MAGEEP Education Network

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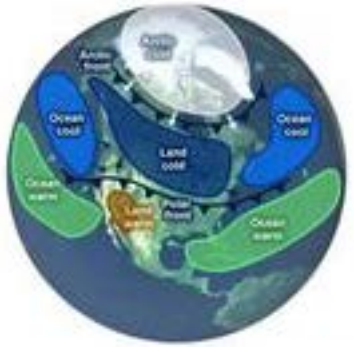

Water System Adaptation to Hydrological Changes

Module 1
Introduction to Water System Adaptation

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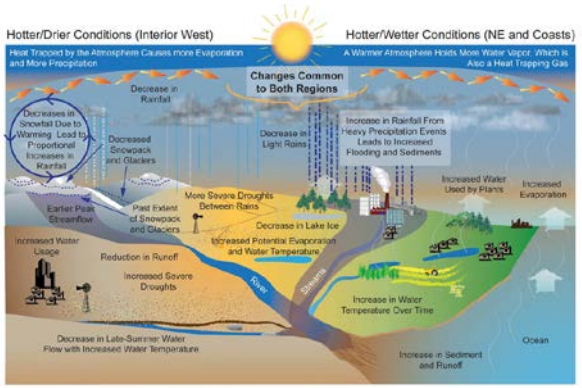
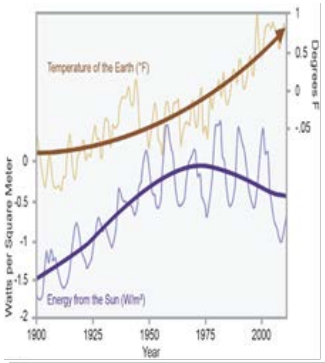
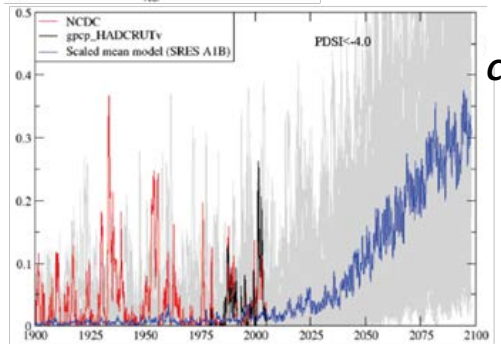


Key Topics: Module 1

Climate Process

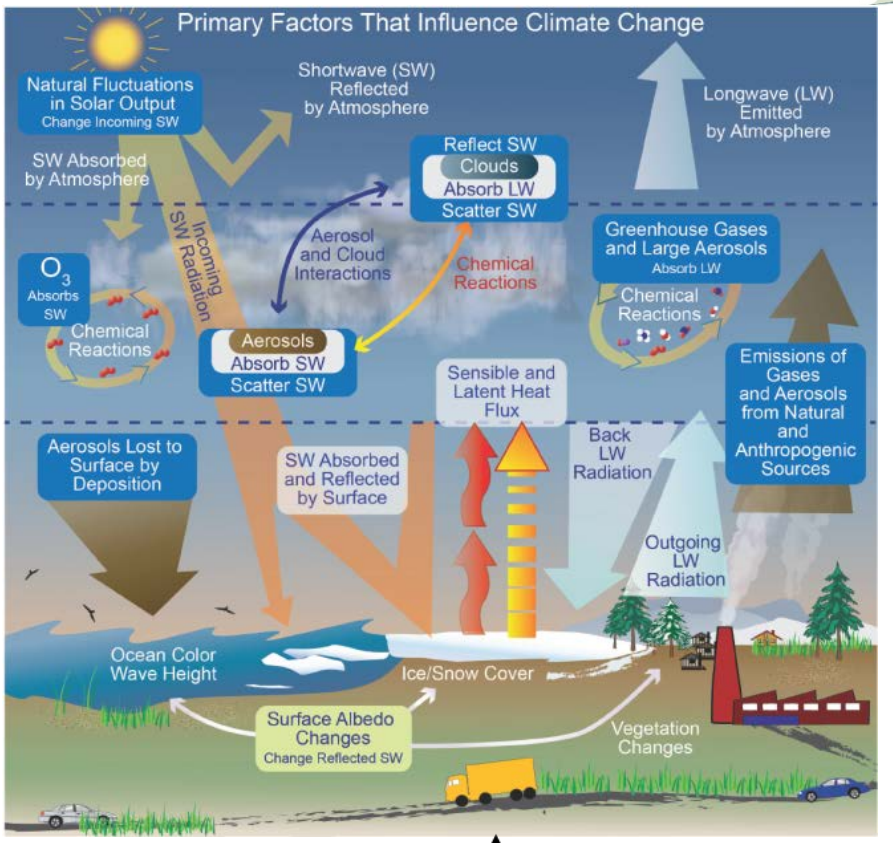




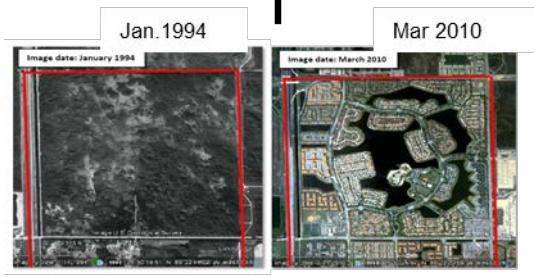
Climate impacts

IPCC (2013)

Atmospheric and hydrologic responses



Adaptation



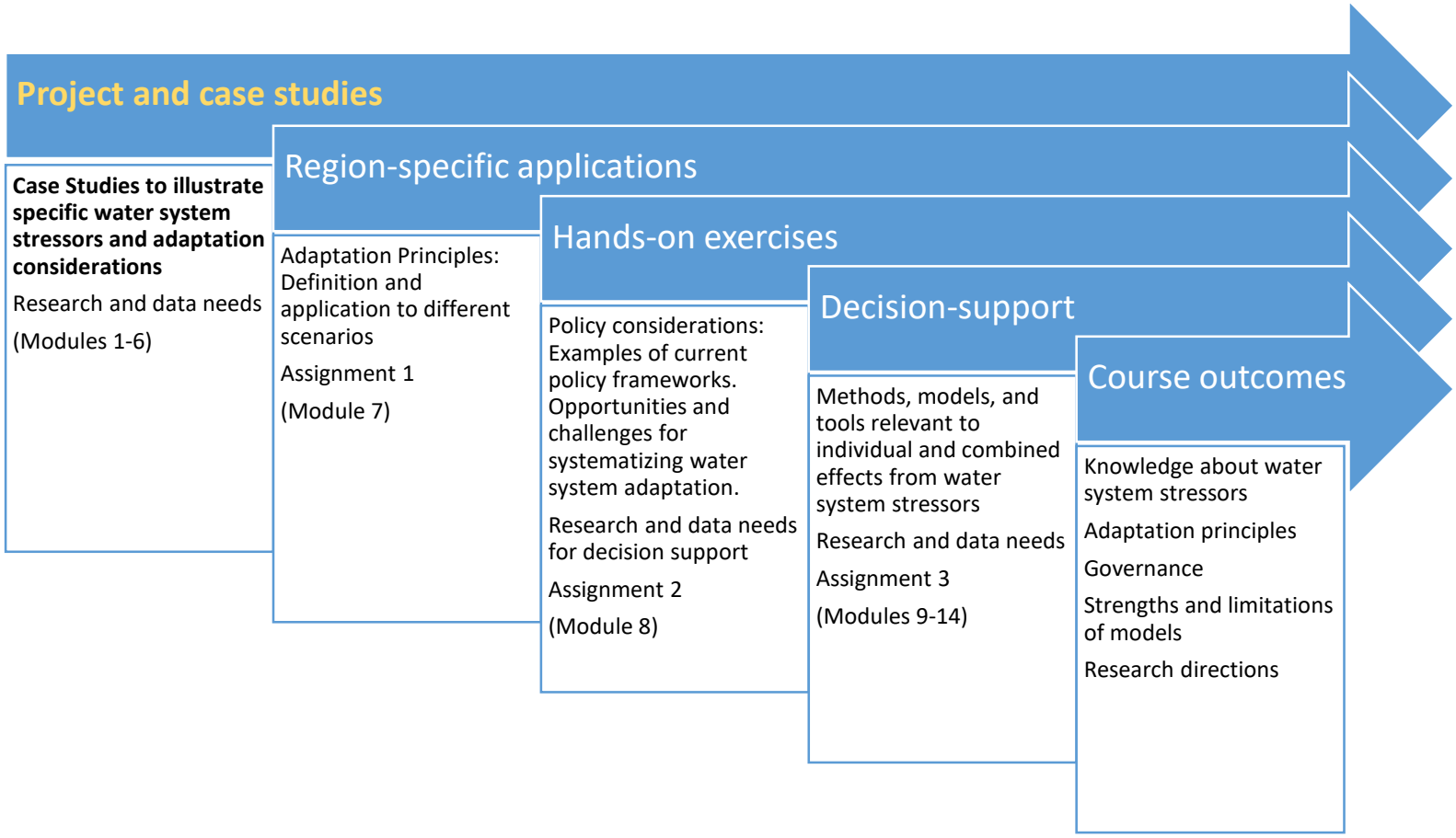
Doral, FL. IPCC WGIII (13)

Adaptation and feedback

- Course overview
- Learning objectives
- Format
- Expectations
  - Participation
  - Assignments
  - Project
  - Feedback
- Topical preview
- Keys for success

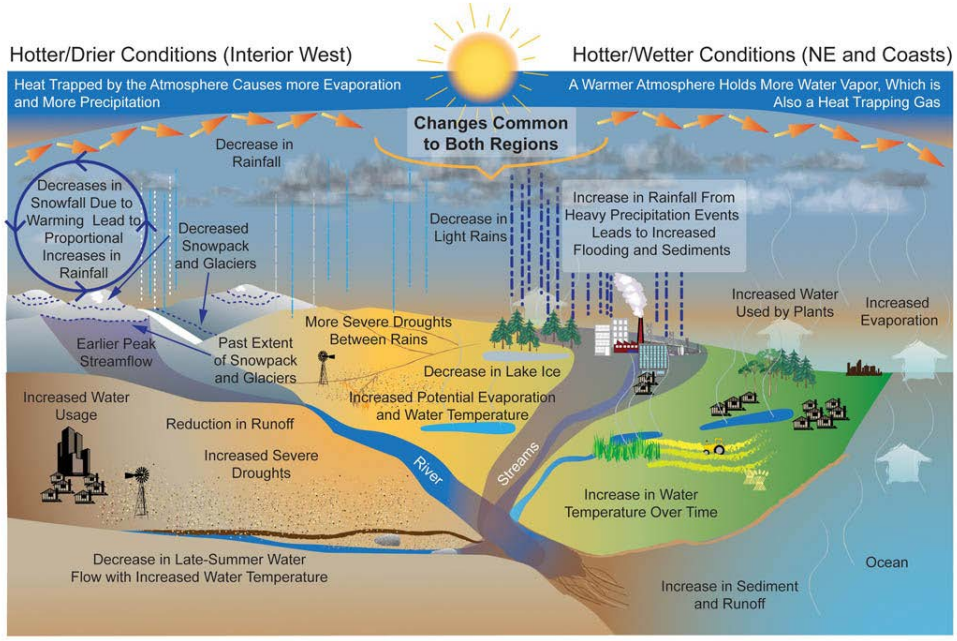
Water infrastructure condition, development/urbanization, and socio-economic patterns

Course Roadmap



Water System Adaptation: Guiding Principles

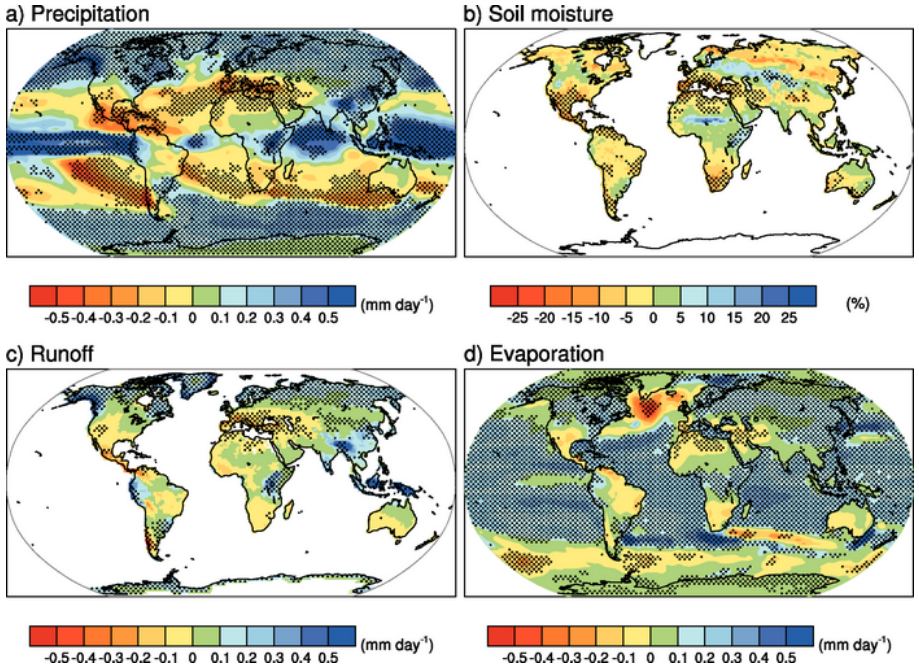
- Develop framework for systematic and comprehensive analysis of the source, intensity, duration, and frequency of hydrologic disruptions at local, regional, and watershed scales
- Establish short-, medium-, and long-term goals, benchmarks, and milestones
- Evaluate and triage integrity, resilience, and security of water systems
- Define vulnerability to hydrologic threats and identify points-of-control
- Review literature and available decision-support tools
- Determine data and information needs and sources
- Develop actionable short-, medium-, and long-term adaptation plan



Learning Objectives

- Linkages between water systems, multiple stressors, and actionable adaptation plans
- Water system resilience under stressors that vary in intensity, duration, frequency, and uncertainty
- Constraints and opportunities related to regulatory policies and governance
- Capacity reserve and adaptive planning
- Methods, techniques, and models to examine watershed hydrology and develop water system engineering solutions

Multi-model mean changes in 4 principle hydrological parameters



https://www.ipcc.ch/publications_and_data/ar4/wg1/en/figure-10-12.html

Course Format and Expectations

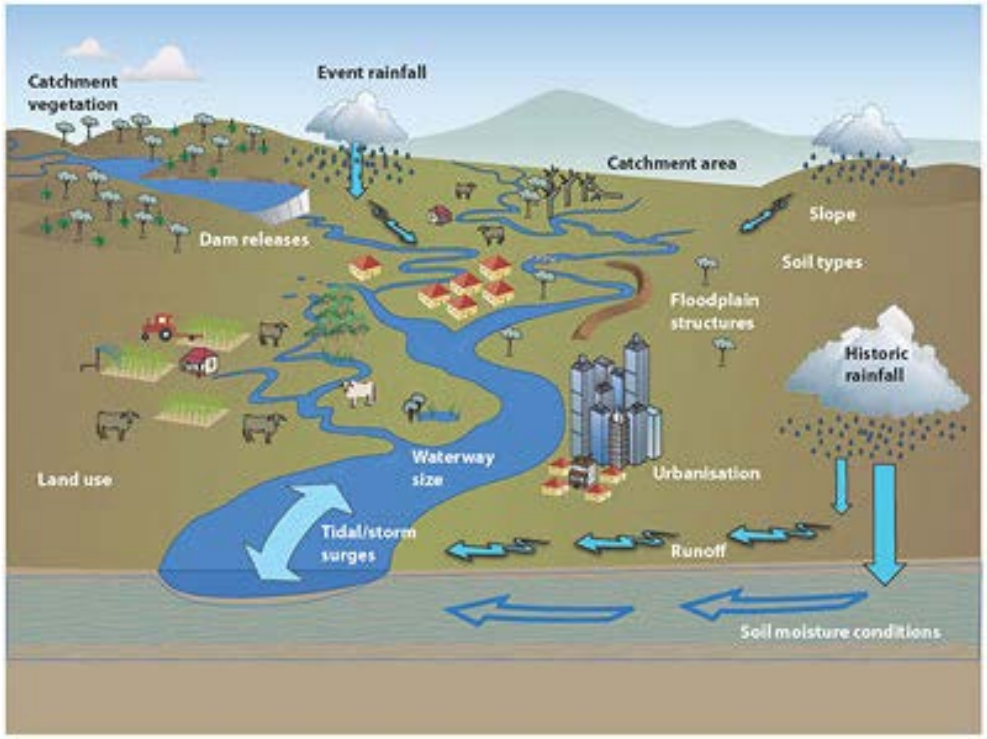
- Thematic presentations:
  - Case studies (modules 1-6)
  - Adaptation principles (module 7)
  - Policy considerations (module 8)
  - Models, methods and tools (modules 9-14)
- Course project
- Assignments
- Supplemental reading (optional)

Course Project

- Scope
  - Individual or group effort
  - Topic and approach must be approved by course instructor
  - Example topics
    - Local or regional adaptation case study
    - Literature review of specific topic
    - Data analysis and modeling
    - Other topic relevant to course content
- Milestones
  - Topic selection and approval (prior to module 3)
  - Proposal (prior to module 6)
  - Progress update (prior to module 14)
  - Presentation (module 15)

Water System Stressors to Be Covered

- Intense storms
- Prolonged drought
- Land-use changes/Urbanization
- Storm-surge
- Sea level changes
- Salt water intrusion



Case Studies

- Recurring floods in urban environments
- Prolonged drought conditions
- Urbanization and fragmented land-use planning
- Coastal infrastructure vulnerabilities
- Multiple concurrent threats

Water System Adaptation Goals

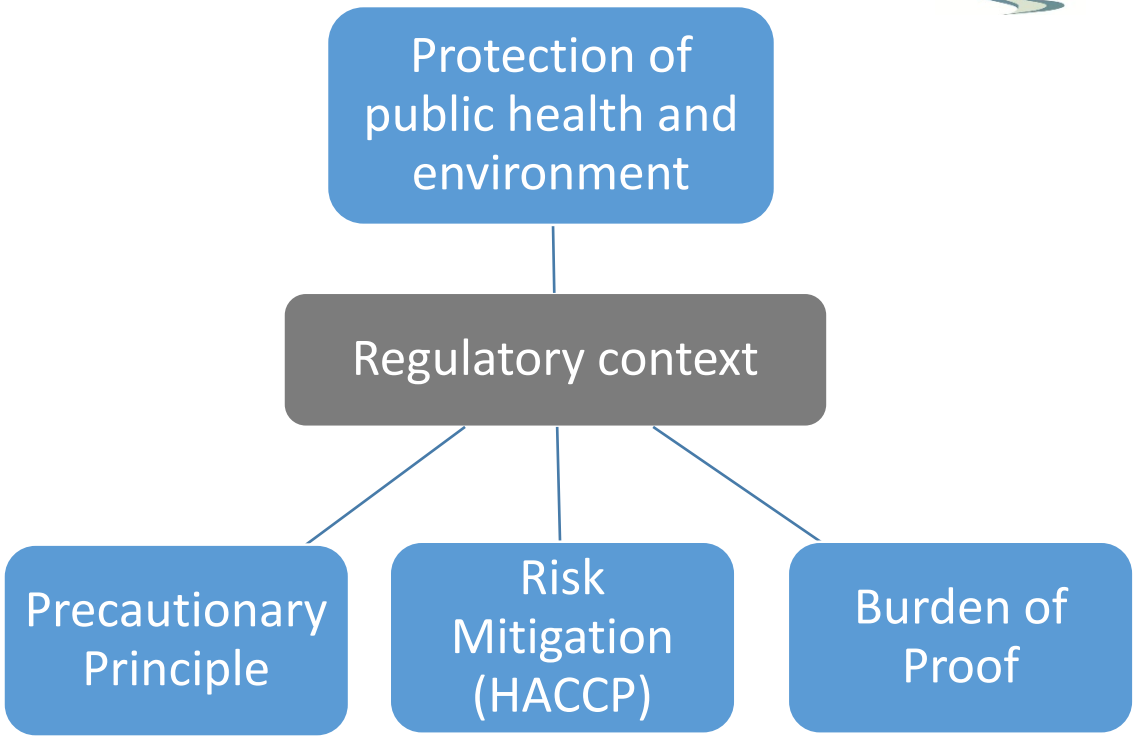
- Public health protection and emergency response
- Water system integrity
  - Infrastructure resilience to:
    - Sewer overflows
    - Water main breaks
    - Water use variability
  - Continuity of flow
- Water quality management
  - Monitoring
  - Upstream controls
  - Treatment system reliability and multiple barriers

Risk Assessment/Risk Management of Water Systems

- Engineered water systems
  - Provisioning water
    - Drinking water
    - Irrigation
    - Industrial and commercial water use
  - Collection, treatment, and reuse
    - Wastewater
    - Storm water
  - Storage
    - Surface storage
    - Managed underground storage
- Ecosystem protection and enhancement
- Managing chemicals and wastes to protect public health and the environment

Regulatory Philosophies

- Data requirements
- Baseline conditions
- Control points
  - Source/Upstream
  - Multiple Barriers
  - Critical Points
  - Point-of-use
- Enforcement



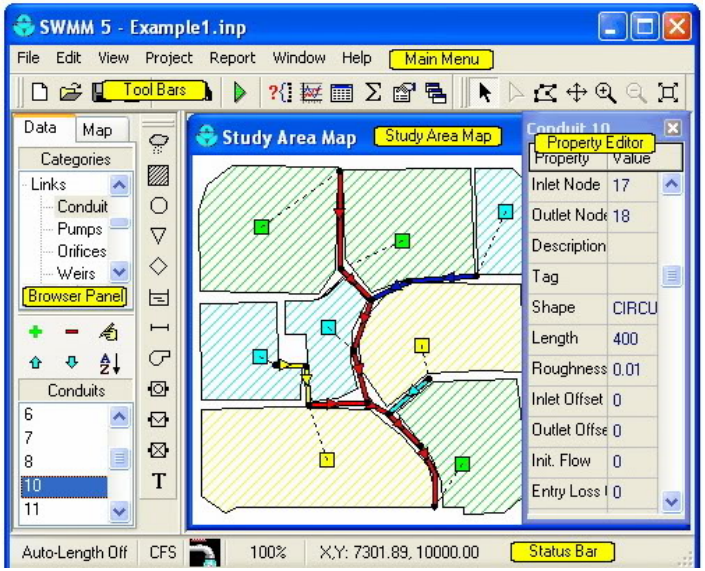
Risk Management Framework Example: Hazard Analysis and Critical Control Points (HACCP)

- Systematic review of physical, chemical, and biological threats/hazards
- Seven Principles
  - Hazard Identification and preventive measures
  - Identify Critical Control Points (CCP)
  - Establish Critical Limits
  - Establish Monitoring system for each CCP
  - Establish Corrective Actions
  - Documentation and record keeping
  - Verification/validation

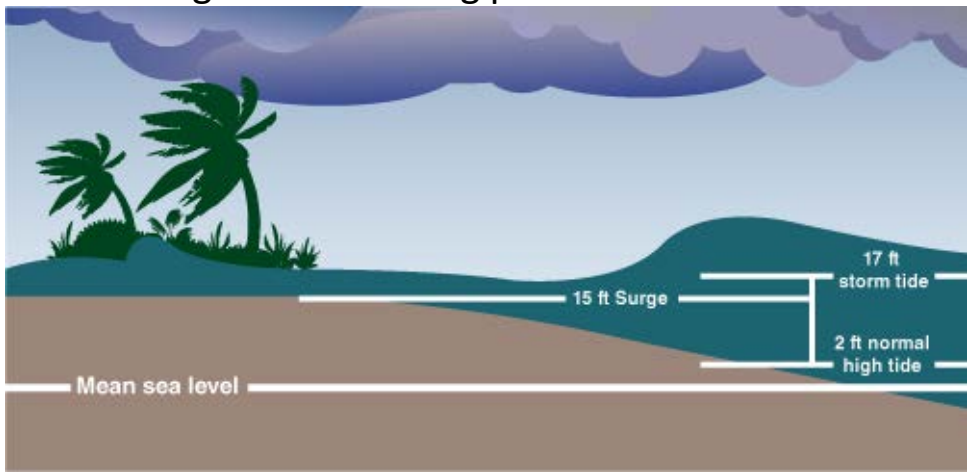
Models

- Watershed Hydrology
  - Storm water
  - Storm surge
  - Sea level rise
  - Drought
- Water quality
  - Surface water
  - Groundwater
  - Salt water intrusion
- Water infrastructure
  - Integrity
  - Quality
- Process engineering

Design software (e.g., SWMM)

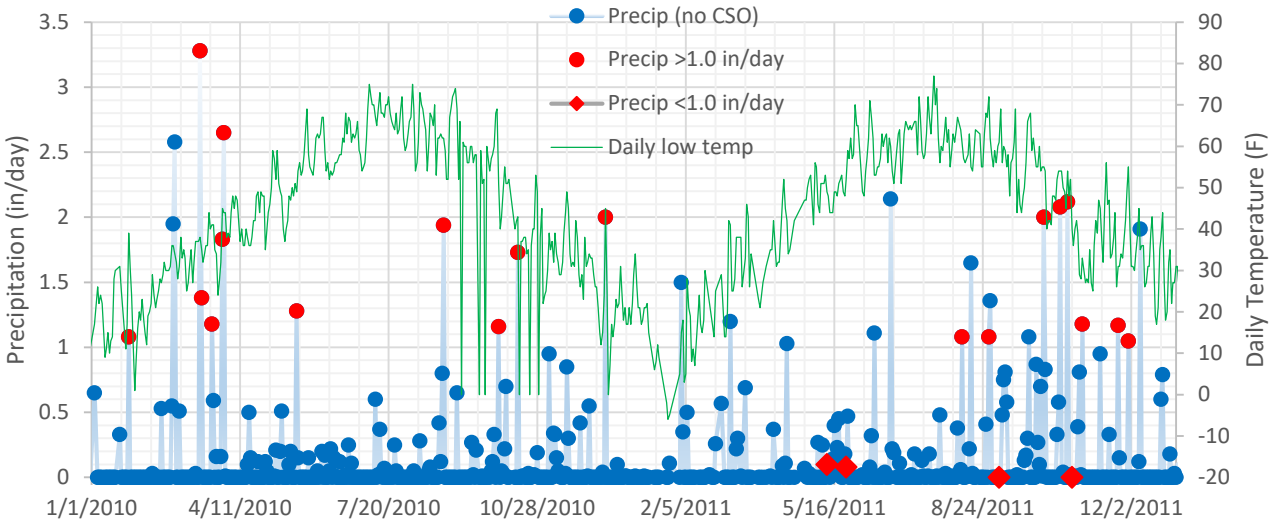


Storm surge and modeling platforms



Data and Information Needs

- Scale
  - Temporal (frequency)
  - Spatial (specific locations)
- Baseline (historic data availability, statistics)
- Parameters
  - Water quantity and availability
  - Water quality



Looking Ahead to the Next Module…..

- Identify locally-relevant climate stressors
- Initial scoping of project topic
- Review background resources