

SatBałtyk System- modern tool for monitoring and research of the Baltic Sea

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The comprehensive, precise and high quality information on the state of environment should underpin not only scientific analyses, but all decisions regarding the economy, transport, recreation and signing of the international conventions between the countries bordering the Baltic Sea. The SatBałtyk System presents on website maps of spatial distribution of values of almost one hundred features of the Baltic Sea environment including the coastal zone as well as the state and optical properties of the atmosphere. This provides up-to-date, reliable data that foster accurate diagnosis of the state of the environment and allows observation of changes occurring in the Baltic ecosystem. This system was developed and deployed in 2015 by the Consortium associating four scientific institutions: the Institute of Oceanology PAN in Sopot –the coordinator, the University of Gdańsk, the Pomeranian Academy in Słupsk and the University of Szczecin.

SatBałtyk System description.

The SatBałtyk System is a satellite-based operational platform for monitoring of the Baltic Sea. There are no doubts that satellite observations that can cover large sea area in a single instant could be a perfect tool to study the marine environment. Nevertheless efficient and systematic day-to-day monitoring of the entire Baltic will provide reliable information only if we use more sources of data. For this reason the SatBałtyk System combines three types of data: satellite data used for day-to-day monitoring of large sea areas, models data which utilises hydrodynamic and ecohydrodynamic models describing phenomena taking place in the marine environment and point data acquired using traditional oceanographic measurement techniques.

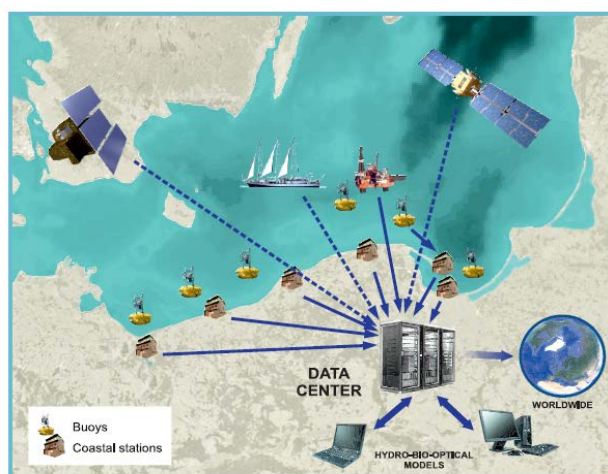


Figure 1: Scheme of the SatBałtyk System infrastructure

To ensure the reliability of provided parameters a very complex information flow system was organized (Fig1). Important role is played by in situ measurements from the systems conducting continuous monitoring (buoys, shore stations, or other measurements platforms with research instruments) and research vessels. Traditional methods of marine ecosystem study are by their nature limited in time

and space, but they accurately describe the local situation. This attribute makes them very valuable for developing satellite algorithms for the current determination of physical, chemical and biological characteristics, or validate and verify the accuracy of characteristics provided by numerical models coupled in SatBałtyk System.

Using models and algorithms allow estimation of marine environment parameters not only on the surface layer but also at different depths in water column and taking into account their spectral characteristics. They were also used to transgress the limitations of remote sensing methods, existing for example due to the cloud radiation cover over the investigated area, or when data from visible and infrared domain are unavailable. An advanced and innovative methodology of merging the satellite and modelled data allows to deliver a live assessment of the current state of the Baltic Sea environment, even when satellite data acquisition could not be made.

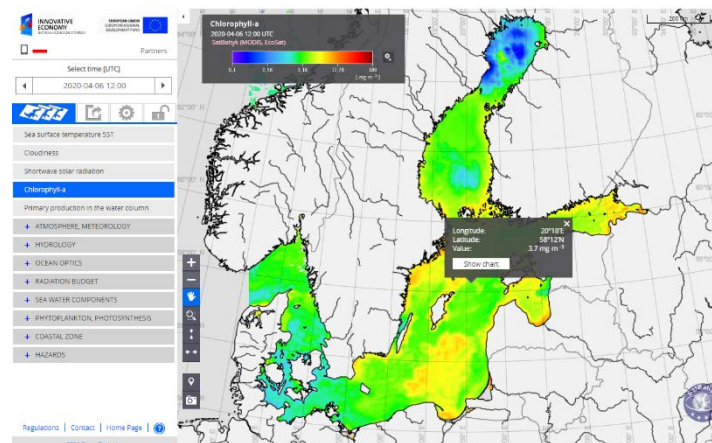


Figure 2: SatBałtyk System website <http://satbaltyk.ioopan.gda.pl/>

The parameters currently available in the System have been divided into eight task-oriented groups (as presented in Fig. 2). Apart from the typical oceanographic characteristics of the marine environment, like sea surface temperature, the system determines specialised parameters describing complex natural processes, for example the quantum yield of photosynthesis. Many of these characteristics are unique, and their values are not determined operationally by any other comparable system.

The System's functionalities allow browsing the value distribution maps of all provided parameter in near real time throughout the entire Baltic Sea area and reading these values for each pixel with a 1 km side. Authorised users can download the numerical values of the parameters in various formats. It is also possible to analyse the variability in time of each of the parameters available in the SatBałtyk System. It enables not only to track long-term changes in the marine environment, but also the comprehensive analysis of the processes running in the Baltic ecosystem. The SatBałtyk System offers not only current NRT information but also historical data (since 2010) are available together with a short forecast of modelled parameters.

Summary.

The Satbałtyk System has become the state-of-the-art research tool, that meets the requirements of present-day oceanography, especially in tracking changes of the marine environment, resulting either from progressive eutrophication or as the effects of climate change. Such set of data describing the Baltic ecosystem allows observing changes in many of its characteristics to much greater extent, than it was possible previously on the basis of data collected during many research cruises. It contributes significantly to the development of knowledge and enables accurate diagnosis of the condition and observations of the change occurring in the Baltic environment. Data provided by the SatBałtyk System will be available soon also on the eCUDO.pl platform.