Pacific Northwest
NATIONAL LABORATORY

Integrated Coastal Modeling

ICoM

icom.pnnl.gov

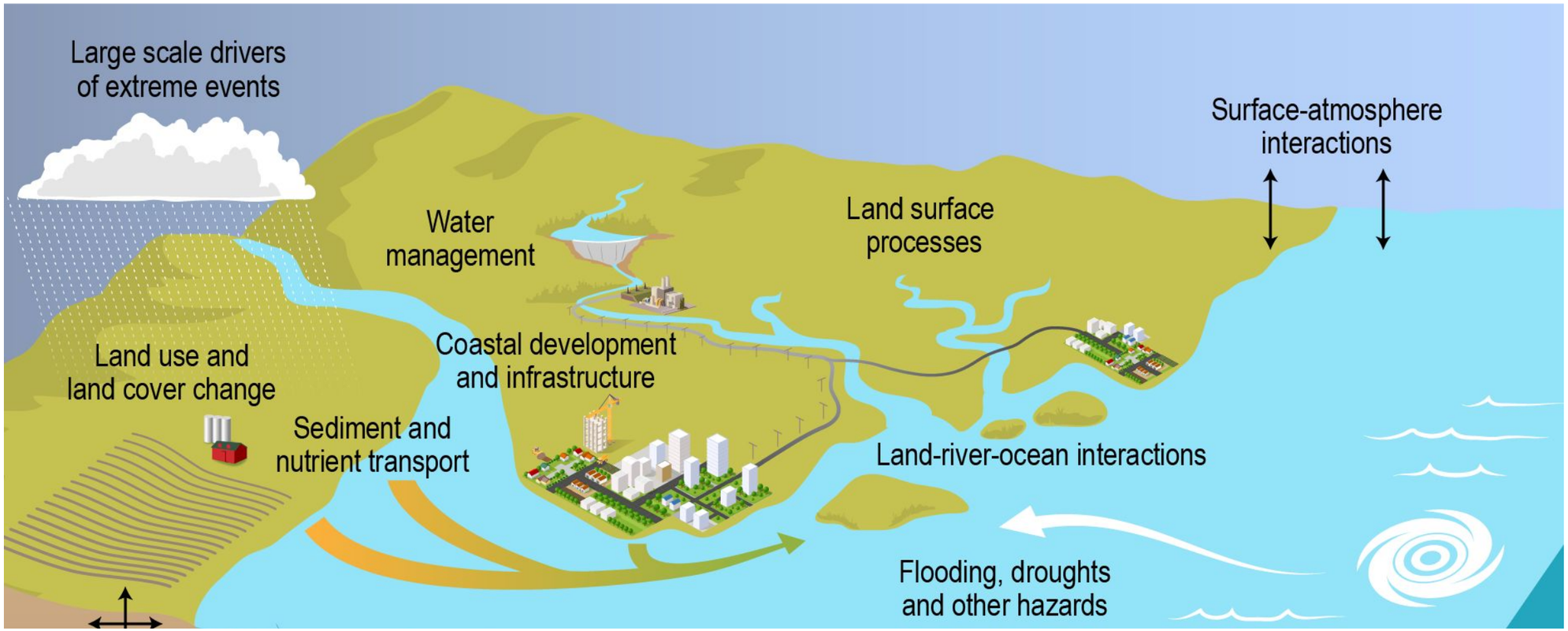
Ian Kraucunas

U.S. DEPARTMENT OF ENERGY BATTELLE

PNNL is operated by Battelle for the U.S. Department of Energy

Integrated Coastal Modeling (ICoM) is funded by multiple programs in the Earth and Environmental System Science Division of the Department of Energy's Office of Science

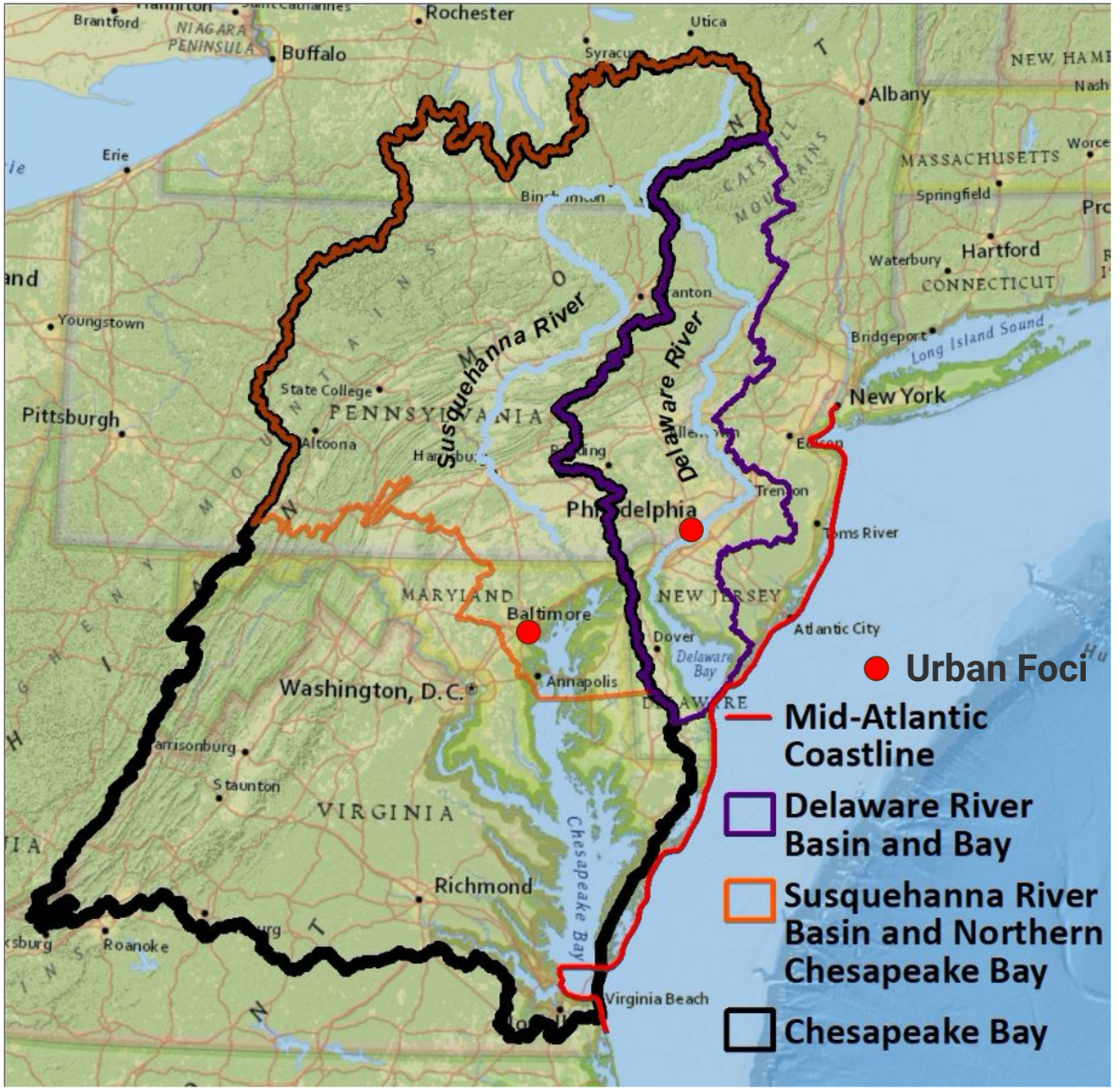
Developing, evaluating, and applying a variety of modeling tools to analyze coastal processes, hazards, and responses



Our long-term vision is to deliver a robust predictive understanding of coastal evolution that accounts for the complex, multiscale interactions among physical, biological, and human systems

Mid-Atlantic Study Region

- Strong urban to rural and upland to estuary gradients
- Exposed to many different stresses and extremes
- Opportunities to compare and contrast systems
- Many collaboration opportunities (COMPASS-FME, BSEC, USGS, DBRC, MARISA, MACH, etc.)



Research Topics and Program Areas for Phase One (FY 2020–2024)

Cross-Cutting Topics

Grid generation, remote sensing, coastal modeling test cases, and other cross-cutting data and tools

Long-term changes in flooding, drought, hypoxia, and other coastal hazards

Impacts of urbanization, development, and other land use changes on coastal systems

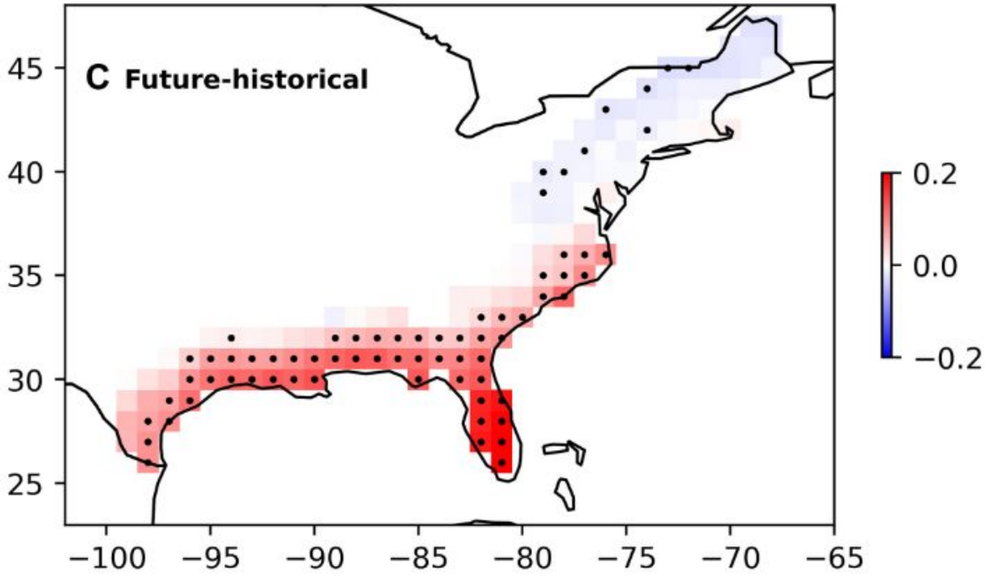
Regional & Global Model Analysis (RGMA)	MultiSector Dynamics (MSD)	Earth System Model Development (ESMD)	Environmental System Science (ESS)
Large-scale drivers of storms, droughts, and other extreme events	Interactions between coastal development, critical infrastructure, and natural systems	Earth system drivers of coastal flooding	Influence of surface water – groundwater interactions and lateral flow on coastal flooding
Influence of surface-atmosphere interactions on extreme events	Probabilistic natural hazard characterization	Land-river-ocean interactions affecting coastal salinity gradients	
Influence of land surface process on land-atmosphere interactions	Ability of adaptation to reduce risk or enhance resilience	Controls on fate and transport of sediment and nutrients	

Improving understanding of how large-scale patterns and surface-atmosphere interactions drive mid-Atlantic extreme events

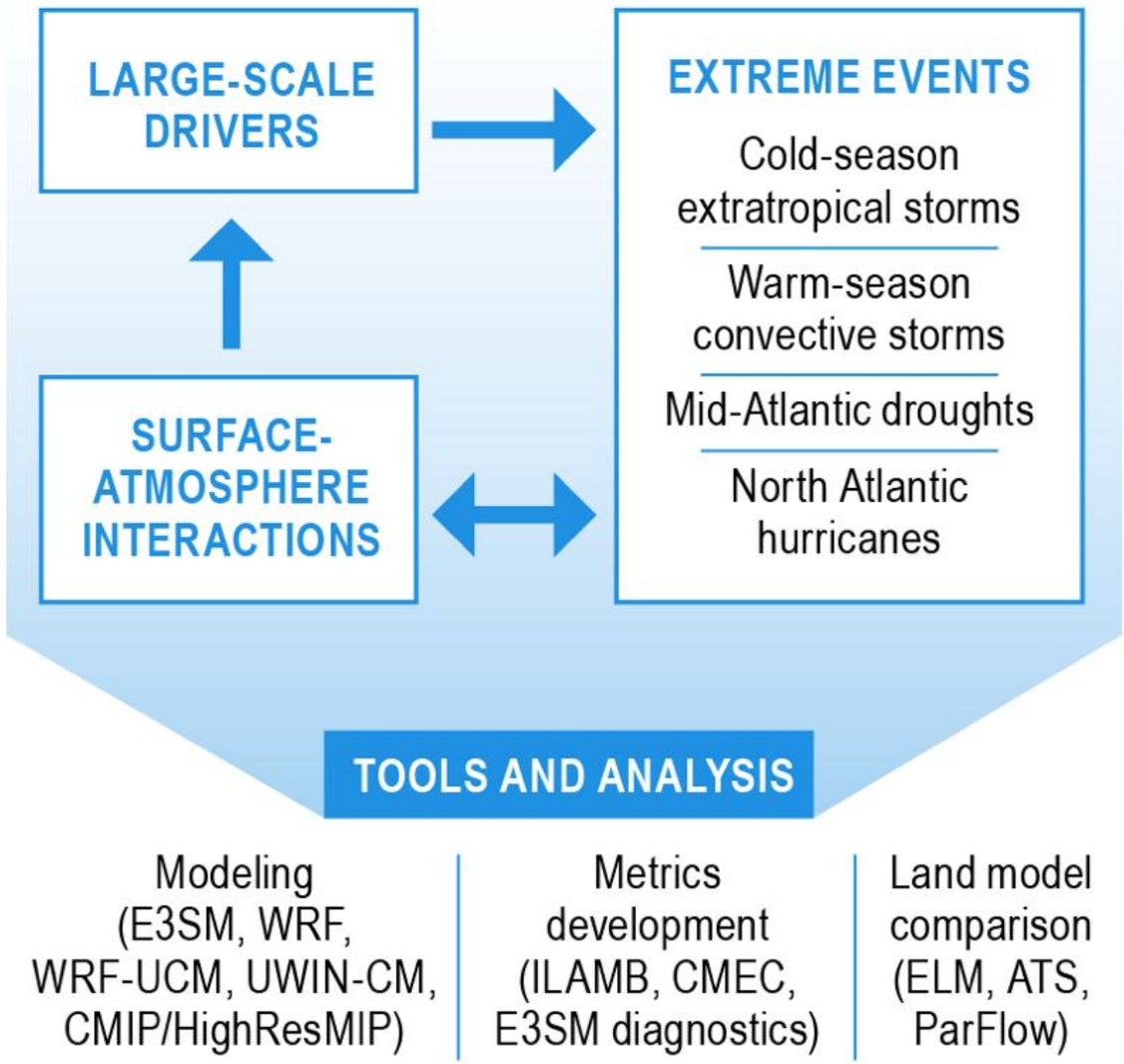
RGMA Program Area

Ruby Leung and Karthik Balaguru

Projected change in hurricane frequency



Balaguru et al. 2023

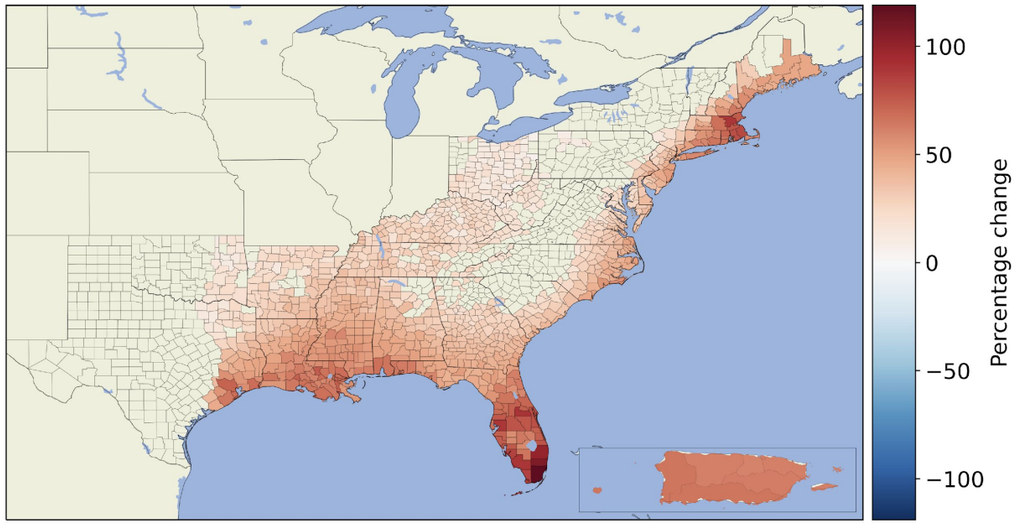


Coupling infrastructure, coastal development, and hazard modeling to characterize evolving risks and resilience

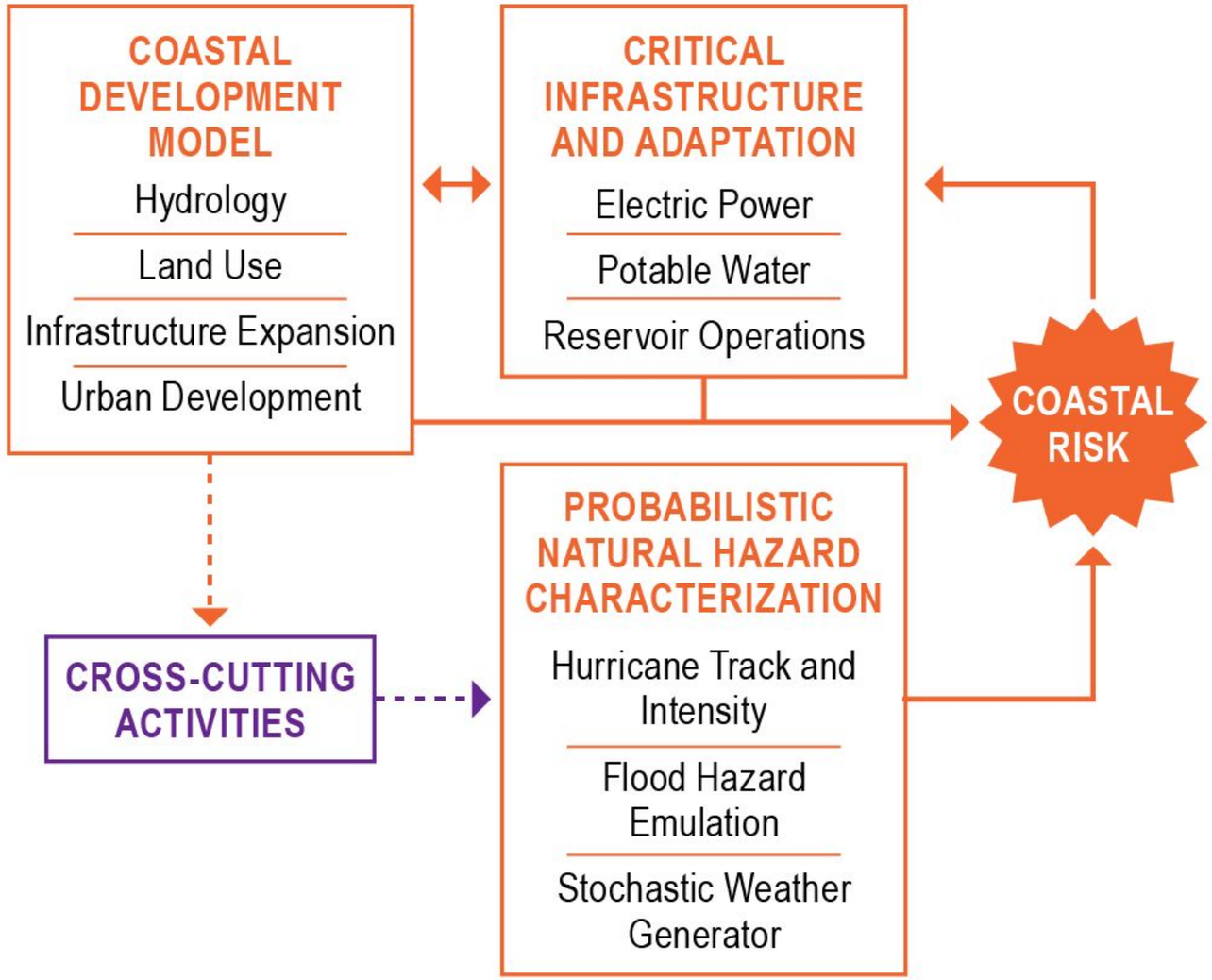
MSD Program Area

Dave Judi and Ning Sun

Projected change in future power outage risk



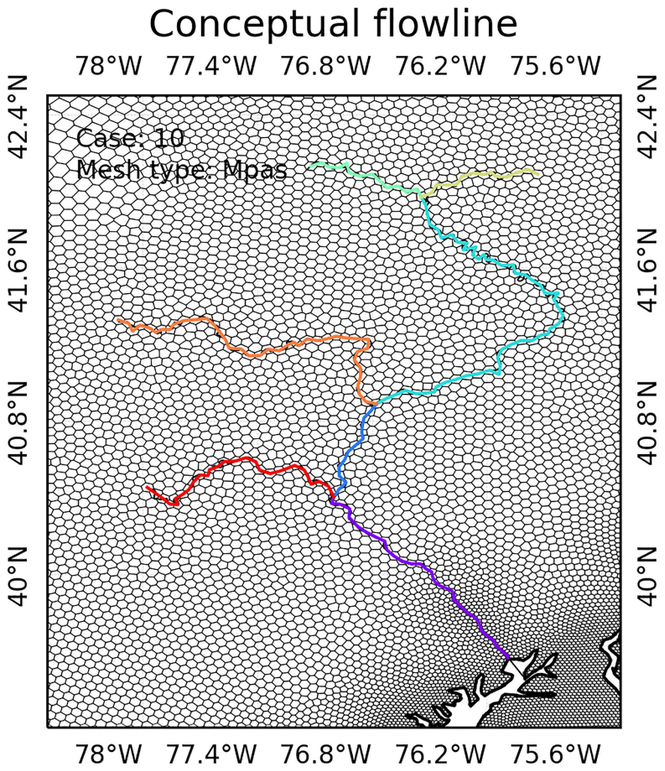
Rice et al., 2024 (submitted)



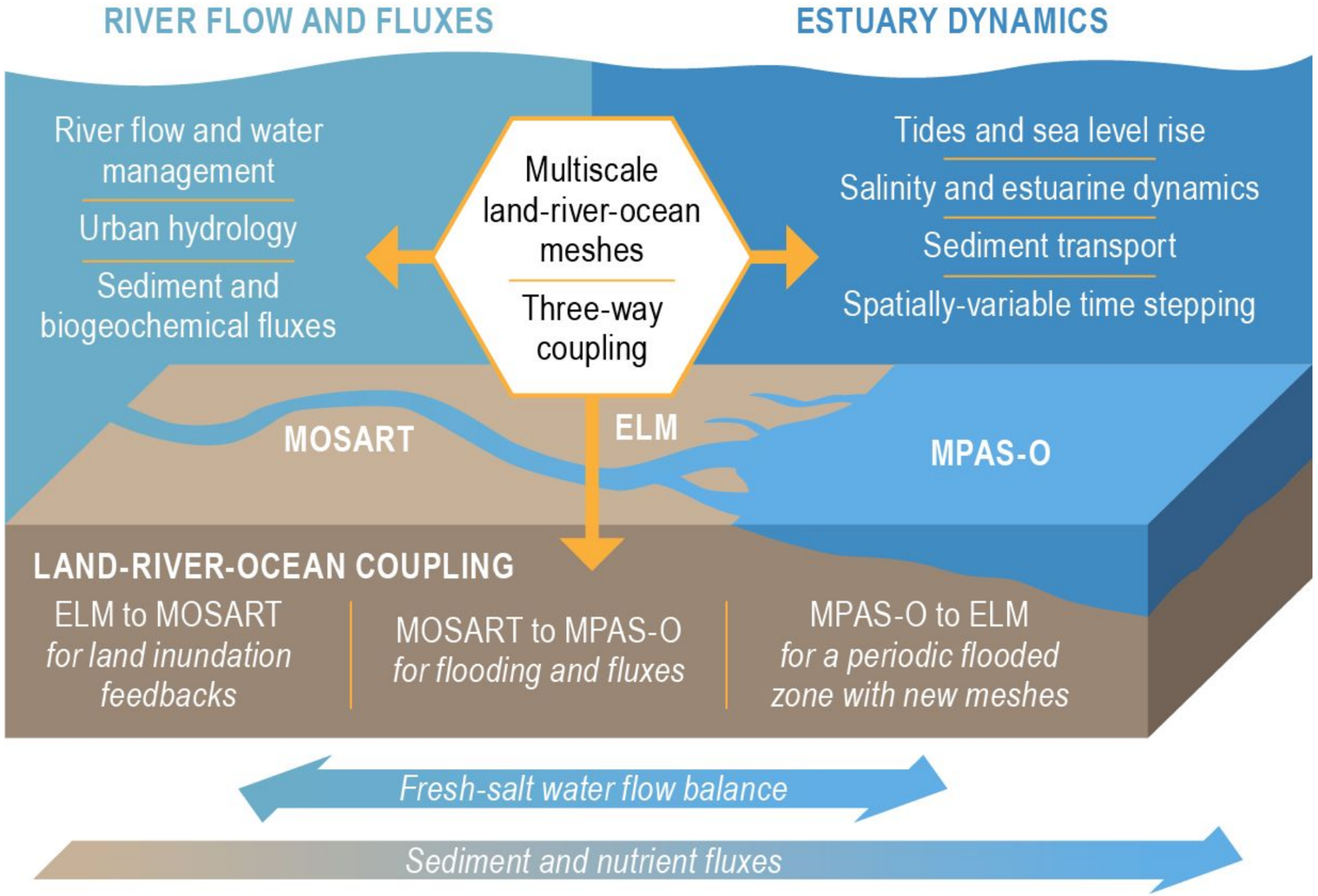
Extending E3SM to better resolve human-land-river-ocean interactions and corresponding fluxes

ESMD Program Area

Rob Hetland and Zeli Tan

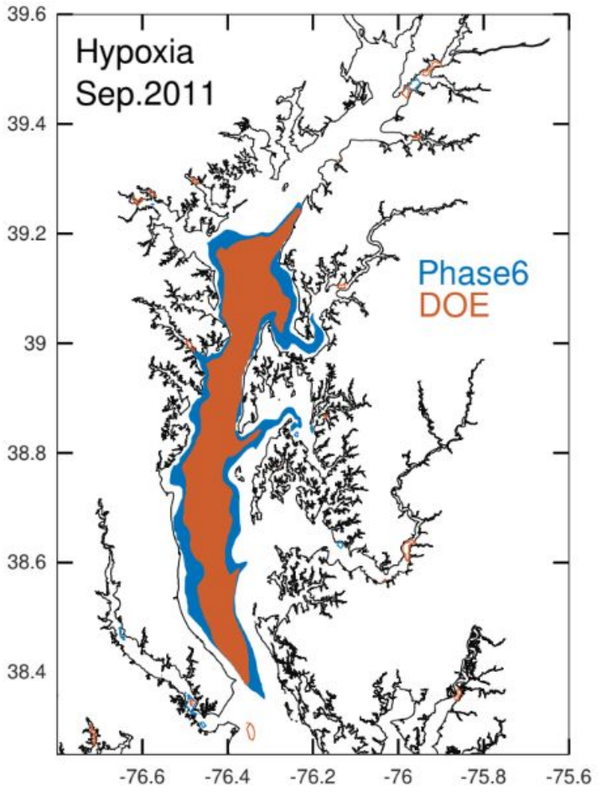


Liao et al., 2023

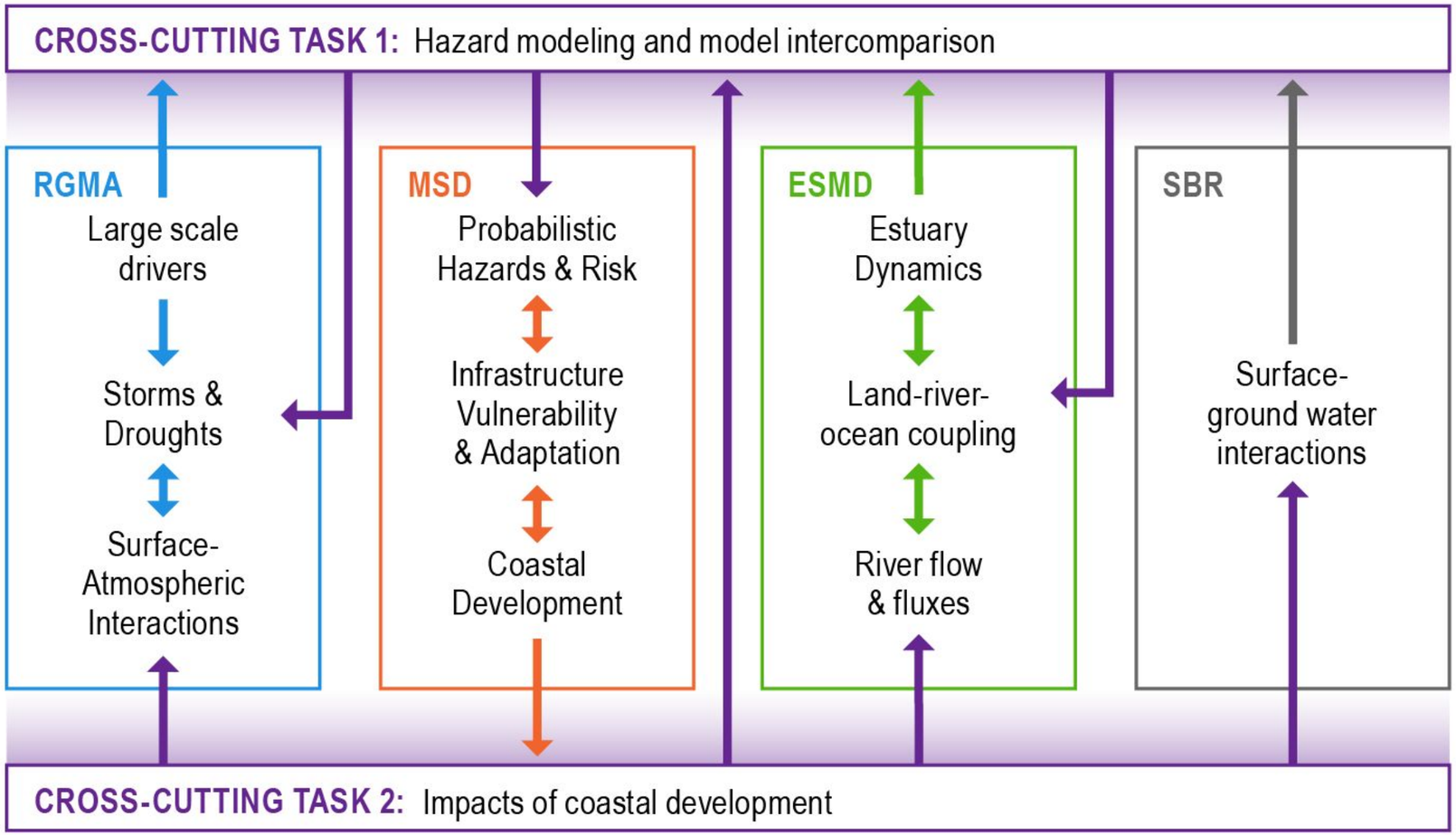


Evaluating different modeling techniques and elucidating the role of coastal development in driving natural system changes

ICoM's Cross-Cutting Research Area



St. Laurent et al., 2024



Tentative Foci for Phase 2:

ICoM Program Areas

MultiSector Dynamics

- Regional-to-urban scale athropogenic stressors
- Coastal urban development patterns and responses
- Regional-to-urban scale infrastructure systems

Regional and Global Model Analysis

- Hydrologic extremes: drivers, feedbacks, and human influences
- Thermal Extremes: Ocean-Land Contrast and Urban impacts

Earth System Model Development

- Coastal inundation in E3SM
- Resolving coastal ocean processes in E3SM
- Marsh dynamics and biogeochemistry

Integrating themes

- Coastal hydrologic risk and resiliance
- Heat extremes and impacts across ocean, atmosphere, and land
- Coastal development, marshes, and water quality

The ICoM Team
(all-hands meeting in Baltimore, Fall 2022)