TerraSAR-X Data Acquired in Pursuit Monostatic Mode during TanDEM-X Commissioning Phase

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Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Outline

- TanDEM-X Commissioning Phase(s) and Formation Built-Up
- Drift Phase: Moving Objects
- Pursuit Monostatic Phase
  - Interferometry Added
  - Complementary Imaging Configurations
- User Access to Pursuit Monostatic Data

TanDEM-X Commissioning Phase(s) and Satellite Formation Built-Up

16.000 km
@ Launch

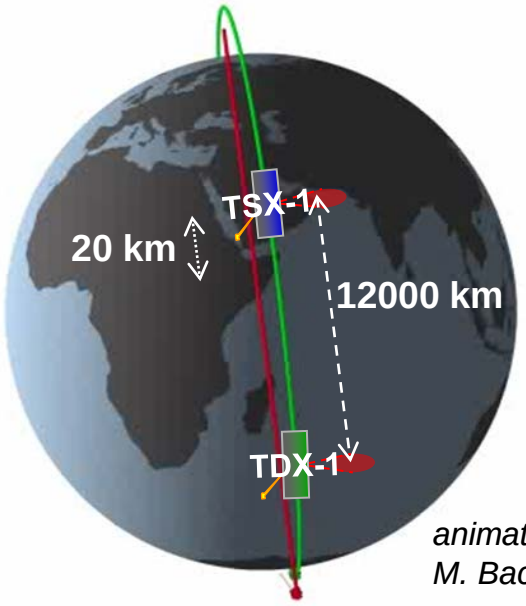
12.000 km
@ 1st Image

→ 20 km
for P.S.M. CP

LEOP and
GS checkout

Orbit drift

1 month



Earth Rotation: 460 m/s @ Eq.

→ full swath offset on ground
@ 47s (330 km) distance

animation by
M. Bachmann

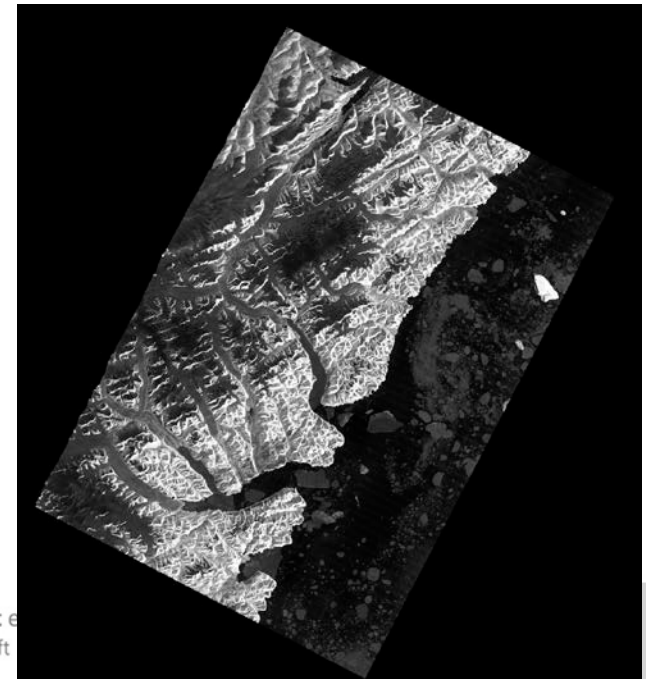
LEOP and Drift Phase

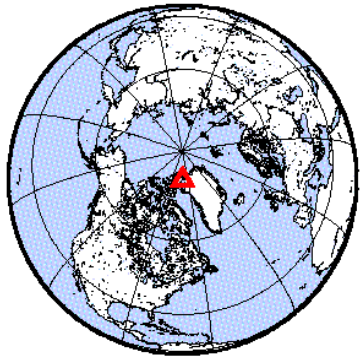
- 3.6 (!) days after launch: start of TDX data taking and processing with operational TerraSAR-X processing chain
- commissioning of Kiruna ground station for routine TDX data reception
- continuation of operational TSX services by Neustrelitz ground station
- from first day on: very good TDX performance
- system data taking by instrument team
- from July 18 on: stop of drift and built up of pursuit monostatic flight configuration

Drift Phase: TDX-TSX ScanSAR acquisitions separated in time by 110 seconds (~800 km distance)

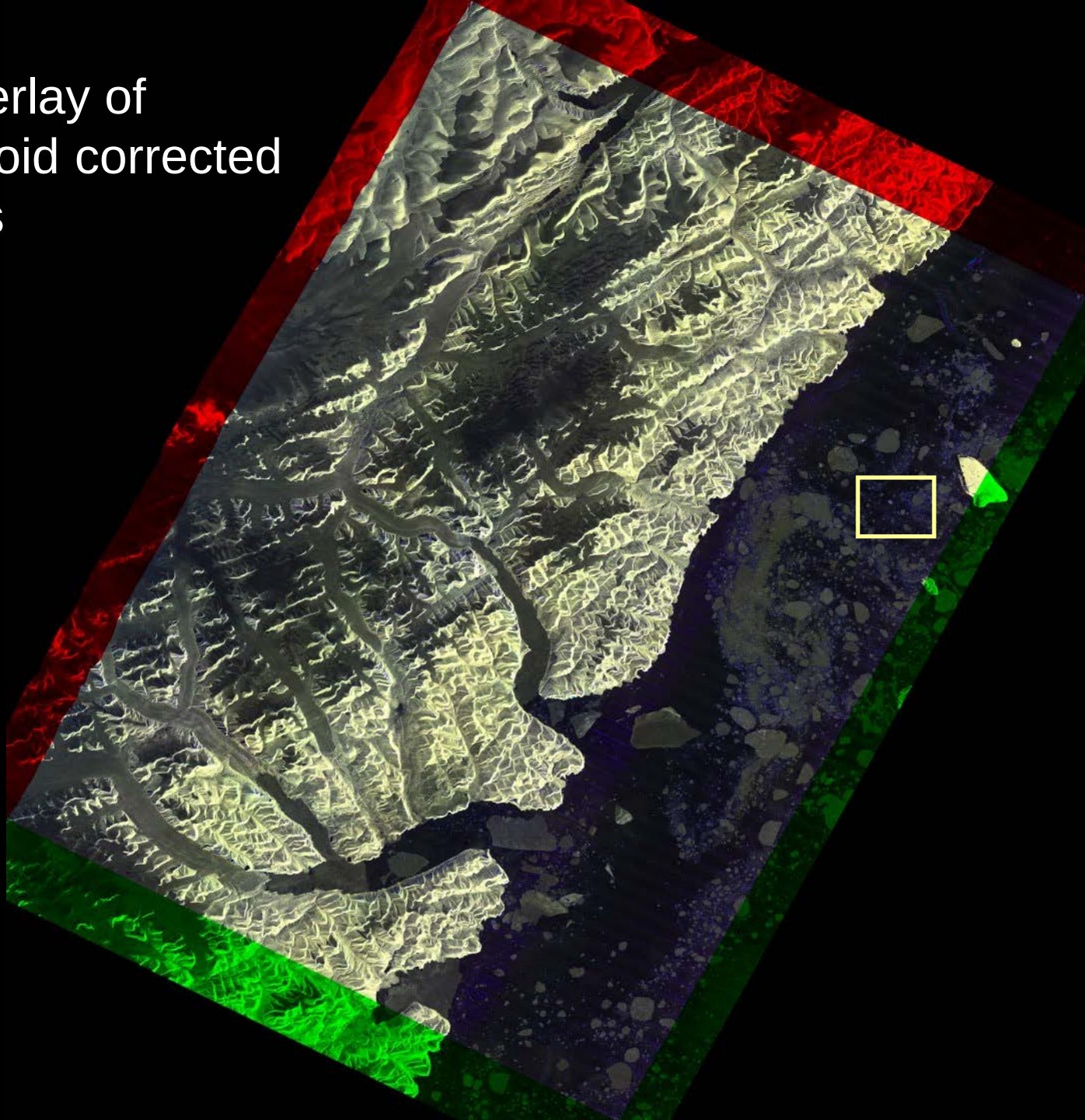
- scene heading angle difference of 0.4 deg
  - azimuth spectra shifted by ~3300 Hz
  - ScanSAR azimuth bandwidth ~500 Hz

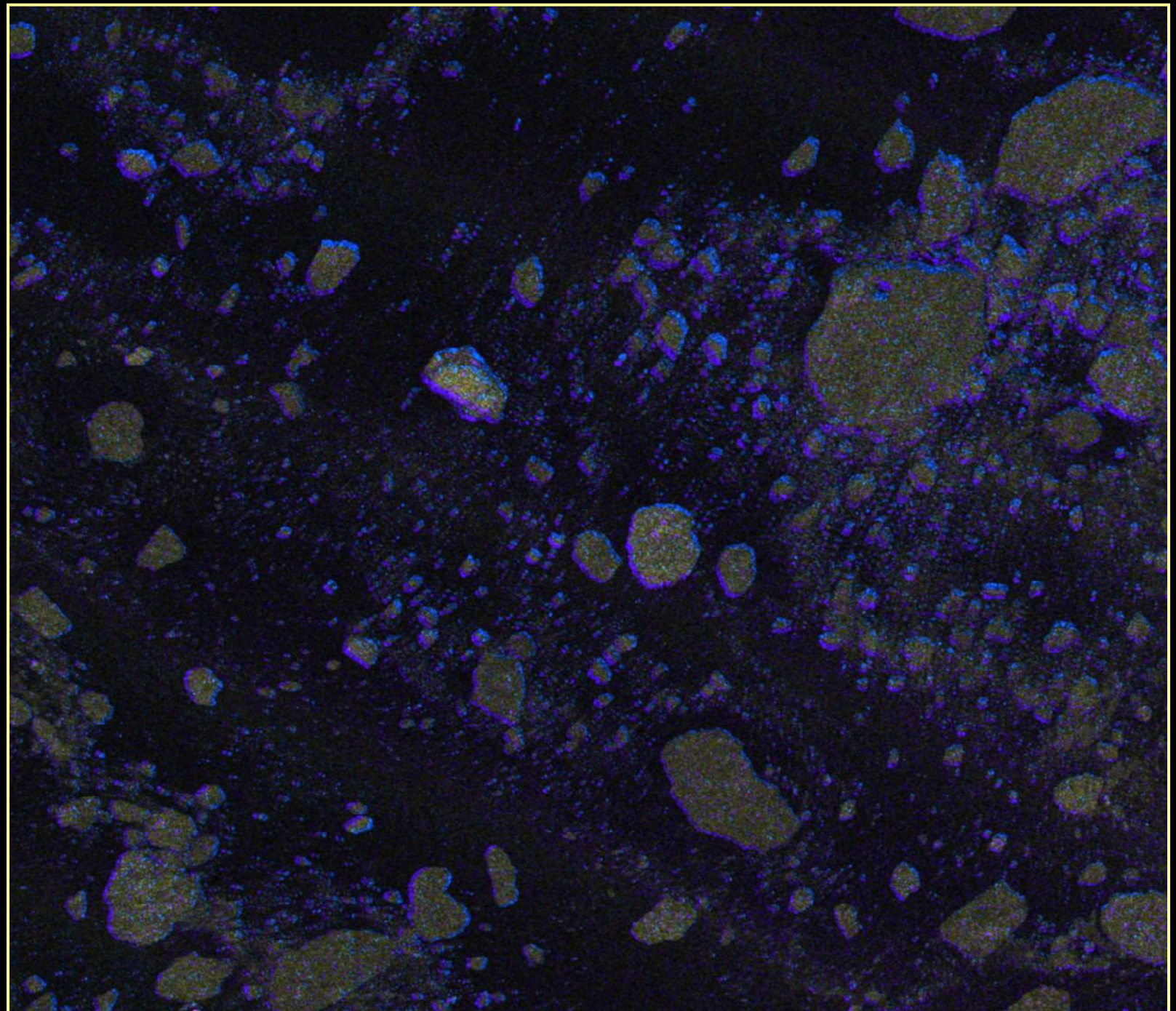
  => *no spectral overlap, no coherence*
- but: incoherent cross correlation

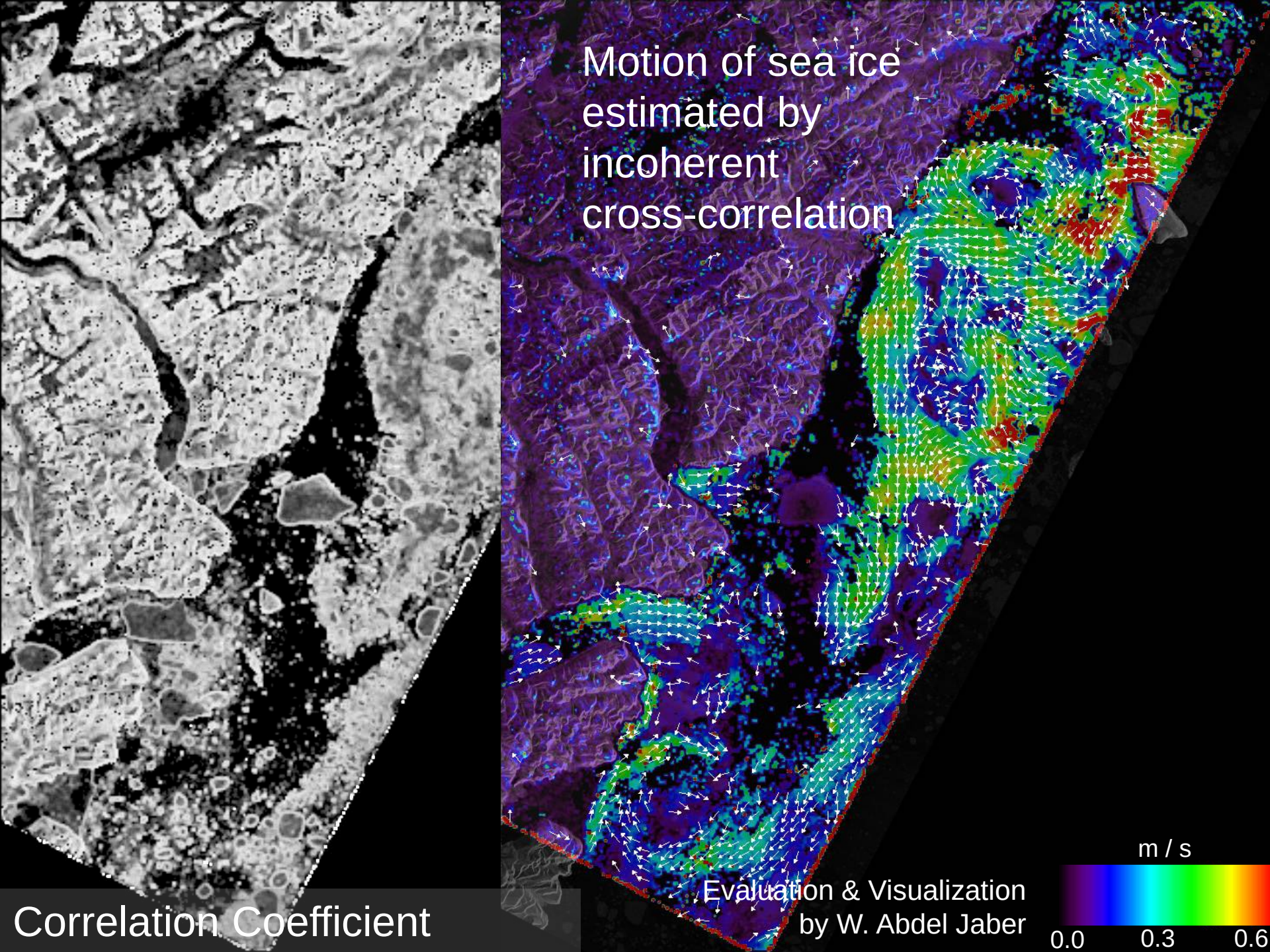




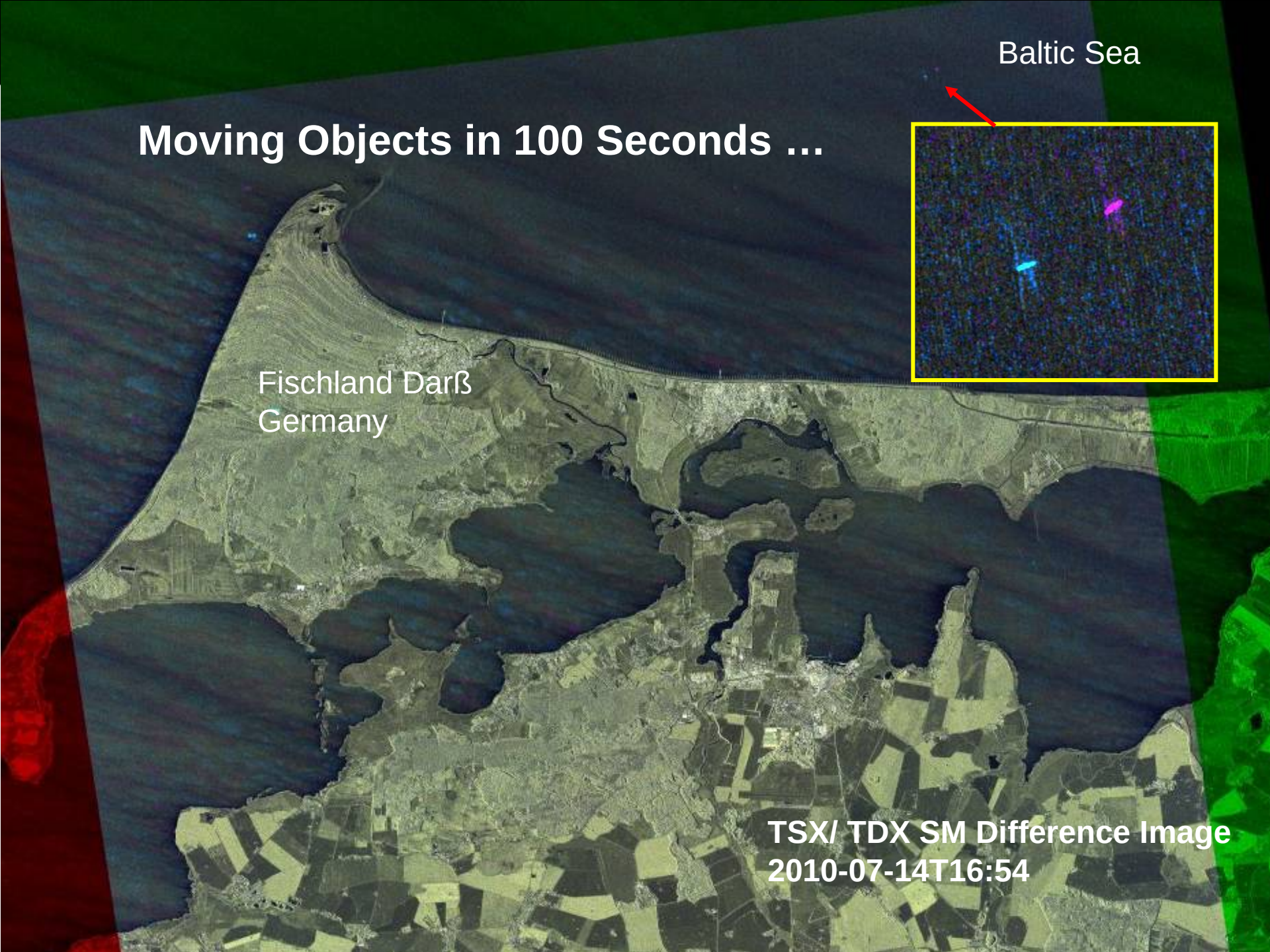
Color coded overlay of enhanced ellipsoid corrected intensity images






Motion of sea ice
estimated by
incoherent
cross-correlation
Correlation Coefficient
Evaluation & Visualization
by W. Abdel Jaber
m / s
0.0
0.3
0.6

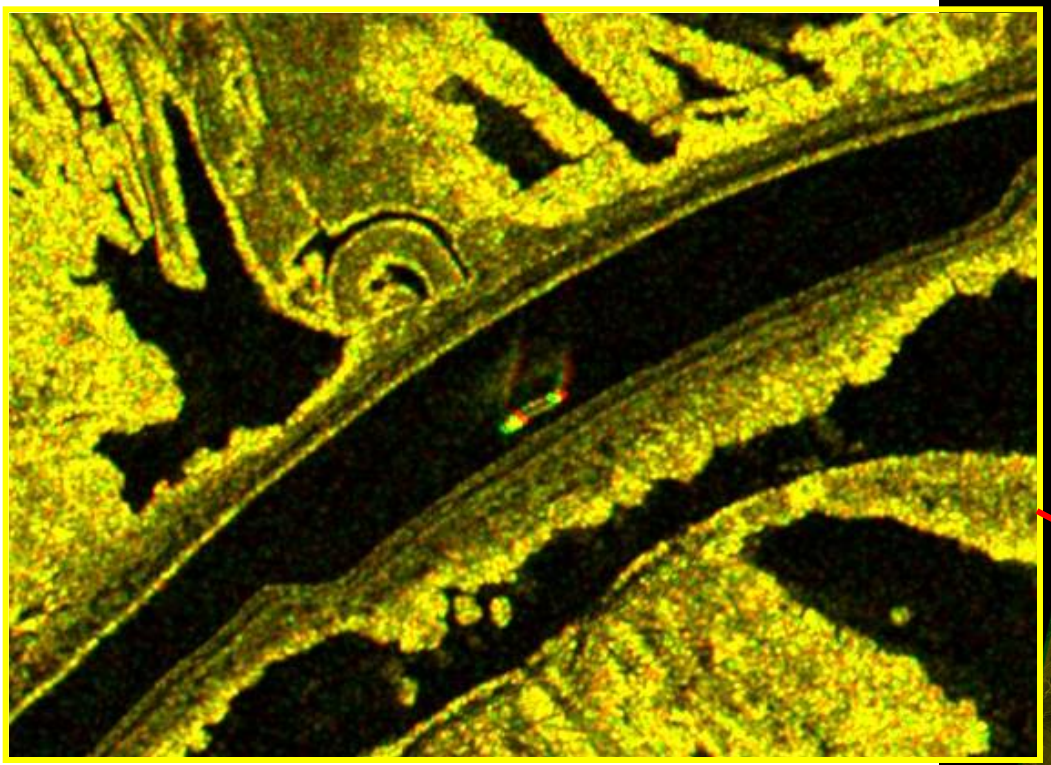
Moving Objects in 100 Seconds …

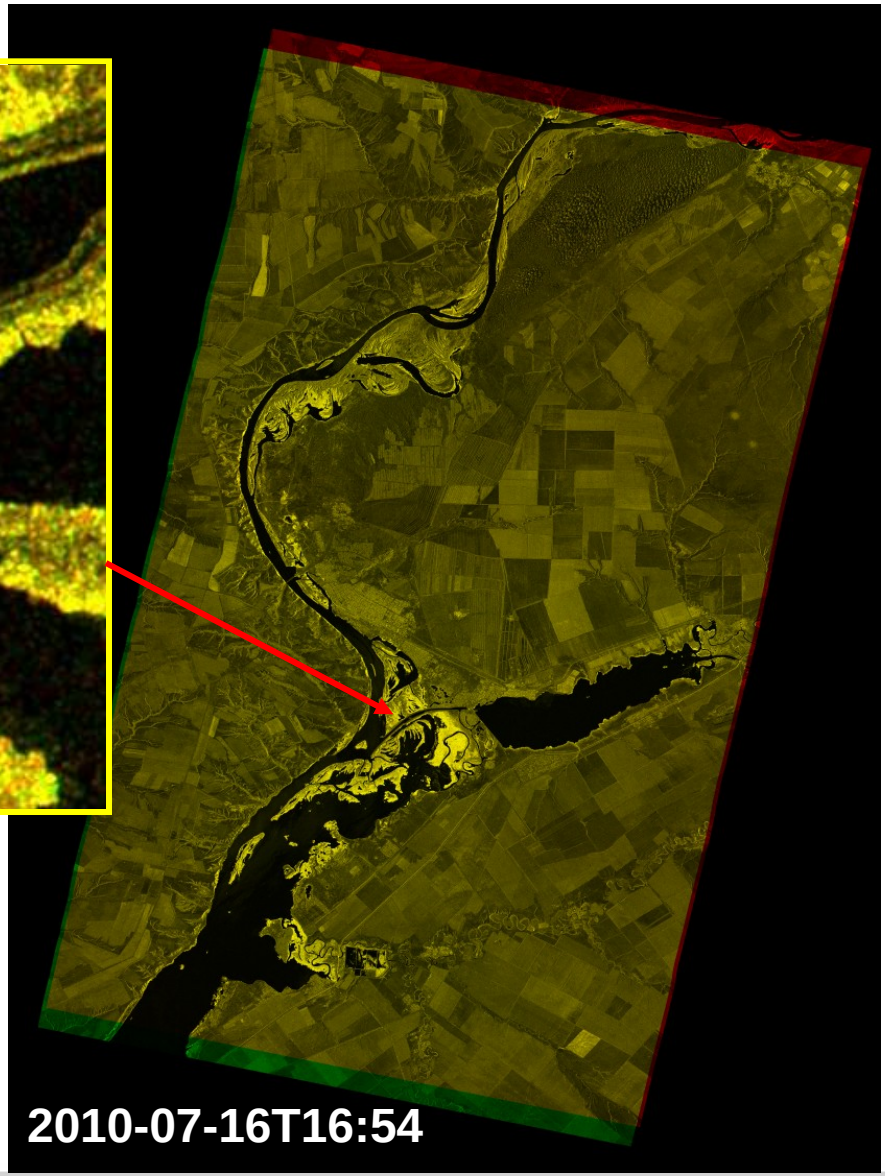


Processing by DLR
Ship Detection Processor in Neustrelitz

courtesy: E. Schwarz

… and within 4 Seconds





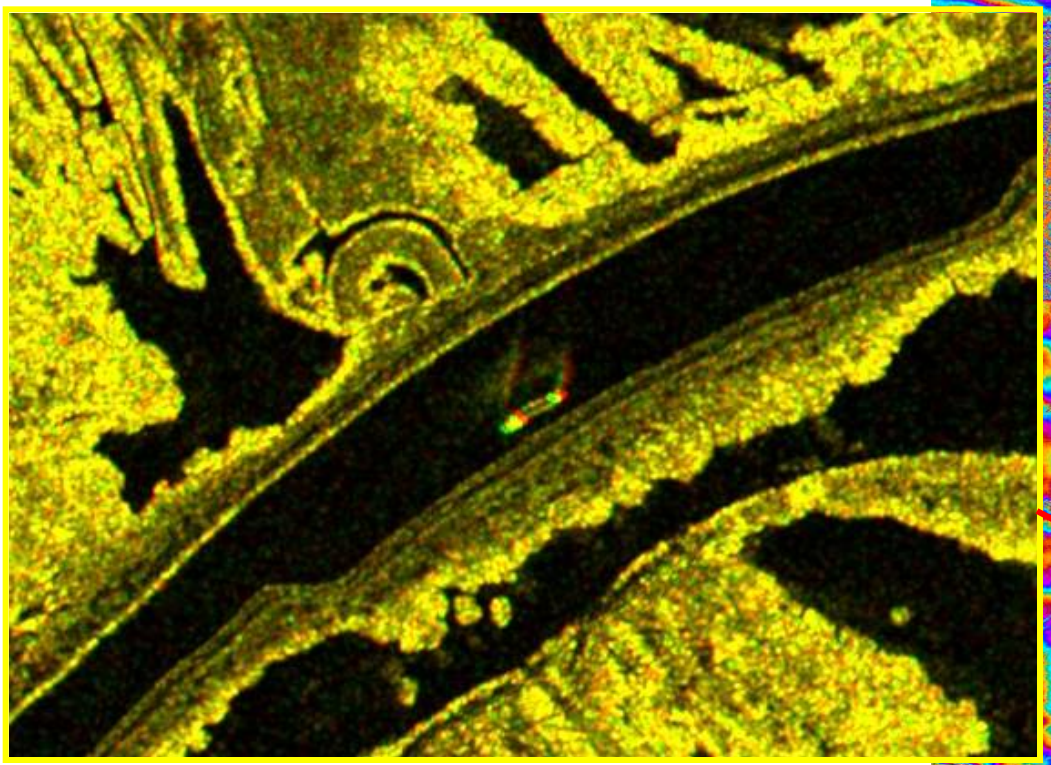
Nearly in 20km Formation:

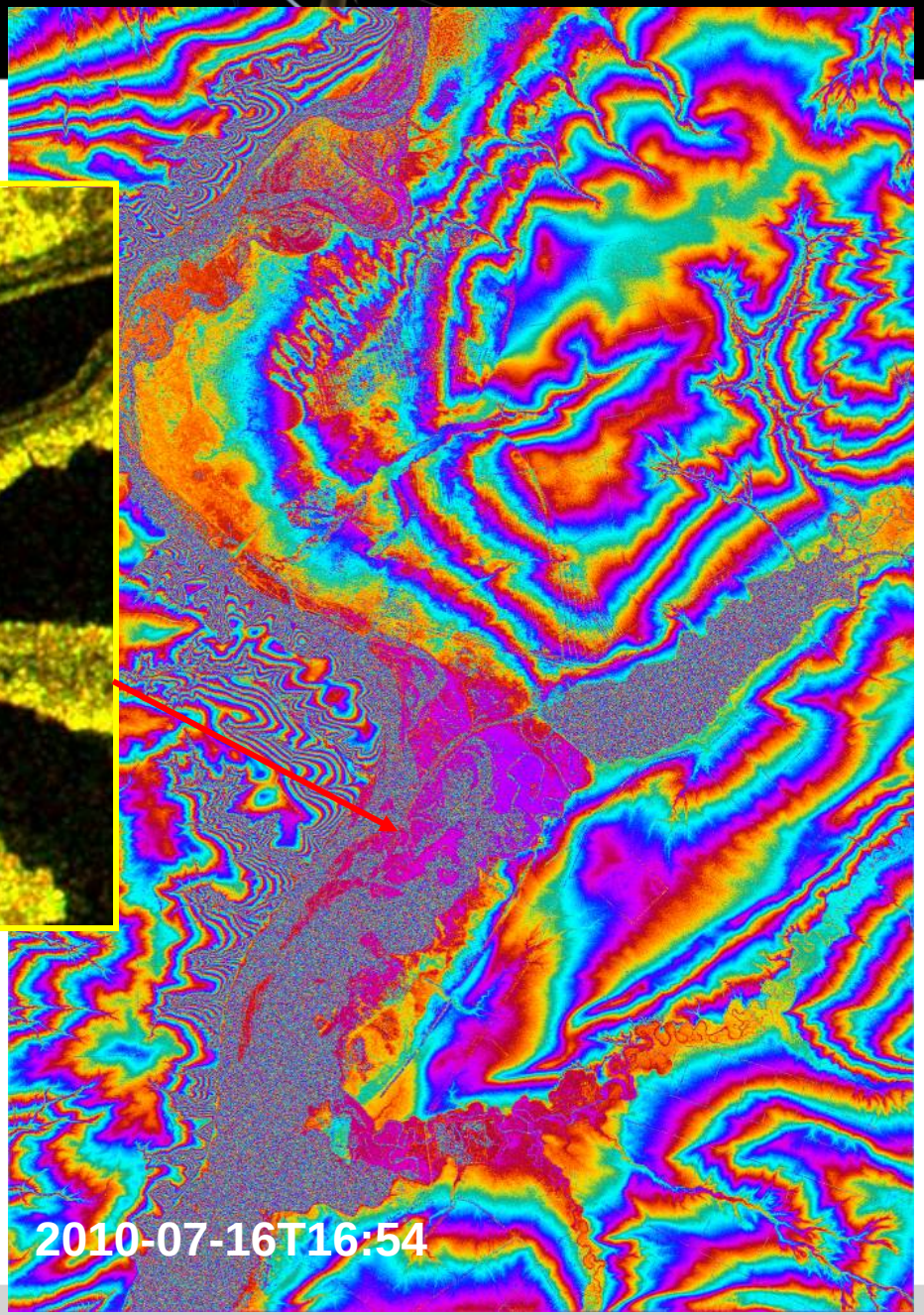
- Acceptable Baselines (<4km)

- Spectral Overlap

→ InSAR / DEM Generation !

… and within 4 Seconds





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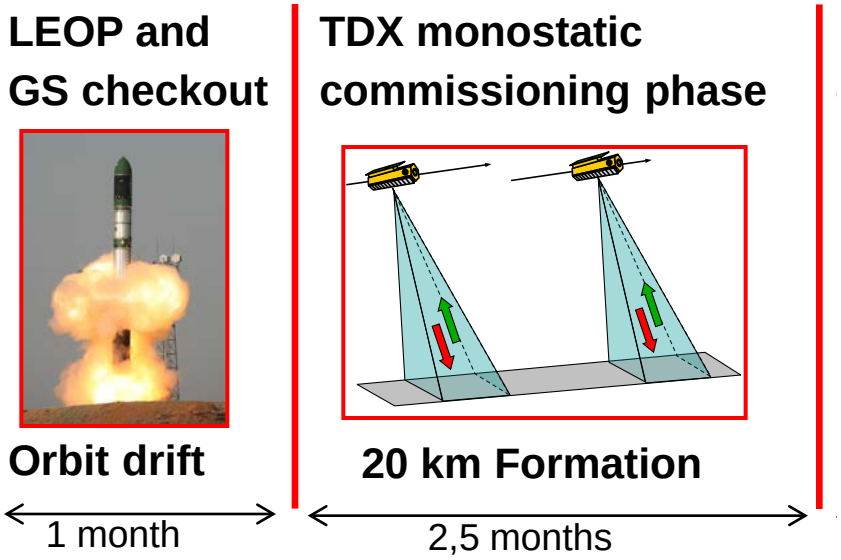
TanDEM-X Commissioning Phase(s) and Satellite Formation Built-Up

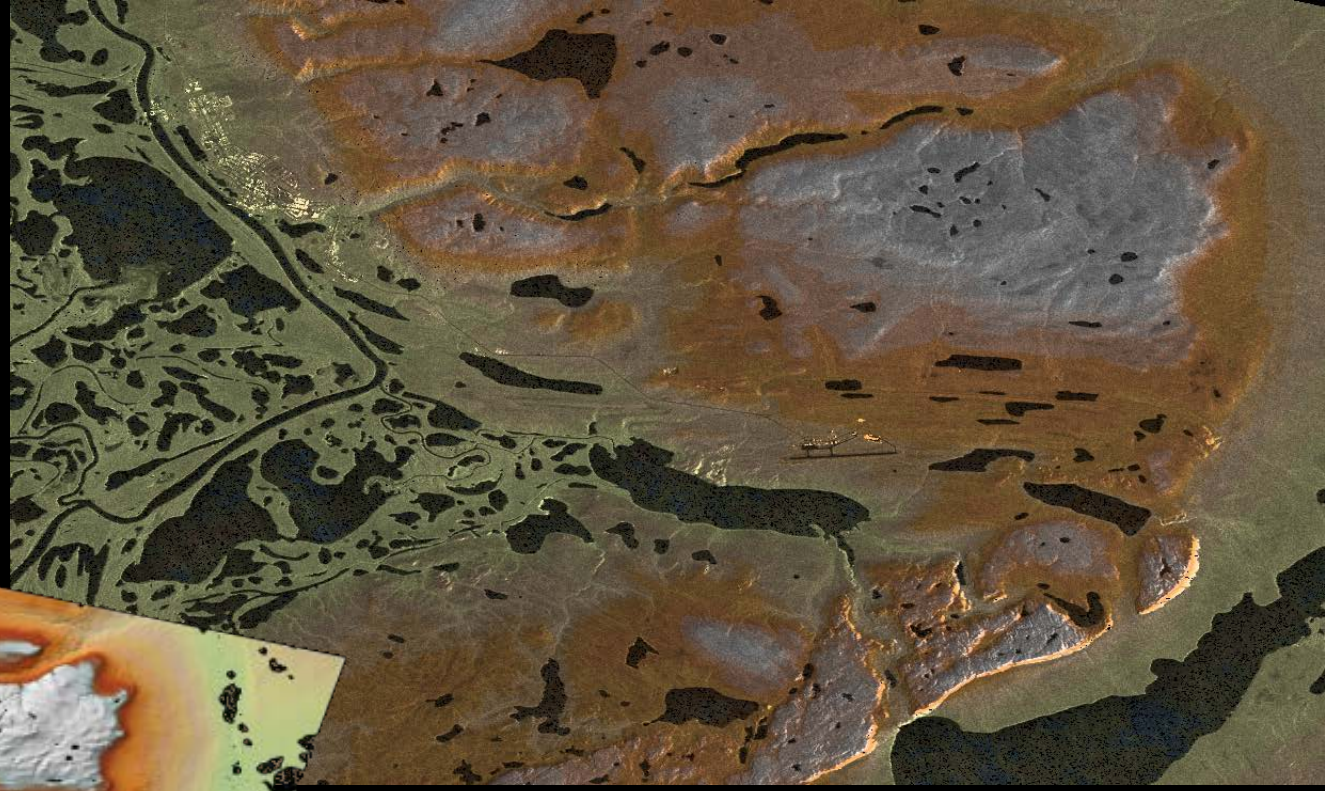


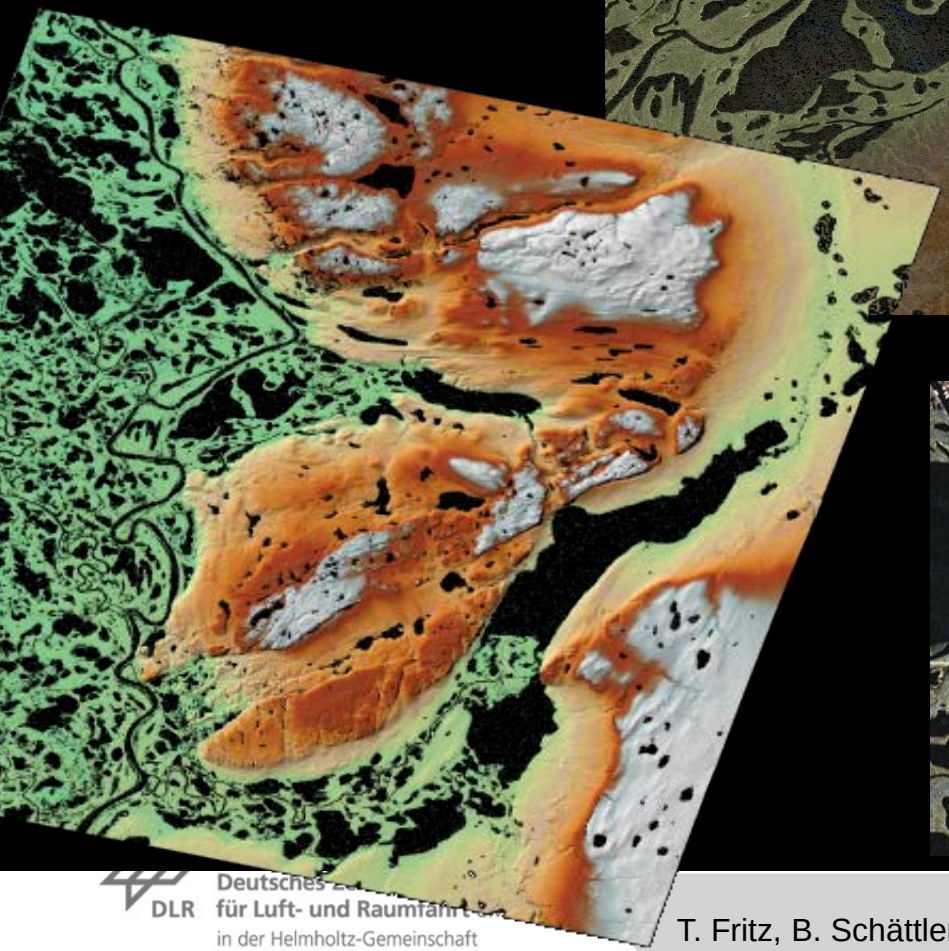
Pursuit Monostatic Commissioning Phase

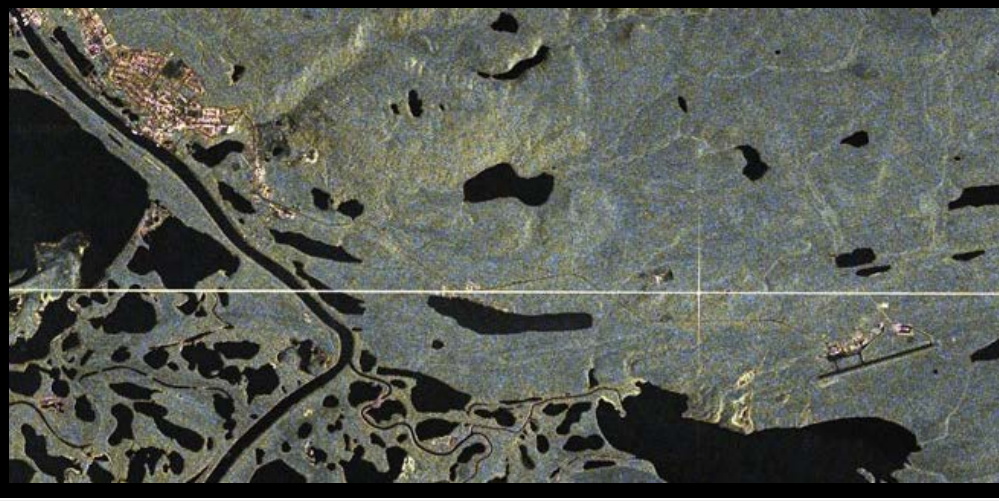
- Jul. 22: PSM configuration with 20 km distance (2.6 sec) reached
- TDX started its helix flight, 1.3 km width compensated for Earth rotation
- acquisition and processing of TanDEM-X data in pursuit monostatic configuration started
- operational qualification of Inuvik ground station
- TDX calibration and verification
- Oct. 5: release of TerraSAR-X mission based on both satellites TSX and TDX

DLR Ground Station

Inuvik, NWT

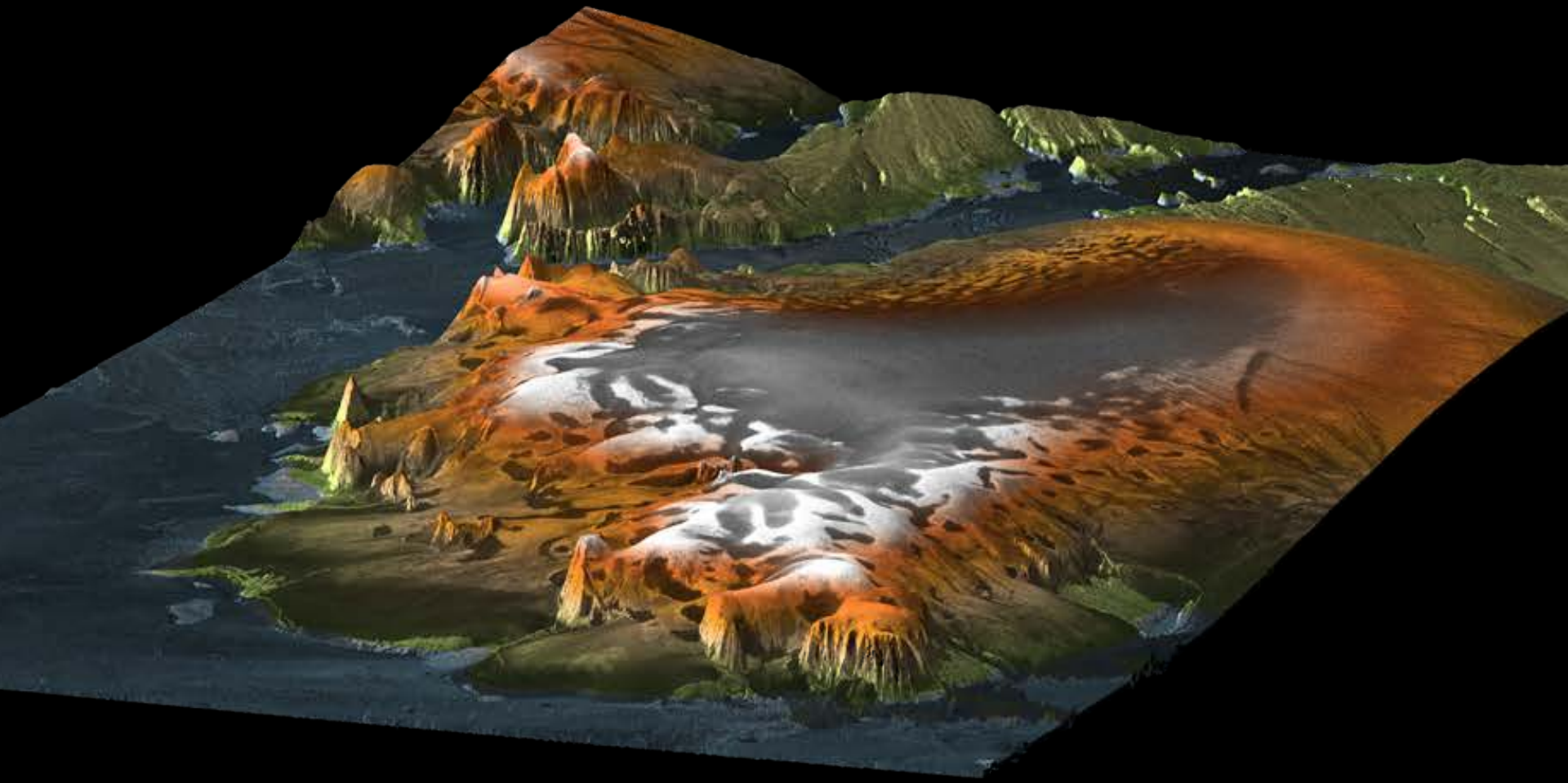




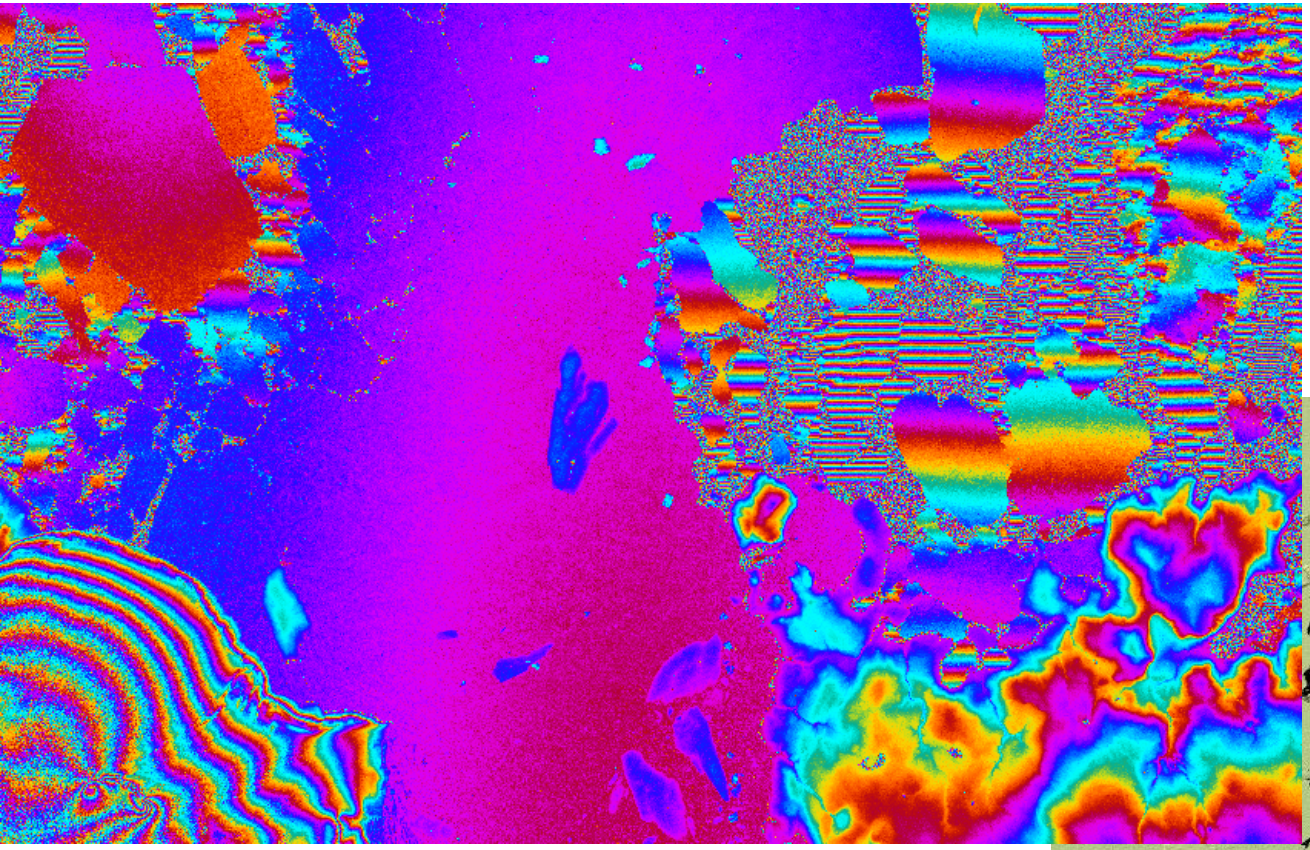


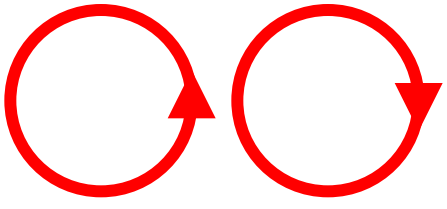
October Revolution Island Revisited

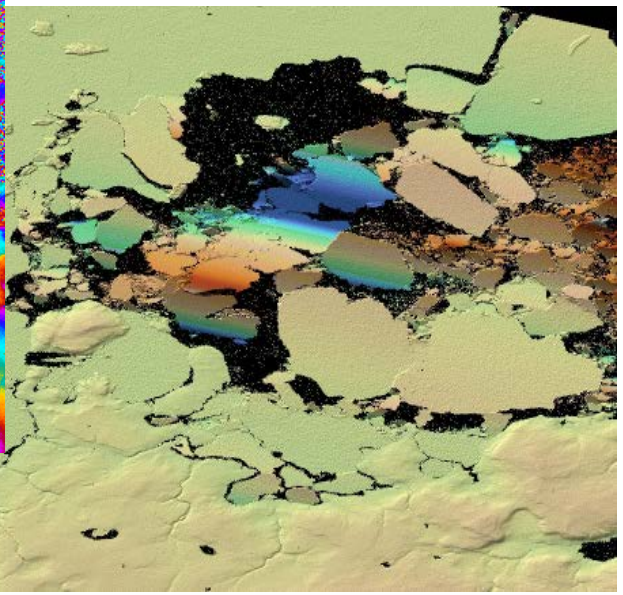
High Resolution DEMs at 79°N, 96°E



Ice Movement Effects on PSM InSAR Phases / DEMs (ATI)



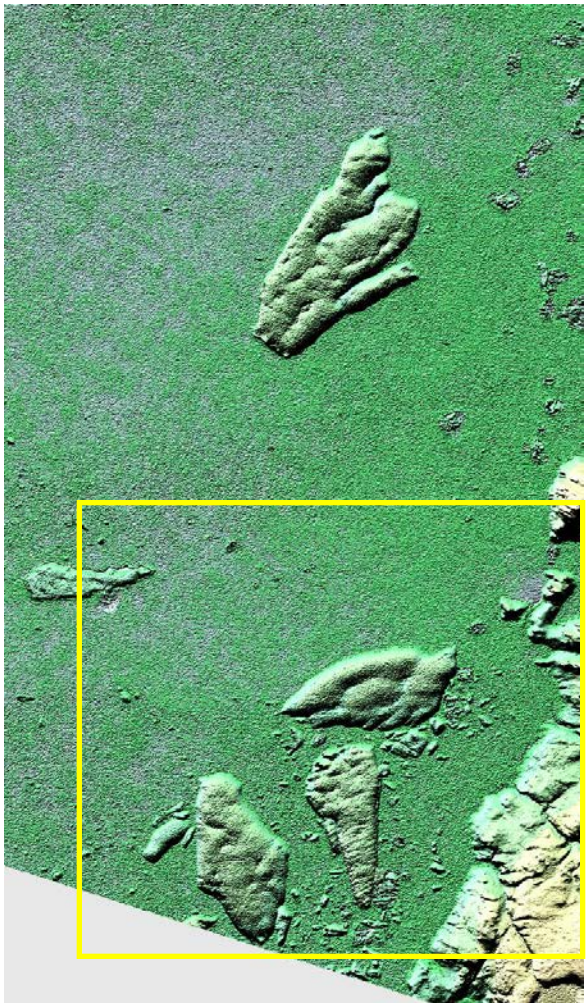


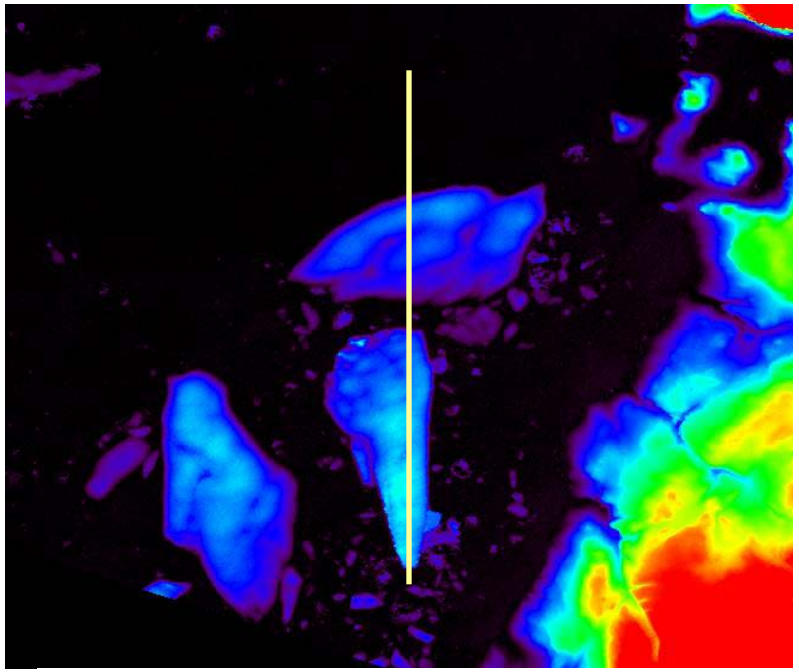


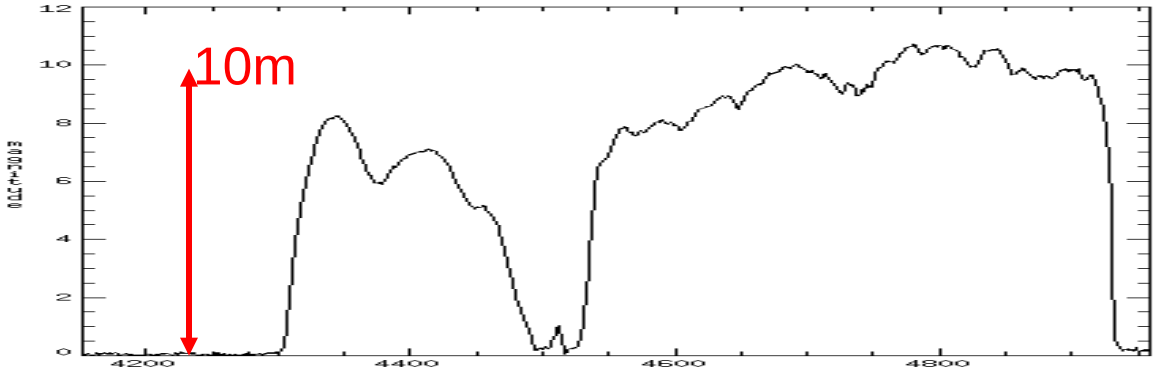
range

azimuth

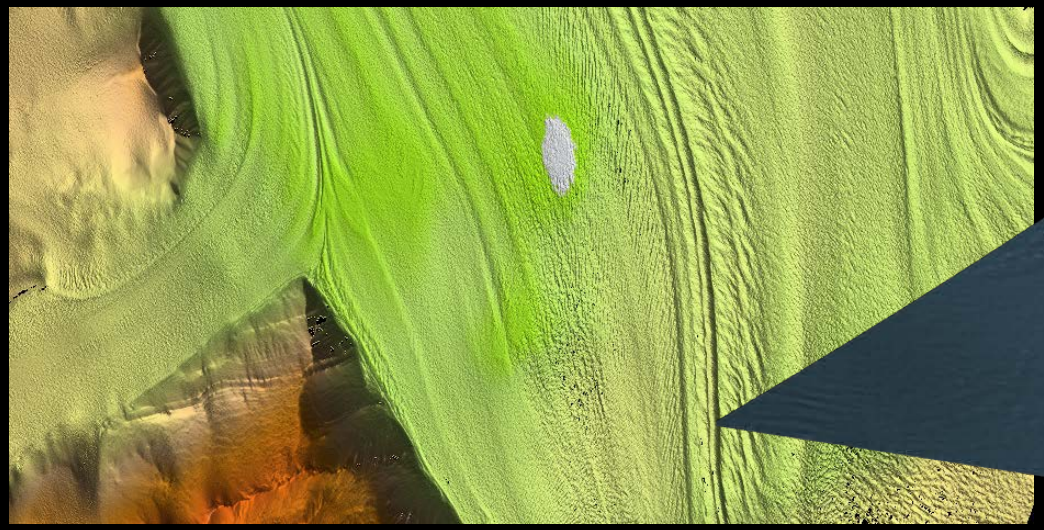
Large Baseline Interferometry – Submeter Accuracy



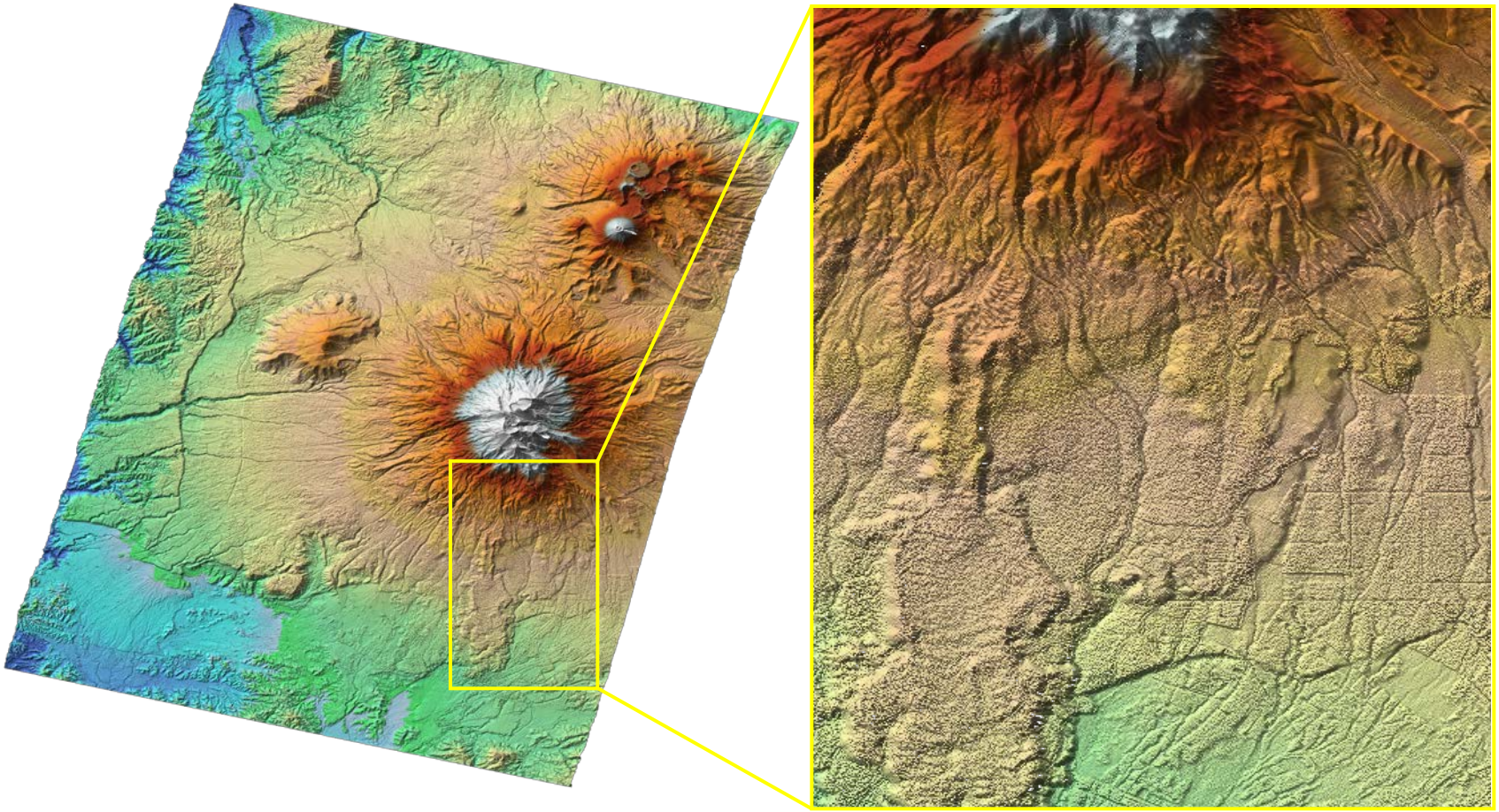




Nimrod glacier at **82°South**
in **Left-Looking Mode**



Pursuit Monostatic Time Lag → Loss of Coherence for Vegetation and Water Bodies :(



Mount Ruapehu, New Zealand, 2010-09-07T17:36:40

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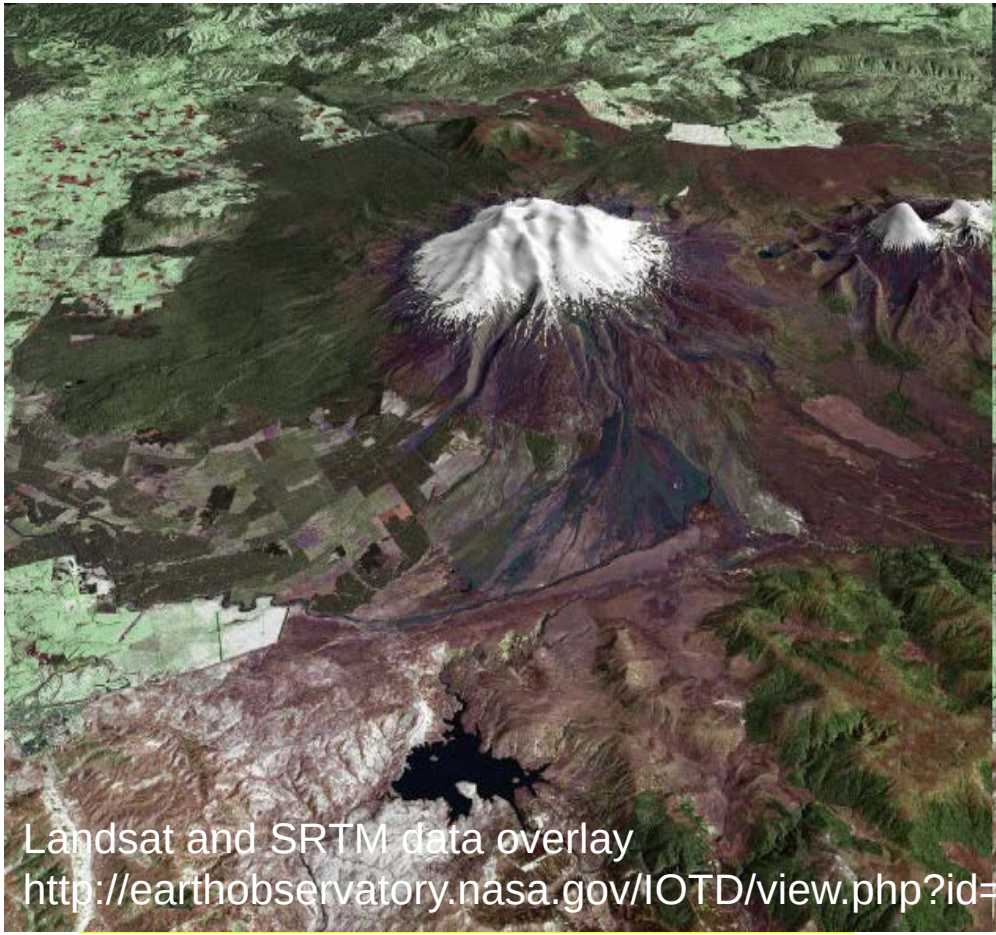
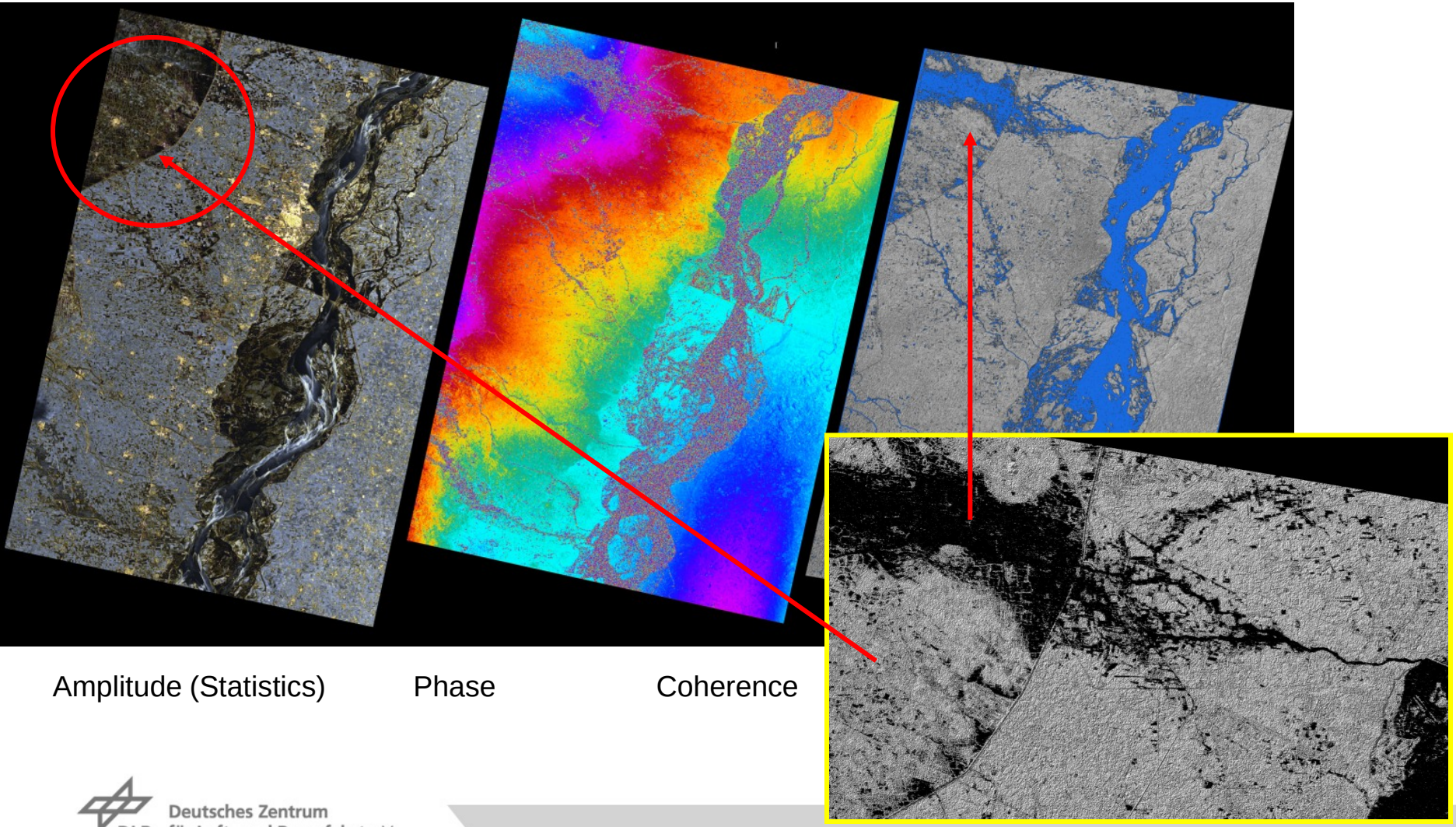


Mount Ruapehu, New Zealand, 2010-09-07T17:36:40

Pursuit Monostatic Time Lag → Loss of Coherence Used for Flood Mapping (+) Pakistan August 2010

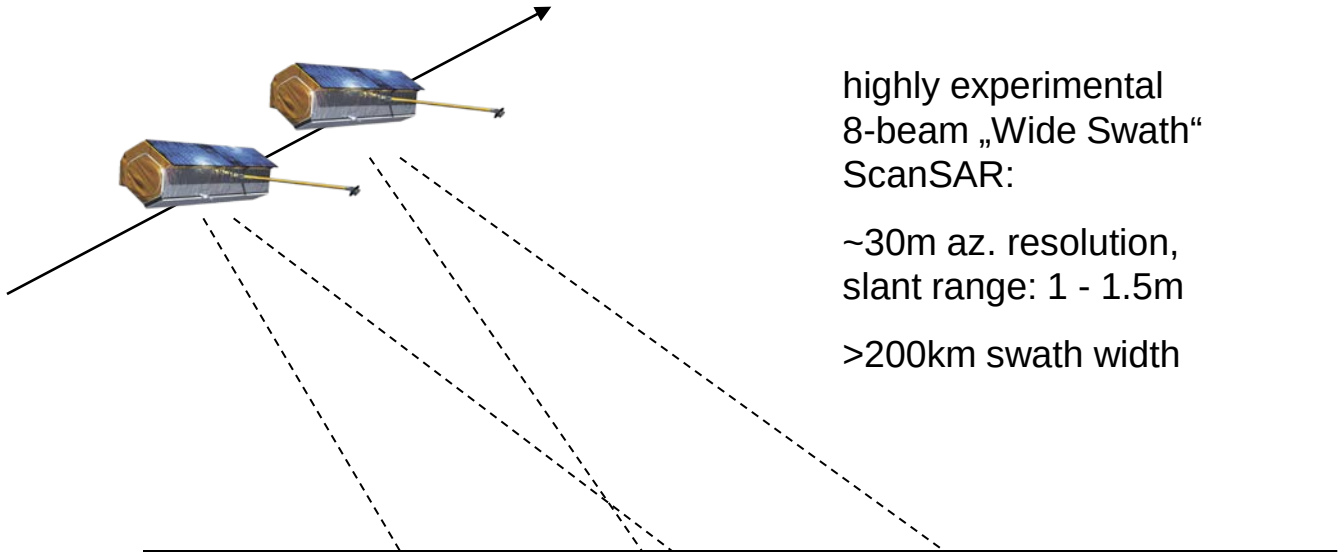


Amplitude (Statistics) Phase Coherence

TSX TDX

Manual (!) commanding by U. Steinbrecher and D. Schulze (IHR), processing with operational TMSP. *Wide-Swath-SC (and Ultra-Wide-SC) is not an operational mode !*

Experimental Commanding in PSM: 2 Adjacent, Simultaneous Wide-(8-beam)-ScanSARs



highly experimental 8-beam „Wide Swath“ ScanSAR:

~30m az. resolution, slant range: 1 - 1.5m

>200km swath width

200km + 200km

beams 1-8 9-16

2010-07-14T16:54

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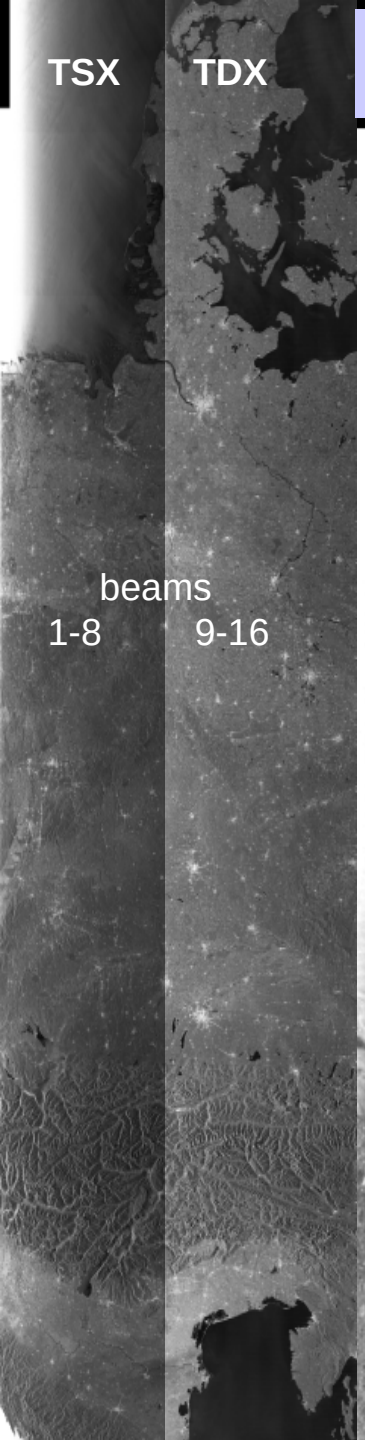

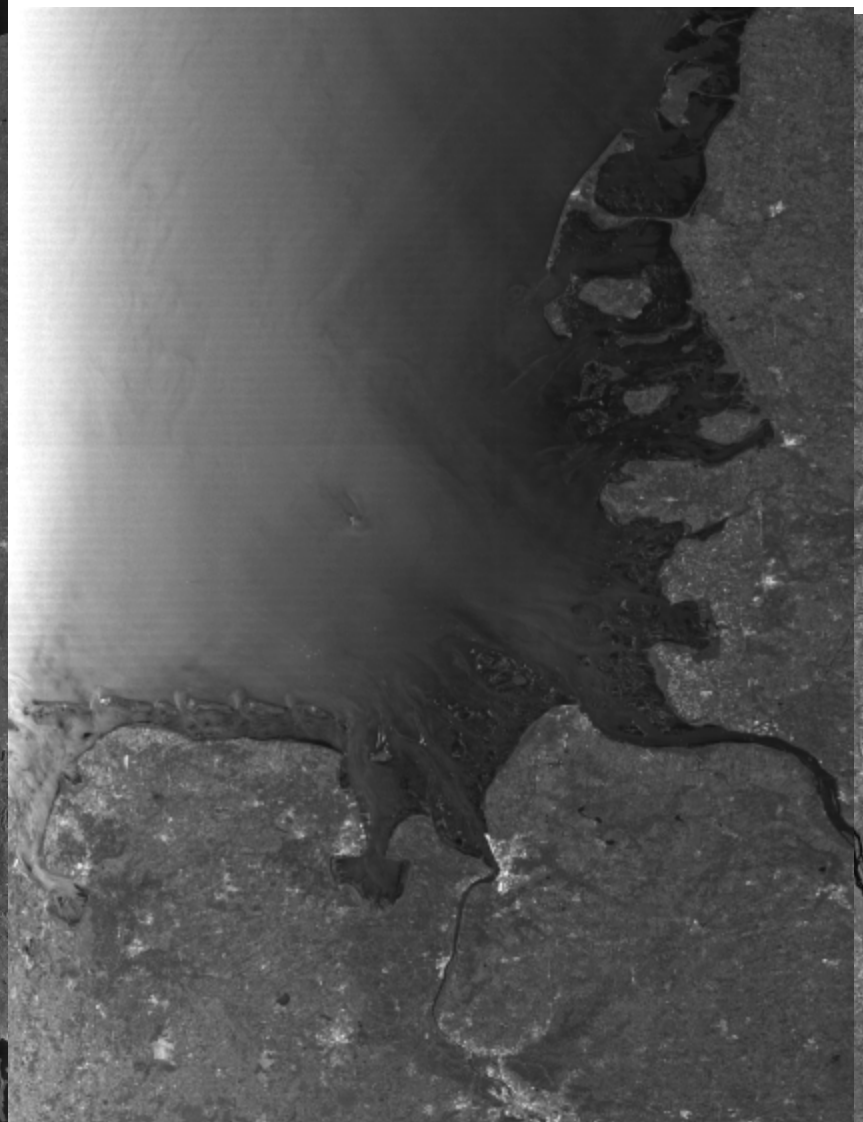

Quicklook Resolution Only

TSX TDX

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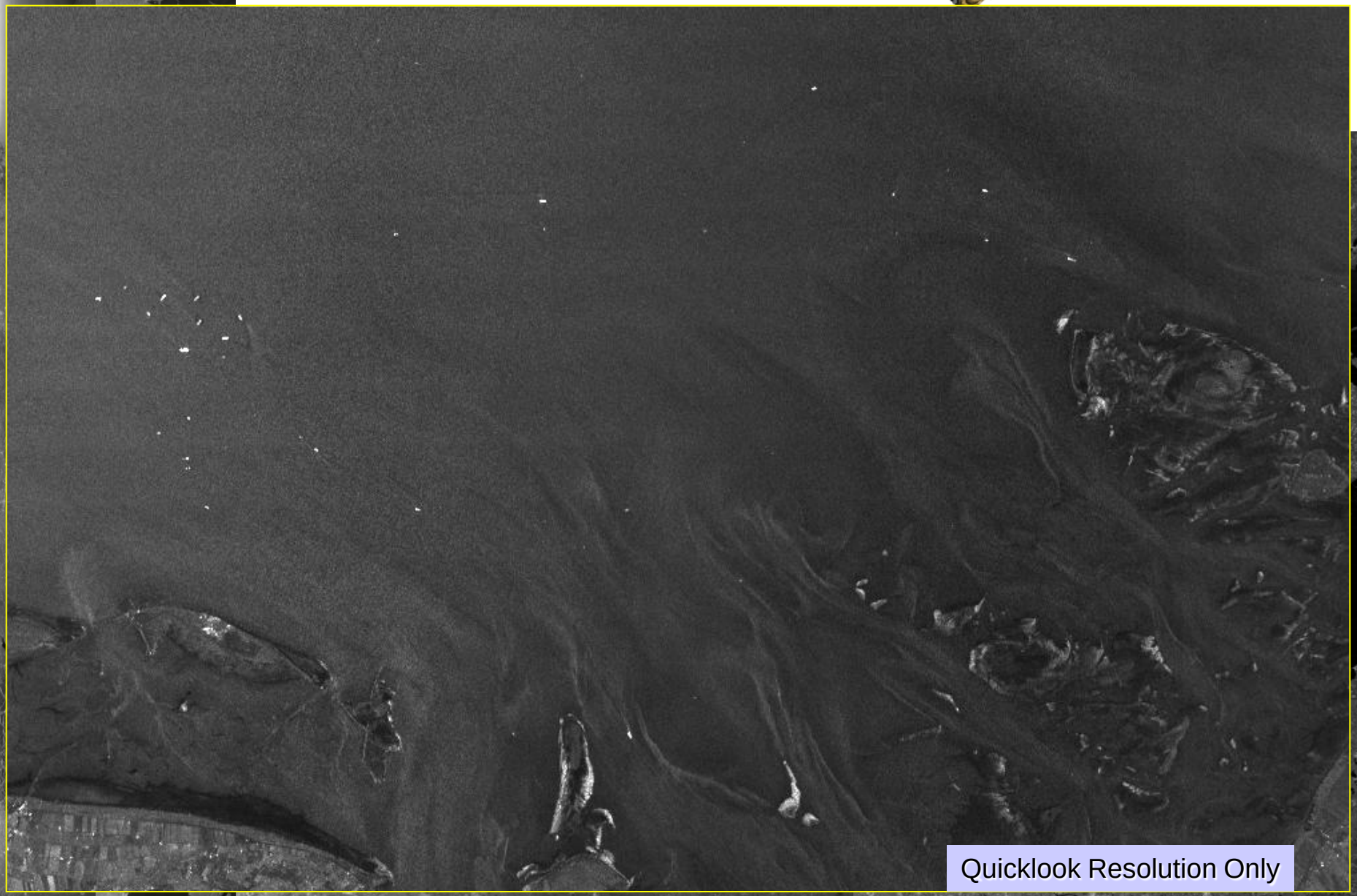

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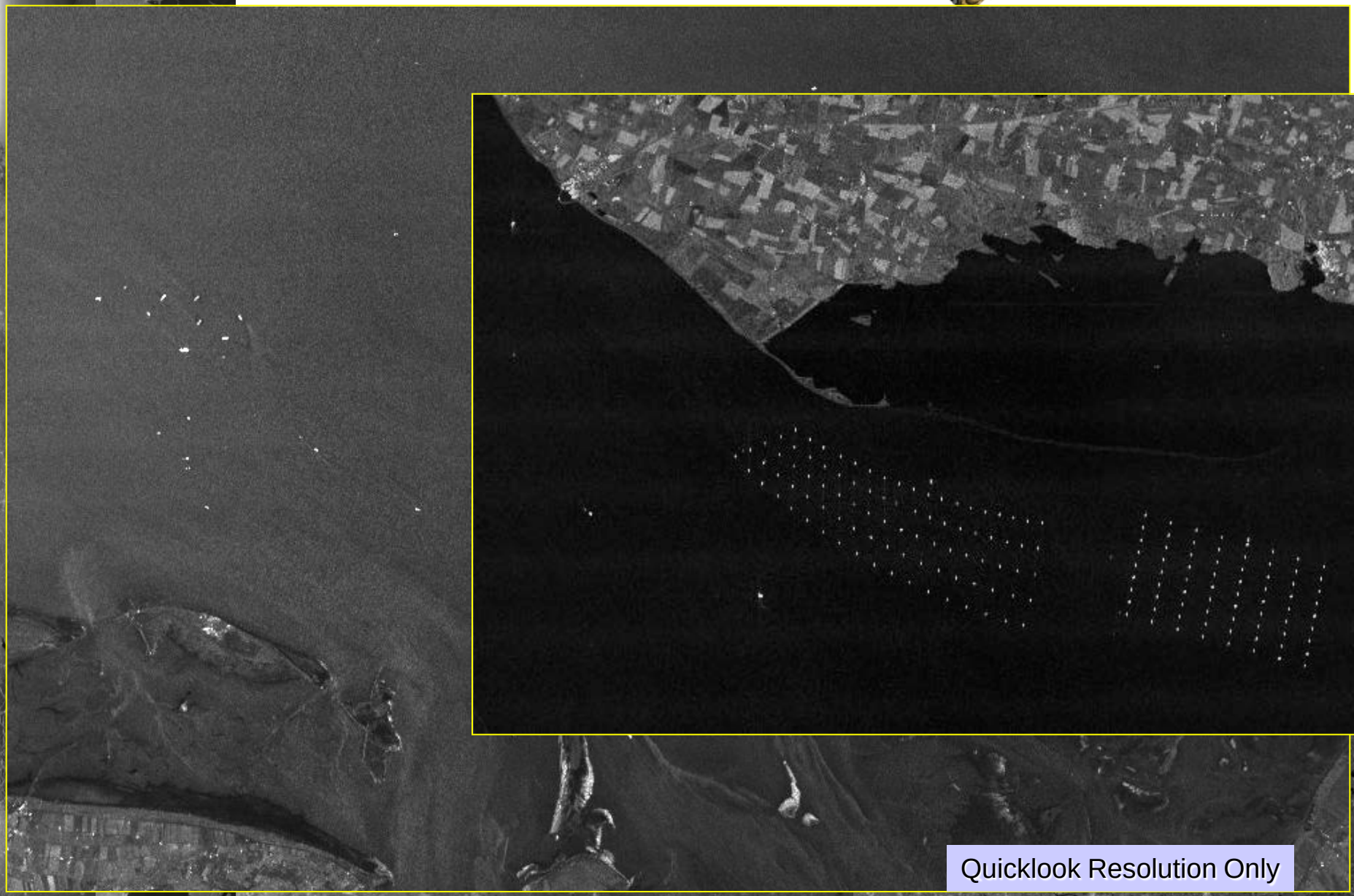
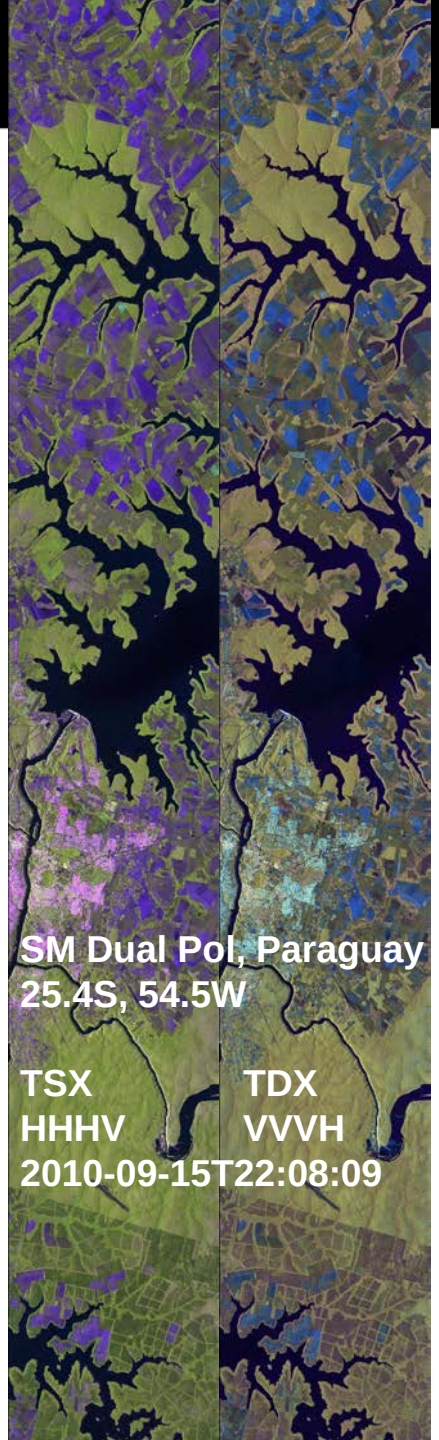
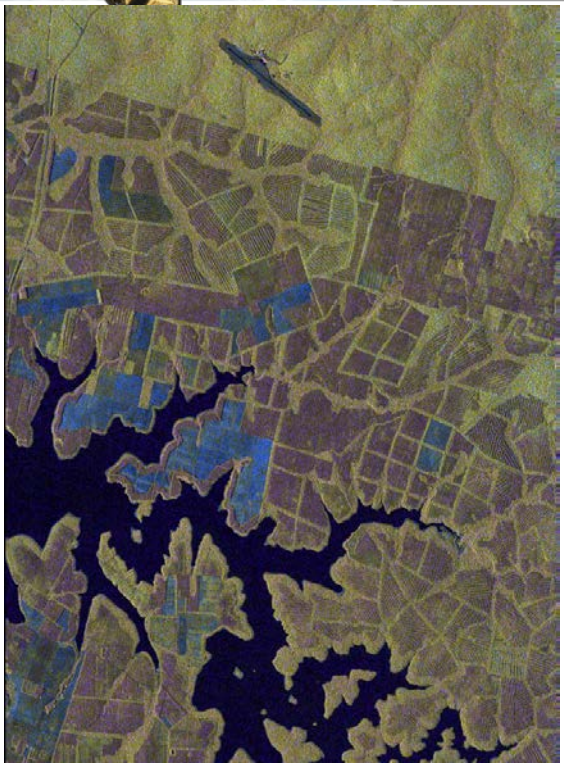


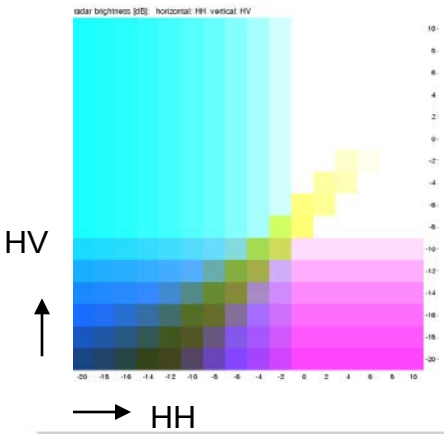
Quicklook Resolution Only

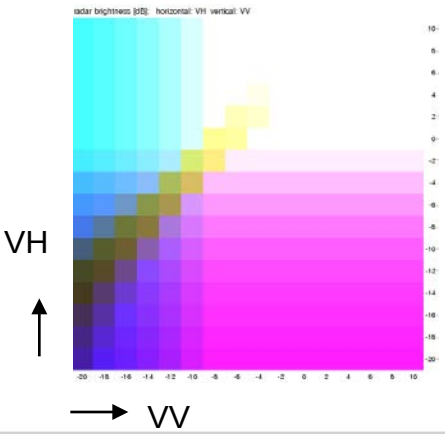


SM Dual Pol, Paraguay
25.4S, 54.5W

TSX HHHV
TDX VVVH
2010-09-15T22:08:09





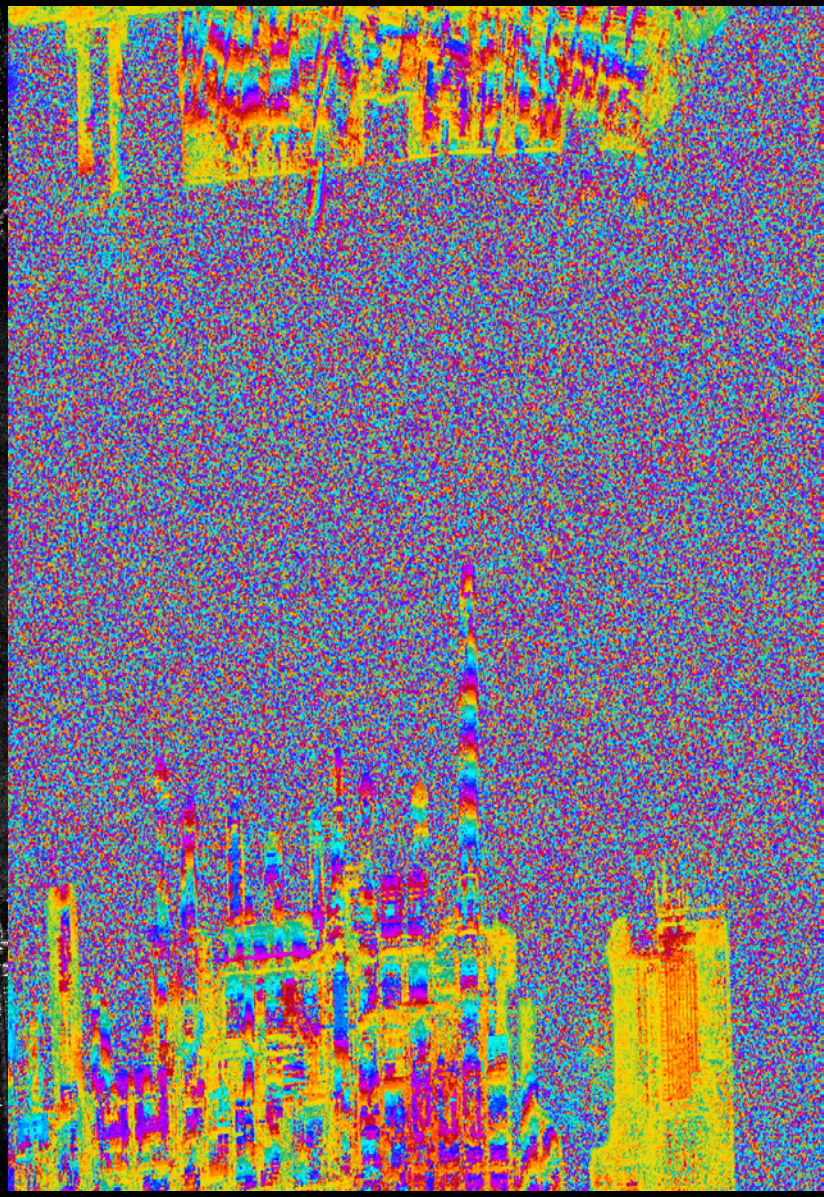


TDX HS Image over New York
2010-08-15T11:13:25
spot_010R, 20.7º incidence angle


Beekman
Tower
One Financial
Square
Lower Manhattan
Goldman Sachs
Headquarter
East Bathtub
with Crane

TSX – TDX Difference Image

www.youtube.com/user/NJPhotographer62
Norwegian Dawn Arrives in New York (August 15,2010)



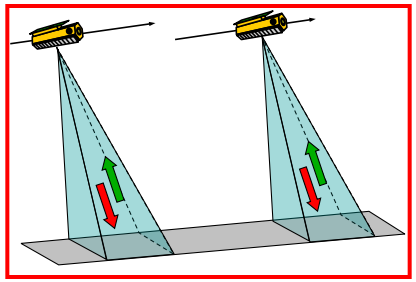
TanDEM-X Commissioning Phase(s) and Satellite Formation Built-Up

LEOP and GS checkout

Orbit drift

1 month

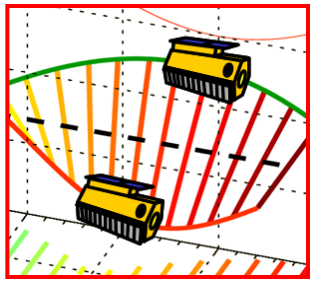
TDX monostatic commissioning phase



20 km Formation

2,5 months

Bistatic commissioning phase



Close Formation

2 months

250 - 1000 m

Bistatic Commissioning and Start of Operational Phase

- mid Oct 2010: built up of close formation and start of bistatic instrument operation
- mid Dec 2010: start of operational DEM data acquisition

User Access To TerraSAR-X Pursuit Monostatic Data

TerraSAR-X TDX basic products from pursuit monostatic commissioning phase show nominal TerraSAR-X product performance.

- Upload to EOWEB for TerraSAR-X users is planned.
- Thus:
  Ordering for SSC, MGD, GEC, EEC product generation will be possible.
- Pursuit monostatic pairs are contained.
- Close to 500 single scenes already identified and prepared for upload from ground segment commissioning activities alone.

TerraSAR-X Science Web Page: *http://sss.terrasar-x.dlr.de/*

User Access To Pursuit Monostatic Data in the TanDEM World

TerraSAR-X TSX/TDX pairs usable as an interferometric TanDEM acquisiton shall be also made available for the TanDEM-X world.

Requires

- setup and integration of new systematic workflow:
  TerraSAR-X raw data pairs => TanDEM-X CoSSC
- reprocessing of TerraSAR-X pairs as TanDEM data takes.

Then

- upload to EOWEB for TanDEM-X science users
- ordering of co-registered SSC pairs

Upload into TerraSAR-X and TanDEM-X world shall be done in parallel.

TanDEM-X Science Service System *http://tandemx-science.dlr.de/*

Thank You For Your Attention