

Prosjektbeskrivelse (Project description) for master/-, bachelor/-, prosjektoppgaver og spesialpensum

Foreløpig oppgavetittel/title	Thin sea ice detection with CryoSat-2
Emnekode/code	FYS-3931
Student navn/name	Trym Fjeldstad Varland

Problemstilling/content:

Over the past two decades sea ice in the Arctic basin has transitioned from mainly thick, old multi-year ice to thinner, younger first-year ice types, as the northern polar climate has warmed at a rate 3-4 times faster than the global average. The thickness of the ice is a critical consideration for maritime vessels navigating ice-covered waters, for instance in the region around Svalbard, so it is a high priority of the Norwegian Ice Service to remotely detect the ice thickness from space.

We can detect the thickness of sea ice with the spaceborne SAR Altimeter CryoSat-2; however, previous research has suggested that CryoSat-2 has very low accuracy when the ice is thinner than ~1 meter in thickness.

Mål/objectives:

In this project we will re-evaluate the lower detection limit of CryoSat-2 to see if we can get reliable measurements down to a few 10s cm in thickness.

Metode/methods:

For this goal, we will use the latest physically based dataset of CryoSat-2 sea ice freeboard derived from a SAR waveform model applied to the altimeter observations. The student will compare this to independent thin sea ice measurements from the SMOS L-band radiometer and to airborne measurements collected on the European Space Agency SMOSice campaign. Other instruments that estimate thin sea ice would also be relevant, this could be measurements from the NASA's Operation IceBridge or the Beaufort Gyre Exploration Program (BGEF) mooring array for example.

Tidsplan/timetable:

The timetable would also include, meeting with the supervisor every other week.

Week 6-9: reading papers

Week 10-11: Investigate other instruments that would be relevant

Week 12-13: Start to organize data and areas of interest

Week 14-16: Complete satellite data analysis and move on to reference datasets

Week 17-19: Complete analysis and start writing up

Teknisk/vitenskaplig samarbeid /Technical/specific partner (if any):

Litteratur/bibliography:

[https://agupubs-onlinelibrary-wiley-com.mime.uit.no/doi/full/10.1029/2012GL050916](https://agupubs.onlinelibrary-wiley-com.mime.uit.no/doi/full/10.1029/2012GL050916)

SMOS-derived thin sea ice thickness, <https://tc.copernicus.org/articles/8/997/2014/>

A weekly Arctic sea-ice thickness data record from merged CryoSat-2 and SMOS satellite data, <https://tc.copernicus.org/articles/11/1607/2017/tc-11-1607-2017.html>

Assessment of contemporary satellite sea ice thickness products for Arctic sea ice, <https://tc.copernicus.org/articles/13/1187/2019/tc-13-1187-2019.html>

Monitoring Arctic thin ice: a comparison between CryoSat-2 SAR altimetry data and MODIS thermal-infrared imagery, <https://tc.copernicus.org/articles/17/809/2023/>

A Spatiotemporal Comparison and Assessment of Multisource Satellite Derived Sea Ice Thickness in the Arctic Thinner Ice Region, <https://ieeexplore.ieee.org/abstract/document/10504637>

Sikkerhetsopplæring/safety:

Studenter som skal jobbe selvstendig i felt, på tokt eller laboratorier, må ha nødvendige HMS-kurs. Kryss av for nødvendige kurs.


Students who will work independently in the field, on a tour or in the laboratory need the necessary HMS- courses. Who is necessary for this project?

	HMS-0501 Sikkerhet på laboratoriet, felt og tokt
	HMS-0504 Biologisk materiale
	HMS-0506 Strålevern

Signatures:

Student, formell veileder og andre veiledere er enig i alle punkter i veiledningskontrakten og bekrefter å ha satt seg inn i de [etiske retningslinjene for veiledning](#).

By signing this application form, the supervisor commits to providing academic supervision and confirms that the use of resources is approved. By filling in and signing this application form, the student secures academic supervision according to the attached [ethical guidelines](#), and the necessary resources to complete the course.

Veileder(e) / supervisor, (date and signature)	30/01/2025 Jack Landy	
Student (date and signature)	30/01/2025 Trym Varland	