



ICoM

Integrated Coastal Modeling

Ian Kraucunas
on behalf of the ICoM team



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



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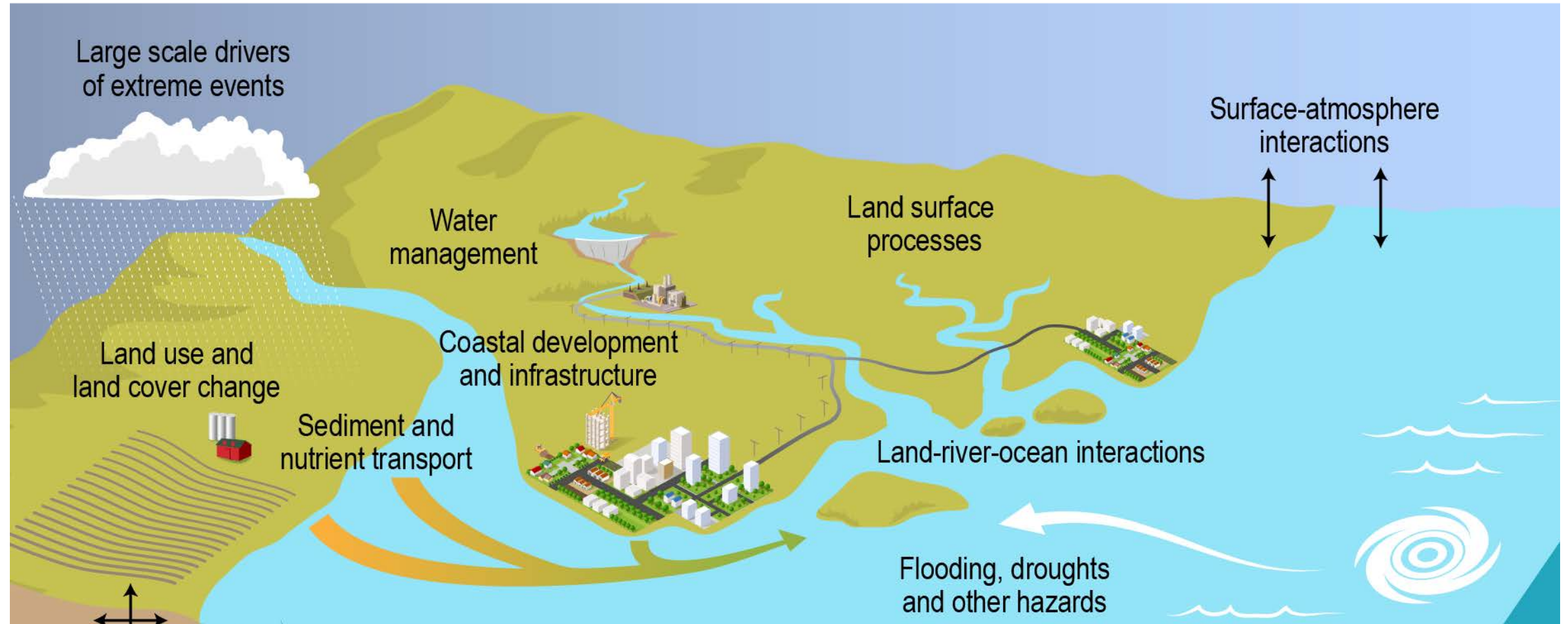


THE UNIVERSITY
OF ARIZONA



ICoM is funded by multiple programs in the
Earth and Environmental System Science
Division of DOE's Office of Science

ICoM Focuses on Key Processes and Uncertainties



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

- Exposed to many different stresses and extremes
- Key uncertainties well aligned with DOE strategic goals
- Opportunities to compare and contrast systems
- Potential to leverage existing investments and capabilities
- Sets the stage for future research



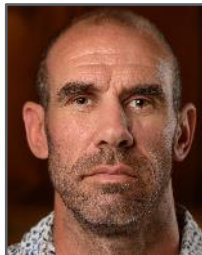
Coupling Infrastructure, Coastal Development, and Hazard Modeling to Characterize Time-Evolving Risks and Resilience

MultiSector Dynamics (MSD) Program Area

MSD PI
Dave Judi



Task Leads



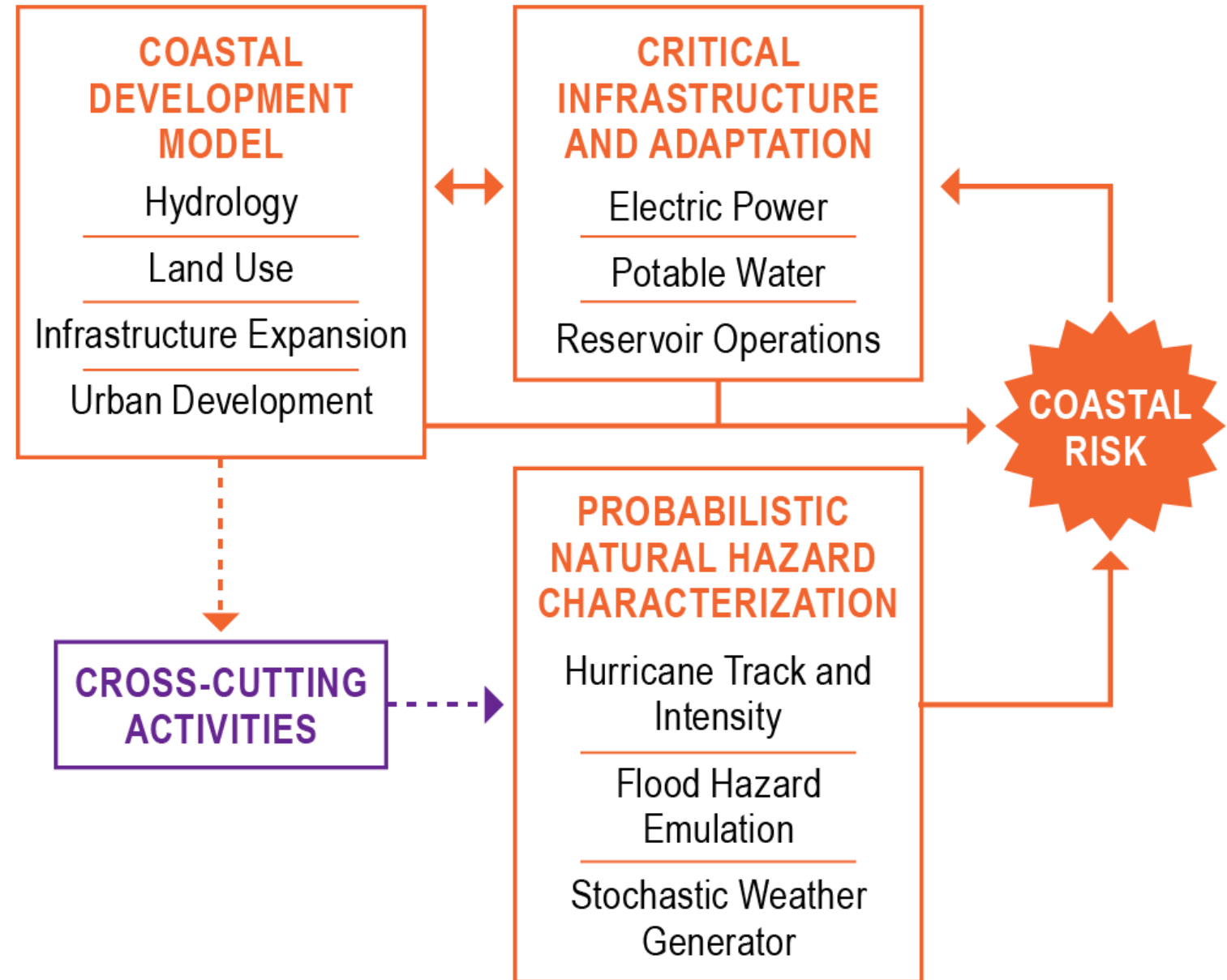
Brent Daniel



Donatella
Pasqualini



Klaus Keller



Extending E3SM to Improve the Representation of Human-Land-River-Ocean Interactions and Corresponding Fluxes

Earth System Model Development (ESMD) Program Area

ESMD PI
Elizabeth Hunke



Task Leads



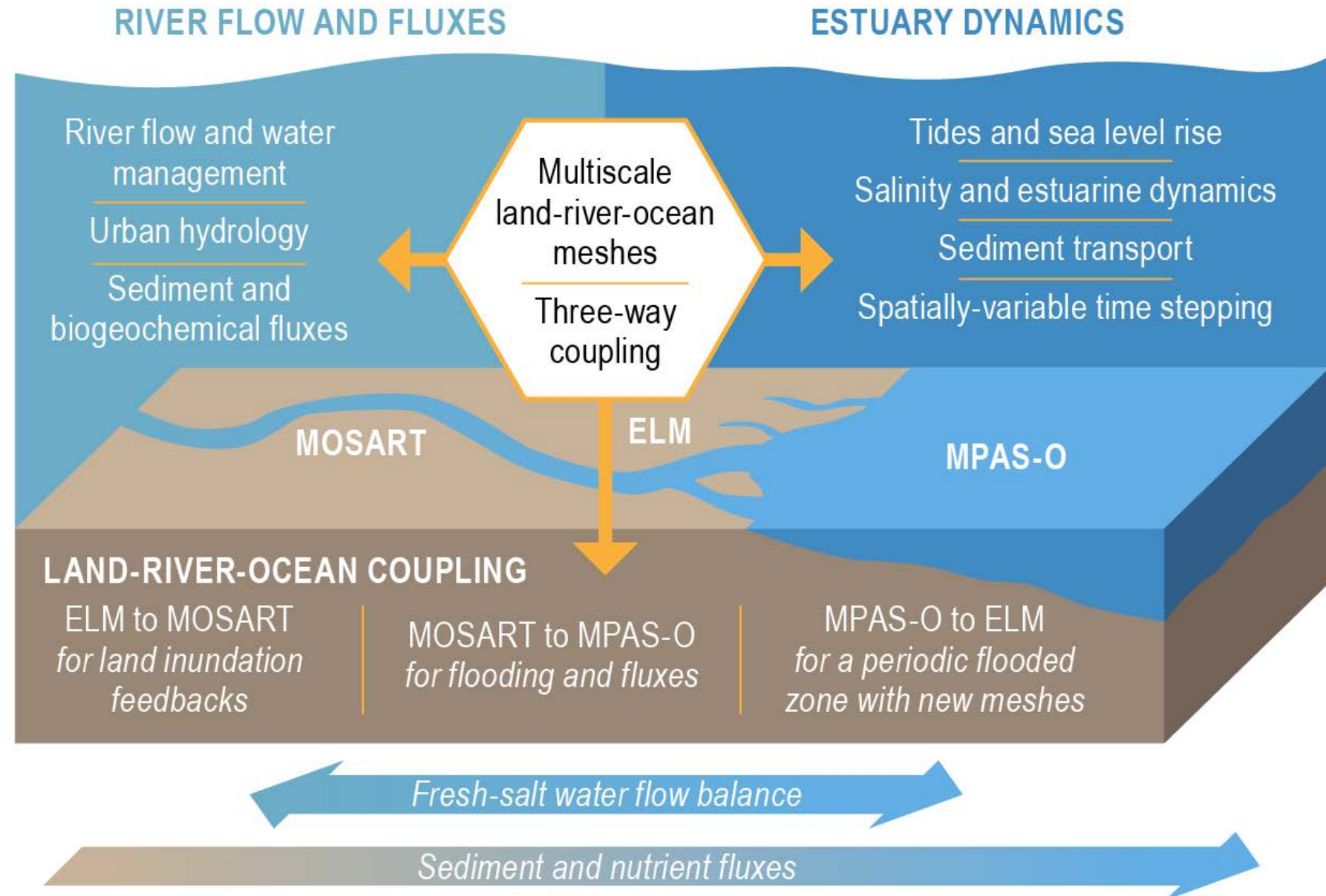
Zeli Tan



Tian Zhou



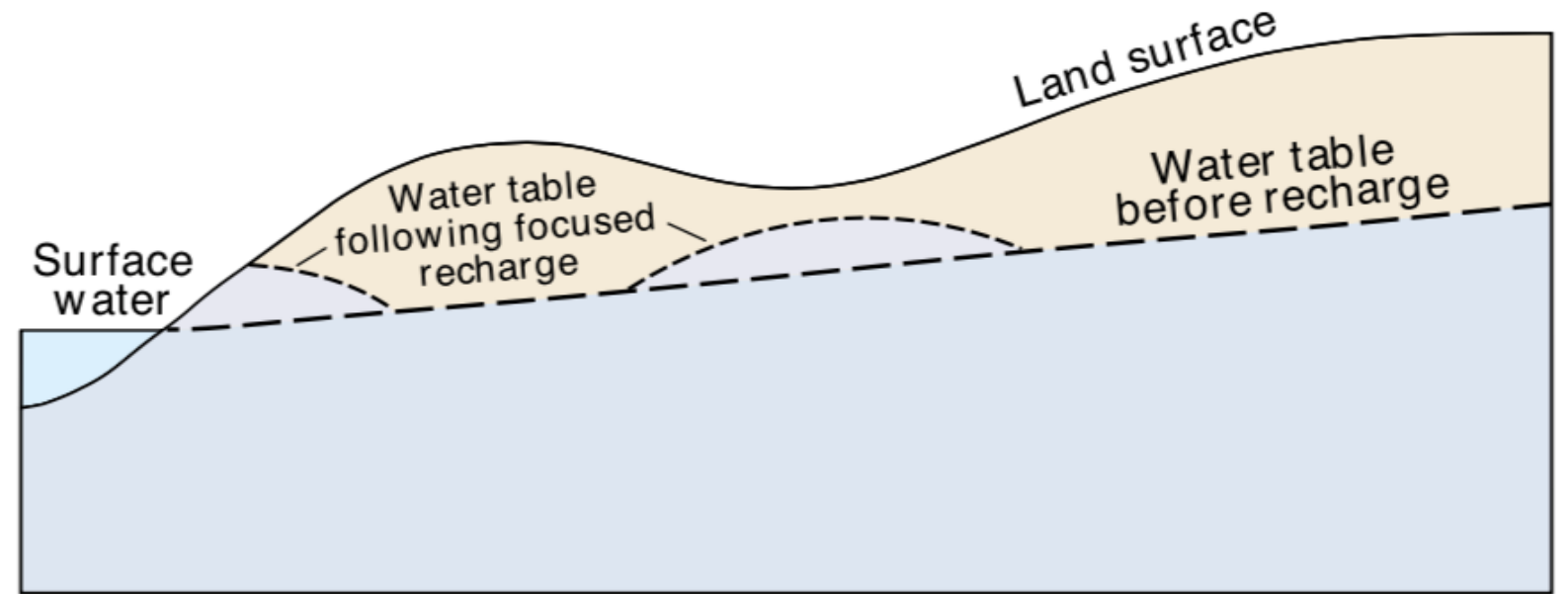
Gautam Bisht



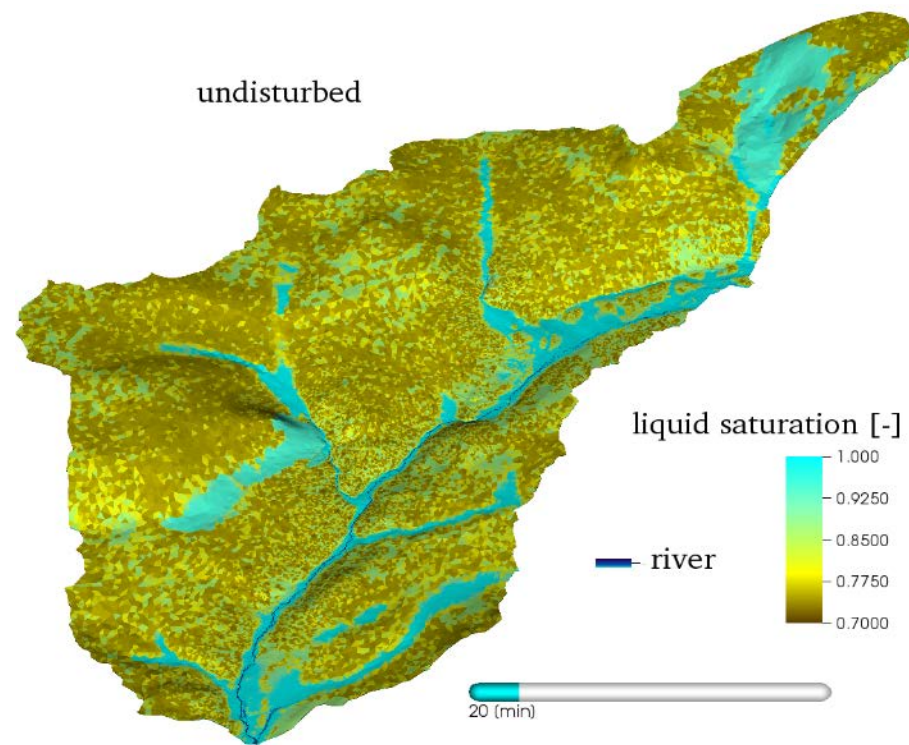
Characterizing Subsurface Hydrological Response and its Interaction with Surface Water during Storms and Droughts

Subsurface Biogeochemistry Research (SBR) Program Area

SBR PI and Task Lead
David Moulton



(USGS, 1998)



Advanced Terrestrial Simulator (ATS) – illustrative results courtesy of Ethan Coon, ORNL



Improving Understanding of How Large-Scale Meteorological Patterns and Surface–Atmosphere Interactions Drive Mid-Atlantic Extreme Events

Regional and Global Modeling and Analysis (RGMA) Program Area

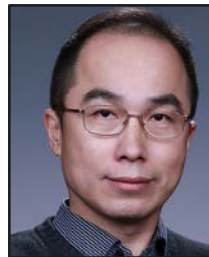
RGMA PI
Ruby Leung



Task Leads



Paul Ullrich



Yun Qian



Gautam Bisht

Key Staff



Karthik Balaguru



Laura Condon



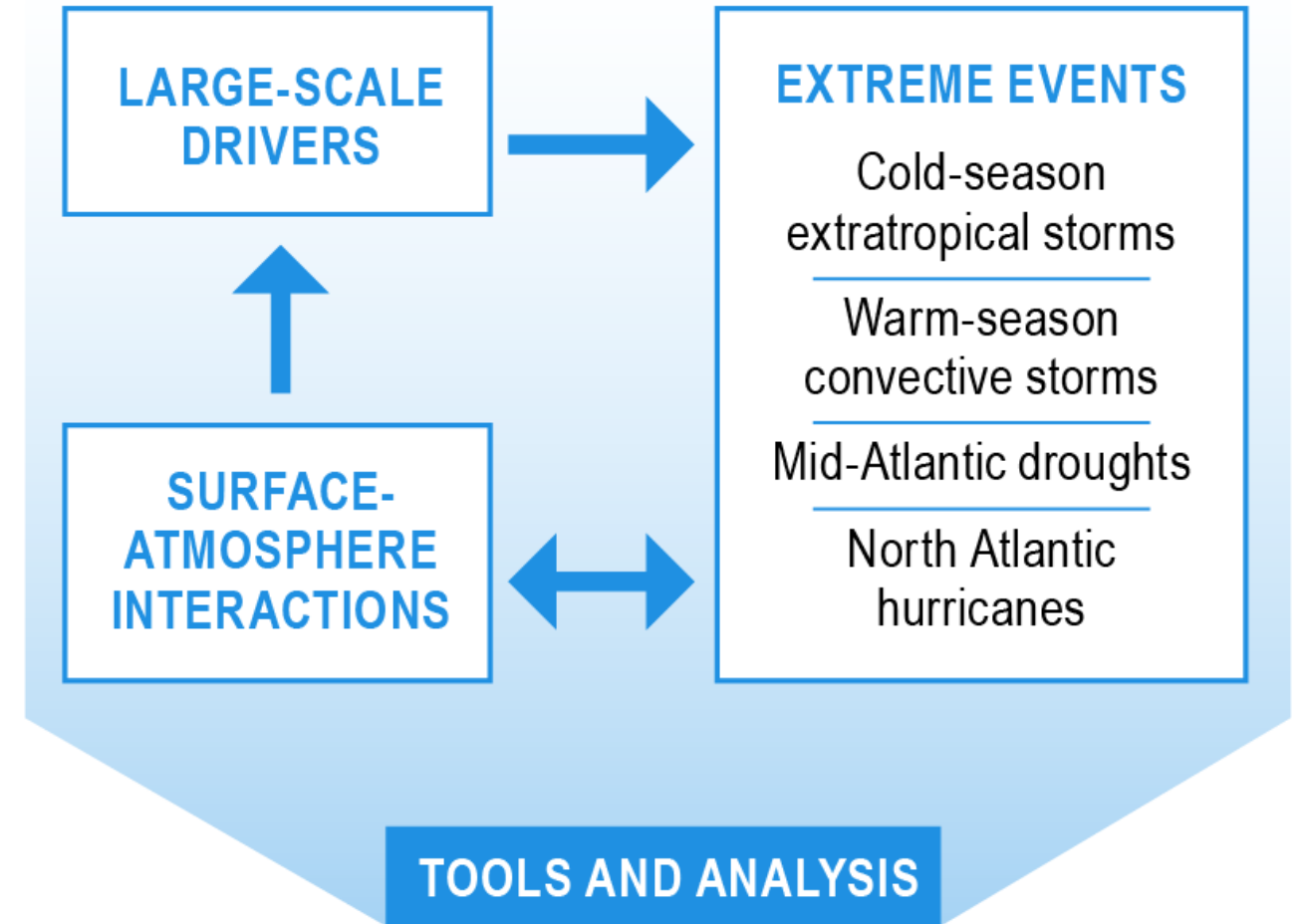
Lu Dong



Michael Wehner



Colin Zarzycki



Modeling
(WRF, WRF-UCM,
UWIN-CM, E3SM,
CMIP/HighResMIP)

Metrics
development
(ILAMB, CMEC,
E3SM diagnostics)

Land model
comparison
(ELM, ATS,
ParFlow)

Improving Understanding of How Large-Scale Meteorological Patterns and Surface-Atmosphere Interactions Drive Mid-Atlantic Extreme Events

Winter Storms

Atlantic City, NJ, 2016



WunderBlog Archive - Category 6™

Category 6 has moved! See the latest from Dr. Jeff Masters and Bob Hansen here.

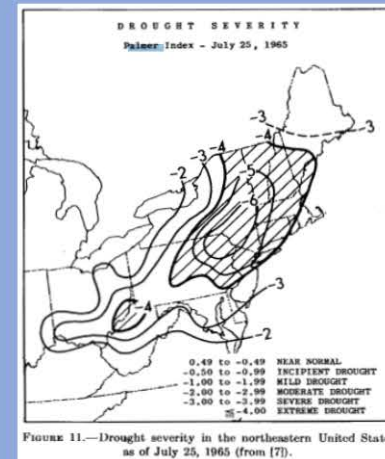
Colossal Nor'easter Dumps Record Snow from Maryland to New York

By: Bob Hansen 6:23 PM GMT on January 24, 2016

A ferocious, long-lasting winter storm took its parting swipes at the Eastern Seaboard on Saturday night with a pile of snowbound cities and shattered records. Millions of people in the nation's most densely populated and densely populated areas that matched or exceeded the largest amounts observed in more than a century of recordkeeping. It's surprisingly difficult to measure snow in an accurate and consistent way, so you s



Persistent drought, 1960-1965



Droughts

Prettyboy Reservoir, 2002



Hurricanes

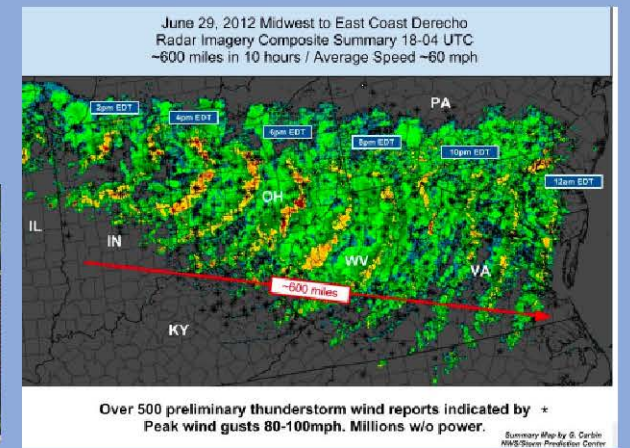


Hurricane Irene 2011



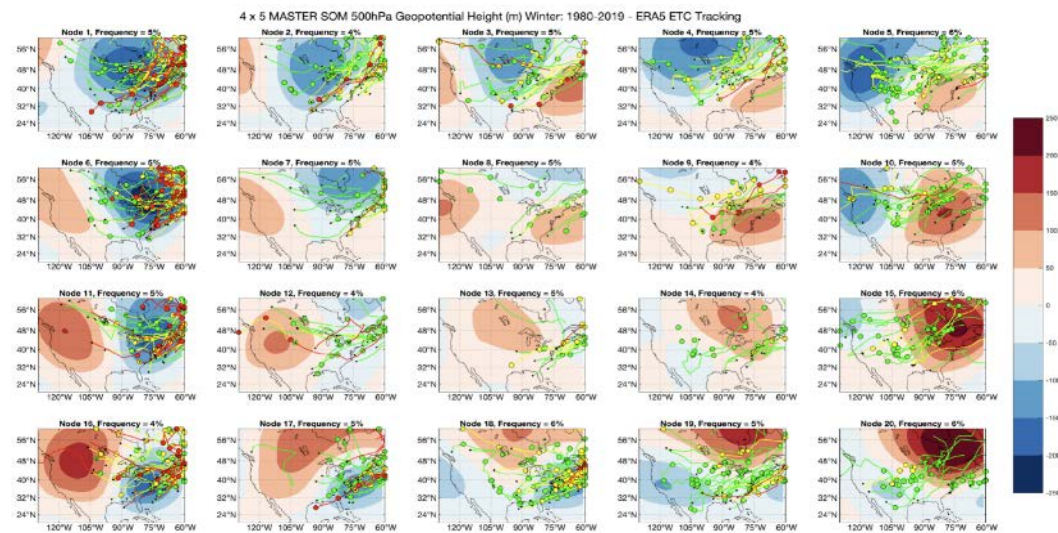
Summer Storms

June 2012 derechos

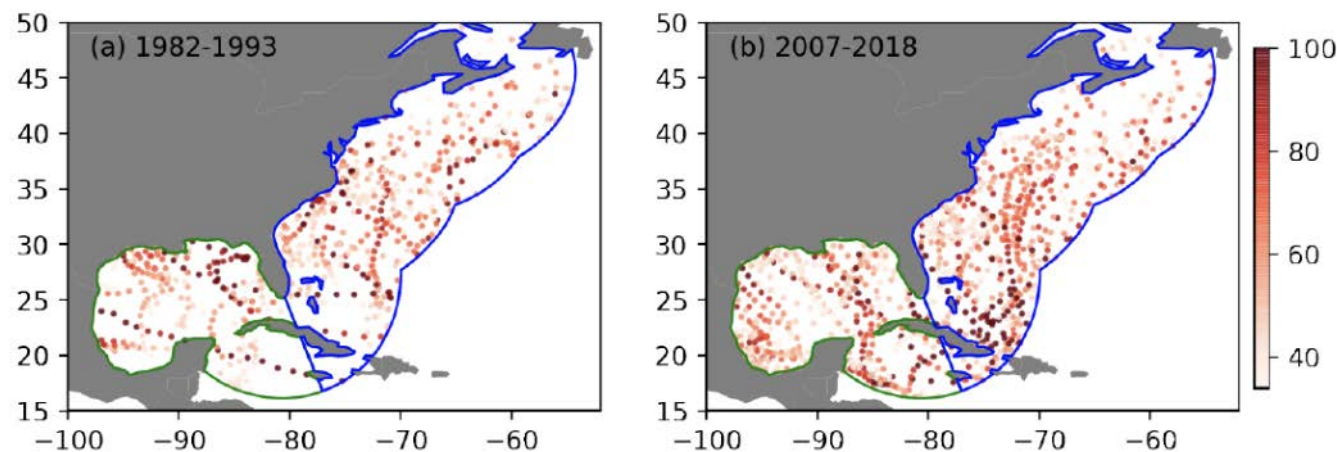


Improving Understanding of How Large-Scale Meteorological Patterns and Surface–Atmosphere Interactions Drive Mid-Atlantic Extreme Events

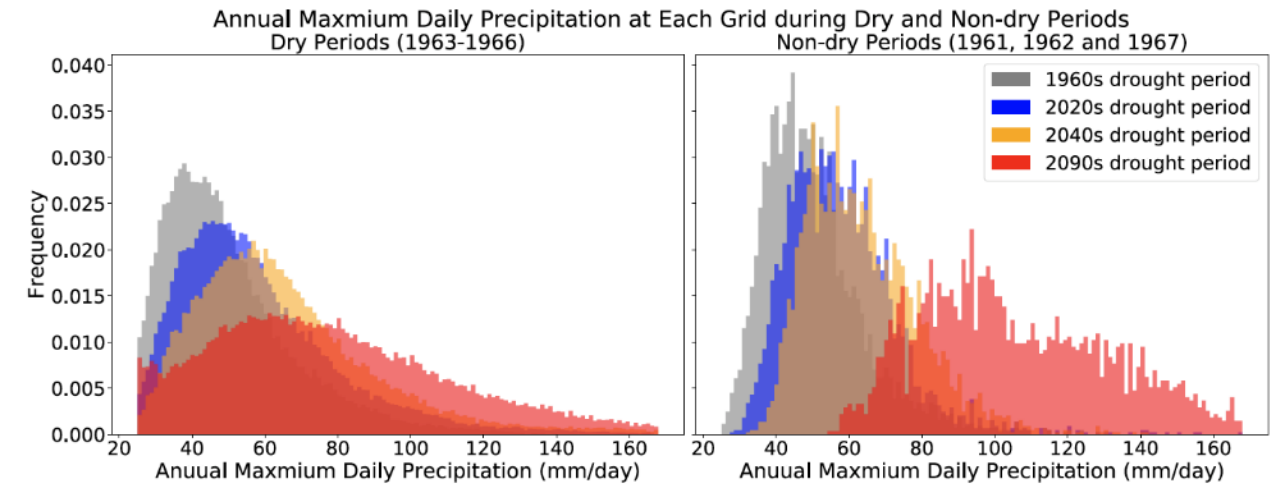
Large-scale meteorological patterns of extratropical storms based on self-organizing map analysis



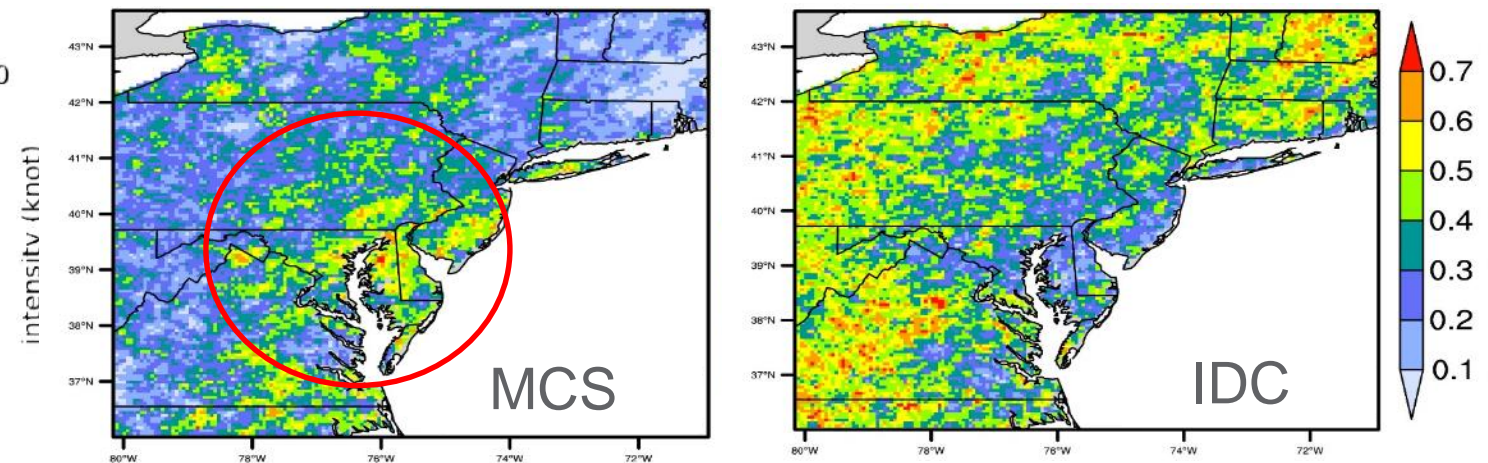
Tropical cyclone activity within 1000 km of the coastline has increased between 1982 and 2018



Annual maximum daily precipitation increases in the future based on pseudo-global warming WRF simulations of the 1960s drought

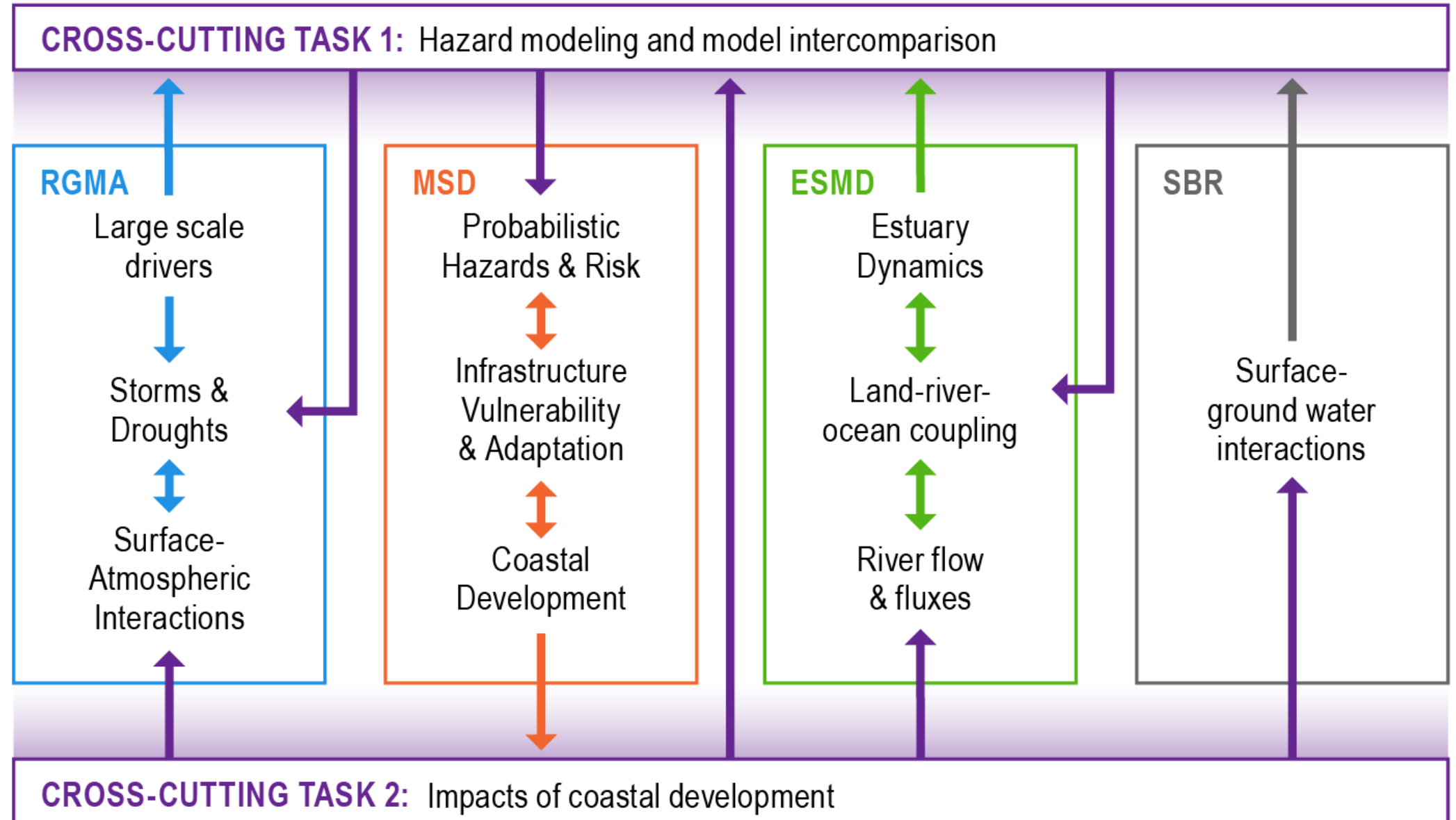


Top 1% precipitation is mainly associated with individual deep convection (IDC) except in the coastal mid-Atlantic region where mesoscale convective systems (MCS) have larger contributions



Evaluating Different Modeling Techniques and Elucidating the Role of Coastal Development in Driving Natural System Changes

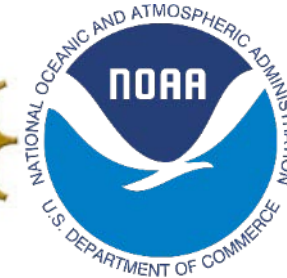
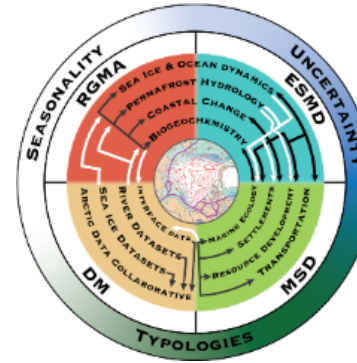
ICoM's cross-cutting research tasks leverage and inform activities in each of the programmatic research areas





ICoM Leverages Many Other Projects and Serves as a Cornerstone for DOE's Growing Portfolio of Coastal Research

- Use a hierarchy of fit-for-purpose models
- Leverage existing capabilities where possible
- Increase complexity over time
- Use case studies and scenarios to guide experiments and promote integration
- Leverage observations and characterize uncertainties
- Coordinate with other projects and activities, both inside and outside DOE, to accelerate progress and enhance impact



COMPASS is a brand new BER activity focusing on coastal measurements and modeling

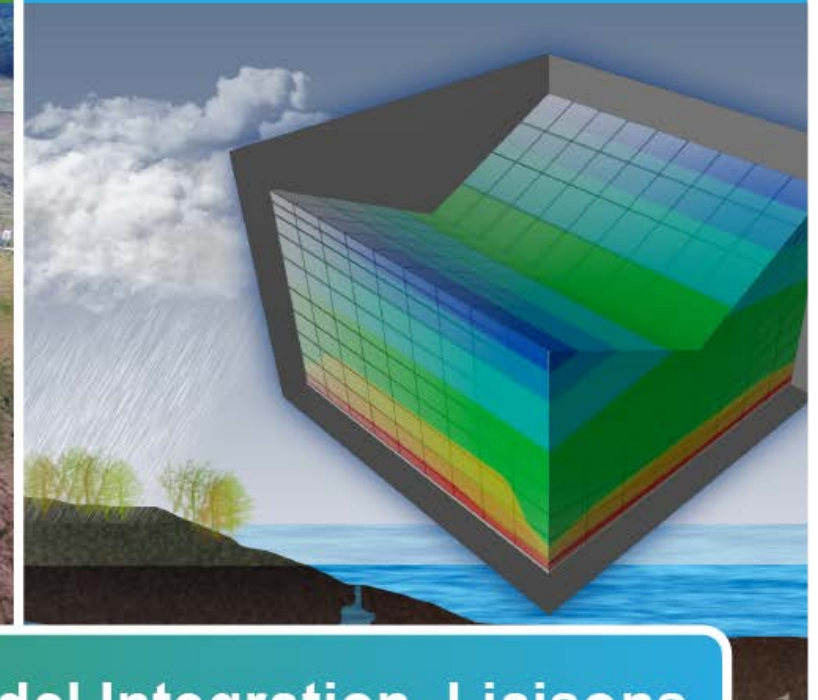


COASTAL OBSERVATIONS, MECHANISMS, AND PREDICTIONS ACROSS SYSTEMS AND SCALES

Field, Measurements, and Experiments

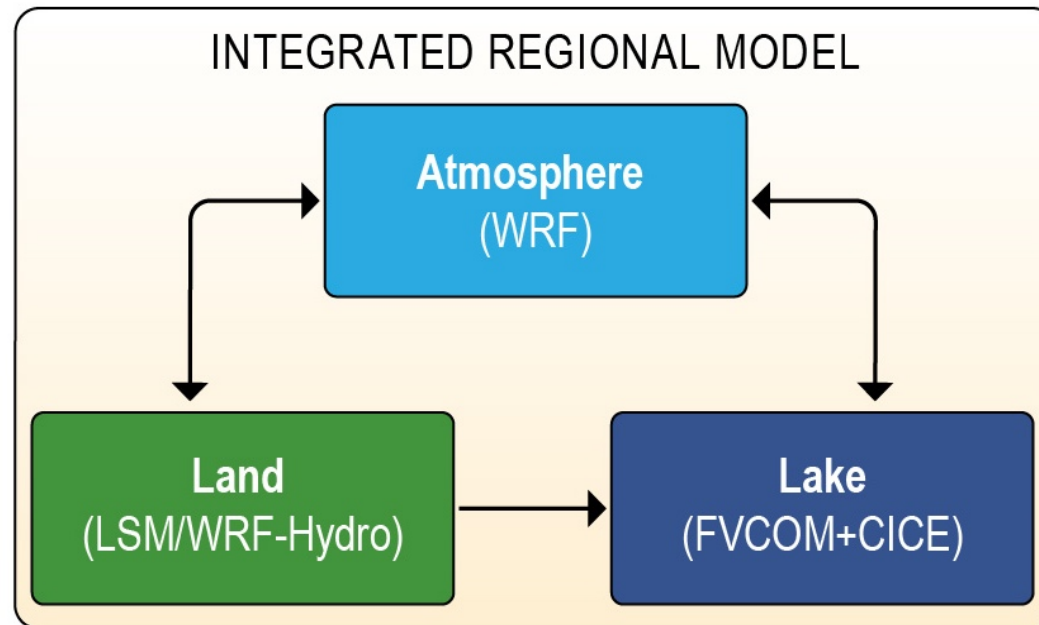


Great Lakes Modeling

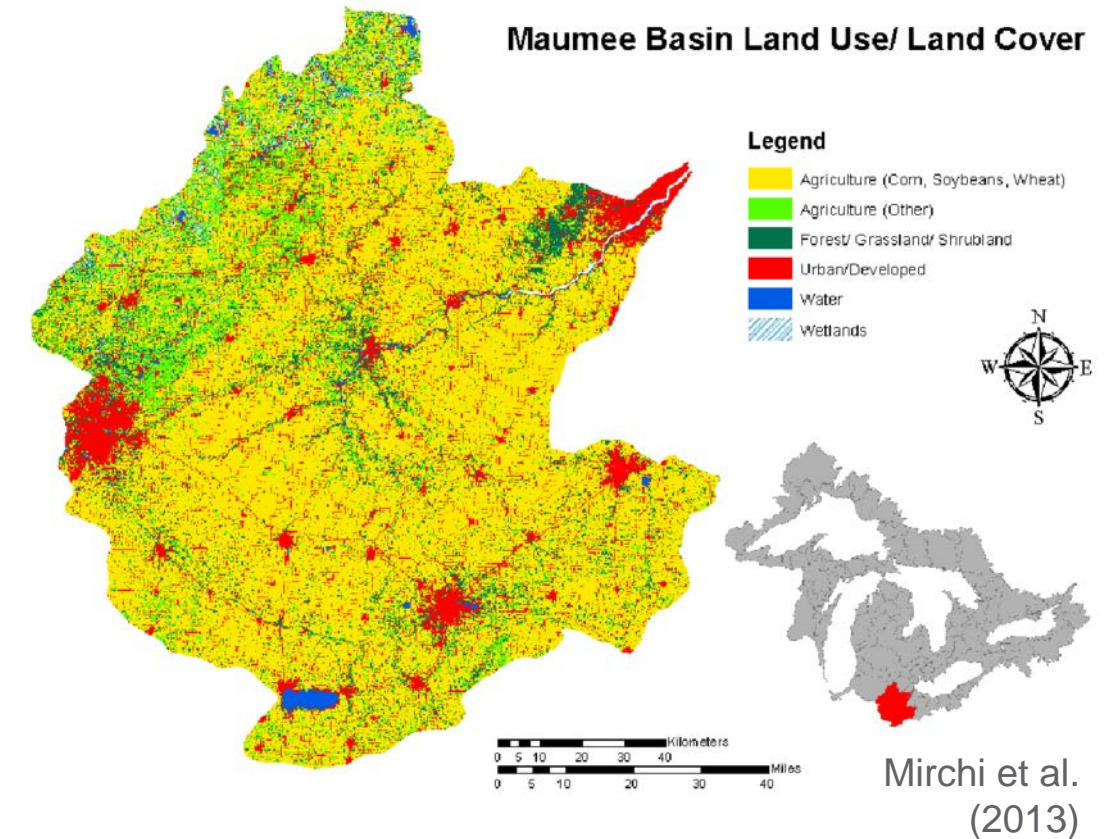


Computation, Data-Model Integration, Liaisons

COMPASS-GLM will enhance predictive understanding of freshwater coastal systems at regional to watershed scales



How do precipitation, runoff, and air temperature in the Great Lakes Region interact with lake water balance, thermal structure, and circulation to influence regional climate changes and extremes?



How do managed drainage practices, legacy nutrient stores, and hydrologic intensification affect nutrient removal and transport in the Maumee River Basin?



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Thank you

