DOOS platform considerations

Focus on platforms that can be deployed below 1000m and in a globally distributed fashion (or at hotspots, choke points, places of societal interest)

Uwe Send
Scripps Institution of Oceanography, San Diego

DOOS workshop, SIO, 08 Dec 2016
Research vessels (repeat hydrography)
Gliders (0-1500m)

0 - 10 km ~ 8 h

20-40 cm/s

1500 m
Water column moorings, moored profilers
Deep Argo pilot arrays are in the Indian Ocean, South Australian Basin, Southwest Pacific Ocean, and North Atlantic Ocean.

28 Deep Argo floats are currently active.


Deep Argo float models include Deep NINJA (JAMSTEC and TSK); Deep Arvor (NKE), Deep APEX (Teledyne/Webb), and Deep SOLO (Scripps and MRV).

Above: A conceptual map of Deep Argo after completion: 1228 floats at 5° X 5° resolution.
Planned: deep floats tracking ice shelf & bottom water (Weddell Sea)

- Sound-source network on the shelf + floats (extend AWI network)
- Deep profiler (4000 m) programmed to follow the ocean bottom and measure vel., T, S

European project (ERC) – JB Sallée 2015-2020
Ice-tethered Profilers  (C.Provost)

Trajectories from 6 deployments in 2015
Acoustically tracked floats

RAFOS: good lagrangian measure of trajectories and dispersion, very limited payload.

ARGO floats with acoustic navigation: more sensors possible
Deepglider™

Length: 1.8 m  
Diameter: 0.3 m  
Mass: 75 kg (10 kg compressee/expansee)  
Maximum Depth: 6 km  
Buoyancy Engine Displacement: 1125 cc  
Batteries: 12 kg (62 DD Li primary 17 MJ)

Endurance: 18 months  
Range: 10,000 km  
~275 dives to 6 km

Acquisition cost: ~$200K  
Usage cost: ~$50K/mission ~$33K/year
BATS survey 2015
279 days, 163 full-depth dives
9 months spent half the battery energy

Deepglider track

Labrador Sea eddy
dissolved oxygen (color)
potential density anomaly $\sigma_\theta$ (contours)

C. Eriksen, University of Washington
Bottom moorings, bottom landers
Benthic ecological observatories

Example: FRAM - FRontiers in Arctic Marine Monitoring

Lander-Systems

Chamber

Profiler

SMART subsea cables in the ocean observing system

Use of existing telecom cables to connect seafloor sensors

Initial application tsunamis and earthquakes

- Telecom + science
- Cable repeaters host sensors
- Potential: 20,000 repeaters, 1 Gm, 50 km, 10-20 year refresh cycle
- Initially: bottom pressure, temperature and acceleration; supplement later

Proposing: Wet demo pilot

Bruce Howe

Plus other platforms

- cabled observatories
- VOS
- AUVs
- ROVs
- manned submersibles
- .......
How can DOOS make us of deep the platforms?

OceanObs09:

- the 3 communities should join forces in ocean observation, share resources, platforms, funding, cruises, advocacy, etc.
- observe also the unknown unknowns (especially true for deep ocean) to have the data that might be needed 50 years from now (e.g. when seafloor is destroyed due to mining)
Share and leverage platforms

Examples:

- OceanSITES moorings exist and get serviced each year, available to add sensors for BCG, ecosystem acoustics (active&passive), cameras, etc.

- Research ships go to many places: can add people/staff to run fish acoustics, get deep samples during CTD casts, deploy “quick” gap-filling sensors on the way.
Coordinate platform distributions, exploit synergies

1) Assemble platform inventory from all GOOS panels (existing and planned)

2) Which of those can be exploited to address high-level science questions/societal needs?

3) Identify geographic gaps for DOOS to tackle (guided by GOOS panels)

4) Compare time/space coverage and accuracies to identify gaps which DOOS can advocate for

5) Exploit technical/analytical capabilities: floats/gliders sample more locations but fewer variables; moorings can carry more advanced sensors and be calibrated before/after; ships can take full suite of water samples
Low-hanging fruit?

1) Add BGC and ecosystem sensors deep on some existing OceanSITES moorings
   - “proven sensors” in operational mode
   - “pilot project” for more advanced/innovative sensors

2) Build a small number of Deep Argo floats with BGC and ecosystem sensors (both pilot and start observing some regimes)

3) Identify a few deep ecosystem regimes, hotspots, mining areas, or choke points where additional deployments of infrastructure is of scientific value across disciplines and of societal value