

CoPe Scoping session: **HUB for Science of Episodic and Extreme Events**

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*Idea in a nutshell*

Our recommendation is to create a HUB to standardize data collection, coordinate and mobilize responses, fill in knowledge gaps, and foster research on coastal episodic and extreme events. This HUB will be focused on facilitating rapid, proactive and interdisciplinary science research.

*What is your specific, differentiated recommendation?*

We recommend development of a centralized HUB focused on data collection and basic science related to episodic and extreme coastal events. Episodic and extreme events are defined as any high-impact environmental, social, economic, or ecological events that include sudden onset and large changes to one or more key systems within the coastal environment. We envision a single national hub that is exclusively focused on extreme and episodic events rather than this being a topic handled by multiple hubs. The complexity of adequately addressing this problem and the need for developing an understanding of drivers of resistance and resilience for coastal communities via this HUB requires this targeted approach. Comprehensive monitoring includes across systems (physical, biological, social), standardization across locations and events, and through time to capture baseline conditions, event impact, and both short-term and long-term recovery dynamics (Fig. 1).

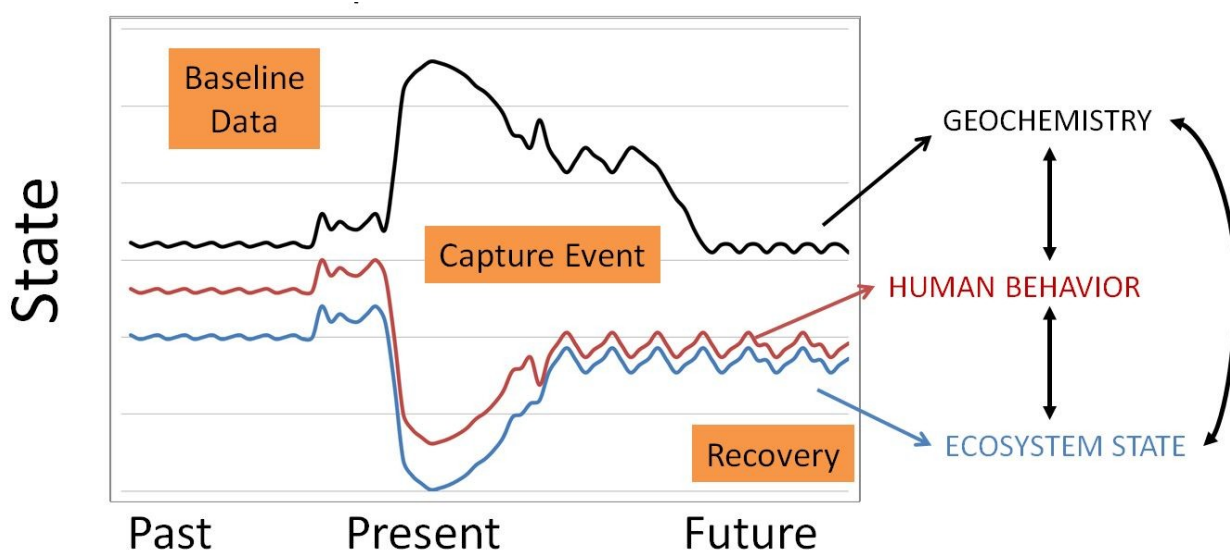


Figure 1. Critical aspects of episodic and extreme coastal events to be captured by new recommended HUB.

### *Extreme and episodic HUB development motivation*

Extreme and episodic events, defined as an environmental perturbation greater than a defined impact threshold (to be determined), are expected to increase in frequency and intensity in coastal zones around the world. These events include both natural events, including those influenced by climate change such as hurricanes and coral bleaching, and human-made disasters, such as oil spills. Gaps in, and lack of coordination between, current data collection capabilities across a range of disciplines limits our scientific capabilities to learn from episodic and extreme events and limits scientific studies related to these events to be backward-looking rather than proactive with studies focusing on future scenario planning. No practical pathway currently exists for mobilizing expertise and data collection across the physical, biological, and social systems, or operational and research observational platforms for high-impact coastal events. Greater scientific characterization of extreme event monitoring and analysis can inform our understanding of the drivers of the resistance and resilience of coastal systems that determine public health, social and economic conditions, coastal infrastructure, ecosystem state and variabilities within and among these systems.

### *What impact or value does it seek to deliver?*

The HUB will be a specific centralized NSF-funded entity that leverages connections with a large network of NSF-funded research scientists across all coastal disciplines as well as partners and stakeholders in public, private, and other local, state, and government agencies (e.g., NOAA, NASA, FEMA). The HUB will have a number of key activities addressing the science of episodic and extreme events in coastal environments. These components, elaborated below, include:

- 1). Comprehensive monitoring and study
- 2). Observational data gap-filling
- 3). Standardization of data collection and QA-QC
- 4). Fostering interdisciplinary research
- 5). Bridging the science with the community and engaging the community

Long term, high resolution, and comprehensive monitoring systems are critical to capture the state of the system before, during and after extreme and episodic events. The comprehensive monitoring systems will include data collection in subject areas (including geo-science, bio-science, social science and other relevant data) that have not previously included proactive data collection during extreme and episodic events. Results will inform modeling and scenario planning to identify gaps and prepare for future events. Comprehensive monitoring will include oceanographic, biological, social, economic, ecological, and atmospheric data. A key role of the hub will be the standardization of such monitoring across events and locations in order to gain a broad understanding of the drivers of extreme/episodic event impact and responses among different systems. A specific focus will be on fostering interdisciplinary activities and research enabled by the broad, open access data collection repository housed as part of the hub. The

hub will also serve as an agent to bridge the science with the public, including providing education/outreach, linking users and subject experts, and engaging citizen science.

*Partnerships and stakeholders*

The HUB will mobilize and coordinate rapid response to ensure extreme and episodic events are adequately characterized. This will include partnerships with mission driven agencies (e.g., NOPP, NOAA, USGS), other research driven agencies (e.g., NASA, DOE) and state and municipal level agencies who will be leading specific response efforts. Community response and behavior during events will be monitored through “human observing systems” such as social media data. How to best utilize citizen science involvement and potentially including a citizen science data collection component to this study will also be explored. New and emerging observational technologies will be included as much as possible into the continually evolving comprehensive monitoring system within the HUB. For example, rapid-deploy drone technology both in the air and ocean developed by other programs could be integrated into activities within this HUB.

*Methods and outcomes*

Tools and assets that the episodic and extreme coastal event HUB will incorporate/develop/advance include: observatory systems already in operation, new observation needs based on gap analysis, complex statistical and modeling tools, scenario planning, trial runs. Key insights will include the drivers of system response to extreme and episodic events across natural-human systems, the interactions and feedback between short-term and long-term responses, and an understanding of the baseline against which to compare extreme events.

Tools that the HUB will incorporate/develop/advance include

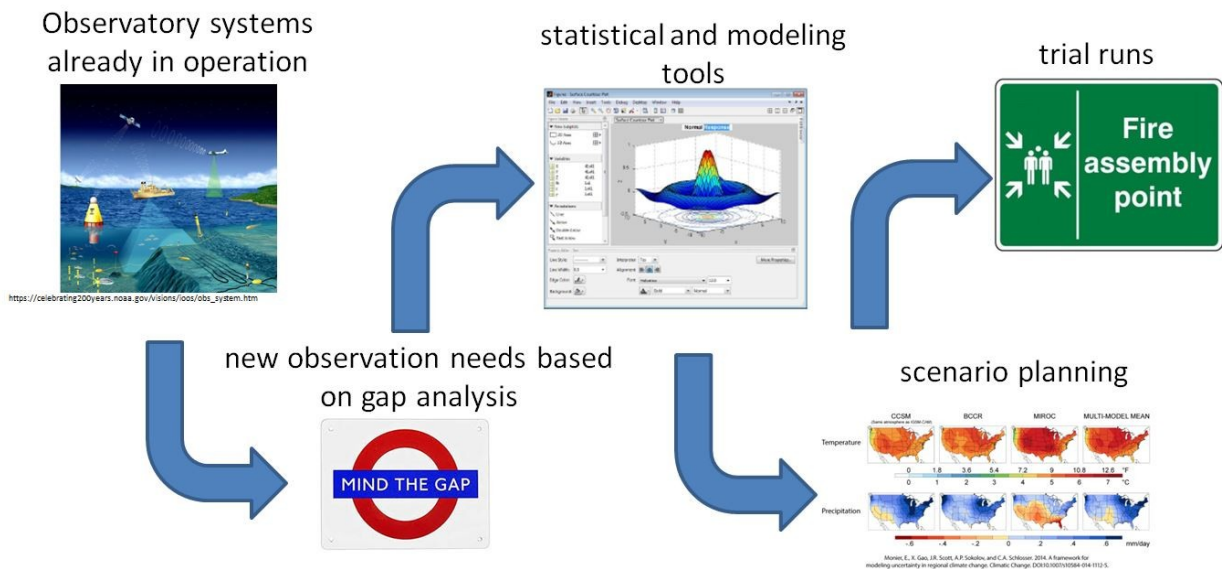


Figure 2. Tools, science, and societal impacts the proposed HUB will incorporate