Climate Change Initiative

Pascal Lecomte & PP Mathieu
Head of the ESA Climate Office
CCI Programme Manager

WDAC Meeting
Ashville, US – 8 April 2016

CCI Some Results

CCI Programme (2010-2017)

300 scientists, 100 research org, 13 ECVs, IPCC AR5 (27 CCI scientists)

Horizontal Supporting Activities

- System Engineering WG
- Data Standards WG
- Colocation Meetings
- Integration Meetings

CCI ECV Projects

- Cloud
- Aerosol
- Greenhouse Gases
- Ozone
- SST
- Sea Level
- Sea Ice
- Ocean Colour
- Glaciers
- Ice Sheets
- Land Cover
- Fire
- Soil Moisture

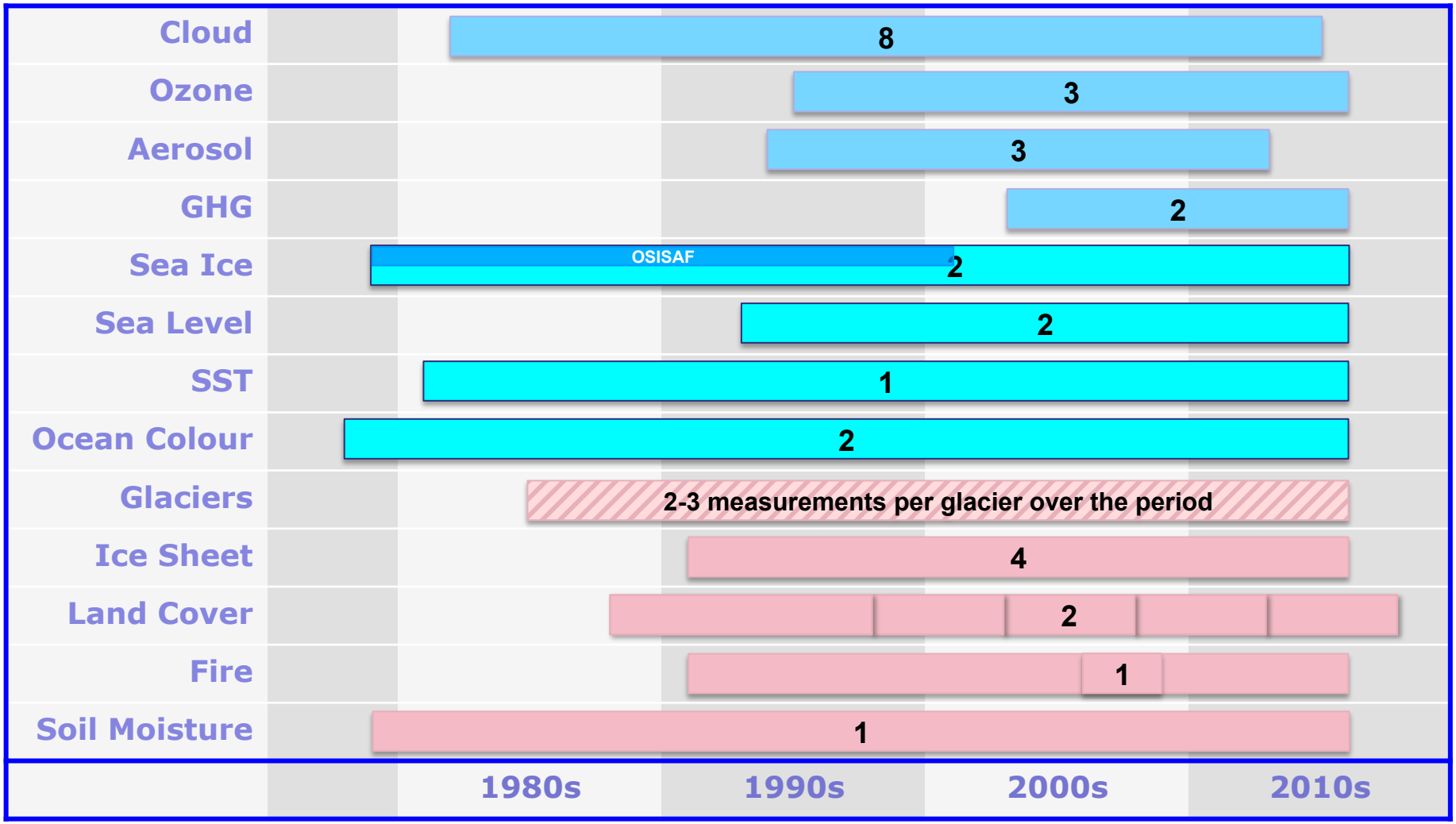
Cross-ECV & Exploitation

- Climate Modeller User Group
- Research Fellowships
- Ice Sheet Mass Balance Intercomparison Exercise
- Cross-ECV Workpackages

Communication and User Support

- CCI Visualisation Tool
- CCI Open Data Portal
- CCI Toolbox

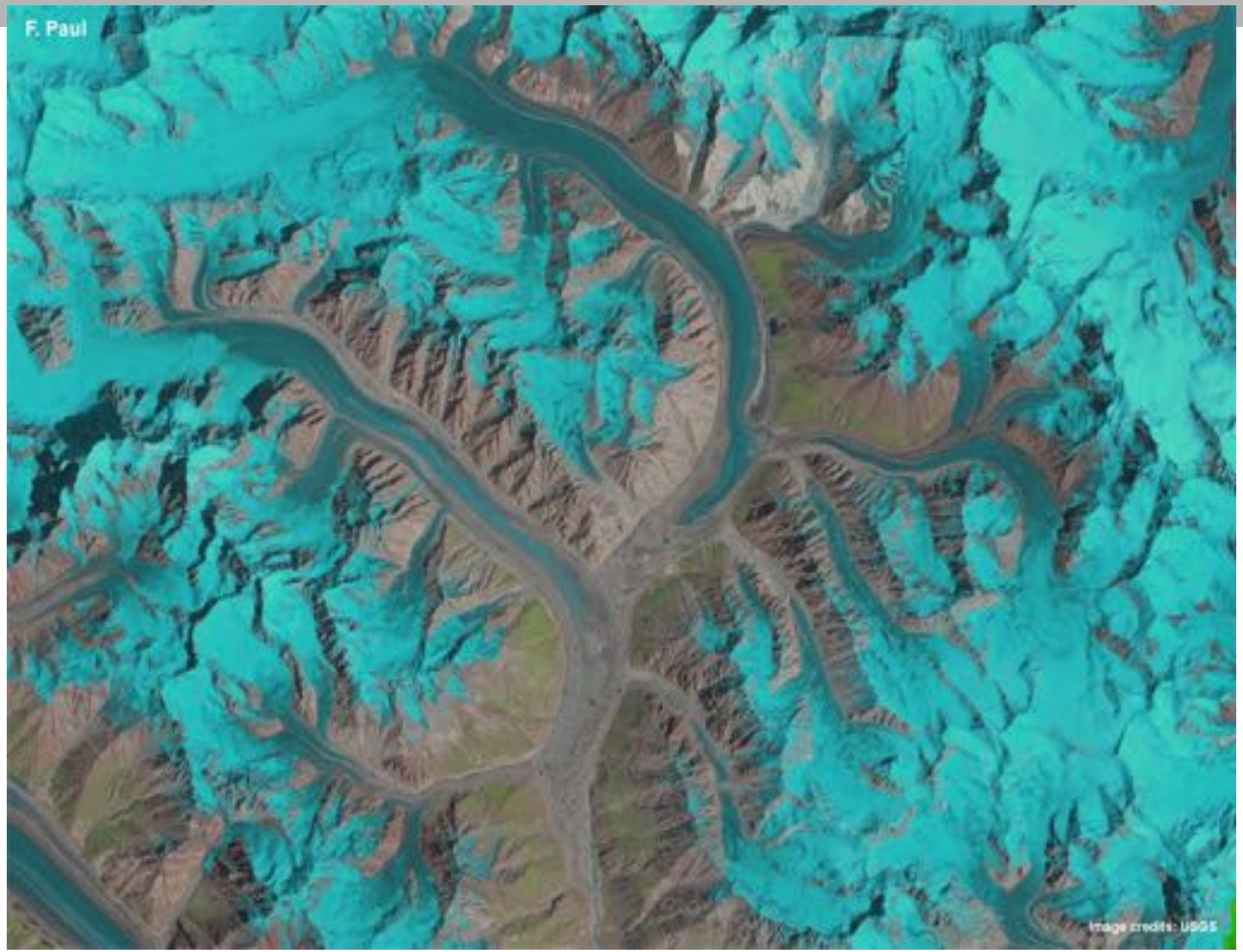
CCI Products Time Coverage



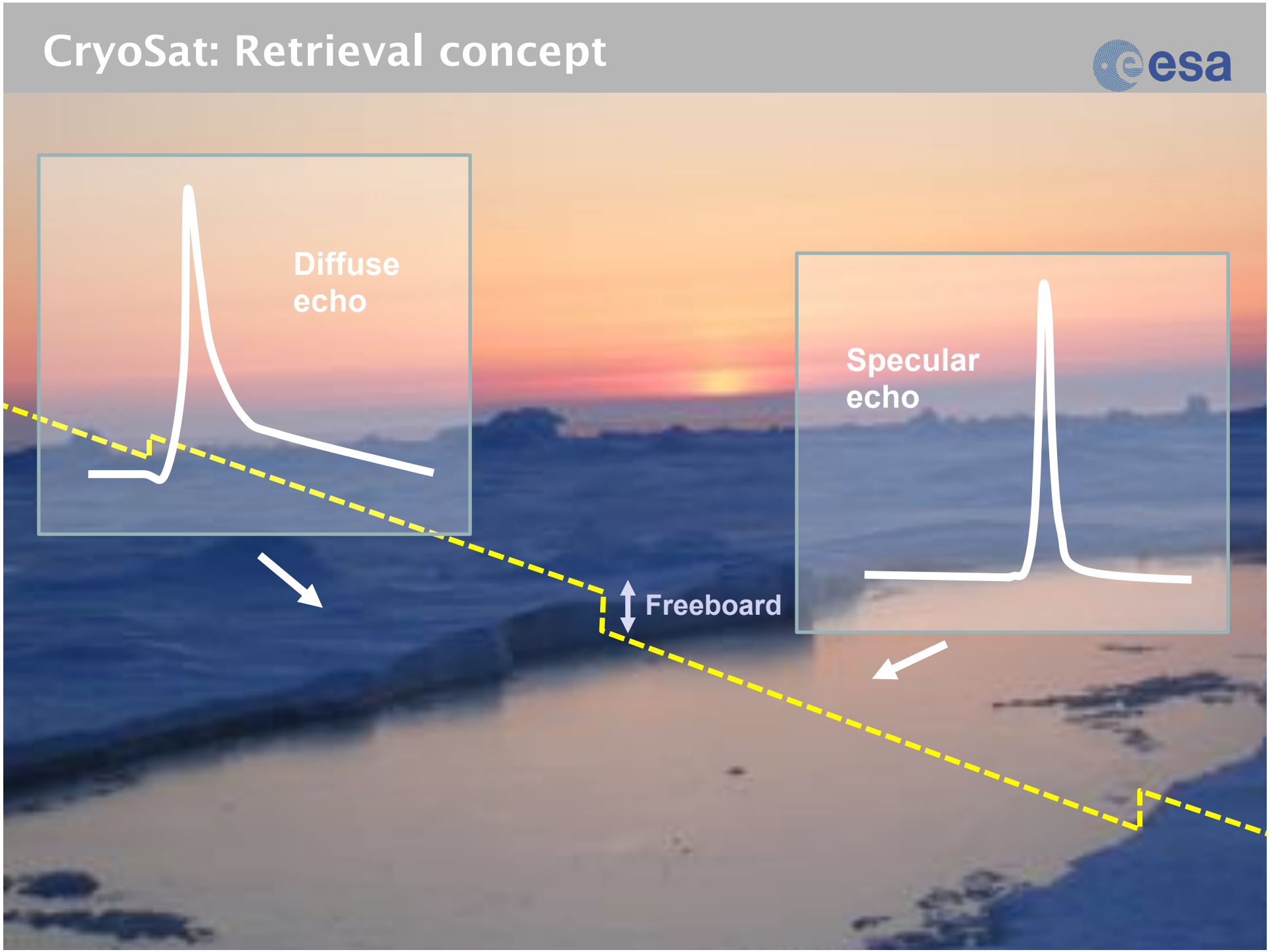
CCI
Living Planet Fellowship

N.	Title	Name	Surname	Host Institution	MS
48	Swarm as an Auroral Mission	Megan	Gillies	University of Calgary	**CD**
23	Is The Earth's Magnetic field POtentially reversing? New insights from Swarm mission	Francisco Javier	Pavón Carrasco	INGV	**IT**
7	Sea level reconstructions from altimetry and tide gauges with improved methods	Sandra-Esther	Brunnabend	University of Bonn	**DE**
29	Reconstruction of 3D time-series of the West Spitsbergen Current using altimetry combined with in situ data and a numerical model	Anna Izabela	Bulczak	IsardSAT Sp. z o.o.	**PL**
26	Synergistic use of SMOS data to Study Slippery Layers In the eastern tropical pacific fresh Pool	Sébastien	Guimbard	IFREMER	**FR**
32	The interconnectivity of magma reservoirs: independent component analysis of satellite radar imagery	Susanna	Ebmeier	University of Bristol	**UK**
4	Developing a CryoSat-2/GRACE product to spatially partition surface mass balance and ice dynamic mass loss across Greenland and Antarctica	William	Colgan	Geological Survey of Denmark and Greenland	**DK**
58	improving the Predictability Of WatEr Resources	Miguel	de Oliveiros Vieira	University of Lisbon	**PO**
47	Sea ice breakup during large wind-wave events	Peter	Sutherland	Université Pierre et Marie Curie	**FR**
1	Extending the Performance of AerGom to explore New aerosol related Species and to Improve OzoNe retrieval	Charles	Robert	Institut d'Aéronomie Spatiale de Belgique (BIRA-IASB)	**BE**
5	A new method for assessing mineral dust sources using vertical profile information retrieved from IASI radiances	Sophie	Vandenbussche	Institut d'Aéronomie Spatiale de Belgique (BIRA-IASB)	**BE**
2	Statistics of AeRosol and Clouds INTeractions from satellites	Luca	Lelli	University of Bremen	**DE**
4	CCI data for assessing SOil moisture controls on Fire Emissions	Matthias	Forkel	Vienna University of Technology (TU Wien)	**AT**

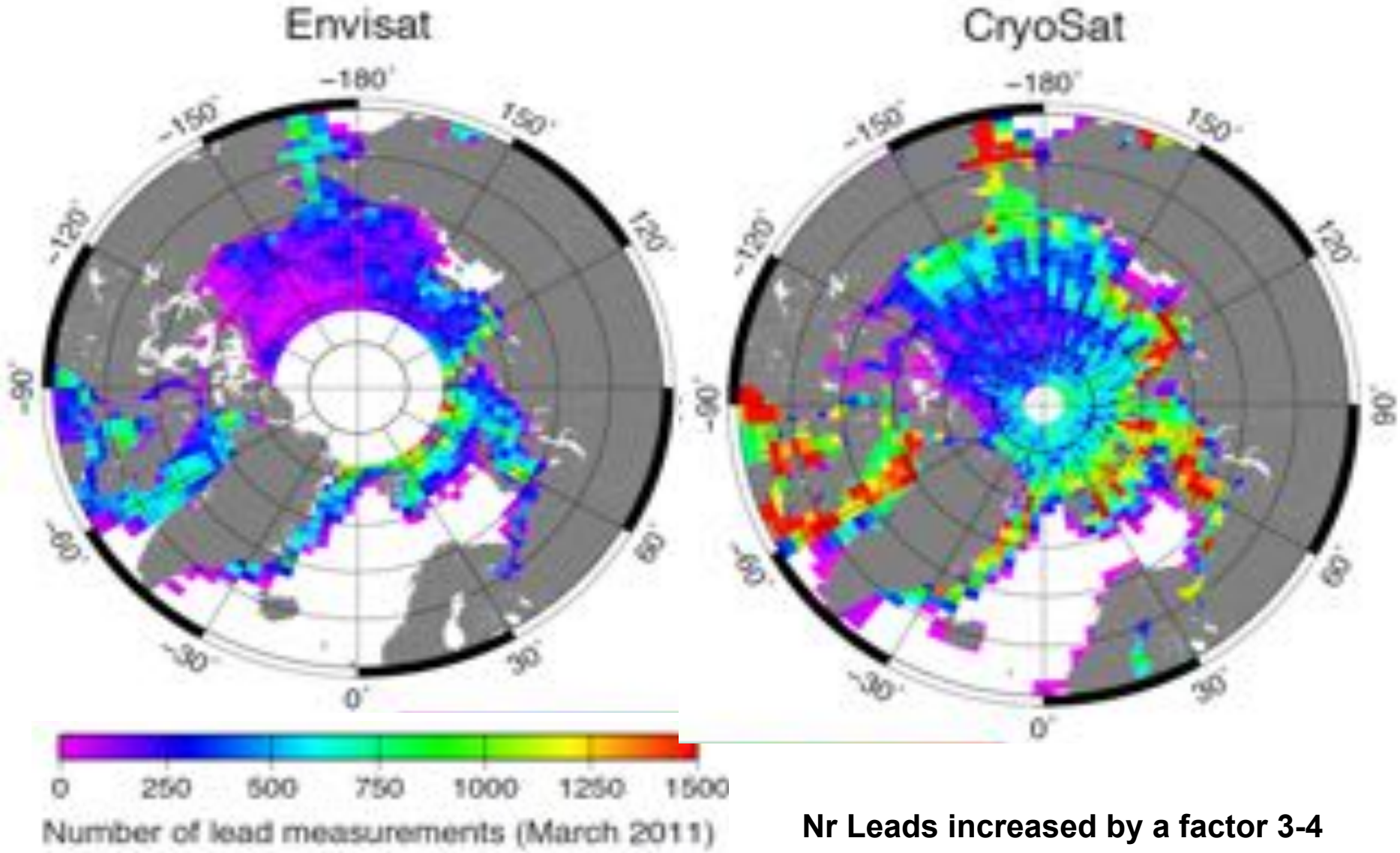
Time series 1990-2015: Karakoram surges



CryoSat: Retrieval concept

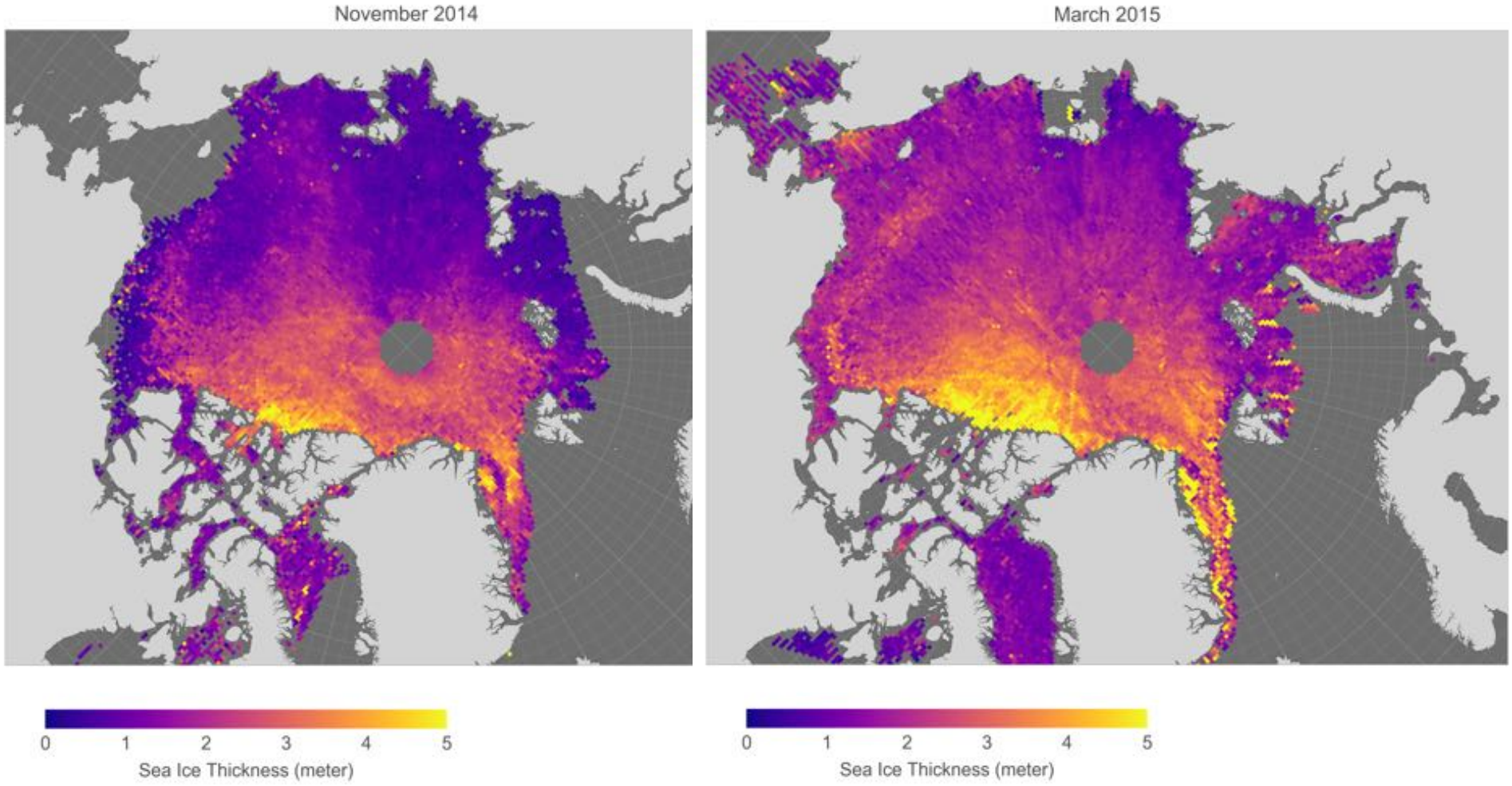


CryoSat: Past missions & science gap

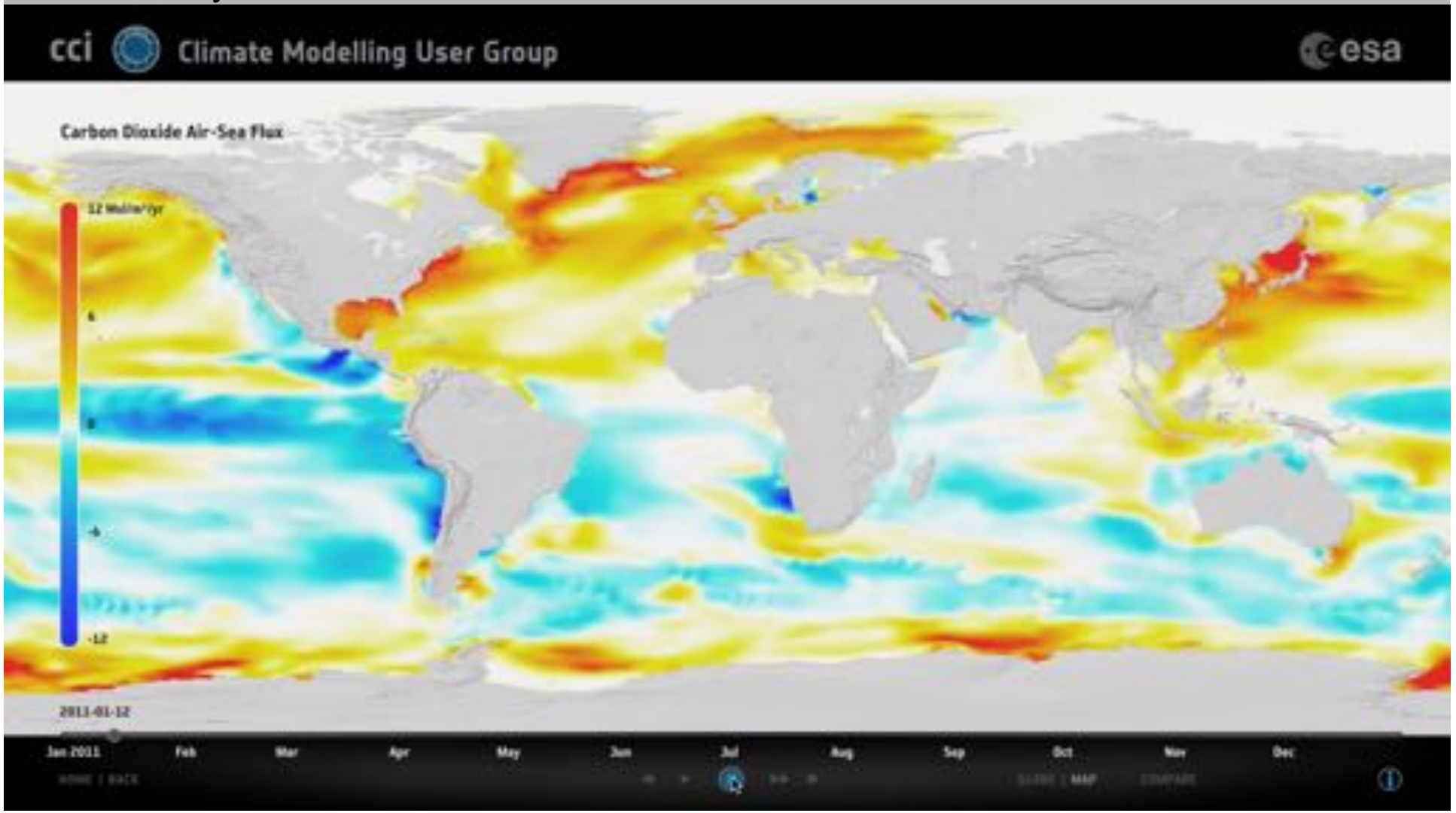


Nr Leads increased by a factor 3-4

Ice thickness in the Arctic from CryoSat

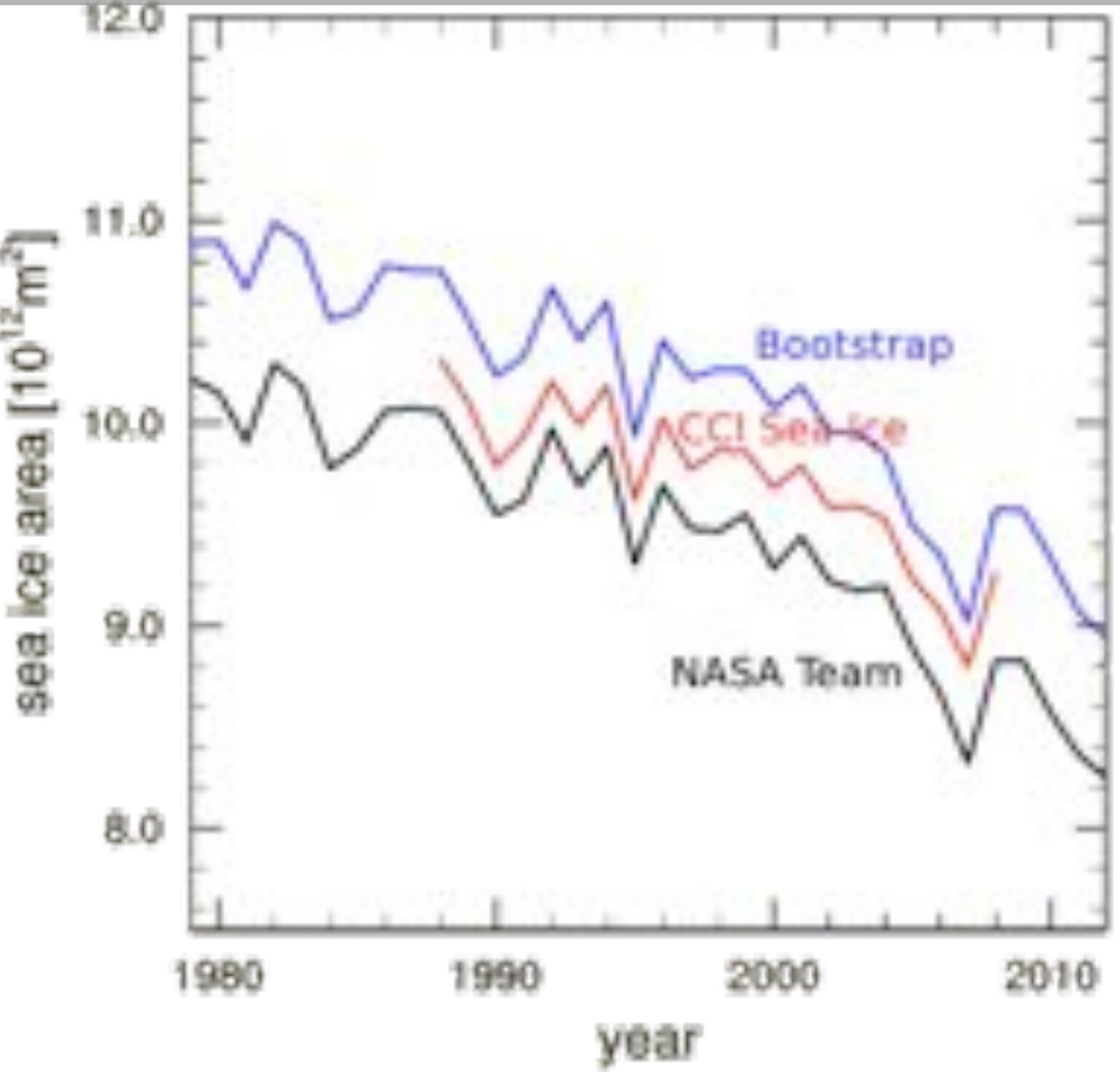


Ice thickness in the Arctic
from CryoSat



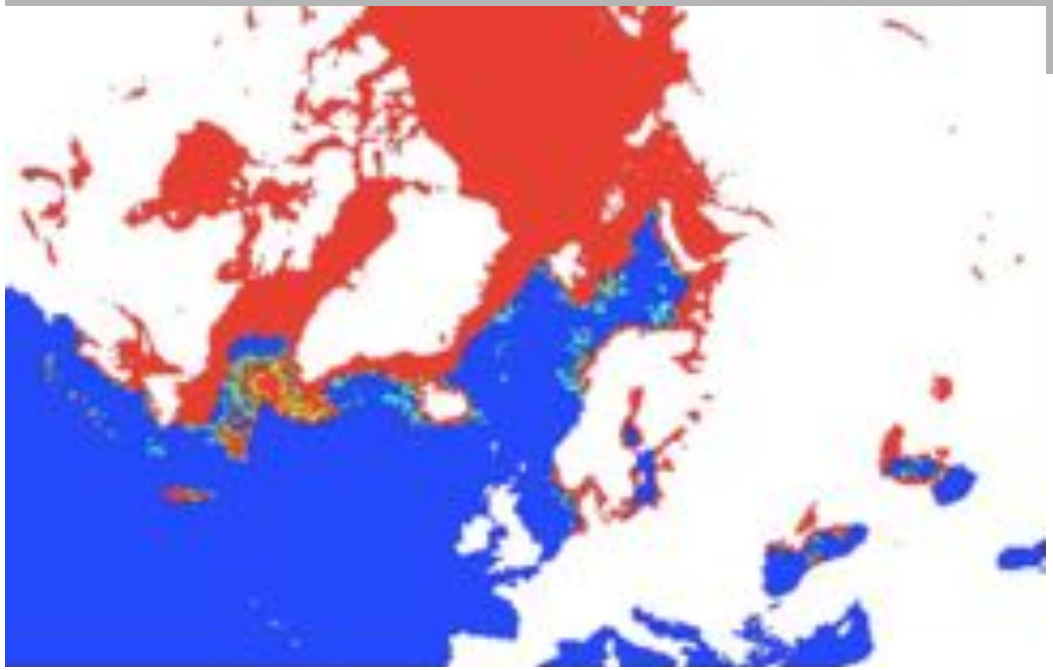
Challenges

Sea-ice Extent algorithms & Melt Ponds

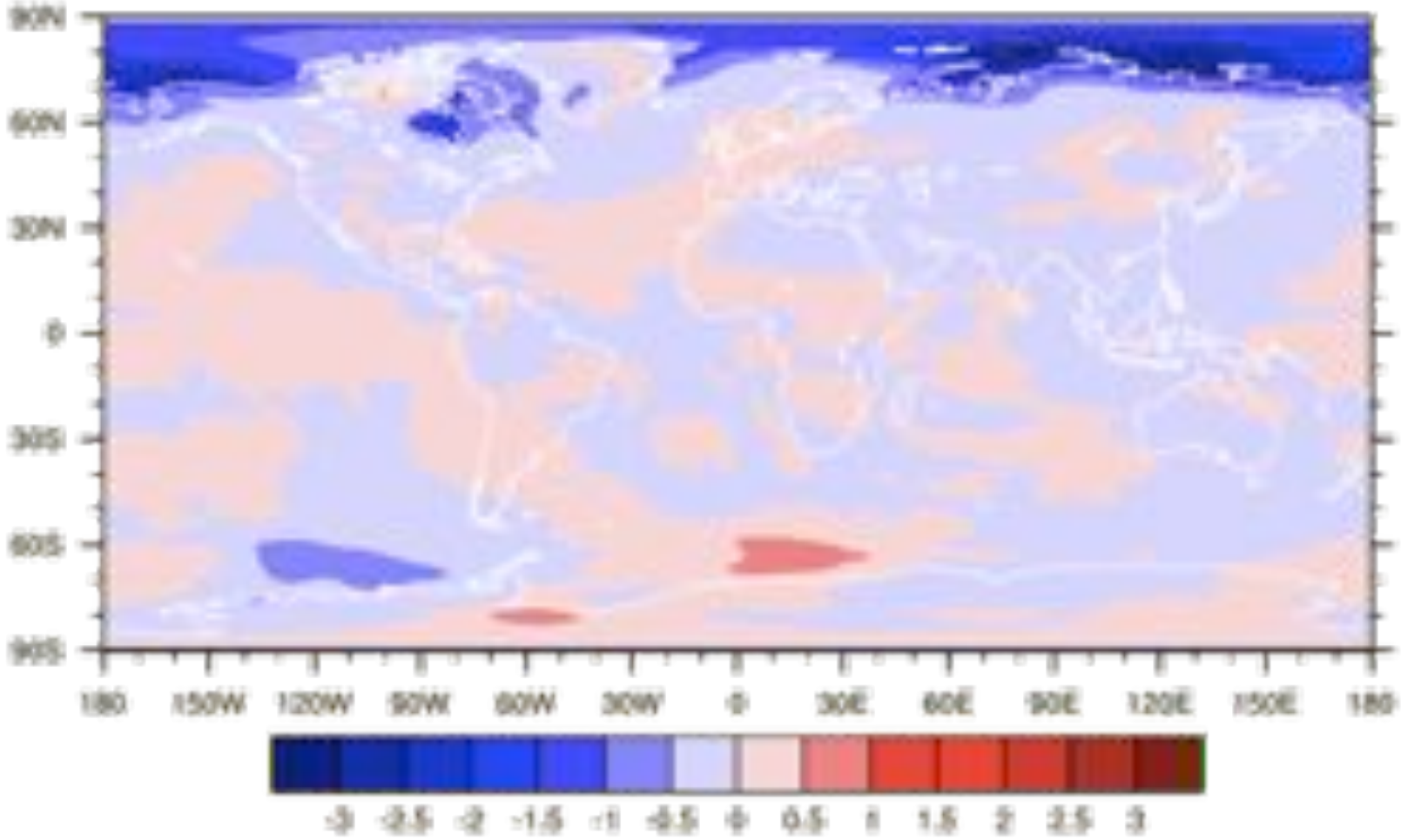


Sea-ice Extent algo & Melt Ponds

Sea-ice Extent algo assumptions



Impact of algo on model temperature



Temperature difference in September after initialisation in May (Bootstrap - NASA Team)

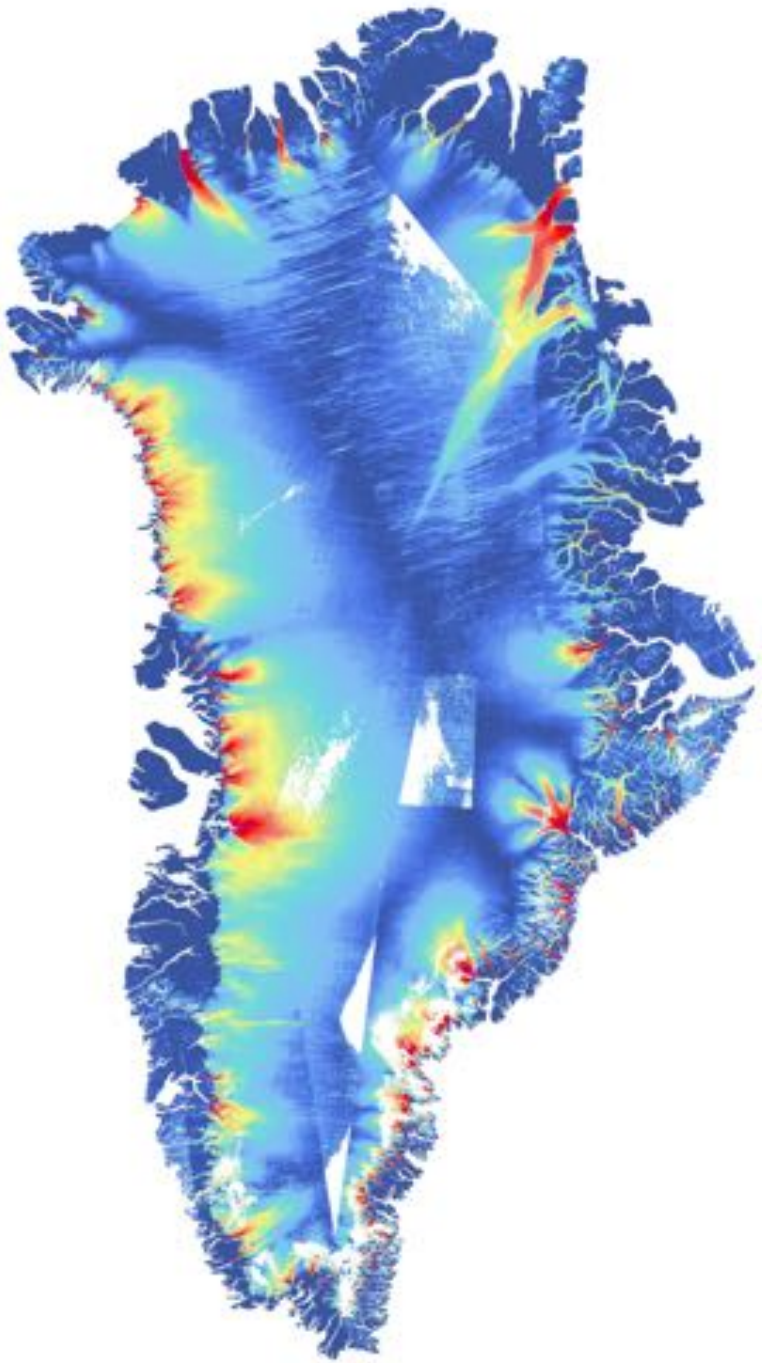
Sentinel Era

Greenland-wide IV coverage (Enveo)

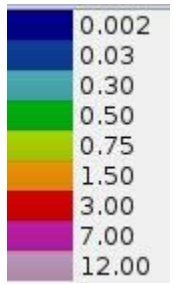
ECV release Dec 2015

Sentinel 1 IWS SLC
Period: Nov 2014-Dec 2015
(mainly winter scenes)

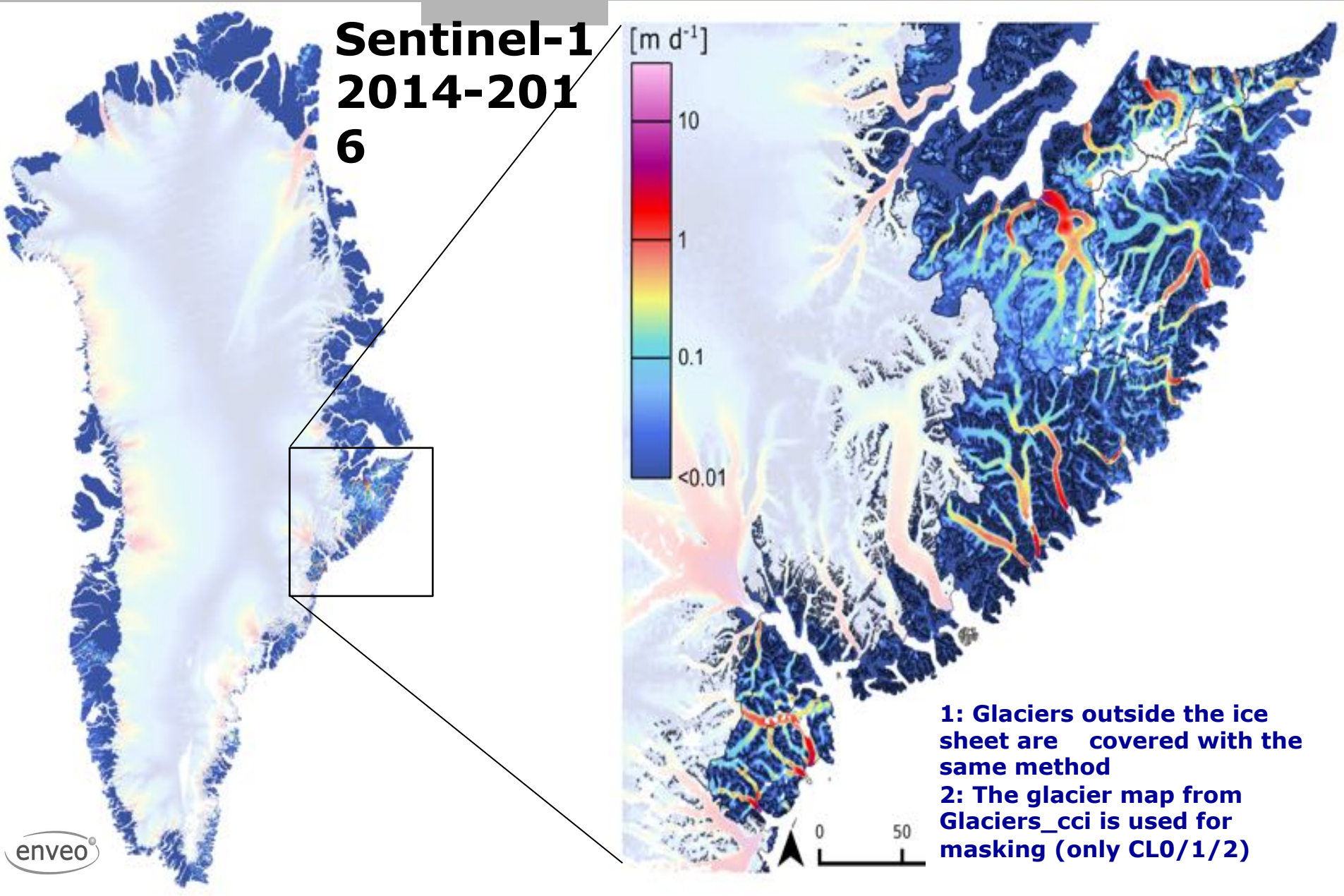
Arrangements agreed with ESA for several yearly data acquisitions =>
Time series of frequent epoc possible (but processing intensive!)



Velocity [m/d]

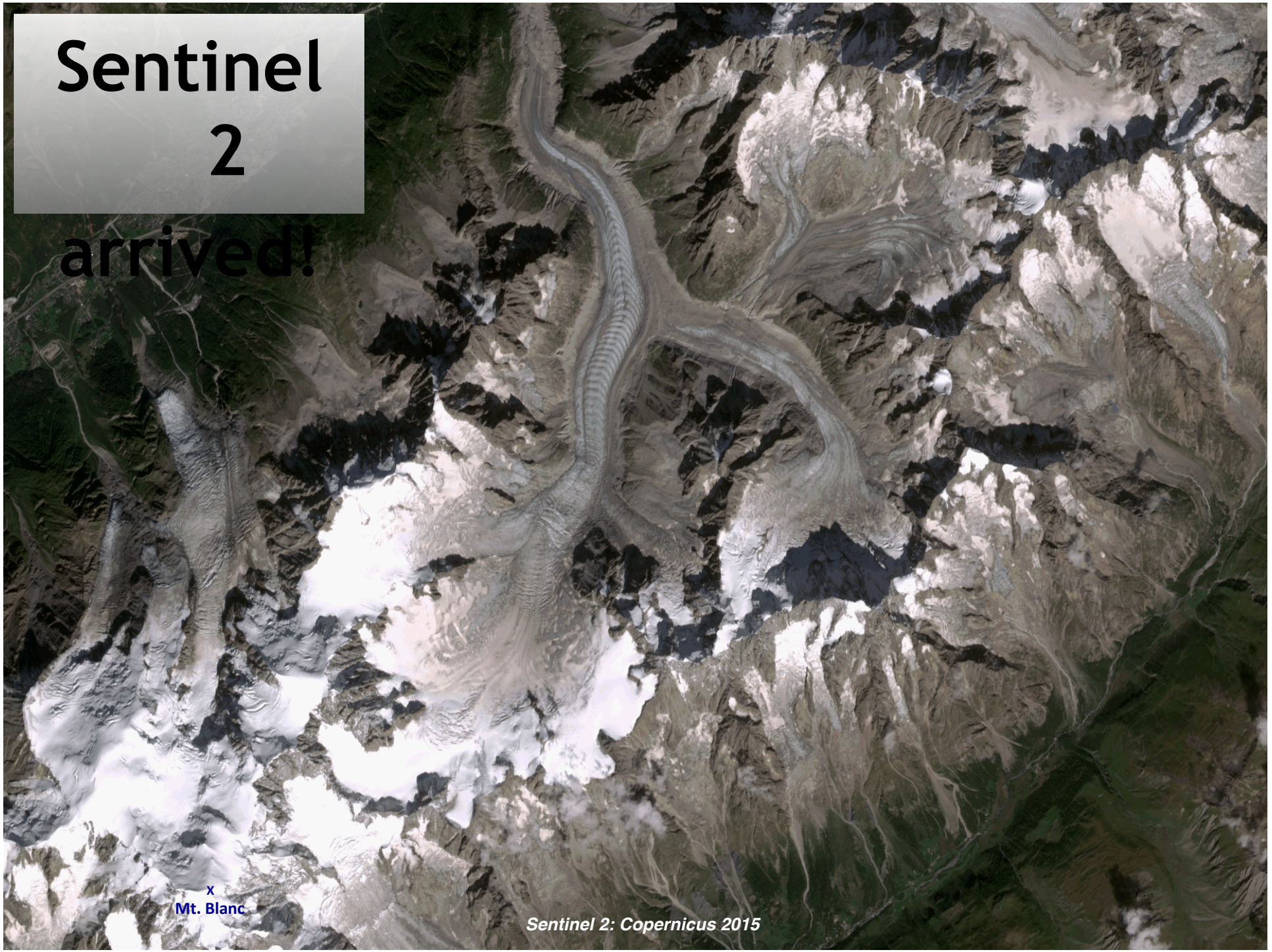


Cross-ECV data production: Velocity Greenland



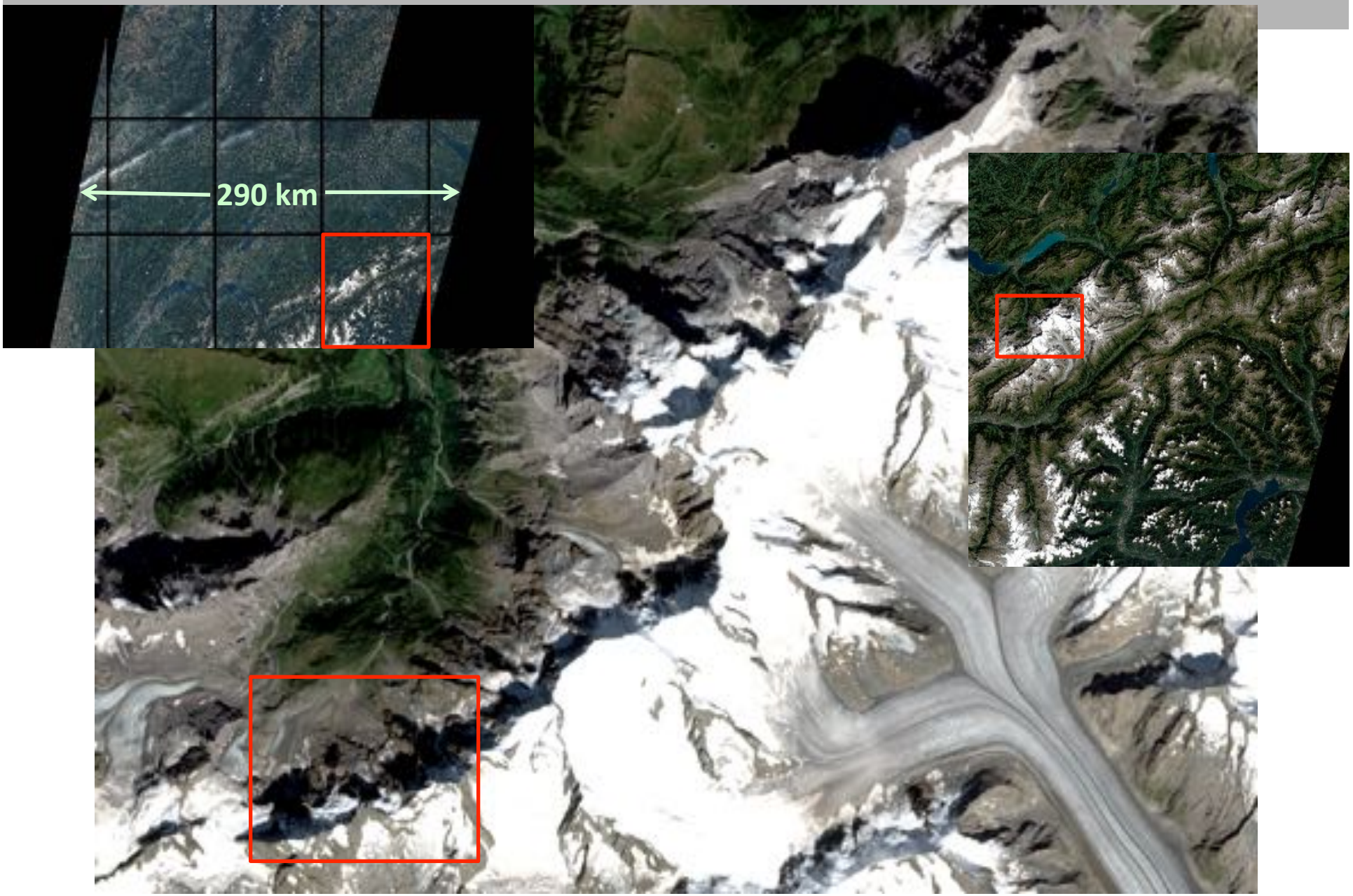
1: Glaciers outside the ice sheet are covered with the same method
2: The glacier map from Glaciers_cci is used for masking (only CL0/1/2)

Sentinel 2 arrived!

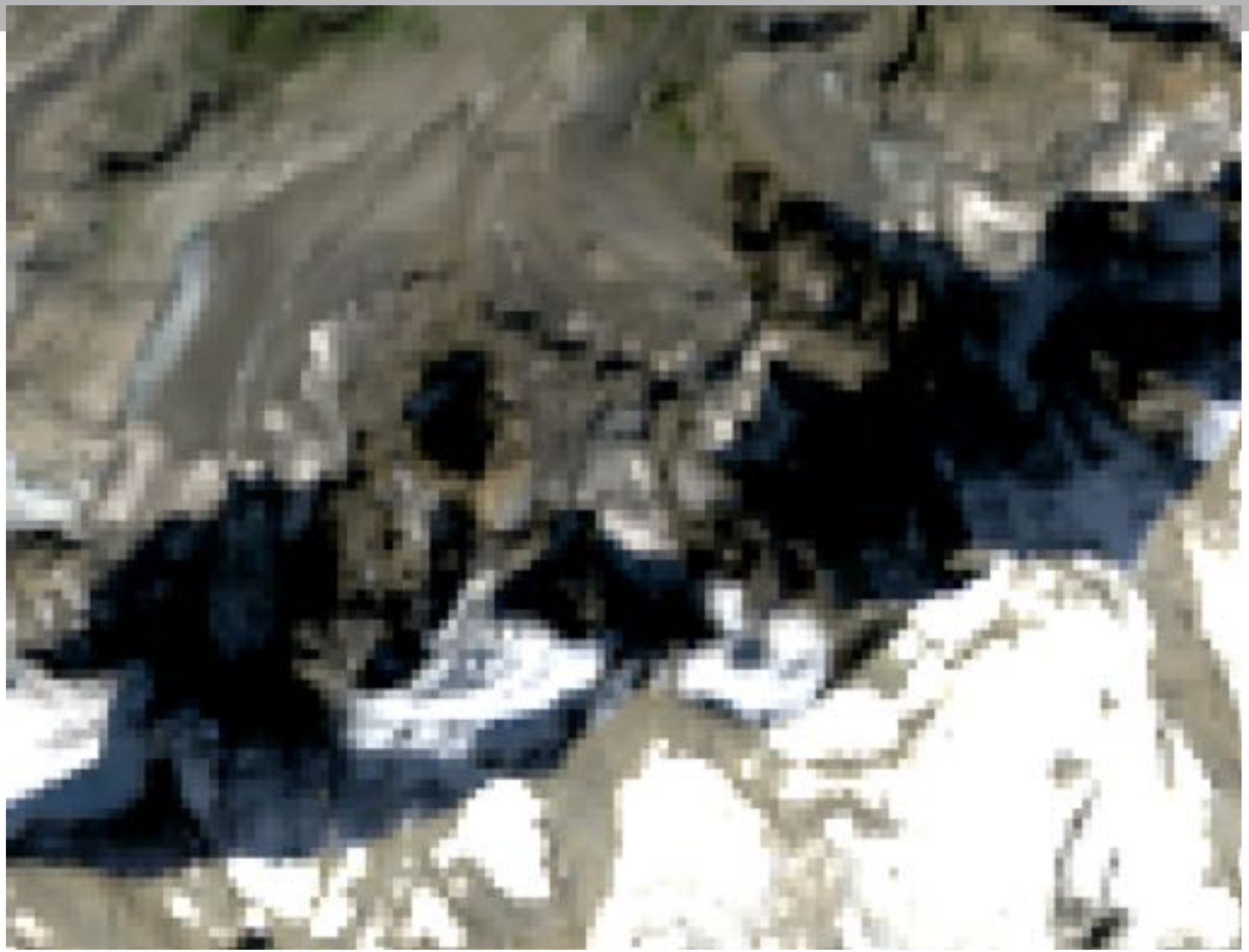



Upper
Grindelwald
Gauli
Lower
Grindelwald
Unteraar
Oberaar
Fiescher
Sentinel 2: Copernicus 2015

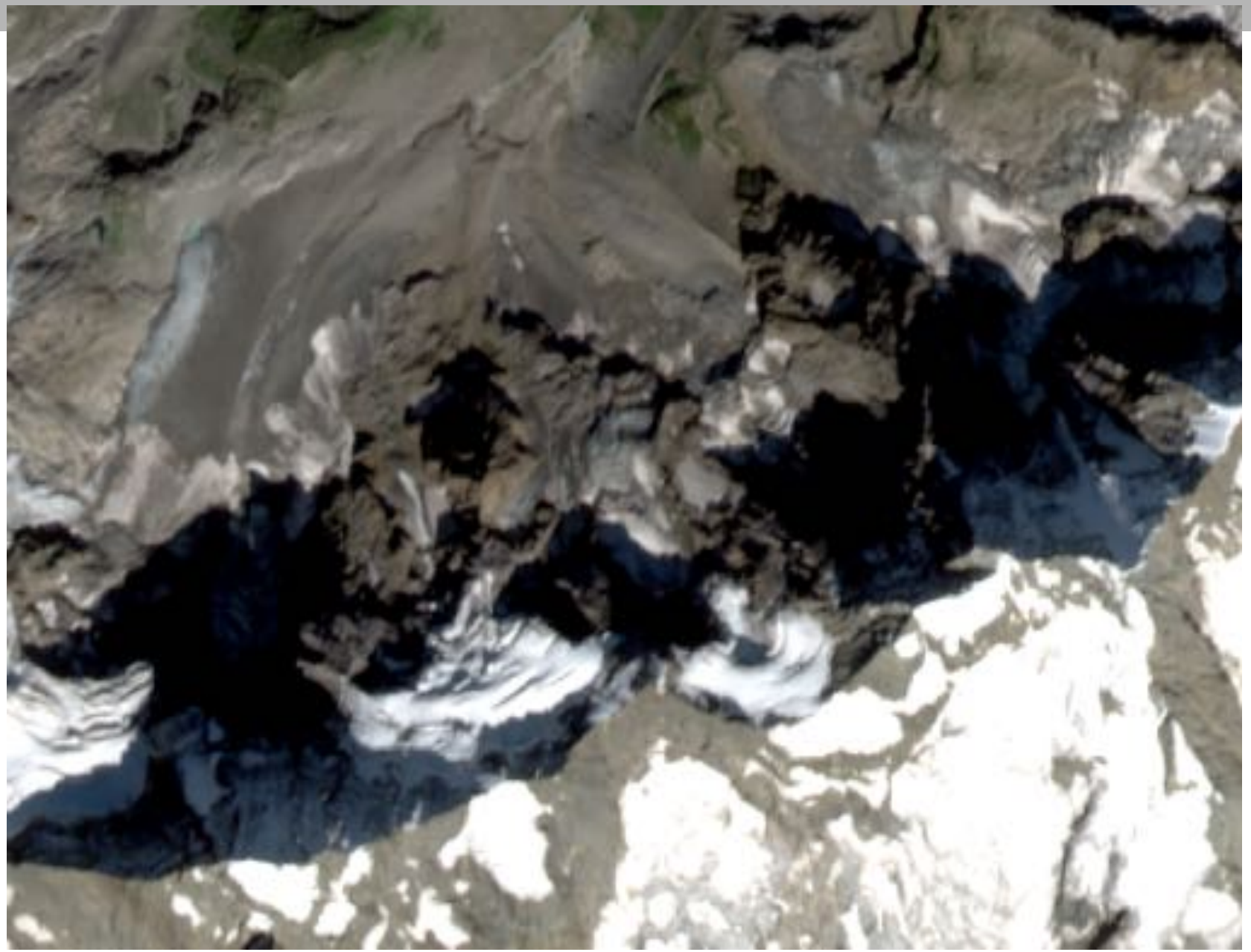
Sentinel 2 tiles and test region



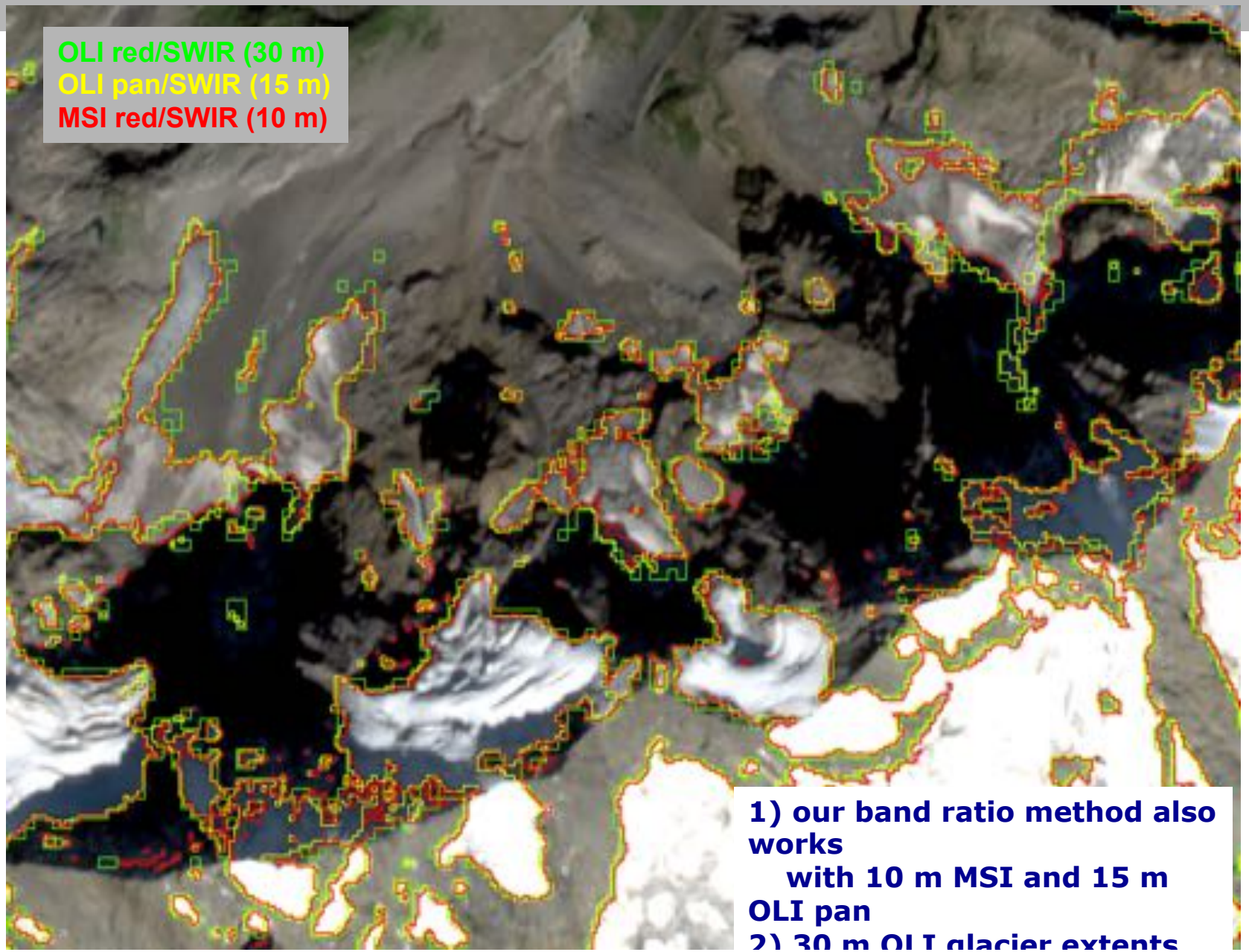
Spatial resolution Landsat OLI (30 m)



Spatial resolution Sentinel 2 MSI (10 m)



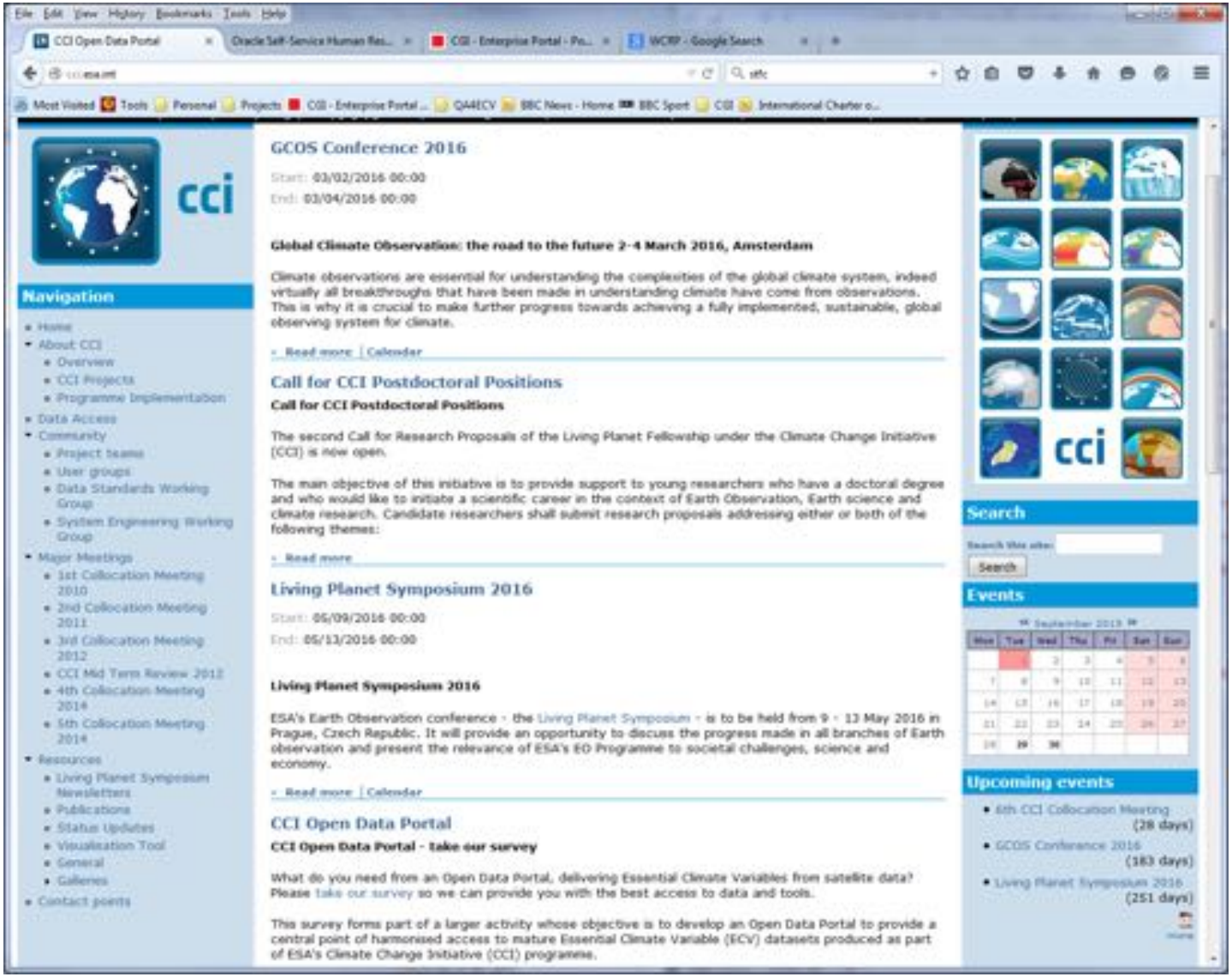
Glacier outlines from OLI and MSI

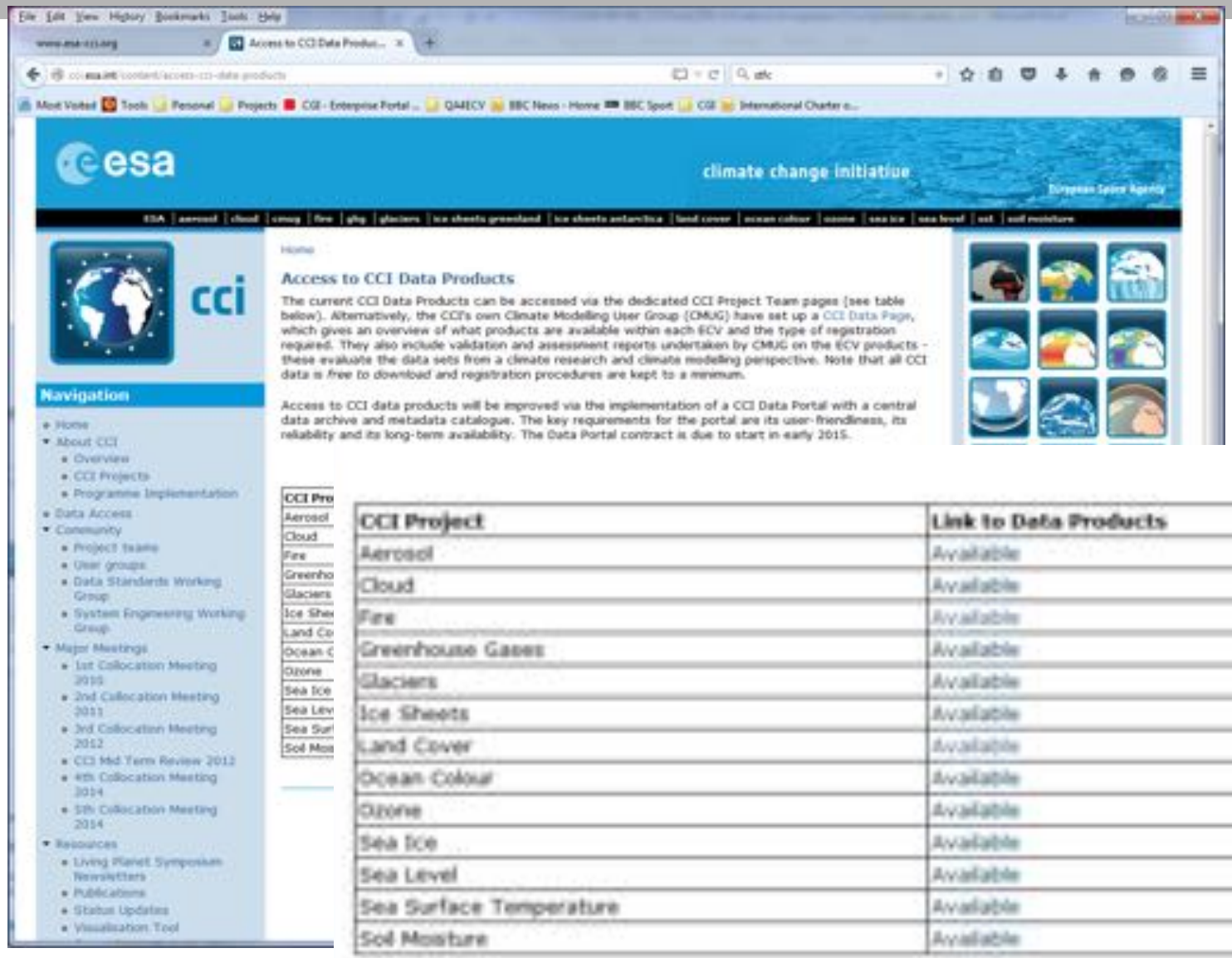


1) our band ratio method also works
with 10 m MSI and 15 m OLI pan
2) 30 m OLI glacier extents

Tools

CCI Portal

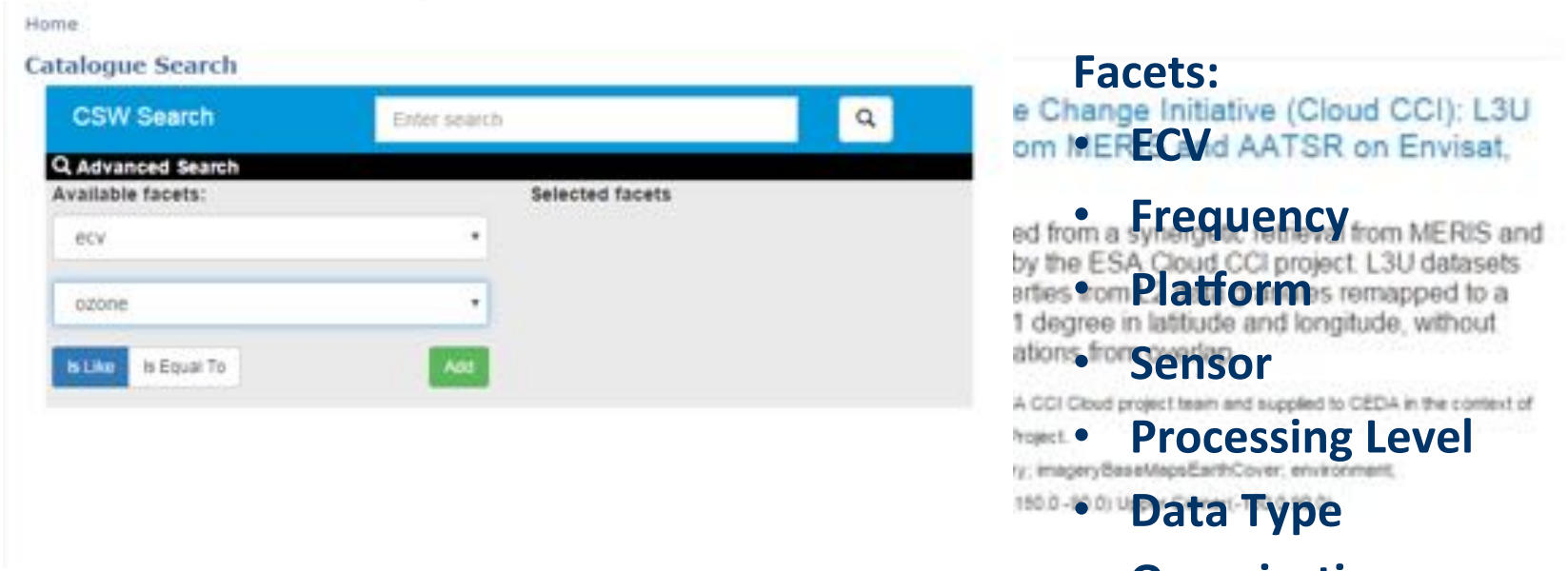

CCI Open Data Portal
Navigation
Home
About CCI
Overview
CCI Projects
Programme Implementation
Data Access
Community
Project teams
User groups
Data Standards Working Group
System Engineering Working Group
Major Meetings
1st Collocation Meeting 2010
2nd Collocation Meeting 2011
3rd Collocation Meeting 2012
CCI Mid Term Review 2012
4th Collocation Meeting 2014
5th Collocation Meeting 2014
Resources
Living Planet Symposium Newsletters
Publications
Status Updates
Visualisation Tool
General
Galleries
Contact points
GCOS Conference 2016
Start: 03/02/2016 00:00
End: 03/04/2016 00:00
Global Climate Observation: the road to the future 2-4 March 2016, Amsterdam
Climate observations are essential for understanding the complexities of the global climate system, indeed virtually all breakthroughs that have been made in understanding climate have come from observations. This is why it is crucial to make further progress towards achieving a fully implemented, sustainable, global observing system for climate.
Read more | Calendar
Call for CCI Postdoctoral Positions
Call for CCI Postdoctoral Positions
The second Call for Research Proposals of the Living Planet Fellowship under the Climate Change Initiative (CCI) is now open.
The main objective of this initiative is to provide support to young researchers who have a doctoral degree and who would like to initiate a scientific career in the context of Earth Observation, Earth science and climate research. Candidate researchers shall submit research proposals addressing either or both of the following themes:
Read more
Living Planet Symposium 2016
Start: 05/09/2016 00:00
End: 05/13/2016 00:00
Living Planet Symposium 2016
ESA's Earth Observation conference - the Living Planet Symposium - is to be held from 9 - 13 May 2016 in Prague, Czech Republic. It will provide an opportunity to discuss the progress made in all branches of Earth observation and present the relevance of ESA's EO Programme to societal challenges, science and economy.
Read more | Calendar
CCI Open Data Portal
CCI Open Data Portal - take our survey
What do you need from an Open Data Portal, delivering Essential Climate Variables from satellite data? Please take our survey so we can provide you with the best access to data and tools.
This survey forms part of a larger activity whose objective is to develop an Open Data Portal to provide a central point of harmonised access to mature Essential Climate Variable (ECV) datasets produced as part of ESA's Climate Change Initiative (CCI) programme.
Search
Search
Events
Upcoming events
6th CCI Collocation Meeting (28 days)
GCOS Conference 2016 (183 days)
Living Planet Symposium 2016 (251 days)



CCI Project	Link to Data Products
Aerosol	Available
Cloud	Available
Fire	Available
Greenhouse Gases	Available
Glaciers	Available
Ice Sheets	Available
Land Cover	Available
Ocean Colour	Available
Ozone	Available
Sea Ice	Available
Sea Level	Available
Sea Surface Temperature	Available
Soil Moisture	Available

ECV	Volume	Notes	Version
aerosol	0.2 TB	L2 and L3 products	various
cloud	8.1 TB	L3C, L3S and L3U phase1_v1.0	v1.0 (v2.0)
fire	4.7 GB	burned_area grid and pixel	v3.1
ghg	23.0 GB	L2 xch4, xco2 products (CRDP_2)	various
glaciers	6.8 MB	rgi50	V5.0
ice sheets greenland	1.0 GB	surface_elevation_change, ice_velocity, calving_front_locations, grounding_line_locations	v1.0
land cover	17 GB	300m global LC Maps	1.6.1
ocean colour	30 TB	v1-release, geographic and sinusoidal	v1.0
ozone	1.4 GB	L3 total_columns, limb_profiles, nadir_profiles	various
sea ice	0.2 TB	sea_ice_concentration L4 products	v1.11
sea level	1.5 GB	IND and L4 MSLA products	v1.1
soil moisture	45 GB	daily_files ACTIVE, COMBINED, PASSIVE	v02.1, v02.2
sst	3.7 TB	L4 Analysis, L3U ATSR, L2P AVHRR	v01.0, v01.1
total	**42.3 TB**		

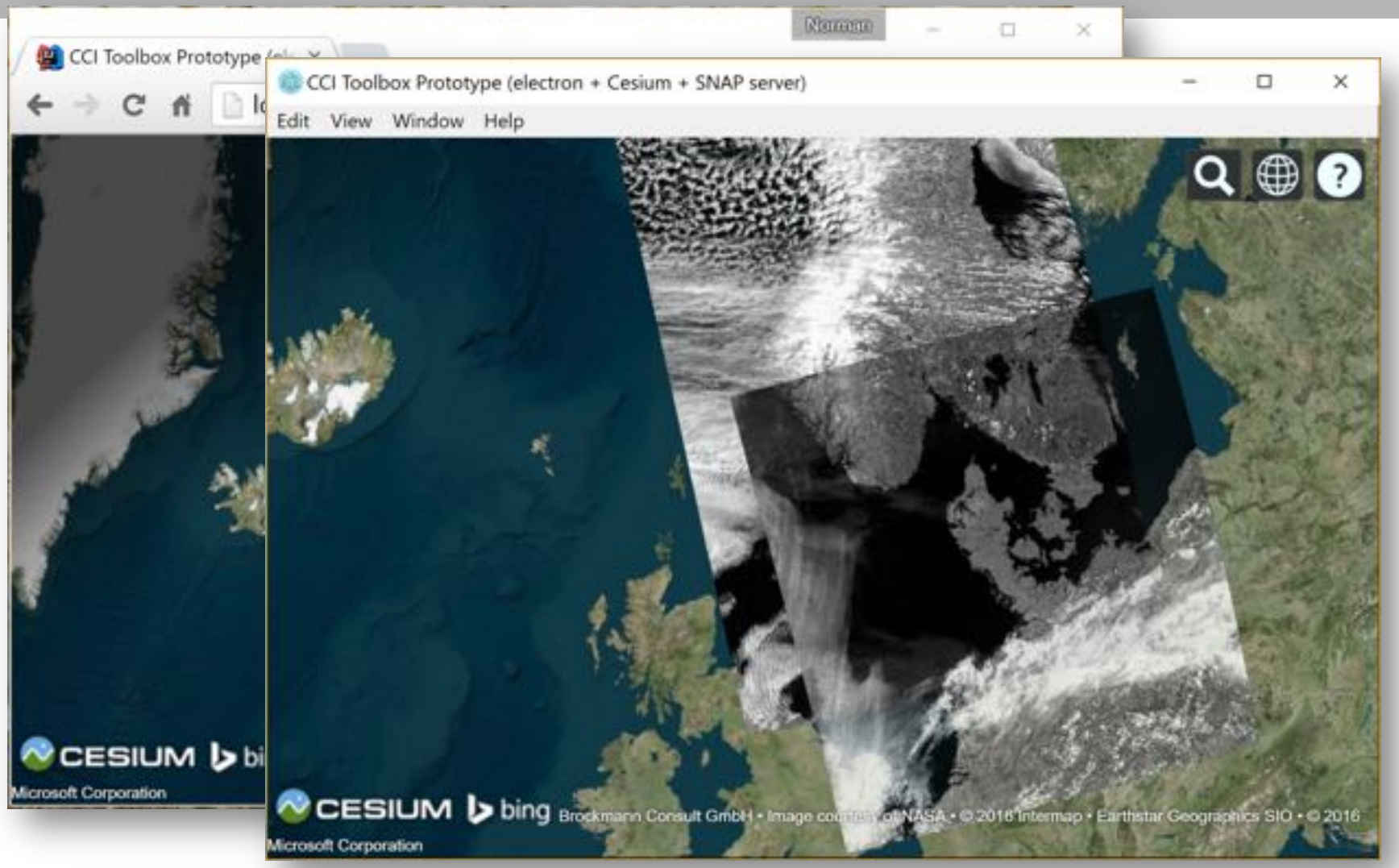
Catalogue records



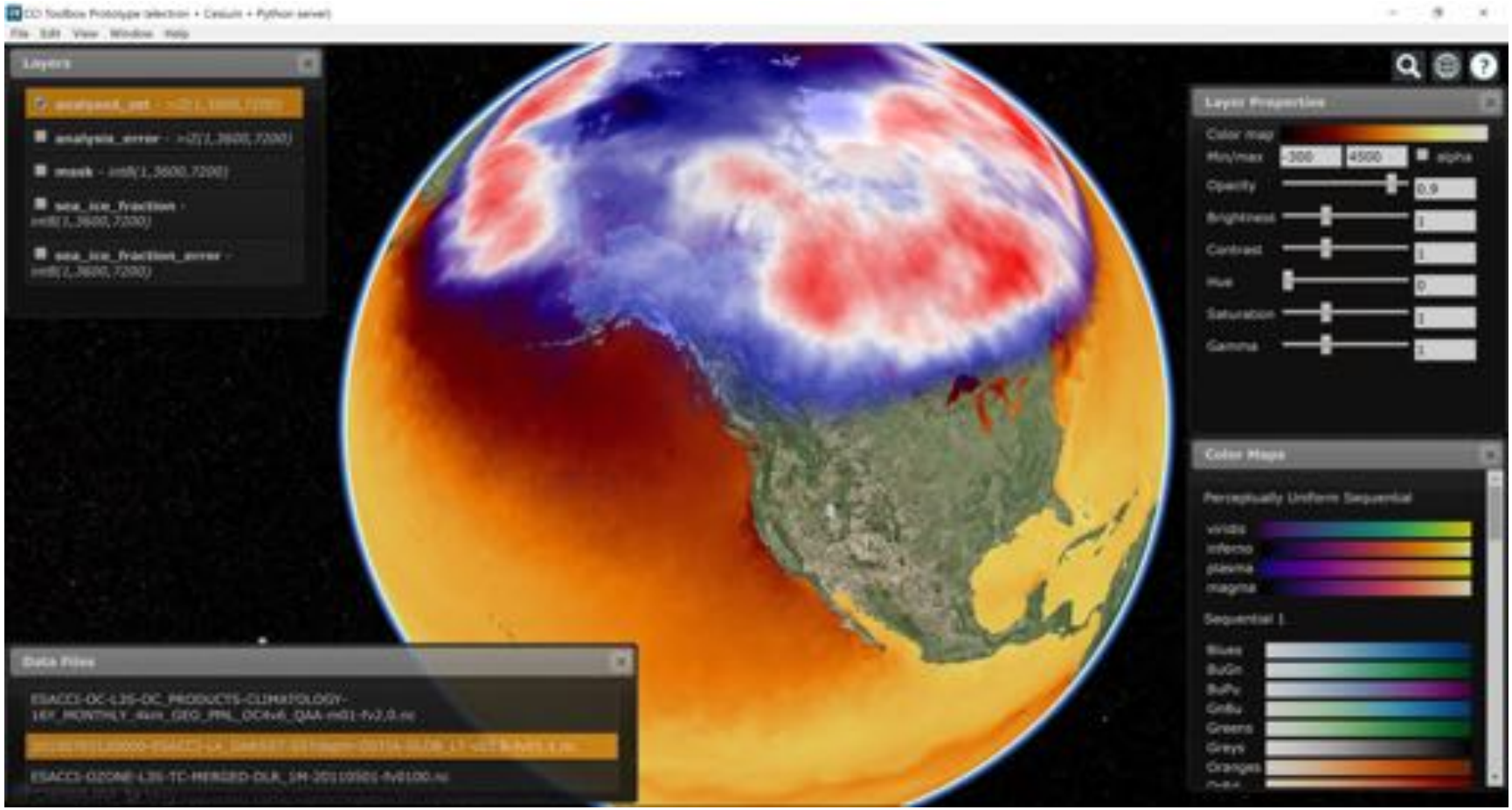
Facets:

- **ECV**
- **Frequency**
- **Platform**
- **Sensor**
- **Processing Level**
- **Data Type**
- **Organisation**

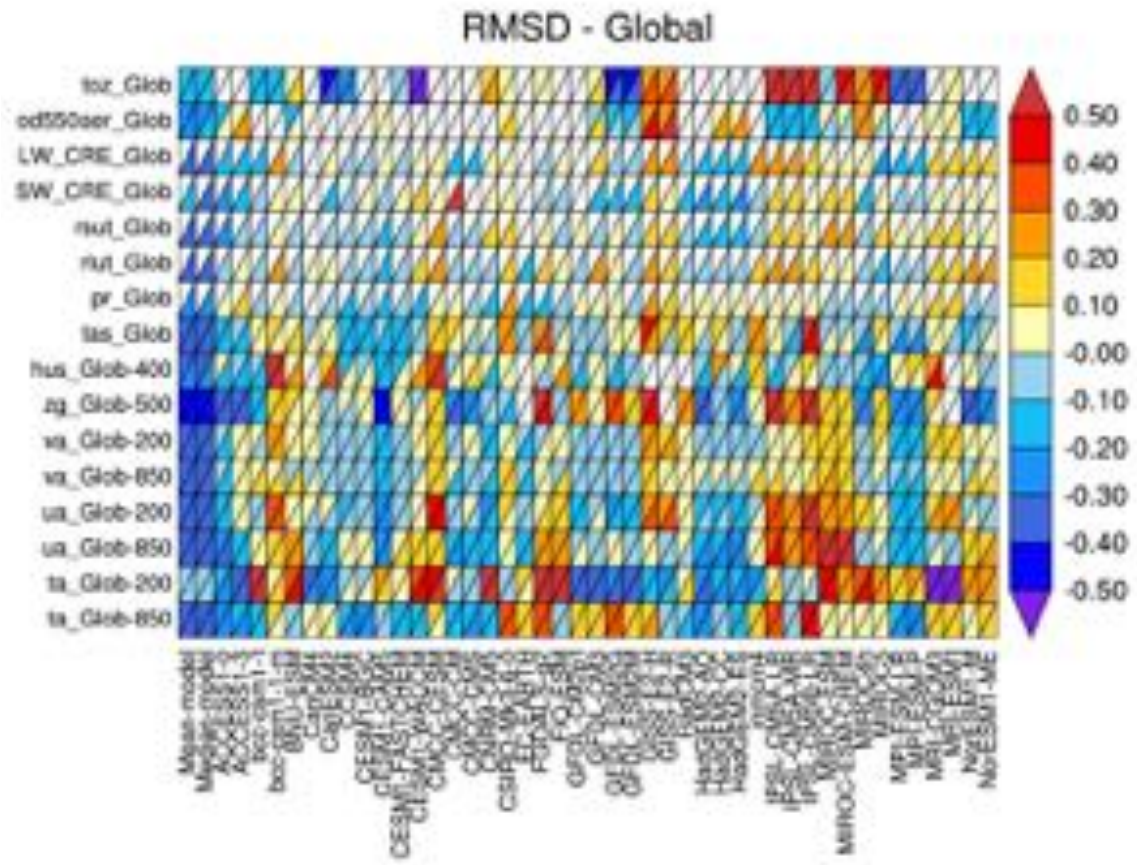
CCI Toolbox Prototype 1 – Demo



CCI Toolbox Prototype 2 - Demo



Performance Metrics calculated with ESA CCI Data [DLR]



NEW:
ESA CCI total column ozone

ESA CCI AOD 550 nm already implemented in ESMValTool version 1.0

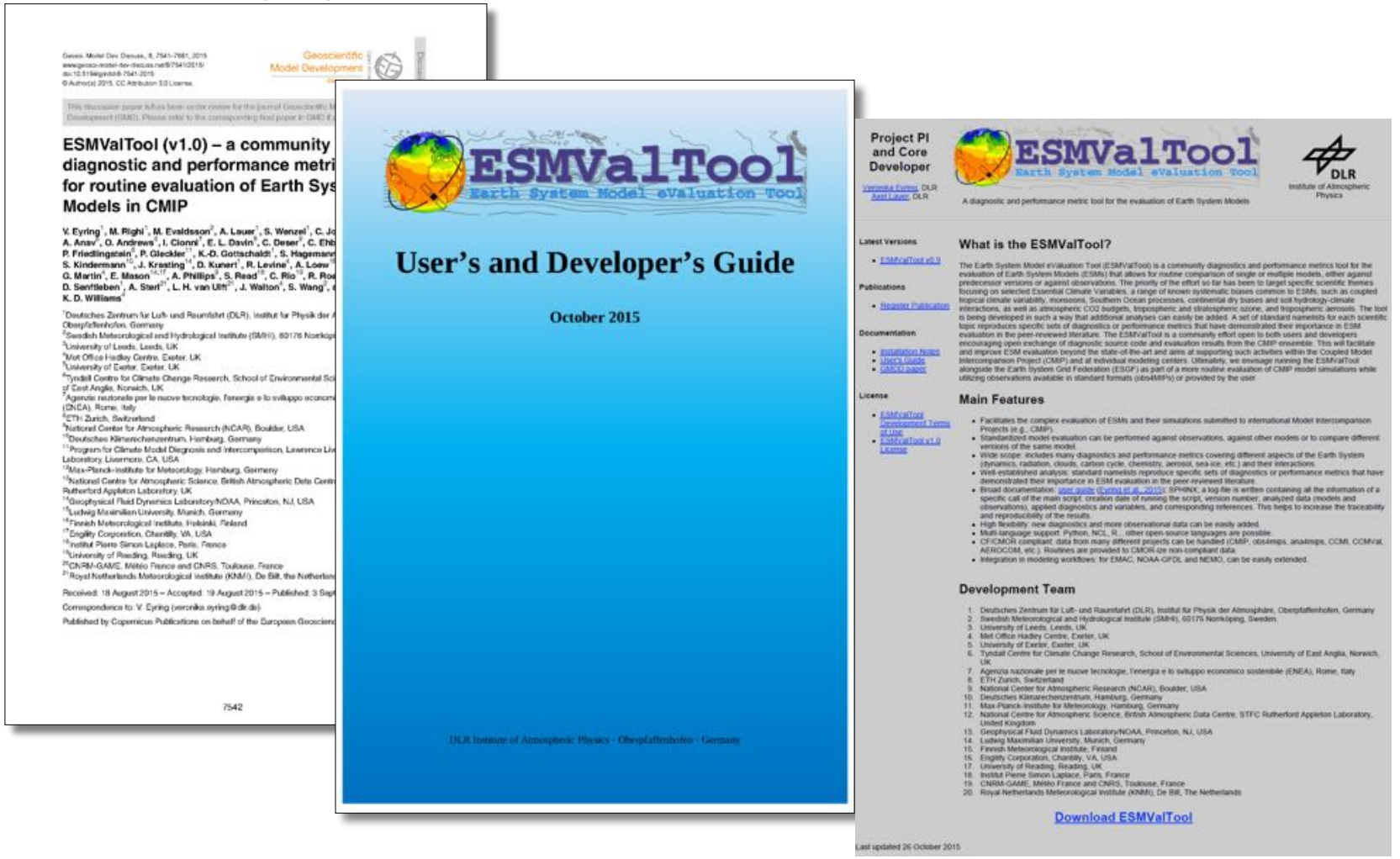
Implementation of other ESA CCI datasets planned

- **Clouds & Radiation**
- **Aerosol+**
- **XCO2**
- **SIC and SIT**
- **Ocean colour**
- **SSTs**
- **Land Cover**
- **Fire**
- **Soil Moisture**

ESMValTool Version 1.0 released with ESA CMUG contributions

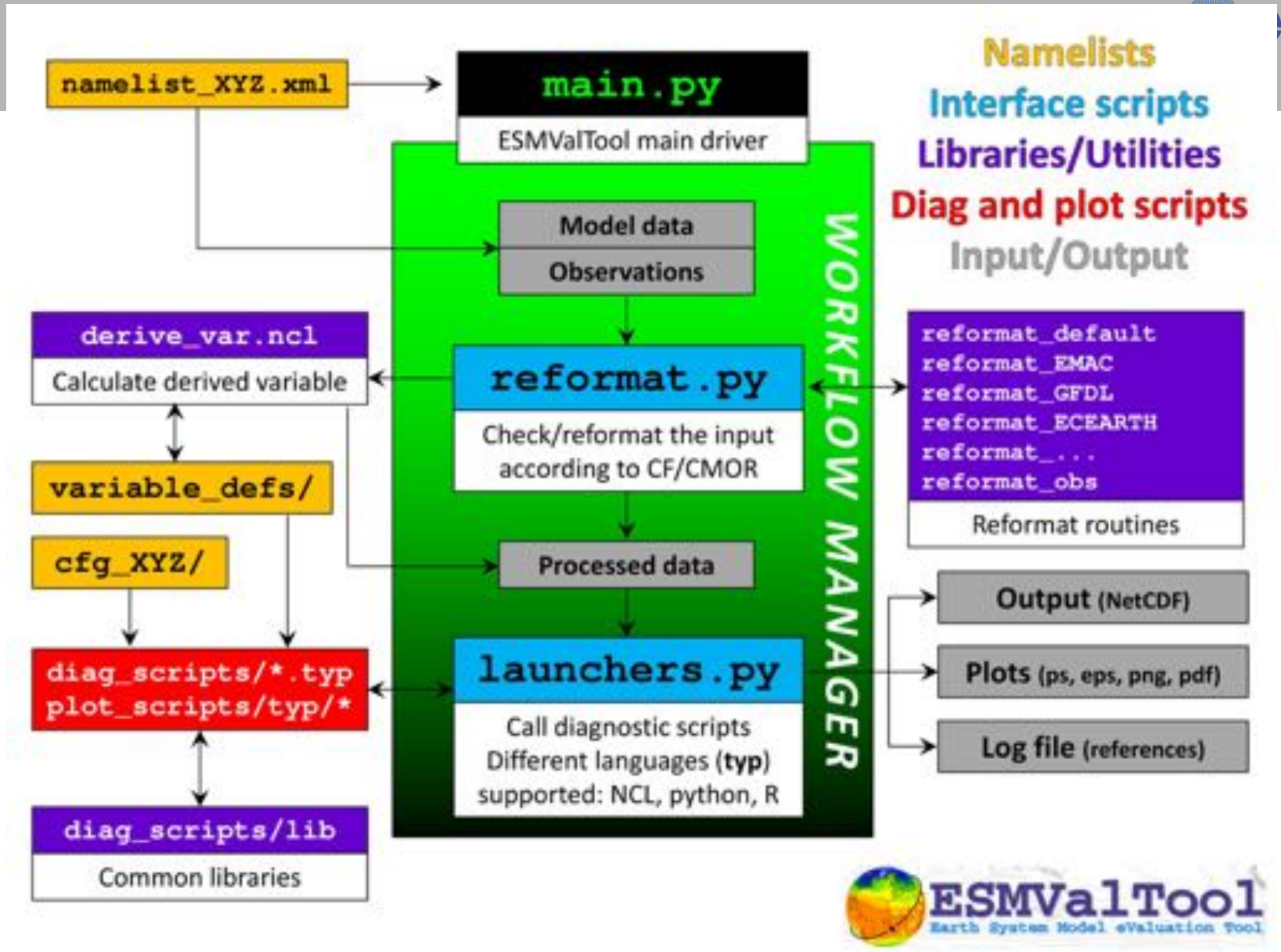
http://www.esmvaltool.org/

Eyring et al., Geosci. Model Dev. Discuss, 8, 7541-7661, 2015



Current Status: Contributing Institutions
(currently ~60 developers from 22 institutions and ~40 users)

1. Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Germany
2. Swedish Meteorological and Hydrological Institute (SMHI), Norrköping, Sweden
3. Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA), Italy
4. British Atmospheric Data Centre (BADC) , UK
5. Centre for Australian Weather and Climate Research (CAWCR), Bureau of Meteorology, Australia
6. Deutsches Klimarechenzentrum (DKRZ), Germany
7. ETH Zurich, Switzerland
8. Finnish Meteorological Institute, Finland
9. Geophysical Fluid Dynamics Laboratory (GFDL) NOAA, USA
10. Institut Pierre Simon Laplace, France
11. Ludwig Maximilian University of Munich, Germany
12. Max-Planck-Institute for Meteorology, Germany
13. Met Office Hadley Centre, UK
14. Météo France, Toulouse, France
15. Nansen Environmental and Remote Sensing Center, Norway
16. National Center for Atmospheric Research (NCAR), USA
17. New Mexico Tech, USA
18. Royal Netherlands Meteorological Institute (KNMI), The Netherlands
19. University of East Anglia (UEA), UK
20. University of Exeter, Exeter, UK
21. University of Reading, UK
22. University of Wagingen, The Netherlands

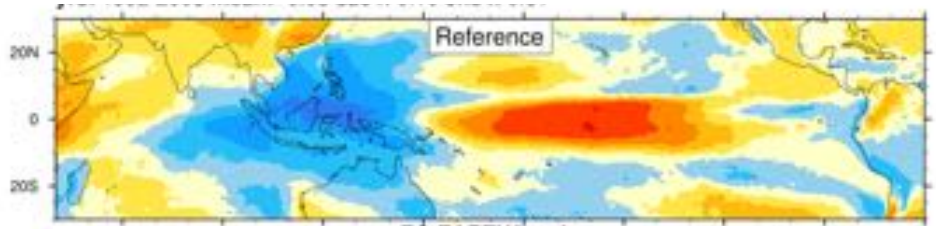

namelist_XYZ.xml
main.py
ESMValTool main driver
Namelists
Interface scripts
Libraries/Utilities
Diag and plot scripts
Input/Output
Model data
Observations
WORKFLOW MANAGER
derive_var.ncl
Calculate derived variable
reformat.py
Check/reformat the input according to CF/CMOR
reformat_default
reformat_EMAC
reformat_GFDL
reformat_ECEARTH
reformat_...
reformat_obs
Reformat routines
variable_defs/
cfg_XYZ/
Processed data
Output (NetCDF)
diag_scripts/*.typ
plot_scripts/typ/*
launchers.py
Plots (ps, eps, png, pdf)
Log file (references)
Call diagnostic scripts
Different languages (typ) supported: NCL, python, R
diag_scripts/lib
Common libraries
ESMValTool
Earth System Model eValuation Tool

ATMOSPHERE: Teleconnections Clouds & SST [SMHI]

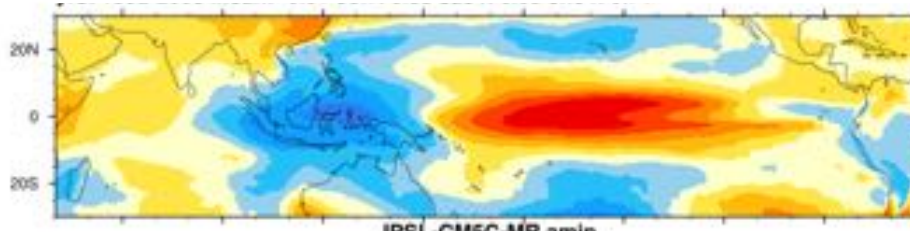
Preliminary results using ESMvaltool Teleconnection diagnostics for the correlation between Nino3.4 CCI-SST and CCI -Cloud cover, and SST/ Clouds in two AMIP simulations,1982-2008

ANN-mean Cloud-Nino3.4 SST teleconnections

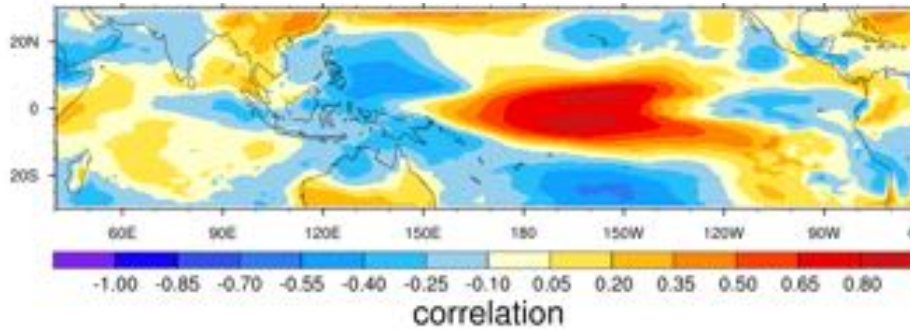
CCI SST&Clouds



EC-Earth SST&Clouds

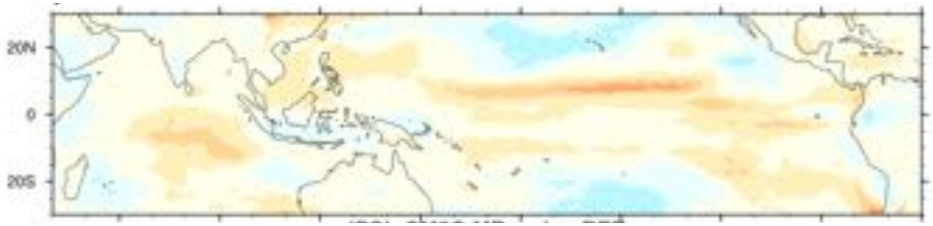


IPSL SST&Clouds

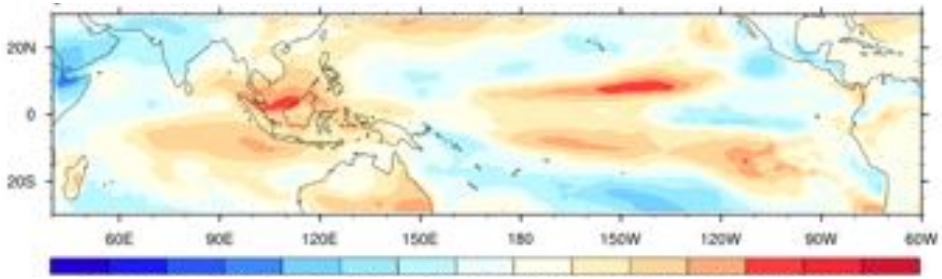


Observed and modelled teleconnection pattern similar, but the models show hint of "double" ITCZ

EC-Earth - CCI correlations



IPSL - CCI correlations



Difference in models and observed correlation

CCI+

Preliminary analysis of new ECVs in CCI+

Atmosphere	Ocean	Terrestrial
Composition	**Surface**	
Aerosol Properties	Sea Surface Temperature	Land Cover
Carbon Dioxide & Methane	Sea Level	Fire Disturbance
Ozone	Sea Ice	Soil Moisture
Long-Lived Greenhouse Gases	Ocean Colour	Glaciers and Ice Caps
	Sea State	Ice Sheets
Upper Air	Current	Snow Cover
Cloud Properties	Sea Surface Salinity	Albedo
Temperature	Carbon Dioxide Partial Pressure	Leaf Area Index (LAI)
Water Vapour	Phytoplankton	FAPAR
Wind Speed and Direction	Ocean Acidity	Lakes
Earth Radiation Budget	**Sub Surface**	Above Ground Biomass
Surface	Carbon	Permafrost
Surface Air Pressure	Current	Ground Water
Surface Air Temperature	Nutrients	River Discharge
Surface Precipitation	Ocean Acidity	Soil Carbon
Surface Radiation Budget	Oxygen	
Water Vapour (Surface humidity)	Salinity	
Near-Surface Wind Speed, Dir	Temperature	
	Tracers	
	Global Ocean Heat Content	

Within scope of CCI	Started in CCI	

Preliminary analysis of new ECVs in CCI+

Atmosphere	Ocean	Terrestrial
Composition	**Surface**	
Aerosol Properties	Sea Surface Temperature	Land Cover - High Resolution
Carbon Dioxide & Methane	Sea Level	Fire Disturbance
Ozone	Sea Ice	Soil Moisture
Long-Lived Greenhouse Gases	Ocean Colour	Glaciers and Ice Caps
Precursors (for Aerosols and Ozone)	Sea State	Ice Sheets
Upper Air	Current	Snow Cover
Cloud Properties	Sea Surface Salinity	Albedo
Temperature	Carbon Dioxide Partial Pressure	Leaf Area Index (LAI)
Water Vapour	Phytoplankton	FAPAR
Wind Speed and Direction	Ocean Acidity	Lakes
Earth Radiation Budget	**Sub Surface**	Above Ground Biomass
Surface	Carbon	Permafrost
Surface Air Pressure	Current	Ground Water
Surface Air Temperature	Nutrients	River Discharge
Surface Precipitation	Ocean Acidity	Soil Carbon
Surface Radiation Budget	Oxygen	Land Surface Temperature
Water Vapour (Surface humidity)	Salinity	
Near-Surface Wind Speed, Dir	Temperature	
	Tracers	
	Global Ocean Heat Content	

Within scope of CCI	Started in CCI	Proposed in CCI+ Extension

(ii) New R&D on ECVs already started in CCI

ESA/PB-EO(2015)24 Annex 2 lists many CCI ECV products expected to be sufficiently mature for pre-operational production by the end of CCI (2017-2018).

Further R&D on ECVs is needed in CCI+ to:

- Improve quality of ECV products closer to meeting GCOS goals (e.g. accuracy, spatial resolution, long term stability), and improve cross-ECV consistency.
- Develop algorithms for "difficult" ECV variables required by GCOS,
  e.g. regional sea-level, coastal ocean colour, aerosol absorption, sea-ice drift.
- Extend ECV length by developing methods to bring older less well-calibrated satellite instruments into the time series (e.g. AVHRR), and develop corrections for future instrument degradation.
- Fully exploit the new capabilities of Sentinel and Earth Explorer instruments,
  e.g. new types of measurement, new spectral bands, wider swaths, higher resolution.
- Develop climate-quality methods to join-up multi-mission time series, especially where there are gaps, e.g. Envisat to Sentinel-1/3.
- Increase maturity of ECV product uncertainty estimates.
- Develop better merged ECV products.
- Perform algorithm round-robins to assess promising new ECV retrieval techniques.

Climate Modelling and the new ECVs

ESA announced the following candidates to be considered for CCI+

- Ocean Salinity
- Sea State (e.g. height/freq/dire waves)
- Lakes (e.g. level, area, temp, phase)
- Above Ground Biomass
- Snow Cover (e.g. cover, SWE)
- Long-lived Greenhouse Gases (e.g. CFC, SF6)
- Precursors Supporting the Ozone and Aerosol ECVs
- High-Resolution Land Cover
- Land Surface Temperature
- Water Vapour
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