



Key Science Questions

Guiding overarching science questions from which observational requirements can be derived

Human activities have profound, possibly irreversible impacts on ocean health, in terms of its physical state (warming, freshening, circulation changes), its biogeochemistry (carbon uptake and acidification), and its ecosystems (loss of biodiversity, ecosystem functions and services). A major challenge persists in characterizing and quantifying these changes at depth levels that have hitherto been difficult to access via available observing systems.

A set of leading research questions were identified during the DOOS 2016 Workshop. Questions selected were based on their international societal and inter-generational relevance. In most cases, adequate baseline measurements don't yet exist, and/or spatiotemporal sampling is insufficient to detect changes.

Guiding overarching science questions from which observational requirements can be derived are:

1. What is the role of the deep-ocean in the Earth's energy imbalance and land-sea water redistribution on annual to decadal time scales? This includes closing the heat and fresh water budget, the warming and freshening of the deep ocean, and their contribution to sea level change.
2. How are natural and anthropogenic variations in climate connected to the global overturning circulation and its variability? This includes linkages with variations in deep and bottom water formation rates and water properties, circulation and deep-ocean mixing, geothermal heating, and impacts on deep sea ecology.
3. How does deep pelagic ecology respond to natural variation and multiple climate change stressors, including warming, deoxygenation, acidification, changes in biological production, as well as industrial activities?
4. How might such changes influence the function of the solubility and biological carbon pumps, continental slope nephroid layer transport and the sequestering of carbon in the deep ocean, and the supply of organic carbon food supplies to deep-sea communities?
5. What drives variations in seafloor fluxes of heat, nutrients, tracers, oxygen and carbon? How are these quantities connected to greater ocean dynamics? This includes the longer-term links between seafloor fluxes and greater oceanic physical and biogeochemical properties.



6. How might natural and anthropogenic change influence the functional importance of animals and microbes in the deep sea and at the seafloor? What environmental variations do they experience in space and time? This includes consideration of benthic storms and currents, turbidity, T, pH, O₂, and POC flux. This will inform spatial planning and impact assessment for seabed mining, bottom trawling and oil and gas extraction. As a GOOS Project, DOOS will be aligned with the Framework for Ocean Observing (Framework). In 2012 the GOOS adopted the Framework as a guide for GOOS activities and alignment. The purpose of the Framework is to assist in the development and delivery of an integrated ocean observing system fit for many purposes.

<http://deepoceanobserving.org/observations/key-science-questions/>