CBP Modeling Effort and Sea Level Rise

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Annapolis

CBP needs on SLR numbers

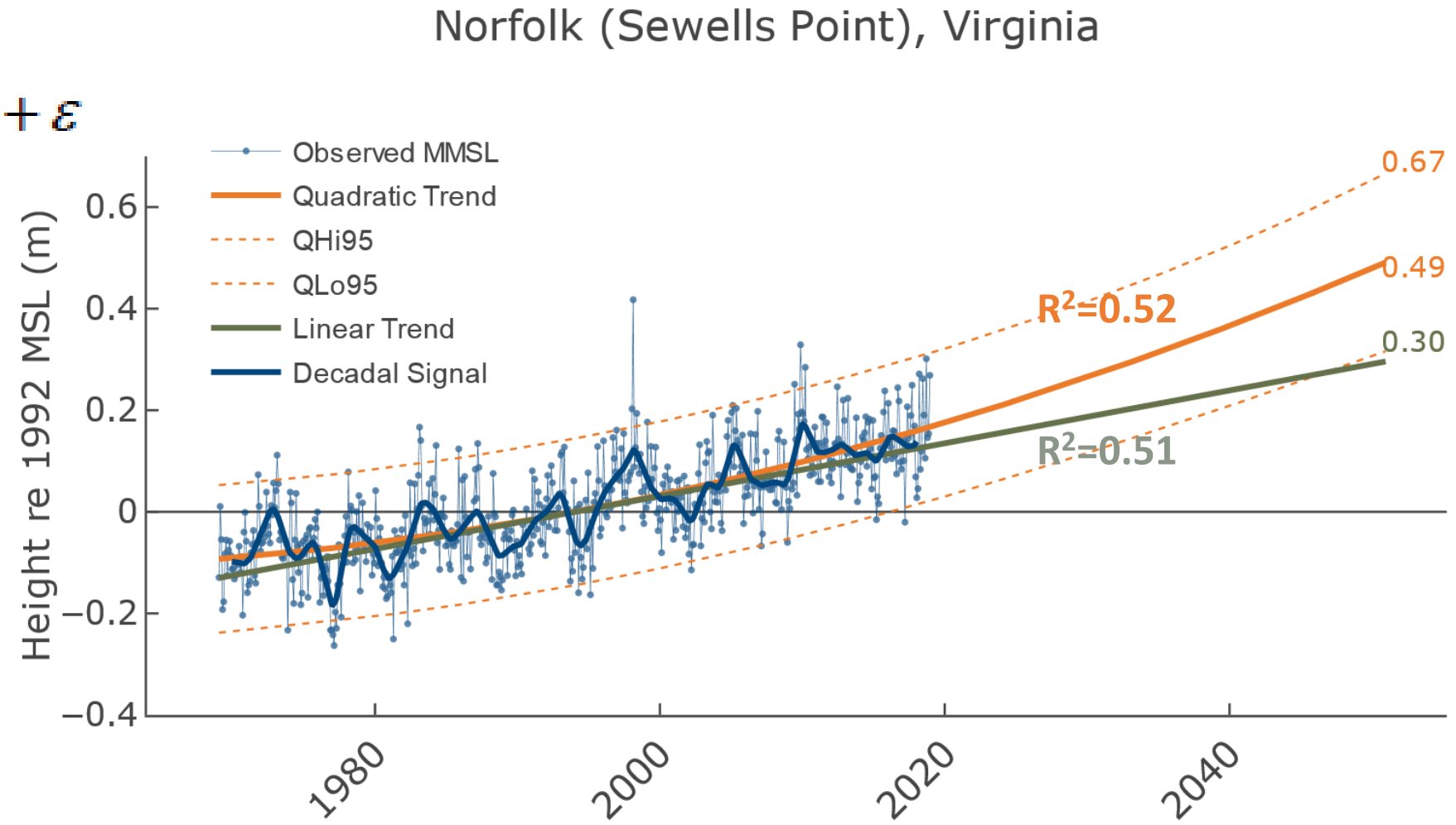
- 2025
- 2035
- 2045
- 2055

Quadratic function projection, Norfolk

$$h = \beta_0 + \beta_1 t + \tfrac{1}{2}\beta_2 t^2 + \varepsilon$$

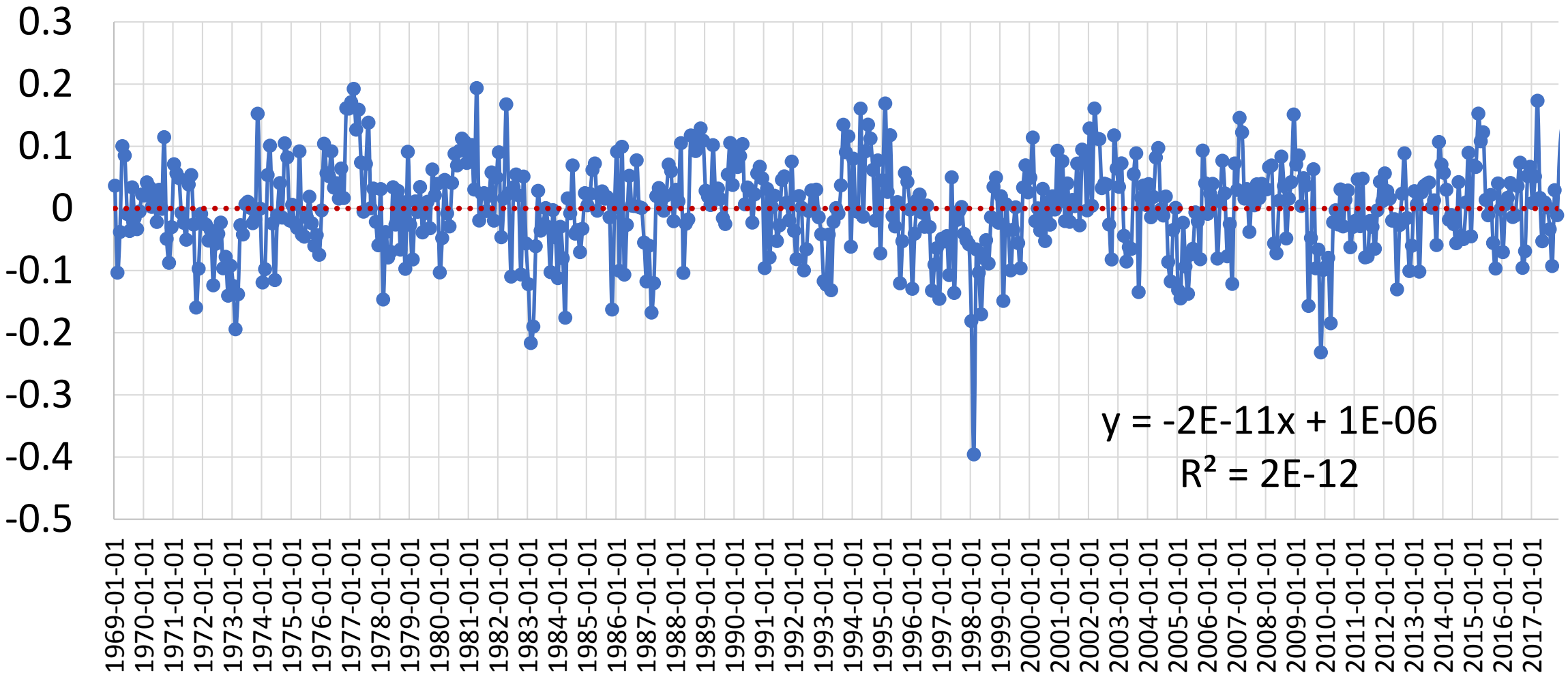
β_1 = 5.203 mm/yr
β_2 = 0.12 mm/yr^2

(with 2018 data.
Boon, Mitchel and others)

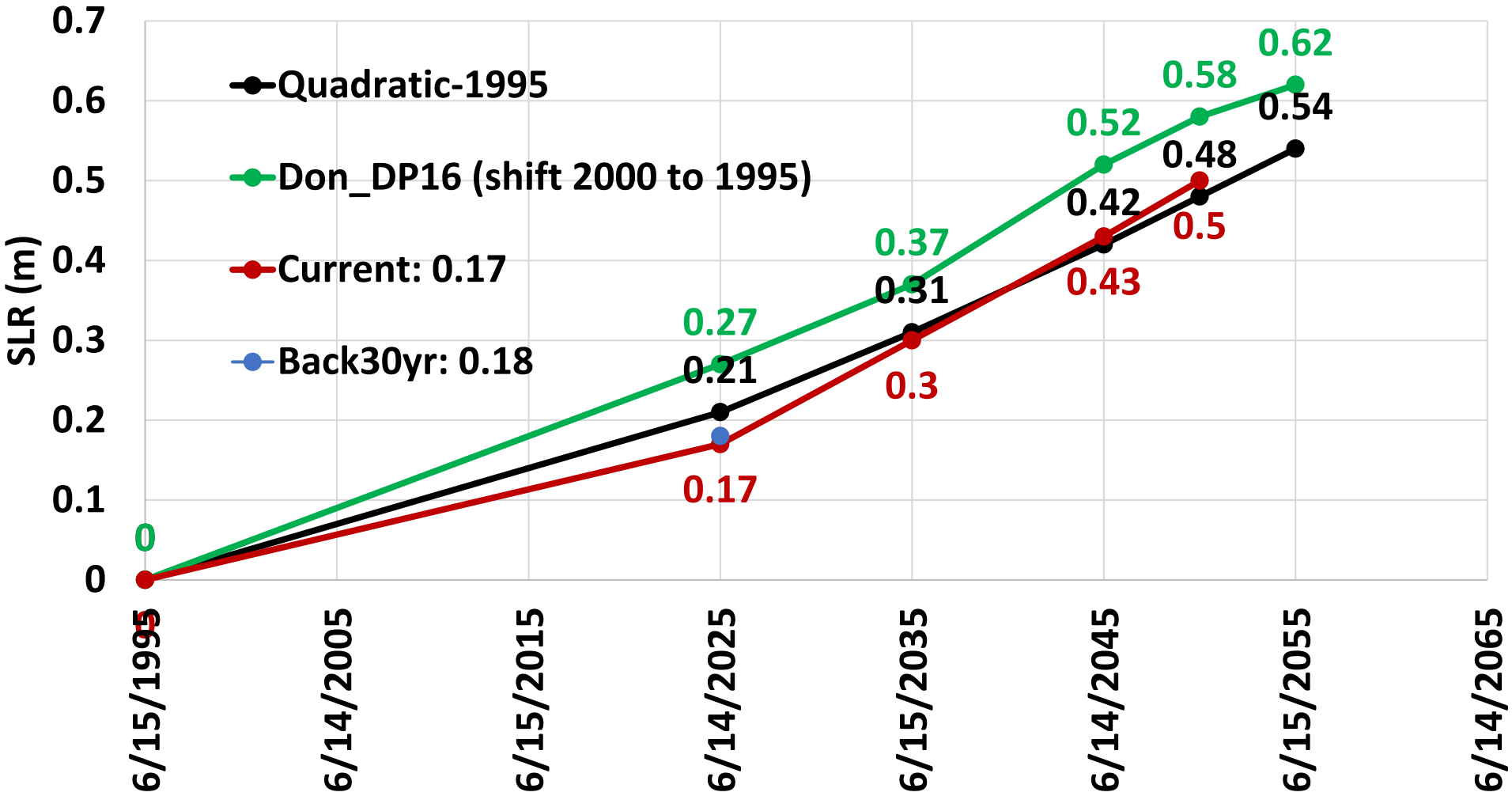


https://www.vims.edu/research/products/slrc/localities/norfolkva/index.php

Residual of Quadratic Projection- Sewells Point



SLR future projection-Sewells Point

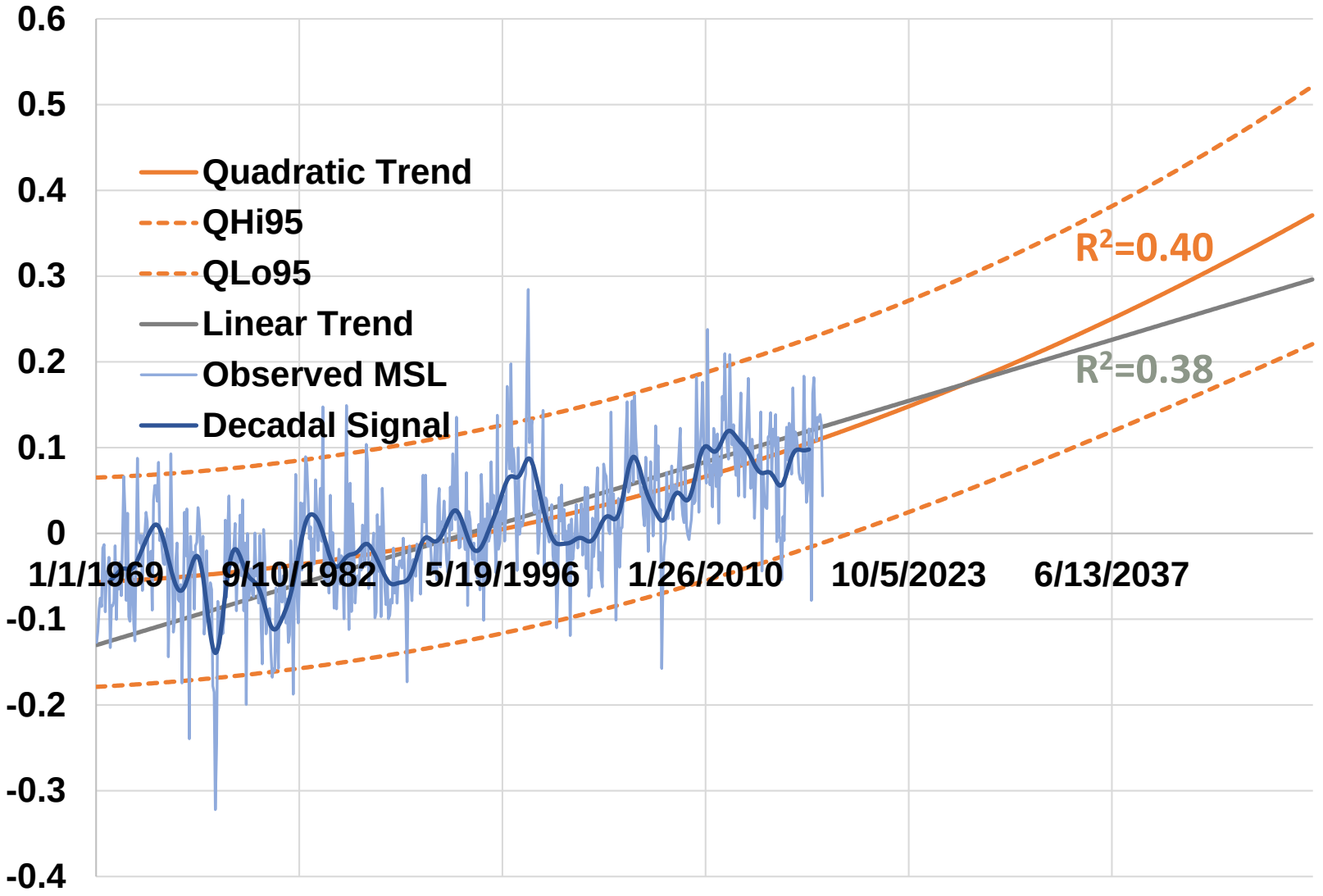


Quadratic function projection, Baltimore

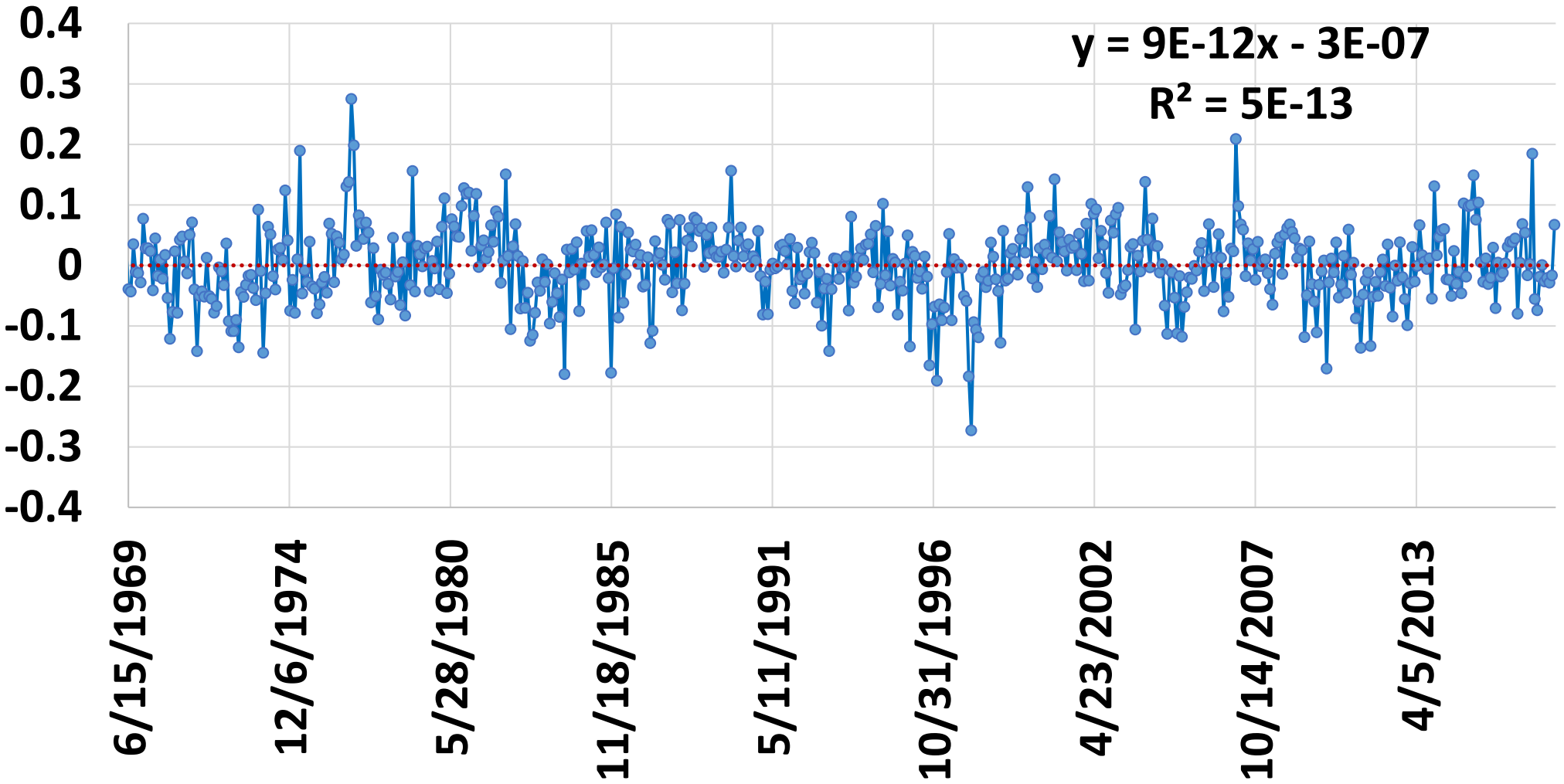
$\beta_1 = 3.513$ mm/yr

$\beta_2 = 0.115$ mm/yr^2

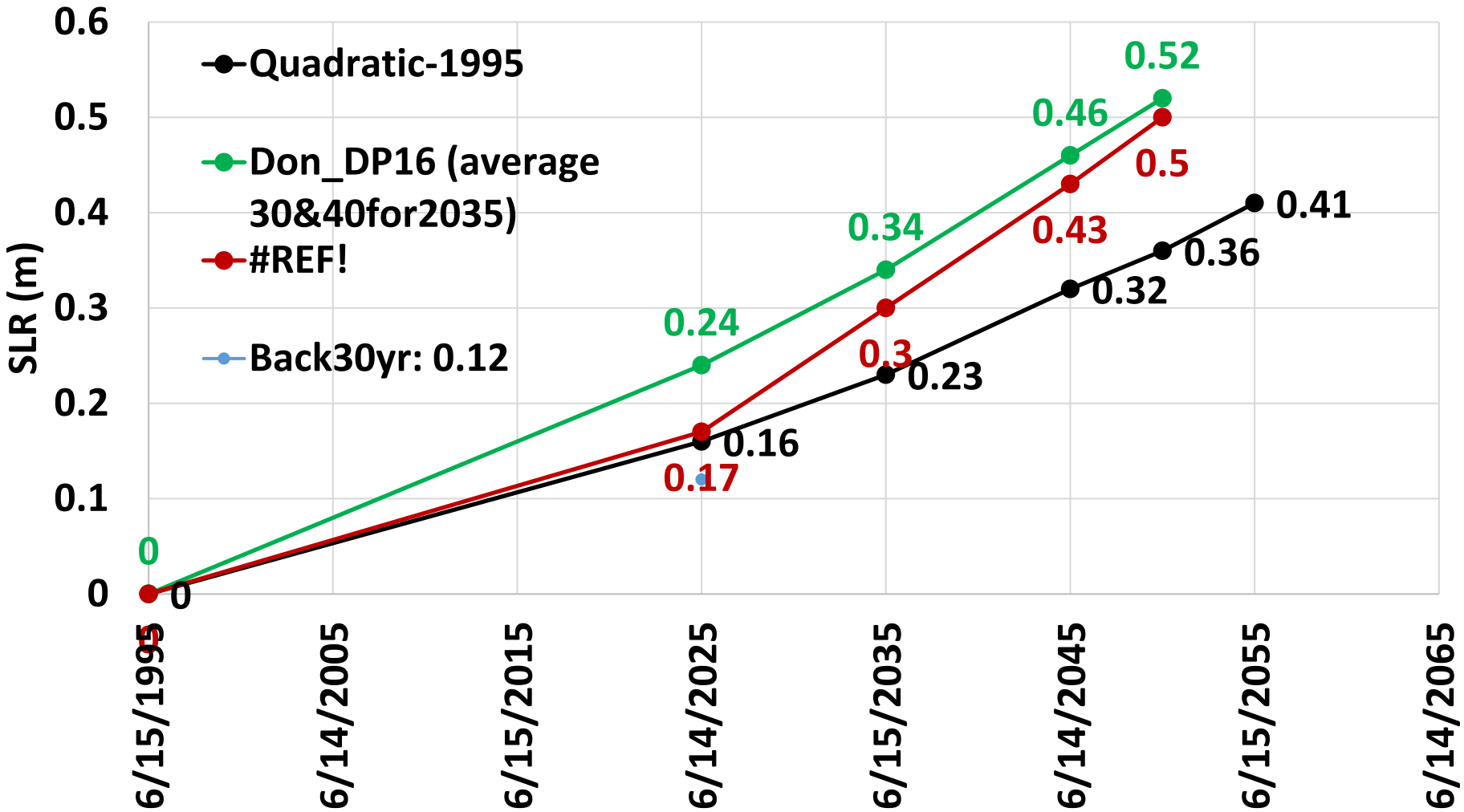
(with 2018 data.
Boon, Mitchel and others)



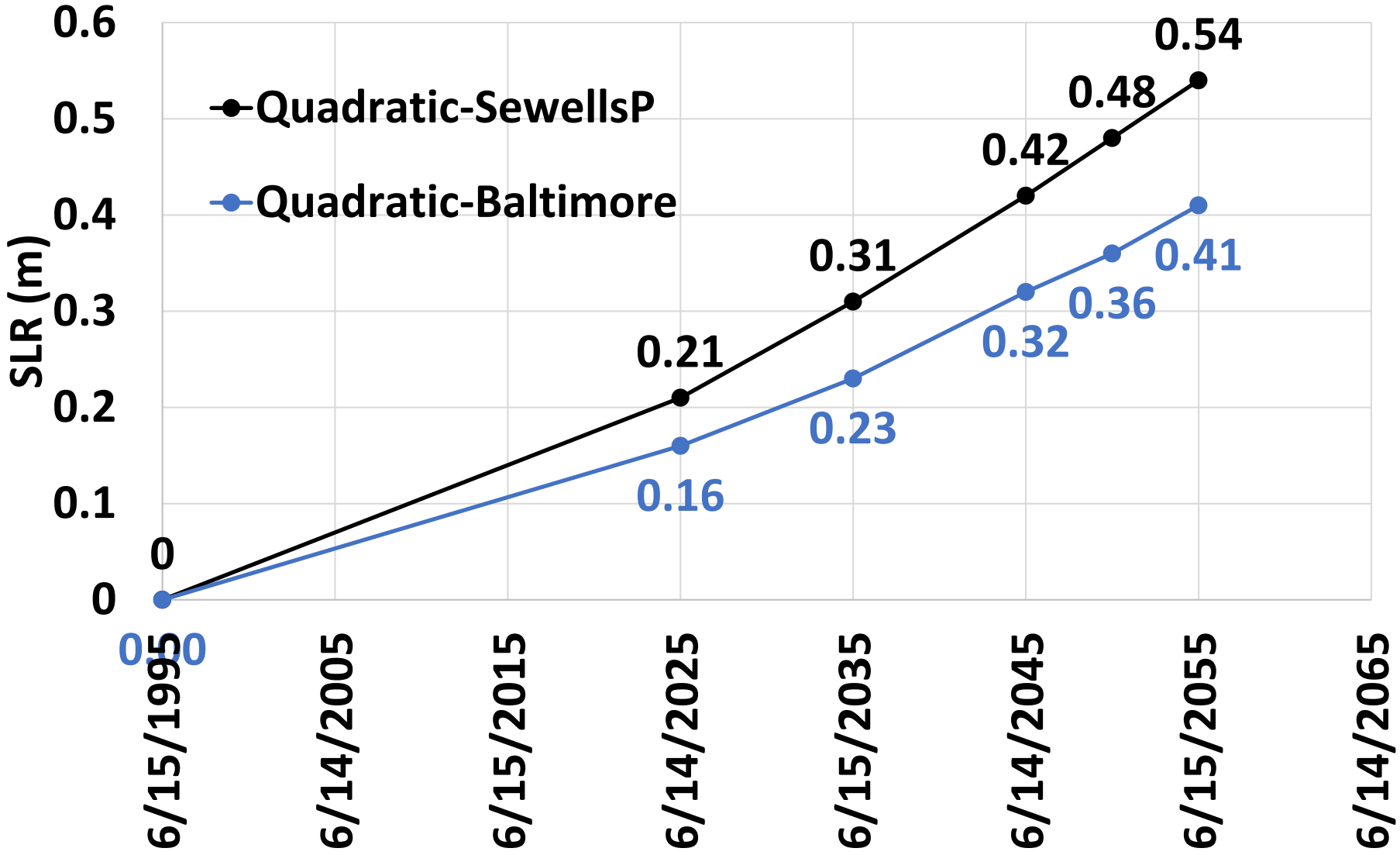
Residual of Quadratic Projection Baltimore



SLR future projection-Baltimore



Difference between Baltimore & Sewells Point



Land Subsidence and Relative Sea-Level Rise in the Southern Chesapeake Bay Region (Eggleston 2013)

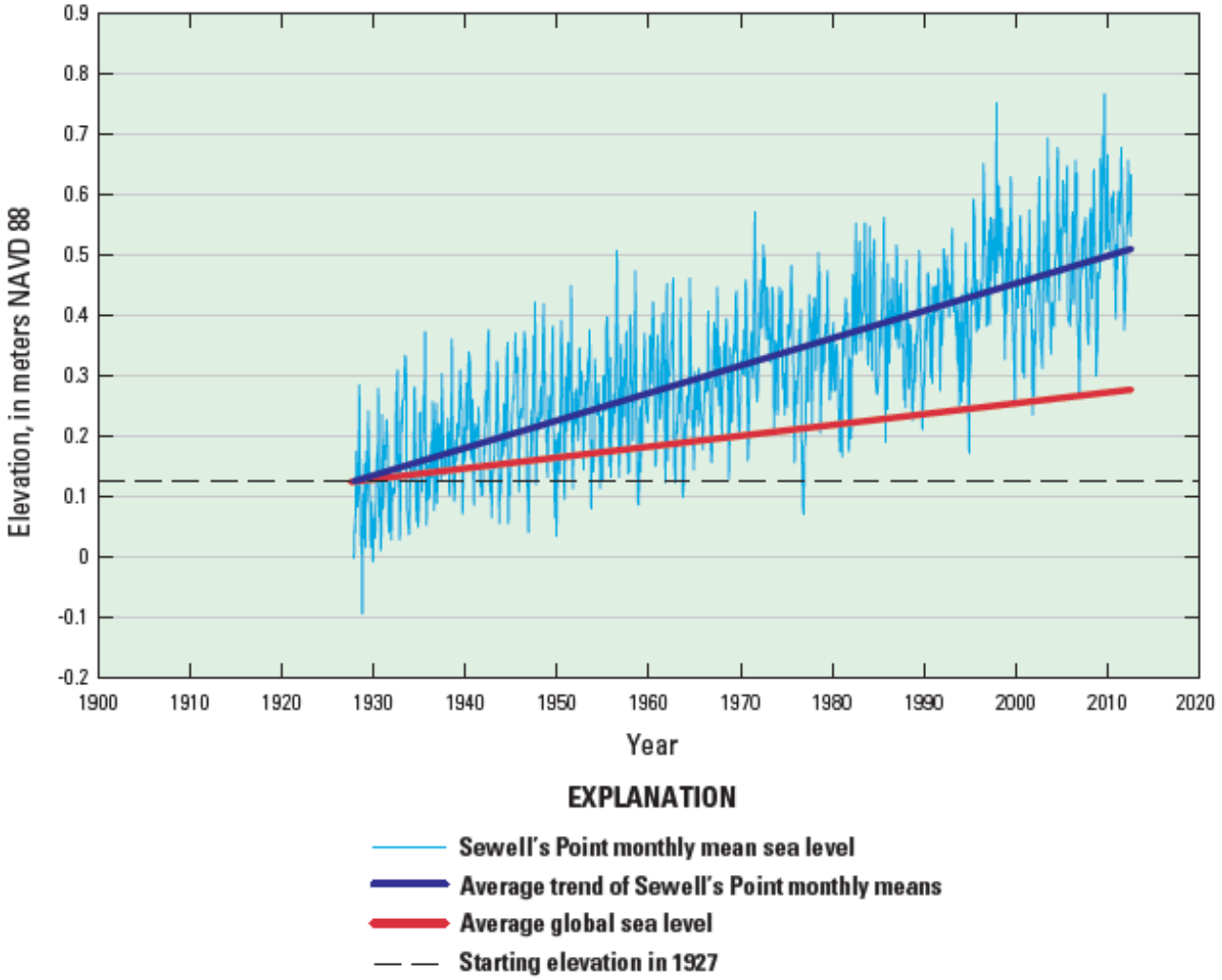


Table 3. Observed sea-level rise and subsidence in the southern Chesapeake Bay region.

[IPCC, Intergovernmental Panel on Climate Change; mm/yr , millimeters per year; NA, not available; NGS, Natio
Oceanic and Atmospheric Administration; SD, standard deviation; USCG, U.S. Coast Guard; USGS, U.S. Geologi

What was measured	Monitoring technique	Agency	Number of stations	Period	R Average
Global data					
Estimated average global sea-level rise	Various	IPCC[2]	NA	1961–2003	1.8
Southern Chesapeake Bay region data					
Aquifer compaction	Extensometer	USGS[3]	2	1979–1995	–2.6
Land subsidence	Geodetic survey	NGS[4]	17	1940–1971	–2.8
Land subsidence	Fixed GPS	NOAA/USCG[5]	3	2006–2011	–3.1
Relative sea-level rise	Tidal station	NOAA[6]	4	1927–2006	3.9

[1]Negative values indicate downward motion (land subsidence), positive values upward motion.
[2]Data are from Bindoff and others (2007).
[3]Data are from Pope and Burbey (2004).
[4]Data are from Holdahl and Morrison (1974).
[5]Data are from Snay and Soler (2008) and National Geodetic Survey (2013) from Continuously Operating Reference Station (C
[6]Data are from Zervas (2009).

Land elevation change in the Southern Chesapeake Bay Region (Eggleston 2013)

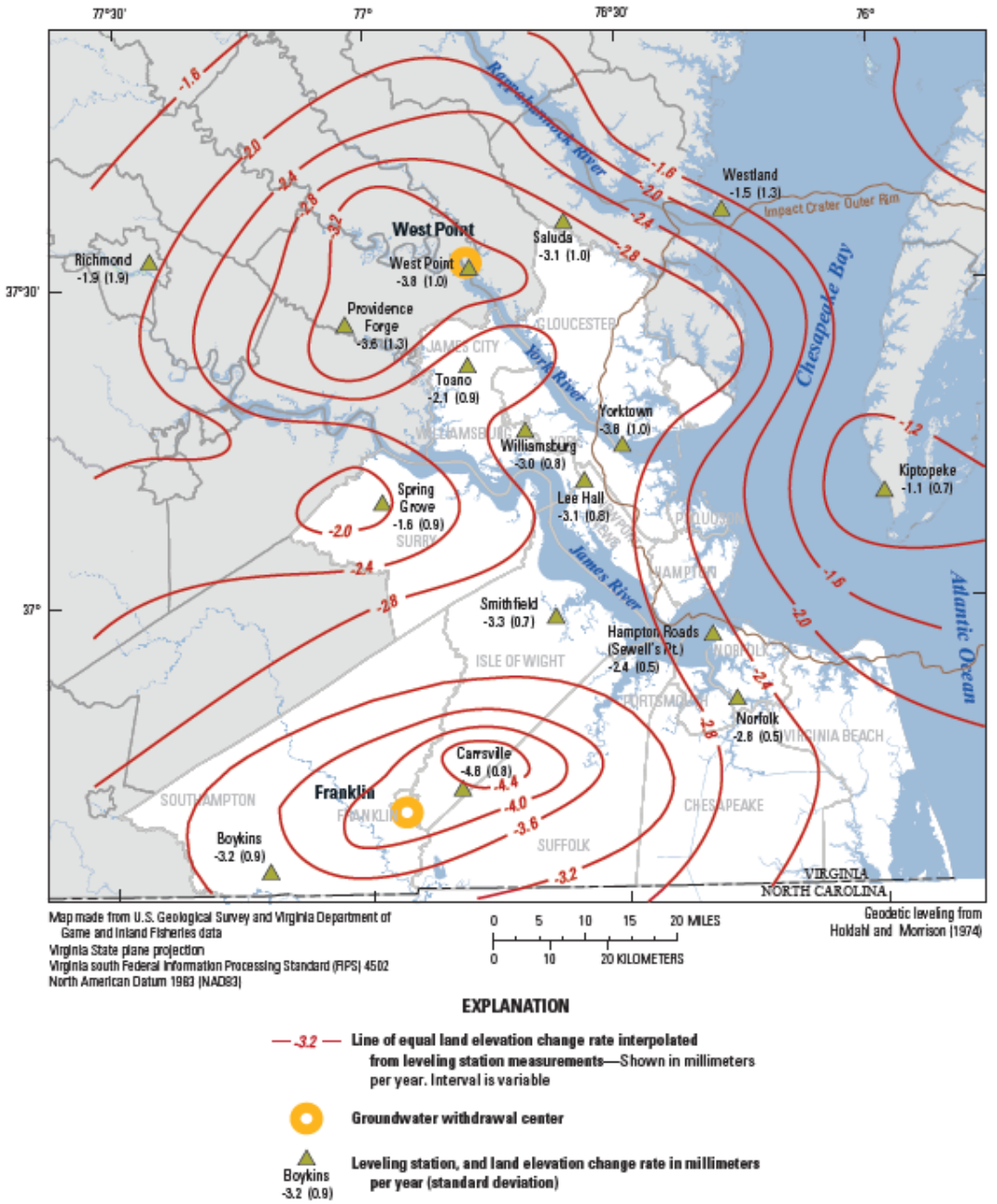
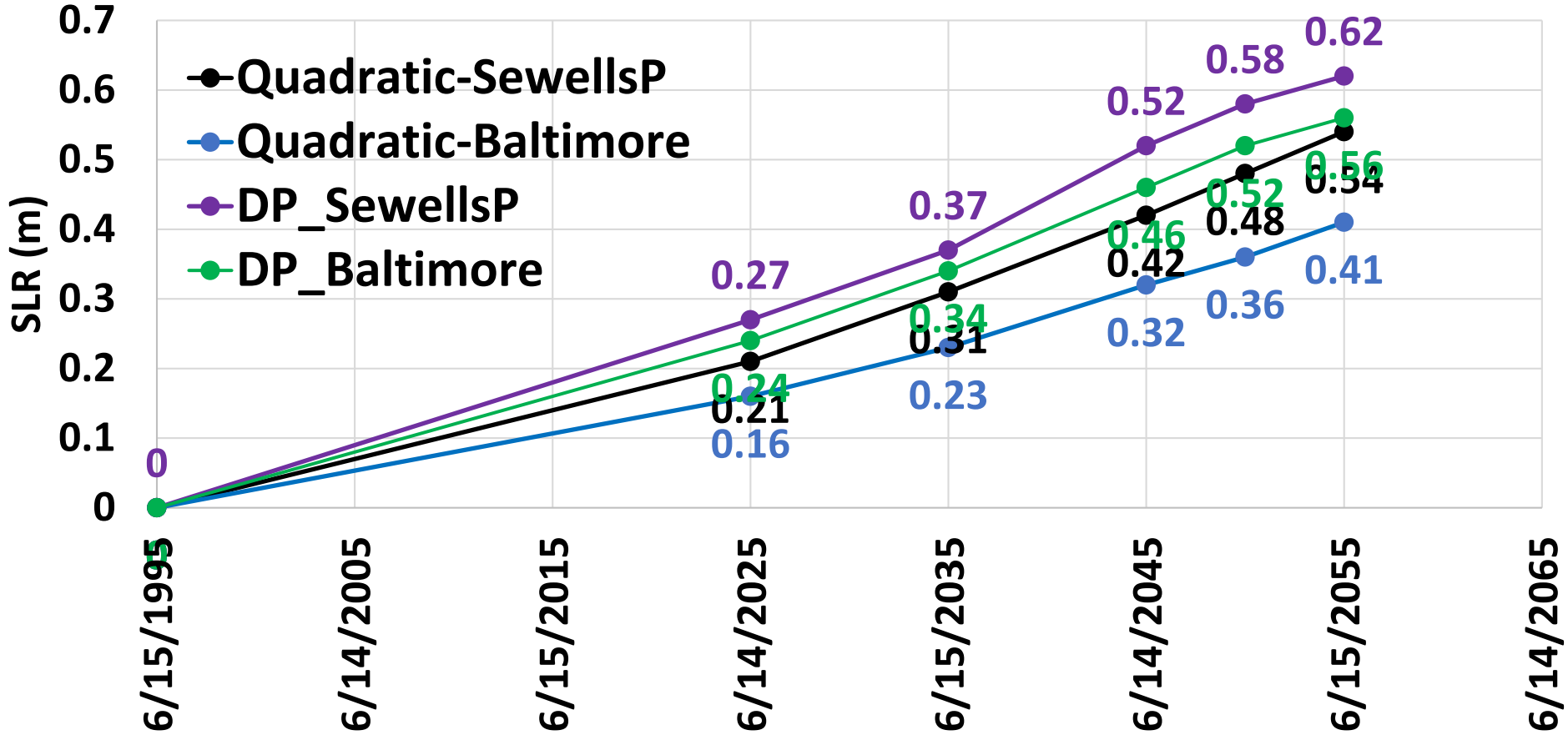


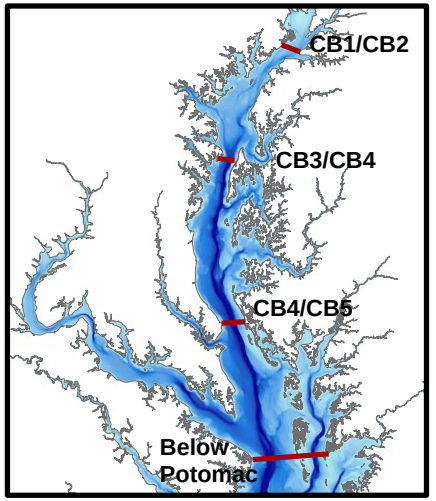
Figure 12. Land elevation change rates from 1940 through 1971. Adapted from Holdahl and Morrison (1974). Contours indicate lines of equal land elevation change rate (mm/year) and negative elevation change rates indicate subsidence. Values in parentheses are standard deviations.

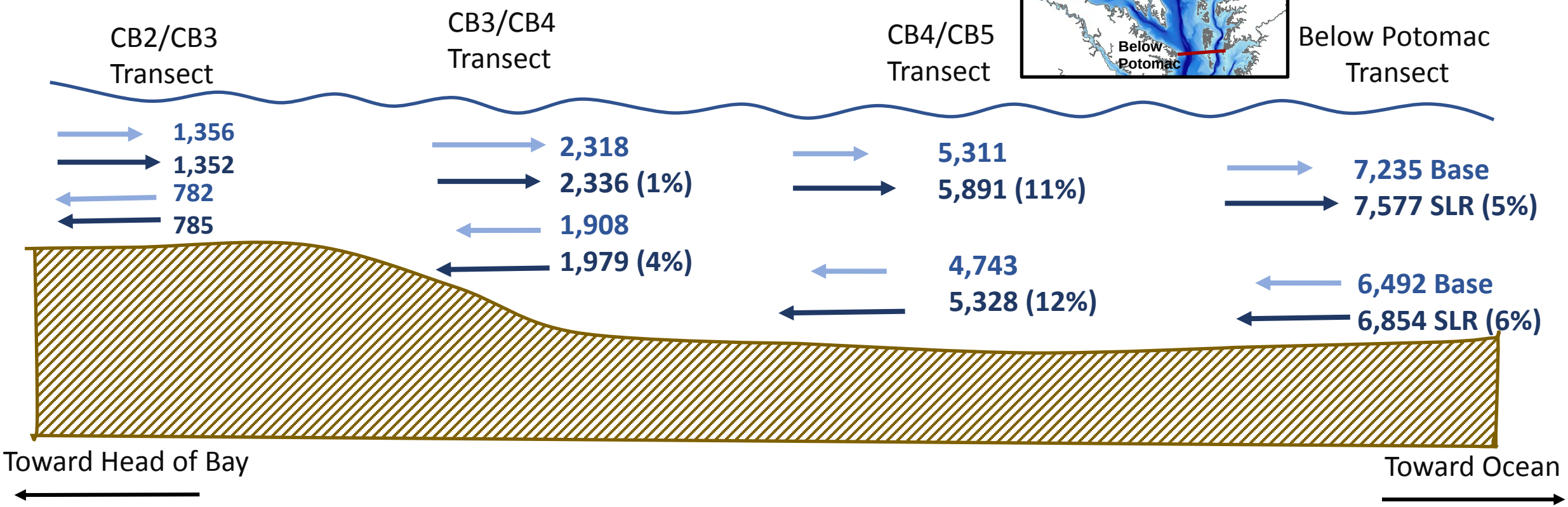
Question: What numbers should we use?



	2025	2035	2045	2050	2055
Quadratic average	0.18	0.27	0.37	0.42	0.48
DP average	0.26	0.36	0.49	0.55	0.59
Average	0.22	0.31	0.43	0.49	0.53

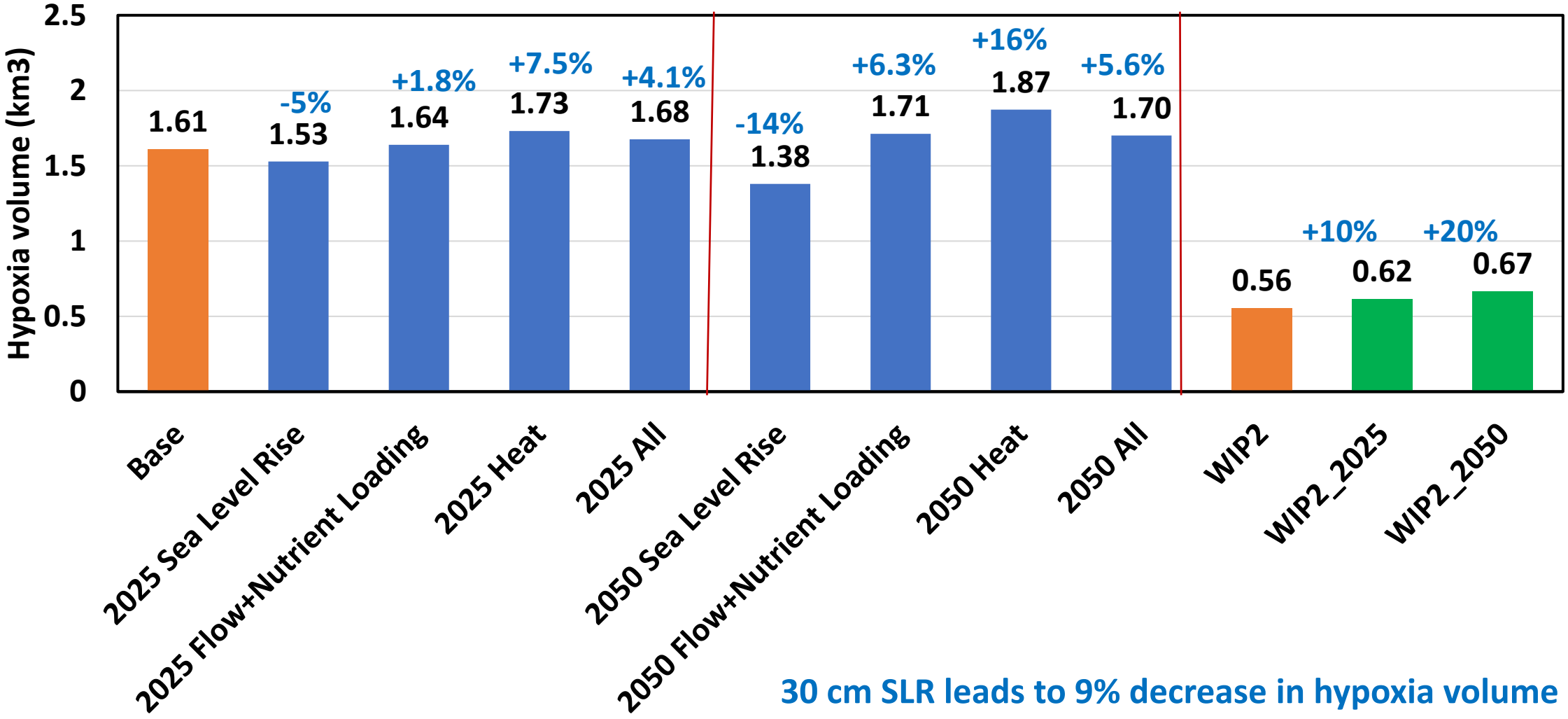
Cross-transect water mass fluxes
Base case versus sea level rise (SLR)
Summer 1993-1995





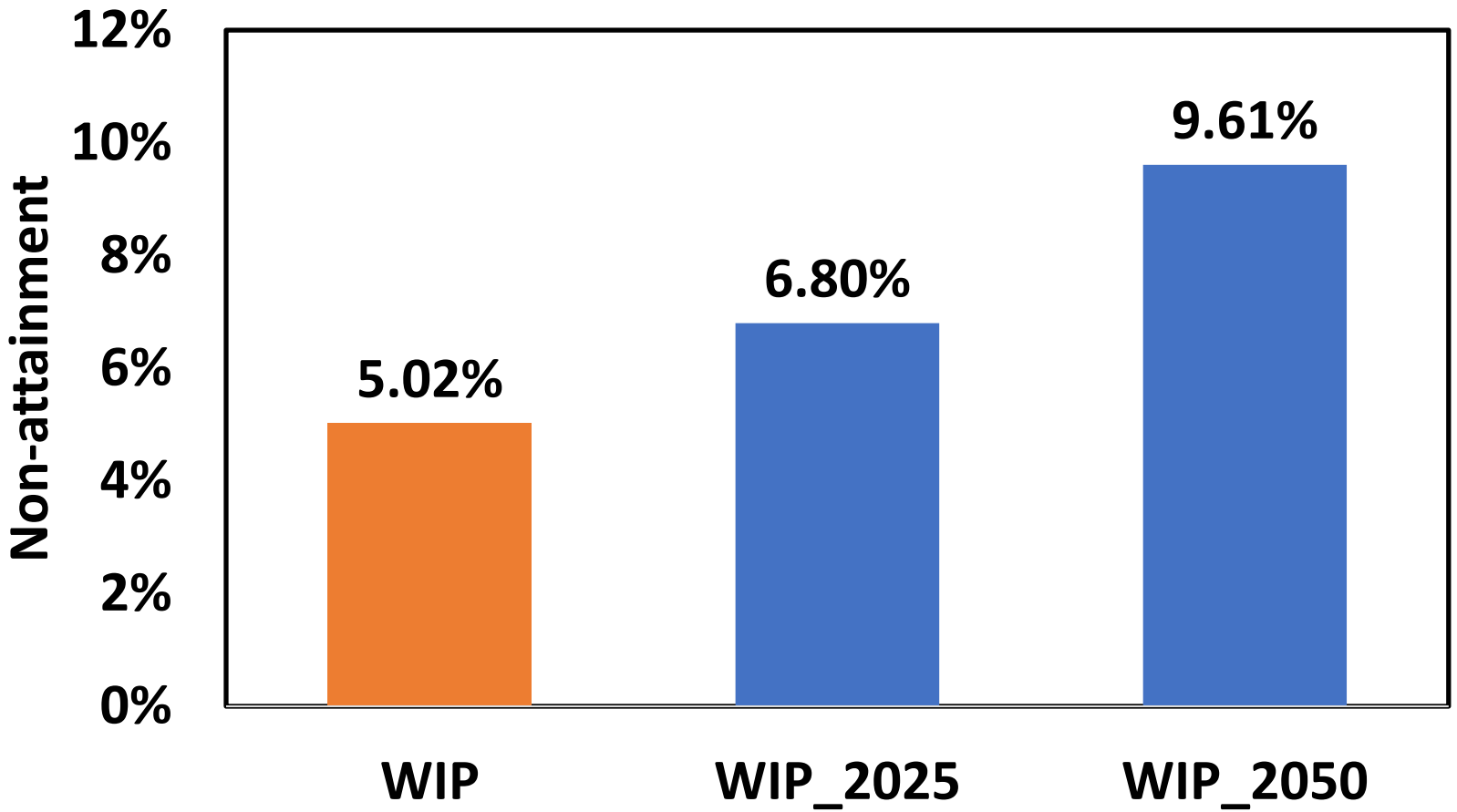
Base = Beta 2 Calibration. SLR = 0.5m Sea Level Rise Scenario representing relative Chesapeake sea level riser from 1995 to 2050. Units in mean cubic meters per second (m^3/s) for summer 1993 to 1995 hydrodynamics.

Average hypoxia volume (<1 mg/l) in summer (Jun-Sep) 1991-2000 in CB4MH



30 cm SLR leads to 9% decrease in hypoxia volume

Estimate on water quality attainment in the Deep Channel CB4MH Under the WIP condition



21st Century Projections for Baltimore, Maryland (from 1995)								
			Based on DP16 projections @ RCP4.5					
	1995	2000	2010	2020	2025	2030	2040	2050
95%			17	28	34	42	57	74
83%			14	24	29	36	48	63
50%	0	3	12	20	24	29	39	52
17%			9	14	17	21	29	39
5%			6	10	12	14	30	26

21st Century Projections for Sewell's Point, Virginia (from 2000)								
			Based on DP16 projections @ RCP4.5					
	1995	2000	2010	2020	2025	2030	2040	2050
95%			15	28	34	42	59	76
83%			12	24	29	36	50	65
50%		0	10	19	23	29	41	54
17%			7	13	16	21	21	41
5%			4	9	11	14	15	29