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Sea Salt Aerosols in the Winter/Spring Arctic

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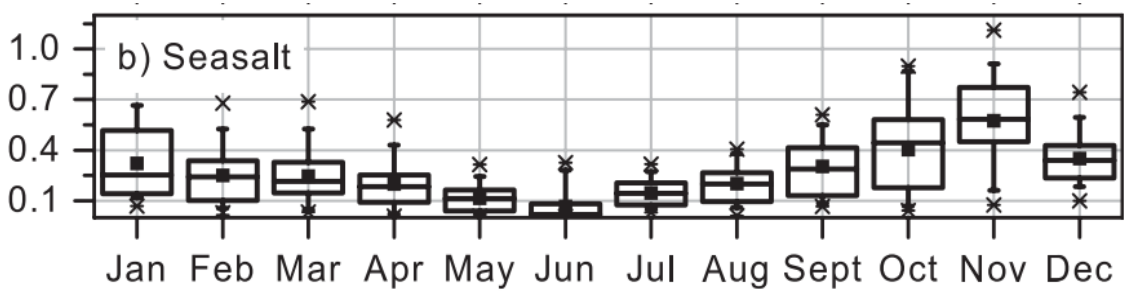
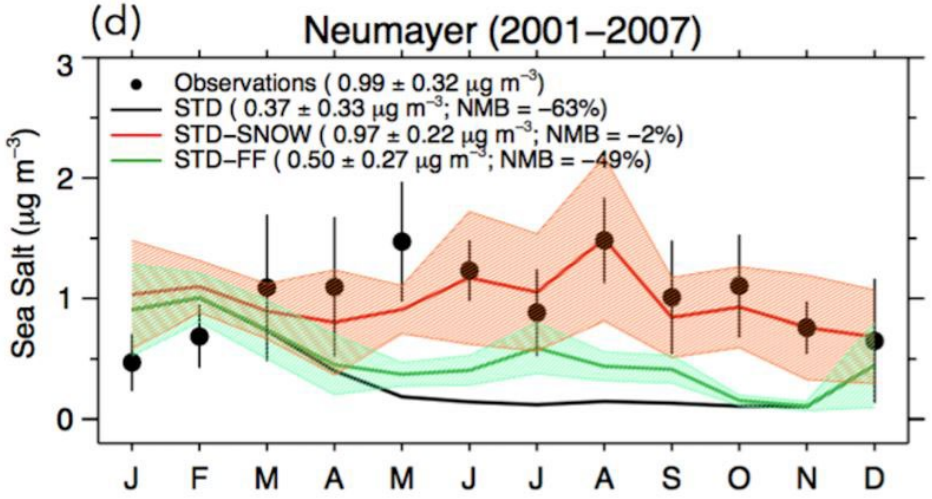
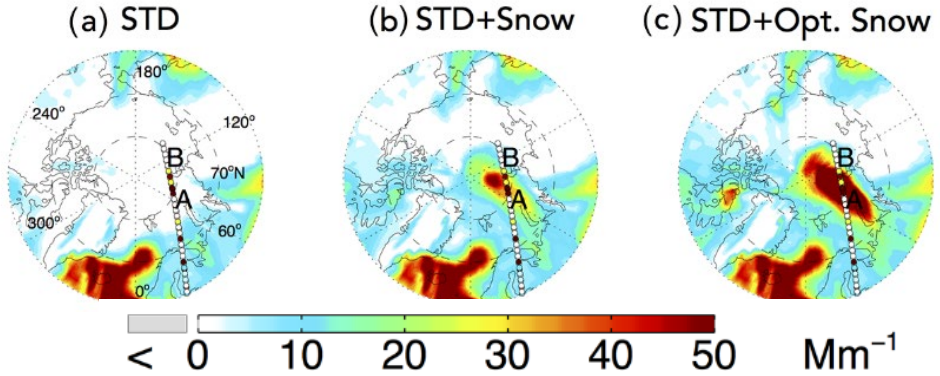
Sea Salt Aerosol Sources in the Arctic



Maximum submicron sea salt mass concentrations in the Arctic during winter is attributed to long-range transport of sea spray aerosols.

Quinn et al. (2002), JGR

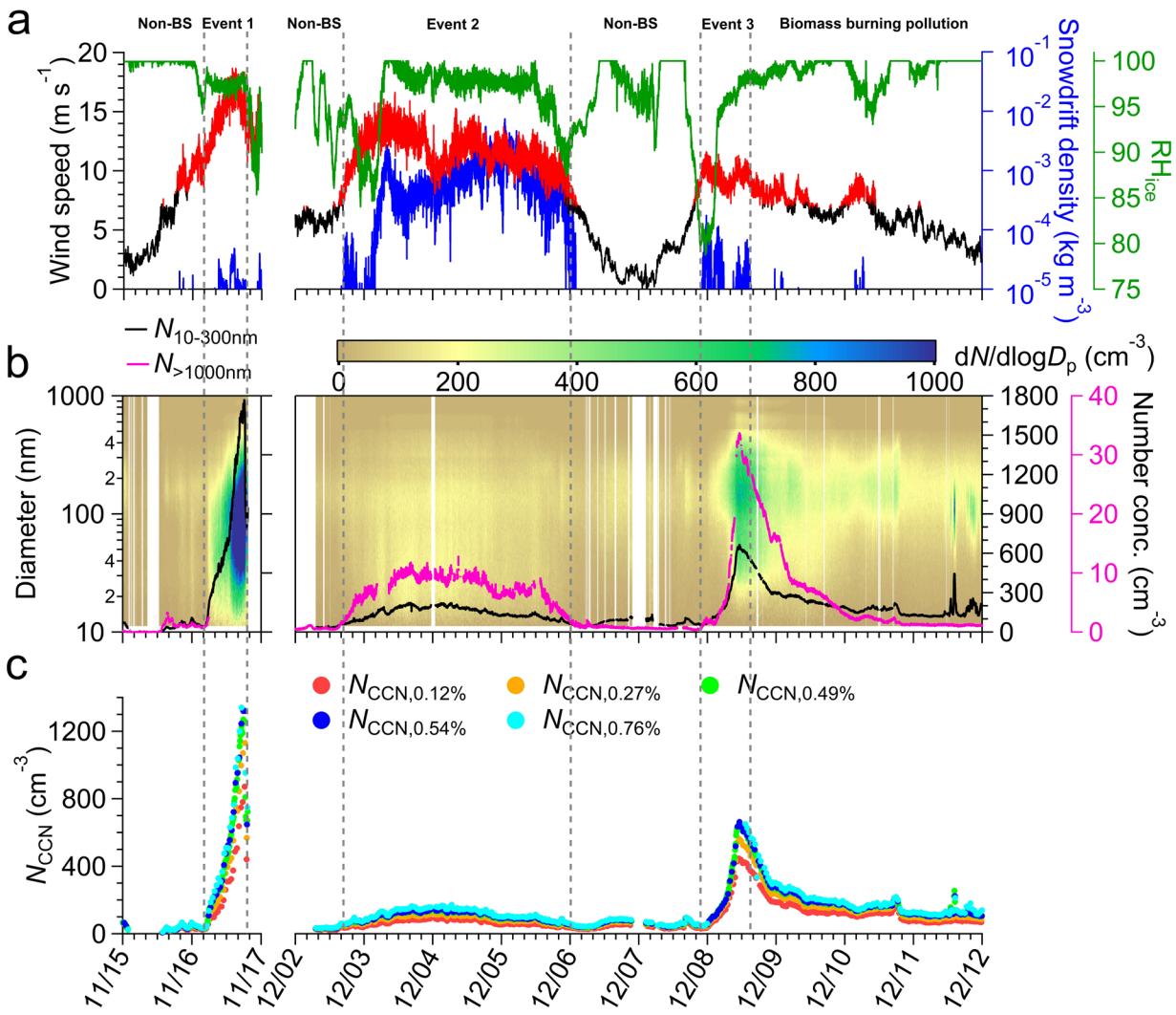




Wintertime and springtime peaks of sea salt mass concentration can only be successfully reproduced with the inclusion of blowing snow.

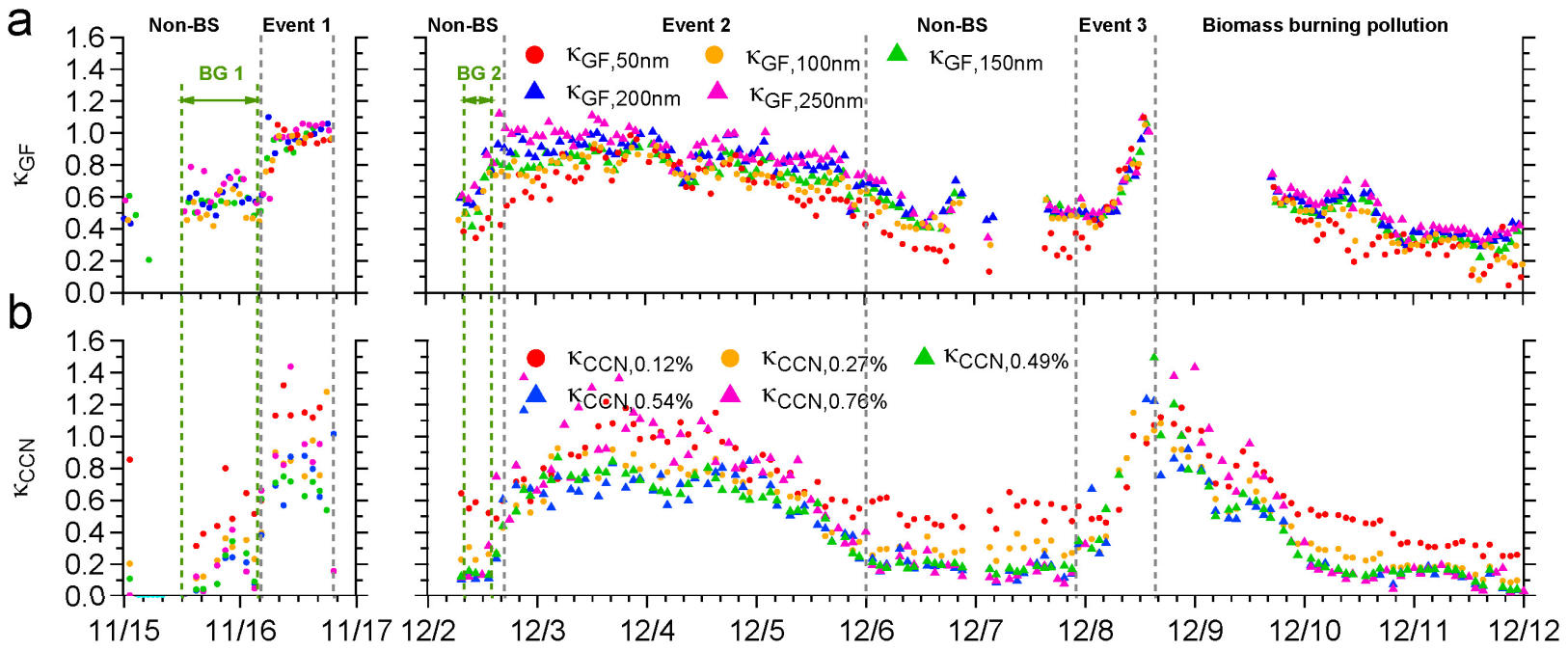
Huang et al. (2017), ACP
Huang et al. (2018), ACP

Sea Salt Aerosols from Blowing Snow



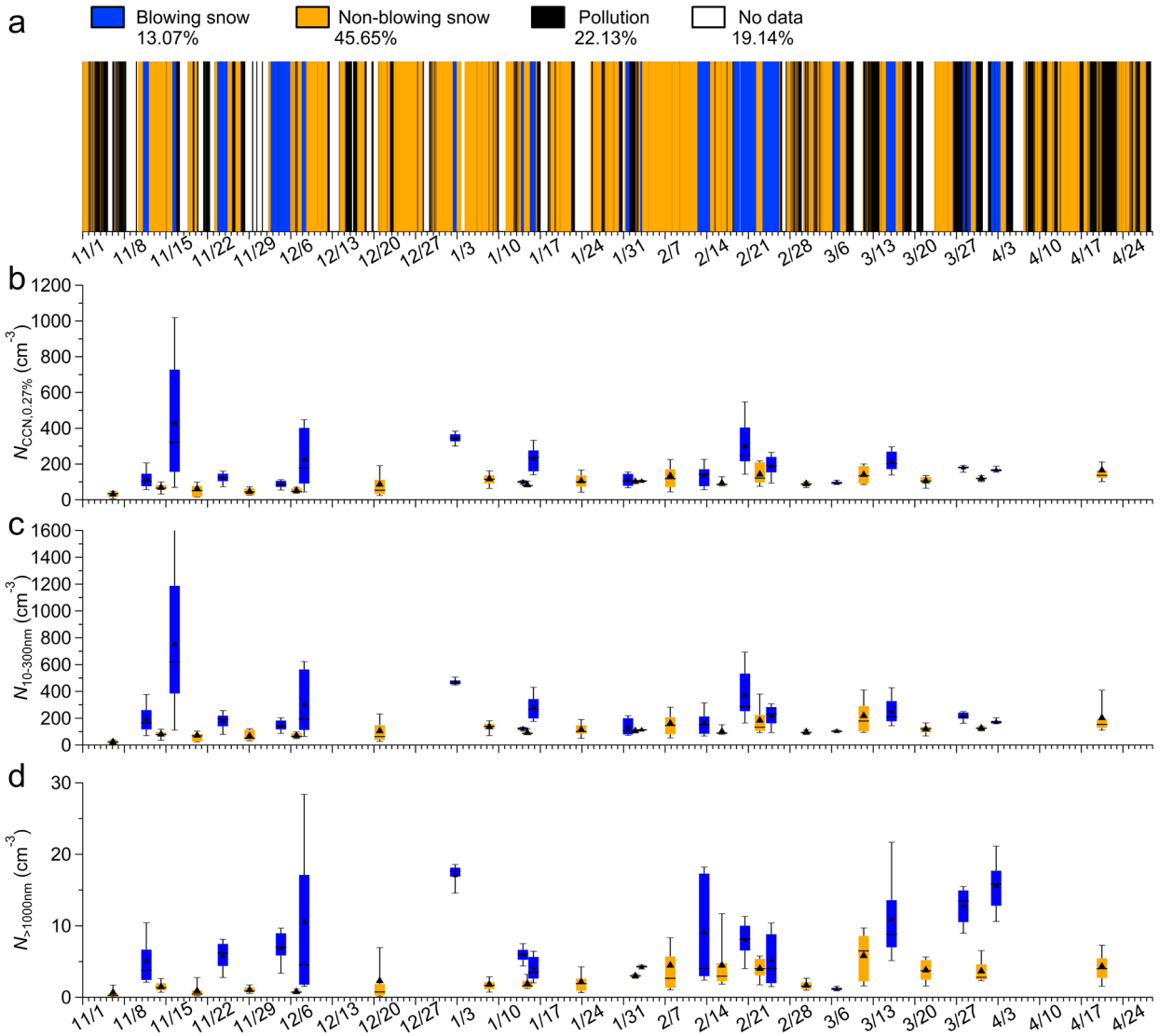
- Identify the blowing snow events based on snowdrift density and wind speed
- Three examples of blowing snow events
- Fine-mode, super-micron aerosols and CCN concentration enhanced during blowing snow events

Particle Hygroscopicity during the Blowing Snow Events



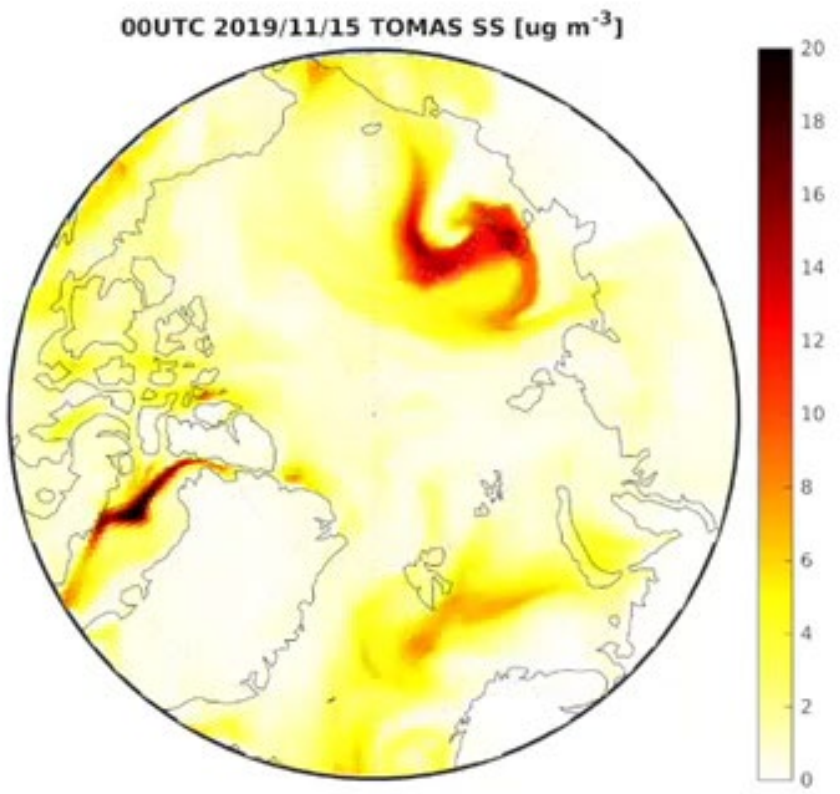
- Particle hygroscopicity derived from CCN activation (κ_{CCN}) and growth factor (κ_{GF}) shows that the fine mode particle composition is dominated by sea salt.

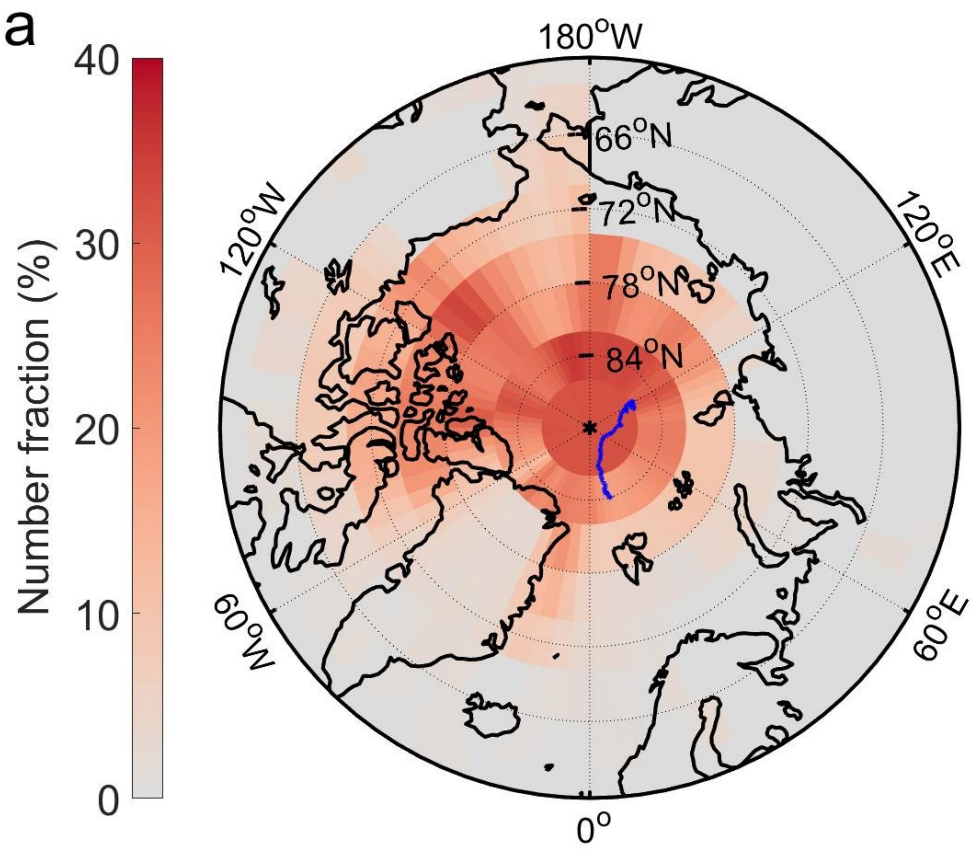
Temporal Variation of the Blowing Snow Events



- Blowing snow events occurred over 20% of the time from November to April.
- CCN, fine-mode and super-micron aerosol concentrations increased up to 10-fold from background.

GOES-Chem-TOMAS Simulation of the Blowing Snow Events





- Model simulation captures the blowing snow events in the Arctic.
- Blowing snow can occur over larger areas in the Arctic (southwards to 60 °N).
- Blowing-snow-produced sea salt particles account for more than 28% of particles in the north of 80 °N.

Take-home Messages

- The sublimation of blowing snow generates high concentrations of fine-mode sea salt aerosols (diameter below 300 nm), enhancing CCN concentrations by up to 10-fold above background levels.
- Blowing snow events occurred more than 20% of the time.
- Blowing-snow-produced sea salt account for more than 28% of particles in the 80 ^{o}N.

Acknowledgements

ASR Atmospheric System Research

U.S. DEPARTMENT OF ENERGY Office of Science

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