SEA LEVEL RISE IN THE CHESAPEAKE BAY

Projections for 2050

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Center for Coastal Resources Management
Virginia Institute of Marine Science

Overview

- Why use local tide gauge-based projections?
- How were they created?
- What are the projections for Baltimore, Annapolis and Norfolk?

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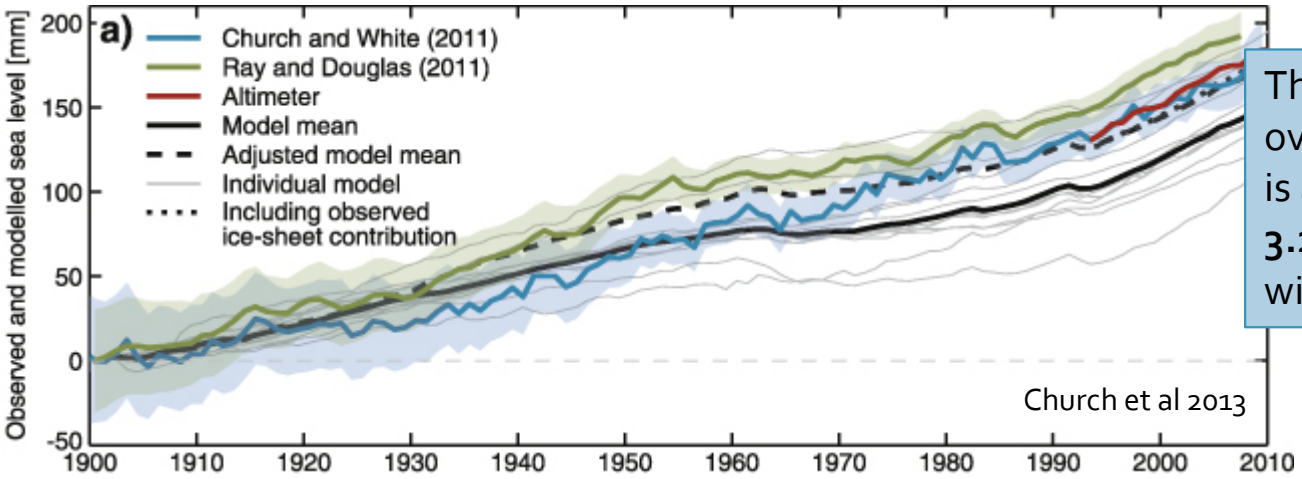
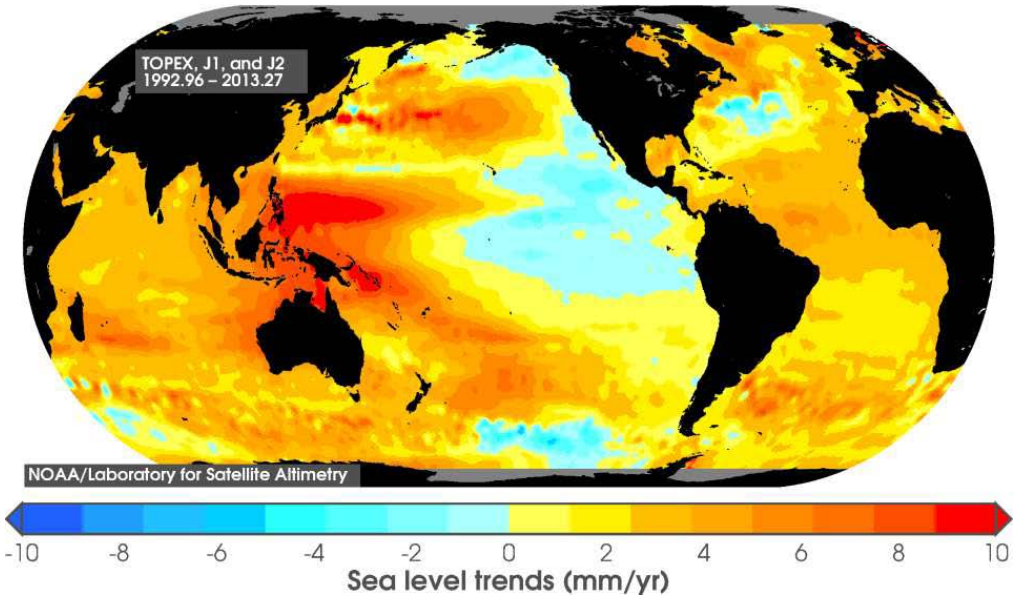
"Global mean sea level" is a model



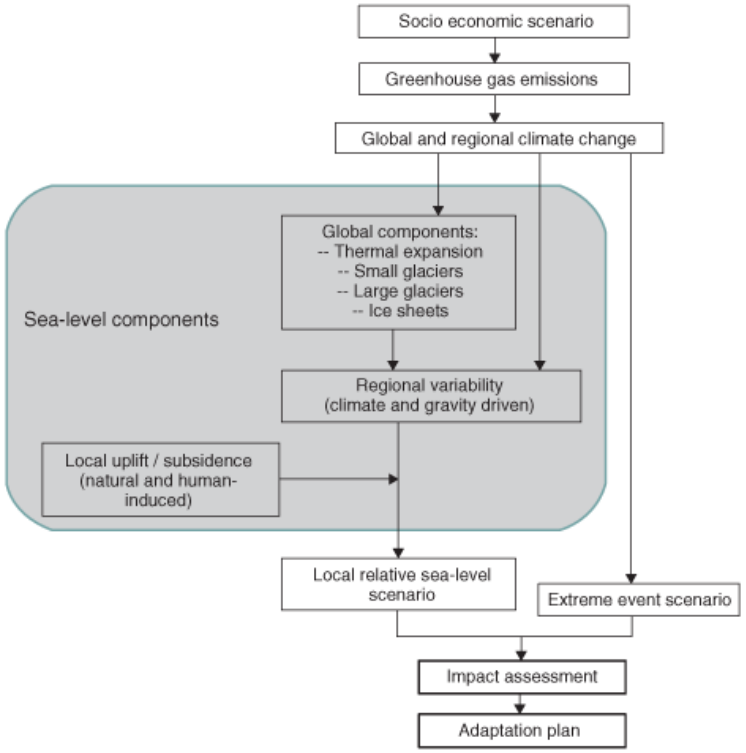
Church et al 2013

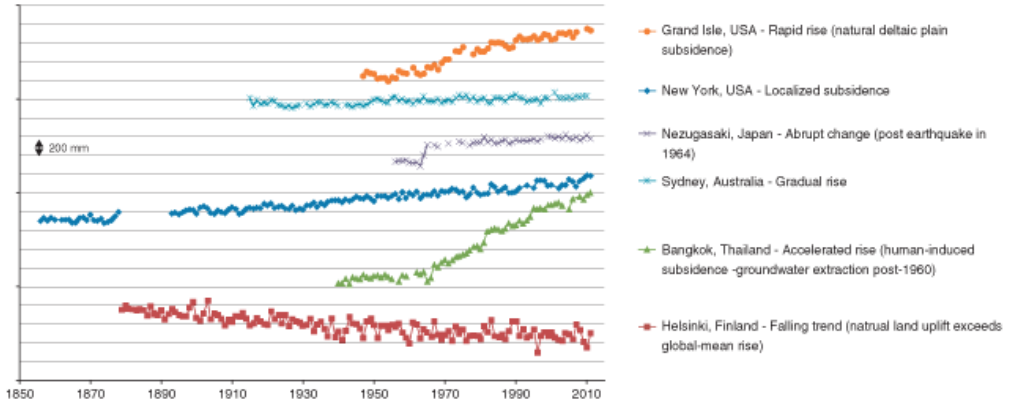
The tide gauge average rate over **1993–2010 of 3 mm yr^{-1}** is almost equal to the rate of **3.2 ± 0.4 mm yr^{-1}** observed with satellite altimeters



(http://ibis.grdl.noaa.gov/SAT/SeaLevelRise/slr/map_txj1j2_no_green.png)

Local/Regional Sea Level Rise – Downscaling Projections



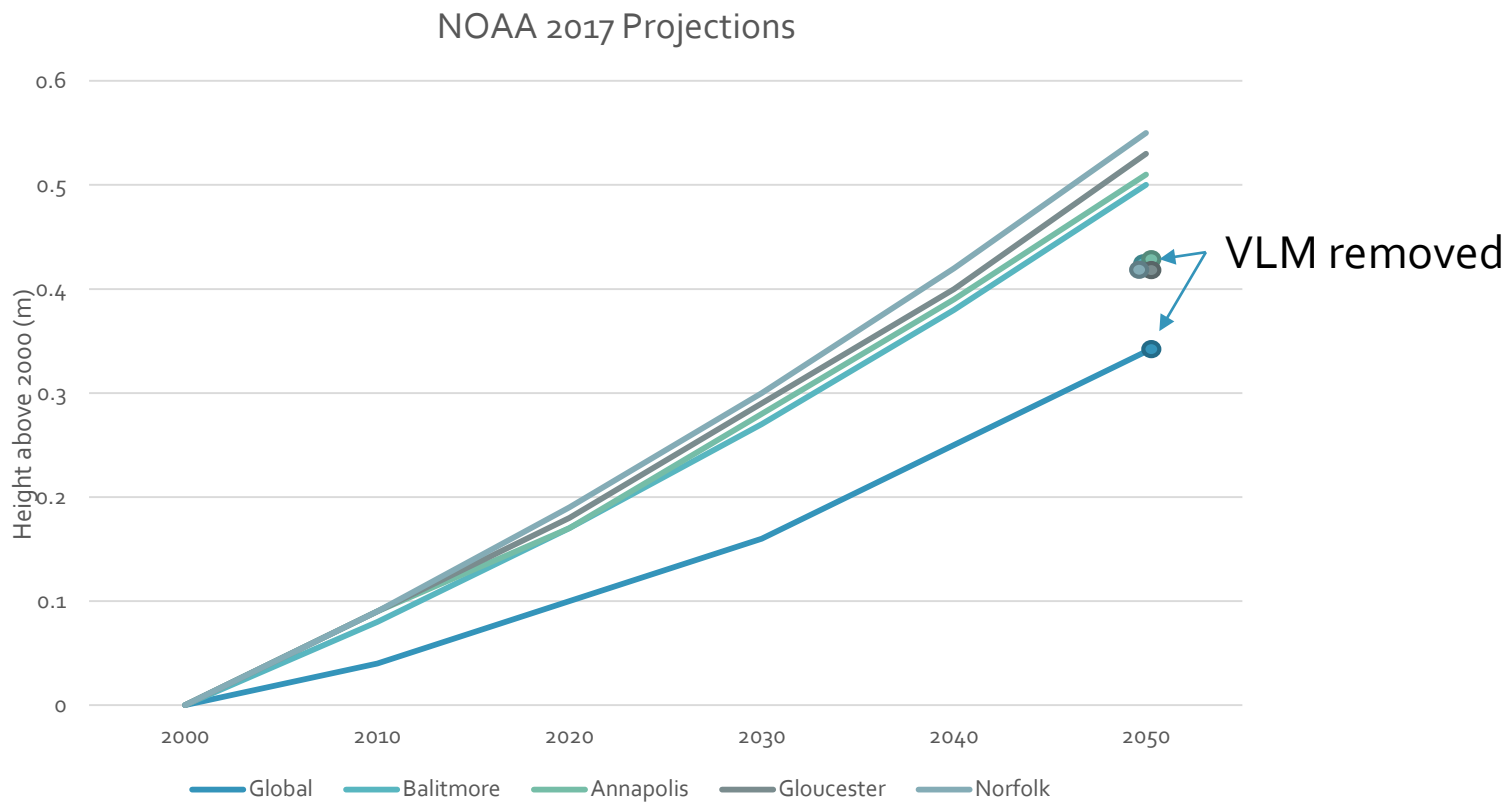


$$\Delta RSL = \Delta SL_G + \Delta SL_{RM} + \Delta SL_{RG} + \Delta SL_{RLM}$$

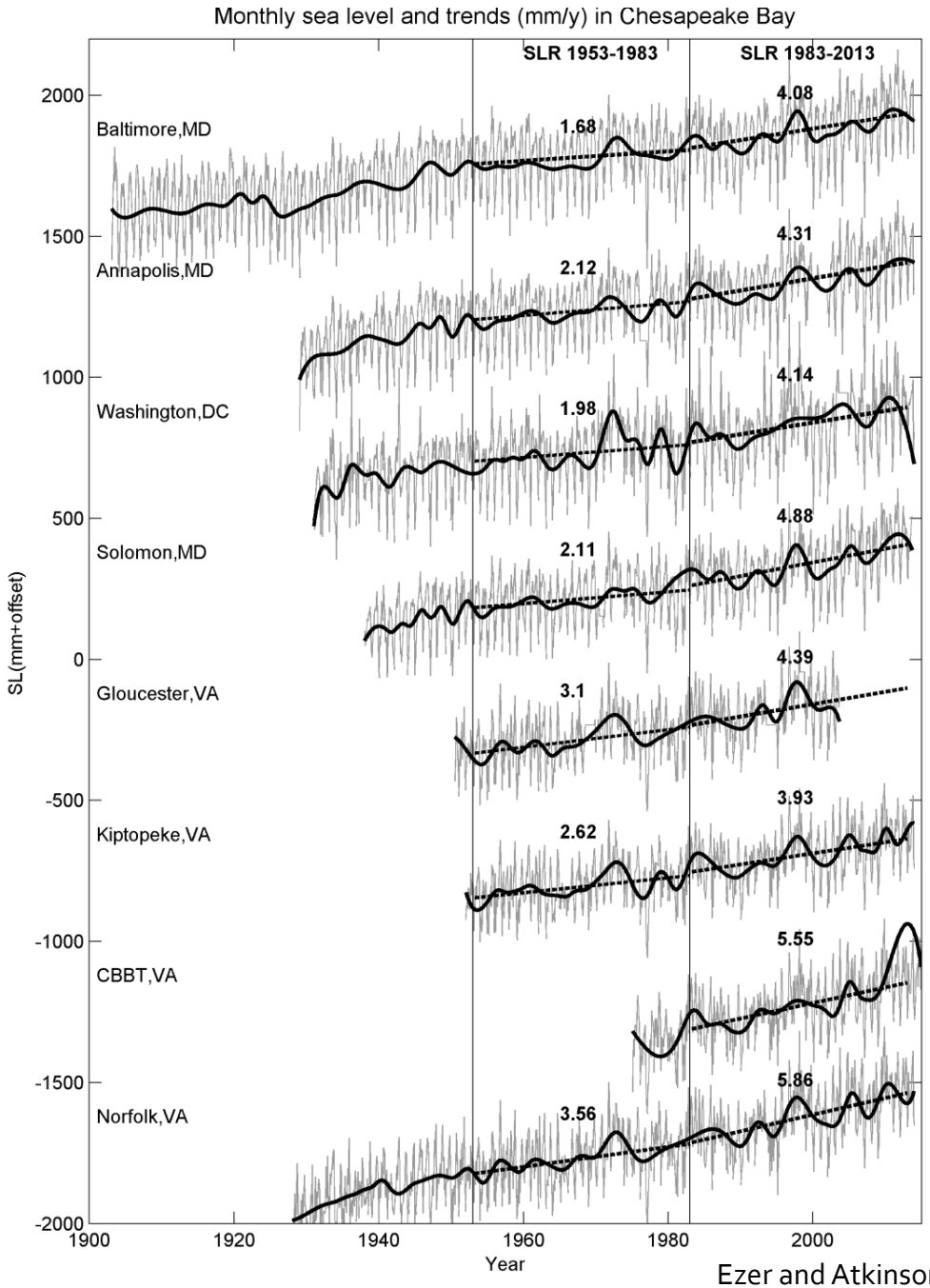
ΔSL_G = change in global mean sea level
ΔSL_{RM} = the regional variation in sea level from the global mean due to meteo-oceanographic factors
ΔSL_{RG} = the regional variation in sea level due to changes in the earth's gravitational field
ΔSL_{RLM} = the change in sea level due to vertical land movement

Nicholls et al 2013

Global model downscale- Intermediate



Bay stations
Linear trends

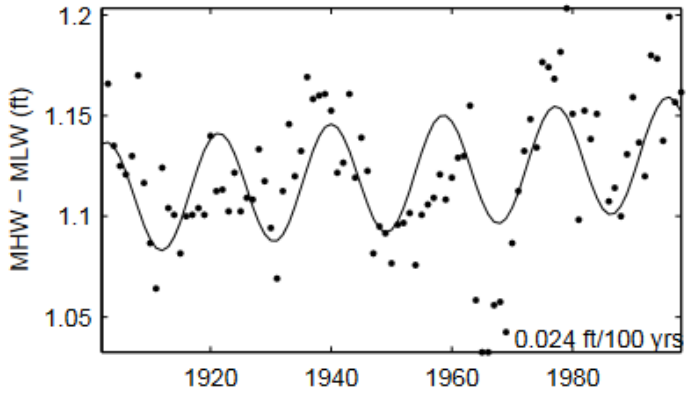


Ezer and Atkinson 2015

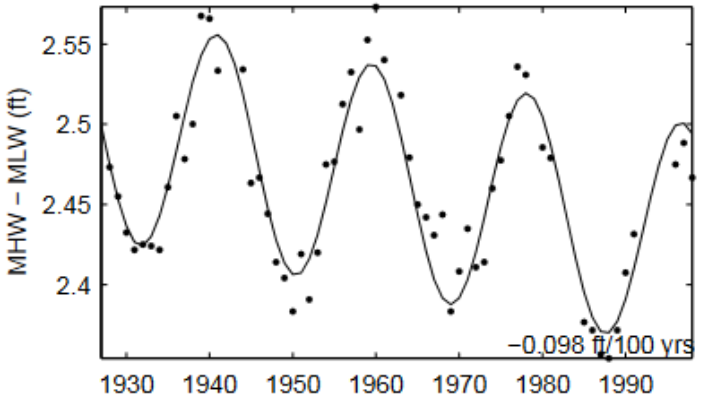
Tidal amplitude changes

Baltimore = 7 mm/century
Annapolis = 55 mm/century
Norfolk = -30 mm/century

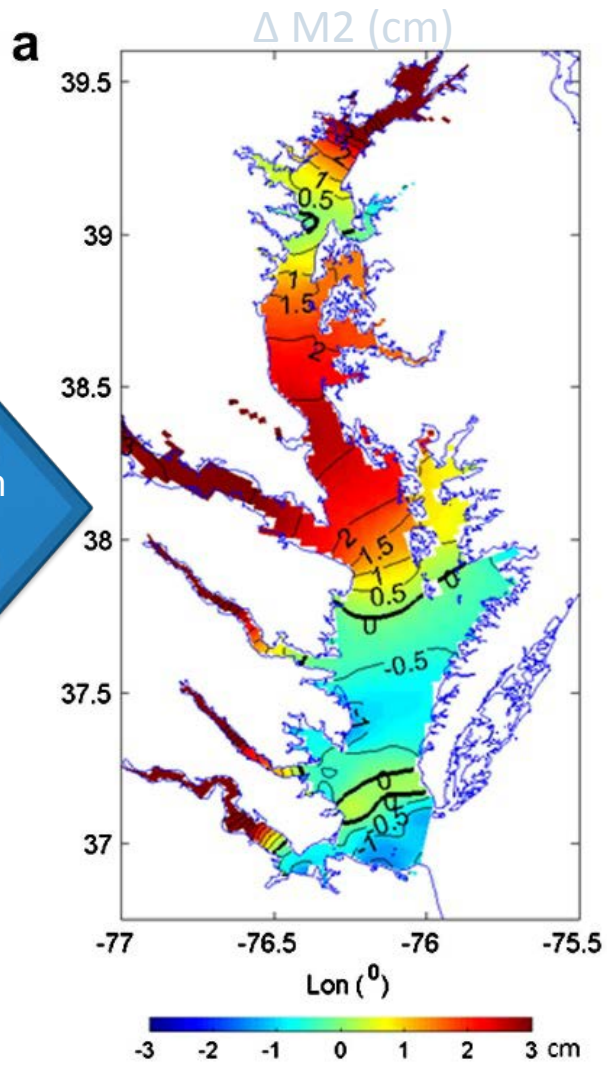
Baltimore



Norfolk



1.0 m SLR



Flick, R.E., Murray, J.F. and Ewing, L.C., 2003. *Journal of Waterway, Port, Coastal, and Ocean Engineering*, *129*(4), pp.155-164.

Hong, B. and Shen, J., 2012. Estuarine, Coastal and Shelf Science, 104: 33-45.

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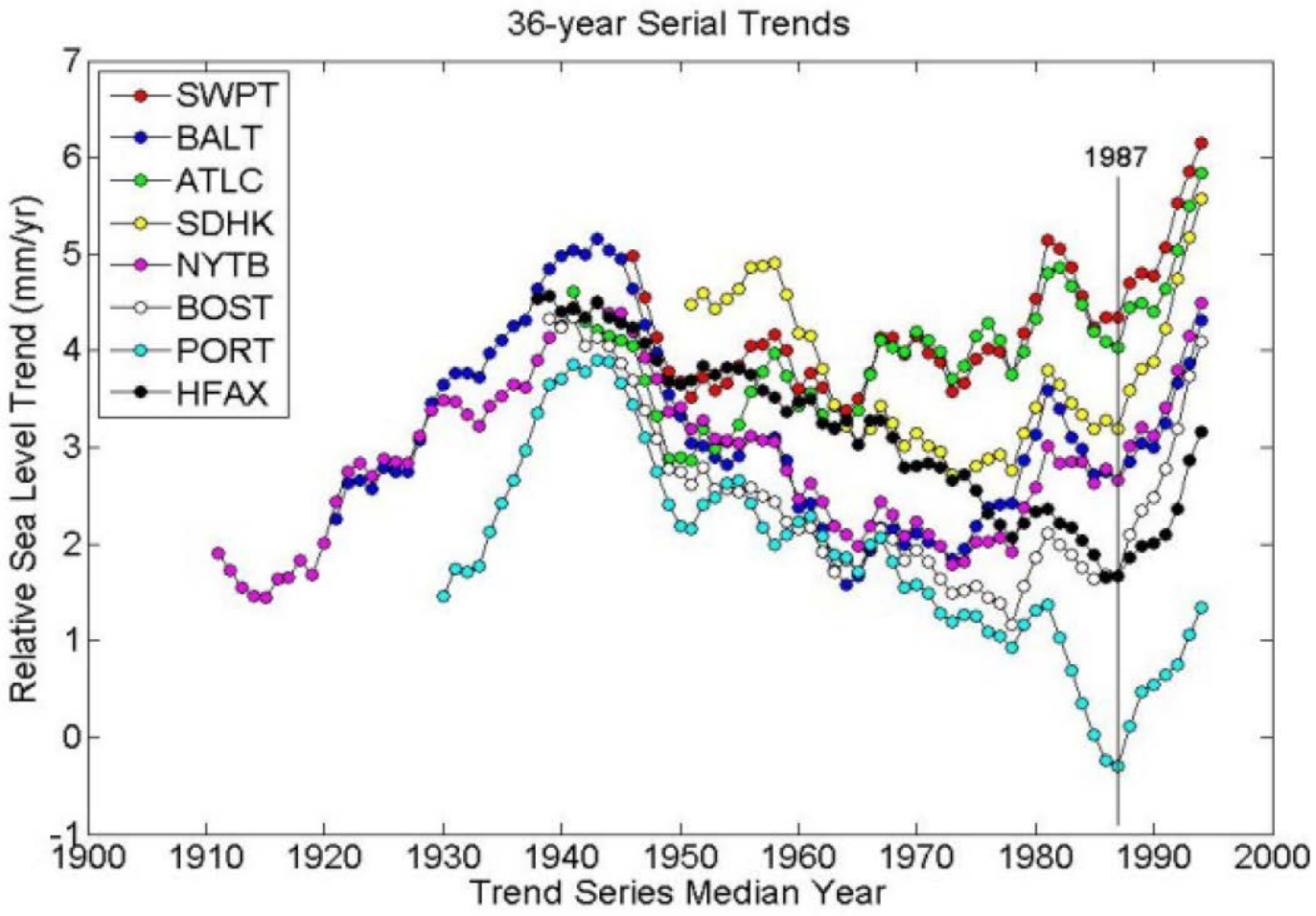
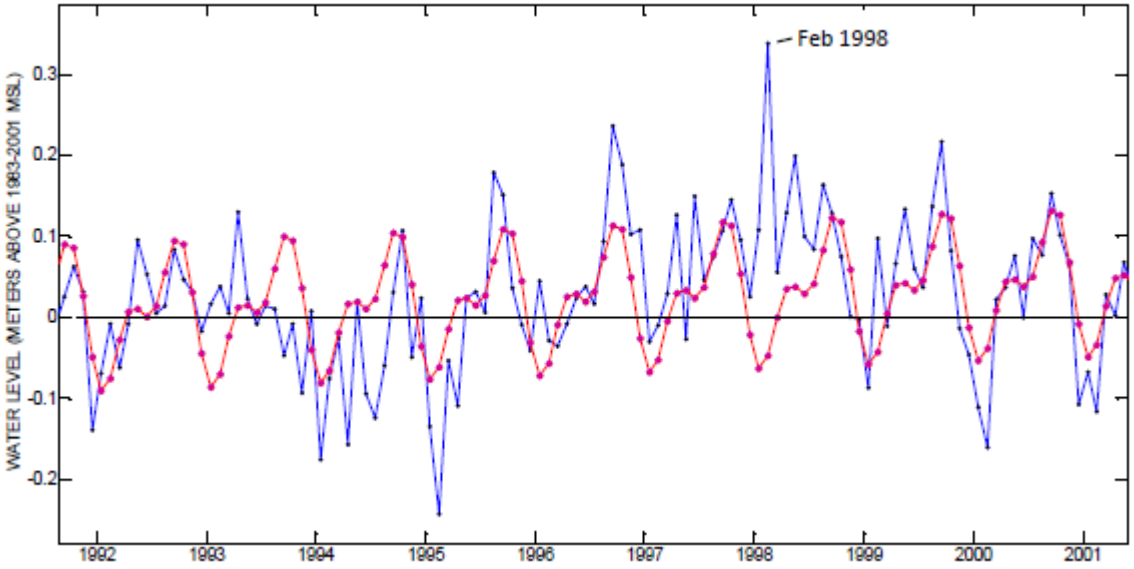
Length of record – 1969 to present



Boon et al. 2017

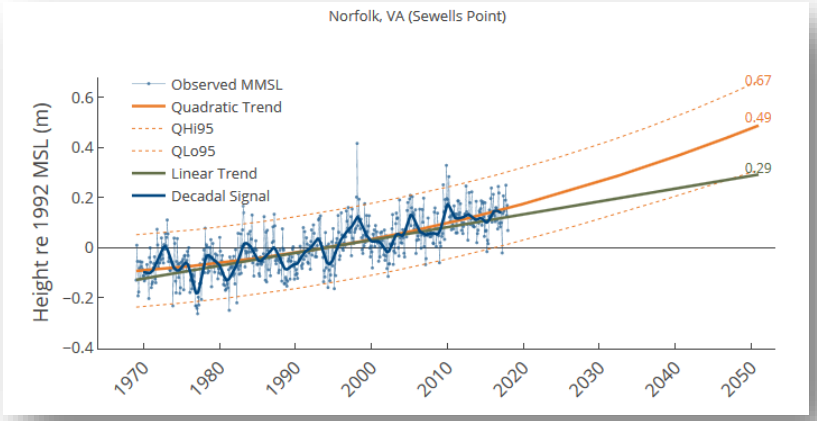
Removing known variation –
least-squares harmonic analysis applied directly to a detrended multidecadal MMSL series

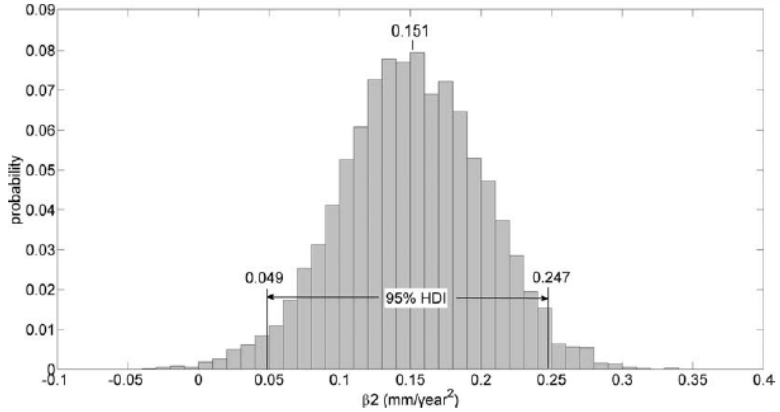


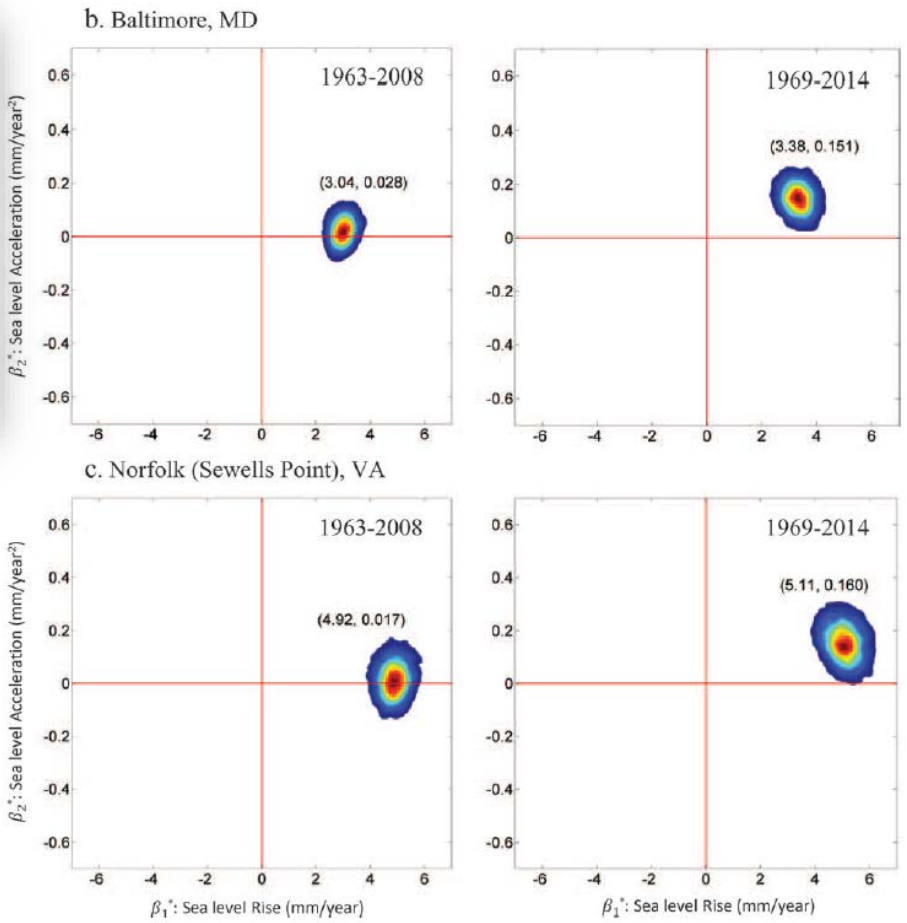
Boon et al. 2017

Trend Analysis -- Monte Carlo, moving block bootstrap

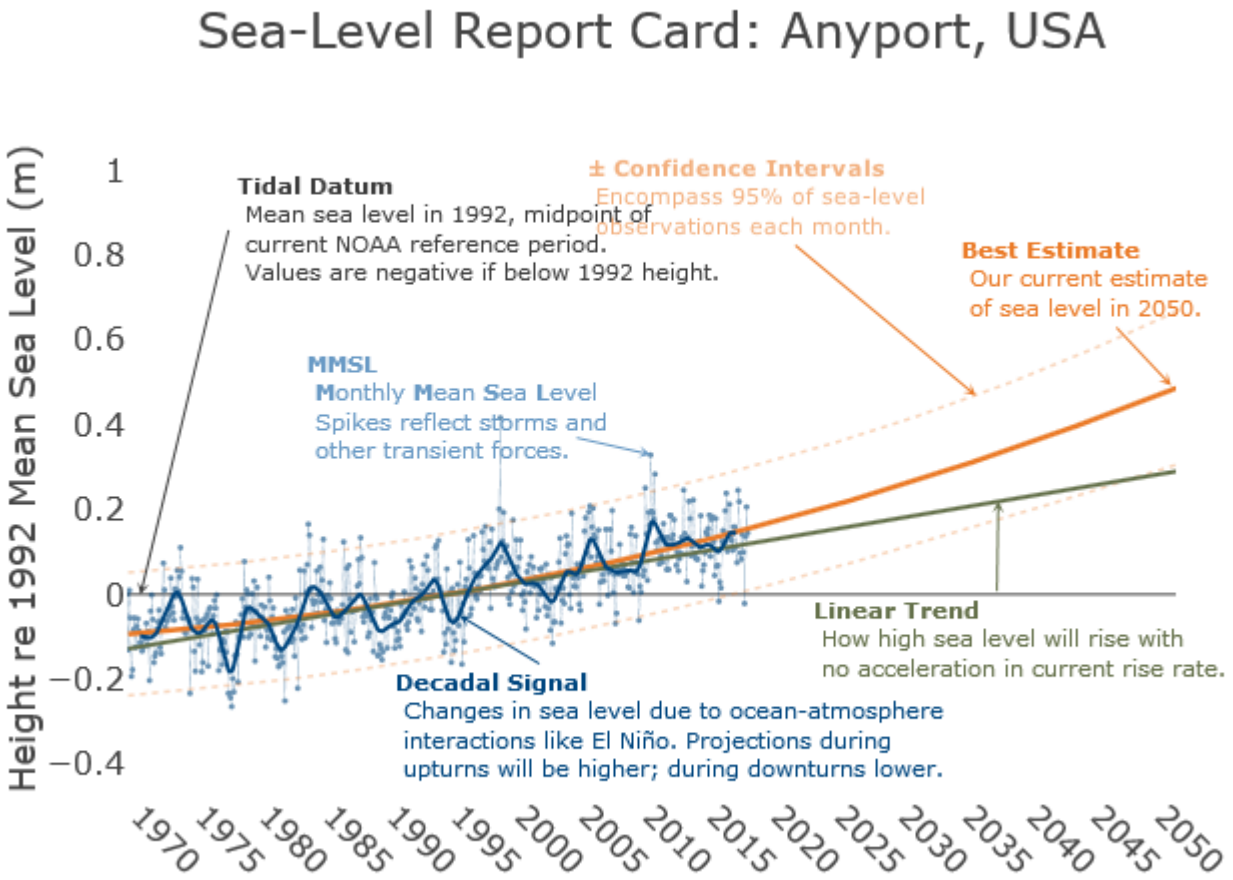
$$p(\beta_1^*, \beta_2^* | Data) = p(\beta_1^* | Data) \cdot p(\beta_2^* | Data)$$







Boon, J.D. and Mitchell, M., 2015. *Journal of Coastal Research*, *31*(6), pp.1295-1305.



https://www.vims.edu/research/products/slrc/index.php

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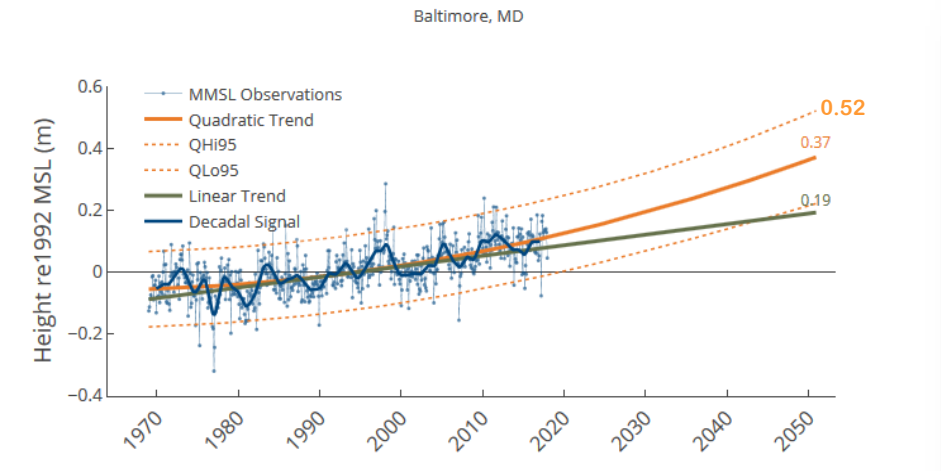
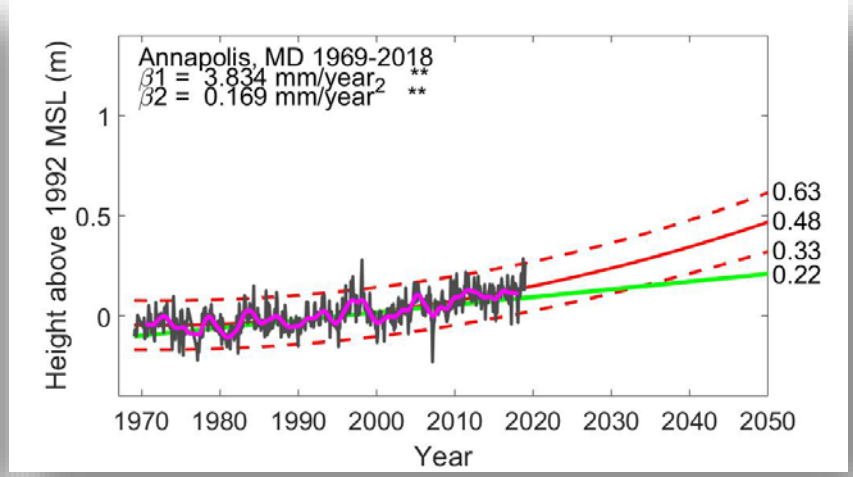
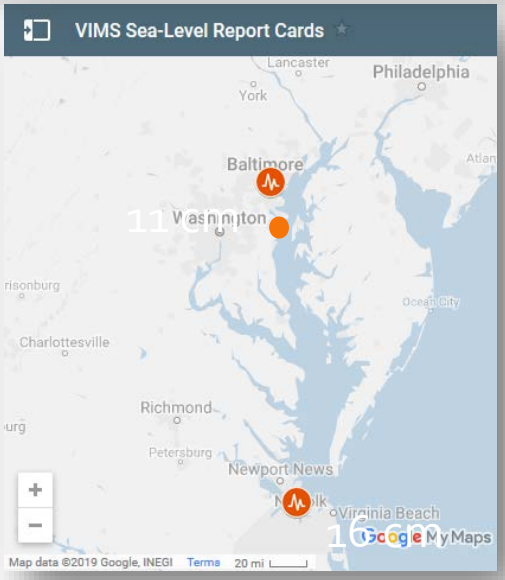
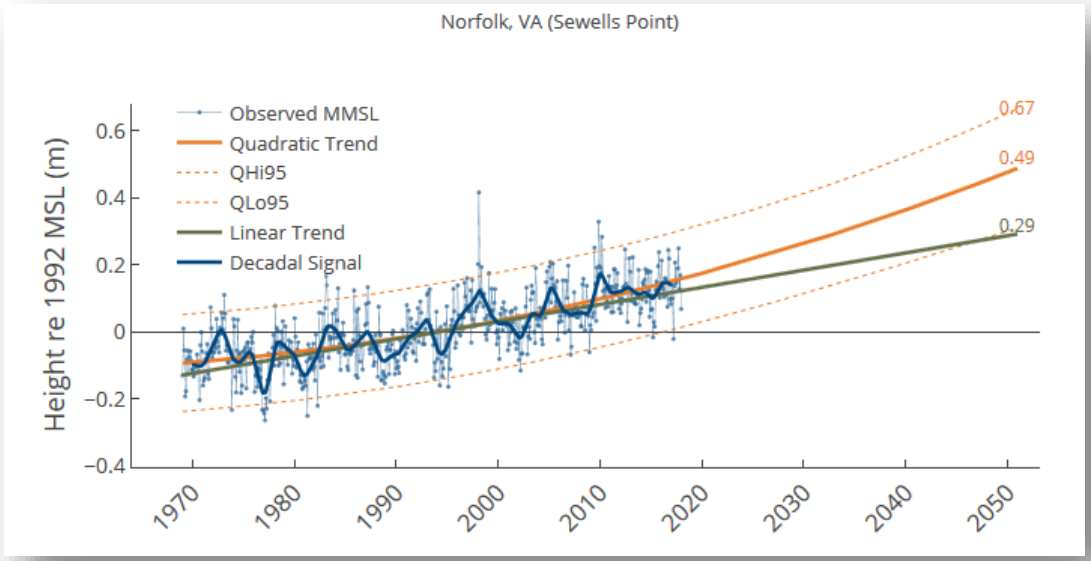
(Relative) Sea Level Rise in the Bay









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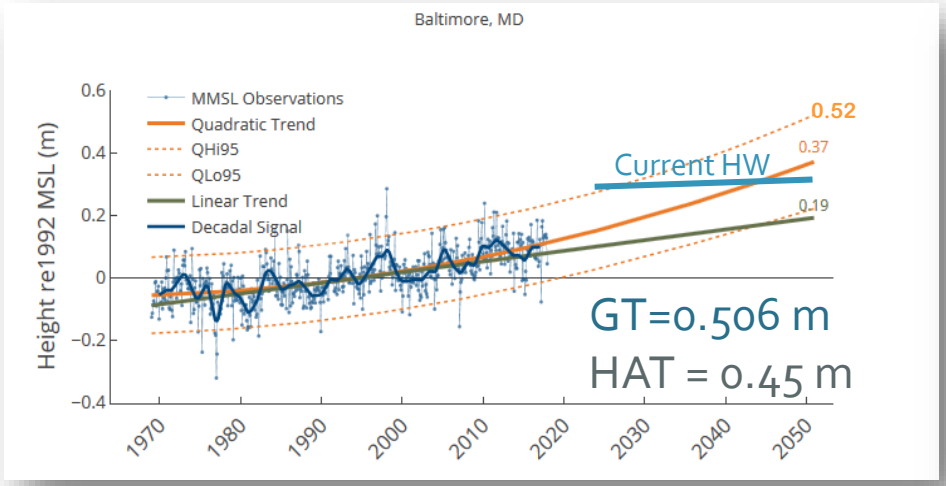
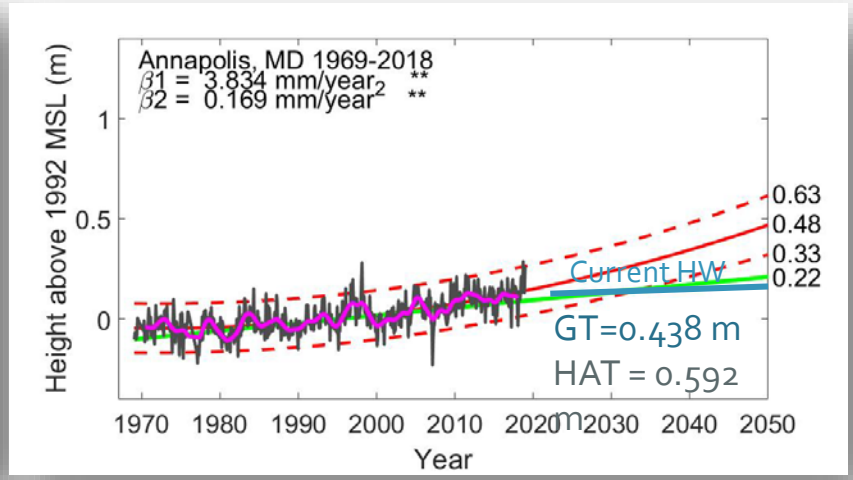
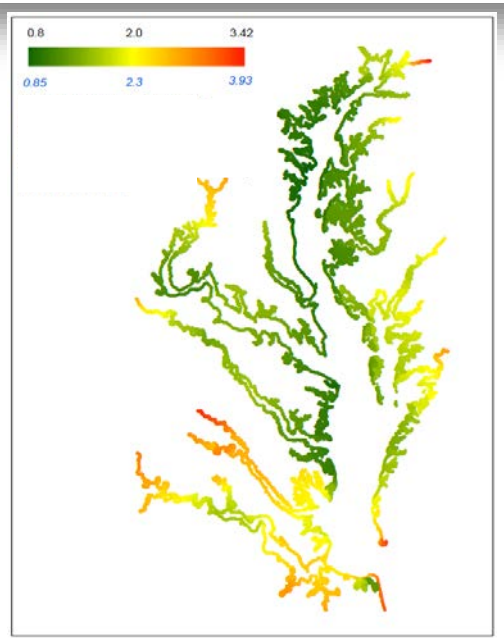
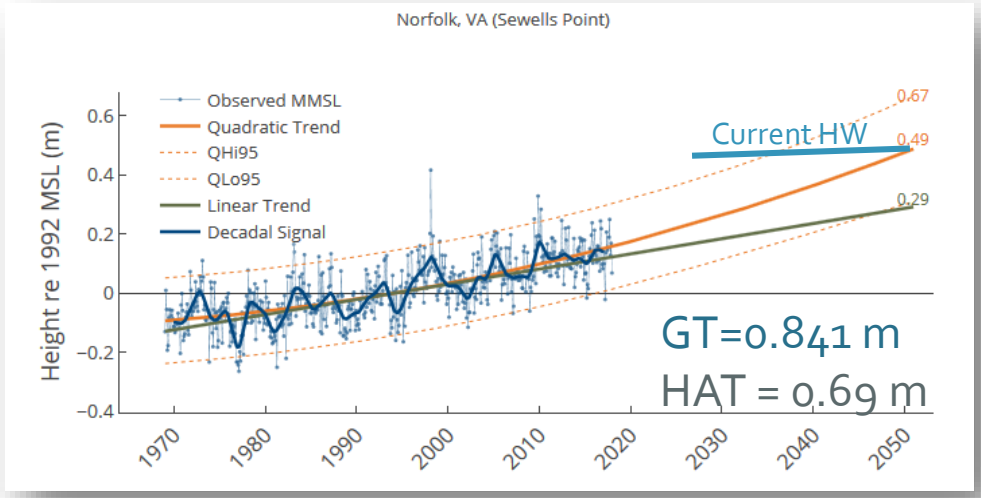






Map by Julie Herman; herman@vims.edu



Questions? molly@vims.edu