

National Scientific Conference

# REMOTE SENSING. CHALLENGES IN GATHER AND SHARING DATA

book of abstract



19 September 2019

Institute of Oceanography Polish Academy of Sciences,  
ul. Powstańców Warszawy 55, 81-712 Sopot, Poland

[www.ioпан.pl/KNK2019/](http://www.ioпан.pl/KNK2019/)

## **CONFERENCE AGENDA**

9:00 – 09:30 REGISTRATION

9:30 – 10:00 OPENING

10:00 – 11:00 Young Stars Presentations

Igor Antoon, Katarzyna Barton–Elwart, Aleksandra Chwalczuk, Maria Kaciuba, Adam Labuhn, Paweł Mering, Krystian Zagrobely, Przedstawiciele Studenckiego Kłastry BSSC, Wyższa Szkoła Administracji i Biznesu w Gdyni  
*Use and processing satellite data to ensure the marine environment safety (Wykorzystywanie i przetwarzanie danych satelitarnych w celu zapewnienia bezpieczeństwa środowiska morskiego)*

Wojciech Zawadzki, Wyższa Szkoła Administracji i Biznesu w Gdyni  
*Universal Space Traffic Management System as an Indispensable Instrument for the Prevention of Contamination of Outer Space Environment (Uniwersalny system zarządzania ruchem kosmicznym jako niezbędny instrument zapobiegania zanieczyszczeniom środowiska kosmicznego)*

Mateusz Dyrda, Stowarzyszenie Robotyków SKALP  
*Small Satellites - Big Radars*

Łukasz Mosdorf, N7 Mobile  
*HAB Risk - Satellite monitoring and forecasting of the Cyanobacteria Blooms for the Baltic Sea coastline (Hab Risk - Satelitarny monitoring i prognoza zakwitów cyjanobakterii dla wybrzeża Bałtyku)*

Weronika Motyl, Marine Technology  
*3DSS-DX-450 - a new quality of hydrographic data acquisition (3DSS-DX-450 nowa jakość pozyskiwania danych hydrograficznych)*

11:00 – 11:30 COFFEE BREAK

11:30 – 13:10 MAIN SESSION – Session dedicated to the project eCUDO.pl\*

Mirosław Darecki, Marcin Wichorowski, Mirosława Ostrowska,  
Instytut Oceanologii Polskiej Akademii Nauk  
*eCUDO.pl - platform for gathering and sharing oceanographic  
data, from satellite sensors to sea bottom instruments  
(eCUDO.pl - platforma do gromadzenia i udostępniania danych  
oceanograficznych, od poziomu satelitarnego do dna morskiego)*

Dorota Simpson<sup>1</sup>, M.A. Adrian Faasse<sup>2</sup>, <sup>1</sup>Wyższa Szkoła  
Administracji i Biznesu w Gdyni, <sup>2</sup>Independent Senior Advisor  
Circular Economy  
*Green economy - "A new engine of growth" (Zielona gospodarka  
- „Nowy motor wzrostu”)*

Paweł Chyc, Wyższa Szkoła Administracji i Biznesu w Gdyni  
*Protection of intellectual property in space (Ochrona własności  
intelektualnej w przestrzeni kosmicznej)*

Bożena Łapeta, Piotr Struzik, Instytut Meteorologii  
i Gospodarki Wodnej – PIB, Kraków  
*Sat4Envi Project – collection and use of satellite data, also for  
South Baltic Sea area (Projekt Sat4Envi – gromadzenie  
i wykorzystanie danych satelitarnych, w tym dla obszaru  
Południowego Bałtyku)*

Karolina Wróbel, Instytut Geodezji i Kartografii  
*Copernicus satellite data and products derived there from  
support for land, sea and ocean (Dane satelitarne Copernicus  
i produkty z nich pochodzące wsparciem dla monitoringu lądów  
oraz mórz i oceanów)*

13:10 – 13:40 Adam Mikołajczyk, Urząd Marszałkowski Województwa  
Pomorskiego  
*Space sector - a challenge for the Pomeranian region (Sektor  
kosmiczny - wyzwanie dla regionu pomorskiego)*

13:40 – 14:30 POSTER SESSION, LUNCH

14:30 – 15:30 DISCUSSION, CONFERENCE REMARKS

## Remote sensing. Challenges in gather and sharing data

### ABSTRACTS

Igor Antoon, Katarzyna Barton-Elwart, Aleksandra Chwalczuk, Maria Kaciuba,  
Adam Labuhn, Paweł Mering, Krystian Zagrobelny  
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#### **Use and processing satellite data to ensure the marine environment safety**

This issue presents instruments and recommendations that will help increase the influence of public administration in the protection of the Baltic marine environment sphere. Thanks to international cooperation at the level of the United Nations, the European Union as well as cooperation of regional states, programs are created, which provide necessary knowledge to the interested countries. As part of this symbiosis, legal regulations are created and a faster technological development takes place, which contributes to more effective solving of problems related to changes of the climate of our planet. These tools are, among others, satellites that are used to oversee the Baltic area. This results in the goals and challenges that the Polish public administration must face. It is difficult to overestimate the knowledge that satellite data provides us with. Monitoring of the Baltic Sea area takes place on a continuous basis. Thanks to the existing and emerging Baltic observation systems, Poland can systematically determine the state and forecasts of changes in the marine setting.

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#### **Universal Space Traffic Management System as an Indispensable Instrument for the Prevention of Contamination of Outer Space Environment**

Since the beginning of the space age, the nearest part of outer space – Earth's orbit – has become noticeably cluttered. Amongst almost 8,500 objects launched into outer space, approximately 2,000 are currently active, while the rest rest have become the byproduct of space flights – space debris. In past decades space exploration was mainly the domain of governments, but recently we can witness a rapid increase in commercial and other non-governmental outer space ventures. It is estimated that due to progressive privatization of outer space activities the total amount of space assets will double from the number of ever send previously in the period of only next ten years. The dramatic growth of the number of actors, and

consequently objects in outer space requires more governance and international coordination of space traffic, which currently are almost non-existent. As this new paradigm-shifting space race is going to be driven basically by profit, a huge concern arises that these new participants may overexploit our common orbital resources, and make the Kessler syndrome become a reality. As states bear international responsibility for national activities in outer space, it is their duty to properly regulate commercial space activities to be safe for other space assets and friendly to the space environment. Therefore, the United States has initiated the legislation on the establishment of the national space traffic management system to effectively manage commercial space activities, and promote this solution across the international community. However, it seems to be questionable whether, from a long term perspective, independent national space traffic management systems will be sufficient to ensure the sustainable development of outer space, with regard to the specificity of orbital traffic and legal status of outer space – a sort of supranational solution may become necessary.

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### **Small Satellites - Big Radars**

Earth observation is one of the basic tasks that satellites face. Over the past several years, this segment has undergone a revolution. Every year, the possibilities of the devices that we place in our planet's orbit are increasing. What recently was available only to the richest countries in the world, today is available to almost everyone. The benefits of careful Earth observation are evident in an increasing number of aspects of our lives, such as early warning of natural phenomena, forest surface control, water status analysis, climate change research, etc. The importance of this segment of the satellite market can be demonstrated by the budgets of space agencies they devote all over the world to the maintenance and expansion of their constellations responsible for "looking down".

There are many technologies that allow us to view Earth from orbit. The most popular and the oldest method is to take photos in the visible spectrum of light. With the development of technology, the possibilities of obtaining information this way have also increased. Currently, observation satellites are equipped with sophisticated spectrometers to record electromagnetic radiation in the range from infrared to ultraviolet radiation. Despite the undisputed advantages, instruments based on the registration of reflected radiation have a clear disadvantage: they can not see the earth through the clouds or at night. The technology that allows you to get

an image despite the adverse weather conditions are the active methods, which include radar scanning.

In my presentation I will try to show how synthetic aperture radar technology is combined with one of the pillars of the concept of "Space 4.0" referring to the fourth industrial revolution in terms of the space industry. I will try to introduce the method of operation of such radars, present existing solutions and potential development paths of mega constellations equipped with this technology.

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### **HAB Risk - Satellite monitoring and forecasting of the Cyanobacteria Blooms for the Baltic Sea coastline**

Widely distributed around the globe, cyanobacteria (also known as Green-Blue Algae or GBA) grows in marine and fresh waters in colonies large enough to be seen from space. The association of toxicity with such blooms first affect invertebrates and fishes and frequently leads to the closure of recreational waters when blooms happen. Even if they do not product toxins, GBA blooms include a variety of environmental impacts that arise from having excessive algal populations. Both these categories of blooms are therefore potentially harmful (even not inherently) to ecosystems and environment, hence their name, harmful algal blooms (HABs).

Considering the combination of the adverse impacts of cyanobacteria on aquatic systems that may in turn affect various economic sectors and develop major public health issues, the development of large scale monitoring tool of cyanobacterial blooms is expected to benefit local population, tourism, and aquaculture.

In the Baltic Sea, summer GBA blooms regularly occur. Either toxic or not, they are considered as a major issue. Coastal areas are of major concern since they concentrate a wide ranges of issues related to GBA blooms. Based on successful demonstration of surface cyanobacterial bloom detection using optical medium resolution imagery HAB Risk platform aims at delivering daily refreshed monitoring and additional drift forecasting products focusing cyanobacteria blooms and their associated concentration in the Baltic Sea coastal regions.

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### **3DSS-DX-450 - a new quality of hydrographic data acquisition**

The 3DSS-DX-450 sonar is a pole mounted 3D side-scan and combines high-resolution three-dimensional imagery with time-synchronous motion and navigation information that offers straight forward and accurate documentation of underwater features and objects such as wrecks. The 3DSS-DX utilizes state-of-the-art acoustic transducer array technologies, SoftSonar™ electronics, and advanced signal processing techniques to produce superior swath bathymetry and 3D side-scan imagery. This technology is able to resolve multiple concurrent acoustic arrivals, separating backscatter from the seabed, sea-surface, water-column and multipath arrivals.

3D side-scan has got wide swath coverage, up to 14 times water depth, and 0.4° beamwidth. It is working on 450 kHz frequency. 3DSS-DX-450 provides simultaneous 3D side-scan, 2D Side-scan, and bathymetry data outputs.

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### **eCUDO.pl - platform for gathering and sharing oceanographic data, from satellite sensors to sea bottom instruments**

Gathering and sharing data from different resources is currently one of the fundamental activity for all stakeholders engaged in research and exploitation of the marine environment. Efficient management and digital availability of acquired information from various sources is crucial for planning and conducting activities and investments in coastal and offshore areas. Moreover, using together data from various sources, e.g. both satellite data and related in situ data, significantly increases the potential and usability of both data sets.

The volume of oceanological data observed for last years is growing exponentially, among others due to progressive development, especially in recent years, of satellite technologies for observation of the marine environment. For

example, daily amount of data provided by the SatBałtyk System operating since 2015 exceed 1 GB and covers almost hundred parameters of entire Baltic Sea produced using satellite data.

Rich resources of various information related to the marine environment are usually distributed across variety of infrastructures, data centers, collections and are stored in various formats, making discovery of all available sources of data and their harmonisation sometimes extremaly hard. To solve this difficulty a consortium of Polish institutions, engaged in research and exploitation of marine resources, is developing Electronic Platform for Sharing Oceanographic Data - eCUDO.pl, which will provide access to oceanographic data, based on information explored from diverse sources: archives, online data streams, satellite sensors, numerical models and fleet of autonomous measuring devices.

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### **Green economy - “A new engine of growth”**

The term “green economy” still does not have one, universal definition accepted by scientists, practitioners, institutions, politicians, etc. Although the concept is widely discussed by members of international organizations, like UN or EU, G20, governments, NGOs, local authorities, there are still a lot of misunderstandings around it the more so that new terms are created to name innovative ideas that have already been implemented or are in the phase of projecting such as blue economy, sharing economy or circular economy. Economists are generally opposed to adding adjectives to the term “economy” stating that there is only economy, however the adjectives inform about what is the idea behind these terms. As the problem seems worth investigating this was the reason for undertaking research in this field. One of the purposes of the article is to find the similarities and/or differences between these terms The other purpose is tightly connected with the title of the paper and has to demonstrate that “greening” economic activities can foster innovativeness and stimulate economic development measured not only by using Gross Domestic Product as an indicator but also other measures like Human Development Index or well-being measures. The methods were based on study literature, reports and cases illustrating of the best practices. The findings showed that there are a lot of similarities between various terms naming environmental.

friendly economic sustainable development. Green economy should not be perceived as a cost or burden but more like a trigger factor for initiative and innovativeness of groups and individuals.

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### **Protection of intellectual property in space**

The issue of innovation is closely related to the need to guarantee proper patent protection. In particular, this concerns innovation in space, where every centimeter of a space object is ridden with modern technology that requires effective protection. Technological innovations easily cross national borders, being used for instance during the continental shelf exploitation process, in the case of servers connected to a global network and located on the high seas or in outer space on artificial communication satellites or on the International Space Station. Technological innovations brought to space have so far mainly served the people living on Earth (so-called down-stream). The scope of these innovations is primarily communication, remote sensing and related environmental protection both on land and at sea.

In contrast to technological innovations, industrial property law - which is a tool for the protection of these innovations - is traditionally subject to the territoriality principle. This means that on the basis of currently functioning rules, in each case, industrial property rights are limited to the territory of a country, a group of countries or a geographical region. This results in a situation in which the territorial nature of intellectual property rights confronts the quasi-territorial treaty law of the cosmic, which in particular applies to the International Space Station. As a consequence, space activities on Earth could violate intellectual property law in this space. From the point of view of public international law, the concept of national territory and its borders does not raise any doubts. On the other hand, the issue of borders and proper jurisdiction appears in areas outside the national territory, where economic and industrial activities are carried out. In order to bring closer the problem of intellectual property protection in outer space, it is worth analyzing the current and analogous practice in maritime areas outside the national territory.

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### **Sat4Envi Project – collection and use of satellite data, also for South Baltic Sea area**

Institute of Meteorology and Water Management – National Research Institute is a leading partner of Sat4Envi Project – “Operating system for gathering, sharing and promotion of digital satellite information about the environment”, which main goal is distribution of satellite data, being scientific resources – public information. Realisation of Project is on-going in years 2018-2020. It will make free access to the spatial satellite information with different resolution and thematic scope for the wide spectrum of users: scientists, public administration, public services, civil protection, students and citizens. Both historical and actual satellite data from Copernicus Sentinel satellites, as well as from meteorological and other environmental satellites, which data are collected and processed by IMWM-NRI, will be freely available for use. Specialized trainings and information distribution will be conducted, creating demands for spatial satellite data and increasing digital competences of society.

Data from meteorological and medium resolution environmental satellites, mainly concern state of the atmosphere and Earth surface ( e.g. temperature, moisture, cloudiness, cloud types, radiation balance at the Earth surface, snow cover, precipitation, aerosol content and atmospheric chemistry), being important source of information about the processes in the atmosphere and on the Earth surface. They could be used for the analysis of actual state and monitoring of temporal changes. Long series of satellite data allows for monitoring of climate change. Due to resolution of those data (350 m – 40 km), they cannot be applied for detailed regional analysis.

The Copernicus Sentinel satellite system brings completely new quality of data for analysis of Earth surface (both land and sea). The following Sentinel missions data are shared: Sentinel-1 equipped with SAR instrument with 5x20 m resolution for monitoring of sea and land, Sentinel-2 equipped with high resolution optical radiometer (from 10 m), Sentinel-3 with medium resolution radiometer from UV to IR spectrum and radar altimeter and finally Sentinel-5 dedicated for atmospheric chemistry monitoring. The spectrum of those data use is really wide, allows for monitoring of biosphere, hydrosphere and atmosphere, analysis of changes proceeding in this environment.

About 350 TB of data were collected up to now, both level 1 and processed products, covering the whole area of Poland with approximately 500 km margin

around. They cover also South Baltic Sea including Polish Coastal Zone. With use of those data, could be monitored: sea surface temperature, wind field over sea surface, surface level anomalies, significant wave height, suspended matter in the surface layer, ship traffic, oil slicks and many other phenomena.

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### **Copernicus satellite data and products derived therefrom support for land, sea and ocean monitoring**

The Copernicus program is the flagship initiative of the European Commission and the European Space Agency. Formerly known as GMES (Global Monitoring for Environment and Security), it is a European program for establishing European potential for Earth observation and monitoring. The purpose of the Program is to build a constellation of observation satellites as well as operational services, allowing the use of data obtained from satellites and from ground measuring stations to monitor: the state of the atmosphere and the seas and oceans, climate change, natural disasters, the security of citizens and many others phenomenon. Satellites and space technologies provide key services for our societies; have a direct impact on everyday life, and the space industry is a source of growth and jobs. The European Union implements its policy based on space technology - protecting the marine and terrestrial environment and biodiversity. The Copernicus program is open and free to all interested users.

Copernicus Land Monitoring Service (CLMS) provides geographical information on land cover to a wide range of users in the field of ground-based environmental applications. This includes land use, land cover characteristics and changes, vegetation status, water cycle and surface energy of the earth. CLMS products are divided into five categories:

- Systematic biophysical monitoring
- Land cover and land use mapping
- Thematic mapping of hotspots
- Reference data
- Ground traffic service

Products coming from the Sentinel-1 and 2 satellites are the Copernicus Land (CLMS) service, which is detailed information on land cover for EU Member States and partner countries. The flagship product on this website is detailed information about land cover for EU countries - CORINE Land Cover. Other data from this site are pan-European raster data - High Resolution Layers, and local

products focusing on detailed information about land cover and its use only for thematic areas.

Marine data are the engine of 'smart and sustainable growth' in the European Union. Copernicus Maritime Service was designed to respond to problems arising in the environmental protection, business and science sectors. Utilizing information from both satellite and in-situ observations, it provides daily the latest analysis and forecasts that offer unprecedented ability to observe, understand and predict events in the marine environment. The Sea and Oceans Monitoring Service (CMEMS) provides detailed information on water temperature, salinity, sea surface height, sea ice coverage, and more.

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\*\*\*Elektroniczne Centrum Udostępniania Danych Oceanograficznych eCUDO.pl\*\*\* is a Project POPC.02.03.01-00-0062/18 funded within the frame of Operational Programme Digital Poland for 2014-2020, managed by Digital Poland Project Centre (CPPC) with allocated budget 15.261.546,00 PLN (84,63% –ERDF, 15,37% national budget). The Project is carried out by consortium of 7 research and scientific institutions: Institute of Oceanology Polish Academy of Sciences (leader), Maritime Institute in Gdańsk, National Marine Fisheries Research Institute, Polish Geological Institute – National Research Institute, University of Gdańsk, Pomeranian University in Słupsk and University of Szczecin. The main aim of the project is to increase the digital availability and usability of public sector information by digitising and sharing oceanographic data. This will be viable by deployment of the Electronic Platform for Oceanographic Data Exchange - eCUDO.pl, providing unified access to national oceanographic science resources



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## LIST OF POSTERS

### **Magdalena Pawlik, Dariusz Ficek**

Institute of Physics, Pomeranian University in Słupsk

*Pyłek sosny nierozwiązany problem w teledetekcji satelitarnej*

### **Violetta Drozdowska**

Institute of Oceanology Polish Academy of Sciences

*Study on organic molecules in the surface microlayer of the Baltic Sea - perfecting the models for interpretation of remote satellite imagery of sea surface*

### **Paulina Aniśkiewicz**

Institute of Oceanology Polish Academy of Sciences

*Wpływ planetarnej warstwy granicznej na wyniki modelowania z zastosowaniem modelu WRF, na przykładzie schematów TEMF oraz BouLac, w fiordzie Porsanger*

**Kamila Haule<sup>1</sup>, Mirosław Darecki<sup>2</sup>**

<sup>1</sup>Maritime University in Gdynia

<sup>2</sup>Institute of Oceanology Polish Academy of Sciences

*Remote sensing reflectance of oil dispersed in seawater*

**Karolina Borzycka, Sławomir Sagan, Monika Zabłocka**

Institute of Oceanology Polish Academy of Sciences

*Zmiany właściwości optycznych wody morskiej na obszarach farm omułków*

**Katarzyna Dragańska-Deja**

Institute of Oceanology Polish Academy of Sciences

*Uncertainties of satellite information on the concentration of suspended matter in the glacial bays, Spitsbergen*

**Roman Majchrowski<sup>1</sup>, Dariusz Ficek<sup>1</sup>, Damian Stoltmann<sup>1</sup>, Joanna Stoń-Egiert<sup>2</sup>**

<sup>1</sup>Institute of Physics, Pomeranian University in Słupsk

<sup>2</sup>Institute of Oceanology Polish Academy of Sciences

*Indeks pigmentów niefotosyntetyzujących w Bałtyku na podstawie danych satelitarnych*

**Marcin Paszkuta**

University of Gdańsk

*Satelitarna detekcja zachmurzenia nad Bałtykiem - trudności i postępy*

**Halina Kowalewska-Kalkowska<sup>1</sup>, Marek Kowalewski<sup>2,3</sup>**

<sup>1</sup>University of Szczecin

<sup>2</sup>University of Gdańsk

<sup>3</sup>Institute of Oceanology Polish Academy of Sciences

*Wykorzystanie danych z Systemu SatBałtyk w badaniach upwellingów przybrzeżnych w południowym Bałtyku*

**Tomasz Zapadka**

Institute of Physics, Pomeranian University in Słupsk

*Satelitarny model do kontrolowania bilansu promieniowania powierzchni Morza Bałtyckiego*

**Marta Konik, Mirosław Darecki**

Institute of Oceanology Polish Academy of Sciences

*Multi-year dynamic of the algae blooms in the Baltic Sea during the MODIS era*

## **ORGANIZING AND PATRONIZING INSTITUTIONS**

Polish Space Agency – honorary patronage

- Space Sciences Committee Polish Academy of Sciences - Gdańsk Branch
- Baltic Sea & Space Cluster
- Institute of Oceanology Polish Academy of Sciences
- Polish Scientific Committee on Oceanic Research (Polish SCOR) (Marine Physics Section)
- Space and Satellite Research Committee of the Polish Academy of Sciences (Remote sensing Section)
- SatBałtyk Scientific Consortium
- Institute of Meteorology and Water Management – National Research Institute

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- **Katarzyna Dragańska-Deja** – Institute of Oceanology Polish Academy of Sciences
- **Paulina Aniśkiewicz** – Institute of Oceanology Polish Academy of Sciences

## MORE INFO

**Space Sciences Committee  
Polish Academy of Sciences / Gdańsk Branch**  
in cooperation with  
**Baltic Sea & Space Cluster**  
invites for joint conferences

- 20th September, 2018  
**Baltic Sea & (Outer) Space**  
**New perspective for our region**  
Instytut Oceanologii Polskiej Akademii Nauk, Sopot
- 22nd November, 2018  
**Seaport + Space Infrastructure**  
**Synergic Network under common management**  
Wyższa Szkoła Administracji i Biznesu, Gdynia
- 14th March, 2019  
**Autonomous ships**  
**Inevitable reality at sea**  
Politechnika Gdańska
- 16th May, 2019  
**Institutional Cooperation at Sea & (Outer) Space**  
**Essential adjustments needed to boost full potential**  
Uniwersytet Gdański, Wydział Prawa i Administracji
- 19th September, 2019  
**Remote-sensing**  
**Challenges in gather and sharing data**  
Instytut Oceanologii Polskiej Akademii Nauk, Sopot
- 14th November, 2019  
**Sea and underwater drones**  
**"Unidentified Sea Objects"**  
Akademia Marynarki Wojennej, Gdynia