

Cryosurf

Combining CryoSat-2 Swath Altimetry with Operation Ice Bridge and IceSat-2 – A Neural Network Approach

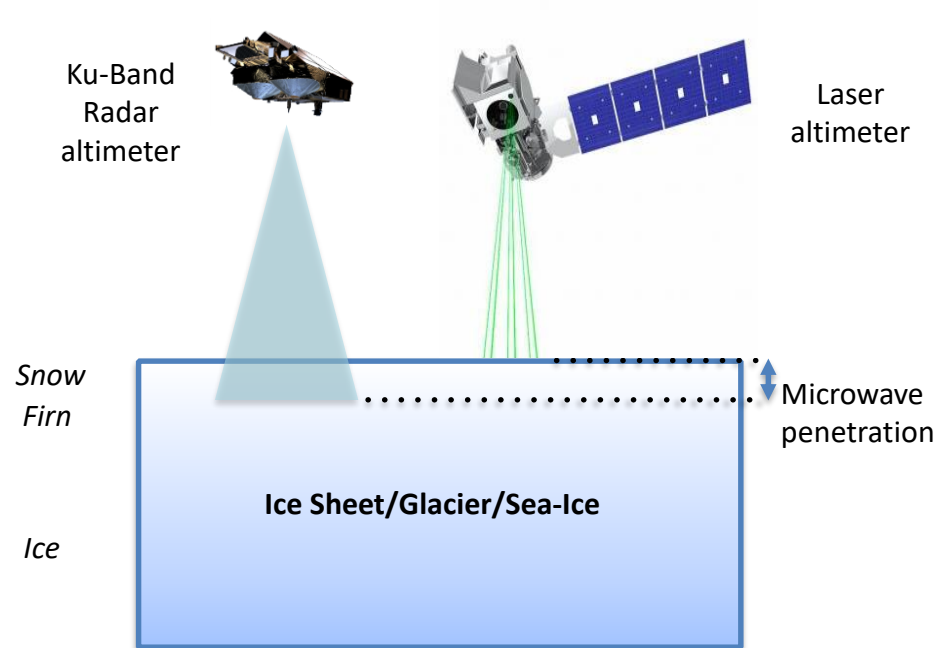
<https://cryosurf.org>

DUAL-CRYO - 13/01/2021

Background



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Complex multivariate physics:

- Incidence angle
- Surface density profile
- SARIn numerical approximations (especially in complex topography)

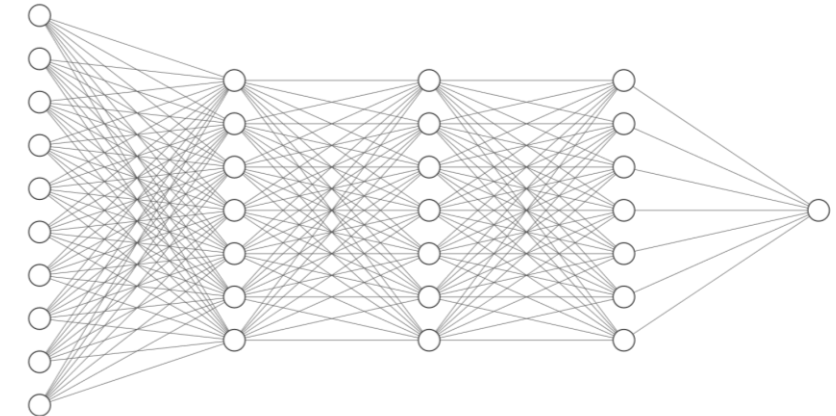
Known process limitations:

- Phase-departure for shallow slopes
- Open questions around validity for low power/coherence

Unknown limitations/systemic errors in both altimeters/bands?

Method

- Supervised regression neural network
- Dynamic architecture refined with grid search
- Thousands of permutations tested



Example model (Input size 10, 3 hidden layers, hidden layer width 7)

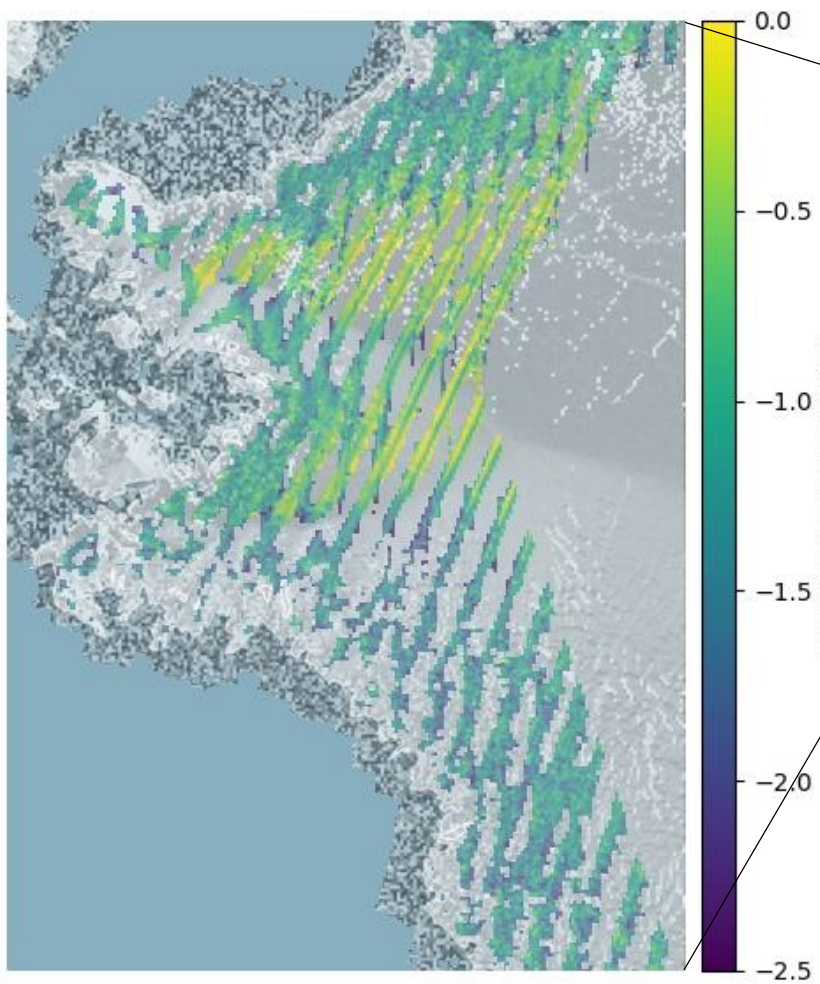
Point Info	Augmented from Reference DEM	Derived Swath Info
Coherence	Aspect (vectorized)	DistanceToPoca
Power	Roughness	Elevation-RollingMean
Elevation	AlongTrackSlope	6 Neighbouring Relative Elevations
	AcrossTrackSlope	Satellite heading (vectorized)

Example Input Parameters

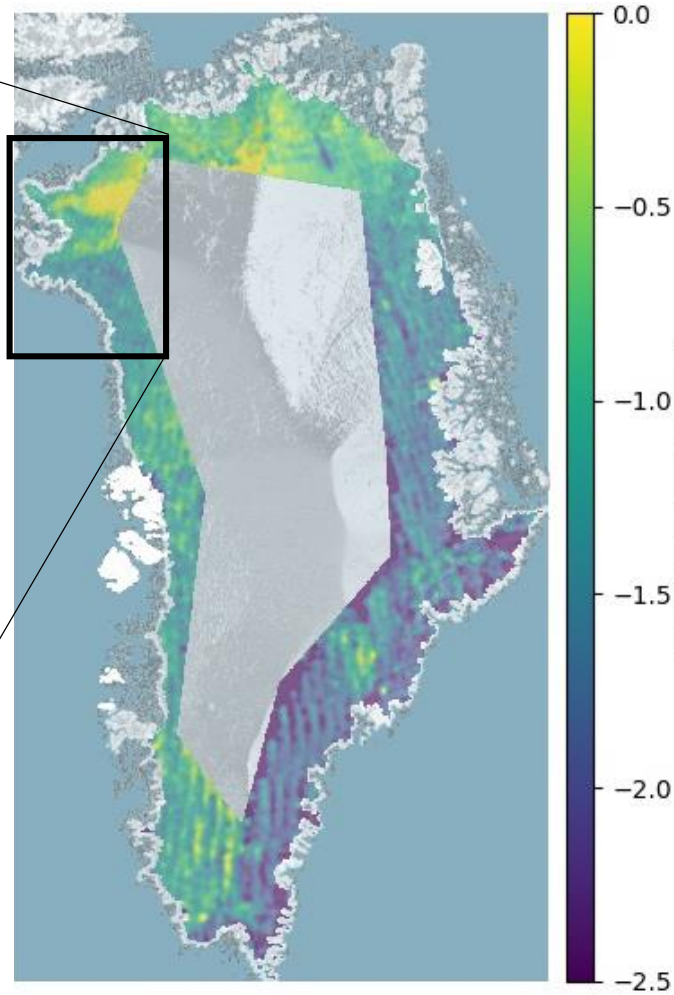
Model in Action



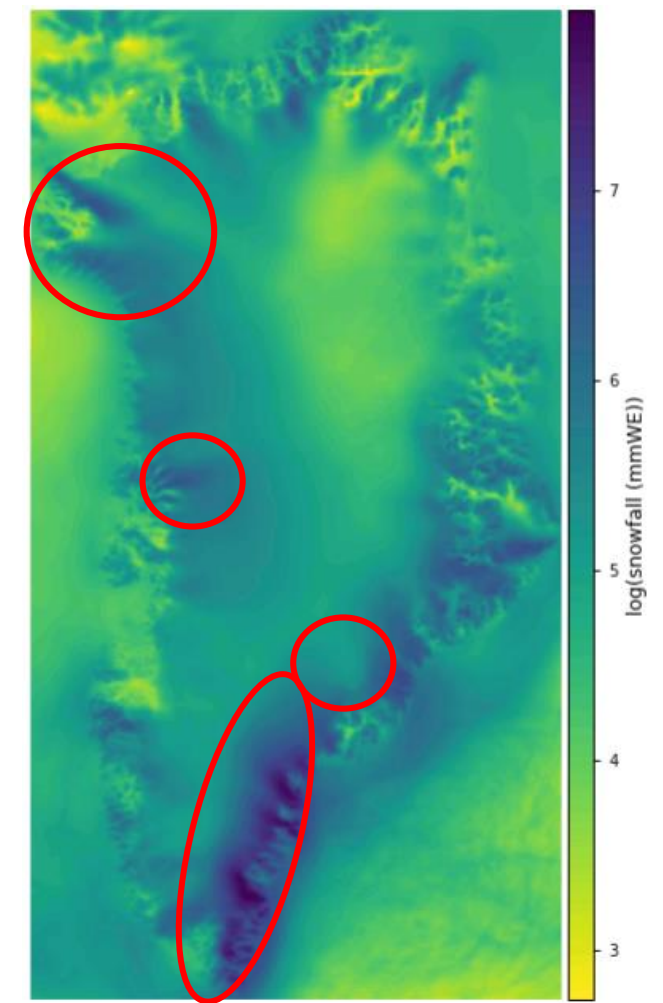
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Model predictions aggregated into a 2km gridded product for April 2016

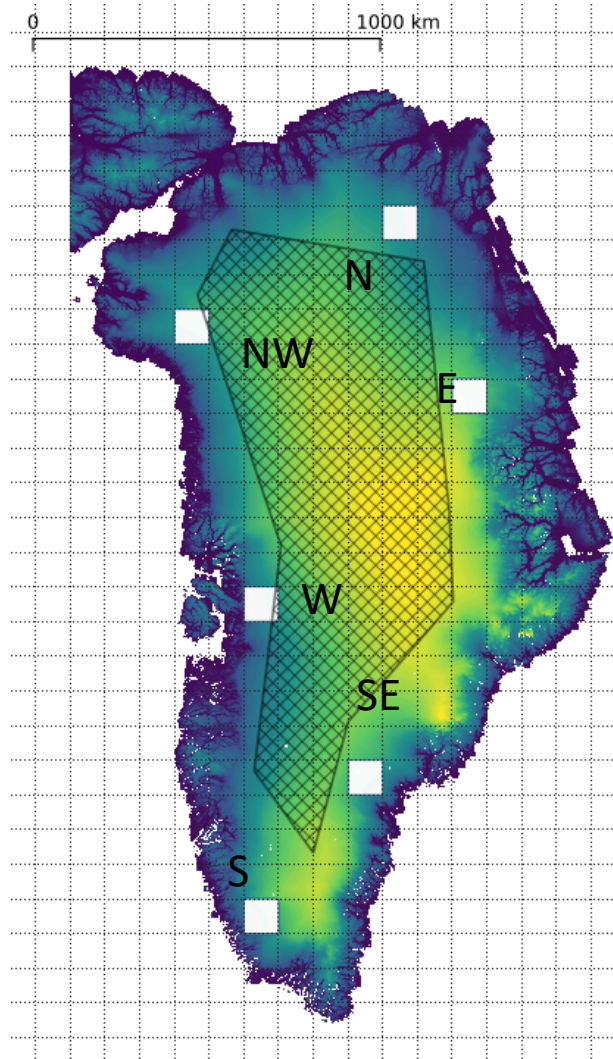


2km gridded product with interpolation and smoothing for entire GRIS SAR-In area, April 2016

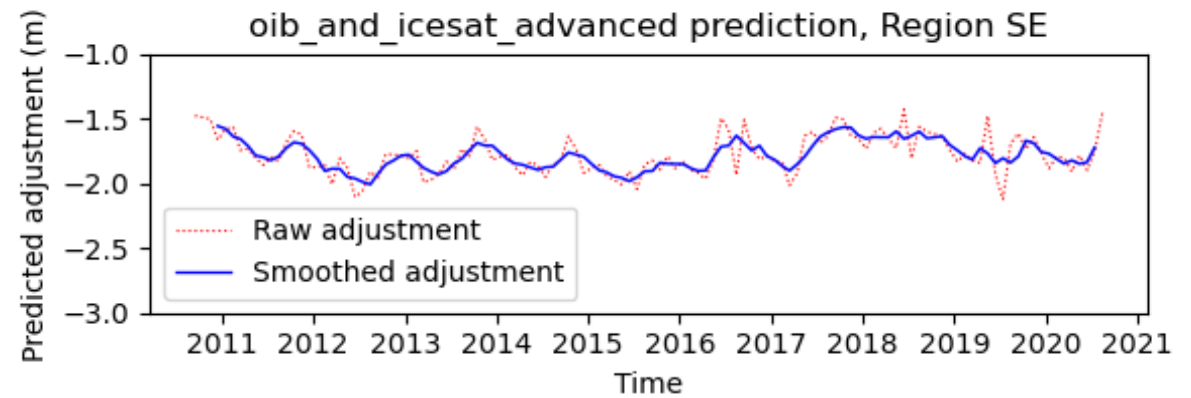


MAR model of accumulated annual snowfall 2016

Temporal Analysis



100km timeseries candidate selection



Model predicted monthly adjustment for 'SE' test area

Challenges

- Analysing and verifying the underlying model behaviours
- Correlating results to concrete observations or existing models

Roadmap

- Application to other SAR-In regions of interest (e.g. Antarctica, Alaska)
- Application to sea ice
- Extension to the Ka-band CRISTAL Mission
- Broader SARIn/RADAR <-> LIDAR conversions

Cryo2Ice Coincident Observations Explorer

Select ICESat-2 and CryoSat-2 data that **coincides in space and time** back to 2018

Predicted ground tracks for future planning

Simple download of coincident data from ESA and NASA

Future plans to add:

Operation IceBridge

CryoTempo-EOLIS

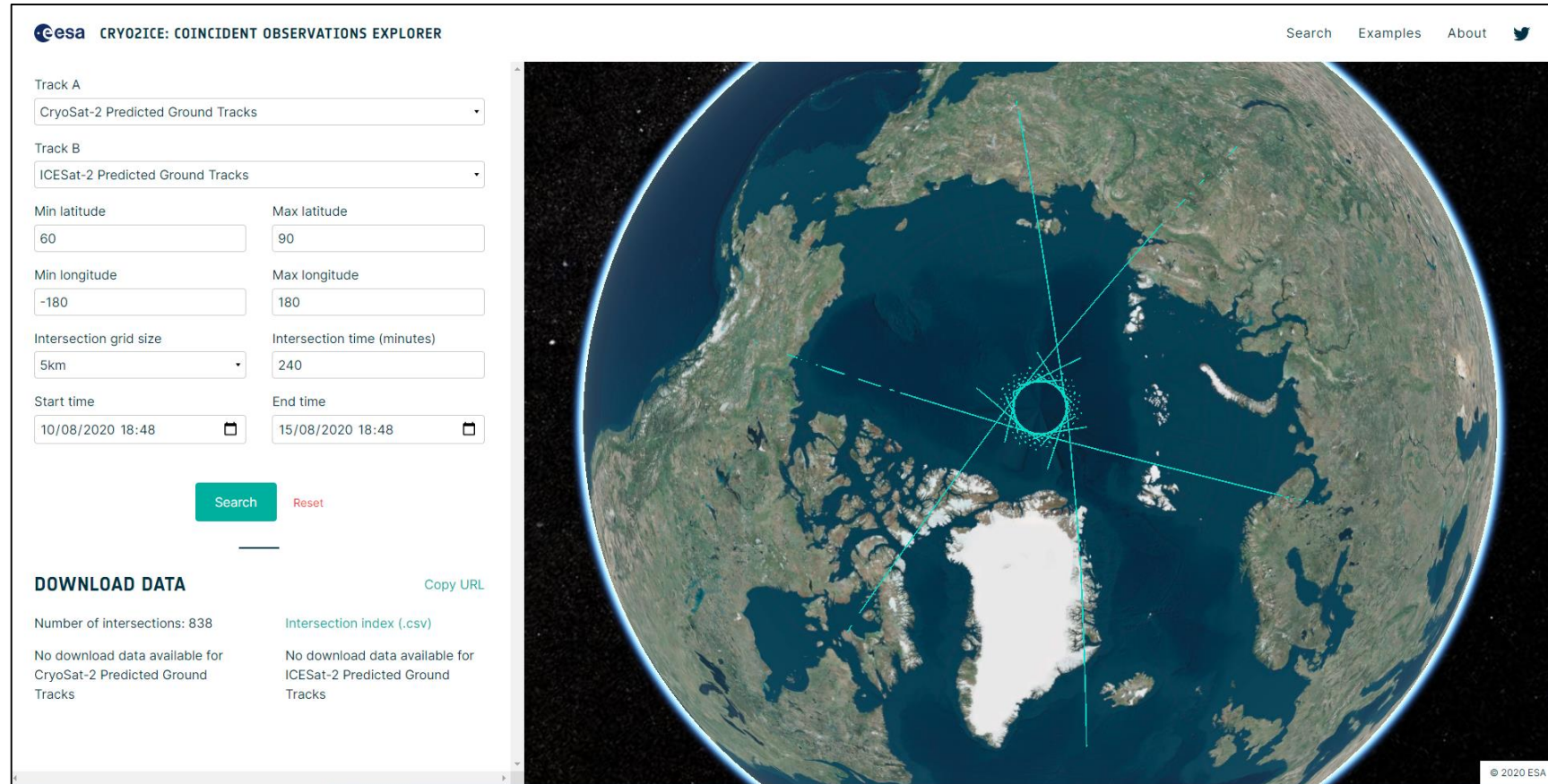
CryoVex

* All CryoSat2 data back to 2010

* IceSat ATL03

* Sentinel

* + More



Screenshot of cryo2ice.org in beta

Demo/Development site
Cryo2ice.org

First Release
February 2021



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