Coastal Urban Resilience in a Changing Climate

COSS Task Team | June 2021

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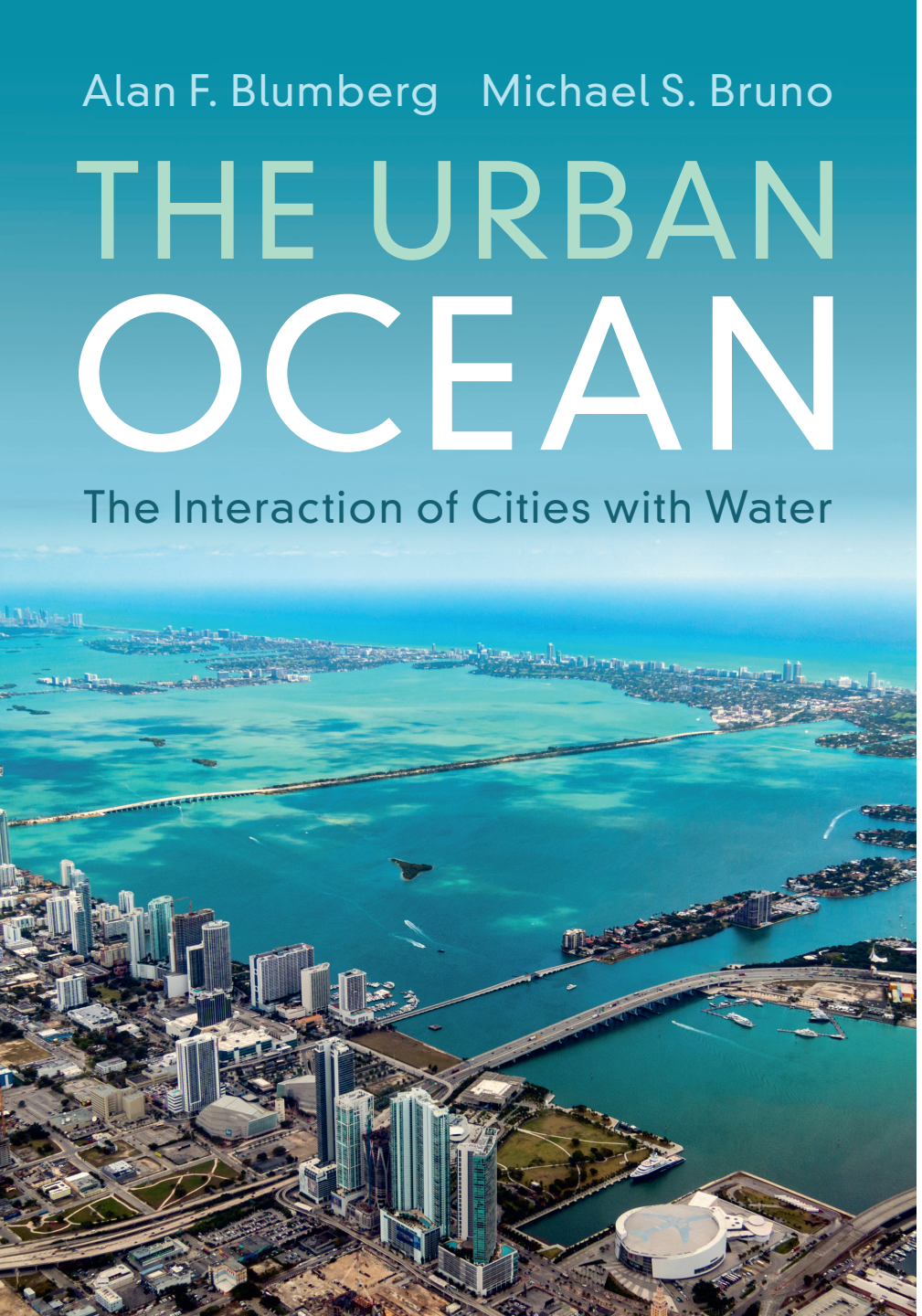
JUPITER



The Urban Ocean is Where the Ocean, Land, and People Come Together…

…. the interface between ocean and land, extending seaward to approximately the middle of the continental shelf (a gently-sloping transition from the coastline to a depth of 100 to 200 meters, followed in most cases by an abrupt drop in water depth at the shelf break), and inland to include all areas strongly influenced by the proximity to the ocean.

We live in an urban, coastal world. Coastal cities are home to more than 50% of the global population,

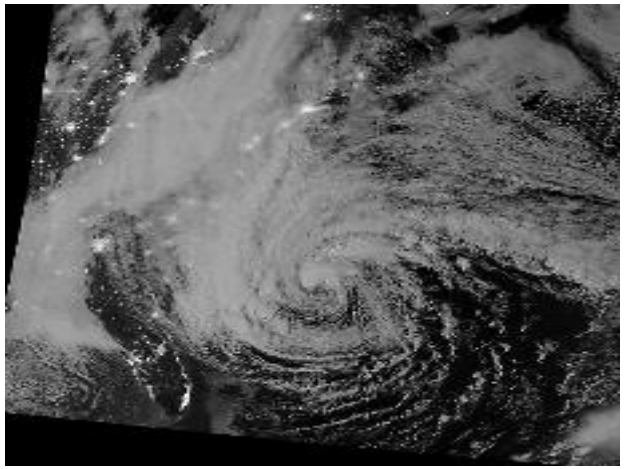
Of the 23 megacities of the world, cities with over 10 million in population, 18 are on the coast.

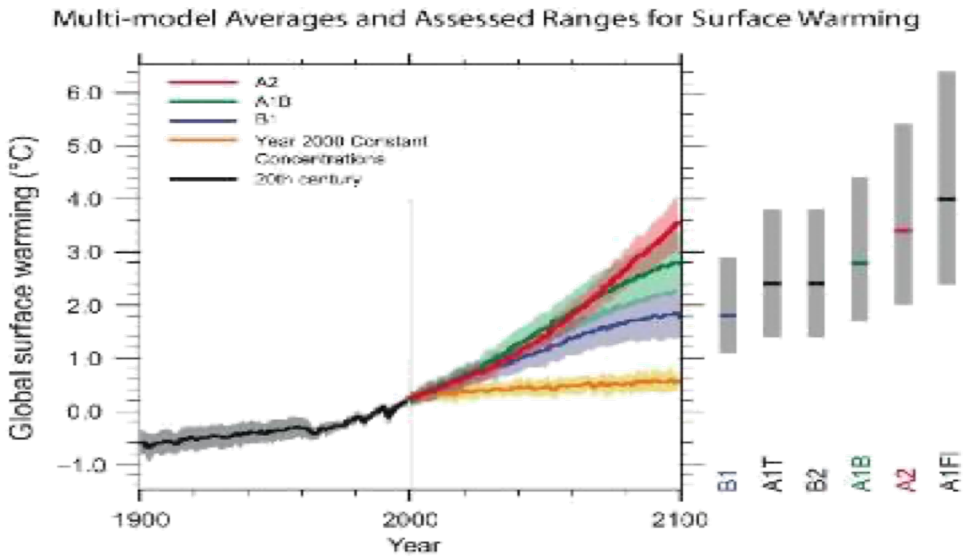
The Vision

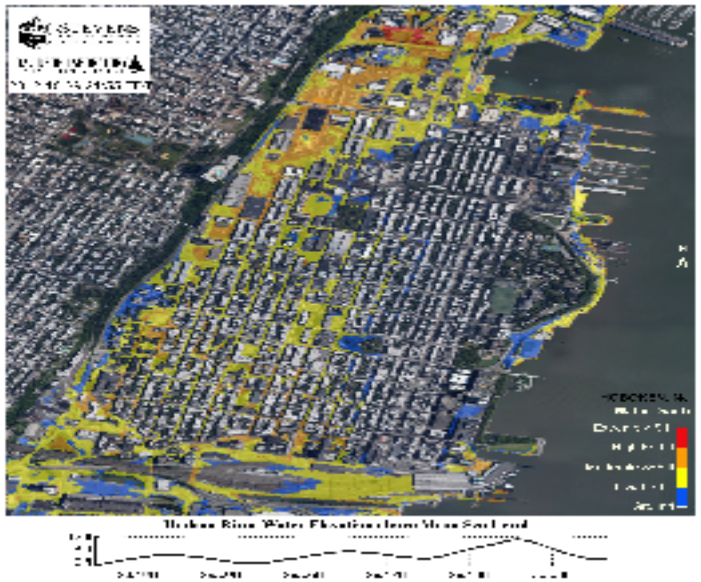
Today people forecast the weather.

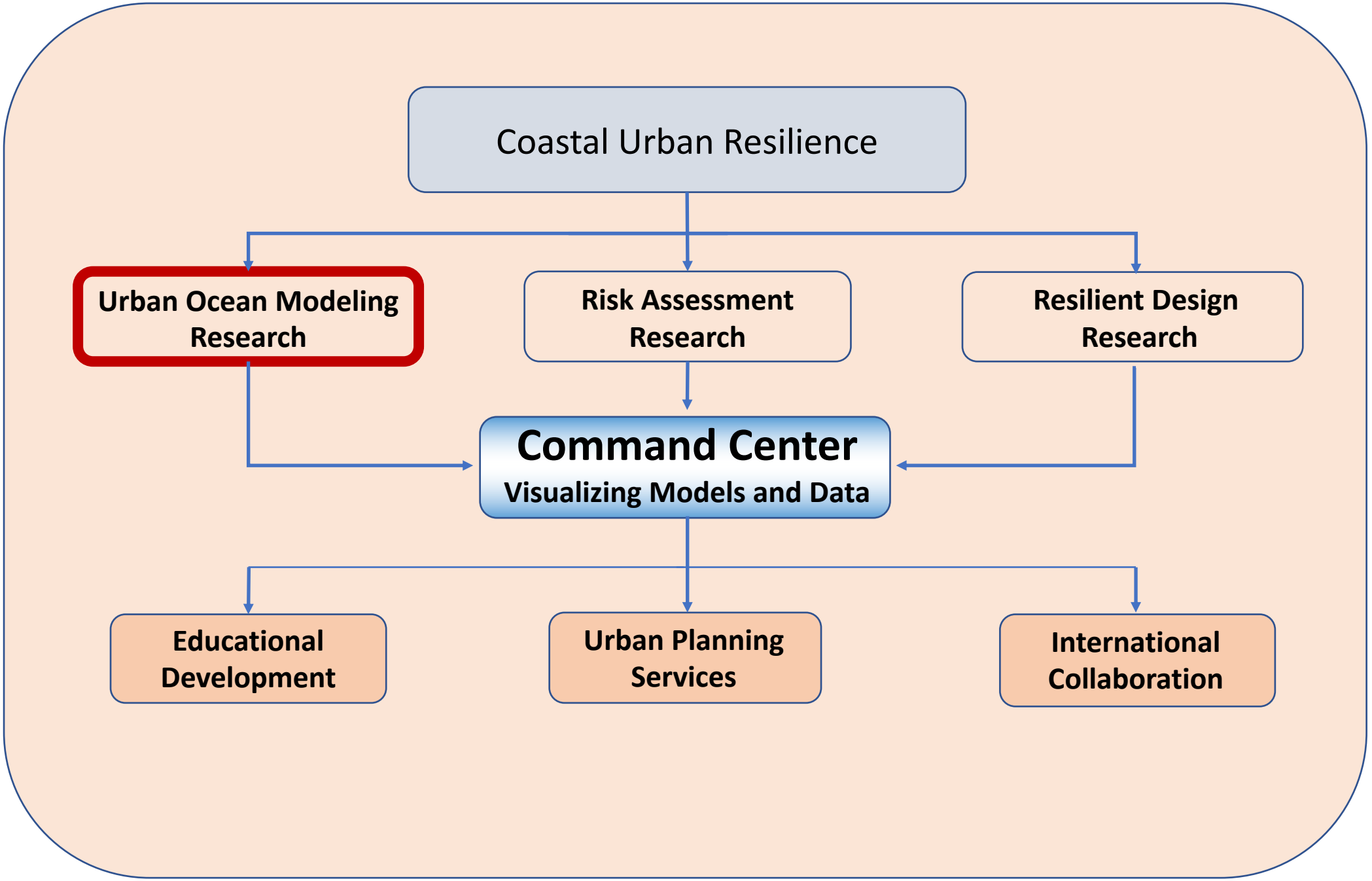
What is needed are forecasts of the impact of that weather as our climate changes.

A premier multidisciplinary research and educational initiative is needed to support safety of life and property for those who live on the urban coasts of the world.








Coastal Urban Resilience
Urban Ocean Modeling Research
Risk Assessment Research
Resilient Design Research
Command Center
Visualizing Models and Data
Educational Development
Urban Planning Services
International Collaboration

Urban Ocean Modeling Research

- Improve the science dynamics of flooding by linking to surface and groundwater, wetlands, estuaries, surf zone, geomorphology and sediment transport.
- Reduce/quantify boundary condition errors associated with DEM/bathymetry/bedforms/sediment properties
- Employ more grid resolution
- Numerical methods for improved treatment of the vertical coordinate to reduce spurious numerical mixing.
- Use AI/ML along with assimilation techniques with in-situ and remote-sensing measurements
- Improve parameterizations for horizontal diffusion and bottom drag

Parameterizations?

Horizontal diffusion - either employ an advection scheme that is diffusive, or add enough artificial diffusion to prevent grid-scale energy pile-up: Smagorinsky model: $A_H = C\Delta x^2|\bar{\bar{e}}|$

Eternal struggle between diffusion and dispersion

Bottom drag - better parameterizations for C_D!

a) Wave-current drag
b) Directionally-dependent drag over asymmetric bedforms
c) Drag over dunes + ripples and better parameterizations for their formation and migration
d) Vegetation drag

Thank you

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