Toward a Revised RCOOS Plan for SECOORA

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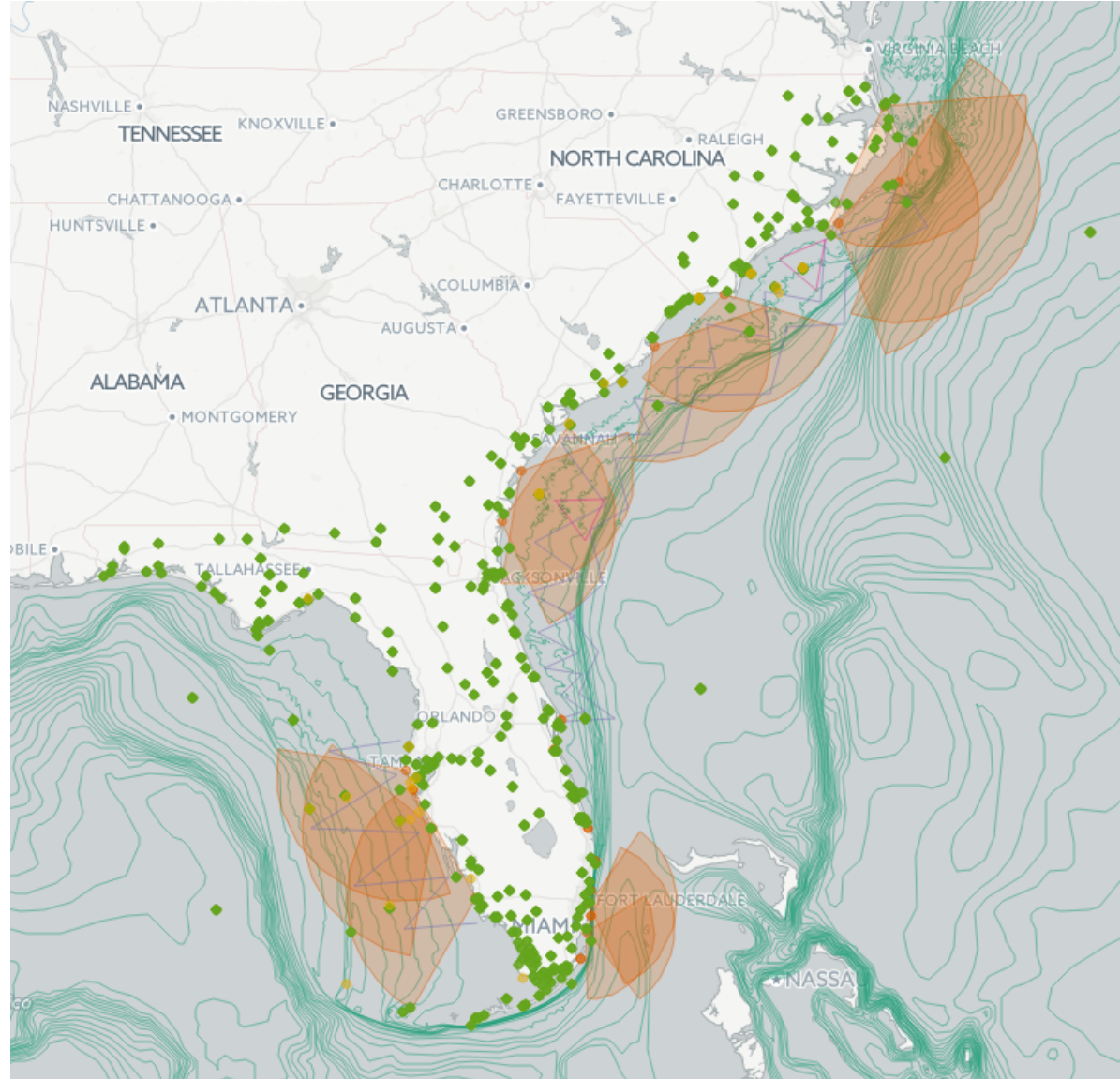
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Axiom Gap Filling Tool

Kyle Wilcox (kyle@axiomdatascience.com)
https://secoora.github.io/secoora-point-editor/docs/

Goal

Develop a complete build out plan for a SECOORA RCOOS.

Steps to achieve the goal

1. Map out the SECOORA vision for Coastal stations, Moorings, HF-radar, Waves, Gliders/Profilers and coordinated Simulation Models, with each of these elements supported by concise scientific justifications. Note that the national plans will be the starting point for the HF-radar and Wave plans.

2. Cost out each of the elements.

3. Prioritize the build out so that SECOORA can approach this in a unified, agreed upon manner.

WFS Design Example

Mooring Design Rationale:

- Span dynamically defined regions: 1) the inner shelf (interacting surface and bottom Ekman layers, or effectively out to ~the 50m isobath), 2) the outer shelf (a baroclinic Rossby radius of deformation in from the shelf break ~20-30km) and 3) the nearshore (river/estuarine influence).
- Maximize spatial coverage for winds (an hexagonal array, versus lines).
- Occupy sensitive regions within the above context of the array.
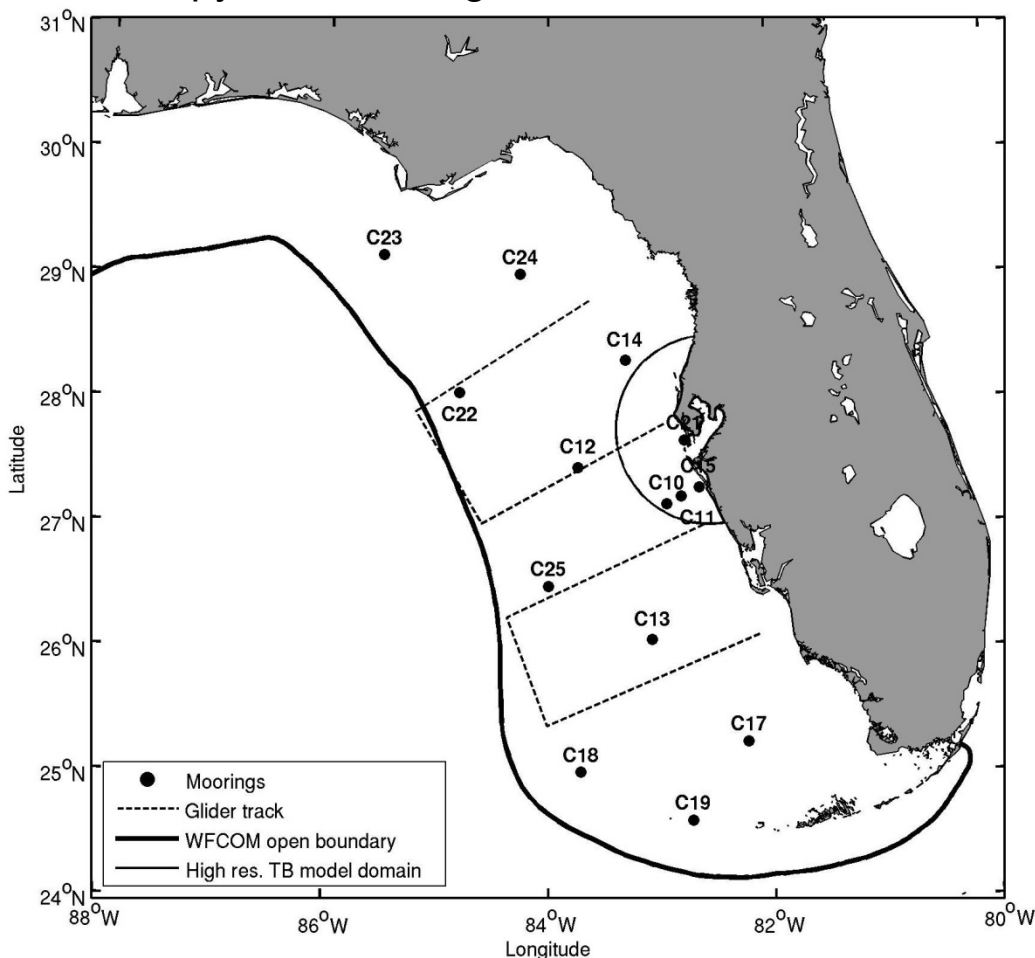
Model Design Rationale:

- Coastal ocean models (e.g., WFCOM) that downscales from the deep-ocean, across the continental shelf and into the estuaries.
- Higher resolution estuary models that nest into WFCOM.
- Both coastal ocean and estuary models require a data assimilative, deep-ocean model to accurately provide open boundary values (e.g., SABGOM, HYCOM).
- Coupled wave, sediment, biological modules embedded in coastal ocean and estuary models.

WFS Design Example Continued

Additional considerations:

- Robust instrumentation exists for physical variables, not so much for biological variables. We must accommodate both to build a multidisciplinary array, but we need to start with what we can do now, adding sensors as they become available, versus waiting.

- But note that numerical weather prediction requires 7 variables. Ocean circulation prediction requires 5 variables. It is impossible to predict non-conservative biological processes without first getting accurate circulation fields. Even with accurate circulation, the simplest biological prediction (e.g., primary productivity) requires a minimum of 4 more state variables, and such a model is useless for HABs. In other words, *prognostic* biological models are unlikely to ever be successful unless we can simplify them. This is our approach for the WFS.

- All models require accurate wind forcing. Marine weather forecasting is limited by a lack of offshore wind observations, hence the need for more buoys. NWS will benefit from more observations to assimilate into numerical weather prediction models, NOS will benefit from improved forcing functions for coastal ocean circulation and ecological models and NMFS will benefit from better circulation fields to determine fisheries-related water properties. Thus a well-designed coastal ocean buoy program provides a foundation and a broad-based justification for coastal ocean IOOS.

- Glider and profiler deployments should maximize coverage of regions both:
    - Known to be important for transporting water properties across the shelf, and
    - Known to be manifestation regions of ecologically important processes.

WFS Prioritization Example

WFS highest priority mooring and glider additions:

- *The highest priority mooring addition* is the blue triangle just inside of the shelf break to the north of the Dry Tortugas. We refer to this as the WFS "pressure point." What happens here governs WFS ecology because Loop Current interactions at the "pressure point" set the entire WFS in motion, thereby determining whether the WFS will be oligotrophic, or not. Knowing that models are often incorrect, this remote forcing region must be monitored.

- *The second highest priority mooring addition* is the blue triangle just inside of the shelf break in the Big Bend region. This is where new, inorganic nutrient-rich waters of deeper-ocean origin upwell across the shelf break in response to "pressure point" forcing, and it is adjacent to the Steamboat Lumps protected area. This is also where we want to add out first (near bottom) nutrient sensor.
- *The highest priority glider addition* is the red hourglass. This is thought to be the formative region for *K. brevis* red tide, and it also covers the pathway to the nearshore for new water upwelled across the shelf break and for the material properties transported by this water (e.g., *gag* and other fish larvae).
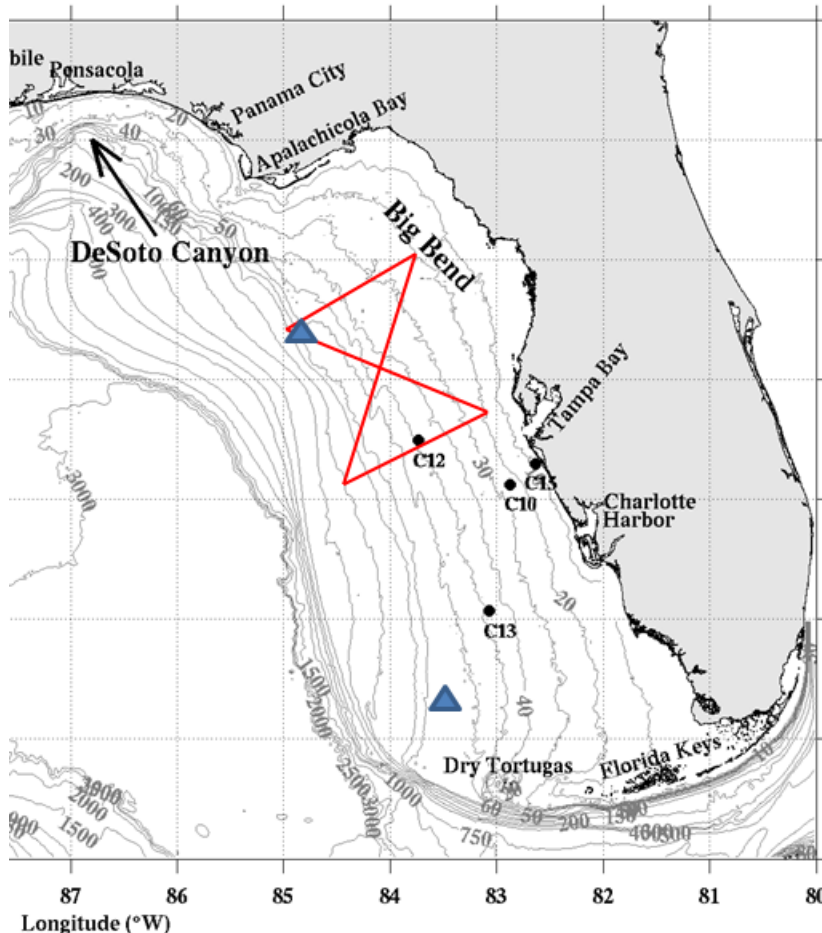
Prioritization within SECOORA

- Whereas individual sub-regional prioritizations may be straight-forward, prioritization within SECOORA will be more difficult.

- Implementation presumes increased budget allocations for SECOORA, either through external fund raising, or through federal/state/local awards.

- Prioritizations within SECOORA will be a moving target because sub-regional successes external to SECOORA may result in unequal opportunities/distributions.

- Regardless, we should be able to arrive at an understanding of equitable allocation under SECOORA funding alone.

- At the very least, by having a scientifically justified and prioritized implementation plan that benefits all stakeholders, we will be able to market this as a unified group. So long as we know that we will all get equitable SECOORA distribution based on justified needs, we may argue as forcefully for each other as we may for ourselves, thus achieving a unified voice in advancing a SECOORA RCOOS.