Racurs' experince in working with Kompsat satellite images

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PHOTOMOD

Digital Photogrammetric Workstation PHOTOMOD

Complete image data processing workflow without third party products

PHOTOMOD GeoMosaic

Powerful software solution for combining georeferenced images from any sources into single seamless, color-balanced, geometrically perfect mosaic.

PHOTOMOD UAS

Stand-alone full photogrammetric UAS-oriented software.

PHOTOMOD Radar

Software is intended for full-scale processing of Earth remote sensing data acquired by spaceborne radars with synthesized antenna aperture (SAR)

PHOTOMOD Lite free

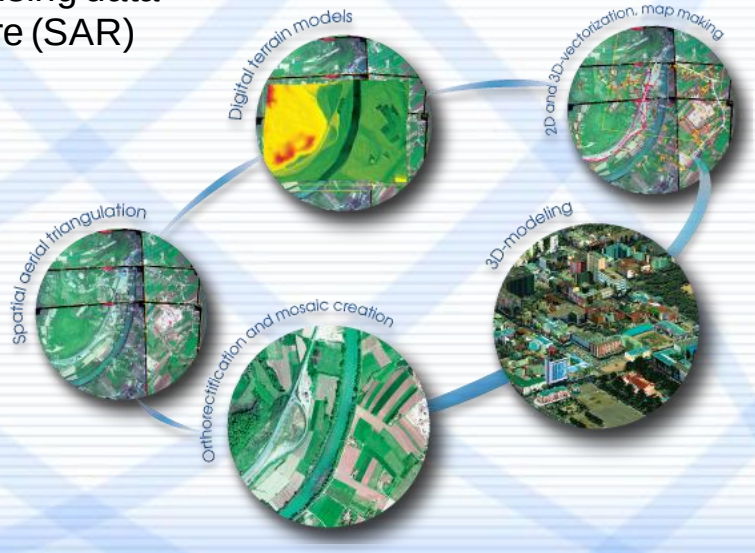
Software package which has all features of DPW PHOTOMOD

PHOTOMOD GeoCalculator free

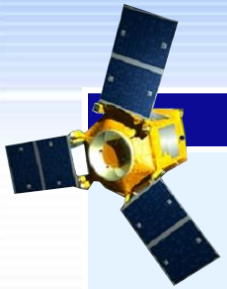
Geodetic calculator

PHOTOMOD DirectGeoreferencing free

Calculations of estimating accuracy assessment of terrain measurements



Scanner satellite images processing



Sensor model	Imaging system	Data format
Rigorous sensor model	ALOS	CEOS
	FORMOSAT-2	DIMAP
	KOMPSAT-2	TIFF/GeoTIFF
	Spot 1-4/HRV, HRVIR	CEOS (SISA, CAP), DIMAP
	Spot 5/HRG, HRS	DIMAP
	TERRA/ASTER	HDF
	EROS A, B	RAW, TIFF
	Resurs-DK	GeoTIFF (+metadataXML)
General-purpose model (DLT and its modifications)	Landsat 7/ETM+	TIFF/GeoTIFF, HDF
	IRS-1C, 1D/PAN	Super Structured, HDF, Fast C
	IRS P6 (Resourcesat-1)	Super Structured, HDF, Fast C
With the use of RPC	IKONOS	TIFF/GeoTIFF(+RPC), NITF
	Spot 6,7	DIMAP v2
	KOMPSAT-2, 3, 3A	TIFF/GeoTIFF(+RPC)
	TH-1,2	TIFF/GeoTIFF(+RPC)
	QuickBird	TIFF/GeoTIFF(+RPC)
	OrbView-3	TIFF/GeoTIFF(+RPC)
	Cartosat-1 (IRS P5)	TIFF/GeoTIFF(+RPC)
	WorldView-1, 2	TIFF/GeoTIFF(+RPC)
	GeoEye-1	TIFF/GeoTIFF(+RPC)
	RapidEye	NITF
	ALOS PRISM/AVNIR-2	TIFF/GeoTIFF(+RPC)
	Canopus-V, BKA, Resurs-P	TIFF/GeoTIFF(+RPC)
	Pleiades	DIMAP v2

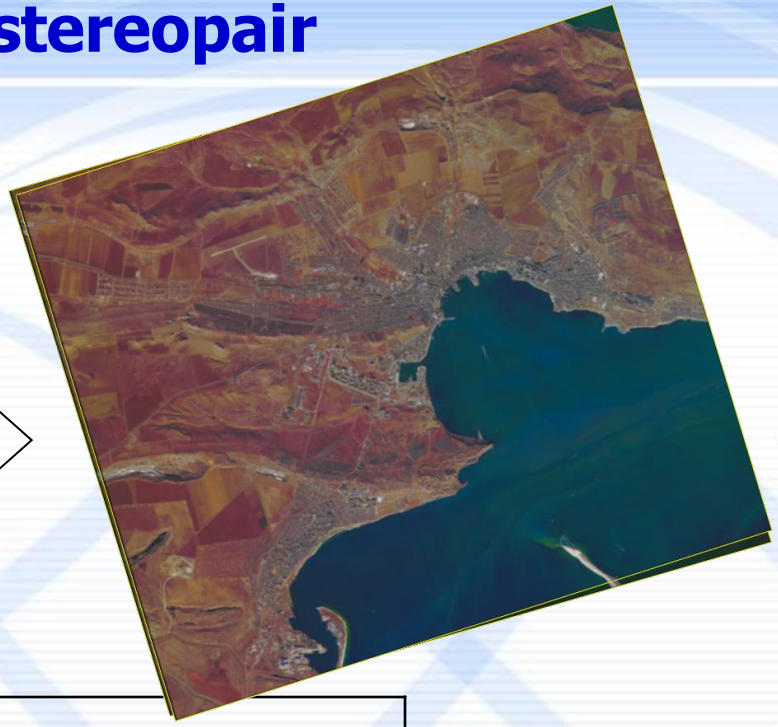
Remote Sensing Data tests in PHOTOMOD

Sensor	Test type	Year
QuickBird	Accuracy estimation	2005
SPOT-5	Accuracy estimation and interpretability	2006
Cartosat-1	Data Evaluation	2007
GeoEye-1	Accuracy estimation	2009
Pleiades	Accuracy estimation	2013
SPOT-6/7	Accuracy estimation and estimation of interpretation properties	2014
KazEOSat-1	Accuracy estimation	2015
Resurs-P	Accuracy estimation	2015
Kanopus-V (level 1)	Accuracy estimation	2015
TerraSAR-X	Quality assessment of geometric and radiometric parameters	2015
Kanopus-V (level 2)	Accuracy estimation	2016
Kompsat-3	Accuracy and output DSM quality estimation	2016

KOMPSAT-3 and 3A satellite information

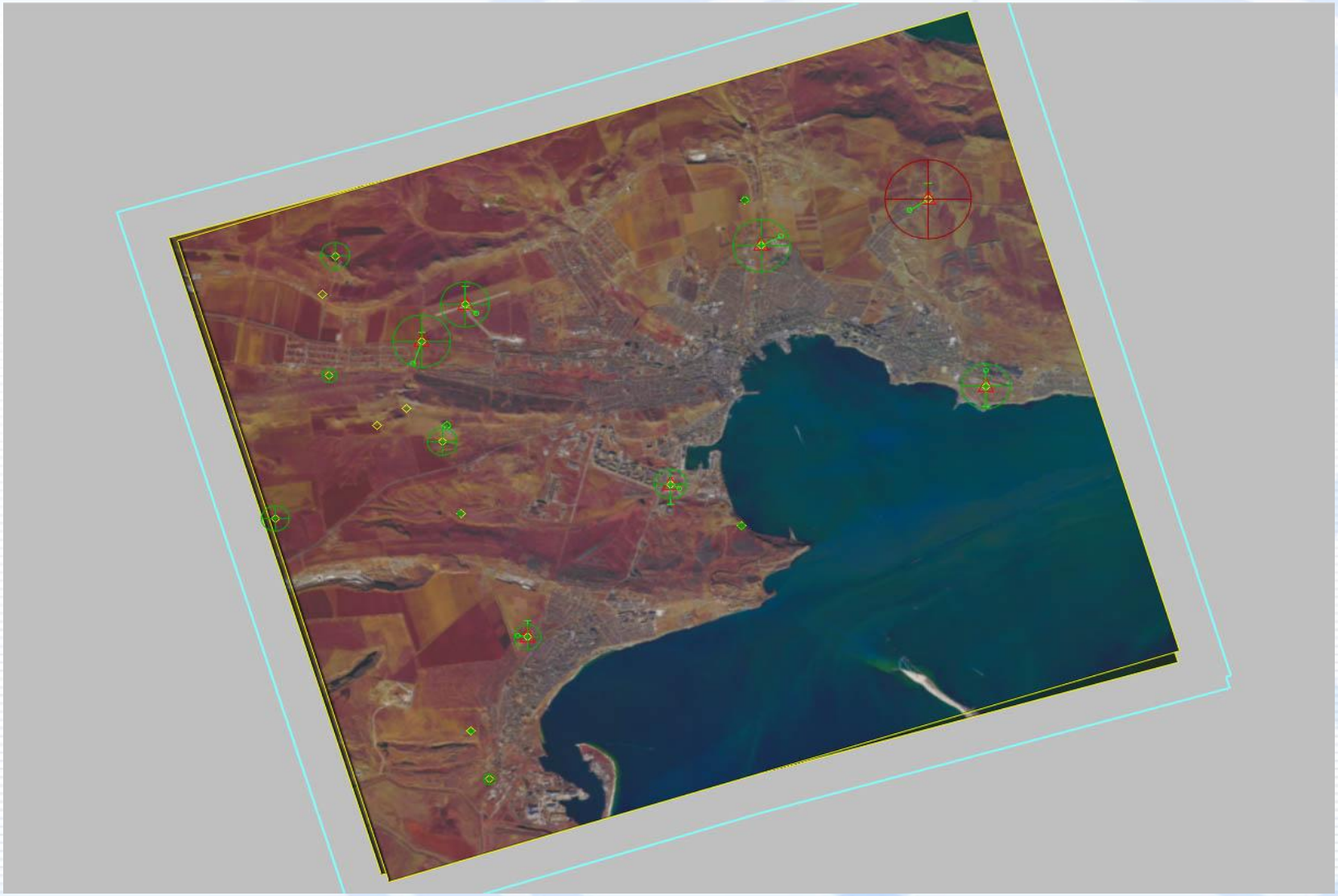
Parameter	KOMPSAT-3	KOMPSAT-3A
Ground Sampling Distance	PAN 0.7m / MS 2.8m PAN 0.5m / MS 2m	PAN 0.5m / MS 2m PAN 0.4m / MS 1.6m
Swath Width	16 km (nadir)	13 km (nadir)
Spectral Bands	PAN: 450 nm ~ 900 nm MS1(Blue) : 450 nm ~ 520 nm MS2(Green) : 520 nm ~ 600 nm MS3(Red) : 630nm ~ 690nm MS4(NIR) : 760 nm ~ 900 nm	PAN: 450 nm ~ 900 nm MS1(Blue) : 450 nm ~ 520 nm MS2(Green) : 520 nm ~ 600 nm MS3(Red) : 630nm ~ 690nm MS4(NIR) : 760 nm ~ 900 nm
Location Accuracy	< 70 m CE 90 < 40 m CE 90 with POD / PAD (Expected)	< 70 m CE 90 (Specification) < 10 m CE 90 with POD / PAD (Measured)
Radiometric resolution	14 bits/pixel	14 bits/pixel
Mean LTAN (Local Time on Ascending Node)	13:30	13:30
Orbit high	685 km	528 км
Orbit inclination	97.513º	98.13º

KOMPSAT 3 stereopair



Parameters	Images	
ID	L0F_20151102172047_18466_024 Level1R PAN PhPanSharpened	L0F_20151102172119_18466_024 Level1R PAN PhPanSharpened
Acquisition date and time	02/11/2015 10:20:32.982	02/11/2015 10:21:46.763
Along track GSD (m)	0.816432	0.815886
Across track GSD (m)	0.7552	0.755241
Off-nadir angle, deg	22.5	22.3
Convergence angle	44.8	

Adjustment with 7 GCPs of 0.2 m accuracy



Adjustment accuracy

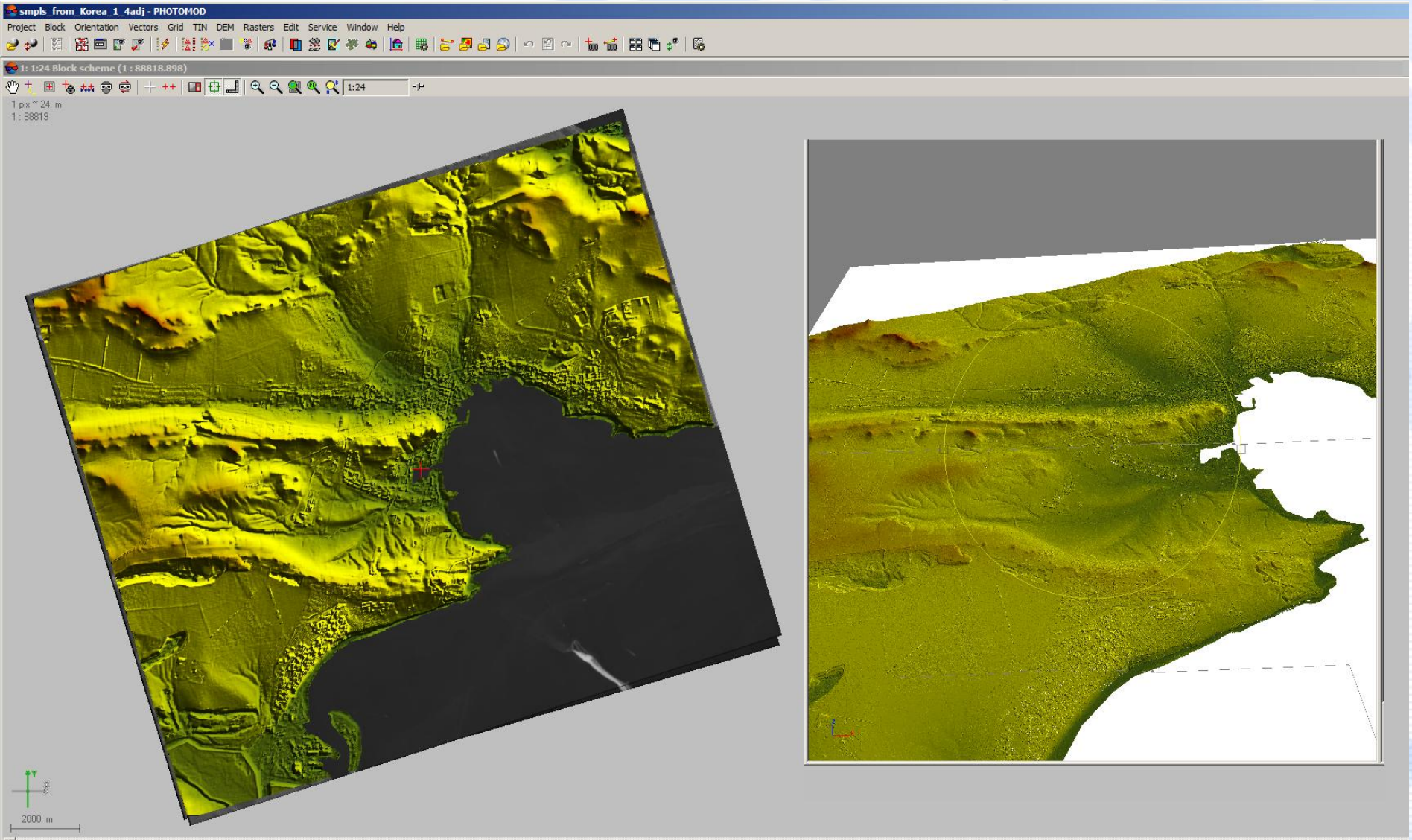
Geometric model	Control points number	RMS residual (control points), m		Max. residual (control points),m		Check points number	RMS residual (check points), m		Max. residual (check points), m	
		dS	dZ	dS	dZ		dS	dZ	dS	dZ
RPC	0	-	-	-	-	7	18.4	15.4	18.8	16.2

Geometric model	Control points number	RMS residual (control points), m		Max. residual (control points), m		Check points number	RMS residual (check points), m		Max. residual (check points), m	
		XY	Z	XY	Z		XY	Z	XY	Z
RPC+bias	1	0.24	0.28	0.24	0.28	6	1.11	0.568	1.9	1.29

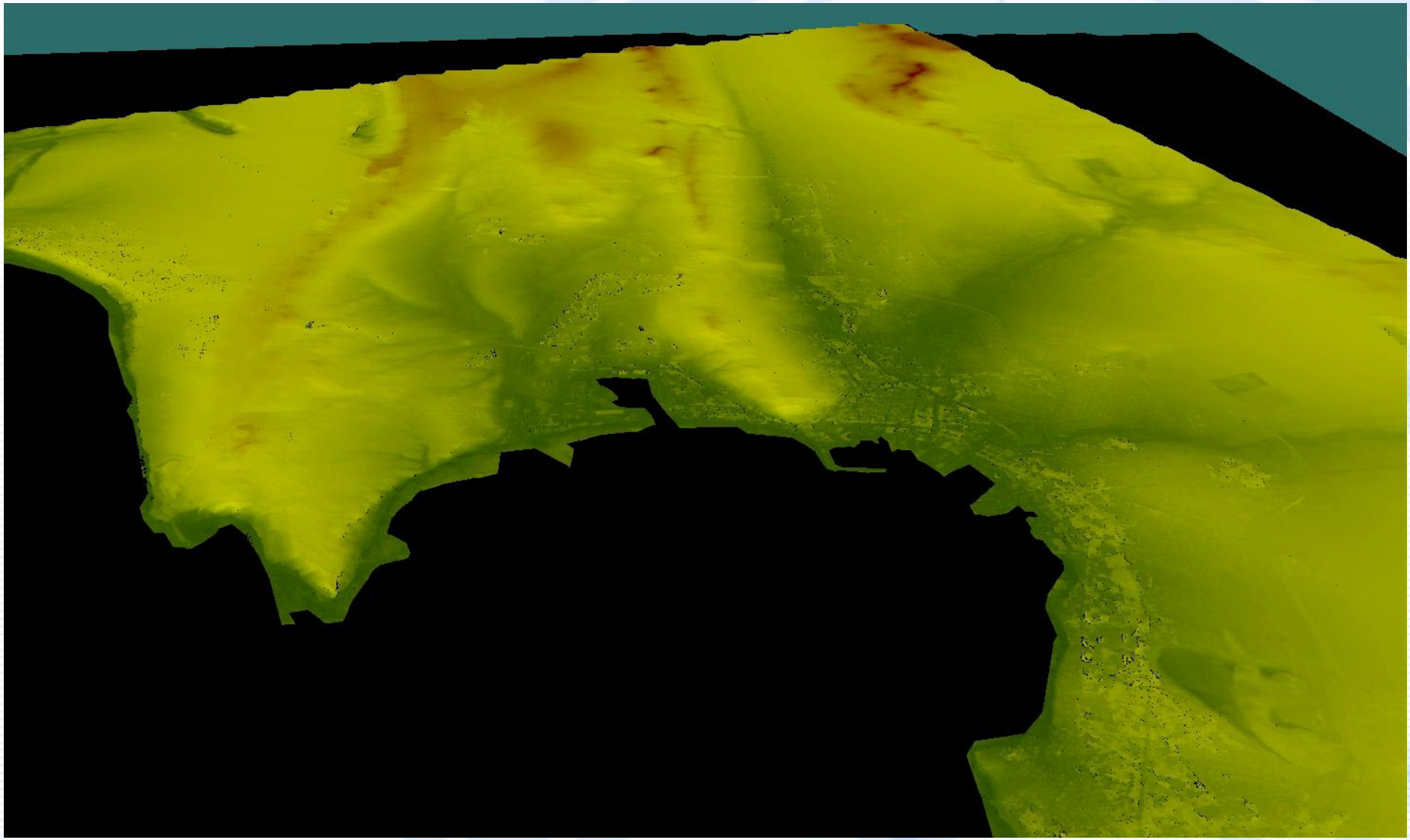
Geometric model	Control points number	RMS residual (control points), m		Max. residual (control points), m		Check points number	RMS residual (check points), m		Max. residua (check points), m	
		dS	dZ	dS	dZ		dS	dZ	dS	dZ
RPC+bias	7	0.502	0.471	0.714	0.62	0	-	-	-	-

1 GCP was enough to reach 5000 scale accuracy requirements (Russian standards)

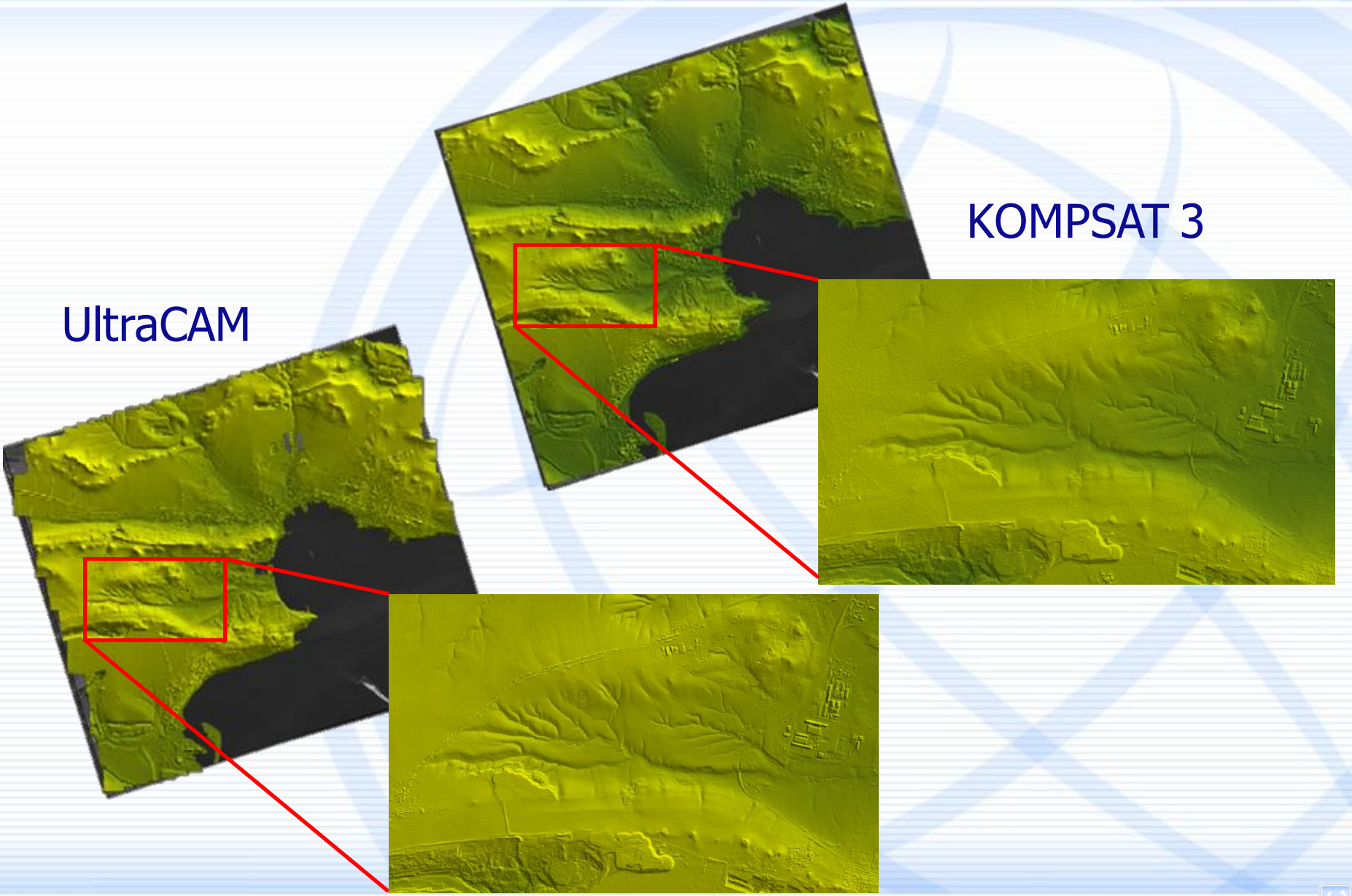
Dense DSM creation (cell size 0.7 m)



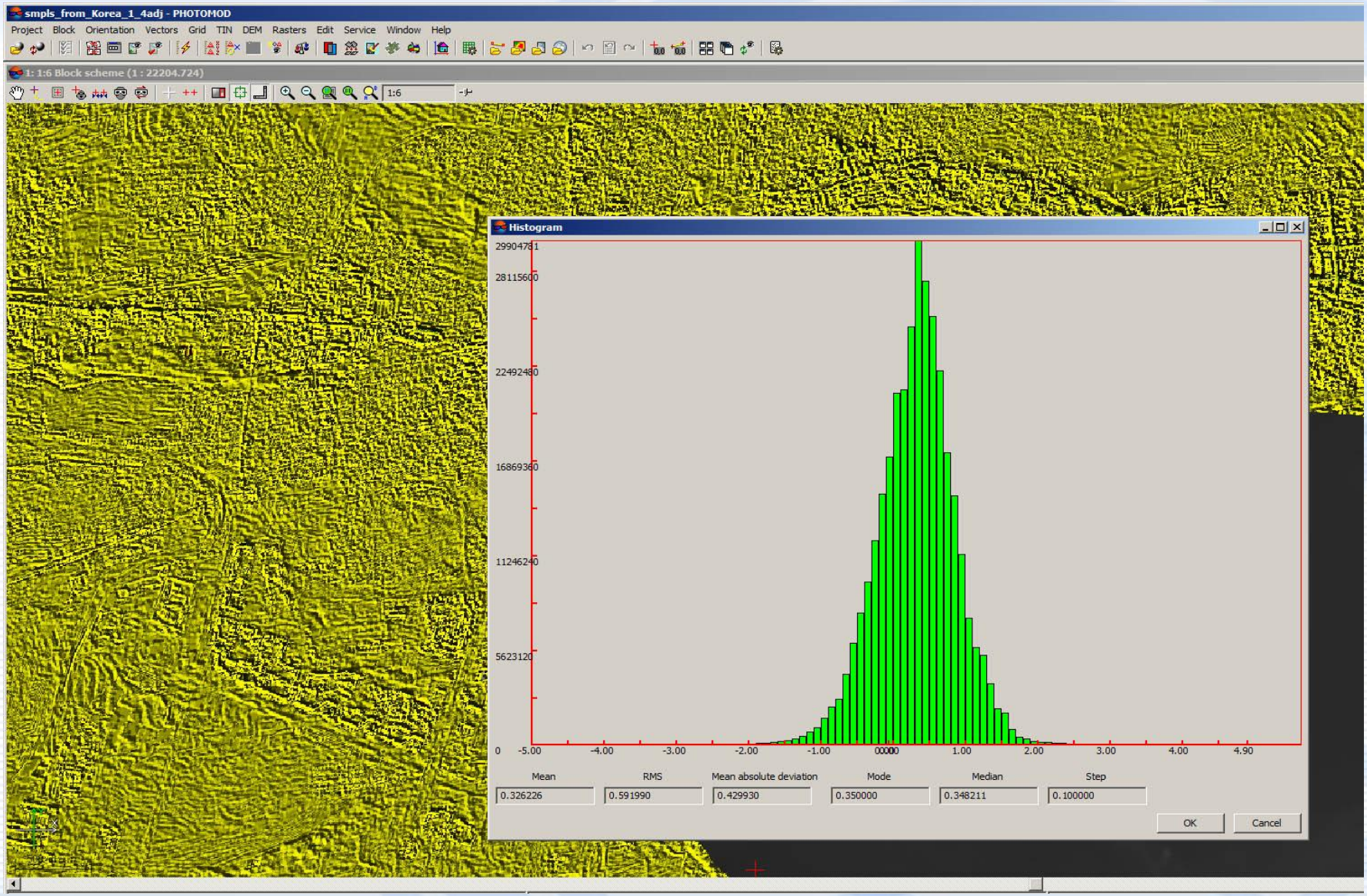
Dense DSM creation (cell size 0.7 m)



KOMPSAT 3 vs Aerial survey (GSD = 0.18 m)

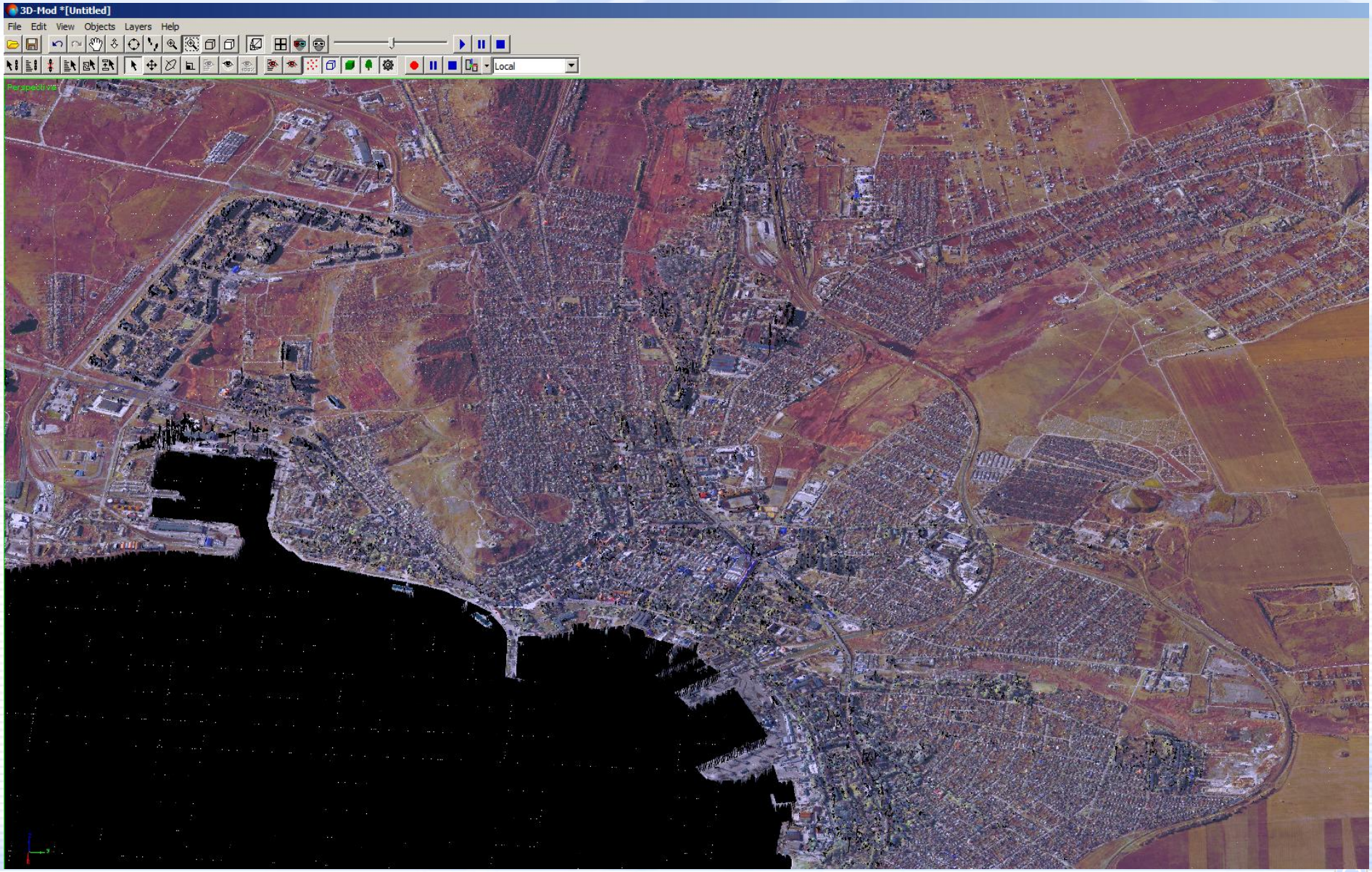


“Aerial” dDSM – “Satellite” dDSM

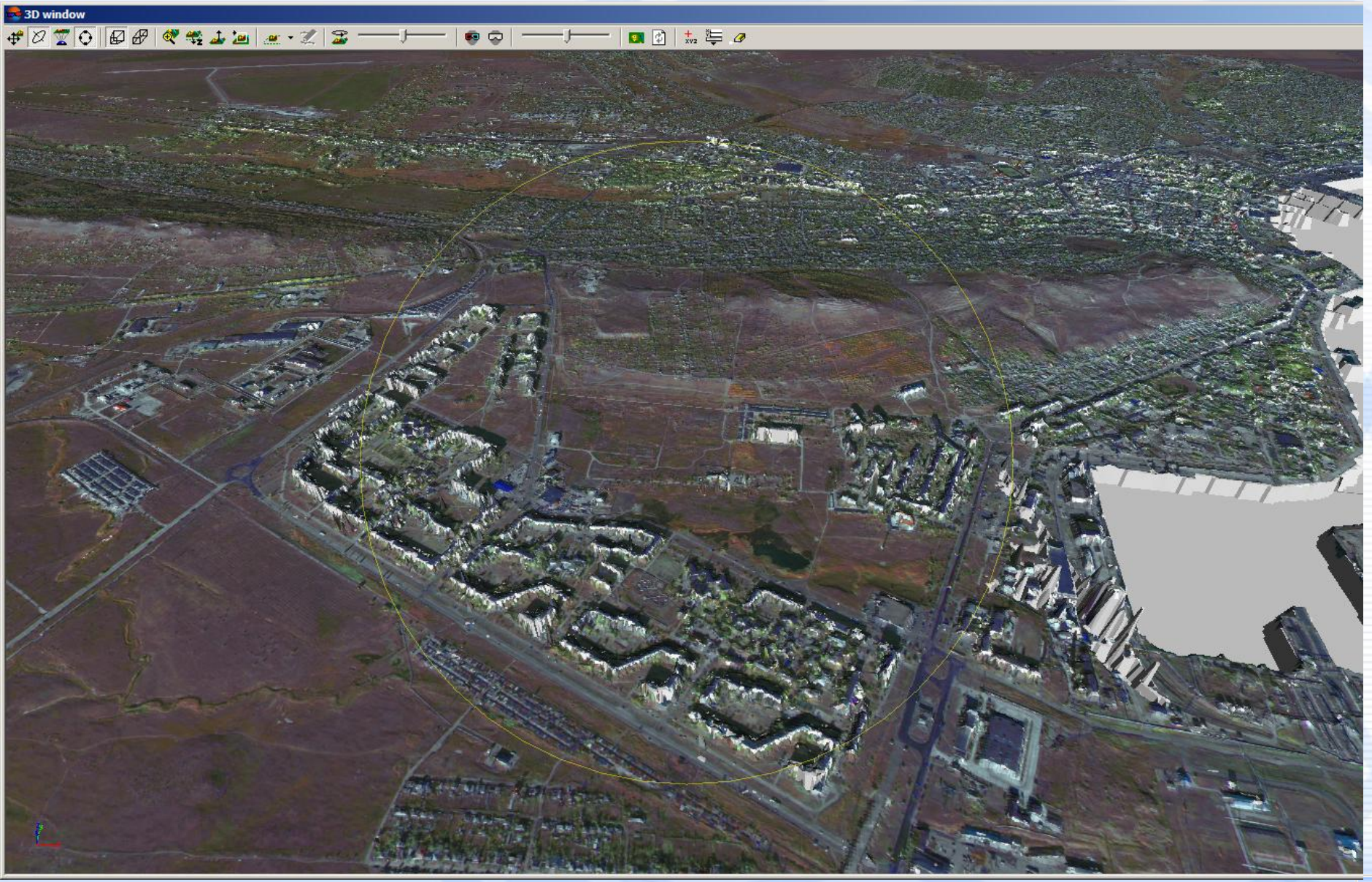


Mean Z difference = 0.326 m, **RMS = 0.59 m**

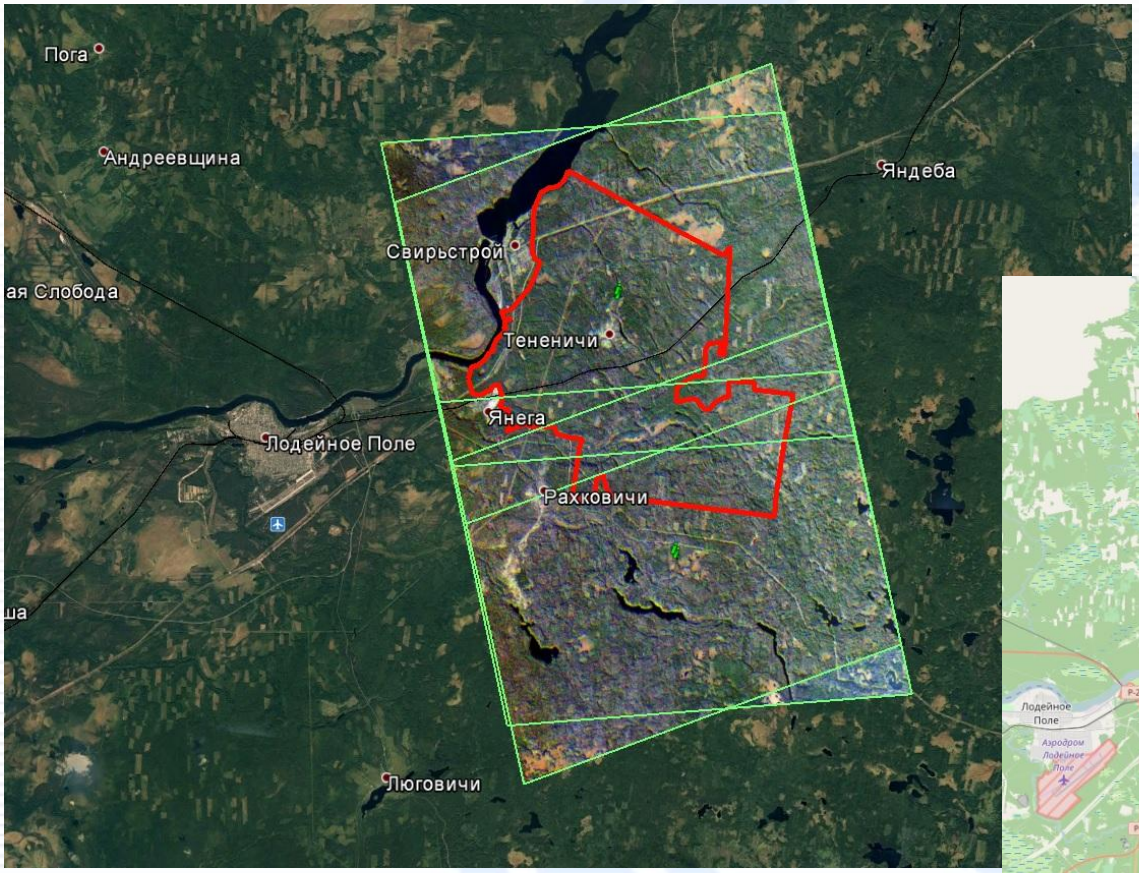
3D model from KOMPSAT 3 stereopair



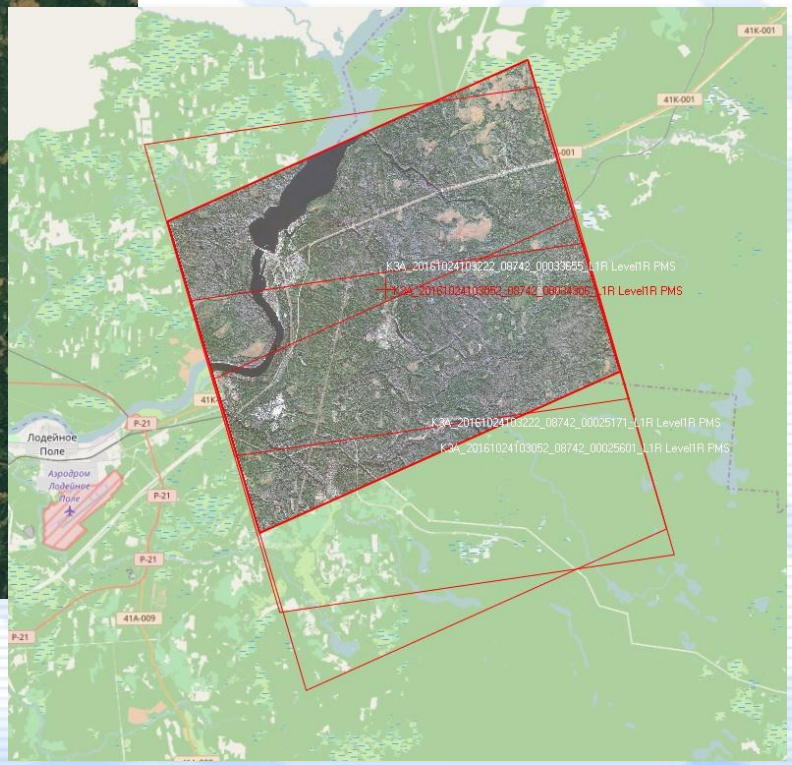
3D model from KOMPSAT 3 stereopair



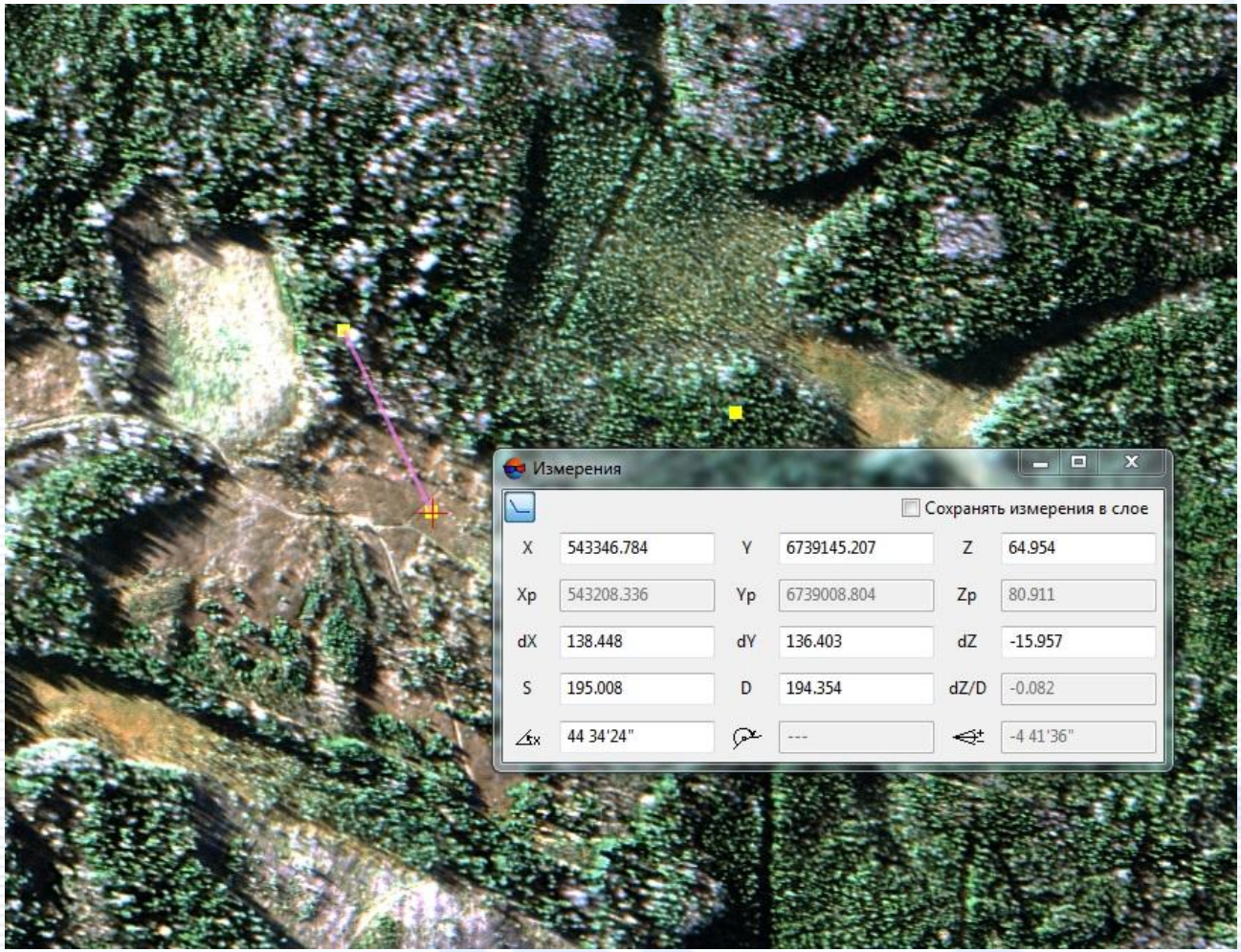
Kompsat-3A: Lodeynoe pole test site



Lodeynoe pole, Russia
Images: 4; Orbit: 1
Date: 26th October 2016
Convergence angle: 65.439



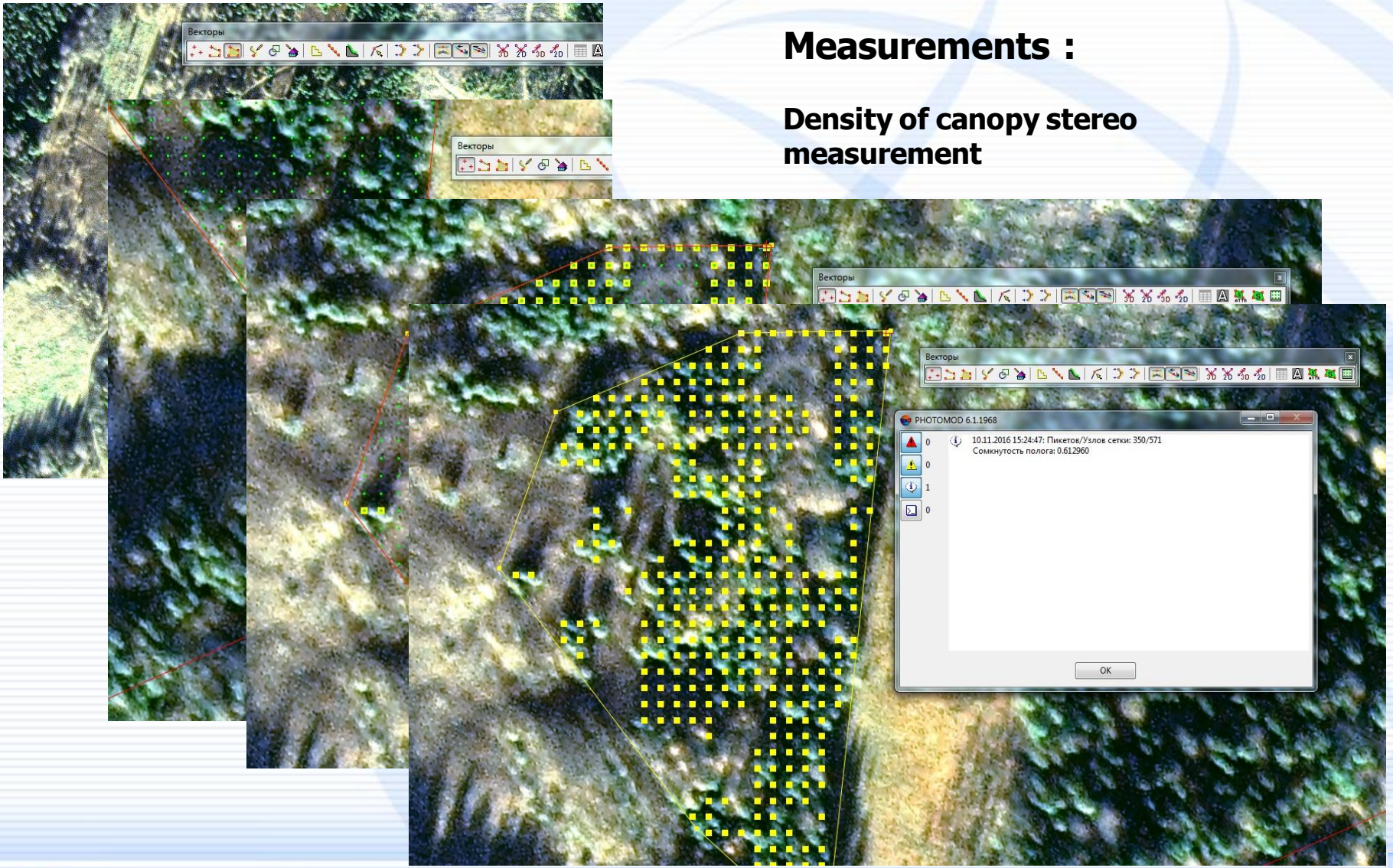
Kompsat-3A: Lodeynoe pole test site. Forest inventory via PHOTOMOD



Measurements :

Trees height stereo measurement

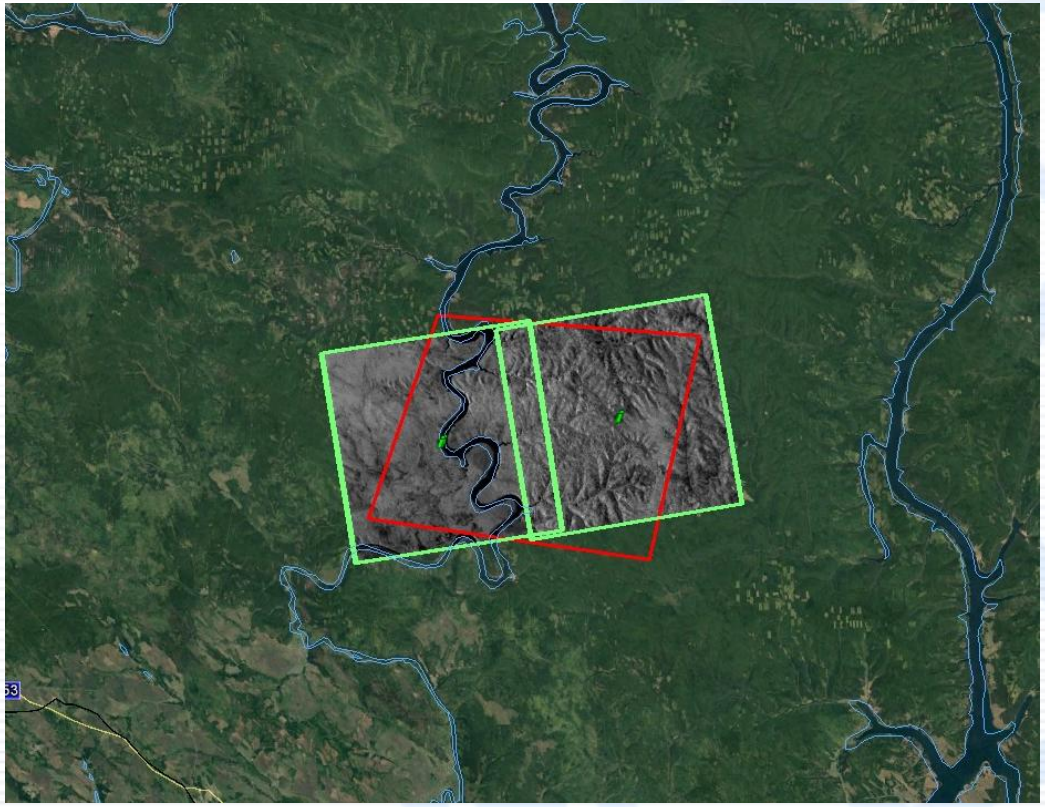
Kompsat-3A: Lodeynoe pole test site. Forest inventory via PHOTOMOD



Measurements :

Density of canopy stereo measurement

Kompsat-5: Test site in Irkutsk Region



Irkutsk Region, Russia
Scenes: 4;
ST mode, 3 m resolution;
Polarisation: HH
Interferometry with 28 days period: end of August 2016 – end of September 2016

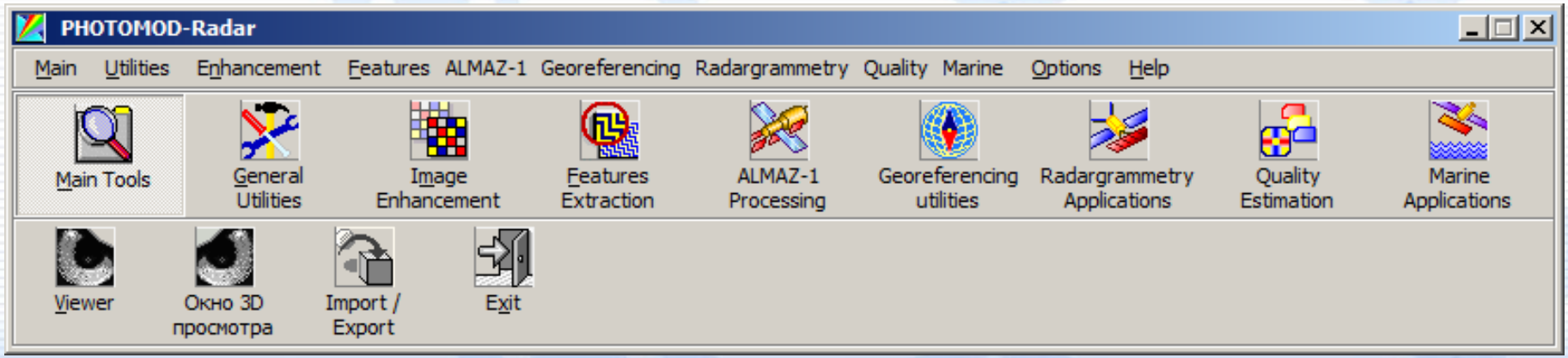
Kompsat-5 satellite information

Parameter	Value	Remark
Design life	5 years	
Instrument mass	520 kg	Without the payload module structure
Peak power consumption	1.7 kW	
Average power consumption	600 W	2 minutes operation and downlink
Center frequency	9.66 GHz (X-band) or 3.2 cm wavelength	
Standard modes	2.5m / 3m GSD, 30 km swath width	At nominal incidence angle of 45˚
High resolution modes	0.85m / 1m GSD, 5 km swath width	
Wide swath modes	5m / 20m GSD, 100 km swath width	

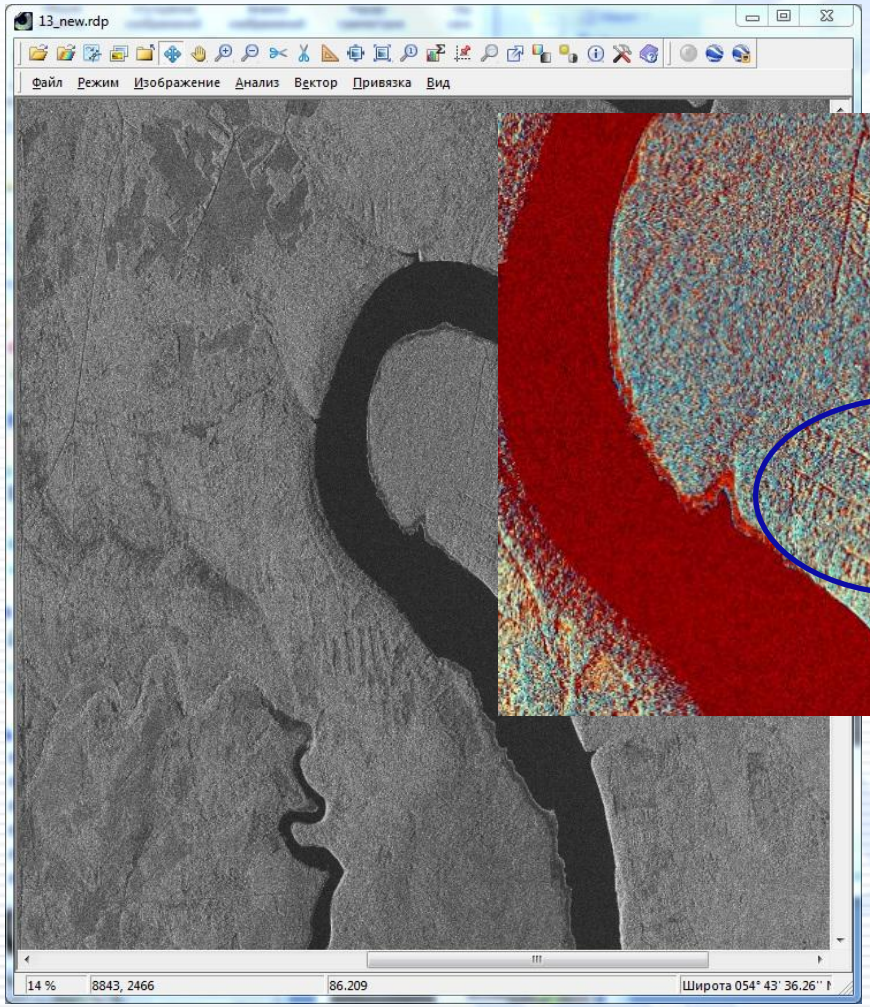
PHOTOMOD-Radar software. Basic knowledge

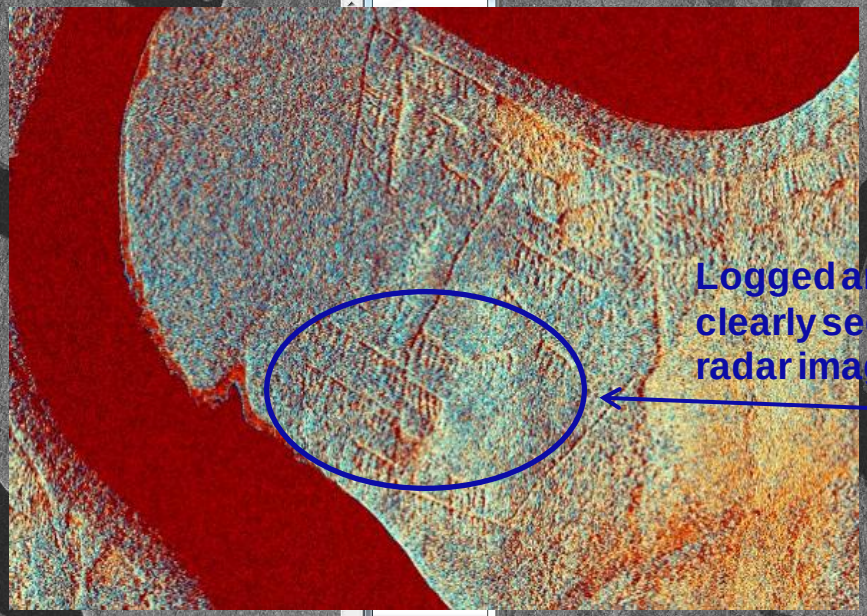
Software package «PHOTOMOD-Radar» is designed for advanced processing of the Earth remote sensing imagery obtained of spaceboard synthetic aperture radars. Software tools provide a following possibility:

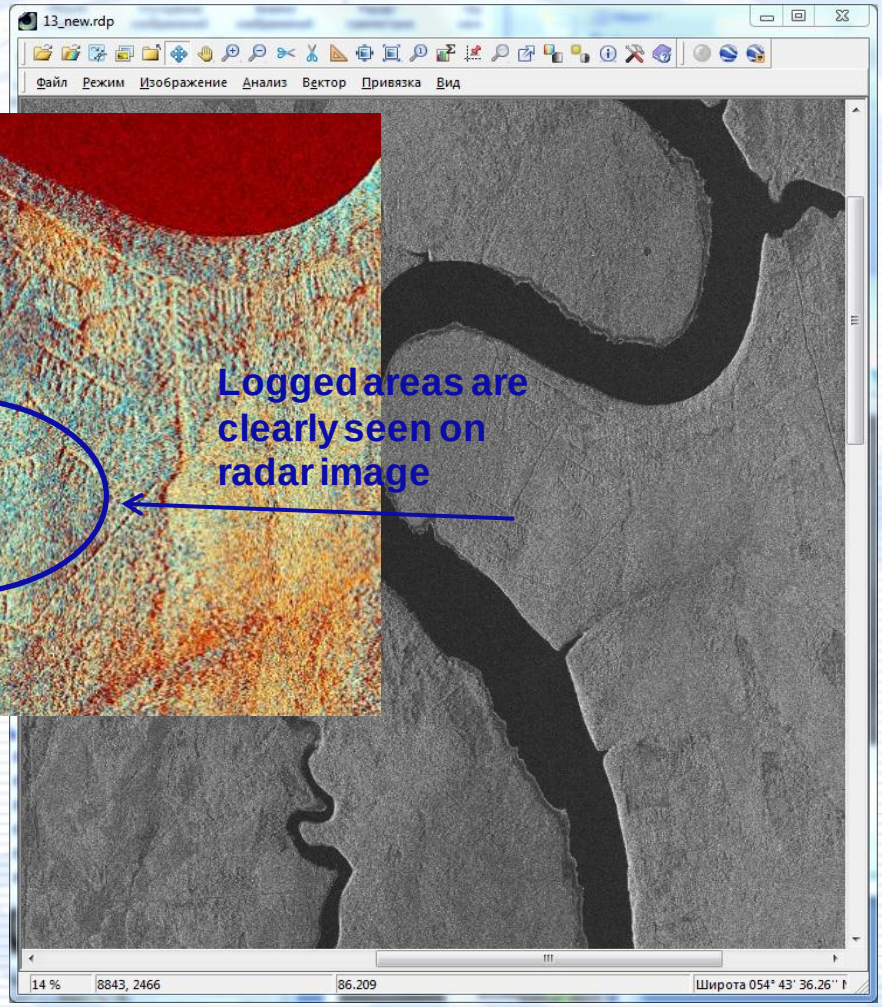
- import and visualization of SAR images;
- geometric correction;
- enhancement;
- features extraction;
- generation of DEM's via stereo processing and interferometric techniques;
- small surface shifts extraction through differential interferometry techniques;
- classification based on polarimetry analysis;
- ships detection;
- sea surface parameters estimation;
- oil slicks detection;
- tracking of objects;
- coherent changes detection;
- end so on.



Kompsat-5: Detecting logged areas



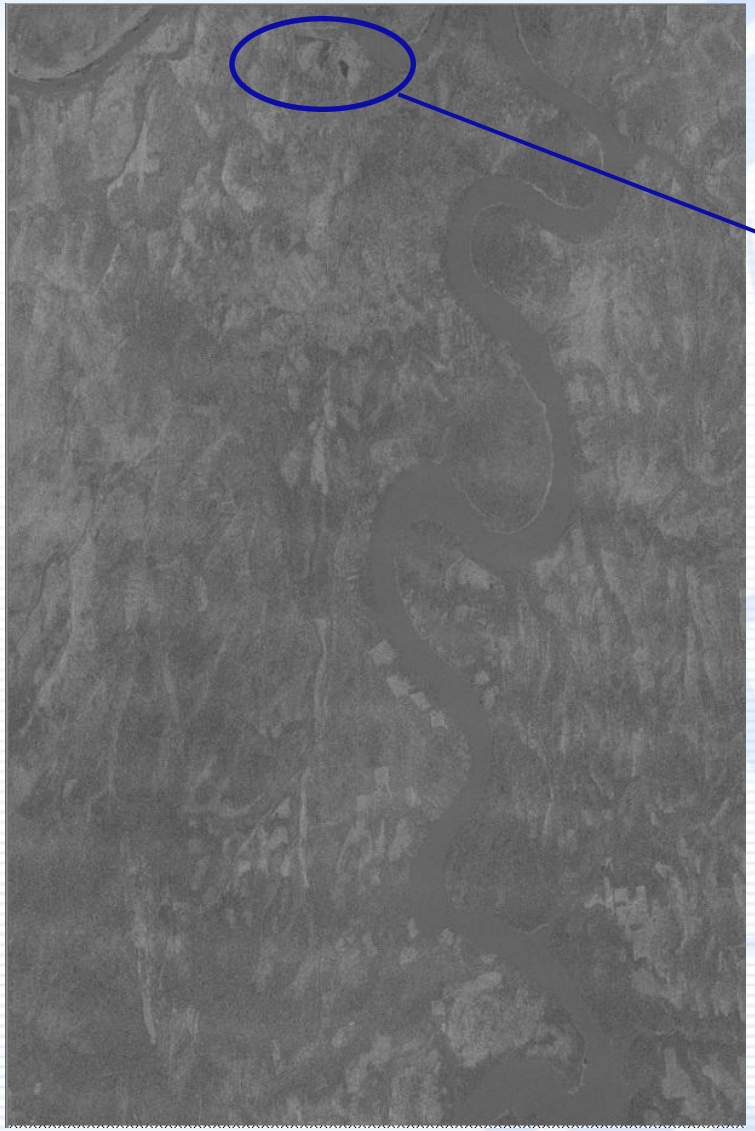


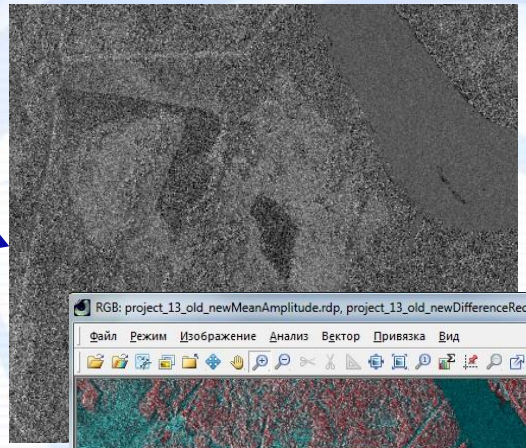


August 2016

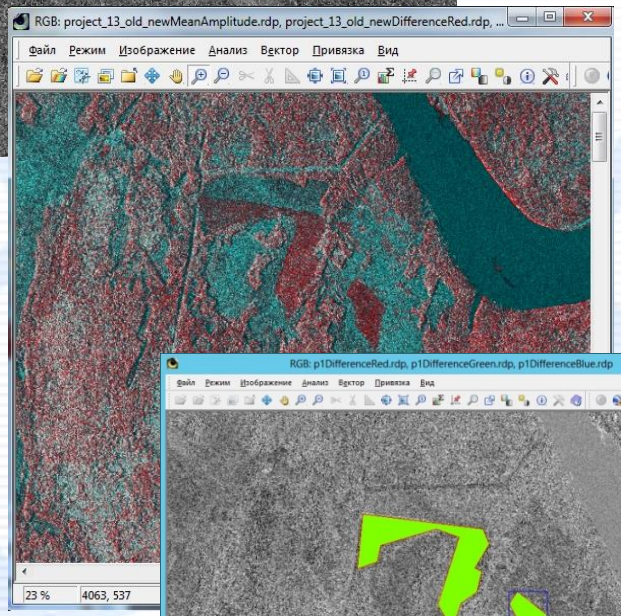
September 2016

Kompsat-5: Detecting changed areas. Coherent combining

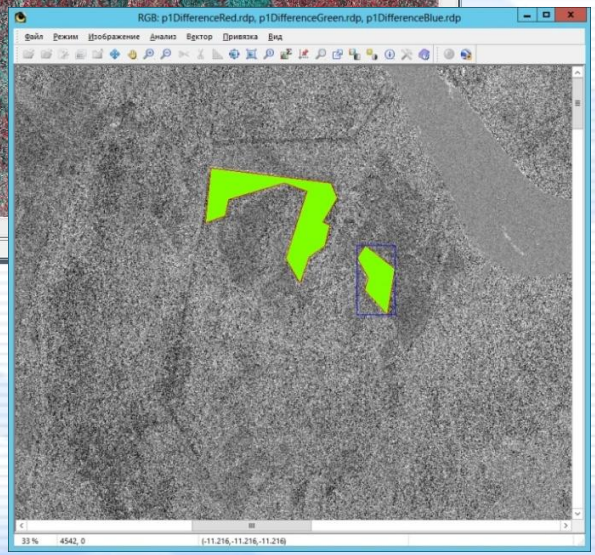




Difference visualization



Difference in false color image



Vectorization

Thank you for your attention !