Boundary Ocean Observation Network for the Global South:

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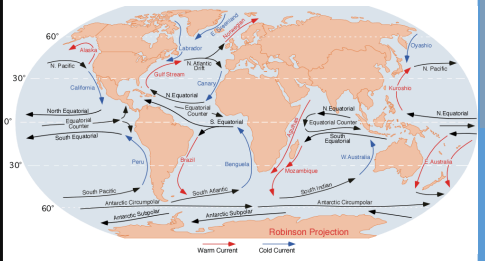
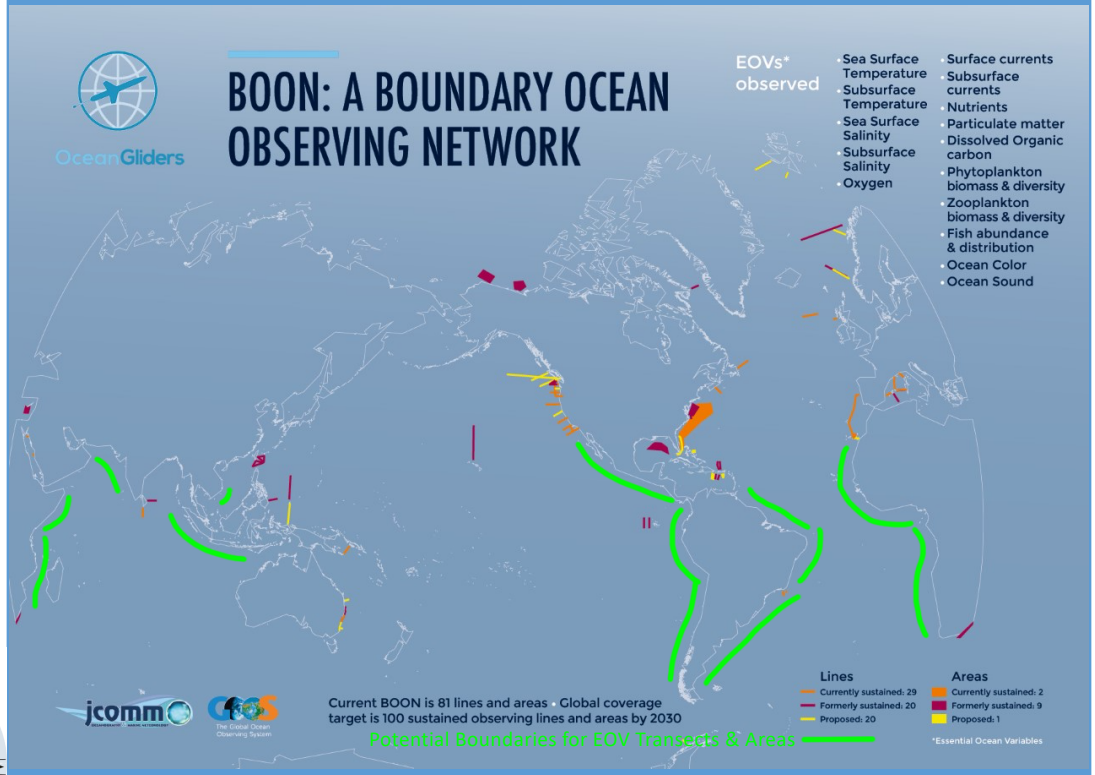
Abstract:

The UN Decade of Ocean Science for Sustainable Development should establish a Boundary Ocean Observing Network (BOON) for the Global South (GS). The BOON is an existing network of established timeseries transects and areas collecting long term data sets. Timeseries are critical for making immediate operational decisions and identifying long term trends of anthropogenic global environmental change. The BOON has proven important enough to continue observations and expand them. Due to resource and expertise limitations, expanded locations are in similar locations. The UN should build on this success and establish a BOON for the Global South. The same benefits will be garnered by countries and regions that have been missing out. Increased observation coverage will improve understanding of the Ocean-Climate System, e.g. improved climate prediction models. The UN will need to facilitate activities to realize a BOON for the Global South including: coordinating local scientists, partnering scientific and technical experts with local scientists, identifying new affordable and easy-to-operate technologies, securing funds for initial and ongoing costs, and building a framework to continue the BOON-GS long after the Ocean Science Decade.



Ocean Currents (wikipedia.org)



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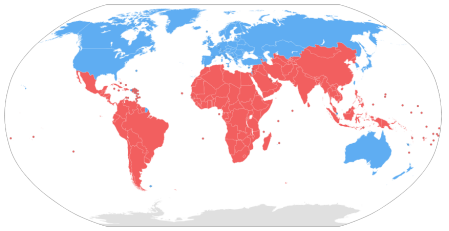
The Global South

The "Global South" (GS), more a geopolitical than geographical term, characterizing countries of Latin America, Africa, Southern Asia, and Island Nations with developing, emerging, or newly industrializing economies and which may have a history of colonial rule. Indeed, most GC countries are north of the equator.



Global South Countries in red (Clarke 2018)

← Figure

OceanGliders image of Lines and Areas of the BOON, modified for this poster with green lines indicating GS ocean boundaries (oceangliders.org)

The BOON

The Boundary Ocean Observation Network (BOON) is an affiliation of institutions who perform observational operations along transects and areas at oceanic-continental boundaries. The BOON, part of the OceanGliders Program and the Global Ocean Observing System (GOOS), supports active glider coordination worldwide and distributed in national and regional observing systems. Underwater gliders are commonly used for observations along the transects, due to their cost-effectiveness and high-data density profiles. Ocean boundaries are critical locations for many ocean processes and for society (Testor, et al 2019).

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BOON Global South

The UN Decade should establish BOON-Global South as an observation network in Latin America, Africa, and Southern Asia utilizing methods used and refined by the BOON. Ocean boundaries are locations where oceans meet continental land masses. They are critical regions for geophysical processes, regionally & globally. Important for fishing, river discharge, biogeochemical interactions, and understanding changes in the ocean.

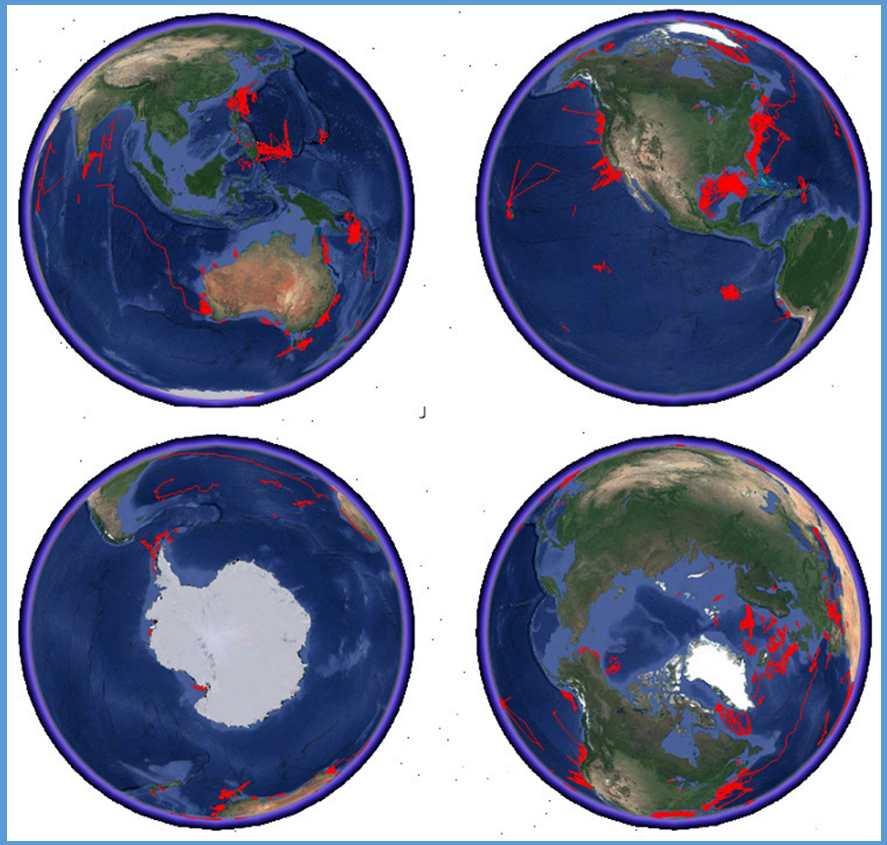
The existing BOON successfully supports time series observations in transects & areas in North America, Europe, East Asia, and Australia. Observational transects have been established in South America, Africa, & Asia Pacific, however these relied on existing BOON researchers. The BOON leaders have proposed additional transects, though primarily near other existing observational systems. Creating a BOON-GS will bring benefits to more countries and improve global efforts to collect data from under-observed regions. The UN Decade is a perfect vehicle for establishing a BOON-GS. The required coordination, collaboration, financing, & capacity building are core UN capabilities.

Figure →

Gliders tracks of past deployments until Oct. 2018 (OceanObs'19), as viewed using google-earth. (Testor, et al 2019). GS observational transects and areas can build upon earlier or adjacent glider observations.

Further South… Antarctica

GS Researchers (e.g. Chile & Argentina) would also be poised to establish an Antarctic observational node. As the glider tracks show, there is existing data on which to build a new time series.



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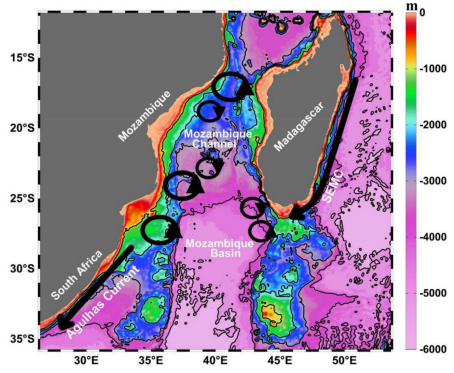
Existing Science

Globally there are many time series that have been discontinued and transects that utilized expensive assets, such as research vessels and moored arrays. These locations present an excellent opportunity to reestablish time series observations and/or replace with economical technologies. Globally, OceanGliders have collected data in many important boundary areas. The data could help identify locations for new time series. Reviving time series and replacing expensive observation methods with new and economical technologies has been previously achieved. The science community has the expertise to run these observations, has many candidate locations with historical data sets. There are affordable observation technologies, such as underwater gliders, that can also easily scale from small efforts to full ocean observation systems. This is good evidence that a network for the Global South can be established.



Main oceanographic features in the Mozambique Channel and Mozambique Basin… southern branch of the East Madagascar Current (SEMC), the Agulhas Current, Mozambique Channel eddies, as well as dipoles stemming from the SEMC (Lamont, et al 2018).

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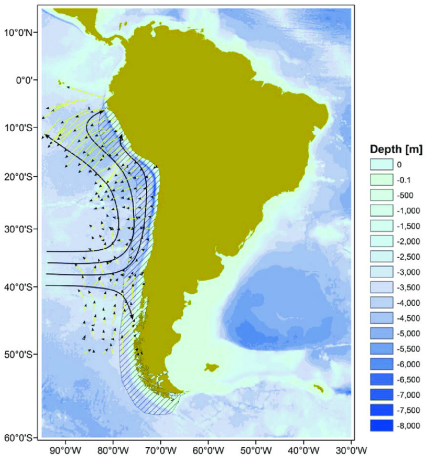
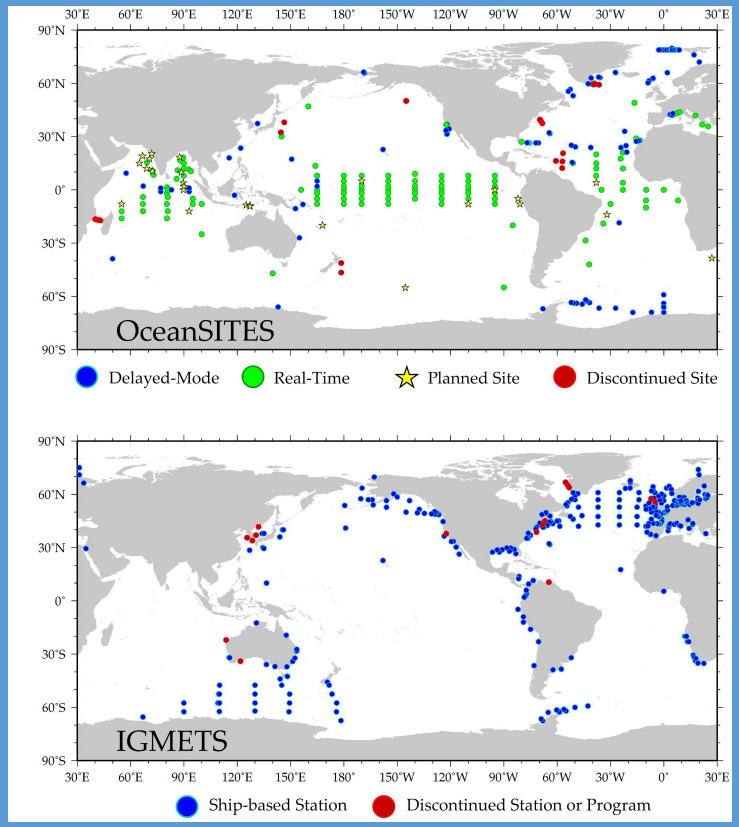
Sectors Engaged

New ocean observation technologies will need to have lower initial investment costs, present lower maintenance effort, and require less operational personnel. Data handling and data observations will be critical for BOON-GS, but the software expertise can arise from non-ocean sectors. Deployments and recoveries of autonomous vehicles and sensor platforms will require hiring local vessels.

The data collected will be of tremendous importance to local communities. The water mass data will support pollution spill tracking. Ecological data will aid sustainable fishing (e.g. upwelling information) and provide baseline information necessary for establishing marine protected areas. Better understanding of marine ecology, especially as it changes, ultimately promotes food security. Observations can track hazards, such as Harmful Algal Blooms (HABs) and anoxic upwelling events.



The Humboldt Current Large Marine Ecosystem. (Taylor, 2008)



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Capacity Building

The existing BOON is an excellent scientific and operational example for the GS. However, it was created in the context of developed economies. A GS network will require efforts to build capacity, reinforce institutions, and develop engagement opportunities for young researchers and professionals. The UN Decade needs to provide new funding, technology, & opportunity for researchers and university students. The collected data and data portal could be use in classrooms to help teach mathematics, basic sciences, and earth sciences. Glider deployments could be merged with onboard field trips, similar to Ocean Inquiry Project. If research facilities can become centers for community education and ecological information.

← Figure

OceanSITES, predominantly autonomous ocean observing assets. IGMETS, ship-board ocean time series programs, an activity of IOC-UNESCO (Benway, et al 2019). BOON-GS can build upon existing time series efforts.

Achievable

All components of the BOON-GS have been accomplished in other efforts. Collaborative boundary currents obs have been performed in the GS (Lee, et al 2016). Multi-national efforts in regional observations provide the road map (Barth, et al 2019). New marine technologies are emerging that reduce observational cost & complication (Ordoñez, et al 2020), enabling operations in geographically remote places (Rudnick, et al 2016). Ocean time series are provide insight on the changing ocean (Benway, et al 2019). Caution must be made to avoid "colonial science" (De Vos, 2020), by including local researchers into each step of the process. The UN has worked with the GS, developing a climate changes engagement strategy and that experience will be critical for the BOON-GS effort (unsouthsouth.org).

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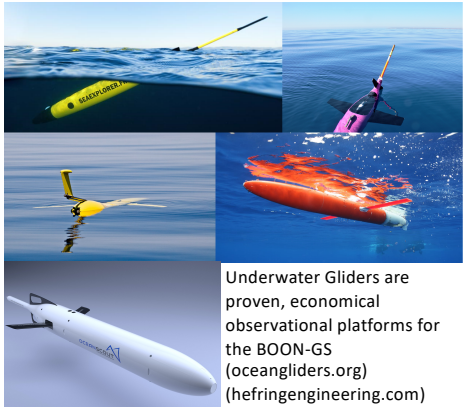
Collaboration

BOON-GS phases present opportunities for international participation and collaboration. DISCOVERY: identify research partners and observation locations, identify key technologies, perform initial baseline data collection including geophysical maps, and procure technologies. OPERATION: kick-off operations, support data handing & QC, and provide guidance on best practices for maintaining a transect. LONGTERM EFFORTS: multi-region research papers, new research efforts based on findings, and integrate new observations into global climate models.

UN Decade partners will need to help 1) establish objectives, locations, & partners 2) provide institutional support, 3) identify new technologies to reduce costs 4) fund technology acquisition, 5) partner GS & BOON researchers for best practices, 6) incorporate BOON-GS data in Data Acquisition Centers, 7) realize educational opportunities for GS students.

BOON-GS is realizable as an extension of the existing BOON program. There exists a successful approach. The UN Decade and OceanGliders can perform the coordination.



Underwater Gliders are proven, economical observational platforms for the BOON-GS (oceangliders.org) (hefringengineering.com)

Discovery	Operation	Long-Term
Identify Local Research Partners & Begin Collaboration	Kick-off Observational Operation (support & capacity build)	Local Researchers Continue Observations
Identify Key Technologies	Data Handling & QC (support & capacity build)	Incorporate Local Students & Young Professionals
Baseline Data Collection	Share & Develop Best Practices (support & capacity build)	Multi-Region Collaboration & Publication
Technology Procurement	Program Adjustments	Integrate New Observations into Global Assessments
Procedures, Processes, & Data Infrastructure		

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← Figure

A possible processes for establishing & continuing the BOON-GS

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