

The Framework for Ocean Observing: Best Practices for the Global Observing System



My apologies for not attending. I would love to be there! Some temporary health issues have prevented me from travelling. Best of luck for the conference in Yeosu!

Eric Lindstrom
NASA Headquarters

and

John Gunn

Australian Institute of Marine Sciences

and

Albert Fischer

Intergovernmental Oceanographic Commission

and

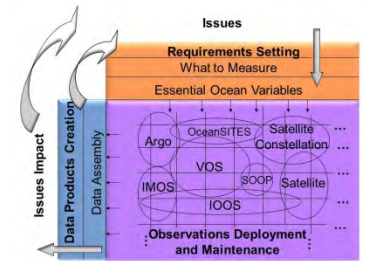
Andrea McCurdy Consortium for Oceanleadership

and

Candyce Clark US National Oceanic and Atmospheric

Framework for Ocean Observing

OUTLINE



- Where are we with ocean observations today?
- OceanObs'09 and the motivation for a new way of thinking
- Framework for Ocean Observations
- Conclusion
- Charge to W1 – Friday 18 May – *all invited!*

The Global Ocean Observing System (GOOS)

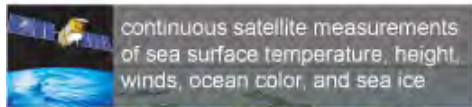


- the system GOOS
 - **collaborative system of sustained observations**
 - built on requirements
 - in situ and satellite
 - operational and research funding
 - linked to data management and product generation activities
 - global-scale and coastal
- the GOOS programme
 - advocacy for all elements of the system
 - provide a **platform for collaboration**
 - promote **global participation**
 - animating Framework for Ocean Observing processes
 - in **collaboration** with other partners, adapting structures in stable and stepwise way, assessing and encouraging the readiness of components
 - **integrating** new observations while **sustaining** present ones

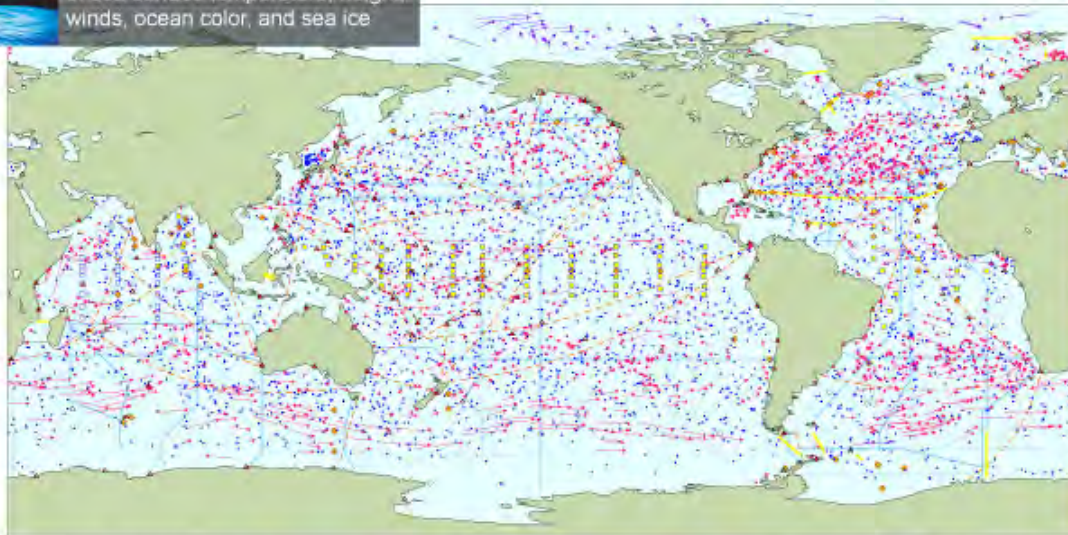


Ocean observing system for climate – drawing from best practices

Requirements for Essential Climate Variables



Total *in situ* networks **62%** December 2011



Transport monitoring

48%



29 sites

Global time series network

34%



58 moorings planned



Global tropical moored buoy network

79%



119 moorings planned



100% Surface measurements from volunteer ships (VOS)

250 ships in VOSclim pilot project



100% Global drifting surface buoy array

5° resolution array: 1250 floats
ice buoys



66% Tide gauge network (GCOS subset of GLOSS core network)

170 real-time reporting gauges



81% XBT sub-surface temperature section network

51 lines occupied



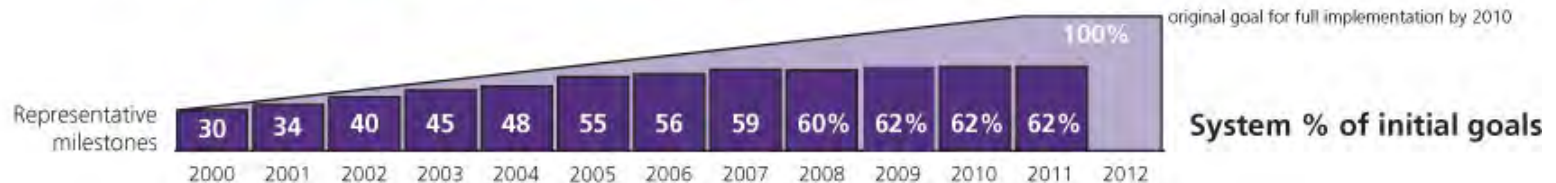
100% Argo profiling float network

3° resolution array: 3000 floats



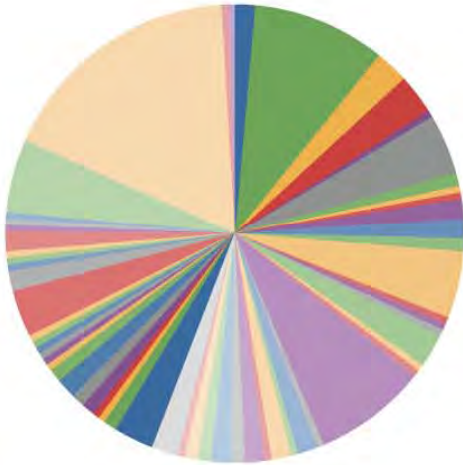
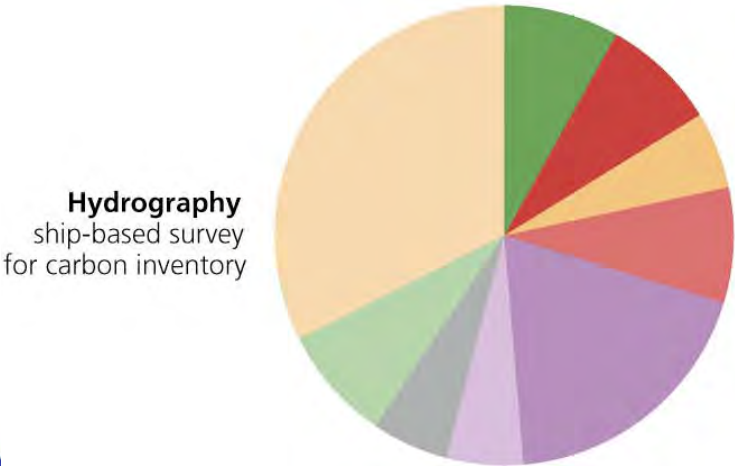
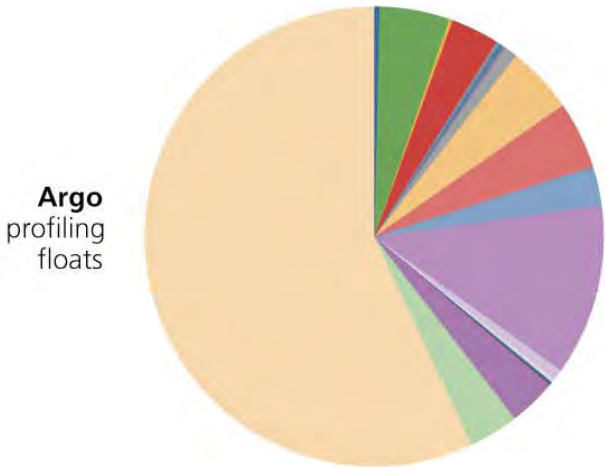
62% Repeat hydrography and carbon inventory

Full ocean survey in 10 years



GOOS for climate

global participation varies by network



- ARG
- AUS
- BRA
- CAN
- CPV
- CHL
- CHN
- COK
- CRI
- DJI
- ECU
- EUR
- FSM
- FJI
- FRA
- DEU
- GHA
- HKG
- IND
- IDN
- IRL
- ISR
- JPN
- KEN
- KIR
- MYS
- MDV
- MNP
- MHL
- MUS
- MEX
- MOZ
- MMR
- NRU
- NLD
- NZL
- NOR
- OMN
- PAK
- PLW
- PAN
- PNG
- PER
- PHL
- PRT
- RUS
- STP
- SEN
- SYC
- SGP
- SLB
- ZAF
- KOR
- ESP
- LKA
- SWE
- TZA
- THA
- TGO
- TON
- TUV
- GBR
- USA
- VUT
- VNM

OceanObs'09

Ocean information for society: *sustaining the benefits, realizing the potential*



Alberto Piola, Susan Wijffels, Ray Schmitt, and Anny Cazenave in Session 2A



Conference co-chairs Julie Hall, Ed Harrison, and Detlef Stammer



Patriocio Bernal, Executive Secretary of the IOC, opens the conference

Why a Framework? (www.oceansobs09.net)

- OceanObs'09 identified tremendous opportunities, significant challenges
- Called for a **framework for planning and moving forward with an enhanced global sustained ocean observing system over the next decade**, integrating new physical, biogeochemical, biological observations while sustaining present observations

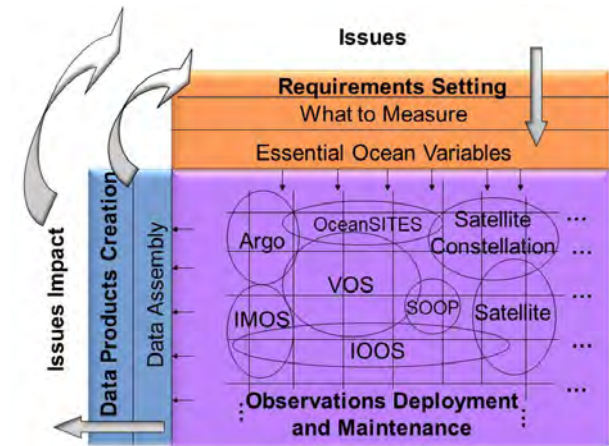
Sponsors and Task Team

Keith Alverson, Bee Berx, Peter Burkill, Francisco Chavez, Dave Checkley, Candyce Clark, Vicki Fabry, Albert Fischer, John Gunn (co-chair), Julie Hall, Eric Lindstrom (co-chair), Yukio Masumoto, David Meldrum, Mike Meredith, Pedro Monteiro, José Mulbert, Sylvie Pouliquen, Carolin Richter, Sun Song, Mike Tanner, Martin Visbeck, Stan Wilson

- **IOC** Intergovernmental Oceanographic Commission of UNESCO
- **GEO** Group on Earth Observations
- **CEOS** Committee on Earth Observation Satellites
- **POGO** Partnership for Observation of the Global Oceans
- **SCOR** Scientific Committee on Oceanic Research
- **SCAR** Scientific Committee on Antarctic Research
- **GCOS** Global Climate Observing System
- **GOOS** Global Ocean Observing System
- **JCOMM** Joint WMO-IOC Tech. Comm. for Oceanography and Marine Meteorology
- **PICES** North Pacific Marine Science Organization
- **ICES** International Council for the Exploration of the Sea
- **CoML** Census of Marine Life
- **IGBP** International Geosphere-Biosphere Programme
- **WCRP** World Climate Research Programme

Framework for Ocean Observing

Key Concepts of the Framework



- Articulates ‘**best practices**’ based on a ‘**systems approach**’ for building an interoperable system

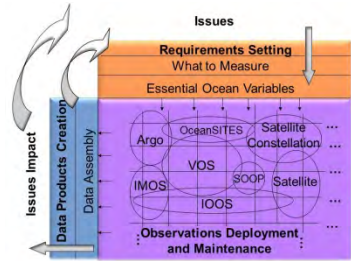
- Establishes “**Essential Ocean Variables (EOVs)**” as basis for aligning elements of the system.

- Proposes an approach to introducing new components of the system through “**Readiness Levels**”

- Argues that an “**Integrated Observing System**” will be a derivative of the Framework processes.

Framework for Ocean Observing

Boundaries of the Framework



Outside the Framework

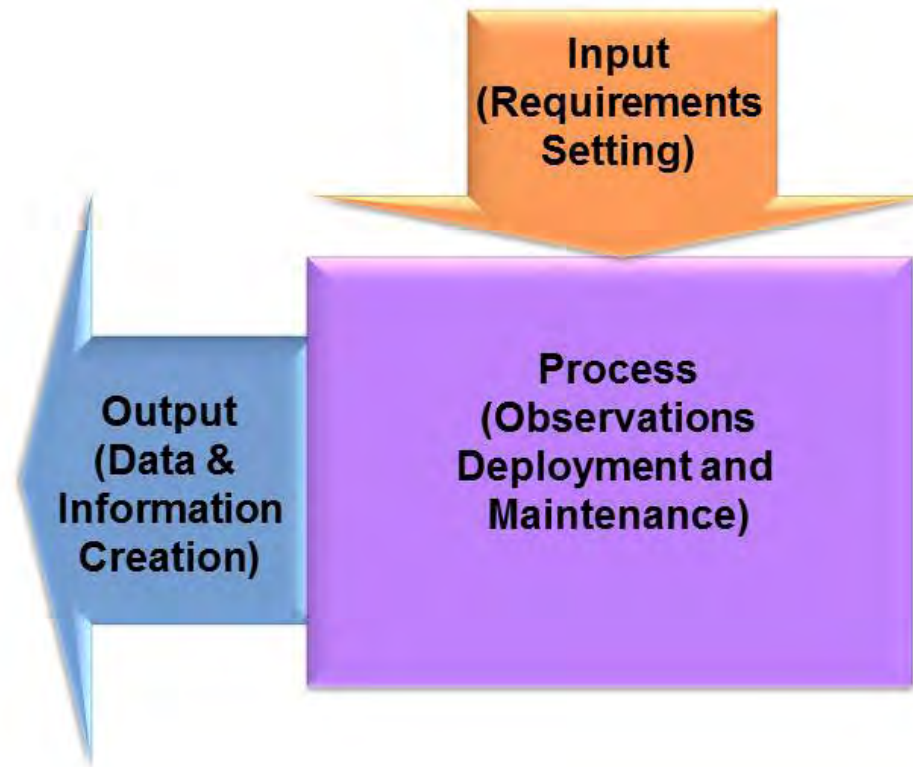
- Quantitative Analysis
- Application of Science to Societal Issues

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- Qualitative Analysis
 - Policy Questions

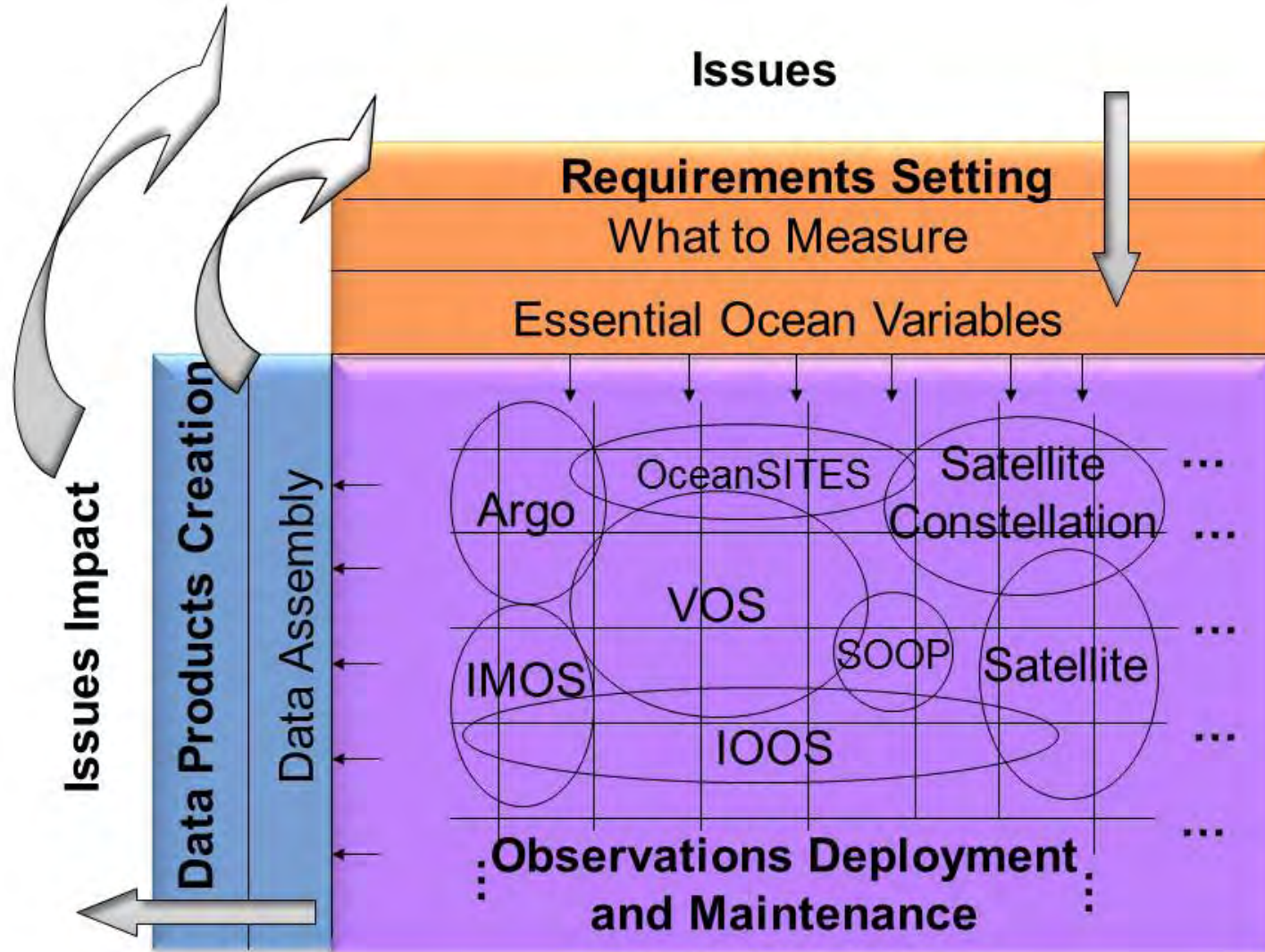


Framework for Ocean Observing

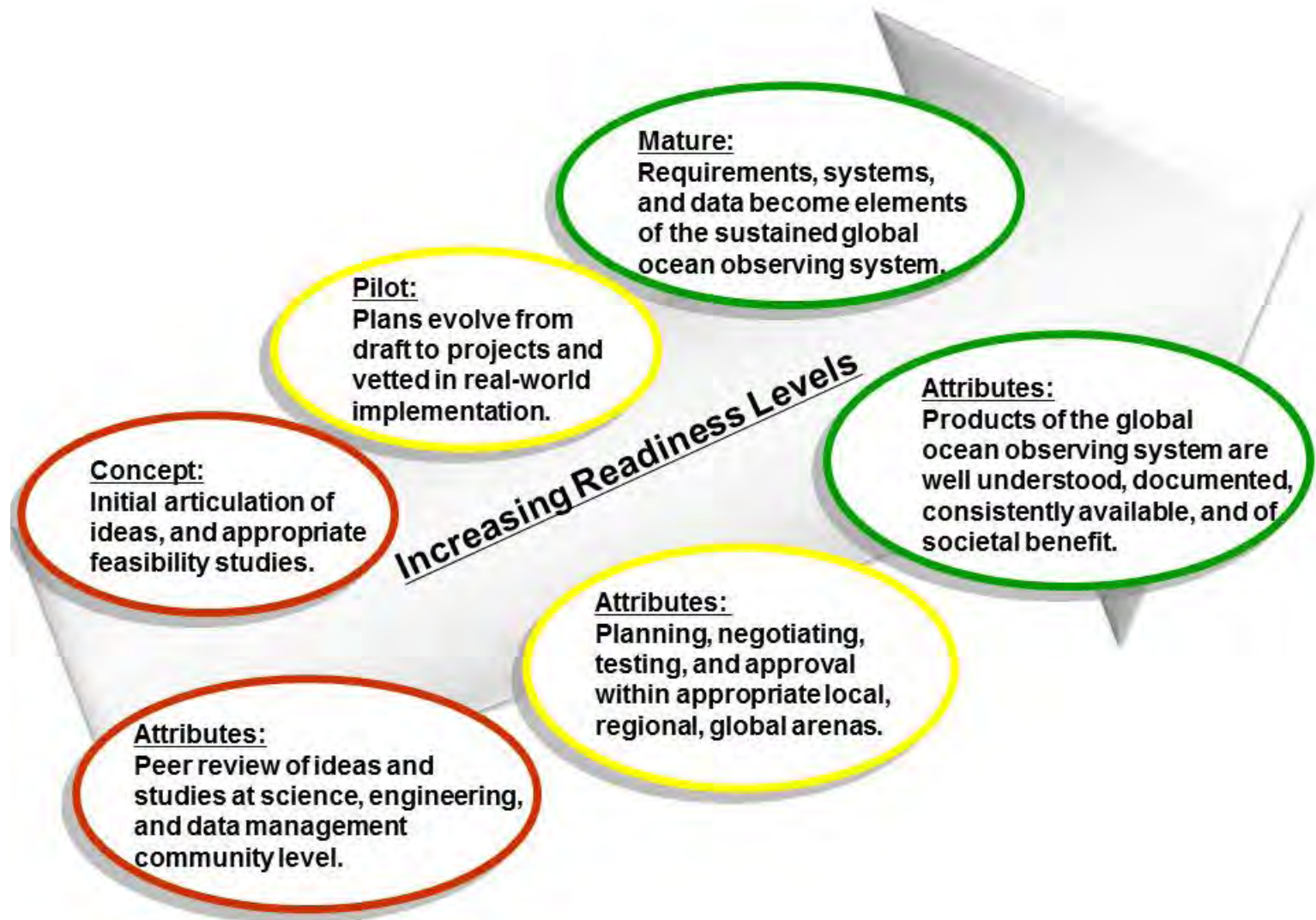
A Simple System



Structure of the Framework



Framework for Ocean Observing Readiness Levels



Highest
Readiness
Level

Requirements

Observations

Data & Information

Mature

- Requirements: Sensors & Scales
- What to Measure: Essential Ocean Variables

Pilot

- Observations: Facilities & Management
- Data: Infrastructure & Assembly Centers
- Information: Products and Services

Concept

Lowest
Readiness
Level

Highest
Readiness
Level

Requirements

Mature

- Sustained implementation and under periodic review
- Mission qualified at regional and/or global scale
- Consensus on observation impact or fitness-for-purpose

Pilot

- Deployment in an operational environment
- Verification of the spatial and temporal sampling strategy
- Measurement strategy verified by sea trial

Concept

- Proof-of-concept determined via feasibility study
- Measurement strategy documented
- Environment information identified

Lowest
Readiness
Level

Highest
Readiness
Level

Observation Deployment & Maintenance

Mature

- System is sustainable globally and under periodic review
- Implementation details fully qualified
- Peer review and deployment demonstrate fitness-for-purpose

Pilot

- Maintenance and servicing logistics operationalized
- International commitments to sustaining components verified
- Trial project in an operational environment

Concept

- Operational, scalable, and technology proof-of-concept
- Observing platforms technology and design are documented
- Idea for measuring system is formulated

Lowest
Readiness
Level

Highest
Readiness
Level

Data Management and Products

Mature

- Sustained products available and under user group review
- Data globally available and of service to the community
- Data management and distribution determined to be fit-for-purpose

Pilot

- Data operational through system-wide availability and use
- Data and archival plans and practices verified
- Data management practices determined and tested for quality and accuracy throughout the system

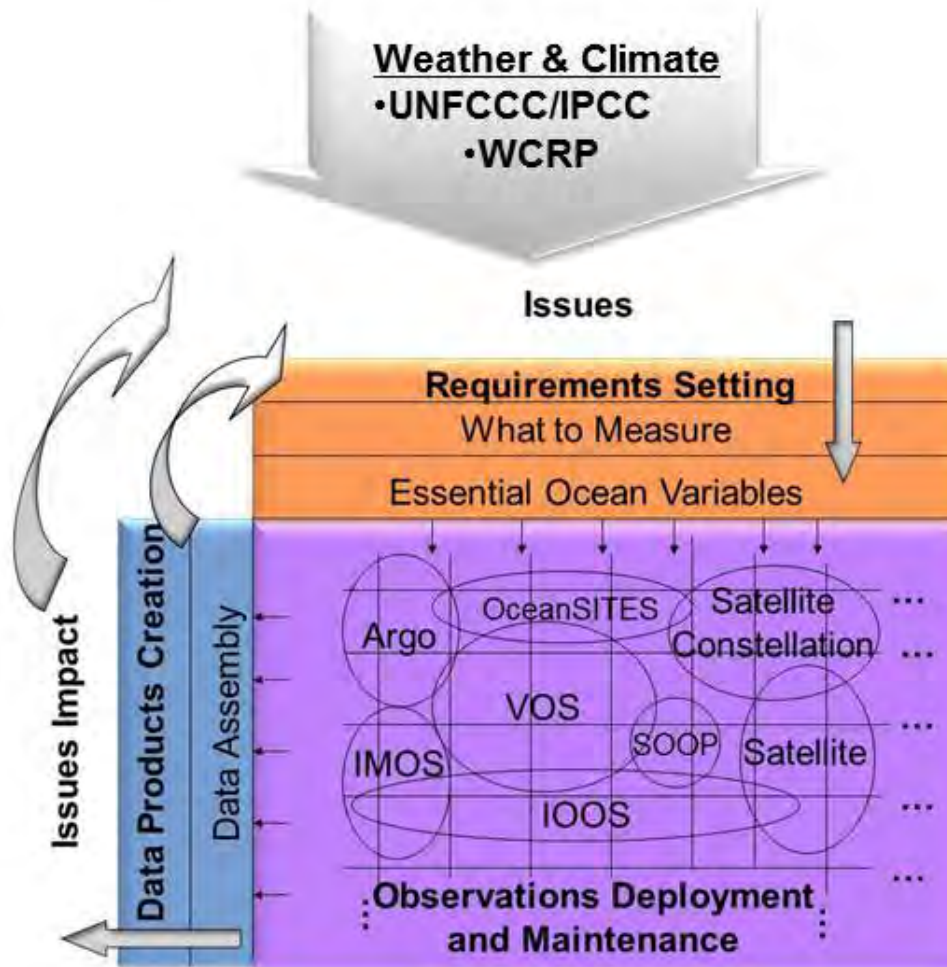
Concept

- Data model proven to meet observational needs
- Interoperability model is documented and socialized
- Data model is identified and articulated

Lowest
Readiness
Level



Framework: Societal Driver 2012



Framework: Societal Drivers Next Decade

Regional

- Regional Seas
- CCAMLR

Fisheries

- FAO
- RFMOs

Ecosystem services/

Biology

- CBD
- CSD
- WSSD

Assessments

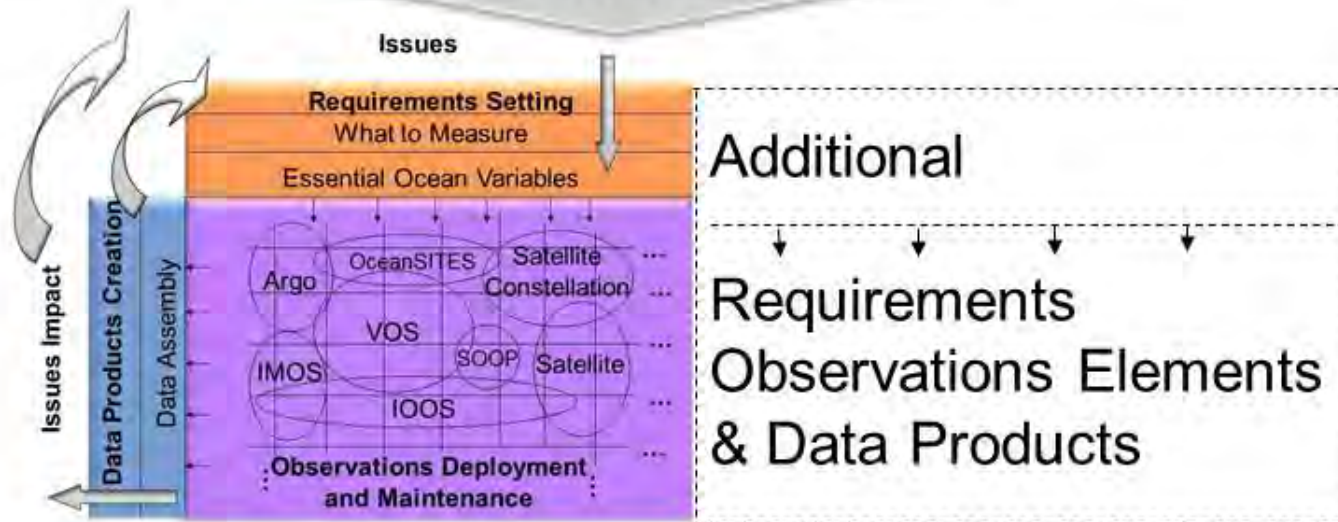
- Global Marine (UN)
- TWAP (GEF)
- Regional

Real-time services

- Emergency support
- Ocean forecasting

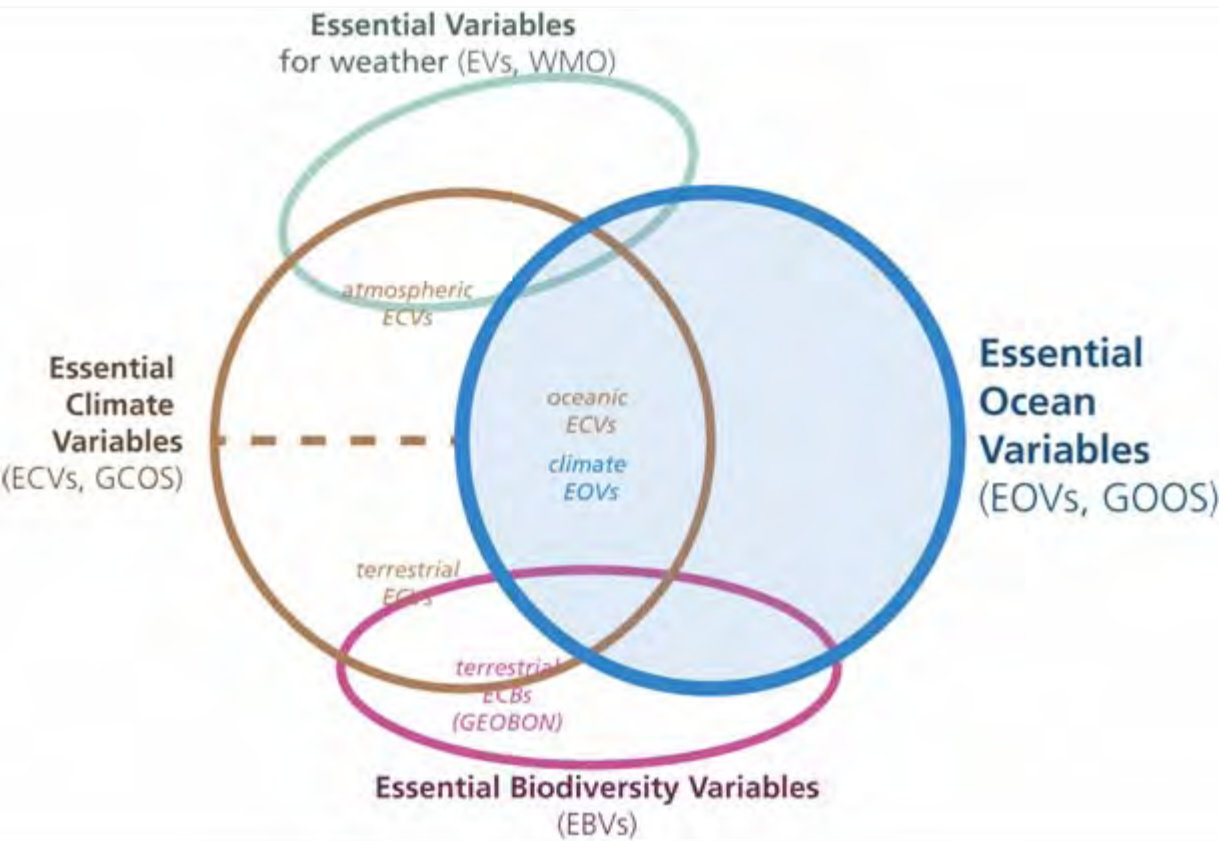
Weather & Climate

- UNFCCC/IPCC
- WCRP
- Climate services



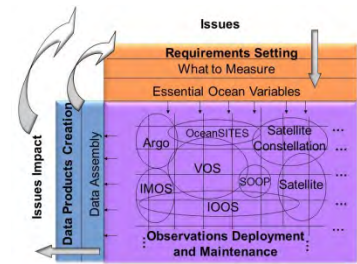
Driven by requirements, negotiated with feasibility

Essential Ocean Variables



- **We cannot measure everything, nor do we need to**
- Basis for including new elements of the system, for expressing requirements at a high level
- Driven by requirements, negotiated with feasibility
- Allows for innovation in the observing system over time

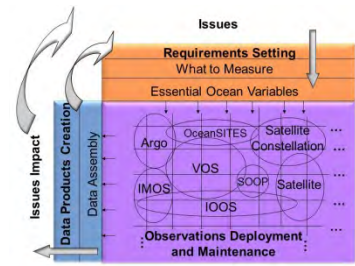
CONCLUSION



- New way of thinking and organizing
- Essential Ocean Variables (EOVs)
- Assessment of readiness
- Multi-disciplinary will lead to a wider set of products and services for community
- Charge for Workshop 1 – Friday 18 May

W1 Workshop: Ocean Observations: Strategic framework – Friday 18 May

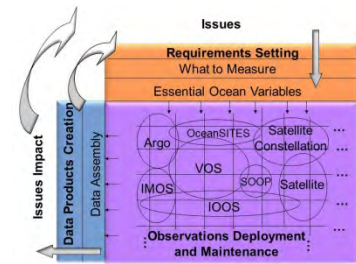
Chair: David CHECKLEY and Candyce CLARK



CHALLENGE TO PICES AND SESSION 2 PARTICIPANTS:

- What Essential Ocean Variables (EOVs) would you like to see?
- PICES should be involved in coordination and assessing requirements and fitness-for-purpose --- HOW?
- How to integrate new biogeochemical, biodiversity and ecosystem observations into a sustained observing system?
- Please come – early career scientists encouraged to come and shape the future!

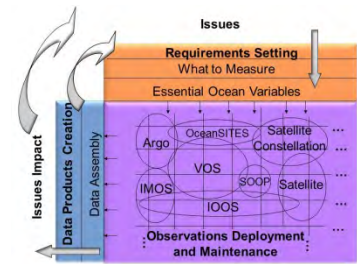
Characteristics



- **Common language and consistent handling** of requirements, observing technologies, and information flow among different, largely autonomous, observing elements
- Seeks to **support self-funding and self-managing elements**
- **Essential Ocean Variables** as common focus
- Assessment and promotion of **Readiness**
- Coastal and open ocean
- An “**Integrated Observing System**” will be a derivative of an EOV-based approach driven by requirements.

Back-up Slides

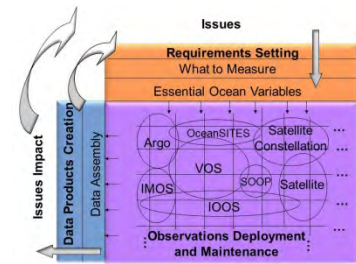
Stakeholders, Roles and Governance



- The Task Team considered several approaches for **governing** the Framework and agreed it must be:
 - **Characterized by Simplicity**
 - **Based on Functional Needs**
 - **Bring Stakeholders Together**
 - **Nominal Operating Costs**
- Requires **ongoing engagement** of international sponsors and other bodies comprised of:
 - **Oversight and Coordination Bodies**
 - **Expert Teams and Reviews**
 - **Implementation Plans and Teams**
- Recommends establishment of a **Framework Steering Group** representative of international sponsors of OO'09:
 - **Adopted by IOC, GOOS**
 - **First meeting in late June**

Framework for Ocean Observing

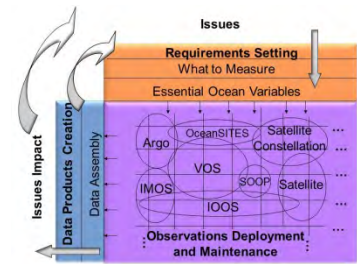
Benefits

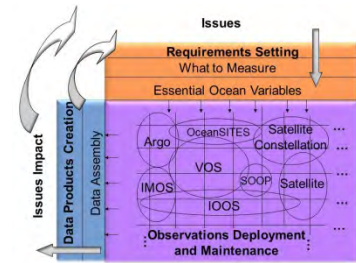


- For Ocean Observing Communities
 - **Focus on variables allows innovation**, research, while sustaining the key output of the observing system
 - Clear path to **selling utility** of observations to high level, articulation of societal importance
 - **Learn from** best practices and principles of **other observing systems**
 - **Reduce/remove duplication** of measurements
 - **Clearer entry points** for the needed coordination; cross-disciplinary positive **synergy**: shared platforms, data systems
 - Other **data** available to set your data in context

Requirements Setting within the Framework

Functional Groups	Primary Activity
Oversight Panel <i>(Oversight & Coordination)</i>	<ul style="list-style-type: none"> • Requirements • What to Measure • Variables (EOVs)
Expert Teams <i>(Expert EOV Review)</i>	<ul style="list-style-type: none"> • Sampling Requirements • Implementation Strategies
Implementation Communities <i>(EOV Implementation)</i>	<ul style="list-style-type: none"> • Feasibility Assessment • How to Measure



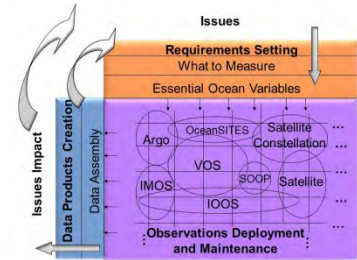


Observation Deployment & Maintenance within the Framework

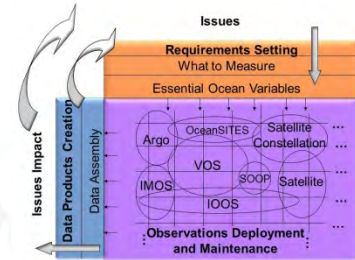
Functional Groups	Primary Activity
Oversight Panel <i>(Oversight & Coordination)</i>	<ul style="list-style-type: none"> • Governance • Deployment • Commitments
Expert Teams <i>(Expert EOVS Reviews)</i>	<ul style="list-style-type: none"> • Identify Synergies & Best Practices • Promote Standards • Technology Infusion
Implementation Communities <i>(Observing Element Teams)</i>	<ul style="list-style-type: none"> • Trade-Space Determination • Quality Control • Technology & Standards Maturation • International Cooperation

Data & Information Creation within the Framework

Functional Groups	Primary Activity
Oversight Panel <i>(Oversight & Coordination)</i>	<ul style="list-style-type: none"> • Feedback Into Requirements • Process & Validation of Requirements
Expert Teams <i>(Expert EOVS Reviews)</i>	<ul style="list-style-type: none"> • IT & Data Management Teams (Global, GTS, CEOS) • Latency, Aggregation • Promotion of Standards & Interoperability
Implementation Communities <i>(Observing Element Teams)</i>	<ul style="list-style-type: none"> • Verification and Validation • Definition & Data QC • Product Development



Governance Structure for Sustained Global Ocean Observing



Framework Steering Group Members / Appointed by Sponsors

- | | |
|-------------------------------------|--|
| Oversight & Coordination | <ul style="list-style-type: none"> • Management • Review/Development of Requirements • Convention Negotiation • Facilitate Community-wide Coordination and Alignment • Endorsement of Mature Elements |
|-------------------------------------|--|

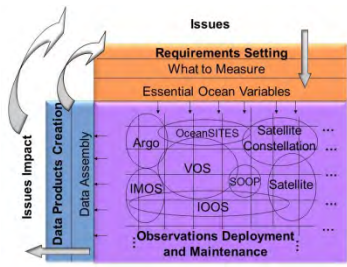
Ocean Observing Panels / Appointed by Steering Group

- | | | |
|--|---|--|
| <p>Physical Panel</p> <ul style="list-style-type: none"> • Build on OOPC | <p>BioGeoChem Panel</p> <ul style="list-style-type: none"> • Build on IOCCP and related projects | <p>Bio/Ecological Panel</p> <ul style="list-style-type: none"> • Could draw on PICO Plan |
| <p>Expert Reviews</p> | <ul style="list-style-type: none"> • Develop new EOVs • Articulate Best-practices • Assess Readiness Levels • Review and ensure fit-for-purpose system outputs among EOVs • Develop Implementation Strategies • Coordinate National, Regional, Local Activities | |

EOV Expert and Implementation Teams / Identified by Steering Group & Panels

EOVs: SST / Sea Level / pCO₂* / Plankton* / Alkalinity* / Transport* / Other* (*-potential)

- | | |
|--------------------------------|---|
| Observing Element Teams | <ul style="list-style-type: none"> • Improve Readiness Levels (Design Pilots, New Products) • Develop Implementation Plans • Improve Literacy (Train experts, Educate Users, Facilitate Integration) • Coordination |
|--------------------------------|---|



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