

An aerial photograph taken from an aircraft window, showing a vast, textured expanse of ice or snow covering the ground. The ice has a mottled, uneven appearance with various shades of blue and white. In the upper left corner, the dark interior of the aircraft and the white wing structure are visible. The sky is a clear, pale blue. The text is overlaid in the center-right of the image.

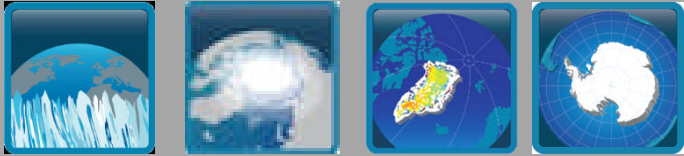
The Cryosphere CCI's

Glaciers CCI – 2011-

Greenland Ice Sheet CCI – 2012-

Antarctica Ice Sheet CCI – 2015-

Sea Ice CCI – 2012-



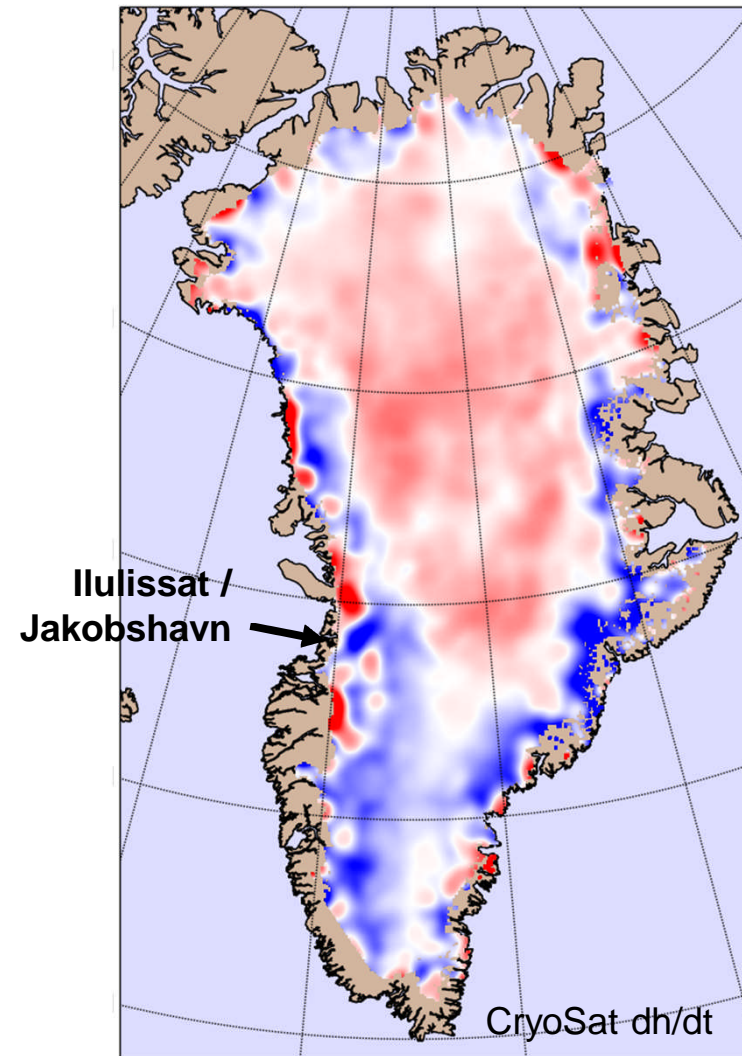
Ilulissat Climate Days 2015

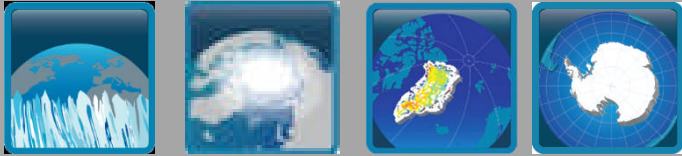
International workshops on
Changes of the Greenland Cryosphere

Ice Sheets CCI meeting

Ilulissat, Greenland, June 2-5, 2015

www.polar.dtu.dk/meetings

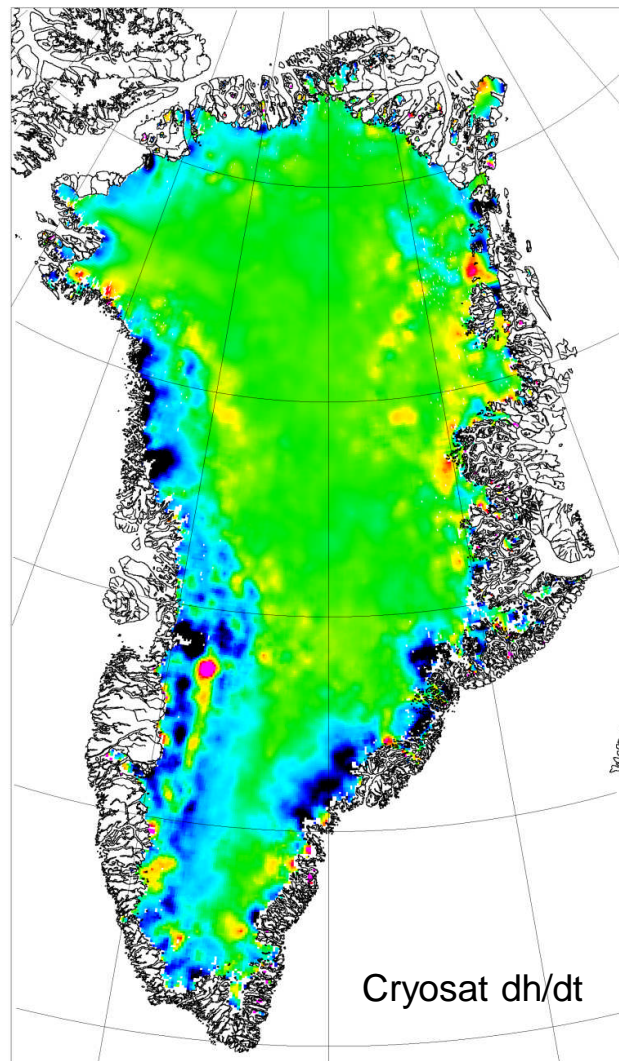




Greenland Ice Sheet CCI



Phase 1 2012-14 ECV's



ECV Product	Spatial resolution	Temporal resolution	Period	Spatial and temporal coverage, first 3-yr phase
Surface Elevation Change (SEC)	5 km grid	4 per year	1991-present	All ice sheet, 1991-2012 5-year running means
Ice Velocity (IV)	500 m grid	1 per year*	1991-present	Coastal margin (winter 1995/96 and summer 2008) Timeseries on Jakobshavn and Upernavik isbræ; North Greenland interior drainage basin (winter 1991/92)
Calving Front Location (CFL)	250 m shapefile	4 per year	1991-present	19 named major glaciers (some glaciers sampled yearly, depending on data availability)
Grounding Line Location (GLL)	250 m shapefile	1 per year	1991-present	Petermann, Hagen and 79-Fjord Glaciers

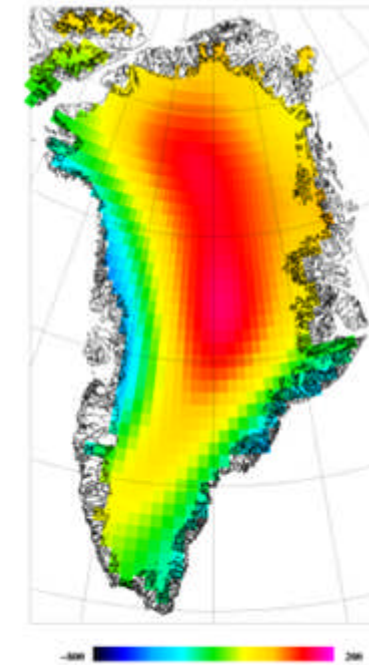
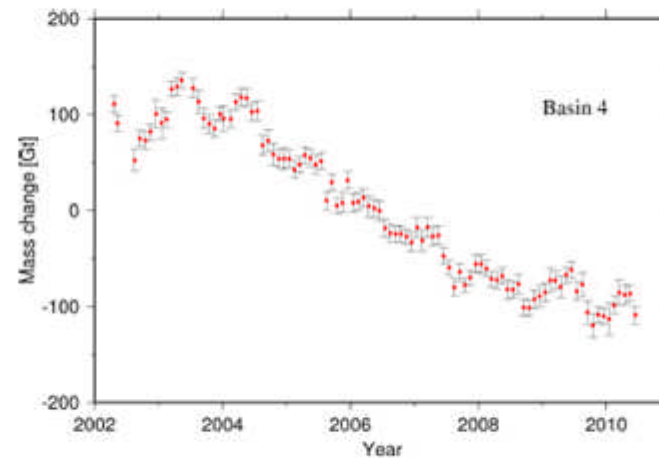




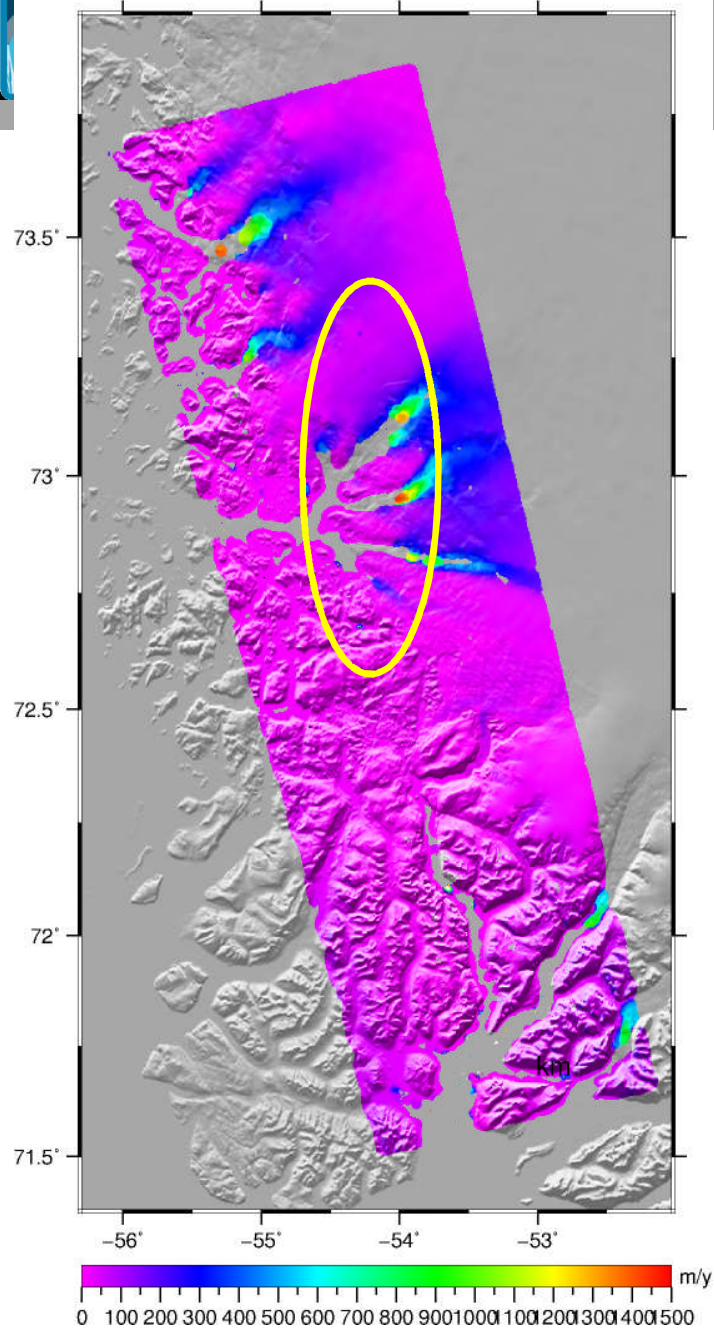
Greenland Ice Sheet – 2015-18



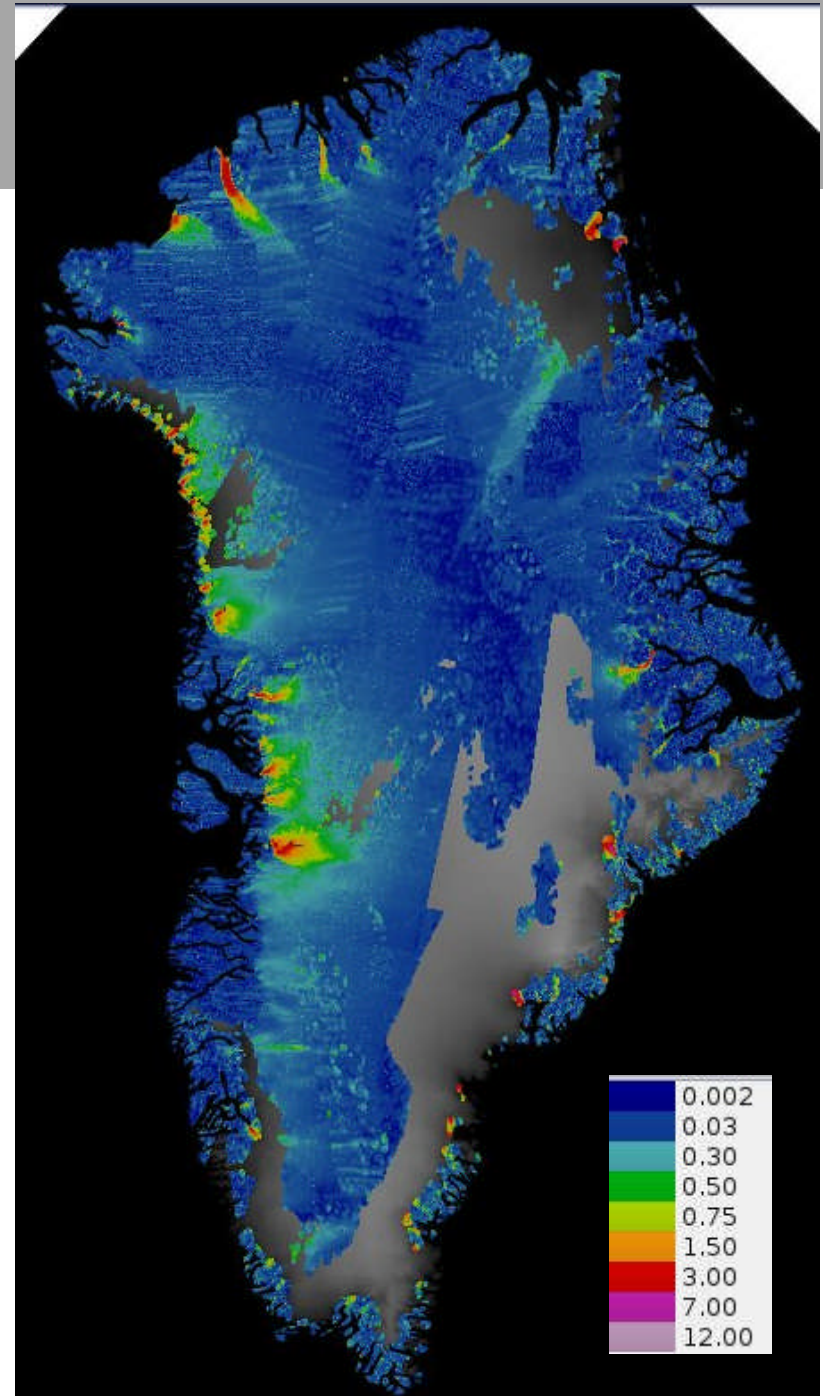
- Surface Elevation Change (SEC) – Rerun ERS/Envisat + CryoSat + AltiKa + S-3
- Ice Velocity (IV) – Greenland-wide: Sentinel-1, RadarSat, ALOS2?
 - Time series on 9 glaciers: S-1, optical (IMGRAFT +)
- Calving Front Locations (CFL) – continue time series, S-1, S-2 optical
- Grounding Line Location (GLL) – continue time series, S-1
- Gravimetry Mass Balance (GMB) – grid and basin dM/dt products 2002-2017?



PALSAR 20071022_20080122 track_69



Ice Velocity:
Time series
and repeated
coverage of
Greenland





Antarctica CCI



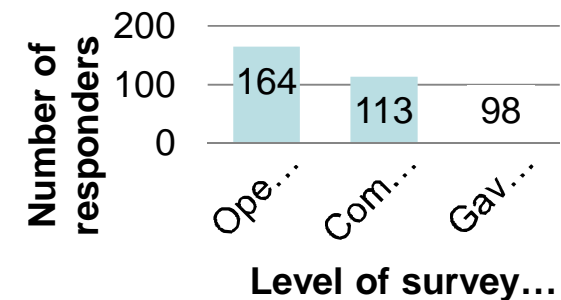
ECVs:

- Elevation changes
- Ice velocity
- Grounding lines
- Mass balance from GRACE

Building on Greenland CCI:

- Updated documents
DARD, URD, ATBD ..
- New user questionnaire
more than 150 respondents ..

AIS_cci Survey Responses

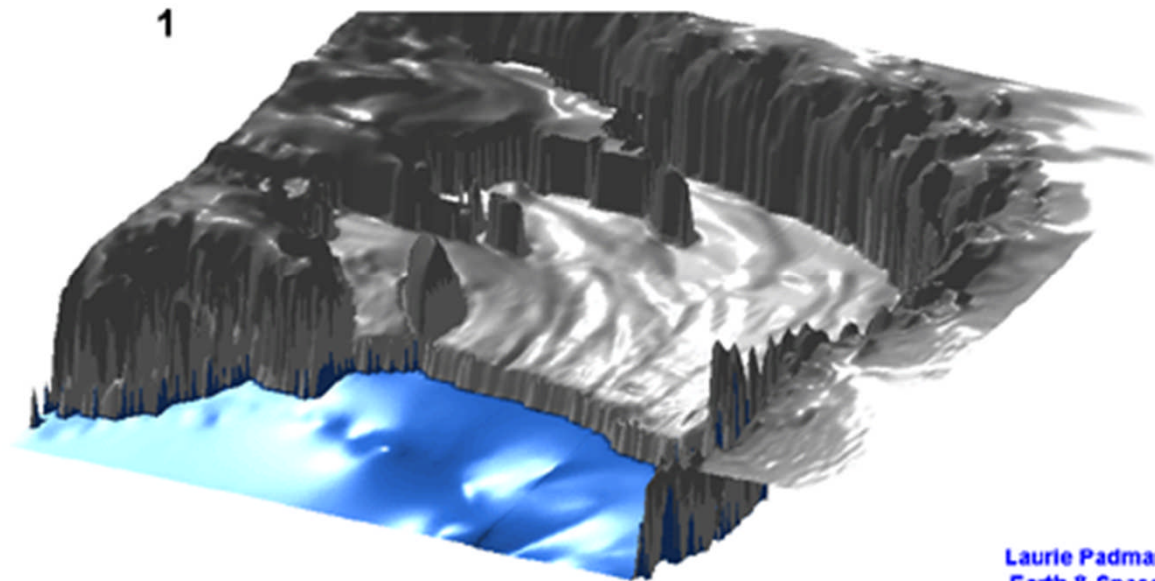




Antarctica ECV: Grounding lines



	Grounding Line
Product Format	Shapefile
EO Input Data	E1, E2, EV, R1, TSX, S1
Temporal Range	1992 –
Temporal Frequency	decadal
Spatial Coverage	5-10 key ice streams
Spatial Resolution	250m line



Laurie Padman
Earth & Space
Research



CCI Greenland – Antarctica links

- **Common Climate Research Group**

Lead:

Prof. David Vaughn, BAS

CRG members with expertise on Greenland:

Prof. Jon-Ove Hagen (University of Oslo, Norway),

Dr. Gudfinna Adalgeirsdottir (University of Iceland)

Dr. Andreas Ahlstrom (GEUS)

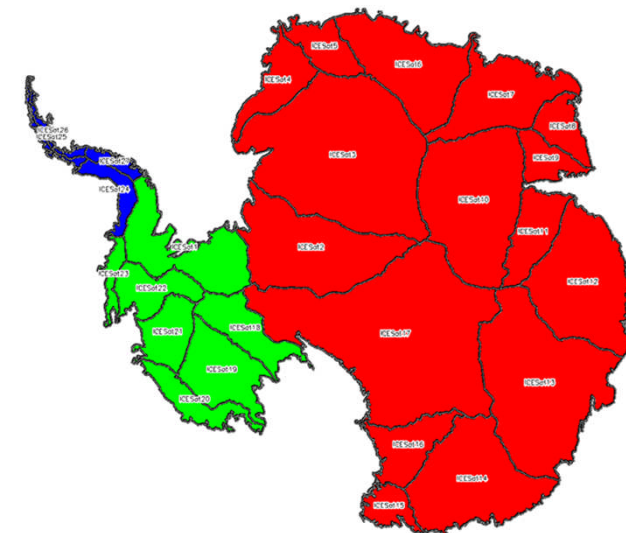
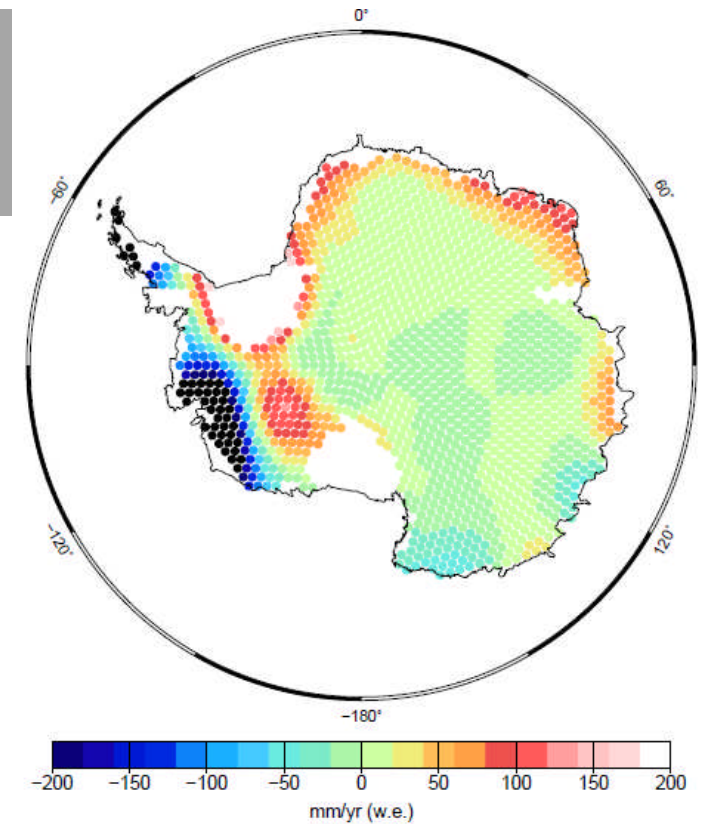
CRG members with primary expertise on Antarctica:

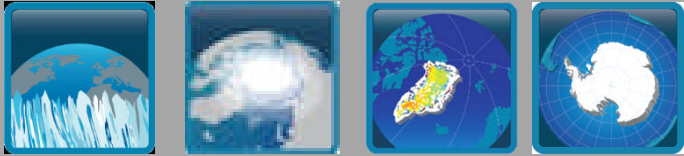
Prof. Michiel van den Broeke (University of Utrecht),

Dr. Hartmut Hellmer (Alfred Wegner Institute)

Prof. Anne le Brocq (University of Exeter)

- **Co-located project meetings: ~ 1/year**
- **Common ECVs: SEC, GMB, IV, GFL**
- **Common Round-Robin for GMB**





Sea ice CCI - SIC

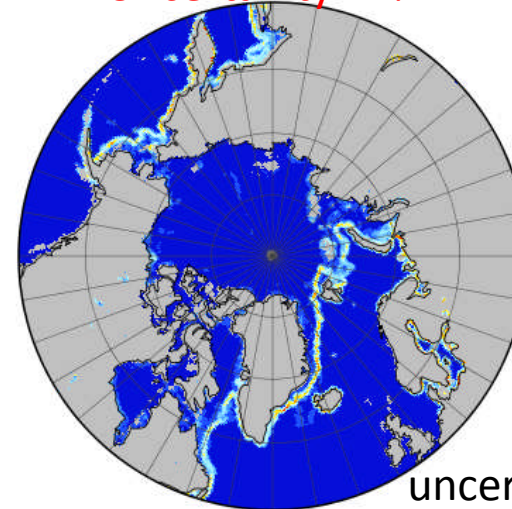
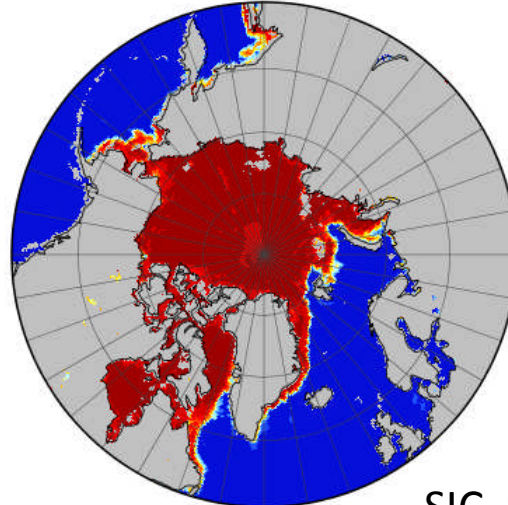


Ice concentration in %

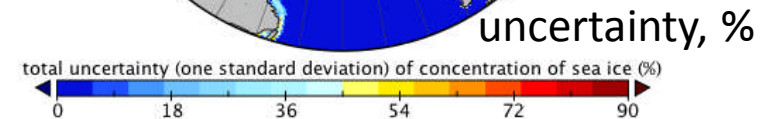
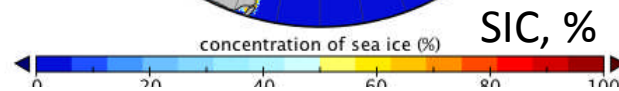
Uncertainty in %

3 – 4 %

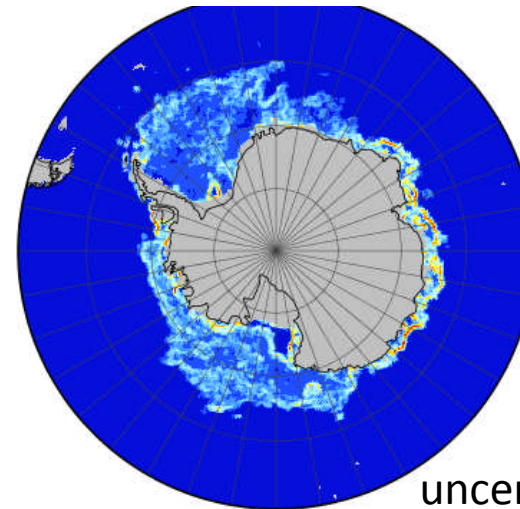
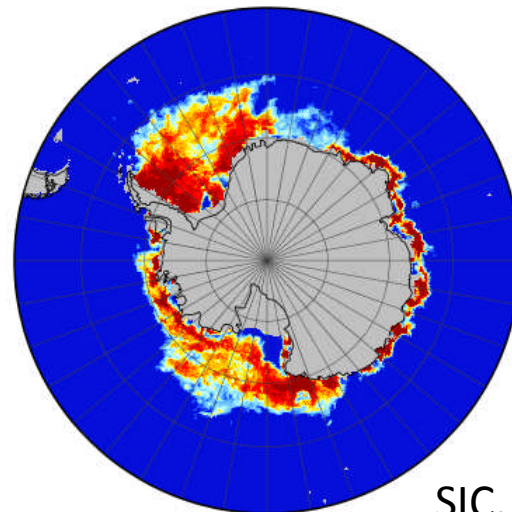
AMSR-E
25 km EASE
grid



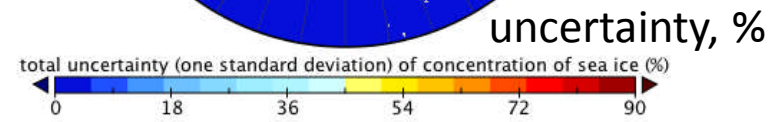
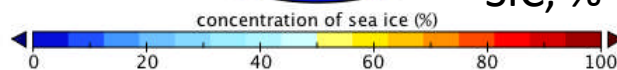
> 50 %



Uncertainty =
tiepoint +
smearing +
daily variability
with a grid cell



20-30 %



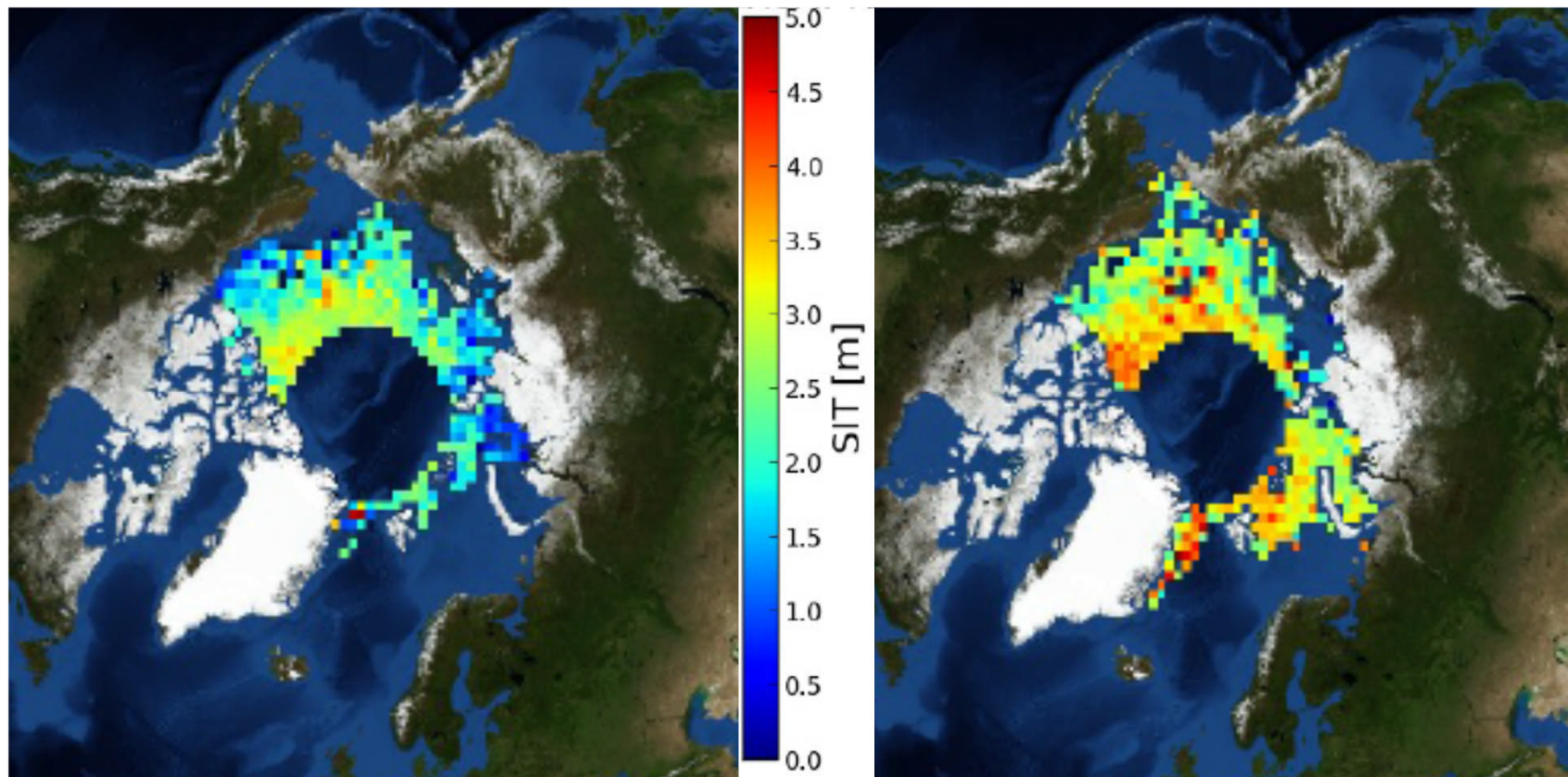


Sea ice CCI - SIT



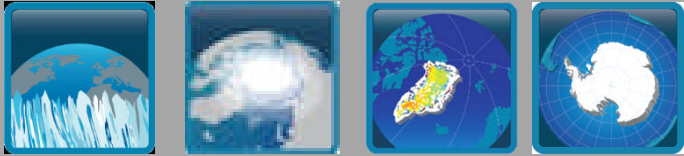
Sea Ice Thickness ECV to be released shortly ..

Example of monthly product – ENVISAT SIT



November 2003

March 2004

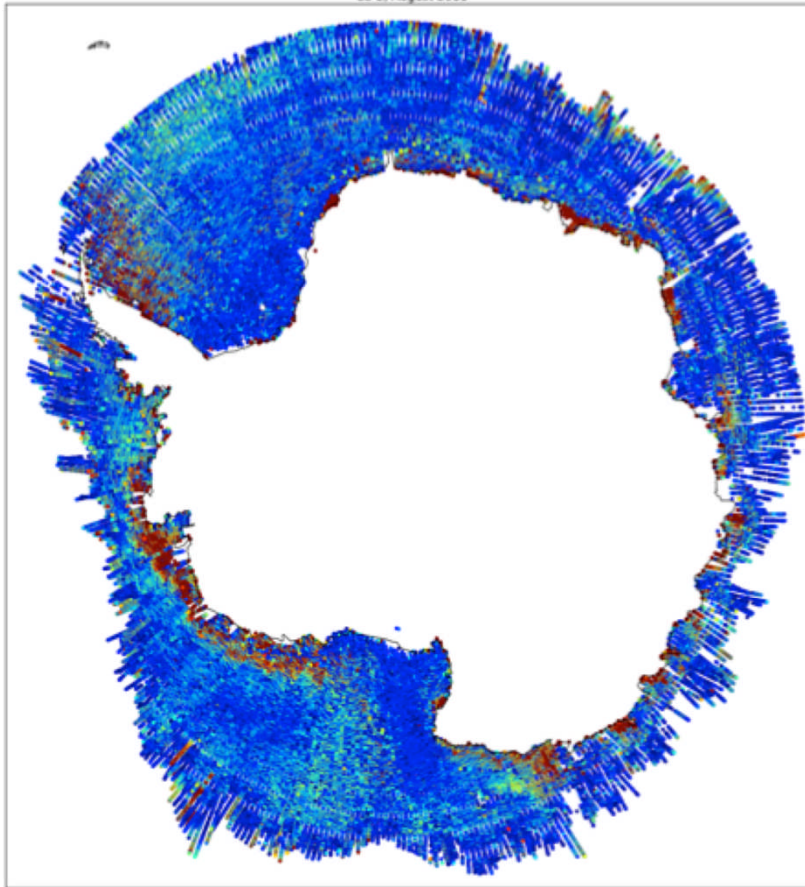


Sea ice CCI – SIT Antarctica



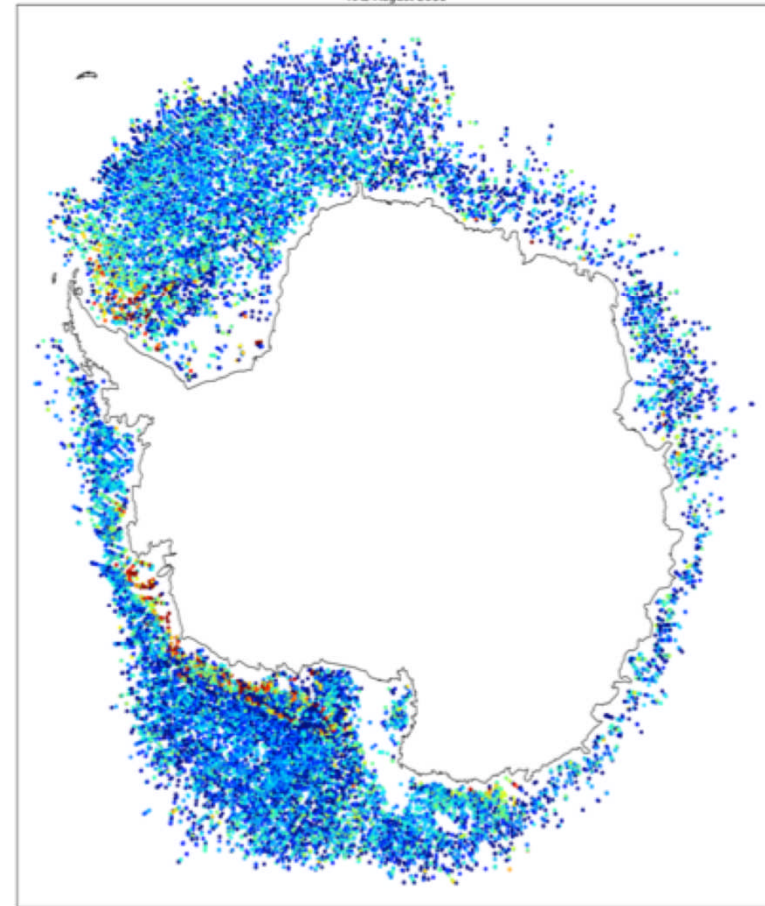
Non-gridded freeboard from
CryoSat-2 August 2011

CS-2, August 2011

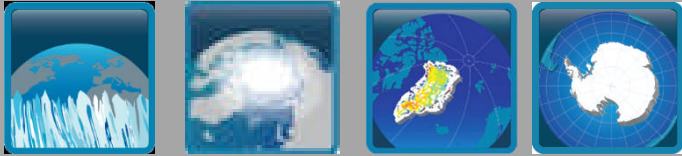


Non-gridded freeboard from
ENVISAT August 2011

RA2 August 2011



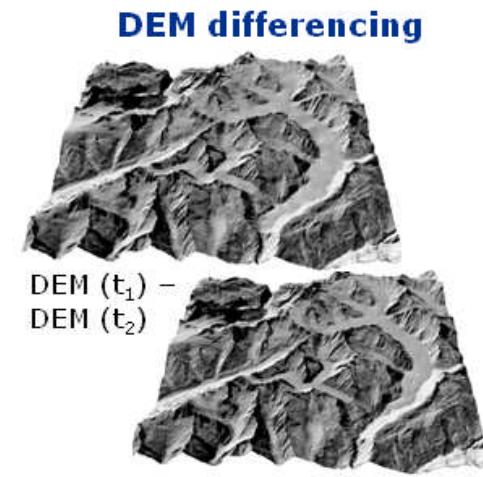
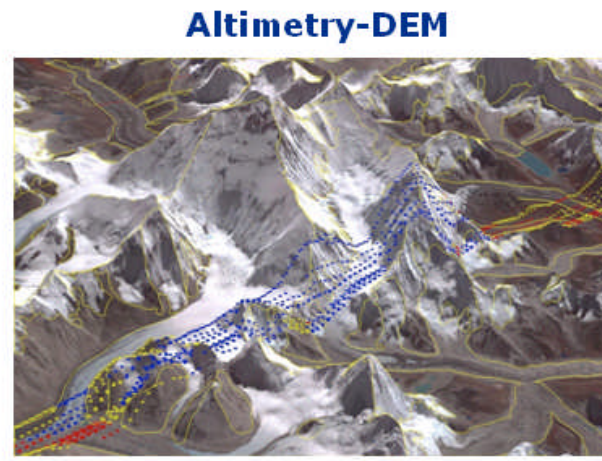
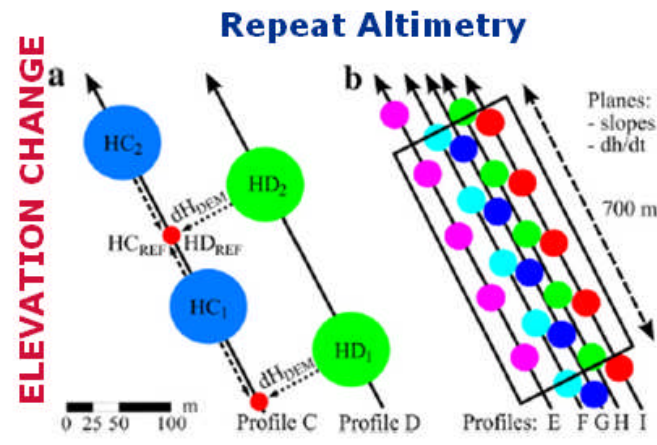
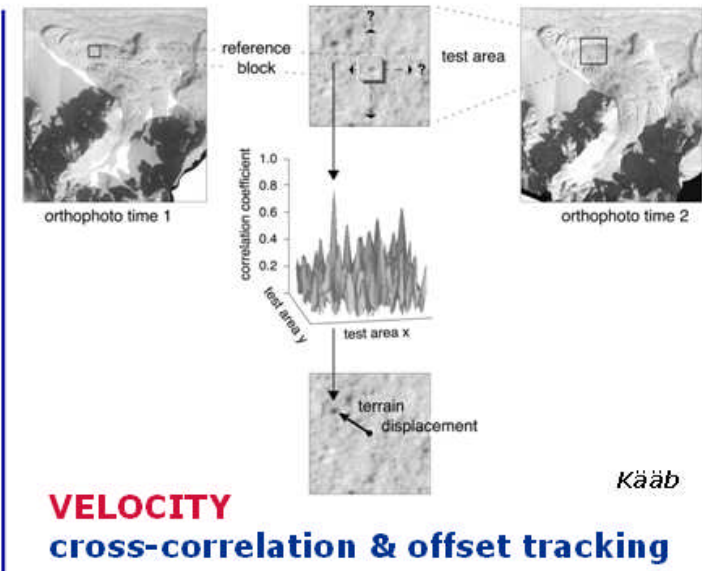
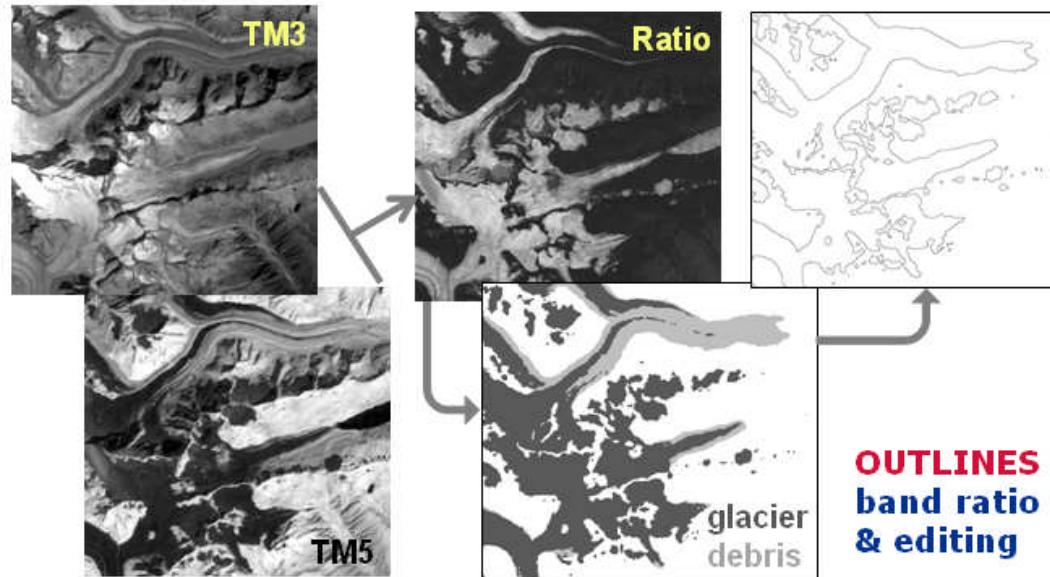
Provided by Sandra Schwegmann, AWI



Glaciers CCI



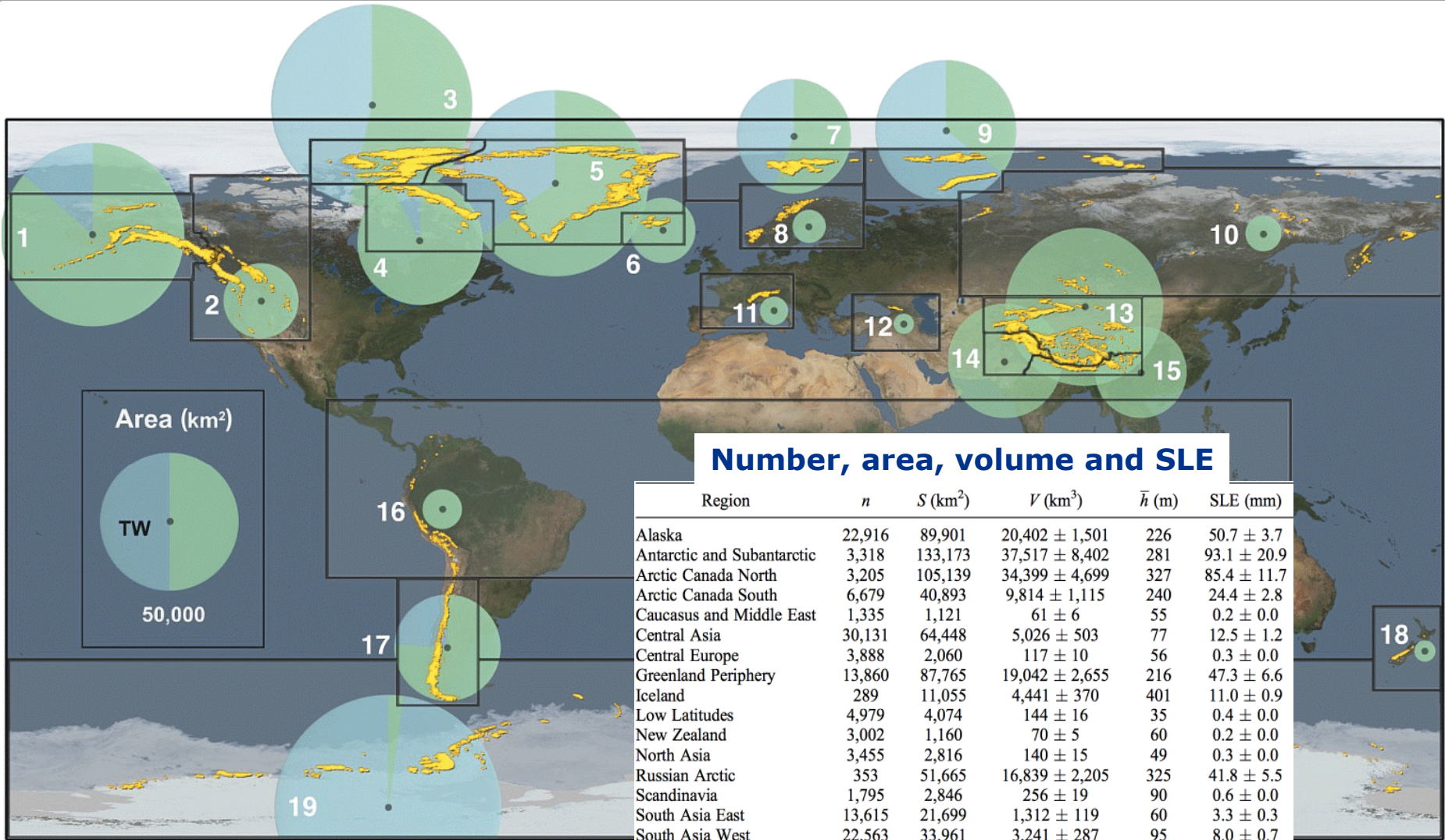
3 ECVs: Glacier outlines, Ice velocity, Elevation changes + *ice thickness option*





Current applications: RGI

Glaciers CCI: Randolph inventory



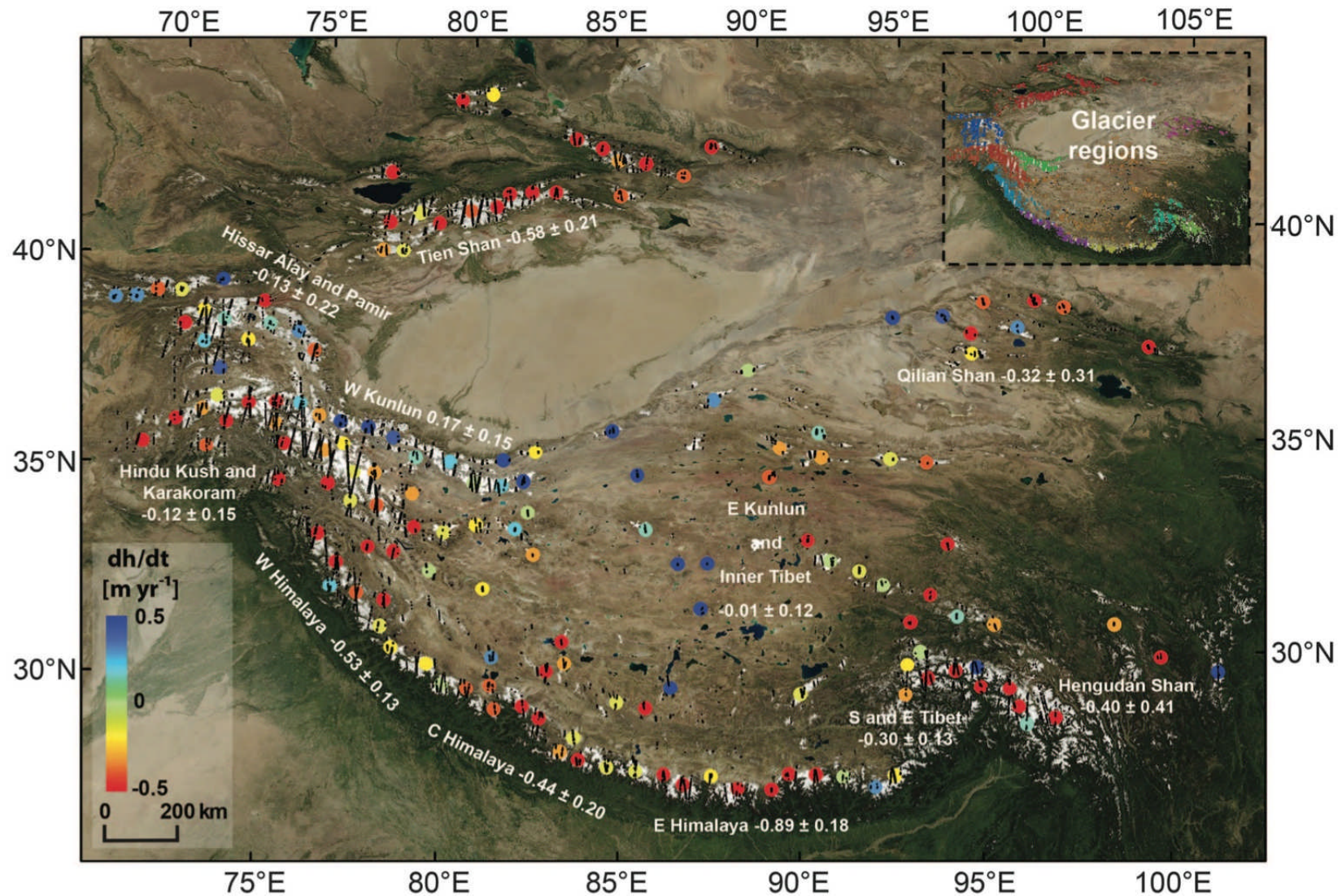
Potential sea level contribution: 42 cm

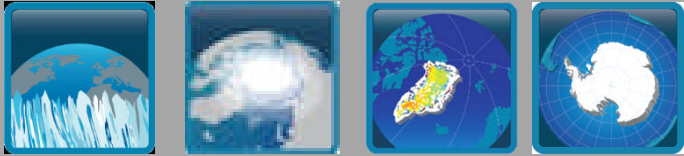
IPCC (2013)

Huss and Farinotti (2012)

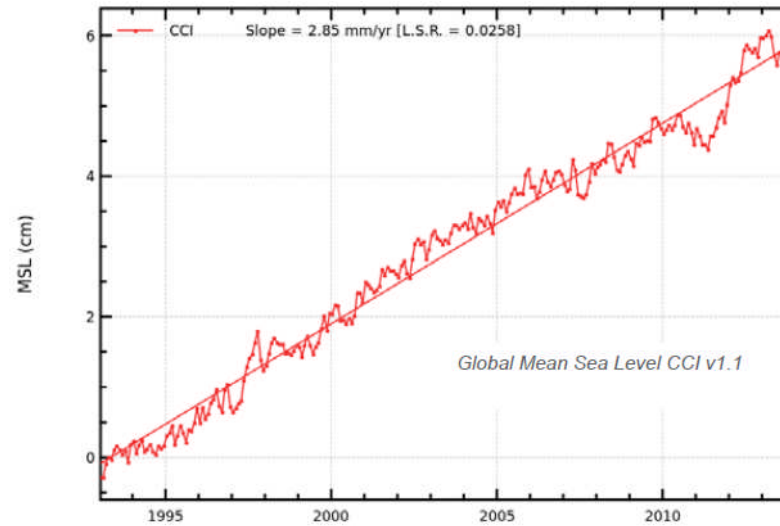


Glaciers CCI: Application – mass loss of Himalayan / Tibetan glaciers

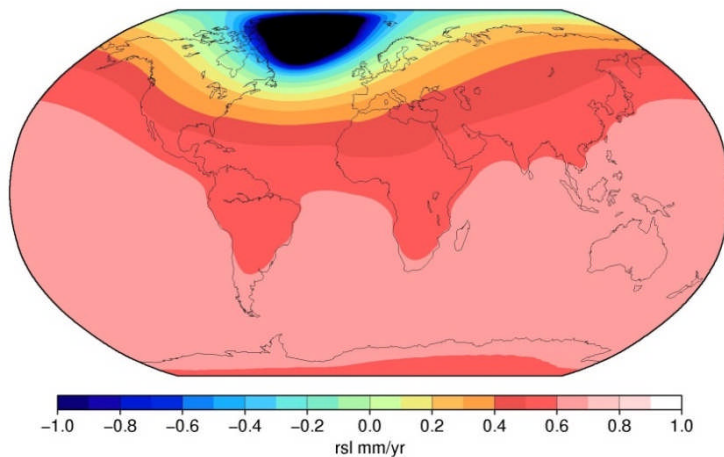




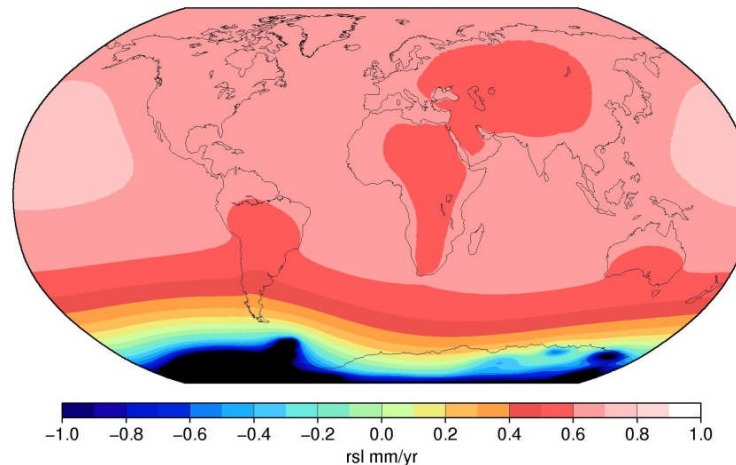
- **Sea level closure** (Greenland, Antarctica, Glaciers, Sea Level, Sea Ice CCI)
- **GRACE / altimetry option** merged high-resolution mass loss?
- **Optical IV mapping** (large-scale, more focus on non-ESA data)?
- **Area overlaps** (Greenland and Antarctica Peninsula glaciers ..)



Greenland melt SLR



Antarctica SLR





Applications and users



CCI	Main applications	Secondary	Current users / metrics	Common issues
Glaciers 2011-	Glaciologists, hydrologists, general public	Climate Models, hydrology models	<300 RGI downloads; 25+ papers, >600 citations of appl.	<i>Overlap to ice sheet margin glaciers</i> <i>EO data access</i>
Greenland Ice Sheet 2012-	Stakeholders (sealevel rise) Natl. monitoring programs / public	Climate modellers – long term predictions	~ 45 reg. users ~ 100 down- loads across 4 ECVs	<i>Availability EO data (SAR + REAPER/CS2)</i> <i>ex.: GRACE- Antarctica</i>
Antarctica 2015-	Glaciologists General scientists and public	Climate modellers - long term predictions	<i>T.b.d. – more than 150 particip. in user requir. survey</i>	<i>Common algorithm+ processing chains</i> <i>ex.: GRACE- Greenland</i>
Sea Ice 2011-	Climate modellers (request long timeframe 1979-)	Ice mapping Climate science / general public	<i>10's of downloads SIC (SIT in prep)</i>	<i>Altimetry SIT (REAPER/CS2)</i> <i>Arctic Sea Level</i>