Submission form for Ocean-Shot Concepts

1. Storm Impacts on Ocean Systems and Coastal Communities

1. Contact info:

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2. Abstract (describe hypothesis, scientific and/or technological objective, 200 word limit):

Extreme storms have significant impacts on the nearshore system (where ocean and estuarine waves and surge interact with land) that pose high societal risk. Recent studies have improved our understanding of storm impacts. However, important processes and their interconnections have been neglected owing to challenges caused by a lack of observational systems, cross-disciplinary knowledge, and by single-discipline-focused funding avenues. Developing a holistic understanding of the interactions and feedbacks resulting in storm impacts to the nearshore system, including socio-economic effects and responses, requires integrated, simultaneous observations and studies of meteorology (winds and precipitation), oceanography (e.g., waves, surge), biology (vegetation, bacteria, fisheries), hydrogeology (groundwater flow, biogeochemistry, solute transport), geotechnology (sediment characteristics, soil behavior), morphology (erosion), and natural and built infrastructure.
Real-time measurements before, during, and after storms are not only necessary to understand and model the fundamental, coupled mechanisms that affect the nearshore system and drive change during extreme events, but also to calibrate remotely-sensed measures of the surface wind field, water quality, or ocean color, and to inform the general public as well as the private and government entities responsible for operational weather forecasting, codes and standards development/enforcement, emergency management, property and casualty insurance, reinsurance, and catastrophe modeling.

3. Relevant Ocean Decade Challenge(s) (see below):

Challenges 6 & 7: developing real-time observing systems to learn about major storm impacts, and to provide data for coastal managers and industries
Challenges 1, 2, & 5: by improving understanding of impacts of major storms and feedbacks between processes, including (i) effects on fisheries and shellfisheries, (ii) impacts associated with pollutant transport during inundation, overland & riverine flows, and groundwater transport, (iii) effects of winds and surge on infrastructure resilience

4. Vision and potential transformative impact (200 word limit):

The nearshore system is vital to the national economy, security, commerce, and recreation. Recent hurricanes caused loss of life, destruction of property, damage to infrastructure, transportation systems, and the power grid, disruption of the food supply (farms and fisheries), spread of pollution, pathogens, and contaminants, and economic distress. However, there are few observations during large storms. Concurrent observations of geomorphological, oceanographical, hydrogeological, meteorological, biological, and engineering processes are rare. Integrating these observations during extreme storms with sociological and economic studies will lead to new theories and rapid advances in understanding of the nearshore system, coastal resilience, and community response, and will lead to improved coastal management strategies. In addition to advancing theories for ocean and land processes and interactions, development of rapidly deployable monitoring stations providing real-time observations of physical, chemical, and biological measurements will provide critical information for emergency management, federal agencies, coastal industries, and communities. However, to attain this goal it is necessary to develop a national initiative, expand existing networks of researchers, and create new technologies for novel observing systems that can be deployed rapidly in areas likely to be impacted by impending storms.

5. Realizable, with connections to existing U.S. scientific infrastructure, technology development, and public-private partnerships (150 word limit):

The NSF NHERI CONVERGE and Extreme Events Reconnaissance groups (EERs), USGS-Federal agency storm team

(including NOAA, FEMA, NPS and others), NIST, and other academic and agency groups already conduct responses to some major storms. New observing technologies and better coordination and integration or research, real-time decision-making, and policy could leverage and expand these efforts into a national focus that could lead to transformative advances, as well as immediate benefits to communities and industries. Connecting these efforts to existing ocean and land observing and research networks would further expand the impact and process-understanding. Furthermore, a national observing effort and organization will assist major metropolitan areas that are developing plans for major storm impacts, and could entrain university-led initiatives (eg, MIT's Climate Grand Challenge efforts).

6. Scientific/technological sectors engaged outside of traditional ocean sciences (100 word limit):

Major storms ross the ocean-land boundaries, and thus understanding impacts requires engagement across many scientific and technological sectors, including earth processes, atmospheric sciences, engineering, and socio-economic sciences. In addition, development of new observing technologies requires big data science, computer sciences, as well as engineering systems.

7. Opportunities for international participation and collaboration (100 word limit):

All countries with coastal areas have similar concerns regarding impacts of major storms. Some other countries are beginning to attempt to develop similar organized research and observational systems. The US could be a leader in developing new observing technologies, and providing an example of a coordinated research-agency-industry organization.

8. Develops global capacity and encourages the development of the next generation of ocean scientists (100 word limit):

As noted above, there already are several efforts focused on observing and understanding storm impacts, and there has been some effort to organize across traditional disciplines and groups (academic, agency, etc). However, there remains a serious lack of observing capability, and a national focus could enable major improvements in coordination, as well as consistent responses to all events on all coasts. These efforts would be easily translatable to other countries, with the US leading advancements in observing technology and providing a novel example of academic-federal-local-industry collaborations and associations.