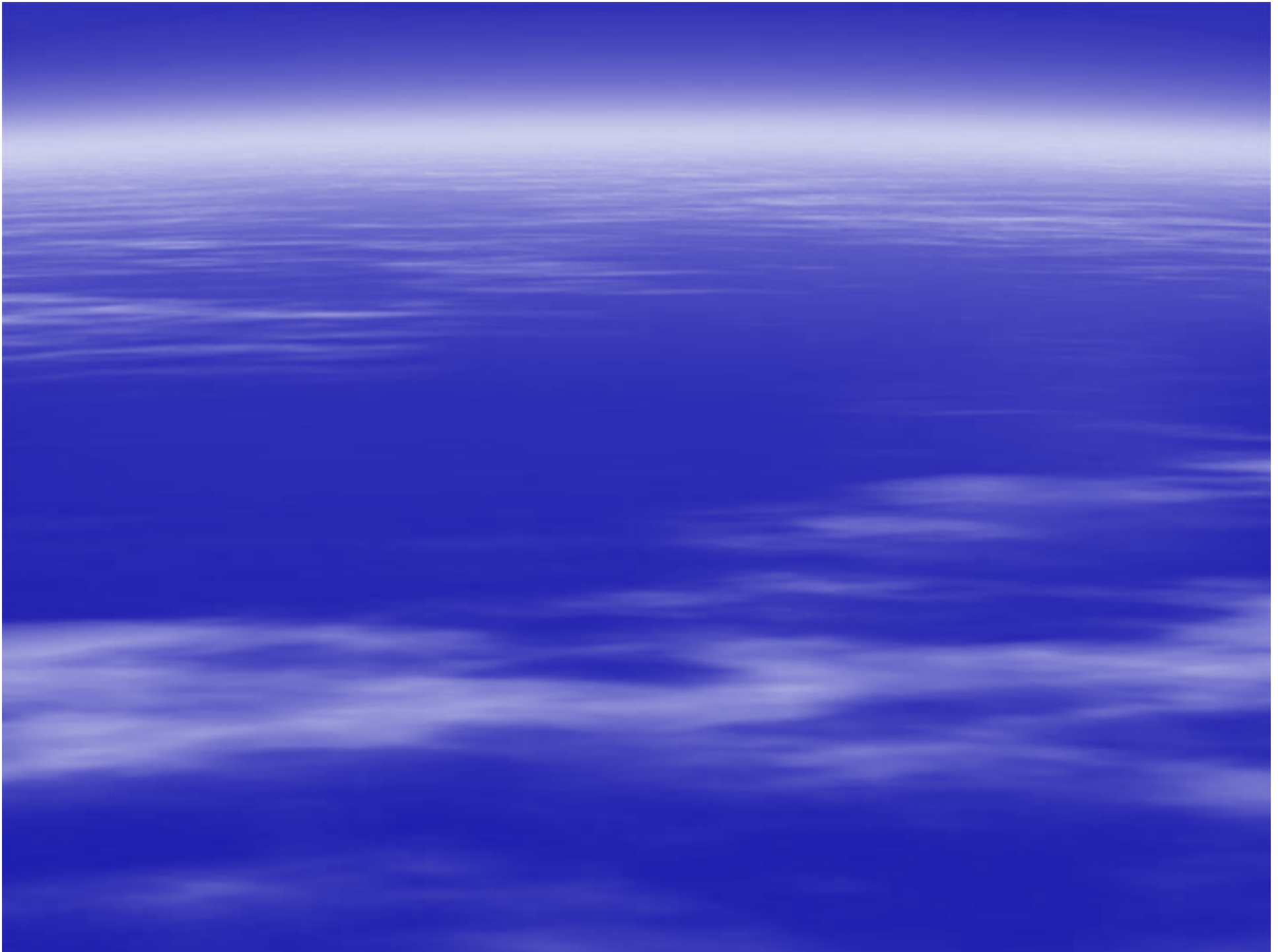
CN=1100 cm^{-3}

Activation fraction N_{IN}/N_{CN}

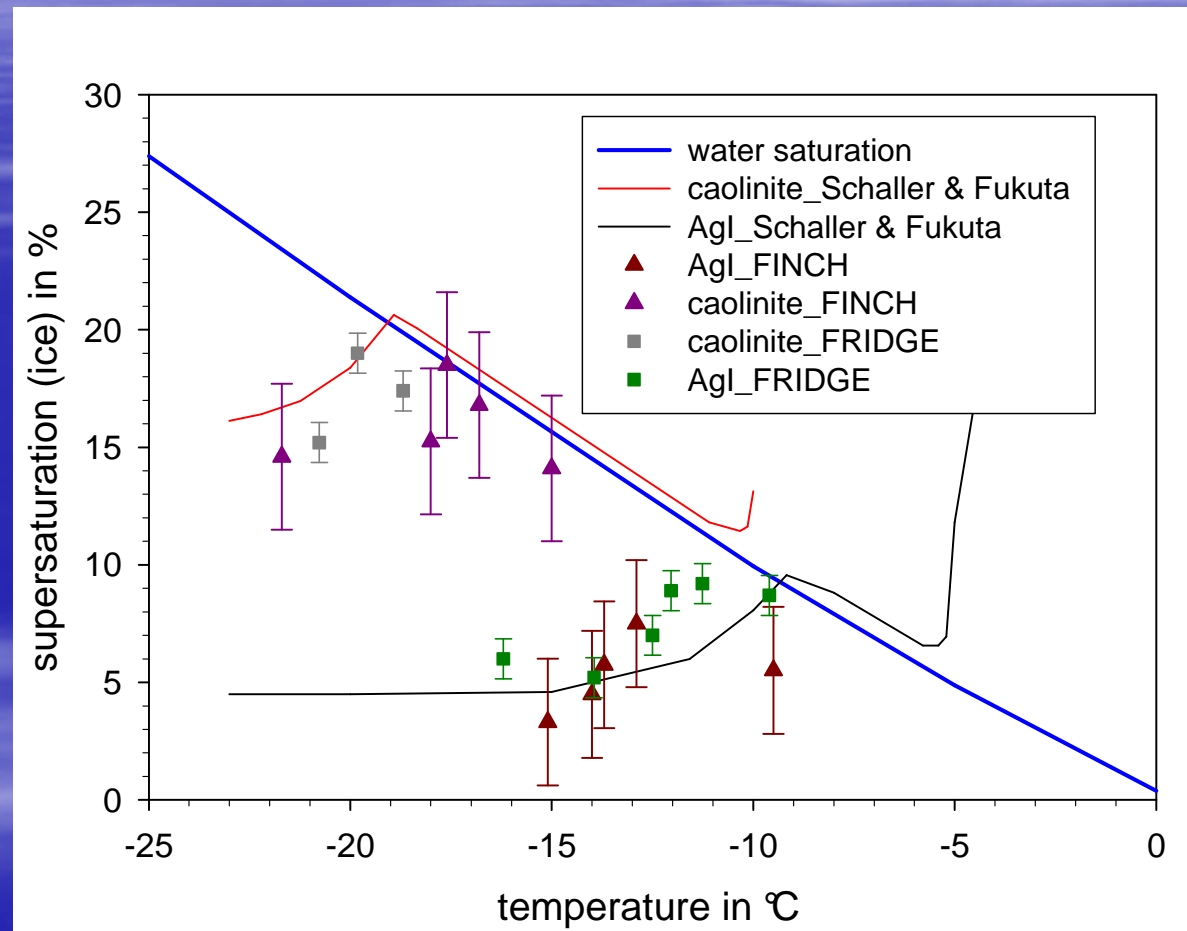


Conclusion

- Measurement of to low supersaturation (ICIS)
- Hint of very fast activation of the IN, $<1\text{ms}$
- Lower activation fraction in comparison with other IN-counter
- Limited IN number concentration ($\sim 300\text{ IN/l}$)
- Low activation fraction of soot



Lab measurements



FRIDGE:
FRankfurt Ice-nuclei Deposition freezinG Experiment