National Aeronautics and Space Administration

An Architecture for Science and Applications Needs at the Coastal Interface - The Fulcrum of Lateral Exchanges between Land and Sea

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Program: FY22 R&TD Strategic Initiative
Strategic Focus Area: Earth System Science and Application Architecture Development
Strategic Initiative Leader: Jessica L Neu

Objectives

The objective has been to bring together a diverse set of scientists, modelers, technologists and systems engineer, at different career levels, to consider an integrated approach for developing an observing system to address the coastal interface in preparation for the 2027-2037 Earth Science Decadal Survey (ESDS). It is anticipated that the upcoming ESDS will involve ever increasing complexity of Earth system science and an increasing trend toward science for societal benefits. To that effect, this project aims to address the grand Earth system science challenge of the coastal interface. Current technology and systems are unable to address this questions globally because

a) simultaneous measurements of water, sediment, and carbon flux are limited to field measurements that are not spatially distributed or uniform;
b) there is no space-based instrument capable of measuring fluxes of water, sediment, and carbon simultaneously in coastal and inland waters at spatial and temporal resolutions sufficient for most rivers;
c) there is lack of an integrating model framework, spanning land surface models, river routing models, and coastal ecosystem models, paired with improved constraint and parameterization from satellite observables;
d) this question requires largely siloed science disciplines to work together (e.g., hydrologists, coastal oceanographers, biogeochemists, ecologists, geomorphologists).

Background

The future landscape of Earth science is rapidly changing from a siloed, single satellite/observable discovery-based science to an interdisciplinary, multi-platform societal-benefits driven science grand challenges. One of these is the coastal interface - the nexus of lateral flow and exchange of water, carbon, and sediment (largely via rivers) between the land and sea for which there is a need for holistic, integrated systems approach between observations, models, and science disciplines - spanning hydrology, coastal-oceanography, biogeochemistry, ecology, and geomorphology to improve scientific understanding of the climate interface that enables informed management and policy evaluation.

Approach and Results

The approach of the project team has been to encompasses science stakeholders (within JPL) spanning the land-sea continuum to provide input on their scientific needs, goals, objectives, as well as gaps in current observations and models to draft a Science and Application Traceability Matrix (SATM) that is responsive four out of five Earth Science Decadal Survey (DS) panels with a niche in applications. This incorporates the different drivers from upstream watershed-scale and downstream coastal ocean processes along with the responses in the coastal interface region (Figure 1). In parallel, the team has been engaging with potential external stakeholders and partners and is preparing to do series of mini symposium followed by community workshop in second year of the project.

Significance/Benefits to JPL and NASA

This project is advancing the Earth Science and Technology Directorate's (ESTD - 8X) initiative goals by assessing the scientific and technical landscape and developing an "end-to-end" system architecture to help more strongly position JPL to address a grand Earth system science challenge (i.e., the coastal interface), and its mission-to-information landscape that can contribute to national decision-support needs. Such an architecture will prepare JPL to advance science and applications - in terms of observables, model and decision support infrastructures - for the 2027-2037 Earth Science Decadal Survey. Further, it promotes cross-organization collaboration, enables knowledge transfer between and within organizations, and trains/evaluates the next generation of scientists, technologists, and science system engineers.

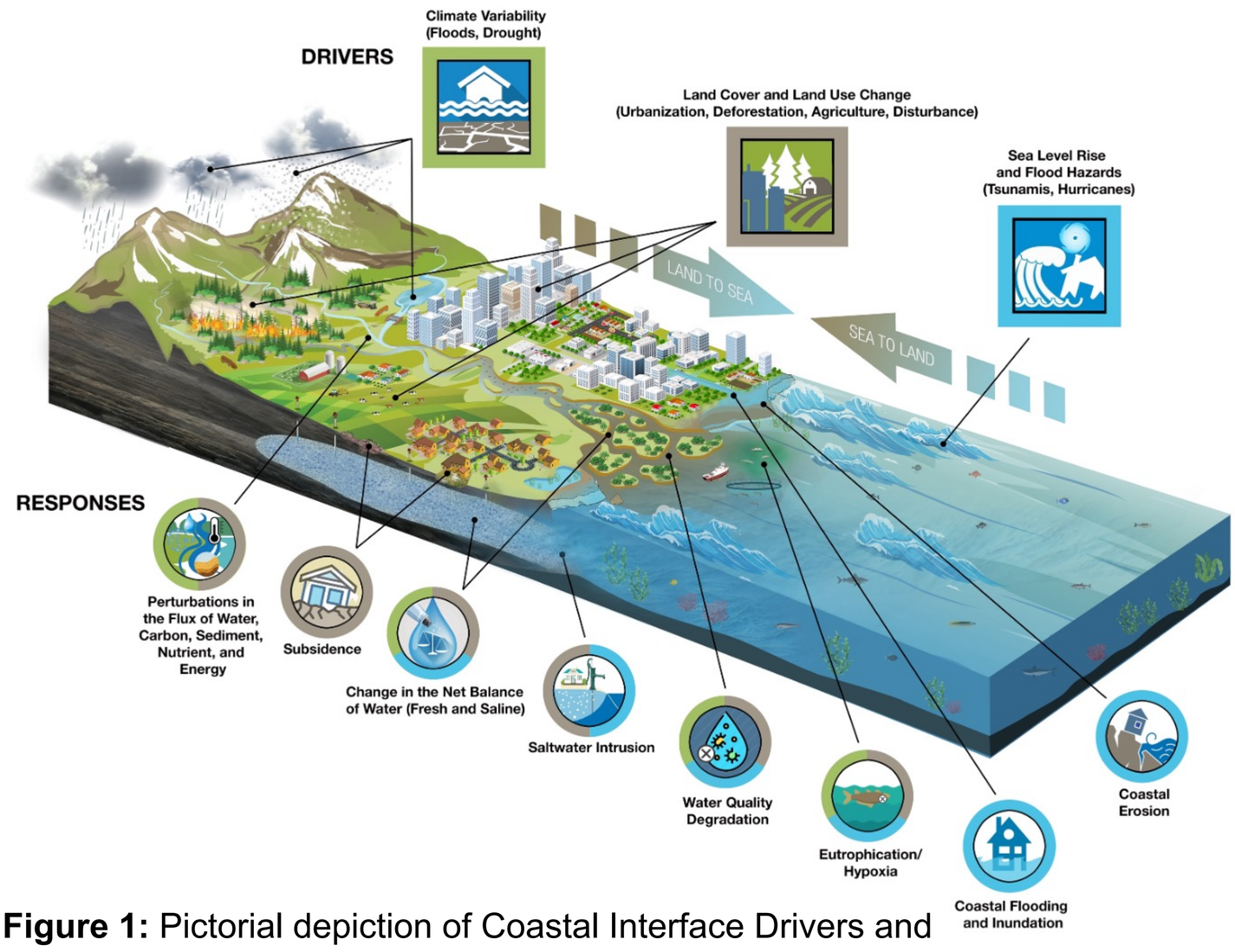

Figure 1: Pictorial depiction of Coastal Interface Drivers and Responses that is informing Science and Application Traceability Matrix (SATM) for the system architecture development.

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