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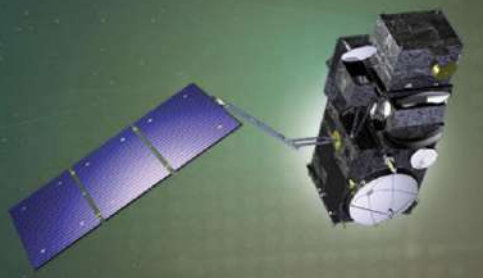


7th Sentinel-3 Validation Team Meeting 2022

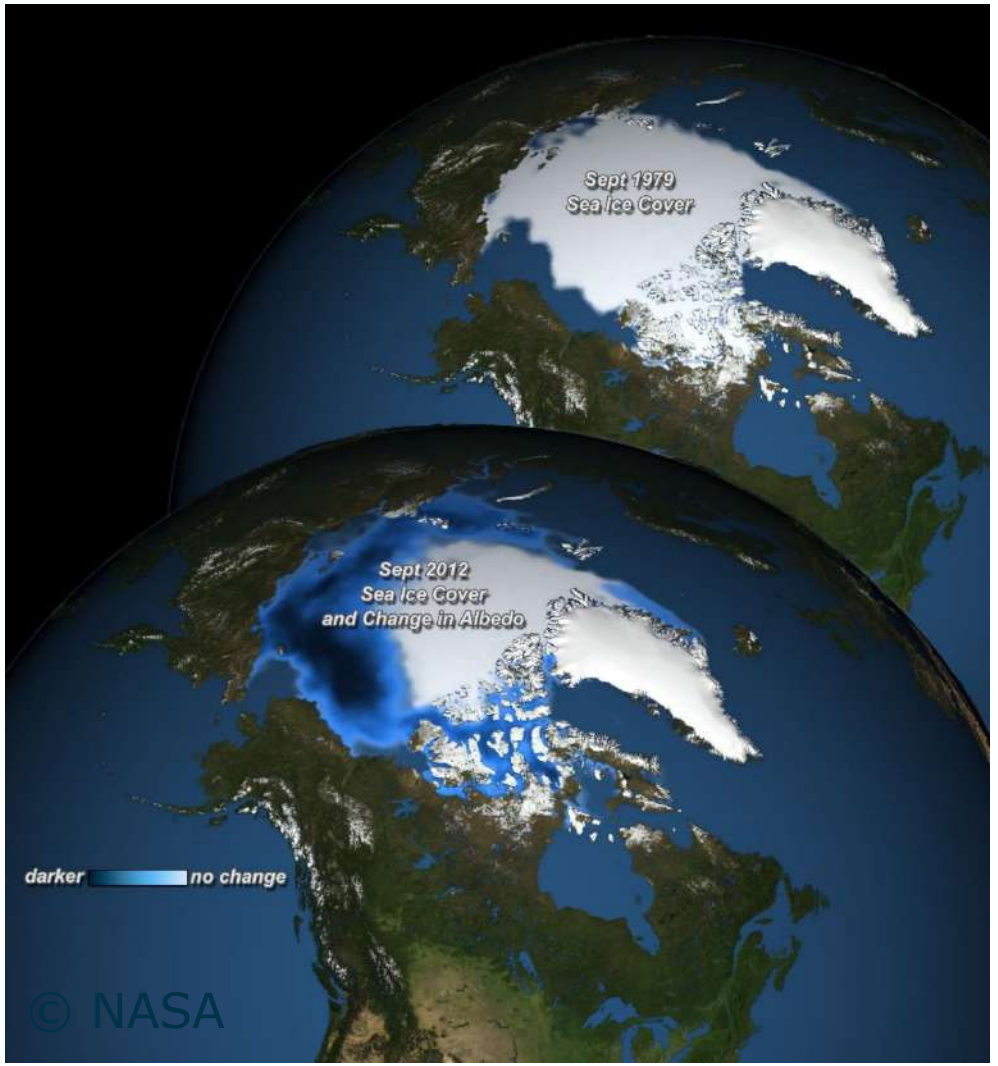
18-20 October 2022 | ESA-ESRIN | Frascati (Rm), Italy

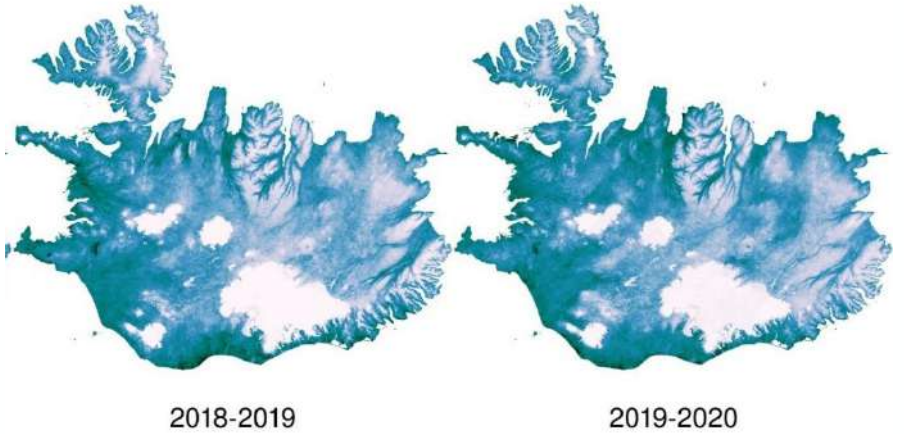
Intensive validation of new XBAER snow products derived from SLSTR/Sentinel-3

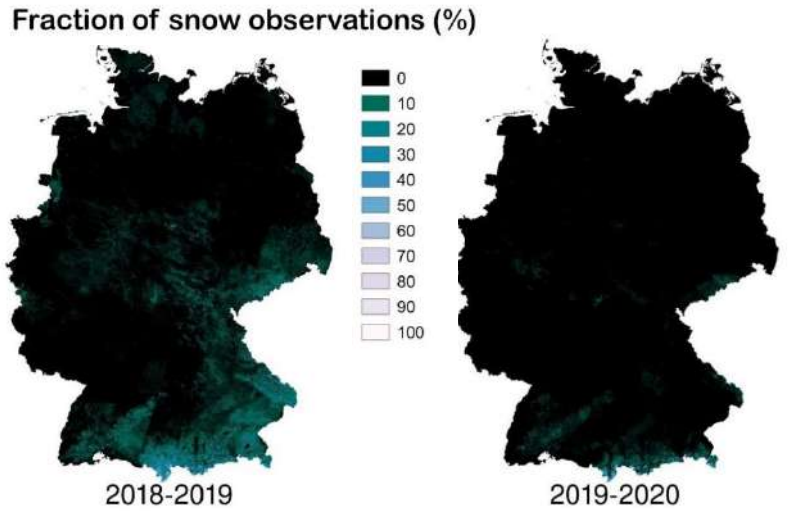
Linlu Mei, Vladimir Rozanov, Marco Vountas, John P. Burrows

Institute of Environmental Physics, University of Bremen

Popular snow properties







© Simon Gascoin

What else do we need to quantify snow climate effect

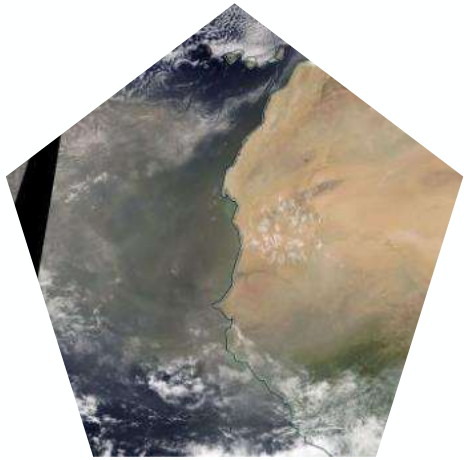
XBAER provides **snow grain size** (SGS), **snow particle shape** (SPS) and **specific surface area** (SSA)

SGS is the effective radius, defined as $3V/(4A_p)$, where V and A_p are the volume and average projected area, respectively (in µm)

<u>SPS is ……</u>

The SSA is defined as the area *S* of the ice–air interface per unit mass *M*
SSA = *S*/*M* expressed in $m^2\ kg^{-1}$

Concept consistent, instrument tuned algorithm family

Aerosol	Cloud	Surface	Cryosphere
			
MOD04	MOD35 MOD06	MOD09 MCD43	MOD10

Mainly focus on MERIS/AATSR – OLCI/SLSTR

- Aerosol optical thickness, Angstrom coefficient, single scattering albedo, fine-mode fraction……..
- Cloud fraction, cloud mask, cloud optical thickness, cloud effective radius……
- Surface reflectance, surface BRDF, surface Albedo
- Snow grain size, snow particle shape, specific surface area, snow albedo……

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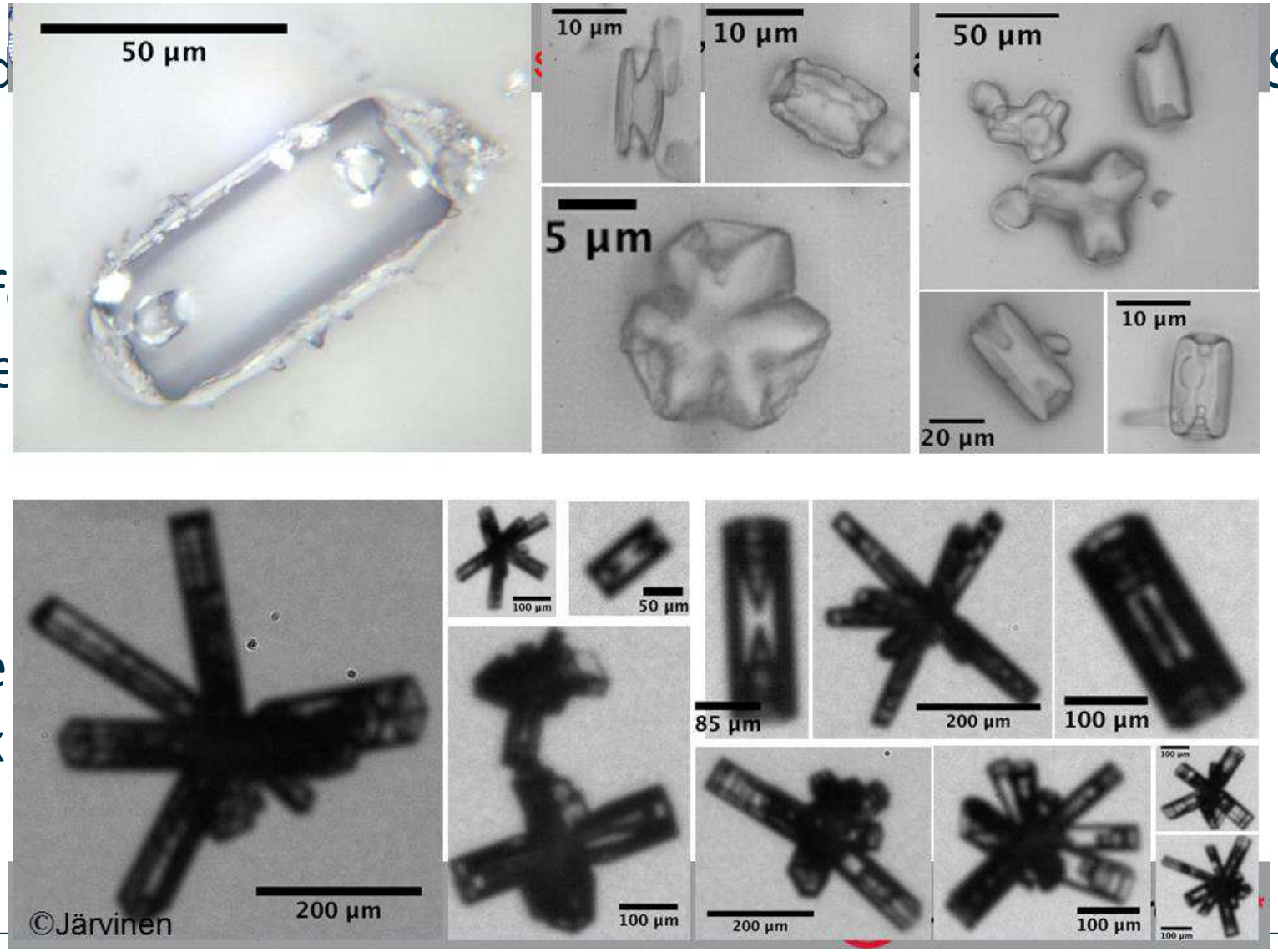
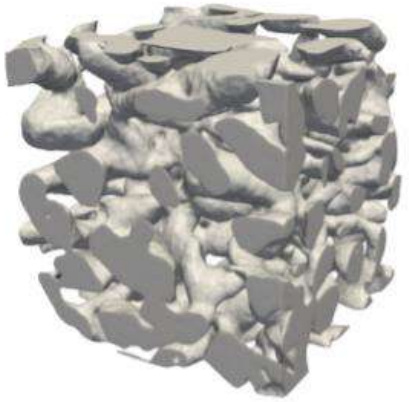
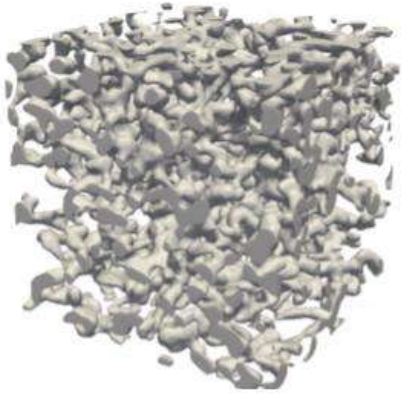


What else do we need to quantify snow climate effect

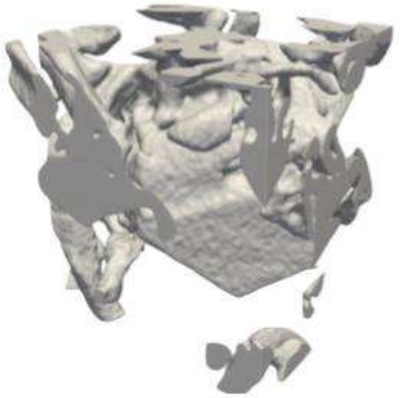
XBAER pro**vides snow grain size** (SGS), **sn** **pecific surface a**

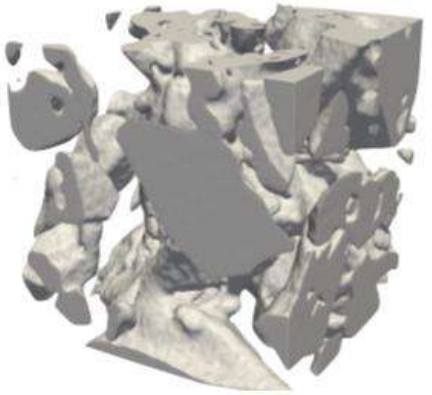




SGS is the **/** volume and average p **µ**

<u>SPS is ……</u>





The SSA is **e** *1*

SSA = *S/M*

Images from online source

What else do we need to quantify snow climate effect

XBAER provides **snow grain size** (SGS), **snow particle shape** (SPS) and **specific surface area** (SSA)

SGS is the effective radius, defined as $3V/(4A_p)$, where V and A_p are the volume and average projected area, respectively (in µm)

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What else do we need to quantify snow climate effect

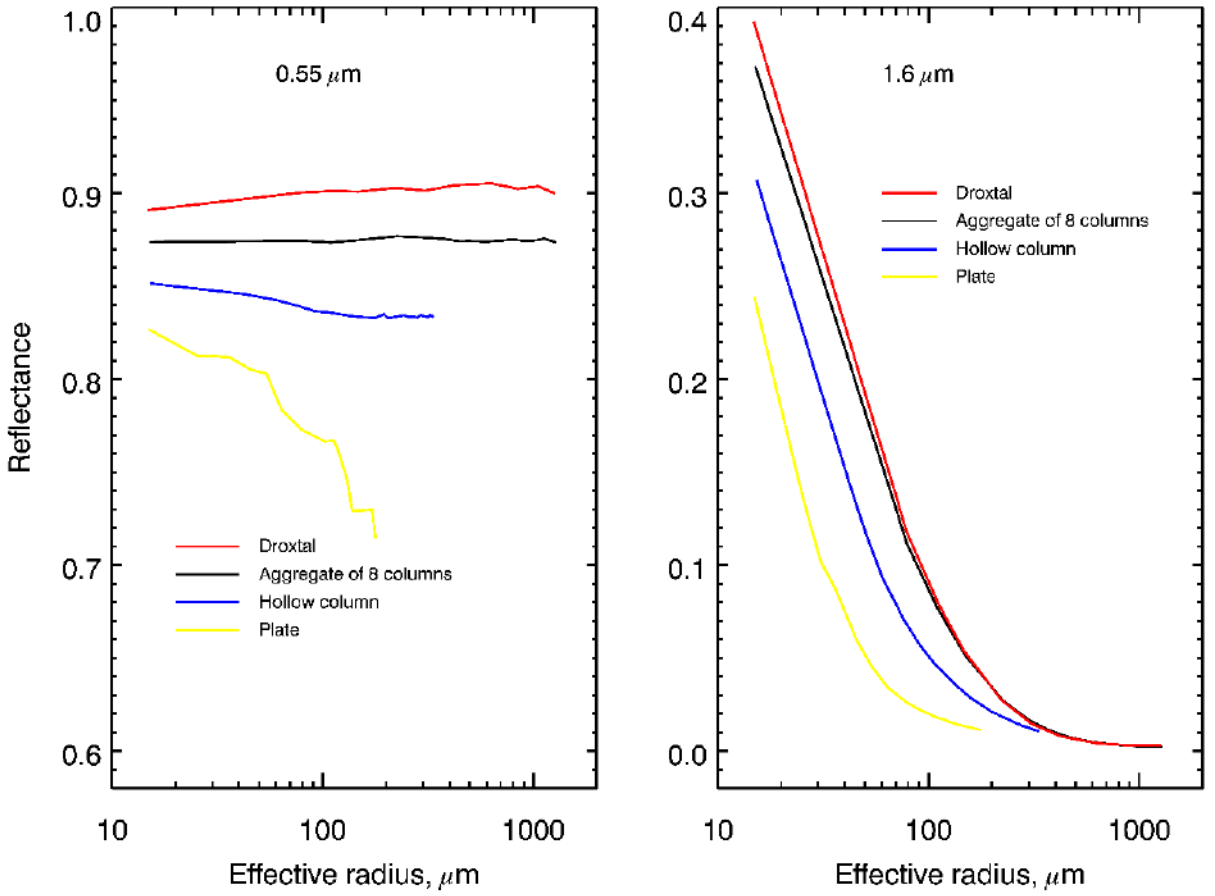
XBAER provides **snow grain size** (SGS), **snow particle shape** (SPS) and **specific**

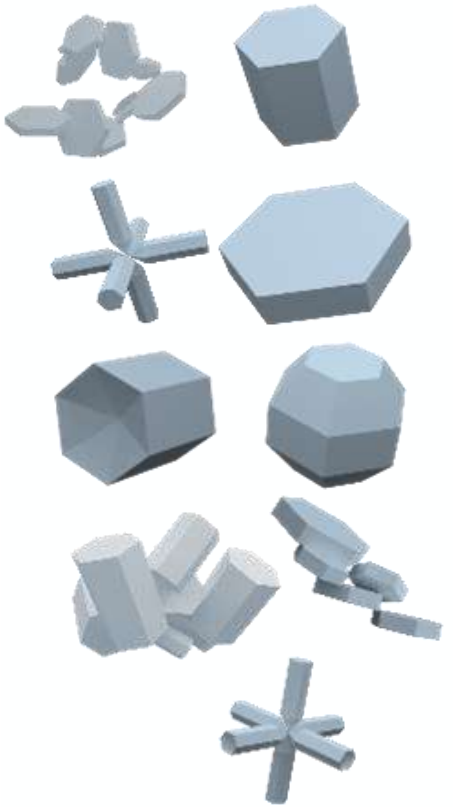
SSA is essential for the estimation of snow electromagnetic characteristics such as scattering and absorption properteis (including albedo in the near infrared), microwave radiation, snow metamorphism and problems link to above ice snow(e.g. Domine et al., 2007, Hagenmuller et al., 2016). And from a satellite point of view, it may provide information of surface structures.

The **SSA** is defined as the area *S* of the ice–air interface per unit mass *M*

SSA = *S*/*M* expressed in $m^2\ kg^{-1}$

XBAER snow retreival theoretical background



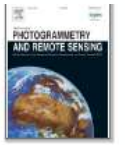


- A visible and a NIR channel
- Geostationary-like polar-orbit observations
- Spatial resolution as high as possible

(Mei et al., 2021 TC)

XBAER snow retreival theoretical background

ISPRS Journal of Photogrammetry and Remote Sensing
Volume 188, June 2022, Pages 269-285



A new snow bidirectional reflectance distribution function model in spectral regions from UV to SWIR: Model development and application to ground-based, aircraft and satellite observations

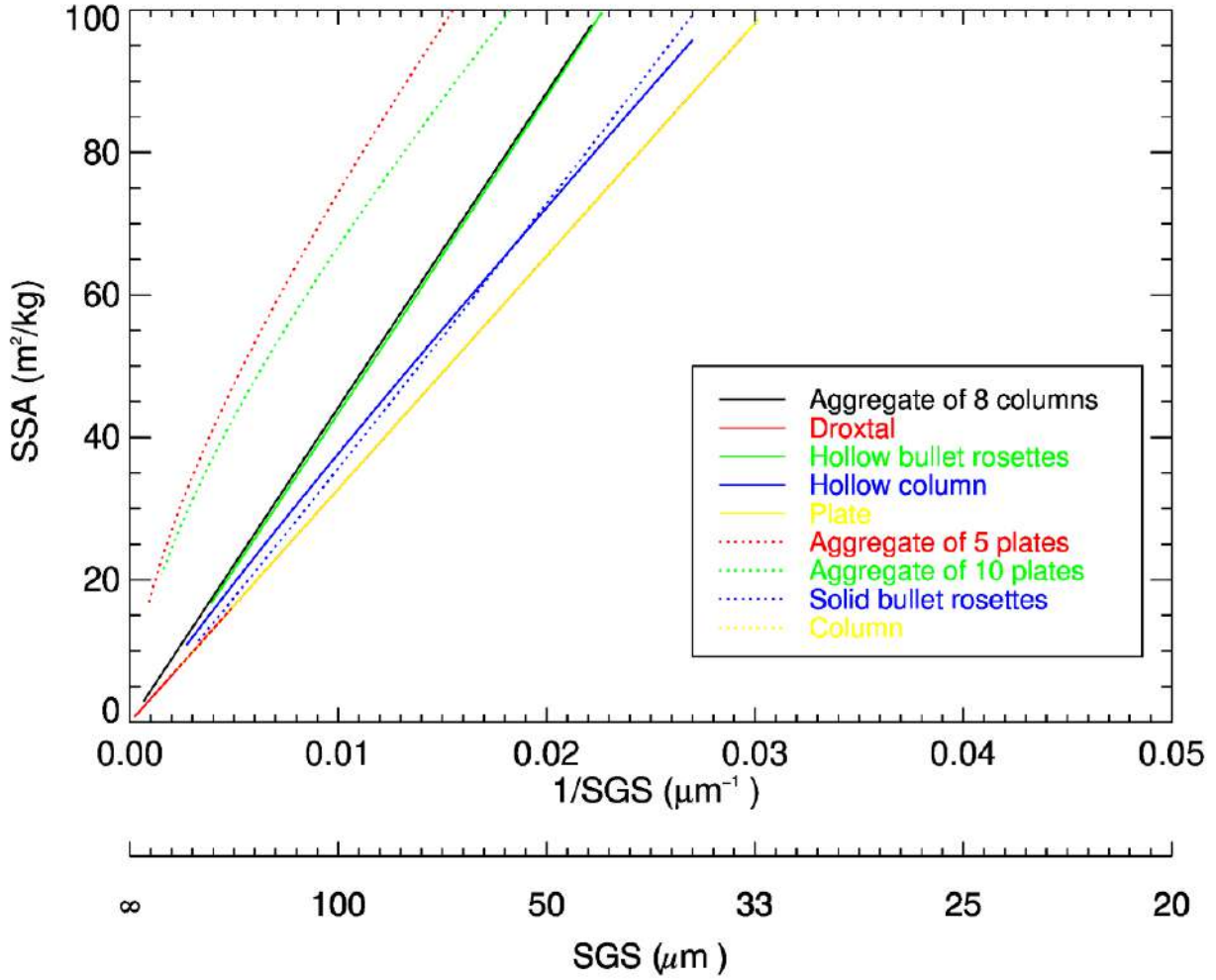
Linlu Mei [a], Vladimir Rozanov [a], Ziti Jiao [b], John P. Burrows [a]

Status: this preprint is currently under review for the journal GMD.

SCIATRAN software package (V4.6): update and further development of aerosol, clouds, surface reflectance databases and models

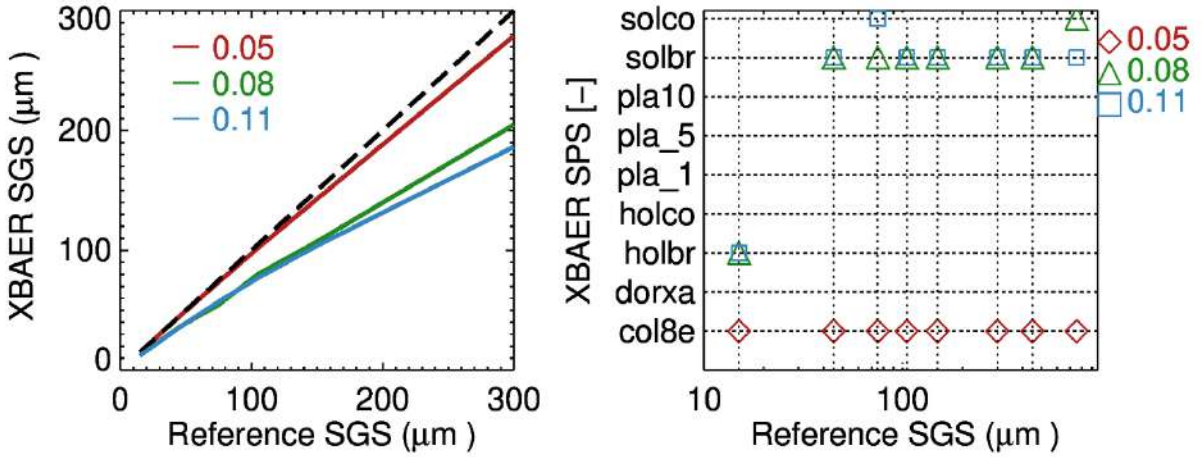
Linlu Mei, Vladimir Rozanov, Alexei Rozanov, and John Burrows
Institute of Environmental Physics, University of Bremen, Germany

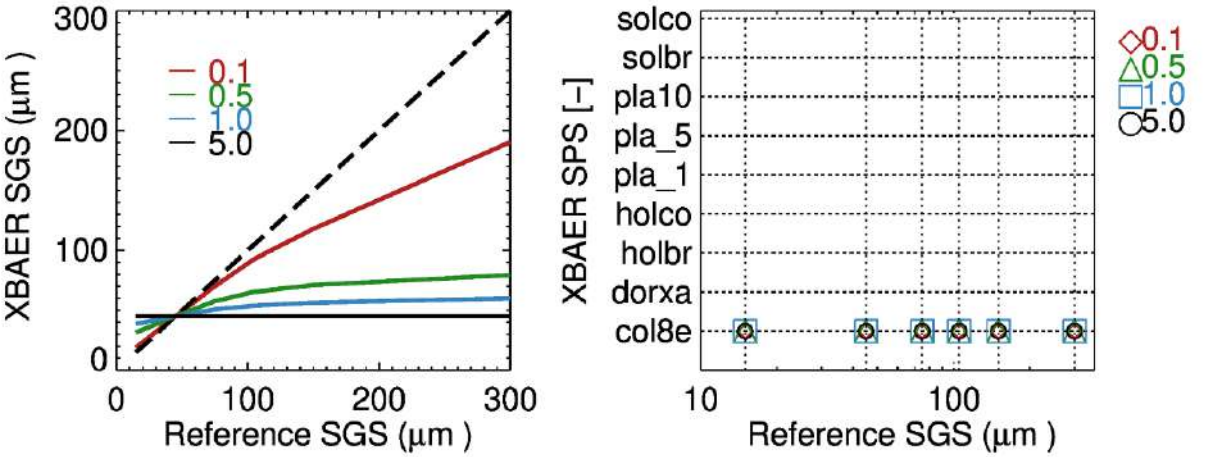
XBAER snow retreival – sensitivity study

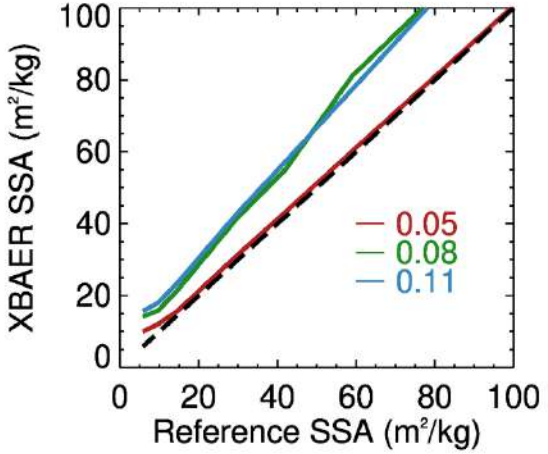


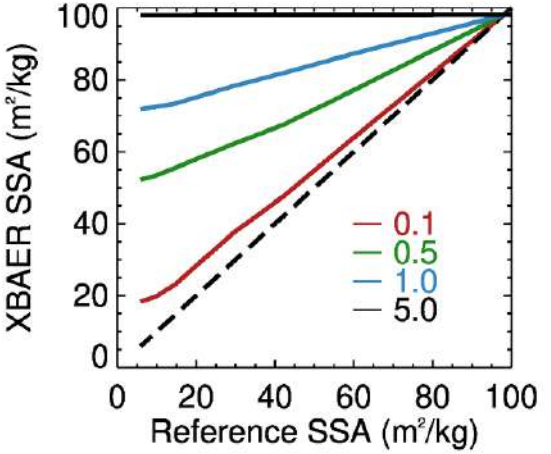
- Huge difference for SSA estimation with different assumptions of SPS when SGS keeps the same

XBAER snow retreival – sensitivity study

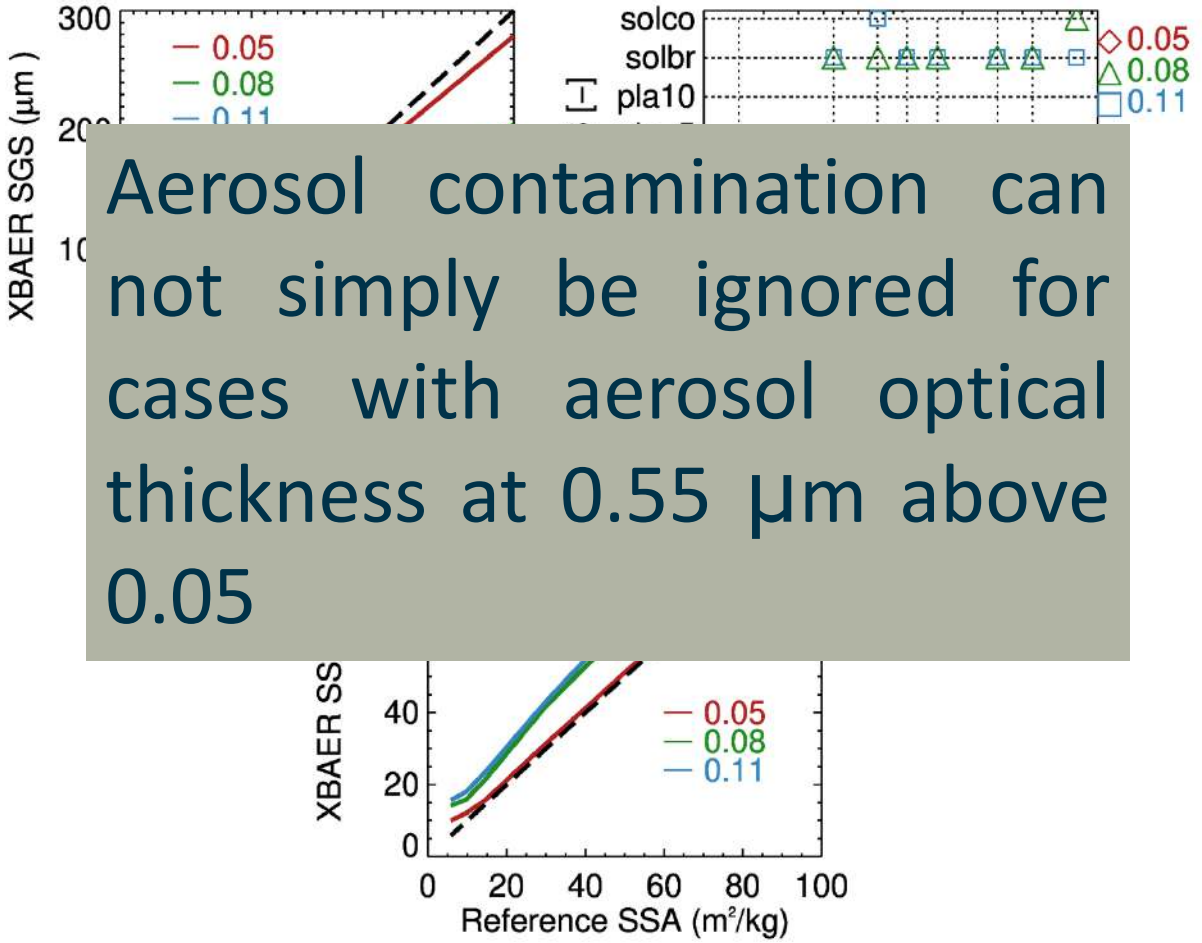




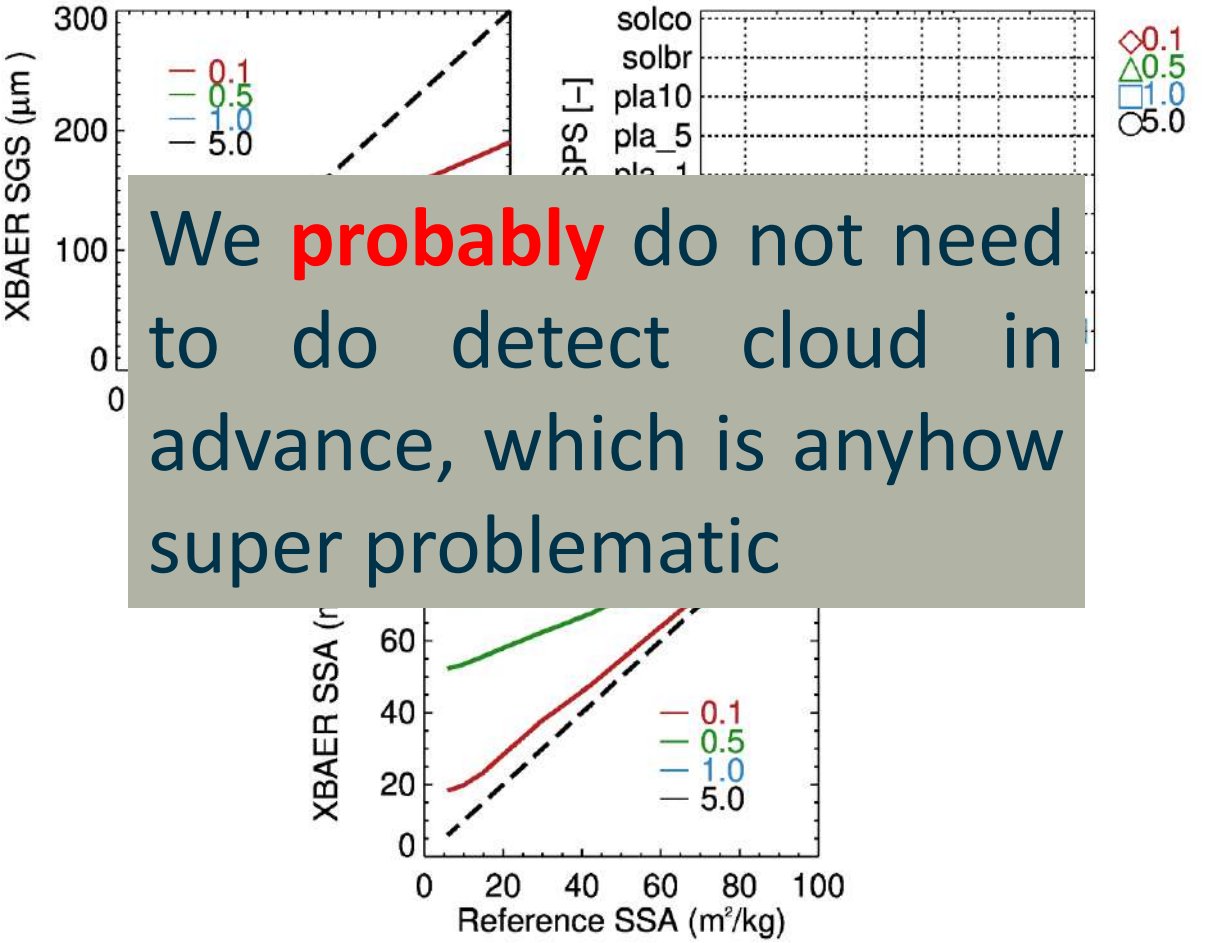




XBAER snow retreival – sensitivity study

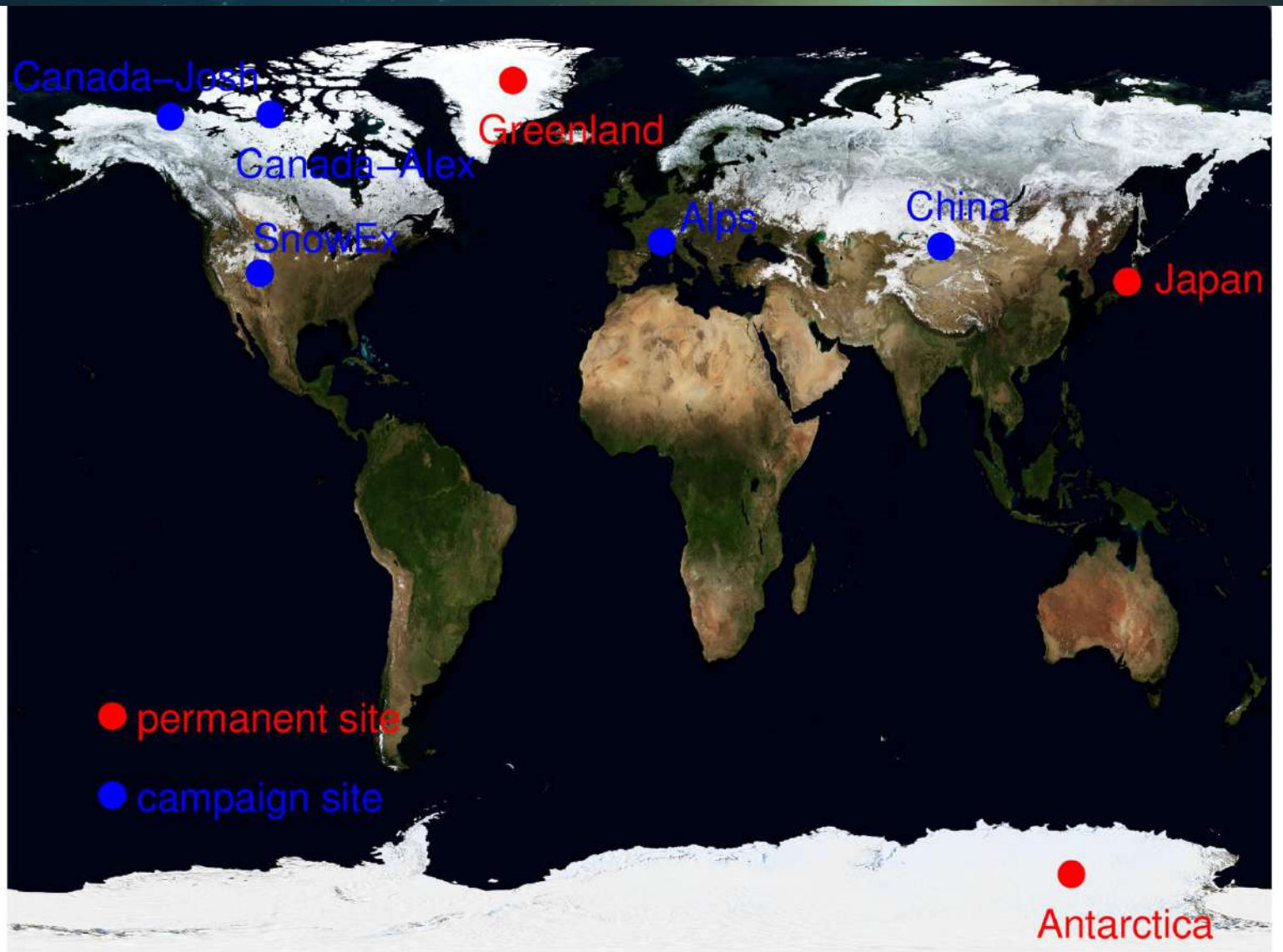


Aerosol contamination can not simply be ignored for cases with aerosol optical thickness at 0.55 µm above 0.05



We **probably** do not need to do detect cloud in advance, which is anyhow super problematic

Current status of validation (period 2016 - 2020)



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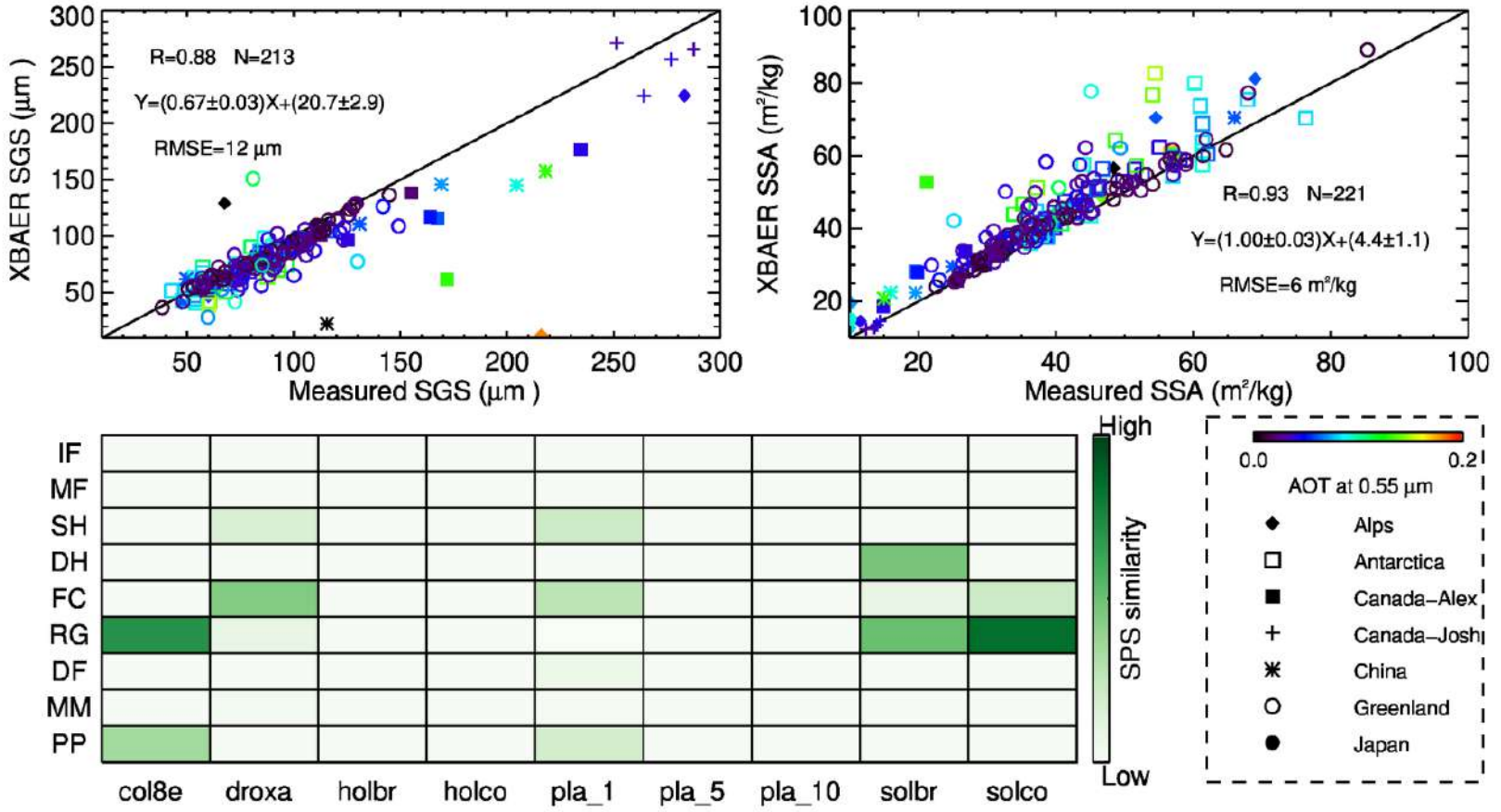
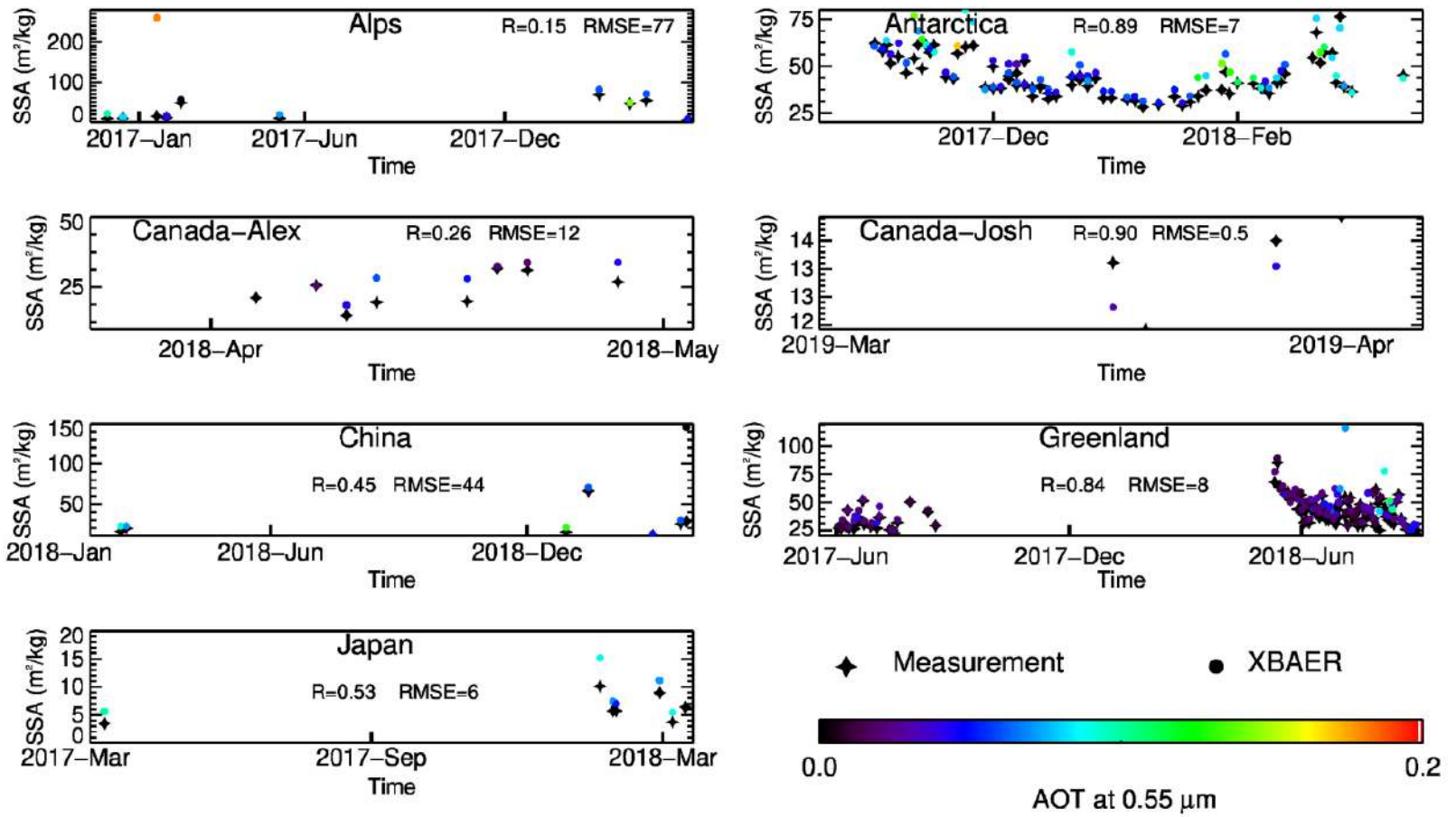


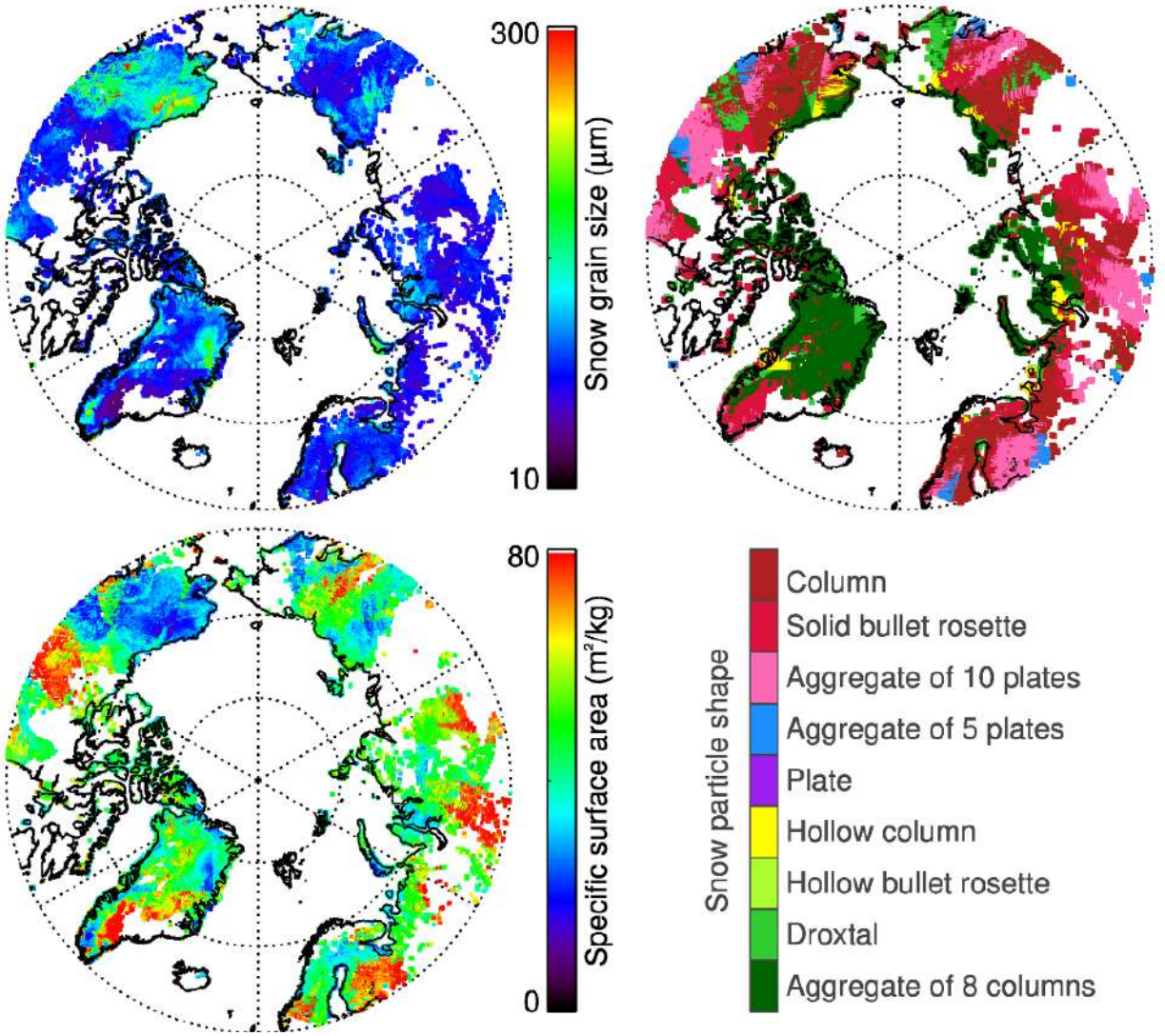
Good agreement in general

Current status of validation (period 2016 - 2020)

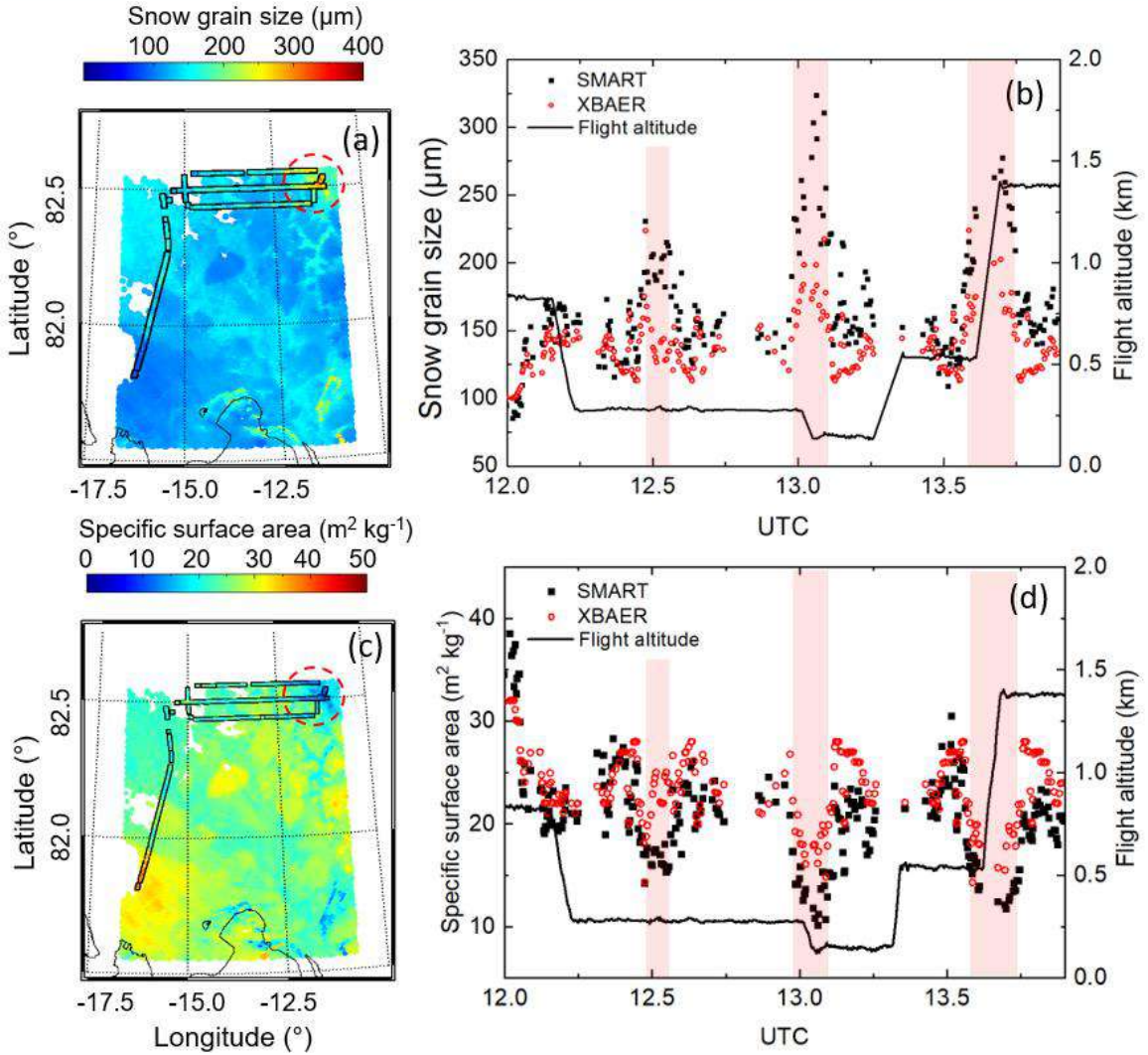


Problems……

Arctic-wide XBAER SLSTR snow research product

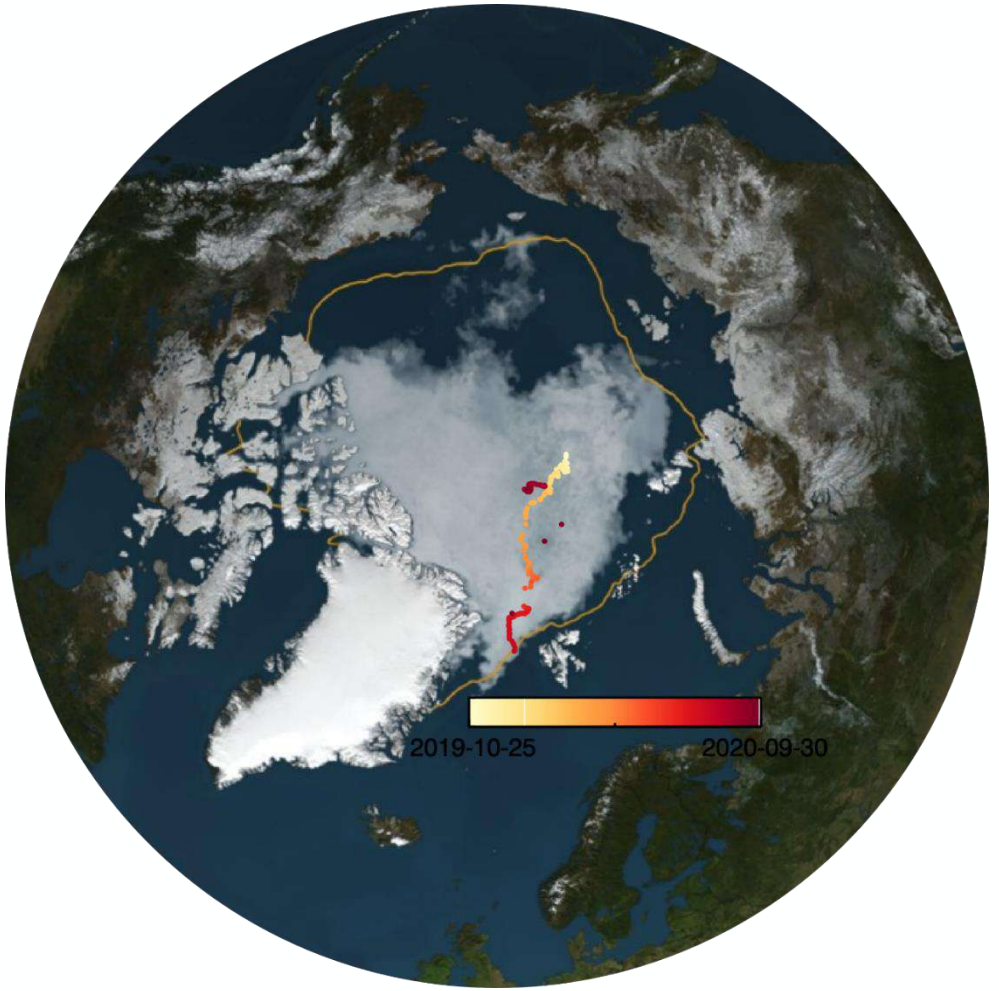


Arctic-wide XBAER SLSTR snow research product - applications



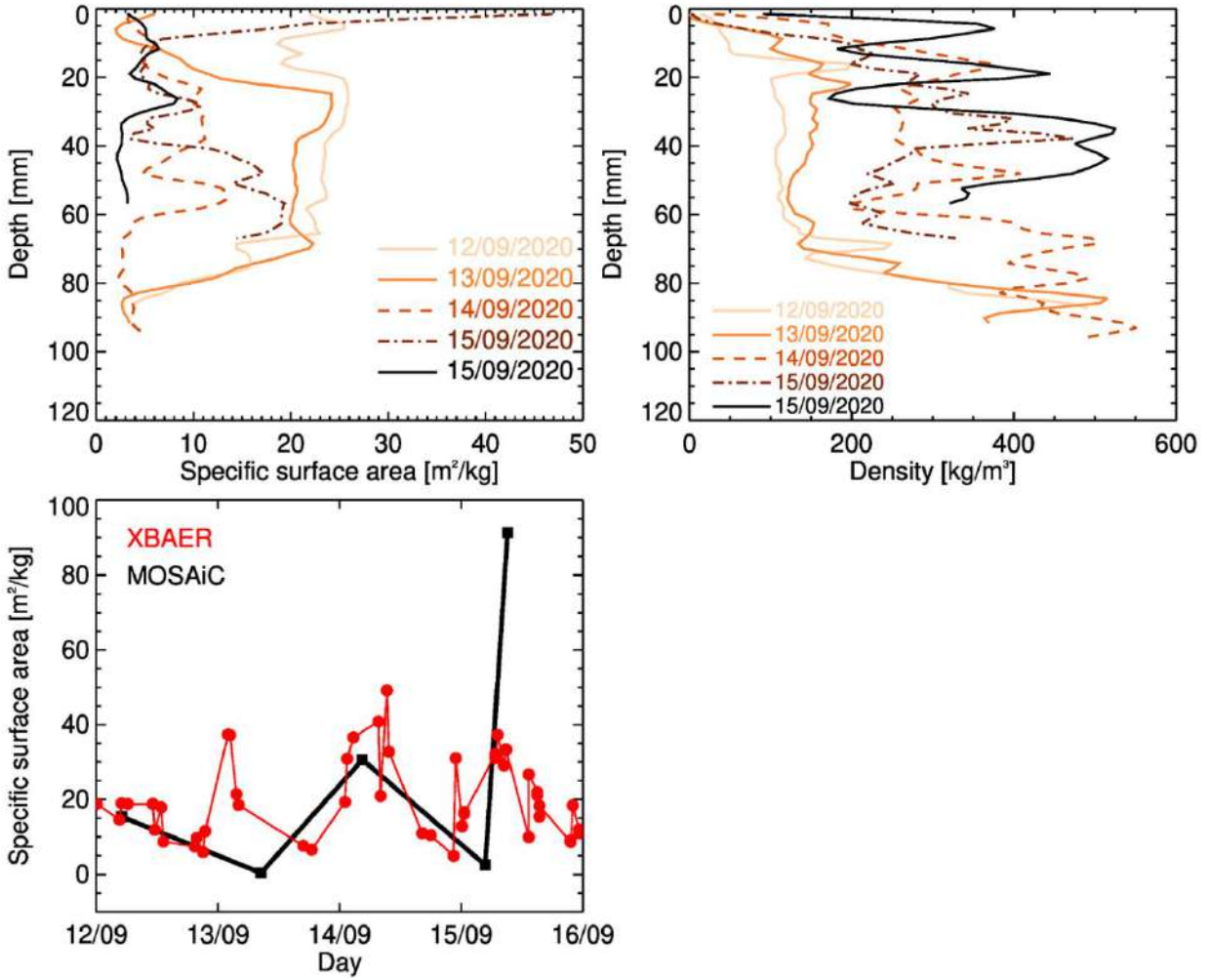
Polar Airborne Measurements and Arctic Regional Climate Model Simulation Project (PAMARCMiP) campaign held in March/April 2018

Arctic-wide XBAER SLSTR snow research product - applications

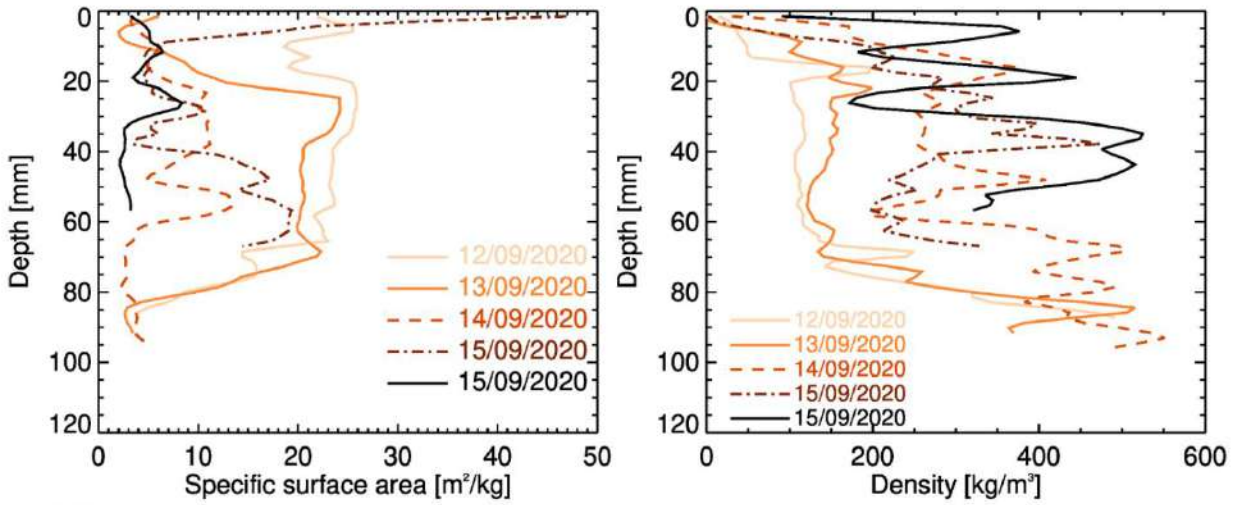


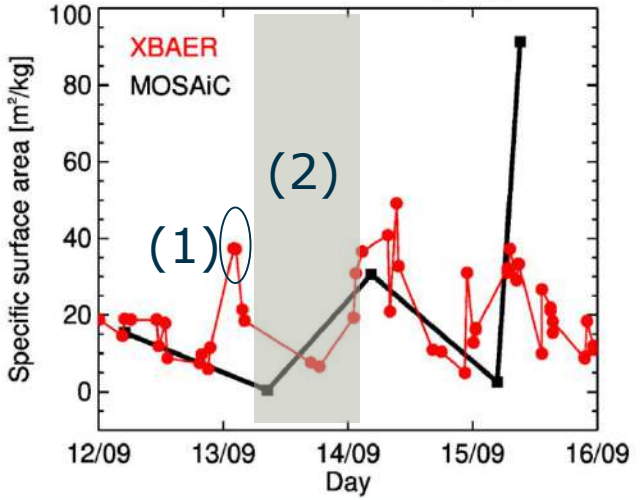
MOSAiC snow measurements - **Snow specific area**

Arctic-wide XBAER SLSTR snow research product - applications



Arctic-wide XBAER SLSTR snow research product - applications

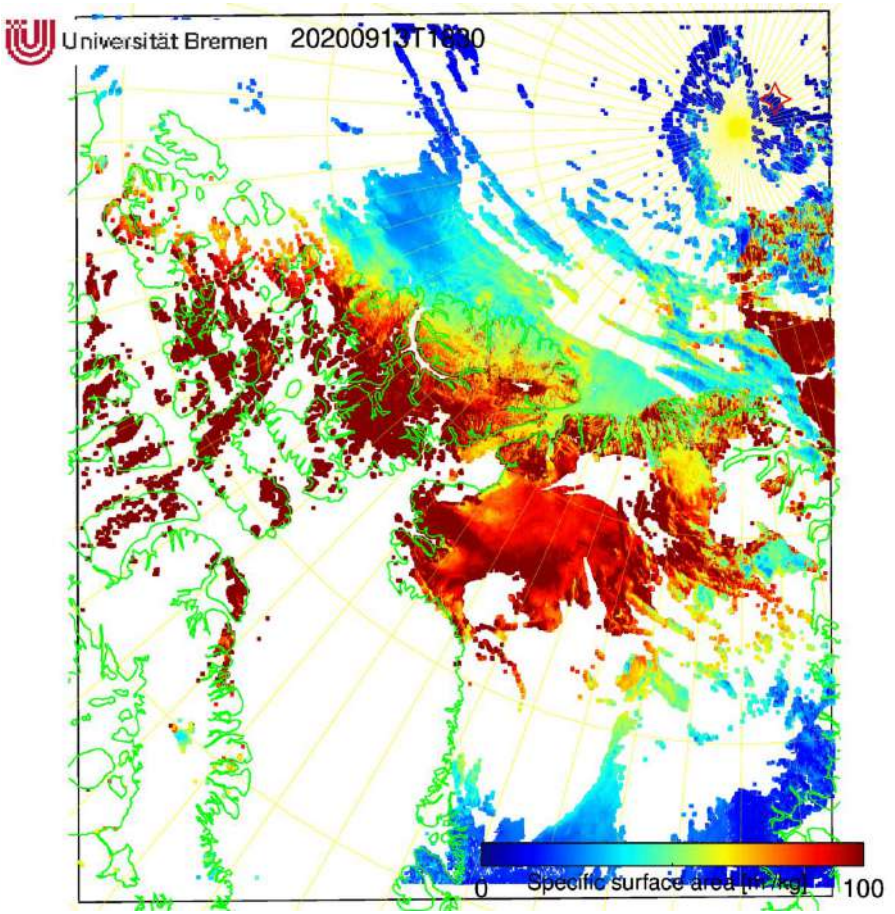


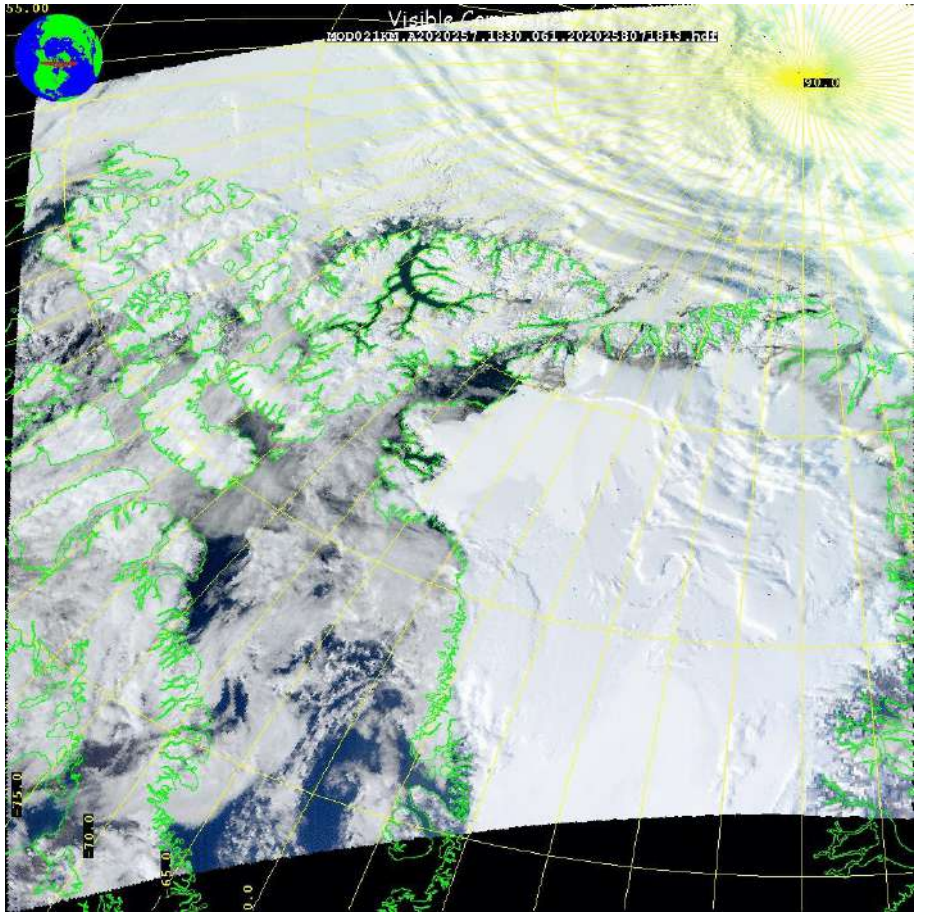


(1) Cloud

(2) Rain

Arctic-wide XBAER SLSTR snow research product - applications





Linlu Mei mei@iup.physik.uni-bremen.de