ESA dual-frequency campaign datasets

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EOP-SMS, Campaigns section

Dual frequency workshop
13-14 Jan 2021

Overview

- CryoVex Heritage: CryoVex campaigns before 2016 (Ku & laser)
- Evolution: CryoVex campaigns after 2016 (Ku & Ka & laser)
- Airborne sensors
- Ground radar measurements
- Data availability: ESA campaigns archive and DOI’s

The CryoVEX heritage

2002

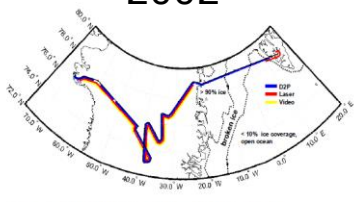
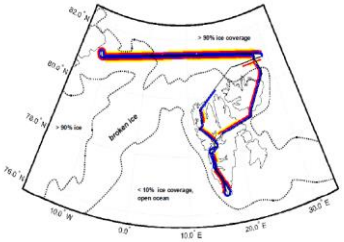


Figure 3a. May 18, 2002: Transit from Thule to Svalbard.



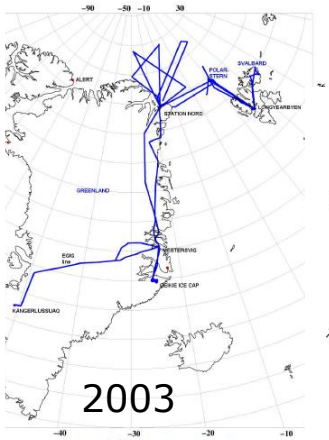
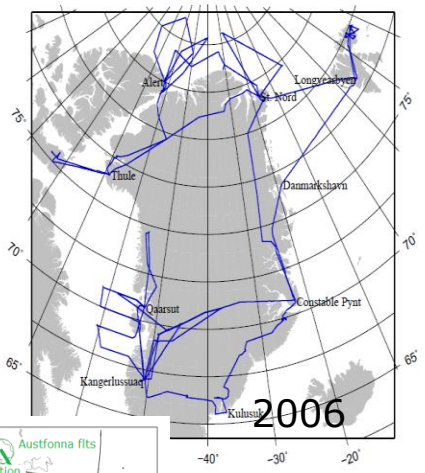
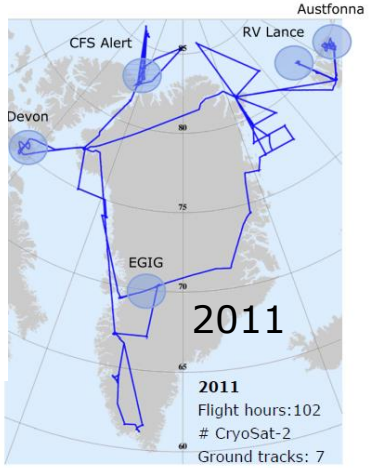
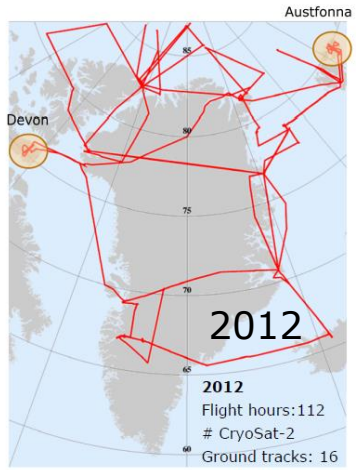


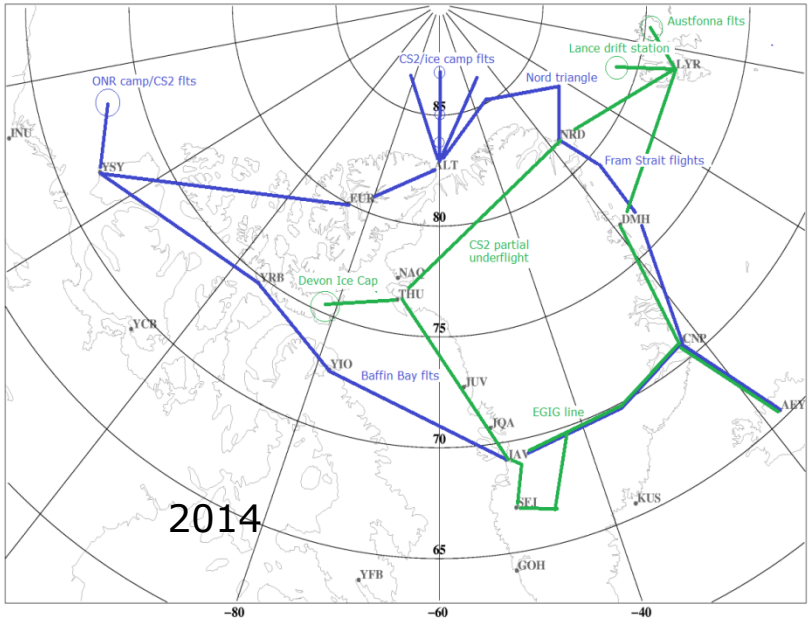
Fig. 2. Flight tracks of Cryovex-2003

2003









The CryoVEX heritage

Validation approach based on:

- Repeated campaigns to capture temporal changes in snow/ice geophysical characteristics
- Coordinated and collocated ground, aircraft and satellite experiments

✓ Sea ice campaigns in 2002, 2003 and 2008, 2011, 2012, 2014

✓ Land ice campaigns in 2003, 2004, 2006, 2007, 2008, 2011, 2012, 2014, 2016

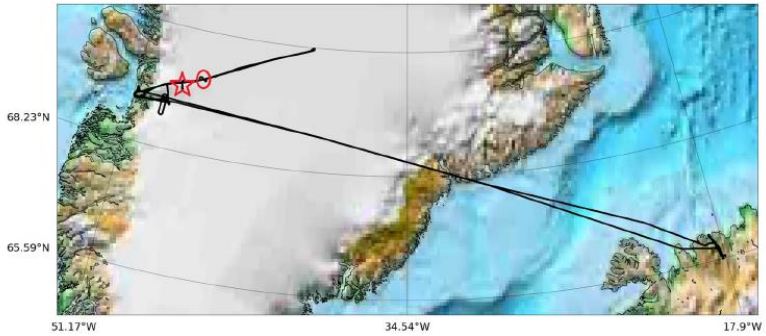
✓ Collaboration with NASA and IceBridge campaign activities from 2011 to 2017

✓ Collocation of CryoSat/Airborne measurements mainly through underflights

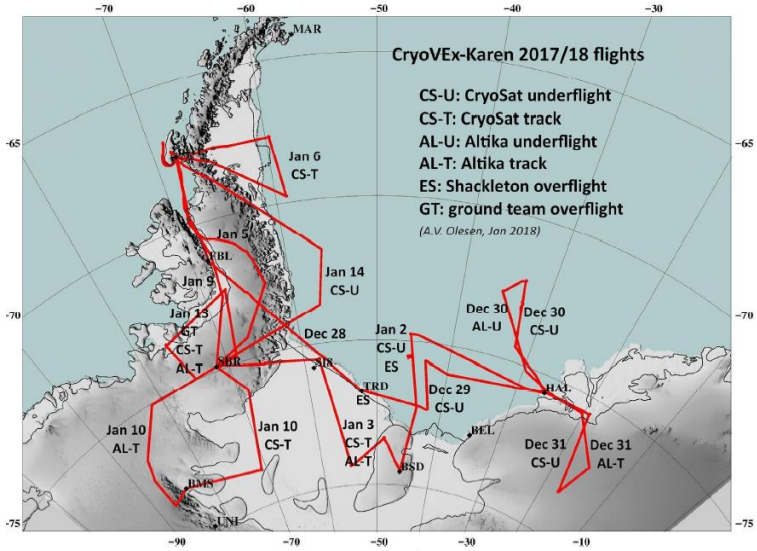
✓ Most data collected during spring (logistics, year-to-year comparisons enabled etc…) and in the Arctic

CryoVex evolution

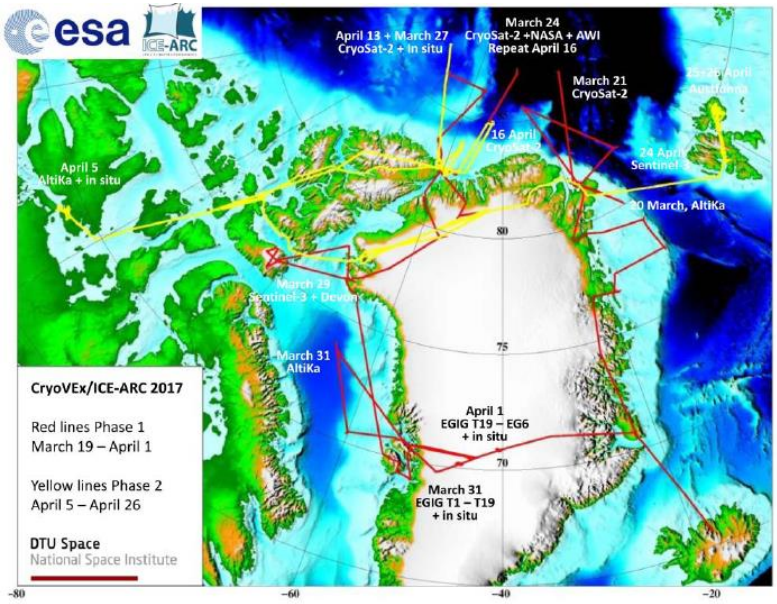
Greenland Oct 2016



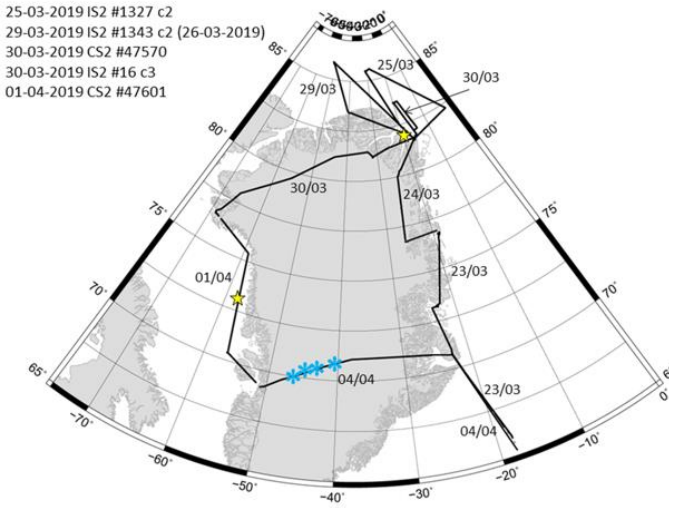
Antarctica Dec 2017/Jan 2018



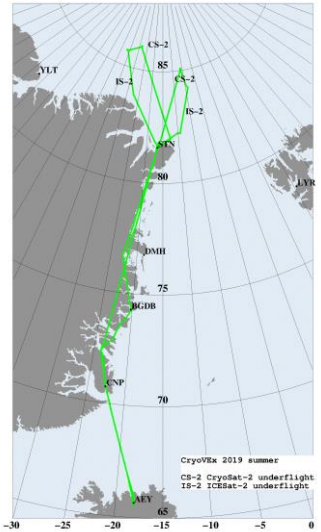
Arctic Mar/Apr 2017



Greenland Mar/Apr 2019



Greenland August 2019



The CryoVEX evolution

Validation approach based on:

- Repeated campaigns to capture temporal changes in snow/ice geophysical characteristics + **explore future mission concepts such as two-frequency Ka- and Ku-band** radar altimeter concepts for future polar monitoring (CRISTAL).
- Coordinated and collocated ground, aircraft and satellite experiments

✓ Sea ice campaigns in 2017, 20018 and 2019

✓ Land ice campaigns in 2016, 2017, 20018 and 2019

✓ Collaboration with NASA and IceBridge campaign activities ended in 2017, start of collaborations with CNES, LEGOS and JAXA

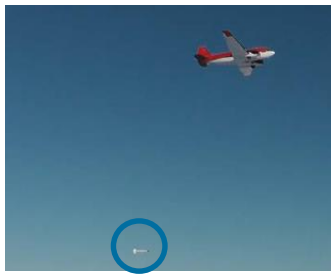
✓ Underflights of CryoSat/S-3/Altika and Icesat-2

✓ **Not only spring measurements but summer campaign in Antarctica in 2017/2018 and first summer Greenland campaign in 2019**

Airborne Sensors

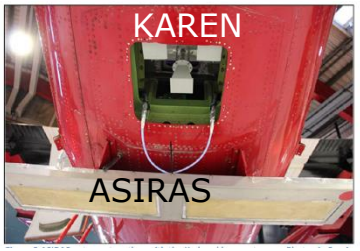
Until spring 2016:

- ALS
- Ku-Band radar ASIRAS (built by RST) and discontinued in 2020 after more than a decade of exceptional performance
- EM-Bird (on ESA campaigns led by AWI)



Since fall 2016:

- ALS
- ASIRAS (till spring 2019)
- Ka-Band radar KAREN (built my MetaSensing)
- CReSIS Ku/Ka-Band Radar (since summer 2019 and planned for 2021/2022 campaigns)



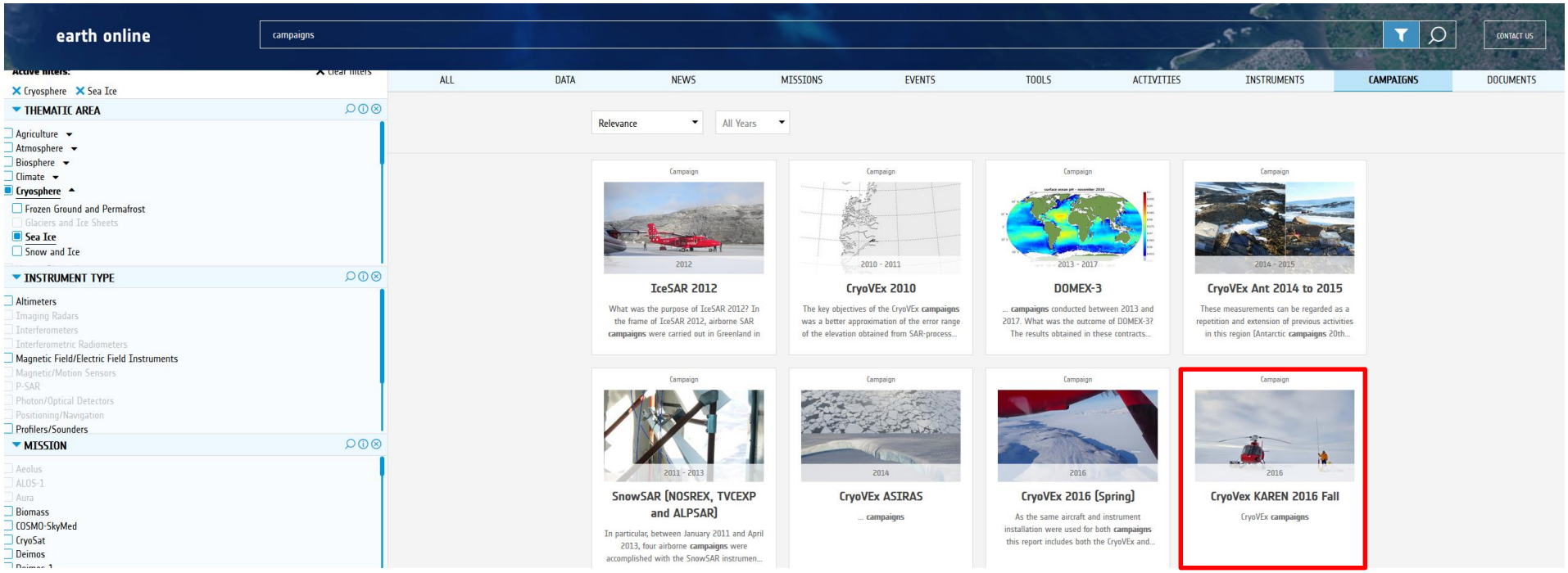
Radar ground measurements

- Until 2019, radar ground penetrating radar at Ku-Band from Leeds (Andy S. group)

- MOSAIC expedition (Sept 2019-Sept2020) unveiled the new Ku, Ka- band ground penetrating radar from UCL/Univ. Manitoba (Julienne S. group)

New webpages and DOI

https://earth.esa.int/eogateway/search?text=campaigns&category=Campaigns&filter=cryosphere,sea-ice&sortby=RELEVANCE



- ✓ All CryoVEx campaigns up to Antarctica 2017/2019 available in the ESA archives
- Data from 2019 spring and summer will be available by Q2 2021
- Data from ground KuKa MOSAIC is expected to be available by Q2 2021

New webpages and DOI

- Collect simultaneous Ku-band radar altimeter data with ASIRAS and ALS data, to study penetration of radar signals into the ice sheet
- Repeat of the earlier flown EGIG-line to detect ice sheet changes
- Surface measurements (shallow ice cores and ice densities) on the ice sheet inland of Ilulissat at T1, T4 and T5 on EGIG-line and in the Ilulissat glacier region using helicopter
- Investigate dependencies of SARIn phase information from coincident measurements of KAREN and ASIRAS in high-altitude mode

Scientists studying the ice sheet. Credit: A. Shepherd (Univ. Leeds)

What was the outcome of the CryoVex-KAREN 2016 Fall Campaign?

Airborne data was acquired over the Greenland Ice Sheet along the EGIG-line at different altitudes representing both the ablation, percolation and the dry snow zone. This data set along with the in-situ observations of density profiles from shallow ice cores and SnowMicroPen adds valuable information of the seasonal behaviour of the radar signals, which has so far only been obtained in the spring during previous CryoVEx campaigns.

The horizontal location of the KAREN and ASIRAS reference points from the post-processed data are within the expected accuracies of their physical displacement. Comparison of phases of coincident SARIn acquisition from KAREN and ASIRAS data show no direct dependencies. However, the phases seem to be anti-correlated, which is currently being investigated.

As expected KAREN show primarily surface scattering with little penetration, whereas ASIRAS show primarily surface scattering in the percolation zone and penetration down to about 15 m in the dry snow zone with several visible melt layers.

Download the CryoVex-KAREN 2016 Fall Campaign Final Report

Campaign Summary

Year	2016
Thermatic area	Cryosphere/Land ice
Geographic Site	Greenland

Digital Object Identifier: https://doi.org/10.5270/esa-kd5tk5w - CryoVex-KAREN 2016 Fall Campaign: "ESA CryoVEx/KAREN 2016 fall Campaign - First airborne field campaign with combined Ku/Ka-band radars over the EGIG-line with coincident in situ measurements"

Data

A short proposal must be written and submitted to access this data. Users must register through EO Sign In to submit the proposal.

How to submit a request for the campaign data on EO-DISP

Questions?