

Consider the two climate hazards you've picked in Module #1. Alternatively, you can pick two other hazards. But, picking the same hazards would be easier.

Currently used data					
		Data Source 1		Data Source 2	
	Section of regional plan	Data source	Example of plots	Data source	Example of plots
Extreme heat	<p>3.3. Climate & Environmental impacts</p> <p>ii. Key climate impact areas</p> <p>a. Rising temperature</p>	<p>San Francisco Bay Area Region Report (California's Fourth Climate Change Assessment). (2018). [Regional Report]. Governor's Office of Planning and Research. https://climateassessment.ca.gov/regions/</p>	<p>3.60 Average hottest day of the year for the nine-county Bay Area</p>	<p>Cal-Adapt: Local Climate Change Snapshot Tool, n.d.</p>	<p>"CalAdapt's local threshold is defined as the 98th percentile value of historical daily maximum or minimum temperatures observed at a location"</p> <p>No plot</p>
Sea Level & Flooding	<p>3.3. Climate & Environmental impacts</p> <p>iii. Impacts to workforces</p>	<p>USGS HERA Coastal Flooding Tool</p>	<p>3.69 Percent of total employees within each county that will be vulnerable to 4.9 feet of sea level rise with annual storm frequency, by sector</p>	<p>Caltrans Transportation Asset Vulnerability Study, District 4, Caltrans No. 74A0737. Sea level rise and storm surge data provided by the U.S. Geological Survey from the Coastal Storm Modeling System (CoSMoS). GIS data from CoSMoS can be</p>	<p>3.71 Sea level rise impacts to the Caltrans state highway with 5.74 feet of SLR</p>

				viewed and downloaded from the Our Coast Our Future interactive map available here: http://data.pointblue.org/apps/ocof/cms Source: Caltrans Vulnerability Assessment for District 4 (Caltrans, 2018).	
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Sea level rise & flooding				
Data tool or system	Source/curator	Example plot or analysis	Date(s) created	Data quality
Hazard Exposure Reporting and Analytics (HERA) - Impact of Sea Level Rise and Storms on Coastal Flooding Hazards	USGS	3.69 Percent of total employees within each county that will be vulnerable to 4.9 feet of sea level rise with annual storm frequency, by sector	See data quality	<p>“The USGS Coastal Storm Modeling System (CoSMoS) project created all flood hazard zones for the various storm and sea level rise selections.” [link]</p> <p>“The Coastal Storm Modeling System (CoSMoS) is a dynamic modeling approach that has been developed by the United States Geological Survey in order to allow more detailed predictions of coastal flooding due to both future sea-level rise and storms integrated with long-term coastal evolution (i.e., beach changes and cliff/bluff retreat) over large geographic areas (100s of kilometers). CoSMoS models all the relevant physics of a coastal storm (e.g., tides, waves, and storm surge), which are then scaled down to local</p>

				<p>flood projections for use in community-level coastal planning and decision-making. Rather than relying on historic storm records, CoSMoS uses wind and pressure from global climate models to project coastal storms under changing climatic conditions during the 21st century.</p> <p>Projections of multiple storm scenarios (daily conditions, annual storm, 20-year- and 100-year-return intervals) are provided under a suite of sea-level rise scenarios ranging from 0 to 2 meters (0 to 6.6 feet), along with an extreme 5-meter (16-foot) scenario. This allows users to manage and meet their own planning horizons and specify degrees of risk tolerance.” [link]</p> <p>Road data for 2021 are from the Homeland Infrastructure Foundation-Level Data (HIFLD) secure-data repository [link]</p> <p>Rail data for 2021 are from HIFLD open-data repository [link]</p>

Extreme heat				
Data tool or system	Source/curator	Example plot or analysis	Date(s) created	Data quality

<p>Projections from California's Fourth Climate Change Assessment</p>	<p>Governor's Office of Land Use & Climate Innovation; California Natural Resources Agency; California Energy Commission</p>	<p>3.60 Average hottest day of the year for the nine-county Bay Area</p>	<p>Report published January 16, 2019</p> <p>Data is for historical period of 1976 - 2005 and projected period for 2070 – 2100</p>	<p>The projections shown in figure 3.60 of the report are based on downscaled data from CMIP6. CMIP6 is the sixth iteration of projections from the Coupled Model Intercomparison Project. Essentially, it represents the most up to date climate projections, based on robust global climate models (GCMs) underlied by first principles.</p> <p>GCM projections are at a relatively coarse native resolution, ranging from approximately 100 to 250 km. In order to capture anomalies at more local scales, downscaling must be conducted. LOCA (Localized Constructed Analogs) downscaling is a statistical technique used to refine coarse climate model data to a finer resolution more suitable for regional or local analysis. This method improves upon traditional downscaling by using historical climate data to establish a more realistic spatial pattern. LOCA downscaling identifies "analogs" in historical records that closely resemble the large-scale patterns of a given model output. It then constructs finer-resolution data based on these analogs, capturing localized climate variability more accurately. The resulting data offers high-resolution projections with better representation of extremes. These high resolution estimates are more suitable for regional impact assessment studies.</p> <p>Though output from global climate models</p>
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				<p>have many shortcomings and uncertainties, the projections shown in report figure 3.60 represent state of the art climate modeling science.</p>
<p>CalAdpat</p>	<p>Developed by the Geospatial Innovation Facility at the University of California, Berkeley with funding and advisory oversight by the California Energy Commission and the California Strategic Growth Council.</p>			<p>Allows for visualization of downscaled CMIP5 climate data (see above)</p> <p>Lower quality compared to above, because it is not the most recent iteration</p>

Additional data (15 points):

- Suggest at least 2 additional data sources or data systems that the region could use for analyzing climate hazards.
 - Briefly explain how each one can support the regional analysis.
 - Compare the analysis results between the plan results and what your analysis shows.
 - Clarify the following for these data sources/ systems:
 - Data source: who collected the data
 - Date(s) created
 - Data quality: explain why the data quality is high, medium, or low. You can refer to data accuracy, data completeness, timeliness, and reliability.
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The first additional data source we recommend is the San Francisco Bay Shoreline Vulnerability Index (SVI) [citation]. This index is a measure of shoreline vulnerability to erosion and/or overtopping due to extreme tides, waves, storm surges, and sea level rise [citation]. It uses the following six characteristics to determine the shoreline vulnerability for the primary shoreline (defined as the first elevated shoreline facing the Bay):

1. Vulnerability of shoreline type of flooding and sea level rise
2. Adaptability to sea level rise by shoreline type
3. Presence of fortification
4. Presence of frontage and/or secondary shoreline protection
5. Elevation
6. Wave energy

Each characteristic is weighted based on its relative importance to the shoreline's flood vulnerability. This tool was developed by the San Francisco Bay Area Conservation and Development Commission (BCDC) in collaboration with Silvestrum Climate Associates.

The SVI for the San Francisco Bay Area demonstrates medium to high data quality, integrating accurate, high-resolution spatial data from Bay Shore Inventory (San Francisco Estuary Institute) and expert-driven assessments. The Bay Shore Inventory is a database of 100 foot segments of elevated Bay shore features for all nine counties. Each segment was classified as levees, berms, embankments, transportation structures, wetlands, natural shoreline, channel openings, and water control structures.

Characteristics 1–4 were gathered by administering a survey to expert practitioners in the field and then statistically analyzing their responses. The survey pool included engineers, planners, county managers, restoration scientists, and transportation analysts.

With vertical accuracy within 5 cm, the foundational data is reliable and reviewed by local agencies across all nine Bay Area counties, covering key characteristics such as elevation, fortification, and frontage. While some attributes, like ownership and maintenance, are not uniformly complete, the SVI's methodological rigor, combining local expertise and established vulnerability metrics, enhances its reliability for flood risk assessment. Though periodic updates are recommended to maintain relevance as shoreline conditions evolve, we rank this quality of this data tool as high.

The addition of information from SVI to the Regional Plan for the Bay Area could serve to complement the existing assessment of sea level rise on road networks. While USGS's Coastal Storm Modeling System (CoSMoS) provides an estimate of hazard level due to storm surges and sea-level rise, it does not take into account the presence of fortifications or frontages.

The second additional source that we recommend is the California Heat Assessment Tool (°CHAT). This interactive platform was developed by Four Twenty Seven, Inc. in partnership with Argos Analytics, Habitat Seven, and the Public Health Institute, and was funded by the California Natural Resources Agency as part of development of the state's Fourth Climate Change Assessment.

°CHAT provides a nuanced approach to identifying and projecting Heat Health Events (HHEs) in California, considering both historical and future climate impacts on public health. CHAT defines an HHE as any heat event that negatively affects public health, calibrated to each local area's climate and historical population sensitivity. CHAT uses thresholds unique to each local area, reflecting historical sensitivity to heat, which varies by region. To establish these thresholds, the tool uses a distributed lag non-linear model (DLNM) with data from 1984 to 2013, including temperature and vapor pressure metrics from the PRISM Climate Group, paired with emergency department visit records (2005-2013) during summer months.

Future projections in °CHAT are based on LOCA downscaled models capturing daily humidity and temperature changes at a 6-kilometer resolution through 2099. This enables °CHAT to show how the frequency, duration, and characteristics of HHEs may evolve across percentile-based ranges, accommodating uncertainties. °CHAT is a valuable tool for visualizing and preparing for complex, localized heat risks across California as climate change progresses. While plots 3.60 and 3.60 show projected changes in average hottest day of the year and annual average maximum temperatures, °CHAT emphasizes the *health impacts* of heat through locally adapted thresholds, additional climate factors, and percentile-based projections of HHE frequency and severity.

Overall, °CHAT has high data quality, with strengths in accuracy and reliability. It uses high-resolution PRISM climate data and emergency department records from OSHPD, employing a robust statistical model to link heat exposure to health outcomes. The tool's data completeness is medium to high, integrating essential variables like temperature, humidity, and health impacts, though it lacks recent health data (post-2013) and comprehensive year-round data. Timeliness is medium, as the projections are based on older datasets.