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TITLE: Global Observing Needs in the Deep Ocean

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ABSTRACT:

The deep ocean below 200 m water depth is the least observed, but largest habitat on our planet by volume and area. Over 150 years of exploration has revealed that this dynamic system provides critical climate regulation, houses a wealth of energy, mineral, and biological resources, and represents a vast repository of biological diversity. A long history of deep-ocean exploration and observation led to the initial concept for the Deep-Ocean Observing Strategy (DOOS), under the auspices of the Global Ocean Observing System (GOOS). Here we discuss the scientific need for globally integrated deep-ocean observing, its status, and the key scientific questions and societal mandates driving observing requirements over the next decade. We consider the Essential Ocean Variables (EOVs) needed to address deep-ocean challenges within the physical, biogeochemical, and biological/ecosystem sciences according to the Framework for Ocean Observing (FOO), and map these onto scientific questions. Opportunities for new and expanded synergies among deep-ocean stakeholders are discussed, including academic-industry partnerships with the oil and gas, mining, cable and fishing industries, the ocean exploration and mapping community, and biodiversity conservation initiatives. Future deep-ocean observing will benefit from the greater integration across traditional disciplines and sectors, achieved through demonstration projects and facilitated reuse and repurposing of existing deep-sea data efforts. We highlight examples of existing and emerging deep-sea methods and technologies, noting key challenges associated with data volume, preservation, standardization, and accessibility. Emerging technologies relevant to deep-ocean sustainability and the blue economy include novel genomics approaches, imaging technologies, and ultra-deep hydrographic measurements. Capacity building will be necessary to integrate capabilities into programs and projects at a global scale. Progress can be facilitated by Open Science and Findable, Accessible, Interoperable, Reusable (FAIR) data principles and converge on agreed to data standards, practices, vocabularies, and registries. We envision expansion of the deep-ocean observing community to embrace the participation of academia, industry, NGOs, national governments, international governmental organizations, and the public at large in order to unlock critical knowledge contained in the deep ocean over coming decades, and to realize the mutual benefits of thoughtful deep-ocean observing for all elements of a sustainable ocean.

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