Observing System Capabilities -- Gap Assessment and Design

Prerequisites of design process

- Clear vision, priorities and requirements – not easy, especially across all scales
- Some commonalities across scales – most obvious is core/essential variables list
- Can then translate priorities into requirements for each variable; reconciling multiple requirements challenging

Steps towards design

- Census of observing system components – what existing systems will 'commit' to being part of IOOS?
- Gap assessment – what's missing in present system to be able to satisfy the requirements? Need to define adequacy when multiple requirements exist – balance of costs, priorities, time frame

Design process

- Should blend expert knowledge and more objective assessment
- Complexity demands ongoing design and evaluation
- Numerous existing quasi-independent observing programs suggests a System of Systems design approach is needed, highlights need for interoperability between subsystems at all scales.

Overarching Issue Challenges

- Short-term. Are core/essential variables the right way to bridge across the various scales (global/national/regional) of U.S. IOOS? Which subset of variables provides the most benefit in connecting across the scales of observing efforts?
- Longer-term. How might a SoS approach improve U.S. IOOS efforts in: Interoperability? Best practices? Standards? Community models/components?

OBSERVING SUBSYSTEM

Observing Subsystem - Status

- Many observing programs exist, internationally, nationally, regionally and locally
- Ships: critical sampling platform and support for autonomous platforms
- In-situ platforms: buoy/mooring arrays, drifters, profiling floats most developed; gliders increasingly important; others
- Remote sensing: satellite systems mature; sub-orbital, land-based increasingly important

Observing Subsystem – gaps

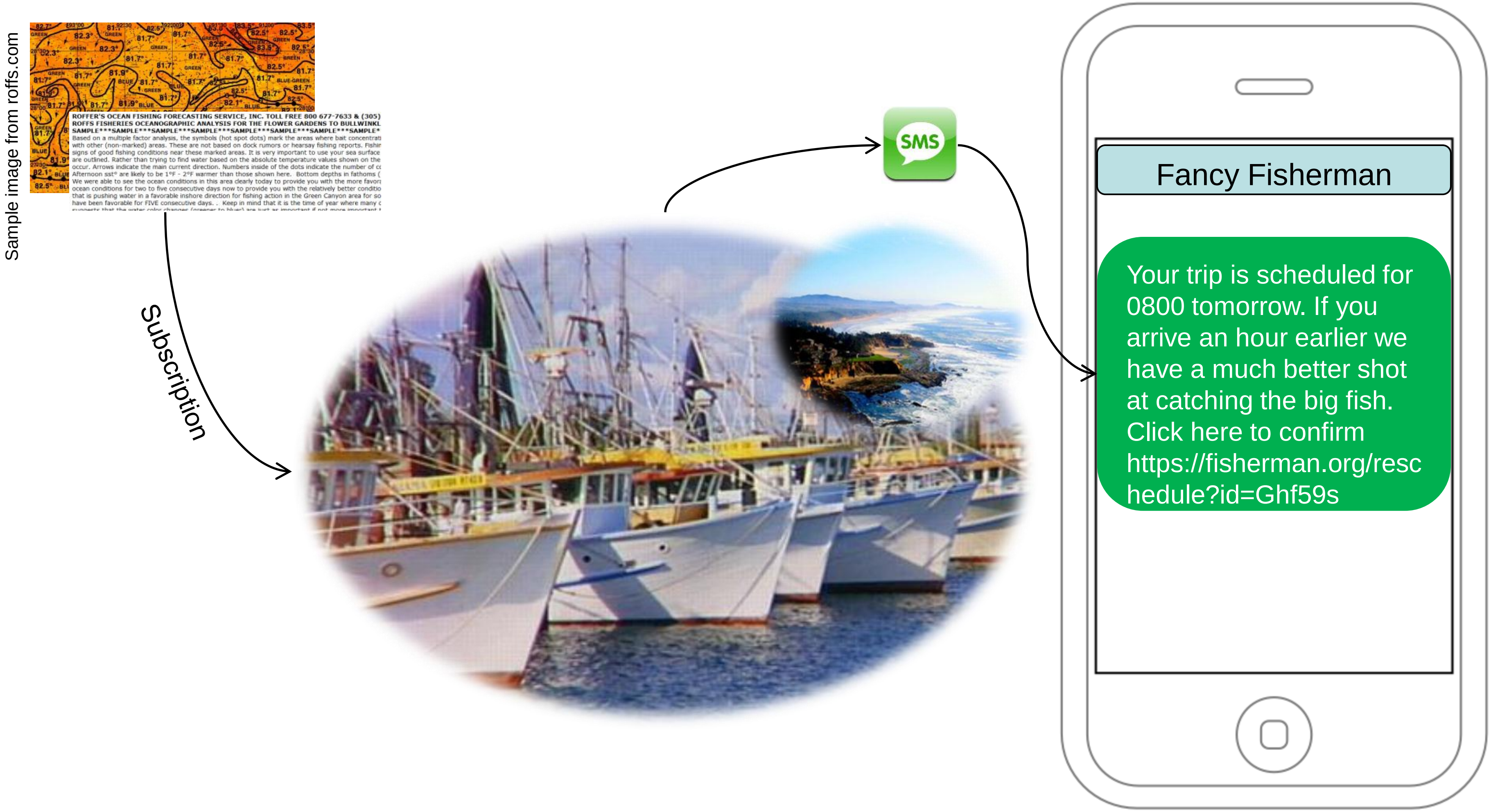
- Many gaps can be identified: deep ocean measurements; under ice; coastal winds; repeat coastal spatial surveys; automated fisheries assessments; biogeochemical variables in general,…
- Gaps exist and can be filled in in-situ and remote sensed networks
- Technology on-ramp gap: dual use in both research and operations

Observing Subsystem Challenges

- How is adequacy of existing observing assets best assessed and gaps best defined? Should it be done by variable? By priority? By geographic location? Some mix of these? Who/how? What is the national process for doing this?
- How should the technologies to fill gaps be identified? Should we advocate for standards or common practices across scales as a way to improve efficiency and reduce cost? Or will this stifle innovation?
- How do we promote bringing new technologies into IOOS while maintaining an operational output?
- Given a large gap in biogeochemical and ecosystem automated observing, should a dedicated effort be made to advance these technologies?

DATA MANAGEMENT AND COMMUNICATIONS

The year is 2022…



Services, services, services. Who has responsibility for distributing data?

- Observing System Operators/Data Providers
- Data Assembly Centers (Regional/Thematic?)
- Archives
- Modeling Centers
- Anyone really,

The Smithsonian/NASA Astrophysics Data System

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The Unified Access Framework (UAF) guide to building an interoperable gridded data service in about 15 minutes

O'Brien, K.; Austin, M.; Casey, K. S.; de la Beaujardiere, J.; Habermann, T.; Hankin, S. C.; Koyuk, H.; McCulloch, L.; Mendelssohn, R.; Rutledge, G. K.; Signell, R. P.

American Geophysical Union, Fall Meeting 2011, abstract #IN34A-02

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DMAC - gaps

- Ongoing discussion of the structure and responsibilities of Data Assembly Centers including relationships to Archive Centers
- Commitments and prioritizing build out (Regional DACs on board, what are our expectations of the large federal systems?)
- Interoperability – must be true for all subsystems but relies on clear definition within DMAC
- Adequacy – what are realistic expectations of the subsystem? Much exists now.

DMAC Challenges

- Explore the number, type, and functionality of DACs needed to support the IOOS DMAC Subsystem.
- Encourage closer coordination between Regional Associations and the data centers in Federal agencies.
- Make Web services distribution the primary standard for disseminating IOOS information.
- Adopt Quality Assurance of Real-Time Ocean Data (QARTOD) as a starting point for QA development within U.S. IOOS
- Improve and formalize processes for collecting and prioritizing data requirements, and assessing progress against the core variables.

MODELING AND ANALYSIS

Analysis, modeling and applications: status

- Significant advances have made modeling pervasive in coastal research, emergency response, decision making (grids, cpus, numerics, bcs, forcing, dynamic, paramerizations, DA)
- One advance deserves special attention: the ability to measure the impact of observations on performance (e.g impact of glider vs. mooring)
- Advanced 3D & 4DVAR forecast systems are now being used in several regions
- IOOS sponsored modeling testbeds have helped advance metrics, paramerizations, best approaches for specific environmental/regional issues. (and unexpected benefits in R2O, O2R)

Analysis, modeling and applications: gaps

- We don't have a system view that fuses modeling and observations (modeling viewed as a downstream activity)
- Few regions have defined priorities in terms of performance metrics or used models to assess or optimize the observing system
- IOOS-sponsored modeling testbeds have been limited regionally and functionally
- We do not have a IOOS/US/GOOS modeling plan

Analysis, modeling and applications: challenges

- How to expand testbed activity?
- How do we best spread best tools and techniques to other regions?
- How to make an IOOS/US/GOOS modeling plan?
- Can we evolve IOOS toward optimal system design, driven by regionally-defined societal needs specified in terms of performance metrics, and taking into consideration limited observational and computational resources?

Analysis and applications: Challenges

- Should analysis of ocean state be a funded, ongoing activity?
- Should application development be a funded, ongoing activity?