

“See The Sea” – new opportunities for distributed collaboration aimed at solution of oceanographic problems using remote sensing

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General description.

The "See the Sea" (STS) is an information system developed by the Space Research Institute of the Russian Academy of Sciences (IKI RAS, Moscow, Russia), to study various processes and features in the ocean and sea using diverse satellite data. The STS is the toolkit to work with remote sensing data and to analyze results. Its key advantage is in an ability to perform a complex analysis of data varying in physical character, spatial resolution and units of measurement. The system also provides access to long-term (over 20 years) distributed archives of satellite data for the entire Eurasia from 1995 to the present, including Synthetic Aperture Radar (SAR): Envisat ASAR, ERS-2 SAR, Sentinel-1A, -1B; optical systems: MODIS Terra/Aqua, MERIS Envisat, TM/ETM+/OLI Landsat-5/7/8 satellites series, MSI Sentinel-2A, -2B, OLCI Sentinel-3 and hyperspectral data from Hyperion and HICO systems. Currently, the volume of the archive is over 2 PB and it is updated with real time data daily. In addition, the multi-year weather data are available on-line. The STS is an open system capable to incorporate any required data (such as altimeter data, buoy data, in situ measured data, and other).

The STS capabilities.

The main goal of the system is to develop the toolkit for efficient work with diverse data involved into analysis of various processes on the ocean surface. First of all, the STS satellite service allows to perform data transformation and analysis without any preliminary data download, but by accessing the data "on the fly" in the STS archives. It is important that users of the system have no need to install any special software to their PCs. They can also avoid downloading large volume of data for processing, which is especially significant when data processing from new sensors, such as Sentinel 1 & 2 (one MSI Sentinel-2 image may take up to 7 GB). Using the STS is also possible to analyze data provided by the system using a standard Internet browser. The STS automatically downloads complete satellite data as soon as they appear on appropriate servers, for example for Sentinel 1 & 2 data in the Sentinels Scientific Data Hub (SSDH) (<https://scihub.copernicus.eu/>). The received data are transferred into the UTM/WGS84 projection. From the resulting file, a number of quick view files are generated containing double-thinned georeferenced data with a pyramid of resolutions. These datasets accompanied by metadata are then transferred to the Center for Collective Use of IKI RAS ("IKI Monitoring") archives where they are stored and from where delivered on request to various information systems. For displaying data in cartographic interfaces of various information systems (including the STS), the online data display unit compiles from the archived data information products (layers) using either the basic resolution or quick look files depending on the scale requested. The required data, so called virtual data products, are actually being prepared on-line when user requests it from the band data stored in the archives. The database stores rules for their formation in a special table structure. The rules allow building of arbitrary band combinations with different normalizations, as well as transformations according to formulas written in a meta-syntax and pixel by pixel transformations. Such approach significantly reduces storage requirements for the set of data products and enables easy addition of new products and modifications of existing ones without extra processing or enlarging physically stored data.

The STS provides a comprehensive toolkit for data processing and analysis; and has capabilities of cartographic web-interface similar to desktop GIS applications. This toolkit is also based on the technology developed by the IKI RAS. Image Algebra, Classification, Image Color Enhancement, Indexing, and some