pogo Partnership for Observation of the Global Oceans

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***Tony Haymet**, Director, Scripps Institution of Oceanography; **D. James Baker**, former Director, NOAA; **Jesse Ausubel**, CoML Programme Director, Sloan Foundation, **Shubha Sathyendranath** of the Bedford Institute of Oceanography and fellow POGO experts are available for advance interviews.*

The 2007 GEO conference takes place Nov. 28-30 in Cape Town, South Africa.

Additional resources, including two new videos for release Nov. 27 in South Africa and on YouTube.com, are available to media at www.ocean-partners.org/GEOministerial2007.htm

Human Safety, Prosperity Depend on Better Ocean Observing System: Scientists

Call for adequate initial system to produce insights, forecasts useful to public, policy makers

Speedy diagnosis of the temper and vital signs of the oceans matters increasingly to the well being of humanity, says a distinguished partnership of international scientists urging support to complete a world marine monitoring system within 10 years.

The Partnership for Observation of the Global Oceans (POGO) says warming seas, over-fishing and pollution are among profound concerns that must be better measured to help society respond in a well-informed, timely and cost-effective way.

“A system for ocean observing and forecasting that covers the world’s oceans and their major uses can reduce growing risks, protect human interests and monitor the health of our precious oceans,” says Dr. Tony Haymet, Director, Scripps Institution of Oceanography, University of California San Diego, USA, and Chair of POGO’s Executive Committee.

“The world community resolved to construct a comprehensive, integrated ocean observing system two decades ago. The good news is we have demonstrated that a global ocean observing system can be built, deployed and operated with available technologies. Now we must move from experiment and proof-of-concept to routine use. We have progressed less than halfway to our initial goals. Let's complete the task before we are struck by more tsunamis or comparable calamities."

The cost of an adequate initial system would require a further investment roughly estimated at $2-3 billion, involving:

- **a stable network of satellites surveying** vast extents of the surface of the oceans;
- **fixed stations** taking continuous measurements on the seafloor or as floats and buoys moored in the water column and at the surface;
- **small robot submarine ocean monitors,** some drifting with the currents, others motoring along programmed routes;
- **marine animals ingeniously outfitted with electronic tags** that equip them to capture and transmit data about the environments they visit;
- **merchant marine** and **research vessels,** opportunistically observing along their routes.

Data analysis, integration with observations from the atmosphere and other sources, and assimilation into models then may produce insights and forecasts useful to the public and policy makers.

"Oceans cover a majority of our planet – 71% – yet are vastly under-sampled," says Dr. Haymet. "We have an urgent need and new technological marvels available today to complete a system by which marine scientists could authoritatively diagnose and anticipate changing global ocean conditions – something akin to the system that enables meteorologists to predict weather.

"A continuous, integrated ocean observing system will return the investment many times over in safer maritime operations, storm damage mitigation, and conservation of living marine resources, as well as collecting the vital signs of the ocean that are needed to monitor climate change."

The scientists' call for completion of the "first draft" of the ocean observing system is made as ministers and officials from the 71 member nations of GEO (the intergovernmental *Group on Earth Observations*) assemble in Cape Town, South Africa, Nov. 28-30. The meeting will review progress and map out next steps in a 10-year effort to build a ground-based, ocean-drifting, air-borne and space-based Global Earth Observation System of Systems (GEOSS) to monitor all of Earth's environmental conditions.

Technologies

"The rapid pace of technological development is opening up entirely new approaches to ocean measurement, including biological and physical observations from fish and marine mammals. The potential for exploiting the merchant marine as platforms for monitoring ocean properties, although well demonstrated, offers tremendous opportunity for further development. Molecular biological techniques are transforming the way we identify species and interpret their evolutionary development; important opportunities for combining biological and physical data to better understand the linkage between marine ecosystems and ocean dynamics," says David Farmer, Fellow of the Royal Society and head of the University of Rhode Island's Graduate School of Oceanography.

Among technologies deployed by ocean observers:

Diving Robotic Probes

Deployments today include some 3,000 small, drifting "Argo" probes that measure pressure, salinity and temperature at depths down to 2 km and return to the surface every 10 days to transmit readings via satellite. The instruments measure conditions driving climate change. POGO officials say up to 10 times as many floats are needed to produce a high-resolution global picture of marine conditions.

Unmanned vehicles and research vessels

Field testing is underway of so-called 'air-clippers': atmosphere and ocean surface sensors tethered to balloons. With these sensors, scientists have achieved concurrent atmospheric and ocean measurements from within the eye of a strong cyclone where the balloons become trapped.

Meanwhile, scientists using robotic submersible equipment to record life and conditions in the remote deep ocean say they have barely scratched the surface with resources available.

Aboard research ships, scientists can sample and monitor marine species distribution and abundance, and develop the next generation of observing technologies – devices, for example, that perform at-sea DNA sequencing of microbial, bacterial, and planktonic life forms, yielding real-time marine equivalents of "pollen counts".

Innovative Sonar Approaches

The naval acoustics technology of transmitting sound in all directions but detecting it with a hydrophone array and then transforming the signal into an image of objects in the ocean, has been demonstrated with spectacular success in the coastal ocean. Images covering thousands of square kilometres have revealed the presence of very large fish schools containing tens of thousands of fish and spanning many kilometres. Other sonar systems are allowing the mapping and characterization of the seafloor with unprecedented accuracy.

Tags

As part of the international Census of Marine Life (CoML), approximately 2,000 marine animals that journey into the open, deep ocean have been tagged by project TOPP (Tagging of Pacific Palagics), creating a team of animal oceanographers that reveal biodiversity hotspots, nurseries, and migratory routes that need protection and also describe the physical state of the areas of the oceans the animals inhabit.

The 22 species tagged include elephant seals, white sharks, leatherback turtles, squid, albatross and sooty shearwaters. (To see a video of tags at work: http://biology.st-andrews.ac.uk/seaos/movies/seaos_withVO.mpg).

Light, depth, temperature and salinity data captured by the tags are transmitted via satellite as the creatures travel. Elephant seals, for example, spend 10 months at sea and dive up to 1.5 km below the ocean surface.

Acoustic tags deployed by another CoML project, POST (Pacific Ocean Salmon Tracking), allows researchers to follow animals that stay on the shallow continental shelves, such as salmon and sturgeon, as correspondents, creating insights into their migration and survival – where and why they die – that suggest better strategies for sustainable fisheries. Over 12,000 POST-coded acoustic tags have been released over the POST array, resulting in more than 4 million detections of the movements and survival of the tagged animals.

CoML Chief Scientist Ron O’Dor says the endorsement and support of ministers in Cape Town is being urged for the Ocean Tracking Network, recently created to expand use of these techniques into a continuous worldwide system.

CoML experts also want GEO ministers to endorse standard protocols to govern a global, low cost near-shore biodiversity monitoring system, operational within five years, to shed light on invasive species, climate change and other concerns.

Moored buoys

Across Earth’s equatorial region, roughly 50 moored buoys have been deployed to measure temperature, currents, waves and winds, salinity, carbon dioxide, allowing scientists to study the signs of and predict destructive weather patterns such as El Niño. Scientists say four times as many are needed to create more uniform coverage. Some areas have no sampling stations at all.

In a growing number of places, meanwhile, pressure gauges deployed near shore and on the deep seafloor help detect both sea level rise and tsunamis. The deep-sea operation involves a surface buoy to receive the information from below and relay it to ground stations via satellite. There were six such Deep Ocean Assessment and Reporting of Tsunamis (DART) stations, all of them deployed in the Pacific, at the time of the earthquake and devastating Indian Ocean tsunami of December 2004. An additional 32 DART buoys were soon announced, including stations in the Indian, Caribbean and Atlantic oceans.

Cabled observatories
Using cables hundreds of kilometers long on the seabed at depths down to 3 km, dotted with instrument "nodes," scientists can access and control scientific sensors and remotely-operated vehicles and cameras.

The information gleaned will improve understanding of plankton blooms, fish migrations, changing ocean conditions, climate change, underwater volcanic eruptions, earthquakes and the processes that cause them, and help warn of approaching tsunamis.

Satellites
The ocean observing system suffers from major gaps in the observational coverage of satellites, which provide a high-altitude window on such marine characteristics as sea surface roughness, temperature, currents, ice cover and shifting meadow-like areas where marine plants grow.

Societal benefits

Are oceans absorbing less carbon and thus losing the ability to dampen climate change? Is the flow of deep water in the North Atlantic slowing to bring a chill – the premise of Hollywood's apocalyptic film "The Day After Tomorrow"? Are reefs being bleached? Scientists envision an ongoing, integrated ocean observing system that routinely surveys and monitors conditions and offers prompt diagnoses and timely forecasts of problems – practical information of benefit to humanity in many ways:

Mitigating damage from natural disasters and bad weather
Deeper understanding of ocean behaviour will help society better forecast and protect itself from catastrophic storms such as hurricanes, typhoons and tsunamis.

Better ocean information will improve short- and long-range weather and climate prediction, thereby strengthening disaster preparedness and damage mitigation and strategies for agricultural and seafood harvests. As well, better ocean observing will improve safety of the marine transportation network – which conveys 90% of goods traded internationally – with accurate, timely information about ocean conditions.

Human health and well-being

Among the benefits offered by better ocean observing: measurement of sea surface temperatures could predict movement of fish from traditional waters, and even outbreaks of disease, which have been associated with warmer water, while monitoring pollution-induced eutrophication will help predict toxic algal blooms.

Energy

Oceans are a growing source of energy – oil and especially natural gas – as operators reach into the seafloor in deeper and deeper parts of the ocean with multi-billion dollar facilities. Offshore wind farms would also depend on timely, reliable information on ocean conditions. Better ocean observation will help harness various energy sources safely and efficiently with minimal environmental impact.

Climate and ocean acidity

A more fully developed ocean observing system will foster important new insights into how altered ocean conditions, including warmer water and increasing acidity, affect weather, climate and the role of the oceans as a carbon sink. Scientists want to know how warmer water, for example, impacts microscopic life forms that consume some 50 giga-tonnes of carbon per year, about the same as all plants and trees on land.

Water resources

As the planet's primary reservoir, oceans govern the global water cycle. Improved ocean observations will help scientists better understand precipitation patterns.

Marine ecosystems and biodiversity

A majority of life on Earth eats, swims, crawls, fights and lives in oceans. Water temperatures affect where species live and travel, as well as the distribution of nutrients, plankton and on up the food web. An integrated ocean observing system will illuminate the impact of shifting ocean conditions and pollution on marine and coastal ecosystems and the distribution, abundance and biodiversity of organisms.

Calls for Action

D. James Baker, former Administrator of the U.S. National Oceanic and Atmospheric Administration, says: “The exciting progress to date also shows the size of the remaining opportunity. We have pathetically few measurements of the oceans relative to their importance to life on Earth and the extent to which we rely on them for energy, weather, food and recreation.”

According to South African oceanographer John Field, chair of the Scientific Committee of the Global Ocean Observing System: “In the first few decades of this century we can develop an ocean observing system comparable in value to the system we so appreciate for our weather forecasts. If in the year 2020 ocean monitoring and prediction are much improved, we may recall the 2007 Cape Town Summit as when governments intensified the key commitments.”

“People who watch and worry about each sea unite in support of a much improved, integrated global ocean observing system,” says Prof. Howard Roe, Director Emeritus, National Oceanography Centre, Southampton, U.K. and past POGO Chair, who will lead the POGO delegation in Cape Town.

Finally, notes Jesse Ausubel, CoML program director for the Alfred P. Sloan Foundation: "2012 will be the centenary of the sinking of the Titanic. I think Captain Smith would be disappointed by the continuing hesitation to firm up our ocean observing system."

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OCEAN UNITED
Ocean United is an informal forum created under POGO leadership that brings together many organisations with interests in various aspects of ocean observations, and speaks with a common voice in support of ocean observations.

POGO

The Partnership for Observation of the Global Ocean (POGO) links much of the ocean research community. POGO was created by directors and leaders of major oceanographic institutions to focus attention on technical compatibility among observing networks; shared use of infrastructure; and on public outreach and capacity building.

GOOS

GOOS is co-ordinated by the Intergovernmental Oceanographic Commission, World Meteorological Organization, the UN Environment Programme and the International Council for Science. It is being implemented by concerned partners worldwide.

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POGO executives are available Tues. afternoon Nov. 27, Agfa Room, Two Oceans Aquarium, Cape Town. Contact during the conference: Emlyn Balarin, Tel:+27-21-650-3283; +27-082-224 3941 (mob); Emlyn.Balarin@uct.ac.za.