REPORT
on the use of equipment purchased by the Russian State Hydrometeorological University under the SUNRAISE project

Given the recommendation that the equipment must be installed as soon as practically possible after the start of the project, RSHU started preliminary consultations on tender preparation as soon as the project eligibility period has started. The upgrade of university computer storage facilities was the critical issue, given the intention to provide the satellite data RSHU Satellite Oceanography Lab retrieves, processes and stores to the consortium members dealing with Polar-related education and research training. The university has consolidated available resources to purchase Lenovo ThinkSystem DS2200 SFF FC/iSCSI Dual Controller Unit, which was not yet available on the market at the time of SUNRAISE proposal and demonstrates state-of-the-art advanced features at an affordable price.

The purchased Data Storage System is used to store the archive of satellite images and model data RSHU retrieves and develops, and to make the data accessible via RSHU SATIN Web-catalog (http://satin.rshu.ru/) and the Arctic portal Storm Ice Oil Wind Wave Watch System (SIOWS, http://siows.solab.rshu.ru/). The latter being a Web GIS, designed to display various satellite, model and in situ data, it uses developed at RSHU Satellite Oceanography Laboratory storing, processing and visualization technologies for operational and archived data, and allows synergistic analysis of both historical data and monitoring of the current state and dynamics of the "ocean-atmosphere-cryosphere" system in the Arctic region, as well as Arctic system forecasting on the basis of thermodynamic models with satellite data assimilation. SIOWS Arctic portal provides learning resources for the new RSHU “Polar Meteorology and Climatology” BSc programme. SIOWS Arctic portal also provides data for eScience and learning modules developed by SUNRAISE consortium.

The Data Storage System Lenovo ThinkSystem DS2200 SFF FC/iSCSI Dual Controller Unit is located at the main RSHU server facilities at Malookhtinnsky Ave., 98. The access to the hardware is limited to the authorized technical personnel only, but the number of unique visitors to SIOWS and SATIN platforms has exceeded 4000 in a lifetime of SUNRAISE project by 14 October 2021.

The equipment is intended for incoming and outgoing exchange students (summer schools and joint field practices), for Masters and PhD research projects in sustainable development and environmental studies. The estimated number of final beneficiaries is about 1000 people a year (about 4000 people during the project period). The coronavirus restrictions did not affect the use of equipment.

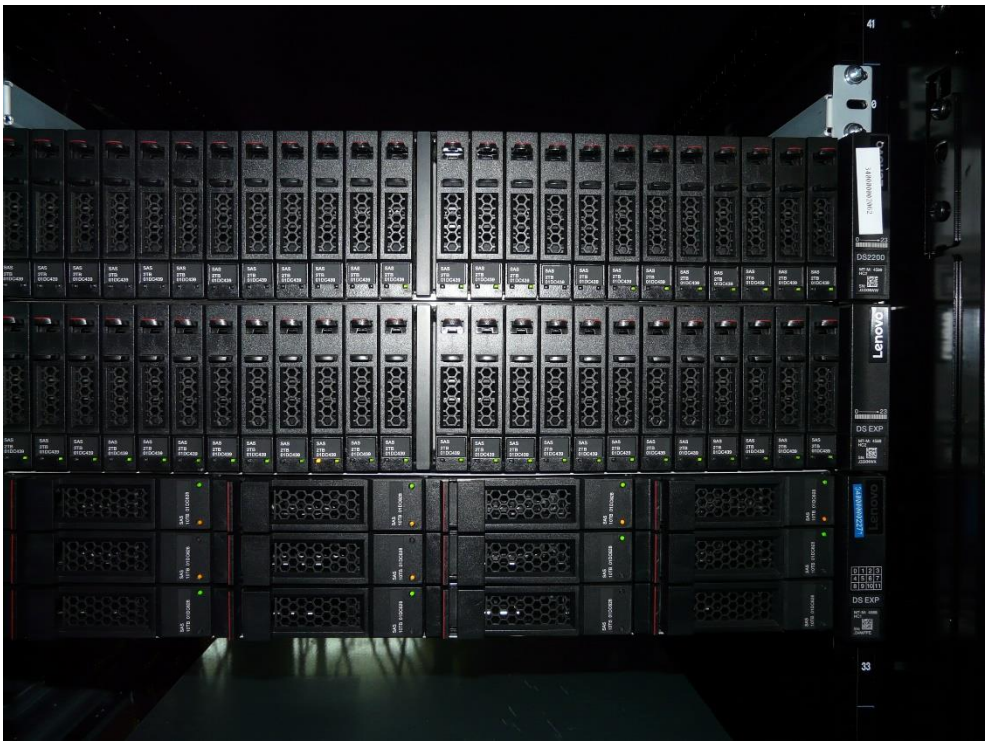

Photo 1. The appearance of Lenovo ThinkSystem DS2200 SFF FC/iSCSI Dual Controller Unit mounted into the server stand

Photo 2. Erasmus+ project sticker as required by the grant agreement

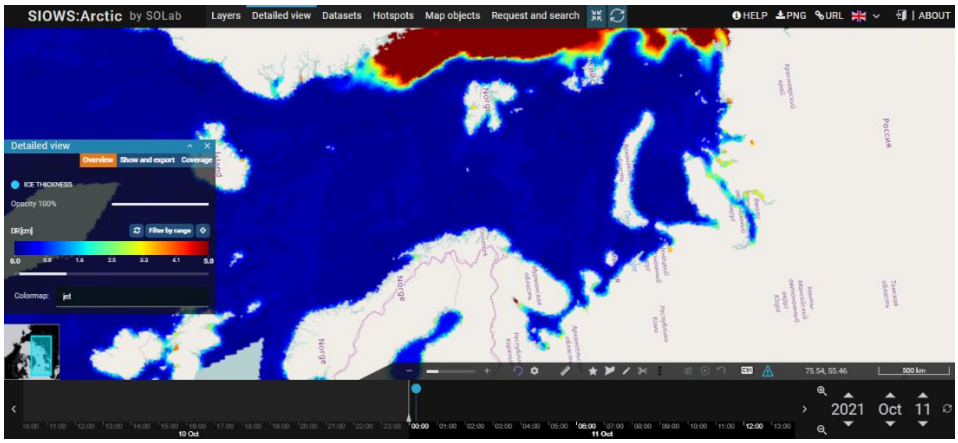

Figure 1. Arctic Sea Ice extent as visualized by the SIOWS Arctic portal

Figure 2. Sentinel-1B satellite imagery as visualized by the SIOWS Arctic portal.

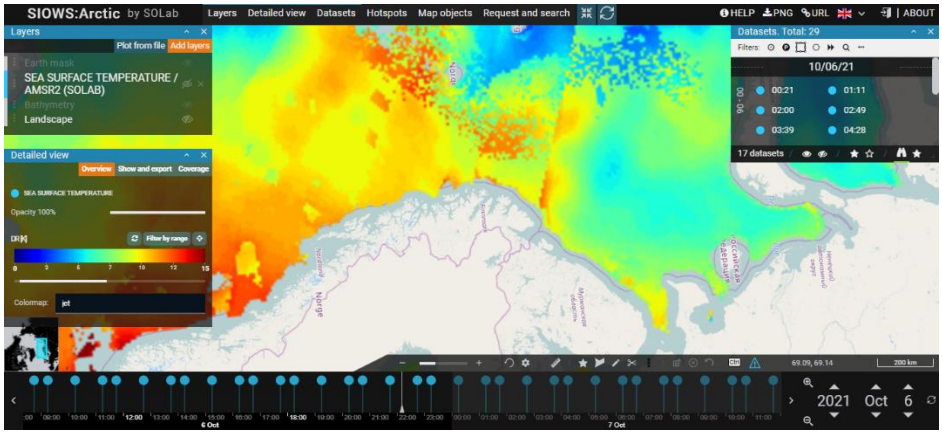

Figure 3. Sea surface temperature model data as visualized by the SIOWS Arctic portal

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Морские, речные и озёрные льды

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Изменчивость морского льда в Арктике по данным Арктического портала

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Variability of sea ice in the Arctic according to the Arctic Portal

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Keywords: ***Arctic Portal, satellite data, sea ice monitoring in the Arctic.***

Summary

The Arctic Portal of the Laboratory of Satellite Oceanography of the Russian State Hydrometeorological University is an open geo-informational system designed for operational monitoring of the sea ice–ocean–atmosphere system in the Arctic. Possibilities to use the Arctic Portal for the Arctic sea ice monitoring on the basis of satellite data, as well as the types of satellite measurements suitable for studying the properties of sea ice: active and passive microwave data; data of spectral radiometers in the infrared (IR) and visible ranges are considered. Every type of satellite data has certain limitations. For the study of sea ice the most suitable are the all-season remote sensing data – measurements of microwave instruments, independent of clouds and time of a day. Existing in the world resources of the sea ice maps and satellite data on sea ice are either closed for users or limited in their informational content. Several types of satellite data are currently available on the Arctic portal: Sentinel-1 synthetic aperture radar (SAR) images, 8-day averaged MODIS reflectivity data, optical and IR MODIS data of original time and spatial resolution, Norwegian Meteorological University sea ice maps, and data on consolidation of sea ice, based on passive microwave radiometer measurements. Some data is additionally available in the test mode. The effectiveness of combined use of various satellite data on the sea ice is proved by the examples of sea ice analyses.

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Ключевые слова: ***Арктический портал, мониторинг морского льда в Арктике, спутниковые данные.***

Представлены возможности Арктического портала (геоинформационного сервиса) для мониторинга ледяного покрова Арктики на основе спутниковых данных. Дан обзор основных типов спутниковых инструментов, позволяющих изучать морской лёд. Обоснована эффективность совместного применения результатов обработки разных спутниковых данных, имеющихся в среде геосервиса.

Введение

Оперативные данные о ледяном покрове Арктики позволяют исследовать характеристики морских льдов, изучать ледовый режим и обеспечивать безопасность и эффективность судоходства, в том числе на трассах Северного морского пути [1]. Использование спутниковых измерений в различных диапазонах электромагнитного спектра разного пространственного и временно́го разрешения – основной метод изучения арктических льдов, так как только с их помощью можно получить пространственное распределение характеристик морского льда. Крупнейшие зарубежные центры обработки, хранения и распространения спутниковых дан-

Figure 4. An example of the use of the SIOWS Arctic Portal in a research paper developed by RSHU staff and students

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Identification of temperature anomalies in the western Caspian Sea in 2017 based on remote sensing data

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Abstract
Aim. The study of temperature anomalies in the western Caspian Sea based on space imagery materials in order to detect upwelling phenomena.
Materials and Methods. We used temperature indicators of seawater for the summer season of 2017 when a sharp decrease by more than 2°C in average daily temperature occurred. Space images were obtained from the specialized centres of Ocean Color NASA, Earth Science Data Systems NASA and SATIN. Remote sensing data were processed using SeaDAS and ArcGIS programs. Ground data were obtained from the resources of the Unified State System of Information about the Situation in the World Ocean (ESIMO). An ArcGIS database was created and maps compiled.
Results. The first upwelling occurred on 9-17 June 2020. The minimum water temperature in the Makhachkala area was 14°C with an increase in salinity to 12‰ over an area of 1,500 sq.km. An increase in the content of dissolved oxygen of up to 9.70 mg/l and pH 8.64 was recorded. A second upwelling of medium intensity occurred from 19 June-July 1 with a minimum temperature of 17.9°C. The decrease in temperature was 2.8°C with an increase in salinity by 1‰. The surface area was 454 sq.km. A third case of upwelling was recorded from 26 August-September 1 and was characterised by a decrease in water temperature of 7.4°C (near the coast, 17.1°C). The average salinity increase was 0.32‰ while the O_2 concentration was 8 mg/l over an area of 500 sq.km.
Conclusion. Due to its large size, the Caspian Sea is characterised by spatial inhomogeneity of oceanological parameters, which can be recorded based on the results of processing satellite images and their verification using ground data. In the western part of the sea the upwelling is periodic and of different scales.

Key Words
Geodata, satellite imagery, remote sensing, GIS, ArcGIS, Caspian Sea, upwelling.

Figure 5. An example of the use of the SIOWS Arctic Portal and its SATIN API in a research paper developed outside of RSHU