

Satellite Applications

Practical Session: Sentinel-1 ice speed tracking

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1st ESA Advanced Training Course on Remote Sensing of the Cryosphere

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Innovate UK
Technology Strategy Board



**Centre for
Polar Observation
and Modelling**

Natural Environment Research Council

CATAPULT

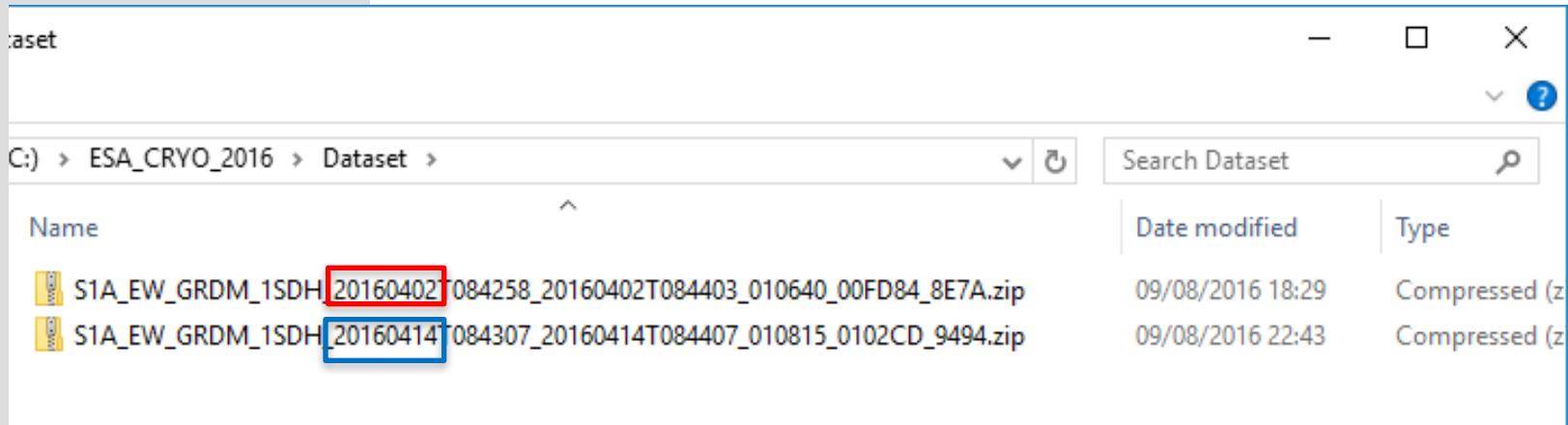
Objective

To show how to derive Ice Velocity by processing a pair (12 days apart) of Sentinel-1 TOPS Extra Wide Swath (EW_GRDM_1SDH) images by using offset tracking technique.

In particular:

- Only HH polarisation is exploited;
- SNAP version 4 is used;
- Exercise will use Graph Builder, Batch Processing, GUI.

Dataset



Product type: EW_GRDM_1SDH

Acquisition mode: Extra Interferometric wide swath

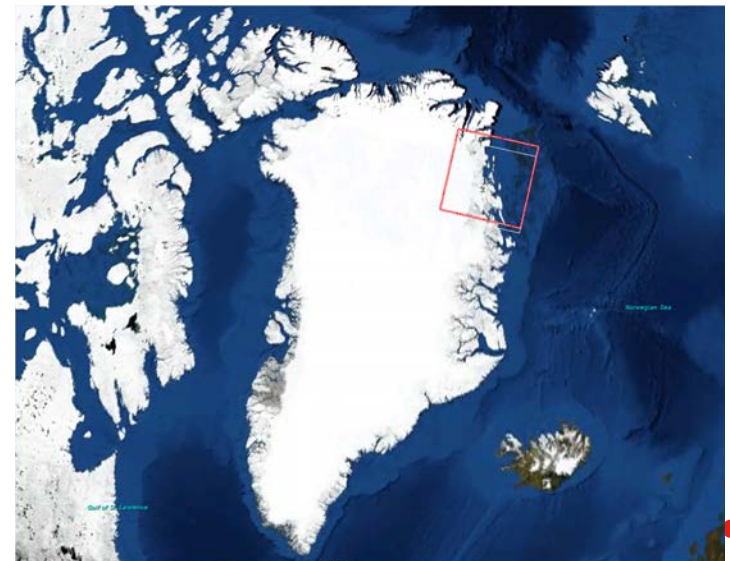
Product type: GRD (detected)

Polarisation: HH and HV

Resolution: 80 m

Orbit: Descending

Location: Nioghalvfjærdsfjorden Glacier (Greenland)

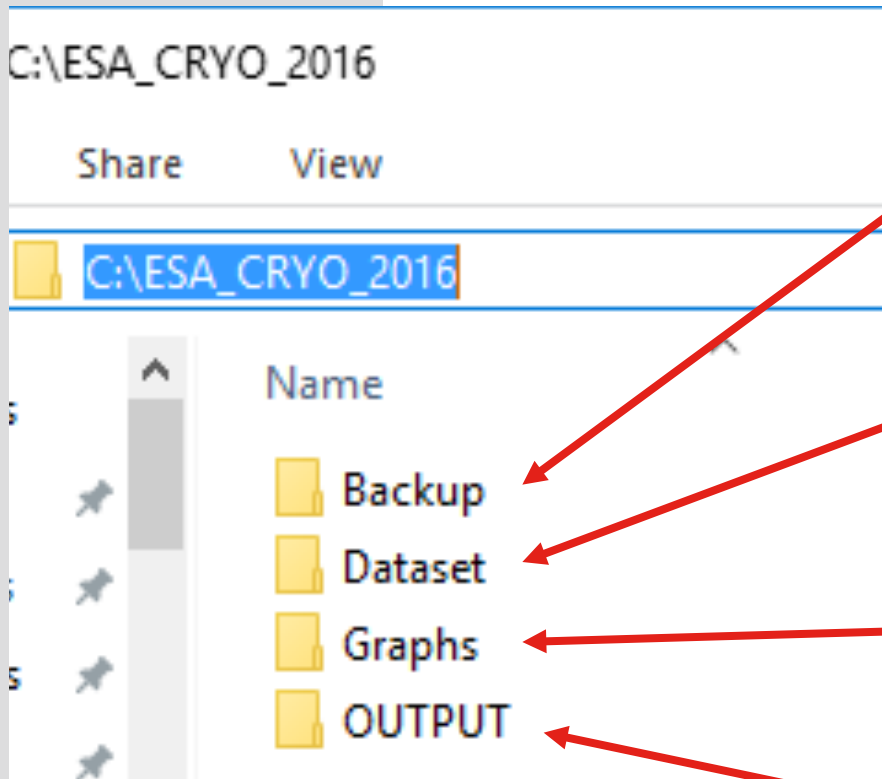


Dataset

Q1. What is the repeat period of Sentinel-1a only, and what did this reduce to after the launch of Sentinel-1b?

Q2. During this computer practical you are using Sentinel-1 Extra Wide (EW) swath mode data to measure ice velocity, however; the cryosphere community have requested ESA routinely acquire Interferometric Wide (IW) swath mode Sentinel-1 data over the ice sheet margins. What are 2 major differences between EW and IW mode data, and suggest a reason why IW mode was not used during this practical?

Exercise folders



BACKUP folder with results and graphs

Dataset folder containing the input for the exercise

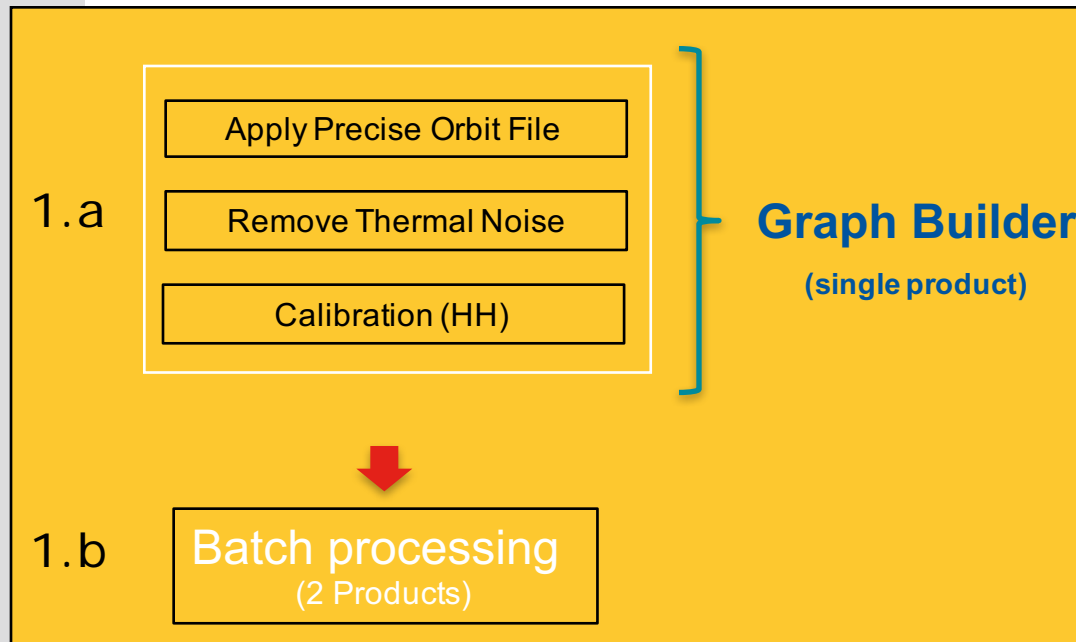
Folder where save the graphs

The OUTPUT of the exercise will be stored here

Processing Steps

0. Open a Sentinel-1 GRD product

GUI



Processing Steps

2.

DEM assisted
Coregistration

Subset

Graph Builder

3.

Offset Tracking

Merging Sigma0 and Ice Velocity
via Band maths Op

Geocoding: RD Terrain Correction

GUI

Step 0: Open product (02/04/2016)

1) Browse the product in **zip** format directly

2) Click over "Import product"

Step 0: Open product (14/04/2016)

The screenshot shows the SNAP software interface. The 'File' menu is open, and the 'Open Product...' option is selected. A file selection dialog box titled 'SNAP - Open Product' is displayed, showing a list of files in the 'Dataset' folder. The file 'S1A_EW_GRDM_1SDH_20160414T084307_20160414T084407_010815_0102CD_9494.zip' is selected. The 'File name' field contains the same filename, and the 'Files of type' is set to 'All Files'. The 'Open' button is highlighted.

- 1) Browse the product in **zip** format directly
- 2) Click over "Open"

Inspecting the abstracted metadata

SNAP

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

Search (Ctrl+F)

Product Explorer x Pixel Info


[1] S1A_EW_GRDM_ISDH_20160402T084258_20160402T084403_010640_00FD84_8E7A

- Metadata
 - Abstracted_Metadata
 - Original_Product_Metadata
- Vector Data
- Tie-Point Grids
- Quicklooks
- Bands
 - Amplitude_HH
 - Intensity_HH
 - Amplitude_HV
 - Intensity_HV

[2] S1A_EW_GRDM_ISDH_20160414T084307_20160414T084403_010815_0102DC_9494

- Metadata
- Vector Data
- Tie-Point Grids
- Quicklooks
- Bands

Navigation Colour Manipulation Uncertainty Visualisa... World View x



Off Globe

[1] Abstracted_Metadata x

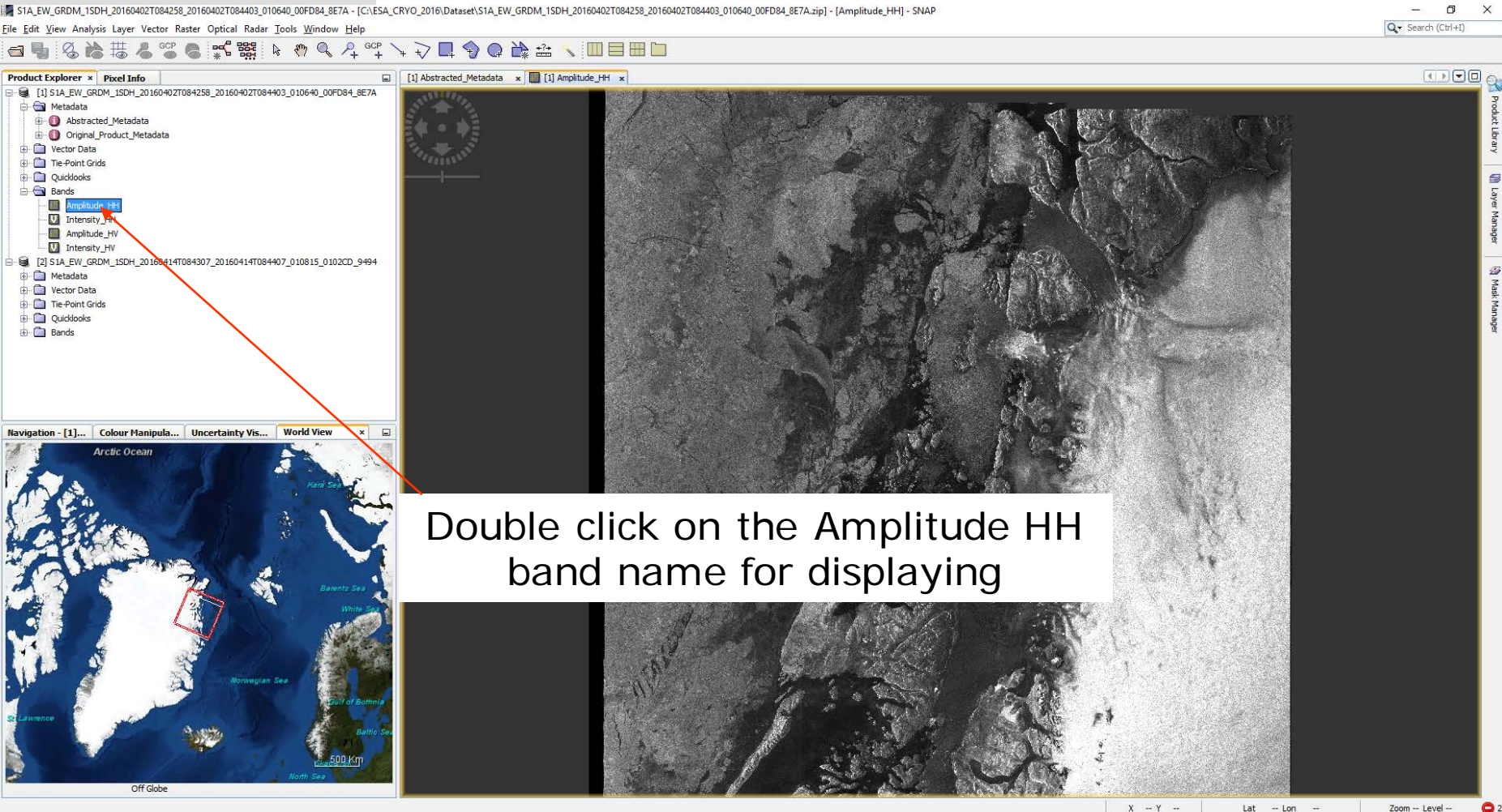
Name	Value	Type	Unit	Description
PRODUCT_TYPE	GRD	ascii		Product type
SPH_DESCRIPTOR	Sentinel-1 EW Level-1 GRD Product	ascii		Description
MISSION	SENTINEL-1A	ascii		Satellite mission
ACQUISITION_MODE	EW	ascii		Acquisition mode
antenna_pointing	right	ascii		Right or left facing
BEAMS	-	ascii		Beams used
SWATH	-	ascii		Swath name
PROC_TIME	02-APR-2016 11:00:45.162862	uint32	utc	Processed time
Processing_system_identifier	ESA Sentinel-1 IPF 002.62	ascii		Processing system identifier
orbit_cycle	75	int32		Cycle
REL_ORBIT	68	int32		Track
ABS_ORBIT	10640	int32		Orbit
STATE_VECTOR_TIME	02-APR-2016 08:42:00.029741	uint32	utc	Time of orbit state vector
VECTOR_SOURCE	-	ascii		State vector source
incidence_near	18.604	float64	deg	
incidence_far	46.423	float64	deg	
slice_num	1	int32		Slice number
data_take_id	64900	int32		Data take identifier
first_line_time	02-APR-2016 08:42:58.794498	uint32	utc	First zero doppler azimuth time
last_line_time	02-APR-2016 08:44:03.099116	uint32	utc	Last zero doppler azimuth time
first_near_lat	79.046	float64	deg	
first_near_long	-6.404	float64	deg	
first_far_lat	80.733	float64	deg	
first_far_long	-25.933	float64	deg	
last_near_lat	75.7	float64	deg	
last_near_long	-15.76	float64	deg	
last_far_lat	76.993	float64	deg	
last_far_long	-30.939	float64	deg	
PASS	DESCENDING	ascii		ASCENDING or DESCENDING
SAMPLE_TYPE	DETECTED	ascii		DETECTED or COMPLEX
mds1_tx_rx_polar	HH	ascii		Polarization
mds2_tx_rx_polar	HV	ascii		Polarization
mds3_tx_rx_polar	-	ascii		Polarization
mds4_tx_rx_polar	-	ascii		Polarization
polar_data	0	uint8	flag	Polarimetric Matrix
algorithm	-	ascii		Processing algorithm
azimuth_looks	3	float64		
range_looks	6	float64		
range_spacing	40	float64	m	Range sample spacing
azimuth_spacing	40	float64	m	Azimuth sample spacing

X -- Y -- Lat -- Lon -- Zoom -- Level --

Inspecting the abstracted metadata

Q3. During this computer practical you are using Sentinel-1 GRD format data. Why is it not possible to perform interferometry with GRD format data, and which Sentinel-1 data format would you use if you wanted to do interferometry?

Display a band (Amplitude HH)



The screenshot shows the SNAP (Sentinel Application Platform) software interface. The main window displays a satellite image of the Arctic region, with a red box highlighting a specific area. The Product Explorer on the left shows a tree view of the data, with the 'Amplitude_HH' band selected. A red arrow points from the 'Amplitude_HH' band name in the Product Explorer to the red box on the satellite image. A text box with the instruction 'Double click on the Amplitude HH band name for displaying' is overlaid on the image. The interface includes a menu bar (File, Edit, View, Analysis, Layer, Vector, Raster, Optical, Radar, Tools, Window, Help), a toolbar, and a status bar at the bottom.

Product Explorer x Pixel Info x [1] Abstracted_Metadata x [1] Amplitude_HH x

[1] S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_8E7A - [C:\ESA_CRYO_2016\Dataset\S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_8E7A.zip] - [Amplitude_HH] - SNAP

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

Product Explorer x Pixel Info x [1] Abstracted_Metadata x [1] Amplitude_HH x

[1] S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_8E7A

- Metadata
 - Abstracted_Metadata
 - Original_Product_Metadata
- Vector Data
- Tie-Point Grids
- Quicklooks
- Bands
 - Amplitude_HH
 - Intensity_HV
 - Amplitude_HV
 - Intensity_HV

[2] S1A_EW_GRDM_1SDH_20160414T084307_20160414T084407_010815_0102CD_9494

- Metadata
- Vector Data
- Tie-Point Grids
- Quicklooks
- Bands

Navigation - [1]... Colour Manipula... Uncertainty Vis... World View x

Arctic Ocean

Greenland

North Sea

500 Km

Off Globe

Double click on the Amplitude HH band name for displaying

X -- Y -- Lat -- Lon -- Zoom -- Level --

Display a band (Amplitude HH)

Q4. During this computer practical you are using Sentinel-1 HH polarisation data. What does HH stand for and what 3 other polarisations are acquired by Sentinel-1?

Q5. If you had a single multi-polarisation SAR image acquired over a glacier, what physical properties of the snowpack might influence the radar backscatter from the different polarisations?

Step 1.a

1.a

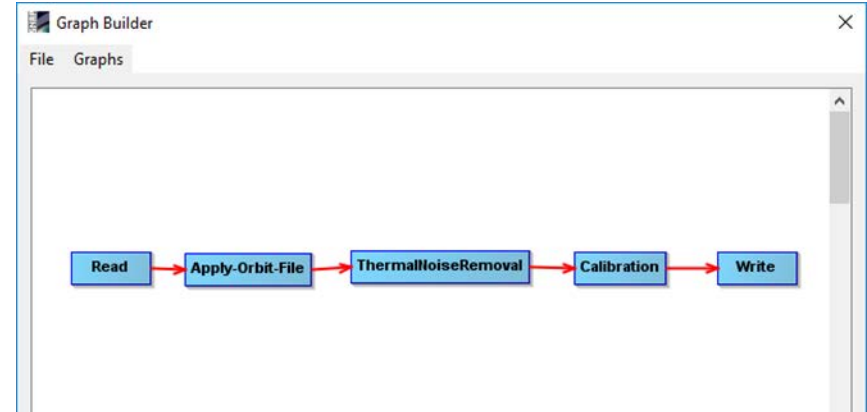
Apply Precise Orbit File

Remove Thermal Noise

Calibration (HH)

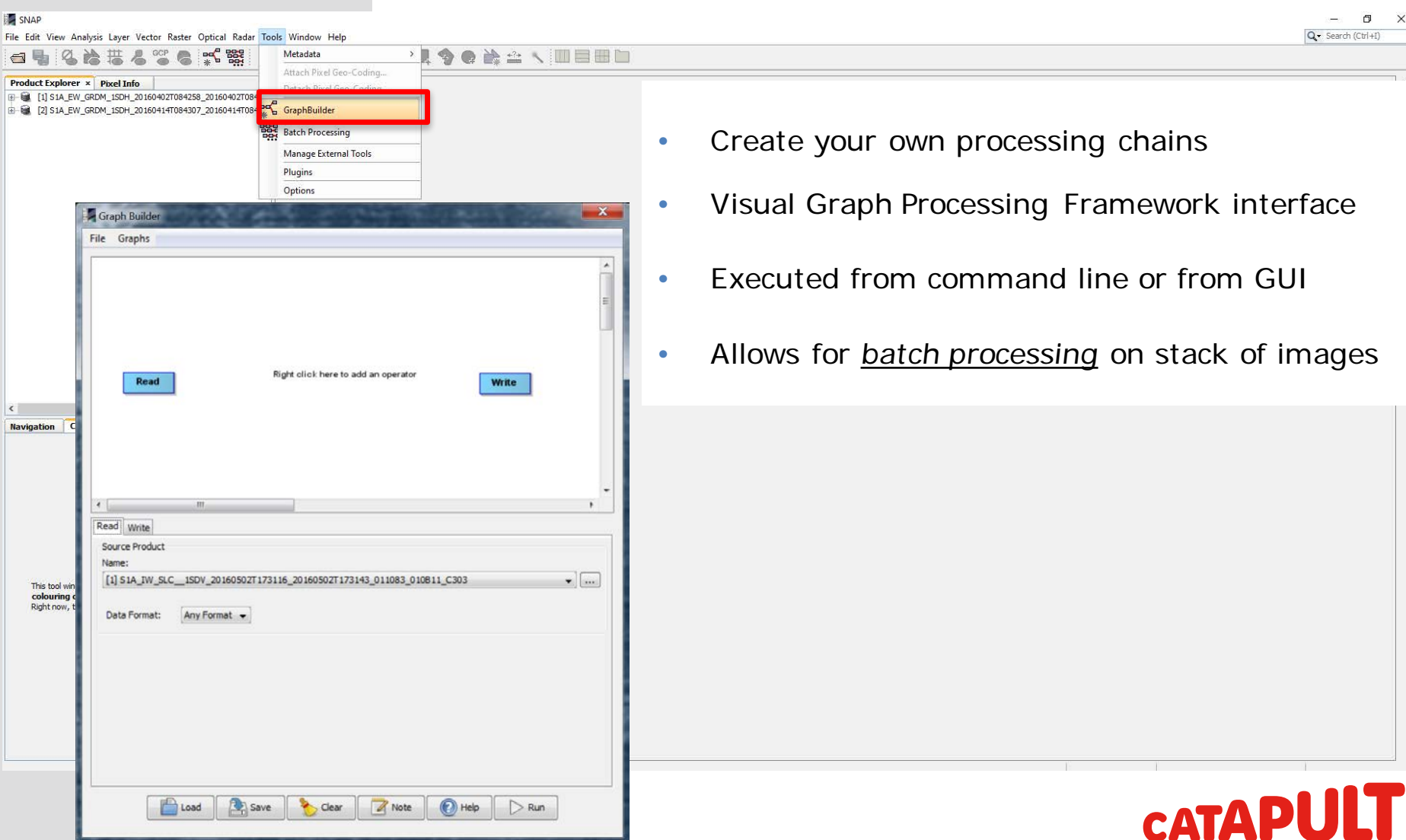
Graph Builder

(single product)



Graph1_HH_PO_CAL.xml

1.a - Building the chain → “Graph Builder”



- Create your own processing chains
- Visual Graph Processing Framework interface
- Executed from command line or from GUI
- Allows for batch processing on stack of images

1.a - Building the chain → “Apply Orbit File” operator

The screenshot displays a software interface with a main menu (File, Edit, View, Analysis, Layer, Vector, Raster, Optical, Radar, Tools, Window, Help) and a toolbar. On the left, a 'Product Explorer' window shows two data products. The main workspace contains two 'Graph Builder' windows. The left 'Graph Builder' window has a 'Read' operator in its graph. A context menu is open over the 'Add' button, showing a tree structure of operators: Input-Output, Optical, Radar, Raster, Tools, and Vector. The 'Apply-Orbit-File' operator is highlighted under the 'Radar' category. Below the graph, the 'Source Product' field is populated with a product ID. The right 'Graph Builder' window shows a completed graph with 'Read', 'Apply-Orbit-File', and 'Write' operators in sequence. Its 'Source Product' field is also populated with a product ID. A status bar at the bottom of the interface contains icons for Load, Save, Clear, Note, Help, and Run.

1.a - Building the chain → “Thermal Noise Removal” operator

The screenshot displays a software interface with a 'Graph Builder' window. The main window shows a processing chain with 'Read' and 'Apply-Orbit-File' operators. A context menu is open over the 'Apply-Orbit-File' operator, showing a list of categories: Input-Output, Optical, Radar, Raster, Tools, and Vector. The 'Radiometric' category is expanded, showing sub-operators: Calibration, RemoveAntennaPattern, Terrain-Flattening, and ThermalNoiseRemoval. The 'ThermalNoiseRemoval' operator is highlighted. A second 'Graph Builder' window on the right shows the updated chain with 'Read', 'Apply-Orbit-File', and 'ThermalNoiseRemoval' operators. The 'Source Product' field in both windows contains the path: [1] S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_8E7A.

1.a - Building the chain → “Calibration” operator

The screenshot displays the Graph Builder interface within a software application. The main window shows a sequence of operators: Read, Apply-Orbit-File, ThermalNoiseRemoval, Calibration, and Write. A context menu is open over the 'Add' button, with the 'Radar' category selected. The 'Calibration' operator is highlighted in the menu. Below the menu, the 'Source Product' field is populated with the ID: [1] S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_8E7A. The 'Data Format' is set to 'Any Format'. The bottom toolbar includes buttons for Load, Save, Clear, Note, Help, and Run.

Product Explorer x Pixel Info

[1] S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403

[2] S1A_EW_GRDM_1SDH_20160414T084307_20160414T084407

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

Search (Ctrl+I)

Product Explorer Layer Manager Main Manager

Graph Builder

File Graphs

Add > Input-Output > Optical > Radar > Raster > Tools > Vector > Coregistration > Feature Extraction > Geometric > Interferometric > Polarimetric > Radiometric > SAR Applications > SAR Utilities > Sentinel-1 TOPS > Speckle Filtering > Apply-Orbit-File > DeburstWSS > Multilook > Calibration > RemoveAntennaPattern > Terrain-Flattening > ThermalNoiseRemoval

Read Write Apply-Orbit-File ThermalNoiseRemoval

Source Product

Name: [1] S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_8E7A

Data Format: Any Format

Load Save Clear Note Help Run

Graph Builder

File Graphs

Read Write Apply-Orbit-File ThermalNoiseRemoval Calibration

Source Product

Name: [1] S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_8E7A

Data Format: Any Format

Load Save Clear Note Help Run

This tool window is used to manipulate the colouring of images shown in an image view. Right now, there is no selected image view.

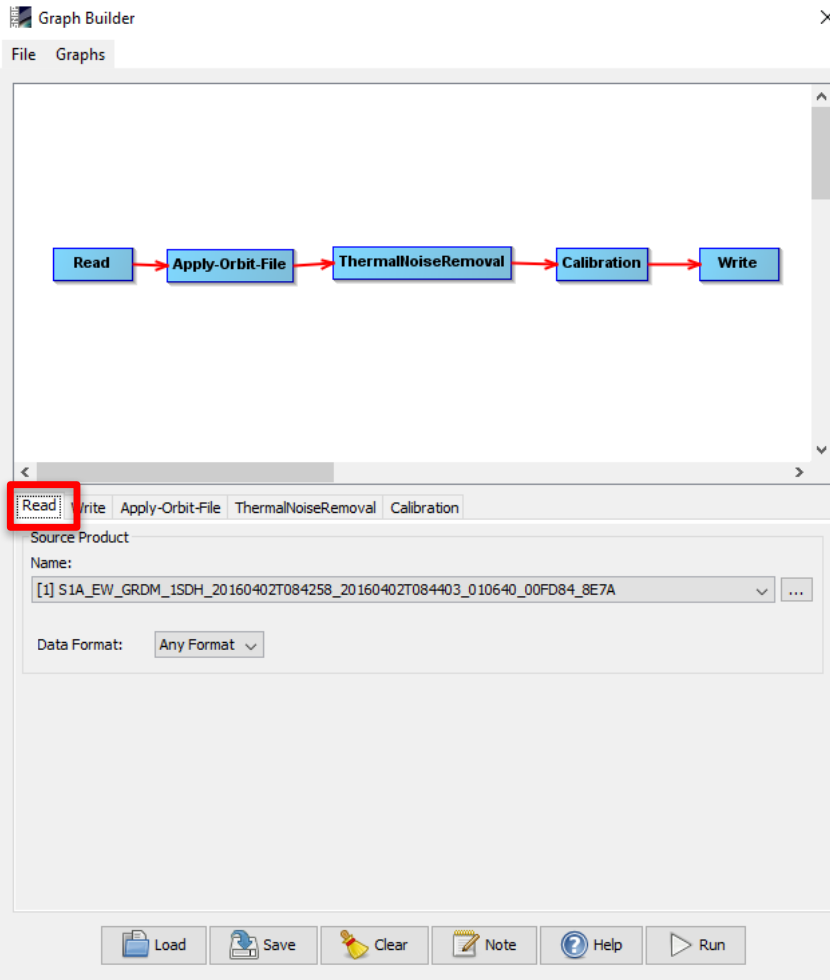
1.a - GB: Connecting the blocks

The screenshot displays the Graph Builder window within a software application. The window is titled "Graph Builder" and contains a "File" menu and a "Graphs" tab. The main workspace shows five blue rectangular blocks: "Read", "Apply-Orbit-File", "ThermalNoiseRemoval", "Calibration", and "Write", arranged horizontally. Below these blocks is an "Add" button with a right-pointing arrow, and a yellow "Connect Graph" button. The bottom section of the window shows a "Source Product" dropdown menu with the selected value "[1] S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_BE7A" and a "Data Format" dropdown set to "Any Format". At the bottom of the window are buttons for "Load", "Save", "Clear", "Note", "Help", and "Run".

Below the main screenshot, a smaller inset window shows the same Graph Builder interface, but with red arrows connecting the blocks in a sequence: Read → Apply-Orbit-File → ThermalNoiseRemoval → Calibration → Write.

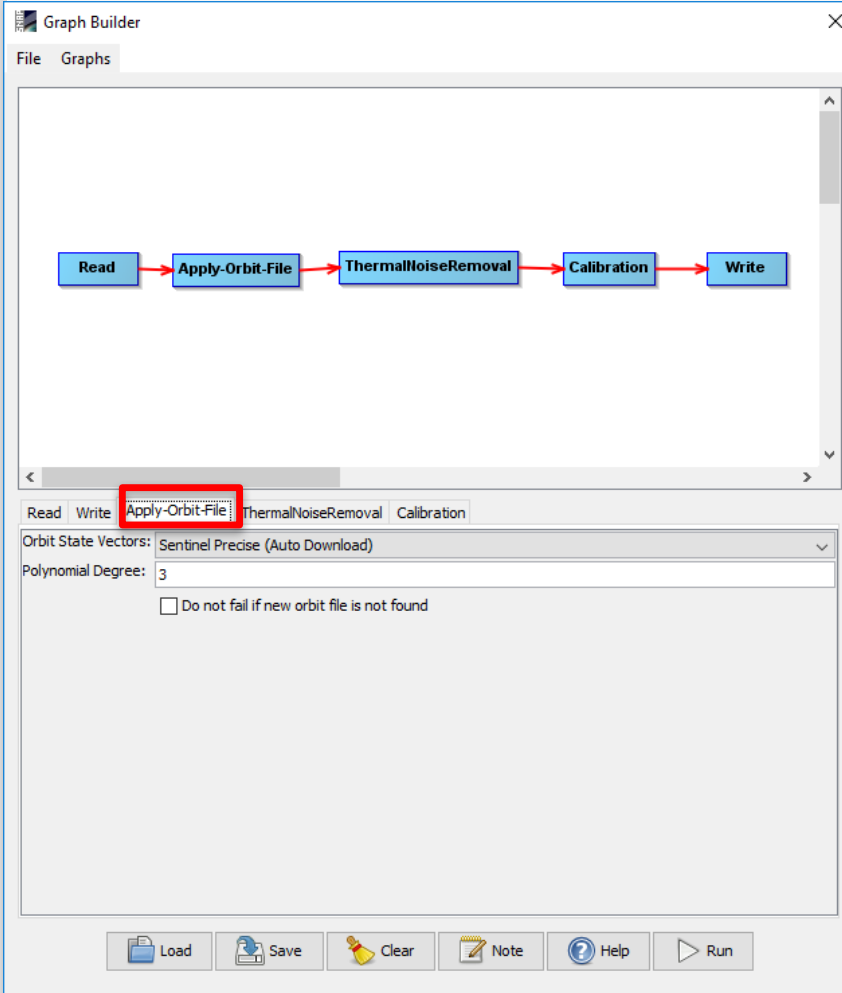
Having the mouse on the white space, click on mouse right button to access the MENU of operators → CLICK on **"CONNECT GRAPH"**

1.a - GB: Inserting the parameters



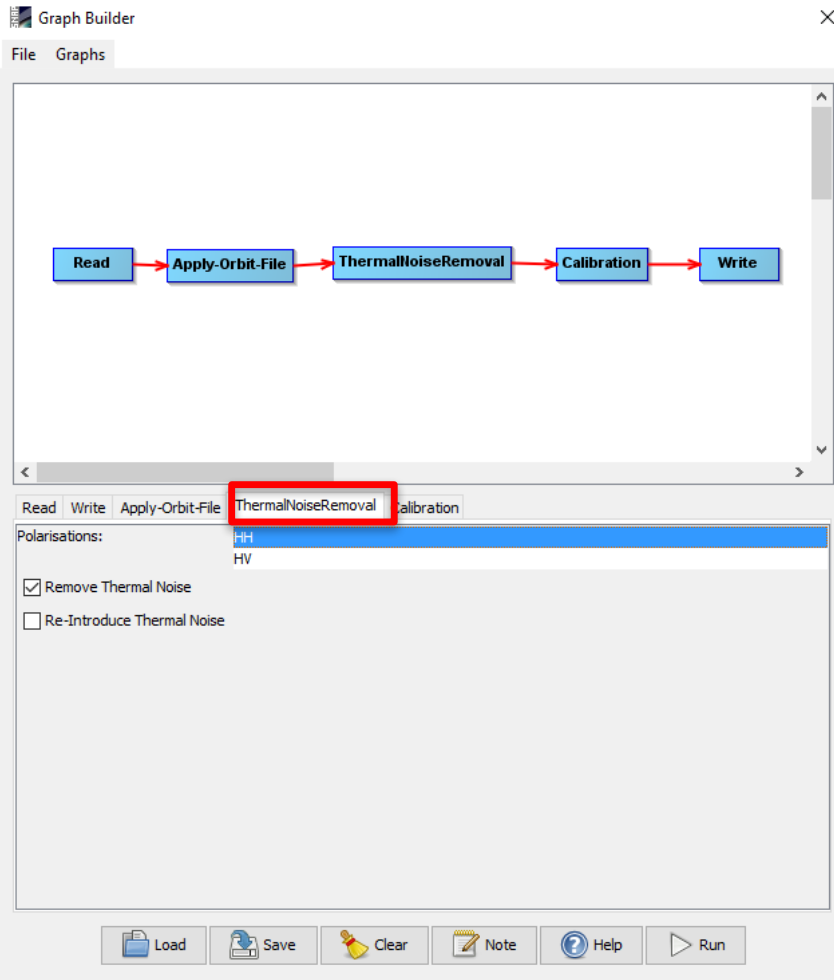
The screenshot shows the Graph Builder interface. At the top, a workflow diagram consists of five blue rectangular nodes connected by red arrows in a linear sequence: Read → Apply-Orbit-File → ThermalNoiseRemoval → Calibration → Write. Below the diagram, a configuration panel for the selected 'Read' node is visible. The 'Name' field contains the text '[1] S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_8E7A'. The 'Data Format' dropdown is set to 'Any Format'. At the bottom of the window, a toolbar contains icons for Load, Save, Clear, Note, Help, and Run. The 'Read' node label in the configuration panel is highlighted with a red box.

1.a - GB: Inserting the parameters



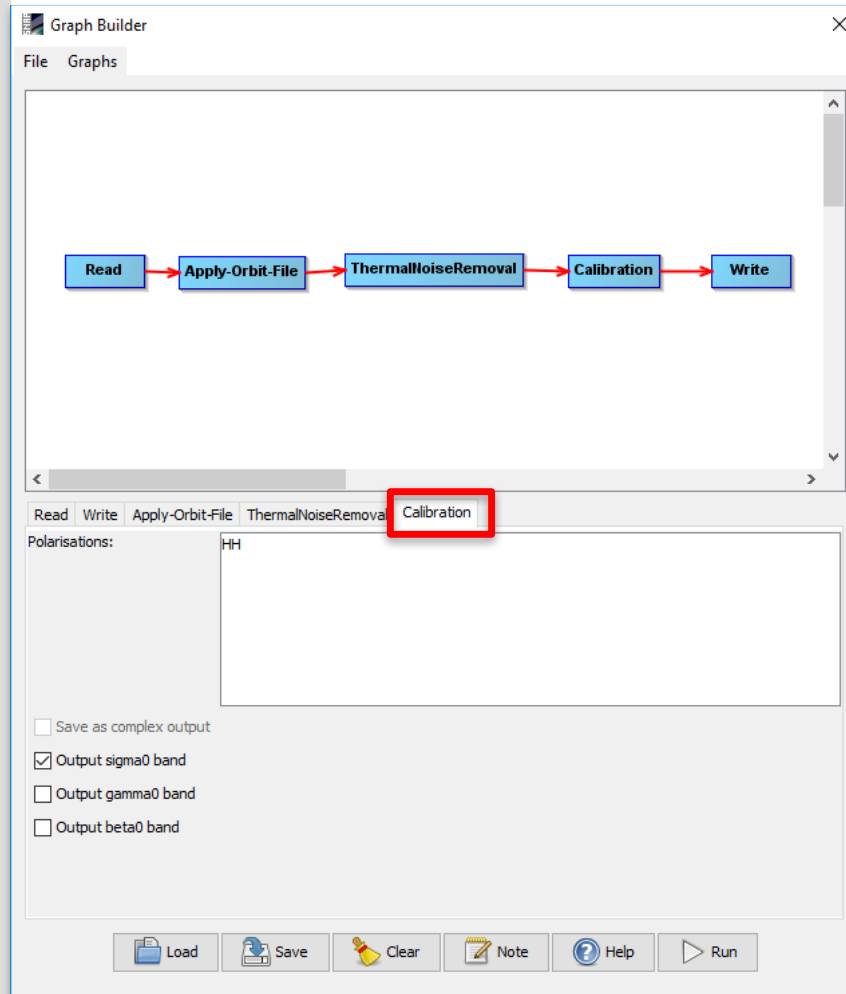
The screenshot shows the Graph Builder application window. At the top, there is a menu bar with 'File' and 'Graphs'. The main workspace displays a workflow graph with five nodes: 'Read', 'Apply-Orbit-File', 'ThermalNoiseRemoval', 'Calibration', and 'Write', connected by arrows from left to right. Below the graph, a toolbar contains icons for 'Load', 'Save', 'Clear', 'Note', 'Help', and 'Run'. The 'Apply-Orbit-File' node is selected, and its configuration panel is visible below. The configuration panel includes a tabbed interface with 'Apply-Orbit-File' selected. It features a dropdown menu for 'Orbit State Vectors' set to 'Sentinel Precise (Auto Download)', a text input for 'Polynomial Degree' set to '3', and a checkbox labeled 'Do not fail if new orbit file is not found' which is currently unchecked.

1.a - GB: Inserting the parameters



The screenshot shows the Graph Builder application window. The main workspace contains a workflow diagram with five steps: Read, Apply-Orbit-File, ThermalNoiseRemoval, Calibration, and Write, connected by red arrows. The ThermalNoiseRemoval step is highlighted with a red box. Below the diagram, a configuration panel for the ThermalNoiseRemoval step is visible. It includes a 'Polarisations:' section with 'HH' and 'HV' options, and two checkboxes: 'Remove Thermal Noise' (checked) and 'Re-Introduce Thermal Noise' (unchecked). At the bottom of the window, there is a toolbar with icons for Load, Save, Clear, Note, Help, and Run.

1.a - GB: Inserting the parameters



The screenshot shows the Graph Builder application window. At the top, there is a menu bar with 'File' and 'Graphs'. Below the menu bar is a workflow diagram consisting of five blue rectangular nodes connected by red arrows: 'Read' → 'Apply-Orbit-File' → 'ThermalNoiseRemoval' → 'Calibration' → 'Write'. The 'Calibration' node is highlighted with a red rectangular box. Below the workflow diagram is a tabbed interface with tabs for 'Read', 'Write', 'Apply-Orbit-File', 'ThermalNoiseRemoval', and 'Calibration'. The 'Calibration' tab is active and shows a 'Polarisations:' field with the value 'HH'. Below this field are four checkboxes: 'Save as complex output' (unchecked), 'Output sigma0 band' (checked), 'Output gamma0 band' (unchecked), and 'Output beta0 band' (unchecked). At the bottom of the window is a toolbar with icons for 'Load', 'Save', 'Clear', 'Note', 'Help', and 'Run'.

1.a - GB: Inserting the parameters

The screenshot displays a software interface with a main window and two floating dialog boxes. The main window features a menu bar (File, Edit, View, Analysis, Layer, Vector, Raster, Optical, Radar, Tools, Window, Help) and a toolbar. On the left, a 'Product Explorer' pane shows two product entries. The central 'Graph Builder' window contains a workflow graph with five steps: Read, Apply-Orbit-File, ThermalNoiseRemoval, Calibration, and Write. Below the graph, a 'Target Product' field is highlighted with a red box, containing the text 'read Write Apply-Orbit-File ThermalNoiseRemoval Calibration'. Below this, a 'Name' field contains a long alphanumeric string, and a 'Directory' field is set to 'C:\CRYO_COURSE'. A 'Select Target Directory' dialog box is open on the right, showing a file browser with 'Look in: OUTPUT' and a 'Folder name' field set to 'C:\ESA_CRYO_2016\OUTPUT'. The bottom of the main window has a navigation pane with 'Colour...' selected and a text box stating: 'This tool window is used to manipulate the colouring of images shown in an image view. Right now, there is no selected image view.'

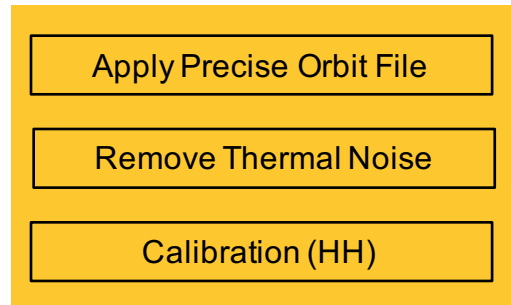
1.a - GB: Saving the chain

- Select the Graph Directory: **C:\ESA_CRYO_2016\OUTPUT**
- File name: **Graph1_HH_PO_CAL.xml**
- Save the chain
- Close the widget

The screenshot displays the SNAP software interface. On the left, the Product Explorer shows two satellite data products. The main window features a Graph Builder workflow with five steps: Read, Apply-Orbit-File, ThermalNoiseRemoval, Calibration, and Write. Below the workflow, the Target Product details are visible, including the Name and Directory (C:\ESA_CRYO_2016\OUTPUT). A red box highlights the 'Save' button in the bottom toolbar, with a blue arrow pointing to it. An inset window titled 'SNAP - Save Graph' is open, showing a file explorer view of the 'Graphs' folder within the 'ESA_CRYO_2016' directory. The file name 'Graph1_HH_PO_CAL.xml.xml' is entered, and the file type is set to 'Graph (*.xml)'. The 'Save' button is highlighted in the dialog box.

Step 1.b: Batch processing Tool

The Chain "**Graph1_SbSVV_PO_CAL.xml**" has been defined for one product.



Now we want to run the chain over the 2 GRD dataset via

batch processing tool

Remember we work with **HH** polarisation only

Batch processing
(2 Products)

Step 1.b: Batch processing Tool

Q6. You have just created a pre-coregistration processing chain which should be applied to each SAR frame before they are coregistered. What were the 3 key steps in this chain, and what was the main reason why you did each step?

1.b - Batch Processing Tool

From Tools, click on Batch Processing to open tool

The screenshot shows the 'Batch Processing' tool window with the following details:

- File Name**
- Type**
- Acquisition**
- Track**
- Orbit**

Target Folder

Save as: BEAM-DIMAP

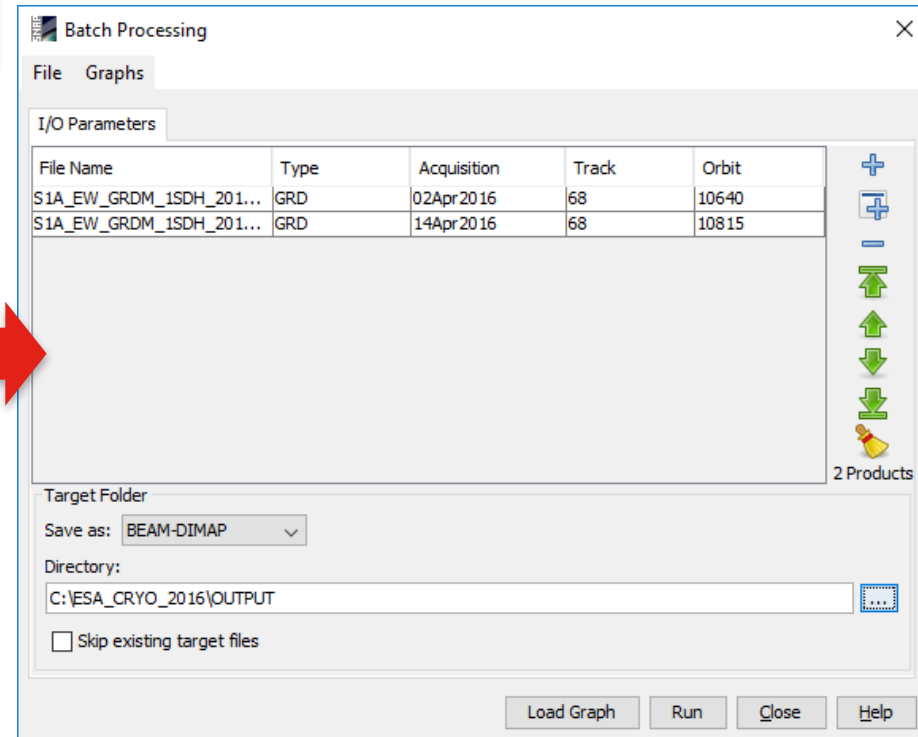
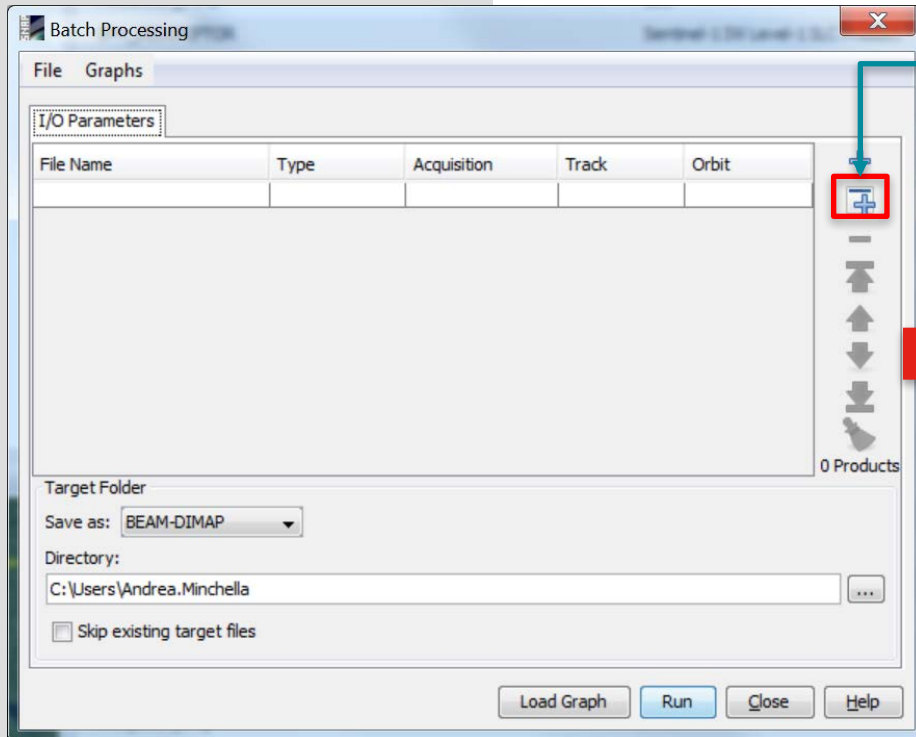
Directory: C:\Users\Andrea.Minchella

Skip existing target files

Buttons: Load Graph, Run, Close, Help

1.b - Batch processing

Click on: **“Add Opened”**: all products listed in the **Products View** will be added

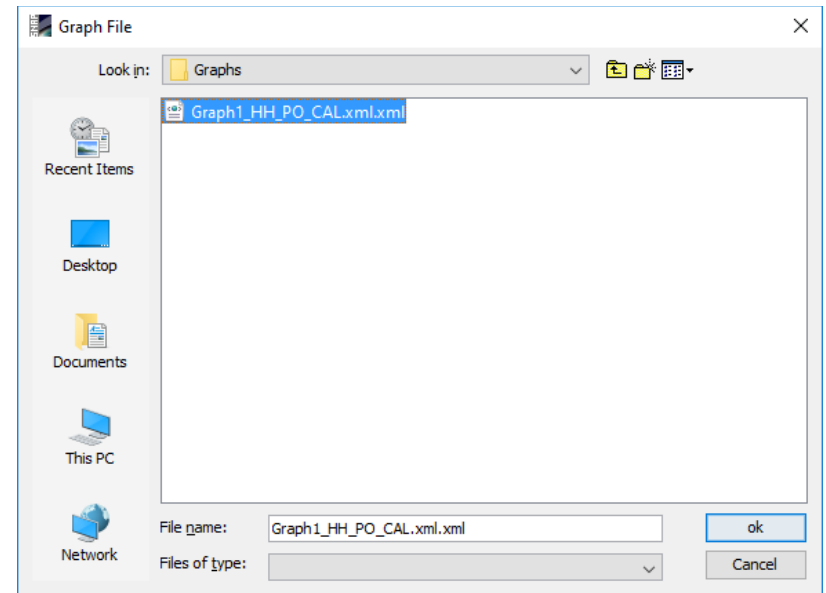
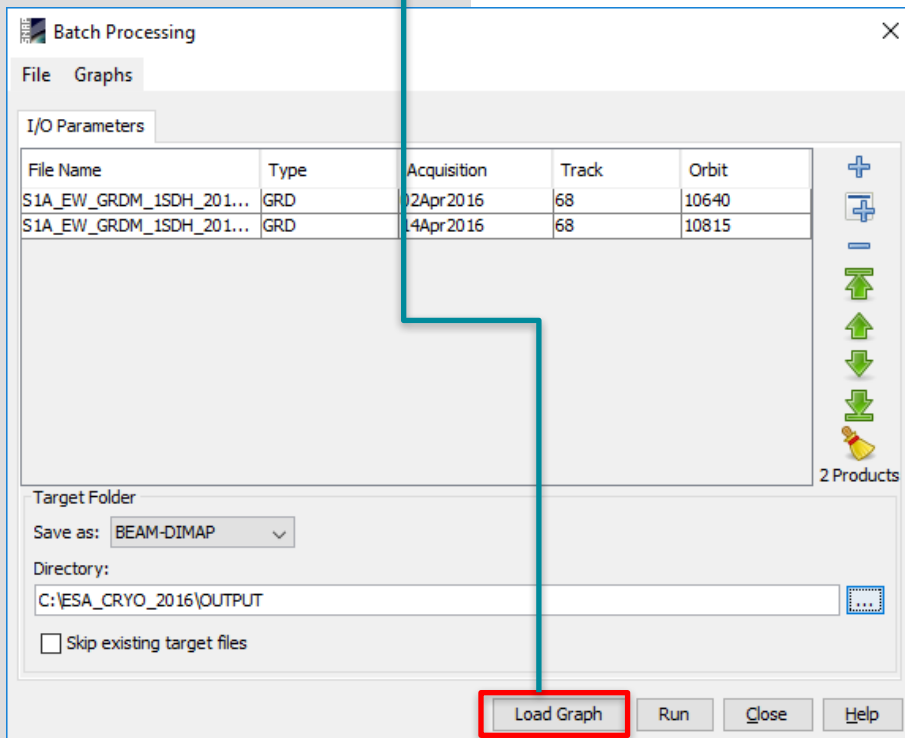


1.b - BP: Loading the graph (.xml)

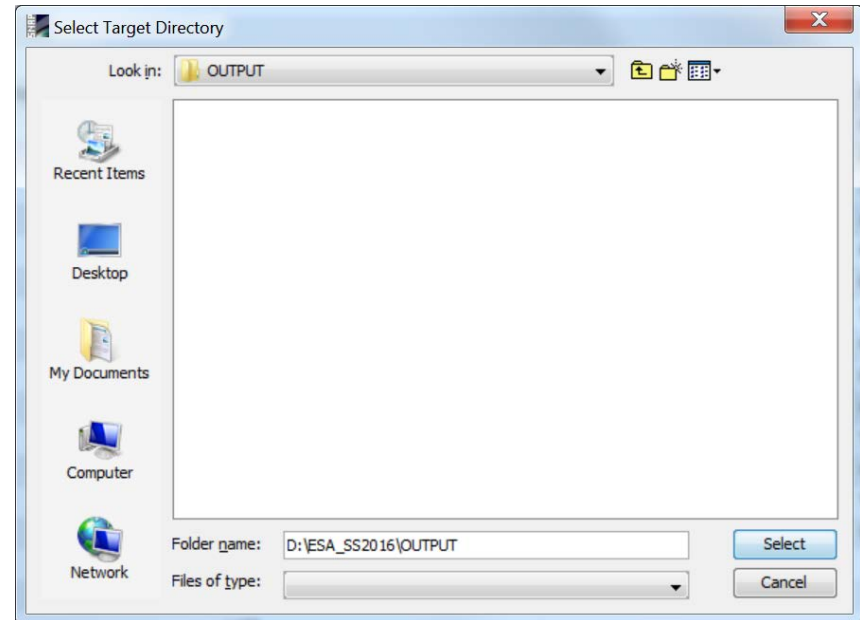
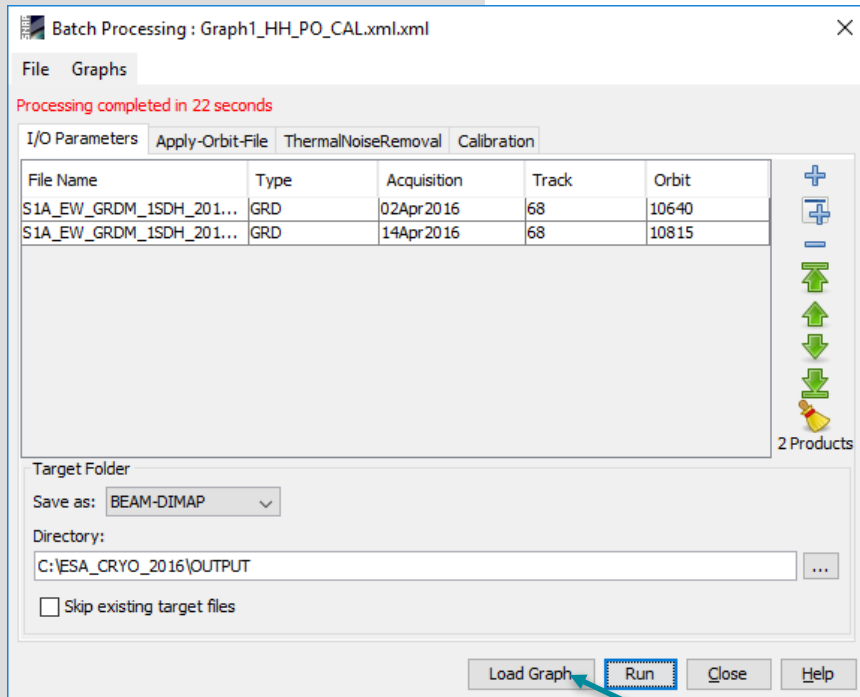
1. By using “**LOAD GRAPH**”, select the created chain

Graph1_HH_PO_CAL.xml

from “C:\ESA_CRYO_2016\Graphs”



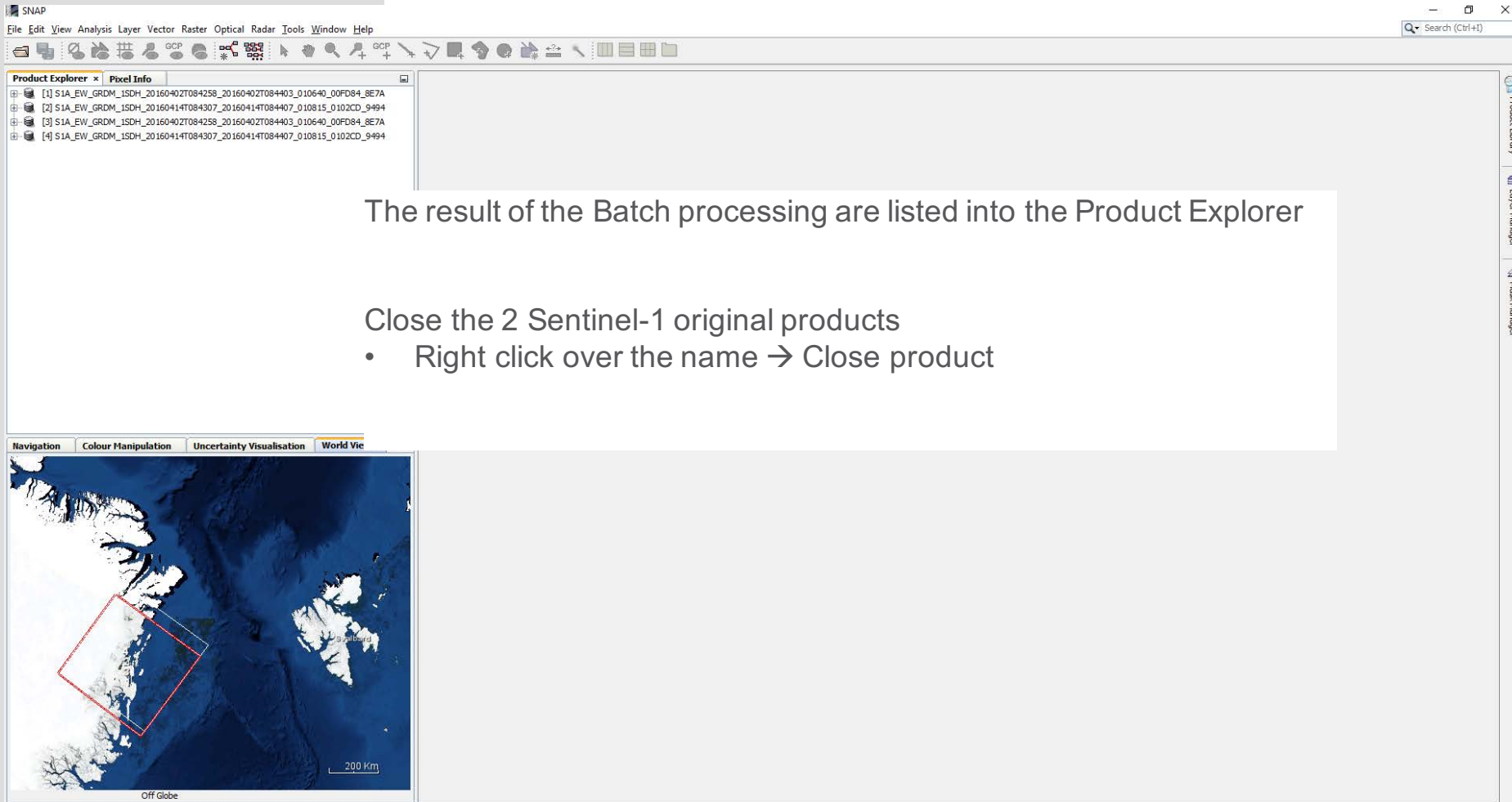
1.b - BP: executing the graph (.xml)



2. Select the OUTPUT directory
3. Cross Check parameters (recommended)
4. Click Run

N.B.: In the Batch Processing Tool we can't specify the name of the output product and the input name will be kept

1.b - Batch processing: results



The screenshot shows the SNAP software interface. The 'Product Explorer' panel is open, displaying a list of four processed Sentinel-1 products:

- [1] S1A_EW_GRDM_ISDH_20160402T084258_20160402T084403_010640_00FD84_8E7A
- [2] S1A_EW_GRDM_ISDH_20160414T084307_20160414T084407_010815_0102CD_9494
- [3] S1A_EW_GRDM_ISDH_20160402T084258_20160402T084403_010640_00FD84_8E7A
- [4] S1A_EW_GRDM_ISDH_20160414T084307_20160414T084407_010815_0102CD_9494

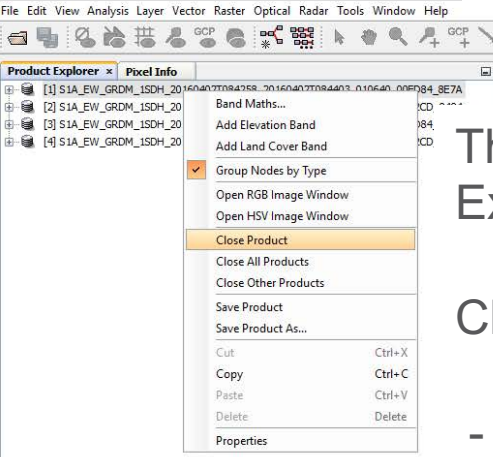
The main map area shows a satellite image of a polar region with a red rectangular selection box. The map is labeled 'Off Globe' and includes a 200 km scale bar.

The result of the Batch processing are listed into the Product Explorer

Close the 2 Sentinel-1 original products

- Right click over the name → Close product

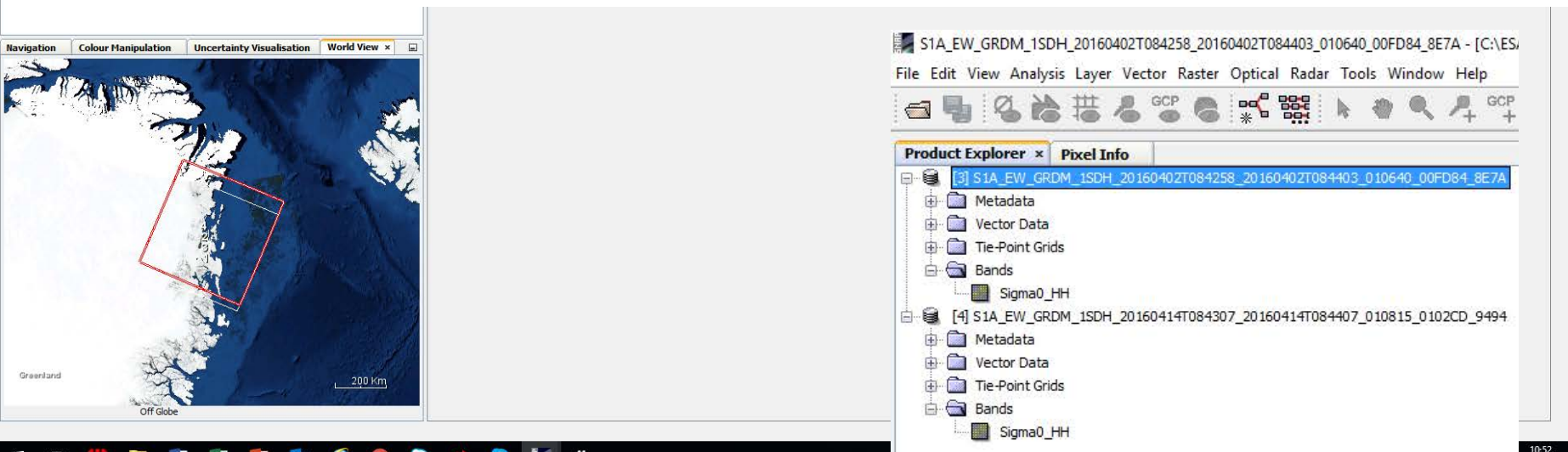
1.b - Batch processing: results



The result of the Batch processing are listed into the Product Explorer

Close the 2 Sentinel-1 original products

- Right click over the product name → Close product



Navigation Colour Manipulation Uncertainty Visualisation World View x

S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_8E7A - [C:\ES\

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

Product Explorer x Pixel Info

- [3] S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_8E7A
 - Metadata
 - Vector Data
 - Tie-Point Grids
 - Bands
 - Sigma0_HH
- [4] S1A_EW_GRDM_1SDH_20160414T084307_20160414T084407_010815_0102CD_9494
 - Metadata
 - Vector Data
 - Tie-Point Grids
 - Bands
 - Sigma0_HH

Greenland
Off Globe
200 Km

Step 2: Coregistration and Subset via GPT

MASTER

Apply Precise Orbit File

Remove Thermal Noise

Calibration (HH)

SLAVE

Apply Precise Orbit File

Remove Thermal Noise

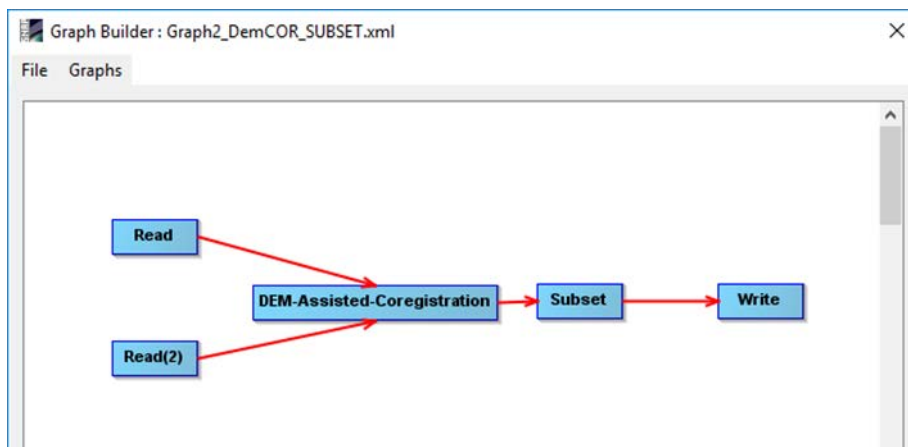
Calibration (HH)

2.

DEM assisted
Coregistration

Subset

Graph Builder



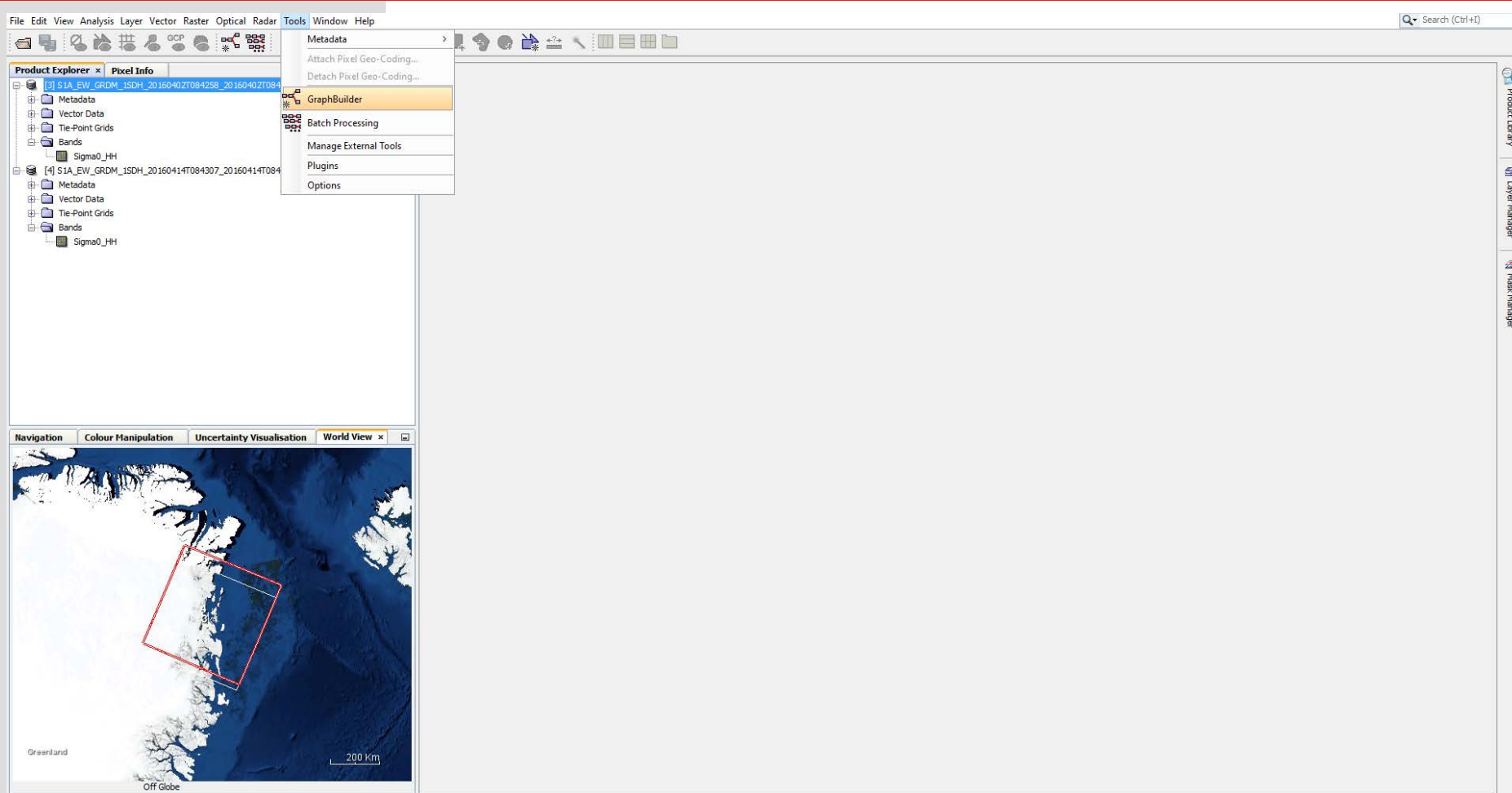
Step 2: Coregistration and Subset via GPT

Q7. What is the purpose of the coregistration step?

Q8. What are the 2 main calculations performed during image coregistration?

Q9. is it possible to coregister 2 SAR images without a DEM, and if so what information is used?

Step 2: Coregistration and Subset via GPT



Step 2: Coregistration and Subset via GPT

The screenshot displays the Graph Builder interface. On the left, a 'Product Explorer' shows a tree view of data products. The main window is titled 'Graph Builder' and contains a 'File' menu and a 'Graphs' area. A red arrow points from the 'Connect Graph' menu option to the 'Read(2)' node in the graph. The 'Read(2)' node is selected, and its properties are shown in the 'Source Product' section below the graph area. The 'Source Product' section includes a 'Name' field with a dropdown menu and a 'Data Format' dropdown menu. The 'Data Format' is set to 'Any Format'. The 'Run' button is visible at the bottom of the window.

Having the mouse on the white space, click on mouse right button to access the MENU of operators

Step 2: DEM assisted Coregistration

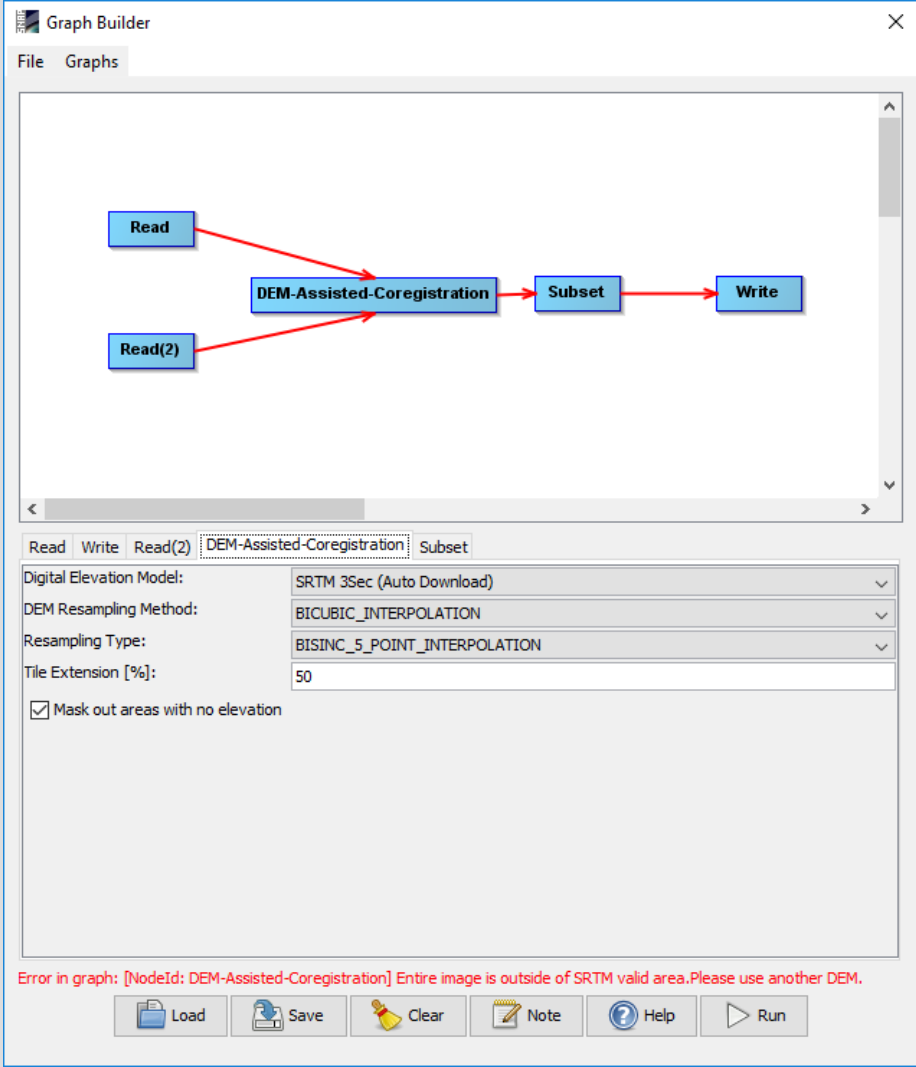
The screenshot displays the Graph Builder interface. The 'File' menu is open, showing a tree structure of operators. The 'Radar' category is expanded, and 'DEM-Assisted-Coregistration' is highlighted. The graph area contains three nodes: 'Read', 'DEM-Assisted-Coregistration', and 'Write'. The 'Read(2)' node is selected, and its properties are shown in the lower panel, including 'Source Product' and 'Data Format'. A blue arrow points from the text below to the 'Read(2)' node.

Having the mouse on the white space, click on mouse right button to access the MENU of operators

Step 2: SUBSET

Having the mouse on the white space, click on mouse right button to access the MENU of operators

Step 2: Coregistration and Subset via GPT



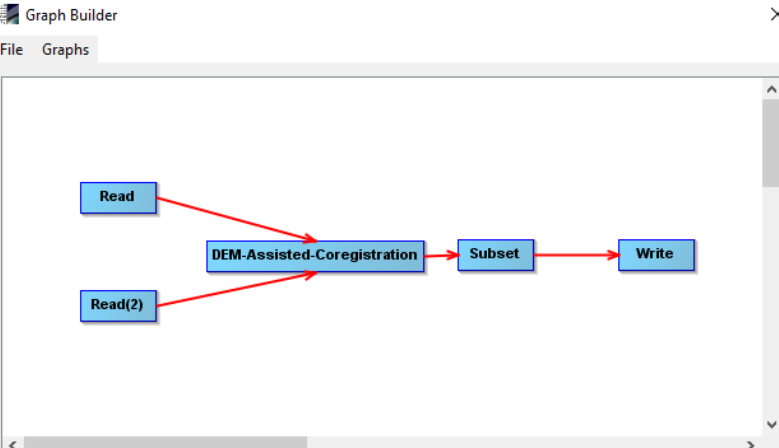
The screenshot shows the Graph Builder interface with a workflow graph. The graph consists of five blue rectangular blocks: 'Read', 'Read(2)', 'DEM-Assisted-Coregistration', 'Subset', and 'Write'. Red arrows indicate the flow: 'Read' and 'Read(2)' both point to 'DEM-Assisted-Coregistration', which then points to 'Subset', which finally points to 'Write'. Below the graph, the configuration panel for the selected 'DEM-Assisted-Coregistration' block is visible. It includes the following settings:

- Digital Elevation Model: SRTM 3Sec (Auto Download)
- DEM Resampling Method: BICUBIC_INTERPOLATION
- Resampling Type: BISINC_5_POINT_INTERPOLATION
- Tile Extension [%]: 50
- Mask out areas with no elevation

At the bottom of the interface, there is a red error message: "Error in graph: [NodeId: DEM-Assisted-Coregistration] Entire image is outside of SRTM valid area. Please use another DEM." Below the error message is a toolbar with icons for Load, Save, Clear, Note, Help, and Run.

Connect the blocks manually

Inserting the parameters



Graph Builder

File Graphs

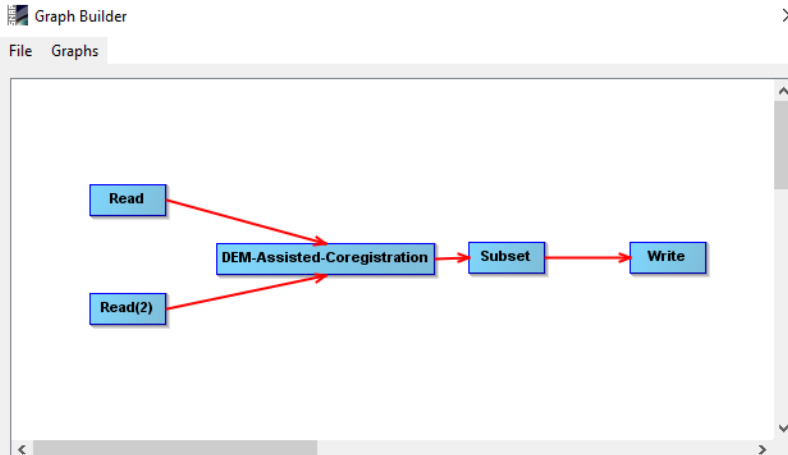
Read Write Read(2) DEM-Assisted-Coregistration Subset

Source Product
Name:
[3] S1A_EW_GRDM_1SDH_20160402T084258_20160402T084403_010640_00FD84_8E7A ...

Data Format: Any Format

Error in graph: [NodeId: DEM-Assisted-Coregistration] Entire image is outside of SRTM valid area. Please use another DEM.

Load Save Clear Note Help Run



Graph Builder

File Graphs

Read Write Read(2) DEM-Assisted-Coregistration Subset

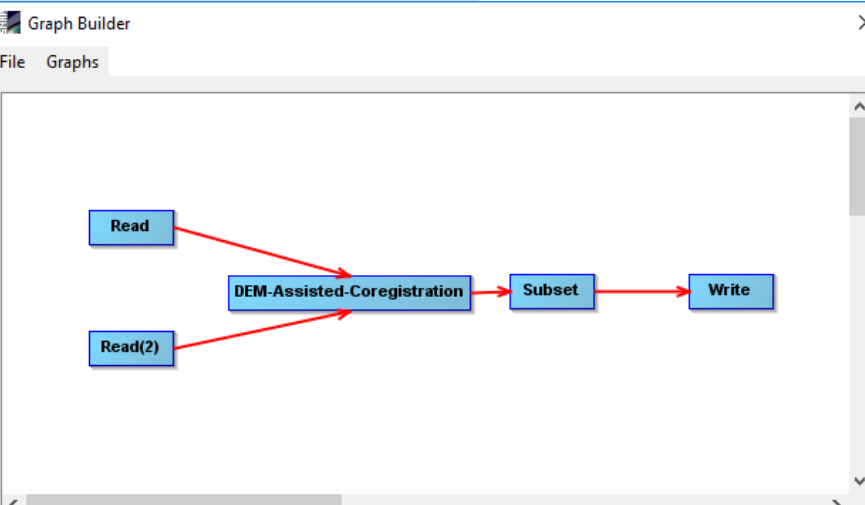
Source Product
Name:
[4] S1A_EW_GRDM_1SDH_20160414T084307_20160414T084407_010815_0102CD_9494 ...

Data Format: Any Format

Error in graph: [NodeId: DEM-Assisted-Coregistration] Entire image is outside of SRTM valid area. Please use another DEM.

Load Save Clear Note Help Run

Inserting the parameters



Graph Builder

File Graphs

Read Write Read(2) **DEM-Assisted-Coregistration** Subset

Digital Elevation Model: ACE30 (Auto Download) ←

DEM Resampling Method: BICUBIC_INTERPOLATION

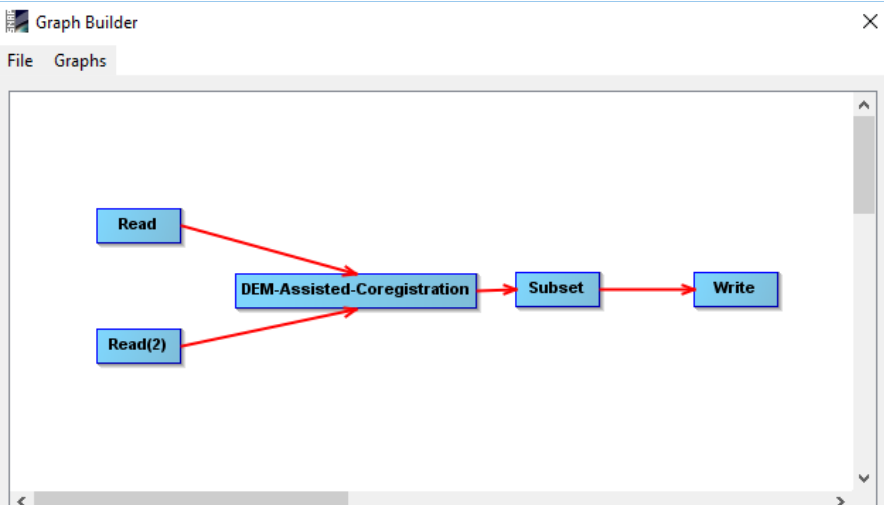
Resampling Type: BISING_5_POINT_INTERPOLATION

Tile Extension [%]: 50

Mask out areas with no elevation

Error in graph: [NodeId: DEM-Assisted-Coregistration] Entire image is outside of SRTM valid area. Please use another DEM.

Load Save Clear Note Help Run



Graph Builder

File Graphs

Read Write Read(2) **DEM-Assisted-Coregistration** Subset

Source Bands: Sigma0_HH_mst_02Apr2016
Sigma0_HH_slv_1_14Apr2016

Copy Metadata

Pixel Coordinates Geographic Coordinates

X: 4555 Y: 1365

Width: 5275 height: 4000

Sub-sampling X: 1 Sub-sampling Y: 1

Load Save Clear Note Help Run

Inserting the parameters



The screenshot shows the Graph Builder interface for a workflow named 'Graph2_DemCOR_SUBSET.xml'. The workflow consists of four operators: 'Read', 'DEM-Assisted-Coregistration', 'Subset', and 'Write', connected by red arrows. The 'Read' operator feeds into 'DEM-Assisted-Coregistration', and 'Read(2)' also feeds into 'DEM-Assisted-Coregistration'. 'DEM-Assisted-Coregistration' feeds into 'Subset', which then feeds into 'Write'.

Below the workflow diagram is a configuration panel for the 'Subset' operator. It includes a 'Target Product' section with the following fields:

- Name: Subset_S1A_EW_HH_M20160402_S20160414_COR
- Save as: BEAM-DIMAP (checked)
- Directory: C:\ESA_CRYO_2016\OUTPUT
- Open in SNAP (checked)

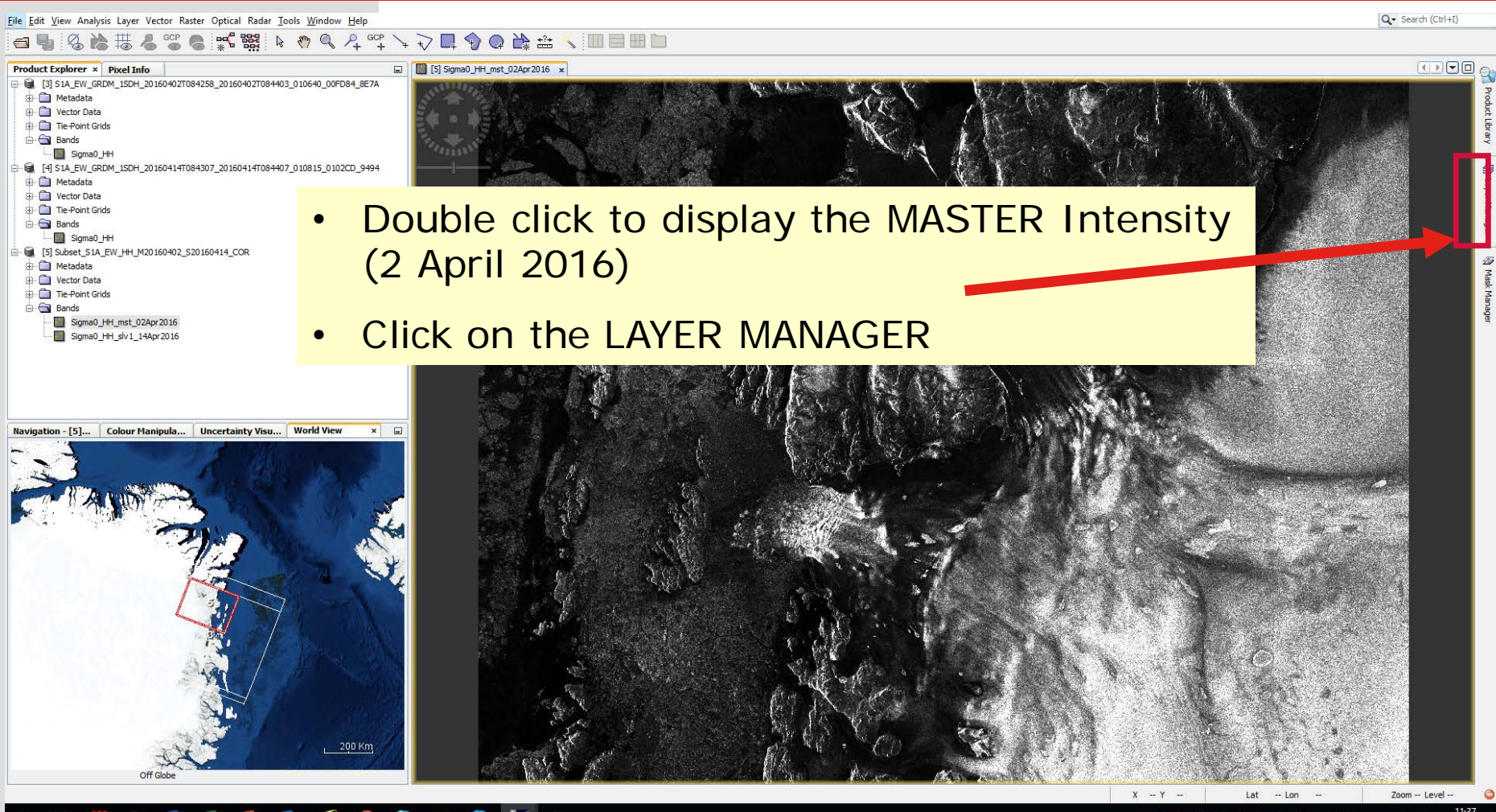
At the bottom of the interface, a status bar indicates 'Processing completed in 24 seconds (6 MB/s 1 MPixel/s)'. A red box highlights the 'Run' button in the bottom toolbar.

After inserting the parameters in the operators, execute the chain

N.B.: in the backup folder
Graph2_DemCOR_SUBSET.xml

Overlay Master and Slave: the Layer Manager

- Double click to display the MASTER Intensity (2 April 2016)
- Click on the LAYER MANAGER



Overlay Master and Slave: the Layer Manager

Q10. We have asked you to extract a subset of the full Sentinel-1 image to work with for the rest of this computer practical. Suggest a reason why we have done this?

Overlay Master and Slave: the Layer Manager

1) Click on +

2) Select Image of Band / Tie-Point Grid and click on Next

1. Select the Slave

Compatible bands and tie-point grids:

- [5] Subset_S1A_EW_HH_M20160402_S20160414_COR
- Sigma0_HH_mst_02Apr2016
- Sigma0_HH_slv1_14Apr2016**
- latitude (Tie-point grid)
- longitude (Tie-point grid)
- incident_angle (Tie-point grid)
- elevation_angle (Tie-point grid)
- slant_range_time (Tie-point grid)

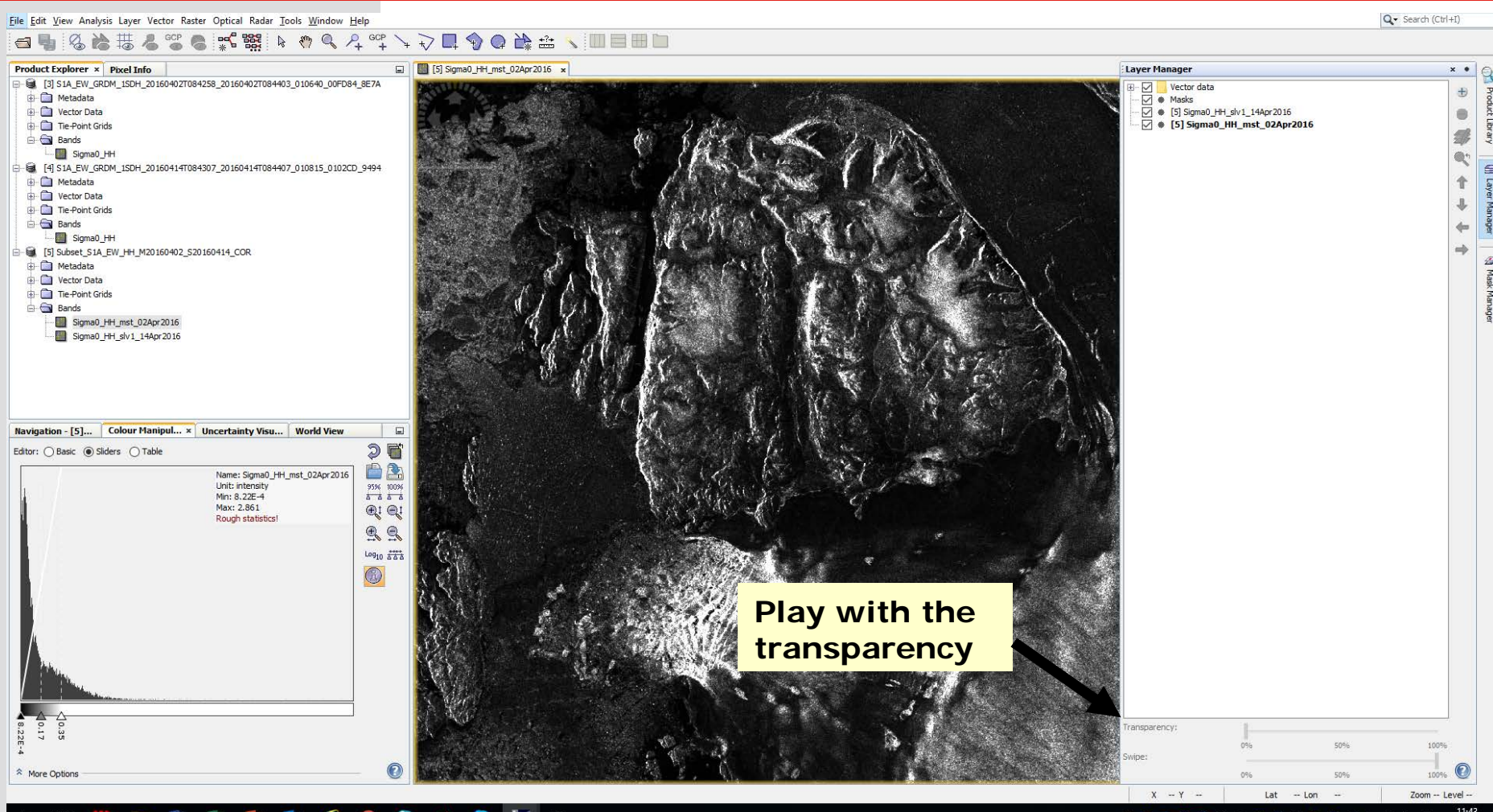
Compatible bands and tie-point grids:

- [5] Subset_S1A_EW_HH_M20160402_S20160414_COR
- Sigma0_HH_mst_02Apr2016
- Sigma0_HH_slv1_14Apr2016**
- latitude (Tie-point grid)
- longitude (Tie-point grid)
- incident_angle (Tie-point grid)
- elevation_angle (Tie-point grid)
- slant_range_time (Tie-point grid)

< Previous Next > Finish Cancel Help

< Previous Next > **Finish** Cancel Help

Overlay Master and Slave via the Layer Manager

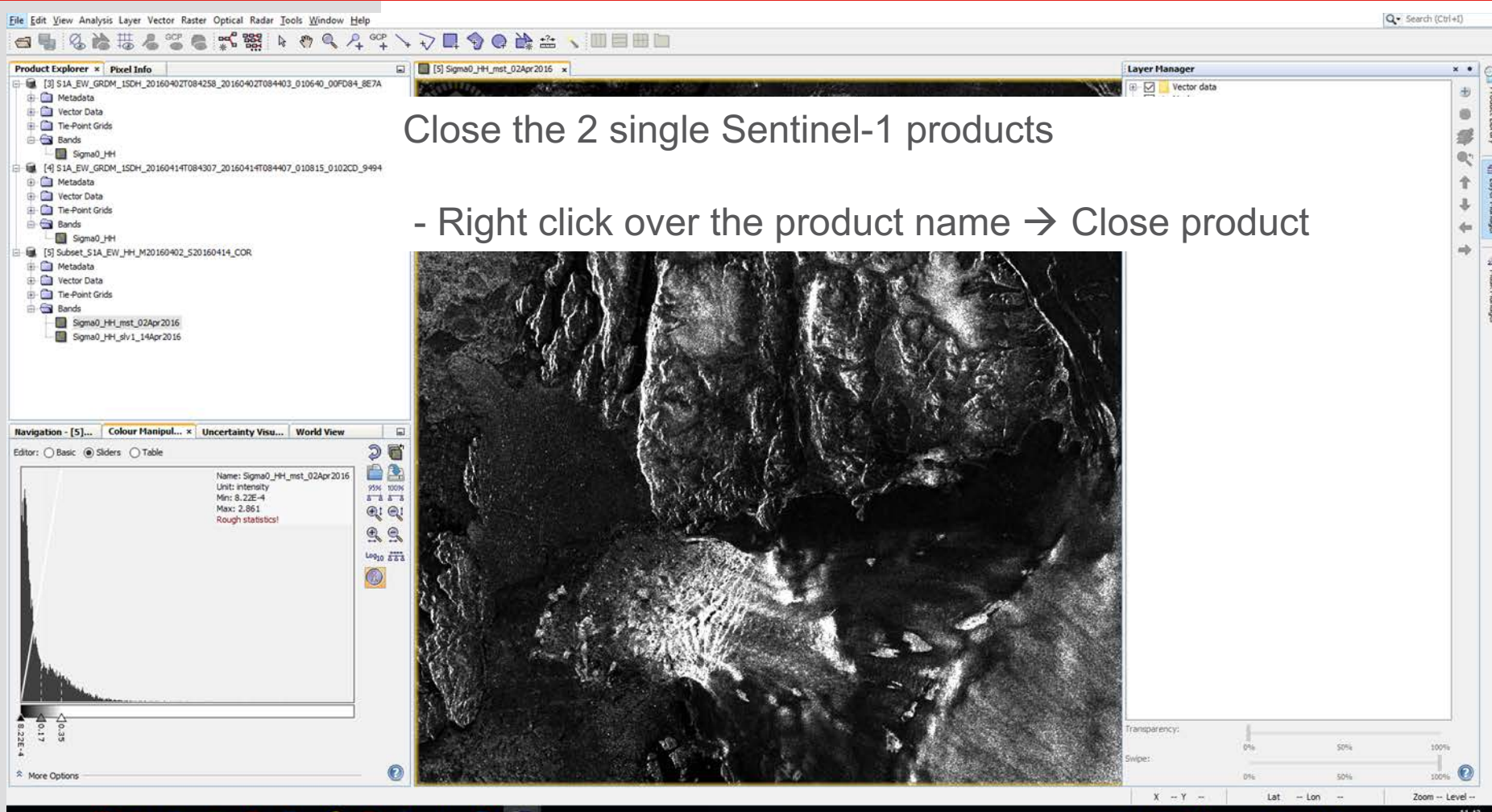


The screenshot displays the QGIS interface with a satellite image of a polar region. The **Product Explorer** on the left shows a tree view of data layers, including 'Sigma0_HH' and 'Sigma0_HH_mst_02Apr2016'. The **Layer Manager** on the right lists the loaded layers, with 'Sigma0_HH_mst_02Apr2016' selected. A yellow callout box with the text 'Play with the transparency' and an arrow points to the **Transparency** slider in the Layer Manager, which is currently set to 0%. The **Navigation** panel at the bottom left shows a histogram for the selected layer, with statistics: Name: Sigma0_HH_mst_02Apr2016, Unit: intensity, Min: 8.22E-4, Max: 2.861, and Rough statistics! The interface also includes a menu bar (File, Edit, View, Analysis, Layer, Vector, Raster, Optical, Radar, Tools, Window, Help) and a toolbar with various GIS tools.

Coregistered Pair

Close the 2 single Sentinel-1 products

- Right click over the product name → Close product



The screenshot displays the QGIS interface with the following components:

- Product Explorer:** Lists three Sentinel-1 products. Product [5] is selected, showing its metadata, vector data, tie-point grids, and bands (Sigma0_HH).
- Map View:** Shows a grayscale image of a coregistered pair of Sentinel-1 products.
- Navigation - [5]:** Includes a histogram for the selected product 'Sigma0_HH_mst_02Apr2016' with statistics: Name: Sigma0_HH_mst_02Apr2016, Unit: intensity, Min: 8.22E-4, Max: 2.861, and Rough statistics! The histogram shows a distribution of intensity values with markers at 8.22E-4, 0.17, and 0.35.
- Layer Manager:** Shows the selected product 'Sigma0_HH_mst_02Apr2016' with a transparency slider set to 0% and a swipe slider set to 0%.

Step 3

2.

DEM assisted
Coregistration

Subset

Graph Builder



3.

Offset Tracking

Merging Sigma0 and Ice Velocity
via Band maths Op

Geocoding: RD Terrain Correction

GUI

Step: Offset tracking

The screenshot displays the SNAP (Scientific Data Processing) software interface. The main window shows a SAR image of a polar region. The 'Tools' menu is open, and 'Offset Tracking' is selected. Two 'Offset Tracking' dialog boxes are overlaid on the main window, showing the configuration for the process.

Offset Tracking Dialog - I/O Parameters:

- Source Product: [5] Subset_S1A_EW_HH_M20160402_S20160414_COR
- Target Product Name: Subset_S1A_EW_HH_M20160402_S20160414_COR_vel
- Save as: BEAM-DIMAP
- Directory: C:\ESA_CRYO_2016\OUTPUT
- Open in SNAP:

Offset Tracking Dialog - Processing Parameters:

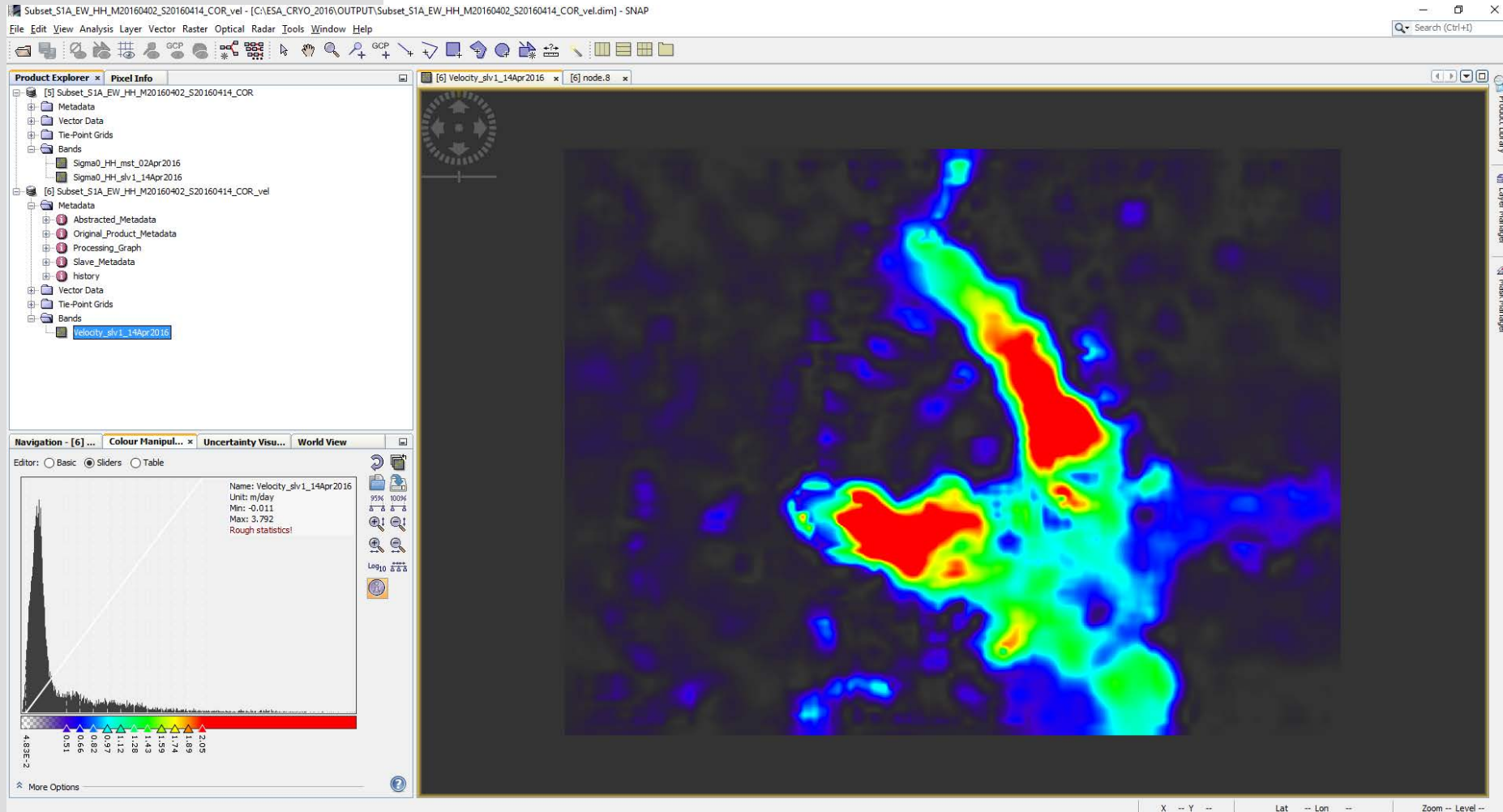
Parameter	Value
Output Grid	
Grid Azimuth Spacing (in pixels)	40
Grid Range Spacing (in pixels)	40
Grid Azimuth Spacing (in meters)	1600.0
Grid Range Spacing (in meters)	1600.0
Grid Azimuth Dimension	100
Grid Range Dimension	131
Total Grid Points	13100
Registration	
Registration Window Width	128
Registration Window Height	128
Cross-Correlation Threshold	0.1
Average Box Size	5
Max Velocity (m/day)	5.0
Radius for Hole Filling	4
Resampling Type	BICUBIC_INTERPOLATION

Step: Offset tracking

Q11. You have used a step size of 40, and a window size of 128.

- a) what are the units of these two numbers?
- b) which number would you need to change if you wanted to produce a finer spatial resolution ice velocity product?
- c) would you increase or decrease this number if you wanted to produce a finer spatial resolution ice velocity product?

Step: Offset tracking → Ice velocity



Step: Offset tracking → Ice velocity

Q12. What is the maximum ice speed you have measured?

Import a colour palette

The screenshot displays the ENVI software interface. The main window shows a satellite image of ice velocity with a color scale from blue to red. The 'Product Explorer' on the left shows a tree view of data files, including 'Velocity_slv_1_14Apr2016'. The 'Colour Manipulation' panel at the bottom left shows a histogram and statistics for the 'Velocity_slv_1_14Apr2016' dataset. The 'Import Colour Palette' dialog box is open, showing the file 'Ice_velocity.cpd' selected in the 'ESA_CRYO_2016' folder. The dialog box has a 'Look in' dropdown set to 'ESA_CRYO_2016' and a 'Files of type' dropdown set to 'Colour palette files (*.cpd)'. The 'File name' field contains 'Ice_velocity.cpd'. The 'Open' button is highlighted.

Product Explorer x Pixel Info

[6] Subset_S1A_EW_HH_M20160402_S20160414_COR

- Metadata
- Vector Data
- Tie-Point Grids
- Bands
 - Sigma0_HH_mst_02Apr2016
 - Sigma0_HH_slv_1_14Apr2016

[6] Subset_S1A_EW_HH_M20160402_S20160414_COR_vel

- Metadata
 - Abstracted_Metadata
 - Original_Product_Metadata
 - Processing_Graph
 - Slave_Metadata
 - history
- Vector Data
- Tie-Point Grids
- Bands
 - Velocity_slv_1_14Apr2016

Navigation - [6] ... Colour Manipul... x Uncertainty Visu... World View

Editor: Basic Sliders Table

Name: Velocity_slv_1_14Apr2016
Unit: m/day
Min: -0.011
Max: 3.792
Rough statistics!

4.83E-2

0.51 1.12 1.74 2.05

Import Colour Palette

Look in: ESA_CRYO_2016

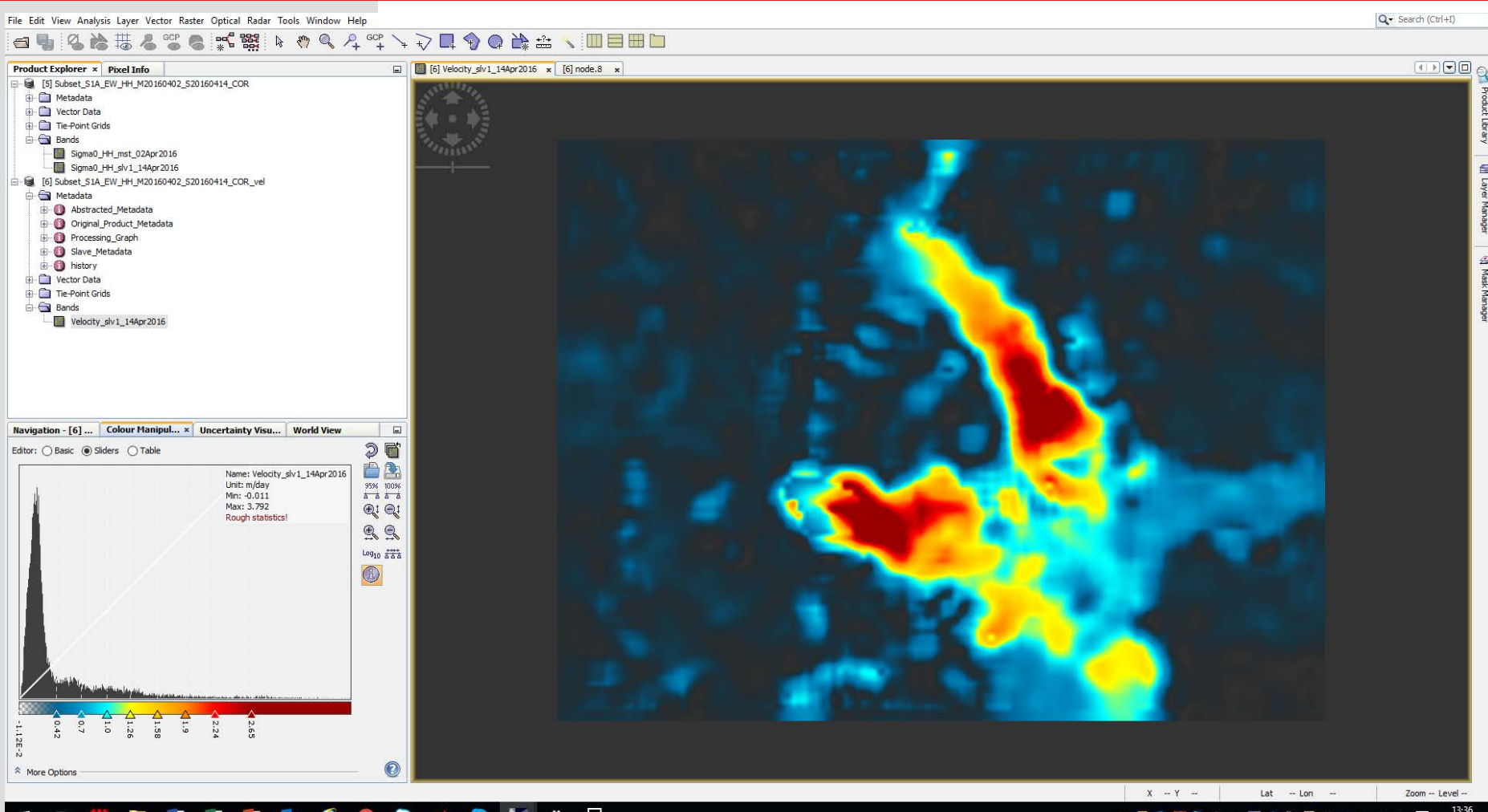
- Backup
- Dataset
- Graphs
- OUTPUT
- Ice_velocity.cpd

File name: Ice_velocity.cpd

Files of type: Colour palette files (*.cpd)

Open Cancel

Import a colour palette

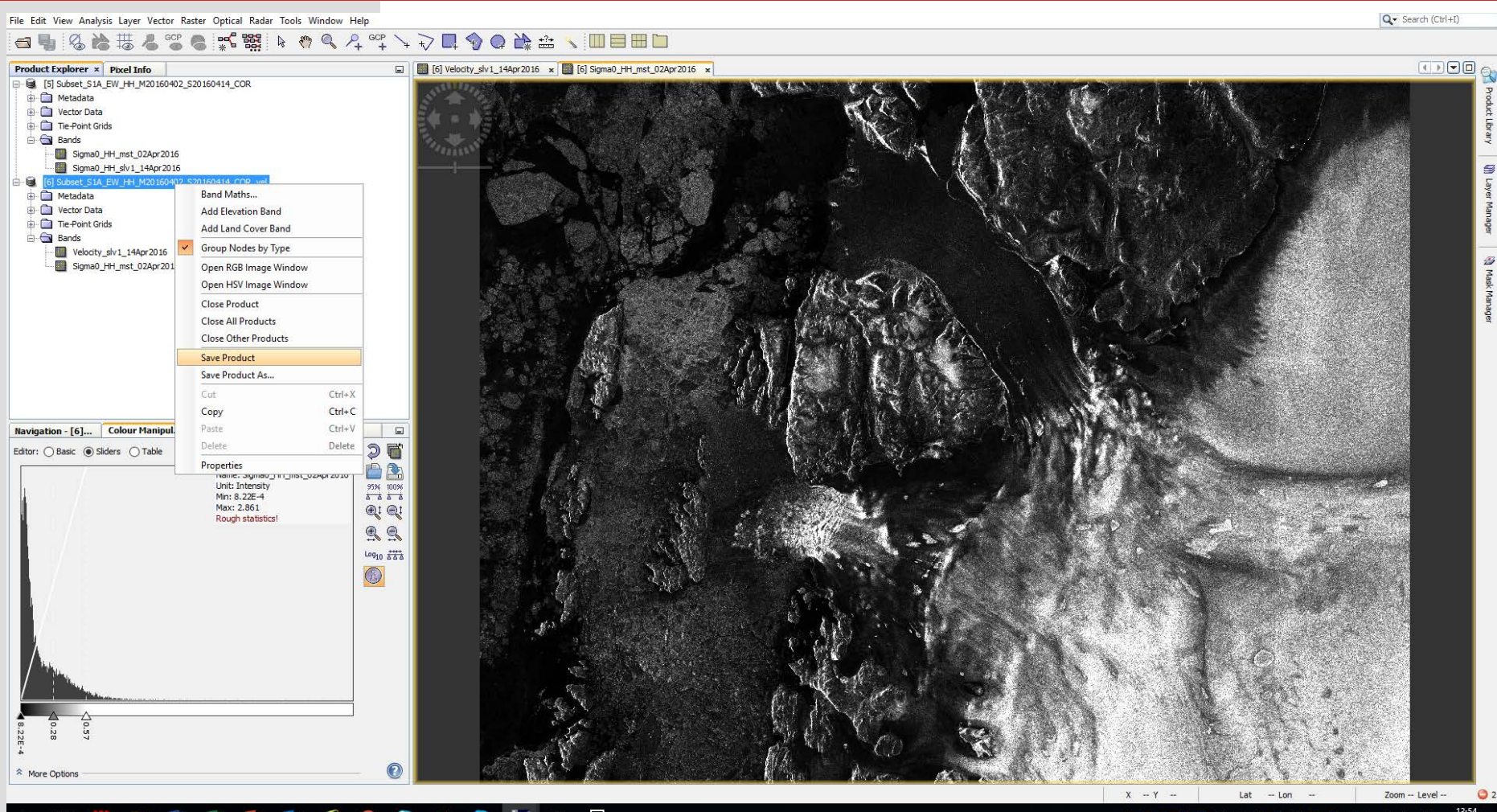


Step 3: Merging Sigma0 and Ice Velocity via Band Maths Op

The screenshot shows the ENVI software interface with the Product Explorer on the left. Two bands are selected: 'Sigma0_HH_mst_02Apr2016' and 'Sigma0_HH_slv1_14Apr2016'. A right-click context menu is open over the selected bands, with 'Band Maths...' highlighted. The 'Band Maths' dialog box is open, showing the 'Target product' as '[6] Subset_S1A_EW_HH_M20160402_S20160414_COR_vel'. The 'Name' field is 'Sigma0_HH_mst_02Apr2016', the 'Unit' is 'Intensity', and the 'Virtual' checkbox is checked. The 'Band maths expression' field contains '\$5.Sigma0_HH_mst_02Apr2016'. The 'Edit Expression...' button is highlighted with a red dashed box. The 'Band Maths Expression Editor' dialog is also open, showing the 'Product' as '[5] Subset_S1A_EW_HH_M20160402_S20160414_COR'. The 'Data sources' list contains '\$5.Sigma0_HH_mst_02Apr2016' and '\$5.Sigma0_HH_slv1_14Apr2016'. The 'Expression' field contains '\$5.Sigma0_HH_mst_02Apr2016'. The 'Show bands' checkbox is checked.

1. Right click over product name → Band Maths Op
2. Name: write Ratio2May14May
3. Check Virtual option
4. Click to Edit Expression

Merging Sigma0 and Ice Velocity



The screenshot displays a GIS application window with a menu open over the 'Bands' folder of a product named 'Subset_S1A_EW_HH_M20160402_S20160414_COR'. The menu options include:

- Band Maths...
- Add Elevation Band
- Add Land Cover Band
- Group Nodes by Type
- Open RGB Image Window
- Open HSV Image Window
- Close Product
- Close All Products
- Close Other Products
- Save Product
- Save Product As...
- Cut (Ctrl+X)
- Copy (Ctrl+C)
- Paste (Ctrl+V)
- Delete

The 'Properties' panel for the selected band shows:

- Unit: Intensity
- Min: 8.22E-4
- Max: 2.861
- Rough statistics!

The main window displays a grayscale satellite image of a polar region. The interface includes a 'Product Explorer' on the left, a 'Navigation' panel with a histogram, and a 'Colour Manipulation' panel. The bottom status bar shows coordinates (X, Y, Lat, Lon) and zoom/level information.

Overlay Sigma0 and Ice Velocity via the Layer Manager

- 1) Click on +
- 2) Select Image of Band / Tie-Point Grid and click on Next

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

Product Explorer x Pixel

[5] Subset_S1A_EW_HH

Metadata

Vector Data

Tie-Point Grids

Bands

Sigma0_HH_mst

Sigma0_HH_slv1

[6] Subset_S1A_EW_HH

Metadata

Vector Data

Tie-Point Grids

Bands

Velocity_slv1_14

Sigma0_HH_mst

Layer Manager

Vector data

Masks

[6] Sigma0_HH_mst_02Apr2016

Add Layer

Select Layer Source

Available layer sources:

ESRI Shapefile

Image of Band / Tie-Point Grid

Layer Group

Mapping Tools

RGB Image from File

Navigation - [6]...

Colour

Editor: Basic Sliders

0.22E-4

0.28

0.57

Log10

More Options

Add Layer

Select Band / Tie-Point Grid

Compatible bands and tie-point grids:

[6] Subset_S1A_EW_HH_M20160402_S20160414_COR_vel

- Velocity_slv1_14Apr2016
- Sigma0_HH_mst_02Apr2016
- latitude (Tie-point grid)
- longitude (Tie-point grid)
- incident_angle (Tie-point grid)
- elevation_angle (Tie-point grid)
- slant_range_time (Tie-point grid)

< Previous Next > Finish Cancel Help

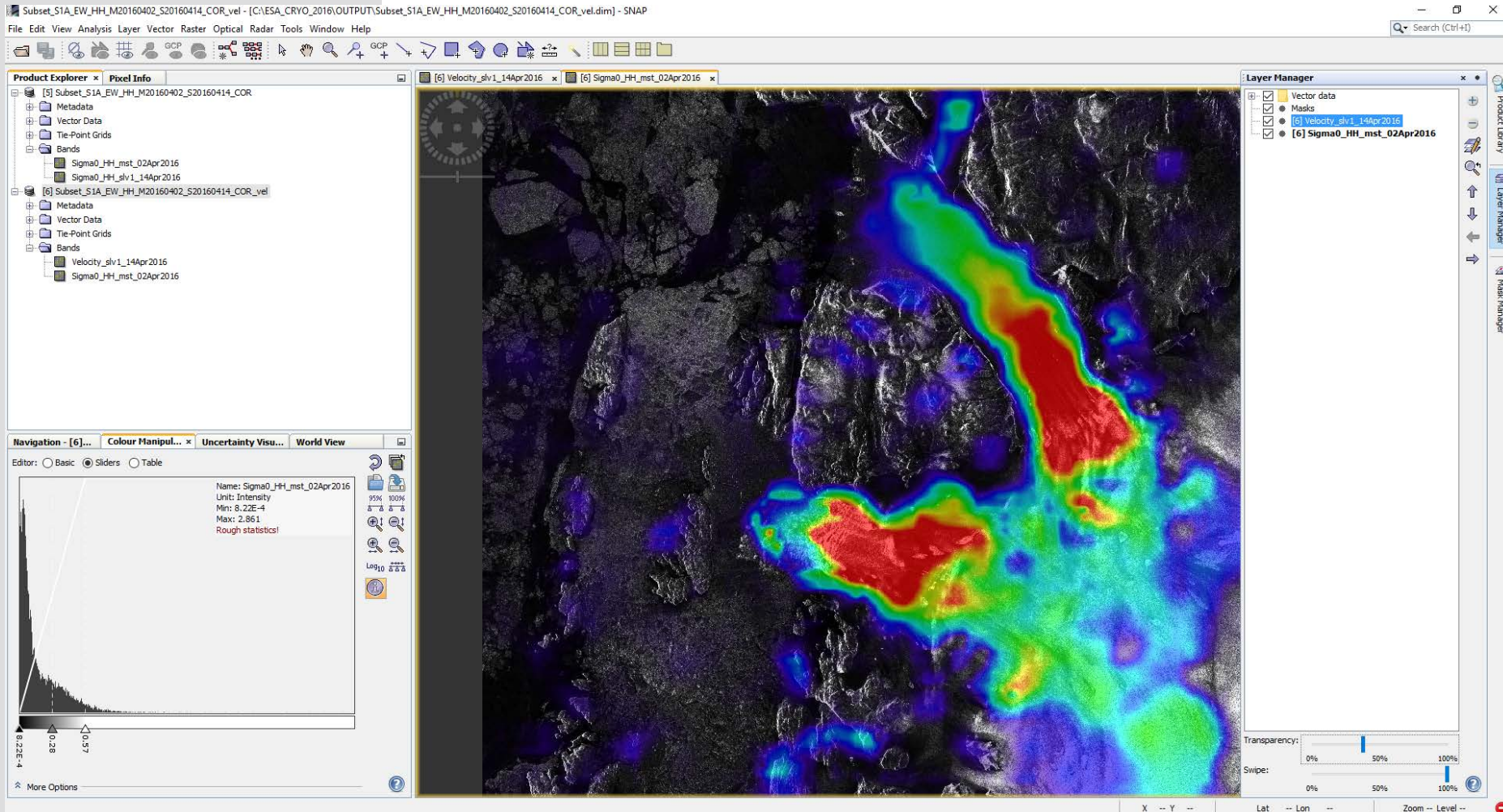
0% 50% 100%

0% 50% 100%

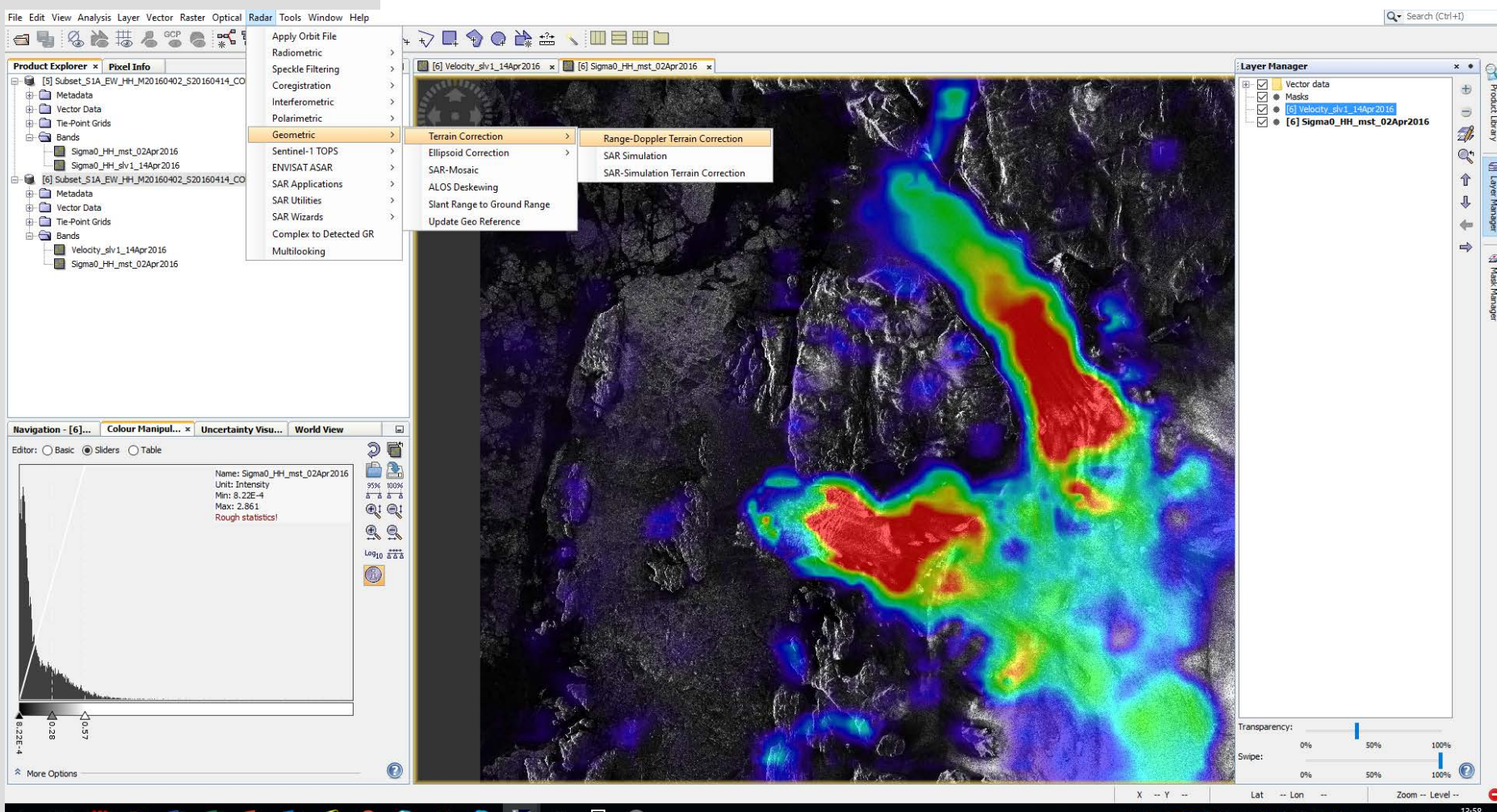
Lat -- Lon -- Zoom -- Level --

13:55

Overlay Sigma0 and Ice Velocity via the Layer Manager



Step 3: Geocoding: RD Terrain Correction



The screenshot displays a SAR processing software interface. The main window shows a SAR image with a color-coded range-Doppler terrain correction overlay. The 'Radar' menu is open, and the 'Terrain Correction' sub-menu is selected, with 'Range-Doppler Terrain Correction' highlighted. The 'Product Explorer' on the left shows a project structure with files like 'Sigma0_HH_mst_02Apr2016' and 'Velocity_slv_1_14Apr2016'. The 'Layer Manager' on the right shows the loaded layers. The bottom-left panel shows a histogram for the 'Sigma0_HH_mst_02Apr2016' layer with statistics: Min: 8.22E-4, Max: 2.861. The bottom status bar shows coordinates and zoom level.

Step 3: Geocoding: RD Terrain Correction

Range Doppler Terrain Correction

File Help

I/O Parameters Processing Parameters

Source Bands: Velocity_slv_1_14Apr2016
Sigma0_HH_mst_02Apr2016

Digital Elevation Model: **ACE30 (Auto Download)**

DEM Resampling Method: BILINEAR_INTERPOLATION

Image Resampling Method: BILINEAR_INTERPOLATION

Source GR Pixel Spacings (az x rg): 40.0(m) x 40.0(m)

Pixel Spacing (m): 40.0

Pixel Spacing (deg): 3.593261136478086E-4

Map Projection: WGS84(DD)

Mask out areas without elevation Output complex data

Output bands for:

Selected source band DEM Latitude & Longitude

Incidence angle from ellipsoid Local incidence angle Projected local incidence angle

Apply radiometric normalization

Save Sigma0 band Use projected local incidence angle from DEM

Save Gamma0 band Use projected local incidence angle from DEM

Save Beta0 band

Auxiliary File (ASAR only): Latest Auxiliary File

Run Close

Map Projection

Coordinate Reference System (CRS)

Custom CRS

Geodetic datum: World Geodetic System 1984

Projection: Geographic Lat/Lon (WGS 84)

Projection Parameters...

Predefined CRS Select...

OK Cancel Help

Select Coordinate Reference System

Filter: Polar

Well-Known Text (WKT):

EPSG:2985 - Petrels 1972 / Terre Adelle Polar Stereographic
 EPSG:2986 - Perroud 1950 / Terre Adelle Polar Stereographic
 EPSG:3031 - WGS 84 / Antarctic Polar Stereographic
 EPSG:3032 - WGS 84 / Australian Antarctic Polar Stereographic
EPSG:3411 - NSIDC Sea Ice Polar Stereographic North
 EPSG:3412 - NSIDC Sea Ice Polar Stereographic South
 EPSG:3413 - WGS 84 / NSIDC Sea Ice Polar Stereographic North
 EPSG:3976 - WGS 84 / NSIDC Sea Ice Polar Stereographic South
 EPSG:3995 - WGS 84 / Arctic Polar Stereographic
 EPSG:3996 - WGS 84 / IBCAO Polar Stereographic

PROJCS["NSIDC Sea Ice Polar Stereographic North",
 GEOGCS["Unspecified datum based upon the Hughes 1980 ellipsoid",
 DATUM["Not specified (based on Hughes 1980 ellipsoid)",
 SPHEROID["Hughes 1980", 6378273.0, 298.279411123064, AUTHORITY["EPSG", "6054"]],
 PRIMEM["Greenwich", 0.0, AUTHORITY["EPSG", "8901"]],
 UNIT["degree", 0.017453292519943295],
 AXIS["Geodetic longitude", EAST],
 AXIS["Geodetic latitude", NORTH],
 AUTHORITY["EPSG", "4054"]],
 PROJECTION["Polar Stereographic (variant B)", AUTHORITY["EPSG", "9825"],
 PARAMETER["central_meridian", -45.0],
 PARAMETER["Standard_Parallel_1", 70.0],
 PARAMETER["false_easting", 0.0],
 PARAMETER["false_northing", 0.0],
 UNIT["m", 1.0],
 AXIS["Easting", "South along 45 deg East"],
 AXIS["Northing", "South along 135 deg East"]]

OK Cancel

Step 3: Geocoding: RD Terrain Correction

Range Doppler Terrain Correction

File Help

I/O Parameters Processing Parameters

Source Bands:
Velocity_slv1_14Apr2016
Sigma0_HH_mst_02Apr2016

Digital Elevation Model: ACE30 (Auto Download)

DEM Resampling Method: BILINEAR_INTERPOLATION

Image Resampling Method: BILINEAR_INTERPOLATION

Source GR Pixel Spacings (az x rg): 40.0(m) x 40.0(m)

Pixel Spacing (m): 40.0

Pixel Spacing (deg): 3.593261136478086E-4

Map Projection: NSIDC Sea Ice Polar Stereographic North

Mask out areas without elevation Output complex data

Output bands for:

Selected source band DEM Latitude & Longitude

Incidence angle from ellipsoid Local incidence angle Projected local incidence angle

Apply radiometric normalization

Save Sigma0 band Use projected local incidence angle from DEM

Save Gamma0 band Use projected local incidence angle from DEM

Save Beta0 band

Auxiliary File (ASAR only): Latest Auxiliary File

Run Close

Range Doppler Terrain Correction

File Help

Processing completed in 57 seconds (7 MB/s 2 MPixel/s)

I/O Parameters Processing Parameters

Source Product
source:
[6] Subset_S1A_EW_HH_M20160402_S20160414_COR_vel

Target Product
Name:
Subset_S1A_EW_HH_M20160402_S20160414_COR_vel_TC

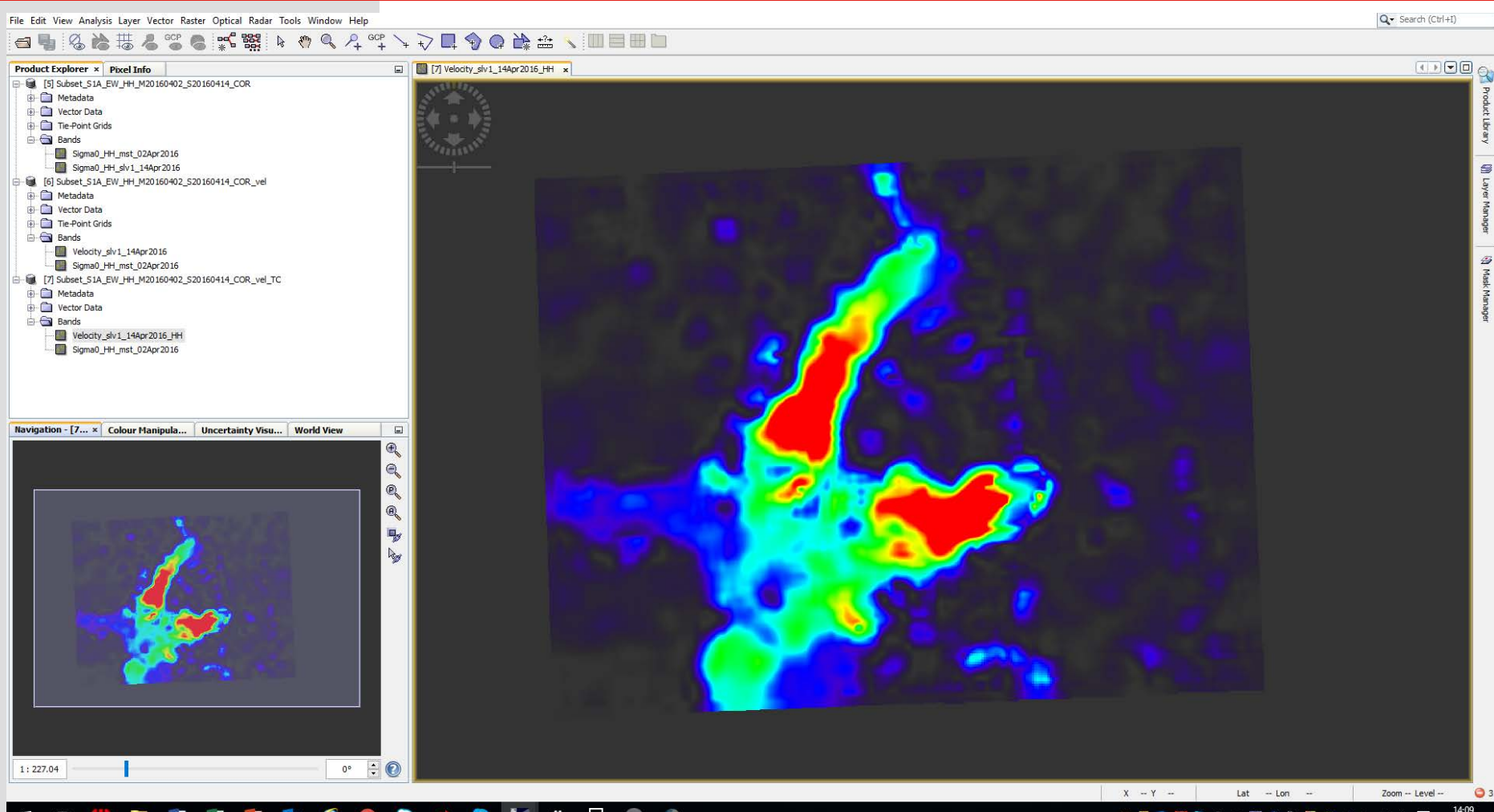
Save as: BEAM-DIMAP

Directory:
C:\ESA_CRYO_2016\OUTPUT

Open in SNAP

Run Close

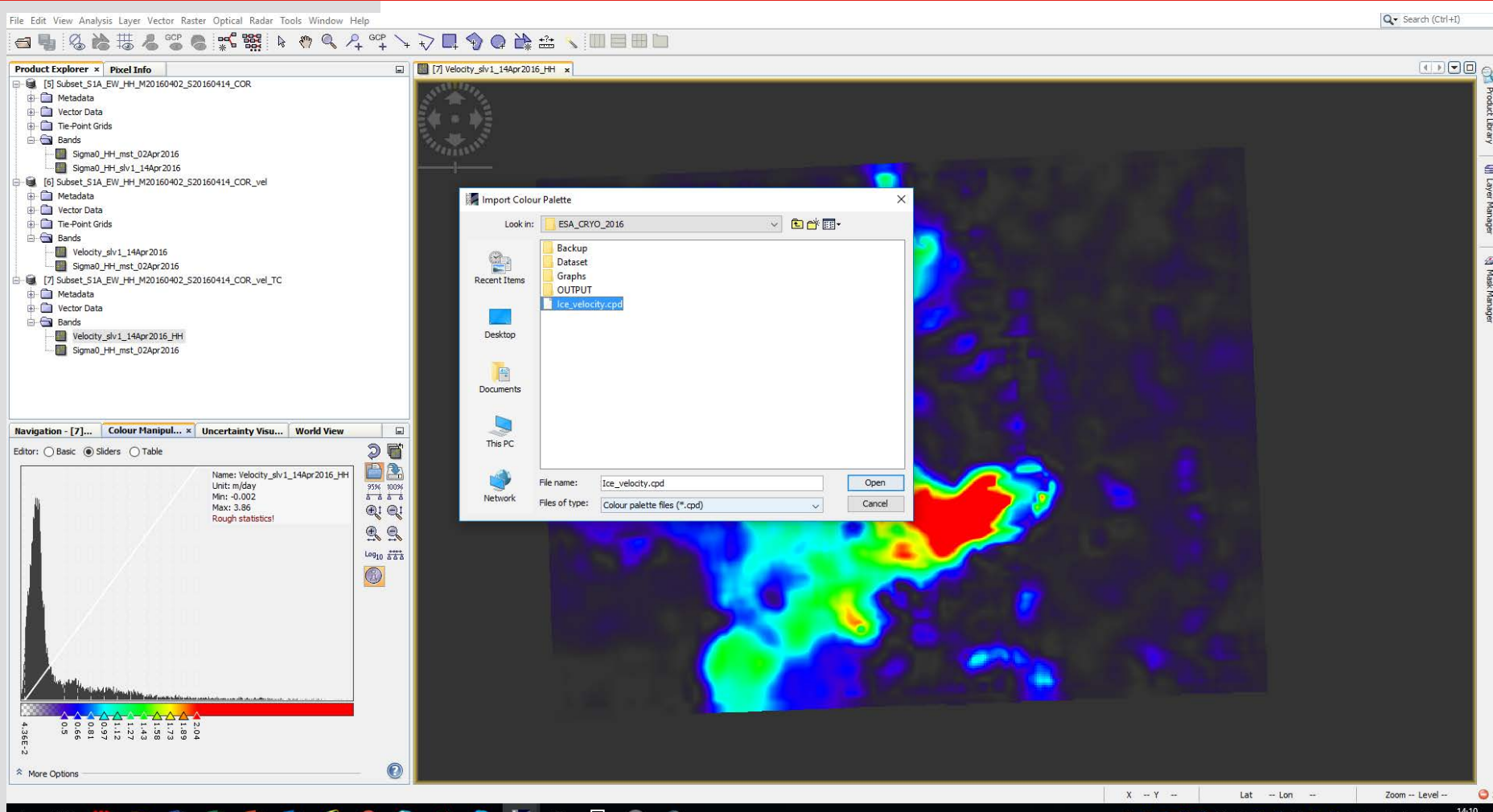
Step 3: Geocoding: RD Terrain Correction



Step 3: Geocoding: RD Terrain Correction

Q13. What is the purpose of geocoding an image?

Import a Colour Palette



The screenshot displays the ENVI software interface. The main window shows a satellite image of ice velocity with a color scale from blue to red. An 'Import Colour Palette' dialog box is open, showing the file 'ice_velocity.cpd' selected in the 'ESA_CRYO_2016' folder. The 'Product Explorer' on the left shows a tree view of data layers, and the 'Colour Manipulation' window at the bottom left shows a histogram and color bar for the 'Velocity_slv_1_14Apr2016_HH' layer.

Product Explorer

- [5] Subset_S1A_EW_HH_M20160402_S20160414_COR
 - Metadata
 - Vector Data
 - Tie-Point Grids
 - Bands
 - Sigma0_HH_mst_02Apr2016
 - Sigma0_HH_slv_1_14Apr2016
- [6] Subset_S1A_EW_HH_M20160402_S20160414_COR_vel
 - Metadata
 - Vector Data
 - Tie-Point Grids
 - Bands
 - Velocity_slv_1_14Apr2016
 - Sigma0_HH_mst_02Apr2016
- [7] Subset_S1A_EW_HH_M20160402_S20160414_COR_vel_TC
 - Metadata
 - Vector Data
 - Bands
 - Velocity_slv_1_14Apr2016_HH
 - Sigma0_HH_mst_02Apr2016

Import Colour Palette

Look in: ESA_CRYO_2016

- Backup
- Dataset
- Graphs
- OUTPUT
- ice_velocity.cpd

File name: ice_velocity.cpd

Files of type: Colour palette files (*.cpd)

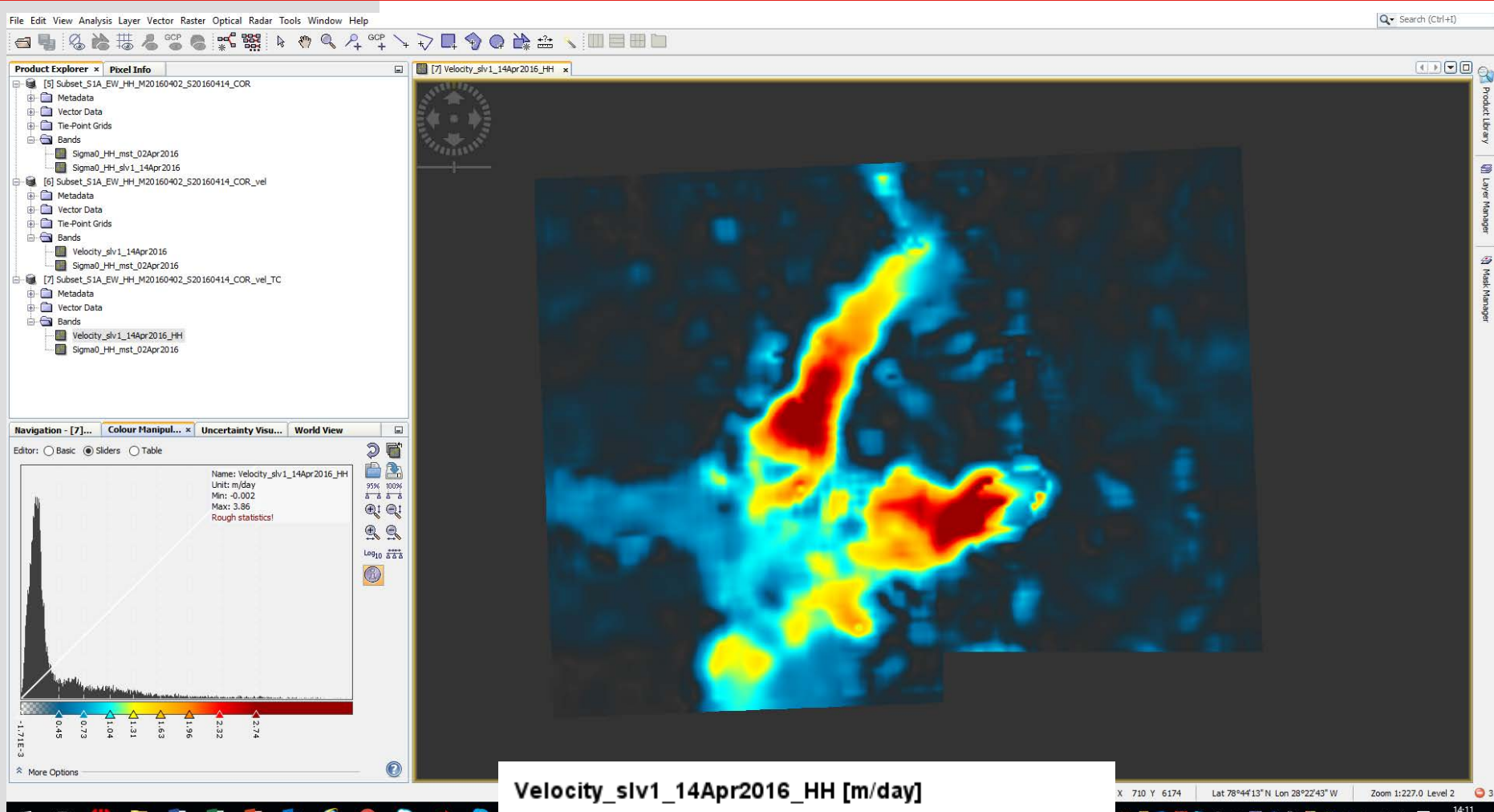
Colour Manipulation

Editor: Basic Sliders Table

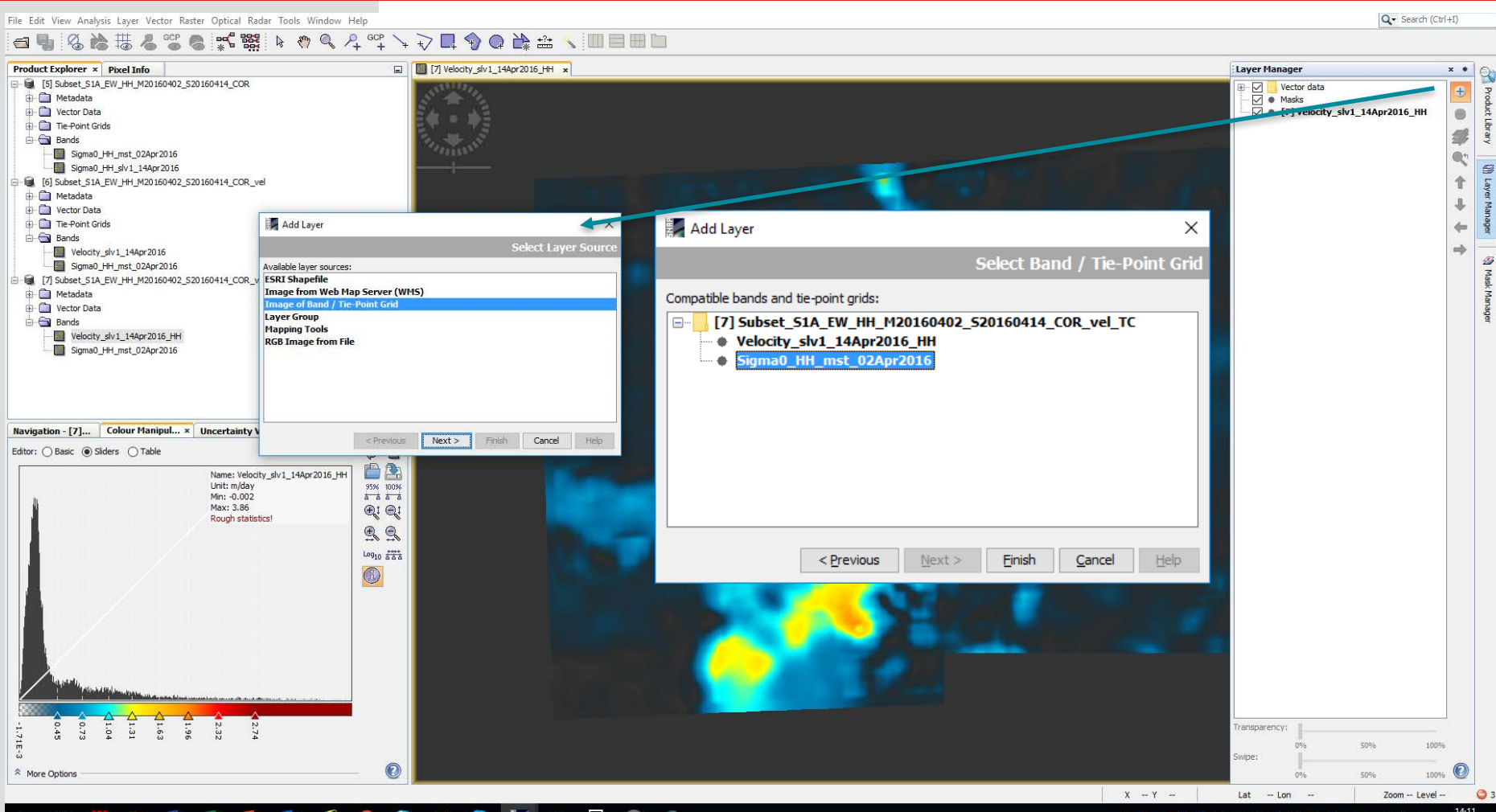
Name: Velocity_slv_1_14Apr2016_HH
 Unit: m/day
 Min: -0.002
 Max: 3.86
 Rough statistics!

4.36E-2
 0.5
 0.81
 0.97
 1.12
 1.27
 1.43
 1.58
 1.73
 1.89
 2.04

Import a Colour Palette



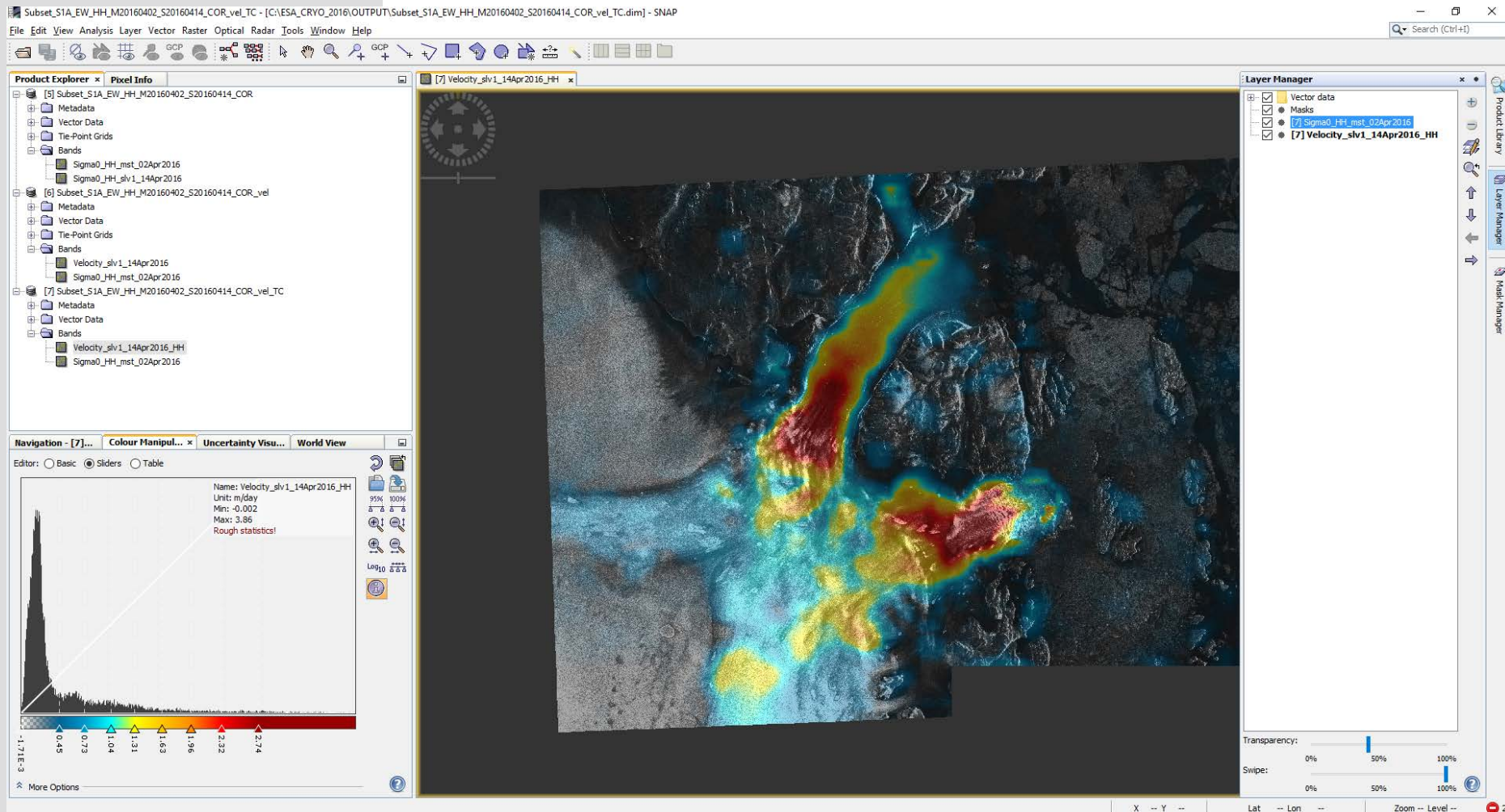
Overlay geocoded Sigma0 and Ice Velocity via the Layer Manager



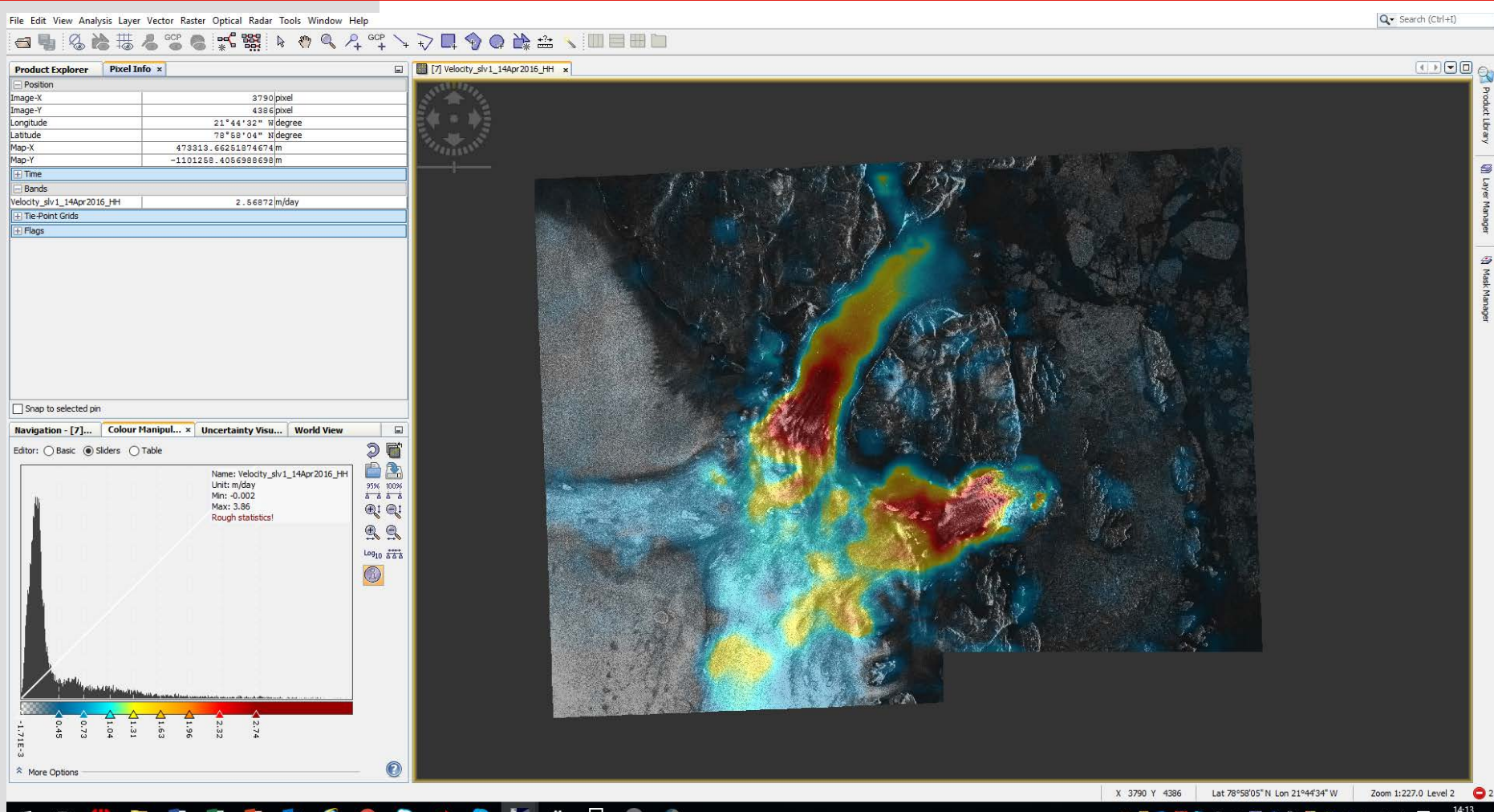
The screenshot displays the ArcGIS interface with several key components:

- Product Explorer:** Shows a tree view of data layers. Under the selected layer, the 'Bands' folder contains 'Sigma0_HH_mst_02Apr2016' and 'Velocity_slv1_14Apr2016'.
- Add Layer Dialog:** A dialog box titled 'Add Layer' is open, showing 'Compatible bands and tie-point grids'. The selected layer is '[7] Subset_S1A_EW_HH_M20160402_S20160414_COR_vel_TC', which contains two sub-layers: 'Velocity_slv1_14Apr2016_HH' and 'Sigma0_HH_mst_02Apr2016'.
- Layer Manager:** Located on the right, it shows the layers added to the map, including 'velocity_slv1_14Apr2016_HH'.
- Navigation - [7]...:** A histogram showing the distribution of values for the selected layer. The x-axis ranges from -1.71E-3 to 2.74, and the y-axis shows frequency. Statistics include: Name: Velocity_slv1_14Apr2016_HH, Unit: m/day, Min: -0.002, Max: 3.86.
- Map View:** The central map area shows a satellite image with overlaid data layers, including a color-coded velocity map and a grayscale Sigma0 map.

Overlay geocoded Sigma0 and Ice Velocity via the Layer Manager



Looking at the Ice Velocity Values



Comparison with ice velocity from CPOM NRT IV website

CPOM have build a Near Real Time (NRT) ice velocity monitoring service. Through this data portal, we distribute frequent maps of ice speed for 5 key outlet glaciers of the Antarctic and Greenland ice sheets, using SAR data acquired by the European Space Agency's Sentinel-1 satellite.

You can visit the website by following this link: <http://www.cpom.ucl.ac.uk/csopr/iv/>

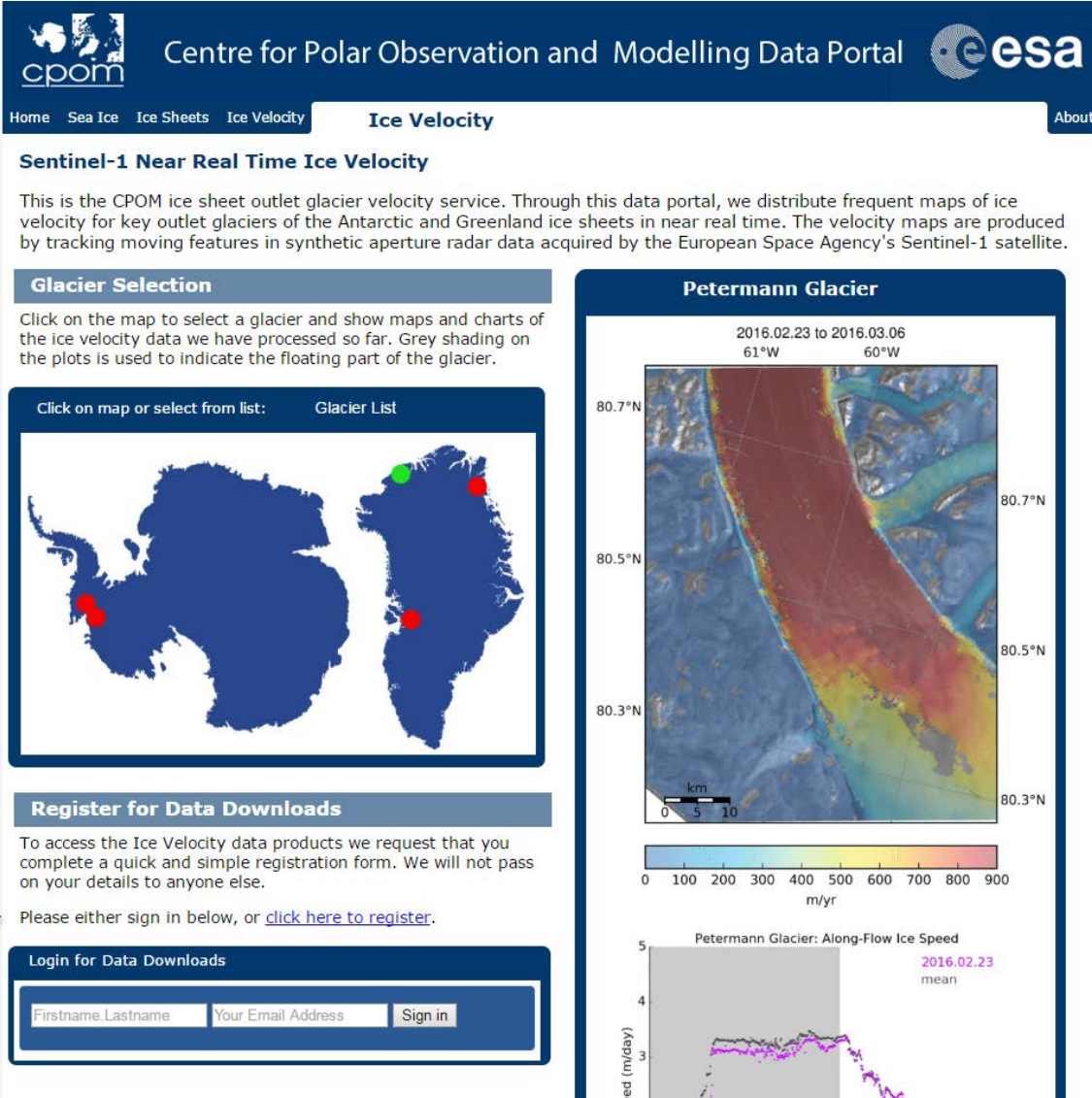
Q14. Which 5 glaciers does the CPOM IV data portal provide data for?


Comparison with ice velocity from CPOM NRT IV website

To make sure we are able to notify users of any improvements or issues with our data, we request that you complete a simple online registration form to gain access.

This gives you access to instantly download grids and transects of ice velocity data on all 5 ice streams.

Please register on the website in the area indicated below:

Centre for Polar Observation and Modelling Data Portal 

Home Sea Ice Ice Sheets Ice Velocity **Ice Velocity** About

Sentinel-1 Near Real Time Ice Velocity

This is the CPOM ice sheet outlet glacier velocity service. Through this data portal, we distribute frequent maps of ice velocity for key outlet glaciers of the Antarctic and Greenland ice sheets in near real time. The velocity maps are produced by tracking moving features in synthetic aperture radar data acquired by the European Space Agency's Sentinel-1 satellite.

Glacier Selection

Click on the map to select a glacier and show maps and charts of the ice velocity data we have processed so far. Grey shading on the plots is used to indicate the floating part of the glacier.

Click on map or select from list: Glacier List

Register for Data Downloads

To access the Ice Velocity data products we request that you complete a quick and simple registration form. We will not pass on your details to anyone else.

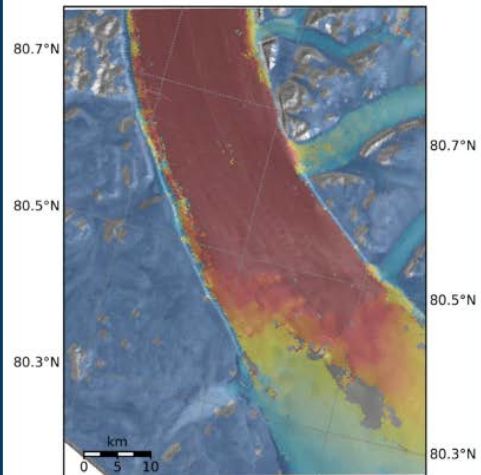
Please either sign in below, or [click here to register](#).

Login for Data Downloads

Firstname.Lastname Your Email Address Sign in

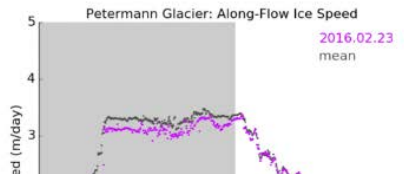
Petermann Glacier

2016.02.23 to 2016.03.06
61°W 60°W



0 100 200 300 400 500 600 700 800 900
m/yr

Petermann Glacier: Along-Flow Ice Speed



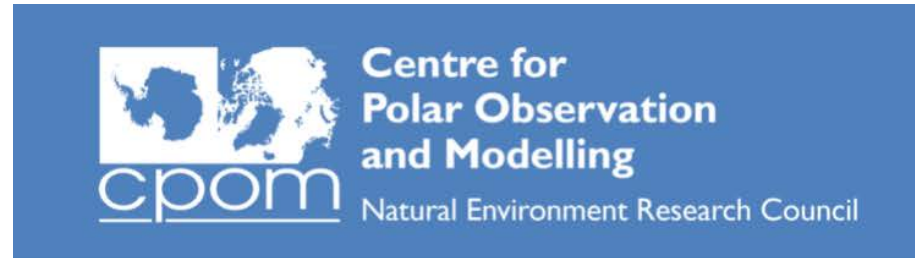
5
4
3
2
1
0
Ice speed (m/day)

2016.02.23 mean

Comparison with ice velocity from CPOM NRT IV website

Once you have registered for the service, you are also able to make special requests for SAR data products not already provided on the CPOM NRT IV service.

Q15. Name 3 other glaciologically useful data products that could be produced from SAR data?



CPOM SAR Facility Data Request Form

Requestor Information

Name*	
Email*	
Organisation*	
Contact Number*	

Dataset Information

Please supply as much information as possible about your requirements. We will aim to fulfil your request based on the data we have access to and will inform you if we cannot fulfil your request. Certain tasks may have a longer lead time as the facility expands its capability. Should this affect your request, we will inform you by email.

Area Of Interest, Name*	
Centre Lat, Lon*	
Approximate bounding box lat, lon. From top left, clockwise	
Period of Interest*	
Number of images	<input type="checkbox"/> Single image <input type="checkbox"/> Time series Approx. temporal spacing _____ <input type="checkbox"/> Other
Satellite (if known)	
Data Type (select all that apply)	<input type="checkbox"/> Geocoded Amplitude Image <input type="checkbox"/> Velocity Data (total magnitude only) <input type="checkbox"/> Velocity Data (2D x and y velocity components)

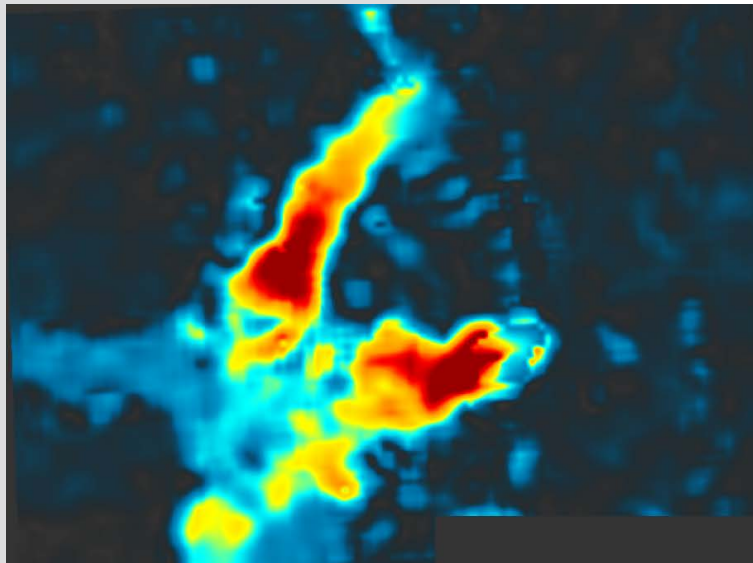
Comparison with ice velocity from CPOM NRT IV website

Navigate to the same image pair that you have just processed on the 79 fjorden ice stream, (otherwise known as Nioghalvfjerdingsfjorden). Either use the website, or click on the link below to reach it directly:

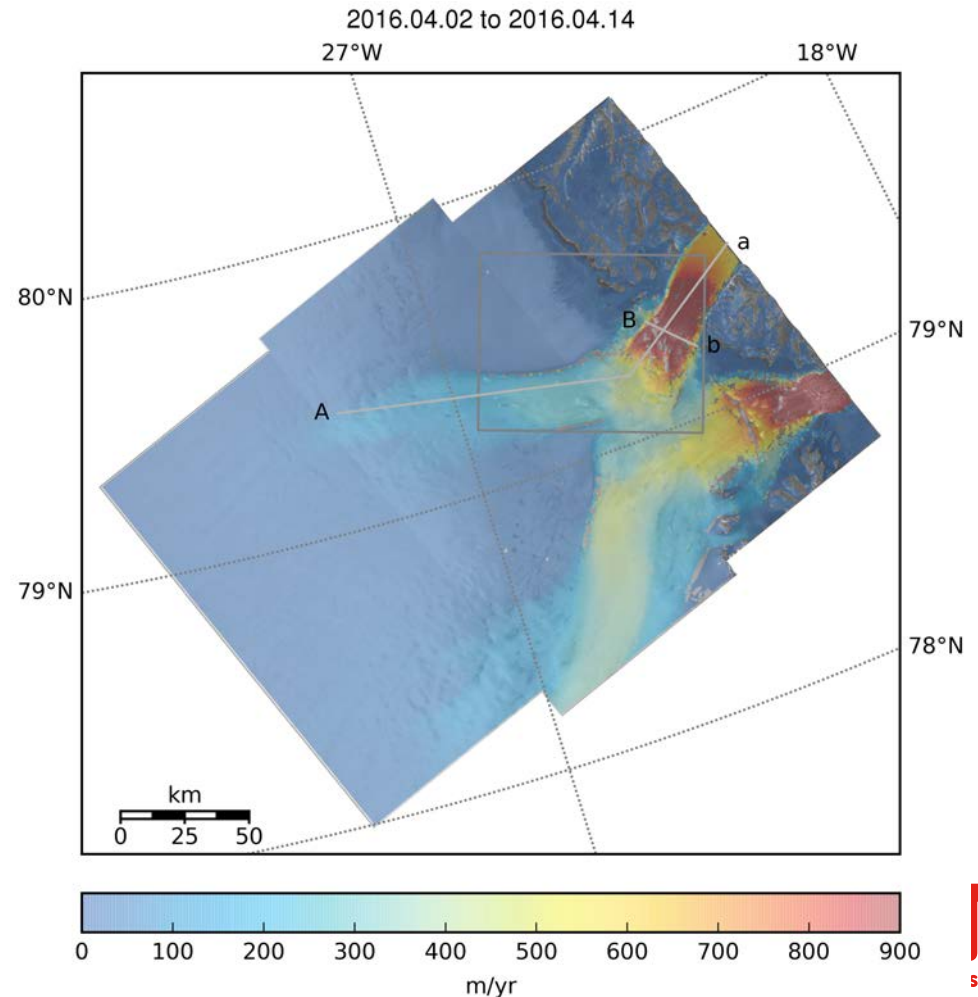
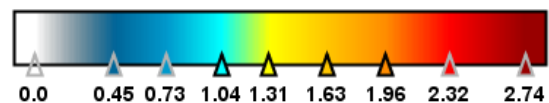
http://www.cpom.ucl.ac.uk/csopr/iv/index.html?glacier_number=0&image_date=160402_160414#output

Comparison with ice velocity from CPOM NRT IV website

http://www.cpom.ucl.ac.uk/csopr/iv/index.html?glacier_number=0&image_date=160402_160414#output



Velocity_slv1_14Apr2016_HH [m/day]

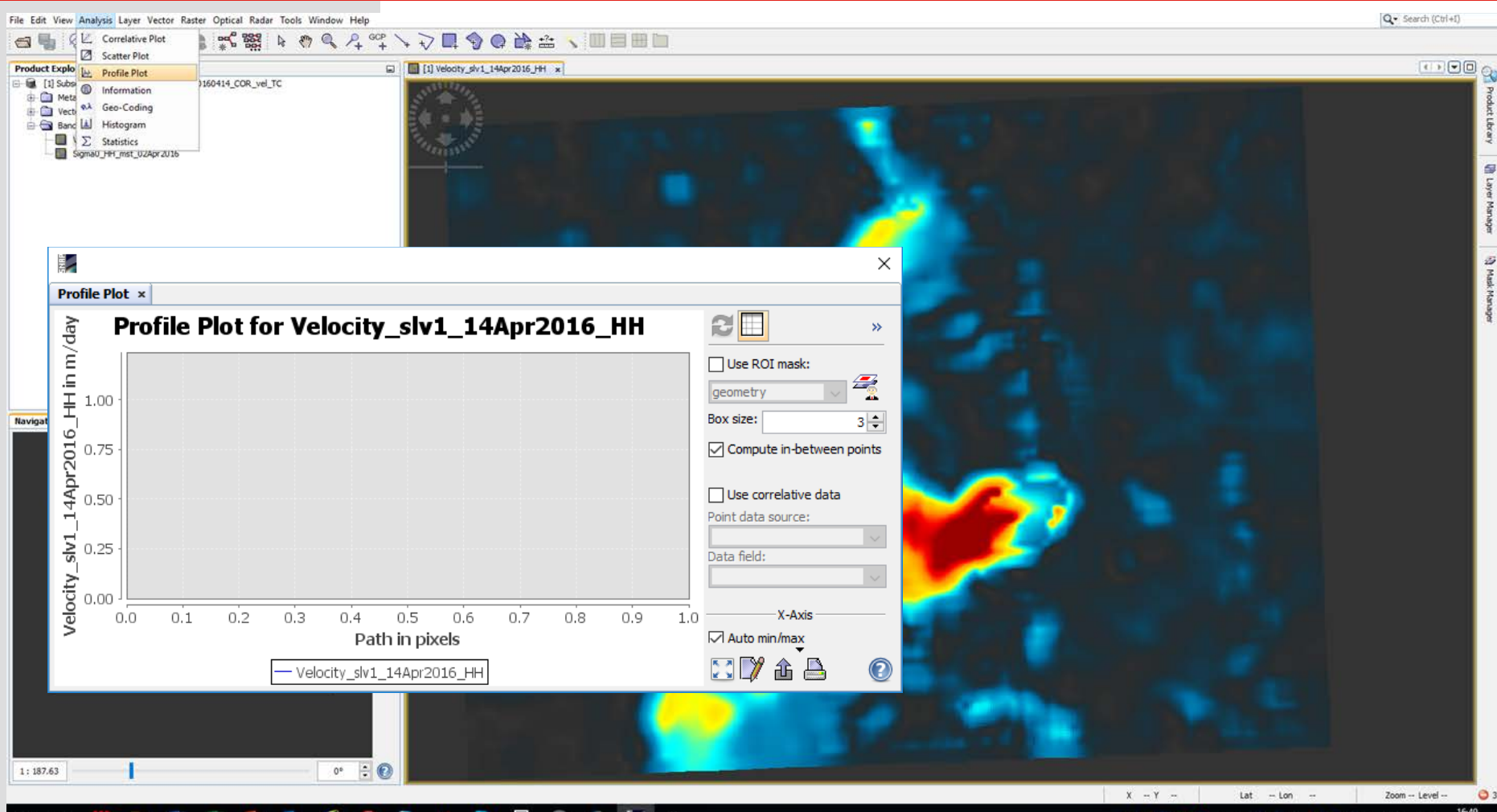


Comparison with ice velocity from CPOM NRT IV website

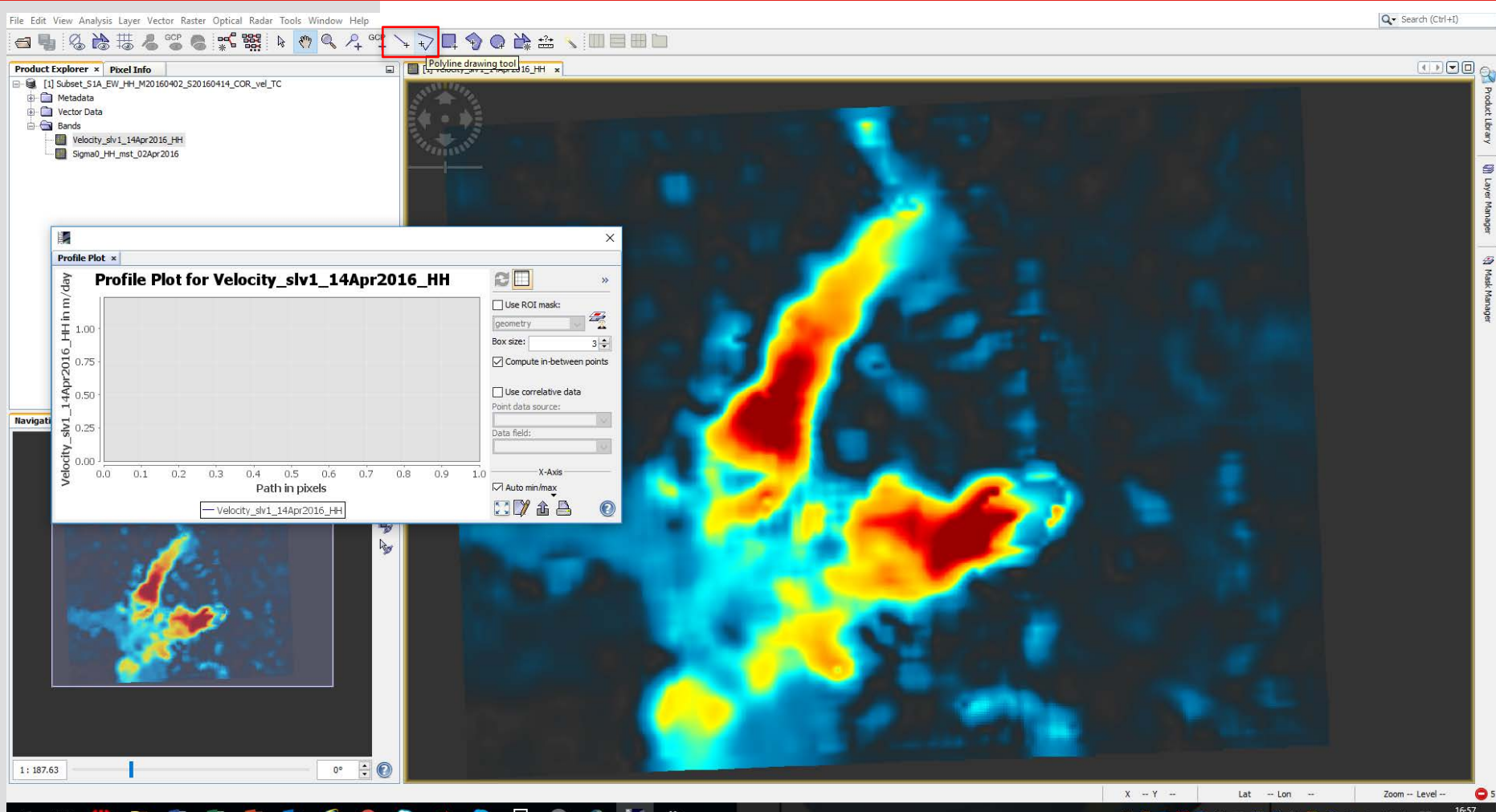
Q16. Briefly describe the differences you can see between the ice velocity measurements you have produced, and the ice velocity data produced from the same image pair on the CPOM NRT IV website (i.e. the two images on the previous slide)?

Q17. Suggest 2 reasons why these differences have occurred?

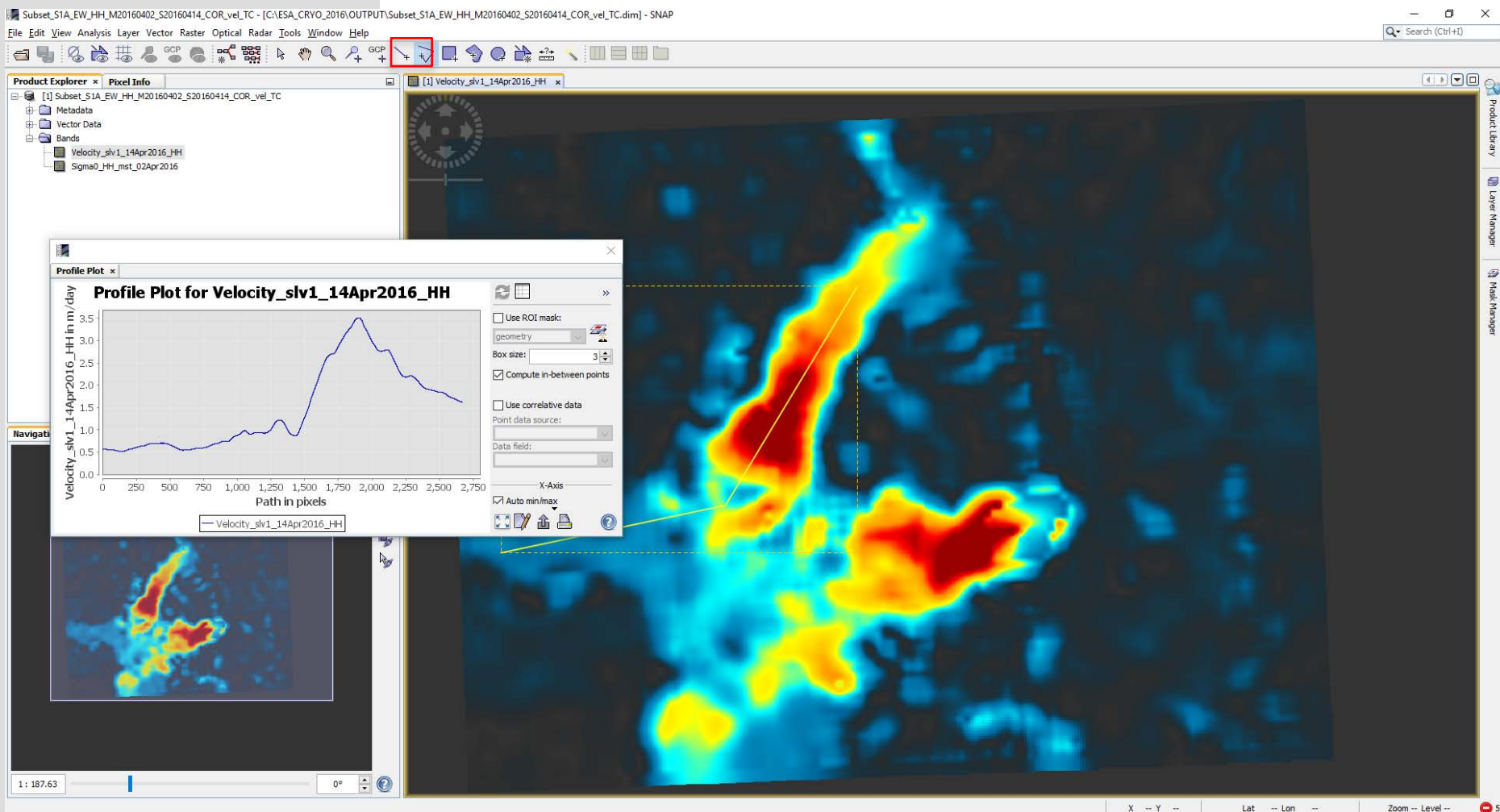
Transect A – Profile Plot



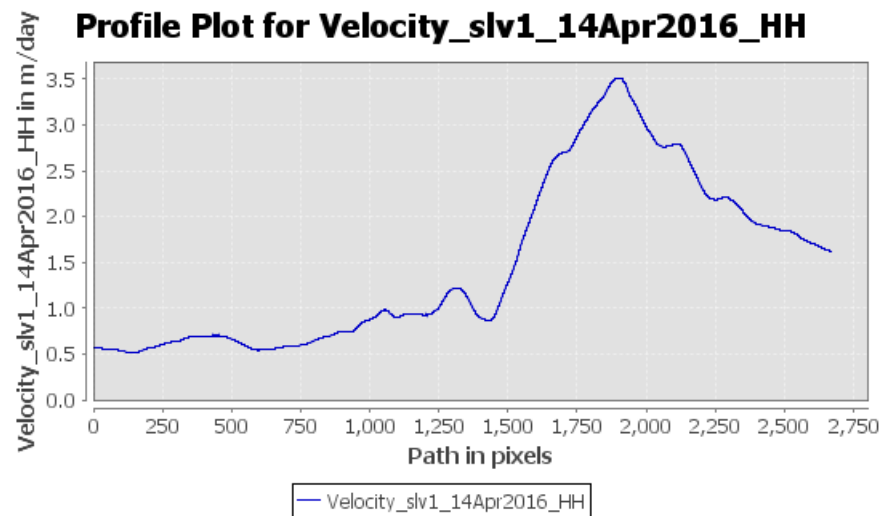
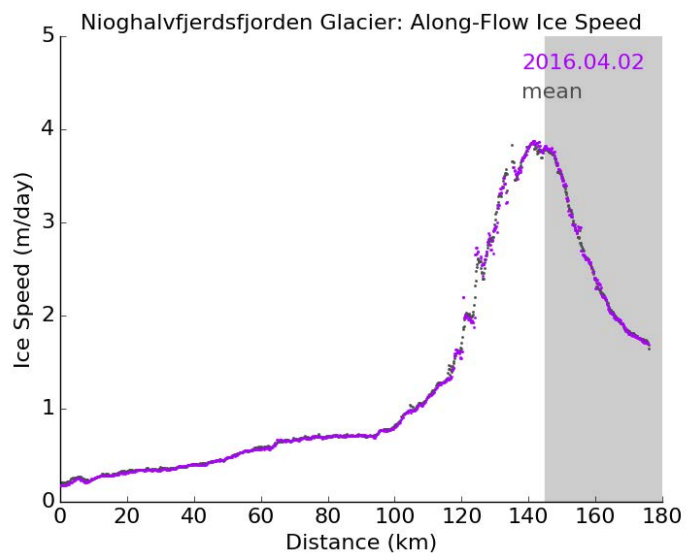
Transect A – Profile Plot



Transect A – Profile Plot



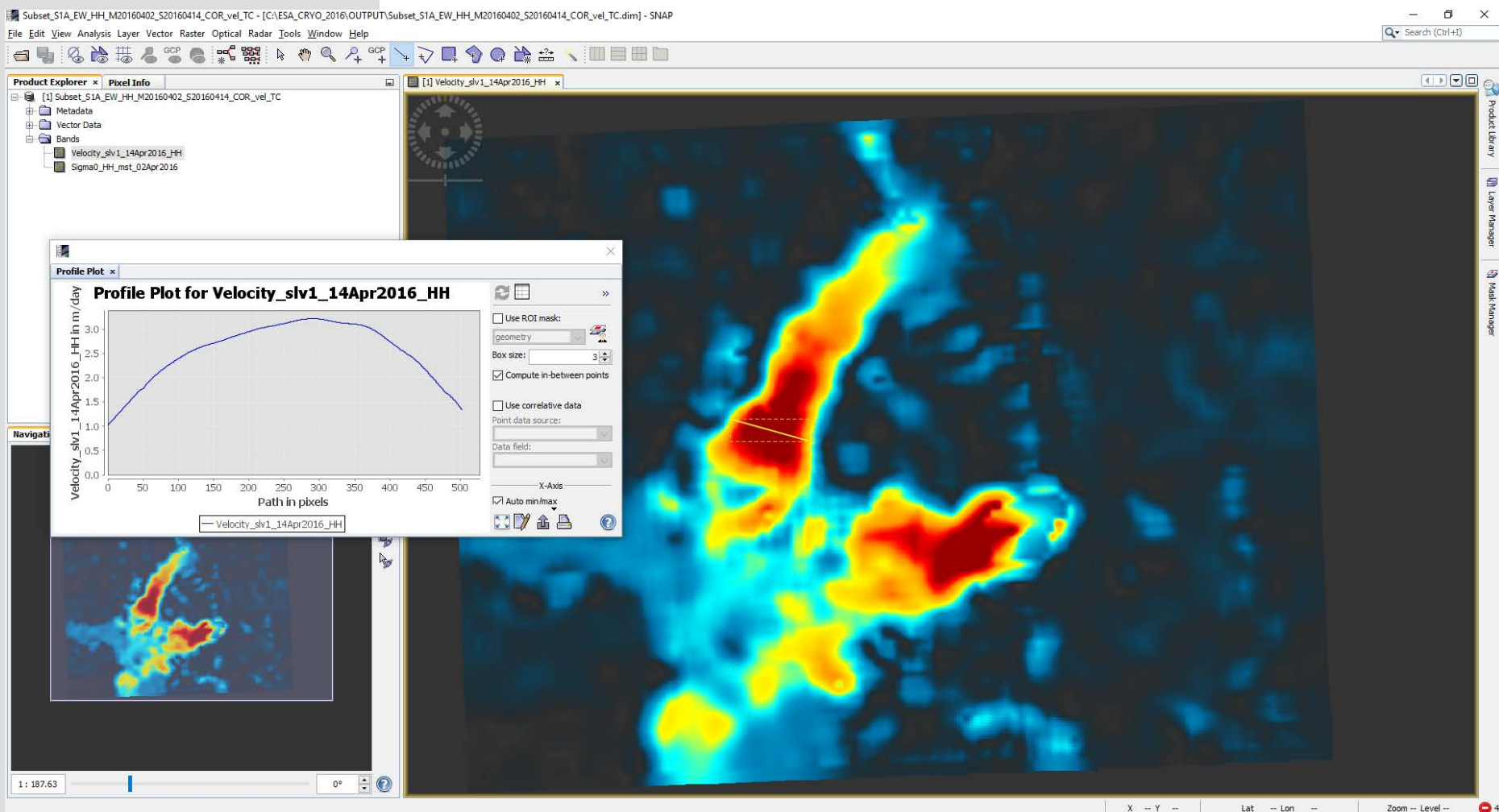
Comparison transect A



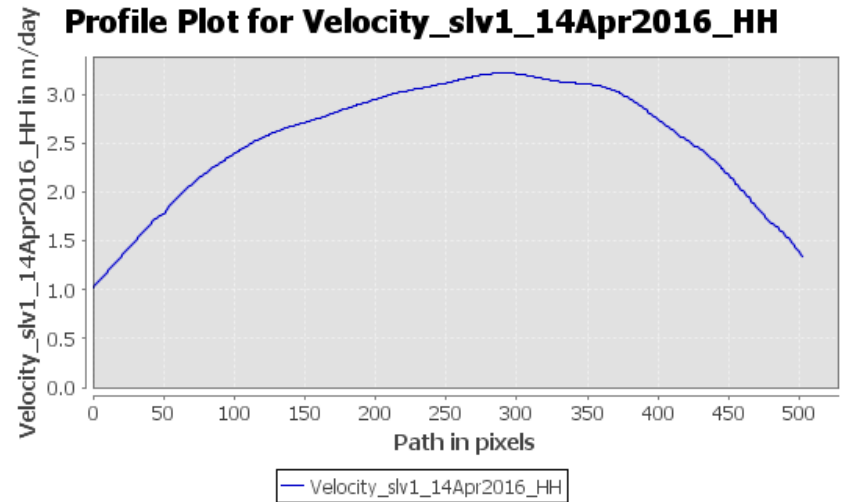
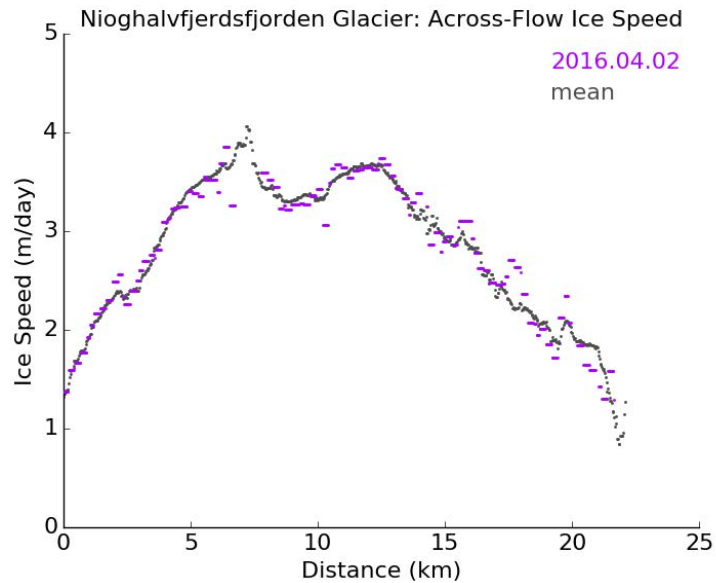
Comparison transect A

Q18. Do you think the ice velocity extracted along the two flow line transects looks the same? Which data product would you use and why?

Transect B



Comparison transect B



Comparison transect B

Q19. What method of mass balance estimation are 'gate' ice velocity transects often used for, and where would the gate ideally be located?

Q20. If you were to download all the flow line transects for 79 fjorden (or look at them in the animation at the top of the CPOM NRT IV website, do you think there has been a long term change in ice speed over the sentinel-1 period of operation?

Satellite Applications

Thank you
Any Question?

Innovate UK
Technology Strategy Board



**Centre for
Polar Observation
and Modelling**

Natural Environment Research Council

CATAPULT