Global Climate Observing System, with a focus on Ocean Activities

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DRIVING THE GLOBAL CLIMATE OBSERVATION AGENDA

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Identify/Review Essential Climate Variables (ECVs) through science panels

Regular review of how these ECV are observed

Develop plans to ensure continuity and improvement of observations

- GCOS follows a 3 phase approach driven by users
- 2015 Status Report started the 3rd assessment cycle with a new Implementation Plan due in 2016 for UNFCCC COP 22

(1st cycle: 1995-1998)

(2nd cycle: 2003-2004-2010)

(3rd cycle: 2015-2016)

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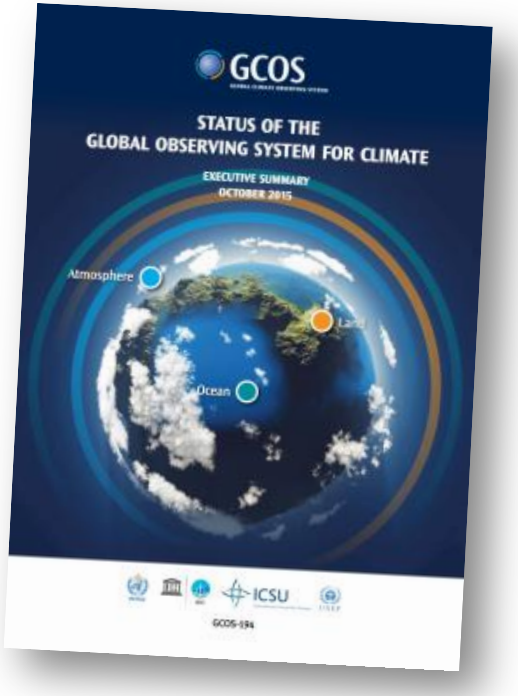
3 SCIENCE PANELS

- 3 Science Panels for Atmosphere, Land and Oceans; all joint with WCRP:
  - Capture requirements for users of climate observations.
  - Identify & review Essential Climate Variables (ECV) and their specification
  - Review adequacy of networks to measure & exchange data
  - Give recommendations for the new Implementation Plan
  - Advocating sustained networks, open data access, and future evolution
  - Coordinate with other observing systems
  - OOPC: Focus on systems based evaluations of the Observing System

GCOS STATUS REPORT

- GCOS *Status of the Global Observing System for Climate* (GCOS-195) has been published.
- It was submitted to this SBSTA at COP 21 in Paris 2015.
- Describes how well climate is currently being observed, where progress has been made, where progress is lacking or where deterioration has occurred.



- provides a basis for the new GCOS Implementation Plan
- covers matters relevant to the other issues such as biodiversity, desertification, wetlands and sustainable development (SDGs).

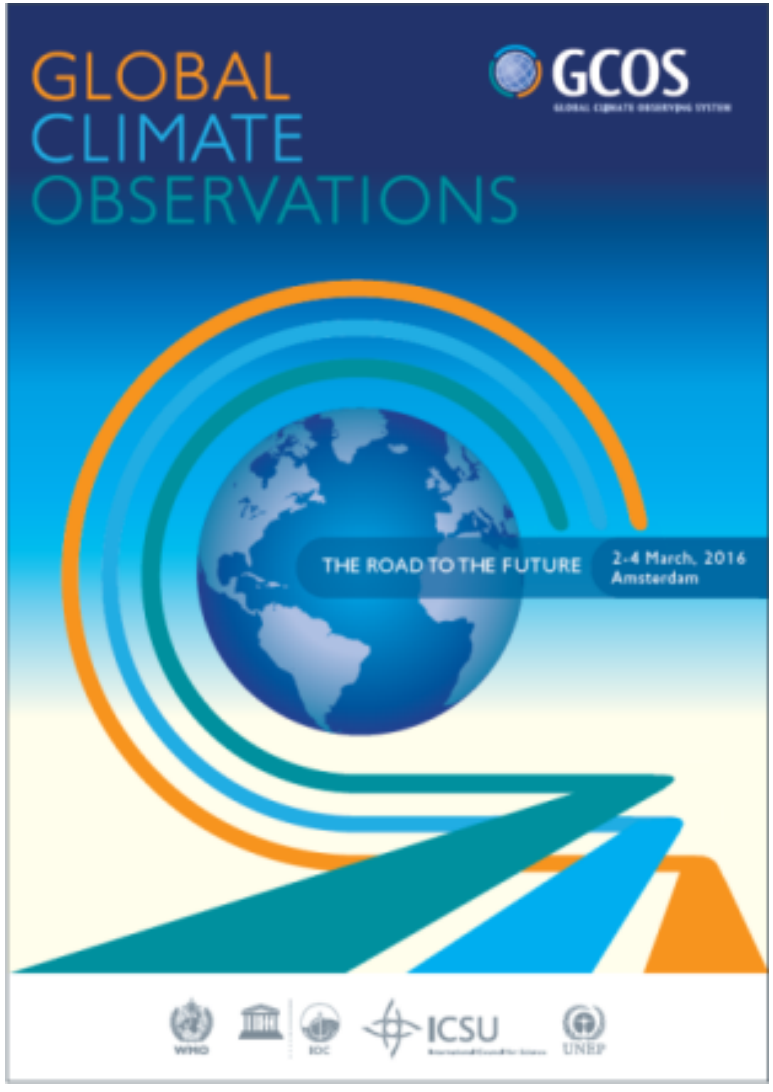
GCOS IMPLEMENTATION PLAN 2016

- Overall message: continuity with progress
- Primary purpose (UNFCCC) remains intact
- Broader context of implementation introduced
  1. Energy, water and carbon cycles reinforced
  2. Cross-convention use of observations (UNFCCC, CBD, UNCCD) proposed
  3. Adaptation + Mitigation framed
  4. Climate Services acknowledged
- Supporting observations introduced
  - gravity, DEM, orbit restitution...

2016 GCOS Implementation Plan

Date	Milestone
2013-2015	Preparatory work in 2013 – 2015 (GCOS panel meetings and three workshops with GFCS/UNFCCC/IPCC; Publication of Status Report)
15 November 2015	Draft Table of Contents submitted to COP21
2-4 February 2016	First Writing Team meeting: Detailed outline & writing assignments
2-4 March 2016	Open GCOS Conference: collect community views
April 2016	GCOS panel meetings finalize their draft chapters
24-26 May 2016	2nd Writing Team meeting: completes draft
June 2016	Limited review (including WMO, Technical Commissions and RAs)
July 2016	Public review (6 weeks)
September 2016	Final version approved by GCOS SC-24
October 2016	Final plan submitted to COP22

GCOS OPEN SCIENCE CONFERENCE



- 2-4 March 2016, Royal Academy of Arts and Sciences, Amsterdam, NL
- 150 participants, from 40 countries
- 100 observers using the video live stream, from 28 countries
- about 150 received abstracts
- 57 invited talks and speakers
- 62 posters being displayed
- dedicated website:

gcos-science.org

Focus on the

OCEAN OBSERVATIONS PANEL FOR CLIMATE

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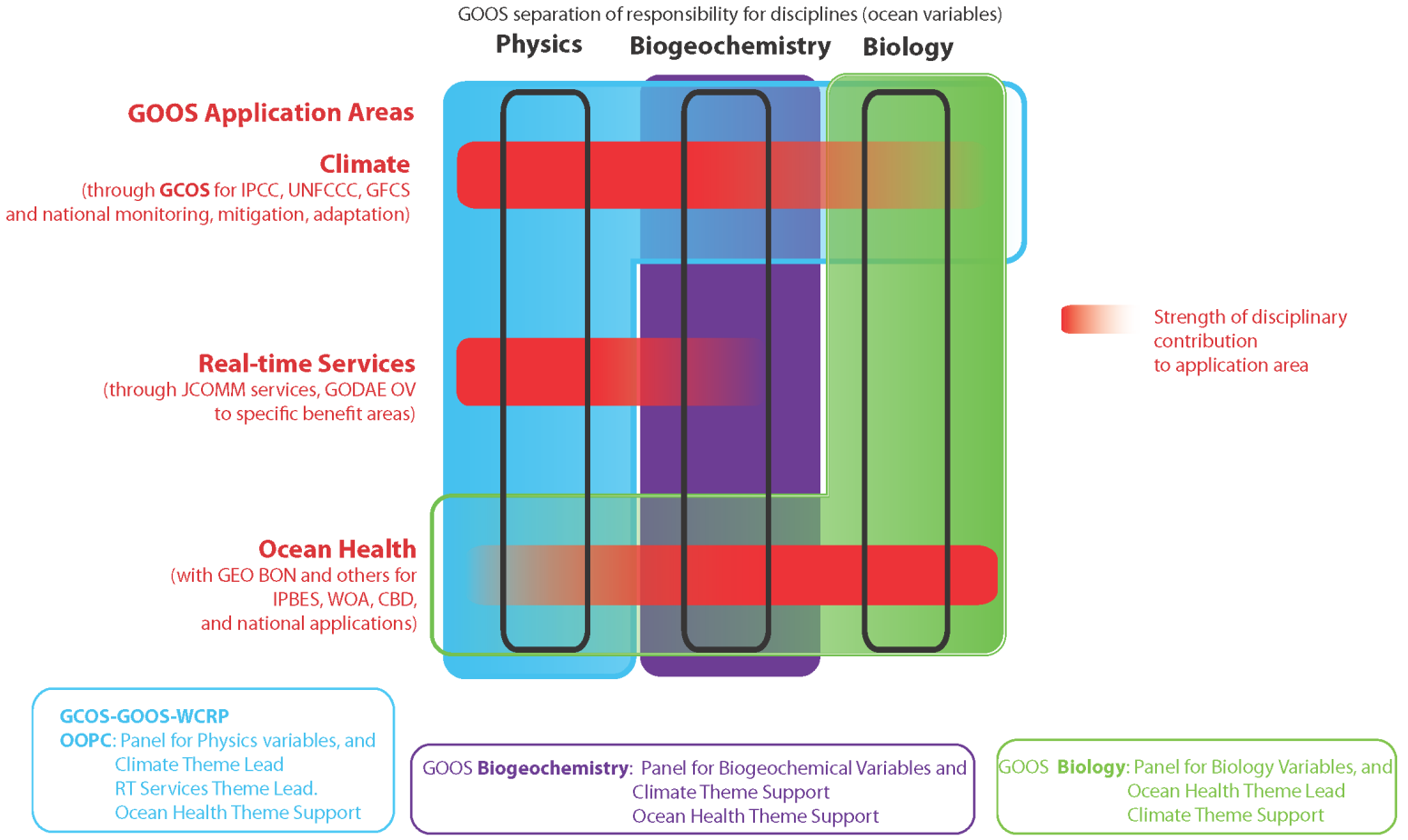
OCEAN OBSERVATIONS PANEL FOR CLIMATE



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OOPC WORKPLAN

- Panel needs to engage on many fronts: focusses activities and provides platform for discussions with partners.
- Task Areas
  - Planning and reporting activities (through GOOS, GCOS, etc)
  - Assessing Observing system performance and design (partnering with GOV, GSOP).
  - Reviewing components of the observing system and focussed systems based evaluations
    - Deep Ocean Observing Strategy (becoming a project)
    - Tropical Pacific (now a project; TPOS 2020)
    - Next: Open Ocean-Shelf Interactions.
  - Topics on 'watching brief, e.g.
    - Air Sea Fluxes
    - Polar Oceans (ice-ocean interface)

Development Project

TROPICAL PACIFIC OBSERVING SYSTEM, TPOS 2020 PROJECT

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KEY DRIVERS OF TPOS 2020

- ENSO is a dominant signal, has driven the development of T.P.O.S. since the beginning.
  - Orientation is strongly phenomenological in addition to scale-driven.
  - We must use what we know about ENSO phenomena in evaluating sampling choices.
- Long history of successful seasonal forecasts made possible by tropical Pacific observations.
  - Operational stakeholders : support for forecast systems
  - Consider model development, model strengths and weeknesses
- Fundamental coupled nature of the tropical climate and its sensitivity to coupled feedbacks:
  - planetary boundary layer as a core piece of what in other places can be primarily an _ocean_ observing system.

Models remain a weakness of ENSO prediction

TPOS 2020 will not itself build models, but much of the impact of TPOS data is through models:

Analyses and reanalyses that synthesize diverse data sources, in situ and satellite.

Bad (biased) models can degrade TPOS data products.

One example where models need observational guidance:

- **The diurnal cycle surprisingly important for the transmission of surface fluxes to subsurface ocean.**
- **Heat and momentum are communicated downwards via mixing produced by afternoon heating/ stratification.**
- **Models without these processes have cooler SST and weaker thermoclines (persistent biases).**

Diurnal cycle composite at 2°N,140°W.

Wind and current vectors, temperature shading.

Afternoon trapping, then downward propagation of T and u (and implied mixing) into the evening.

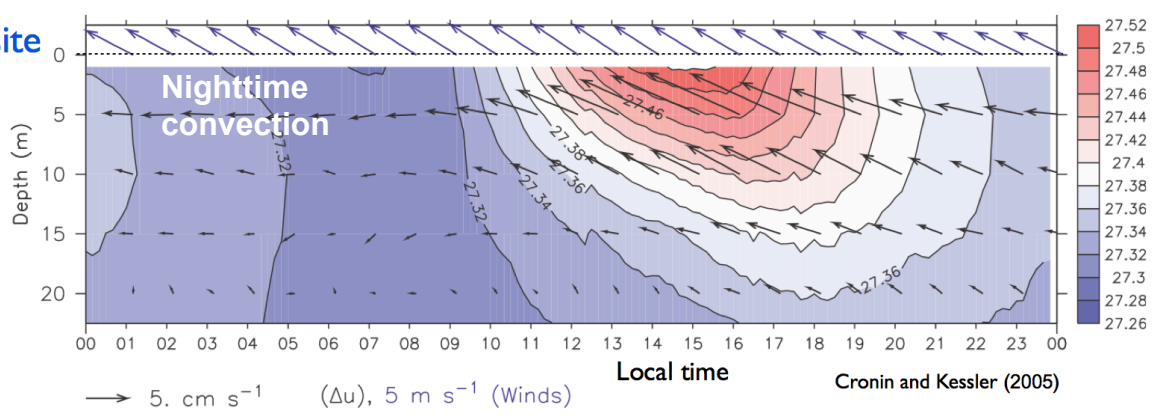


FIG. 5. Mean diurnal composite (24 May 2004–7 Oct 2004) of wind (blue vectors), temperature (color shading), and currents relative to 25 m (black vectors). The vector scale is shown at the bottom.

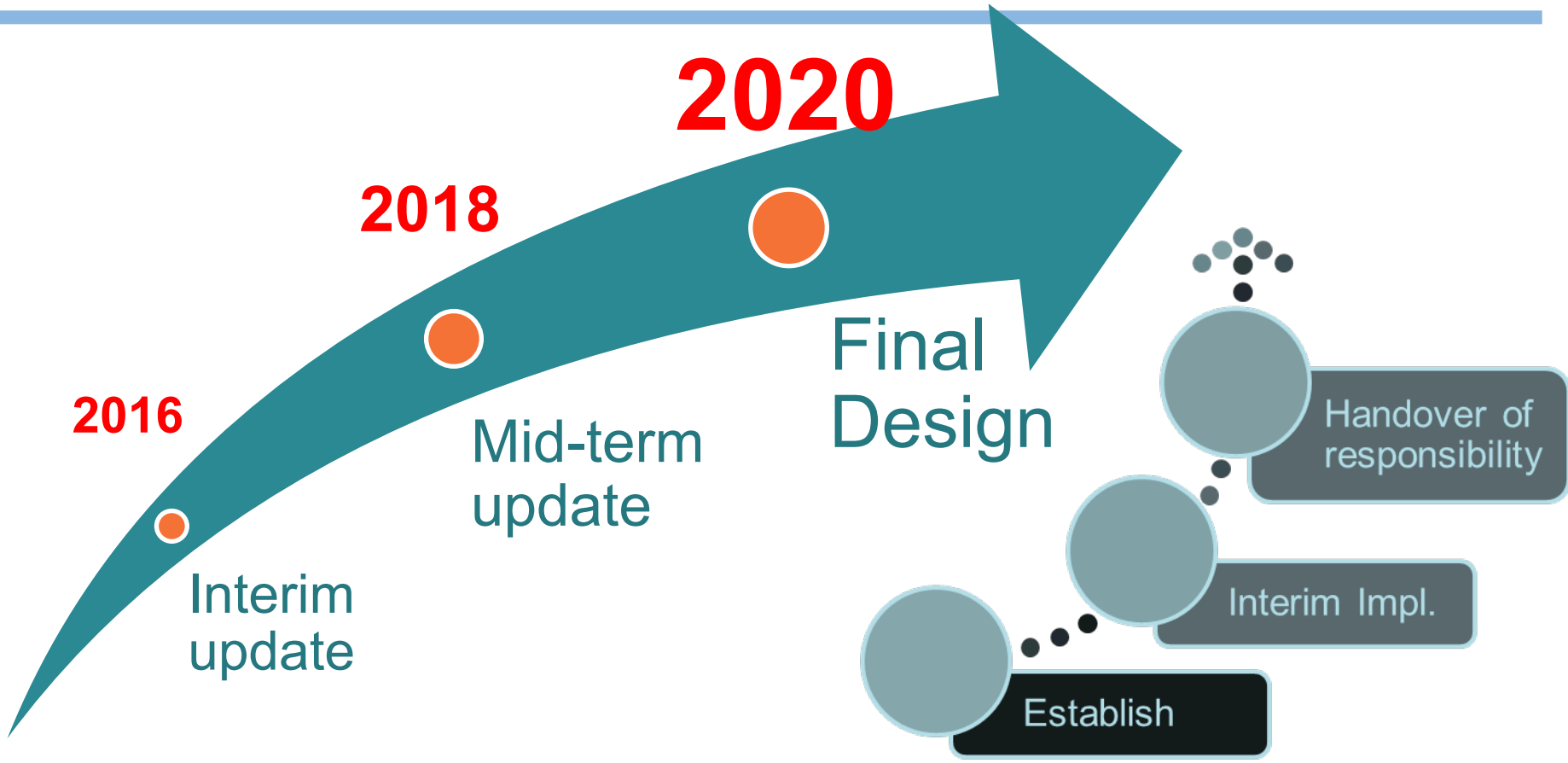
TPOS 2020 will support limited-term process studies to support model development

How can we best use evidence-based system design, and how can we measure success?

- OSEs: "Many lives of an observation" (Balmaseda, 2014)
  - Calibration of Satellite retrievals
  - Model development, tuning, initialization, verification
  - Trend detection
  - Underpin evolving climatologies
  - Process diagnosis

- A typical OSE that tests only the initialization step is not a full evaluation, and the results depend on the particular model and its biases.
  - How can TPOS use OSEs to assess array configurations?
  - Data-based objective techniques to integrate global high-horizontal-resolution satellite data (SST, SSH) with sparse in situ profiles?
  - "Armor3D": Satellites provide mesoscale, in situ tunes for vertical structure and large-scale.

TPOS 2020: TRANSITION



TPOS 2020 Transition Team → Permanent Coordination Mechanism

Next Evaluation Activity:

BOUNDARY CURRENTS AND THEIR INTERACTION WITH THE SHELF

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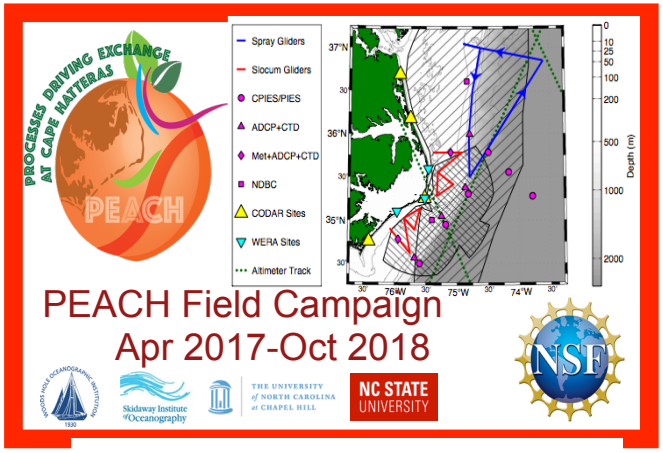
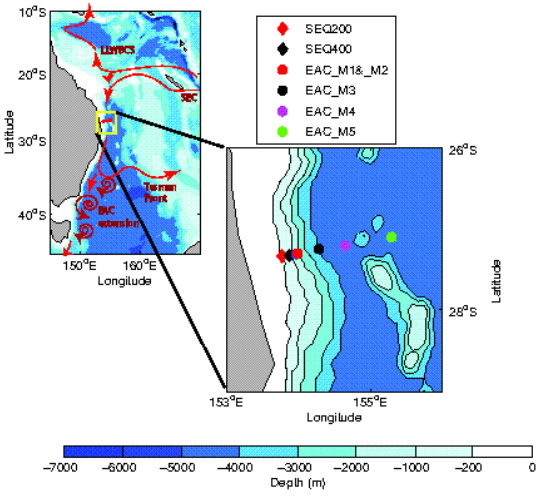
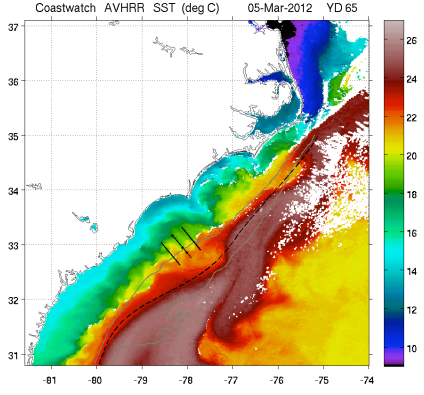
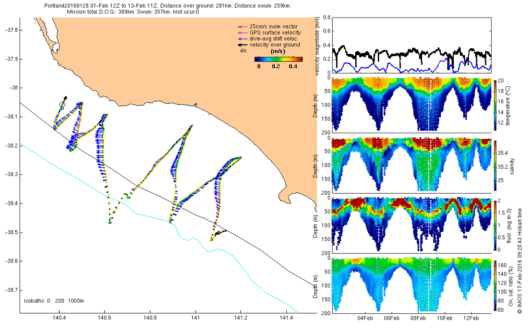
BOUNDARY CURRENT / SHELF SEA INTERACTION: INTEGRATING OCEAN OBSERVATIONS ACROSS THE COASTAL SHELF BOUNDARY

- The proximity of energetic boundary currents at the shelf edge a key dynamic in mediating shelf-sea/deep-ocean exchange, and ecosystem response
- Boundary Current mass, heat and salt transports importance in basin-scale ocean budgets, and need sustained observation









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Boundary Current / Shelf Sea Interaction Evaluation: Rationale

- Comprehensive coastal observing systems could measure shelf-sea/open-ocean exchange in conjunction with networks that capture variability within BC regimes and the ocean interior.
- Regional activities around the world exploring multi-platform approaches to observing boundary currents/shelf interactions
- Many core networks considering their capability to measure Boundary Current regimes, i.e. Argo, OceanSITES, Ocean Gliders, etc Need to assess multiplatform approach.
- Downscaling climate models: Need observations to assess veracity
- 3-D time-varying data assimilative model based circulation estimates in shelf and BC regimes at o(km) scales are in reach: Need observations to synthesize through DA system

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BOUNDARY CURRENT / SHELF SEA INTERACTION
INTEGRATING OCEAN OBSERVATIONS ACROSS THE COASTAL SHELF BOUNDARY

AGU Ocean Sciences session:

- Sampling of Coastal Seas / Deep Ocean Connection studies
- Discussed science questions and drivers, uncertainties, observing requirements, gaps to address
- Demonstrated “realistic” and idealized modeling approaches to building process understanding
- Highlighted increasing use of integrated observing technologies, but also the present limits to the extent of observing system

Next? Workshop on Boundary Current / Shelf Sea Interaction

- Recommendations on intensive international pilot process experiments in specific boundary current/shelf-sea regimes that will guide the development of a sustained observation and modeling system
- Improved techniques for downscaling climate models, and including adequate representations of higher frequency, smaller scale processes that drive coast and shelf dynamics and ecosystem response.

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Questions?

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