Coastal water resources vulnerability to storm surge inundation

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Why coast?

85%

75%
Public attention goes to surface nuisance flooding

Most studies focus on surface water
Storm surges introduce marine flood threaten water resources
Salinization on agriculture
Hurricane Sandy (2012) affected trees for more two years

- London plane trees, once thought to be salt tolerant, fared poorly on Long Island and in NYC after Hurricane Sandy. Photo Courtesy Cornell Urban Horticulture Institute

- In the summer of 2014, Long Beach took down more than 1400 dead trees.
Understand the process by land ocean interaction modeling

- What types of topography are vulnerable to storm surges?
- How to mitigate groundwater salinization?
Storm surges and groundwater salinization

(a) ① Ocean surges runup push seawater toward shore.

(b) ② Topographic depression prolongs infiltration time.
    ③ Connectedness of low-elevation affects rundown process.
Land – ocean interaction model

- Storm Surge
- Vertical Infiltration
- Fresh Groundwater
- Saline Groundwater
Land – ocean interaction model

Couple surface and subsurface flow

- Storm Surge
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Land – ocean interaction model

Couple surface and subsurface flow

Storm Surge

Vertical Infiltration

Variable density flow

Fresh Groundwater

Saline Groundwater
Model simulation starts from hours to decades
Topography varies laterally and vertically
Sea-level rise in the past
Sea-level rise in the future
Coastal water resources and flood risk

- Climate change
  - Accelerated sea level rise
  - Extreme weather events

- Socio-economic development
  - Urbanization and population growth
  - Increased water demand

Sea level rise 3 - 10 mm/year

Subsidence 6 - 100 mm/year

Impacts
- Increased flood risk
- Damage to buildings, infrastructure
- Disruption of water management

Causes
- Groundwater extraction
- Oil, gas, coal mining
- Tectonics