Application of optical remote sensed data for the coastal area monitoring and dredging support

Использование данных оптических спутниковых сканеров при мониторинге прибрежной зоны и сопровождении дреджинга

Vitaly Sychev
IOC UNESCO Chair in Remote Sensing and Modeling in Oceanography
Russian State Hydrometeorological University
St.Petersburg, Russia
RSHU-UNESCO Chair in Remote Sensing and Modeling in Oceanography has participated in the developments of several water quality parameters on the base of the remote sensed data.

Presented research topics include the development of satellite data methods for the studying of chlorophyll-a, algal blooms, turbidity, suspended solids, and bathymetry in the Baltic Sea and coastal areas. The research is performed in collaboration with the IOC/UNESCO Sectors, NIERSC, VSEGEI, and other organizations.
RSHU Students during field works in the Gulf of Finland
Ground works, 2007-08:
Coastal zone erosion studying

Photos Georgy Gogoberidze
Currently available Envisat, MERIS, Landsat, Quickbird, Spot and Aqua/Terra MODIS data have been used for the water quality algorithms that were developed for open sea (case 1) and coastal (case 2) waters.

Water quality regional algorithms are developed for the Eastern Gulf of Finland and Southeastern part of the Baltic proper.

Concentration of chlorophyll-a retrieval algorithm is based on the ratio of two-four channels.

Turbidity of sea waters was calculated on the base of MODIS spectrometer data (250-m resolution) and compared with the ground truth turbidity.

Bathymetry was studied on the base of Jupp’s method and is of good results from coastal line to the depth of 1-1.5 m in the Eastern part of the Gulf of Finlang.

These results of multispectral satellite data analysis may be used for studying the coastal areas and shallow water parameters in the Baltic Sea.
Total radiance, \((L_t)\) recorded by a remote sensing system over water is a function of the electromagnetic energy received from:

\[
L_t = L_p + L_s + L_v + L_b
\]

- \(L_p\) = atmospheric path radiance
- \(L_s\) = free-surface layer reflectance
- \(L_v\) = subsurface volumetric reflectance
- \(L_b\) = bottom reflectance
Reflectance peak shifts toward longer wavelengths as more suspended sediment is added.

*In situ* Spectroradiometer Measurement of Clear Water with Various Levels of Clayey and Silty Soil Suspended Sediment Concentrations.
Space data: Suspended Sediment Plume in the Eastern Gulf of Finland in 1981, Landsat 2

LM21990181981160AAA03
Result of classification on the base of SPOT data in the area of Dubki (June, 2008)
TTR- 2008 cruise observations: resuspension of bottom sediments during engineering works in the inner part of the Neva Bay
Resuspension of bottom sediments during engineering works in the inner part of the Neva Bay 12 May 2006

Terra MERIS and MODIS

1 FNU ~ 1 mg/l suspended sediments
Мутность можно оценить по излучению, рассеянному на взвешенных в воде частицах в диапазоне (551 нм, прибора MODIS спутников Terra и Aqua).

Это может быть минеральная взвесь, детрит, терригенный осадок, фитопланкton и др., но в основном этот в этом диапазоне показано распределение минеральной и детритной компонент взвешенного в воде вещества.
Example of the Giovanni MODIS Time-Series Visualization for the Neva Bay in 2003-2009
Resuspension of bottom sediments in the inner part of the Neva Bay 18 July 2007
Lebiajie Region
3 June 2007 г., MODIS Aqua and Terra imageries
Coastal line changes, evolution of sand accumulative body

Results of ground works at the test sites compared with remote sensed data:

2002

2007
Remote Sensing data retrieval and new results for the North East European seas and coastal areas

Regional seminar

Selected students’ articles

IOC UNESCO CHAIR IN REMOTE SENSING AND MODELING IN OCEANOGRAPHY
RUSSIAN STATE HYDROMETEOROLOGICAL UNIVERSITY

St Petersburg, Russian Federation,
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Among topics of the Conference

Remote sensing data acquisition: coastal area monitoring and dredging support
Remote sensing of Ice in the Gulf of Finland and Lake Ladoga, April, 2004-09

Changes of Ice Conditions, 2004-09

Fishermen on the ice of Lake Ladoga, March, 2009