climate change initiative

GREENLAND ICE SHEET NEWSLETTER

Issue n. 7 | March 2017

Greenland_Ice_Sheet_cci – New Data Products are released

The Greenland_Ice_Sheet_cci project (2015-2018) is now passing Year 2 of Phase 2

The Greenland_Ice_Sheet_cci project processes and provides Essential Climate Variables (ECV's) for the Greenland Ice Sheet, as part of the ESA CCI program.

This newsletter summarizes updated and new data sets, provided to users on the updated project data web site; **http://products.esa-icesheets-cci.org/**

The ECV parameters provide consistent, long term data sets for climate modeling and sea level changes. The data series go back to the first ERS measurements in 1991, or whenever data is available for particular ECV's.

The following ECV parameters are computed and updated at regular intervals:

- Surface Elevation Change (SEC),
- Ice Velocity (IV),
- Grounding Line Location (GLL),
- Calving Front Location (CFL),
- Gravimetric Mass Balance (GMB).

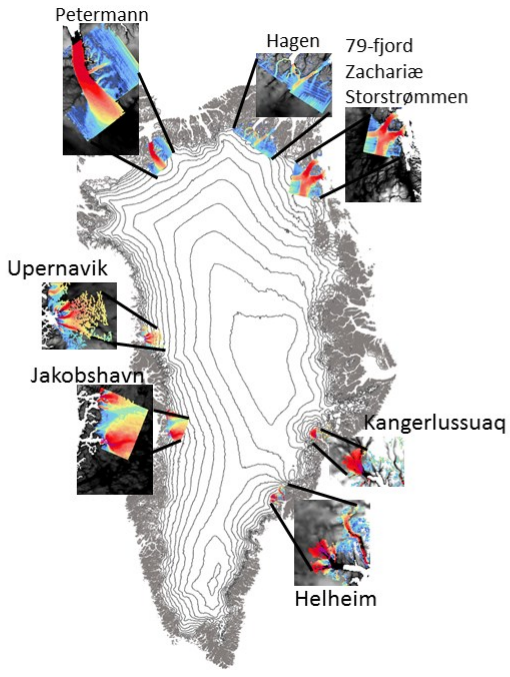
GMB is the new ECV in Phase 2.

See download guide on last page.

In this issue:

Ice Velocity (IV) – SAR – New Data Product – Going Back in Time

Time-series of nine major outlet glaciers back in time are generated, providing a 25-year timeline using SAR data.



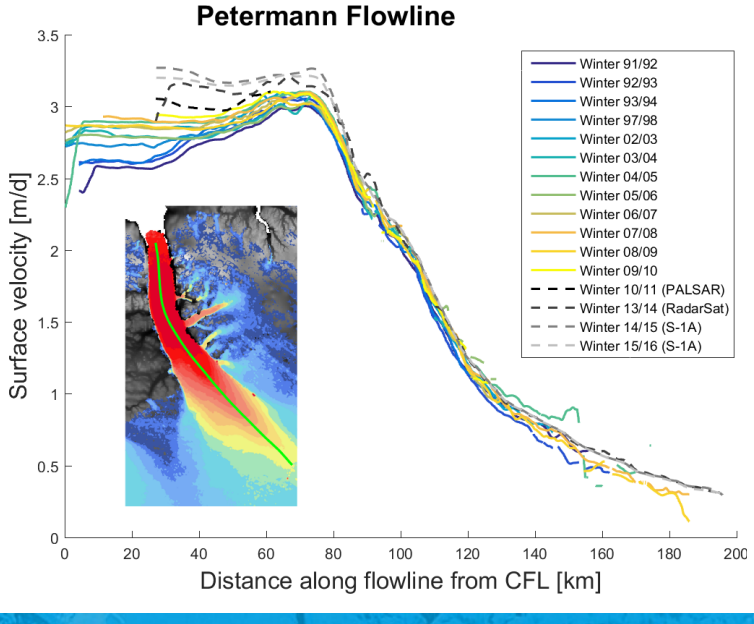
LEFT: Locations of the nine major outlet glaciers with example IV maps.

IV time-series covering the period 1991-2010 are now available for the nine major Greenland outlet glaciers (shown on the left). IV is derived using offset tracking on all obtainable SAR data from ESA's ERS-1, ERS-2 and Envisat missions between 1991 and 2010 with a repeat cycle between 1 and 35 days.

The new time series, created by GEUS, combined with the previous datasets presents a 25 year time line of IV for the nine glaciers.

An example is provided (shown on the right) for Petermann Glacier showing the winter velocity since 91/92 along a central flowline. It shows that there has been a general speed-up of the flow near the calving front over the period.

RIGHT: Example of along-flowline winter IV profiles for Petermann Glacier spanning the period 91/92 to 15/16 using data from the new time series as well as from earlier Greenland CCI datasets. The data from the period 1991 to 2010 is from the new dataset based on ERS-1+2 and Envisar ASAR data. (CFL: calving front location) Inset: IV map of Petermann Glacier and the position of the flow line (in green).



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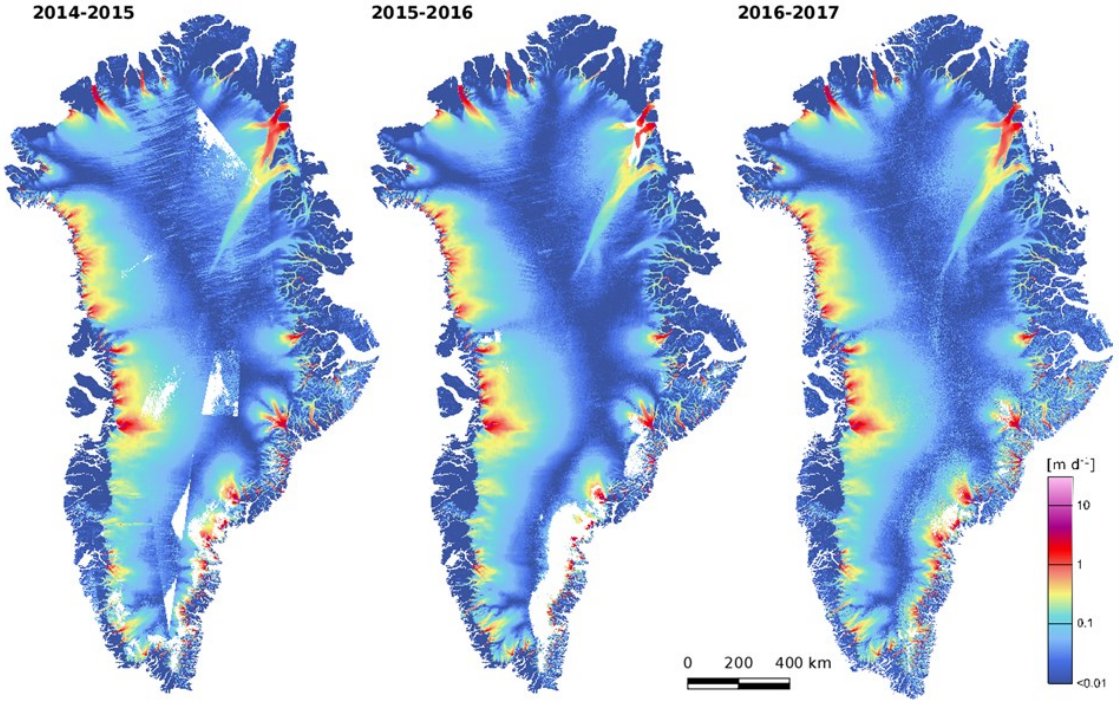
Ice Velocity (IV) – SAR – Third Greenland-Wide Map

Since the start of the Greenland CCI project, three ice-sheet-wide velocity maps have been produced using Sentinel-1 SAR data

The latest product is derived using both Sentinel-1A and Sentinel-1B data acquired within a period of only 2 months during the Greenland winter mapping campaign 2016/2017.

The twin satellite constellation brings the repeat observation time down from 12 to just 6 days, allowing for a much better coverage in regions affected by fast decorrelation (e.g. regions with high snowfall or very fast moving glaciers such as Jakobshavn Glacier) than previously possible.

In total approximately 1800 scenes are used to derive the nearly gapless surface velocity map applying feature tracking techniques. The new ice velocity map is created by ENVEO and is provided at 250m grid spacing available through the Greenland CCI data portal and CryoPortal (see last page).

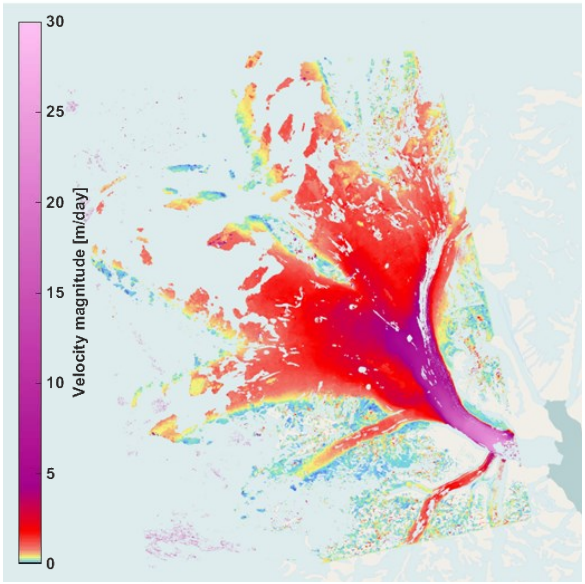


LEFT: Sentinel-1 annual ice-sheet-wide velocity maps for 2014/15, 2015/16 and 2016/17.

BOTTOM LEFT: Optical ice velocity map (magnitude) of the Kangerlussuaq Glacier on the south-eastern edge of the ice sheet. The map was generated using images acquired by Sentinel -2 between the 23rd of July and the 2nd of August 2016.

Ice Velocity (IV) – Optical – New Data Product

Optical IV product from S[&]T, applying offset-tracking to ESA Sentinel-2 data



The new product provides a complementary and independent calculation of ice velocities and an independent verification tool of SAR results. Furthermore, it is a powerful supplement to SAR results, helping in the coverage of epochs and/or areas where SAR data is not available.

In this first release, Optical IV at a grid resolution of 50m is made available for specific time-intervals for a total of 9 major outlet glaciers. Their locations are shown on the map on the previous page: Jakobshavn, Petermann, Hagen, 79fjord, Zachariæ, Kangerlussuaq, Helheim, Upernavik region and Døcker Smith region (not shown on the map).

The Kangerlussuaq glacier (bottom left), located on the south-eastern edge of the Greenland ice sheet, presents a large area of high velocity (purple color), where the ice advances at a magnitude of ~10/20 m/day, with a peak of 25 m/day in the region near the Calving Front. In the bottom of the figure the presence of 2 tributaries is well-visible. The tributaries, which margins are clearly marked by a decrease of the velocity, present velocity lower than the one of the main glacier.

The gaps in the figure are mainly associated with the presence of clouds, while the circular "dots" are associated with lakes.

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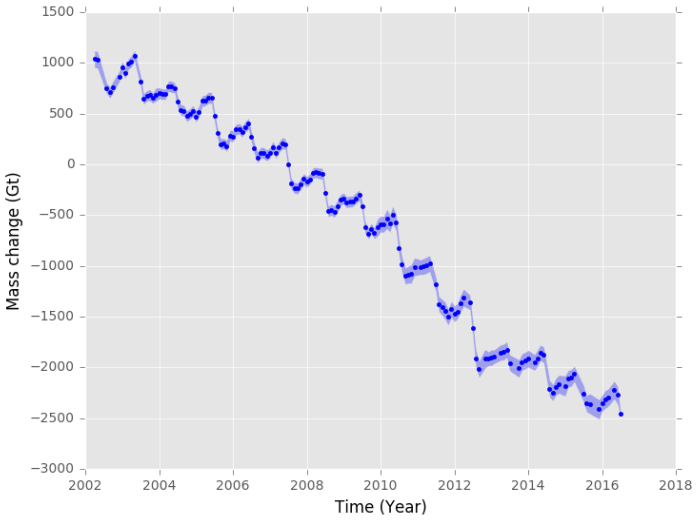
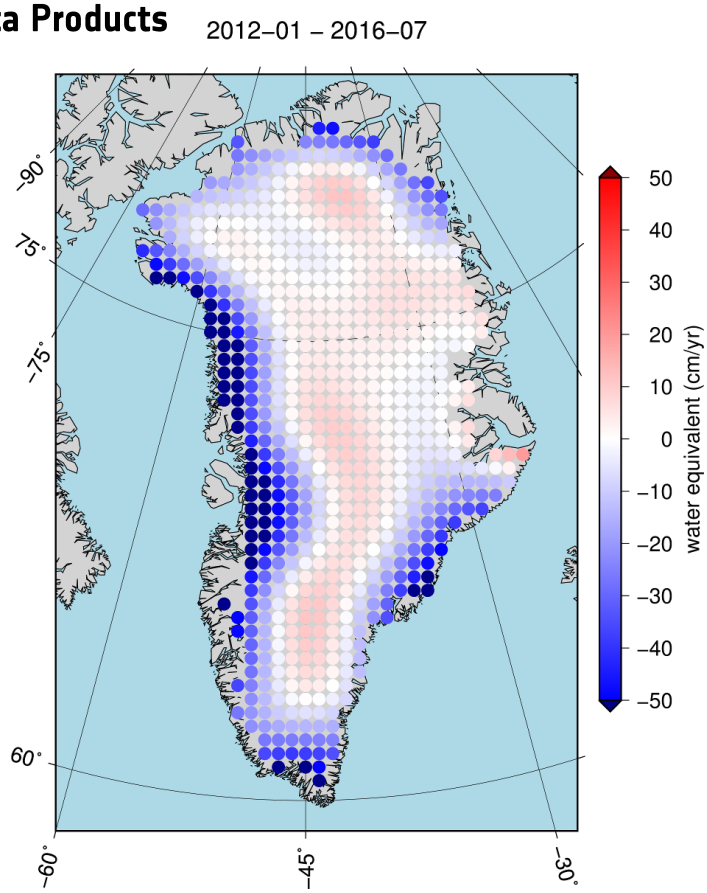
Gravimetric Mass Balance (GMB) - Updated Data Products

The GMB products from DTU Space and TU Dresden have been updated

Mass change time series for 8 drainage basins as well as for the entire Greenland Ice Sheet comprise 148 monthly values within the period 2002-08 – 2016-07. This update extends the time series of the previous product, while leaving already existing solutions unchanged (see left figure).

The GMB gridded product (see right figure), consisting of 5-year mass change trends on a 50km x 50km grid also covering the entire Greenland Ice Sheet, has been updated accordingly. The figure shows the recently added trend grid for the period 2012-01 – 2016-07. Both GMB products make use of the monthly gravity field solution series ITSG-Grace2016 provided by TU Graz.





LEFT: GRACE derived mass change time series for the entire Greenland ice sheet produced by DTU Space.

TOP RIGHT: GRACE derived mass change trends over the Greenland ice sheet for the period 2012-01 - 2016-07 produced by TU Dresden.

BOTTOM RIGHT: Calving front location of Jakobshavn glacier in western Greenland.

Calving Front Location (CFL) – Updated Product

Updated with extended time-series from the early 90's

The Calving Front Location (CFL) marks the ever-changing terminus of marine outlet glaciers.

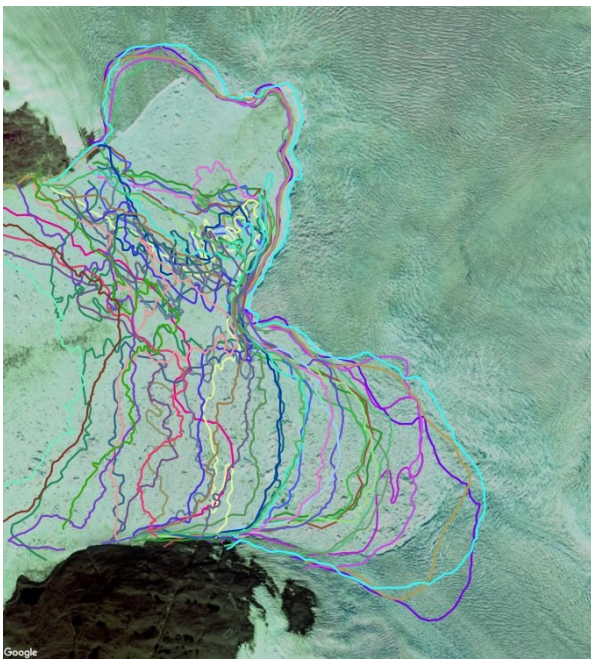
Monitoring the temporal evolution of the CFL is important as indicator of changing boundary conditions or dynamic instability. The product includes annotated vector shapefiles of calving front locations of 28 key Greenland outlet glaciers that are derived by manual delineation utilizing ERS-1/2, Sentinel-1 SAR and optical satellite images.

In the updated version (3) of the data package, the CFL's are further extended both in time and frequency. The time range covered by the latest product spans early 1990 until 2017.

Temporal gaps that existed in release 2 are filled in by including CFL's derived using optical images from Landsat 5,7 and 8.

The dense sampling allows for investigating annual and for some glaciers seasonal signals.

The CFL product was created by ENVEO and is both available through the Greenland CCI data portal and CryoPortal (see last page).



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The Consortium – Progress meeting 7

The Greenland_Ice_Sheet_cci project team comprises nine scientific and industrial partners from Denmark, Norway, UK and Austria. The Science Lead is René Forsberg from DTU, coordinating the activities in close cooperation with Kenneth Hauglund as Project Manager from S[&]T and Contract Officer Marcus Engdahl from ESA.

The scientific team contributing on processor development, data production and analysis are; DMI (Danish Meteorological Insitute), DTU Space, ENVEO, GEUS, NBI (Niels Bohr Institute), NERSC (Nansen Environmental and Remote Sensing Center), S[&]T, TU Dresden and UL (University of Leeds).

In January, in tandem with the Antarctic Ice Sheet CCI and Glaciers CCI sister projects, the 7th progress meeting was held in the beautiful village of Alpbach in the Austrian alps. The meeting was hosted by ENVEO.

In three days of intense work and alpine skiing, plans were laid for the future development of the project.

LEFT: Project Lead René with team members, ready to hit the slopes again.

CENTER: Project Manager Kenneth at the top of Europe.

TOP RIGHT: The picturesque village of Alpbach where the meeting took place.

RIGHT: Team members Marcus (ESA) and Daniele (S[&]T) in scientific discussions on the ski lift.

Download Data Products

Instructions on how to download data products

Enter the Greenland_Ice_Sheet_cci project website; **http://esa-icesheets-greenland-cci.org/** and click on either of the five images under ***Essential Climate Variables*** (ECVs). This will bring you to another page describing the relevant ECV.

At the bottom of the description follow the link "Click here to browse and download products", which brings you the listing of products for the chosen ECV on the Greenland CCI product data portal; **http://products.esa-icesheets-cci.org/**.

Alternatively you may go directly to the product data portal, and click the link "Product Download" below either of the ECV descriptions.

On the product list page, click the link with the description of the desired product. This brings you to the corresponding product details page, where you will find a link next to ***Product file*** from which you can download the data product. The first time you download you will be requested to supply your name and affiliation for our (internal) site usage statistics.

For inquiries or if you experience problems with our websites, please contact Science [&] Technology AS, Andreas Thorvaldsen, **thorvaldsen@stcorp.no**.

Products by ENVEO are also available for download directly from the ENVEO CryoPortal; **http://cryoportal.enveo.at/**

Products by TU Dresden are also available for download directly from **https://data1.geo.tu-dresden.de/gis_gmb/**

Products from all of ESAs CCI projects are collected and made openly available on the CCI Open Data Portal; **http://cci.esa.int/data**

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