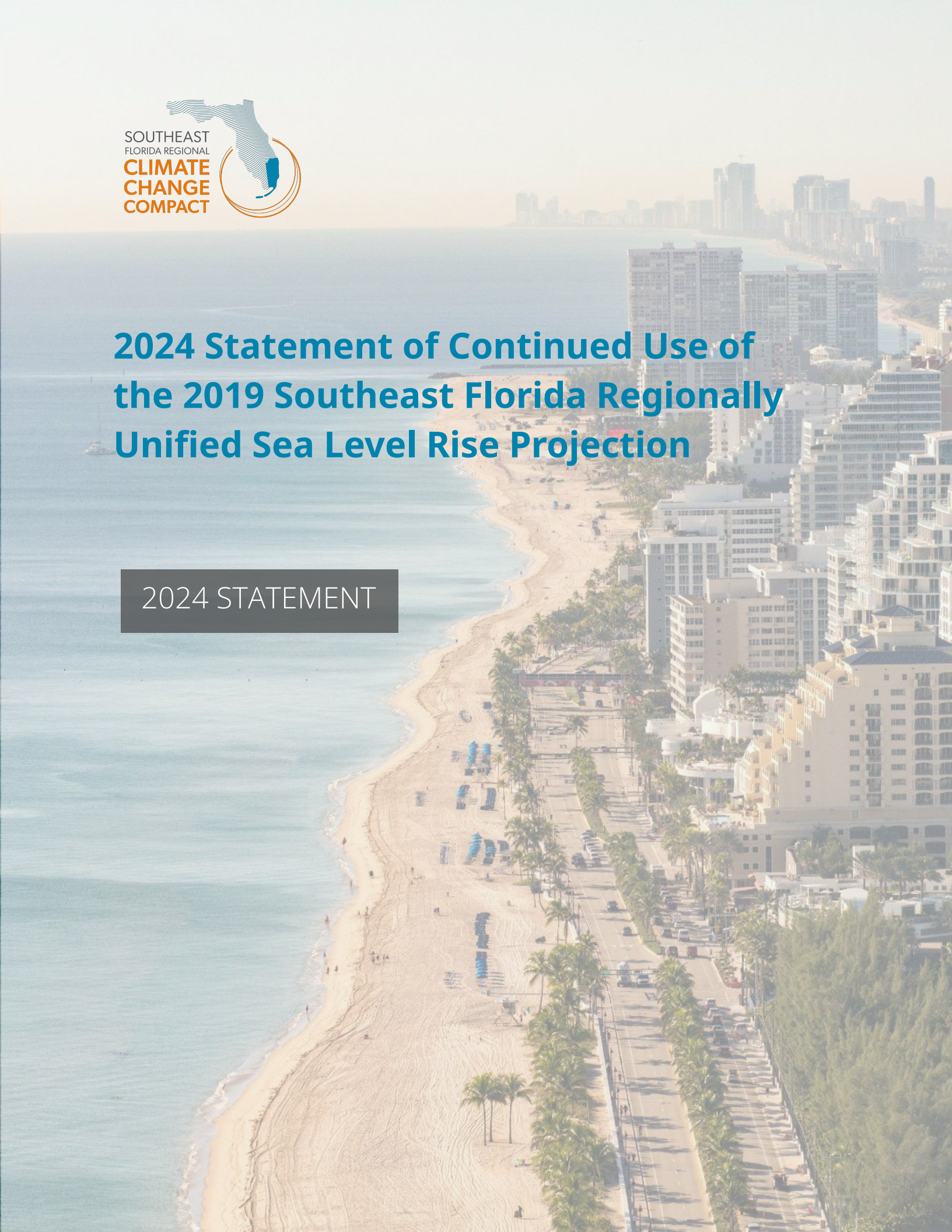
SOUTHEAST FLORIDA REGIONAL CLIMATE CHANGE COMPACT

2024 Statement of Continued Use of the 2019 Southeast Florida Regionally Unified Sea Level Rise Projection

2024 STATEMENT



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Introduction

The Southeast Florida Regional Climate Change Compact (the Compact) first developed the Regionally Unified Sea Level Rise Projection for Southeast Florida in 2011 and has since updated the projection twice, in 2015 and 2019, through the engagement of an ad hoc Sea Level Rise Work Group, composed of scientific experts within the academic community, as well as staff from local, regional, and federal government.

Summary Statement

The Compact has consistently indicated it would review and, if necessary, update the projection every five years, or sooner, as a result of ongoing advances in scientific knowledge and modeling via the peer-reviewed literature on global climate change. The Compact has recently undertaken a review of its 2019 Regionally Unified Sea Level Rise Projection ("2019 Projection") vis-à-vis updates from the National Oceanic and Atmospheric Administration's (NOAA) 2022 Sea Level Rise Technical Report[1], as well as observational trends in the sea level in the region.

[1] Sweet, W.V., B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, M. Craghan, G. Dusek, T. Frederikse, G. Garner, A.S. Genz, J.P. Krasting, E. Larour, D. Marcy, J.J. Marra, J. Obeysekera, M. Osler, M. Pendleton, D. Roman, L. Schmied, W. Veatch, K.D. White, and C. Zuzak, 2022: Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines. NOAA Technical Report NOS 01. National Oceanic and Atmospheric Administration, National Ocean Service, Silver Spring, MD, 111 pp. https://oceanservice.noaa.gov/hazards/sealevelrise/noaa-nostechrpt01-global-regional-SLR-scenarios-US.pdf

As a result of advances in science and modeling, the global scenarios within the NOAA 2022 Report are lower in the near-term than the scenarios in the NOAA 2017 Report Global and regional sea level rise scenarios for the United States (Sweet et al., 2017[2]), which was the basis for the Compact's 2019 Regionally Unified Sea Level Rise Projection. However, the NOAA 2022 Intermediate, Intermediate-High, and High scenarios all fall within the recommended planning range of the Compact's 2019 Projection and guidance, particularly after about 2030. Furthermore, regional sea level rise observed at both the Key West and Virginia Key tide gauges indicate that over the last ten years, increased sea levels are within the recommended planning range provided by the Compact's 2019 Projection.

Therefore, based on the review of the Compact's 2019 Projection relative to the NOAA 2022 Report, as well as observed trends in relative sea level rise in the region, the Compact issues this update to clarify its guidance for the continued use of the 2019 Regionally Unified Projection in Southeast Florida as a basis for resilience planning, design, and construction. The Compact intends to revisit this guidance in the future as new science and modeling become available.

What new science has been released since the release of Compact's 2019 Sea Level Rise Projections?

The 2019 Projections are based on projections of sea level rise developed by the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC, 2014), as well as projections from NOAA (2017), and accounts for regional effects, such as thermal expansion, gravitational effects of ice melt, mass redistribution, changes in ocean dynamics, and vertical land movement. With respect to ocean dynamics, research suggests that future changes to the Florida current, among other factors, may produce regional differences in Southeast Florida's rate of sea level rise compared to global projections.

Since the release of the Compact's 2019 Regionally Unified Sea Level Rise Projection, NOAA has published the 2022 Sea Level Rise Technical Report. The NOAA 2022 Report updates the set of global mean sea level rise scenarios downscaled with output directly from the United Nations Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6; IPCC, 2021a).

[2] Sweet, W.V., R.E. Kopp, C.P. Weaver, J. Obeysekera, R.M. Horton, E.R. Thieler, and C. Zervas, 2017: Global and Regional Sea Level Rise Scenarios for the United States. NOAA Technical Report NOS CO-OPS 083. NOAA/NOS Center for Operational Oceanographic Products and Services.
https://repository.library.noaa.gov/view/noaa/18399

How do the projections compare between the NOAA 2017 and NOAA 2022 Reports?

The NOAA 2022 Report uses new science to build on the NOAA 2017 Report to define a range of global mean sea level (GMSL) rise scenarios for future planning, ranging from a low to a high scenario. The NOAA 2017 Report provides six scenarios of GMSL rise ranging from 1 foot (0.3 m) – "Low", to 8.2 feet (2.5 m) – "Extreme" by 2100. The 2022 Report includes the same scenarios, with the exception of the extreme scenario, which has been removed. NOAA 2022 excludes the extreme scenario because recent science suggests the probability of this scenario is too low to merit inclusion. However, high-end scenarios still allow for substantial sea level rise after 2100.

In the 2022 Report, the projections for the year 2100 for each global scenario stayed the same, since science suggests this range of futures remains possible. However, the timing of the rates of rise in the near-term for the different scenarios was updated based on new modeling and more scientifically justifiable, realistic assumptions of Greenland and Antarctic ice sheet behavior based upon the Intergovernmental Panel on Climate Change Sixth Climate Assessment. As such, while the 2017 and 2022 sea level rise scenarios reach the same global mean sea level values by 2100, the 2022 scenario pathways reflect slower acceleration of sea level rise in the near-term, but a greater acceleration in rates of sea level rise after 2050 (Figure 1).

At the regional level, the 2019 Projections from the Compact, which were largely based on the NOAA 2017 Report, reveal differences related to the corresponding scenarios of the updated NOAA 2022 Report. In the NOAA 2017 Report, the sea level scenarios in the southeast region were significantly higher than the corresponding global scenarios due to regional effects of ocean currents, gravitational effects of ice melt, and vertical land movement. In the NOAA 2022 Report, the regional curves are lower and closer to the new global scenarios.

The updated sea level rise scenarios for a particular location may be downloaded from the new NASA Interagency Sea Level Rise Scenario Tool (Interagency Sea Level Rise Scenario Tool – NASA Sea Level Change Portal) or the USACE's Sea Level Analysis Tool for the tide gauges in the Compact region.

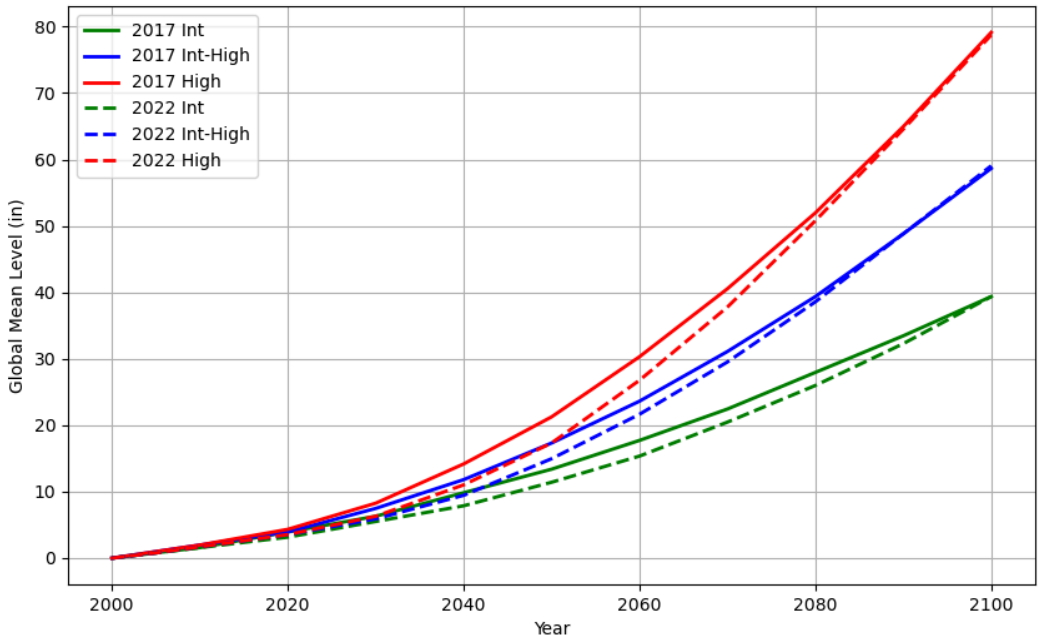

FIGURE 1: Comparison selected NOAA 2017 scenario to the corresponding NOAA 2022 scenarios for **G**lobal **M**ean **S**ea **L**evel (GMSL). While NOAA 2022 scenarios are lower than those of NOAA 2017 but the scenarios reach the same global mean sea level by 2100.

What are the observed trends in sea level rise in Southeast Florida?

Sea level rise scenarios are meant to depict multi-year, long-term averages of mean sea level. Scenarios do not predict future changes absolutely, but describe future plausible conditions in a manner that supports decision-making under conditions of uncertainty. Trends in observed sea level rise provide important information relative to the sea level rise scenarios in the near-term. To smooth out year-to-year variability in observed data, the Compact's 2019 Report used a 5-year mean to assess recent trends. Figure 2 shows an updated comparison, plotted alongside both the Compact's 2019 Projections and the NOAA 2022 update for the Key West tide gauge (located in Monroe County). Similarly, Figure 3 shows the same updated comparison for the Virginia Key tide gauge (located in Miami-Dade County).

- Based on the previous 5-year average, the observed sea level rise at the Key West tide gauge from 2000 to 2023 is about 6 inches.
- In the period from 2012 - 2023, there was a rapid increase in monthly sea level rise along the Southeast Florida coast (Figure 4). Scientists have not concluded definitively what is causing this observed increase, or whether it is a long-term trend or multi-decadal variability.

Based on the Key West tidal record (which has recorded tidal elevations since 1913), observed sea level rise since about 2012 generally follows the Compact's 2019 IPCC Median Curve, and is generally following all three NOAA 2022 scenarios (Intermediate, Intermediate-High, and High), which are similar in their trajectories until around 2020 (Figure 2). Based on the Virginia Key tidal record (which has been recorded since 1996), since about 2012, the observed sea level rise generally follows the Compact's 2019 IPCC Median Curve (and has exceeded it since 2020), as well as all three NOAA 2022 scenarios (Intermediate, Intermediate-High, and High) (Figure 3). Furthermore, after about 2030, the 2022 NOAA Intermediate-High and High scenarios remain within the planning range included in the Compact's 2019 Report (Figures 2 and 3).

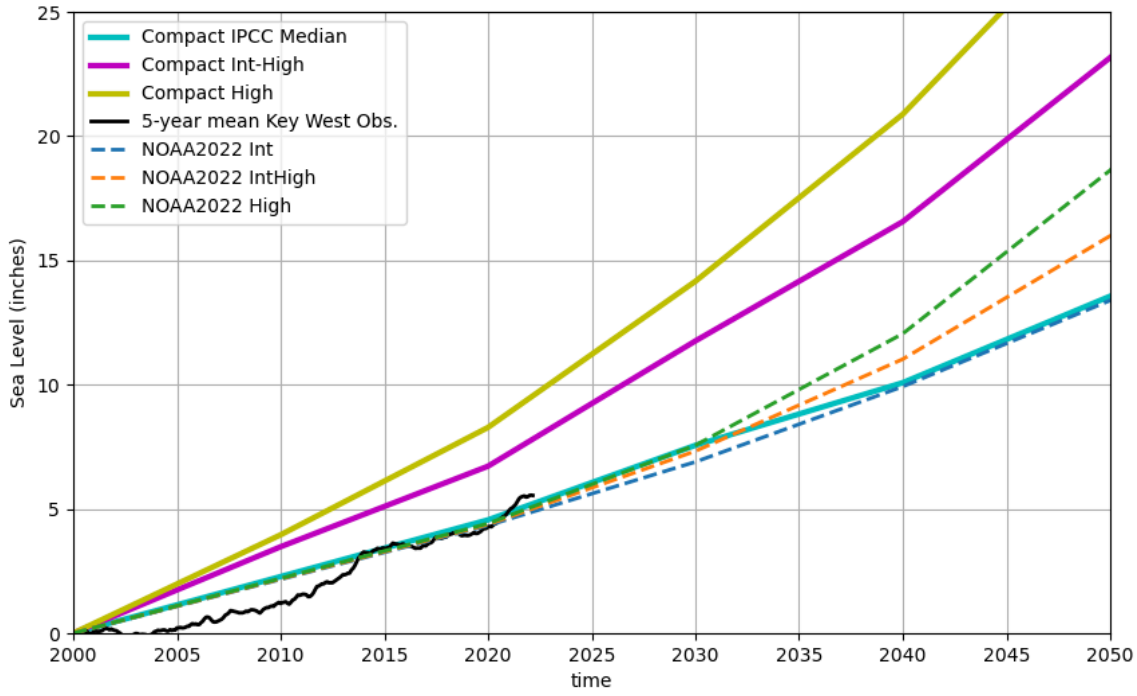

FIGURE 2: Comparison of 5-year average sea level at the Key West (Monroe County) tide gauge (anchored at the end of the 5-year period) with the Compact's 2019 projections and the NOAA 2022 scenarios for Key West.

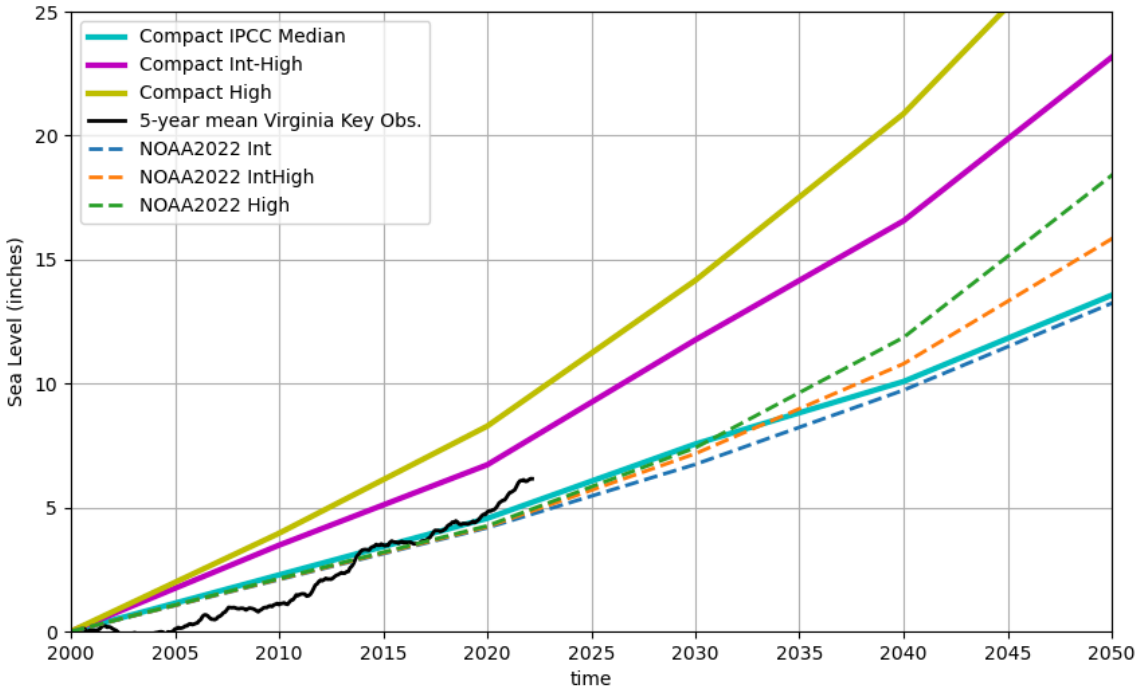

FIGURE 3: Comparison of 5-year average sea level at the Virginia Key (Miami-Dade County) tide gauge (anchored at the end of the 5-year period) with the Compact's 2019 projections and the NOAA 2022 scenarios for Virginia Key.

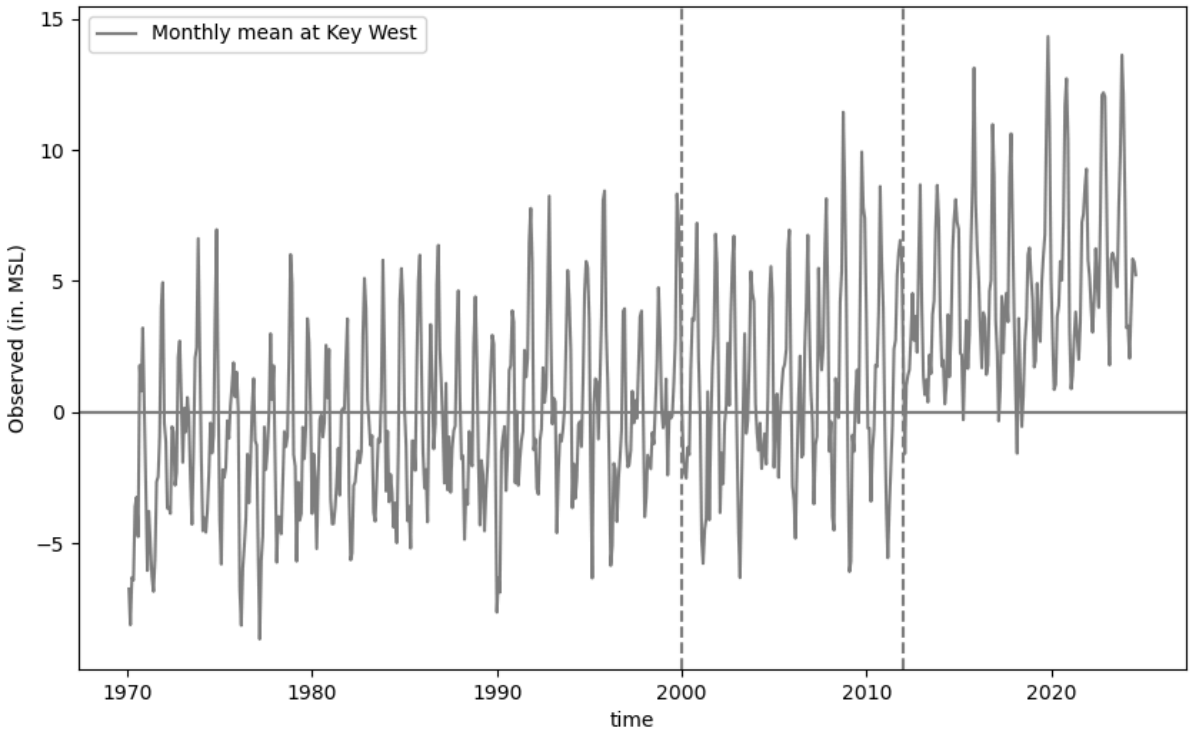

FIGURE 4: The monthly mean sea level at the Key West tide gauge, 1970-2023. Beginning around 2012, there is a rapid increase in sea level, with a step-like change, particularly among the minimum values.

Are the Compact's 2019 Regionally Unified Projections still relevant for resilience planning in Southeast Florida?

The Compact's 2019 Regionally Unified Projection and accompanying guidance document are intended to assist decision-makers at both the local and regional levels in Southeast Florida to plan for and make short-term and long-term decisions about sea level rise and associated vulnerabilities based on best-available science. The Guidance for Application section contains directions and specific examples of how the projection can be used by local governments, planners, designers, engineers, and developers (excerpted below). This regional projection is offered to ensure that all major infrastructure projects throughout the Southeast Florida region have the same basis for design and construction relative to future sea level.

2019 Guidance – Applying Projection Curves to Infrastructure Siting And Design

Application of the IPCC Median Curve

The IPCC Median or lower blue shaded portion of the projection can be applied to most infrastructure projects before 2070 or projects whose failure would result in limited consequences to others. An example of low risk projects may be a small culvert in an isolated area. The designer of a type of infrastructure that is easily replaced, has a short lifespan, is adaptable, and has limited interdependencies with other infrastructure or services must weigh the potential benefit of designing for higher sea level rise with the additional costs. Should the designer opt for specifying the lower curve, she/he must consider the consequences of under-designing for the potential likely sea level condition. Such consequences may include premature infrastructure failure.

Application of the NOAA Intermediate High Curve

Projects in need of a greater factor of safety related to potential inundation should consider designing for the NOAA Intermediate High Curve. Examples of such projects may include evacuation routes planned for reconstruction, communications and energy infrastructure, and critical government and financial facilities or infrastructure that may stay in place beyond a design life of 50 years.

Application of the NOAA High Curve

Due to the community's fundamental reliance on major infrastructure, existing and proposed critical infrastructure should be evaluated using the NOAA High curve. Critical projects include those projects which are not easily replaceable or removable, have a long design life (more than 50 years), and are interdependent with other infrastructure or services. If failure of the critical infrastructure would have catastrophic impacts, it is considered to be high risk. Due to the community's critical reliance on major infrastructure, existing and proposed high risk infrastructure should be evaluated using the NOAA High curve. Examples of high risk critical infrastructure include nuclear power plants, wastewater treatment facilities, levees or impoundments, bridges along major evacuation routes, airports, seaports, railroads, and major highways.

Based on the review of the Compact's 2019 Projection relative to the NOAA 2022 Report and observed trends in regional sea level rise, the continued use of the 2019 Regionally Unified Projection in Southeast Florida and the accompanying guidance for application are still relevant as a basis for resilience planning, design, and construction.

The 2019 guidance for application states, “The blue shaded zone between the IPCC Median curve and the NOAA Intermediate-High curve is recommended to be generally applied to most projects within a short-term planning horizon (up to 2070). The IPCC Median curve represents the most likely average sea level before 2070, but is not representative of the realistic interannual and interdecadal variations that will occur with sea level rise values within the blue shaded zone.” (See Figure 5).

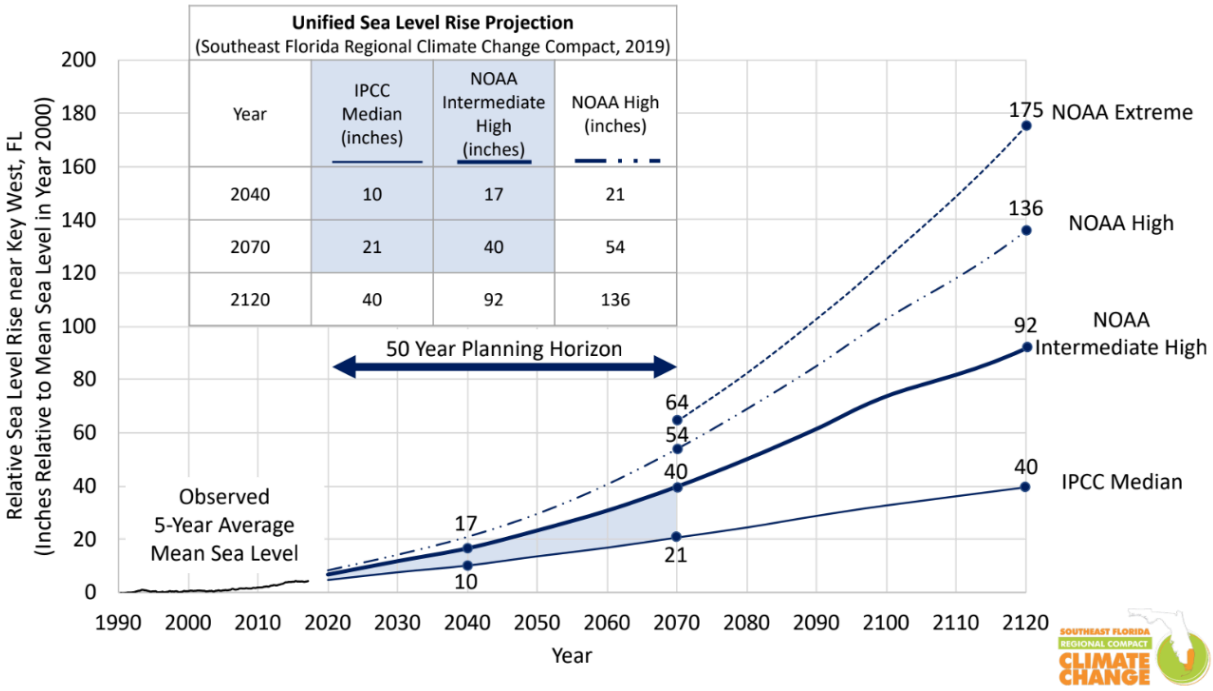

FIGURE 5: The Compact’s 2019 Unified Sea Level Rise Projection.

Indeed, observed trends in regional sea level in Southeast Florida indicate that 5-year mean sea level is generally following the IPCC Median curve, and in some cases exceeding it. Similarly, the observed sea level in the region is also consistent with the NOAA 2022 Intermediate, Intermediate-High, and High scenarios. As discussed, for the last 12 years, there has also been a significant increase in the magnitude of sea level rise in Southeast Florida. Whether this is a persistent trend that will continue into the future or a multi-decadal episodic change is not clear at this time.

Further, according to NOAA 2022, in the next 25 years (by 2050), the expected relative sea level, tide and storm surge heights, and wave effects will contribute to increased total water levels that may lead to a shift in U.S. coastal flood regimes, with major and moderate high tide flood events occurring as frequently as moderate and minor high tide flood events occur today. Sea level rise

along with storm surge will exacerbate compound flooding, where multiple flood mechanisms occur simultaneously and their physical interactions can result in nonlinear increases in flood impact.

When conducting risk-based resilience planning, a future sea level rise scenario (projection) is selected based upon the nature, value, interconnectedness, and lifespan of the existing or proposed infrastructure—all of which inform risk tolerance/aversion. Selecting and designing for a potentially conservative scenario allows more time to act, results in projects and infrastructure delivering longer-term resilience benefits, and minimizes the risk of under-design.