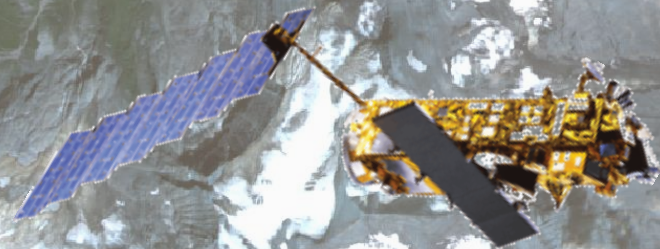# SENTINEL-1, 2 BASED GLACIER PRODUCTS BY ENVEO

presented by **Gabriele Bippus**

**ENVEO IT GmbH**
Innsbruck, Austria

enveo

- **Glacier ice surface velocity** from *Sentinel-1 IWS* data (from crossing orbits (asc/desc)) using Interferometry or Offset Tracking

- **Glacier outlines** from *Sentinel-2 MSI* data

- **Snow and ice areas on glaciers** from *Sentinel-2 MSI* (glacier facies) and *Sentinel-1 IWS* data (wet snow cover on glaciers)

→ ***Sentinel data from ESA Scientific Data Hub***

Glacier Products Specifications

enveo

Products	Sensor	Projection / Datum	Spatial Coverage	Spatial Resolution	Temporal Resolution	Delivery period	Latency time	File Format
Ice Surface Velocity	*Sentinel-1*	Geographic / WGS84	Selected glaciers	5 m - 20 m	Seasonally / Annually	TBD	< 3 months	Raster (GeoTIFF, netCDF)
Glacier Outlines / Area	*Sentinel-2* (*Landsat*)	Geographic / WGS84	Selected regions	10 m	Annually	TBD	< 3 months	Vector (Shapefile, GLIMS Standards)
Snow / Ice Areas on Glaciers	*Sentinel-2* (*Landsat*)	Geographic / WGS84	Selected glaciers	10 m	Seasonally / Annually	TBD	< 3 months	Raster (GeoTIFF), Vector (Shapefile, GLIMS Standards)

Greenland Ice Sheet
Sentinel-1 Ice Velocity Map 2015

v_E, v_N, v_{dz}, 250 m pixel spacing
Main Period: Jan-March 2015
> 800 slices   > 30000 bursts
Method: Offset tracking
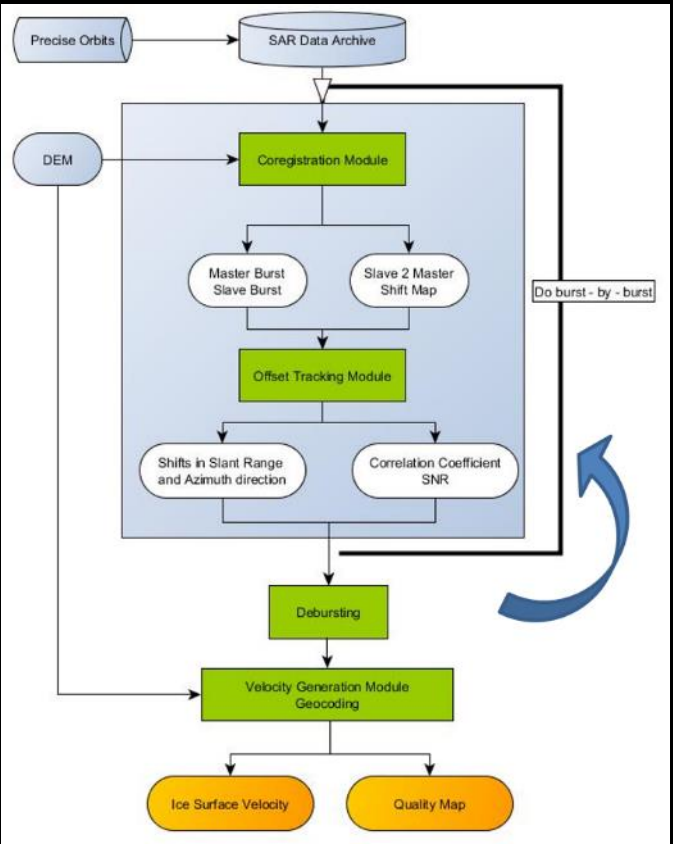
Nagler, et al.,
Rem. Sens. 2015
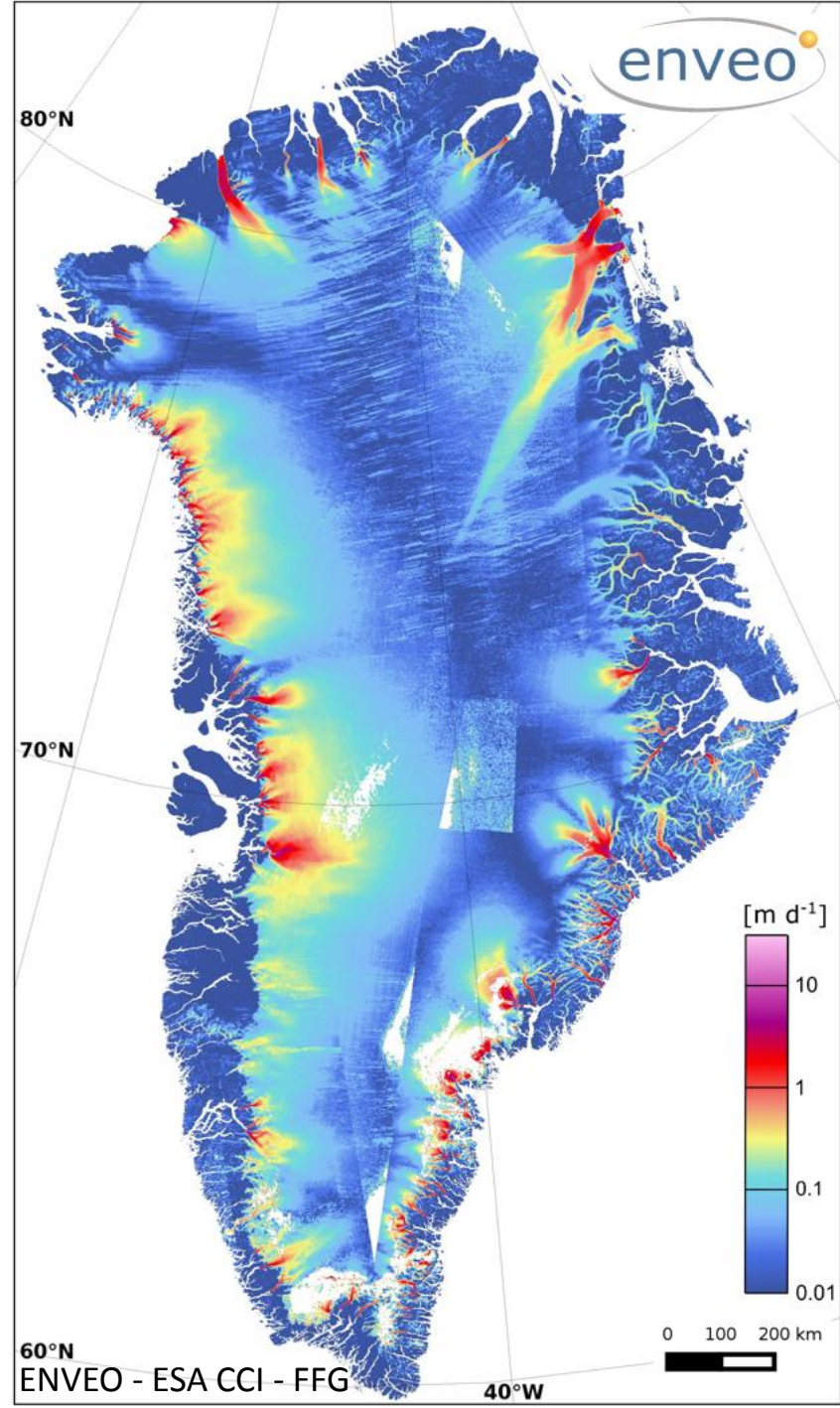
Ice surface velocity products

| Service provider:	ENVEO, GAMMA
Data Base:	Sentinel-1 C-SAR, other (V)HR radar satellite data
Auxiliary data:	DEM
Algorithm / classification:	Offset tracking, InSAR
Service limitations:	For GLV products from S1 SLC data a particular glacier size and ice motion is needed
Data rights:	Publicly available for non-commercial usage, copyright at ENVEO and GAMMA, respectively
Product access:	FTP on user demand
Service status:	On demand
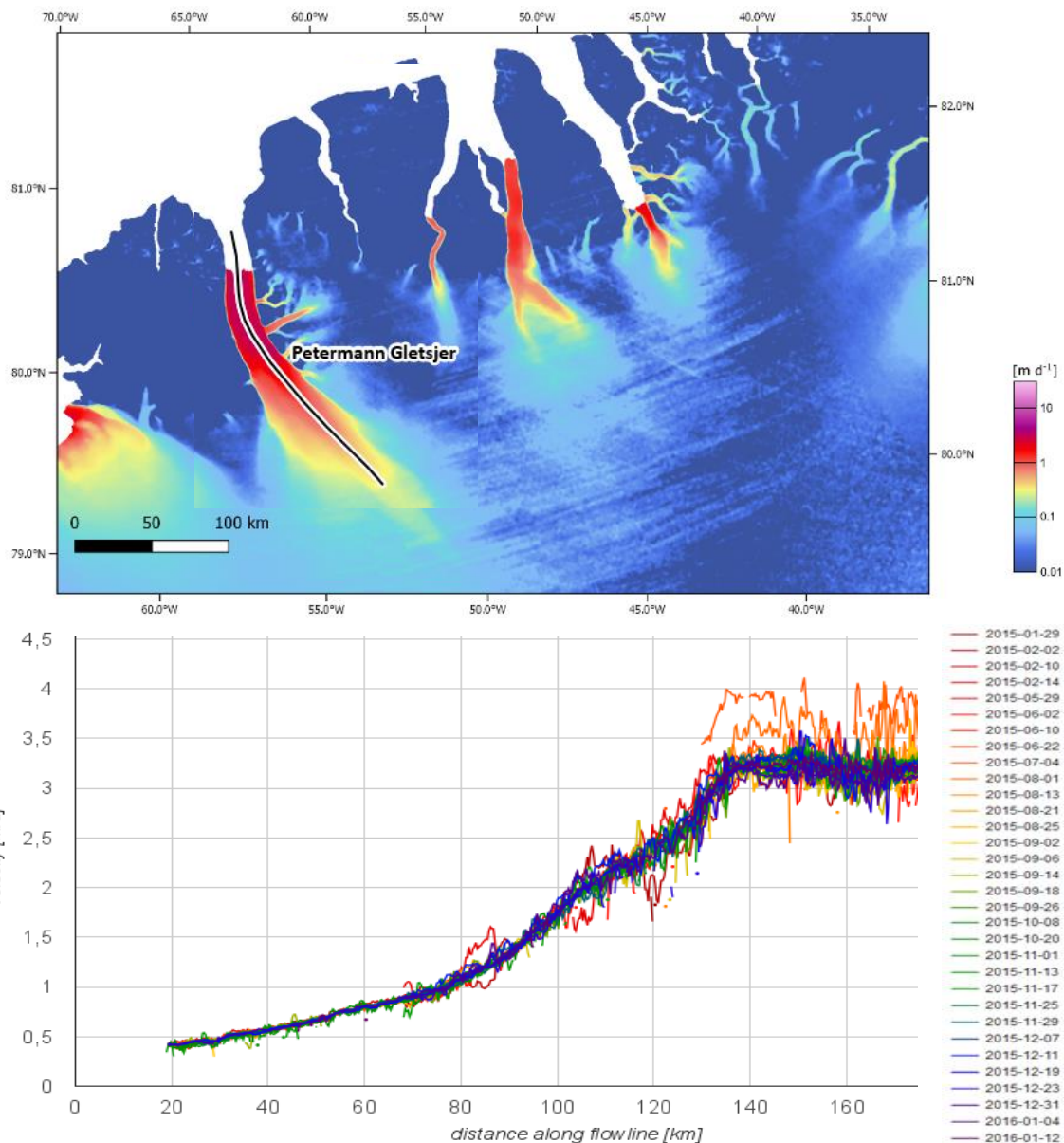
S1 3-15 Jan 2015
12 days
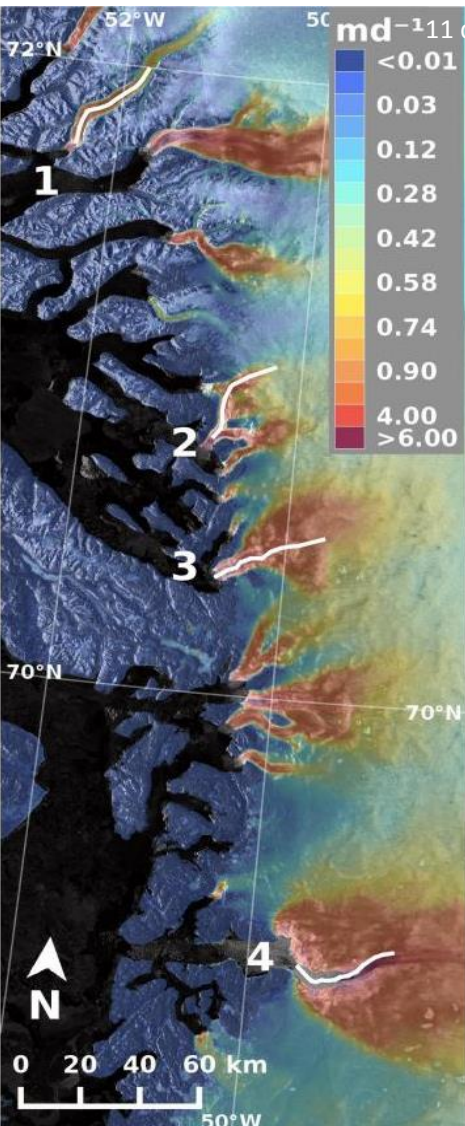
TSX, Dec-Feb 2015
11 / 22 days
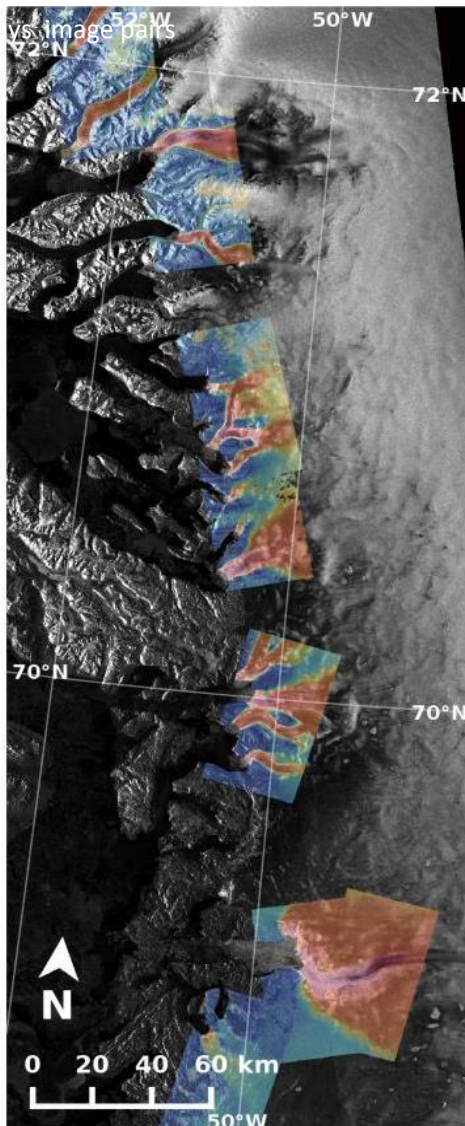
PalSAR, Dec2009,
46 days
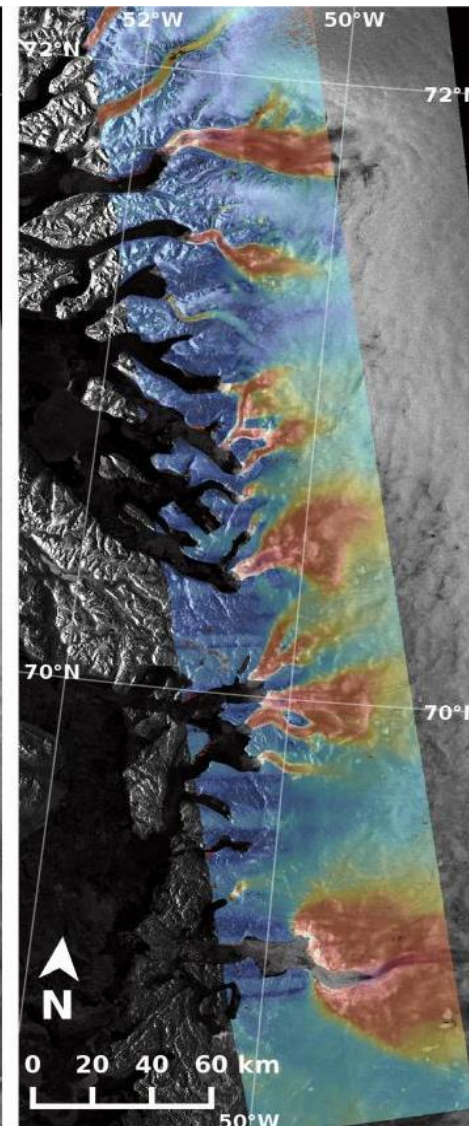
PalSAR, Aug2008
46 days
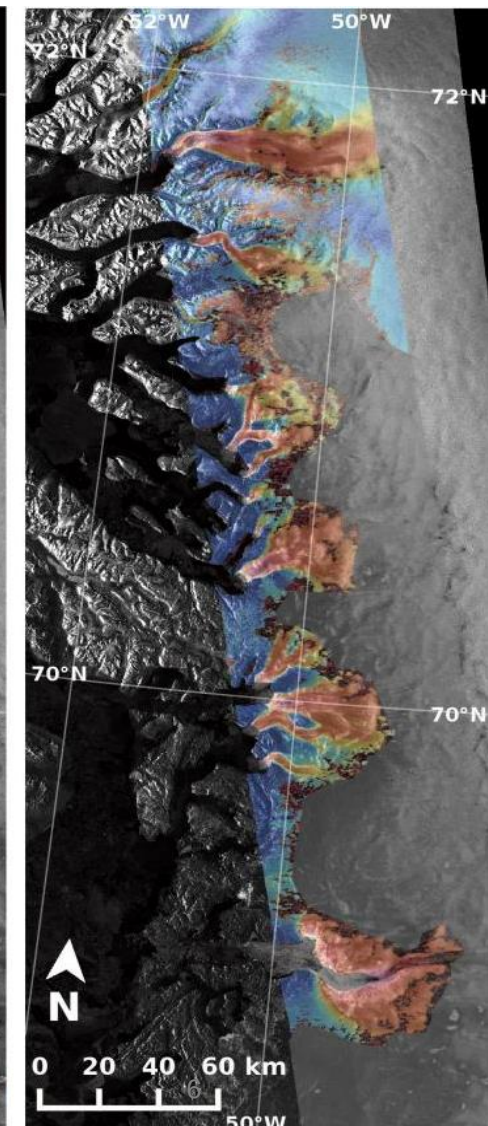
Glacier products from Sentinel-2 data

A scene acquired on 13 August 2015 (during commissioning phase) over the Hohe Tauern, Austria, was used for testing the processing lines for generating glacier outlines and snow and ice areas on glaciers.
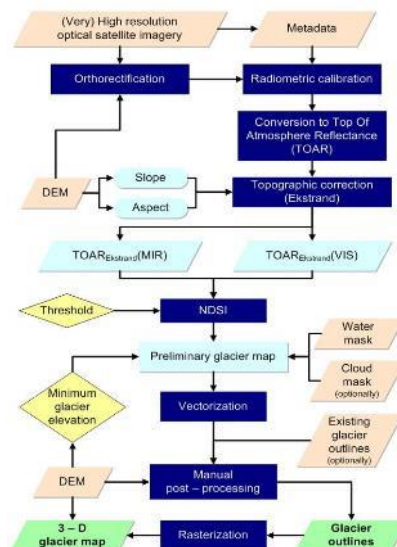
ENVEO was invited as expert at the Sentinel-2 Expert Meeting at ESA in Sept 2015.
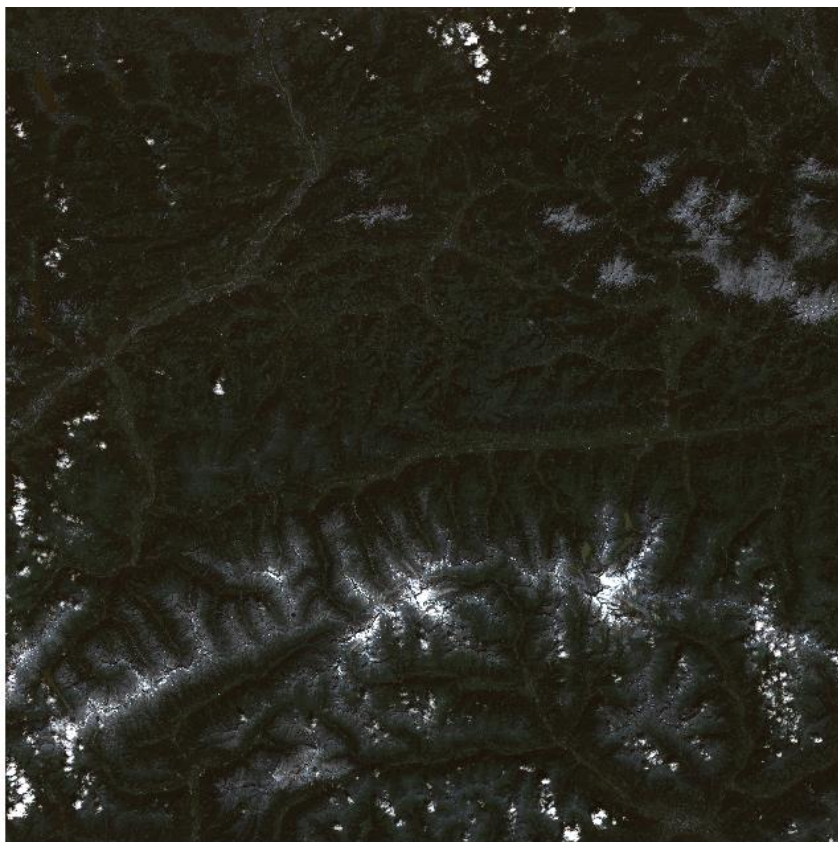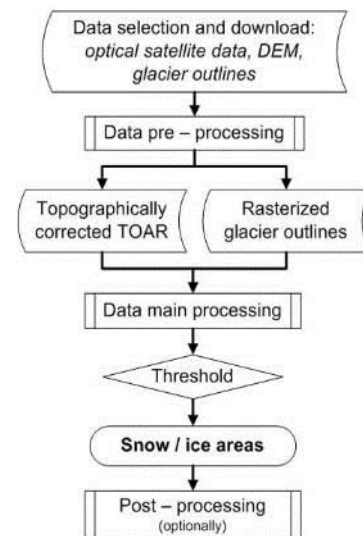

Copernicus Sentinel Data 2015

Glacier outlines

Thresholds applied on NDSI, Band 2, Band 8 & Ratio B2/B4

Snow/ice areas on glaciers

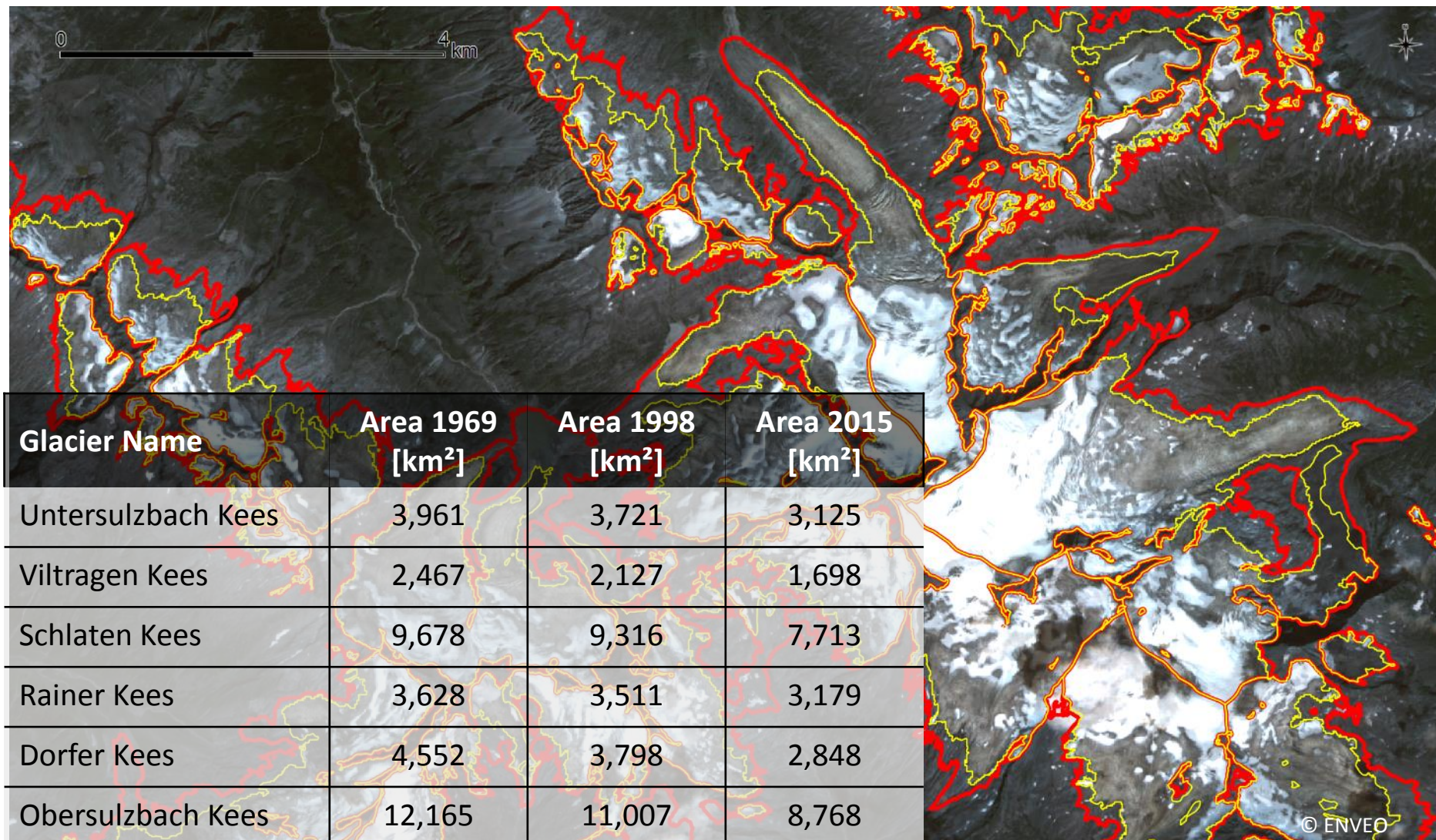Threshold applied on Band 8 within glacier outlines (AGI99)

Glacier outlines

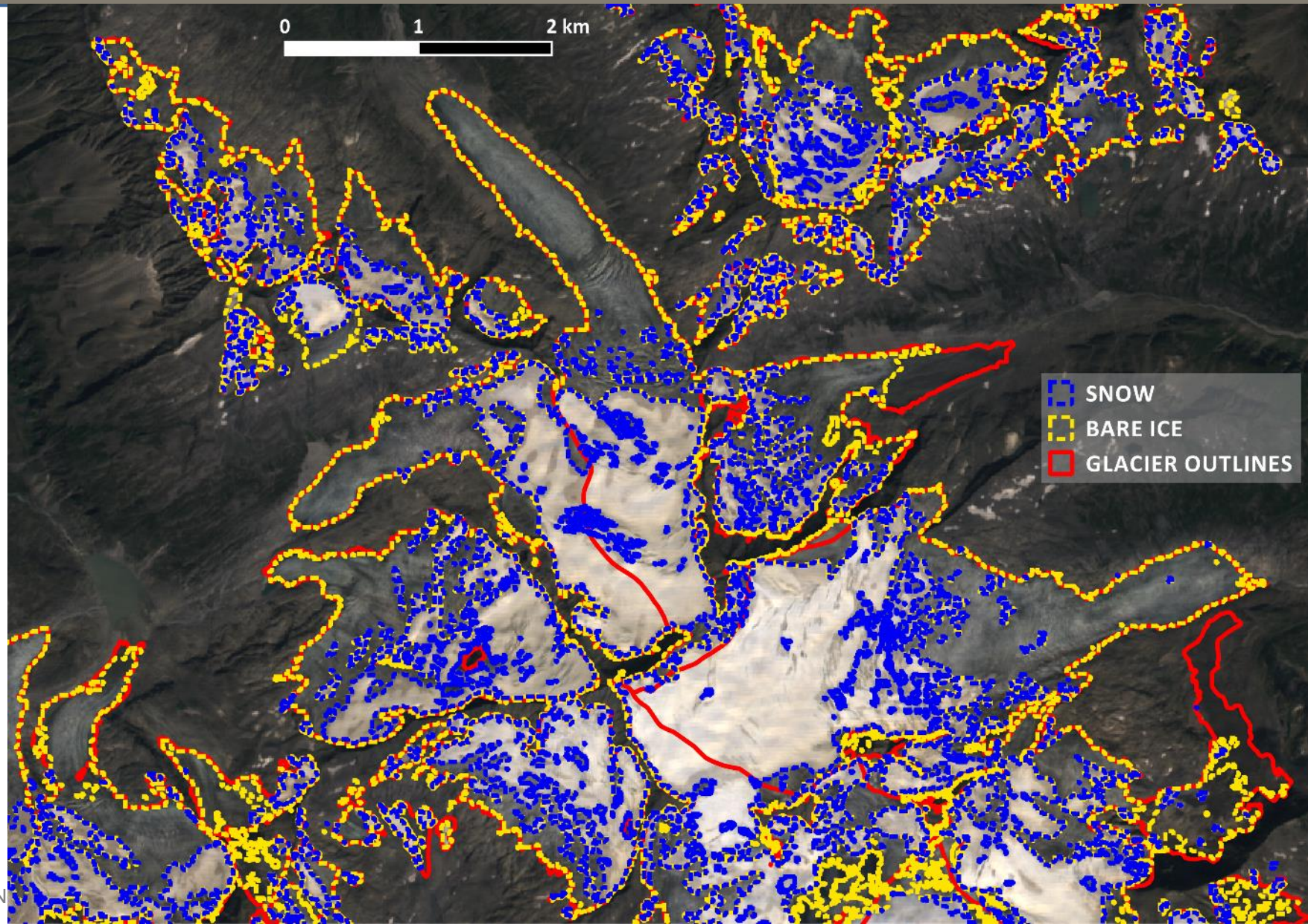|	
Service provider:	ENVEO
Data Base:	Sentinel-2 MSI, other (V)HR optical satellite data
Auxiliary data:	Water mask, DEM
Algorithm / classification:	NDSI, multiple band ratios
Service limitations:	Glaciers affected by cloud cover or cloud shadows are excluded from analyses, usable satellite imagery limited
Data rights:	Publicly available for non-commercial usage, copyright at ENVEO
Product access:	FTP on user demand, submission to GLIMS data base planned
Service status:	On demand
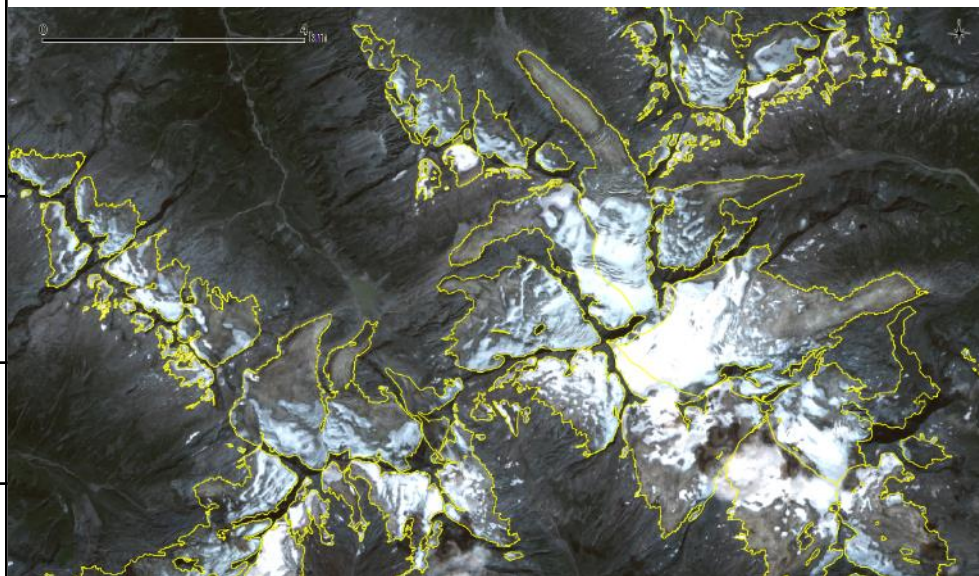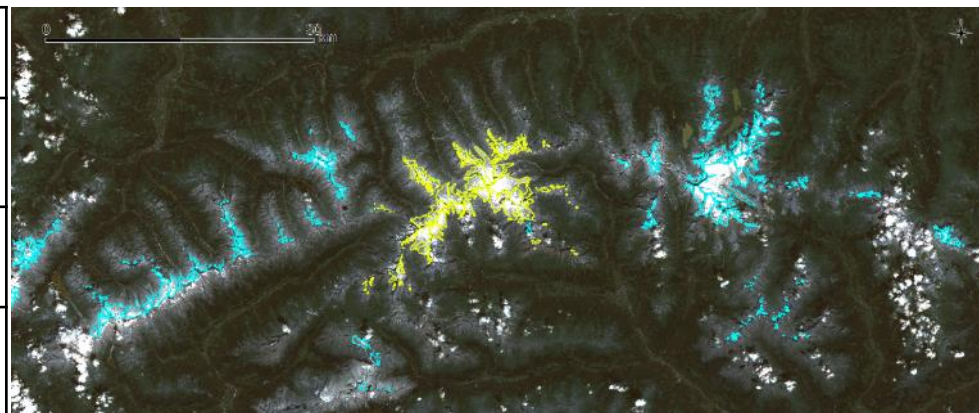
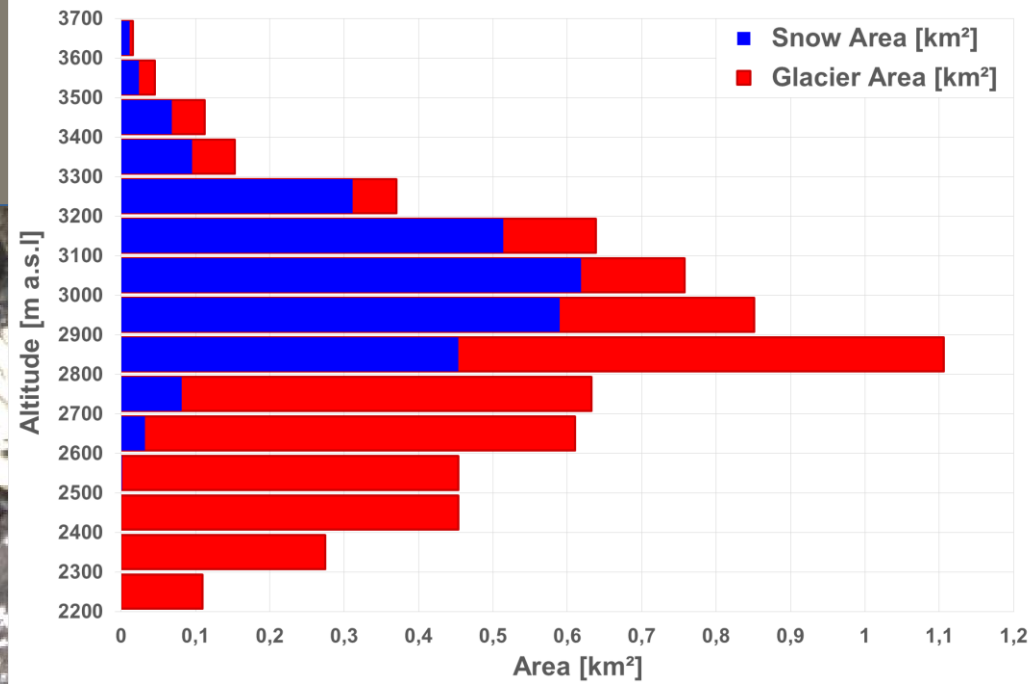Venedigergruppe, Hohe Tauern, Austria, from Sentinel-2 scene of 13 August 2015

Examples for glacier area changes 1969 – 1998 – 2015

Glacier Name	Area 1969 [km²]	Area 1998 [km²]	Area 2015 [km²]
Untersulzbach Kees	3,961	3,721	3,125
Viltragen Kees	2,467	2,127	1,698
Schlaten Kees	9,678	9,316	7,713
Rainer Kees	3,628	3,511	3,179
Dorfer Kees	4,552	3,798	2,848
Obersulzbach Kees	12,165	11,007	8,768
Habach Kees	3,567	3,289	2,366

© ENVEO

SEN3APP Glacier outlines 2015
Austrian Glacier Inventory 1998

Gabriele Bippus

SNOW
BARE ICE
GLACIER OUTLINES

Area altitude distribution of Snow/ice areas
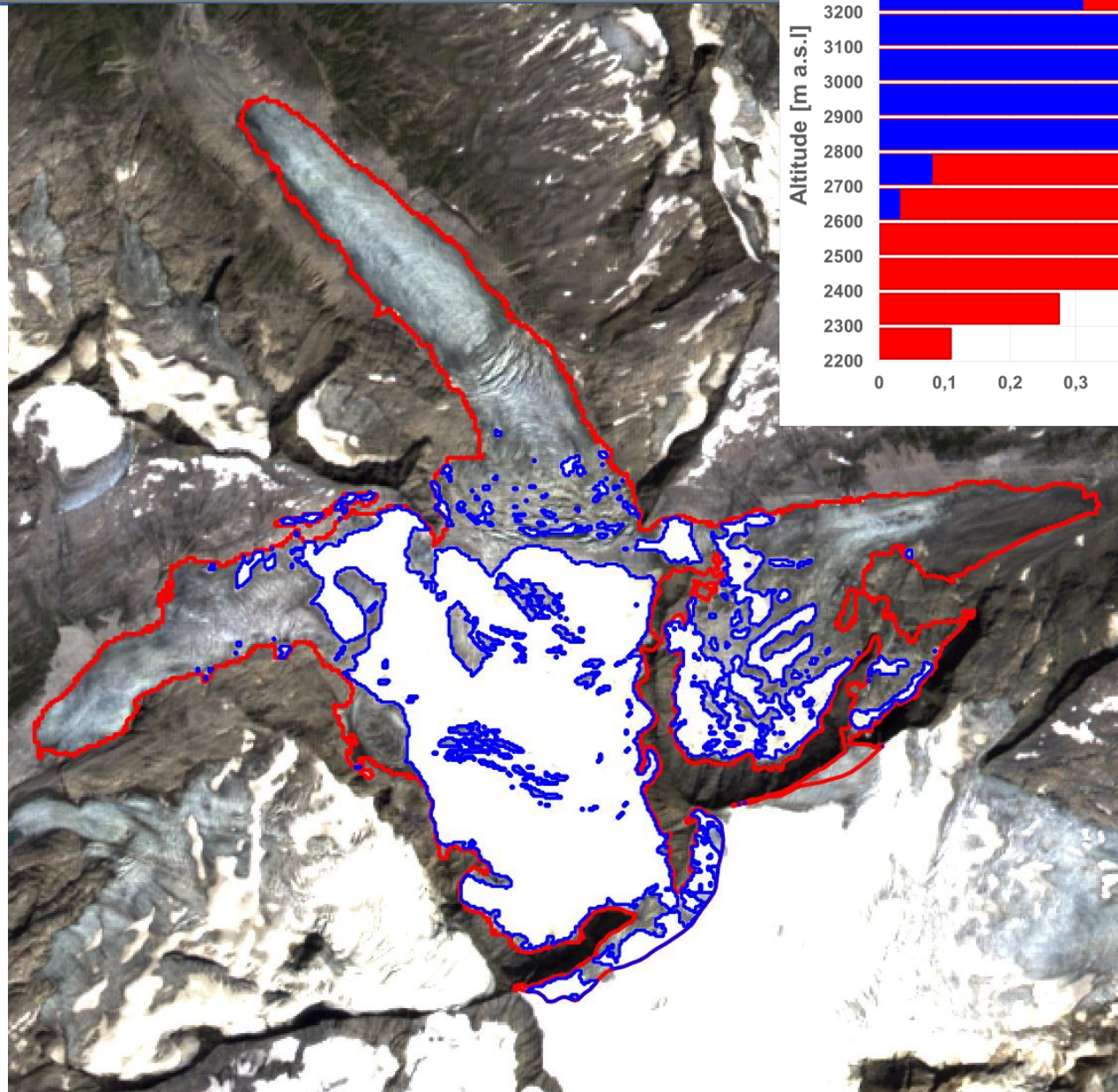
- Existing processing lines adapted/improved for using Sentinel data as input (*ongoing*)

- Implementation of tools for processing of Sentinel-1 data at ENVEO (**completed**)

- Generation of ice velocity maps from Sentinel-1 data (*ongoing*)

- Implementation of tools for processing Sentinel-2 data at ENVEO (*ongoing*)

- Testing processing lines for generation of glacier products from Sentinel-2 images acquired over the Alps (**completed**)

- Further adaptations/improvements of processing lines for glacier products from Sentinel-1/-2 data
- Generation of demonstration glacier products from Sentinel-1/-2 data for selected areas of interest identified by users
- Completing glacier outlines and glacier facies mapping of region Hohe Tauern, Austria, from Sentinel-2 scene of August 2015, and submit data set to GLIMS data base
- Further investigating the synergy of Sentinel-1 and Sentinel-2 for retrieving glacier parameters