FALL 2013 SEMINAR SERIES

DEPARTMENT OF OCEAN, EARTH, AND ATMOSPHERIC SCIENCES
3PM – ROOM 200 IN THE OCEANOGRAPHY/PHYSICS BUILDING
THURSDAY OCTOBER 3rd, 2013

"Flood, Fortify, or Flee: Modeling Coupled Economic and Physical Coastline Dynamics"

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ABSTRACT

Coastal regions around the world are densely populated and as a result, in many locations the coastal environment has become an active economic market for property value. Coastal erosion and damage to property from storms provides a source of vulnerability to coastal economies. To manage this vulnerability, humans have long engaged in the act of beach nourishment –placing sand, typically from offshore sources, onto the beach to widen the beach and increase the height of dunes. As humans alter natural coastal dynamics, the altered natural dynamics then influence future beach management decisions. In this way human-occupied coastlines are a strongly coupled dynamical system. While the time-scale of these coupled dynamics play out over years, humans have the capability of observing the longer-time-scale evolution of the coupled system as it responds to changing environmental forcing, namely rising sea level and altered storm patterns. This long-time-scale dynamic of observing the system can cause humans to adapt their interactions in the natural coastal environment. Understanding how the future vulnerability of human occupied coastlines will evolve in response to predicted increases in sea level rise and changing storminess requires treating the human occupied coastline as a complex adaptive system. A numerical model is presented that couples natural coastal processes with an agent-based economic model for real estate markets and mitigation to explore evolving vulnerability of coastal property and the potential for abandonment of coastal real estate markets. The coastline model simulates barrier island processes that respond to both storms and slow scale dynamics associated with sea level rise. The economic model simulates rational agent actions in a real estate market as agents attempt to purchase coastal property and choose mitigation strategies for evolving coastal risks. Adaptation is simulated by providing a spectrum of models to agents for observing coastal environmental conditions and predicting system evolution in order to inform economic and mitigation decisions. Results from the model for a wide range of sea level rise and storm scenarios show that mitigation eventually gives way to abandonment as an optimal strategy. The specific timing of abandonment and amount of damage that occurs to coastal property is strongly tied to agent beliefs about their changing environment. Model results also show how disappearing nourishment subsidies reduce coastal property value and give rise to a bubble in coastal property value.

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