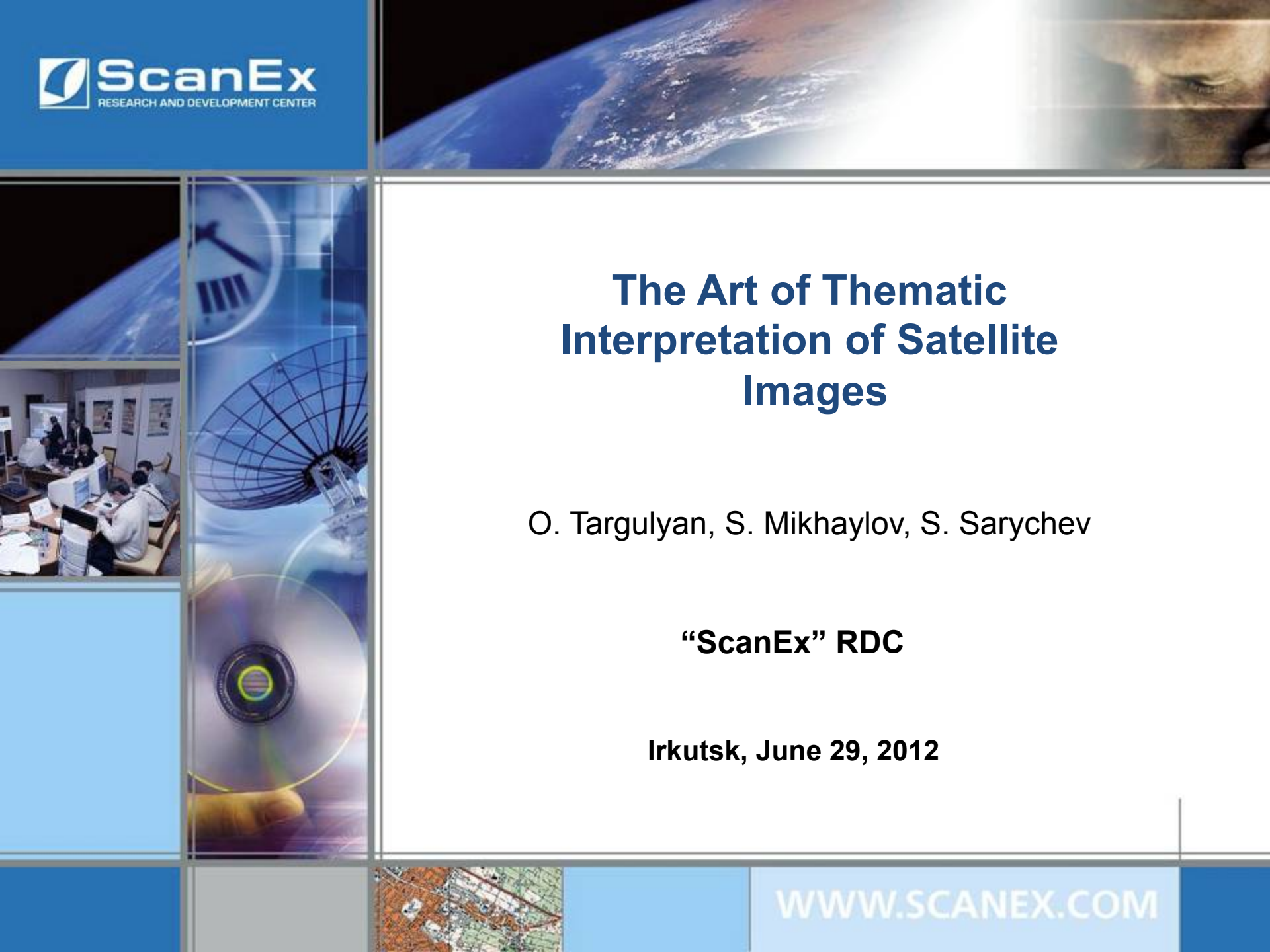




The Art of Thematic Interpretation of Satellite Images

O. Targulyan, S. Mikhaylov, S. Sarychev

“ScanEx” RDC

Irkutsk, June 29, 2012

The Art of Thematic Interpretation of Satellite Images

ScanEx R&D Center has been operating as a private company since 1989.

1. Designing and manufacturing of **personal ground stations** (PGS) Alice-SC™, UniScan™ for reception and processing satellite images in aims of Earth monitoring from space.
2. Remote sensing **data archiving, cataloging, sales** (IRS-1C/1D, P5, P6, Landsat 4/5/7, SPOT 2/4, EROS A/B, RADARSAT-1, ENVISAT-1) and **distributing** (IKONOS, GeoEye-1, QickBird, WorldView-1, TerraSAR-X, ALOS).
3. **Software**: the technology for RS data acquisition, processing, archiving and thematic analysis: ScanReceiver® — ScanMagic® — MagicCatalog® — ScanEx Image Processor® — Thematic PRO®.
4. **Thematic projects** on the base of RS Data.
5. Creating of **geo-portals** on the base of remotely sensed data (www.kosmosnimki.ru)





- **4 centers, 9 UniScan™ receiving stations**
- **Reception from 14 RS satellites** (Terra, Aqua, IRS-1D, IRS-P5, IRS-P6, CARTOSAT-2, EROS-A, EROS-B, SPOT-4, SPOT-5, FORMOSAT-2, RADARSAT-1, RADARSAT-2, ENVISAT-1, LANDSAT-5)
- **Over 150 passes per day, more than 600 GB data received daily**

Governmental and educational stations networks based on UniScan™



UniScan™ network of RosHydroMet



UniScan™ network of EMERCOM of Russia

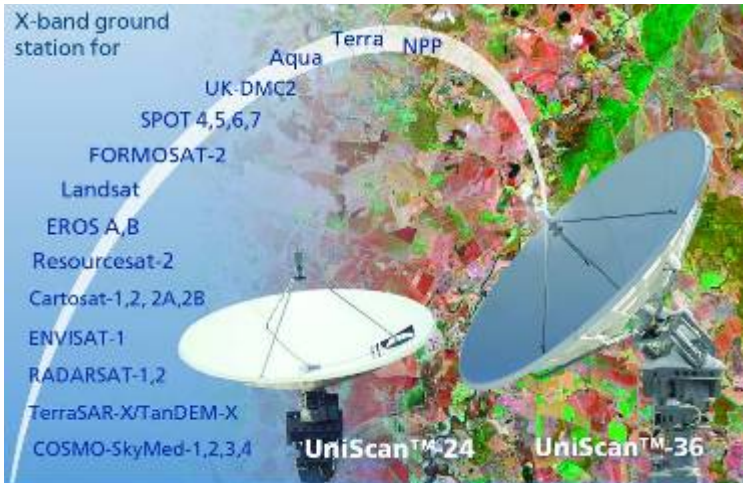


UniScan™ network of Ministry of
Natural Resources of Russia



Educational UniScan™ network

X-Band multimission UniScan™ ground station



Data rates:
up to 320 Mbps

Positioner:
2 and 3 axis

Antenna dish Ø:
2.4/3.1 m



UniScan™-24



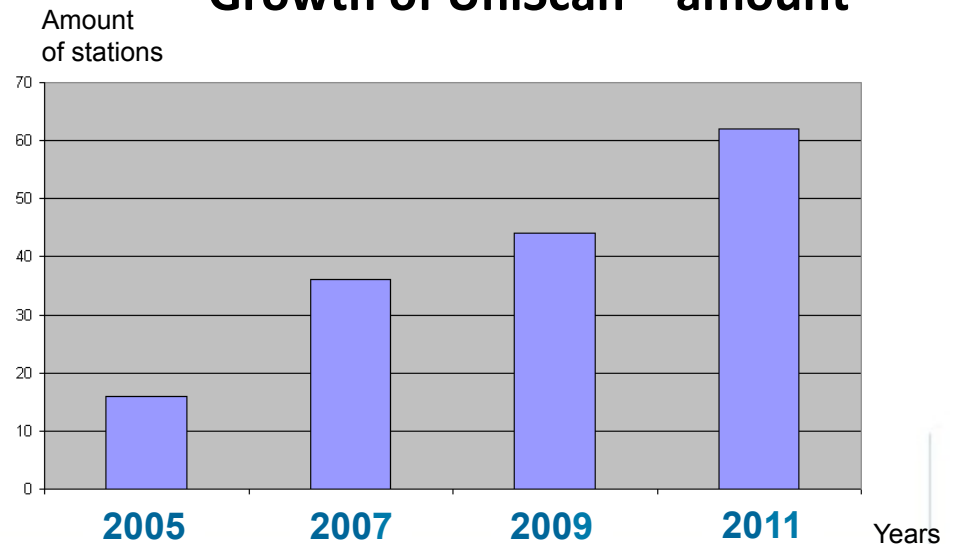
UniScan™-36

**From Earth remote sensing satellites
to UniScan™ ground station:**

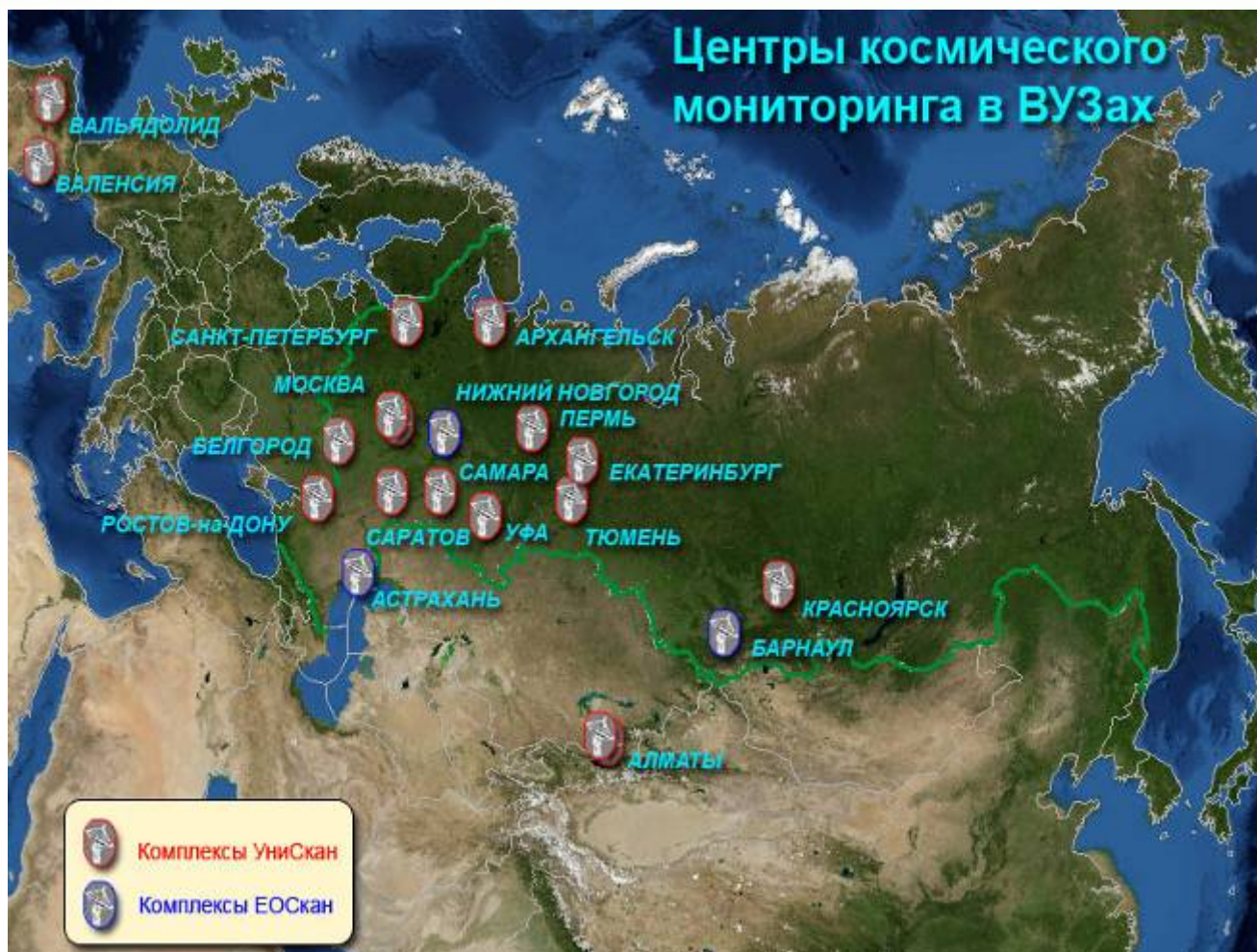
Terra
Aqua
NPP
SPOT 4/5/6/7
FORMOSAT-2
UK-DMC2
IRS 1D/P5/P6
CARTOSAT-2

EROS A
EROS B
Landsat 5
RADARSAT-1
RADARSAT-2
TerraSAR-X
ENVISAT-1

Growth of UniScan™ amount



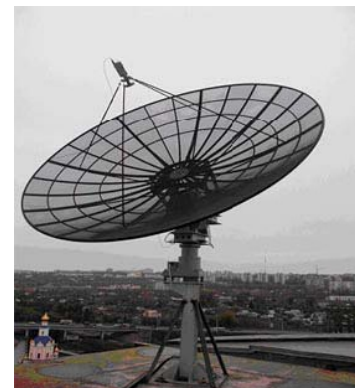
Network of University RS centers based on ScanEx technologies



Educational network: 22 stations UniScan + 2 station EoScan

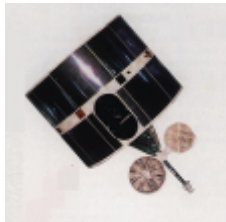
List of Universities in CIS and Spain which operate RS centers based on ScanEx technologies

1. Belgorod State University, **Belgorod**, Russia
2. Kazakhstan-British Technical University, **Almaty**, Republic of Kazakhstan
3. Satpaev Kazakh National Technical University, **Almaty**, Republic of Kazakhstan
4. Lomonosov Moscow State University, **Moscow**, Russia
5. Bauman Moscow State Technical University, **Moscow**, Russia
6. Korolev Samara State Aerospace University, **Samara**, Russia
7. University of Valencia, **Valencia**, Spain
8. Ufa State aviation and technical university (UGATU), **Ufa**, Bashkortostan, Russia
9. Siberian Federal University, **Krasnoyarsk**, Russia
10. Tyumen State University, **Tyumen**, Russia
11. Southern Federal University, **Rostov-na-Donu**, Russia
12. Nizhniy Novgorod Academy of Architecture, **Nigniy Novgorod**, Russia
13. Altai State University, **Barnaul**, Russia
14. University of Valladolid, Laboratory of Remote Sensing (LATUV), **Valladolid**, Spain
15. Astrakhan State University, **Astrakhan**, Russia
16. St.Petersburg State University, **St.Petersburg**, Russia
17. Ural Federal University, **Yekaterinburg**, Russia
18. Arctic Federal University, **Archangelsk**, Russia
19. Plekhanov Mining State University, **St.Petersburg**, Russia
20. Saratov State University, **Saratov**, Russia
21. Siberian State Aerospace University, **Krasnoyarsk**, Russia
22. Stavropol State University, **Stavropol**, Russia
23. Tomsk State University of Control Systems and Radioelectronics, **Tomsk**, Russia
24. Perm State University **Perm**, Russia



Traditional approaches for Remote Sensing laboratories at a university

- Free of charge data downlink;
- Low ground resolution: 250 – 1,000 m



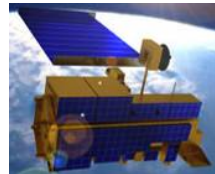
FengYun/MVISR



NOAA/AVHRR



MetOP/AVHRR/3



Terra/MODIS



Aqua/MODIS

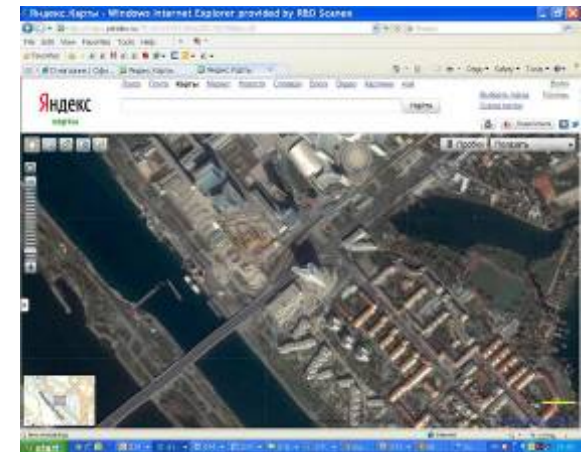
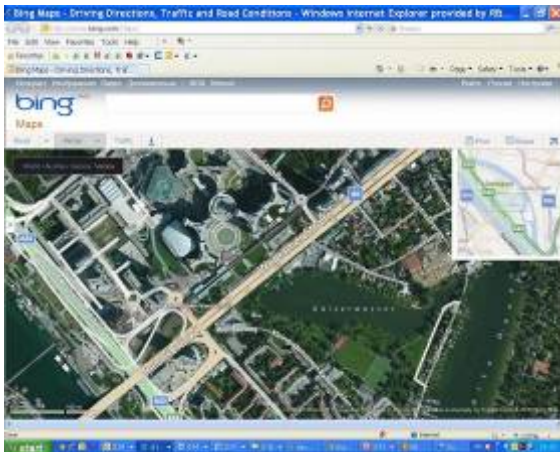


+ high reiteration

- Low resolution of these data makes considerable restrictions for their practical applications for more precision changes of local areas of the Earth

Traditional approaches for Remote Sensing laboratories at a university

- Images from open web sources Bing Maps, GoogleEarth, Yandex.maps, etc.



+ Good resolution for some areas

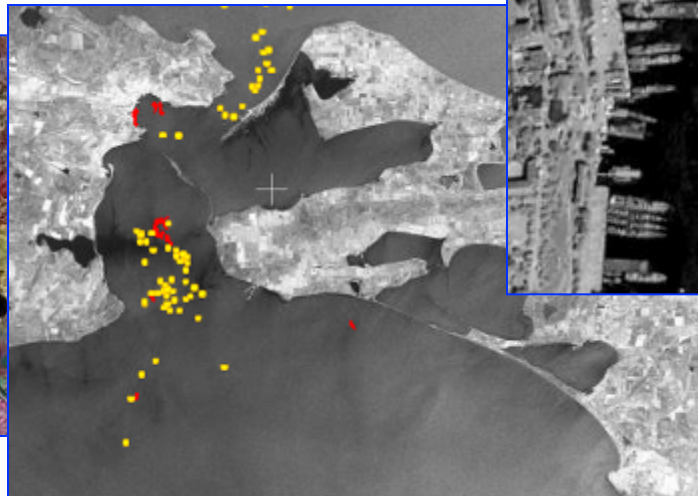
- **JPG pictures (no spectral channels)**
- **Rarely images refreshment**
- **Good resolution ONLY for some areas**
- **License restrictions**

ScanEx approach for Remote Sensing laboratories at a university

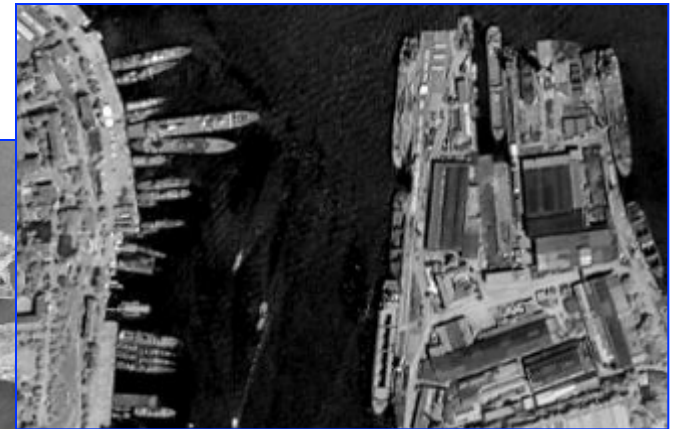
Providing real-time access to high resolution optical and radar Remotely Sensed data



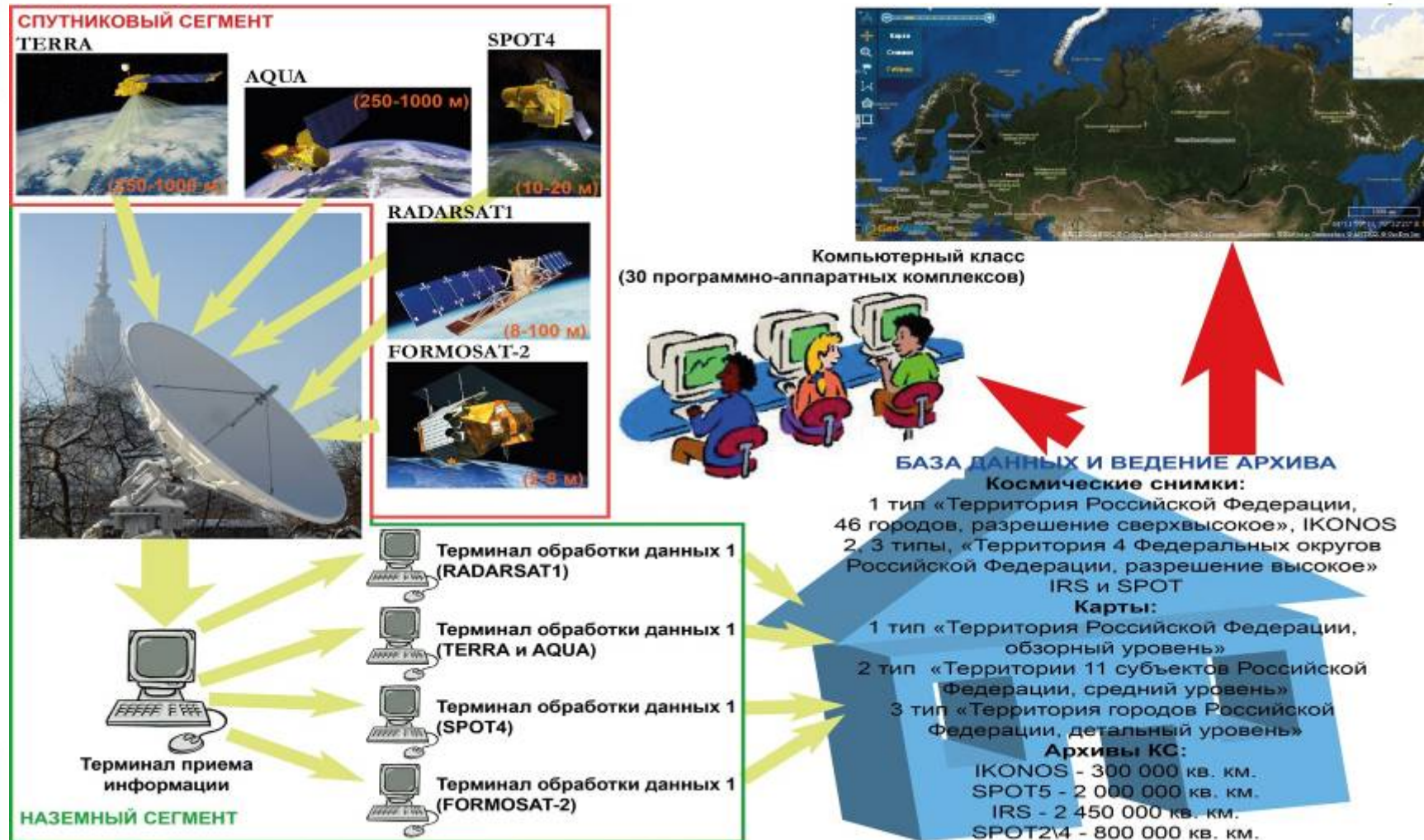
©CNES, Spot Image, 2006.



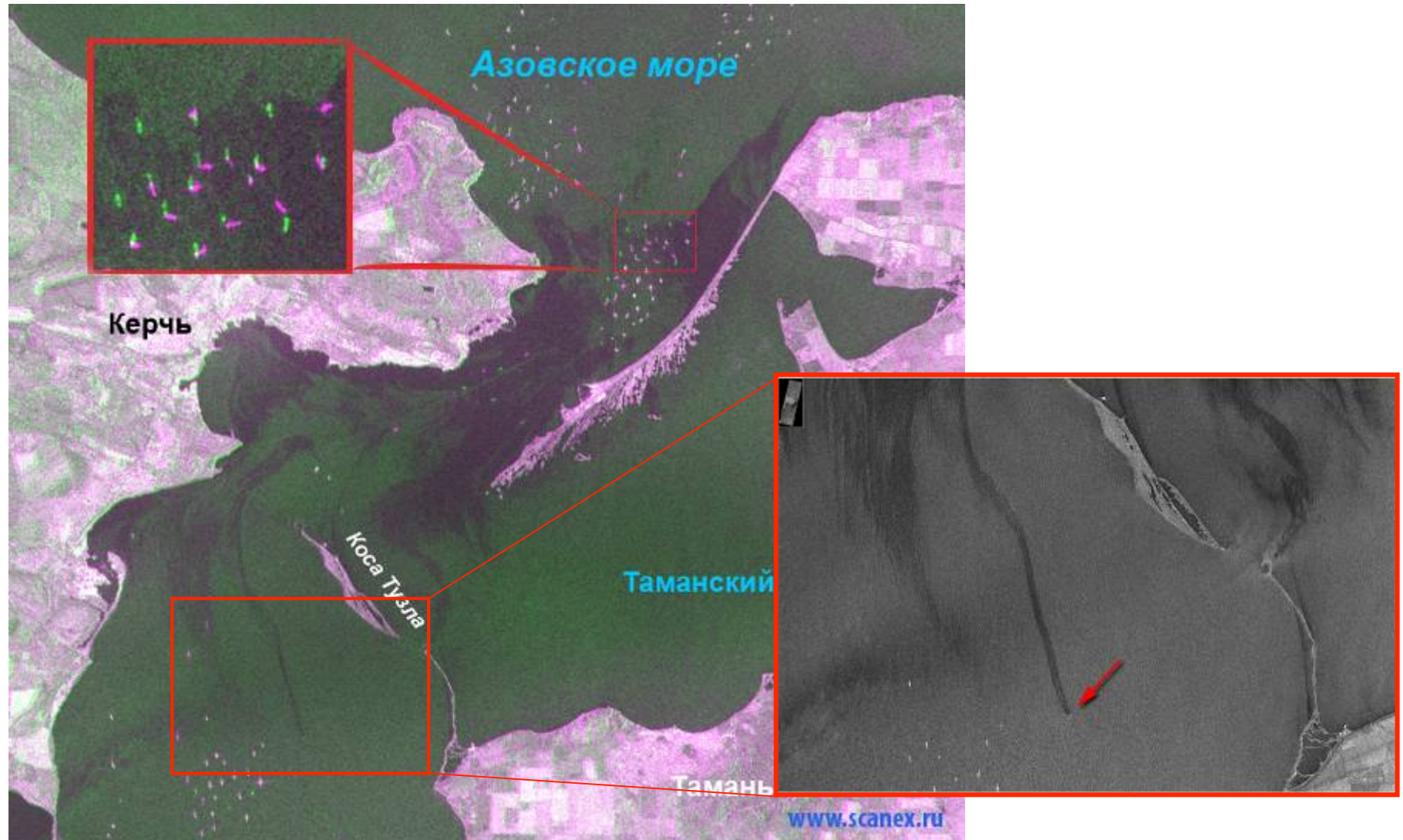
©MDA, CSA, SCANEX, 2008



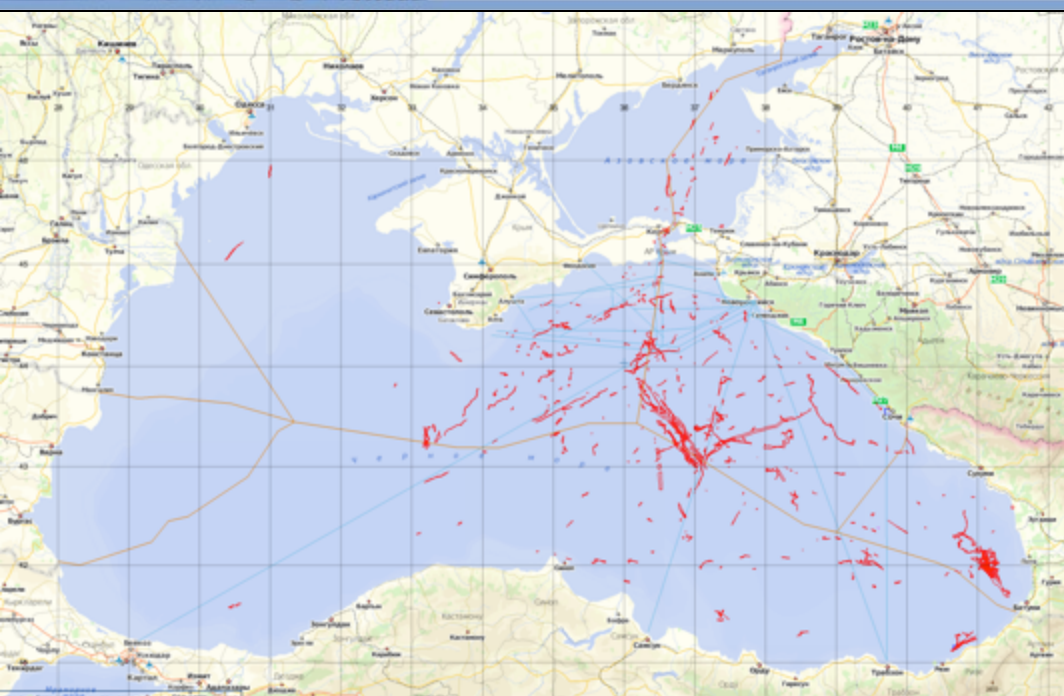
© ImageSat Int. N.V., 2006-2009.



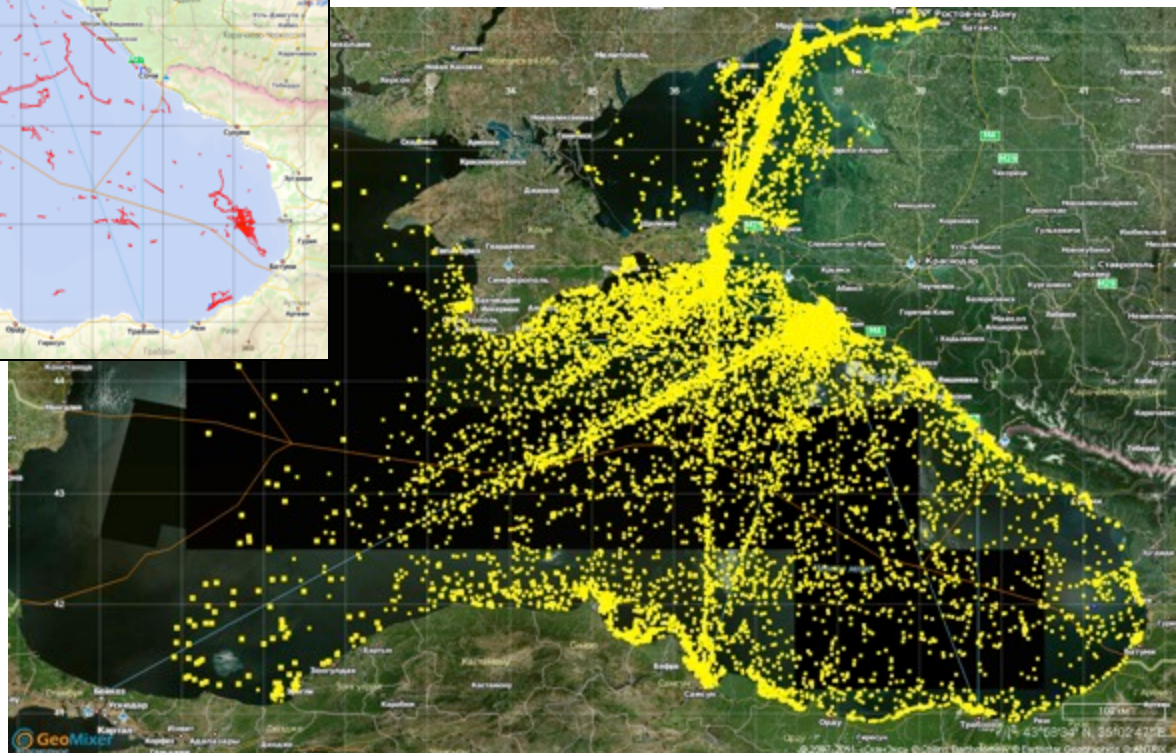
All-weather radar monitoring of oil spills on a sea surface: Kerch strait, 2010



Black sea monitoring, 2011

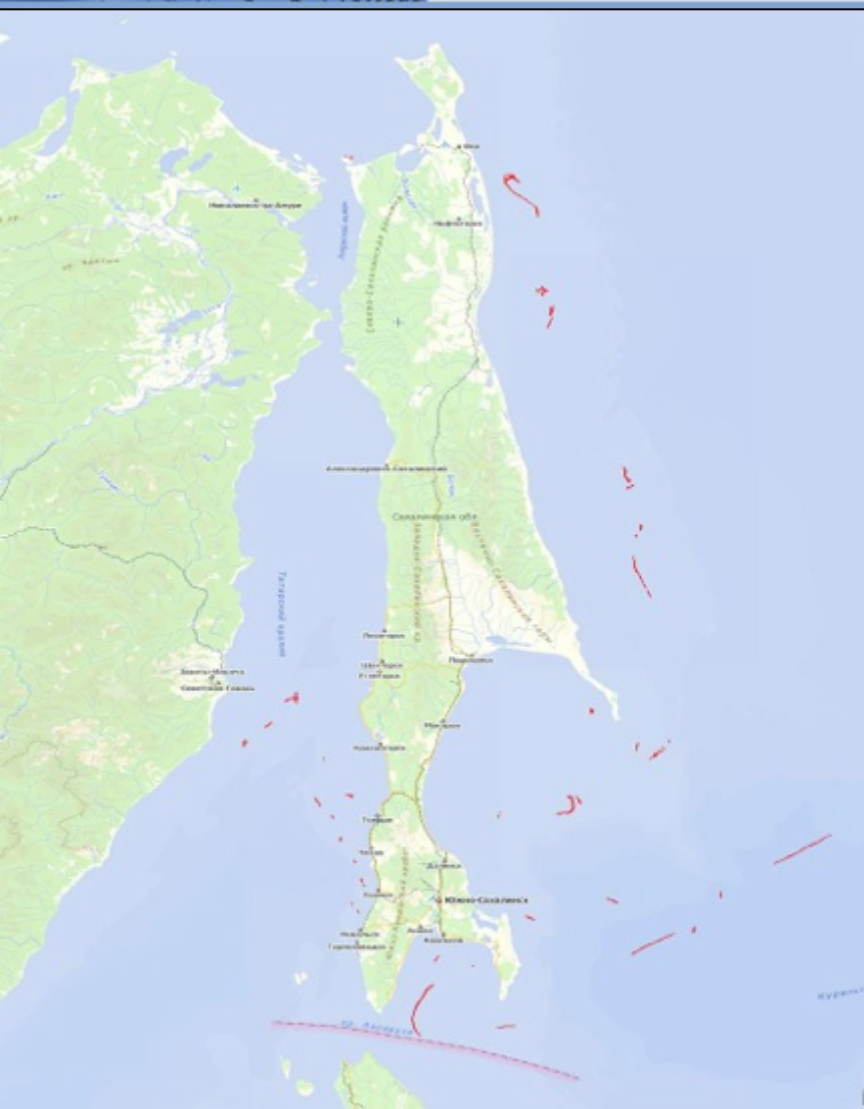


Sea surface oil pollution, integral map for 2011

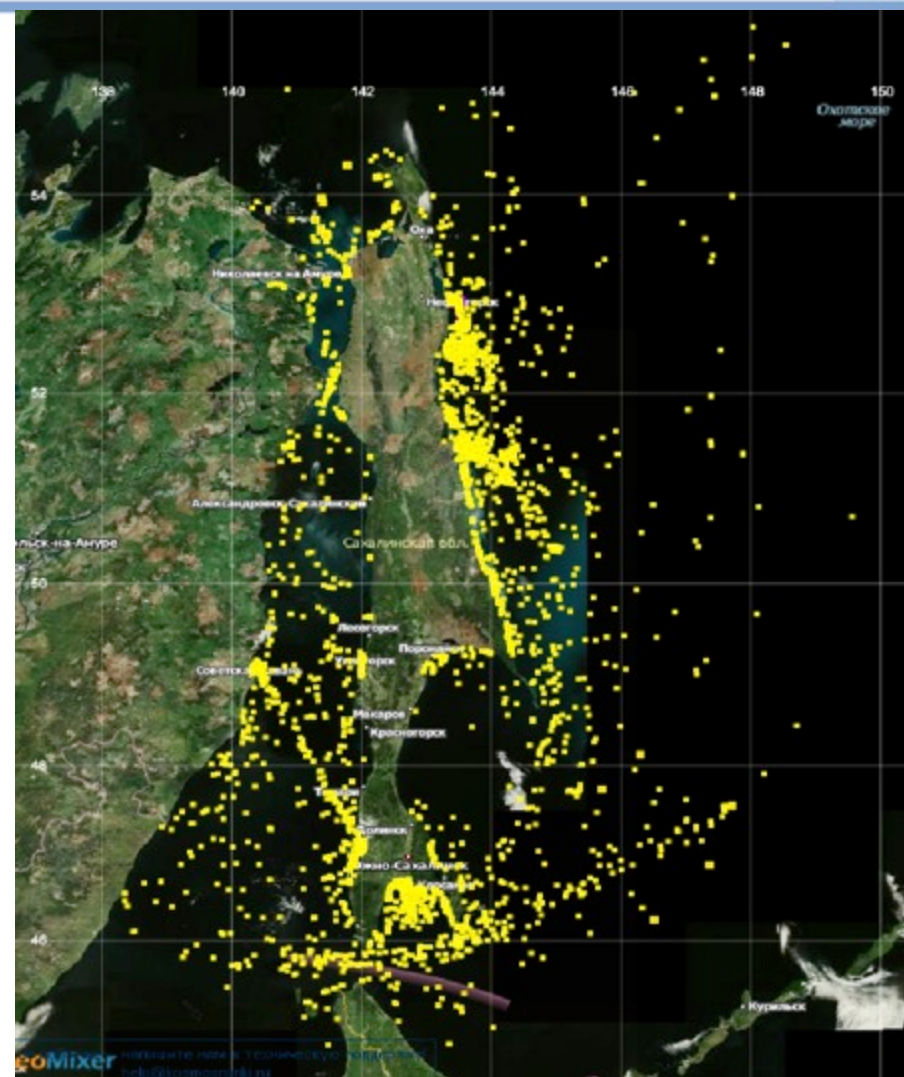


Ship navigation integral map, 2011

Sakhalin monitoring, 2011

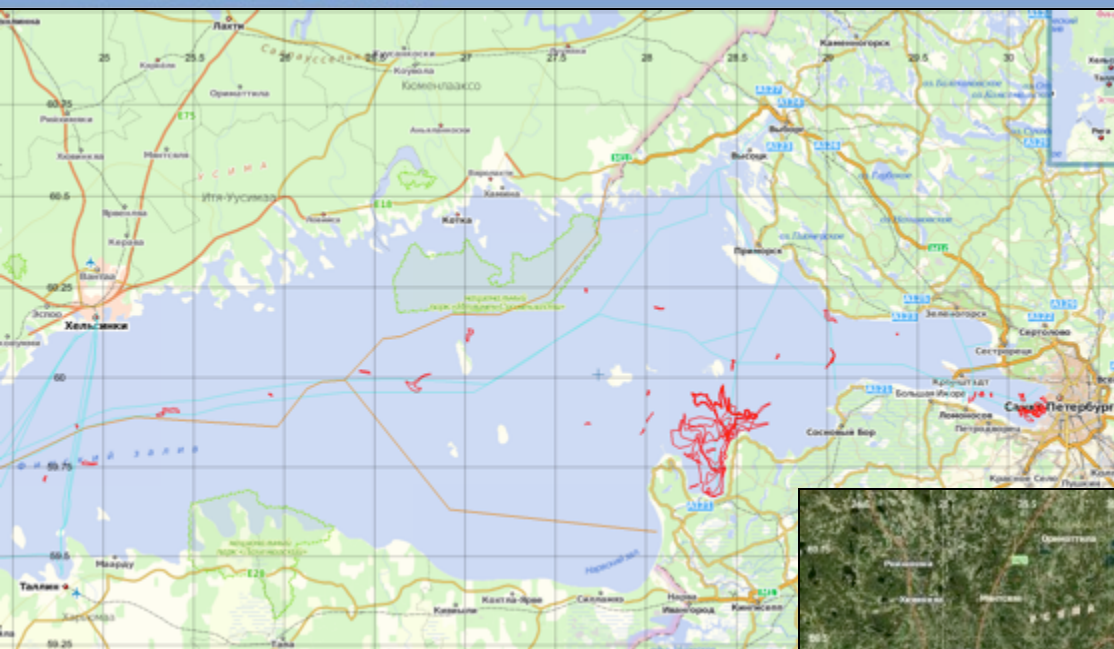


Sea surface oil pollution, integral map for 2011

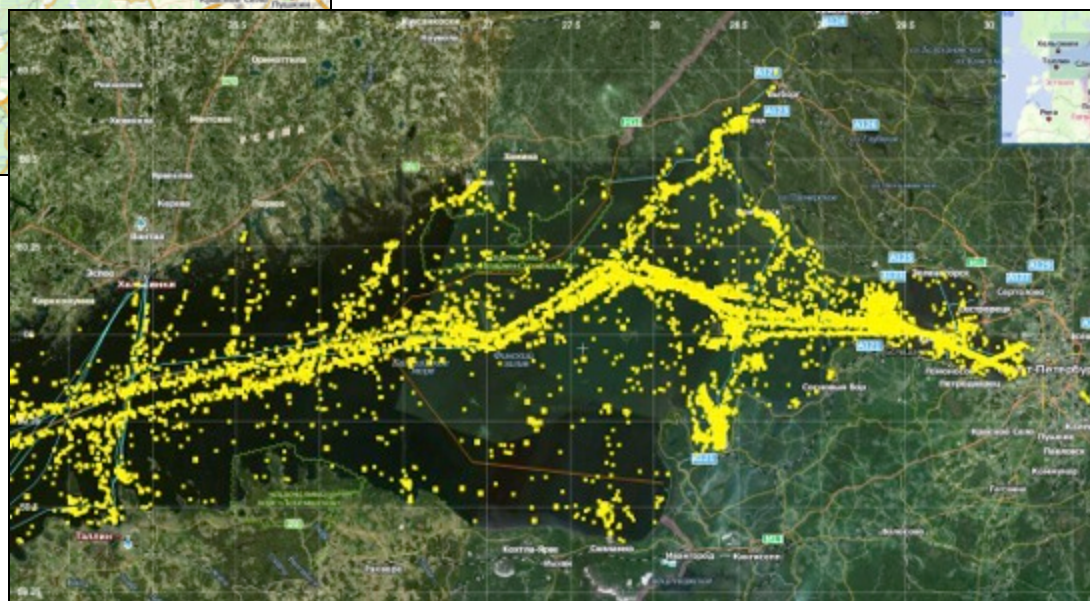


Ship navigation integral map, 2011

Baltic sea monitoring, 2011



Sea surface oil pollution, integral
map for 2011

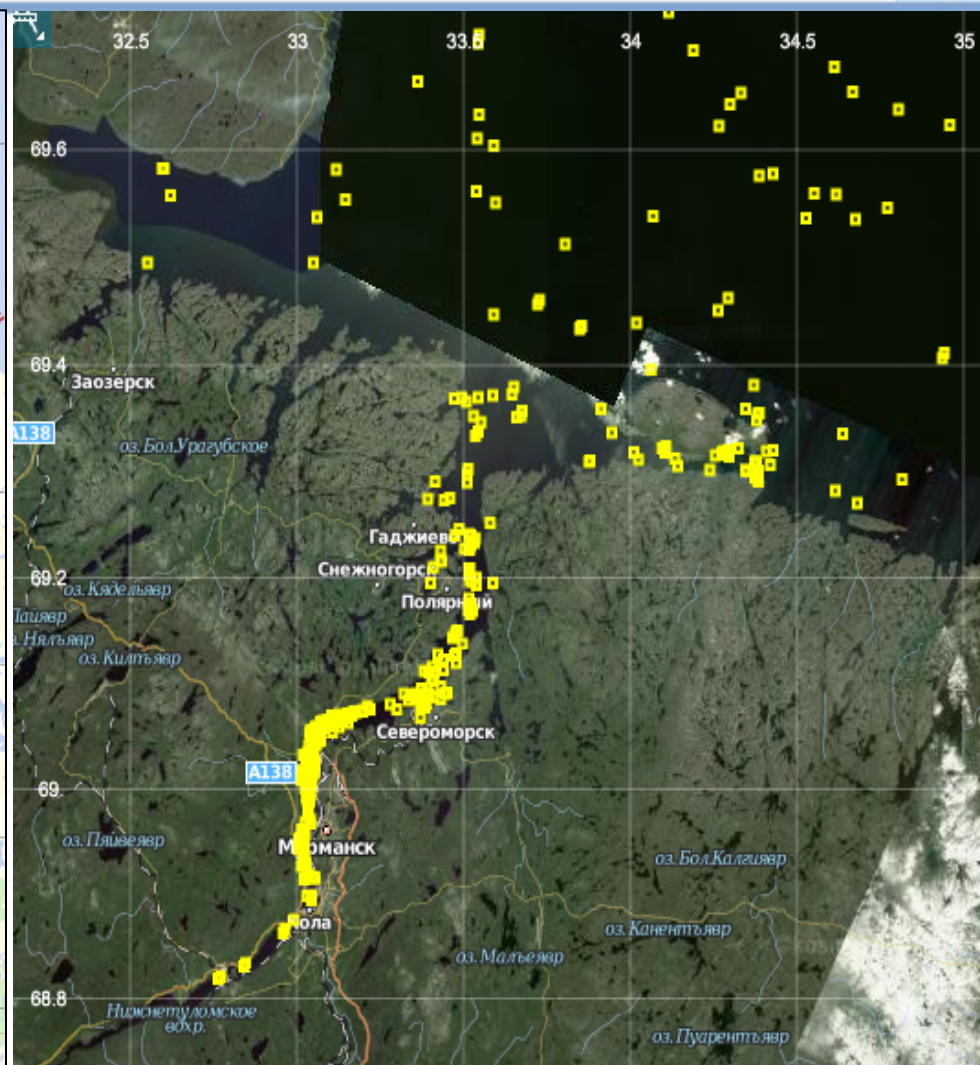


Ship navigation integral map, 2011

Kola gulf monitoring, 2011

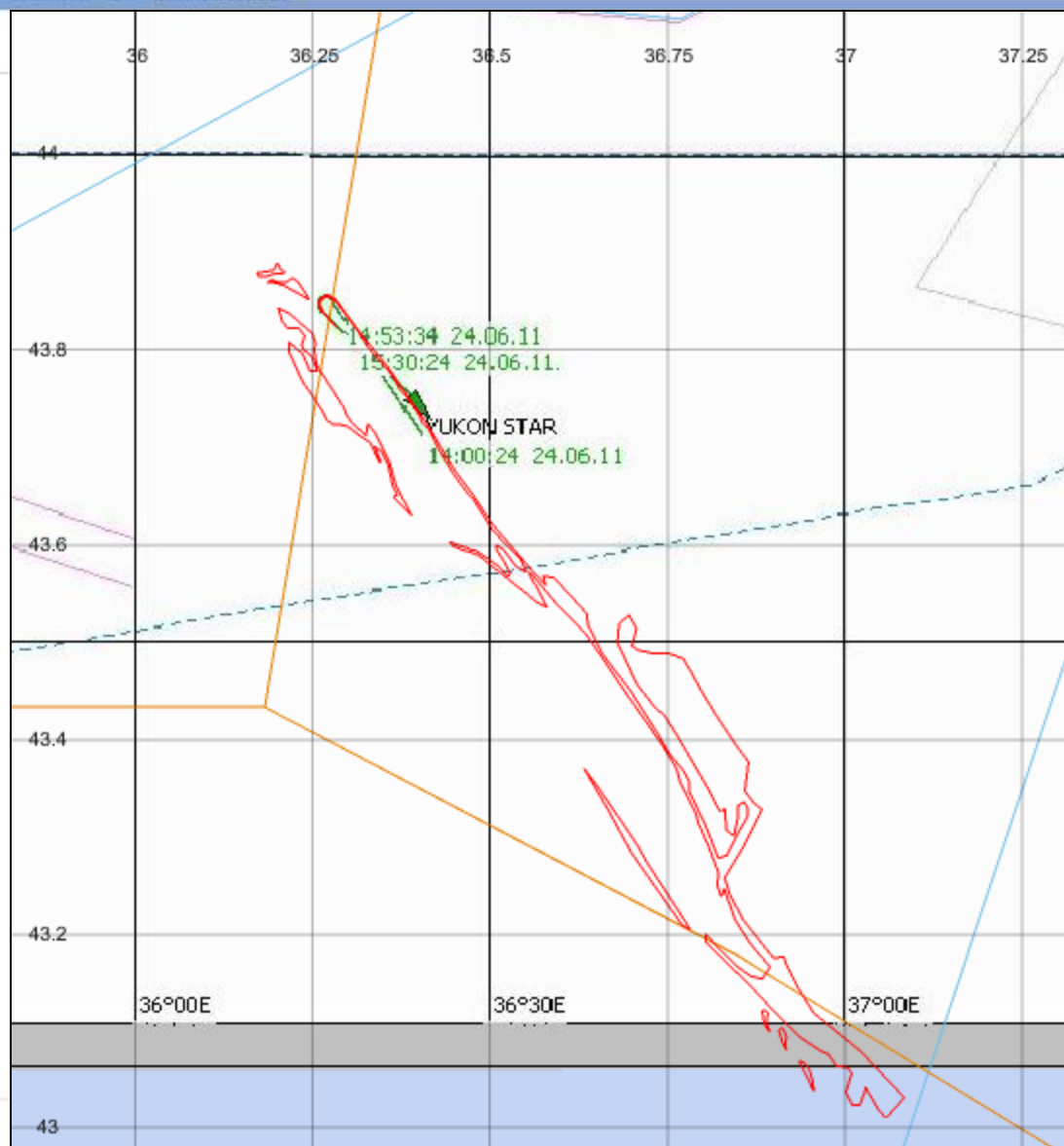


Sea surface oil pollution, integral map for 2011



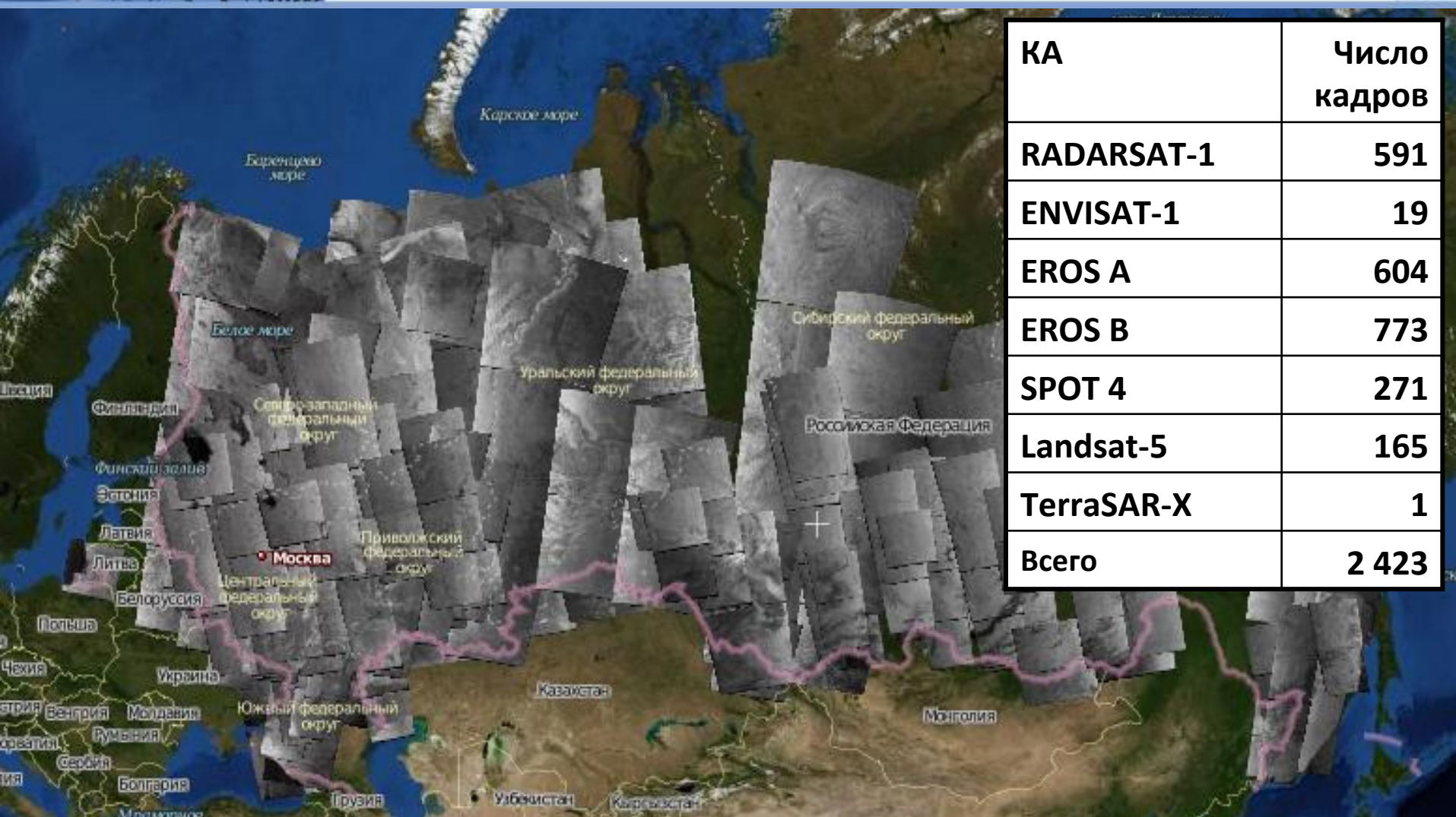
Ship navigation integral map, 2011

Combination of VMS data and information on oil pollution from satellite image for 24.06.2011 (15:23 UTC)



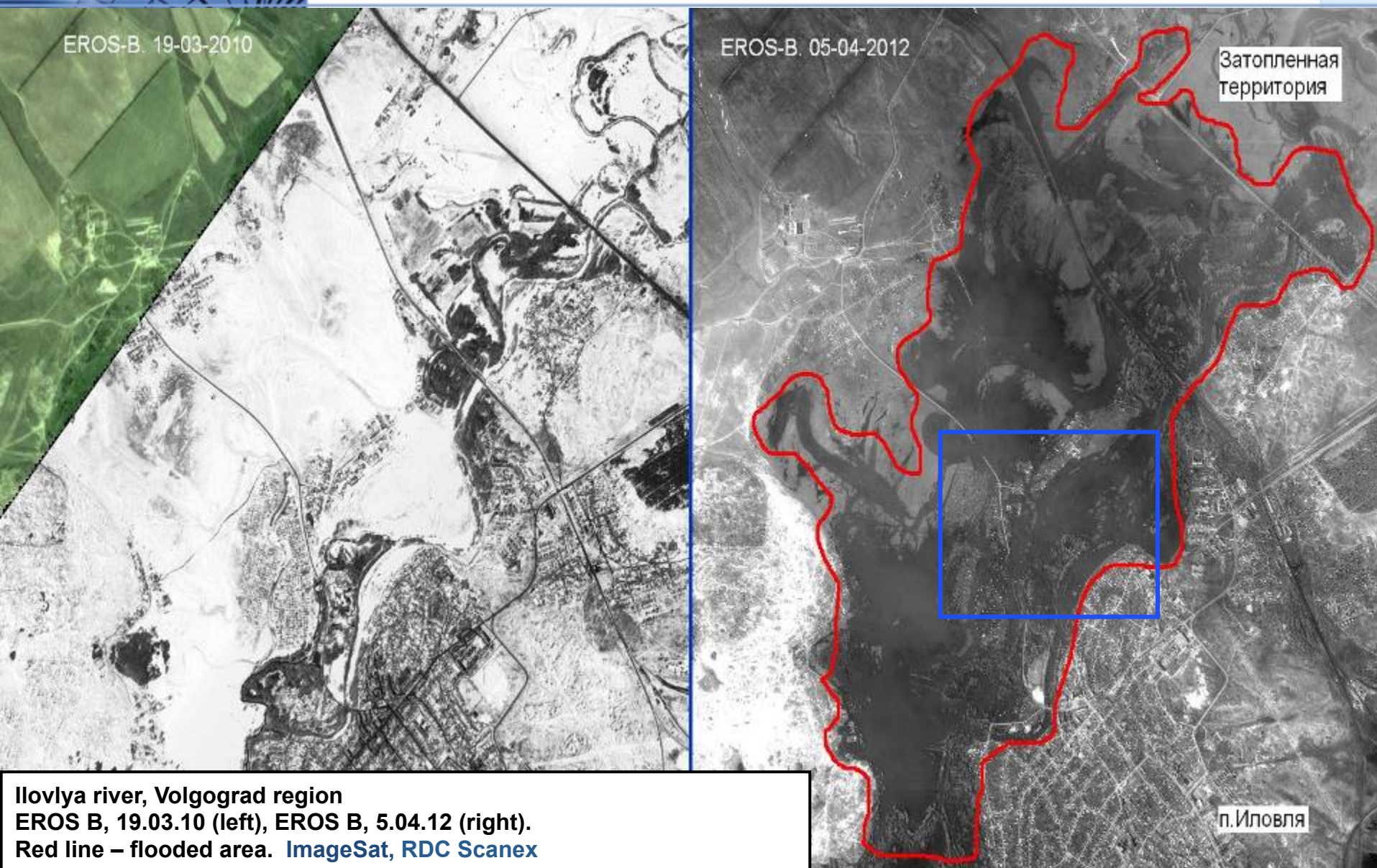
Data combination and following investigation demonstrated that pollution source – tanker «Yukon Star», which proceed illegal palm oil tank washing with sea water. Total polluted sea surface more than 420 sq km.

Flood monitoring with use of SAR and optical data

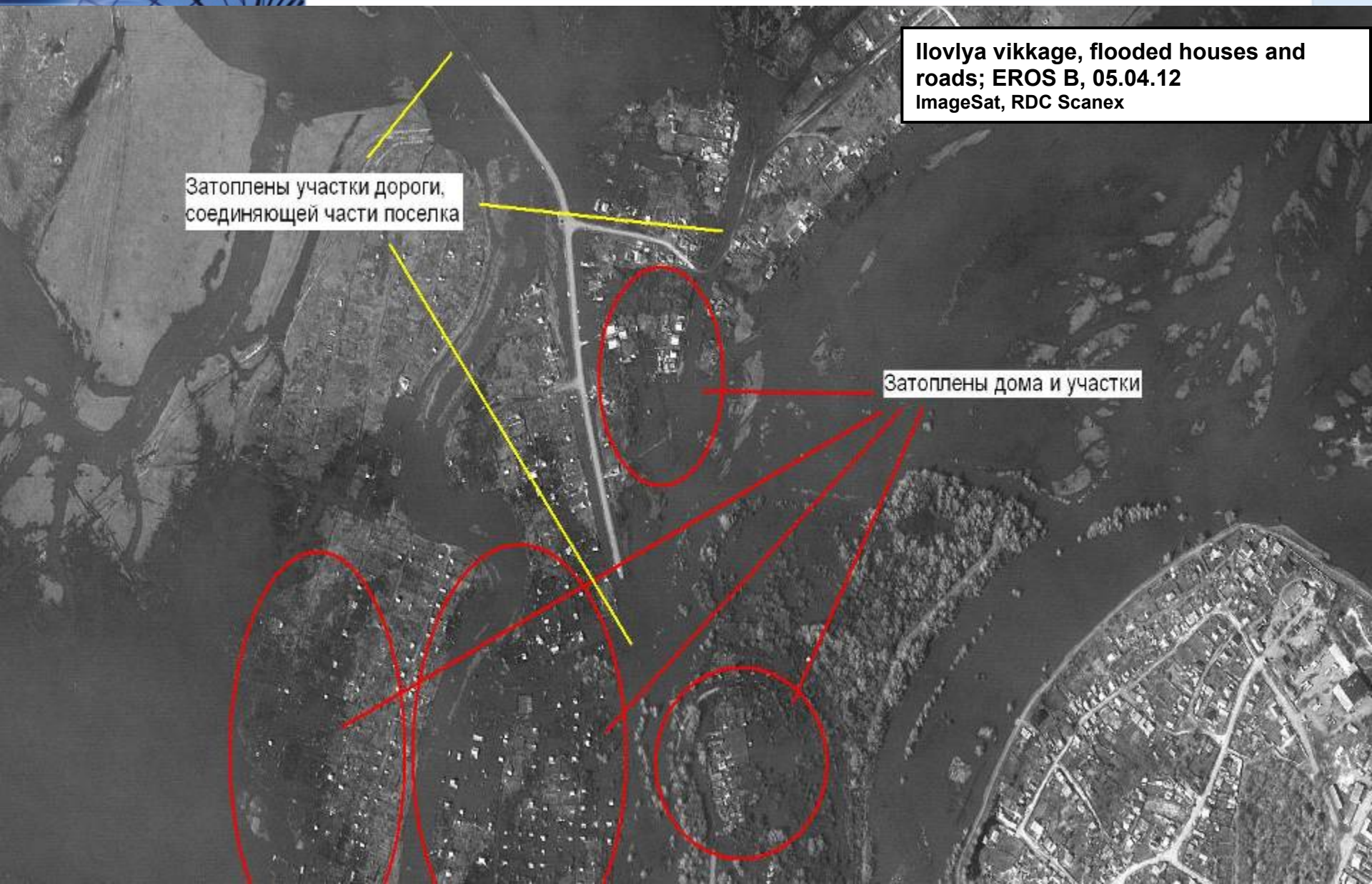


Satellite Images coverage of Russian territory during March-April 2010 flood monitoring project ([web-service Kosmosnimki-Flooding](#))

Flood monitoring with use of SAR and optical data



Flood monitoring with use of SAR and optical data



Ilovlya vikkage, flooded houses and
roads; EROS B, 05.04.12
ImageSat, RDC Scanex

Затоплены участки дороги,
соединяющей части поселка

Затоплены дома и участки



Radarsat-1 (left), EROS-B (right), Pinega river, Archangelsk region, development of ice jam situation during 03:32 – 12:00, May 1, 2011



EROS-B, April 28, 2011, Ice Jam near railway bridge, Pinega river, Ust-Palenga village, Archangelsk region,



For ice navigation support in Arctic RDC ScanEx received, processed and supply to Atomfleet more than 90 SAR images during 2010 and more than 135 images during 2011. Ground stations in Moscow, Megion and Magadan were used for organization of satellite ice conditions monitoring Kara, East-Siberian, Laptev and Chukchi seas.



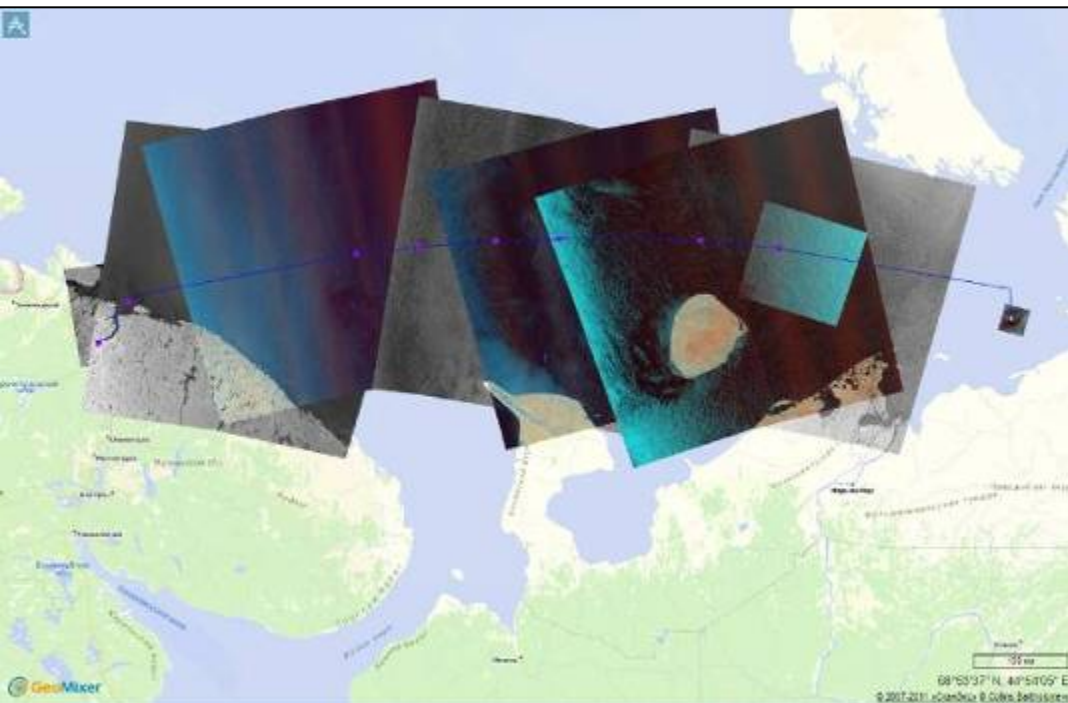
Off-shore oil exploring and production monitoring Prirazlomnaya off-shore oil drilling platform transportation



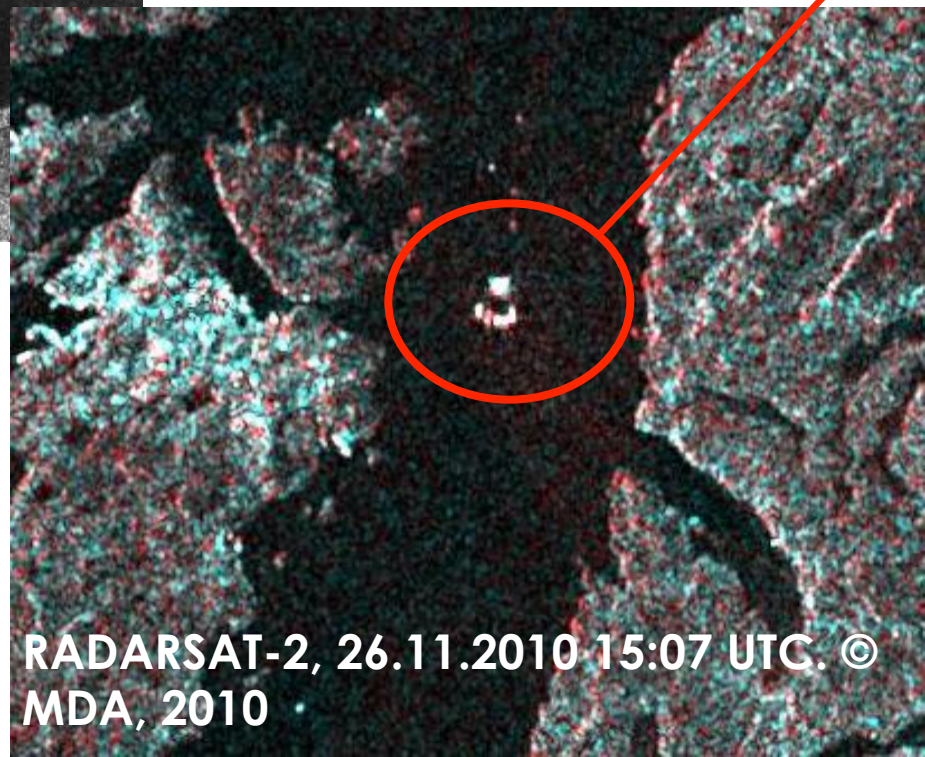
*“Prirazlomnaya” in
Murmansk port,
17.08.2011, EROS-B
_12:48 UTC*



***Satellite images RADARSAT-1/2,
EROS B, SPOT 4 were applied
for “Prirazlomnaya”
transportation monitoring***



Off-shore oil exploring and production monitoring Prirazlomnaya off-shore oil drilling platform transportation



Нефтяная платформа Приразломное, Газпром

**RADARSAT-2, 26.11.2010 15:07 UTC. ©
MDA, 2010**

Wildfire satellite monitoring.

Космоснимки 01

Космоснимки Заказ снимков API GeoMixer Проекты Blog Русский English

Карта Вид Инструменты Сервисы Справка

Карта: Пожары

Вид: Дерево слоев

Шкала прозрачности

Пожары

☒ Границы

☒ Выгоревшие участки земледелия

☒ Границы горей редактируемый слой с границами выгоревших территорий (Скачать)

Адм. деление

☐ Адм. деление 2 РФ границы районов

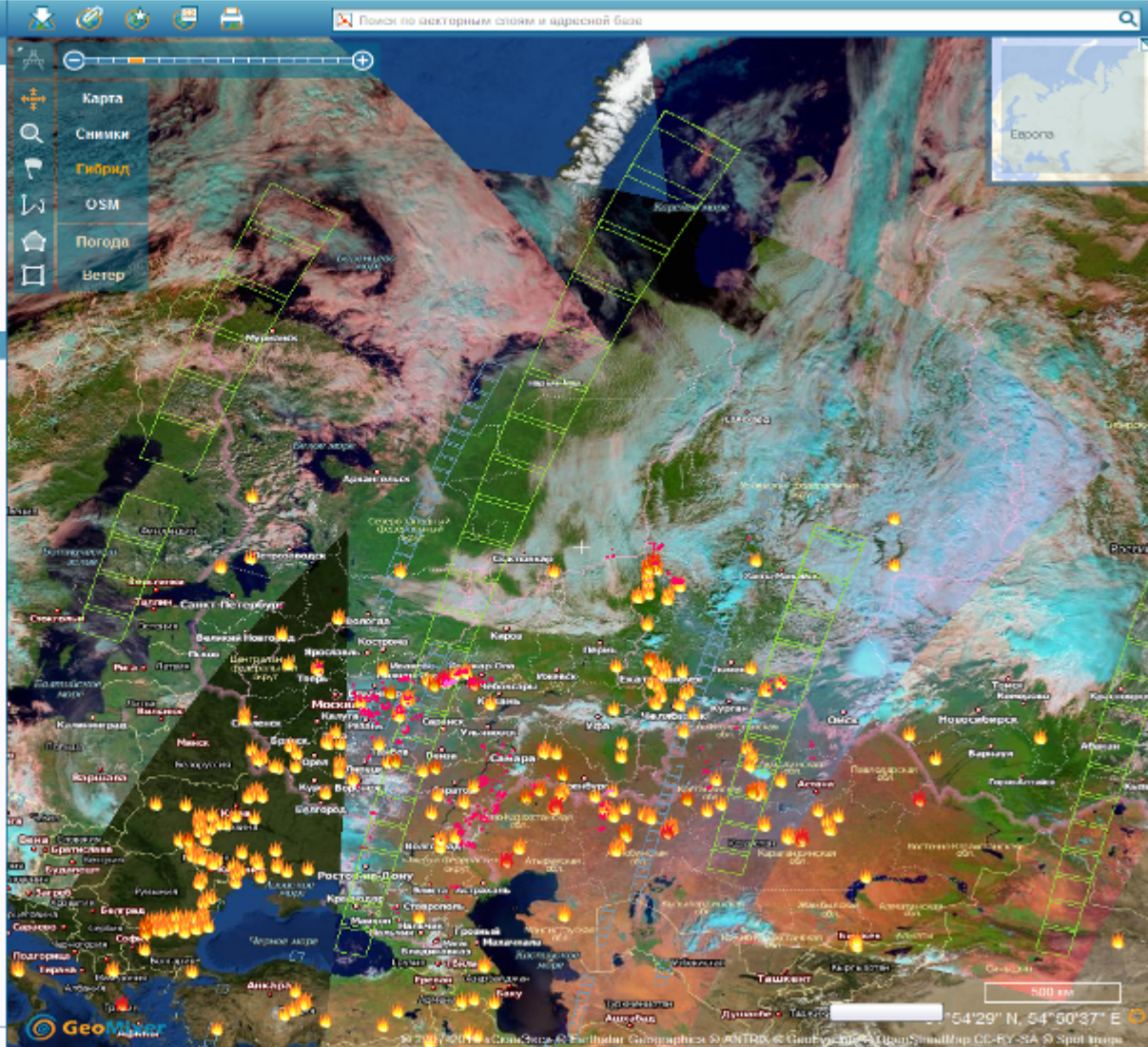
☐ Адм. деление РФ субъекты

☒ Очаги пожаров

☒ Спутниковые снимки в реальном времени

Вид: Календарь событий

Авг 2010						
Пн	Вт	Ср	Чт	Пт	Сб	Вс
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

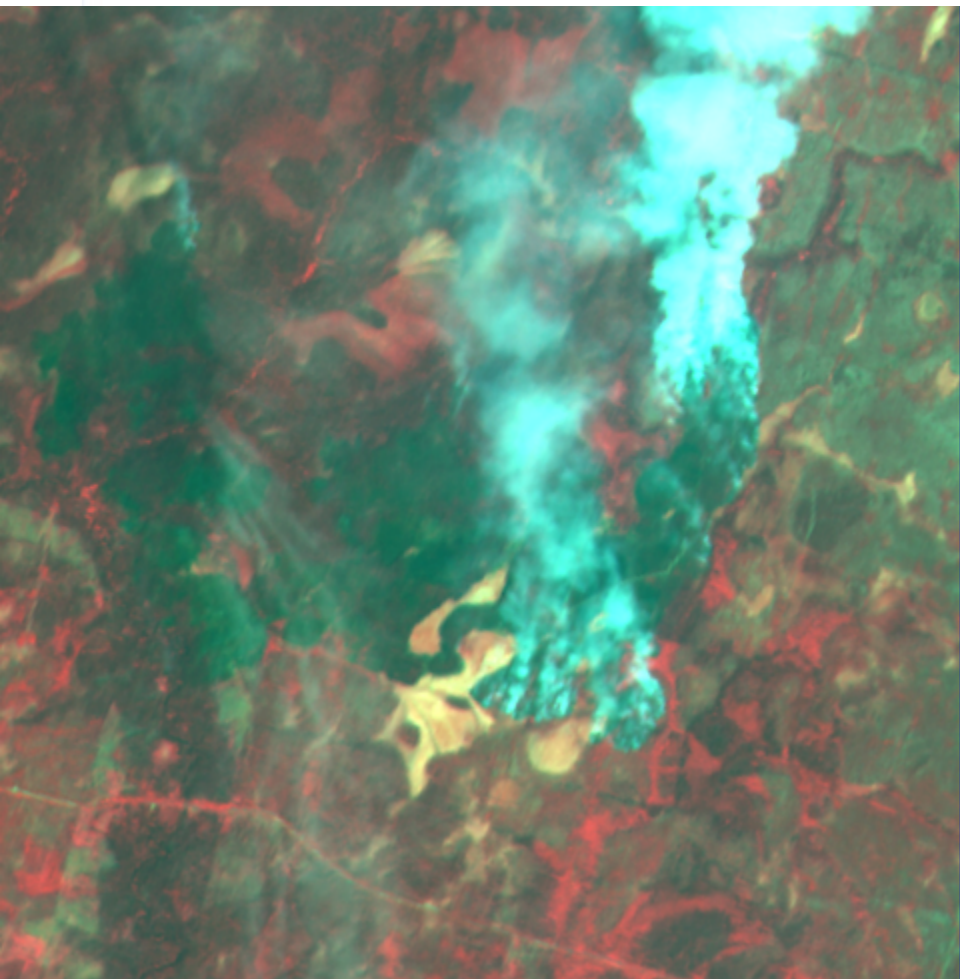


Wild Fire Satellite Monitoring

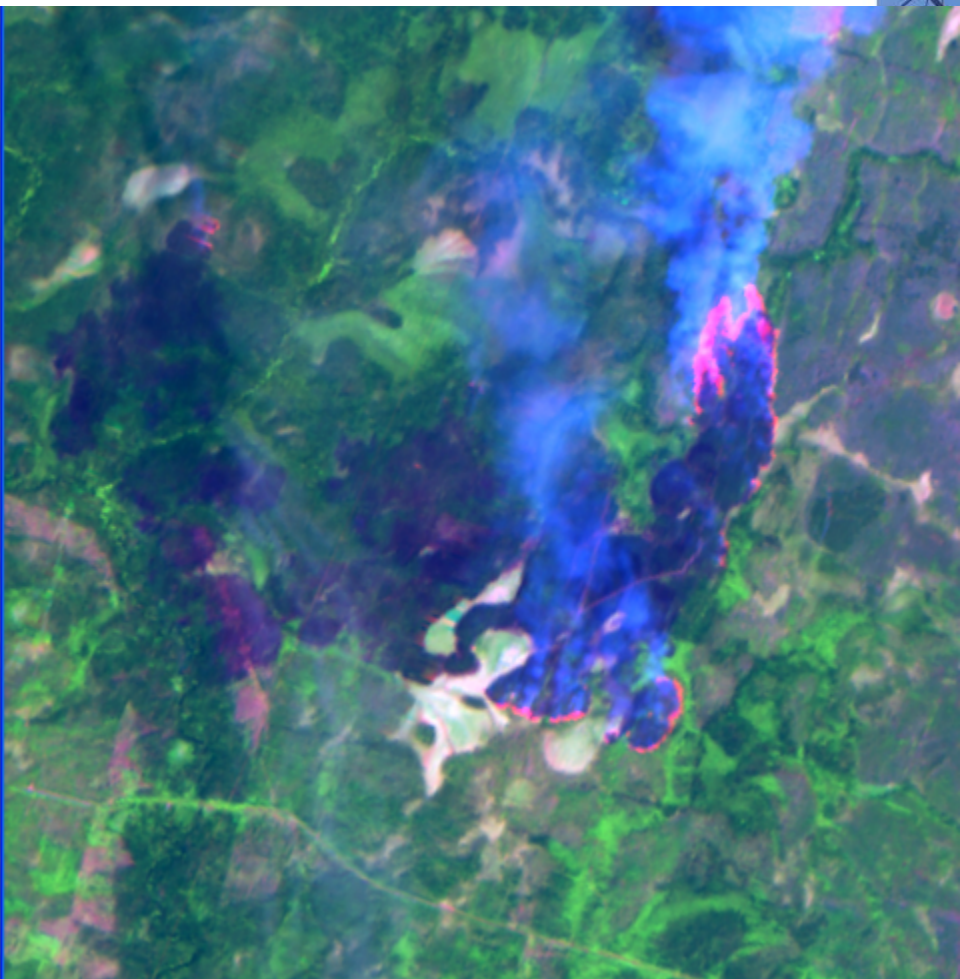


MODIS. Komi republic, 13.07.2011.

Wild Fire Satellite Monitoring



Band combination NIR-Red-Green

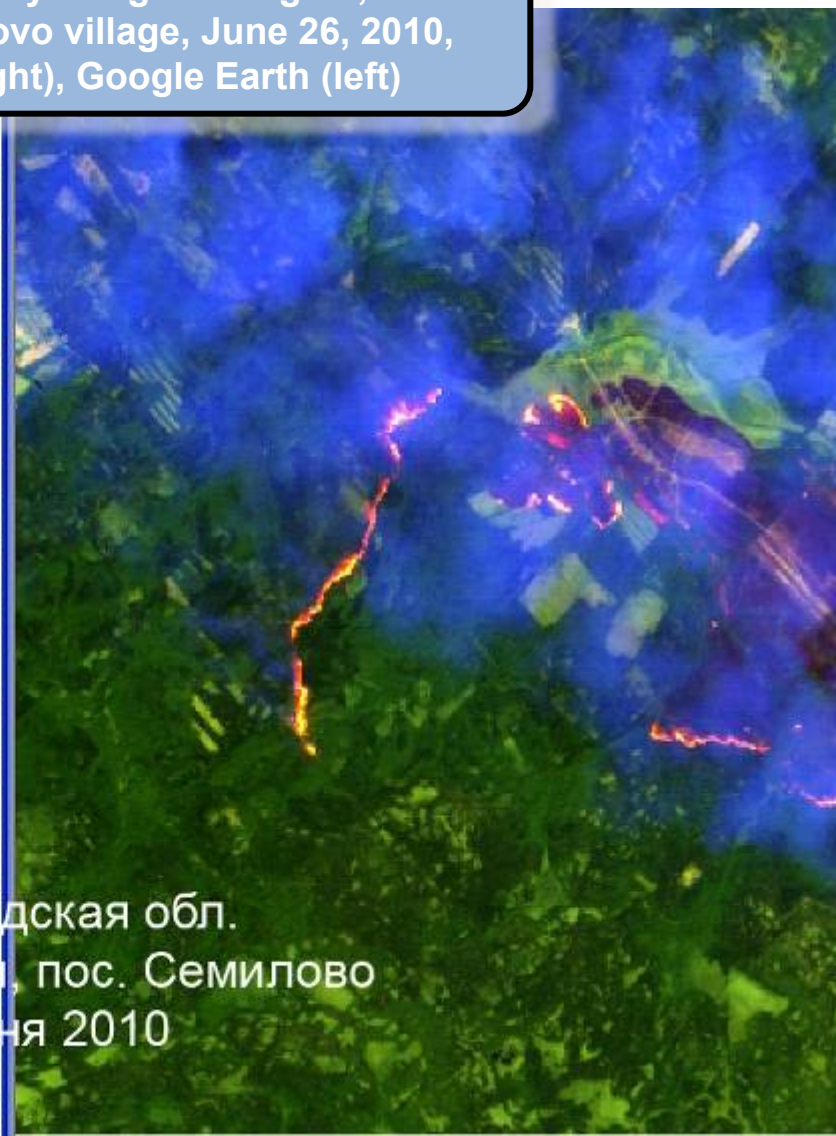


Band combination SWIR-NIR-Red

SPOT-4, Komi Republic, 13.07.2011

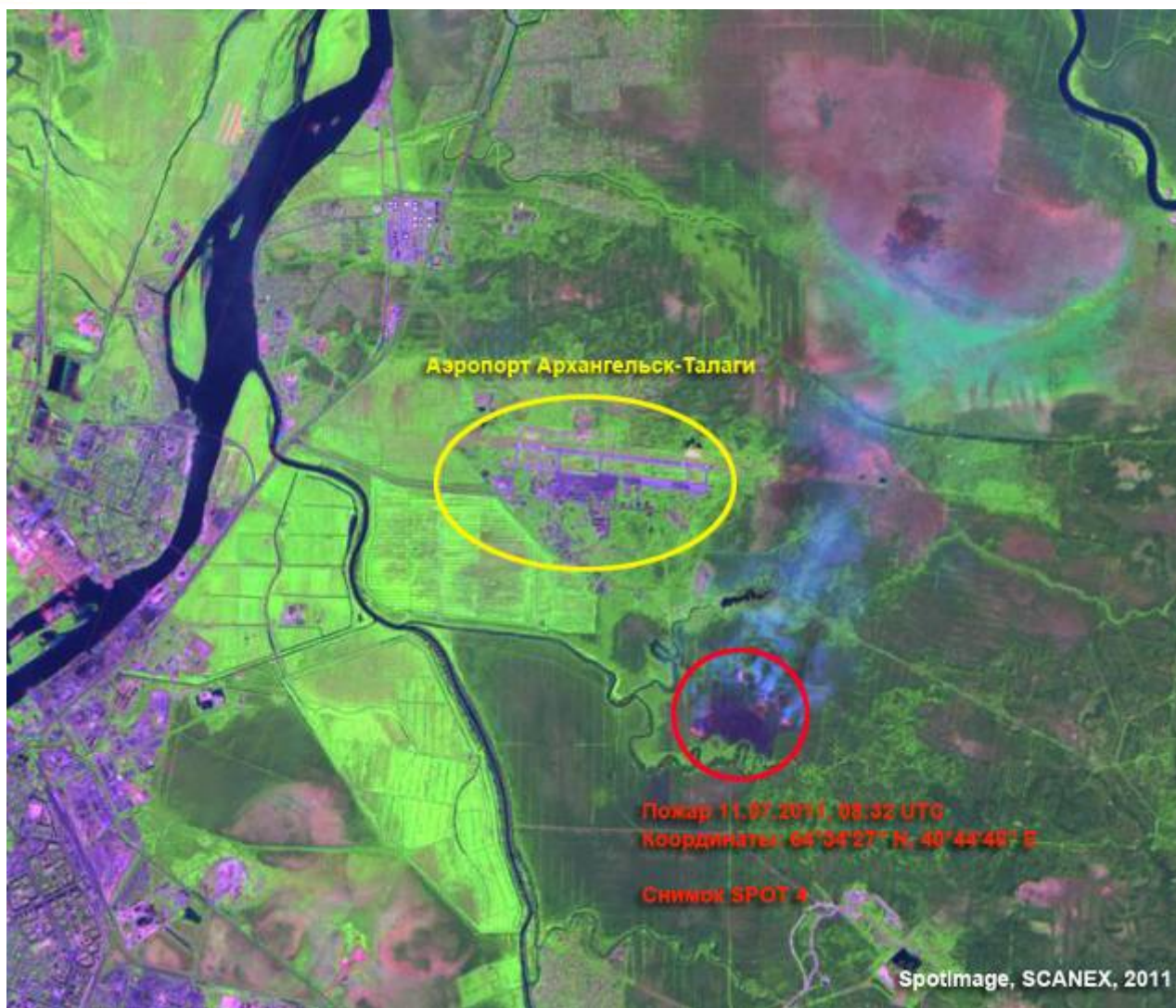
Wildfire near real time monitoring

Forest fires, Nizhny Novgorod region,
Vyksa district, Semilovo village, June 26, 2010,
Landsat-5 data (right), Google Earth (left)



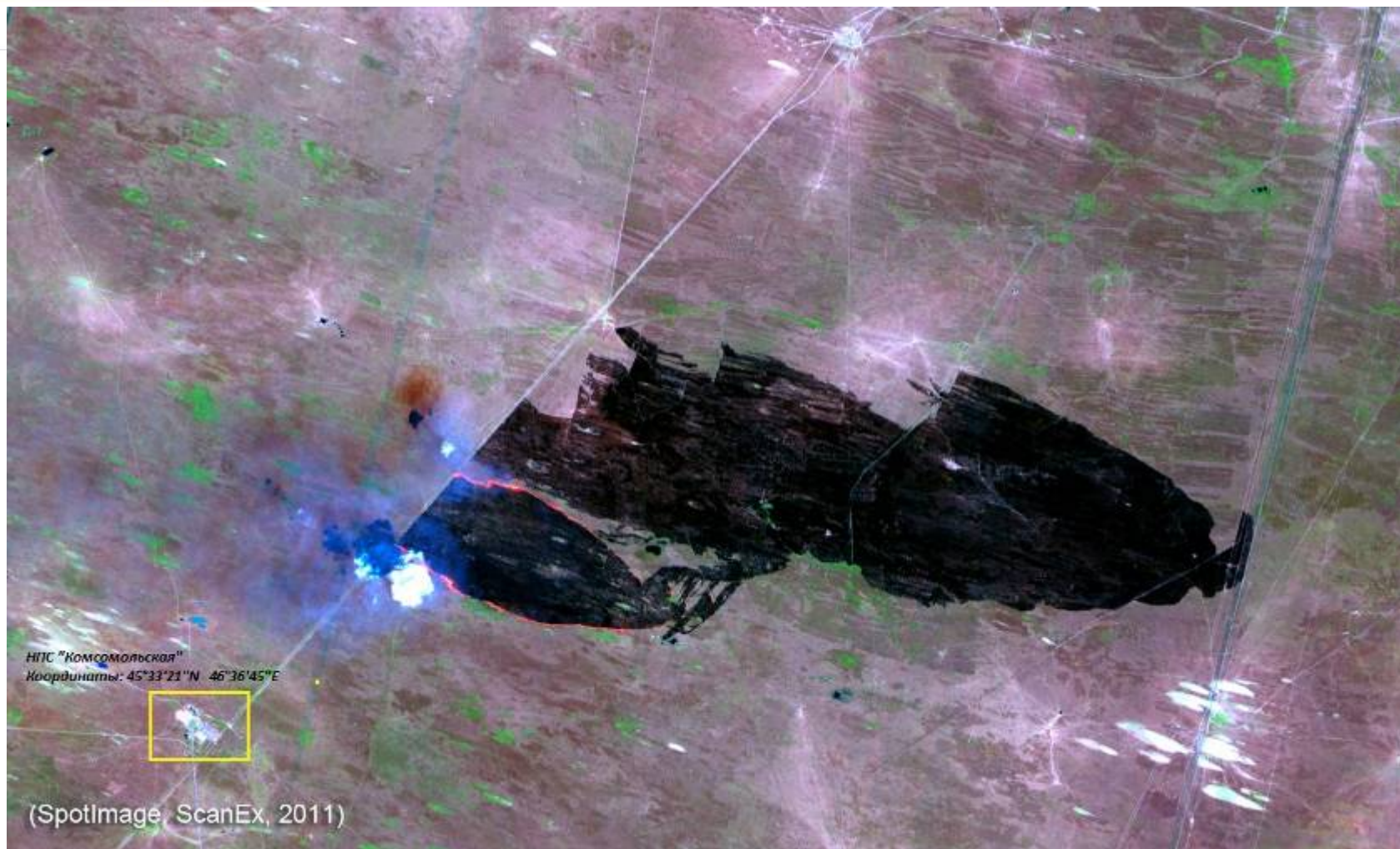
Нижегородская обл.
Выксунский р-н, пос. Семилово
26 июня 2010

Wildfire near real time monitoring



SPOT-4, Archangelsk region, 11.07.2011, forest fire near (3 km) airport Talagi

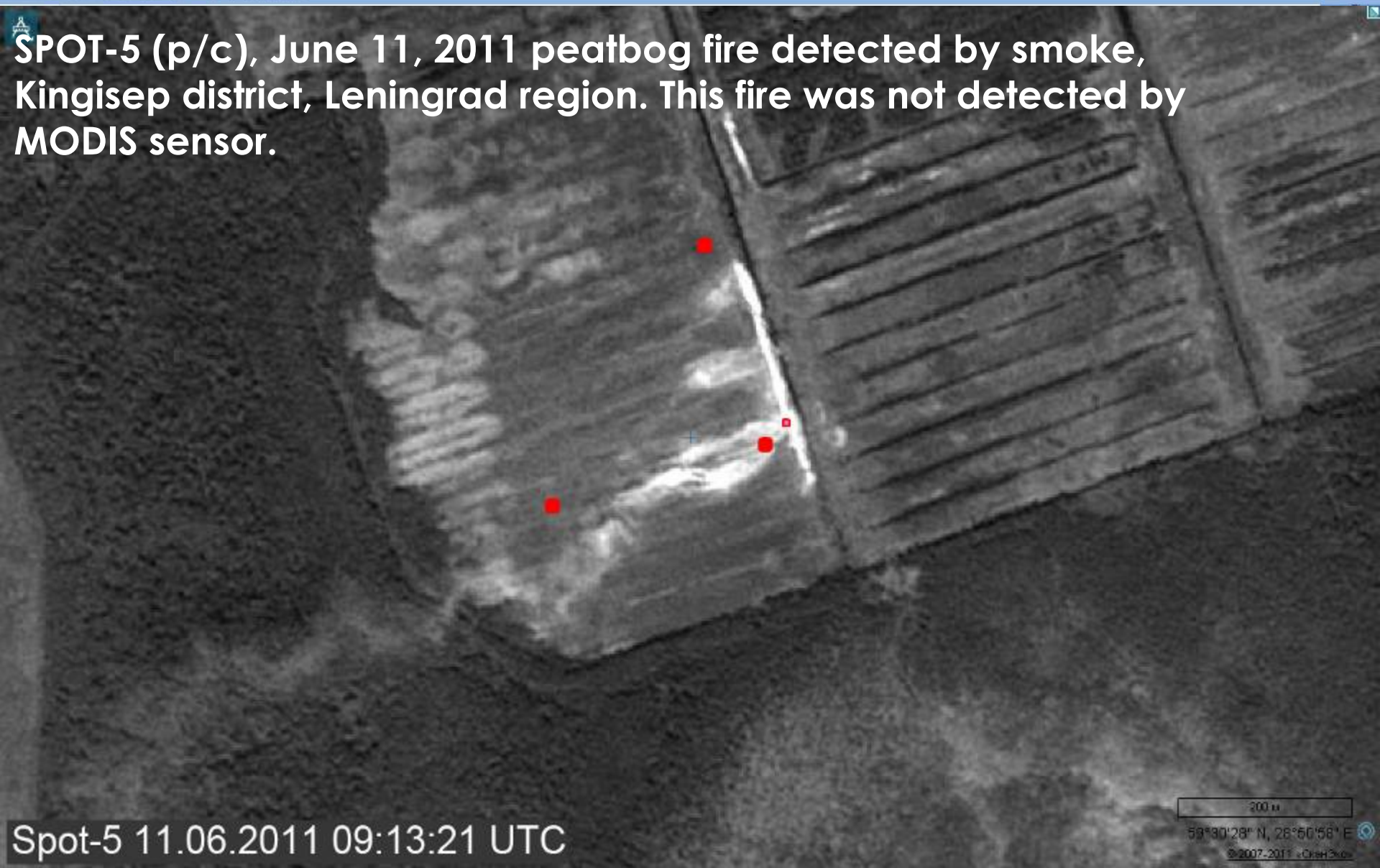
Wild Fire Satellite Monitoring



SPOT 4, Kalmykia Republic, 29.06.2011, 07:28 UTC, wild fire near (5 km) oil pumping station

Peatbog fires satellite monitoring

SPOT-5 (p/c), June 11, 2011 peatbog fire detected by smoke, Kingisep district, Leningrad region. This fire was not detected by MODIS sensor.



Spot-5 11.06.2011 09:13:21 UTC

Steppe fire development, Astrakhan region



Left image: FORMOSAT-2, April 1, 2012, 7:00 UTC. Burned out territory 0,2 sq. km
Right image: SPOT 5, April 1, 2012, 7:57 UTC. Burned out territory 0,7 sq. km



**Haze
removal
after
analyzing
IR band**

**Landsat-5
image**

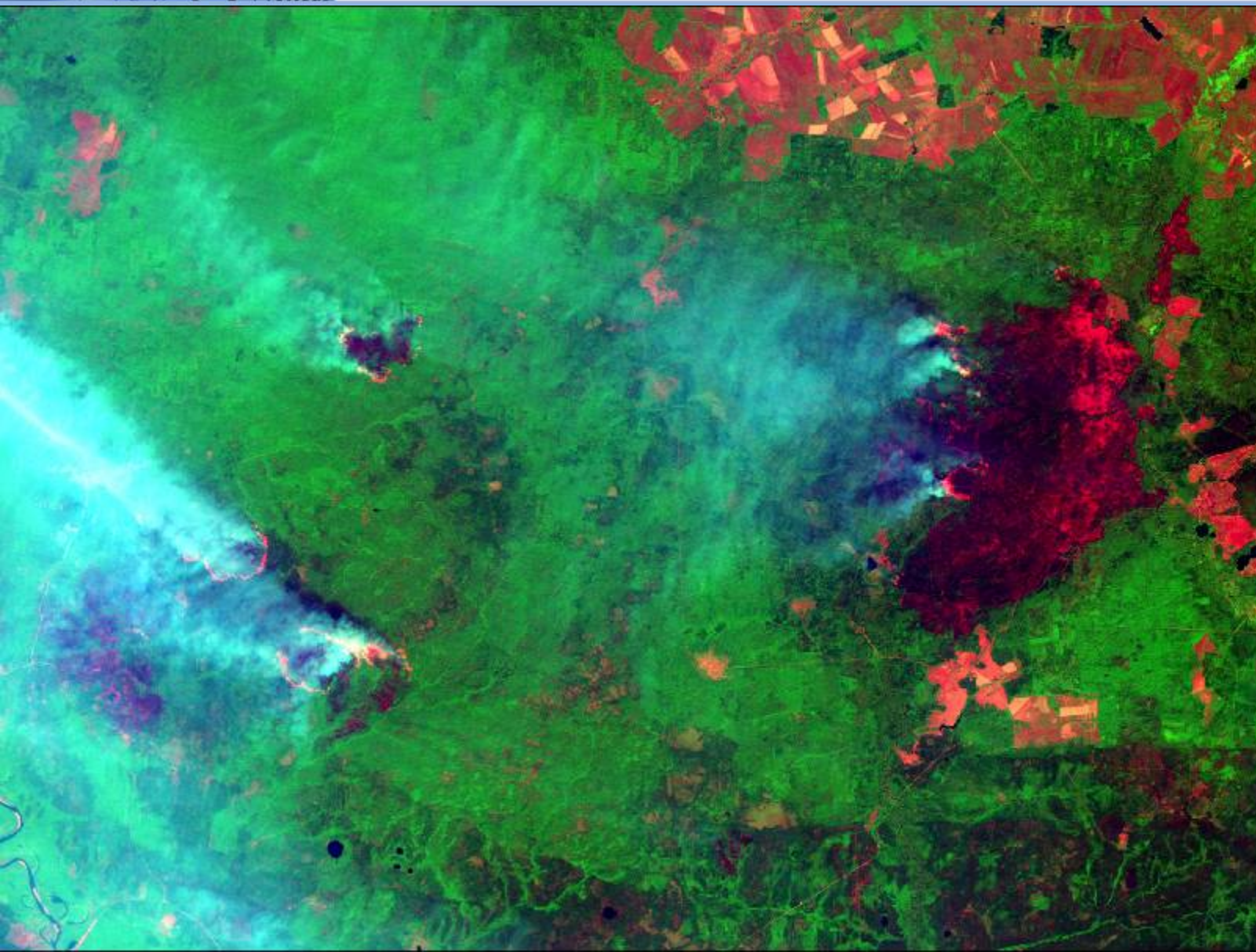
Analytical methods to improve detecting of fires



**Haze
removal
after
analyzing
IR band**

**Landsat-5
image**

Analytical methods to improve detecting of fires



**Haze
removal
after
analyzing
IR band**

**Landsat-5
image**

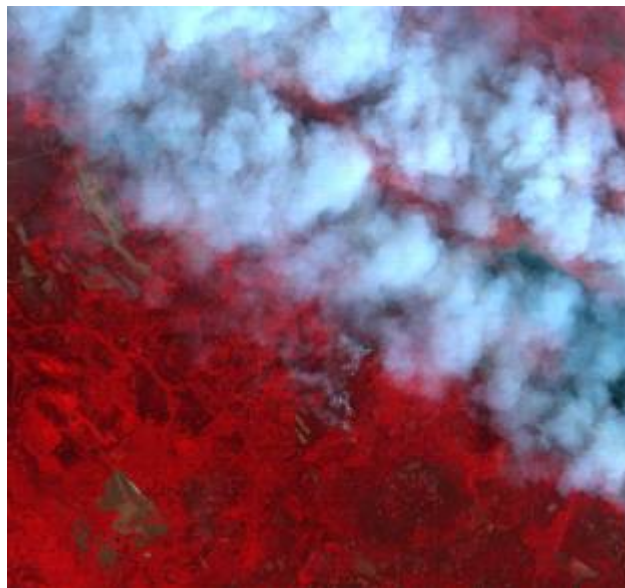
Thermal and middle-IR bands allow detecting fire localization despite of smoke



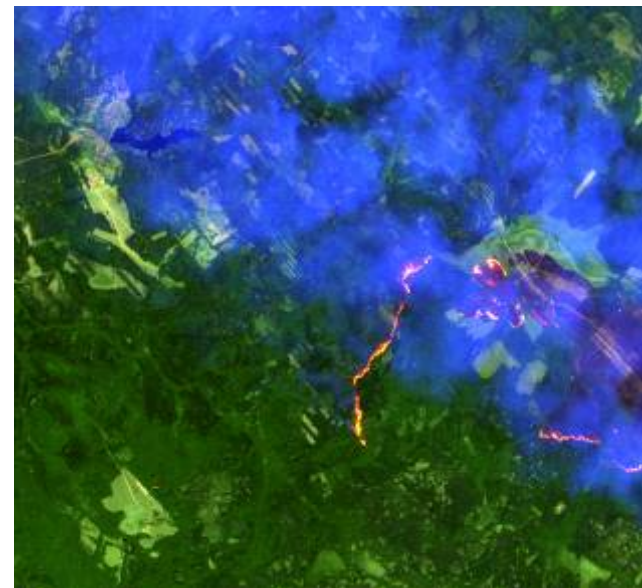
Fire around village Semilovo. LANDSAT-5, 17.06.2010



RGB:321

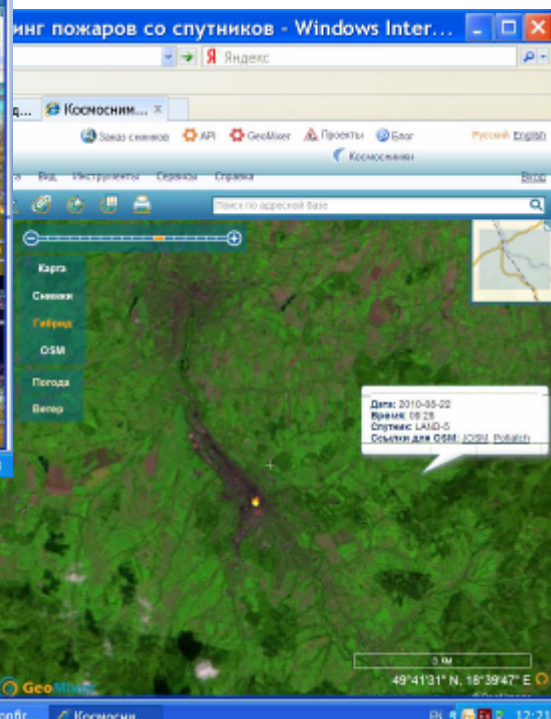
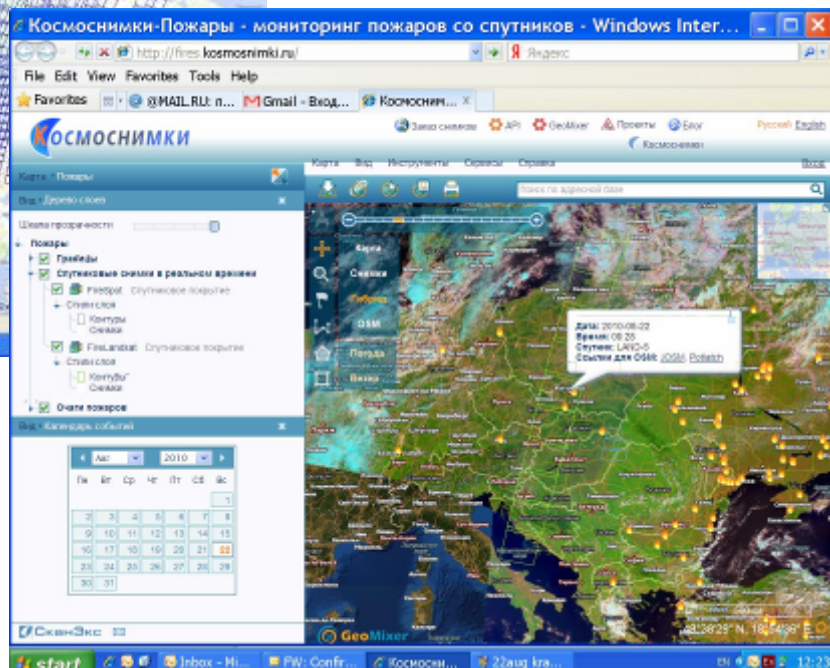
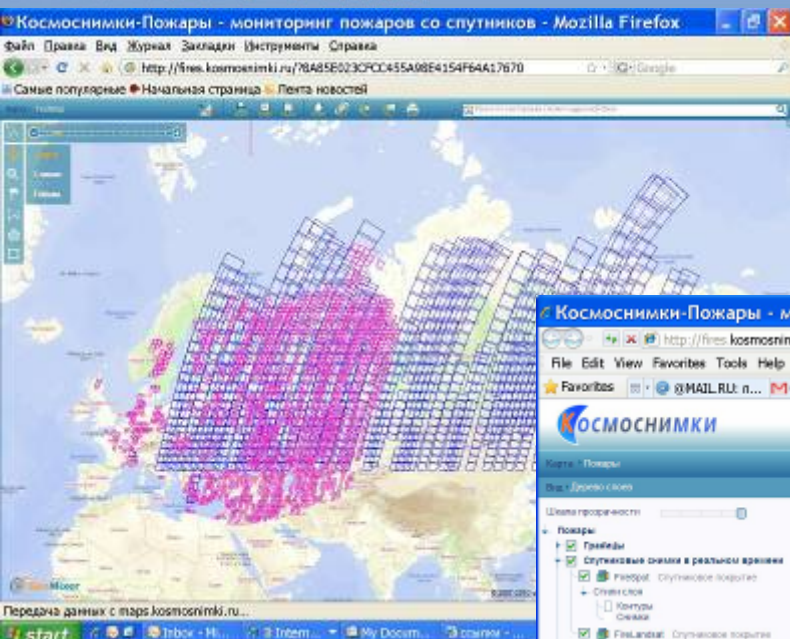


Pseudonatural, RGB:432 (NRG)



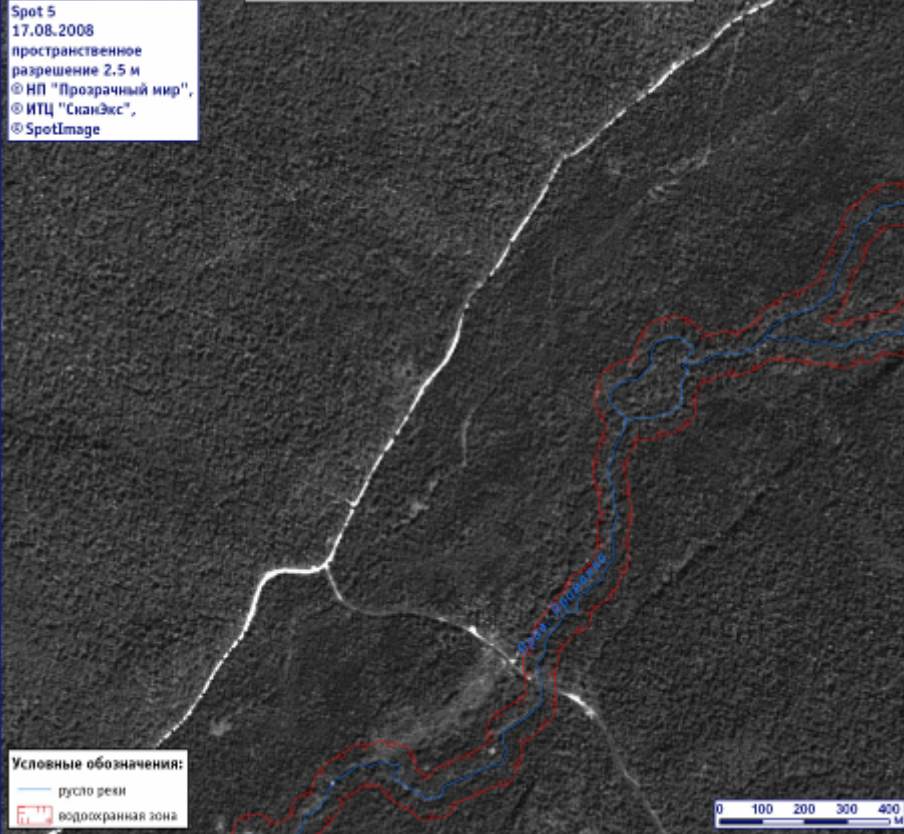
IR synthesis, RGB:754

Forest fires monitoring - web based project based on visualization of Landsat-5 and SPOT-4 (directly received by UNISCAN) combined with Modis data <http://fires.kosmosnimki.ru/>



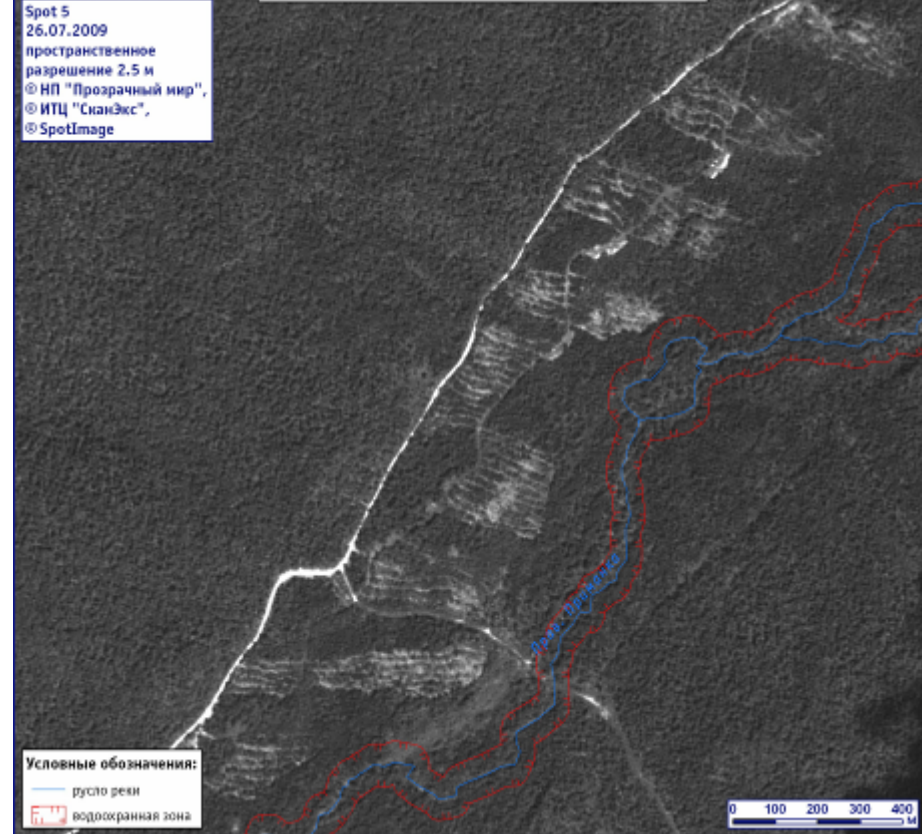
Environment monitoring Identification of forest cutting

Рощинское лесничество. Приморский край



SPOT 5 (resolution 2,5 m), Russian Far East, August 17, 2008. © Spot Image, acquired and processed by R&D Center SCANEX

Рощинское лесничество. Приморский край



SPOT 5 (resolution 2,5 m), Russian Far East, July 26, 2009. © Spot Image, acquired and processed by R&D Center SCANEX

Direct acquisition of high resolution satellite images using personal ground station help to simplify and accelerate illegal forest cutting monitoring



Identification of forest cutting features, Russian Far East, SPOT-5 Fusion (resolution 5 m). © Spot Image, acquired and processed by R&D Center SCANEX

Direct acquisition of high resolution satellite images using personal ground station help to simplify and accelerate illegal forest cutting monitoring



Identification of shelterwood felling, Russian Far East, Eros-B (resolution 0,7 m).
© ImageSat International N.V., acquired and processed by R&D Center SCANEX

Emergencies monitoring.

Smolensk airport, April 10, 2010, Plane crash

Карты Слой Вид Инструменты Сервисы Справка

Русский English LayerManager Выход

Карты > Чрезвычайные Ситуации

Вид > Объекты на карте

прямоугольник (27851 кв. м)

Скачать shp-файл

Очистить

Вид > Дерево слоев

Шкала прозрачности

Чрезвычайные Ситуации

- Смоленск
 - аэроп. Северный, 11.04.2010 (© GeoEye, Inc.) место крушения самолета
- Чили
 - ER-B_Constitution_20100302_trans второе марта 2010
- Гаити
 - Снимок Geo Eye - 1, 13 января 2010 г.
 - Снимок EROS B, 18 января 2010 г.

Поиск по векторным слоям и адресной базе

Карты

Снимки

Гибрид

OSM

50 м

54°25'N, 32°02'59"E

© 2010 GeoEye, Inc. All rights reserved. GeoEye is a registered trademark of GeoEye, Inc.

Emergencies monitoring. Smolensk airport, April 10, 2010, Plane crash



Emergencies monitoring, Port-au-Prince, Haiti, Stadium tent camp, 2010

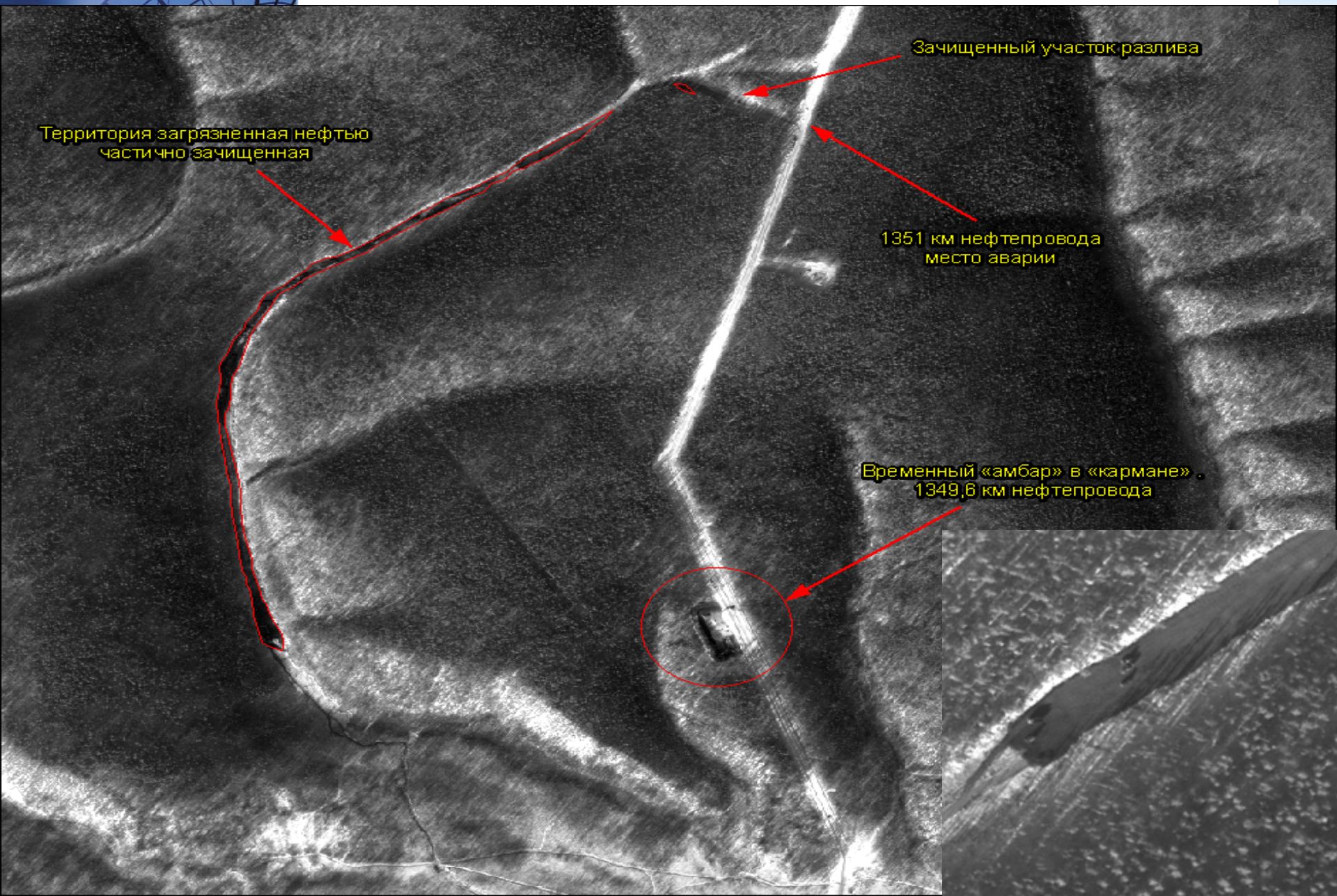


QuickBird, 2008, Google

GeoEye-1, 13.01.2010, GEOEYE

EROS-B, 17.01.2010, ImageSat

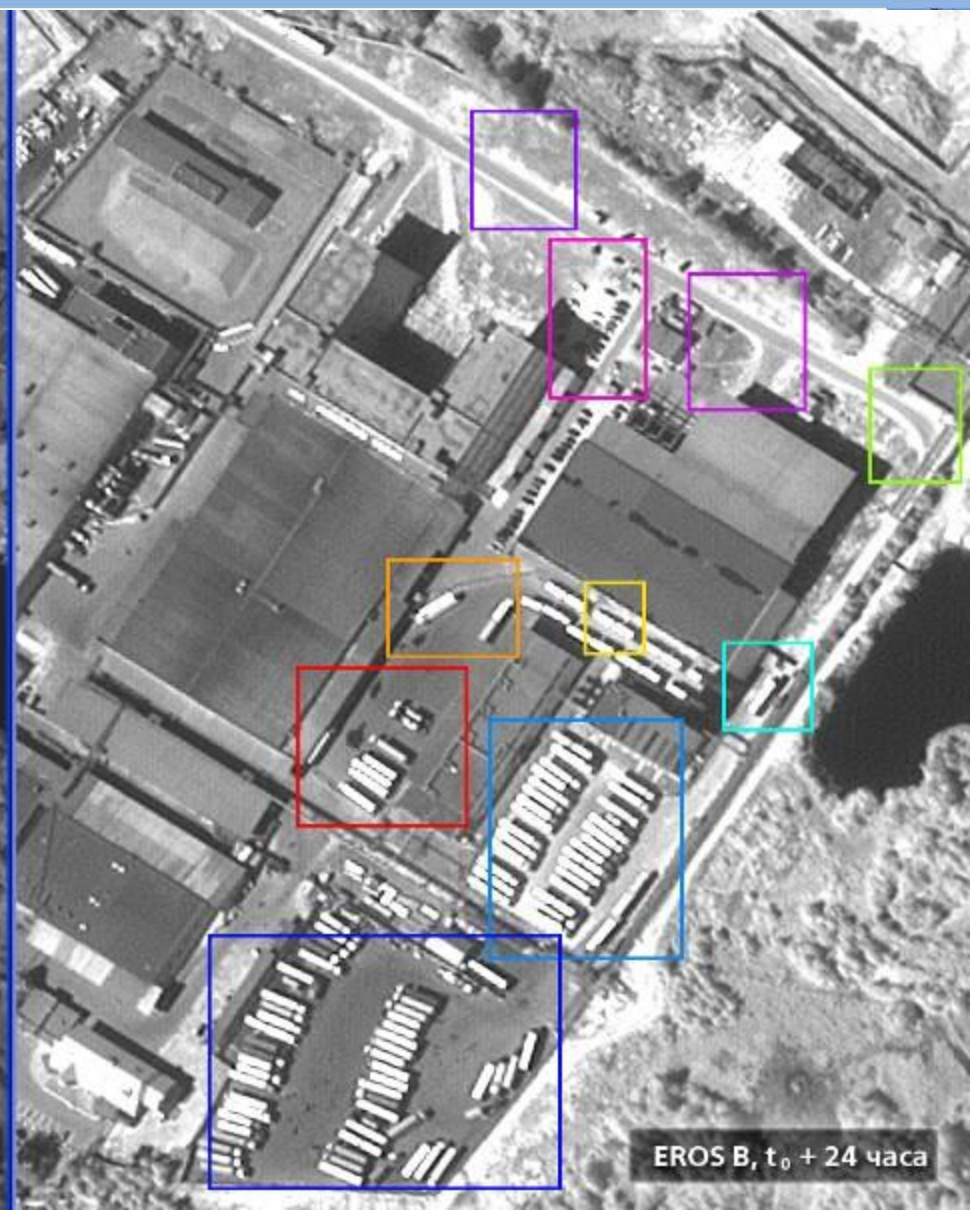
Environment monitoring of oil industry. ESPO pipeline oil spill, Lensk, 24.2.2010



Infrastructure development monitoring. Bridge construction, Nizhny Novgorod, 2007-2008



Transport company activity monitoring



Search system at http://search.kosmosnimki.ru/index_eng.html
browsing global catalogues of high resolution space images
(EROS-A/B, IKONOOS, QuickBird, WorldView-1/2, GeoEye-1).

Search results for March-June 2009
(Madagascar, National Park illegal logging)

Космоснимки - Поиск Спутниковых

http://search.kosmosnimki.ru/

File Edit View Favorites Tools Help

Космоснимки - Поиск Спут...

Ссылка на карту Поиск по контуру

Поиск снимков Покупка Online

Помощь Чат О проекте Блог

Найти

IKONOS (1m) QuickBird (0.6m)
EROS A (2m) WorldView-1 (0.5m)
EROS-B (0.7m) GeoEye-1 (0.5m)

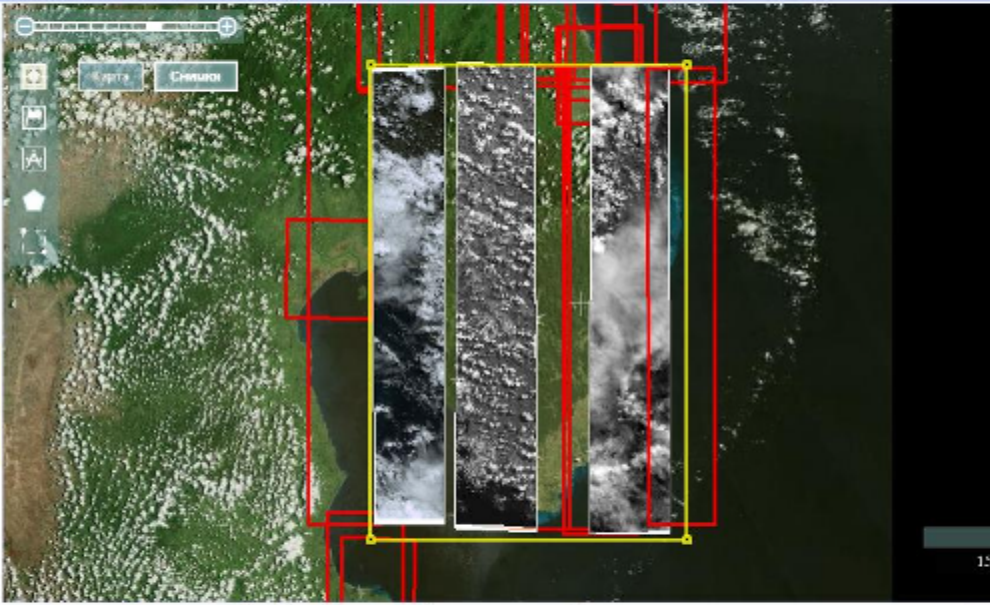
Best Лучшее покрытие?

С даты: 1 мая 20
По дату: 1 янва 20
Ежегодно? Облачность: 80

Искать снимки Заказать

На карте:
прямоугольник (9348 кв. км)

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Спутник Дата съемки Облачность Угол съемки № по каталогу Стереопара

☐	QuickBird	16.12.2008	30%	6°	1010010008ED2900	
☐	WorldView	03.05.2008	32%	17°	10200100024E6B00	
☐	WorldView	26.10.2008	33%	19°	102001000457AA00	
☐	WorldView	24.07.2008	41%	18°	1020010003374500	
☐	QuickBird	19.08.2008	43%	18°	10100100082E3B00	
☒	WorldView	03.05.2008	45%	18°	1020010002B35300	

Сделано в ИТЦ СканЭкс

Найдено снимков: 24 Выбрано снимков: 3



“History from Space” web based project utilized high resolution aerial images from World War II, declassified Cold War time and recent space images <http://goroda.kosmosnimki.ru/>

Combination of aerial (1941, German aircraft) and space images (1966, KH-7 US mission), IKONOS (2009) S-Petersburg (resolution about 1 m)

Города в пространстве и

http://goroda.kosmosnimki.ru/

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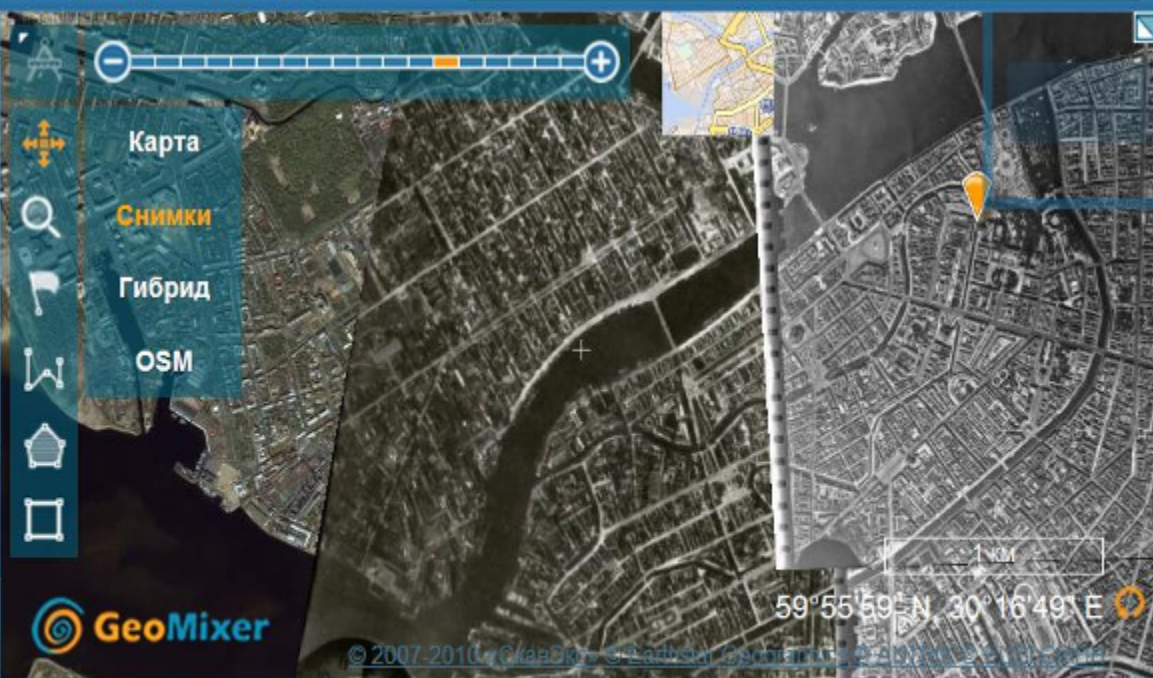
Map Города и веси



Search vector layers and address base

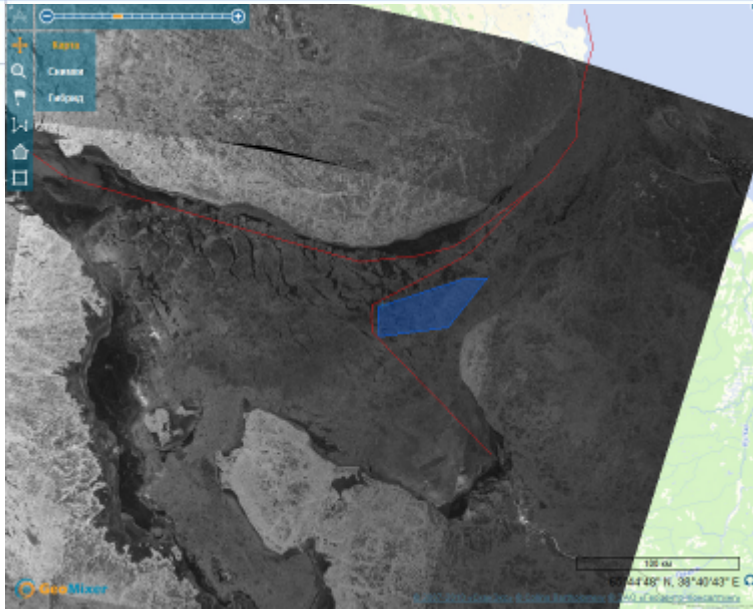


- ☒ Moscow 16 July 1966, part 5 (USGS)
- ☒ Московская область
 - ☒ Dmitrov 16 July 1966 (USGS)
- ☒ Санкт-Петербург
 - ☒ Leningrad 26 June 1941, part 1 (www.wwii-photos-maps.com)
 - ☒ Leningrad 26 June 1941, part 2 (www.wwii-photos-maps.com)
 - ☒ Leningrad 28 August 1942 (www.wwii-photos-maps.com)
 - ☒ Leningrad 17 May 1966 (USGS)
- ☒ Красноярск
 - ☒ Krasnoyarsk 3 February 1967 (USGS)
 - ☒ Krasnoyarsk 1 September 2007 (EROS A)
 - ☒ Krasnoyarsk 15 July 2007 (EROS A)
- ☒ Севастополь
 - ☒ Sevastopol 22 April 1966 (USGS)



Environment monitoring

Satellite monitoring of ice ship navigation in White sea for Greenland seal population protection

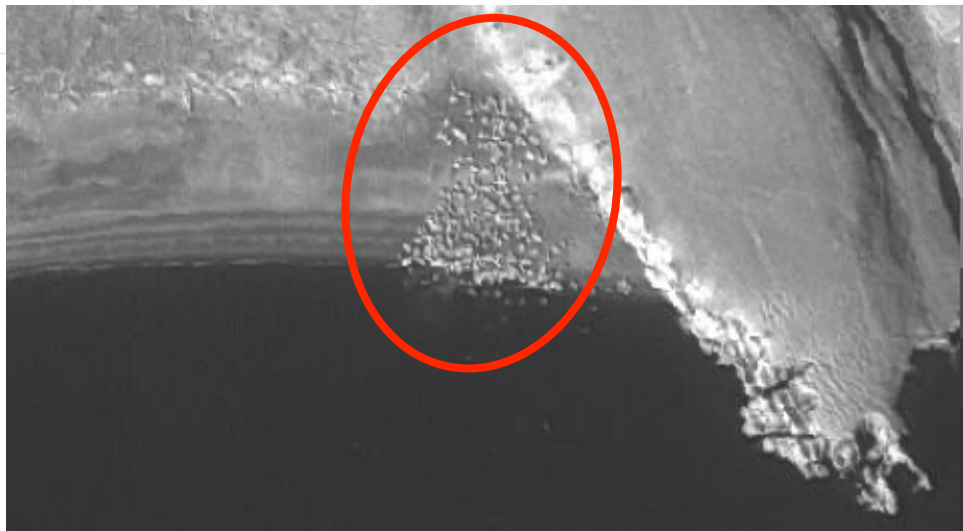


RADARSAT-1 imagery data on the “Kosmosnimki.ru-White Sea” Web service.

- **Blue** zones – whelping areas as per data of Federal Agency for Marine and River Transport,
- **Red** lines – recommended routes bypassing the whelping areas,



Environmental monitoring. Arctic walrus population calculation, Vaygach island.



EROS B, 04.09.2011, 0.7 м/pic, Imagesat Int., SCANEX, 2011

