

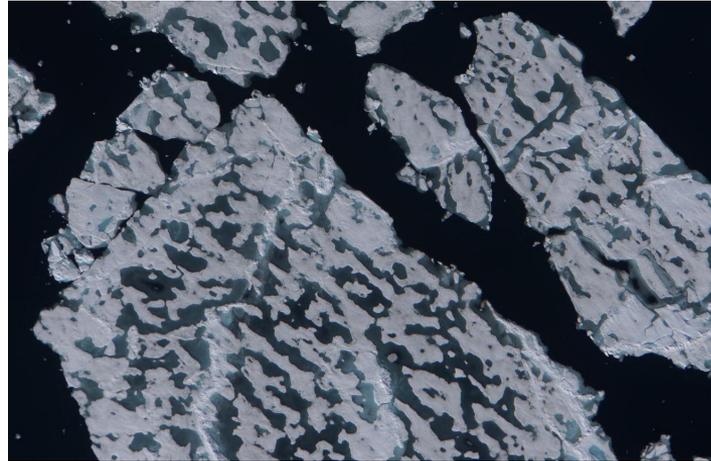


Machine Learning for the Detection of Arctic Melt Ponds from Infrared Imagery

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Buth, Dennis G. Wilson

Melt Ponds on Arctic Sea Ice

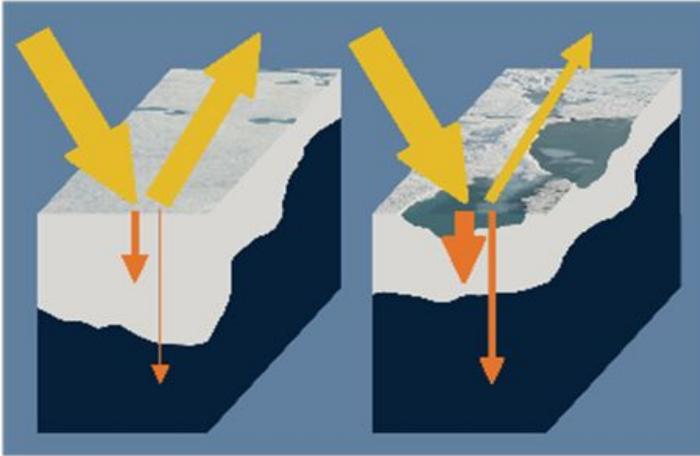
- Form from surface meltwater during summer
- Can cover up to 60% and 80% of sea ice area



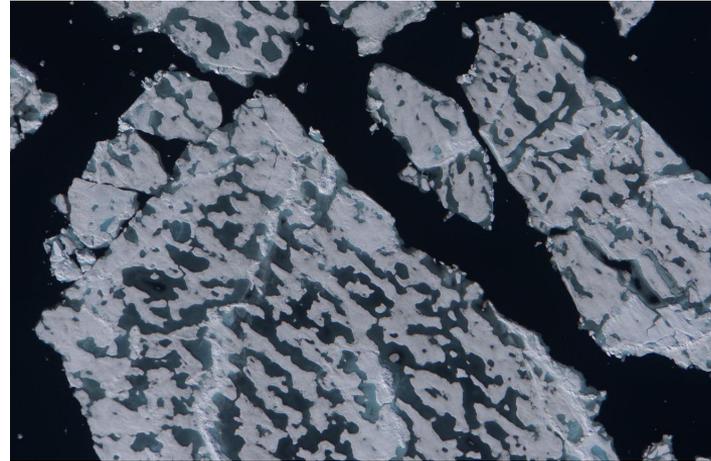
PS131 ATWAICE Campaign, expedition grant AWI_PS131_02.

Melt Ponds on Arctic Sea Ice

- Form from surface meltwater during summer
- Can cover up to 60% and 80% of sea ice area
- Significantly reduce surface reflectivity



Sunlight reflectance of sea ice without melt ponds (left) and with melt ponds (right). Image by Hannah Niehaus.



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Melt Pond Observations

- Melt pond parameterization is a major source of uncertainty in climate models and sea ice concentration retrievals
- Limited data available

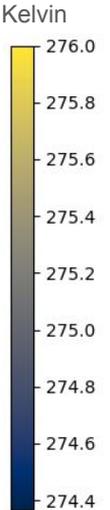
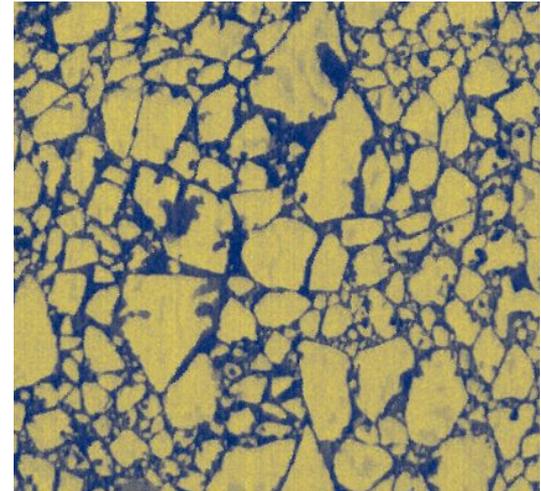
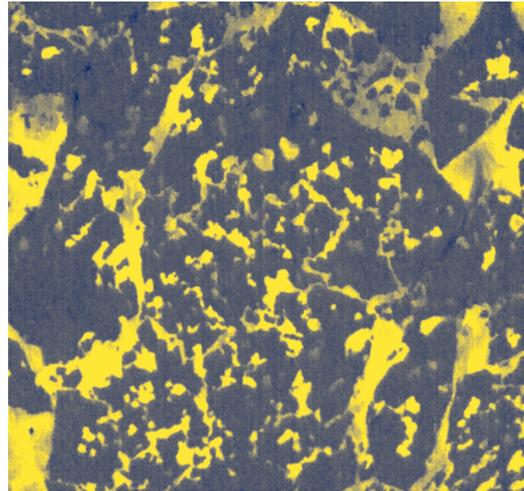
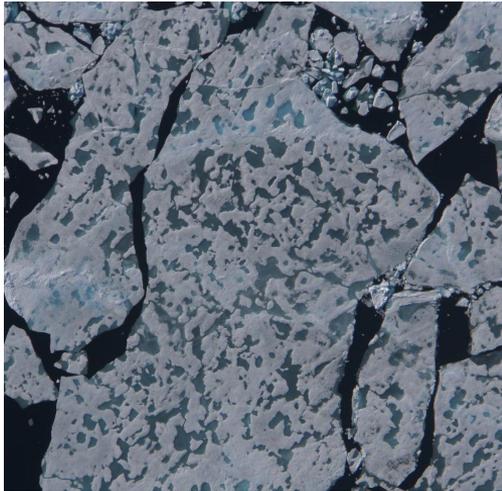
Goal: Enhance melt pond data by developing a method to segment helicopter-borne thermal infrared (TIR) data into different surface classes.

Helicopter-borne TIR Dataset

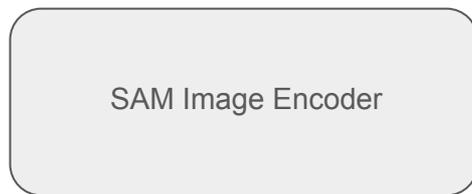
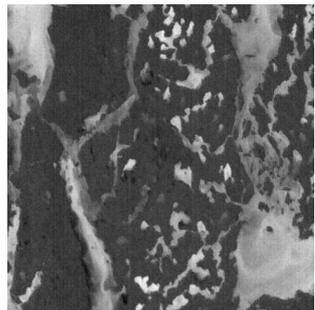
- TIR measures thermal radiation emitted from the surface
- Less dependent on daylight

Helicopter-borne TIR Dataset

- TIR measures thermal radiation emitted from the surface
- Less dependent on daylight
- Challenge: Temporally and spatially varying surface temperatures



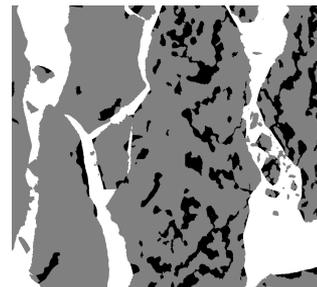
AutoSAM for Melt Pond Segmentation



- ViT pre-trained on SA-1B
- frozen weights



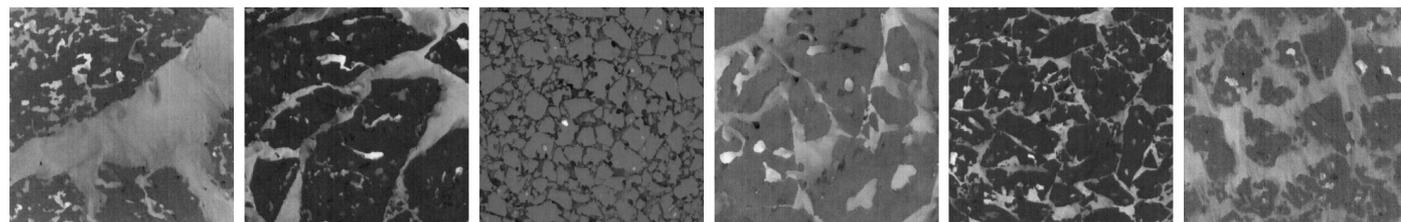
- ViT
- finetuned on TIR



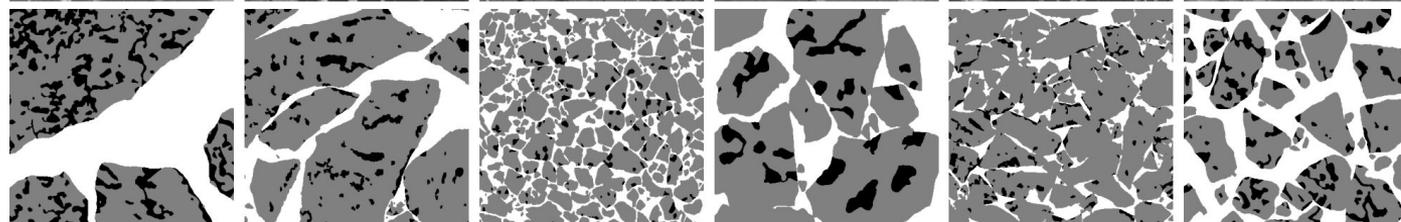
Results

	mean	melt pond	sea ice	ocean
AutoSAM	0.667	0.435	0.868	0.698
U-net	0.582	0.320	0.823	0.602

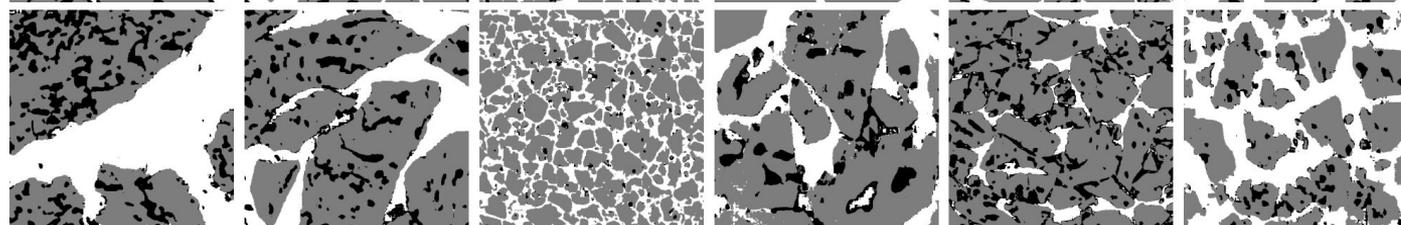
Intersection over Union



input



ground truth



prediction

1

2

3

4

5

6