



Saint Petersburg State University
Institute of Earth Sciences
Department of Cartography and Geoinformatics

DEPARTMENT OF CARTOGRAPHY AND GEOINFORMATICS: EDUCATION AND RESEARCH



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Domains

- Cartography and Mapping
- Geoinformatics and Geomatics
- Remote Sensing and Photogrammetry
- Geodesy

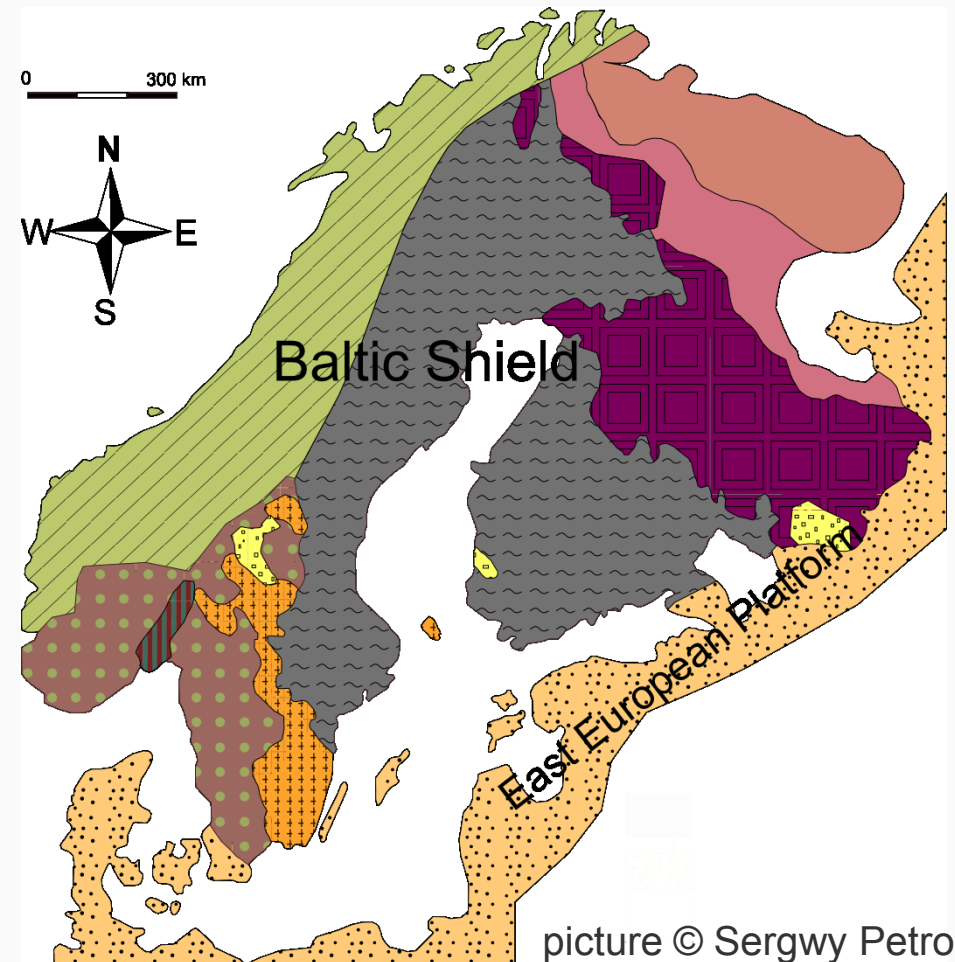
Cases

- GNSS monitoring for geodynamics purposes:
 - monitoring of the lithospheric plates movement;
 - monitoring of the complex engineering structures (St. Petersburg Dam case study).

GNSS Monitoring for Geodynamics Purposes

- Saint-Petersburg is located over a border between Baltic shield and Russian platform.
- Both Baltic shield and Russian Platform are commonly regarded as rigid parts of Eurasian plate.
- Baltic shield is known to deform due to postglacial isostatic adjustment process, this deformation being mostly vertical.
- Recently (Gorshkov et al., 2012) horizontal deformations of the border area between Baltic shield and Russian platform were revealed.
- Does it mean that Baltic shield is moving with respect to Russian platform?

Fennoscandia or Baltic Shield



St.Petersburg Dam Monitoring

- St. Petersburg Dam is 25 km long complex of engineering constructions for flood control, road and sea transportation.
- Two huge Navigation Passes are subject to enormous loads that cause deformations.
- St. Petersburg Dam crosses a fault between Baltic shield and Russian platform which is an additional exploitation risk.
- A network of permanent stations is proposed in order to monitor deformations of Dam constructions.



picture © Sergwy Petrov

St.Petersburg Dam Monitoring

- Two reference (Ref I and Ref II) stations and two working (S1 South and S2 North) ones will be installed as shown in Picture.
- Precise coordinates of S1 South and S2 North stations will be determined with one second time resolution both in global ITRF2008 and local reference frames.
- Precise Point Positioning (PPP) method will be used for global positioning and Real Time Kinematic (RTK) for local one.
- Real time filtering of the coordinates will be performed by means of Stratonovich filter.
- Changes of positions will be displayed in real time over Internet.



The Cases

- GNSS monitoring for geodynamics purposes:
 - monitoring of the lithospheric plates movement;
 - monitoring of the complex engineering structures (St. Petersburg Dam case study).
- Remote sensing data acquisition and processing with UAVs:
 - repeated multi scale and multi temporal flight testing on the test area at Sablino field polygon.

RS Data Acquisition and Processing With UAVs

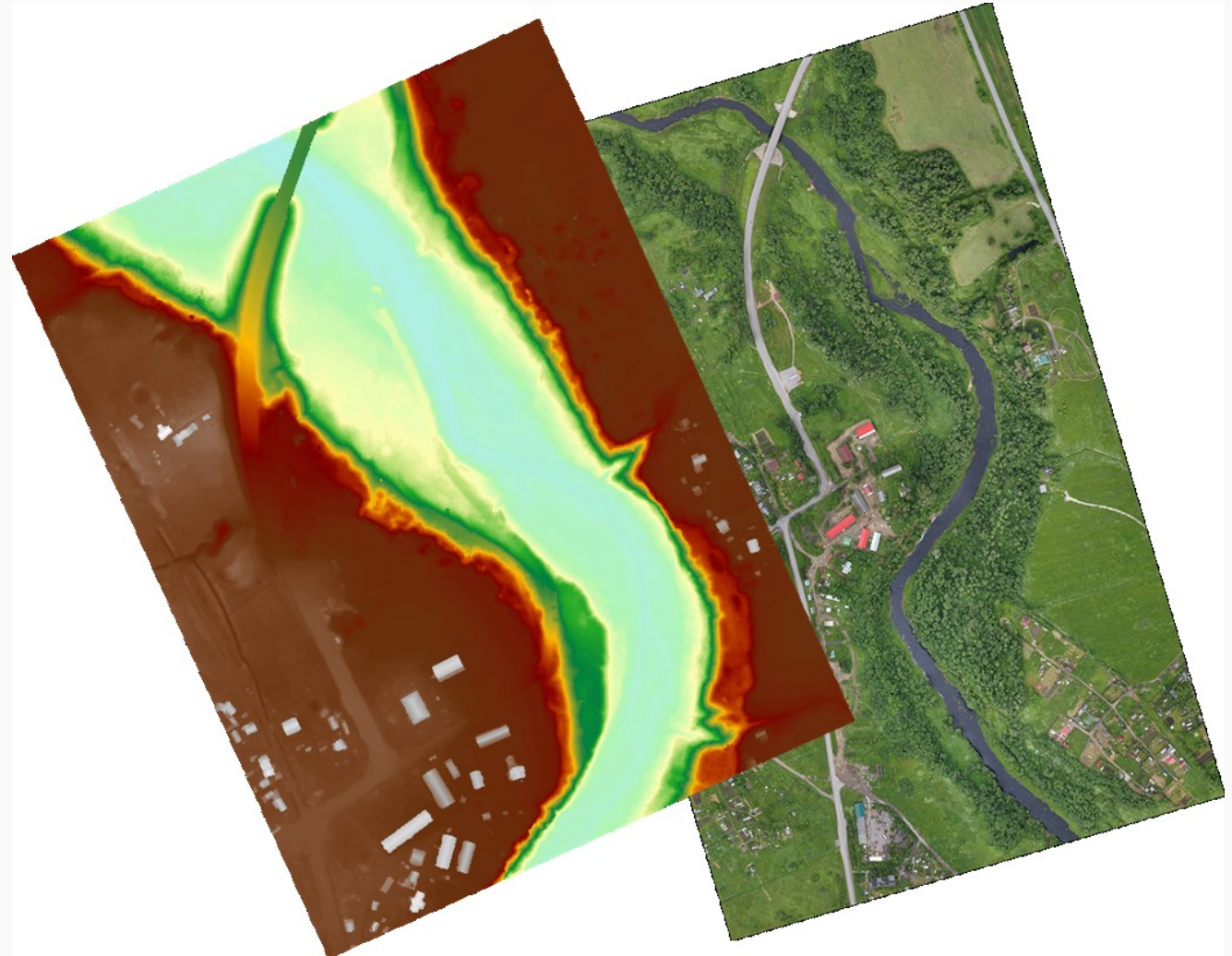
- Repeated imagery collection at the test area.
- In cooperation with UAV producer (Geoscan LLC).
- Geoscan 101 (on the picture) is used also for educational purposes.
- The certified test polygon in perspective.



picture © GeoScan Group

RS Data Acquisition and Processing With UAVs

- Many platforms are presented for UAV-based remote sensing.
- In most cases the RS schema includes only the imagery collection (in visible and infrared bands) and 3D terrain model generation.
- How to automate the data analysis at very high resolution?
- How to design the hyperspectral platform and data collection schema?
- How to process this (micro) big data with non specialized hardware?

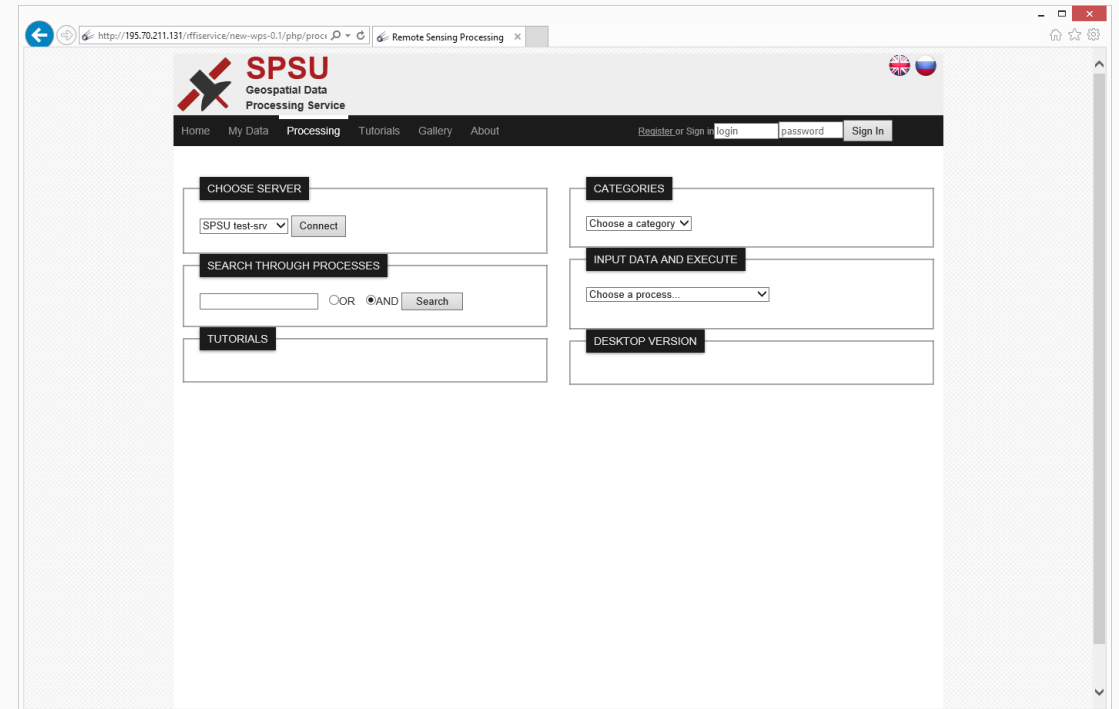
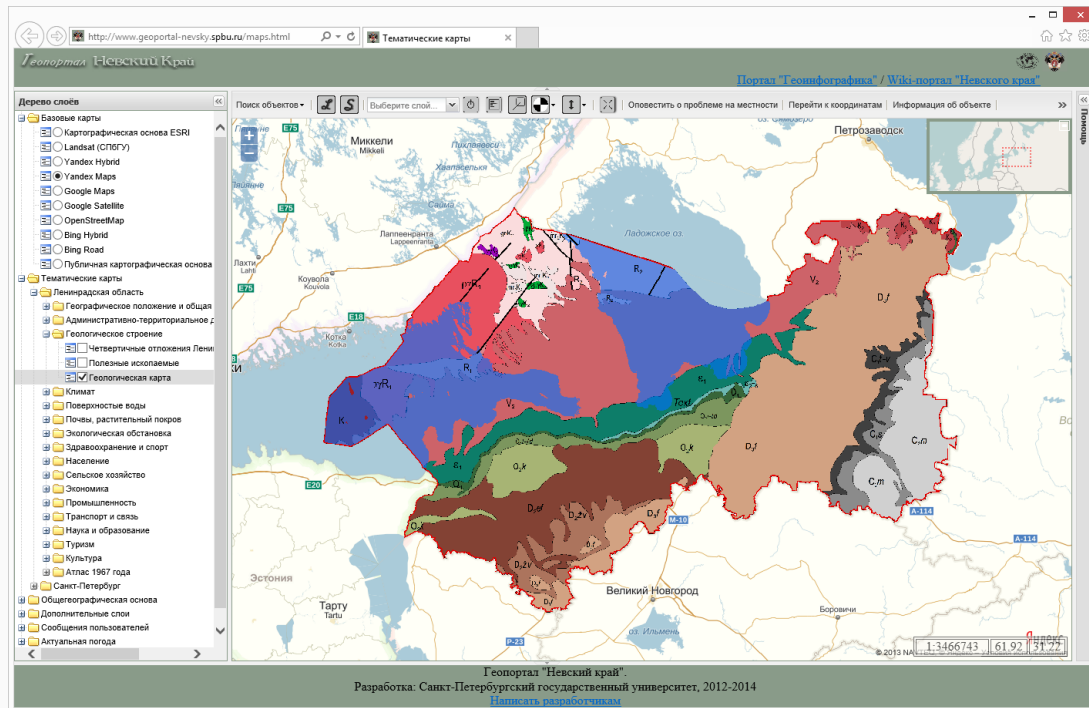


The Cases

- GNSS monitoring for geodynamics purposes:
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- Remote sensing data acquisition and processing with UAVs:
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- Geospatial data Web representation and processing techniques:
 - research project on complex geospatial data representation in geoportal interface (Nevsky Region Geoportal case study);
 - research project on design and implementation of the Hybrid Web Geoprocessing Services.

Geodata Web Representation and Processing

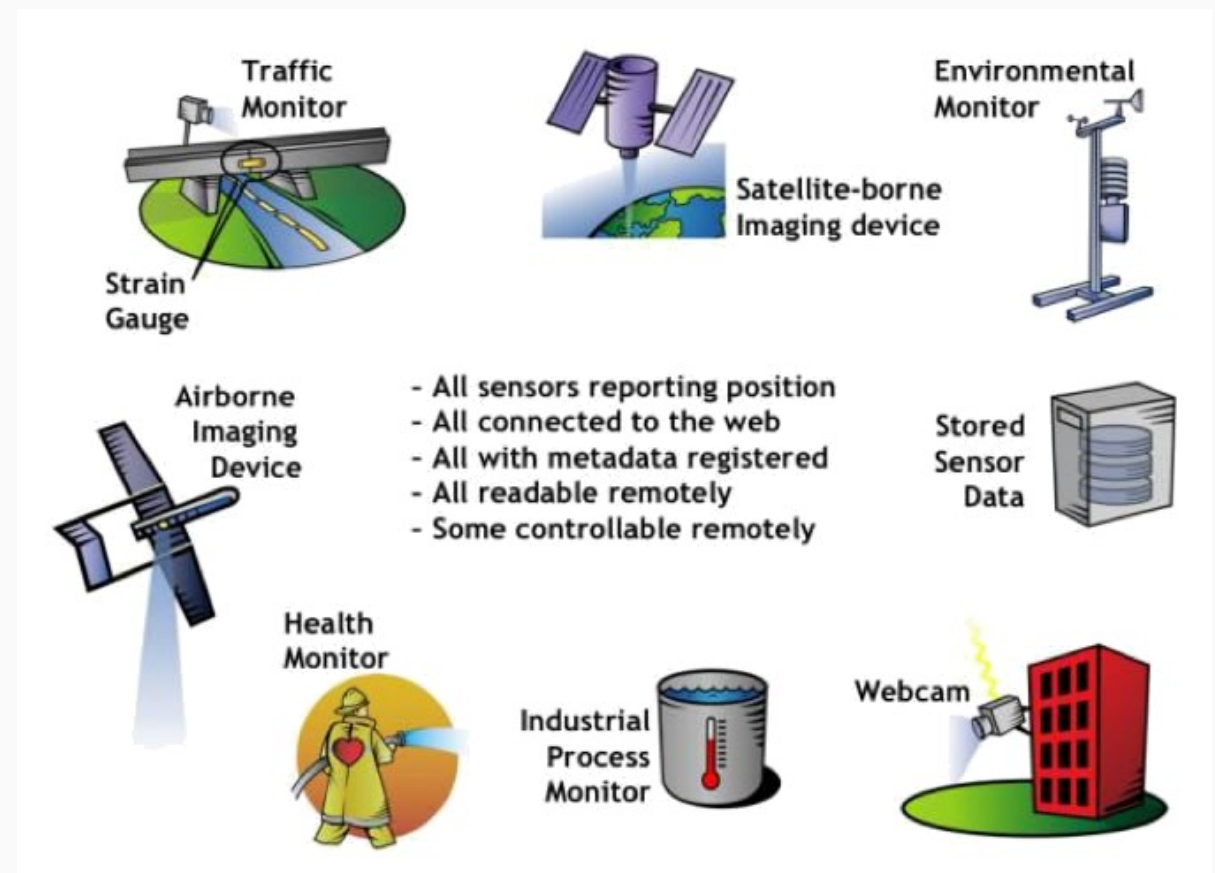
Web server of the Nevsky Region Geoportal – the scientific-referential geoportal of the North-West region of Russia



Web server for the Hybrid Web Geoprocessing Services publication and use (Hybrid – means server side/client side processing)

Geodata Web Representation and Processing

- Some current trends (IoT, M2M) lead to growth of autonomous environment monitoring tools - geosensors.
- The question is how to integrate new technologies into existing geographical information systems?
- Another question is how to organize the data flows, data processing and storage?



picture © <http://www.opengeospatial.org/domain/swe>

The Research Directions

- GNSS monitoring for geodynamics purposes:
 - GNSS receiver's and system's design for monitoring purposes;
 - operational testing of different receiver types.
- Remote sensing data acquisition and processing with UAVs:
 - application of micro sensors for UAV remote sensing;
 - design and test of the multi and hyperspectral UAV remote sensing complexes and techniques;
 - techniques and complexes for processing of the UAV's (micro) big data.
- Geospatial data Web representation and processing techniques:
 - development of the techniques and standards for distributed geospatial data processing;
 - development of the low cost geo sensor networks design schemas.

THANK YOU!

