Breakout Session 1

Boundary Currents / Shelf-Deep Ocean Exchange
1. Interannual variability of currents and water properties has fundamental effects on ecosystem structure/dynamics in all coastal and boundary current systems
2. Cross-shore overturning is key exchange between shelf and deep ocean
3. Episodic events (e.g., upwelling) are key, as are submesoscale processes, and ecological hotspots
4. Land-deep ocean connectivity

1. Relevant processes vary in importance in different locations.
2. Different societal drivers in each boundary or coastal system
3. Technical needs/implementation challenges vary by system
Candidate systems

Figure 6. Conceptual locations for a global network of boundary current arrays. Subpolar boundary current arrays are shown in orange, poleward subtropical western boundary systems in blue, equatorward low-latitude boundary systems in black, major eastern boundary systems in pink. Green shows the possible locations of arrays to monitor key interbasin exchanges.

WBCs (x6) - Agulhus, Somali, Kuroshio, EAC, Gulf Stream, Brazil
EBCs (x5) – California, Humboldt, Canary, Benguela, Leeuwin
## Discussion Topic

### Key points from Breakout discussions

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Societal impact(s) of the project(s)</td>
<td>Heat transport/climate predictability (e.g., rainfall); retroflection drives upwelling; sardine fishery; acidification/carbon cycle</td>
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<tr>
<td>Gap assessment(s)</td>
<td>Variability occurs over large region, current obs limited in spatial extent;</td>
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<tr>
<td>Technology requirements</td>
<td>Will be de</td>
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<td>Financial feasibility</td>
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<tr>
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Breakout Session 2

Boundary Currents / Shelf-Deep Ocean Exchange
Candidate systems

Figure 6. Conceptual locations for a global network of boundary current arrays. Subpolar boundary current arrays are shown in orange, **poleward subtropical western boundary systems in blue**, equatorward low-latitude boundary systems in black, **major eastern boundary systems in pink**. Green shows the possible locations of arrays to monitor key interbasin exchanges.

- **WBCs (x6)** - Agulhus, Somali, Kuroshio, EAC, Gulf Stream, Brazil
- **EBCs (x5)** – California, Humboldt, Canary, Benguela, Leeuwin
- **Also consider enclosed seas (e.g. Med), sub-polar BCs (e.g. Arctic)**?
Candidate systems + OMZs
Candidate systems

• Start with already well instrumented systems?

• California, EAC
  • Backgrounder on EAC/IMOS (‘top down’)
  • Backgrounder on California Current (‘bottom up’)
  • Backgrounder on Baleric Islands/SOCIB

• Review paper(s), observing system reviews?

• Principles?
  • Addressing an economic problem (collapse of Californian sardine fishery – connecting with fisheries is natural in coastal systems)
  • Pathway for obs to interact with modelling and forecasting (So what? What next?)
  • Census of assets in the water, evaluation of effectiveness
  • Tbc...
El Viejo                          La Vieja

Colder

More productive

Lower oxygen

Ecosystem change

Ecosystem susceptible to multiple natural and anthropogenic pressures

Increasing CO$_2$

Decreasing pH

Higher CO$_2$ events

## Four Future Climate Change Scenarios:

<table>
<thead>
<tr>
<th>SCENARIO</th>
<th>RESPONSES &amp; IMPACTS</th>
<th>VULNERABILITY</th>
</tr>
</thead>
</table>
| **Historic Variability** | **Ecological Impacts**
Productivity of stocks fluctuate with warm-unproductive and cool-productive conditions. Species shift their range to 'follow' favorable environmental conditions |
**Potential Human Responses**
Fishermen generally adapted to existing variability but responses can be constrained by regulatory, historical, economic, and social factors |
**Potential Social & Economic Impacts**
Safety concerns in volatile weather/ocean conditions; individual, family and social stress |
**Fish & Invertebrate Stocks**
Fish that favor warm conditions include sardines, highly migratory species, CA spiny lobster, etc. Stocks that favor cool conditions include anchovy, Dungeness and rock crabs, Pacific halibut, spot prawn, etc. |
**Fishing Communities**
Small-scale fishing operations, those with specialized gear, and participants not in risk sharing networks are more vulnerable. |
| **Increased Variability** | **Ecological Impacts**
Contraction and expansion of species’ spatial distributions and variable fish production |
**Potential Human Responses**
Fishermen unable to predict changes; fishermen adapt with new technology |
**Potential Social & Economic Impacts**
Higher costs (fuel, learning, shifting); disruption in distribution links; safety concerns in volatile weather; social stress |
**Fish & Invertebrate Stocks**
Highly specialized or localized species, calcifying organisms are more vulnerable. Long lived species with built-in buffer to high variability are less vulnerable. |
**Fishing Communities**
Highly specialized and localized fisheries, small-scale fishing operations, and those with specialized gear are more vulnerable. |
<table>
<thead>
<tr>
<th><strong>Range Shifts</strong></th>
<th><strong>Ecological Impacts</strong></th>
<th>Changes and/or declines in prey quality; Range contraction of spp. that favor cool-productive conditions; Range expansion of spp. that favor warm-unproductive conditions; Changes in species life histories due to warming (tropicalization)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term warming trends, more frequent warm phases, and fewer cool phases can lead to changes in acidity, temperature, and ocean circulation</td>
<td><strong>Potential Human Responses</strong></td>
<td>Fishermen fish harder for remaining fish after the population shifts; some fishermen follow the fish, leave the fishery, switch species or change effort for new species mix</td>
</tr>
<tr>
<td></td>
<td><strong>Potential Social &amp; Economic Impacts</strong></td>
<td>Higher costs (fuel, learning, shifting); change in distribution links, revenues to communities, and access to permits for former and new species</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Crossing Thresholds</strong></th>
<th><strong>Ecological Impacts</strong></th>
<th>Species decline in response to species or ecosystems crossing thresholds or due to lack of prey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecosystems and fisheries cross sudden tipping points; Change in species composition and food web productivity</td>
<td><strong>Potential Human Responses</strong></td>
<td>Some fishermen leave the fishery, switch species, or change effort for new species mix</td>
</tr>
<tr>
<td></td>
<td><strong>Potential Social &amp; Economic Impacts</strong></td>
<td>Risk of economic disaster for fishing communities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Fish &amp; Invertebrate Stocks</strong></th>
<th>Populations near the edge of their distribution and species that favor warm conditions are less vulnerable. High turnover species are more vulnerable.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fishing Communities</strong></td>
<td>Small-scale fishing operations, those without access to permits, and those not in risk-sharing networks are more vulnerable.</td>
</tr>
</tbody>
</table>
New Technologies: Paradigm Shift
Data Availability (Real time and QC ‘at one click’)

Dapp SOCIB: multi-platform real time data available: 40 surface drifters, 4 Argo profilers, 2 sea-turtles, 2 gliders, 2 fixed moorings, 7 tide gages, 3 real time beach monitoring systems).

http://apps.socib.es/dapp
Candidate systems

- Started to discuss how to design an integrated system
- How to choose the mix of assets?
  - Moorings, Gliders, etc.
- Maturity of sensors (mature/pilot/proof-of-concept)
- Leveraging existing expertise in obs system operation
- Greater use of OSD/OSSE
  - Different maturity (physics, BGC, ecosystems)
- Keep coming back to the questions...
1. Interannual variability of currents and water properties has fundamental effects on ecosystem structure/dynamics in all coastal and boundary current systems.

2. Cross-shore overturning is key exchange between shelf and deep ocean.

3. Episodic events (e.g., upwelling) are key, as are submesoscale processes, and ecological hotspots.

4. Land-deep ocean connectivity.

1. Relevant processes vary in importance in different locations.

2. Different societal drivers in each boundary or coastal system.

3. Technical needs/implementation challenges vary by system.
Breakout Session 3

Boundary Currents / Shelf-Deep Ocean Exchange
What we did in this session

• Discuss our science questions
  • Some rewording to improve clarity
  • Four questions collapsed into three (Land and deep ocean connectivity covered in the other three rather than kept separate)

• Identified the processes we need to understand for each question
  • Q1 x 8, Q2 x 8, Q3 x 4

• Identified time and space scales of observations required to understand each process, for Q1 (Interannual variability)...

• Need to do this for Q2 and Q3...
Science questions

1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...
2. Cross-shore exchange between land, shelf and deep ocean (mesoscale)
3. Ecological hotspots, episodic (e.g. fronts, eddies, upwelling) and persistent (e.g. canyons, headlands, shelf break)

- Relevant processes vary in importance in different locations.
- Different societal drivers in each boundary or coastal system
- Technical needs/implementation challenges vary by system
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

- Processes
  - 1.1 Depth of thermocline – T, S, at what scale?
  - 1.2 Terrestrial inflow of nutrients
  - 1.3 Plankton diversity and abundance
  - 1.4 Higher trophic distribution and abundance
  - 1.5 Volume and heat flux
  - 1.6 Carbon budget, Nutrients and Oxygen
  - 1.7 Eddy fluxes
  - 1.8 Water masses
Q2. Cross-shore exchange between land, shelf and deep ocean (mesoscale)

- Processes
  - 2.1 Terrestrial inflow of nutrients and carbon
  - 2.2 Eddy fluxes (heat, freshwater, carbon...)
  - 2.3 Bottom boundary layer
  - 2.4 Vertical fluxes – upwelling, mixing, eddy pumping
  - 2.5 Wind stress, curl
  - 2.6 Larval transport
  - 2.7 Sediment processes (nutrient fluxes etc.)
  - 2.8 Surface carbon and N2O fluxes
Q3. Ecological hotspots, episodic (e.g. fronts, eddies, upwelling) and persistent (e.g. canyons, headlands, shelf break)

- Processes
  - 3.1 Bottom up (physics), sub-mesoscale
  - 3.2 Top down - aggregation, blooms
  - 3.3 Bottom cover
  - 3.4 Anthropogenic pressures
General issues discussed up front

- EOVs? All, a subset?
- Scales?
- Size of the domain?
  - California Current, Three domains – northern, central, southern
- Topography
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

• 1.1 Depth of pycnocline – T, S, at what scale?
  • across shore 1-10’s kms out to 200km, alongshore 100-200km
  • 2-4 weeks? (enough to resolve annual cycle)
  • 1-10 metres through the TC, lower res below
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

• 1.2 Terrestrial inflow of nutrients
  • Streamflows and BGC (nutrients, carbon, DIC, sediments...)
    • Daily
  • Atmospheric deposition
    • Weekly
  • Groundwater discharge
    • need a number...
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

• 1.3 Phytoplankton (incl Chl) and Zooplankton diversity and abundance
  • across shore 10’s kms, alongshore 100 km
  • 2-4 weeks? (enough to resolve annual cycle)
  • 10’s metres top of the TC (MLD), lower res below (50’s m to 500m)
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

• 1.4 Higher trophic distribution and abundance
  • across shore 10’s kms, alongshore 100 km
  • 2-3 months (seasonal)
  • Top 300 metres? + surface?
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

• 1.5 Volume and heat flux
  • across shore 1-10’s kms?, alongshore 100-200km
  • 2-4 weeks? (enough to resolve annual cycle)
  • 1-10 metres through the TC, lower res to full depth
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

- 1.6 Carbon budget, nutrients and oxygen
  - Surface carbon flux (air sea exchange of CO2)
  - Carbonate system through the water column

- across shore 1-10’s kms?, alongshore 100-200km
- 2-4 weeks? (enough to resolve annual cycle)
- 1-10 metres through the TC, lower res below
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

• 1.7 Eddy fluxes
  • across shore 1-10’s kms?, alongshore 1-10’s kms
  • days
  • 1-10 metres through the TC, lower res to full depth
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

• 1.8 Water masses
  • across shore 1-10’s kms?, alongshore 100-200km
  • 2-4 weeks? (enough to resolve annual cycle)
  • 1-10 metres through the TC, lower res to full depth
Still to be done...

• 2. Cross-shore exchange between land, shelf and deep ocean (mesoscale)

• 3. Ecological hotspots, episodic (e.g. fronts, eddies, upwelling) and persistent (e.g. canyons, headlands, shelf break)

• at finer scales...
Breakout Session 4

Boundary Currents / Shelf-Deep Ocean Exchange
What we did in this session

• Move Q1 forward to EOVs and platforms/sensors
  • Need to do this for Q2 and Q3...

• Analysis of requirements and capabilities in Candidate Systems
• Design criteria (including Observing System Design studies)

• Considerations for selecting pilot projects
  • BC/SI system
  • Scale (large, mesoscale, hotspots)
  • Societal impacts
  • Intersection with Plankton and OMZ groups
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

• 1.1 Depth of pycnocline and distribution of T, S, at what scale?
  • across shore 1-10’s kms out to 200km, alongshore 100-200km
  • 2-4 weeks? (enough to resolve annual cycle)
  • 1-10 metres through the TC, lower res below

• EOVs and platforms/sensors
  • Gliders (T, S), + Mooring(s) where essential
  • XBTs (frequency? not until across the shelf break?)
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

• 1.2 Terrestrial inflow of nutrients
  • Streamflows and BGC (nutrients, carbon, DIC, sediments...)
    • Daily
  • Atmospheric deposition
    • Weekly
  • Groundwater discharge
    • need a number...

• EOVs and platforms/sensors
  • Where available from terrestrial observing networks
  • Potential of satellites?
  • CDOM, Salinity, Susp Sed (ship-based, autonomous)
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

- 1.3 Phytoplankton (incl Chl) and Zooplankton diversity and abundance
  - across shore 10’s kms, alongshore 100 km
  - 2-4 weeks? (enough to resolve annual cycle)
  - 10’s metres top of the TC (MLD), lower res below (50’s m to 500m)

- **EOVs and platforms/sensors**
  - **Satellite Ocean colour + bio-optics**
  - Bio-optics
  - Bio-Acoustics (echo sounders)
  - CPR, Nets and bottle samples (microscopy + genomics)
  - LOPC, FlowCam (Imaging)
  - ESP (+genomics)
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

- 1.4 Higher trophic distribution and abundance
  - across shore 10’s kms, alongshore 100 km
  - 2-3 months (seasonal)
  - Top 300 metres? + surface?

- EOVs and platforms/sensors (potentially high societal impact)
  - Bio-acoustics
  - Animal tagging
  - Ship-based surveys (fisheries, fisheries independent...)
  - Passive acoustics
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

• 1.5 Volume and heat flux
  • across shore 1-10’s kms?, alongshore 100-200km
  • 2-4 weeks? (enough to resolve annual cycle)
  • 1-10 metres through the TC, lower res to full depth

• EOVs and platforms/sensors
  • Gliders (T, S), + Mooring(s) where essential
  • XBTs (frequency? not until across the shelf break?)
  • Current meters
  • Surface drifters
  • Coastal altimetry
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

- 1.6 Carbon budget, nutrients and oxygen
  - Surface carbon flux (air sea exchange of CO2)
  - Carbonate system through the water column

- across shore 1-10’s kms?, alongshore 100-200km
- 2-4 weeks? (enough to resolve annual cycle)
- 1-10 metres through the TC, lower res below

- EOVs and platforms/sensors (all BGC EOVs)
  - Surface - ship transects, moorings
  - Sub-Surface – bottle sampling, moorings
  - Wave gliders (transects, station keeping)
  - Gliders (pH...
Q1. How is ecosystem structure/dynamics in coastal and boundary current systems affected by interannual variability of currents and water properties, including O2/OMZs, pH/ocean acidification...

- 1.7 Eddy fluxes
  - across shore 1-10’s kms?, alongshore 1-10’s kms
  - days
  - 1-10 metres through the TC, lower res to full depth

- EOVs and platforms/sensors
  - Gliders (T, S), + Mooring(s) where essential
  - Current meters
  - Surface drifters
  - Satellite constellation, high resolution
Feasibility and Impact

• Feasibility
  • 3 high
  • 2 medium
  • 1 low
  • Blank = n/a

• Impact
  • 3 high
  • 2 medium
  • 1 low
  • Blank = n/a
<table>
<thead>
<tr>
<th>Q1 Interannual variability...</th>
<th>Gliders</th>
<th>Moorings</th>
<th>Ship based SOOP</th>
<th>Ship based RV</th>
<th>Satellite</th>
<th>Wave Glider</th>
<th>Animal Tagging</th>
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<tr>
<td>1 Depth of pycnocline</td>
<td>3/3</td>
<td>2/2</td>
<td>1/1</td>
<td>3/1</td>
<td></td>
<td></td>
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<tr>
<td>2 Terrestrial inflow</td>
<td>3/3</td>
<td></td>
<td>1/2</td>
<td>3/1</td>
<td>2/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Plankton div &amp; abund</td>
<td>2/2</td>
<td>1/1</td>
<td>2/1</td>
<td>3/1</td>
<td>2/2</td>
<td>2/2</td>
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<td>4 Higher trophic d&amp;a</td>
<td>1/1</td>
<td>2/2</td>
<td>1/3</td>
<td>3/2</td>
<td>1/1</td>
<td>3/3</td>
<td></td>
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<tr>
<td>5 Volume &amp; Heat flux</td>
<td>3/3</td>
<td>3/3</td>
<td>2/2</td>
<td>2/1</td>
<td>1/1</td>
<td></td>
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<tr>
<td>6 Carbon, Nut + O2</td>
<td>1/2</td>
<td>2/2</td>
<td>1.5/2</td>
<td>3/1</td>
<td>2/2</td>
<td>1.5/2</td>
<td></td>
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<tr>
<td>7 Eddy Fluxes</td>
<td>2/2</td>
<td>3/2</td>
<td></td>
<td>3/3</td>
<td>2/2</td>
<td>2/2</td>
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The Rudnick/Beal “Glidmoor”
Prioritising, what next?

• Analysis of requirements and capabilities in Candidate Systems

• Observing System Design studies

• Considerations for selecting pilot projects
Prioritising, what next?

• Analysis of requirements and capabilities in Candidate Systems
  • US West Coast – what is the required backbone (Q1)?
  • IMOS/EAC - international peer review
  • Other Candidate Systems (e.g. Kuroshio?)
  • OO’19 White Paper(s) – looking forward
Prioritising, what next?
Design criteria (including OSD, OSSE)

• Develop concept for multidisciplinary backbone
• Develop generic design process
  • Build on experiences of past comprehensive systems
    • e.g. IMOS EAC, Cal. Current
  • Propose target “threshold” resolution (consider “breakthrough”/“goal”)  
  • What is feasible / what is the impact  
  • Engage GODAE community for OSSE  
  • Balance costs/feasibility/impact of sensor/resolution choice  
  • Prepare “ground segment” in advance
• Develop concept for multidisciplinary relocatable systems at finer scales (mesoscale, hot spots...)
  • Platform/sensor suite selected to deliver EOV suite relevant to region or process specific high level societal goals
• Develop generic design process
• W.r.t.: pilot – use limited time deployment with high resolution to inform subsequent sustained observation network for GOOS?
  • Evaluate “goal”/“breakthrough”/“threshold” limits  
  • Duration to reveal trends from among variability  
  • By testing analysis/synthesis skill with reduced resolution
• Candidate test location (s) ... ?
Prioritising, what next?

- Pilot projects – maybe 2 or 3...
- Considerations for selecting pilot projects
  - Type of system – WBC, EBC, enclosed sea, sub-polar
  - Scale (large, mesoscale, hotspots)
  - Societal impacts
  - Intersection with Plankton and OMZ groups

Ended up having excellent discussion
...but have left ourselves a bit to do!
- feasibility?
Additional slides
## EOVs – Boundary Currents...

<table>
<thead>
<tr>
<th>PHYSICS</th>
<th>BIOGEOCHEMISTRY</th>
<th>BIOLOGY AND ECOSYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea state</td>
<td>Dissolved Oxygen</td>
<td>Phytoplankton biomass and diversity</td>
</tr>
<tr>
<td>Ocean surface stress</td>
<td>Inorganic macro nutrients</td>
<td>Zooplankton biomass and diversity</td>
</tr>
<tr>
<td>Sea ice</td>
<td>Carbonate System</td>
<td>Fish abundance and distribution</td>
</tr>
<tr>
<td>Sea surface height</td>
<td>Transient tracers</td>
<td>Marine turtles, birds, mammals abundance and distribution</td>
</tr>
<tr>
<td>Sea surface temperature</td>
<td>Suspended particulates</td>
<td>Live coral</td>
</tr>
<tr>
<td>Subsurface temperature</td>
<td>Nitrous oxide</td>
<td>Seagrass cover</td>
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<tr>
<td>Surface currents</td>
<td>Stable Carbon Isotopes</td>
<td>Macroalgal canopy</td>
</tr>
<tr>
<td>Subsurface currents</td>
<td>Dissolved organic carbon</td>
<td>Mangrove cover</td>
</tr>
<tr>
<td>Sea surface salinity</td>
<td>Ocean Colour (tba)</td>
<td></td>
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<td>Subsurface salinity</td>
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<tr>
<td>Ocean surface heat flux</td>
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Large Marine Ecosystems (LME): More fish where plankton are

- LME and SeaWiFS-derived Annual Primary Production estimates
Oxygen Minimum Zones (OMZ)

• Deep Ocean OMZ:
  • Plankton settling and decomposing

• Shelf and coastal ocean
  – Plankton settling and decomposing
GOAL: Observe marine life
- Collaborating with GOOS to link networks
- Populate OBIS
- Enable assessments
Observing system reviews – So what? What next?

For a (set of) well observed boundary current regimes, with/without significant roles for BC mediation in shelf sea and land-to-ocean processes …

• What has been learned about the limits/needs for resolution etc. as it informs specific dynamical/ecological processes
• What was learned about how to (or not to) design a multidisciplinary system
• What is missing?
  • Observations: BGC and BioECO EOV?
  • Synthesis – are we observing the rights things and scales
• Lessons on operating and deploying, sensor robustness
• Specific lessons as they may relate to OMZ and Phytoplankton IMSOO objectives where they are being considered in BC/SSI regimes
• What to do next that is new
  • Observing platforms; Operational/design strategy
  • Breakthrough scales (submesoscale, thin layers, boundary layers)
  • Modeling systems for analysis, synthesis, societal outputs
Prototype relocatable BC/SSI intensive array (pilot)

• Develop concept for multidisciplinary end-to-end system
  • Platform/sensor suite selected to deliver EOV suite relevant to region or process specific high level societal goals
• Develop generic design process
  • Build on experiences of past comprehensive systems
    • e.g. IMOS EAC, Cal. Current
  • Propose target “goal”/“breakthrough”/”threshold” resolution
  • What is feasible / what is the impact
  • Engage GODAE community for OSSE
  • Balance costs/feasibility/impact of sensor/resolution choice
  • Prepare “ground segment” in advance
• Limited time deployment with high resolution to inform subsequent sustained observation network for GOOS?
  • Evaluate “goal”/“breakthrough”/”threshold” limits
  • Duration to reveal trends from among variability
  • By testing analysis/synthesis skill with reduced resolution
• Work through to deliverables for high-level applications

Candidate test location ... ?
GODAE analysis of impact of high-resolution observations in well observed BC regimes

- Informs subsequent sustained observation network for GOOS
  - Evaluate “goal”/”breakthrough”/”threshold” limits