CENTRE FOR POLAR OBSERVATION AND MODELLING (CPOM), EARTH SCIENCES, UCL

Scattering characteristics and snow depth determination from KuKa Ku- and Ka- band polarimetric, dual frequency, ground-based radar deployed in altimeter mode during MOSAiC

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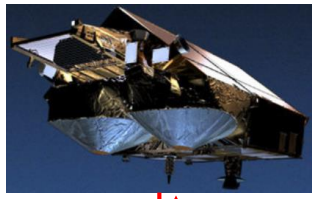
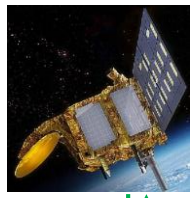
1 University College London
2 University of Manitoba
3 National Snow and Ice Data Center
4 Danish Meteorological Institute
5 Alfred Wegener Institute
6 ProSensing
7 Arctic University of Norway
8 Colorado State University
9 Tsinghua University
10 WSL
11 Ohio State University
12 University of Alaska Fairbanks
13 British Antarctic Survey

Dominant scattering surfaces

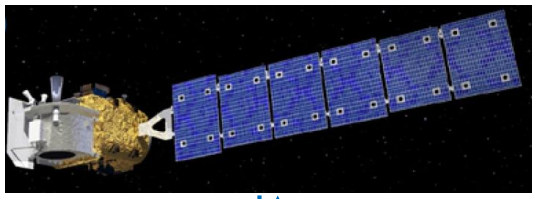
CryoSat-2



AltiKa



ICESat



13.575 GHz

35 GHz

532 nm

snow

?

key uncertainties in sea ice thickness retrieval

ice lens

moisture

brine

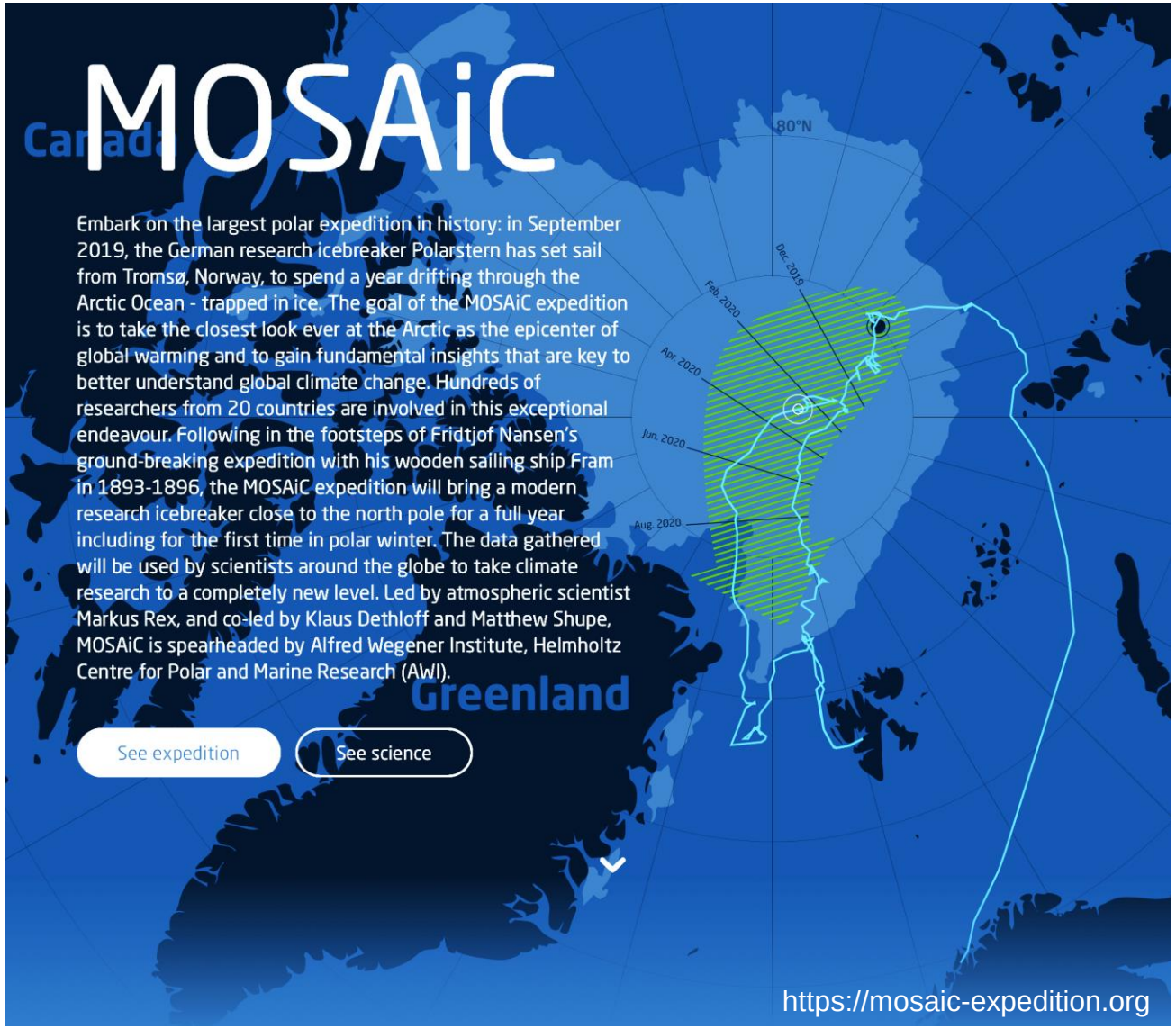
grain characteristics

crust

snow ice

sea ice

sea water

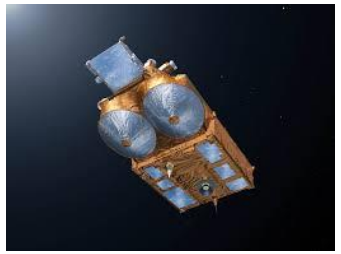


	Ku-band (~CryoSat-2)	Ka-band (~ALTIKA)
Frequency	12-18 GHz	30-40 GHz
Range resolution	2.5 cm	1.5 cm
Antenna beamwidth	16.9°	11.9°

(Stroeve et al, 2020)

AltiKa

CryoSat-2



~700 km

~800 km

simulator

KuKa

Pulse-limited
+ SAR
~ 1.7 x 0.3 km

Pulse-limited
~8 km

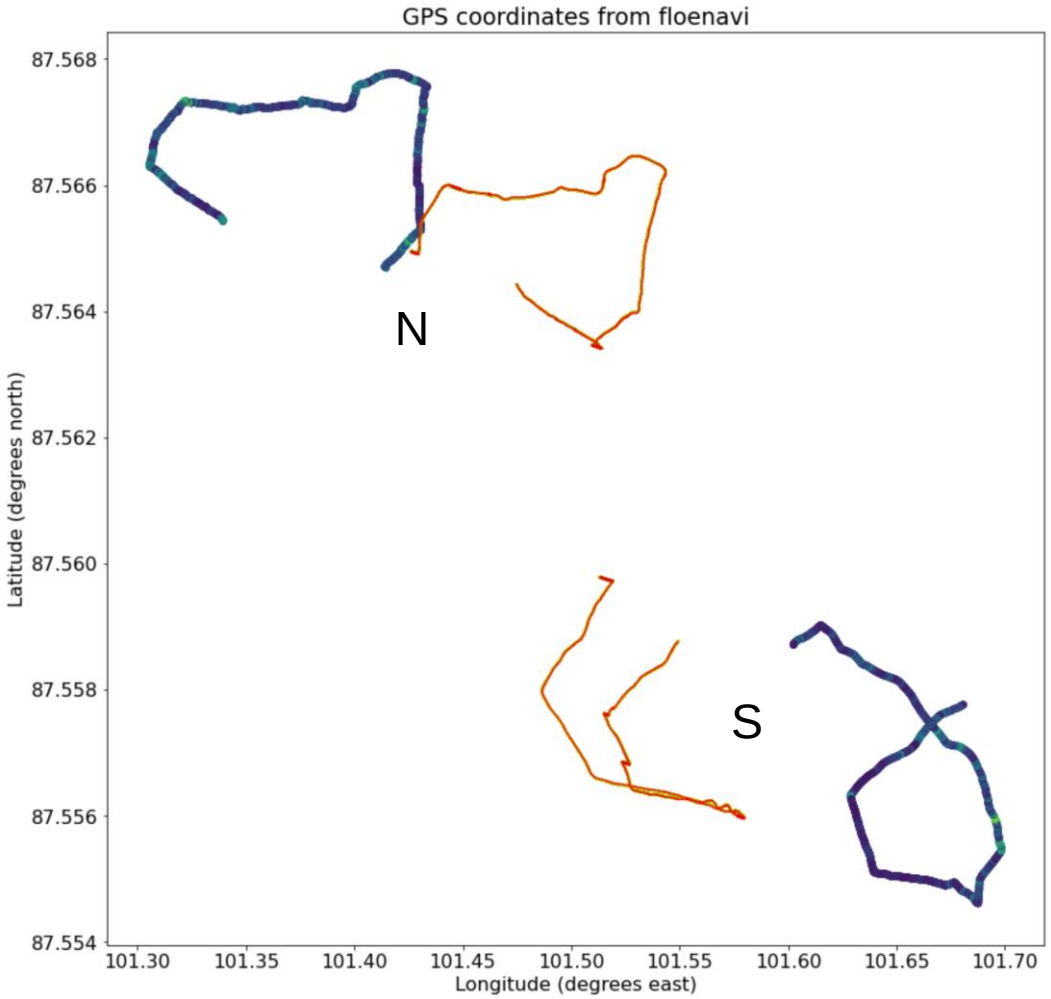
~1.5 m

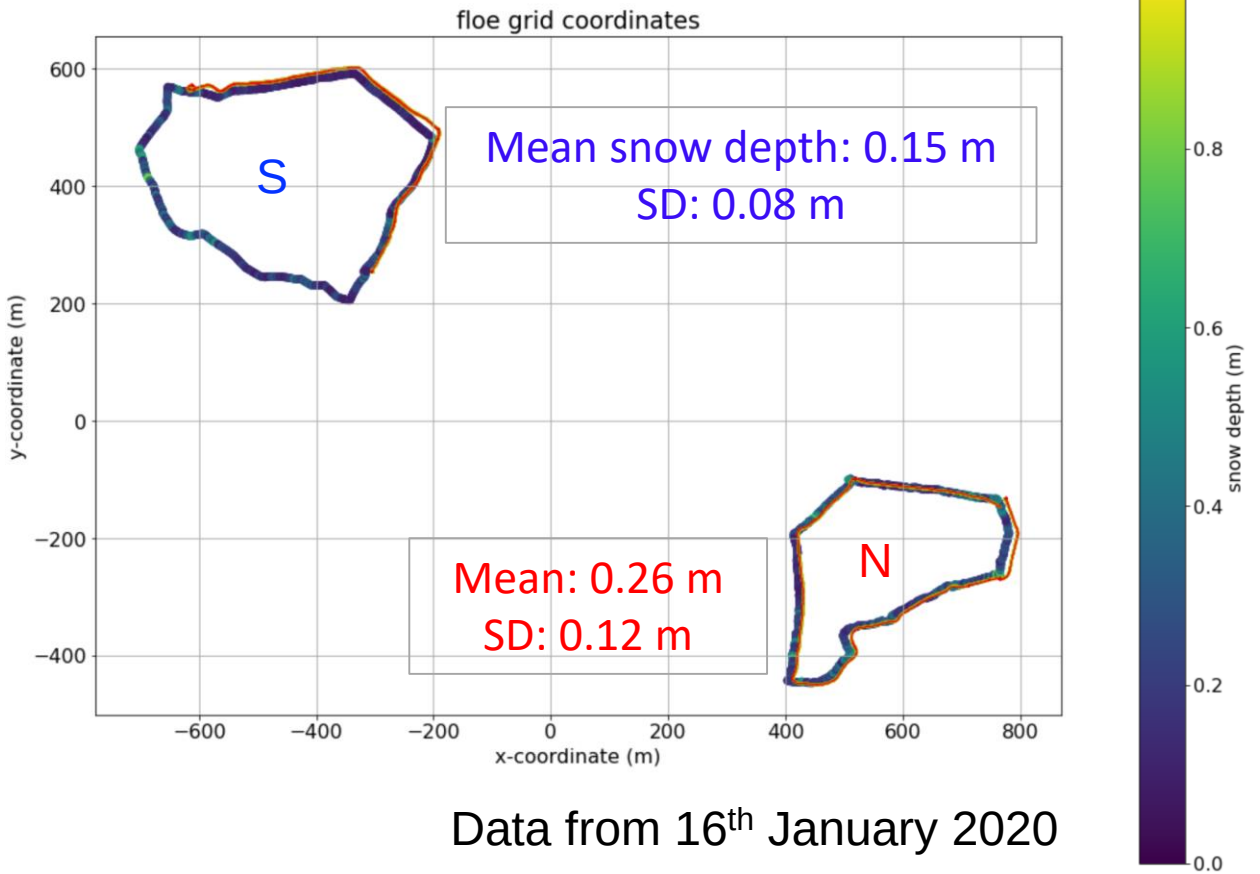
~ 40 cm

Beam-limited

~1.5 m

~ 30 cm





Data from 16th January 2020

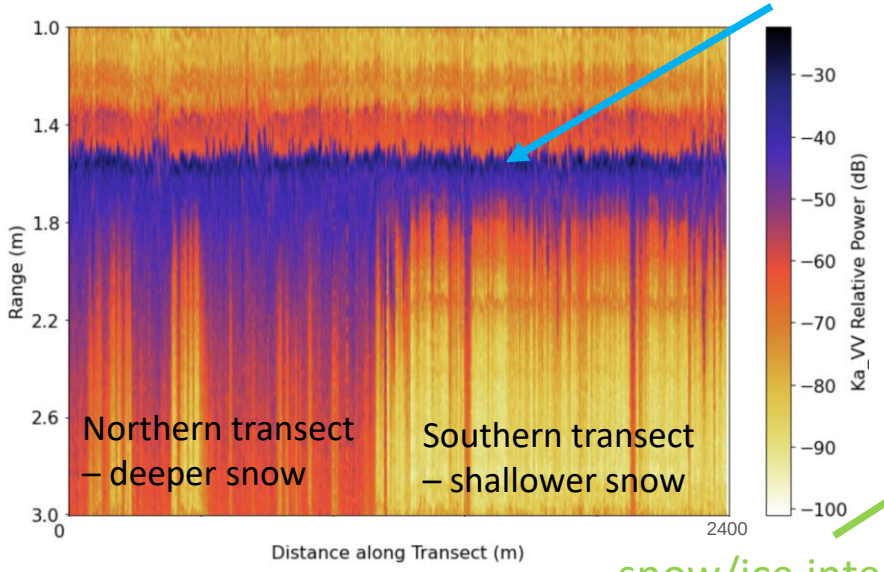
Floenavi: Stefan Hendricks (AWI) https://gitlab.awi.de/floenavi-crs

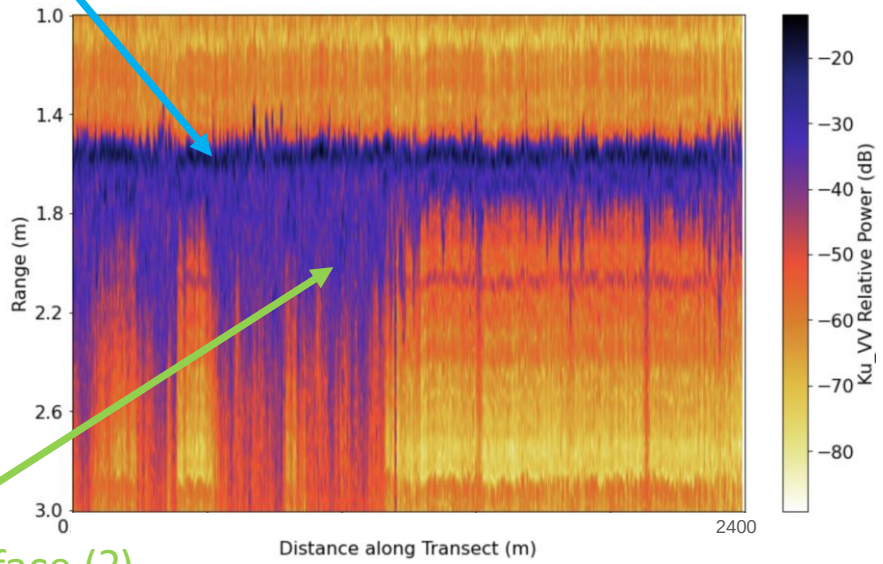
Ka

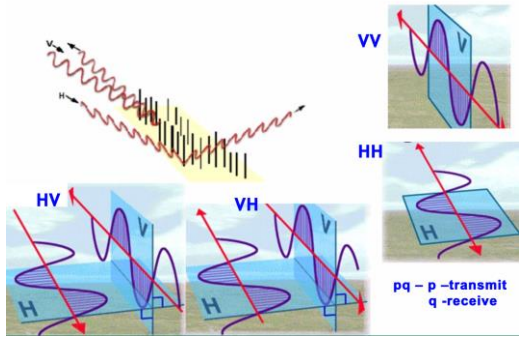
Ku

air/snow interface (?)

VV



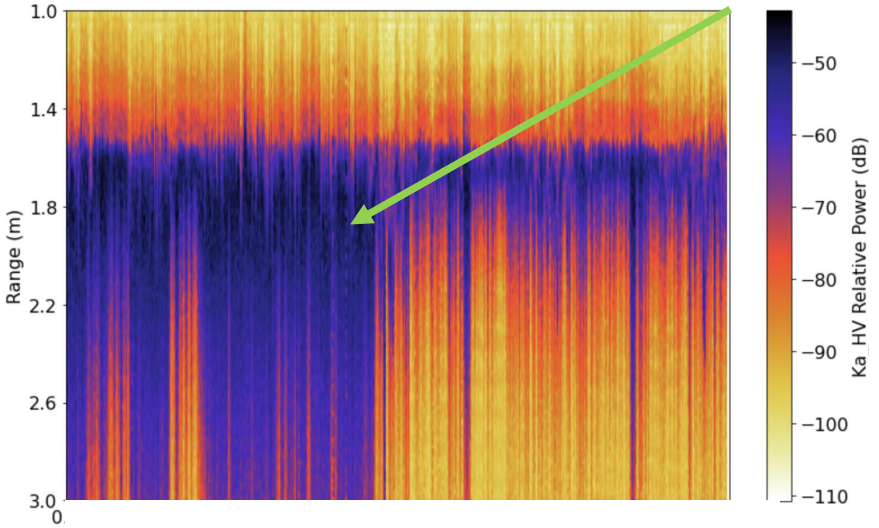


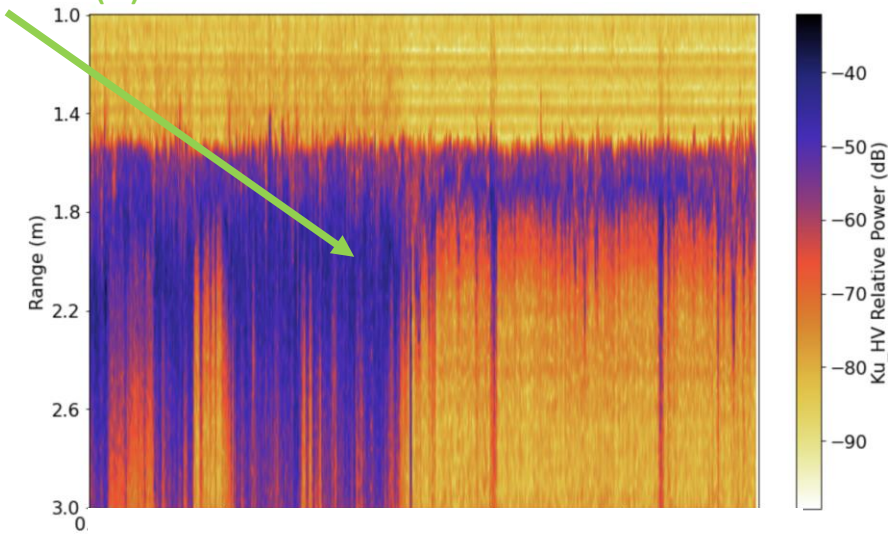


earth.esa.int

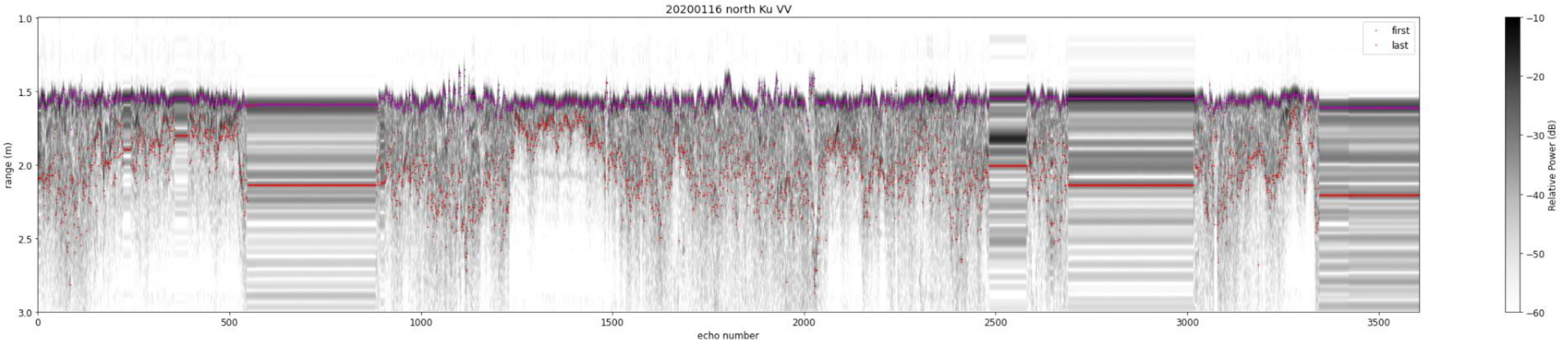
snow/ice interface (?)

HV



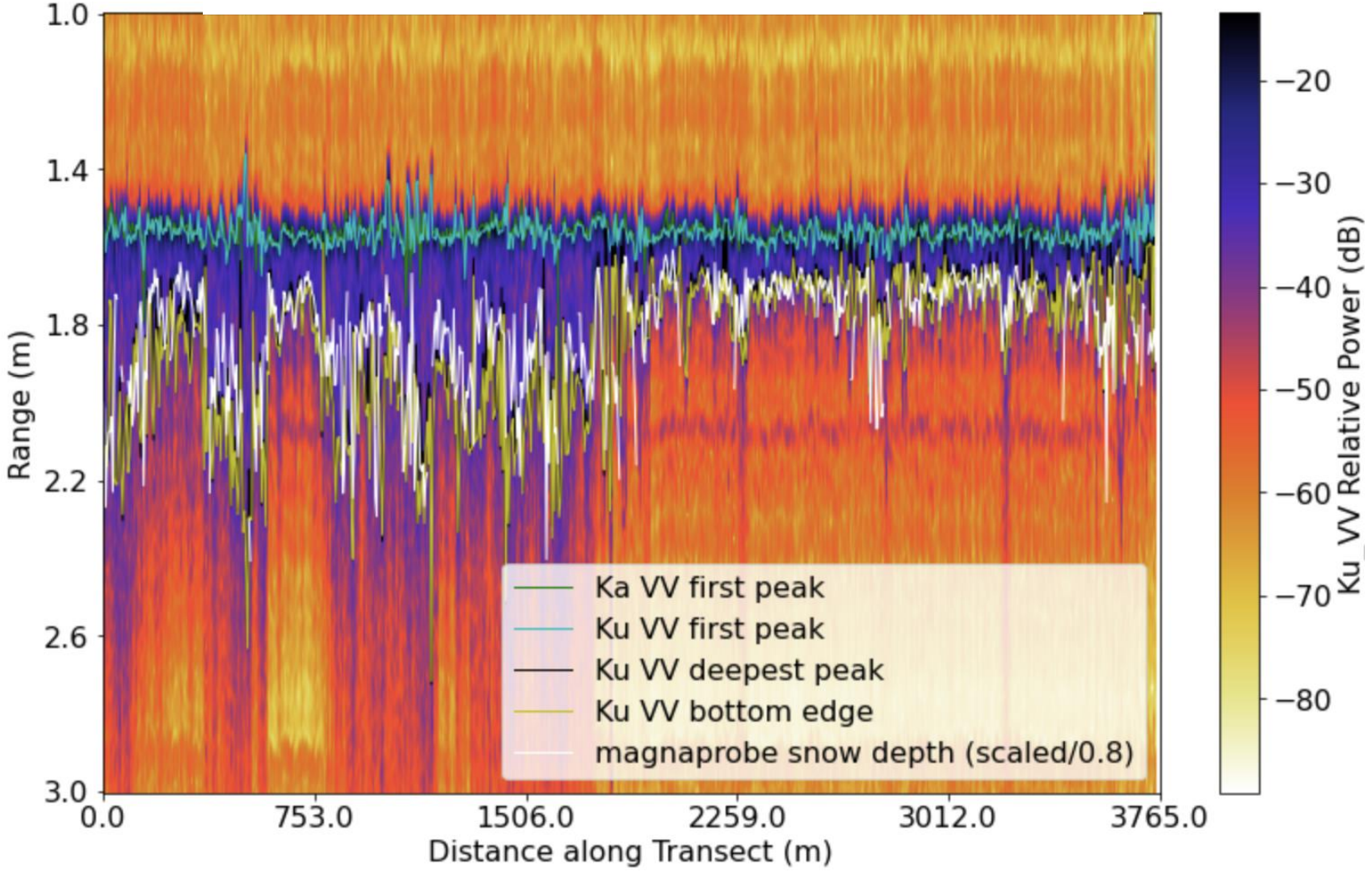


Data from [illegible]th January 2020



Current/future work:

- Deconvolution
- AI/ machine learning

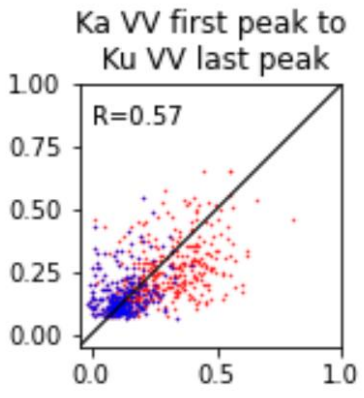


Data from
January 2020

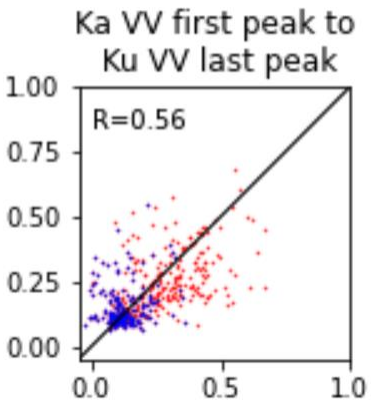
Northern transect
Southern transect

MagnaProbe-derived snow depth (m)

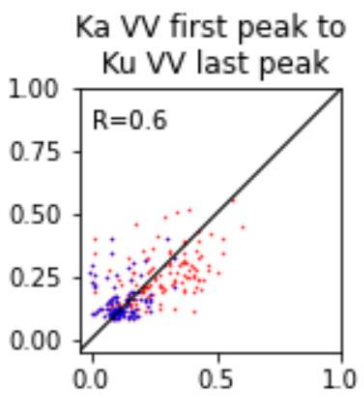
binsize: 3



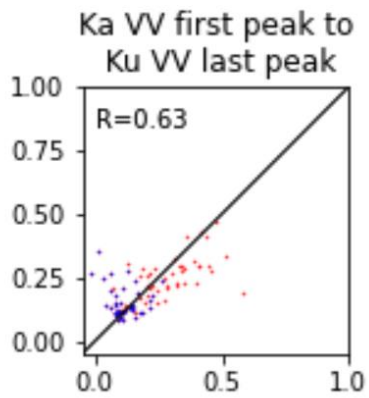
binsize: 5



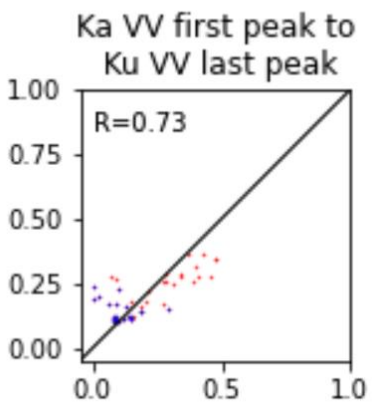
binsize: 10



binsize: 25

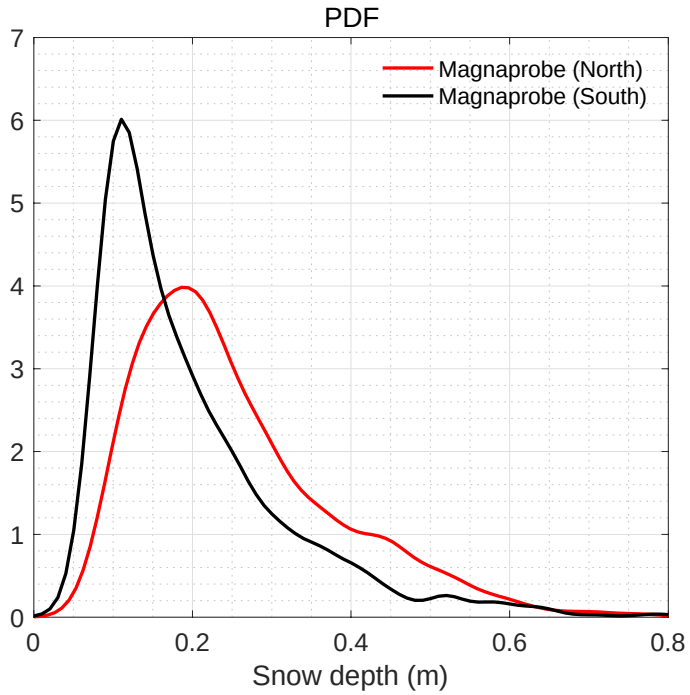


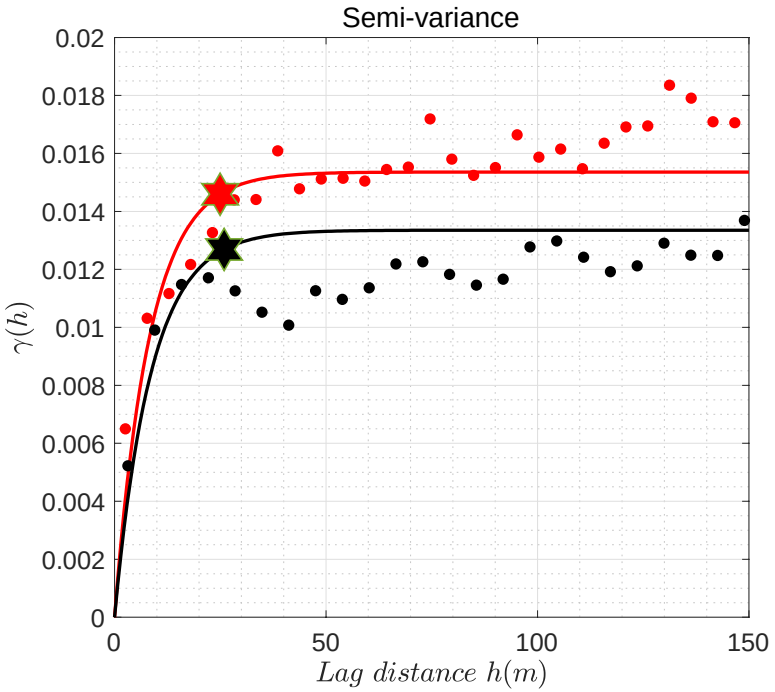
binsize: 50

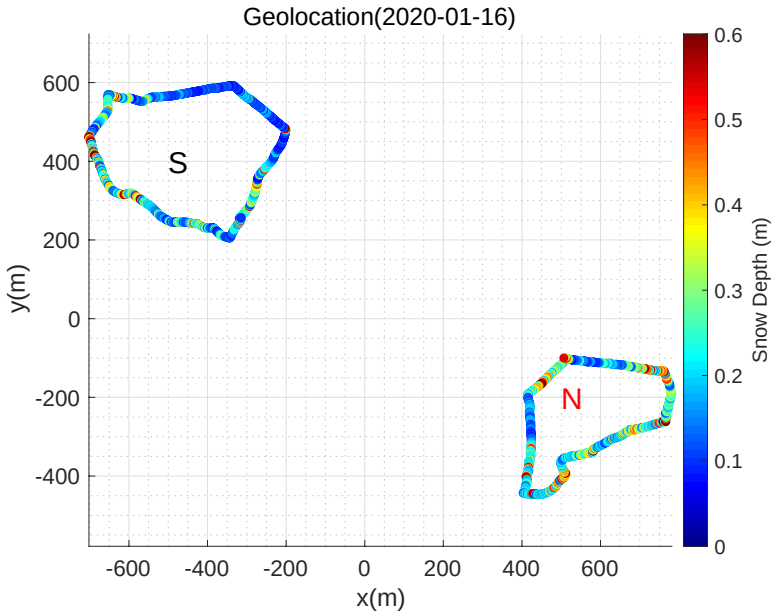


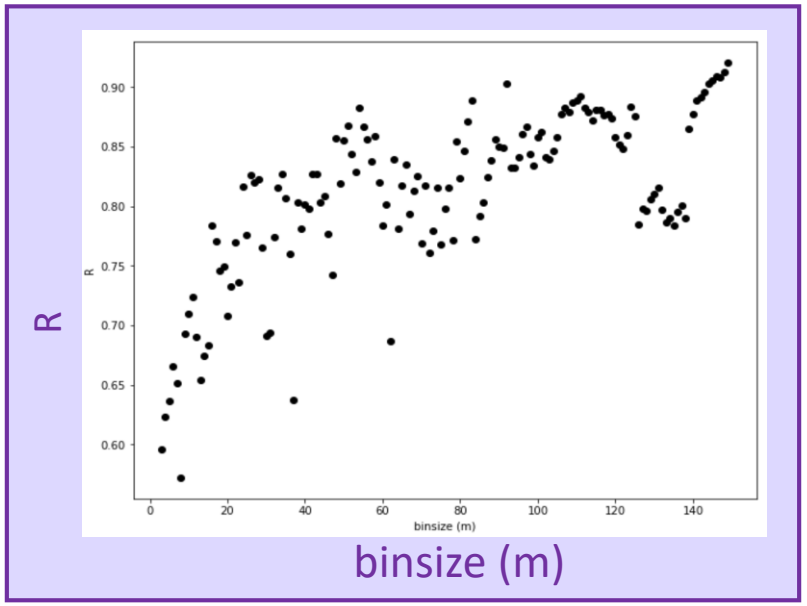
KuKa-derived snow depth (m)

2020-01-16 Variogram analysis by Lu Zhou







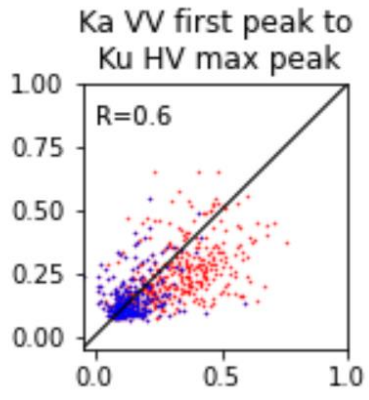


Northern transect

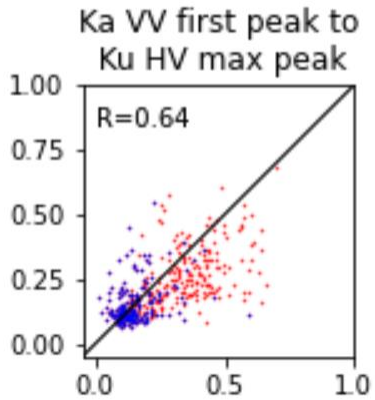
Southern transect

MagnaProbe-derived snow depth (m)

binsize: 3



binsize: 5



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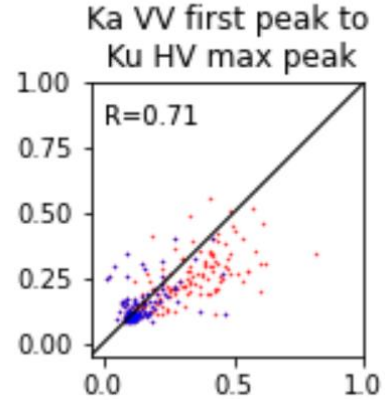

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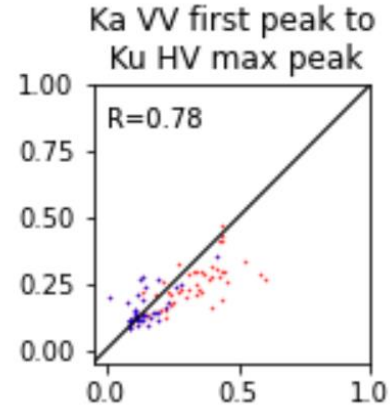
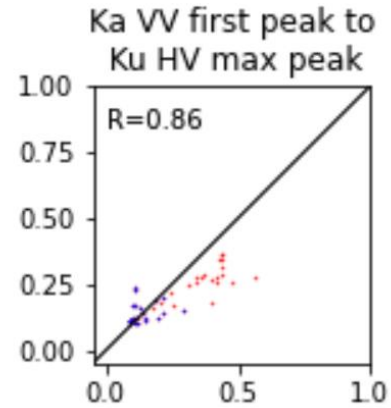
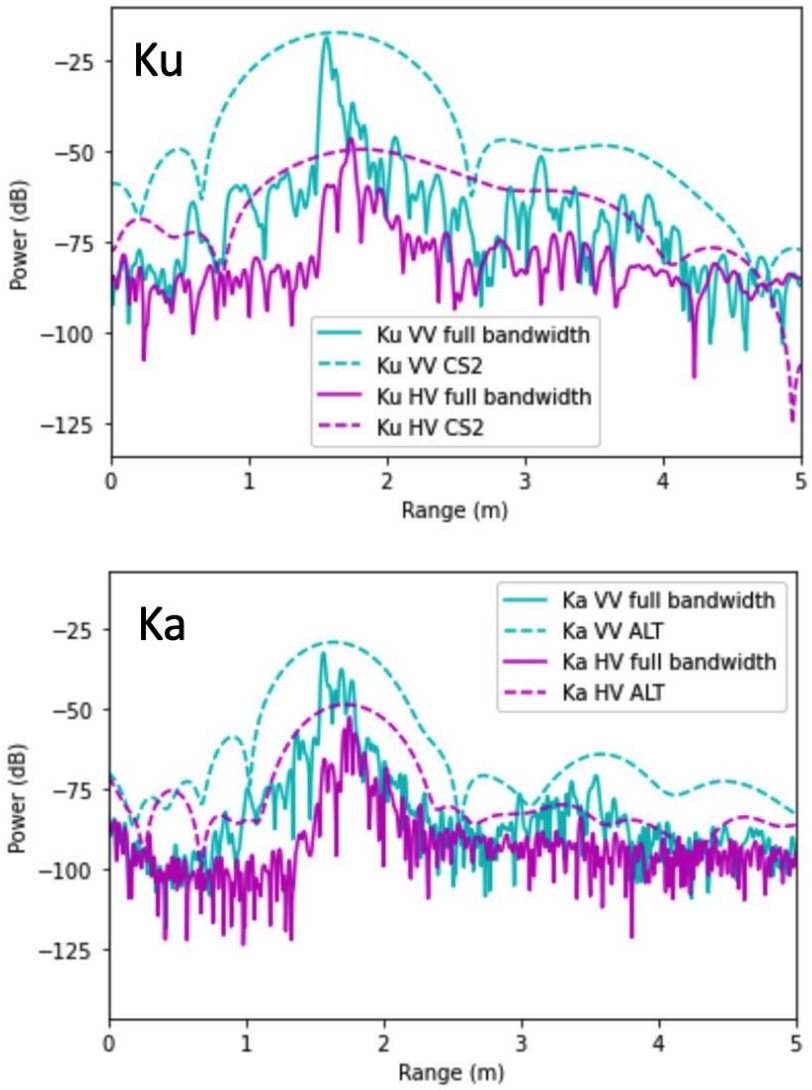


binsize: 50

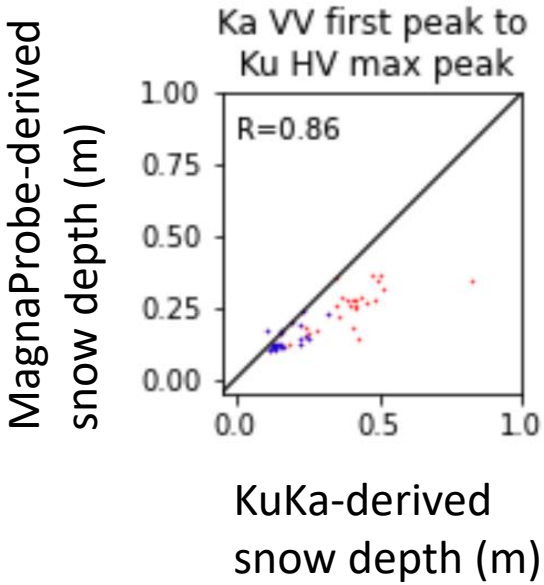


KuKa-derived snow depth (m)

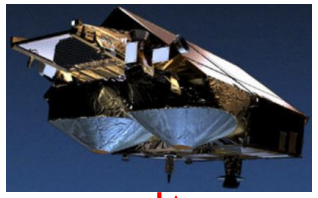


Northern transect

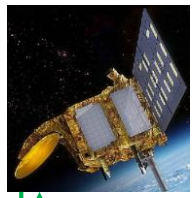
Southern transect



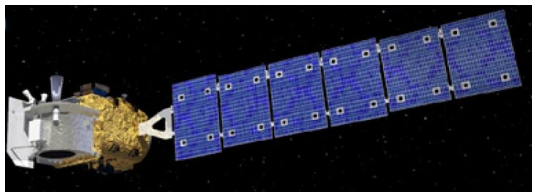
CryoSat-2



ALTiKa



ICESat



13.575 GHz

35 GHz

532 nm

snow

?

$speed = f(density, wetness \ldots)$

ice lens

moisture

brine

grain characteristics

crust

snow

ice

sea ice

sea water

	Ku-band (~CryoSat-2)	Ka-band (~ALTiKa)
Frequency	12-18 GHz	30-40 GHz
Range resolution	2.5 cm	1.5 cm
Antenna beamwidth	16.9°	11.9°

Rothera Research Station

Photo: Stefan Hendricks

Google

Thank you!

NERC NE/S002510/1