INFORMATION NOTE: UNOOSA's contribution to the Secretary General's background note for the preparatory meeting for the High-Level 2020 United Nations conference to support the implementation of SDG 14.

Summary

The United Nations Office for Outer Space Affairs (UNOOSA) provides the following assessment of: i) challenges; ii) space-based solutions to scale up ocean action; and iii) partnerships for the implementation of SDG 14. This document summarizes ocean-related challenges and innovative, scientific space-based solutions to scale up ocean action and collaborative attempts leading to the development of partnerships for the implementation of SDG 14. This assessment is made by UNOOSA through its role as Secretariat of the Committee on the Peaceful Uses of Outer Space (COPUOS) and from knowledge acquired through the implementation of capacity building and advisory services activities. Those services aim at bringing the benefits of space to humankind such as space technologies for health, for agriculture, for climate and for water.

i) Challenges

1. Oceans, along with coastal and marine resources are extremely vulnerable to environmental degradation, overfishing, climate change and pollution. About 80% of oxygen is produced by phytoplankton, which closely links SDG 14 with SDG 13. The sustainable use and preservation of marine and coastal ecosystems and their biological diversity is essential to achieving the 2030 Agenda, in particular for Small Island Developing States.

2. Space technology and applications, combined with non-space technologies play an important role in addressing many water-related issues, including the observation and study of oceans and coastal aquifers, global water cycles and unusual climate patterns, the mapping of watercourses, aquatic weeds and algae blooms, the monitoring of coral reef bleaching, the rehabilitation of water systems, among others. Space-based data shows an average increase in sea level of three millimeters a year since 1992.

3. Among the many challenges related to protecting life under water the monitoring and maintenance of water quality and sea surface temperature are important variables with impact on several SDG 14 targets. To maintain good water quality, the detection and monitoring of contamination sources such as litter, oil spills, and nano or micro plastics is of utmost importance. Space technologies play a key role in understanding the impact of deteriorating factors on water quality. A near-real time detection of polluting sources is in many cases important for timely action and/or accountability.

4. Satellite data shows that the world's largest seaweed bloom stretches from the Gulf of Mexico to West Africa. Deforestation in the Amazon has helped to fuel the growth of a seaweed blanket that exceeded 20 million tons in 2018 (relates SDG 14 to SDGs 13 and 15). Algae blooms may cause pH levels in an estuary to rise significantly, which can be lethal to aquatic animals.

5. Globally, illegal and unreported fishing accounts each year for up to 26 million tons of fish, worth up to €21 billion. This equates to more than 800 kg of fish stolen from the seas every second. Furthermore, inefficient fishing practices lead to unnecessary use of fuel or empty fishing vessels returning to ports. Potential improvements relate SDG 14 to SDGs 2 and 13.

6. Maintaining healthy marine ecosystems is not solely limited to maintaining good water quality and a healthy environment for marine life; it also relates to sustainable food production systems and

implementing resilient agricultural practices that increase productivity and production, but help maintain ecosystems, in particular for Small Island Developing States (addresses SDG 14.2 and 14.4. relates to SDG 2).

7. The protection of endangered species, their habitats, and the management of protected coastal and marine areas remains an important challenge. (addresses SDG 14.2)

ii) Space-based solutions to scale up ocean action

8. Earth observation (EO) data, particularly radar data, can be used to create maps to monitor the spread of oil spills and to provide data in near-real time to authorities involved in clean-up efforts.[1] These maps can be used to look at overlaps with spawning grounds of endangered species and protected areas (addresses 14.1).

9. Space technology is applied with the aim to detect microplastics on or near the surface of the ocean as well as larger pieces of plastic along shorelines[2] (addresses 14.1).

10. Increased on-board real-time processing capabilities of satellites bear the potential of a better and speedier detection of contamination sources (addresses 14.1).

11. EO satellite data is used to monitor changes in the marine environment, such as algae blooms. The identification of harmful algae blooms can assist communities in protecting local coastal ecosystems. (addresses 14.2).

12. Monitoring the sea by means of space technology allows to report on the level, wind, and waves[3]. Sea surface temperature and ocean-colours relating to biophysical parameters, such as the concentration of chlorophyll can be measured (near) real-time[4]. Such oceanographic information is, *inter alia*, indicative of water quality and the occurrence of specific fish species. Precipitation, vapor amounts, wind velocity above the ocean and sea water temperature are used to forecast, sea ice monitoring, and climate and water cycle studies.[5] Observing and understanding the mechanisms of global water cycles also helps to facilitate water resource management and forecast for water related disasters (addresses SDGs 14.1, 14.2, 14.3 and relates to SDGs 13 and 15).

13. Furthermore, satellite constellations allow environmental monitoring and resource management, as well as ecosystem monitoring. The identification and tracking of coastal erosion to support the

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[1] One such example is the explosion of the Deepwater Horizon rig in April 2010, which threatened the spawning grounds of the Atlantic bluefin tuna. Radar data from European and international satellites were transformed into weekly maps showing the location, shape and size of the spill. By overlaying the oil spill extent maps and the 'spawning habitat index', it was possible to see where and how often the oil spill overlapped with spawning grounds. Fortunately, the spawning hotspot in the west was apparently unaffected by the pollution, as observed from satellite images.

[2] The European Space Agency funded a project called "OptiMAL" (Optical methods for Marine Litter detection)

3 Oceanpal® is a low-cost and innovative instrument using Global Navigation Satellite System signals. The instrument is tuned to use signals from the GPS, GALILEO, Beidou, IRNSS and GLONASS constellations. http://spacetech.starlab.es/oceanpal/

[4] During the sixtieth COPUOS session in 2017, Mexico reported about its Satellite Ocean Monitoring System (SATMO) that has been developed in the National Commission for the Knowledge and Use of Biodiversity measuring biophysical parameters near real time.

[5] Japan reported about their Global Change Observation Mission (GCOM) during COPUOS sessions from 2017 to 2019.

assessment of shoreline response to changing natural and man-made conditions can be monitored[6] (addresses SDG 14.2 and impacts decisions on 14.5).

14. Remotely sensed data and Global Navigation Satellite Systems are used to improve productivity of fishing activities, as well as the compliance with fishery regulations. The effect of protection policies on the marine environment can be monitored[7] (this also relates to SDG 13, since increased fishing productivity can reduce the amounts of fossil fuels burned). Many technologies provide a detection of illegal fishing activities or illegal vessel movements in general [8, 9, 10] (addresses SDGs 14.4 and 14.6 relates to SDGs 2, 12, 13).

15. Satellite data has long been utilized for monitoring of endangered species populations, including cetaceans. Global Navigation Satellite Systems trackers are commonly used to track marine migration routes and allow for monitoring of registered pods. Earth observation also allow for monitoring of populations, including their nesting and feeding areas. Monitoring population distribution however still remains a challenge. Citizen science, coupled with online social platforms with geotagging, can complement other solutions of data acquisition, as it allows for real-time reporting of sightings. (addresses SDG 14.4, relates to SDG 9).

16. A qualitative assessment of European Union space programmes’ contribution to SDG 14 targets concluded that European Global Navigation Satellite Systems (EGNSS) and Copernicus contribution to SDG 14 is mainly to the following targets: 1, 2, 3, 4, 5, 7 and c. Contributions can be classified in monitoring and achieving parts of a target or indicator.

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6 Canada reported during the sixty-second session of COPUOS, that it launched the RADARSAT Constellation Mission (RCM), which will enhance Canada’s capability to effectively carry out marine surveillance, ice monitoring, disaster management, environmental monitoring, and resource management, as well as ecosystem monitoring. This technology will be used to identify and track coastal erosion to support the assessment of shoreline response to changing natural and man-made conditions. RCM data will also continue to support important water applications such as oil pollution monitoring – detecting and mapping oil spills and ships in proximity – and ultimately, contribute to the protection of sensitive coastal zones.

7 The Copernicus’ marine environment monitoring service (CMEMS) provides information to protect and manage living marine resources. The service monitors sea-surface temperature and ocean colours, which are indicative of specific fish species.

8 Potential solutions to detect and or reduce illegal fishing activities combine EO data of the oceans with information from fishing-vessel databases and oceanographic data, providing detailed data reports that can alert officials to suspicious vessel movements in a very efficient way. For Example: the “Eyes on the Seas” project by the Pew Charitable Trusts, in partnership with the United Kingdom Satellite Applications Catapult. Learn more here http://www.pewtrusts.org/en/about/news-room/press-releases/2015/01/21/ pew-unveils-pioneering-technology-to-help-end-illegal-fishing

9 Copernicus services can be used to detect, with a higher level of accuracy, illegal fishing activities through synthetic aperture radar imagery. These data can be correlated with a GNSS-enabled Vessel Monitoring System (VMS), providing data to the fishing authorities on the location, speed and course of fishing vessels operating in Europe, allowing authorities to detect and track movement and activity in restricted fishing grounds. Within VMS, the authentication feature of Galileo is expected to contribute by certifying the communicated vessel position, ensuring more reliable services and therefore more safety and better enforcement capabilities.

10 Global Navigation Satellite Systems technology is commonly used in monitoring commercial fishing vessels. The vessel monitoring system (VMS) employed universally within the European Union keeps track of vessels longer than 15m. The vessels are required to emit a signal in regular intervals for authorities to track their operating locations. If GNSS is coupled also with EO data (images), it is also possible for authorities to acquire instant proof of illegal activity during the non-emitting intervals and increase enforcement levels.

iii) Developing Partnerships for the implementation of SDG 14

17. EO applications for ocean monitoring are diverse and involve various types of stakeholders. Intermediate users include private actors from micro-companies to large companies, public authorities, scientific laboratories or research centres. End users are also both public entities and private actors such as fish farmers and cooperatives. The rapidly changing environment requires near-real-time EO data.

18. Member States have reported on various collaborative initiatives during COPUOS sessions between 2017 and 2019. Statements towards cooperation activities include:

    (a) The Surface Water Ocean Topography Mission (SWOT), which is a joint project of the space agencies of France, United States of America, the United Kingdom and Canada, to enable better mapping of inland waters and a better understanding of ocean dynamics.

    (b) During COPUOS in 2018 Canada endorsed the Charlevoix blueprint for healthy oceans, seas and resilient coastal communities and made a commitment to work with G7 partners to launch a joint initiative to deploy Earth observation technologies and related applications to scale up capacities for the integrated management of coastal zones.

    (c) During COPOUS in 2019, France reported on its cooperation in space oceanography with China, which resulted in the development of the CFOSat programme and a cooperation agreement on HY-2 missions dedicated to the study of the oceans. The CFOSat mission is focused on the scientific observation of the oceans and the study of wave and wind conditions.

19. In its sixty-first session (2018) COPUOS recognized the importance of bilateral partnerships in climate change-related activities in the area of Earth observation, such as the collaboration between the National Aeronautics and Space Administration, the German Aerospace Center and the European Space Agency, to track the Earth's water movement and to extend the data series related to the Gravity Recovery and Climate Experiment mission (GRACE). GRACE data can be used to measure contributions of water mass, such as melting of Antarctic ice, to sea level rise.

20. Furthermore, UNOOSA and the Prince Sultan Bin Abdulaziz International Prize for Water have a partnership for the implementation of the Space4Water Portal (http://www.space4water.org) , a portal that aims at fostering knowledge exchange of the space and water sectors. While more focus is given on SDG 6 than on 14, life below water is among the topics covered by this portal. So far, content covers topics like plastic contamination, using satellites to communicated ocean sensor data, or training material on mapping oceans (addresses 14.1).

Sources

Mengqiu Wang, Chuanmin Hu, Brian B. Barnes, Gary Mitchum, Brian Lapointe, Joseph P. Montoya. 2019. The great Atlantic *Sargassum* belt. In: Science, Vol 365, Issue 6448.
https://science.sciencemag.org/content/365/6448/83

Report of the Committee on the Peaceful Uses of Outer Space - Sixtieth session (7-16 June 2017)

Report of the Committee on the Peaceful Uses of Outer Space - Sixty-first session – (20–29 June 2018)

Report of the Committee on the Peaceful Uses of Outer Space - Sixty-second session (2–21 June 2019)

Member States Statements on Agenda Item “Space for Water” from COPUOS sessions between 2017 and 2019.

COPUOS. 2011. Special report of the Inter-Agency Meeting on Outer Space Activities on the use of space technology within the United Nations system to address climate change issues (A/AC.105/991).

COPUOS. 2013. Space for agriculture development and food security: Special report of the Inter-Agency Meeting on Outer Space Activities on the use of space technology within the United Nations system for agriculture development and food security (A/AC.105/1042).

COPUOS. 2015. Space for global health: Special report of the Inter-Agency Meeting on Outer Space Activities on the use of space science and technology within the United Nations system for global health (A/AC.105/1091).

United Nations. 2019. European Global Navigation Satellite System and Copernicus: Supporting the Sustainable Development Goals: BUILDING BLOCKS TOWARDS THE 2030 AGENDA