HEALTHCARE AND WELLBEING SESSION MOM

Meeting Date	08.10.2028	**Time**	14:00-17:00
Meeting Called By	EUSPA	**Location**	Online event
Minutes Taken By	Jeroen Vriends, EY Paola Testa, EY	**Next Meeting Date**	N/A
Attendees	**Gerda Kuum, EUSPA, Session moderator** **Justyna Redelkiewicz, EUSPA** **Speakers** 1. Karin Schenk – EOMAP 2. Martin Polivka – IQVIA 3. Monika Kryzanowska – CloudFerro 4. Antonio Tabasco – GMV 5. Annelies Hommersom – WaterInsight 6. Tins Silovic – Mercator Ocean International 7. Larissa Mussarelli – Novaspace 8. Lucien De Busscher – EY 9. Cristina Ananasso – ECMWF 10. Marco Morelli – siHealth 11. Bartłomiej Lubiatowski - RSQ		
Distribution (in addition to attendees)	UCP Plenary, EUSPA, Public		

Agenda Items	Presenter
1. Welcome and introduction	Gerda Kuum, EUSPA
2. Copernicus Services for Health and Wellbeing	Cristina Ananasso, ECMWF Tina Silovic, Mercator Ocean International
3. Current status of different EO use cases in healthcare	Moderated by Larissa Mussarelli, Novaspace Speakers: - Lucien De Busscher, EY - Martin Polivka, IQVIA - Karin Schenk, EOMap - Artłomiej Lubiatowski, RSQ
4. Roundtable: User requirements validation, identification of adoption barriers and research gaps	Moderated by Paola Testa, EY Speakers:

	- Marco Morelli, siHealth Ltd - Annelies Hommersom, Water Insight - Karin Schenk, EOMap
5. Panel Discussion: How to increase the use of EO data among commercial users	Moderated by Justyna Redelkiewicz, EUSPA Panelists: - Antonio Tabasco, GMV - Darko Ojdanic, OHB - Monika Kryzanowska, Cloudferro - Annelies Hommersom, WaterInsight
6. Questions, conclusions and closing remarks	Speaker: Gerda Kuum, EUSPA

Summary

The Healthcare and Wellness panel of the User Consultation Platform (UCP) 2024 took place on 8th October 2024 as online event, with almost 50 participants. The panel brought together participants from different end-user communities active in the areas of healthcare and Wellness applications, including EO service and solutions providers, international organisations like the European Centre for Medium-Range Weather Forecasts (ECMWF), non-profit organisation such as Mercator Ocean International (MOi), end users and institutional representatives such as DG DEFIS.
The main objectives of the UCP are to present and discuss space technology user requirements and needs in Europe, with a focus on EO, to showcase success stories of companies and projects using EO data and services in the field of Healthcare and Wellness, as well as collecting feedback and relevant first-hand information from the participants on the emerging trends, relevant needs, potential barriers and useful way forward, with a specific focus on the actions that EUSPA can undertake to support the flourishing of this market. This year it was the first time that a session has been dedicated to Healthcare and Wellbeing, and the participant showed significant interest in this domain.

The discussion was structured around the following main key areas: **introduction to the Healthcare and Wellbeing session**, Copernicus services, current status of different EO use cases in healthcare, user requirements validation, identification of adoption barriers and research gaps, how to increase the use of EO data among commercial users.
Concerning the first topic, the European Union Agency for the Space Programme (EUSPA) and the User Community Platform (UCP) as a strategic instrument for EUSPA to enhance engagement with stakeholders were presented. EUSPA's efforts in the health market segment was outlined, including market analysis, pilot initiatives, and support for startups. Current healthcare trends, such as personalized medicine, mental health, telemedicine, wearable technology, and the integration of

Artificial Intelligence (AI) in healthcare were presented, together with the advantages of employing Earth Observation (EO) data in healthcare.

Copernicus services for Healthcare were then proposed: ECMWF's contributes to public health through Earth Observation (EO) data. To this end, Health Hub, a newly coordination center was established and designed to streamline information flow among various EU-level projects. Moreover, the critical role of oceans in human wellbeing was stressed and to ensure oceans are healthy, data are needed. Copernicus Marine Service provides in situ, satellite and forecast data play a key role in supporting tracking of ocean plastics or ensuring sustainable aquaculture with information about unfavourable conditions in the system such low salinity.

The following panel concerned the **current status of different EO use cases in healthcare.**
The panelists discussed patient, hospital, clinical trial, and Earth Observation data, the role AI could play in processing those data, introducing the concept of Bio-Tech and geo-medication, underscoring personalized healthcare as the future. Also interesting insights on the relationship between climate and population health, focusing on heatwaves and cardiovascular diseases: a near-perfect predictive correlation has been identified between weather forecasts and regional cardiovascular disease levels, as well as between climate change and healthcare costs. In addition, aslo the correlation between pollen levels and pharmacy sales data as been prooven as significant, which allows pharmaceutical companies to optimize product development, marketing, and supply chains. Policymakers and healthcare providers could use such models to mitigate the risk of drug shortages. Aslo water quality, which can affect humans and animals, especially in populated areas can effectively be monitored thorugh EO data, which offer reliable, promptly available and continous monitoring.

Regarding the **current status of different EO use cases in healthcare, user requirements validation, identification of adoption barriers and research gaps**, the session focused on three applications: UV monitoring, air quality monitoring and water quality monitoring. Important challenges emerged during the discussion, such as lack of end users awareness of EO added value, lack of standardized certifications, affordability of high resolution (commercial) EO data. Also, the discussions provided valuable insights into the current challenges and potential strategies for leveraging EO data to support environmental health initiatives.

The last panel explored **how to increase the use of EO data among commercial users.** Many existing barriers were identified, namely data anonymity and protection, which are very critical for healthcare, especially when using AI and machine learning, which will be needed considering the ever-growing amount of data available; standardisation; data accuracy and balance between affordability and benefits for the users. Concerning the future importance of AI to fully exploit EO and other data in healthcare, processing power is a key driver of competitiveness, and the EU should invest on it. It also emerged that the EO-based technology is mature concerning the computation of environmental parameters, while establishing the correlation with diseases is less mature. The panellists flagged that the need of clinical studies represents a difficulty. Then when such evidence is produced, public health institutions, health insurance will easily uptake the proposed solution. Therefore, these specificities of the sector slow down the uptake, but once the evidence is produced, opening of big opportunities is expected. The first target to enhance the uptake should be public health agencies and research institutions, but also the wellbeing domain to address specific needs of individual users. Also, the urgency of monitoring environmental (air, water etc.)

conditions is hardly perceived by the wider public and the impact on people's health become visible only in the long run. To get larger support base for EO solutions, the national governments responsible for setting the national protocols would be more willing to move towards now techniques if they feel some pressure at EU level. They are also paying for the programme (Copernicus), so there is trade off here as they pay, and they can get free valuable data. Also pilots and demonstrators could be of help. Also, support on all sides is needed, and a harmonized regulatory framework can be achieved.

1 MINUTES OF MEETING

Agenda Item 1 - Welcome and introduction to the Healthcare & Wellbeing session. Gerda Kuum, EUSPA

Gerda Kuum, the Healthcare & Wellbeing segment leader, initiated the session by presenting the European Union Agency for the Space Programme (EUSPA) and consequently outlined the day's agenda. She emphasized the significance of the User Community Platform (UCP) as a strategic instrument for EUSPA to enhance engagement with stakeholders. The UCP serves as a collaborative platform for users, industry experts, service providers, and entrepreneurs to exchange insights on EU space initiatives and articulate their needs. She highlighted that healthcare now constitutes a distinct market segment.

Kuum detailed EUSPA's efforts in the health market segment, including market analysis, pilot initiatives, and support for startups. She presented preliminary findings on the advantages of employing Earth Observation (EO) data in healthcare, setting the stage for in-depth discussions later in the event.

She proceeded to identify current healthcare trends, such as personalized medicine, mental health, telemedicine, wearable technology, and the integration of Artificial Intelligence (AI) in healthcare. Kuum clarified the healthcare market's structure, dividing it into pharmaceuticals, medical equipment, and healthcare services. She underscored the considerable potential of EU Space data in the healthcare sector, citing specific applications such as clinical trial studies, demand forecasting, logistics planning, emergency response support, hospital readiness, data for medical research, and the optimization of personalized treatment plans.

Concluding her introduction, Gerda Kuum yielded the floor to Cristina Ananasso from the European Centre for Medium-Range Weather Forecasts and Tina Silovic from Mercator Ocean International.

Agenda Item 2 – Copernicus Services for Health & Wellbeing: overview, current state and evolution. Cristina Ananasso, ECMWF and Tina Silovic, Mercator Ocean International

Cristina Ananasso, ECMWF

Cristina Ananasso provided an introduction to the Copernicus program, highlighting ECMWF's mandate to contribute to public health through Earth Observation (EO) data. She introduced the Health Hub, a newly established coordination center designed to streamline information flow among various EU-level projects. The Hub's mission is to translate scientific knowledge into practical applications for end-users. Launched approximately a year ago during EU Space Week, the Health Hub's website has since become a key platform for engaging with end-users. It categorizes health into three main pillars: physical health, well-being, and mental health, and features a comprehensive collection of use cases and user stories that demonstrate the application of data within healthcare.

The "Trigger" project, part of Horizon Europe, examines the relationship between climate/weather and human health, utilizing observations from various sources, including wearables, to build predictive models for extreme weather events like heatwaves.

Tina Silovic, Copernicus Marine for Health
Tina Silovic emphasized the critical role of oceans in human wellbeing and the reason why we need to keep oceans healthy. To ensure oceans are healthy, we need data. Marine data provide important information on the state of the ocean back to the past, on their state in almost real time, but as well we can get forecasts or predictions of the state of the oceans to make informed decisions enhancing our ability to interact safely and sustainably with the marine environment. Copernicus Marine Service provides in situ, satellite and forecast data organising them into blue ocean (physics), white ocean (sea ice), and green ocean (biogeochemistry). There are many applications or use cases showing the use of such data and some of them include tracking of ocean plastics or ensuring sustainable aquaculture with information about unfavourable conditions in the system such low salinity.

Agenda Item 3 – Current status of different EO use cases in Heath & Wellbeing. Lucien De Busscher, EY / Martin Polivka, IQVIA / Karin Schenck, EOMap / Bartłomiej Lubiatowski, RSQ. Moderator: Larissa Mussarelli, Novaspace

Larissa introduced the panel session, posing to the audience the following questions:

What key healthcare applications do you believe could benefit from EU Space data but are currently underutilised or not fully leveraged? (1/2)

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- Correlating population densities x Air pollution x related illnesses
- SKin Cancer (I dont know if it has already been impelmented)
- Waterborne diseases
- Air pollution for lung diseases
- Tracking vector-borne diseases for climate-adaptation and preparedness purposes; Monitoring human/wildlife conflict "events" and encroaching of natural environment by human settlements for monitoring of potential zoonosis; Data on past disasters and modelling on future developments to inform adaptation planning and capital expendutre; Monitoring air

What key healthcare applications do you believe could benefit from EU Space data but are currently underutilised or not fully leveraged? (2/2)

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quality and particulates to investigate prevalence of chronic respiratory (and other) diseases; Overlaying of weather information and seasonal forecasts with population movements and displacements for health preparedness planning.

- Vaccination campaigns where EO can help and generate savings. Also, compliance with environmental rules and the need for many industries to assess the impact of their products and activities on the environment.

Lucien de Buysscher, EY – Vital Signs
Lucien de Buysscher discussed the vast array of vital signs represented by data points, including patient, hospital, clinical trial, and Earth Observation data. He explained how AI is instrumental in structuring the overwhelming volume of raw data collected by healthcare providers. He introduced the concept of Bio-Tech and geo-medication, underscoring personalized healthcare as the future. He also touched on the European Health Data Space (EHDS), a significant EU data initiative that will facilitate the sharing of all health data, including clinical trials, at the EU level. He concluded his section underscroring the growth within the Healthcare sector, particularly the uptake in investments made in the industry.

Bartlomej Lubiatowksi, RSQ
Bartlomej Lubiatowksi's company specializes in AI diagnostics, patient health documentation, and health analytics. They have explored the relationship between climate and population health, focusing on heatwaves and cardiovascular diseases. Using data from the National Health Fund (NFZ) in Poland, they found a near-perfect predictive correlation between weather forecasts and regional cardiovascular disease levels. They also discovered a strong connection between climate change and healthcare costs, identifying dew point temperatures as a significant factor due to their relation to humidity levels.

Martin Polivka, IQVIA
Martin Polivka from IQVIA discussed the intersection of advanced analytics and technology solutions, specifically examining the correlation between pollen levels and pharmacy sales data. They found a significant, albeit delayed, correlation, which allows pharmaceutical companies to optimize product development, marketing, and supply chains. Additionally, they highlighted how policymakers and healthcare providers could use such models to mitigate the risk of drug shortages.

Karin Schenk, EOMAP
Karin Schenk, a remote sensing expert at EOMAP, serves both private and public sectors with a focus on Bathing Water monitoring. She addressed the health risks associated with poor water quality, which can affect humans and animals, especially in populated areas. EOMAP monitors water quality from April to October (the swimming season) to alert the public about harmful substances. The company provides online dashboards with site-specific thresholds and is working on forecasting, gap filling, and high-resolution temperature measurements for future projects.

Agenda Item 4 – Roundtable: User requirements validation, identification of adoption barriers and research gaps. Moderator: Paola Testa, EY

UV Monitoring Session Summary

Session Overview: The session focused on the use of Earth Observation (EO) data for UV monitoring, emphasizing the delivery of daily, localized, and actionable information on solar radiation exposure. The goal is to create historical UVI data at local and regional levels to support tailored recommendations and product development for organizations and businesses.

Audience Engagement: A key question posed to the audience addressed the potential impact of an awareness campaign on UV exposure risks. The query was whether such a campaign would enhance public sensitivity and encourage the use of UV monitoring information, including EO-based data. The panel unanimously agreed, indicating a "YES" and acknowledging the importance of public education in promoting UV safety.

Panel Discussion: Marco Morelli, siHealth Ltd, led the panel discussion, which covered the following critical areas:

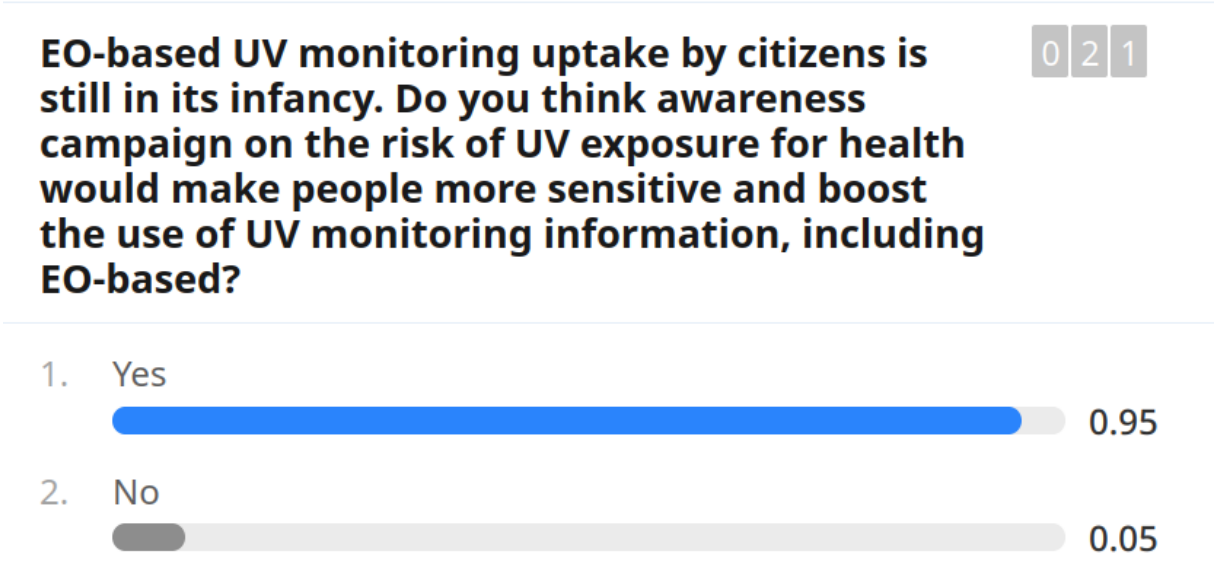
Data access and format – the company utilizes Earth Observation (EO) data to calculate and measure solar radiation exposure in various bands (UV, VIS, IR) and employs GNSS to monitor individual exposure levels. The company uses data from Meteosat MSG and Sentinel-5B for ozone data, with atmospheric conditions updated every 5 minutes at a 3 km/pixel resolution. They face challenges with GPS/GNSS data, as it cannot discern whether a user is indoors or outdoors without user input. SiHealth is working on AI tools to estimate location based on GNSS signals and seeks access to raw GNSS/GPS data, which is typically processed by phone manufacturers.

Sustainable business model – SiHealth operates a medical device smartphone app certified for managing sun exposure, particularly beneficial for individuals with photosensitive skin, outdoor workers, and those at risk of vitamin D deficiency or Actinic Keratosis. The app is involved in

partnerships with corporates for sunscreen and vitamin D supplements, supports skin cancer treatment, and provides a web portal for dermatologists and an app for patients. The company has conducted clinical studies demonstrating the app's effectiveness in modifying sun exposure behaviour and increasing vitamin D synthesis.

Data resolution and coverage - The app provides real-time solar radiation measurements and data to researchers, with a focus on avoiding sunburn and reducing skin cancer risk. The minimum spatial resolution required for solar radiation data is 3 km, and the temporal resolution needed is every 5 minutes. SiHealth is primarily interested in mapping data, particularly building shadows, to improve their service.
In summary, siHealth leverages EO data for its certified medical device app, faces challenges with indoor/outdoor user location data, and sees potential in enhanced Copernicus services to support their business model focused on personalized sun exposure management and health monitoring.

No further insights were provided by the panel on these topics.



Water Quality Monitoring Session Summary

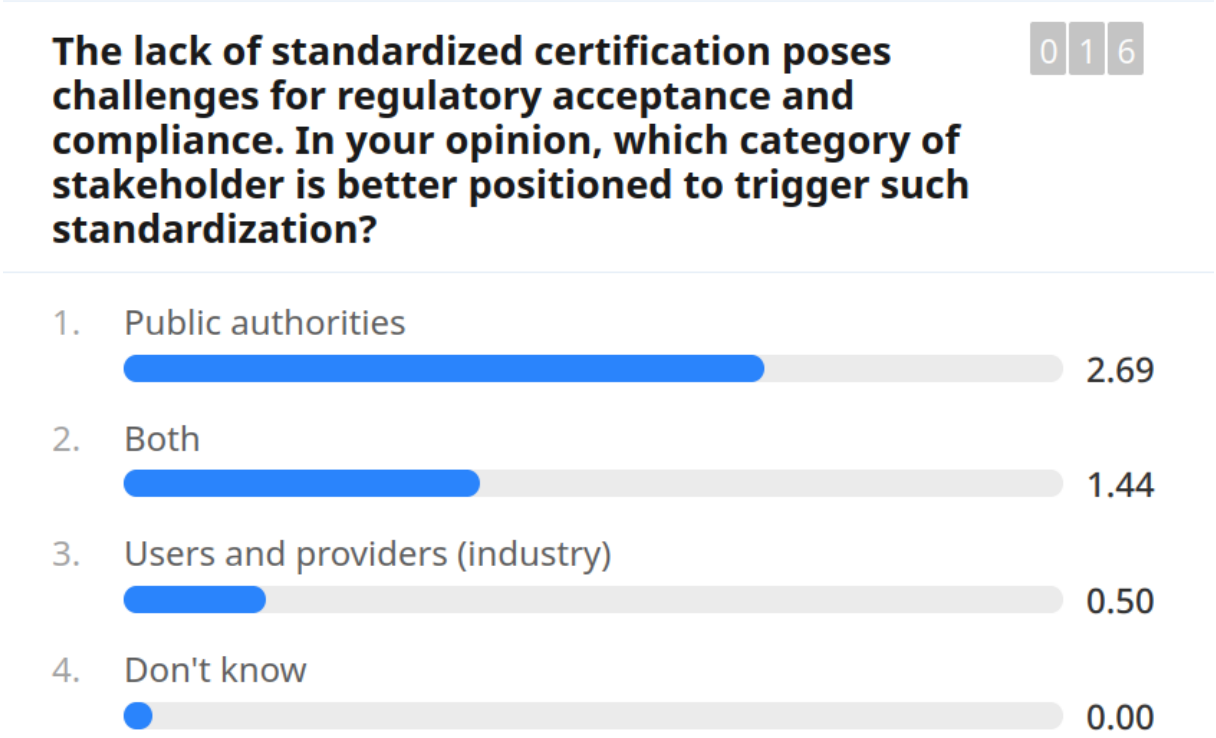
Session Introduction: The moderator highlighted the challenges in water quality monitoring, such as temporal constraints, the absence of standardization and certification, and user skepticism towards new methodologies.

Audience Interaction: Participants were asked to consider which stakeholder category would be most effective in initiating standardization for regulatory acceptance and compliance. The consensus among the panellists was that public authorities are best equipped to lead this effort.

Expert Contributions: Annelies Hommersom, Water Insight, initiated her presentation by addressing the challenge of assuring data quality in the absence of a standard framework. Her discussion points included:

Karin Schenk, EOMap, discussed the synergistic role of EO data in water quality monitoring. She stressed the importance of collaboration between service providers, users, and public authorities to improve service offerings and understanding of EO data's potential. Schenk also identified existing data challenges, such as cloud coverage, and potential solutions like in-situ stations or AI. She noted the Water Framework Directives' lack of specific data reporting requirements.

Additional Insights: Marie Beth Neely and Alexandre Mencik emphasized the high demand for nutrient monitoring from space and the advantages of standardized service offerings for industry compliance with water directives.



Air Quality Monitoring Session Summary

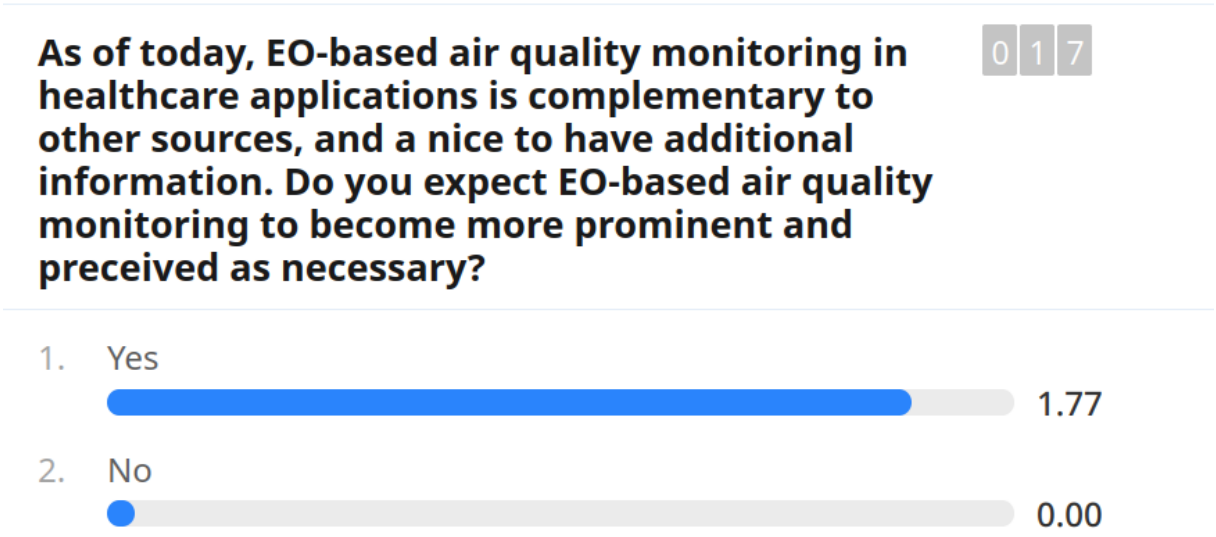
Topic Introduction: The session addressed the application of EO data in air quality monitoring, particularly the current limitations in data resolution and the complementary nature of EO data to other sources.

Panel Query: The panel was asked if EO-based air quality monitoring is expected to become more integral and necessary in healthcare applications. The panelists responded affirmatively with a "YES."

Panelist Observations: Alexandre Mencik highlighted the legal obligations of private companies to monitor and report on air quality, noting this as a key driver for the adoption of EO data. He advocated for increased awareness and the integration of EO data with in-situ measurements for comprehensive data validation.

Darko Ojdanic discussed the competition between in-situ and EO data, suggesting that the focus should be on the potential synergies between the two to improve data uptake and utility.

Conclusion: The sessions underscored the need for increased public awareness, standardization, and collaboration among stakeholders to enhance the adoption and effectiveness of EO data in UV, water, and air quality monitoring. The discussions provided valuable insights into the current challenges and potential strategies for leveraging EO data to support environmental health initiatives.



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Agenda Item 5 – Panel Discussion: How to increase the use of EO data among commercial users. Justyna Redelkiewicz, EUSPA. Panelist: Antonio Tabsco, GMV / Darko Ojdanic, OHB / Monika Krzyzowska, CloudFerro / Annelies Hommersom, WaterInsight

Moderator Justyna Redelkiewicz, EUSPA: EO has high potential to be used in healthcare, as seen in the previous sessions, but the uptake of EO is more an exception rather than the rule. In the present session the objective is to understand which are the barriers (why EO is not yet used in every hospital?) and how those can be overcome, and in particular what EUSPA can do to this end.

Panelists:

- Justyna Redelkiewicz, EUSPA: question to GMV: is healthcare a priority market for EO? And

how do you see the status and maturity of the satellite data implementation in healthcare?

- Antonio Tabasco, GMV: at GMV we started a long time ago in remote sensing, and out technology is applied in different areas, specifically for developing the data platforms for analysis of clinical data or early detection of diseases, improving the doses of radiation therapy for patients. We have been involved in collaborations with hospitals and healthcare institutions, and the idea of integrating our services for agriculture, forestry, emergency management, climate monitoring etc. with healthcare services emerged naturally. The integration of EO in these actives was channelled through two projects funded by the European Space Agency, in which we are working on the analysis of environmental variables that could lead to the identification of factors justifying the appearance of disease. The technology is mature concerning the computation of environmental parameters, while establishing the correlation with diseases is less mature. The number of applications able to prove the correlation between the environmental parameters and different diseases is not huge and it depends on the region. Europe is quite advanced in this regard, while it's not the case for other regions like Africa. On the other hand, working on the correlation between EO-based environmental parameters and vector diseases is easier and there is room for further development.
- Justyna Redelkiewicz, EUSPA: do you see the benefit from the technical side, the usefulness of predictable correlations, but how is it on the commercial side? Do you think it would be easy to see this implemented in hospitals? What does happen after a pilot? Where do you see the existing problems undermining a bug scale up of this kind of services?
- Antonio Tabasco, GMV: in my opinion, the main challenges are related to data anonymity and protection, which are very critical for healthcare, especially when using AI and machine learning. Standardisation represents another issue. For instance, we know how to measure rain and floods, but the way in which we formulate and compute those parameters is different from the way they are intended in the healthcare domain. Also, data accuracy is an existing issue, as the EO data might be good, but if you want to develop a business plan based on the availability of the data, I's not trivial to find a balance between the cost and the data resolution, and how often you can provide it with also a good balance of cost and benefit for the user.
- Justyna Redelkiewicz, EUSPA: do you think you believe that this area will grow in your portfolio of projects? And if so, do you plan to try solving those issues, or you think more joint effort from the European institutions is needed? Can those issues be solved in the short term?
- Antonio Tabasco, GMV: I think we will make an effort to solve them, in fact we are quite active in domains like agriculture or climate resilience and forest monitoring, and there is a direct correlation between the evolution that we have seen in in emergency security and climate resilience and the rise of interest in the use of EO for healthcare. This is due to a concept called One Health, namely an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. In this perspective, EO is useful to produce indexes and analytics useful for healthcare institutions. This probably can be addressed in the medium term.
- Justyna Redelkiewicz, EUSPA: Darko (Ojdanic, OHB) can you please share your opinion and which future do you see for EO in healthcare?
- Darko Ojdanic, OHB: I'd like to comment specifically concerning the application of urban heat areas as we are currently working on it. The focus is on prevention, and we have two customers groups: private individuals and public health institutions. Typically, we offer simulations of the potential options to support public institutions decision making, like how to choose between

grass, small plants of big trees in urban areas to manage the heat. In healthcare is different because clinical studies are needed to support with evidence that what you are proposing will not harm people's health. Therefore, the need of clinical studies represents a difficulty. Then when such evidence is produced, public health institutions, health insurance will easily uptake the proposed solution. So these specificities of the sector slow down the uptake, but once the evidence is produced, it opens big opportunities.

- Justyna Redelkiewicz, EUSPA: how do you see this area developing at OHB?
- Darko Ojdanic, OHB: we would like to expand our business in urban environment in connection to public health, addressing fist low-hanging fruit but without excluding healthcare regardless the challenges it poses.
- Justyna Redelkiewicz, EUSPA: Monika (Kryzanowska, Cloudferro) you are a little bit earlier in the value chain with cloudferro, how do you see the growth of usage of satellite data in healthcare?
- Monika Kryzanowska, Cloudferro: thank you for your question. First of all, I'd like to say that this session is very interesting and inspiring. Cloudferro is operating access to data for the European Space Agency and for trusted and traced users. Most of the users are agro-alimentary business, statistics offices and crisis management operators, but recently also some healthcare stakeholder. The healthcare sector is ready and interested in using EO data since many years. But between us (data) and the end users, applications will need to be developed. In fact, data are used in research, proof of concepts showing interesting correlations, but this is just the beginning. Both Copernicus data and in-situ data are used for these purposes.
- Justyna Redelkiewicz, EUSPA: how do you see the link between EO and AI in healthcare?
- Monika Kryzanowska, Cloudferro: we are experiencing what I call the economy of abundancy, namely availability of massive quantity of satellite-based and non satellite-based data, and this trend will grow in the future. To aggregate, process and correlate all this data, we need AI tools, as they allow to obtain achievements not achievable with traditional approaches like models, thanks to higher processing power. Processing power is a key driver of competitiveness, and the EU should invest on it.
- Justyna Redelkiewicz, EUSPA: Who do you believe will be the first adopter of satellite data on large scale? Hospitals, pharmaceutical companies, the wellbeing part of healthcare, fitness devices? What should be the first target for EUSPA to approach?
- Monika Kryzanowska, Cloudferro: I would bet on wellbeing because the available resolution fits. The resolution, spatial and temporal, is currently a challenge for more professional applications. The expectation to address the other markets is to reach continuous flow of information, not just one picture a day with a certain resolution.
- Justyna Redelkiewicz, EUSPA: do the other panellists agree?
- Antonio Tabasco, GMV: to me the first target of EUSPA should be public health agencies and research institutions because of their mandate to monitor health on a large scale, and this need can be well served by satellite data (country/region level).
- Darko Ojdanic, OHB: I agree that the first target could reasonably be public health agencies and research institutions, but I also see a push from the other side from wellbeing domain, to serve specific needs of individuals, which is addressed best in combination with IoT, navigation and communication services.
- Justyna Redelkiewicz, EUSPA: Annelies (Hommersom, WaterInsight) how do you see the potential of EO for healthcare, and in particular in relation to water analytics?
- Annelies Hommersom, WaterInsight: we see a growing attention on water basins monitoring as, due to climate change, there is the expectation that there will be more cyanobacteria (blue

green algae) blooming in freshwater and costal water where people swim. The actual risks for the health are real, like liver diseases and dementia for instance, and supported by the literature, but these risks are hardly perceived by the public. It's difficult to perform clinical trial on water basins as nobody wants to expose people to those cyanobacteria, therefore the effects can only be monitored by monitoring a significant amount of people and water basins in parallel. Still, taking like bi-weekly samples of water to be processed takes effort and time for both the collection and processing, and the time lag does not allow for early warning. On the contrary, EO monitoring allows for early warning, so this is the main link with healthcare.

- Justyna Redelkiewicz, EUSPA: given the clear value added of the work you do, is it relatively easy to sell your solution?
- Annelies Hommersom, WaterInsight: it's still not easy as we are talking about long-term effects, making harder for people to perceive they are in danger. There are many regulations imposing to public authorities to monitor water quality, but monitoring protocols are often made at national level, which makes the results comparable at national level. On the other hand, there is no place for new techniques, making the uptake of EO-base solutions, which would offer timely and frequent monitoring and spatial insights, very difficult.
- Justyna Redelkiewicz, EUSPA: you are not targeting hospitals or medical centres, right? Your targets are mainly water authorities?
- Annelies Hommersom, WaterInsight: yes we target water authorities at regional level, also provinces which are in charge of informing the public, agricultural sector and aquaculture
- Justyna Redelkiewicz, EUSPA: how do you think EUSPA can support best the uptake of EO-based solutions for healthcare?
- Annelies Hommersom, WaterInsight: to get larger support base for EO solutions, the national governments responsible for setting the national protocols would be more willing to move towards now techniques if they feel some pressure at EU level. They are also paying for the programme (Copernicus), so there is trade off here as they pay, and they can get free valuable data. Also pilots could be of help.
- Justyna Redelkiewicz, EUSPA: any closing remarks from the other participants?
- Darko Ojdanic, OHB: also demonstrators can be very useful. It's difficult to have funding for long validation projects, but they could make the difference.
- Justyna Redelkiewicz, EUSPA: what we see also in other market segments is that, even with TRL 9 solutions, we still need to bridge the gap between to reach the market. EUSPA is working on new tools for this purpose, so stay tuned!
- Monika Kryzanowska, Cloudferro: I think EUSPA plays an important role in derisking innovation development, and the same could be done on the regulatory side.
- Antonio Tabasco, GMV: as it happened for the regulation against deforestation, support on all sides is needed, and a harmonized regulatory framework can be achieved. Also the lack of a standardized and certified approach is a barrier to the uptake
- Justyna Redelkiewicz, EUSPA: we should follow-up to this discussion asking the industry to propose potential standardization options. This year we are addressing Healthcare for the first time and with dedicated resources not available in the past, and we encourage all the participants to reach out to us with any idea you might have

Agenda Item 6 – Questions, conclusion and closing remarks. Gerda Kuum, EUSPA

Many interesting takeaways emerged during the Healthcare session today, including:

- Importance of training datasets
- Potential for EO in managing the shortages of medicines, allergy drugs and better management of pharmaceutical production
- The importance of standardized certification for water quality monitoring
- Importance of data validation to support the uptake

Gerda informed the participants that we will produce minutes of the session and the presentations will be uploaded on EUSPA website. Everybody is welcome to reach out and share further feedback and ideas, that will be used to improve the Report of User Requirements (RUR) and also to take actions on EUSPA side to support the industry.
On the future, more effort will be dedicated to this segment, including further editions of the Healthcare UCP.

User Needs and Requirements – Synthesis of discussion outcomes

The requirements compiled in the draft Report on User Needs and Requirements (RUR) circulated prior to the UCP were reviewed with the participants. The discussions raised the **need to refine some of the requirements and/or to add new ones**. Therefore, requirements which were reviewed and did not deserve any comment or change from the audience are not depicted in the next tables.

Requirements relevant to EO

Application/ Operational Scenario	Parameter	Requirement
UV Monitoring	User Needs	**Size of area of interest**: • Minimum: single spots for outdoor activities (individual beaches, hotel resorts or entire city regions). • High interest on areas with increased UV radiations, like desert areas, water areas, mountain areas, areas in the range of reduced ozone layers (e.g. Australia) **Frequency of Information**: • Near-real time for some applications • Hourly is important for detailed studies and correlations • Daily or weekly UV indexes, however peaks more important than the average value • Daily, weekly, monthly) for planning with information about the expected UV over different regions **Type of service**: Continuous service offering commonly includes a wearable (watch, wristband, skin patch, etc.) that combines satellite data (GNSS) to determine the exact location and the relevant UV-Exposure (EO) to advice the end-user on UV-exposure.
UV Monitoring	Service Provider – EO Requirement	**Spatial Resolution:** 100 m, but cannot be achieved today **Temporal Resolution:** As the processing requires time, the temporal resolution requirement depends on the capabilities of the models: 6-hourly basis which then can generate hourly forecasts → Assumed to be sufficient **Data type / Spectral range** • UV (100-400 nm)

Application/ Operational Scenario	Parameter	Requirement
		VNIR (400-1400 nm)
UV Monitoring	Service Inputs	**Satellite data sources** • Copernicus Land Monitoring Service • Copernicus Atmosphere Monitoring Service • Sentinel-2 (e.g. land cover, vegetation) • Sentinel-3 (e.g. cloud cover, aerosols and water vapour, other atmospheric parameters) • Sentinel-5P (e.g. Solar irradiance) • Meteosat **Other data sources** • MetServices (e.g. ECMWF) and Satellite Application Facility on Ozone Monitoring (EUMETSAT O3M SAF) • EUMETSAT CM-SAF: continuous climate data records on Surface Incoming Solar radiation (SIS) • Surface incoming Direct Irradiation (SDI), spectrally resolved irradiation (SRI) and the cloud albedo (CAL) • Tropospheric Emission Monitoring Internet Service (TEMIS; temis.nl) for initial clear-sky UVIs • UV index forecast by the Copernicus CAMS service • Other air quality parameters (aerosols, clouds, total ozone, etc.) • Digital elevation models, as well as vegetation and surface maps
Water quality, monitoring	User Needs	**Size of area of interest:** Usually at a minimum of 3.000km2, but can fluctuate significantly based on the end-user needs and requirements **Frequency of information:** Daily is what is used in the service offering of many EO-firms. However, they need to supplement this with locally measured datapoints as some pollutants develop extraordinary fast (<1h), meaning the temporal resolution of 1 day is not sufficient **Type of service:** Service provided is mostly continuous to end-users (swimmers / fishers) or public customers that review drinking water basins or have a warning system in place. Some forecasting systems are in development, including the use of Artificial Intelligence.

Application/ Operational Scenario	Parameter	Requirement
Water quality, monitoring	Service Provider – EO Requirement	**Spatial Resolution:** 30cm (to monitor ditches), 5 – 20m, 300-1000 m (sea/oceanic applications) **Temporal Resolution:** Daily **Data type / Spectral range:** Multispectral (400 – 2200 nm), specific spectral bands for monitoring chlorophyll-a and phycocyanin
Water quality, monitoring	Service Inputs	**Satellite data sources:** Sentinel 2 & 3, commercial satellites for high resolution **Other data sources:** In-situ data-collection devices to calibrate the atmospheric correction of the satellites and complement EO-limitations due to atmospheric condition such as cloud formations and the inability to measure some key chemicals. Monitoring data from the user to validate and show the user the data quality.
Air quality, monitoring	User Needs	**Size of area of interest** • Various areas of interest, from a few square kilometres (up to 1000 km2 for megacities), from a specific location within the city up to the size of a whole city. • Maps of an entire region, state, province, or country can be valuable **Frequency of information:** Hourly **Type of service:** Most providers established a continuous service that offer heatmaps of pollution levels. EO-Data is often used to complement in-situ measurements
Air quality, monitoring	Service Provider – EO Requirement	**Spatial resolution:** Minimum: 100 meters **Temporal resolution:** Hourly, daily, monthly **Data type / Spectral range.** Multispectral • VIS (400-800 nm) • VNIR (400-1400nm) • SWIR (1400-3000 nm)
Air quality, monitoring	Service Inputs	**Satellite data sources:** • Sentinel-2 Sentinel-5P (e.g. air pollutants, ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, formaldehyde and methane)

Application/ Operational Scenario	Parameter	Requirement
		• Sentinel-3 (Fire detection) • GNSS/Galileo (e.g. geolocalisation of local sensor networks, determination of user position) **Other data sources** • Meteo data (MSG, METOP, etc.) for low resolution information on air pollutants and on the local meteorological situation • Copernicus Atmosphere Monitoring Service (CAMS) • Air quality data from ground-based sensor networks or drones (the most accurate and high spatial resolution data) • VDC (ESA Atmospheric Validation Data Centre). • Sensors measuring black carbon, which allow correlation between pollution sources and level • Land cover maps produced from EO imagery, such as the Copernicus Urban Atlas. • MAIAC (NASA) which includes large time-series

2 CONCLUSIONS

Throughout the discussions on UV, water, and air quality monitoring, a common theme emerged: the critical need for increased public awareness, standardization, and stakeholder collaboration to maximize the utility and adoption of Earth Observation (EO) data.

For UV monitoring, the panel recognized the potential of awareness campaigns to sensitize the public to the risks of UV exposure, which could lead to a greater uptake of UV monitoring information. This underscores the importance of effective communication strategies in promoting the use of EO data for personal health and safety.

In the light of water quality monitoring, the consensus pointed to public authorities as the key drivers for initiating standardization, which is essential for regulatory acceptance and compliance. The discussions highlighted the challenges of ensuring data quality without standardized frameworks and the need for service providers to work closely with users and authorities to educate and inform about the capabilities and evolution of EO-based services.

Air quality monitoring's session brought to light the complementary role of EO data alongside in-situ measurements. The panellists agreed on the growing importance of EO data in healthcare applications and emphasized the need for increased awareness among private companies about the availability and benefits of EO data. The dialogue also revealed the competitive nature of in-situ and EO data, suggesting that exploring synergies between the two could enhance data validation and uptake.

The panel discussion, hosted by Justyna Redelkiewicz from EUSPA started by questioning the priority of healthcare as a market for EO and the maturity of satellite data implementation in the sector. Antonio Tabasco from GMV acknowledged that while the technology for computing environmental parameters is mature, establishing correlations with diseases is less so. He emphasized the challenges of data anonymity, protection, standardization, and accuracy, which are critical for healthcare applications.

The panelists agreed that there is a need for clinical studies to validate the correlations between EO data and health outcomes, as mentioned by Darko Ojdanic from OHB. Monika Kryzanowska from Cloudferro highlighted the abundance of data and the role of AI in processing and correlating it, suggesting that the wellbeing sector might be the first to adopt EO data on a large scale due to the resolution of data currently available.

Antonio Tabasco and Darko Ojdanic both saw public health agencies and research institutions as the primary targets for EUSPA's efforts, given their mandate to monitor health on a large scale. Annelies Hommersom from WaterInsight discussed the specific application of EO in water analytics and the challenges of long-term effect perception and regulatory barriers to the adoption of new monitoring techniques.

The panelists recognized the importance of EUSPA's role in derisking innovation and the need for a harmonized regulatory framework to facilitate the uptake of EO-based solutions. They called for industry proposals for potential standardization options and encouraged continued dialogue to address the challenges and leverage the opportunities presented by EO technology in healthcare.
EUSPA's commitment to addressing healthcare for the first time with dedicated resources was seen as a positive step toward bridging the gap between technology readiness and market reach. The sessions

concluded with a call to action for all stakeholders involved in environmental health monitoring to engage in a joint effort to address these challenges. By fostering collaboration, enhancing communication, and pursuing standardization, the value of EO data can be fully realized, leading to improved environmental health monitoring and better-informed decision-making for the benefit of society at large.

The Healthcare & Wellbeing UCP session was successfully closed by Gerda Kuum from EUSPA.

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