

***Draft* Sea Level Rise and Storm Surge Highlights for the 2024 Scientific Assessment**

Scientific and Technical Subcommittee Marine Subgroup December 7, 2023



Peter Slovinsky
Maine Geological Survey



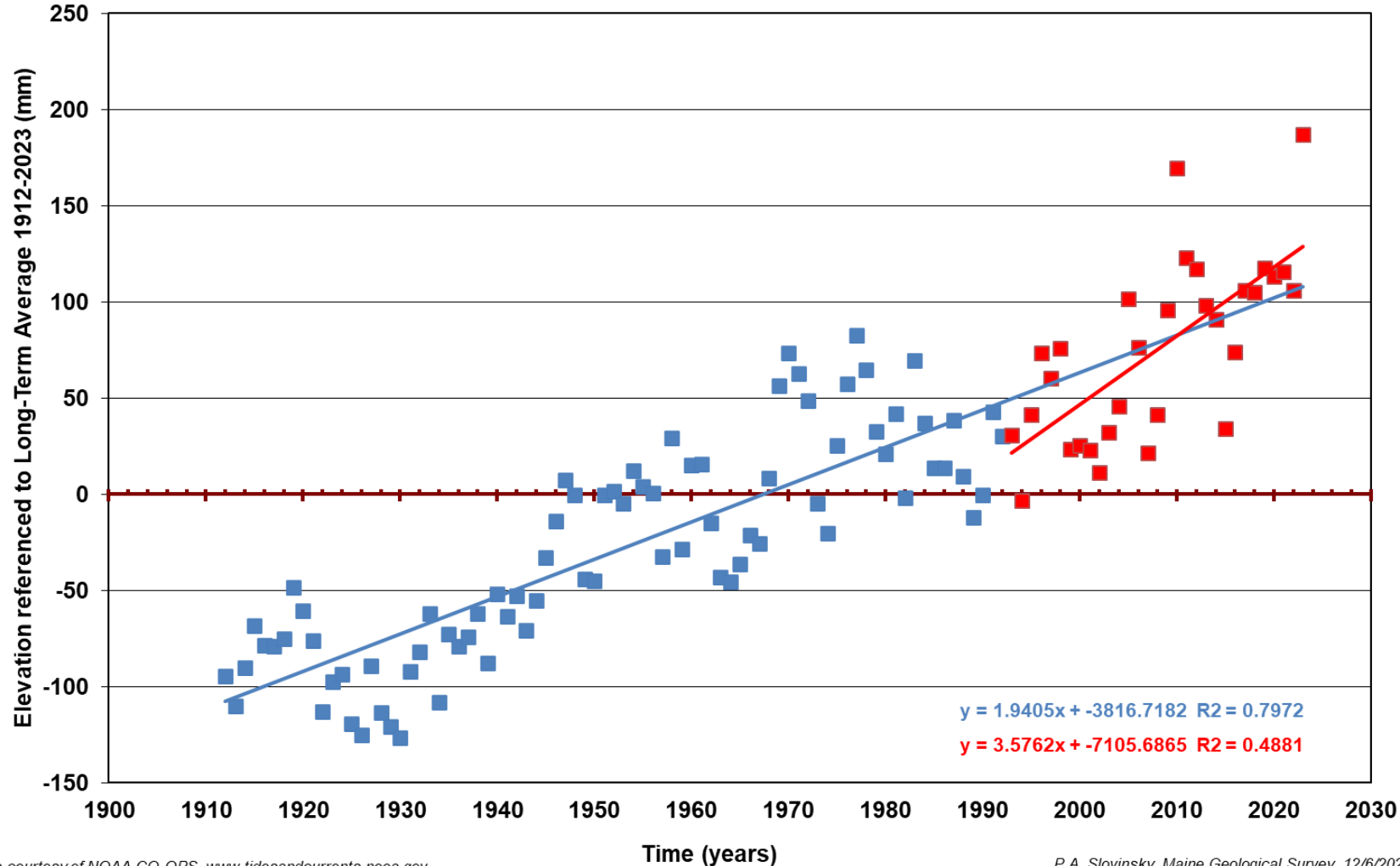
Hannah Baranes
Gulf of Maine Research Institute



Nicholas Whiteman
Maine Geological Survey

Annual Sea Levels, NOAA Station 8418150, Portland 1912-2023

1912-2023 average: 1.94 ± 0.09 mm per year or 0.64 ft (7.64 in) per century
1993-2023 average: 3.58 ± 0.75 mm per year or 1.17 ft (14.08 in) per century



Data courtesy of NOAA CO-OPS, www.tidesandcurrents.noaa.gov

P.A. Slovinsky, Maine Geological Survey, 12/6/2023

Maine's sea levels continue to rise roughly at the same rate as global trends.

About half of observed sea level rise has occurred since 1990, and the short-term rate of SLR is about 75% faster than the long-term rate.

Since the last assessment, averaged sea level rise in Maine (2.20 ± 0.11 mm/yr) slightly exceeds global long-term (1900-present, 1.8 mm/yr) changes, but statistically matches (3.86 ± 0.57 mm/yr) global short-term (1993-present, 3.5 ± 0.4 mm/yr changes.)

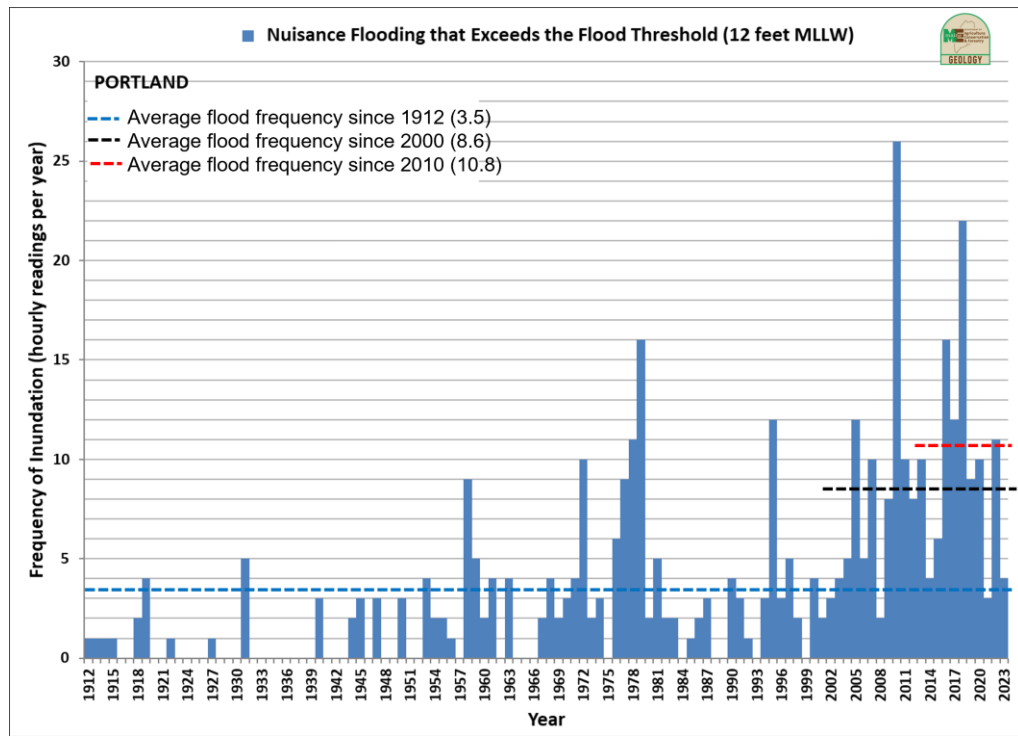
Month	Portland	Bar Harbor	Eastport
	1912-2023	1947-2023	1929-2023
January	2nd	1st	3rd
February	5th	3rd	3rd
March	3rd	1st	1st
April	3rd	3rd	3rd
May	3rd	2nd	2nd
June	1st	1st	1st
July	1st	1st	1st
August	1st	1st	1st
September	1st	2nd	2nd
October	1st	1st	1st
November			
December			

2023 monthly water level is in the top 5 for that month

2023 monthly water level is the 1st for that month P. Slovinsky, MGS

Mean sea levels in Maine continue to trend high and set monthly records.

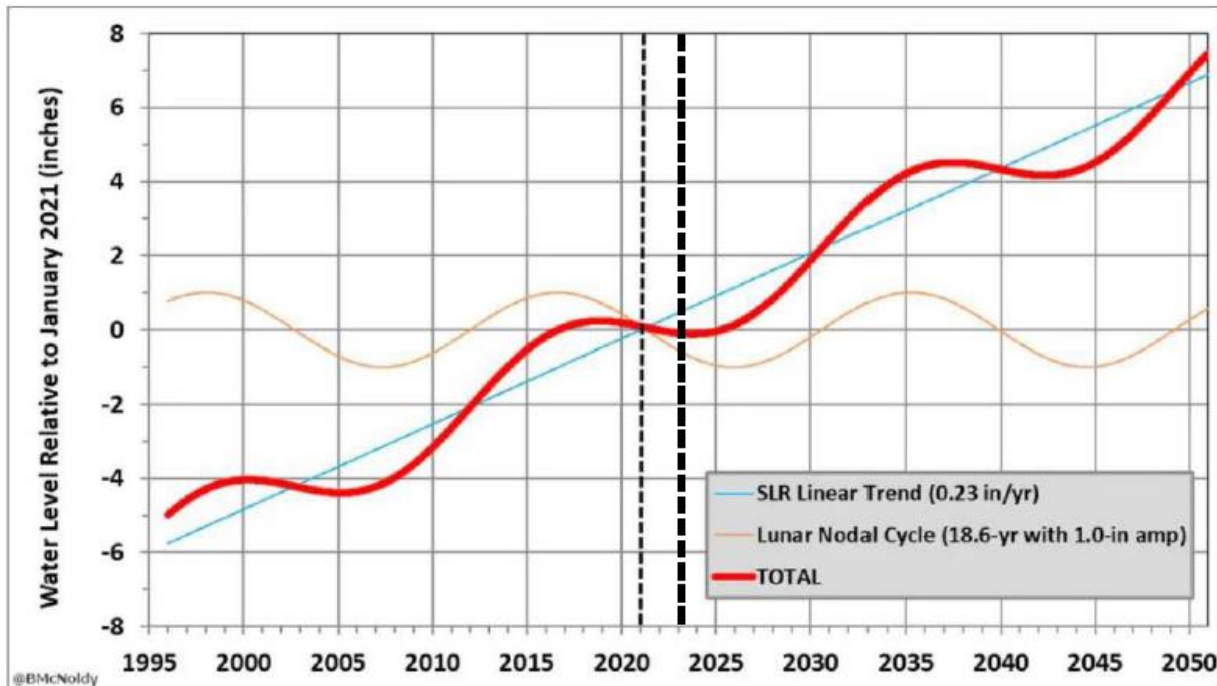
2023 set monthly mean sea level records for 5 to 6 months thus far at Maine's long-term tide gauges with continuous datasets, and the remaining months were within the top 5 recorded water levels for those months.



Nuisance flooding is increasing in Maine and will increase further as sea level rise combines with an increase in tide range due to the lunar nodal cycle.

Especially over the last two decades, Maine experienced an exceedance of long-term average nuisance flooding, **driven by higher mean sea levels.**

(data through October 2023, Graphic by P. Slovinsky, MGS)

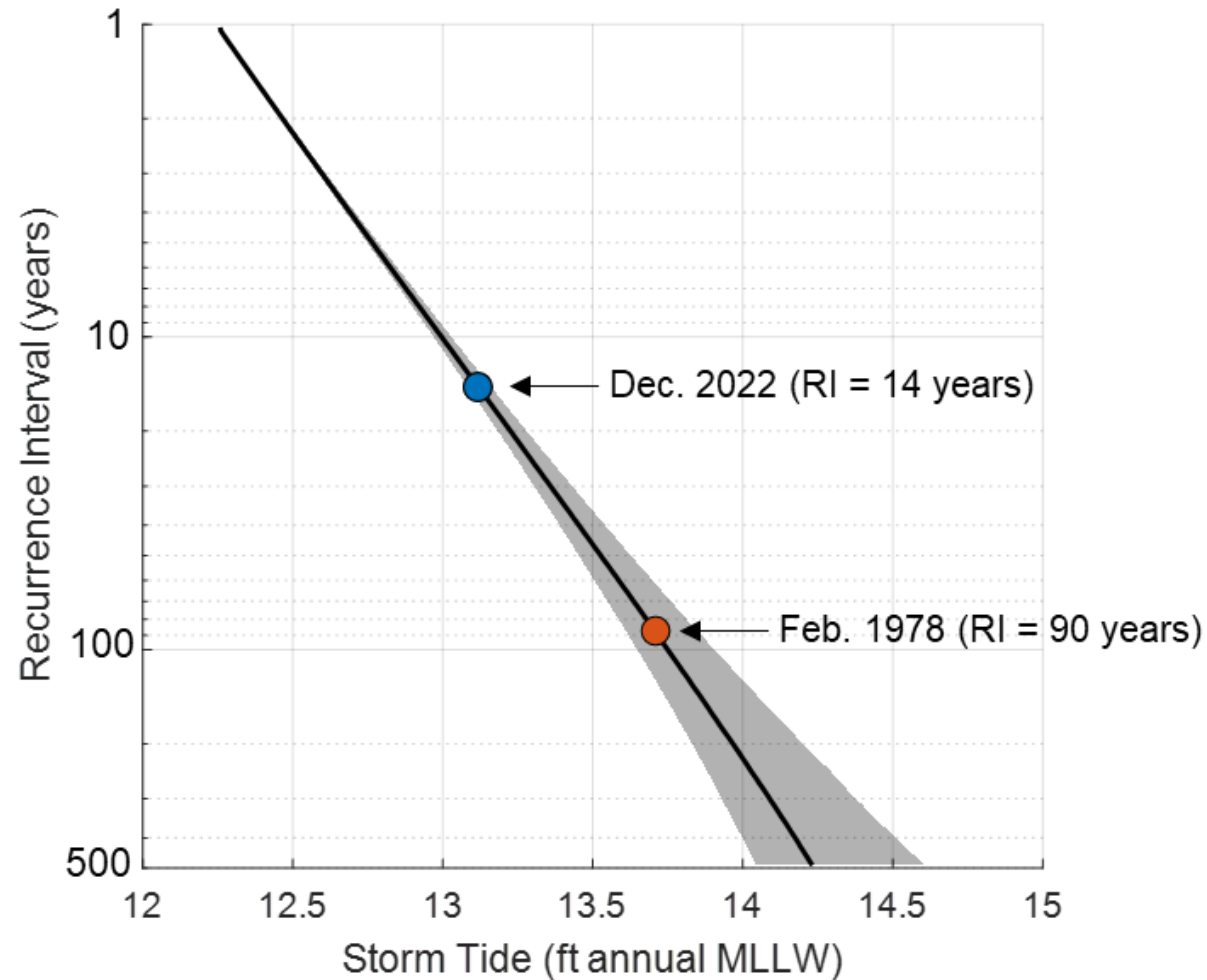


The 18.6 year lunar nodal cycle has been reducing tide range over about the last decade and will reach an estimated minimum in 2024.

The lunar nodal cycle will likely accelerate the increase in frequency and duration of “nuisance” flooding, likely peaking in the mid-2030s.

(Graphic from B. McNoldy and PBS News Hour, 2021).

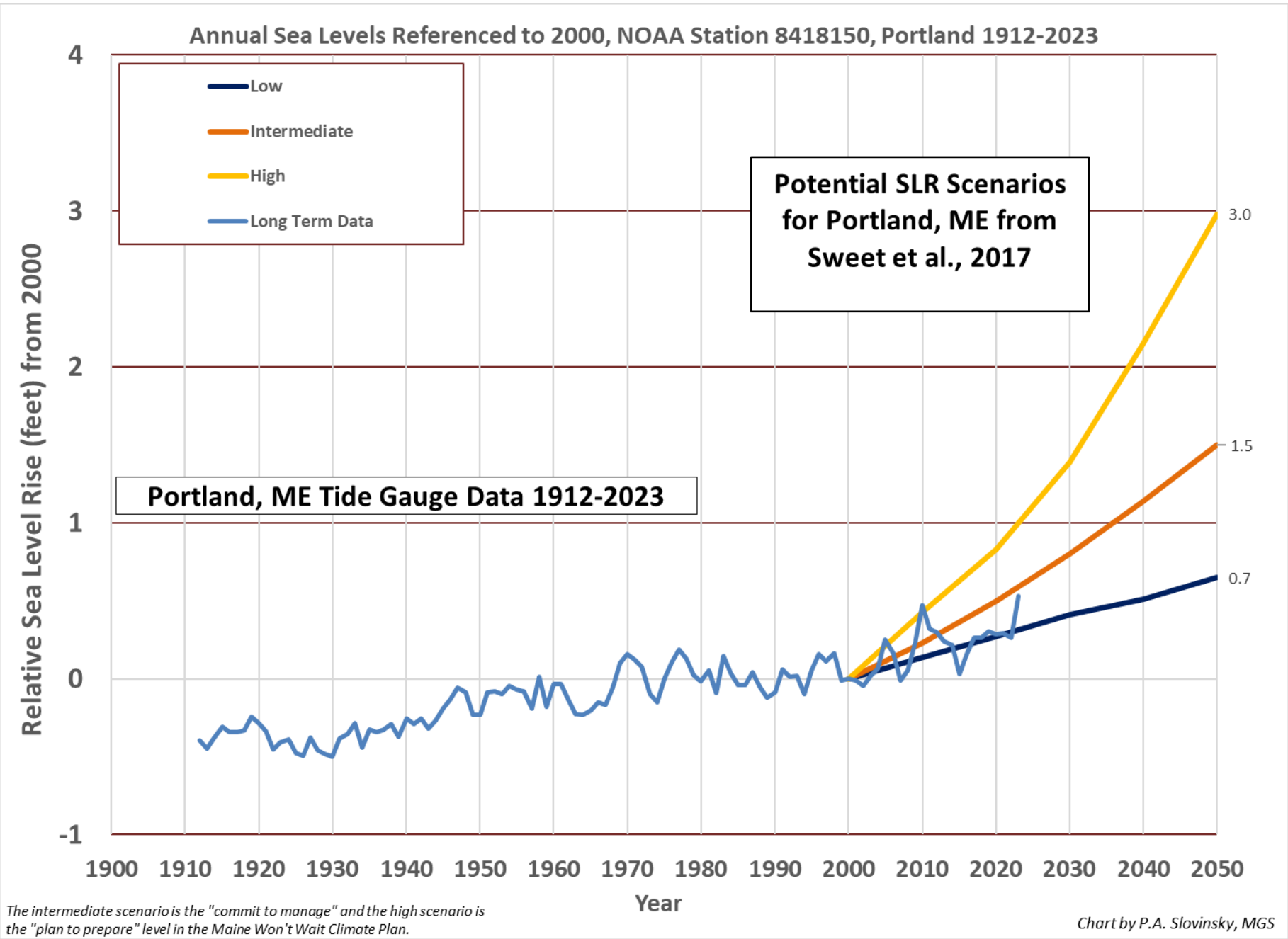
Portland extreme coastal water level probabilities relative to annual MLLW (sea level rise is removed)



In this assessment, we provide more accurate extreme coastal water level statistics at Portland, Bar Harbor, and Eastport and investigate the probabilities of high tides plus large storm surges.

We also discuss several recent and ongoing Maine-specific modeling studies and how these efforts might be applicable to working groups.

Note: These are preliminary statistics for the winter storm season. The distribution will change slightly for low recurrence interval events once combined with the summer season.



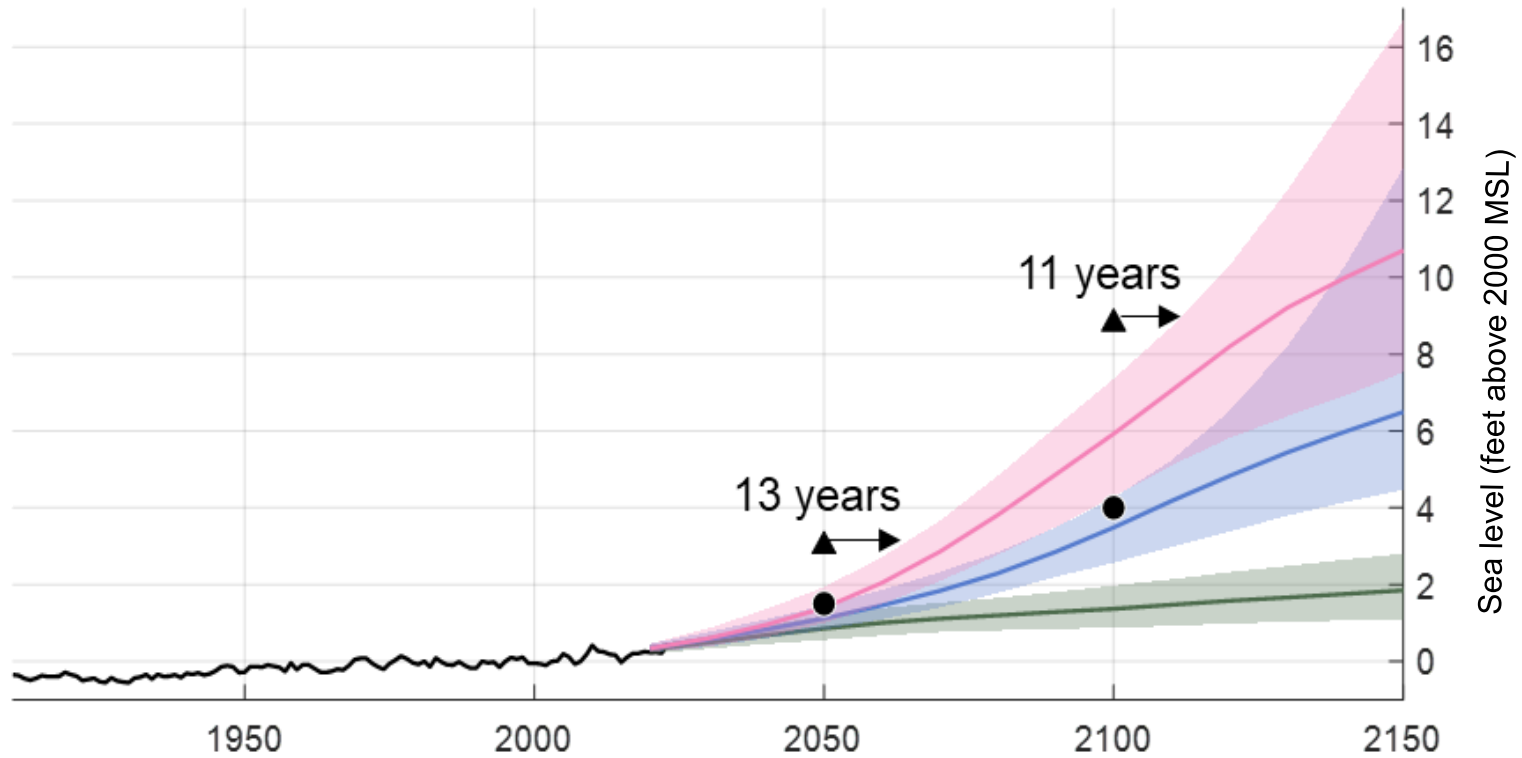
Sea Level Rise in Maine is trending near the “Commit to Manage” Scenario and Working Groups should continue to use this as a guide.

Current sea level rise trends indicate that **Maine’s tide gauges are trending closely to the adopted Intermediate scenario**, which “commits to manage” for 1.5 feet of sea level rise by 2050 and 4 feet by 2100 (with a 2000 start year).

The intermediate scenario is the “commit to manage” and the high scenario is the “plan to prepare” level in the Maine Won’t Wait Climate Plan.

Chart by P.A. Slovinsky, MGS

Portland



- Observed annual mean sea level
- Maine's "commit to manage" scenario (1.5 feet by 2050 and 4 feet by 2100)
- ▲ Maine's "prepare to manage" scenario (3.0 feet by 2050 and 8.8 feet by 2100)
- Sweet et al., 2022 central estimate and likely range for low scenario
- Sweet et al., 2022 central estimate and likely range for intermediate scenario
- Sweet et al., 2022 central estimate and likely range for high scenario

Graphic by H. Baranes, GMRI and adapted by P. Slovinsky, MGS

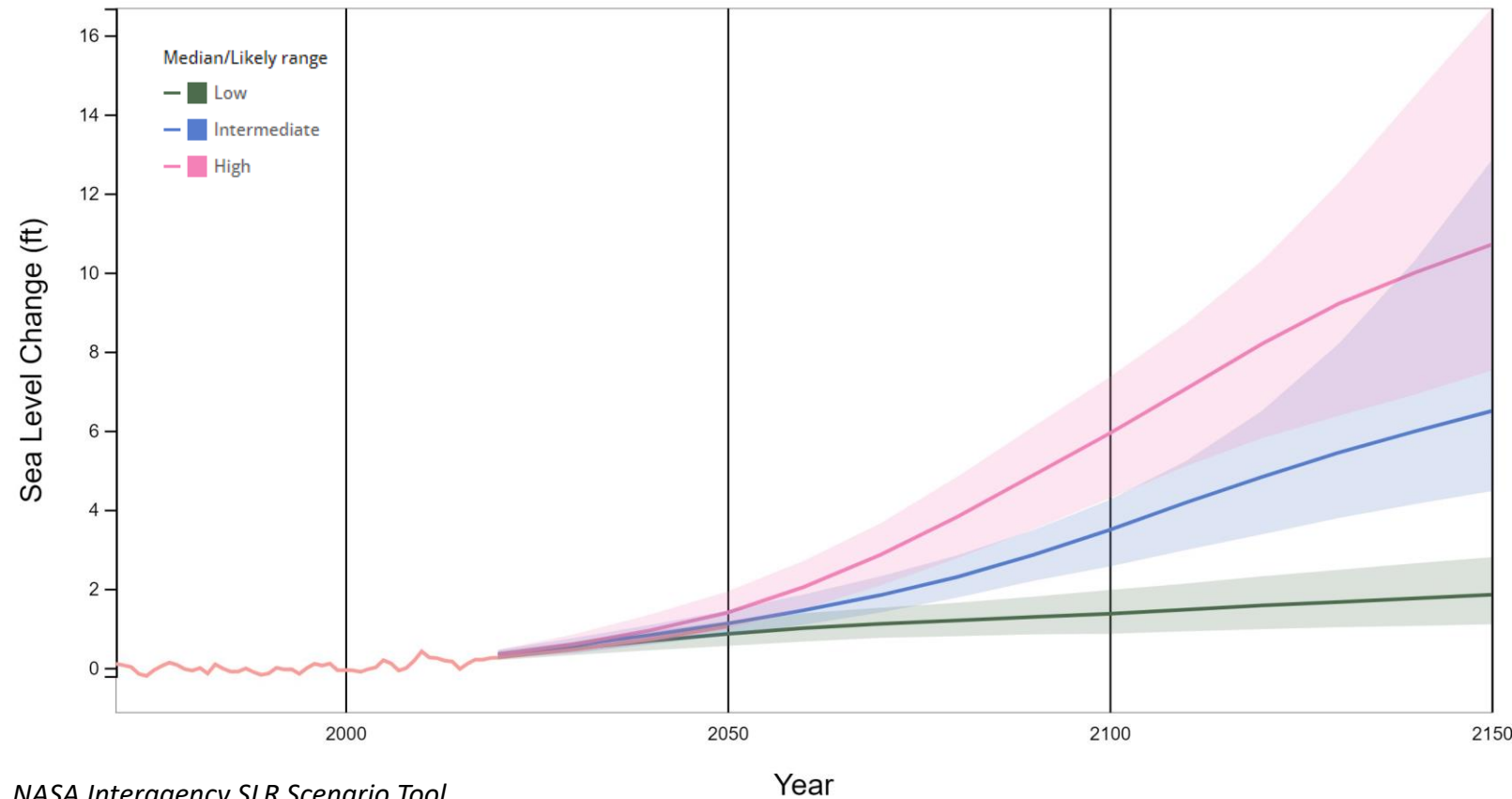
Maine's adopted scenarios remain valid when compared with updated U.S. Interagency Task Force sea level rise scenarios (Sweet et al., 2022).

The "commit to manage" scenario (1.5 feet by 2050 and 4 feet by 2100) falls **within the likely range of the newer Intermediate scenario** (Sweet et al., 2022). **We recommend maintaining this "commit to manage" scenario.**

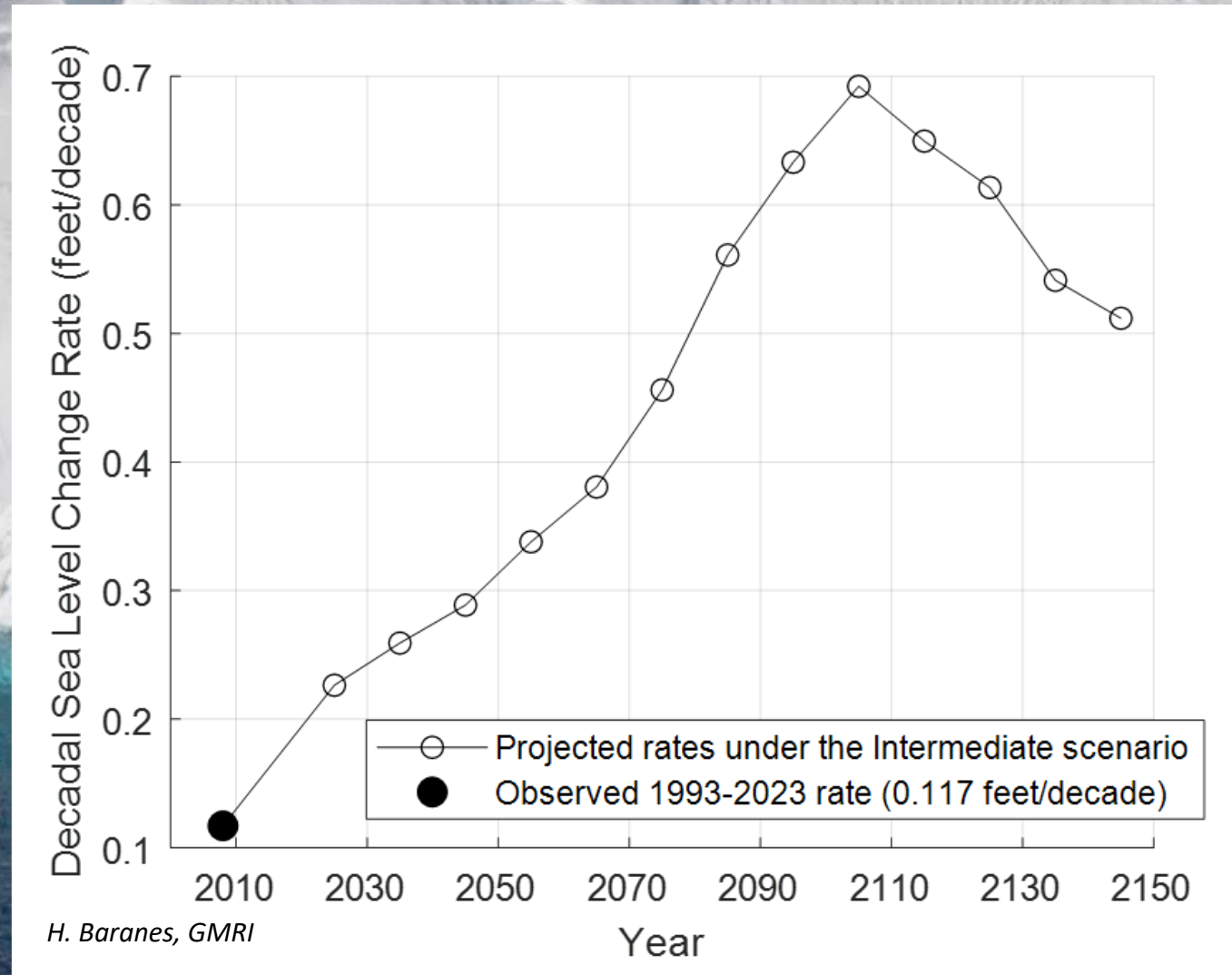
The "prepare to manage" scenario (3 and 8.8 feet for 2050 and 2100, respectively) **falls outside** the likely range of the newer High scenario (1.0 to 2.0 feet for 2050 and 4.3 to 7.5 feet for 2100). **Under the new high scenario, these numbers are within the likely range but about a decade later. Preparing for sea level rise beyond 2100 will be critical for Maine.**



Newer sea level rise curves (Sweet et al., 2022) constrain sea level scenarios out to 2050 based on improved understanding of the timing of ice sheet processes. **These diverge and become less certain after 2050 due to uncertainty of climate feedback factors influencing ice sheet instabilities.** Better understanding of ice sheet instabilities and potential impacts on regional sea level change will be key for constraining scenarios in the future. **We reiterate that planning beyond 2100 for sea level rise will be important for working groups to consider as sea level *will likely continue to rise.***

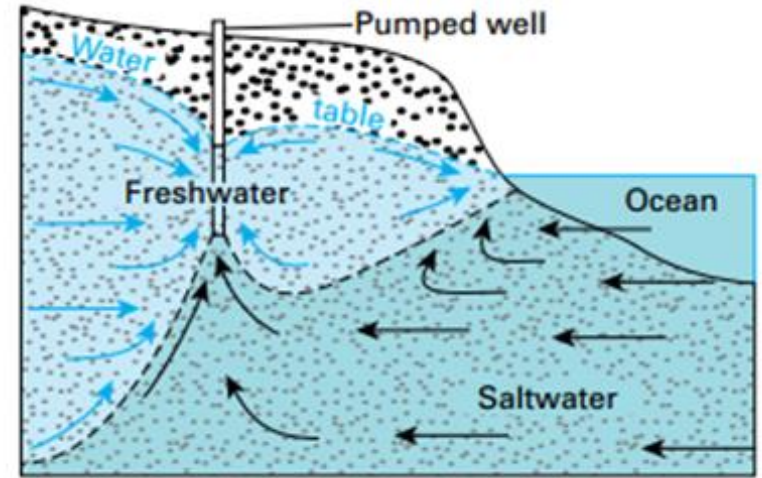


Under Maine's "Commit to Manage" scenario, ice sheet processes cause sea level rise rates to increase by nearly an order of magnitude by the end of the century. **Infrastructure and policy adaptation strategies need to consider this *potential rate of change*, in addition to the *magnitude of change*. An accelerating rate of sea level rise may outpace planning and adaptation efforts before a community's commitment to manage might be achieved**



Other Chapter Elements

- New section on **saltwater intrusion** summarizing the risk and the (very few) investigations of vulnerability of Maine aquifers
- New information from Maine Natural Areas Program study on **upland accommodation space** for marsh migration
- New **sea level policy** resulting from state agency recommendations (2021 Resolve, Chapter 67) and land use regulations from Maine Department of Environmental Protection
- New **policy recommendations** (*is this appropriate for the STS?*)
- New and continued **priority information needs**



U.S. Geological Survey

Report to the Joint Standing Committee on
the Environment and Natural Resources

**Result of Analysis Required by
2021 Public Law, Chapter 67,
Resolve, *To Analyze the Impact of
Sea Level Rise***

January 2022