

Satellite imagery automated processing and analysis technology in IMAGE MEDIA CENTER software

Speaker : Vyacheslav Lobzenev



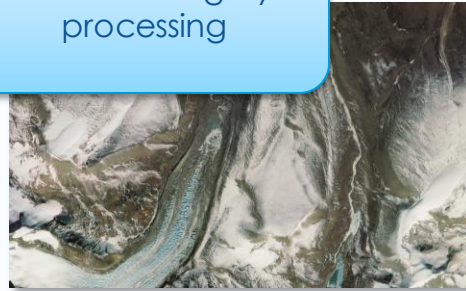


About Innovative Centre Company

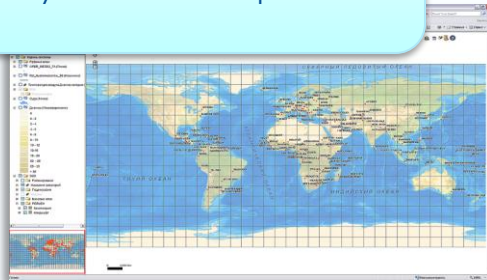
Specialized software
development



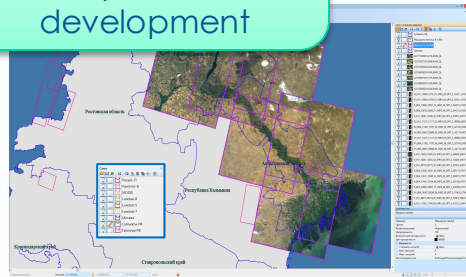
Satellite imagery
processing



Geographic information
systems development



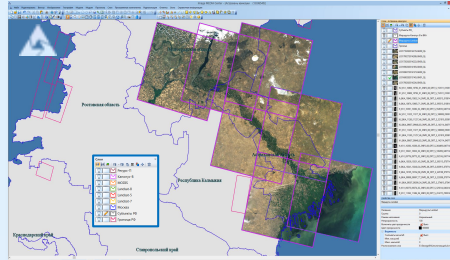
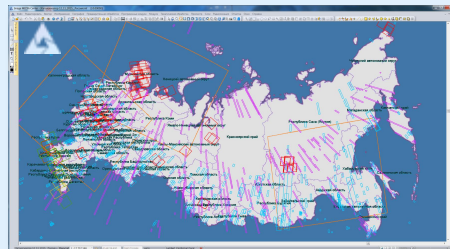
Data storage and
management
systems
development



Remote sensing data processing cycle



Data storage and catalogization



Remote sensing data processing in IMC software





Primary processing cycle

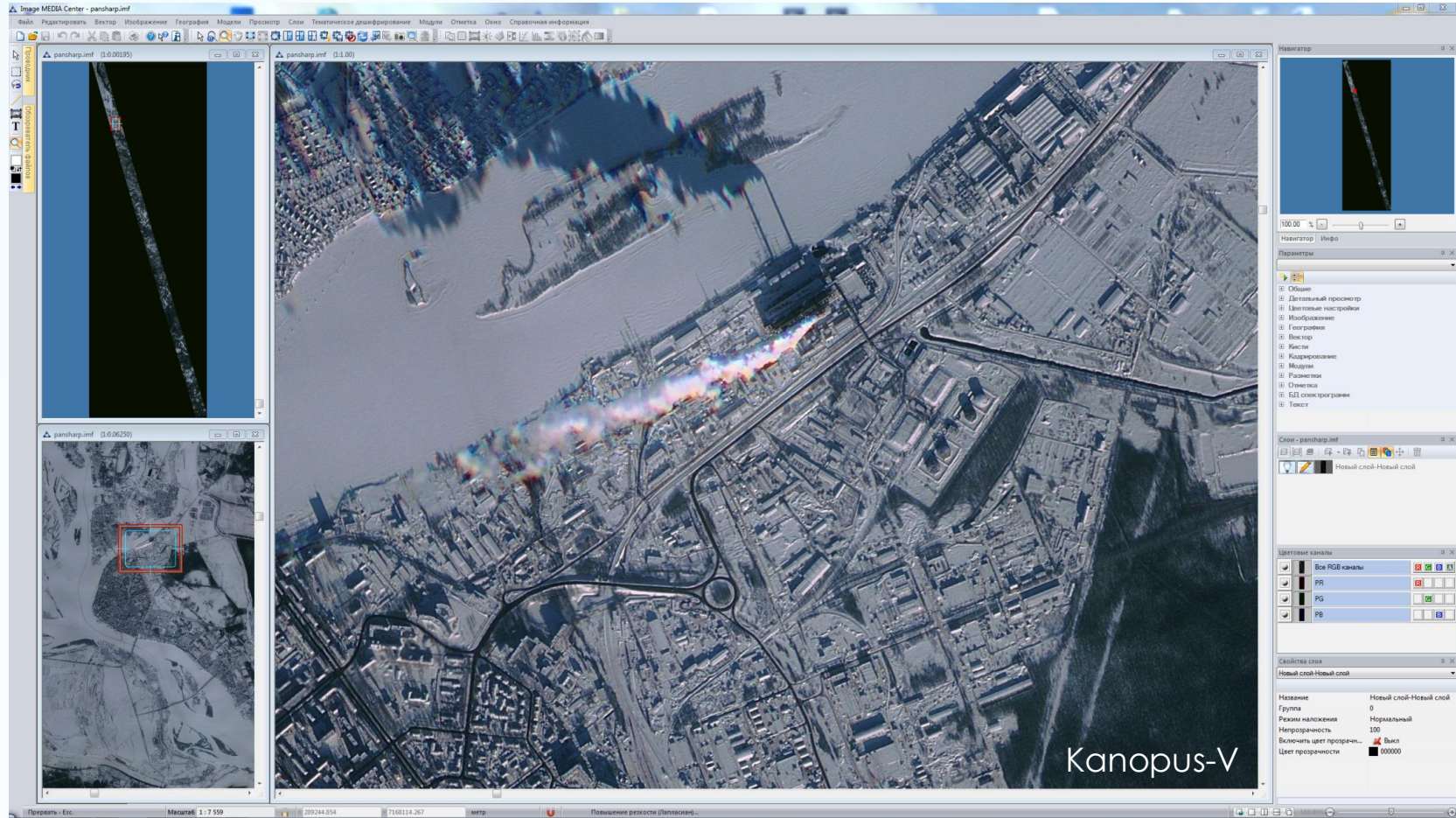
Kanopus-V/BKA

Resurs-P





Remote sensing data obtainment automation



Pixel
projection
2.0 m

Length
580 km

Effective
area
11 600 km²

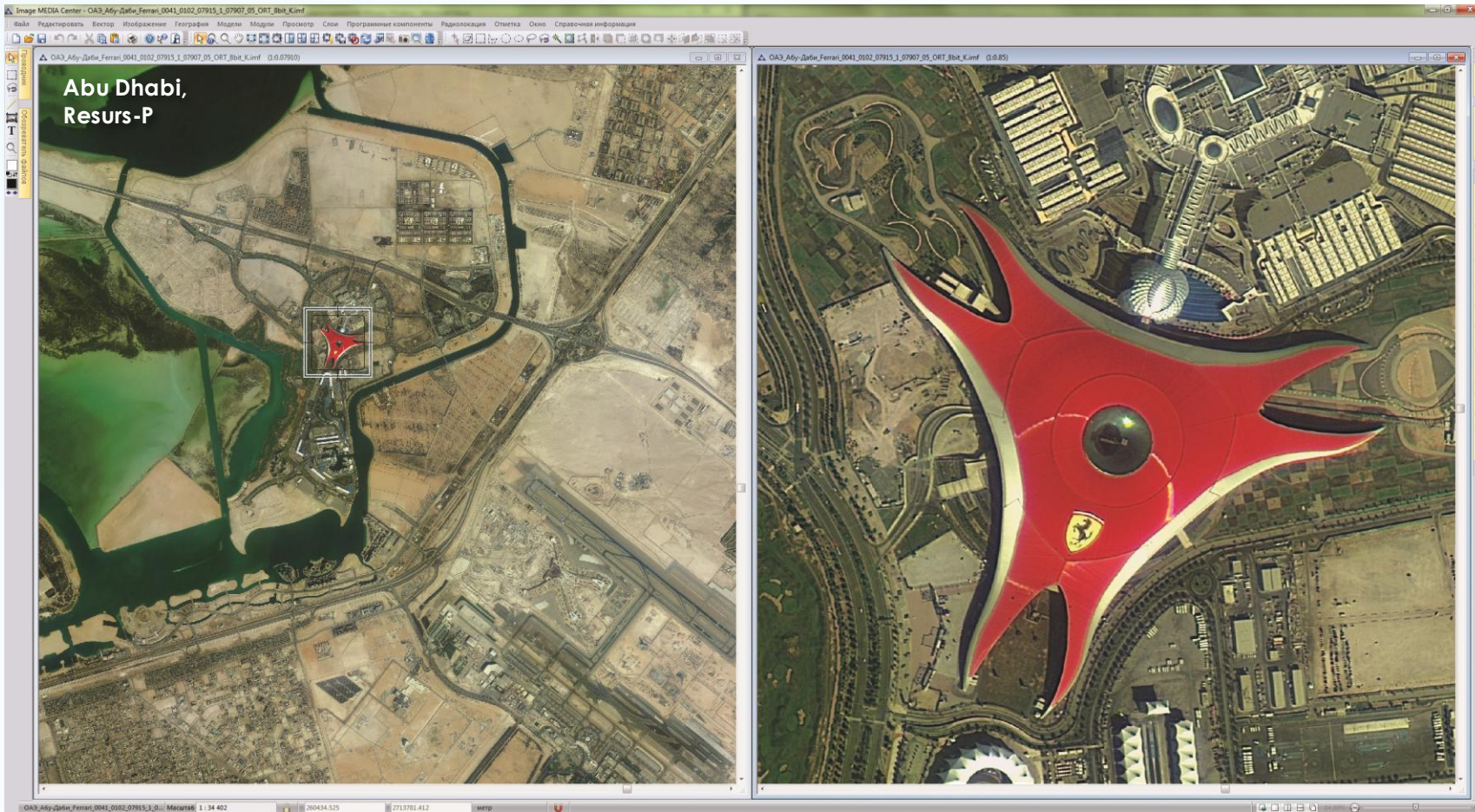
Image size
>200 Gb

Kanopus-V

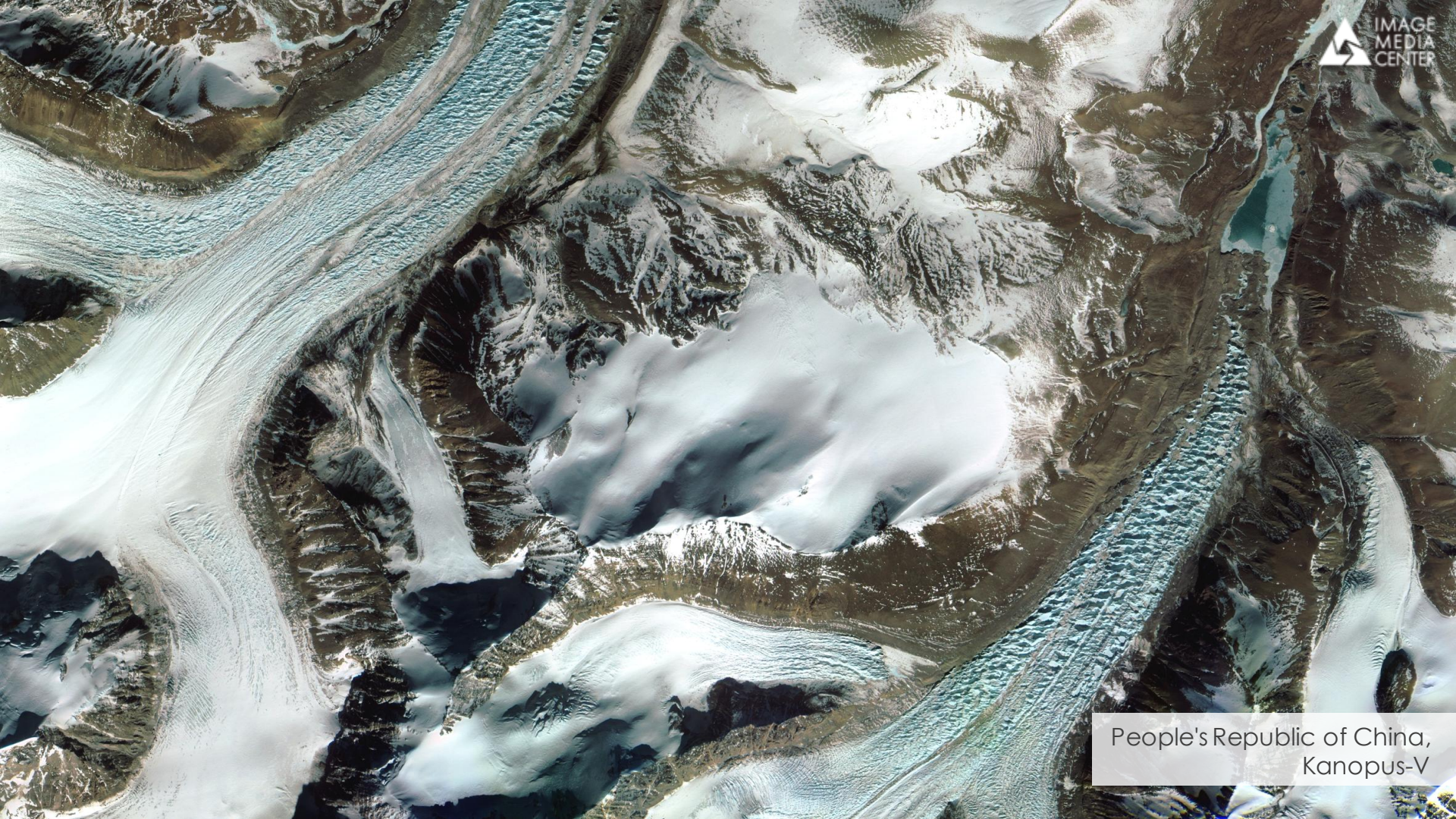


Spain, Kanopus-V

Remote sensing data obtainment automation







People's Republic of China,
Kanopus-V



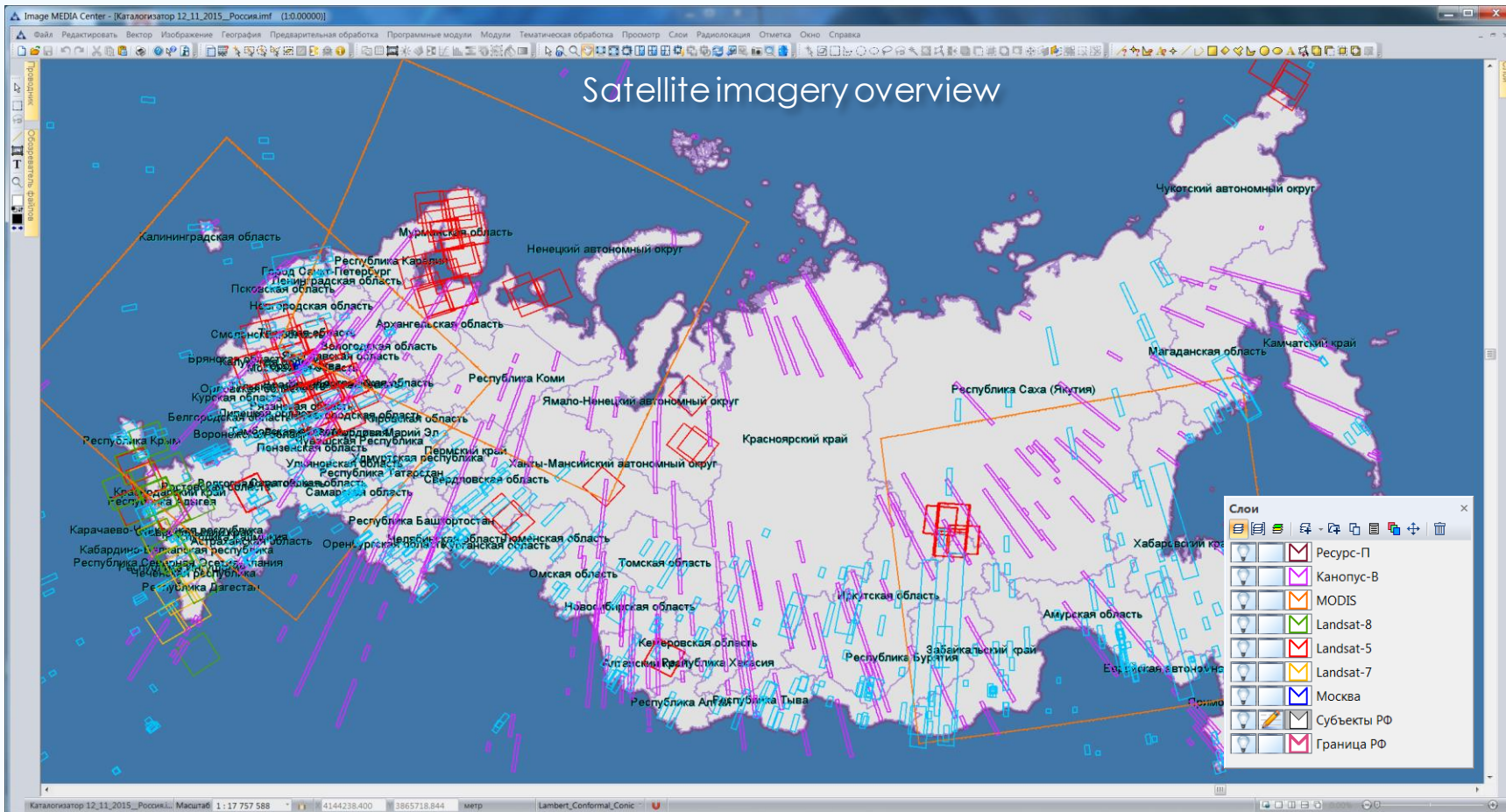


Image MEDIA Center - [Каталог востро] (10.27)

Google Maps layer background

ID	ТИП_КА	АГЕНТАРСТВО	МАРШРУТ	ДАТА_СЪЕ...	СТРАНА	РЕГИОН	ОГМАСАНМЕ
2	Landsat 8	Operational Land Imager	LC81690302013166LGN00	15-6-2013	РФ	Республика Дагестан, Чеченская республика	
3	Landsat 8	Operational Land Imager	LC81790202014211LGN00	30-7-2014	РФ	Краснодарский край	
4	Landsat 8	Operational Land Imager	LC81740202013233LGN00	21-8-2013	РФ	Краснодарский край, республика Адыгея	
5	Landsat 8	Operational Land Imager	LC81790302013176LGN00	25-6-2013	РФ	Краснодарский край	Черное море
6	Landsat 8	Operational Land Imager	LC81740302014204LGN00	23-7-2014	РФ	Краснодарский край	Черное море
7	Landsat 8	Operational Land Imager	LC81730202014181LGN00	30-6-2014	РФ	Краснодарский край, республика Адыгея, Краснодарский край, Республика Северная Осетия-Алания	
8	Landsat 8	Operational Land Imager	LC81740202014204LGN00	23-7-2014	РФ	Краснодарский край, республика Адыгея	
9	Landsat 8	Operational Land Imager	LC81730202014197LGN00	16-7-2014	РФ	Ростовская область, Краснодарский край, Ставропольский край	
10	Landsat 8	Operational Land Imager	LE71740200002250S00	10-8-2000	РФ	Краснодарский край, Республика Адыгея	
11	Landsat 8	Operational Land Imager	LC81730302013166LGN00	13-6-2013	РФ	Кабардино-Балкарская Республика, Республика Северная Осетия-Алания	
12	Landsat 8	Operational Land Imager	LC81730302014215LGN00	3-8-2014	РФ	Кабардино-Балкарская Республика, Республика Северная Осетия-Алания	
13	Landsat 8	Operational Land Imager	LC8166032014212LGN00	31-7-2014	Азербайджан		
14	Landsat 8	Operational Land Imager	LC81730302014302LGN00	29-10-2014	РФ	Кабардино-Балкарская Республика, Республика Северная Осетия-Алания	

Каталог востро Масштаб: 1 : 15 776 872 135.665 38.539 градус Earth Projection: 1, 104

Image MEDIA Center - [Астрахань квинклики (1.0.06540)]

Файл Редактировать Вектор Изображение География Модели Модли Просмотр Слои Программные компоненты Радиолокация Отметки Окно Справочная информация

Волгоградская область

Ростовская область

Астраханская область

Республика Калмыкия

Ставропольский край

Атрибутивная информация

Слой: Маршруты Landsat

ИД	ТИП_КА	АППАРАТУРА	МАРШРУТ	ДАТА_СЪЕМ	СТРАНА	РЕГИОН	ОПИСАНИЕ
0	Landsat §	Operational Land Imager	LC81690282013143LGN01	23-5-2013	РФ	Астраханская область	
1	Landsat §	Operational Land Imager	LC81690272014137LGN00	17-5-2014	РФ	Астраханская область	
2	Landsat §	Operational Land Imager	LC81690282014185LGN00	4-7-2014	РФ	Астраханская область	
3	Landsat §	Operational Land Imager	LC81700262014224LGN00	12-8-2014	РФ	Астраханская область	
4	Landsat §	Operational Land Imager	LC81700272014208LGN00	27-7-2014	РФ	Астраханская область	
5	Landsat §	Operational Land Imager	LC81710262014215LGN00	20-8-2013	РФ	Астраханская область	
6	Landsat §	Operational Land Imager	LC81720262014222LGN00	10-8-2014	РФ	Астраханская область	

Маршруты Landsat - Вектор/Атрибуты векторных объектов

Слой: Астрахань квинклики

- Субъекты РФ
- Маршруты Канопус-В и ВКА
- Маршруты Landsat
- Граница
- LC81710262014215LGN00_CQ
- LC81700272014208LGN00_CQ
- LC81720262014222LGN00_CQ
- LC81690282014185LGN00_CQ
- LC81690272014137LGN00_CQ
- LC81680282013143LGN01_CQ
- LC81700262014224LGN00_CQ
- fr2_kv1_10800_10792_01_3NP2_08_ORT_S_153511_010814
- fr1_kv1_10800_10792_01_3NP2_08_ORT_S_153511_010814
- fr_BKA_10840_10832_14_3NP2_08_ORT_S_450515_010814
- fr_BKA_10674_10665_71_3NP2_08_ORT_S_595913_010814
- fr_kv1_10391_10382_02_3NP2_08_ORT_S_554910_040714
- fr2_kv1_11225_11217_03_3NP2_08_ORT_S_180008_050814
- fr2_BKA_11265_11257_46_3NP2_08_ORT_S_321810_050814
- fr2_BKA_09657_09648_83_3NP2_08_ORT_S_142114_040714
- fr1_kv1_11225_11217_03_3NP2_08_ORT_S_180008_050814
- fr1_BKA_11265_11257_46_3NP2_08_ORT_S_321810_050814
- fr1_BKA_09657_09648_83_3NP2_08_ORT_S_142114_040714
- fr_kv1_10200_10200_03_3NP2_08_ORT_S_364409_040714
- fr_kv1_10041_10033_03_3NP2_08_ORT_S_100209_040714
- fr_kv1_09778_09775_02_3NP2_08_ORT_S_202516_030714
- fr_BKA_10339_10331_45_3NP2_08_ORT_S_395915_070714
- fr_BKA_10165_10164_66_3NP2_08_ORT_S_345109_070714
- fr_BKA_09908_09997_77_3NP2_08_ORT_S_223508_070714
- fr1_BKA_09307_09299_34_3NP2_08_ORT_S_374615_070414
- fr_kv1_09275_09274_02_3NP2_08_ORT_S_535014_040414
- fr_kv1_11393_11384_04_3NP2_08_ORT_S_413215_250814

Свойства слоя

Маршруты Landsat

Название: Маршруты Landsat

Группа: 0

Режим наложения: Нормальный

Непрозрачность: 100

Включить цвет прозрачности: Выкл

Цвет прозрачности: 000000

Видимость: Видно

Учитывать масштаб: Выкл

Мин. масштаб: 0

Макс. масштаб: 0

Расположение слоя: E:\Storage\2\Каталогизация\Аст...

Масштаб: 1:1 733 876

X: 899699.734 Y: 5277841.693 метр

Seamless mosaic creation

1 Contour detection

2 Alpha-channel edges blurring

3 Pixel projection unification

4 Georeferencing

5 Brightness adjustment

6 Seamline creation

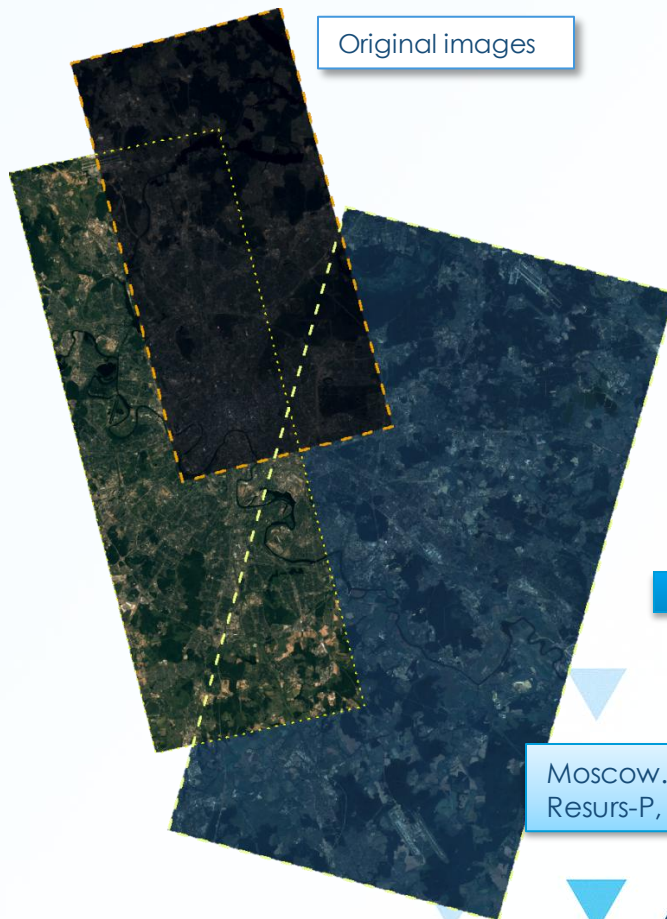
7 Seamless raster mosaic creation

8 Area of interest masking

9 NoData value

10 Vector borders of the area with metadata saving

Original images



Result of mosaic creation in IMC software



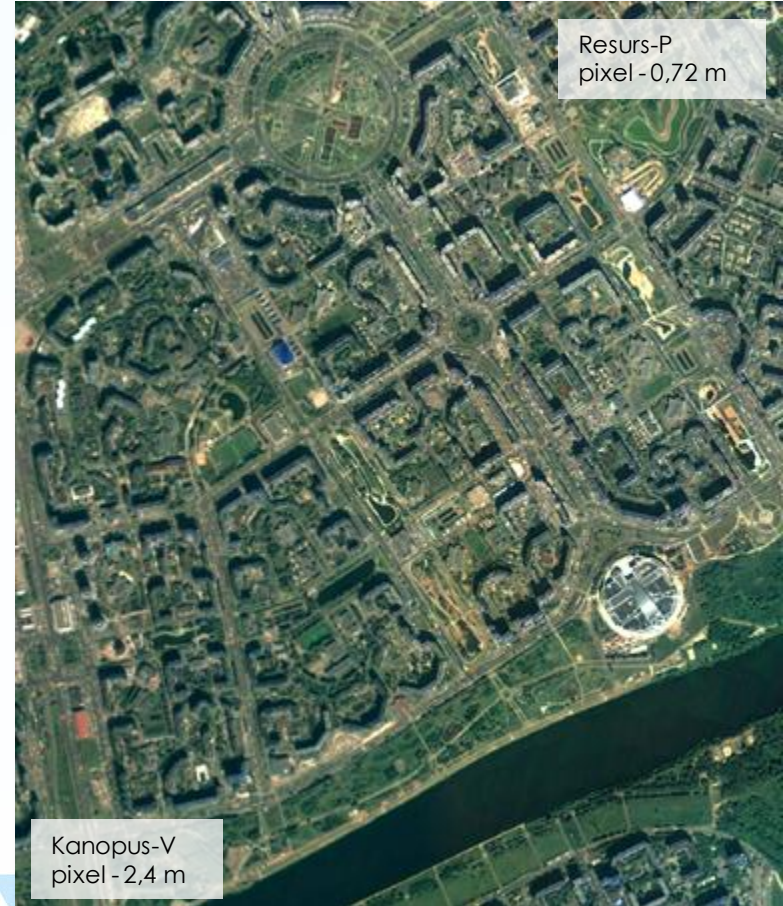
Moscow.
Resurs-P, Kanopus-V

Seamless mosaic





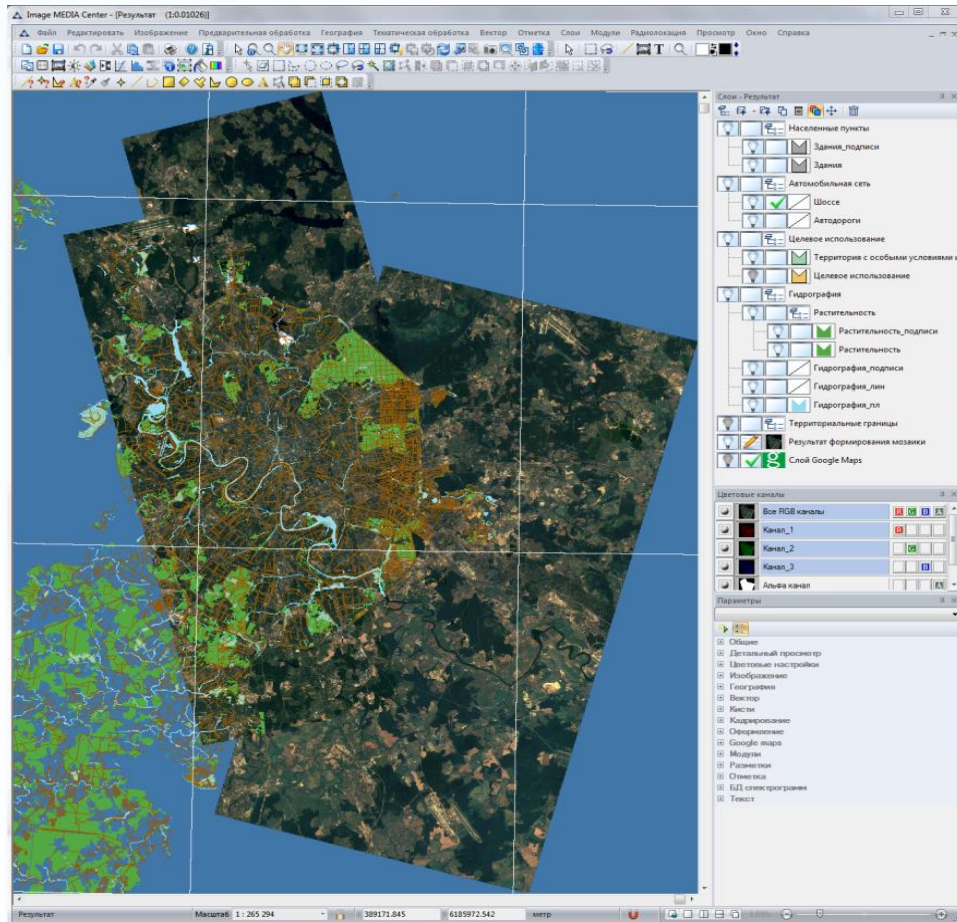
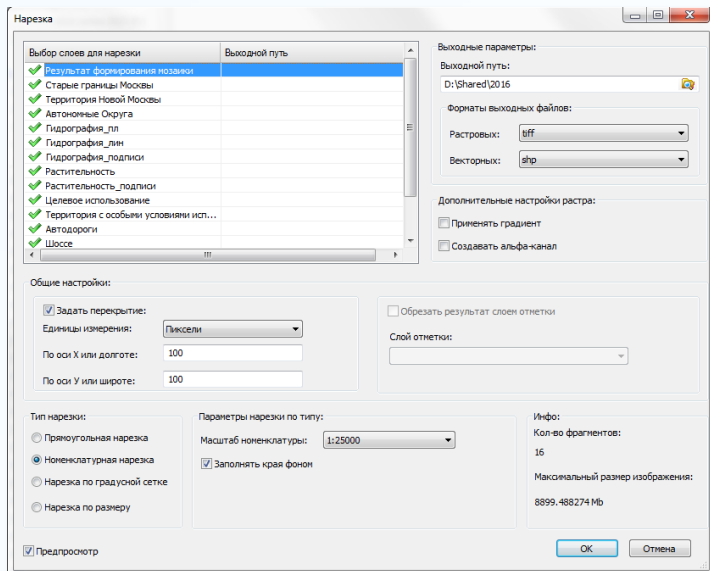
Seamless mosaic automated creation





Cutting types:

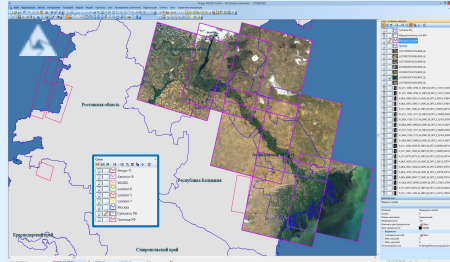
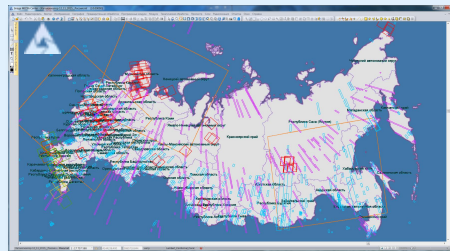
1. Rectangular grid.
2. Nomenclature sheets.
3. Grate grid.
4. Size of the tile.
5. Arbitrary shape.



Remote sensing data processing cycle



Data storage and catalogization



Remote sensing data processing in IMC software





Thematic areas



Agriculture

- spatial distribution of agricultural lands;
- crops monitoring;
- plant distribution area analysis;
- vegetation cover and soil degradation detection;
- damp and saline soils detection, etc.



Forestry

- forest stand and pest infested territories monitoring;
- tree species distribution maps creation;
- wood stock quantification;
- areas of deforestation monitoring.



Ecology

- oil and gas pipelines strains detection and localization;
- oil firm on the water surface detection;
- monitoring of lands polluted with oil;
- defoliation detection ;
- landfill detection.



Mining

- mining areas monitoring;
- oil and gas facilities monitoring;
- temperature anomalies detection.



Emergency situations and military tasks

- emergency situations simulation and monitoring;
- search and rescue operation on the land and sea planning;
- aftermath assessment.



Other tasks

- mapping;
- scientific research and government programs;
- etc...



Thematic processing cycle



Remote sensing data processing in IMAGE MEDIA CENTER

Processing stages

- Preliminary processing (atmospheric correction, mosaic creation, resolution improvement).
- Thematic processing (classification, indices, analysis).
- Results vectorization (attribute information, styles).
- Report generation (statistics, diagrams, description)



Data storage

Satellite images

Resurs-P; Kanopus-V; BKA;
GeoEye-1; Landsat-5,7,8;
GeoEye, Pleiades, WV-2,3;
TerraSAR-X, TanDEM-X;
Radarsat-2; Sentinel-2A, 2B
etc

Vector maps

Road network; urban
infrastructure;
meteorological data;
floristries; protected areas;
agricultural lands; crops;
water bodies, etc

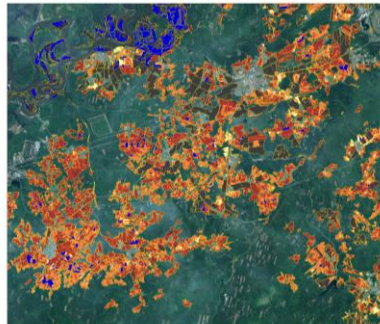
Remote sensing data processing results

- Image quality improvement.
- Vector maps and thematic vector layers.
- Forecasts and models.
- Statistical data.
- Graphic and text reports.

Crops vegetation phase, Russian Federation, Kirov region, Landsat 8 May 2014



Мониторинг состояния посевов



- Условные обозначения
- 0 (инертный грунт)
 - 0.25-0.30 (расход/старение полевых)
 - 0.35-0.45 (высокое отражение/старение)
 - 0.45-0.55 (активный рост/плодородие)
 - 0.55-0.65 (бутоны/цветение, колоски/цветение)
 - Водные объекты
 - Граница СК полей

КА: Landsat 8
Дата съемки: 15.05.2014

Кировская область,
Оричевский район

Слой	Имя	Значение
Field_01	Пашня	0
СК_Пашня	AL	0
OSAR	AL	0
OSAR	NL_HY	год
A_SAR	A_SAR	20110519
CRIP	CRIP	Тимофеевка
CRIP_1	CRIP_1	Пшеница колоса
PI	PI	5.700000
GLM	GLM	3.200000
P2D5	P2D5	236.600000
KD	KD	141.100000
CRIP2	CRIP2	Пшеница колоса
WMSANZE_6	WMSANZE_6	0.723112
AREA	AREA	77.748700



Quantitative and qualitative characteristics of forest determination



Кировская область - Сателлитные данные мониторинга

Киров region,
Pleiades

Атрибутивная информация

Слой: Лиственный лес

Лиственный лес	TYPE	Береза
Береза	AREA_M2	396.464
	AREA_KM2	0.40
	AREA_HA	39.65

Мониторинг подстилающей поверхности в границах ООПТ

КА LandEye-8
Российская Федерация, Кировская область, Средине Вятки, устье Мотыги

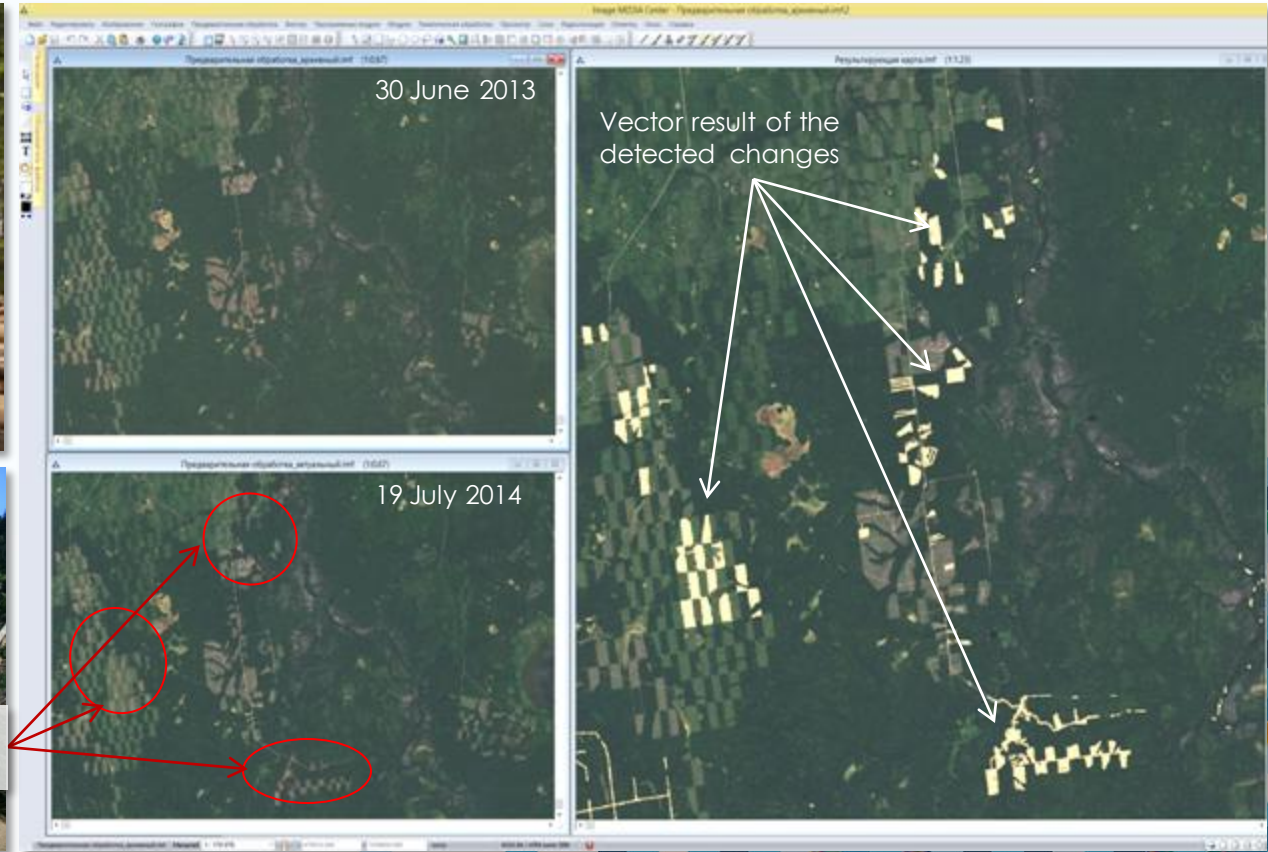
Условные обозначения

Вода	Лесной лес
Земельный фонд	Лесный парк
Лес	Парковые территории
Грунт	Зоны с низкой вероятностью деградации
Искусственные объекты	Границы ООПТ
Травянистая растительность	



Multitemporal deforestation analysis

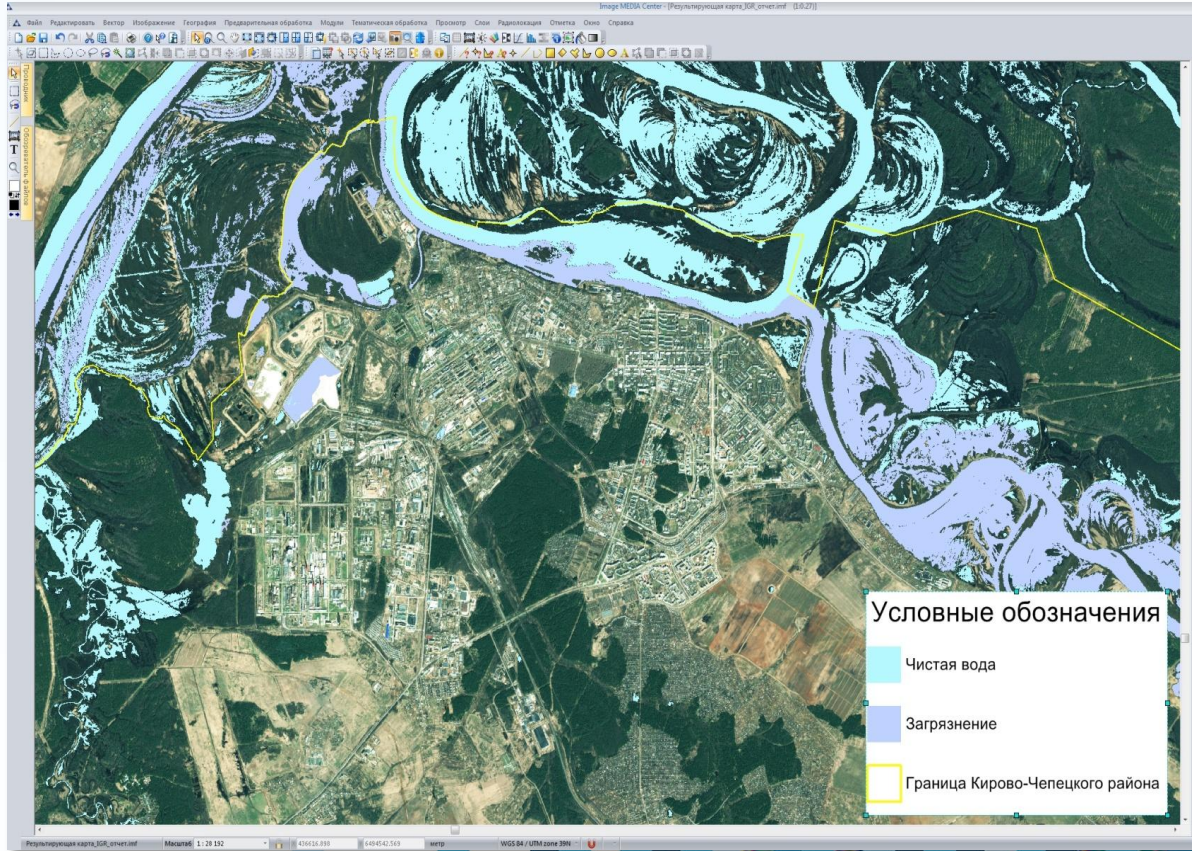
Result of the analysis, Russian Federation, Arkhangelsk region





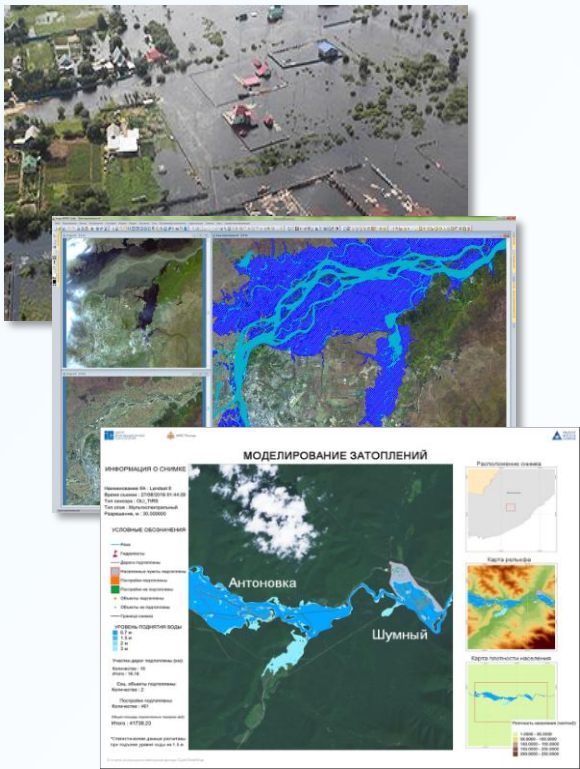
Water pollution monitoring

Russian Federation, Kirov region. Chemical factory. Pleiades. May 2013.



Emergency situations simulation and monitoring

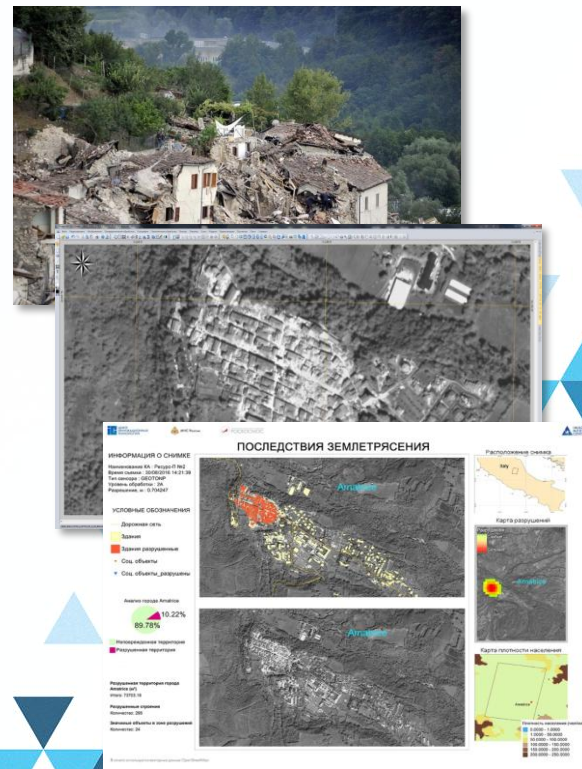
Flood monitoring and simulation



Wildfire monitoring



Earthquake monitoring

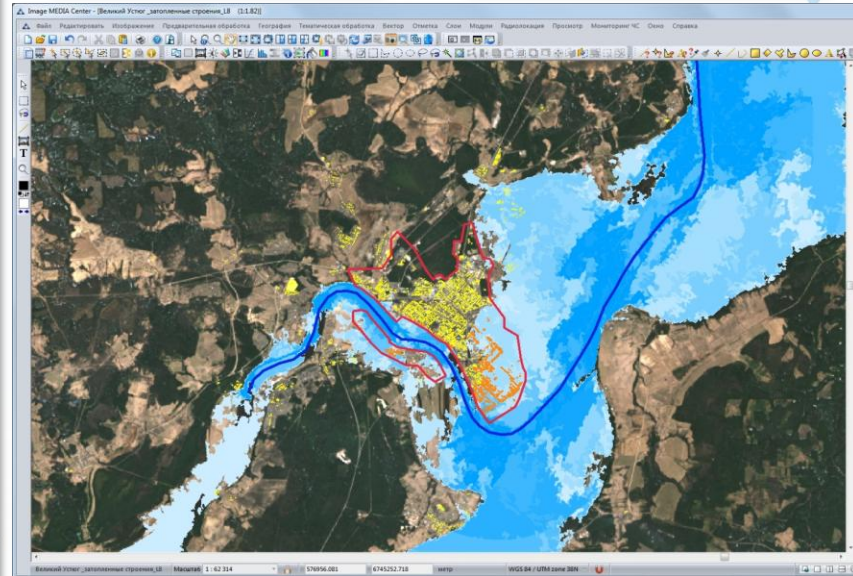
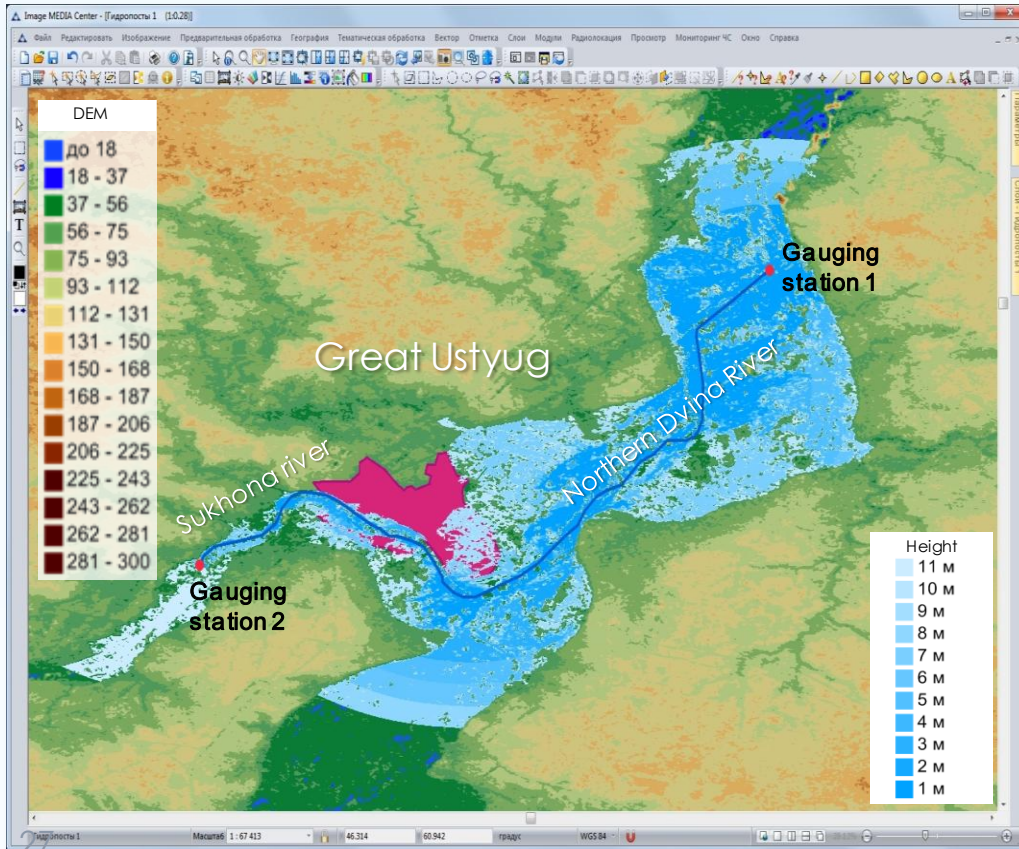




Flood simulation and monitoring

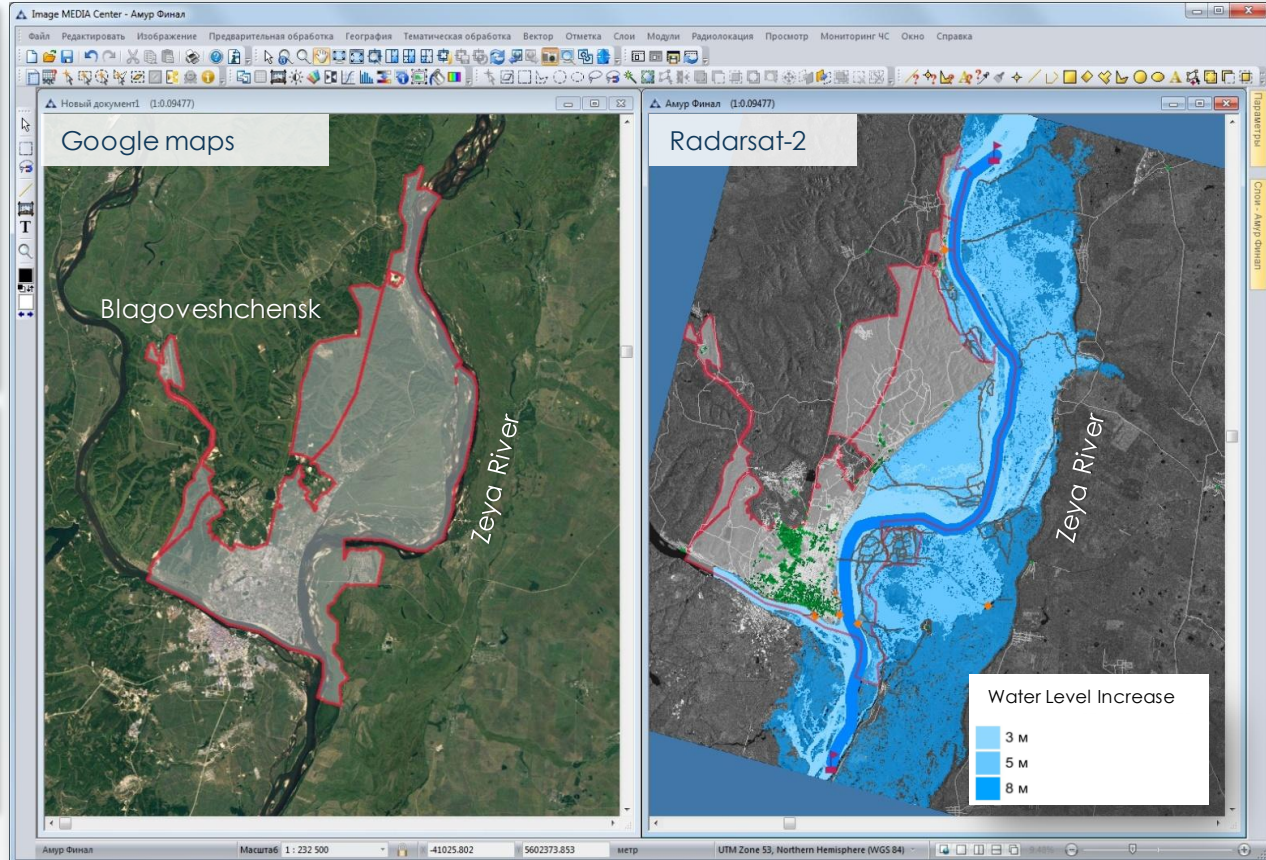
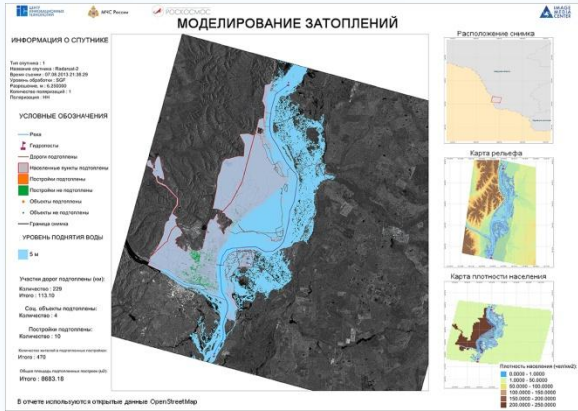
Result of simulation

Russian Federation, Vologda region

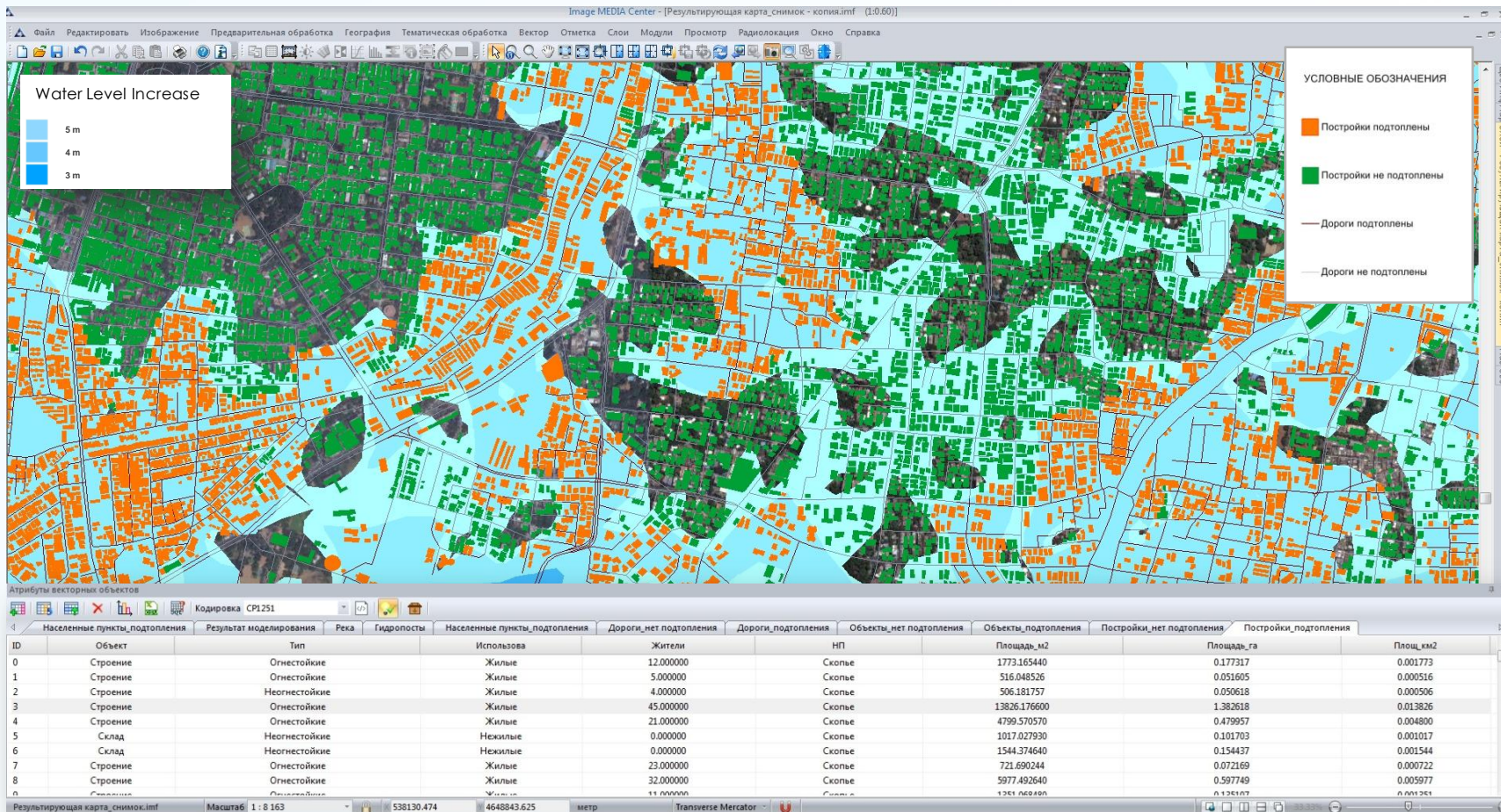


Flood simulation and monitoring

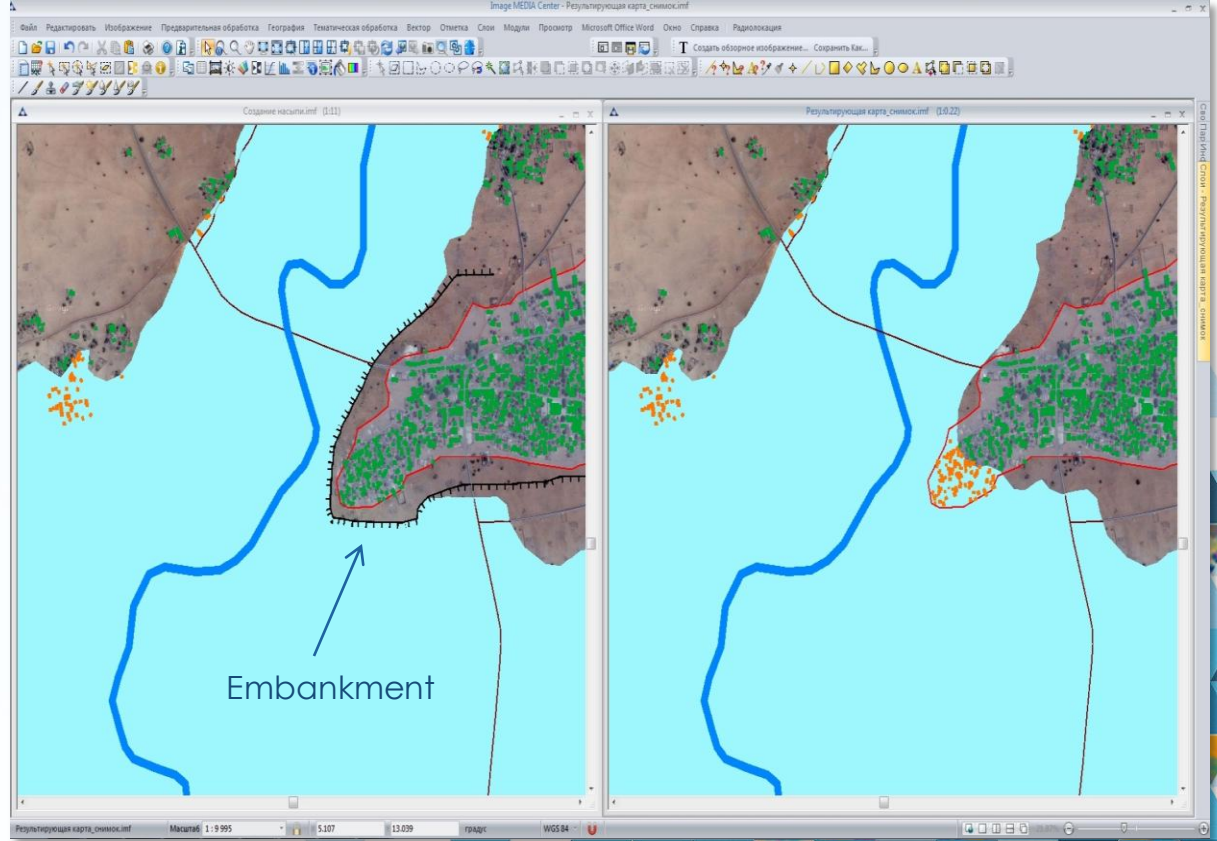
Russian Federation, Amur region



Vector data analysis



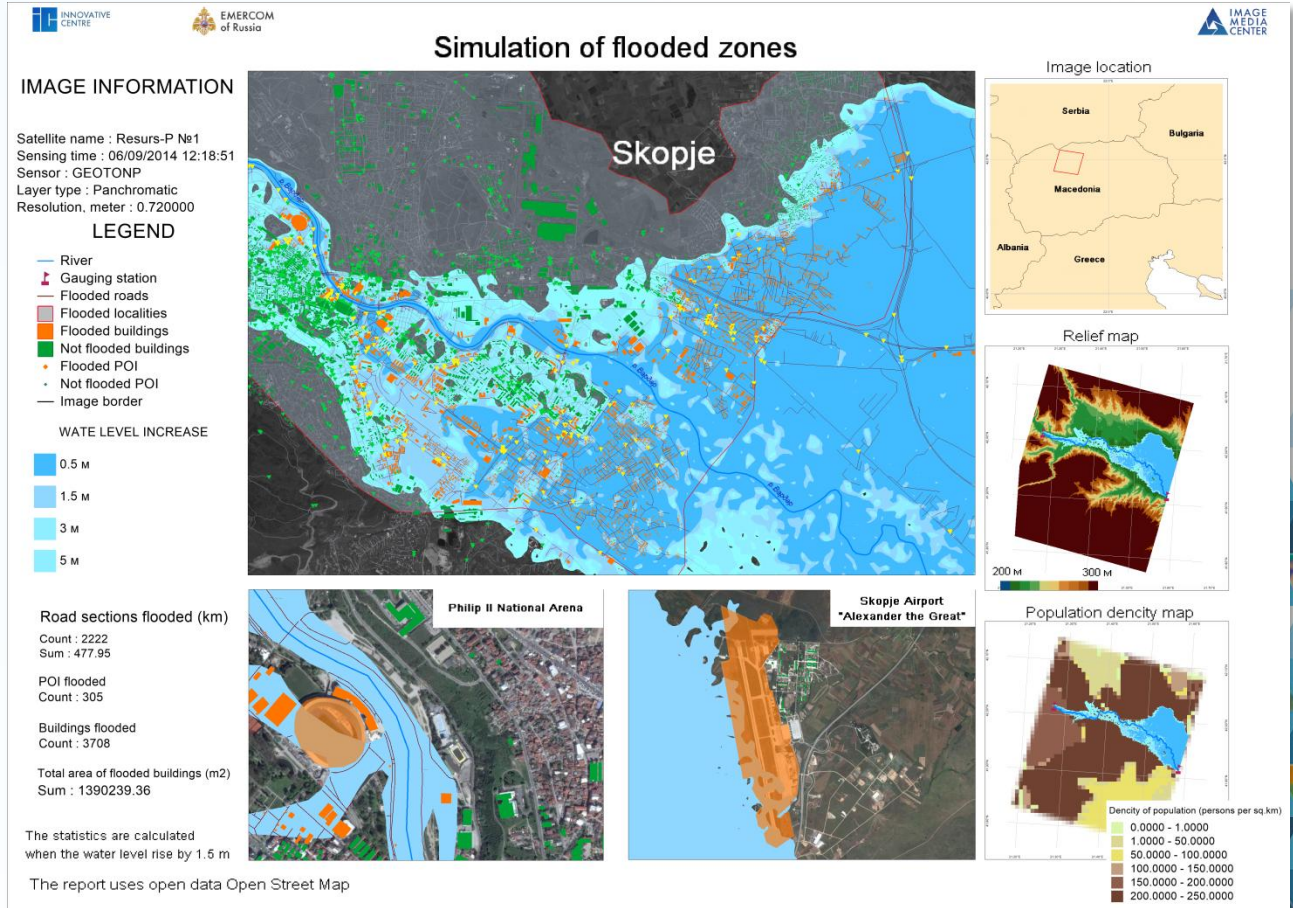
Relief changes displayed on the flood simulation





Report contains:

- Resulting vector map overlaid on the raster image of Google maps service.
- Information about the image.
- Legend.
- Water level increase.
- Information about flooded roads, points of interest and buildings.
- Image location on the world map.
- Relief map.
- Population density map.



Text report-notification generation

List of localities that may require evacuation

Rescue operation manpower and equipment requirements

Restoration works

Meteorological data



Evaluation of flood situation conclusions

14.05.2014 21:03 Amur Oblast

1. 14.05.2014 21:03 as a result of drastic water level increase of the Amur river due to an intensive snow melting (continuous raining) 5 inhabited localities in the following regions: region Blagoveshchensk; have been flooded; total flooded area - 35331.09 ha.

Water level increased by 5.00 m.

Total population of the flooded area - 77 people; among them 53 citizens, 24 villagers, 0 possible casualties.

Flooded area's characteristics

Water level increase	Total flooded area
5.00 m	35331.09 ha

List of inhabited localities affected by flood

Amur Oblast

Name	Population, people	Population in the flooded area, people	Possible fatalities, people	Possible victims, people	Total area, square km	Flooded area, square km	Maximal depth, m
Belogorie	2900	0	0	0	20.530	11.637	0.000
Mykhinka	135	0	0	0	9.030	3.008	0.000
Prizeiskaya	206	0	0	0	2.500	3.603	0.000
Vladimirovka	883	0	0	0	6.770	1.398	0.000

Amur Oblast region Blagoveshchensk

Name	Population, people	Population in the flooded area, people	Possible fatalities, people	Possible victims, people	Total area, square km	Flooded area, square km	Maximal depth, m
Blagoveshchensk	224335	0	0	0	317.080	103.727	0.000

Total amount of buildings affected by flood 10; among them 2 residential buildings, 8 non-residential buildings, ___ socially significant objects.

It may require the evacuation of the residents of the following localities:

- Belogorie
- Mykhinka
- Prizeiskaya
- Vladimirovka

- Blagoveshchensk

2. Manpower and equipment required to carry out rescue operations

Rescue works:

- Number of river intelligence patrols - ___ units. (reconnaissance patrol - 4 people.)
 - Number of reconnaissance airplanes (helicopters) - ___ units
 - Number of rescuers - ___ people.
 - Number of vehicles required for evacuation works - ___ units.
- Number of watercrafts required for evacuation works - ___ units. (capacity of a single watercraft: 70 people.)
 - First Aid (total) - ___ people
 - Including medics- ___ people.
 - specialized medical care (total) - ___ people
 - Including medics - ___ people.

Restoration works (engineering units):

- Number of engineering units for moorings equipment - ___ units. (engineering unit - 20 people)
- Number of engineering units for damaged roads restoration - ___ units. (engineering unit - 20 people)
- Number of engineering units for damaged bridges restoration - ___ units. (engineering unit - 20 people)

Total amount of personnel required - ___ people

Number of temporary shelters for affected population accommodation - ___ units. (Single shelter's capacity - 250 people)

3. Meteorological data: without precipitation, air temperature ___ °N, west wind ___ m/s, atmospheric pressure ___ mm of mercury, humidity ___%, atmospheric conditions: inversion, visibility good

Increase in surface air temperature and intensive snow and ice melting can result into rapid water level increase or the Amur River.

Flash floodings caused by intensive imminent rains and thaws in winter pose a particular threat.

Increase in surface air temperature and intensive snow and ice melting (especially when the ground is frozen) can result into flooding of the roads, which can hamper rescue operations and evacuation.

Position

Signature

Initials and surname

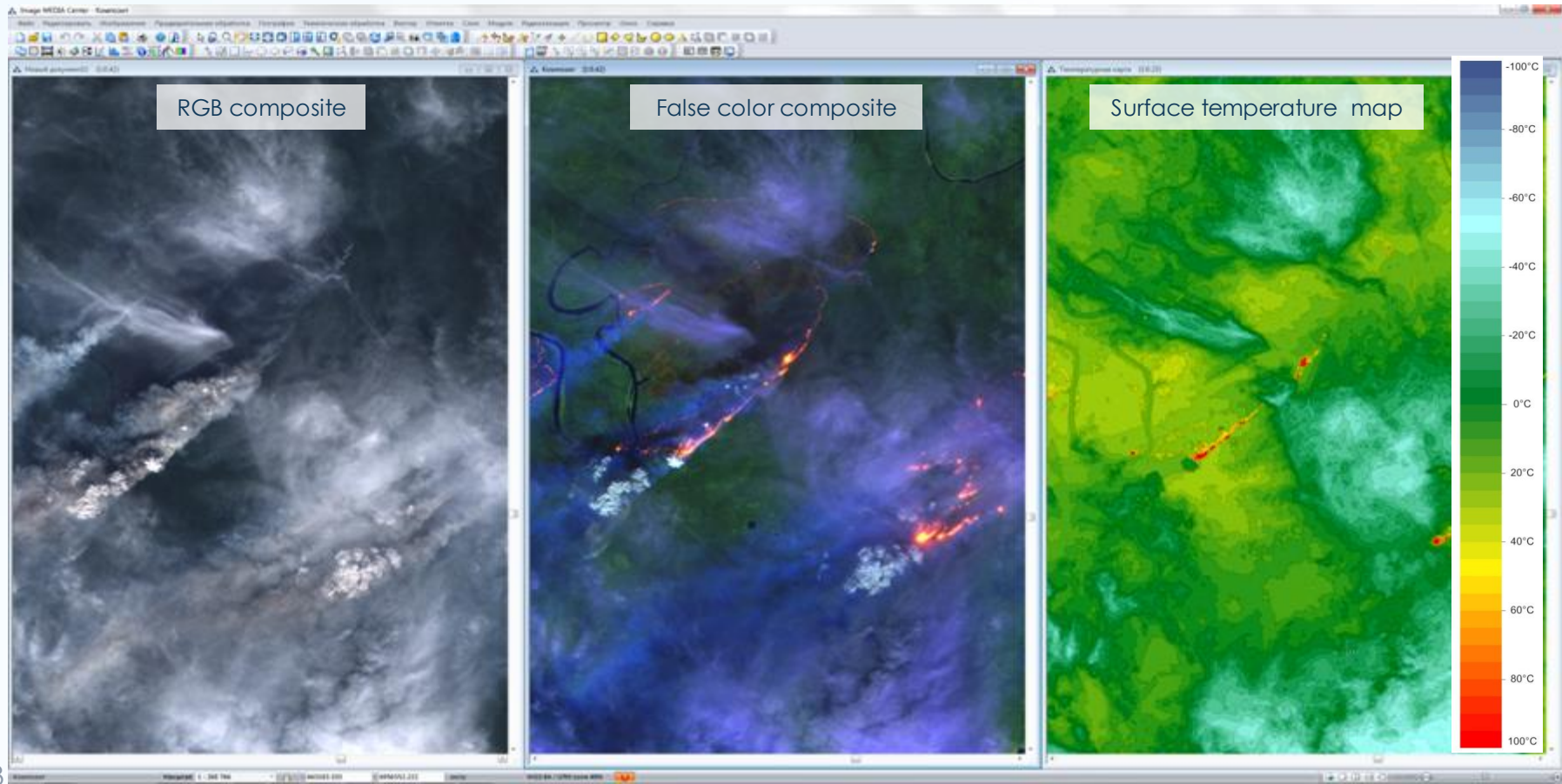
Flooded areas characteristics

List of inhabited localities affected by flood

Information about flooded buildings

Wildfires monitoring

Open fire detection. Russian Federation, Landsat-8





As a part of cooperation with Ministry of Emergency Situations (Russia) Innovative Centre Company performed a monitoring of fires on the Portuguese island of Madeira.

Monitoring was performed in IMAGE MEDIA CENTER software based on the Landsat 8 data received on the August 11, 2016.

INNOVATIVE CENTRE
EMERCOM of Russia

IMAGE MEDIA CENTER

FIRE MONITORING

INFORMATION ABOUT SCENE

Satellite name : Landsat 8
 Sensing time : 11/08/2016 11:40:51
 Sensor : OLI_TIRS
 Processing level : L1T
 Resolution, meter : 30.000000

LEGEND

- Fire areas
- Burnt area
- Vegetation
- Hydrography
- Buildings
- Buildings in the fire areas
- ▲ POI
- Administrative boundaries

Territory analysis

92.56%
7.44%

- Unaffected area
- Burnt area

Burnt area (km2)
Sum : 55.12

Burnt vegetation (km2)
Sum : 25.58

Buildings in the fire areas
Count : 167

POI in the fire areas
Count : 103

OpenStreetMap vector data is used in the report.

Image location

Image in visible spectral range

Population density map

Density of population (persons per sq.km.)




- 0.0000 - 1.0000
- 1.0000 - 50.0000
- 50.0000 - 100.0000
- 100.0000 - 150.0000
- 150.0000 - 200.0000
- 200.0000 - 250.0000


Earthquake monitoring



As a part of cooperation with Ministry of Emergency Situations (Russia) Innovative Centre Company performed an aftermath assessment of earthquake in Italy.

At least 247 people were killed and more were injured after a 6.2-magnitude earthquake struck central Italy.



EARTHQUAKE AFTERMATH ASSESSMENT

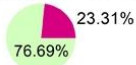
INFORMATION ABOUT SCENE

Satellite name : Resurs-P №1
 Sensing time : 25/08/2016 12:03:36
 Sensor : GEOTONP
 Processing level : 2A
 Resolution, meter : 0.824652

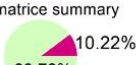
LEGEND

- Road network
- Buildings
- Destroyed buildings
- + POI
- v POI collapsed

Pescara del Tronto summary



Amatrice summary



Unaffected area
 Ruined territory

Ruined territory - Amatrice (m²)
Sum: 73703.18

Ruined territory - Pescara del Tronto (m²)
Sum: 33557.85

Destroyed buildings
Count: 395

POI in the ruined area
Count: 24

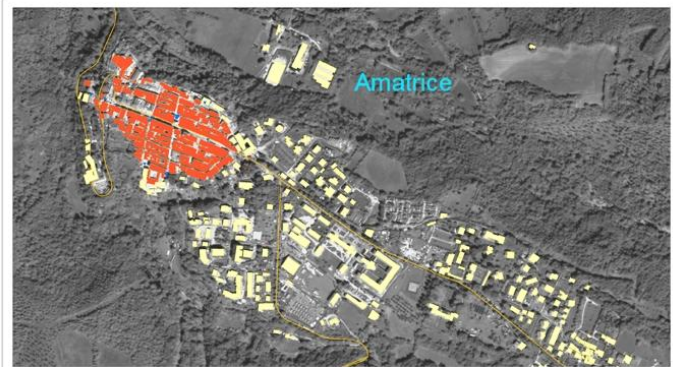
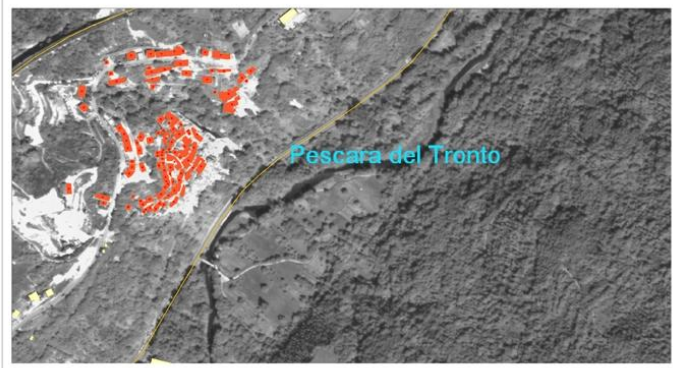

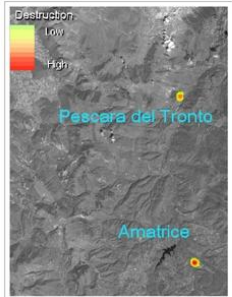



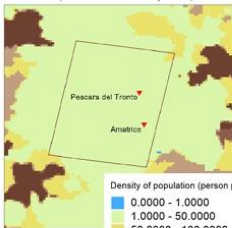
Image location



Map of destructions



Population density map



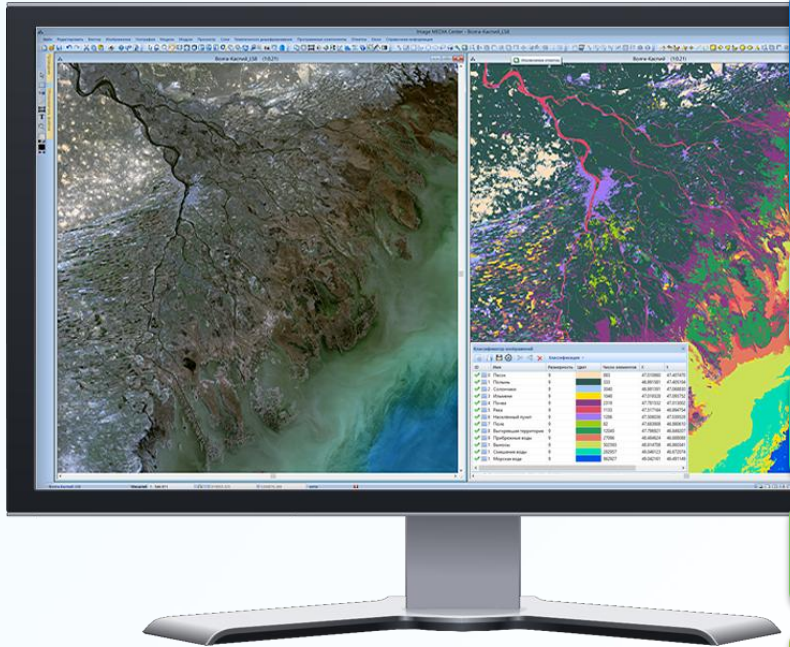
Density of population (person per sq.km2):

- 0.0000 - 1.0000
- 1.0000 - 50.0000
- 50.0000 - 100.0000
- 100.0000 - 150.0000
- 150.0000 - 200.0000
- 200.0000 - 250.0000

OpenStreetMap vector data is used in the report.



IMAGE MEDIA CENTER advantages



Full cycle of satellite data processing and vector maps creation

Combination of raster and vector data in a single workspace

Possibility to store the whole project in one *.imf file

Creation of macros for automated data processing

Large amount of data stream processing

Creation of geographical databases based on DBMS

Opened program architecture and possibility of further program development

Thank you for attention

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