2009

Climate Change in the Casco Bay Region: Maine's Coastal Environment in a Greenhouse World (2009 Presentation)

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CLIMATE CHANGE IN THE CASCO BAY REGION

Maine's Coastal Environment in a Greenhouse World

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Climate change -- the future, right?

- WRONG!
- Climate has changed over the past 150 years in ways consistent with anthropogenic impact
  - Present-day design practices based on historical data are ALREADY misleading
- Decisions we make TODAY have long term effects
  - Try to avoid making decisions today that commit us to poor choices in the future

CBEP And Climate Change

- Casco Bay Plan (update in 2006) does not mention climate at all
- Recognition by CBEP Board in 2008 that addressing CBEP priorities requires consideration of climate
- CBEP Focus
  - Climate adaptation
  - Natural resources
  - Local decisionmakers

CBEP Climate Focus So Far

- Support development of local information on climate change
- Begin to characterize natural resource implications
- Identify impacts of present-day decisions for the future

CBEP Climate–Related Projects

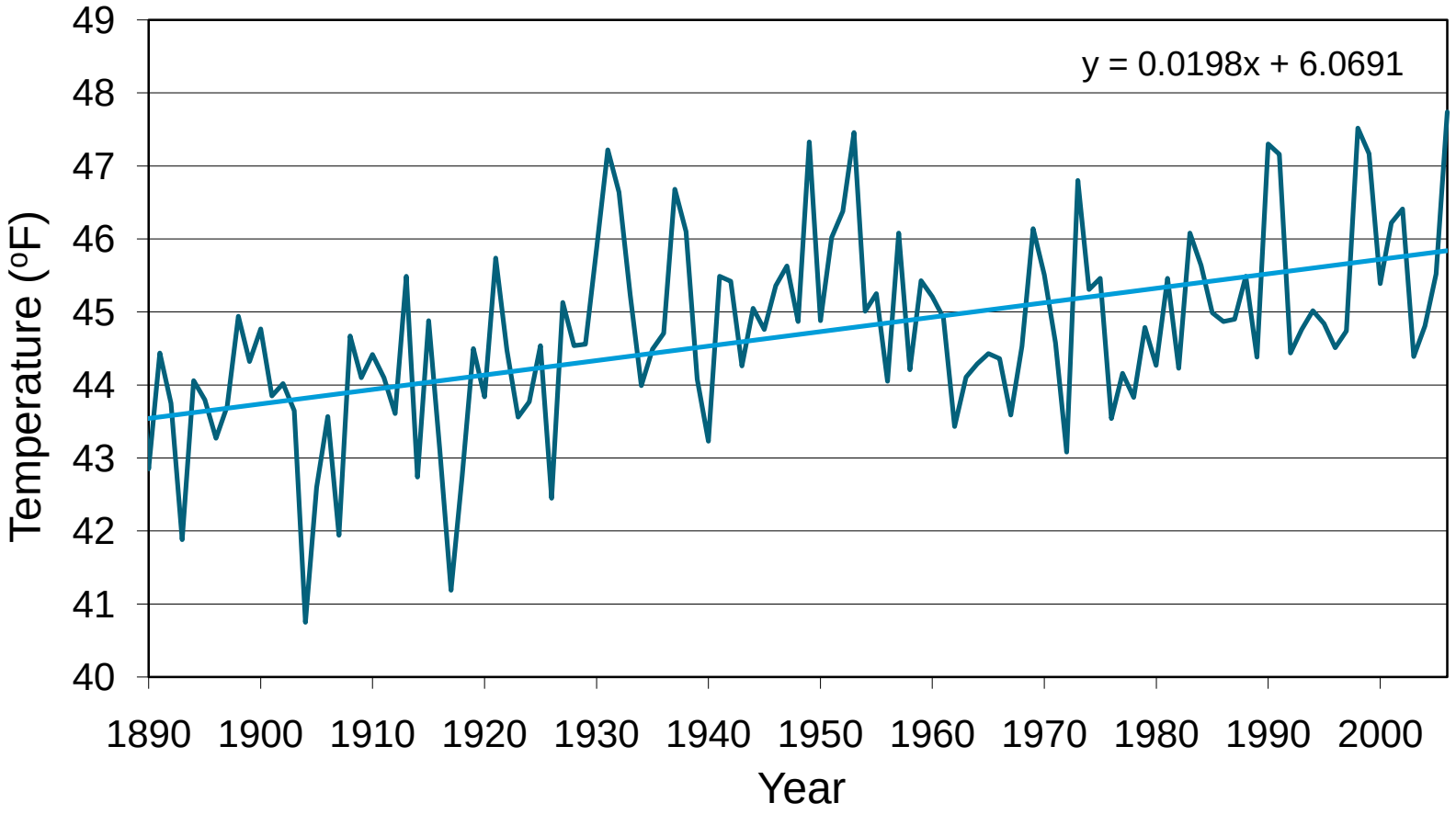
- Recent history of climate in the region
- Projected regional future climates
- Coastal inundation mapping
- Assess vulnerability of coastal ecosystems to climate change
- Fish passage barriers at road-stream crossings

Casco Bay Climate History

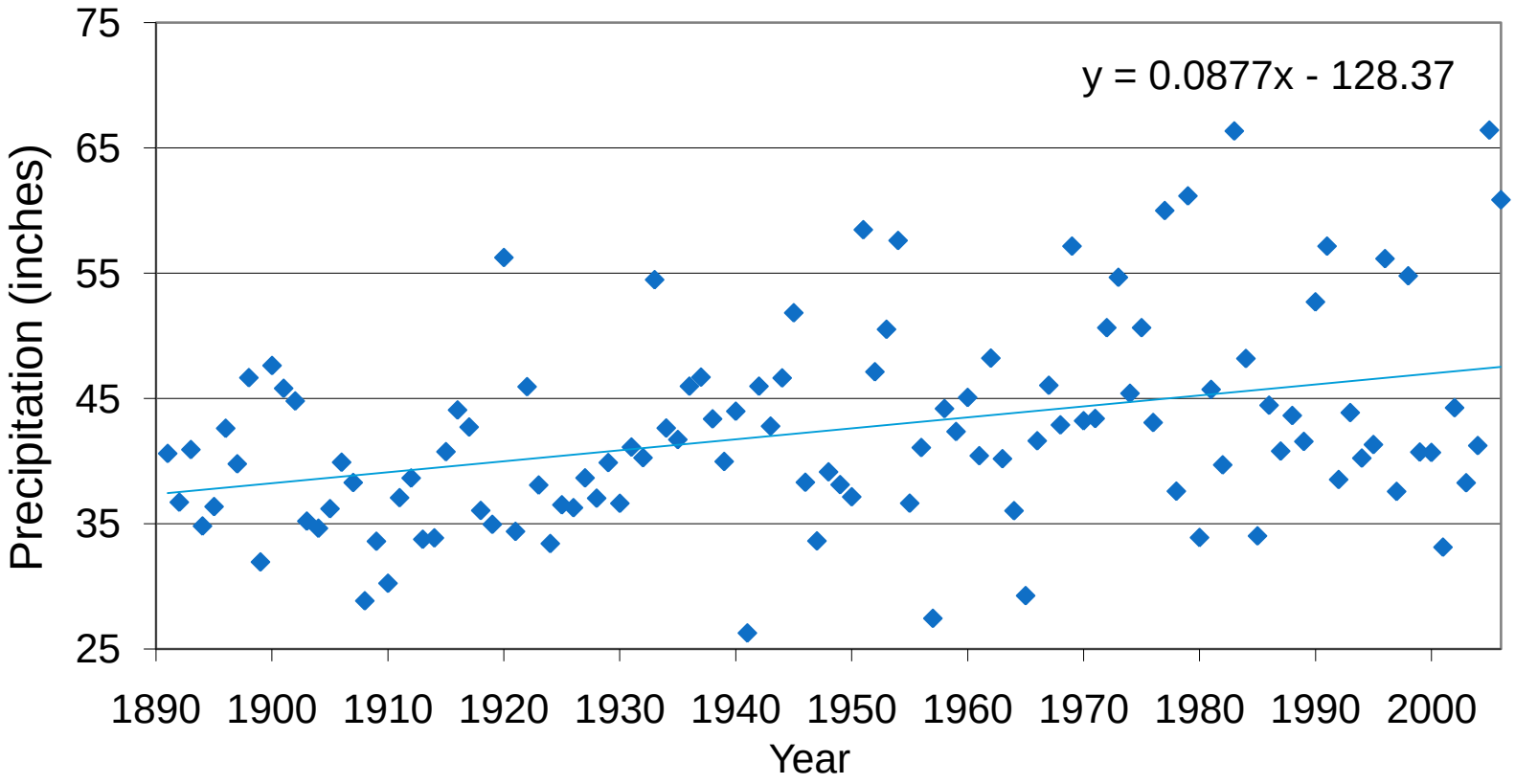
Based on work by Cameron Wake and Elizabeth Burakowski, UNH

The 100 + year period of record shows many systematic changes over time, most consistent with predictions of impacts of anthropogenic effects of release of greenhouse gases.

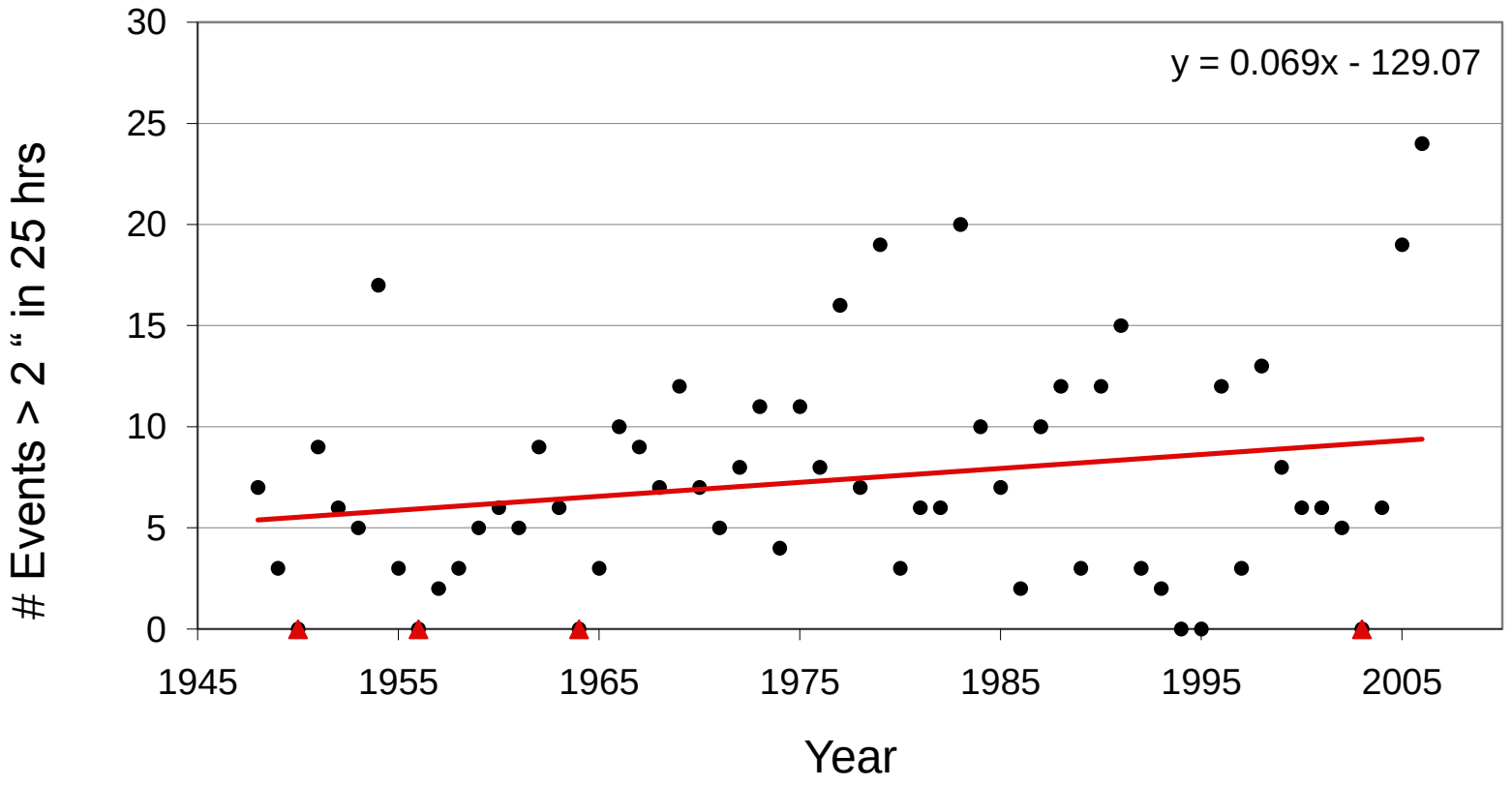
Portland Temperature



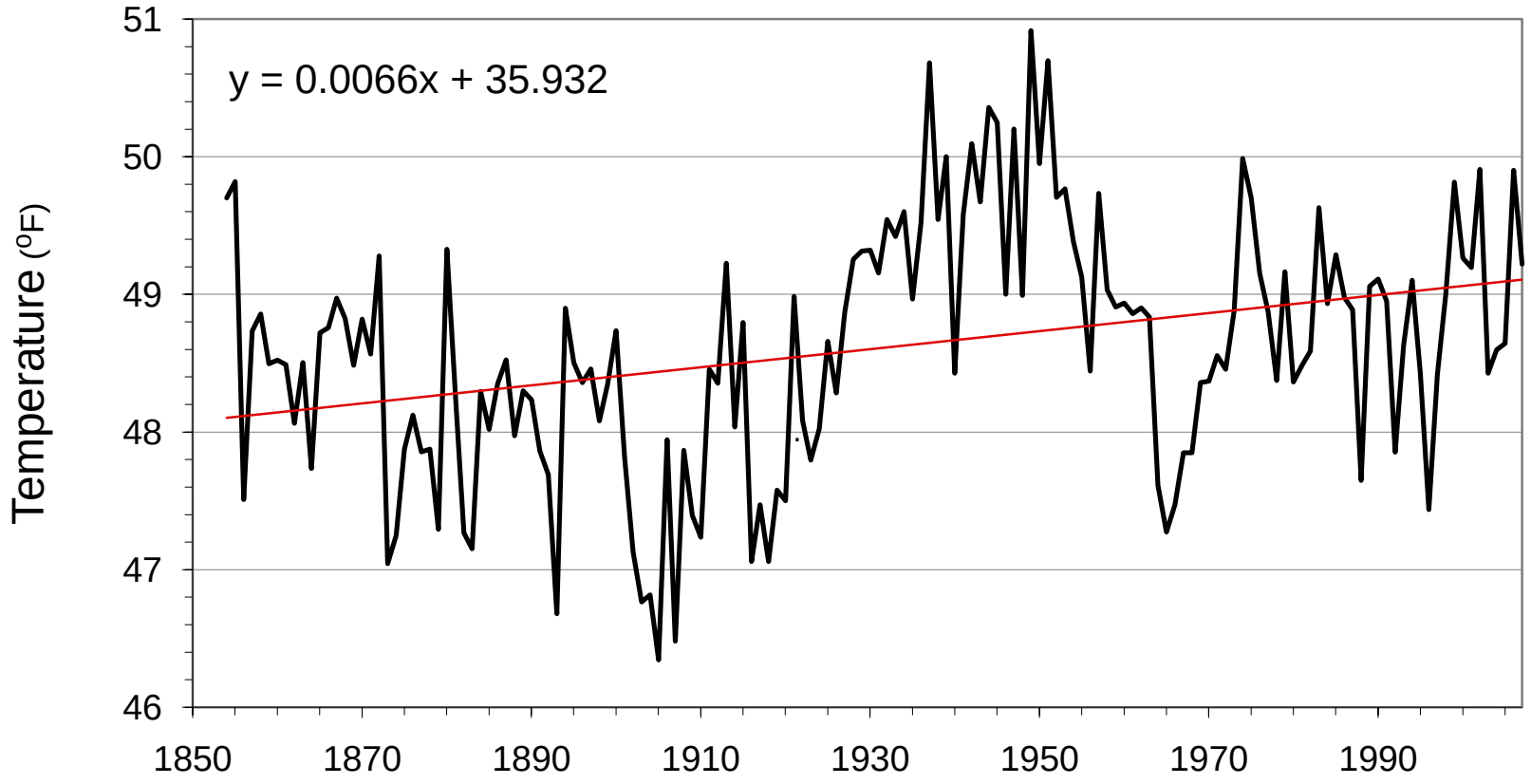
Portland Annual Precipitation



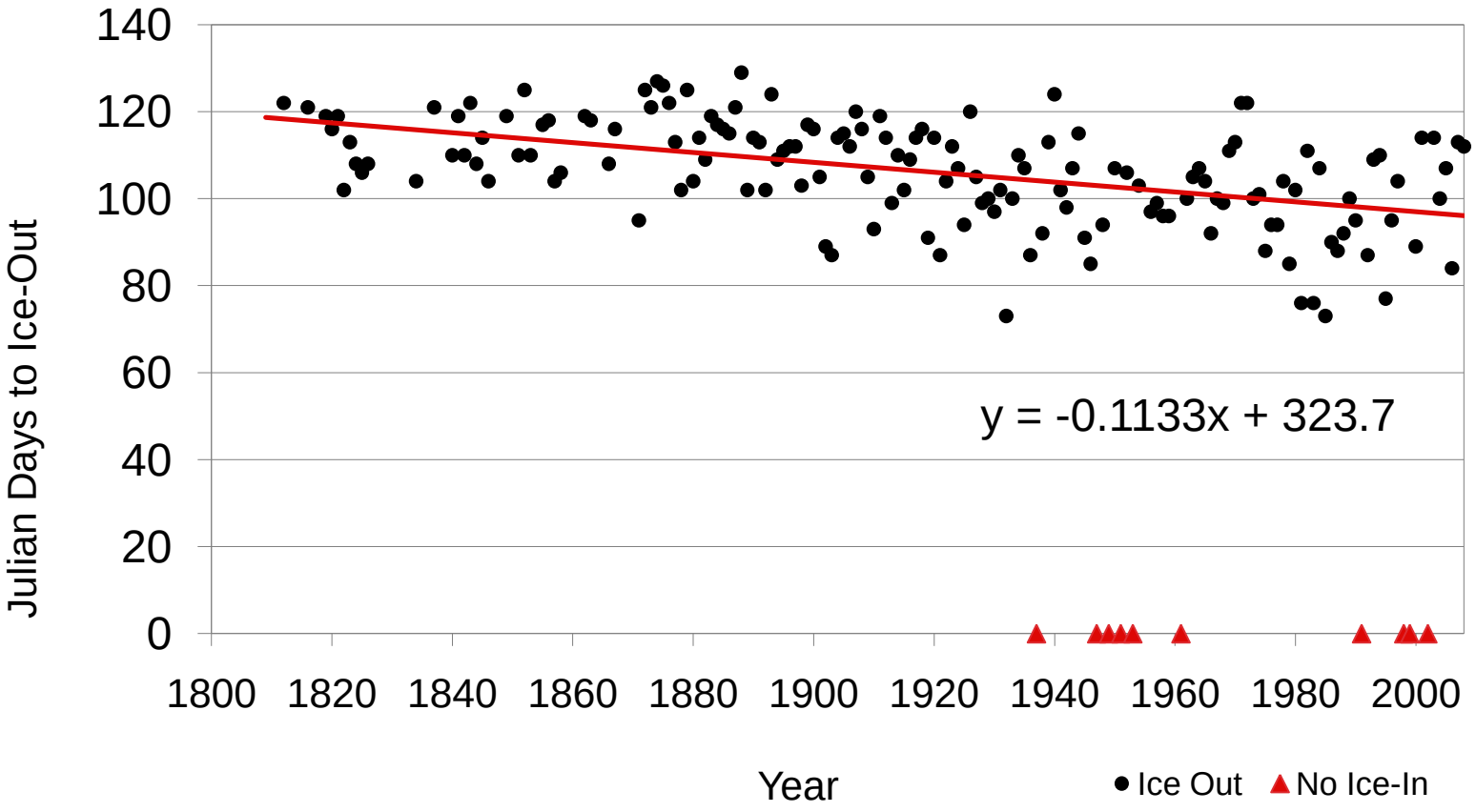
Precipitation - Extreme Events



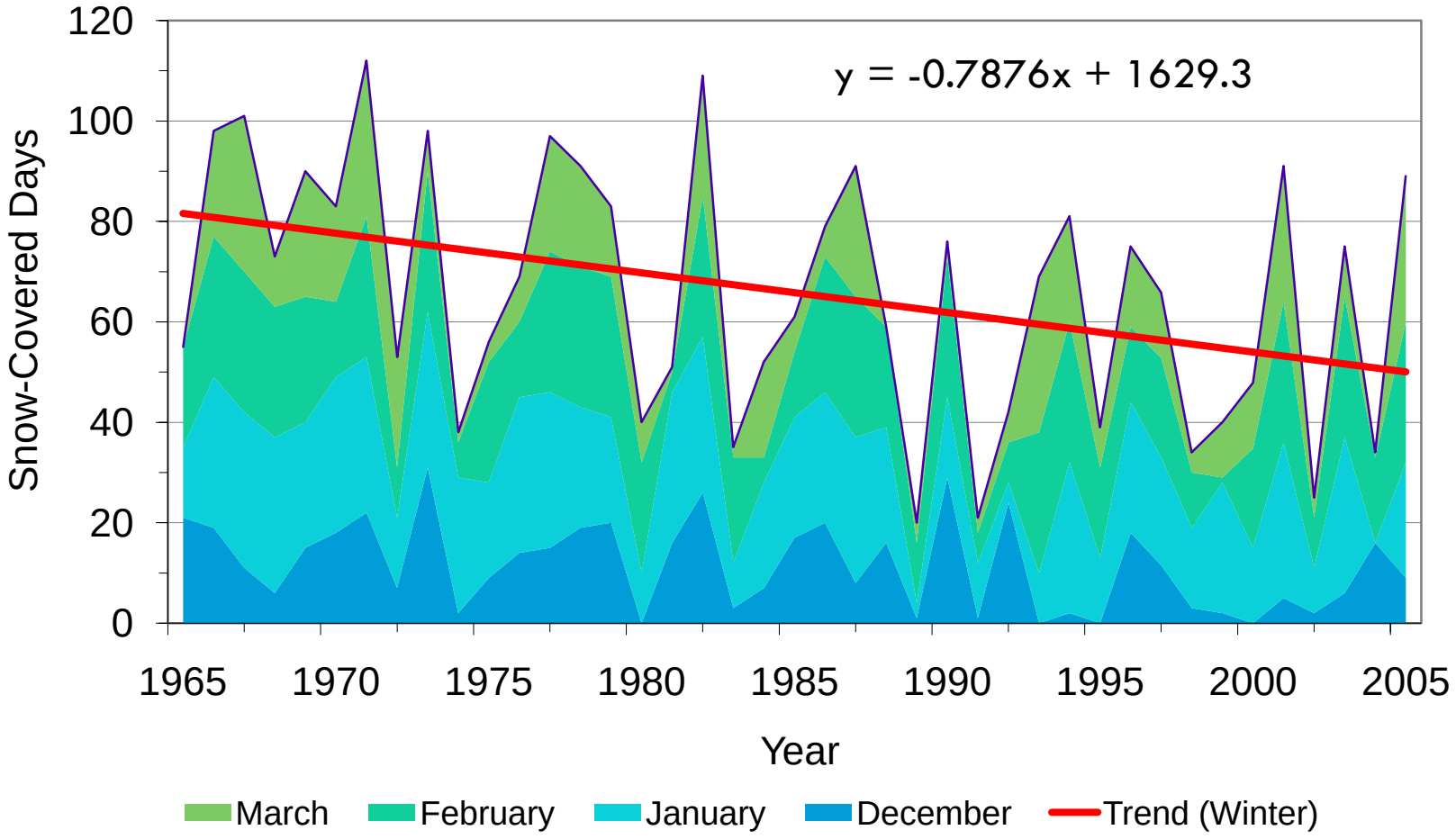
Gulf of Maine Sea Surface Temperature



Sebago Lake Ice Out Dates



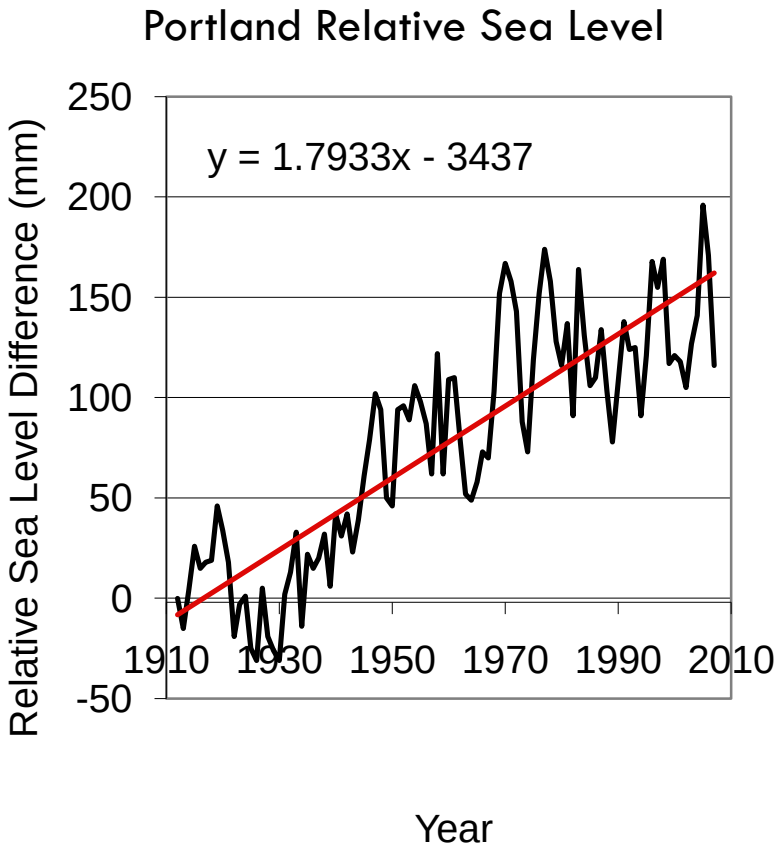
Snow Covered Days, Portland

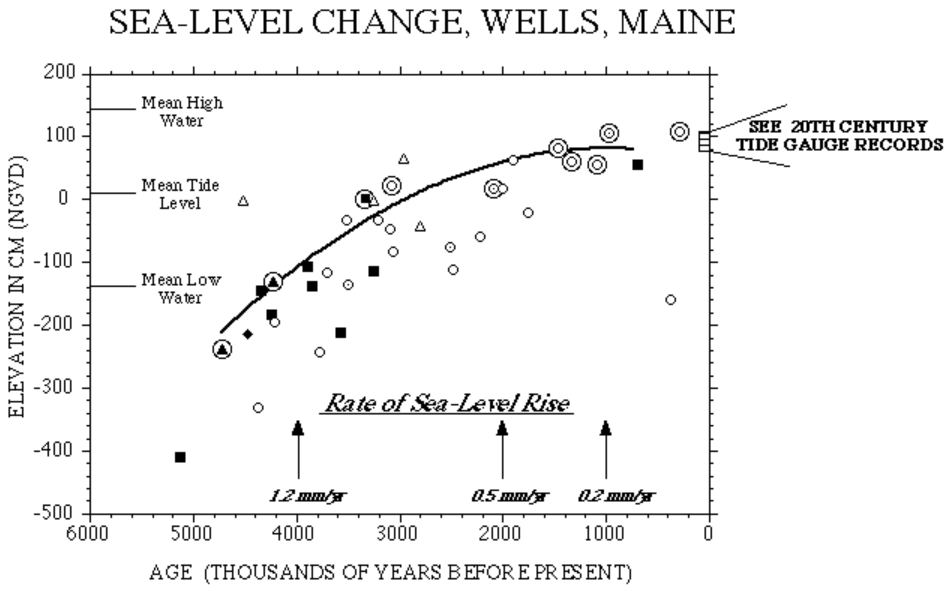


Other Regional Trends

- Snow melt earlier
  - Peak stream flows earlier
- Stream flow with higher probability of extreme events
  - Nominal "100 year storm" with probability ~ 1/20 per year
- Changes in ecological timing
  - Migration, nesting
  - Plant flowering

What about Sea Level?





Sea level is difficult to interpret because of >8000 year history of rising levels. Current rates appear elevated, but it's not clear why.

Projected Climate

Based on work by Katherine Hayhoe, Texas Tech

Results not yet in – Check in in Mid April 2009

Coastal Inundation Mapping

Based on work by Chris Watson and Elizabeth Douglas, U. Mass Boston

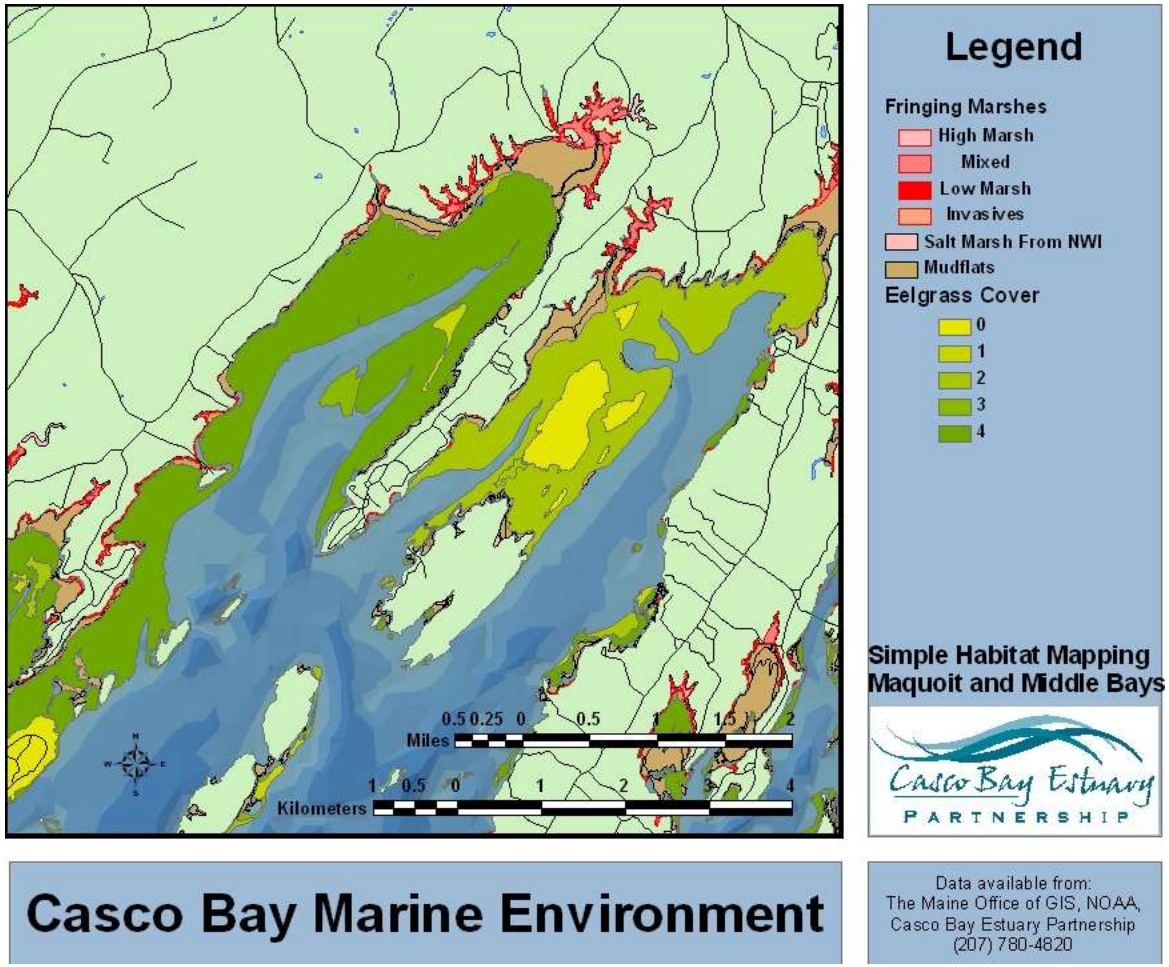
Results not yet in – Check in in Mid April 2009

Vulnerability of Coastal Ecosystems

Based on work by Peter Slovinsky, Maine Geological Survey and CBEP Staff

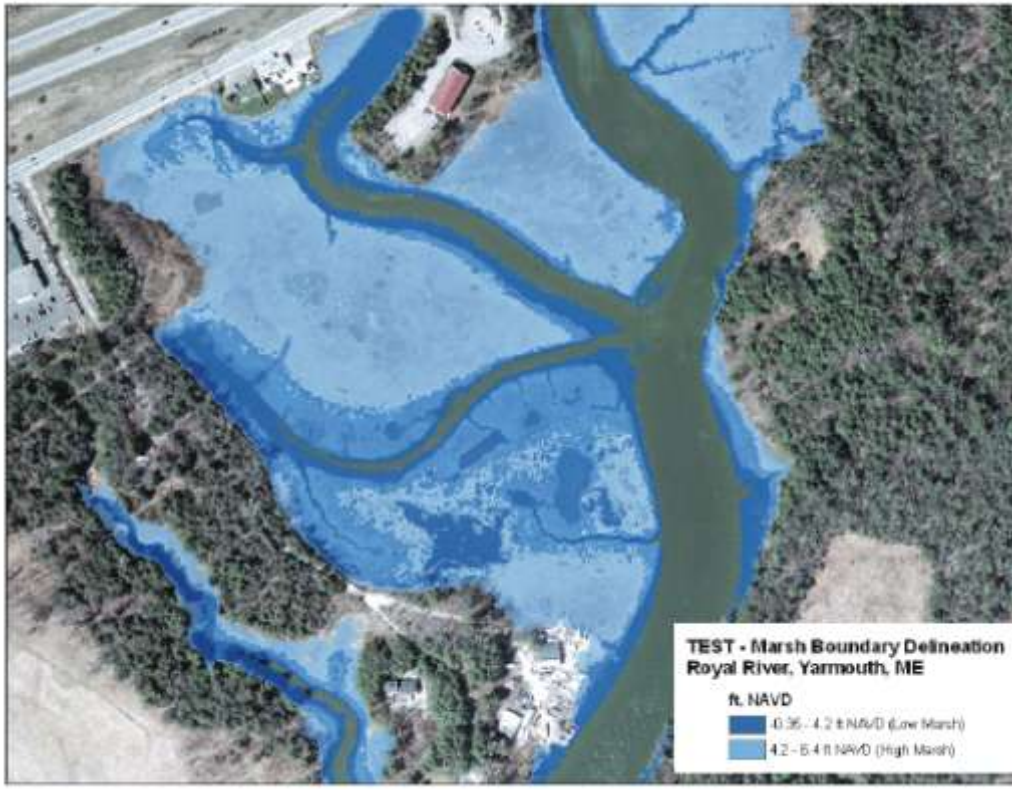
Vulnerability to Sea Level Rise

- Salt Marshes
- Harvestable flats
  - Clams
  - Bloodworms
- Eelgrass



Impact on Salt Marshes

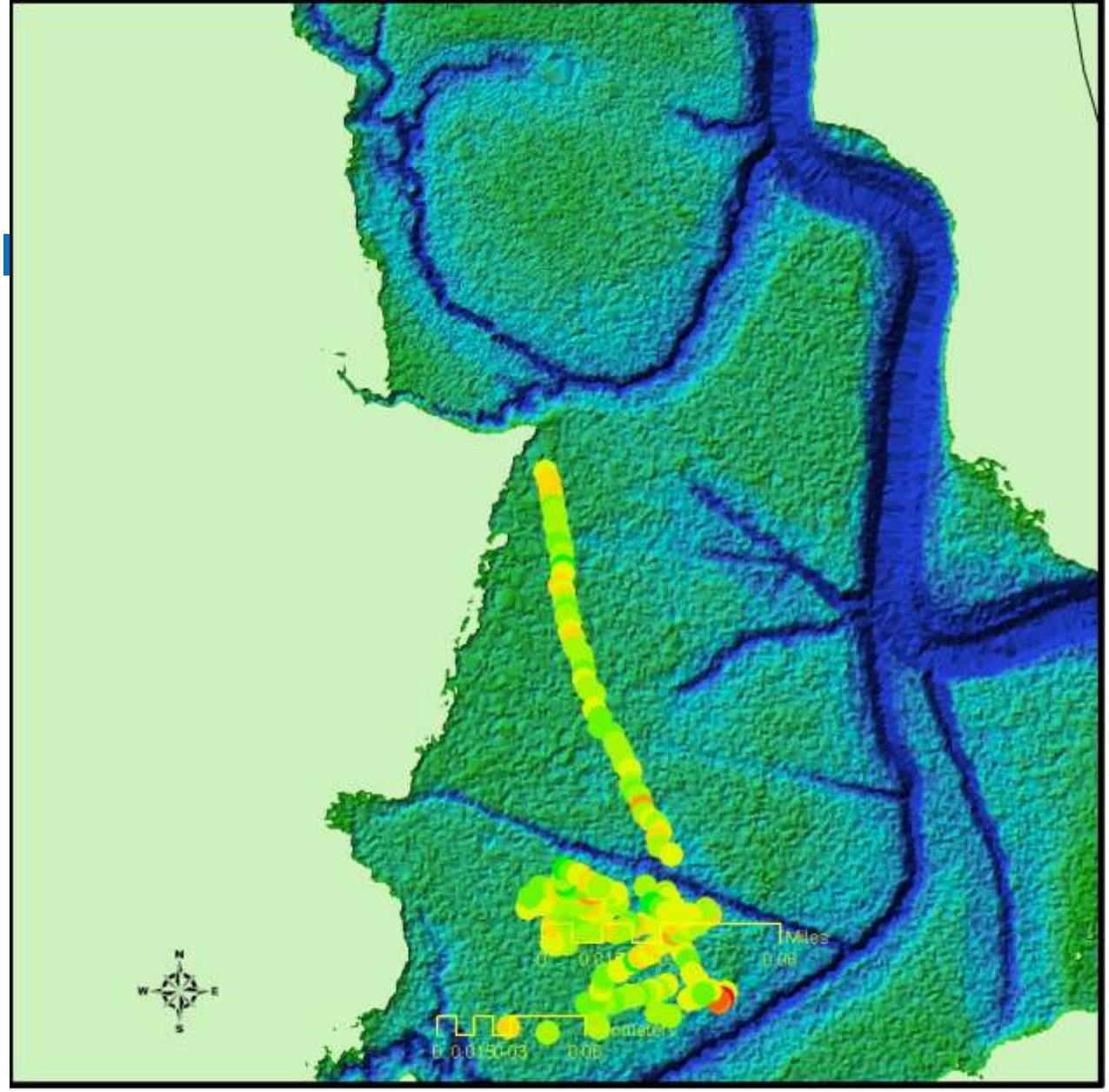
- Rising seas may inundate existing marshes
- New marshes may develop on adjacent uplands
- Use LiDAR to locate
  - Vulnerable areas
  - Areas of upland that could support new wetlands



Demonstration – Use of elevation data to Predict locations of low and high marsh

Technical Problems…

- Available LiDAR for Casco Bay has reduced precision
- Is data suitable?
- Study morphed from demonstration toward method development



Legend

Relative Error (ft)

- < -0.75
- -0.74 - -0.50
- -0.49 - -0.25
- -0.24 - 0.00
- 0.01 - 0.25
- 0.26 - 0.50
- 0.51 - 0.75
- > 0.75

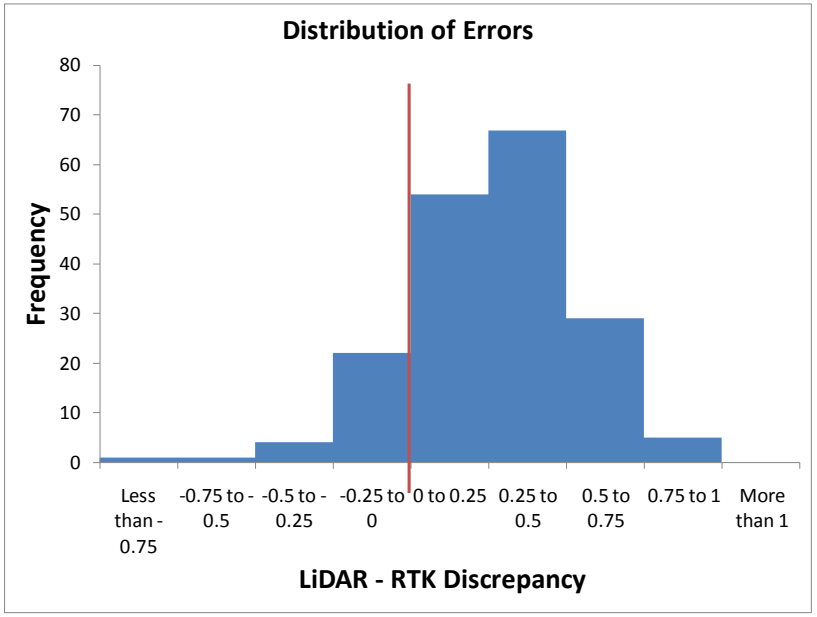
Casco Bay Estuary Partnership

LiDAR Accuracy
Cousins River Marsh

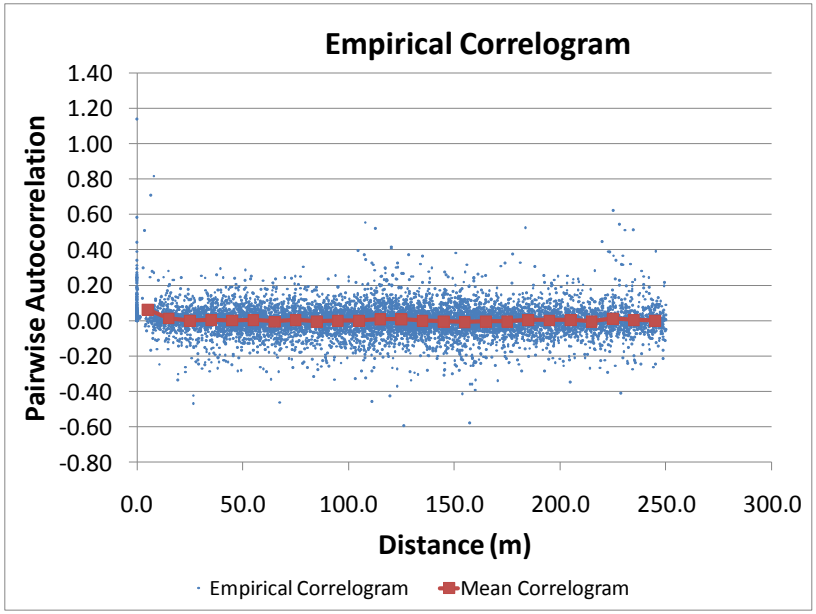
Data available from:
The Maine Office of GIS, NOAA,
Casco Bay Estuary Partnership
(207) 780-4820

Is Existing LiDAR Data Up to the Task?

- Testing LiDAR at the Cousins River Marsh, in yarmouth
- Mean error: 0.26 ft – or about 3 inches.
- RMS Error: 0.38 ft
- Correction possible based on limited local data?



Little Spatial Pattern



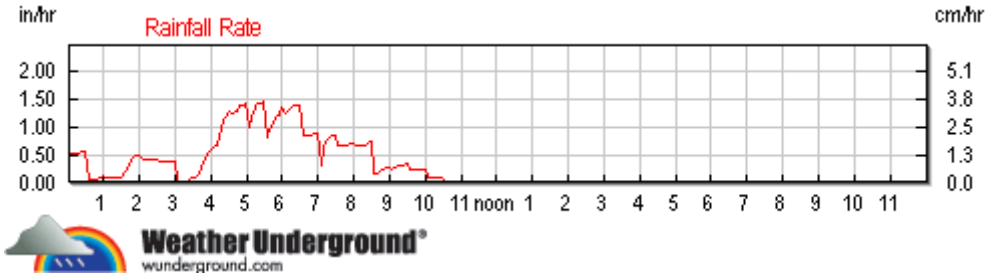
- What little bias there is in the data shows little spatial pattern
- Mean spatial autocorrelations of observed errors are near zero
- This suggests errors in LiDAR could be corrected using local data

Fish Passage Barriers

Culverts that are undersized and pose barriers to fish migration are often also undersized from an engineering perspective

Culverts and Flood Risk

- Storms last August 8
  - more than 4.5 inches of rain in Yarmouth
- Desert Road culvert failed
- Freeport replaced the failed culvert with a larger diameter one – better sized for present and future stream flow.
- It's important to design replacement infrastructure for the weather of the future



Desert Road culvert failure, Freeport August 8, 2008

Culverts and Fish

- Undersized culverts are susceptible to failure.
- They ALSO pose problems for movement of resident and anadromous fishes
- Fish restoration and infrastructure protection goals will often align.

Future CBEP Roles

- Continue to assemble information on past and future climate at a local scale relevant to local decision makers
- Develop an understanding of climate change's implications for key natural resources
  - Vulnerability
  - resilience
- Incorporate implications of climate change into habitat restoration and protection planning
- Develop communications tools to get reliable and useful information about climate change and its implications in fromt of key local decisionmakers