Frequently Asked Questions

State of California Sea Level Rise Guidance: 2024 Science and Policy Update

Questions about applying and navigating the Guidance

1. Is the Guidance a regulatory document?

The State of California Sea Level Rise Guidance: 2024 Science and Policy Update ("2024 Guidance") is not a regulatory document. The authoring entity, the California Ocean Protection Council, is a cabinet-level state body, not a regulatory agency. The 2024 Guidance is intended to foster coordinated and consistent statewide planning and decision-making based on science, and to enable the incorporation of sea level rise into the full suite of relevant sectors, policy decisions, adaptations plans, project designs, and investments. Regulatory agencies, such as the California Coastal Commission and San Francisco Bay Conservation and Development Commission, plan to use the 2024 Guidance to inform their regulatory documents that will guide sea level rise planning under their jurisdictions.

2. Why doesn't the Guidance recommend one specific value of sea level rise to plan for?

First, scientists cannot predict exact sea level at future dates because future sea level rise is dependent on socioeconomic futures that encompass population, economic growth, education, urbanization, and rate of technological development. Metrics associated with each of these factors, which will affect the rate and amount of sea level rise, can only be known in real-time, so it is not possible to project a discrete sea level at a specific future date with 100% confidence. Instead, five Sea Level Scenarios presented in the 2024 Guidance span the plausible range of future sea level rise under all of the possible emissions and global development futures.

Second, sea levels will not rise uniformly across the California coast due to local vertical land motion. Vertical land motion, either in the form of land subsidence or uplift, is driven by a combination of tectonics, sediment compaction, and groundwater and hydrocarbon withdrawal. Vertical land motion has been incorporated in the Sea Level Scenarios for fourteen tide gauges across the state since attempting to make local sea level rise planning decisions based on a statewide average sea level would not take into account local and regional differences in projected vertical land motion.

Third, the 2024 Guidance recommends evaluation of multiple Sea Level Scenarios so relevant communities, planners, regulatory agencies, or otherwise can make informed decisions on which scenarios to plan for in specific cases. Prescribing a one-size-fits-all scenario would remove the autonomy for specific sea level rise planning efforts and projects to plan for less or more conservative future sea level scenarios based on community values.

3. How are the policy recommendations in this guidance just as precautionary as the previous guidance if projected sea level rise appears lower than previously estimated?

As in the 2018 Guidance, the 2024 Guidance recommends evaluation of potential impacts and adaptive capacity across a range of future Sea Level Scenarios and to select which sea level to plan for based on risk tolerance and adaptive capacity. As such, the policy recommendations for how to apply the sea level rise science are equally as precautionary in the 2024 Guidance as they were in the 2018 Guidance. Scientifically, the range of plausible sea level rise in the near term has narrowed and the H++ scenario from the 2018 Guidance is no longer physically plausible (see question 12).

4. What are the geographic bounds of this guidance? Do the policy recommendations and underlying science apply to non-outer coastal areas such as the San Francisco Bay and Sacramento-San Joaquin Delta?

The information contained in the 2024 Guidance is intended to cover and be relevant for tidally influenced areas of the California shoreline; this includes all of California's outer coast and parts of the Sacramento-San Joaquin River Delta. For more information on the specific geographic scope of the report, the spatial footprint of NOAA's VDATUM tool can be used.[1] VDATUM is designed to convert spatial data among different vertical datums including tidal, orthometric, and ellipsoidal datums. Application of the Sea Level Scenarios provided here requires coupling to a vertical datum, and thus the ability to produce relevant datums for a given location can be viewed as a necessary requirement of applicability. The extent inland typically follows the reach of tidal influences along waterways that connect to the ocean. For California, this includes parts of the Sacramento-San Joaquin River Delta, which has significant tidal effects and where marine and freshwater systems meet. For more specific information on the spatial extent covered, users are referred to the VDATUM tool and associated supporting information.

5. What scenario tables should I use if I am located between two tide gauges?

If the project or planning effort is located between two tide gauges, it is appropriate for users to use the Sea Level Scenarios from the nearest tide gauge. However, if the project or planning effort site is located nearly equidistant between two tide gauges, it is appropriate to interpolate between or average the two tide gauges.

Alternatively, when technical capacity and available data allows, jurisdictions that have more localized or site-specific data on vertical land motion can choose to combine the statewide average scenarios in Table 4.1 with their local measurements of vertical land motion for any location on the California coast and San Francisco Bay.

6. Does the Guidance provide 1-degree gridded sea level values?

The 2024 Guidance does not present sea level values in a gridded map format. Instead, the 2024 Guidance provides a set of five Sea Level Scenarios for each of the fourteen NOAA tide

[1] https://vdatum.noaa.gov/

gauges. Appendices 1 and 2 of the 2024 Guidance show locations of the fourteen tide gauges and provide the Sea Level Scenarios for each gauge. Appendix 3 provides instructions for calculating relative sea level rise from the statewide average table and a local vertical land motion value. This can be particularly useful for site-specific projects that are experiencing localized tectonic uplift or subsidence.

Questions about how to consider flooding and storm projections in vulnerability analyses

7. How can I view inundation, flooding, and storm projections in combination with the Sea Level Scenarios on online visualization tools like Our Coast Our Future or CoSMoS that do not have sea level values that match up directly with the scenarios?

Online visualization tools designed to show coastal hazards like inundation, flooding, and storm impact under future Sea Level Scenarios typically require users to specify an amount of sea level rise for which they would like to assess vulnerability to. Visualization tools can be very useful in vulnerability assessments to understand exposure to coastal hazards, but using them in conjunction with the Sea Level Scenarios may require some translation on the user's part. Our Coast Our Future, for example, allows users to select from a limited set of sea level values (i.e., 0.8, 1.6, 2.5, 3.3, 4.1, 4.9, 5.7, 6.6, 8.2, 9.8, and 16.4 feet.) Depending on what sea levels are identified for analysis, there might not be a sea level value option in Our Coast Our Future that is an exact match to the Sea Level Scenarios in the guidance. For these situations, it is not always necessary to analyze the exact numerical values. Rather it is more important that the full range of values from Intermediate to High scenarios, with consideration of storm conditions, is evaluated.

8. What storm scenarios (e.g., 100-year, 20-year, or otherwise) should be considered in vulnerability assessments?

For most applications, analysis of 100-year storm conditions is recommended with wave-driven processes and storm surge being the most important components to consider. However, the coastal water levels resulting from certain combinations of sea level rise and storm scenarios may be similar to others, and therefore not all scenarios need to be thoroughly evaluated. For instance, across California the Intermediate Scenario with 100-year storm conditions, is very similar to the exposure created by the Intermediate-High Scenario with no storms (although they will differ in inundation versus temporary flooding exposure). It is therefore recommended to consider the consequences of storm-induced extreme water levels on a project-by-project basis. Some online visualization tools (such as Our Coast Our Future, see Box 12 in the 2024 Guidance) consider the primary drivers of extreme water levels and can be used as a screening tool to help determine what combinations of Sea Level Scenarios and storm conditions are appropriate for analysis in a vulnerability assessment.

Questions about the scientific basis of the Sea Level Scenarios

9. What's the difference between probabilistic projections and scenarios? Are they different or are they the same approach to presenting future sea level rise?

Probabilistic projections are quantitative estimates of the likelihood of different amounts of future sea level rise that are conditional upon future emissions. Sea level scenarios, on the other hand, are specific values or trajectories of future sea level that are derived from sets of probabilistic projections provided by the Intergovernmental Panel on Climate Change 6th Assessment Report (IPCC AR6). These two approaches should not be viewed as alternatives to each other because sea level scenarios are constructed from projections, but they present scientific information and guide decision-making about the future in slightly different ways.

The 2024 Guidance differs from the 2018 Guidance in that it provides Sea Level Scenarios spanning a range of emissions and global development futures, rather than several sets of probabilistic projections each linked to a specific emissions pathway. While the 2018 Guidance provided probabilistic projections under three IPCC emissions scenarios termed representative concentration pathways, the Sea Level Scenarios in this report span all shared socioeconomic pathways and enable users to consider sea level rise without first selecting a single emissions future on which to base planning.

10. Do each of the scenarios carry with them a probability or likelihood of occurrence? What does it mean when the guidance says a scenario is likely or most likely?

Sea level rise is highly dependent on if and how fast the world's nations reduce global emissions and mitigate warming trends, so there are no probabilities that can be assigned directly to each of the Sea Level Scenarios. Instead, each scenario integrates information on a potential future pathway for warming levels and emissions, known as shared socioeconomic pathways. By extension, assumptions about future warming levels can be translated into the probability of exceeding a particular Sea Level Scenario in that assumed future. Exceedance probabilities associated with each Sea Level Scenario are presented in Table 2.2 of the report.

11. Is the H++ projection from the 2017 and 2018 reports included in the updated Guidance?

The extreme sea level rise scenario (also known as H++) from the 2017 Rising Seas in California report, on which the 2018 Guidance was based, is much higher than best available science now suggests and has not been included in the 2024 update. New scientific consensus from the Intergovernmental Panel on Climate Change Sixth Assessment report suggests that the H++ scenario is not physically plausible as it incorporates too much sea level rise in the near-term and a consequent ongoing high rate of sea level rise throughout the rest of the 21st century.

12. The Guidance states the High Scenario is not likely due to its reliance on low confidence processes. When or in what instances might the High Scenario become likely?

In the High Scenario, pathways combining both high emissions and low confidence processes are dominant, providing over 80% of the samples to construct the scenario. Low emissions pathways are not plausible under this scenario, and intermediate emissions pathways require a significant contribution from rapid ice sheet loss processes. Before 2100, the High Scenario is significantly above the range of shared socioeconomic pathway AR6 scenarios, although the range of plausible sea level expands beyond 2150. The probability of exceeding the High Scenario in 2100 is less than 1% for all warming levels without considering low confidence processes. With very high emissions and warming and contributions from the low confidence processes, this probability increases to 8%. Given the reliance on sea level contributions for processes in which there is currently low confidence in their understanding, a statement on the likelihood of reaching this scenario is not possible.

13. Are the scenarios baselined to the year 2000?

Yes, the Sea Level Scenarios are relative to a 2000 baseline.