



# PIPERS: Preliminary Analysis of Satellite Radar Imagery from Terra Nova Bay

Thomas Hollands, Wolfgang Dierking, Kathrin Höppner (DLR), Paul Wachter (DLR)

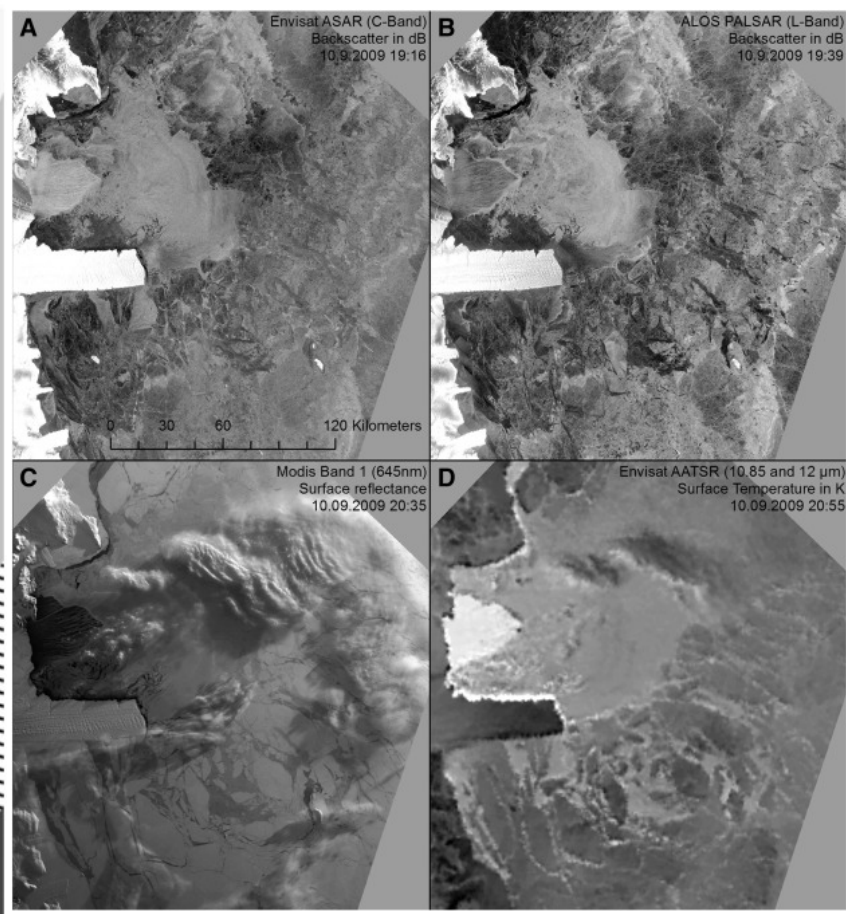
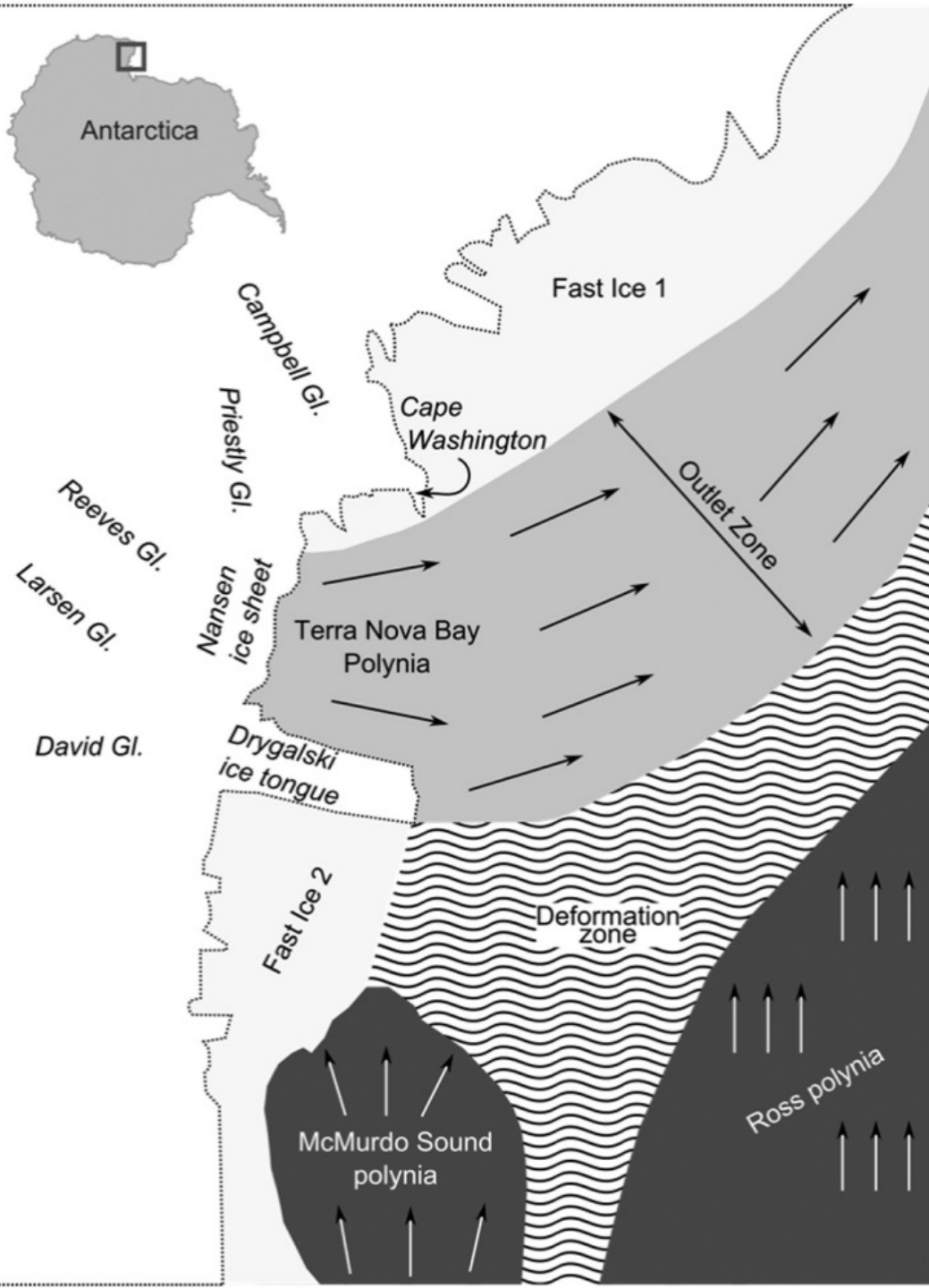
TSX 207-04-17, © DLR





TSX 207-04-17, © DLR





Thomas Hollands, Wolfgang Dierking (2016):  
*„Dynamics of the Terra Nova Bay Polynya: The potential of multi-sensor satellite observations“*, Remote Sensing of Environment, Volume 187, Pages 30-48,  
<https://doi.org/10.1016/j.rse.2016.10.003>.

# Employed data



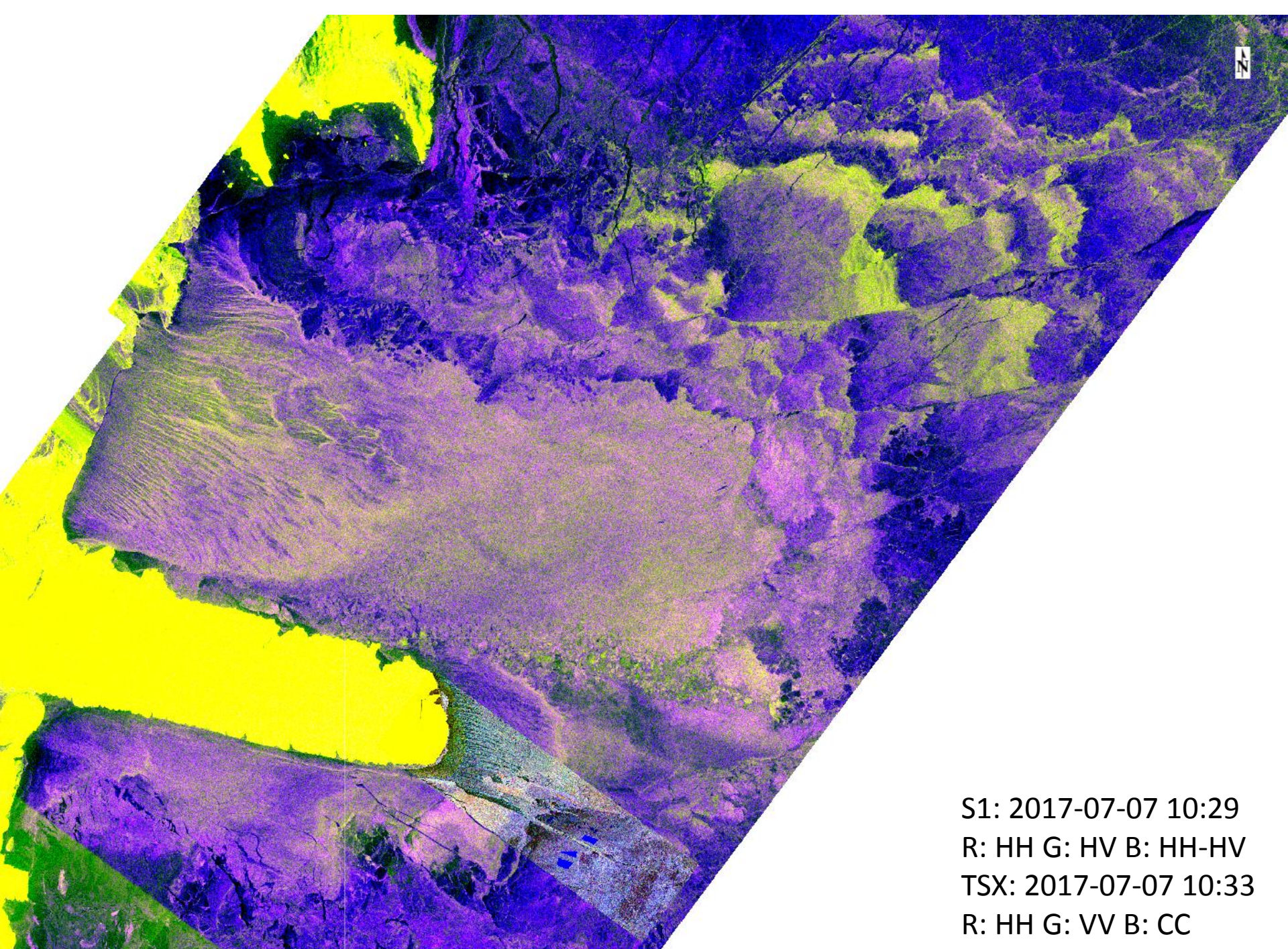
April 2017 – August 2017 (PIPERS: 4 April 2017 – 14 June 2017).

- Sentinel-1 data
  - IW HH polarised 25m x 25m
  - EW HH HV dualpol 80m x 80m
- 35 TerraSAR-X Stripmap DualPol HH/VV
- TerraSAR-X ScanSAR NRT data HH for PIPERS campaign



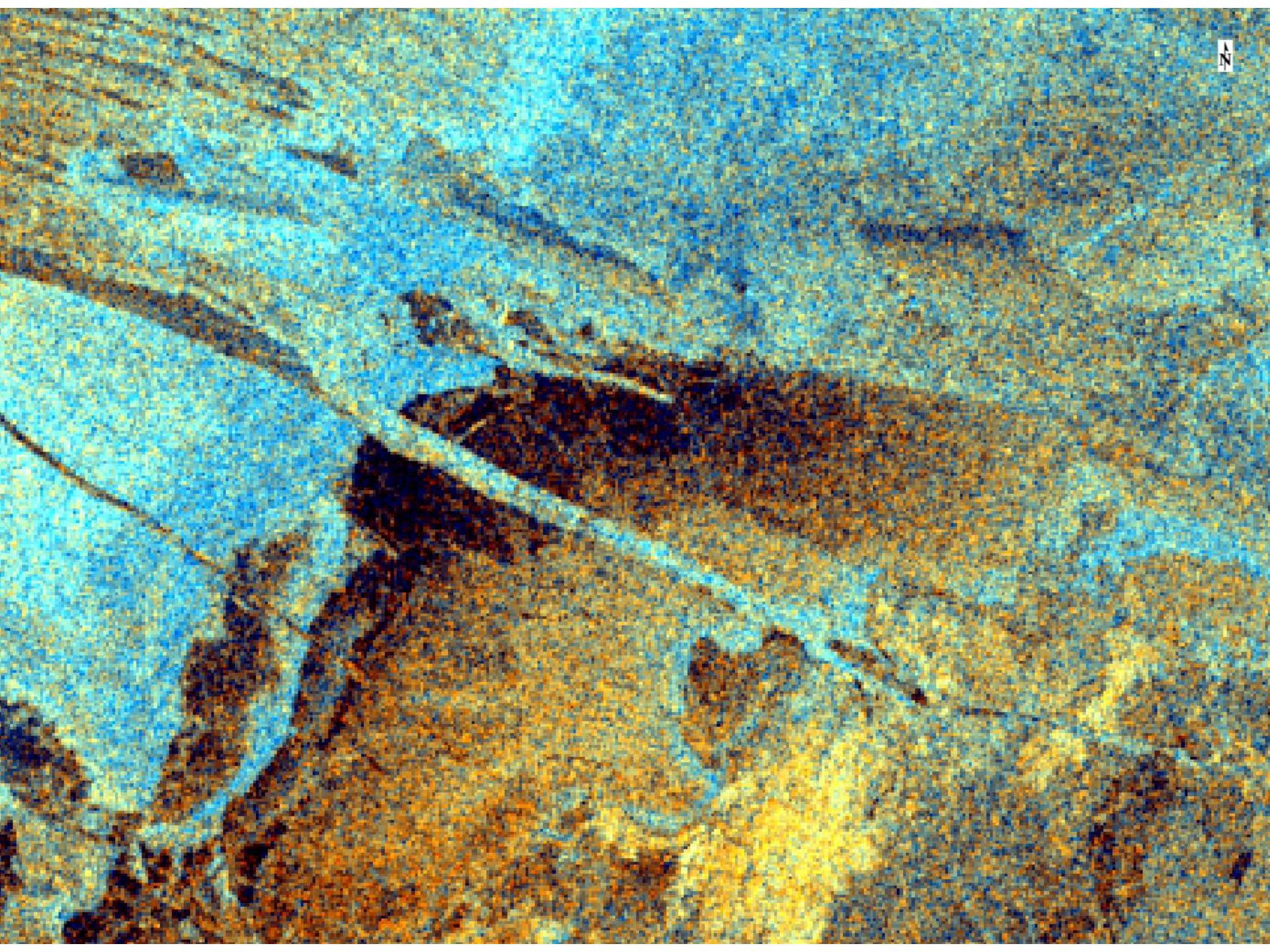
- Collection of ROI representing “homogeneous” sea ice units
- Compute ROI separability (Jeffries-Matusita)
- Reject „non separable ROIs“
- Employ remaining ROIs to perform supervised classification based on „Support Vector machine“



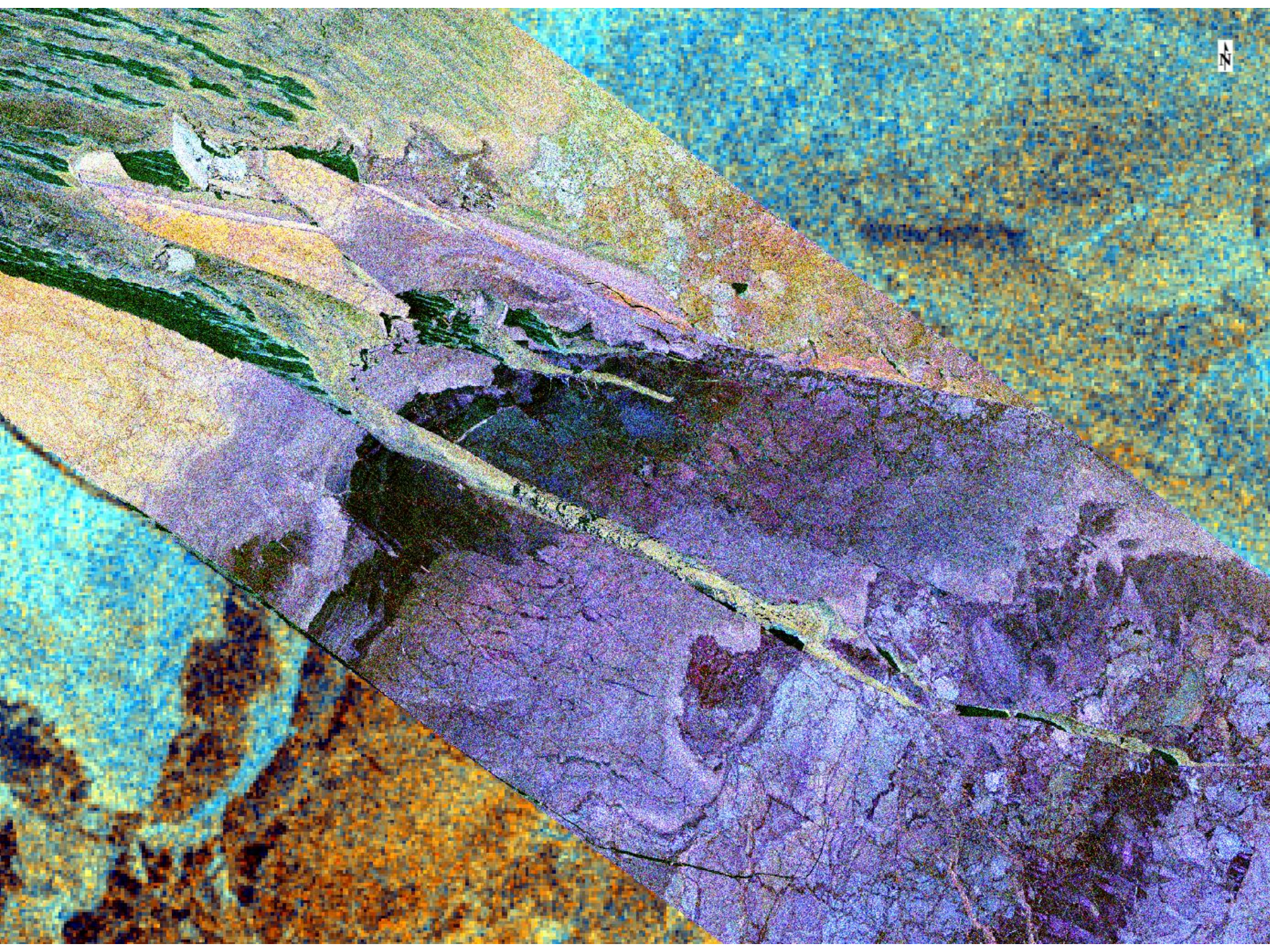


S1: 2017-07-07 10:29  
R: HH G: HV B: HH-HV  
TSX: 2017-07-07 10:33  
R: HH G: VV B: CC

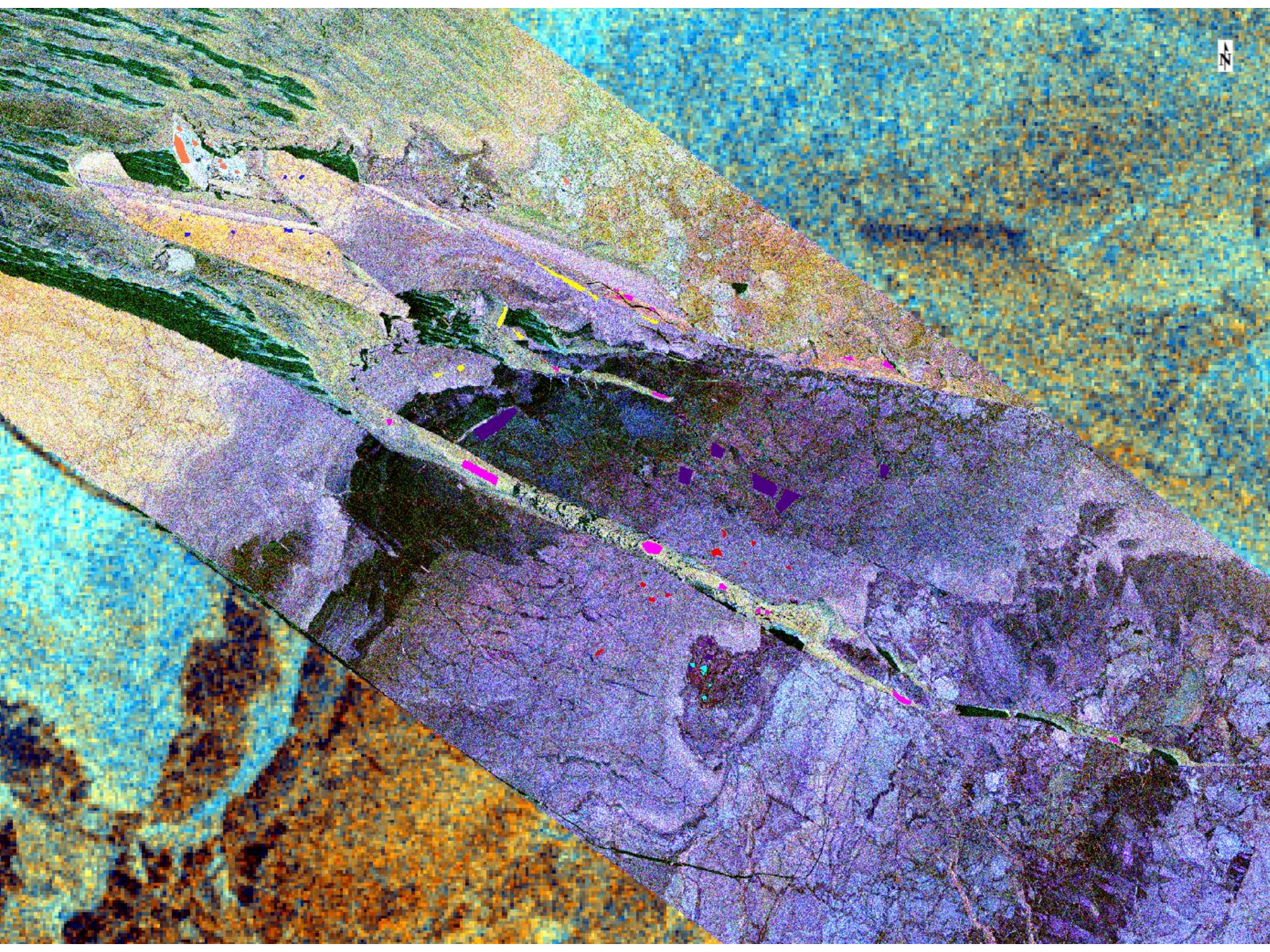






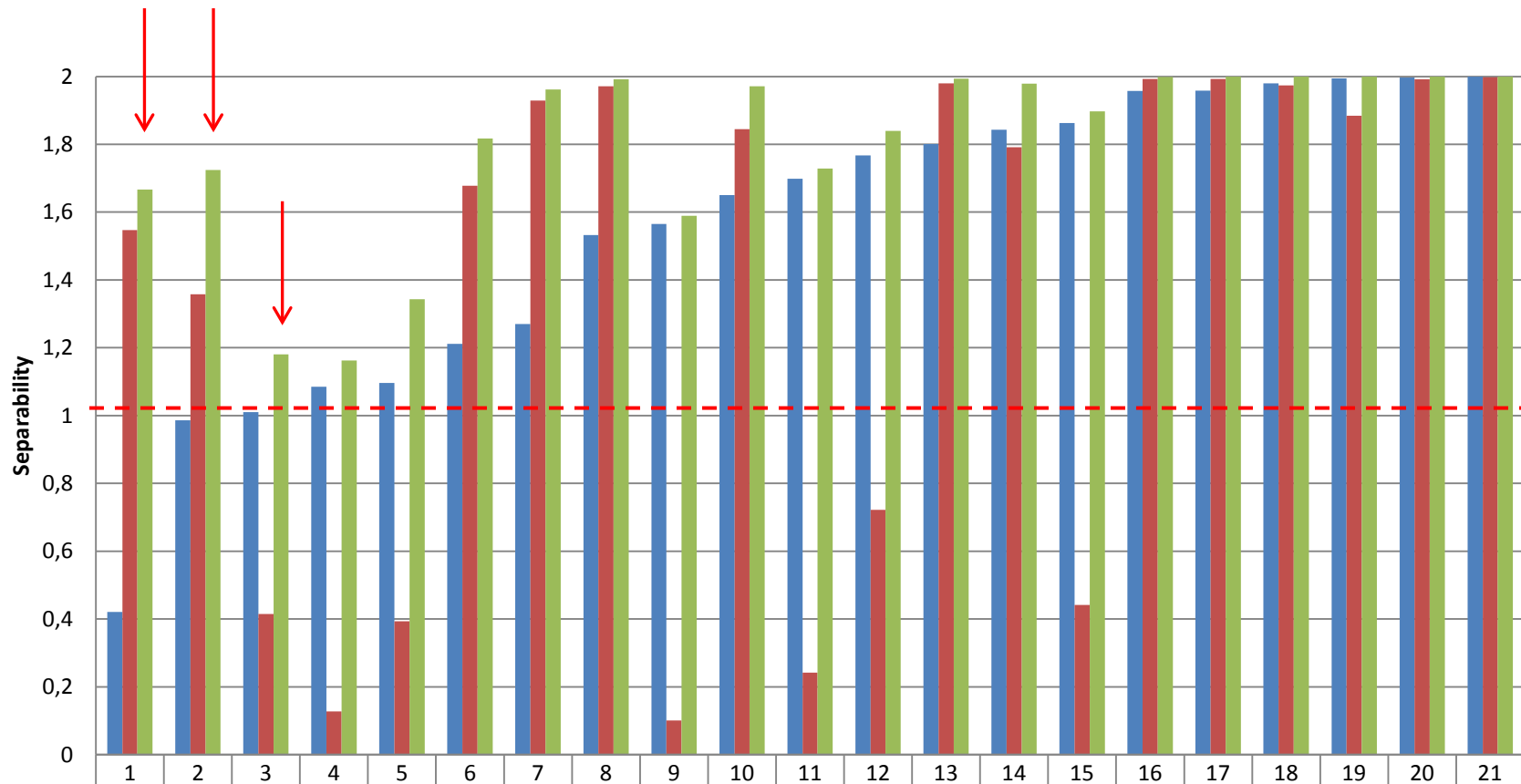






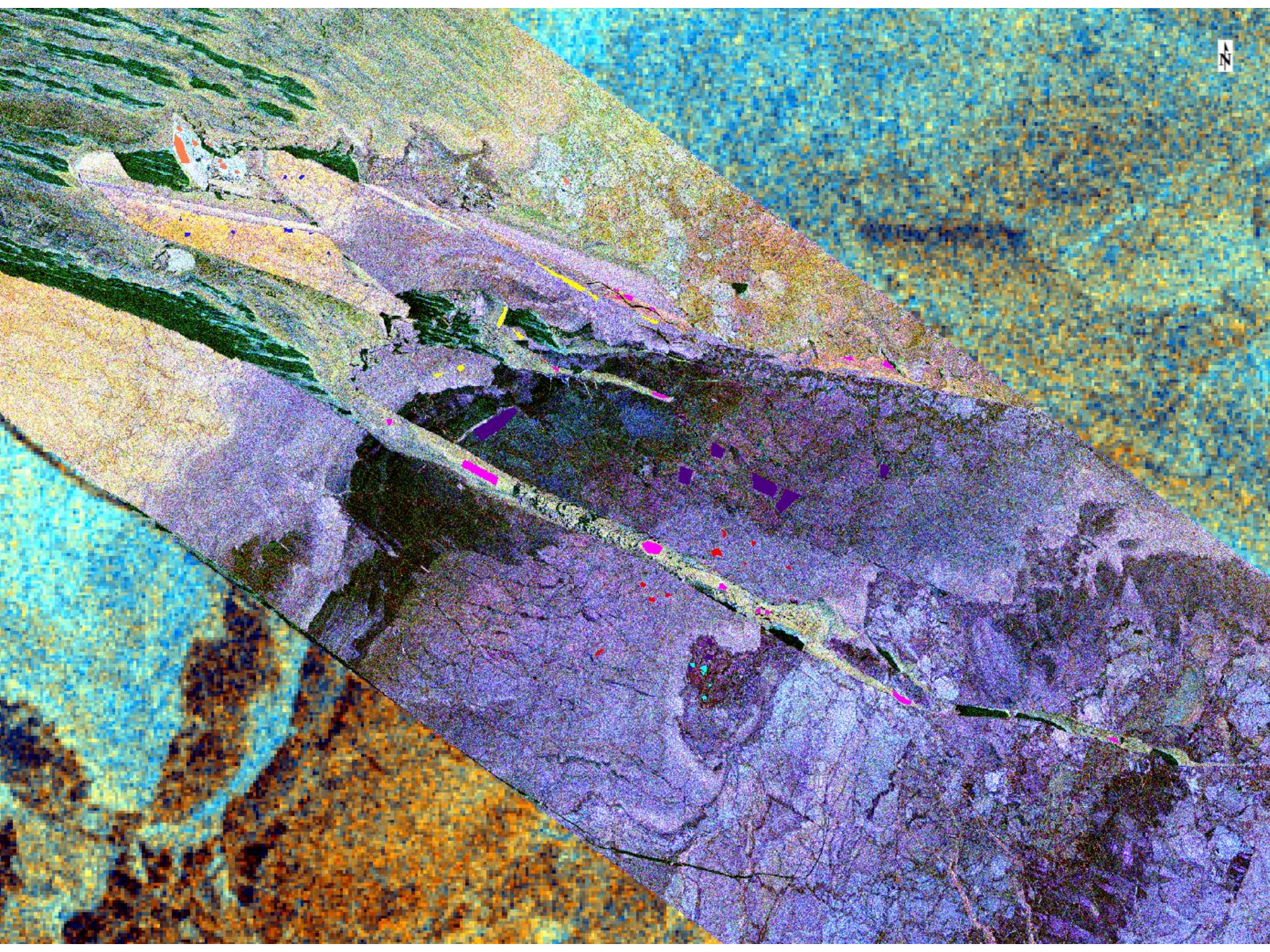


# ROI separability

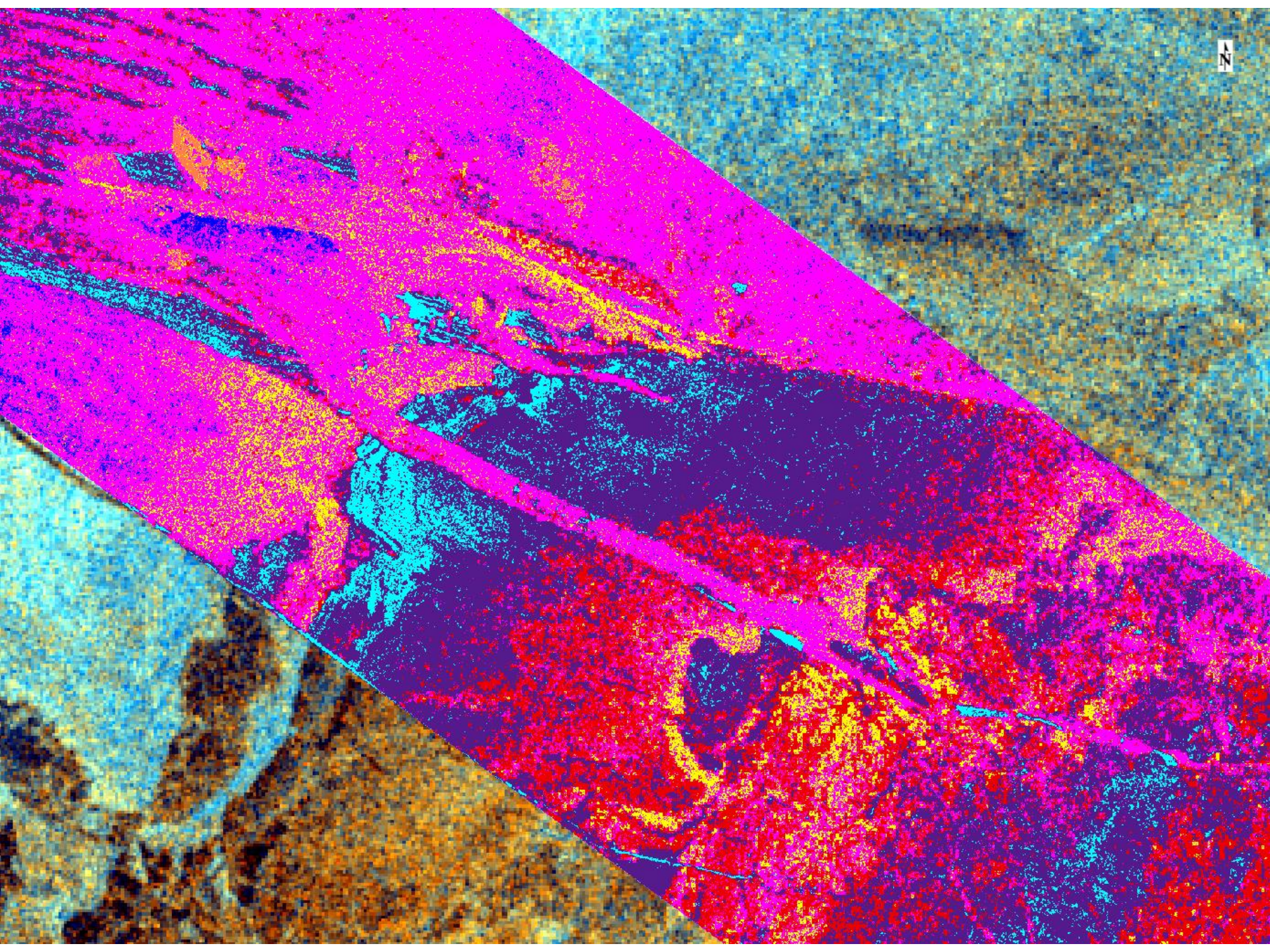


HV S1 might observe some additional volume scattering effects, HH S1 might improve results  
 Due to different wavelength and resolution











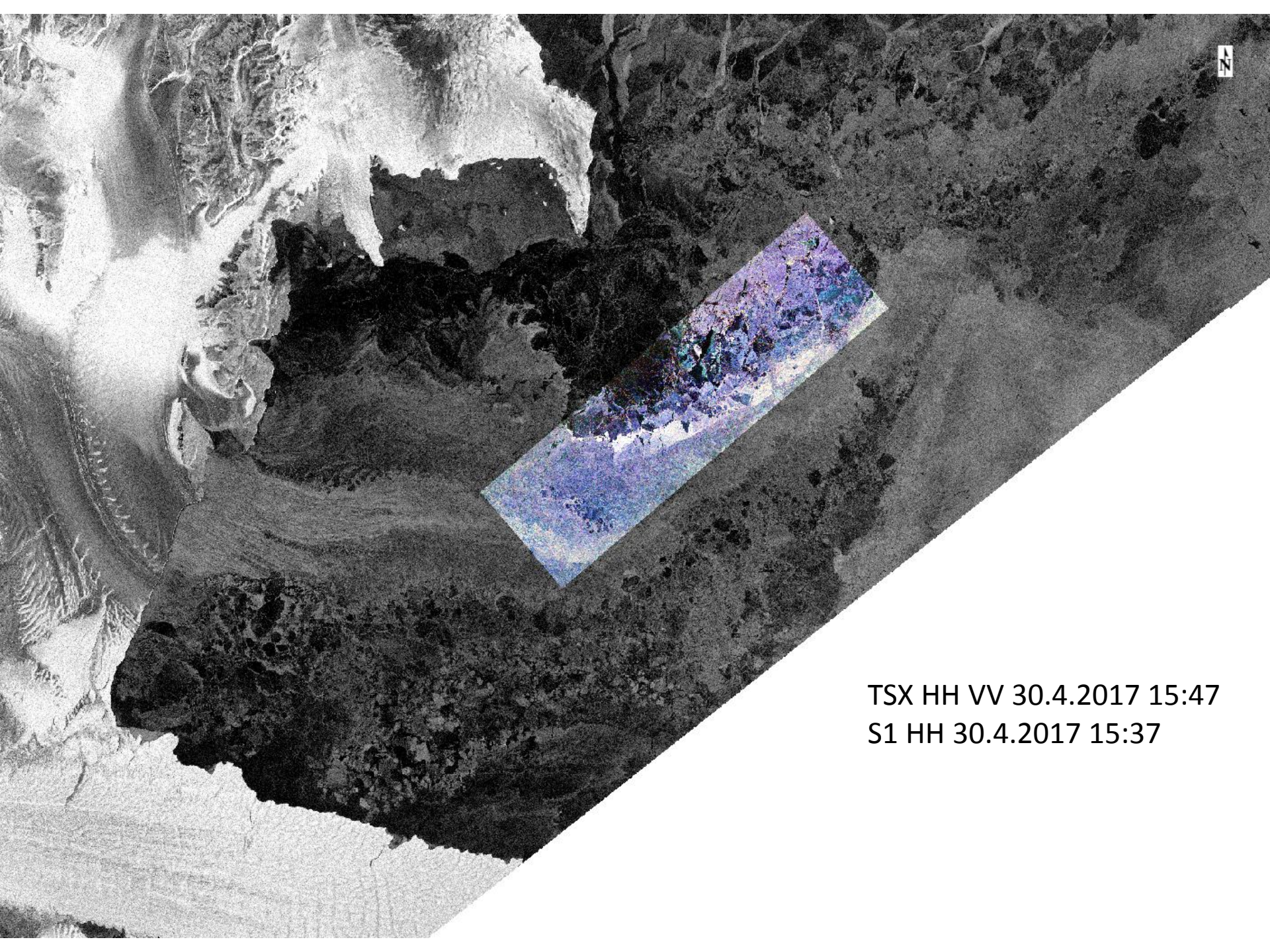
# Visible vs. Statistical differences

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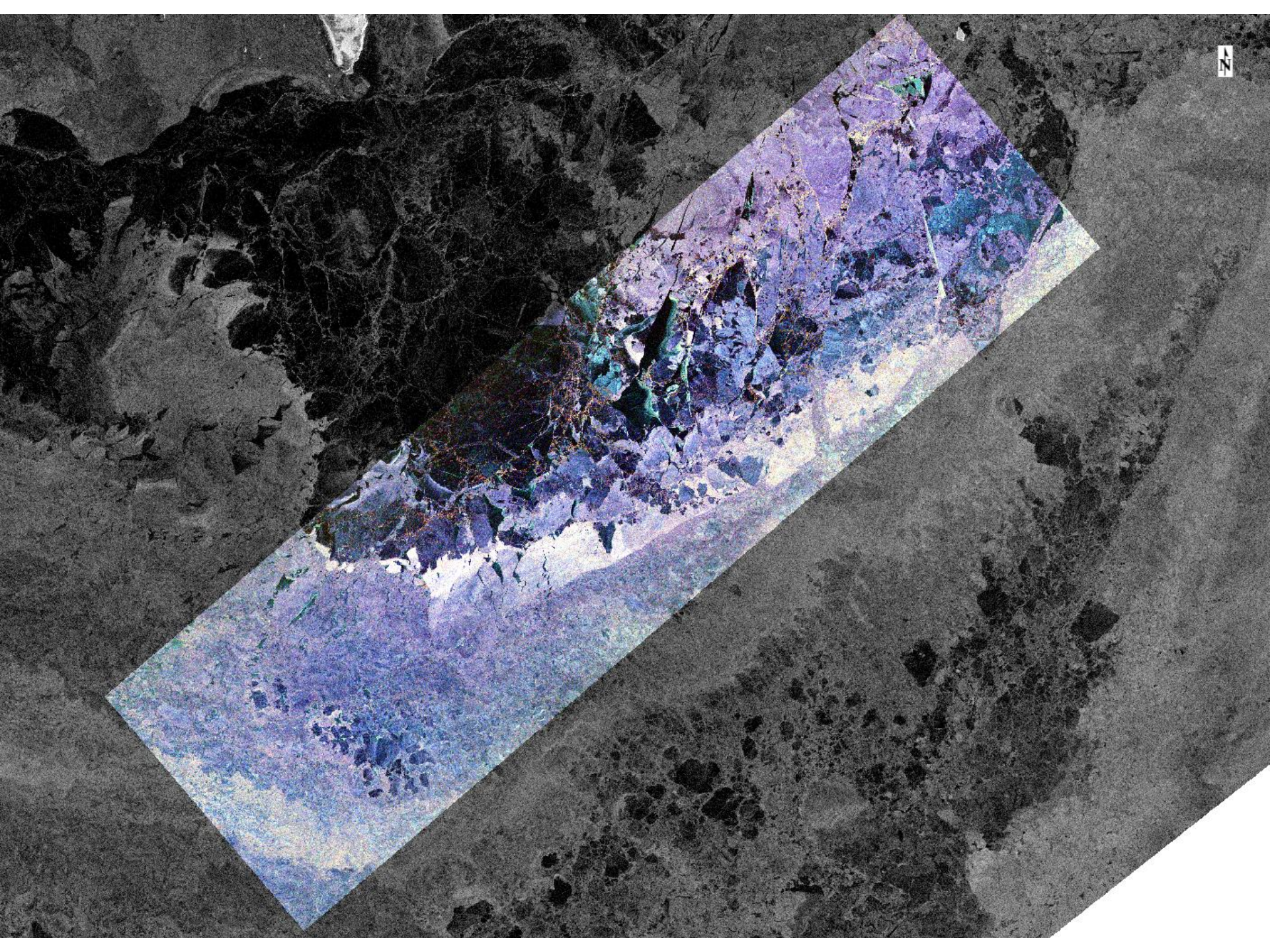
- Visually an obvious situation
- Combination of S1 and TSX improves separability
- No possibility to separate consolidated ice, greased ice and refrozen cracks in this example
- resulting classes are too general (merged visually expected classes)



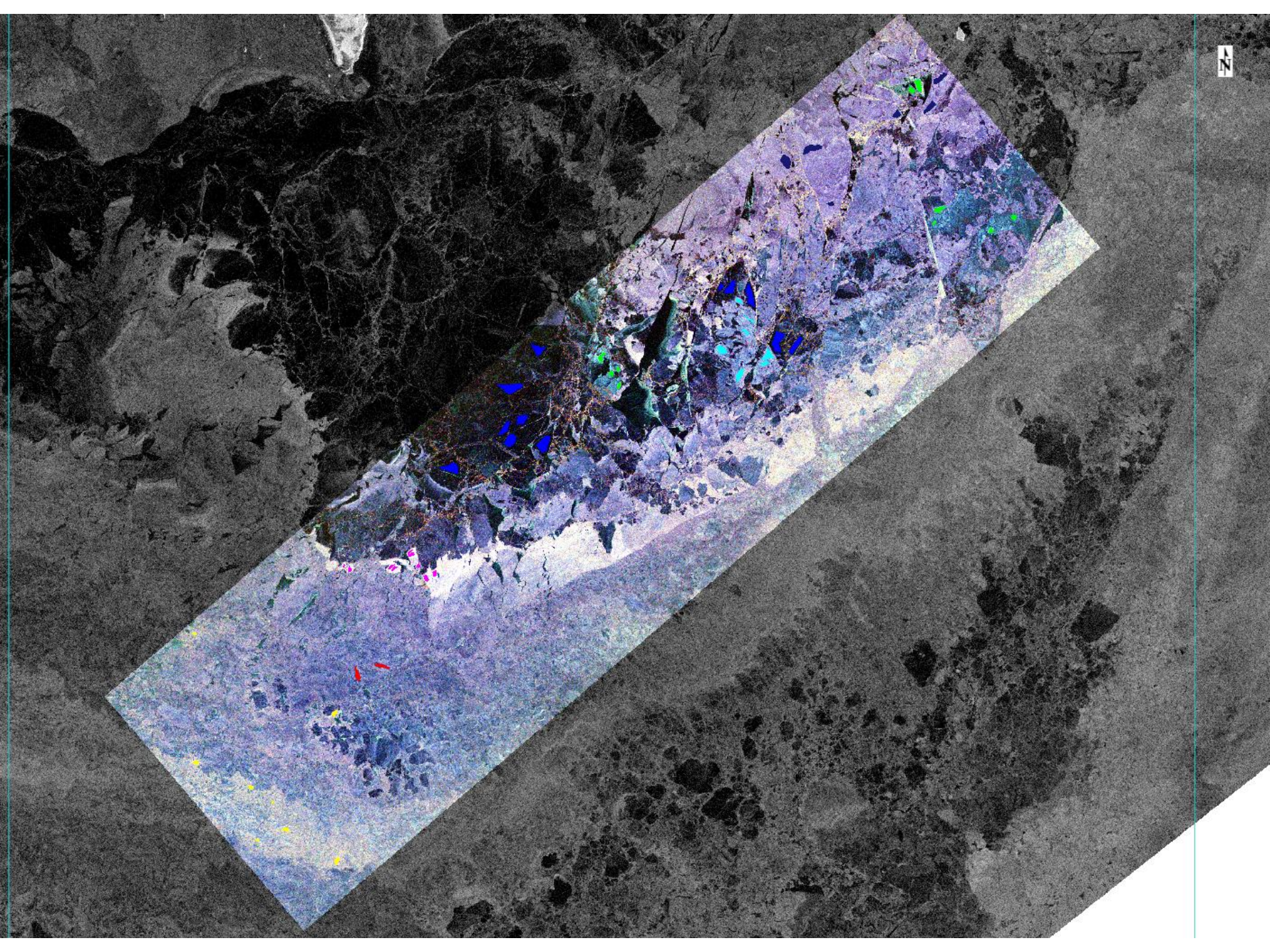


TSX HH VV 30.4.2017 15:47  
S1 HH 30.4.2017 15:37



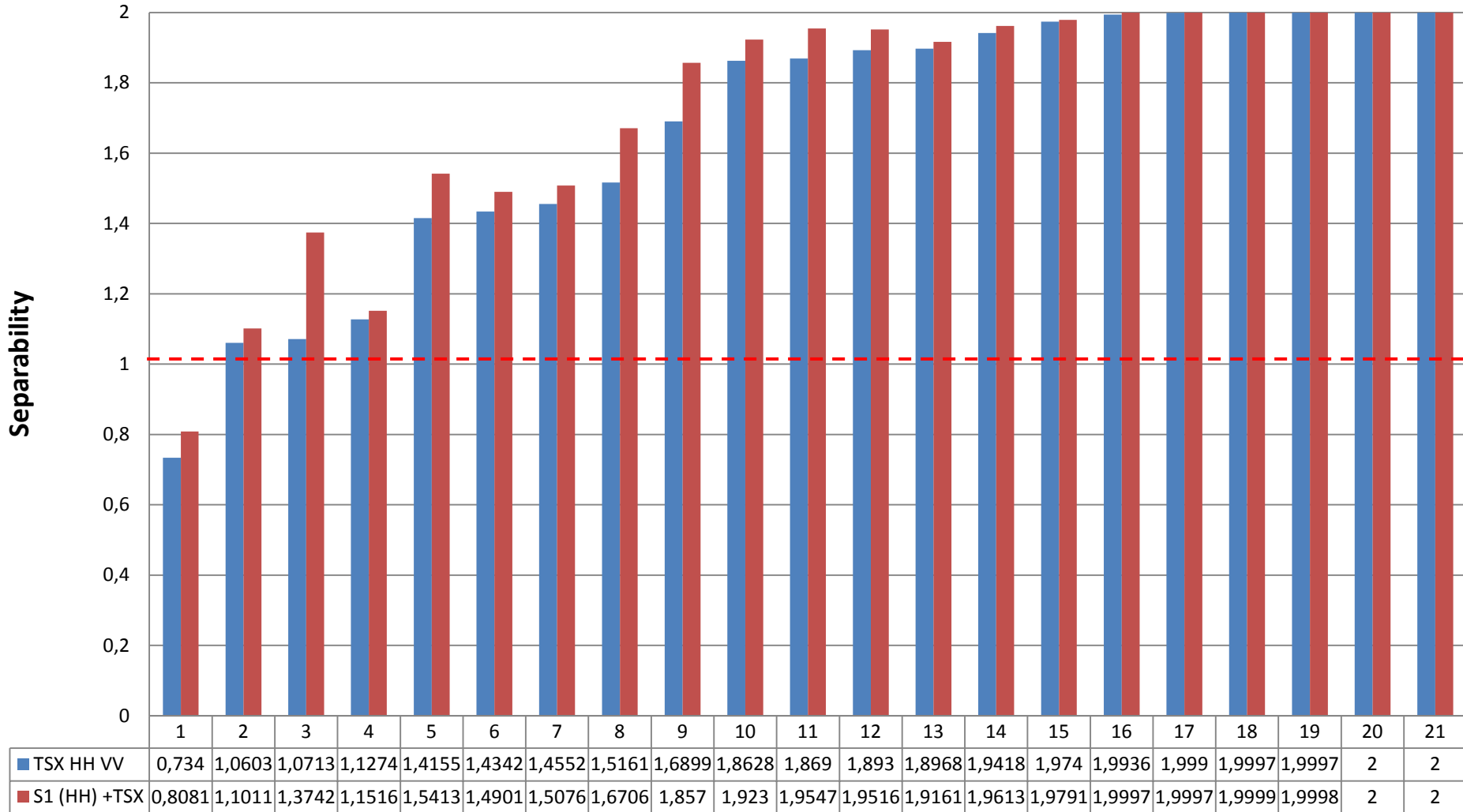






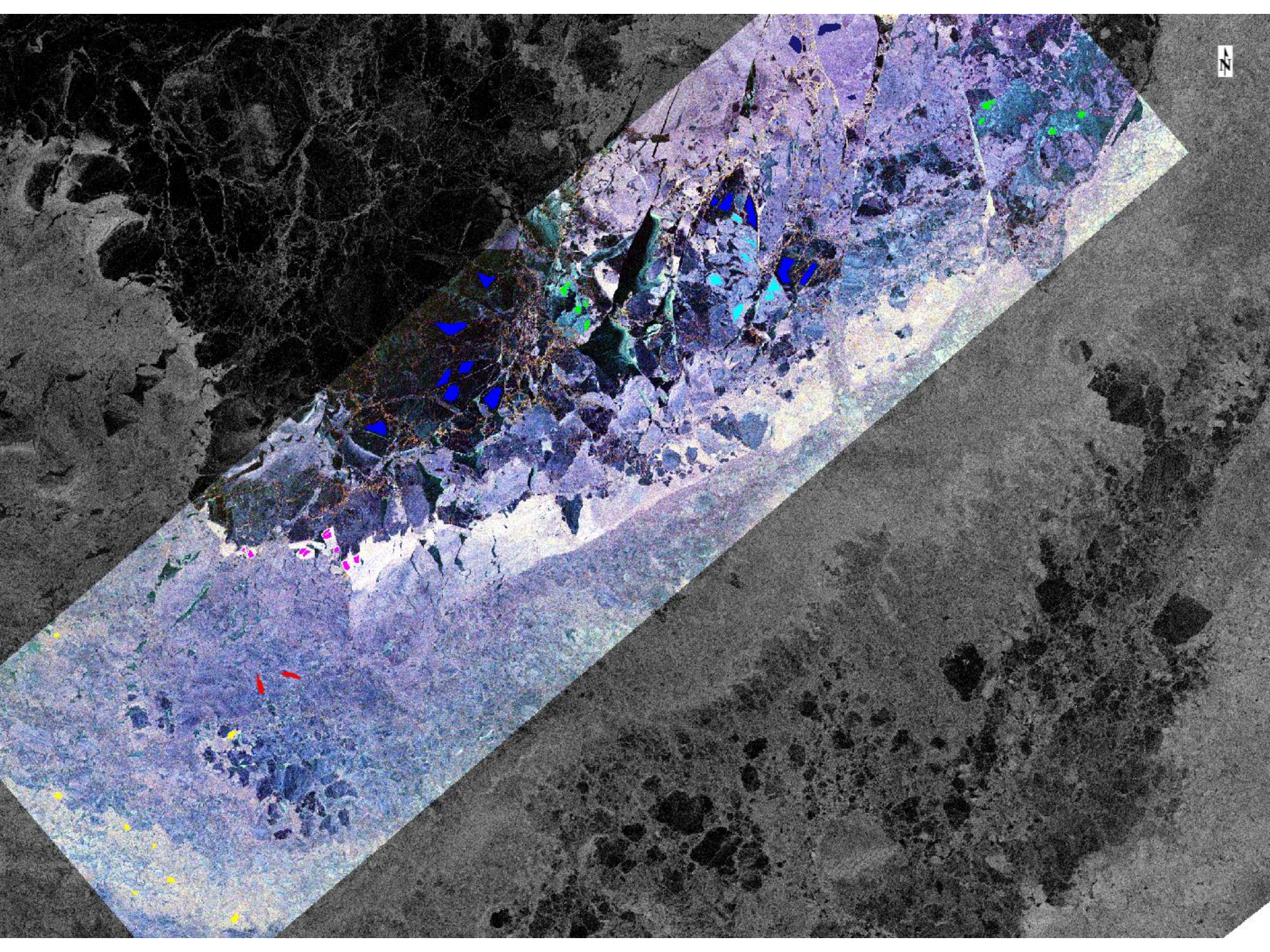


# ROI separability

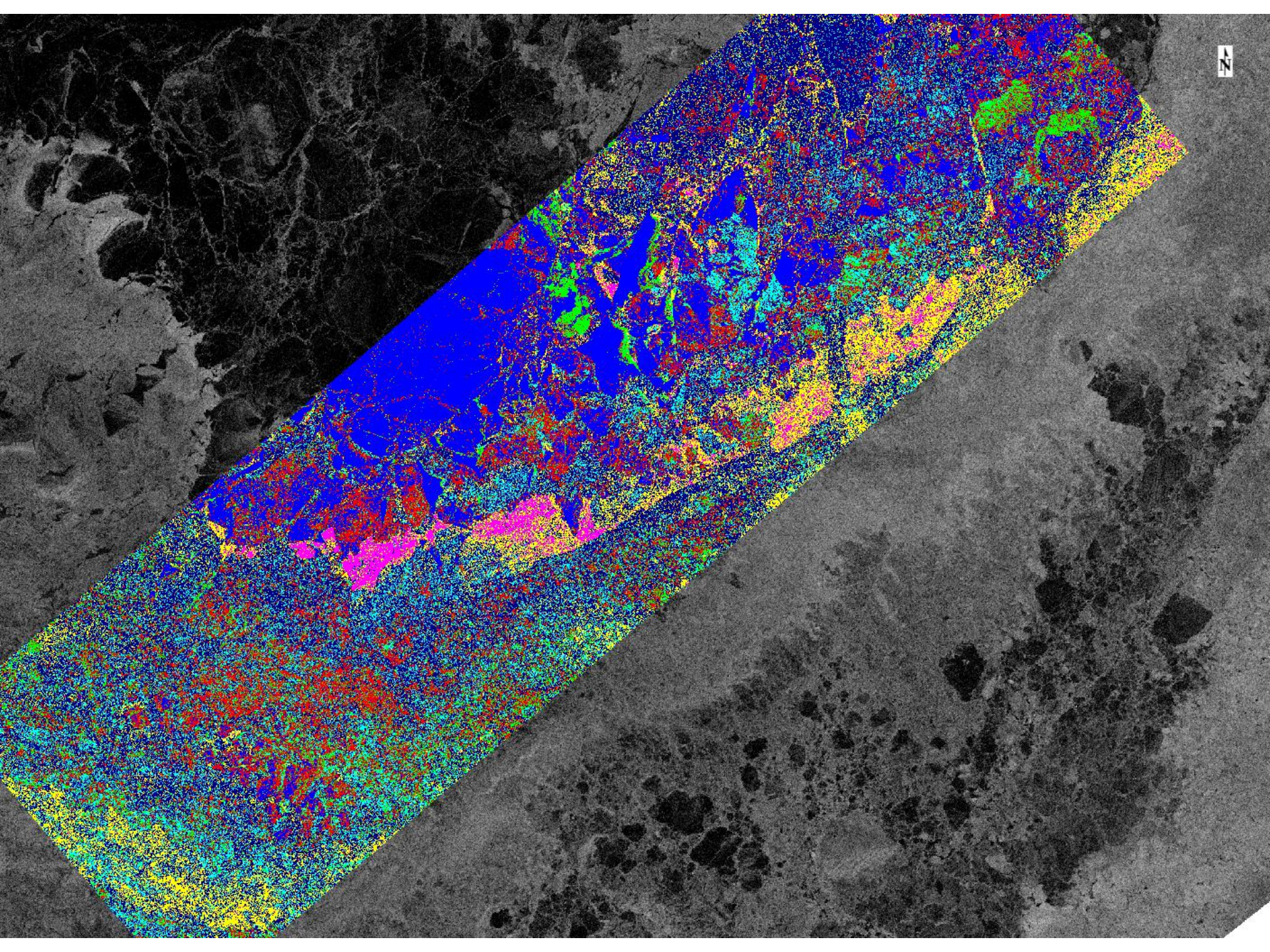


S1 HH might improve separability a bit due to wavelength or resolution



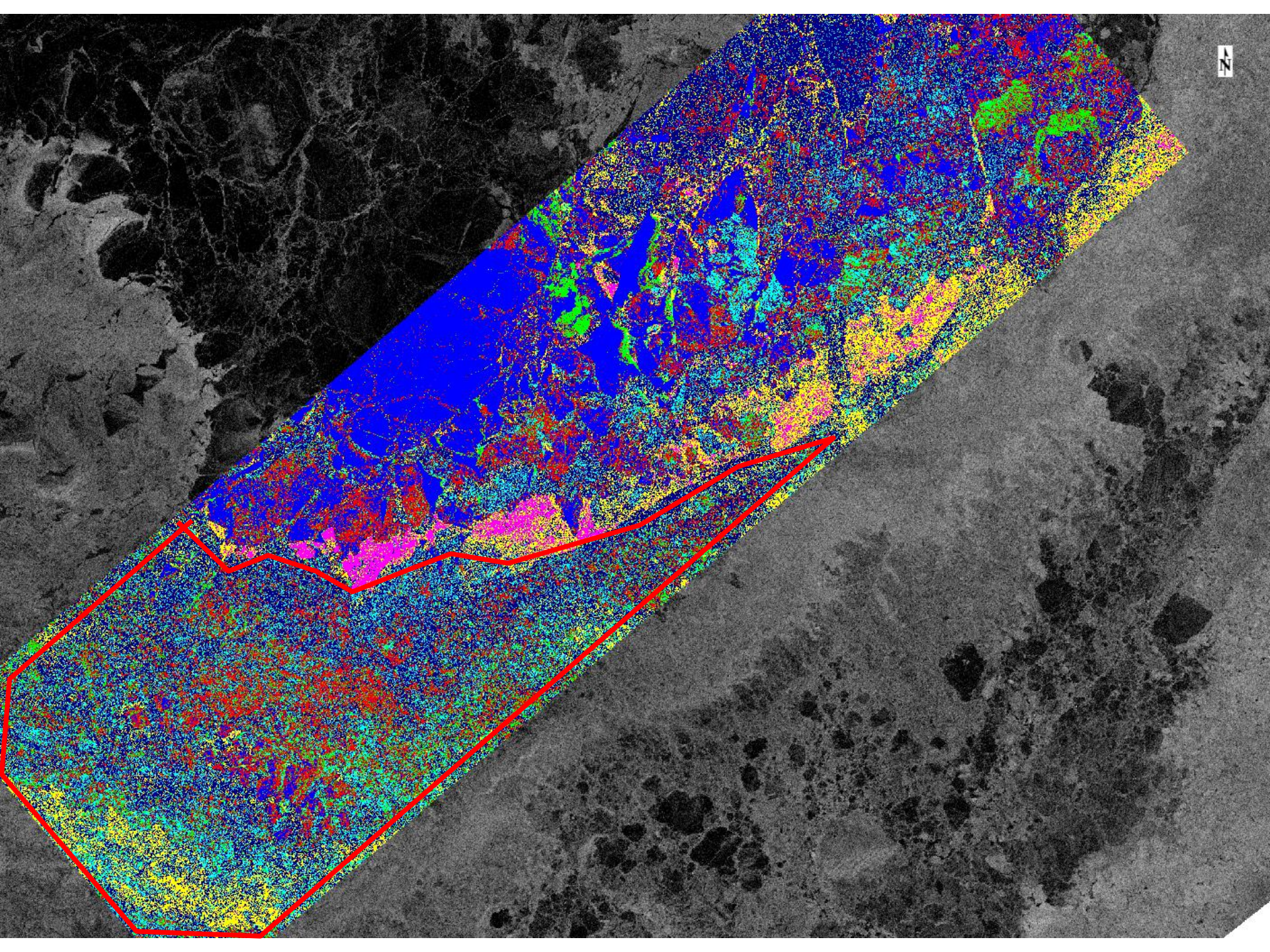




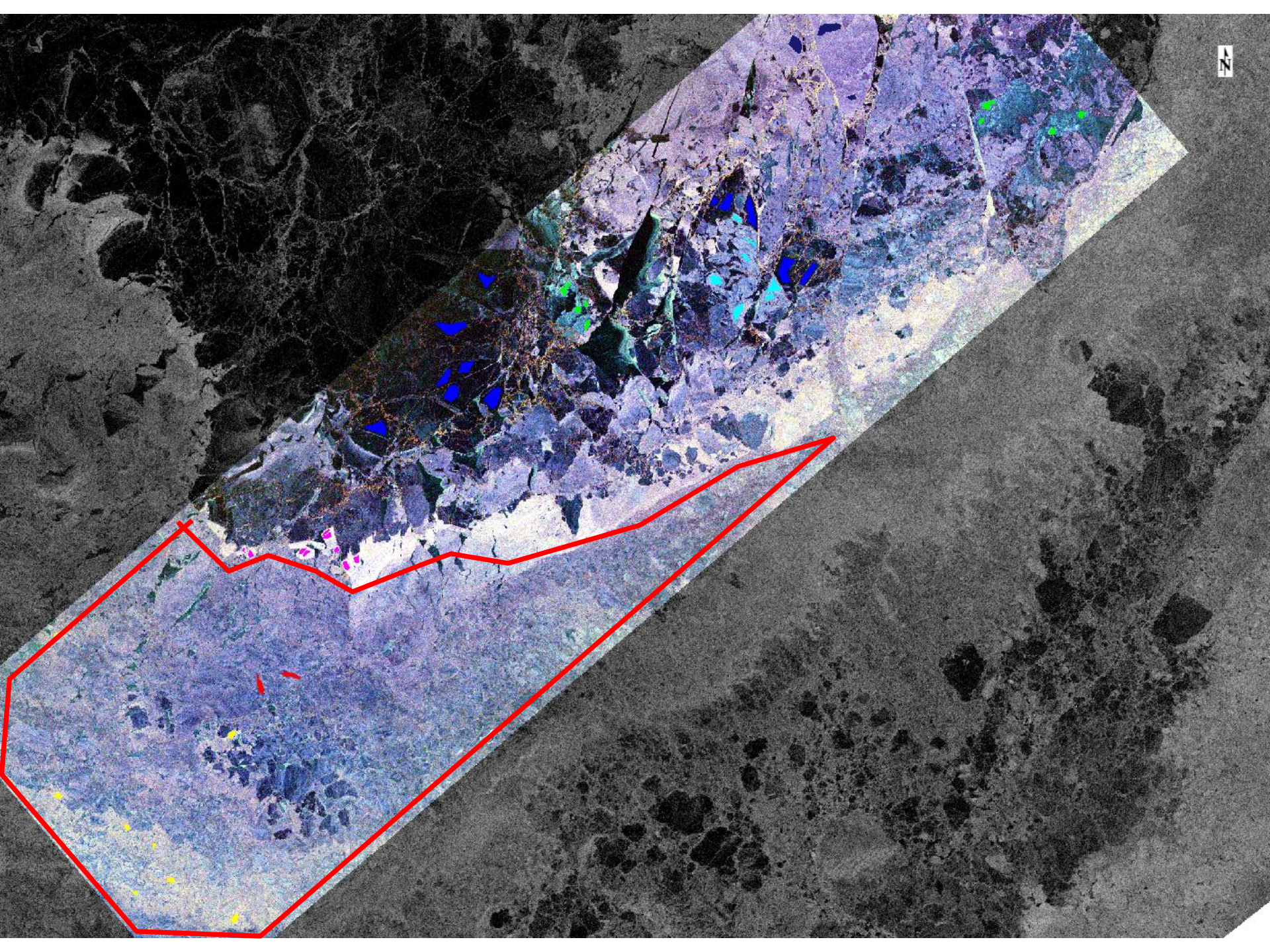


N











# High separability and Meaningfulness

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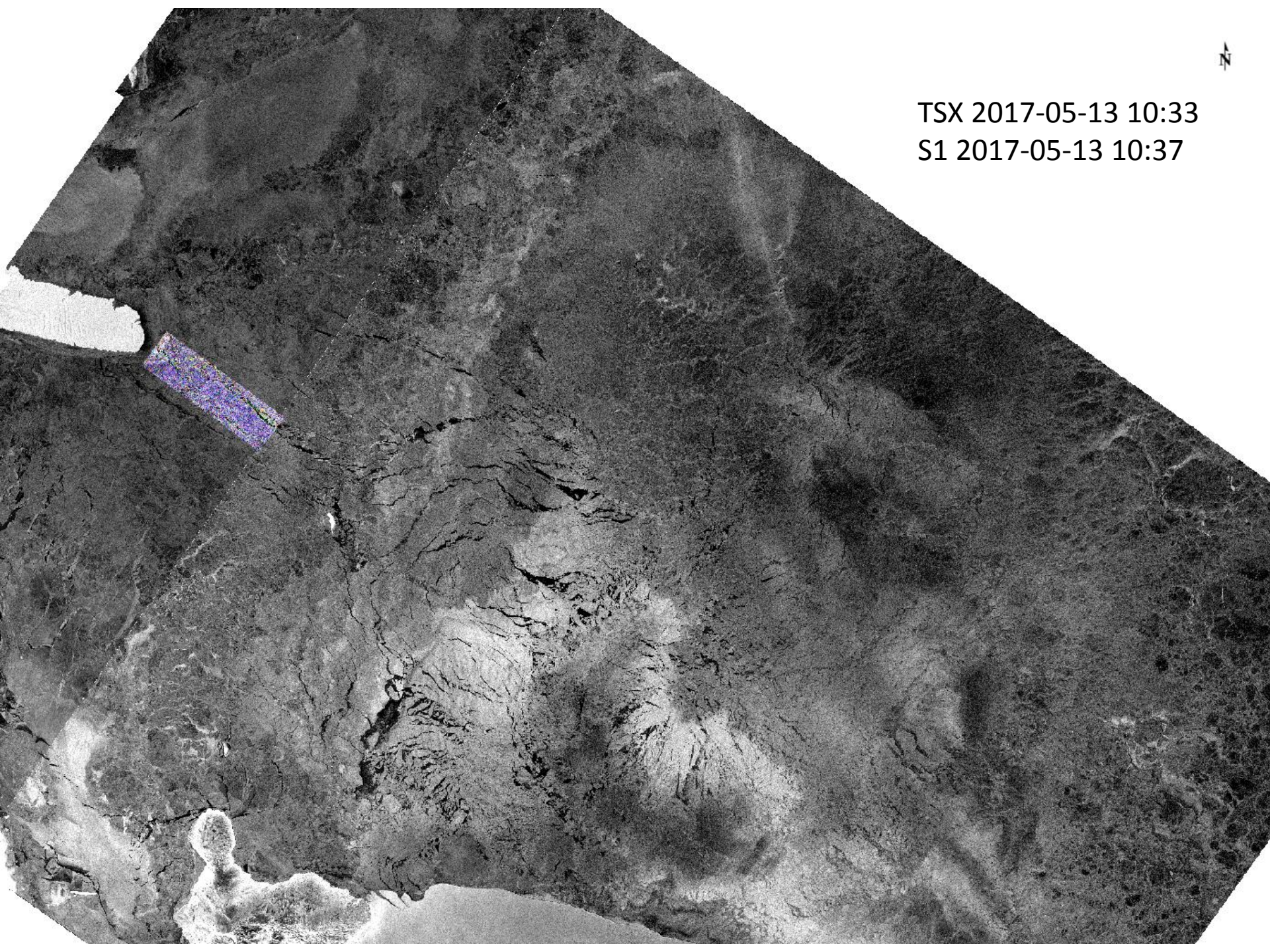
- High separability of ROIs based on backscatter signatures
- Sea ice units subdivided in presumably meaningless subunits
- High spectral separability of ROI only is not sufficient



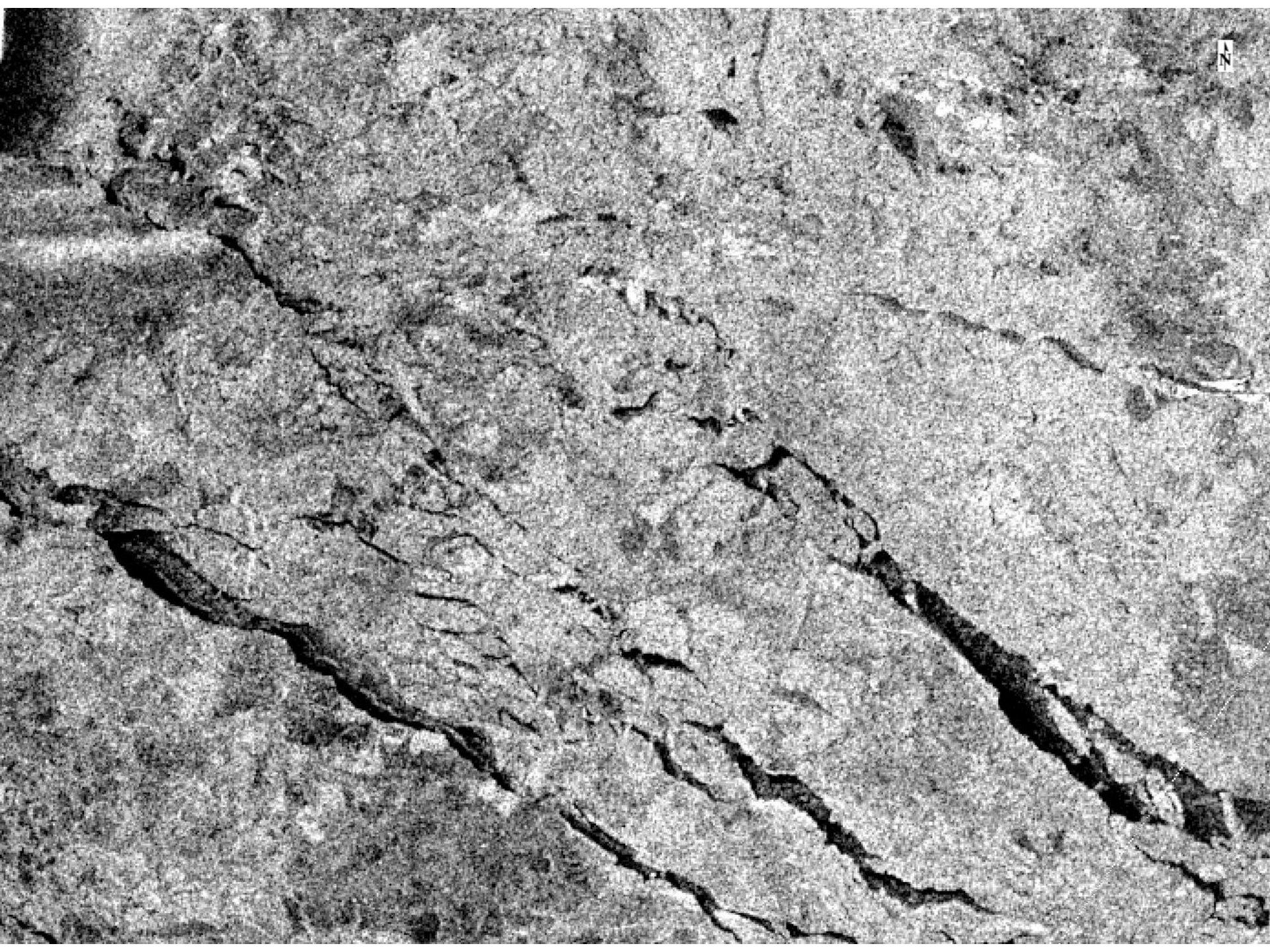
N

TSX 2017-05-13 10:33

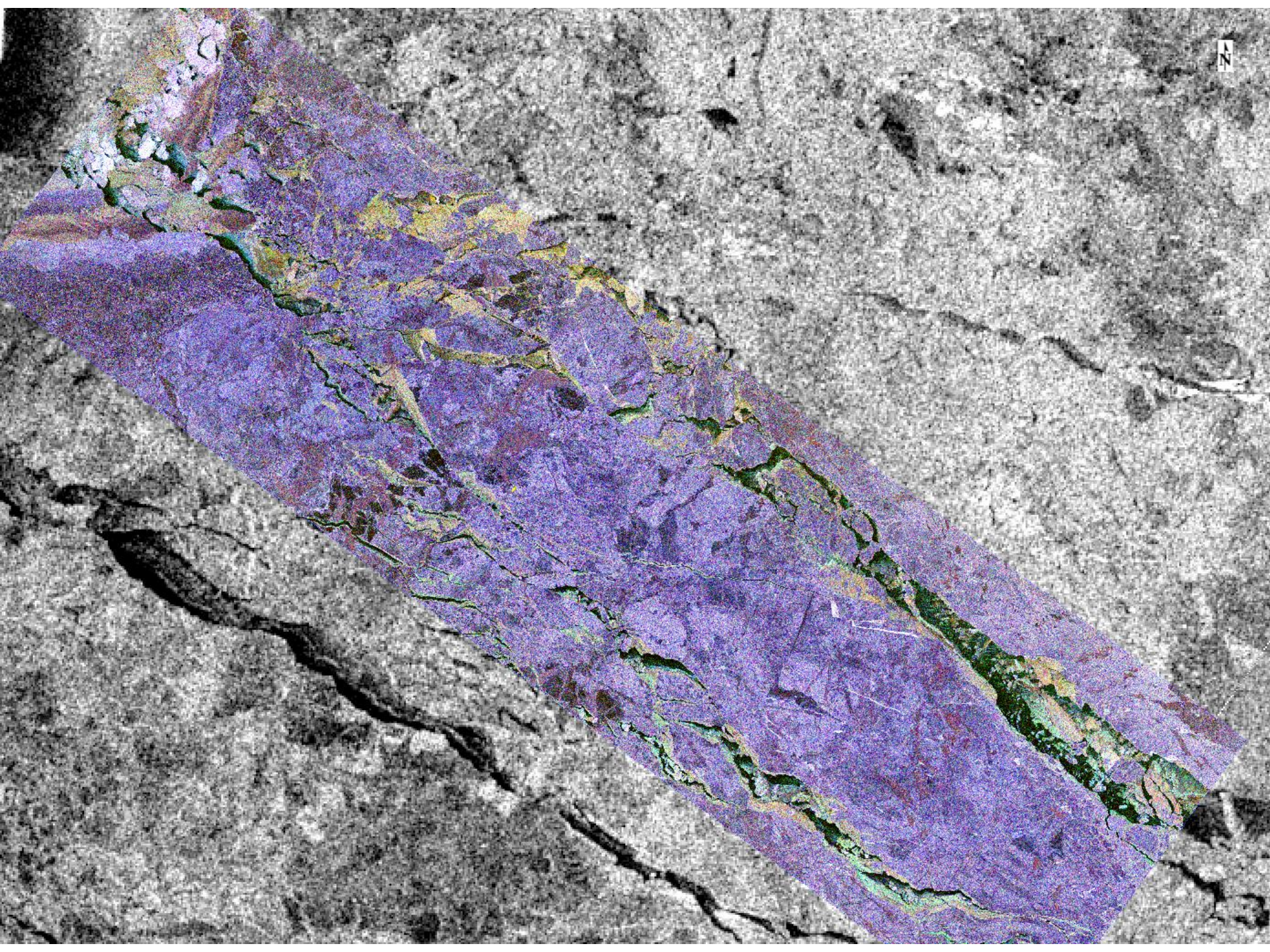
S1 2017-05-13 10:37



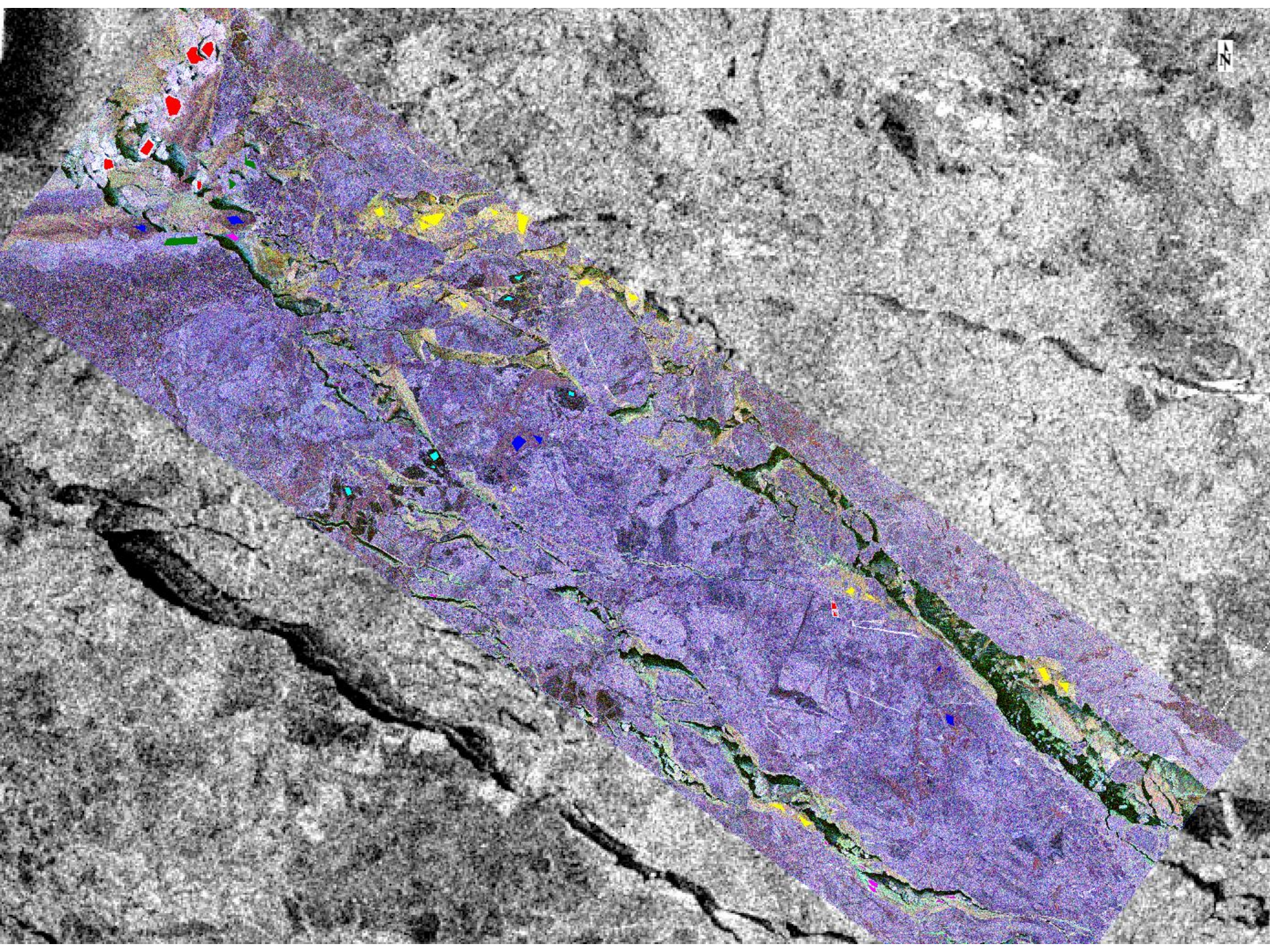






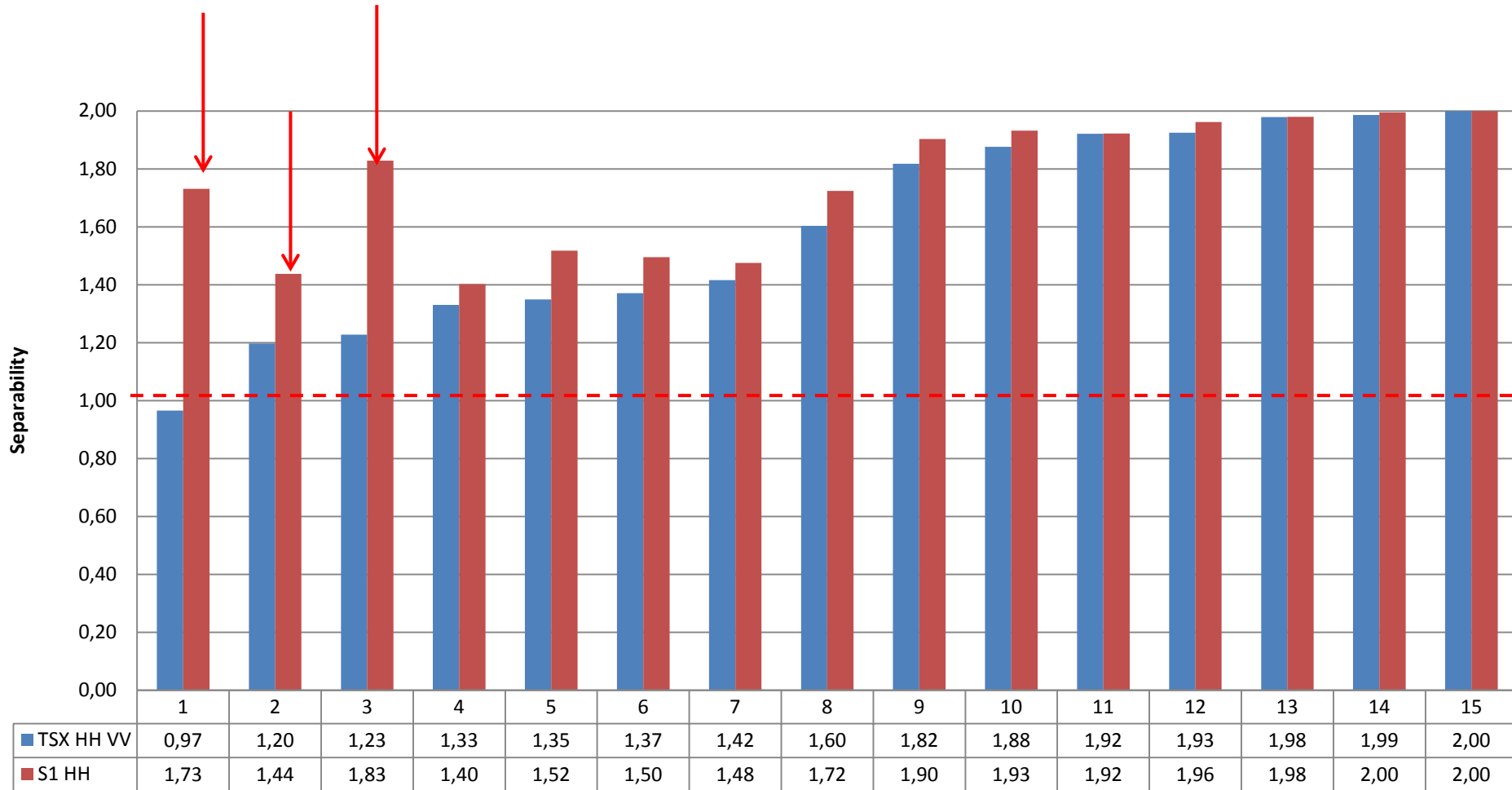




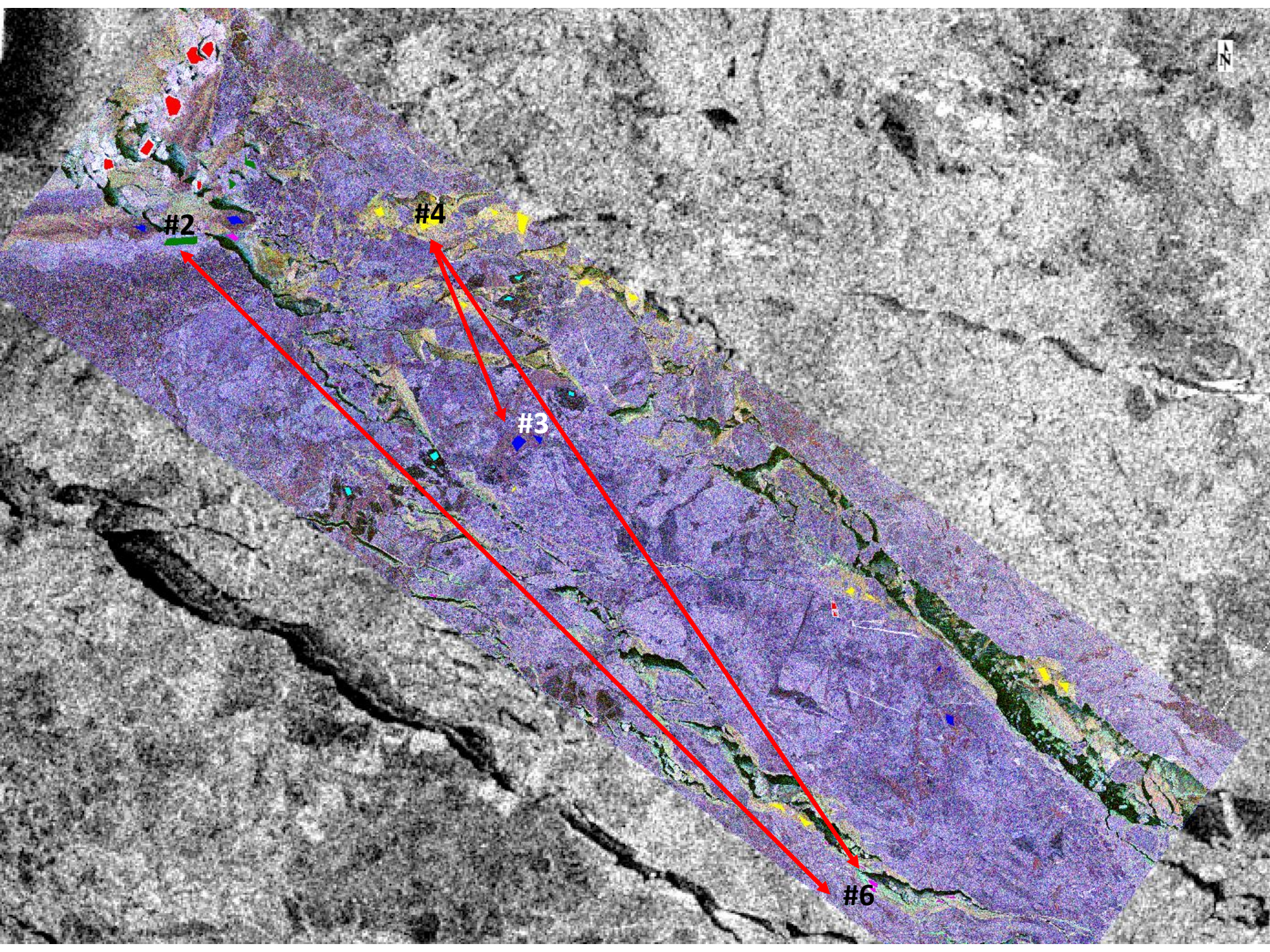




# ROI separability







N

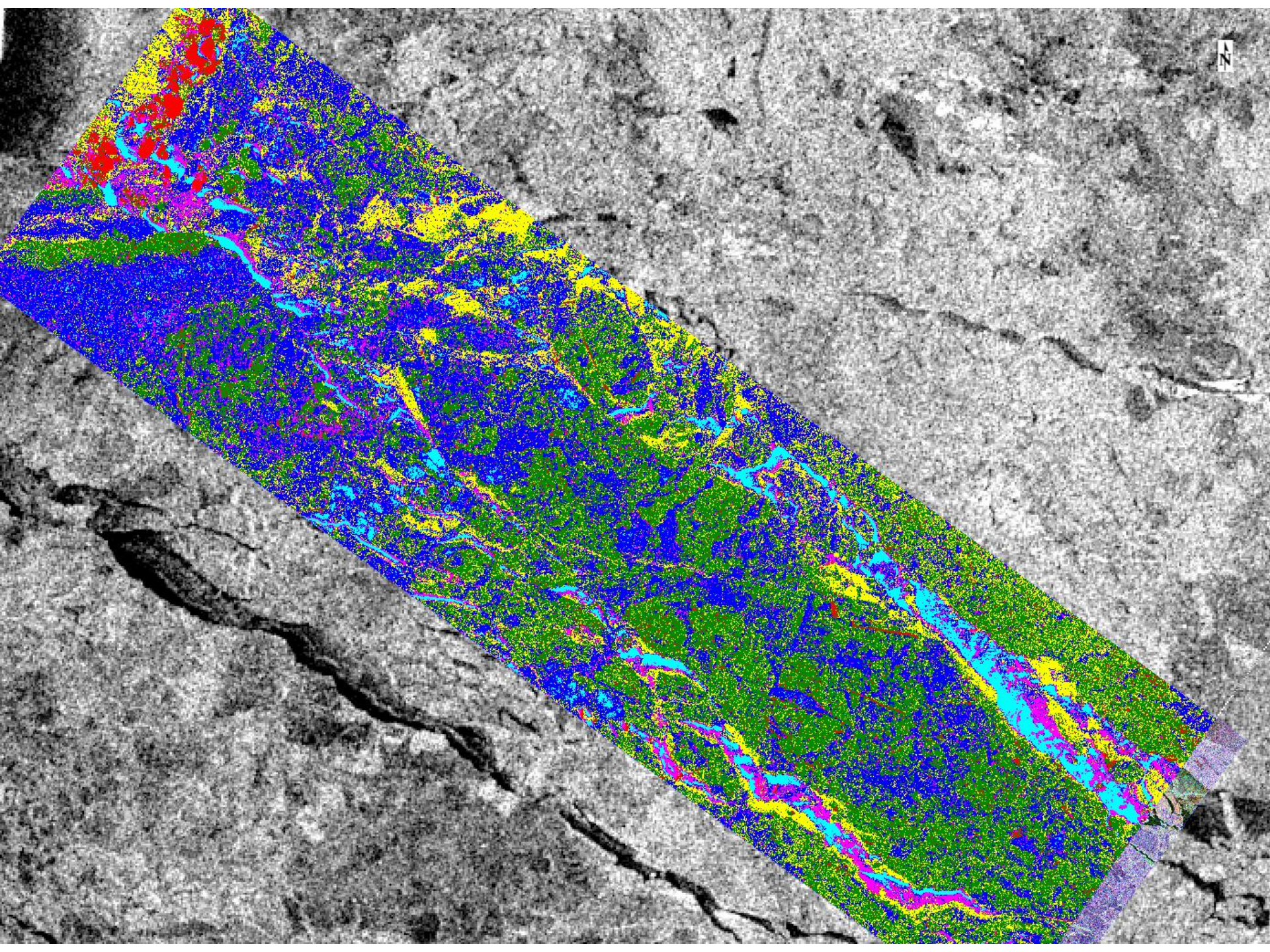
#2

#4

#3

#6





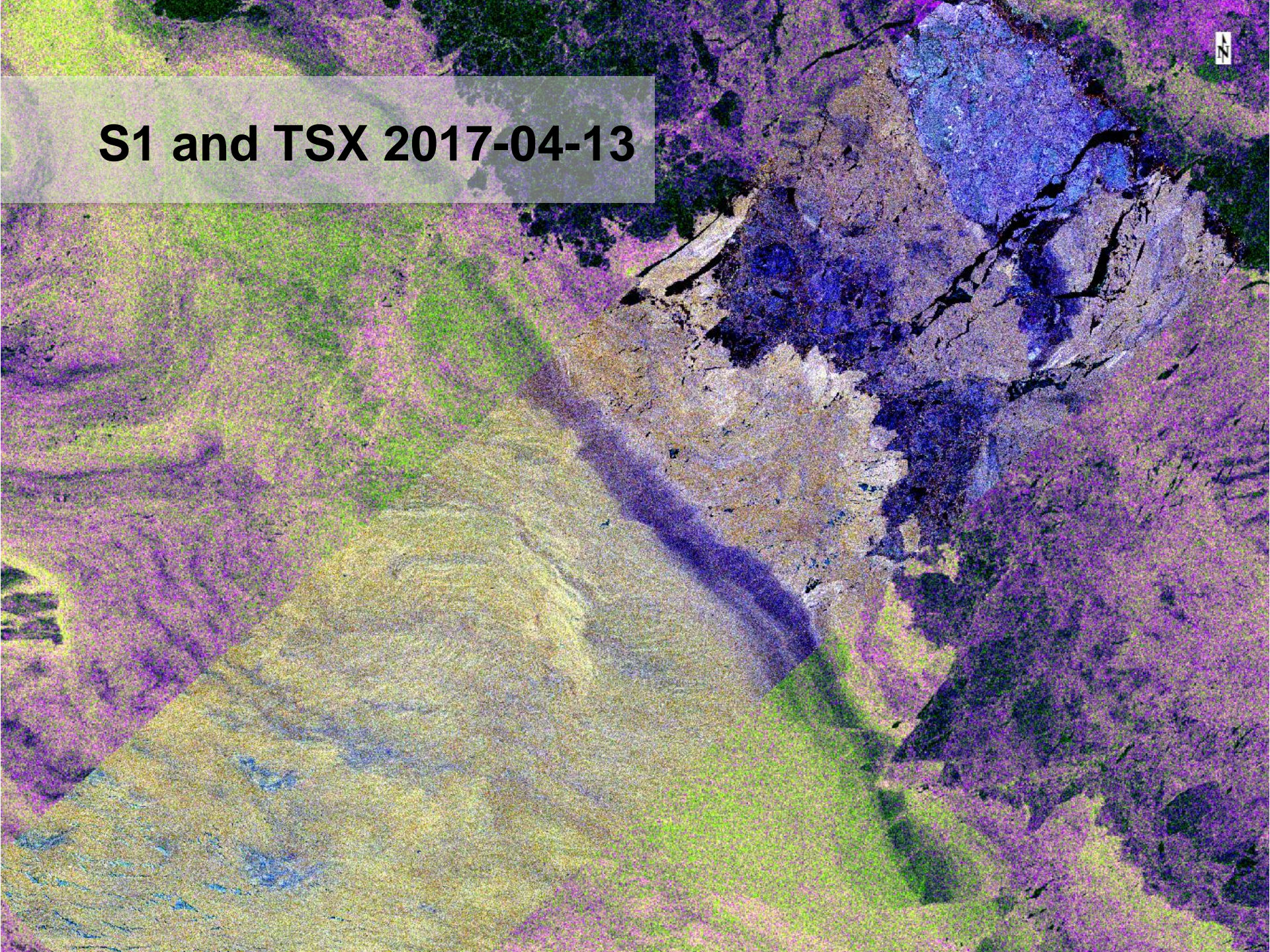


- Improve existing classifications and perform additional ones
- backscatter statistics for ROIs and classification results
- Identification of parameters which influence the backscatter value (e.g. wavelength, polarisation, resolution)
- Description of sea ice characteristics from a backscatter point of view



**S1 and TSX 2017-04-13**

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# Examples of acquired images

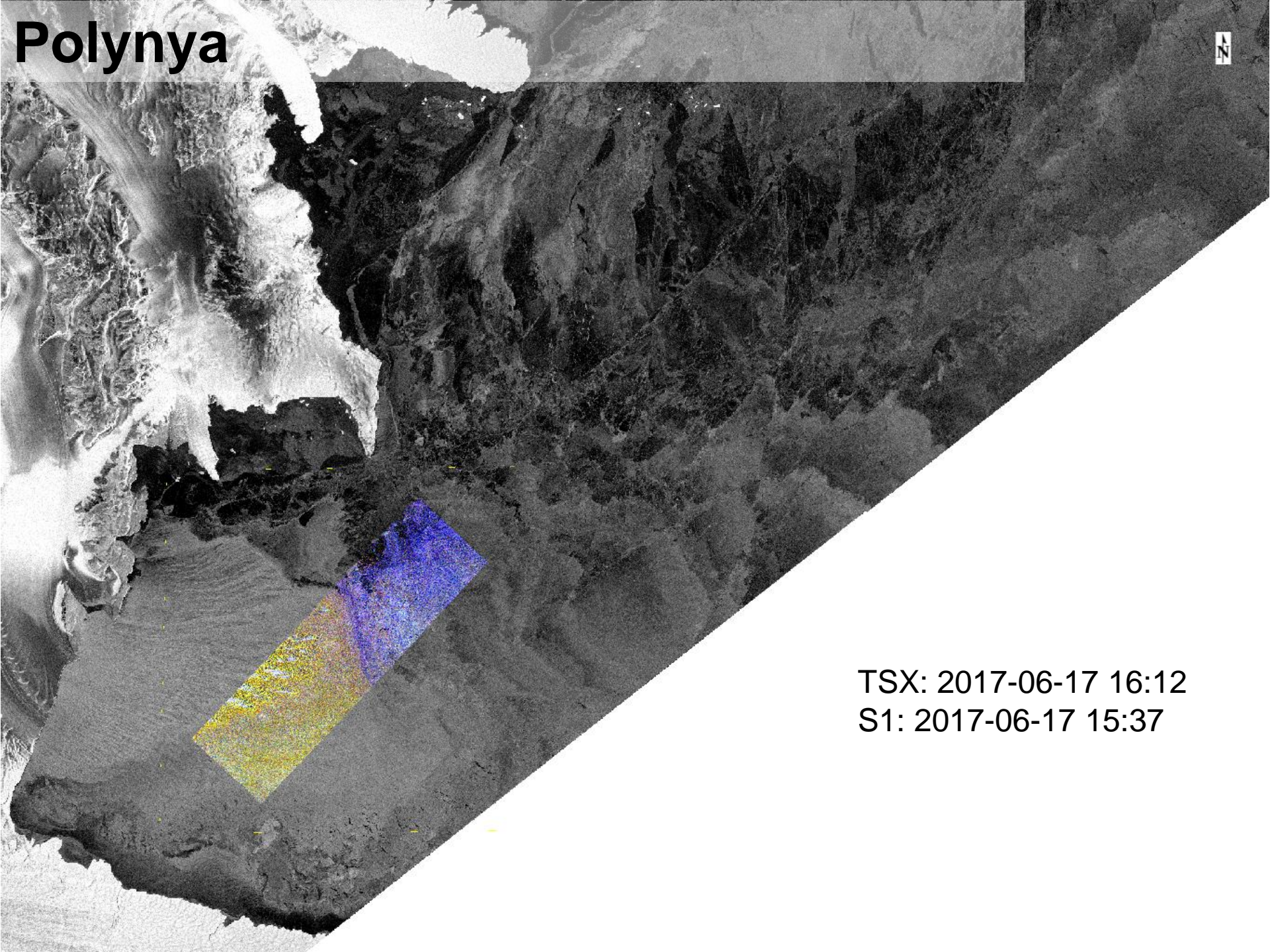
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- Polynya (Open Water and Waves in the greased ice)
- Consolidated Zone
- Outlet Zone
- Deformation Zone



# Polynya

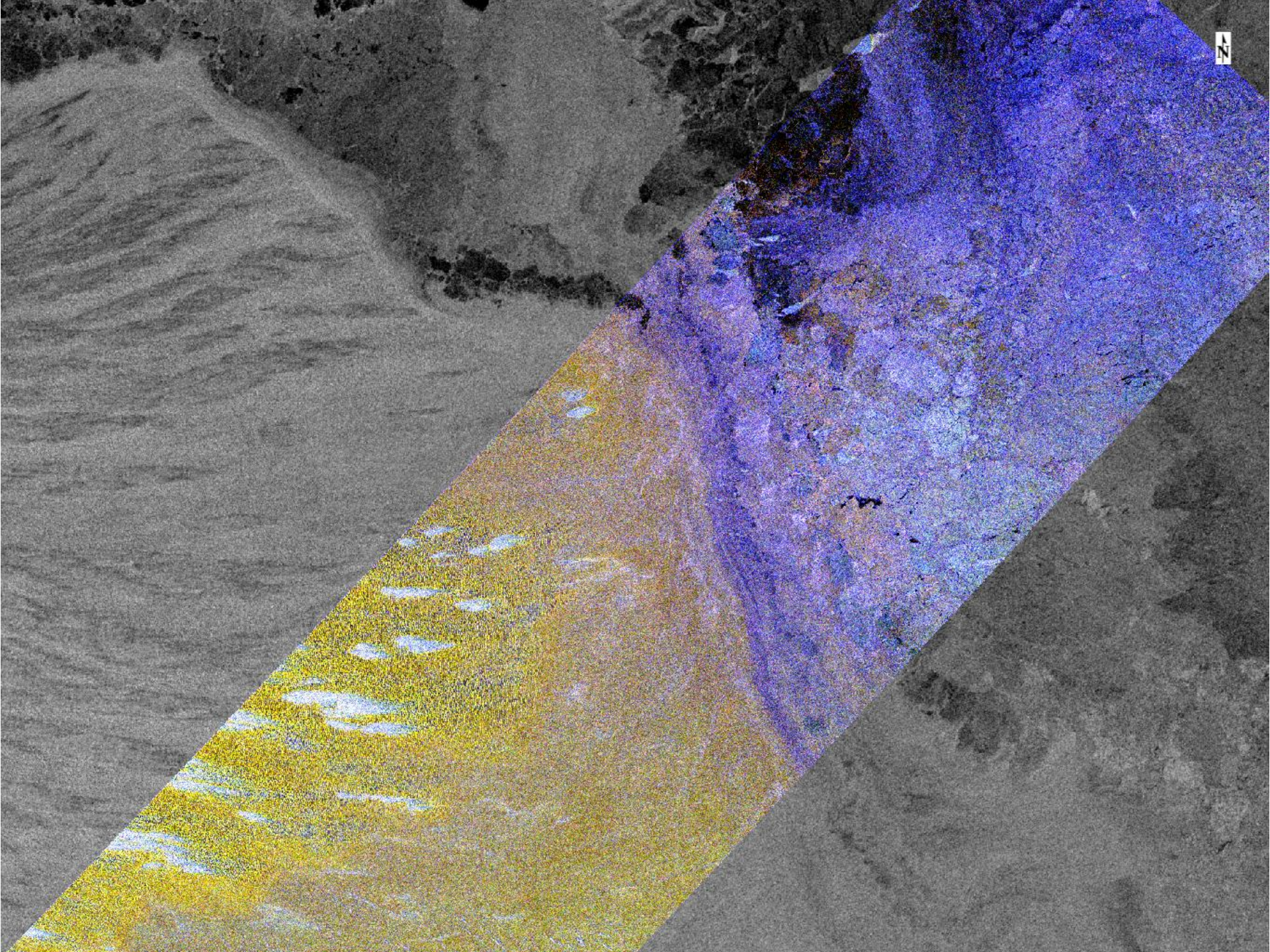


TSX: 2017-06-17 16:12  
S1: 2017-06-17 15:37







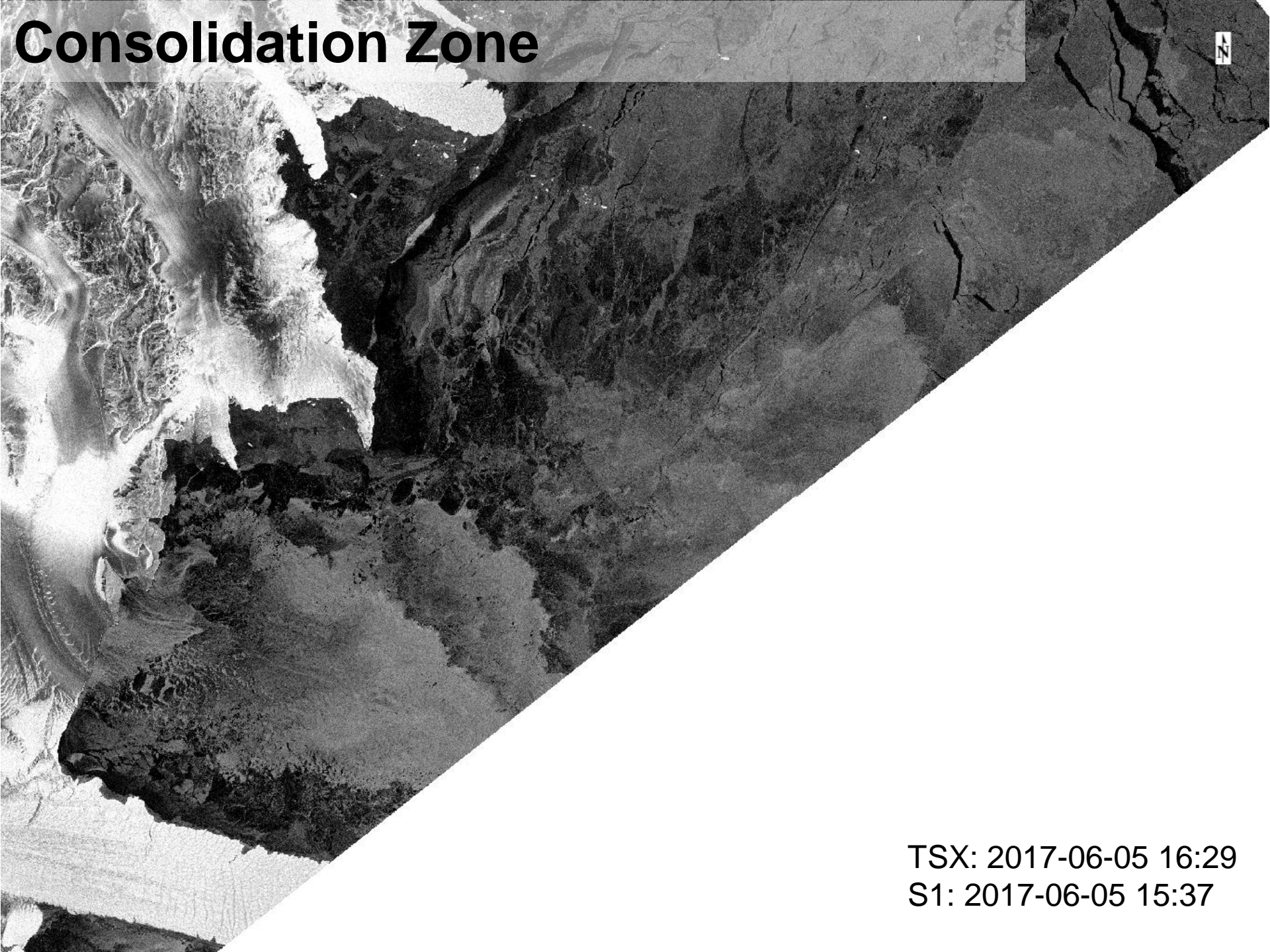








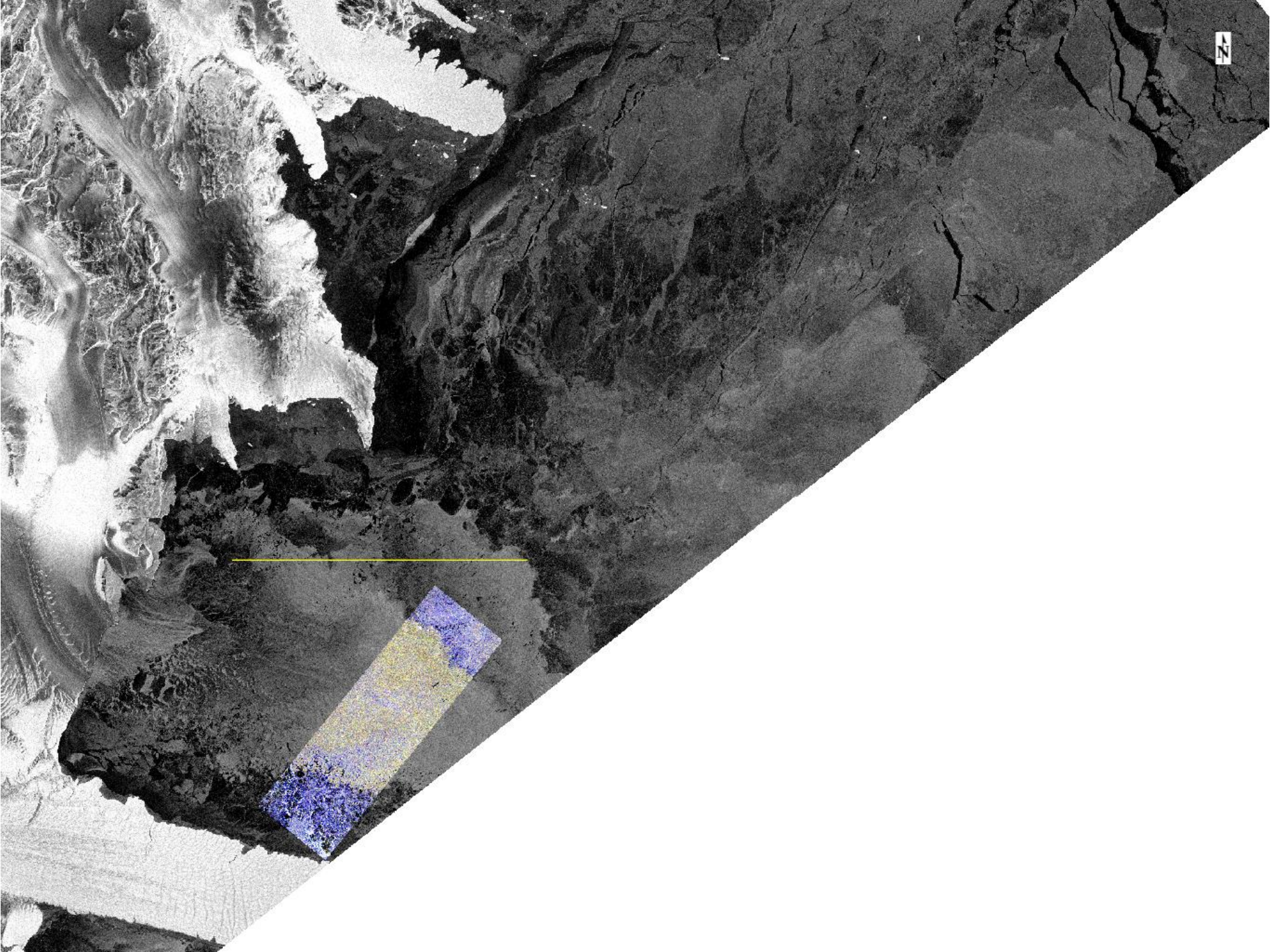
# Consolidation Zone



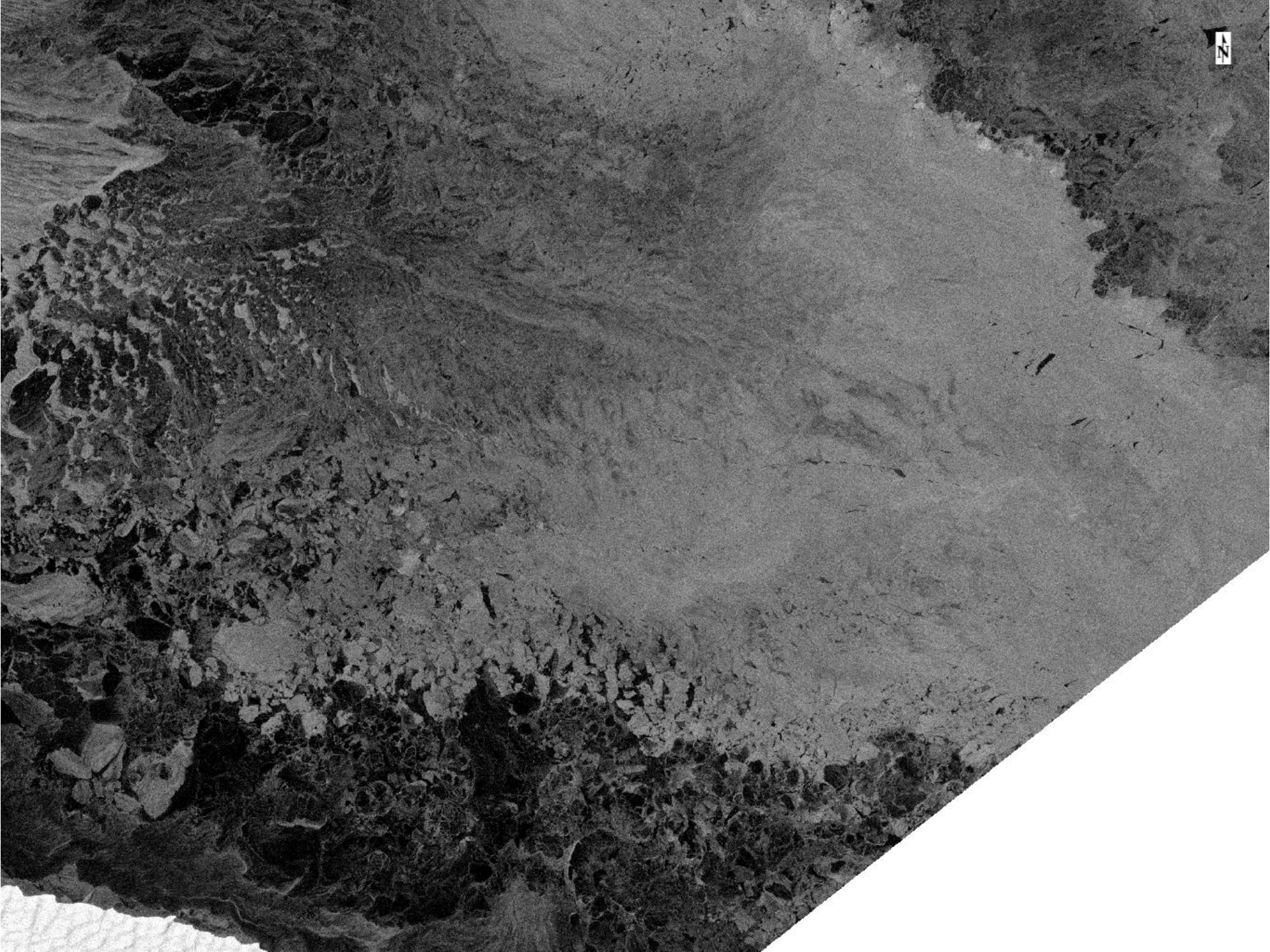
42

TSX: 2017-06-05 16:29  
S1: 2017-06-05 15:37

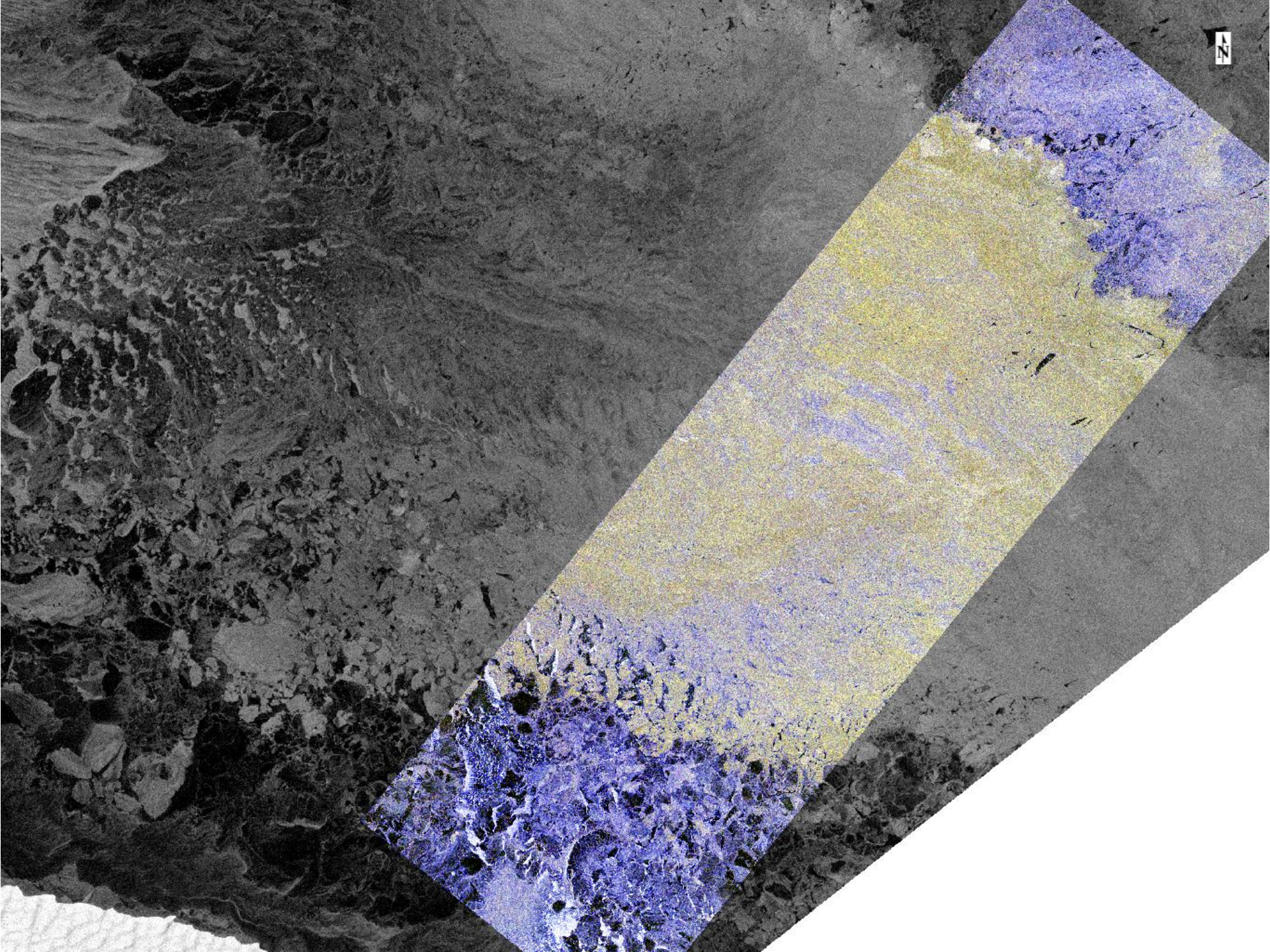






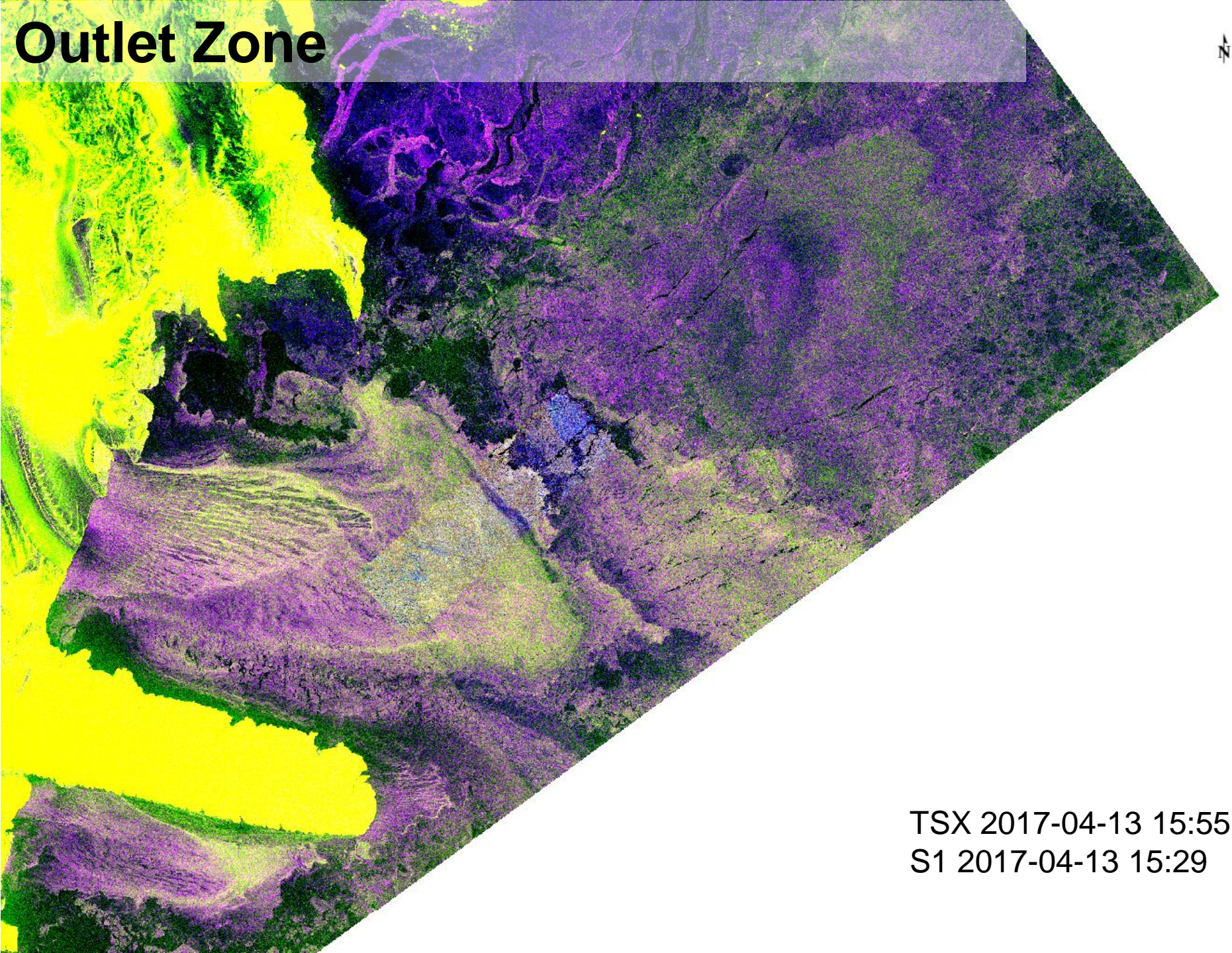






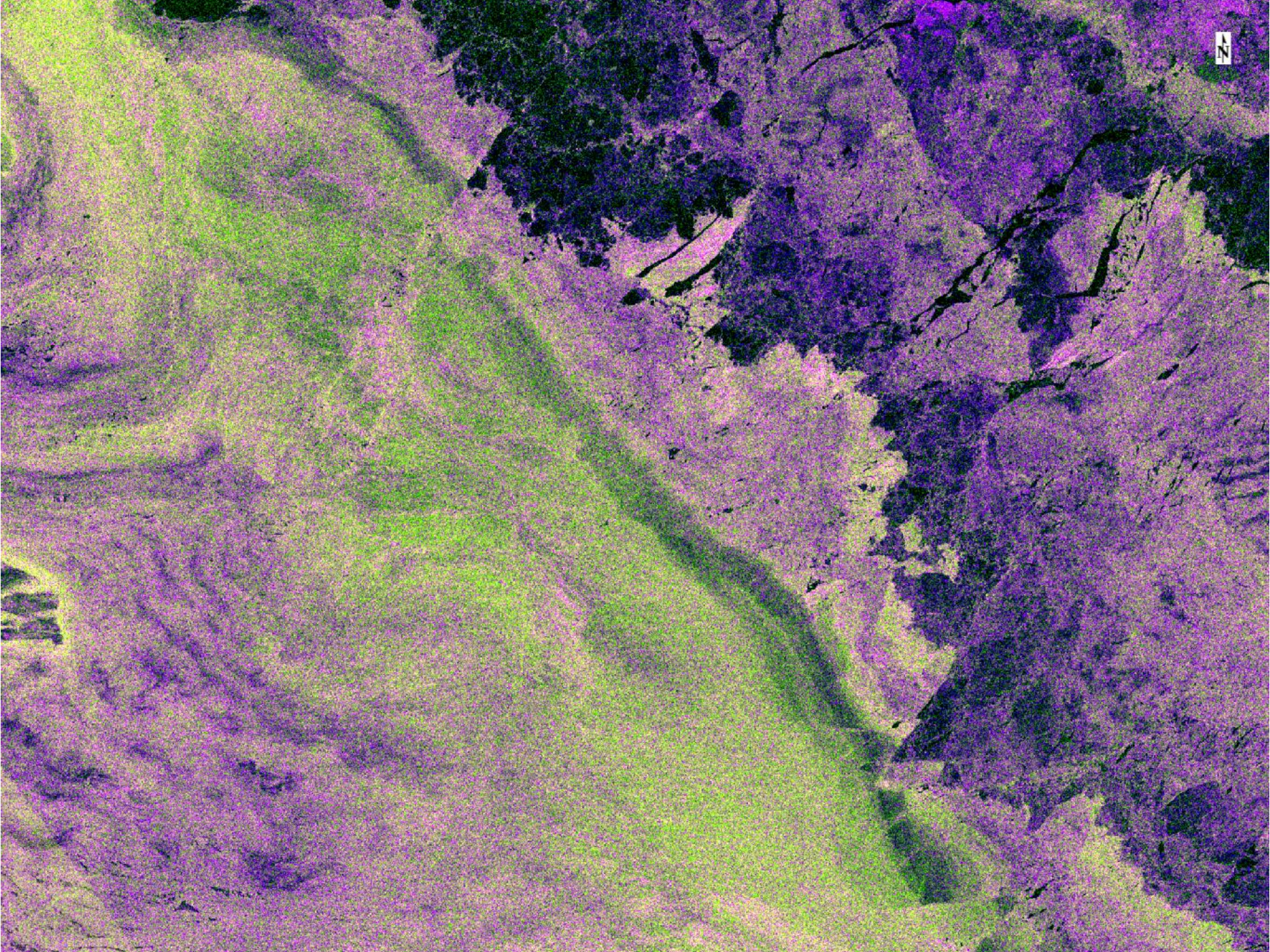


# Outlet Zone



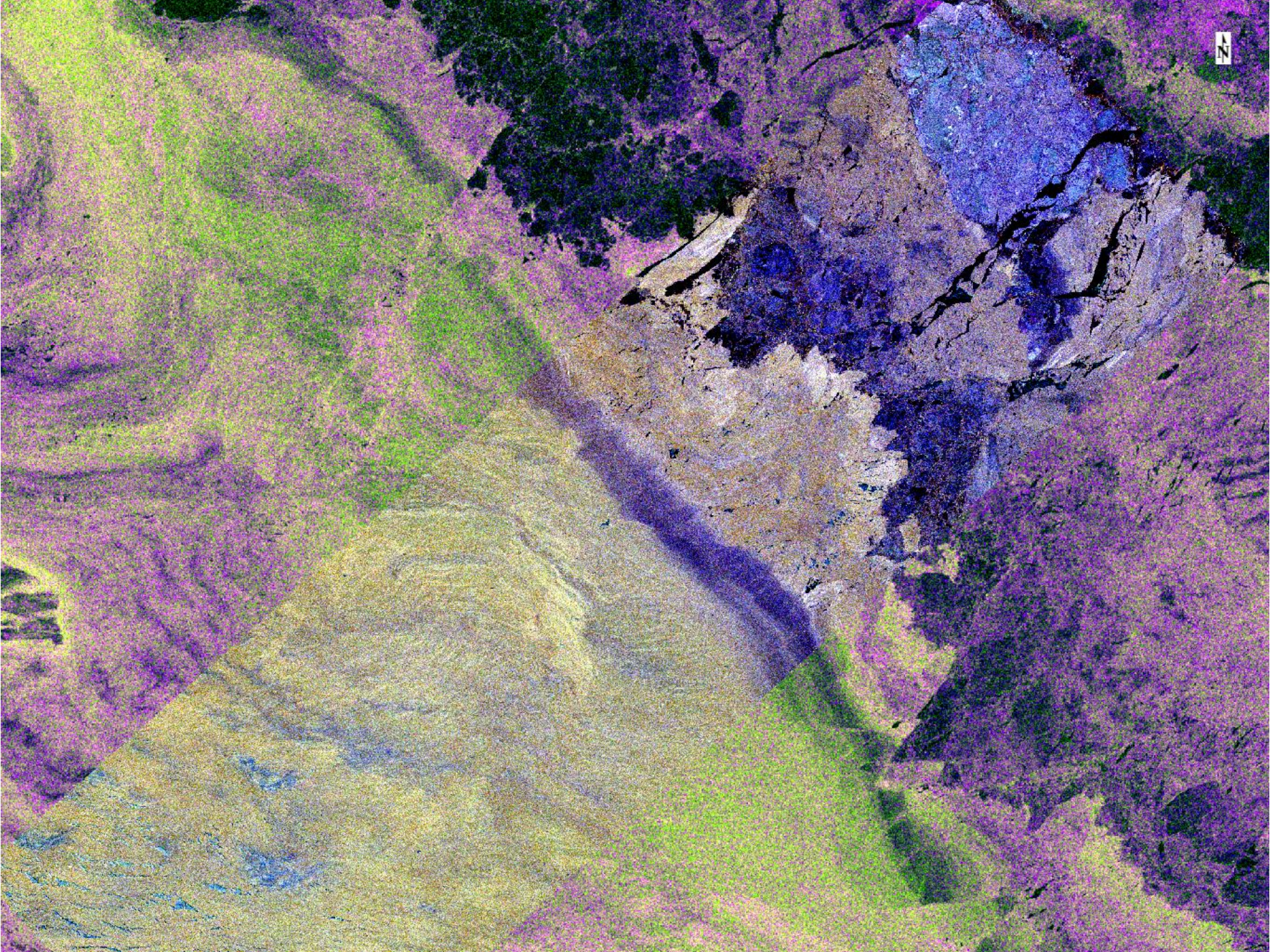
TSX 2017-04-13 15:55  
S1 2017-04-13 15:29





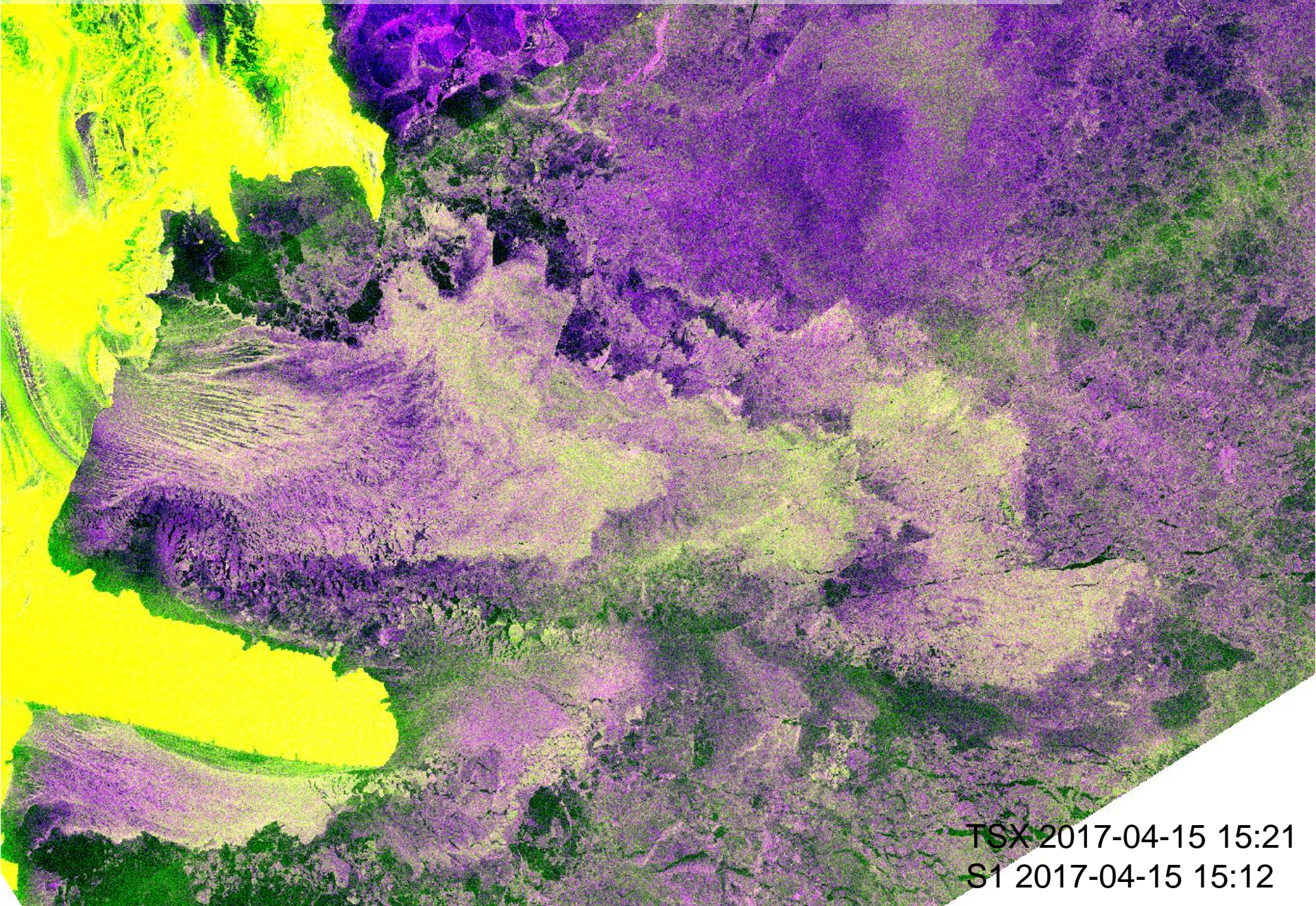
Z





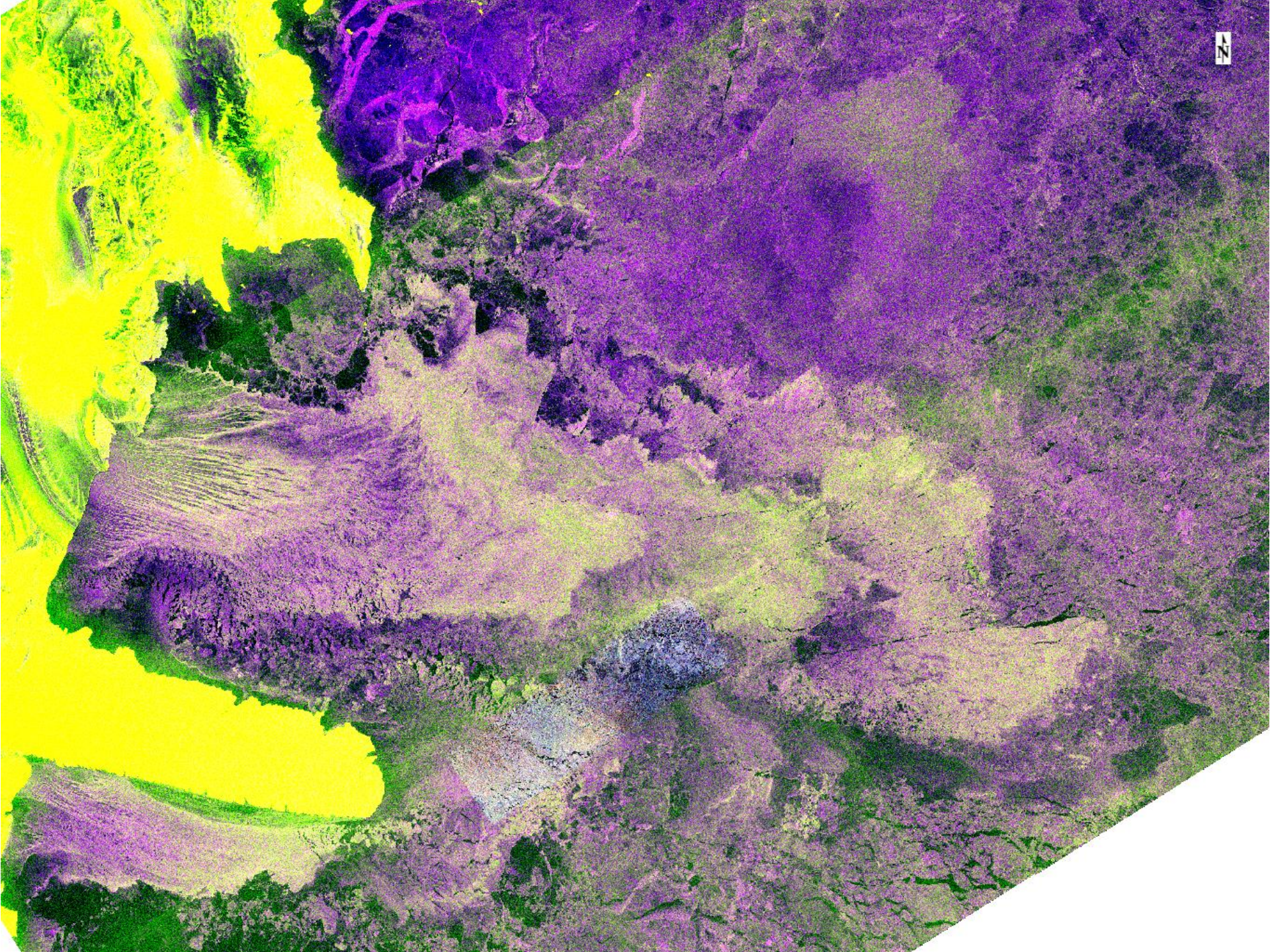


# Deformation Zone

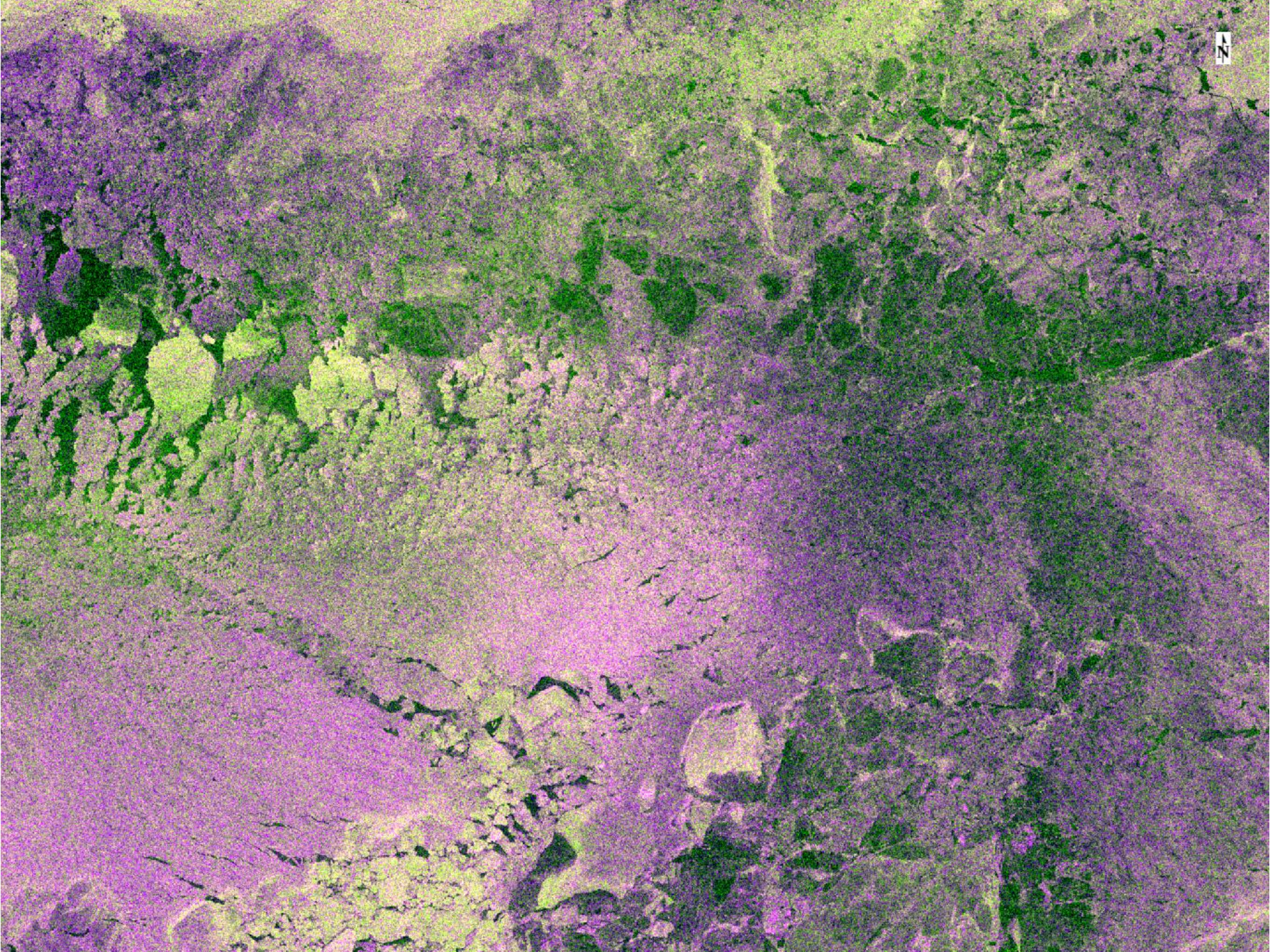


TSX 2017-04-15 15:21  
S1 2017-04-15 15:12

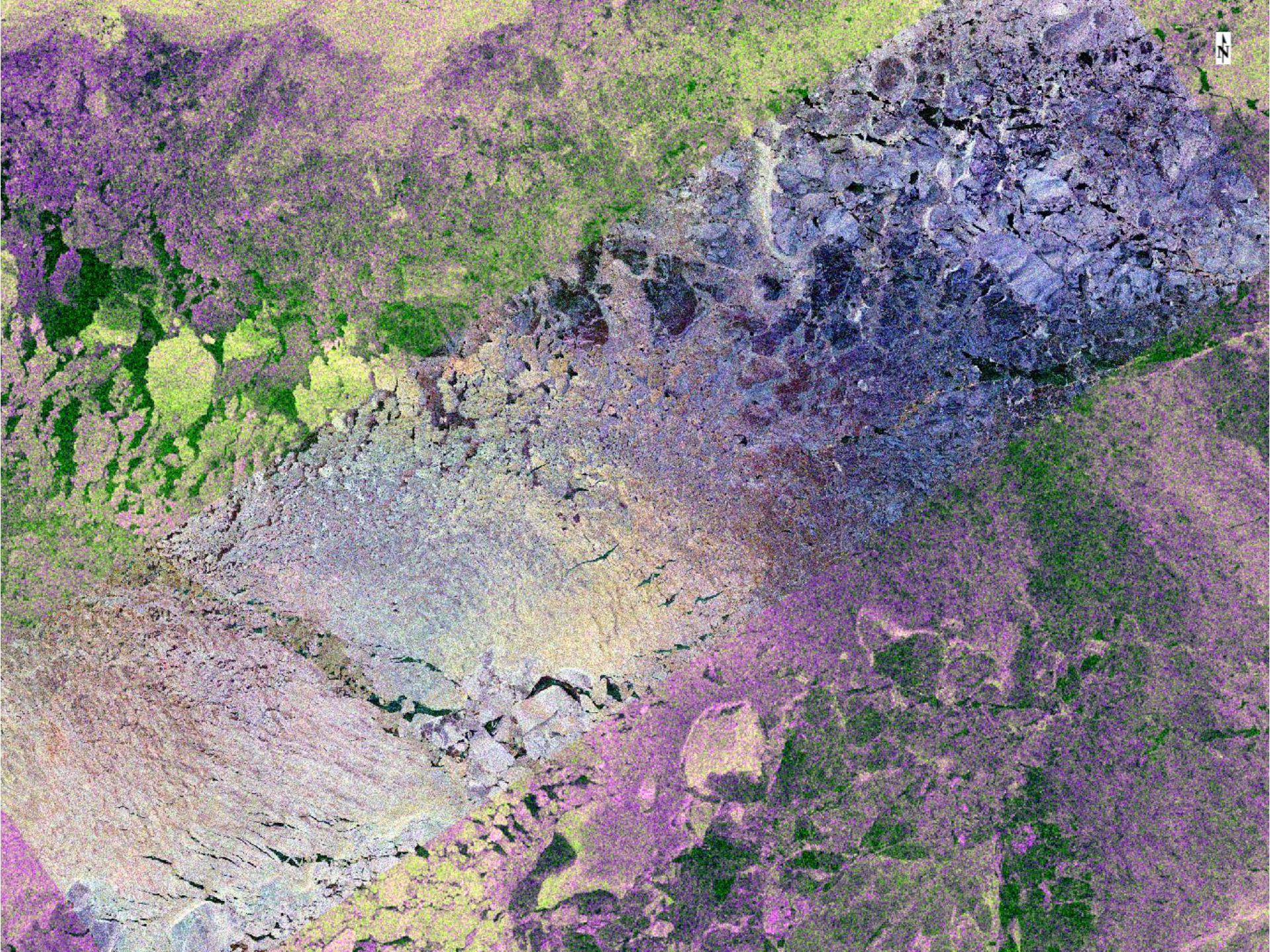














# Consolidation Zone

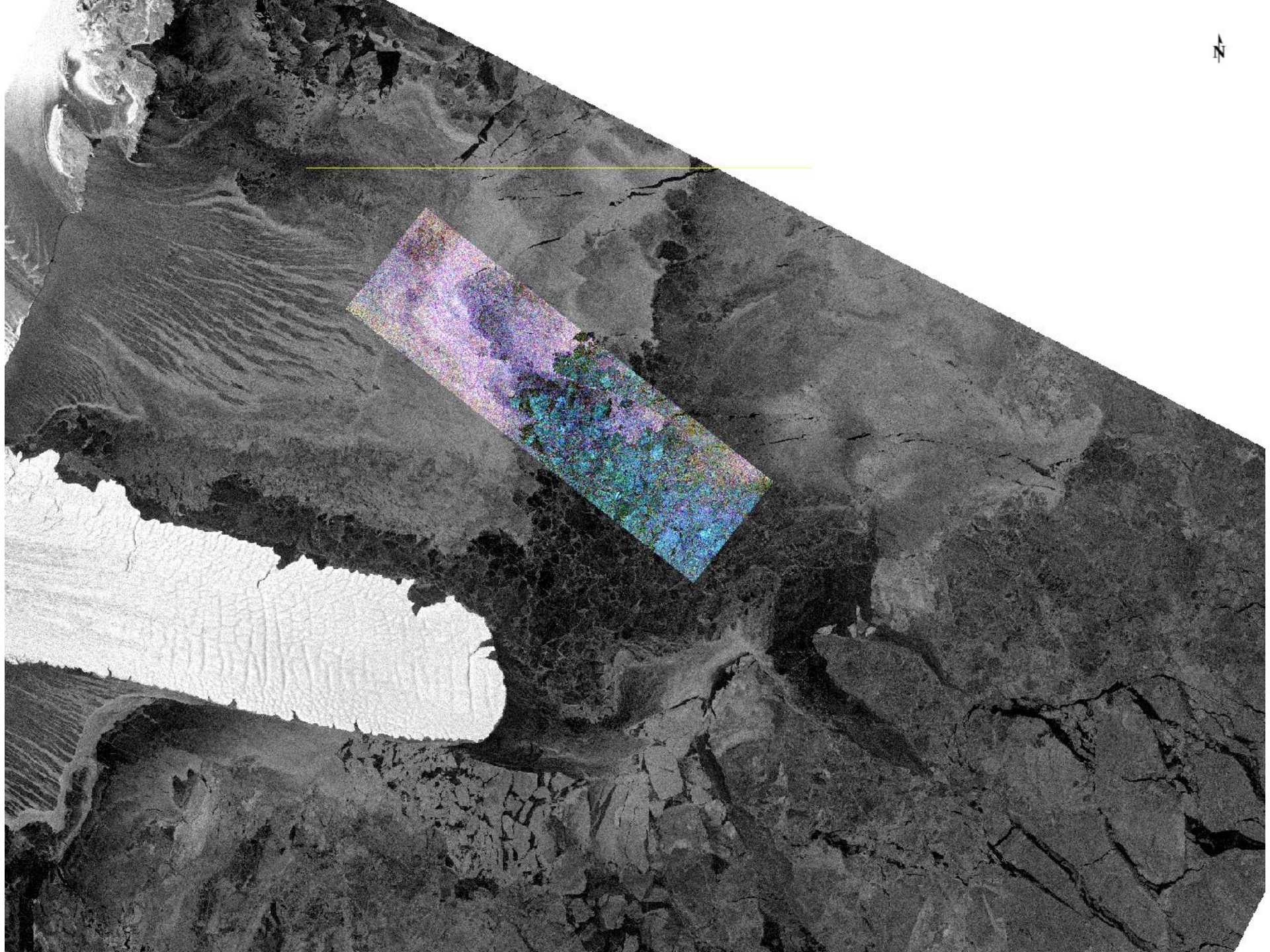


TSX 2017-07-02 10:24

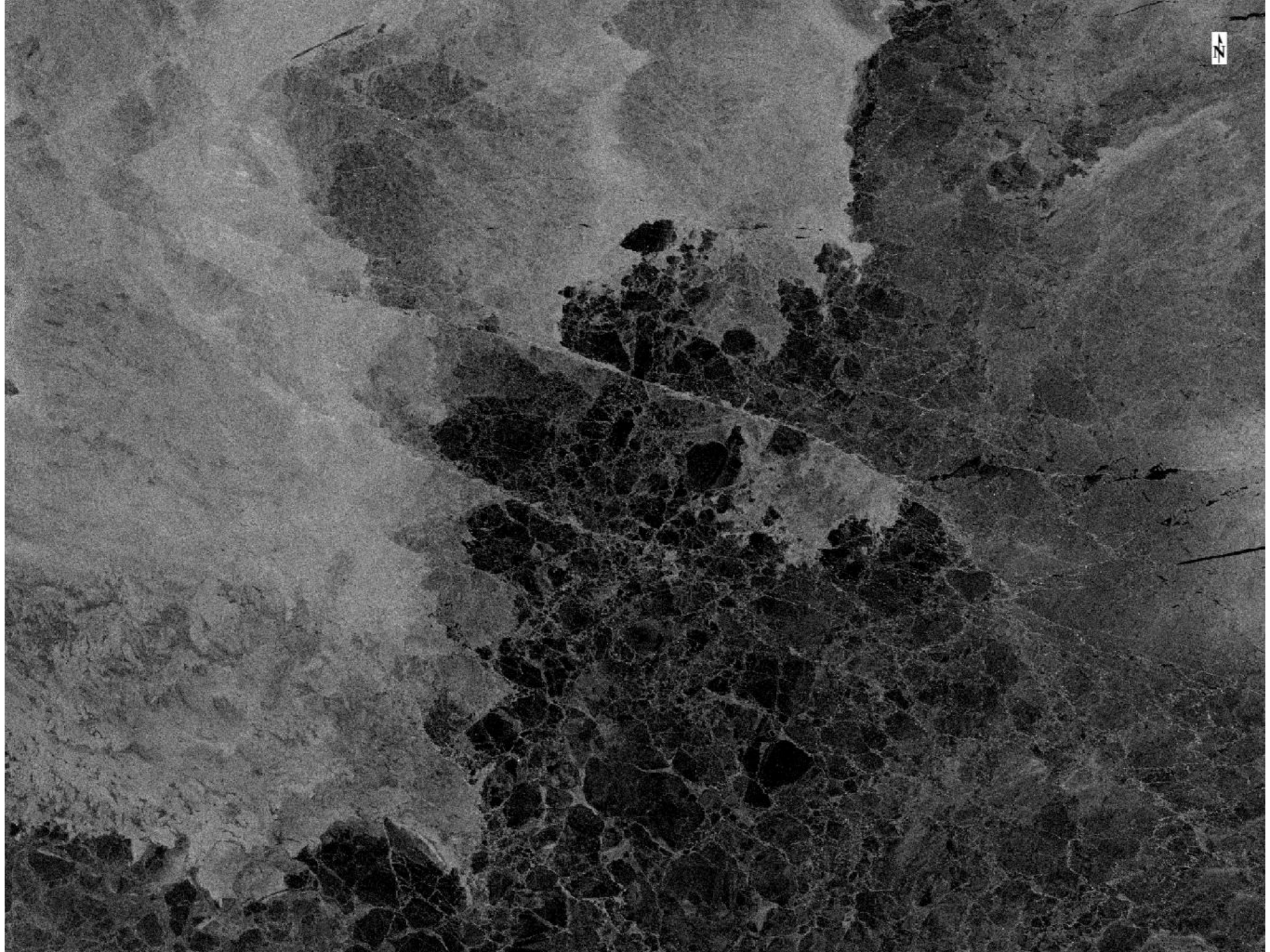
S1 2017-07-02 11:10



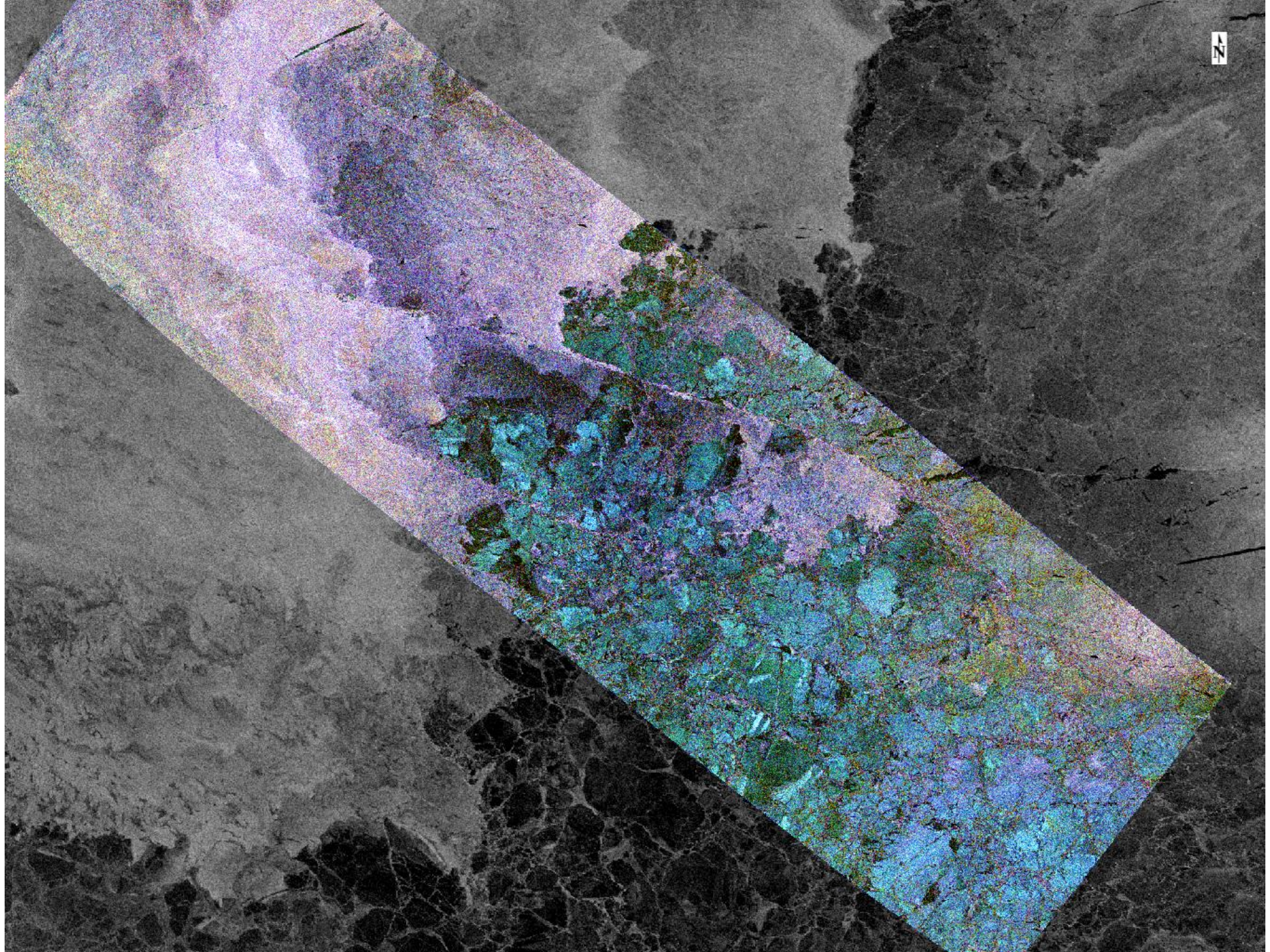






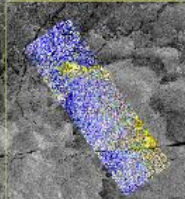






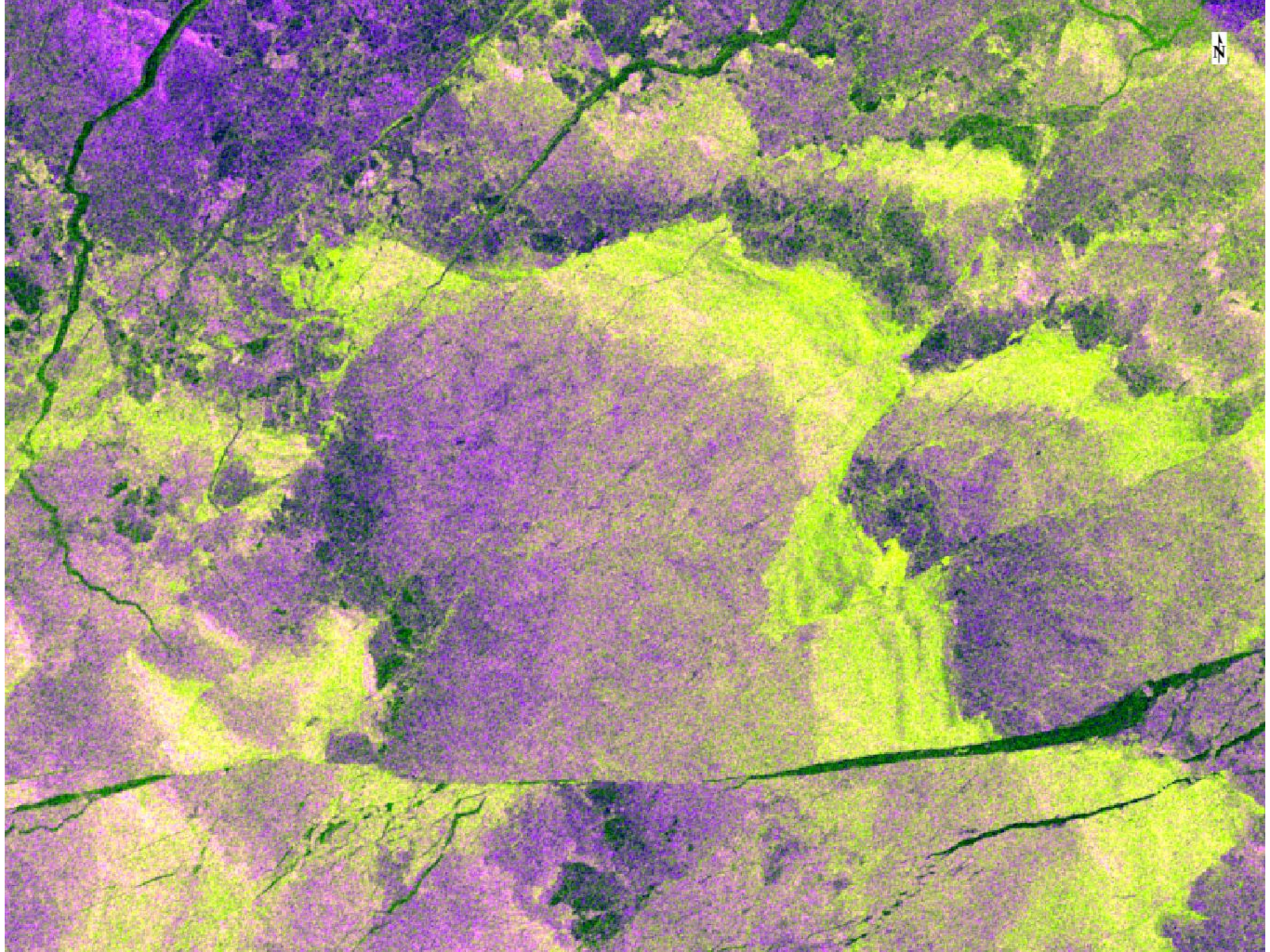


# Outlet Zone

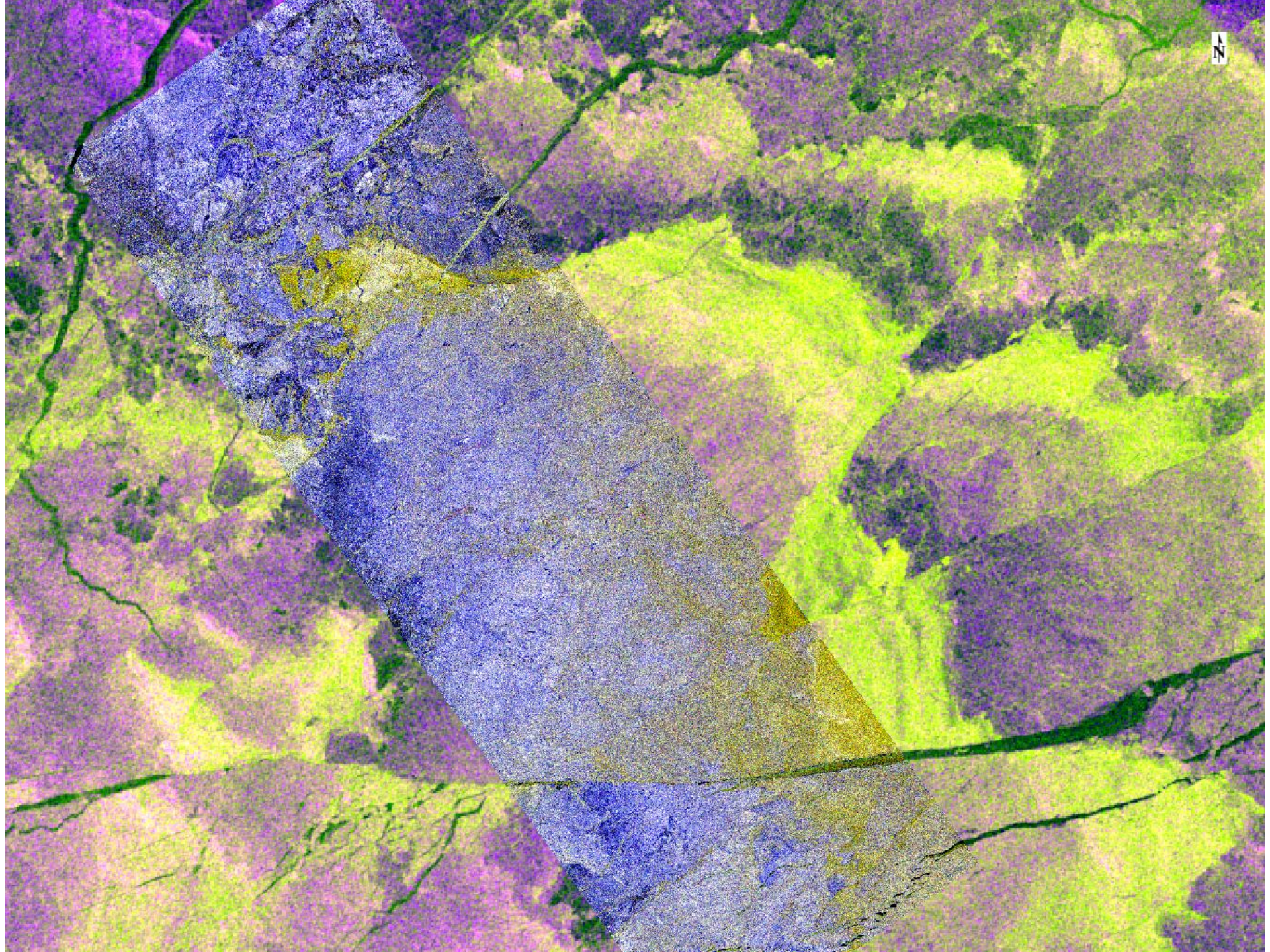


TSX 201707-06 9:16  
S1 2017-07-06 9:47











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### **Employed Data:**

S1 IW HH and EW HH/HV data: Copernicus Sentinel data (2017)

TSX Dualpol HH/VV Stripmap data [2017]: TSX proposal OCE3467, DLR (2017)