Seabed 2030: Developing an Open-Access Map of the Ocean Floor

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Human economic activities and livelihoods today require a greater understanding of what the ocean can provide. Increasing globalization, technological development, and economic development pose risks of greater harm to the ocean that we depend on. We must tread carefully, gathering needed information about marine life, ocean and climate processes, currents, temperature, and the seabed.

A glimpse at Google Maps can give the impression that we already know a lot about the seabed. The map seems complete, but a close inspection of any area will quickly reveal that it lacks detail. This is not a matter of Google leaving out details; in most cases, we have not yet collected the data to create detailed maps.

Without this granular data, without these detailed maps, we lack the information needed to make informed decisions about the activities we conduct in the ocean. To help resolve this problem, The Nippon Foundation-GEBCO Seabed 2030 Project (Seabed 2030) seeks to accelerate seabed mapping to deliver a complete, open-access (freely available), high-resolution map of the global seabed by 2030. With leadership and funding from The Nippon Foundation, Seabed 2030 builds on the General Bathymetric Chart of the Oceans' (GEBCO) legacy of ocean mapping. Established by The Nippon Foundation and GEBCO, Seabed 2030 is also a flagship program of the UN Decade of Ocean Science for Sustainable Development (2021–2030). GEBCO itself is a joint program of the International Hydrographic Organization (IHO) and UNESCO's Intergovernmental Oceanographic Commission (IOC).

Rather than deploying its own vessels, Seabed 2030 encourages multiple sources to share seabed data they've collected. These sources include government agencies and private companies which survey the seabed, research vessels equipped with specialist seabed mapping equipment, and recreational and commercial vessels equipped with a GPS, a depth finder, and a data logger. This collaborative approach is essential for building a global seabed map as quickly as possible and for supporting sustainable economic growth in multiple sectors, including renewable energy, communications and power networks, transportation, fisheries and aquaculture, and tourism and leisure.

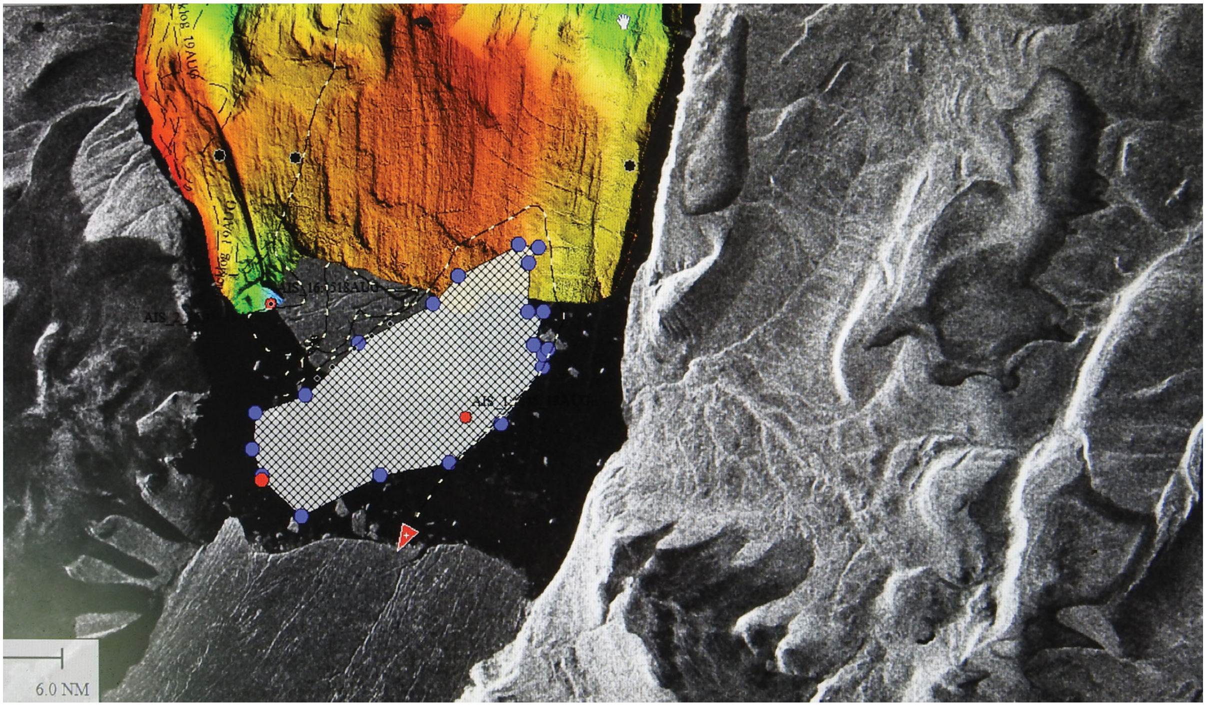

Figure 1. Bathymetric data of the seafloor. Photo courtesy Professor Larry Mayer, University of New Hampshire / Seabed 2030

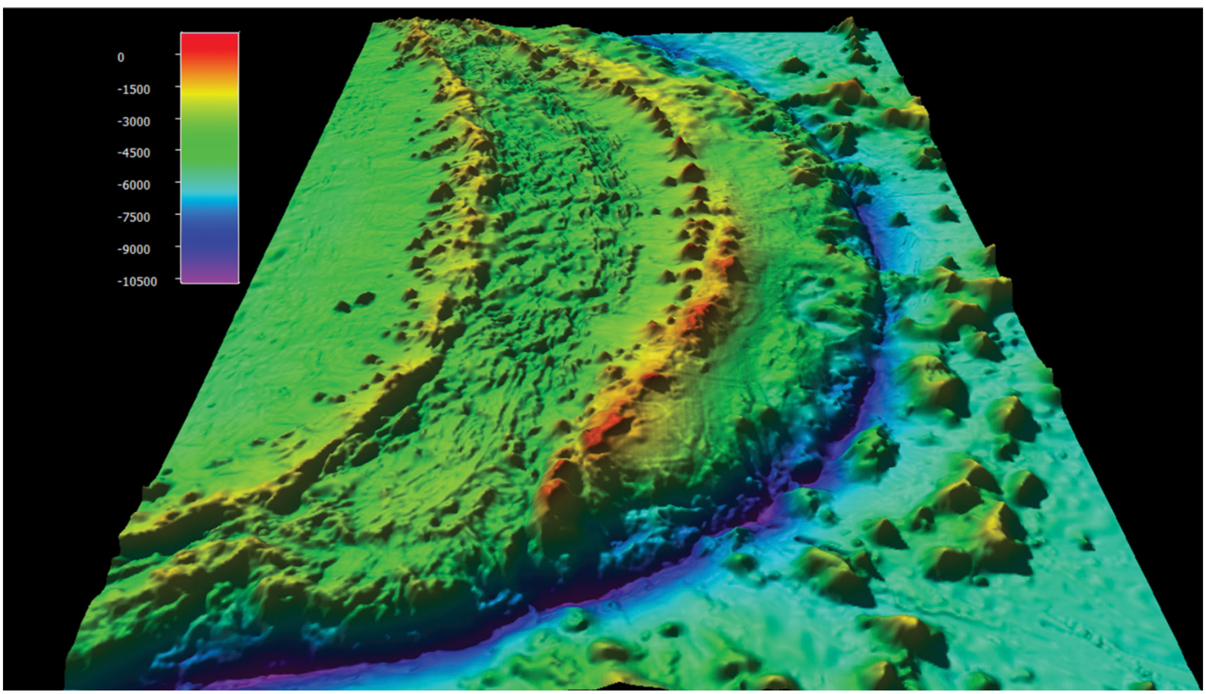

Figure 2. A rendering of the seafloor near the Marianas. Photo courtesy GEBCO

Figure 3. Wind turbines. Photo by Nicholas Doherty / Unsplash

Figure 4. Fishing vessel. Photo by Nicolas Job / Ocean Image Bank

Supporting Renewable Energy

Offshore wind farms are the most familiar renewable energy source, but researchers are also developing new technologies, including wave and tidal power. All of these will require an understanding of the ocean environment.

Exactly where a wind farm should be situated depends not just on wind but also on currents, waves, accessibility, the location of sensitive marine habitats and species, and, of course, local community buy-in. The physical nature of the seabed must also be understood. Wind turbines are attached to the seabed to keep them in place, and the type of system used will depend on the seabed and its depth. Traditional turbines are fixed directly to the seafloor with massive underwater foundations. Floating turbines, on the other hand, use a series of anchors to keep them in place. Fixed-bottom turbines are typically limited to waters sixty to eighty meters deep, but floating turbines can be placed in waters that reach several hundred meters in depth. In both cases, the nature of the seabed—hard rock versus softer sediment, for example—guides engineering decisions.

Seabed dynamics are also key. For example, sand waves—where the sand moves with tides and waves—can reach several meters in height and over a hundred meters in length. These can impact the stability of the attachment system and expose cables that are usually buried in the sediment for protection. These seabed considerations will be equally important for developing offshore renewable energy solutions such as wave and tidal power.

Keeping the World Connected with Submarine Cables

Whether for telecommunication or carrying power, submarine cables have become the backbone of our society. Telecommunication cables enable global internet connectivity, while power cables help ensure that those living on islands and remote coastal locations can turn the lights on. Increasingly, subsea power cables bring the energy collected by offshore renewable energy systems back to land.

Knowledge of the seabed is essential for deciding the route a cable will take. Engineers want to avoid sensitive marine habitats, such as sponge reefs, and underwater hazards where they could get snagged, such as rocky outcrops, steep slopes, and submarine canyons. Seabed dynamics are another consideration. Alongside sand waves, natural hazards such as underwater landslides and earthquakes can pose sizable threats. Researchers are working to understand the processes and triggers of such events and develop susceptibility maps.

In the deep sea, cables are typically laid directly on the seabed, but in shallower waters, cables may be buried to protect them from accidental damage by fishing or anchoring activities, and, equally, to protect vessels and their crew from harm due to accidentally snagging on a cable. The nature of the sediment dictates whether a cable can be buried or not. Softer sediment can be dug into, but where the seabed is too hard, cables must be laid on top of the seabed and weighted down to keep them in place. In these situations, additional protection measures may be needed to protect both cables and vessels. This could include creating a cable protection corridor in which all fishing and anchoring activities are banned.

Other Activities

Approximately 90 percent of traded goods move across the world by sea. Safe transportation—and, indeed, the safety of all vessels—relies heavily on the information gathered by seabed mapping activities.

Nautical charts have been used for hundreds of years, but historical methods of collecting seabed data, such as lead-line mapping—essentially, dropping a weight attached to a rope with measurement intervals marked into the sea and seeing where it hits the bottom—mean older charts often missed vital information, such as the location of rocky outcrops or wrecks. Modern-day multibeam echosounders, which use multiple sound beams to create a highly detailed picture of the seabed, can provide detailed maps to help ensure safe passage. For fishing vessels, these maps can also guide where it is and isn't safe to drop fishing gear. Fishing gear that catches on features on the seabed can put the vessel crew at risk, result in gear becoming lost, or even damage sensitive features. Trawling and dredging, which are used to catch species living near, on, or in the seabed like scallops and cod, have caused damage to shipwrecks, including those considered to be important sites of cultural heritage. Although many hazards to vessels and crew are found in coastal waters, identifying and mapping hazards in deeper waters is also important. For example, in 2005, the submarine USS *San Francisco* collided with a seamount that was not indicated on the nautical charts they had at the time.

Another key reason for seabed mapping is the management and development of ports, which are crucial hubs for global trade, as well as harbors used by commercial and recreational vessels. The depth of a port's (or harbor's) approach, as well as the depth inside the port/harbor itself, determines the size of vessels that can use it. Ongoing monitoring of the seabed is essential for ensuring that the passages do not suffer from sedimentation, which can reduce those depths, and identifying any new hazards that may appear during the lifetime of the port/harbor. As ports and harbors expand or evolve, seabed mapping ensures that new routes are safe and that deeper approaches can be developed where necessary. These detailed seabed maps also help engineers assess whether changes in port and harbor infrastructure are feasible and safe.

Seabed mapping is also vital for managing and protecting marine ecosystems. Maps of the seabed allow scientists and policymakers to identify sensitive habitats, such as coral reefs and sponge reefs, as well as those that may act as nurseries, spawning grounds, and other critical places for species targeted by fishing. With these places identified, managers can implement measures to protect these areas from the impacts of human activities, such as anchoring, fishing, aquaculture development, or sand extraction.

Seabed mapping also supports safe recreational and tourism activities, such as diving, sailing, and wildlife watching. Maps that show key underwater features, such as shipwrecks and natural habitats, contribute to the sustainable use of marine environments, protecting both visitors and fragile ecosystems.

A Work in Progress

When Seabed 2030 commenced in 2017, 6 percent of the global seabed had been sufficiently mapped and shared for inclusion in the open seabed map maintained by the General Bathymetric Chart of the Oceans (GEBCO) program. As of June 2024, that percentage reached just over 26 percent, a testament to the growing recognition that mapping the seabed is a collaborative effort and that open data benefits us all.

As the demand for information increases and the desire for greater cooperation between national governments, regional authorities, and international organizations continues to gain momentum, we can expect to see the open seabed map grow. We will have the data we need. All that will be left is to put it to good use.