

# **THE EXPERIENCE OF FORMOSAT2 AND QUICK BIRD SPACE IMAGES PROCESSING DURING ENVIRONMENTAL MONITORING OF THE GULF OF FINLAND IN TIME OF DREDGING OPERATIONS**

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Space surveys in water area of the Gulf of Finland in 2005 – 2007 had been performed under the programme of ecological-and-production control and environmental support of dredging operations for “Marine Passenger Terminal at Vasil’yevskiy Island of Saint-Petersburg. Building and Reconstruction of Access Ways and Water Area. Auxiliary Works”.

In 2005 we received two images:

- one from IRS satellite, August 18, PAN scanner;
- and the other one from Quick Bird satellite, October 5, 4 spectral layers.

Qualitative analysis of these images allowed inferring that it is possible to perform spatial interpolation and extrapolation of point values of a dredge concentration within the whole dredging area, using high quality space images (absence of cloudiness over the objects viewed), if there is available information on local concentrations of a dredge forming in water during dredging operations.

In 2006 we received 4 Quick Bird images (as of April 30 – baseline image – prior to dredging operations, May 31, June 12, and September 11, 2006), presented in four spectral layers. Ground-truth experiment with sampling and subsequent analysis of suspended matters’ concentrations in a laboratory took place in September in order to process the satellite data. Working with the data in 2006 turned out that it would be practicable to learn how to adequately combine the results obtained during various ground-truth experiments and for different space images in those occasions, when there had been images but no sampling was made.

In 2007 we received 4 Formosat-2 images (of April 25 – baseline image, July 2, August 8 and September 20), presented in four spectral layers: blue – 450-520 nm, green – 520-600 nm, red – 630-690 nm, close IR ( – channel) – 760-900 nm, with resolution for all spectral layers of 8 m in nadir and 8 bit colour depth. Water was sampled on April 25 and 28, and August 8.

The major objective for data processing is to assess the state of water in the Gulf of Finland during dredging operations. The following items were used:

- space images,
- ground-truth data (local values of a dredge concentration in water sampling areas),
- archive databases accumulated during observations (Quick Bird image of 11.09.2006 and values of dredge concentrations in samples received on September 11, 19 and 20, 2006),
- water state, evaluation criteria identified during the analysis.

The work performed resulted in making the master curve of water brightness against values of a dredge concentration for a selected reference image. Using this curve, all available images had been supplemented with characteristics selected as the assessment criteria for the state of water in the Gulf of Finland during dredging operations:

- boundaries of turbidity spot were revealed;
- contour lines of suspended matters’ concentrations were drawn;
- sizes of water area and water amounts with concentrations of 0-10, 10-25, 25-50, 50-75, 75-100 and over 100 mg/l, were evaluated;
- average dredge concentrations for sections of the water area illustrated in the images and for their typical areas were calculated.

In future dredging operations, the possibility of adequate usage of the master curve of water brightness against the values of dredge concentrations for a reference image should be examined with available space images in different points of time and various spacecrafts, and also without ground-truth experiments. Conformity of the results, obtained using the suggested method, with real-life environment must be evaluated as well.