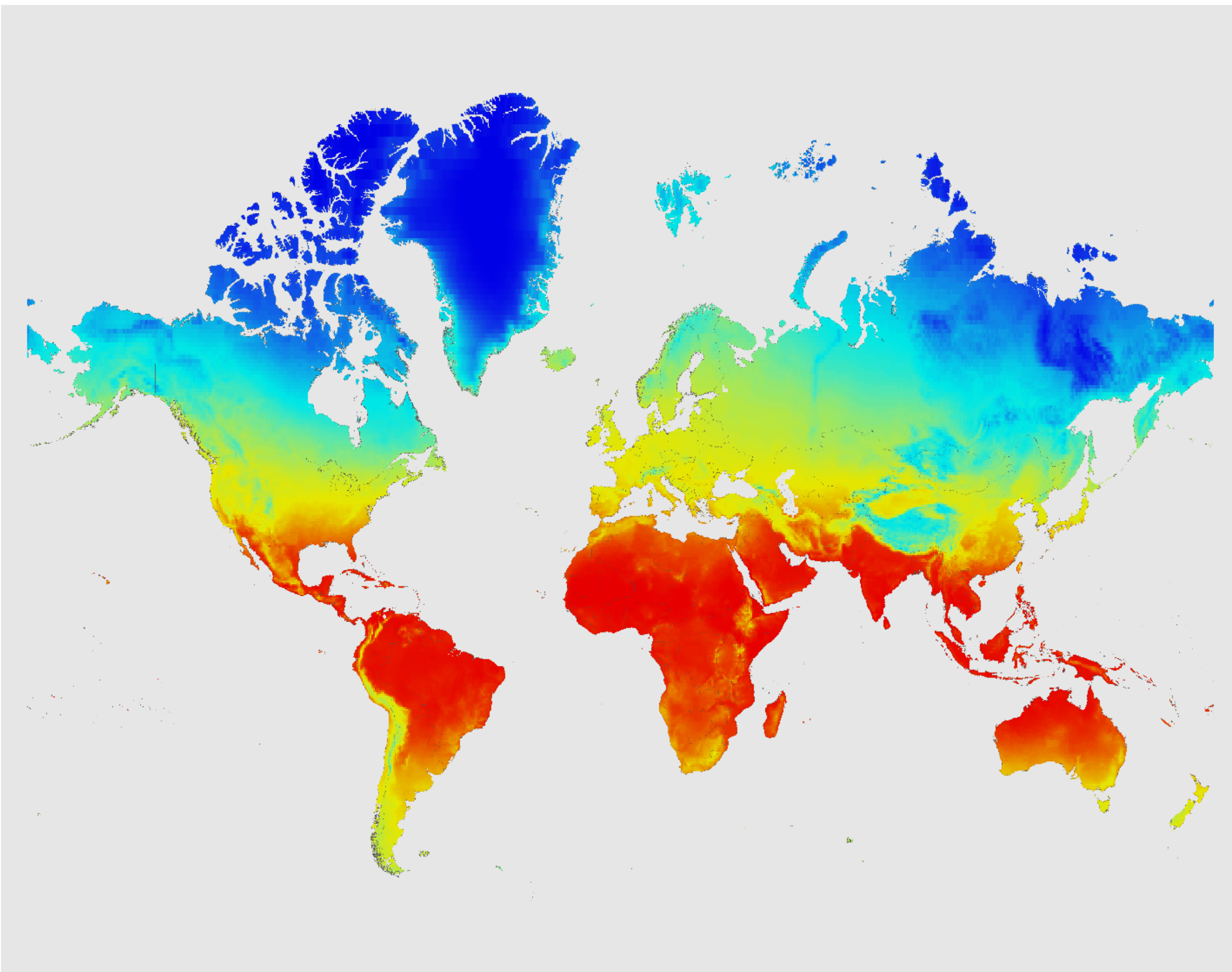
USER MANUAL

CLIMATE CHANGE KNOWLEDGE PORTAL (CCKP)



© 2024

WORLD BANK GROUP | Climate Change Knowledge Portal
For Development Practitioners and Policy Makers

TABLE OF CONTENTS

CCKP STEP-BY-STEP USER MANUAL

1. BACKGROUND

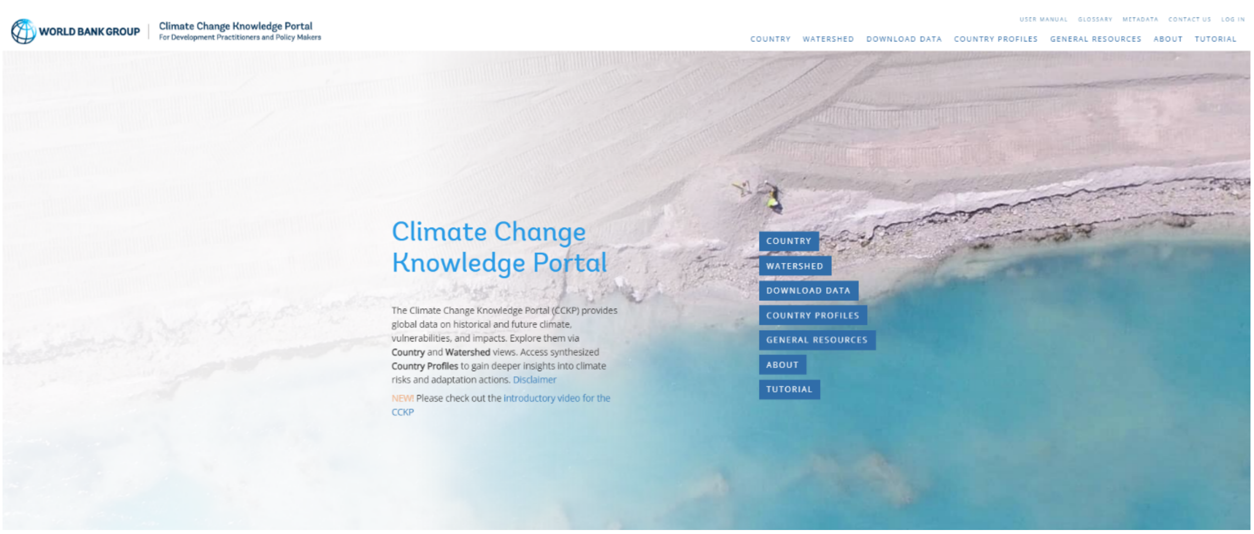
The Climate Change Knowledge Portal (CCKP) serves as a leading hub of global climate data, information, and tools to support decision making and improve the understanding of future climates and projected risks. The aim of the CCKP is to help provide policy makers, development practitioners and interested parties with a resource to explore and analyze climate and climate-related data to assess future scenarios, projected physical climate risks and vulnerabilities for national and sub-national contexts and across key sectors.

The CCKP was designed to provide open access to climate data and related information in order to help users better understand future climate scenarios and characterize potential risks and impacts with data aggregated at national, sub-national, and watershed levels. CCKP data is presented across multiple scales demonstrating historical contexts, climatological means, anomalies, trends, as well as inter-annual and inter-seasonal variability, which can be understood through a variety of interactive visualizations. Further guidance is provided regarding associated uncertainties of climate model outputs and model agreement, as appropriate. CCKP currently produces synthesized Climate Risk Country Profiles, which offer a further integration of climate information, adaptation, and climate-related disaster risk management for development planning.

This **Step-by-Step User Manual** provides a comprehensive overview of the CCKP by introducing key components and their associated functionality, and intends to support users to easily navigate through the platform. For additional supporting documents, please refer to CCKP's **Glossary** and **Metadata**.

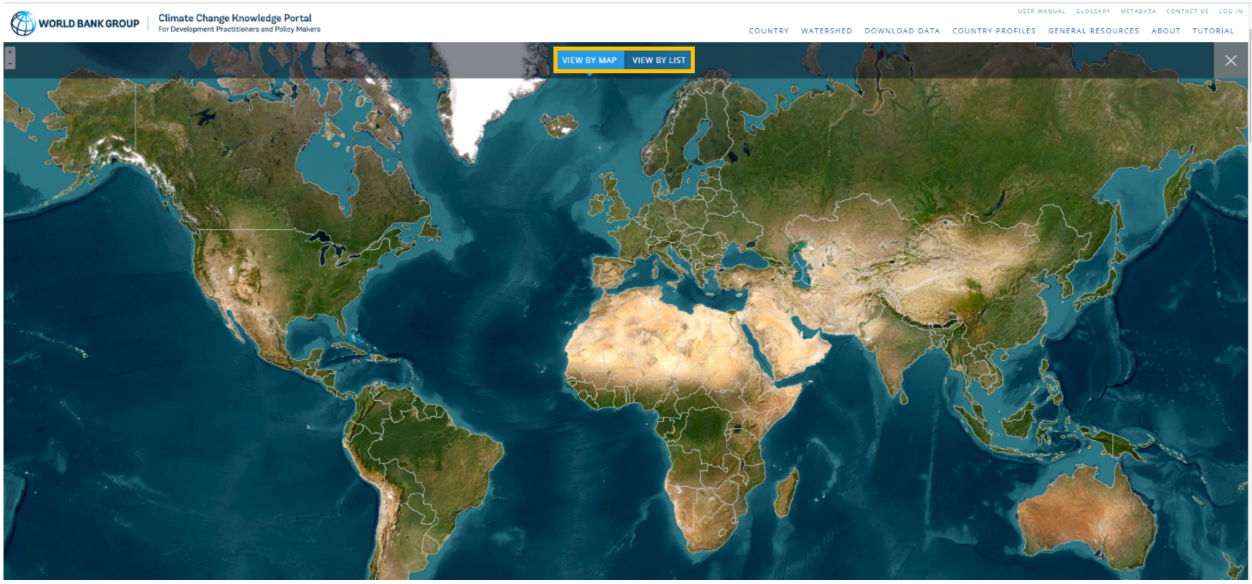
2. ENTERING THE PORTAL

To get started, visit the homepage of the CCKP at climateknowledgeportal.worldbank.org. To explore the data interactive visualization pages, begin by choosing a view of your interests (i.e. Country, Watershed). You can also directly access the Download Data, Climate Risk Country Profiles, General Resources, and Tutorial tabs.



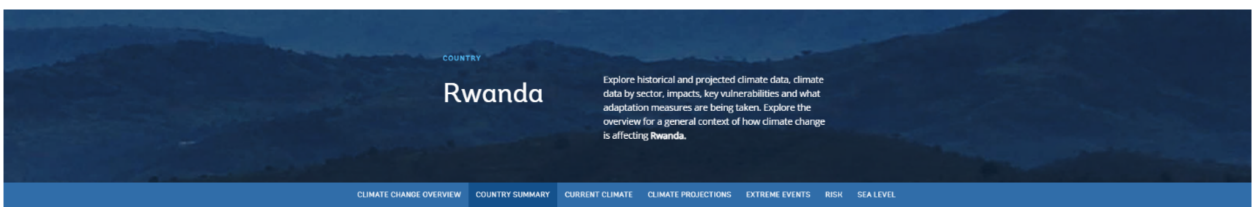
3. SELECT A LOCATION

Narrow down your search by country or watershed. To select a specific country or watershed, click directly on the map or select view by the alphabetized list.



4. SELECT THE CONTENT

CCKP consists of geospatial and temporally referenced data. Therefore, maps and visualizations generated within the portal are a function of user selection. Within ***Country view***, climate data is aggregated for both national and sub-national scales, and information is consolidated and arranged in tabs by the key aspects of understanding climate risk, namely: **Country Summary** (description of climate zones and summary of national development context), **Current Climate** (climatology, including trends and variability), **Climate Projections** (mean projections), **Extreme Events** (historical and projected return levels for extreme precipitation events), **Risk** (exposure to compound heat risk and historical natural hazards), and **Sea Level** (sea level rise projections); detailed below.

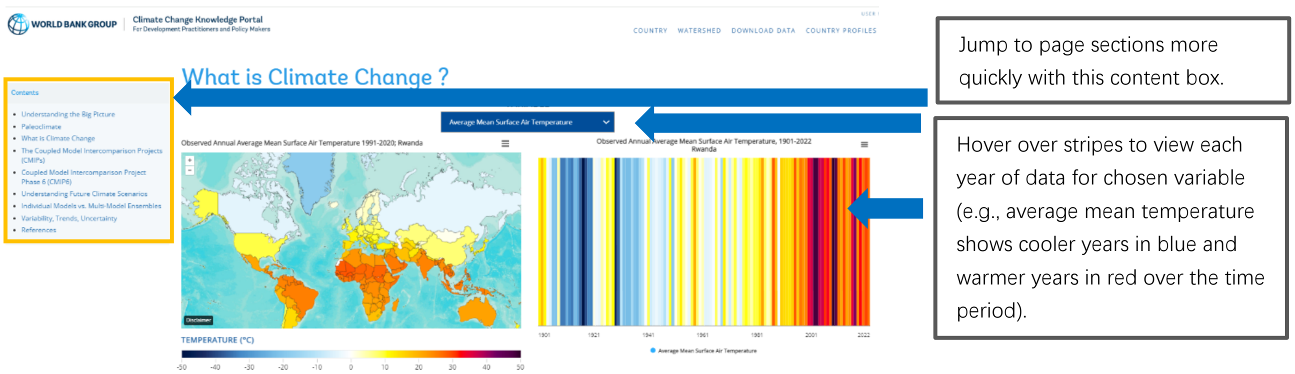


For *Watershed views*, Current Climate and Climate Projections tabs are available as below.

5. CLIMATE CHANGE OVERVIEW

CLIMATE CHANGE OVERVIEW

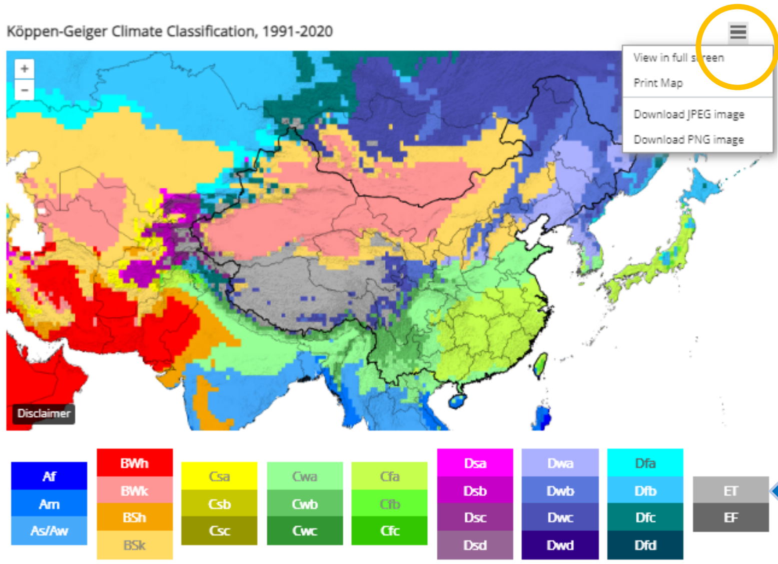
Clicking on the **Climate Change Overview** tab directs the user to a separate webpage that provides general information on and ways of understanding our changing climate globally. This brief overview includes explanations and discussions of longer-term change understood through paleoclimate analysis and how recent emissions from the industrial and post-industrial age are impacting our global climate system. Additional background information is presented to support a stronger foundational understanding of 'climate change,' projected climate scenarios, models and ensembles, variability, and uncertainty. This is meant to provide CCKP Users with a stronger understanding of climate and the context of climate change in order to better engage with the data and information presented throughout CCKP. This page is consistent across all countries.



COUNTRY SUMMARY

The *Country Summary* tab provides information on a selected country's unique climate characteristics and broader development context, with information on general geographic and socio-economic contexts, and key vulnerabilities related to climate change. Country data is presented in two forms: (1) geospatial representation of climate zones according to the Köppen-Geiger Classification (**Figure A**); and (ii) the seasonal cycle of mean temperature and precipitation for the latest climatology, 1991-2020 (**Figure B**). The page also provides Country Specific Information and General Resources Toolboxes, which provides links to key country-specific climate policy documents, important climate related information, and access to other resources to better understand and interpret climate data (**Figure C**).

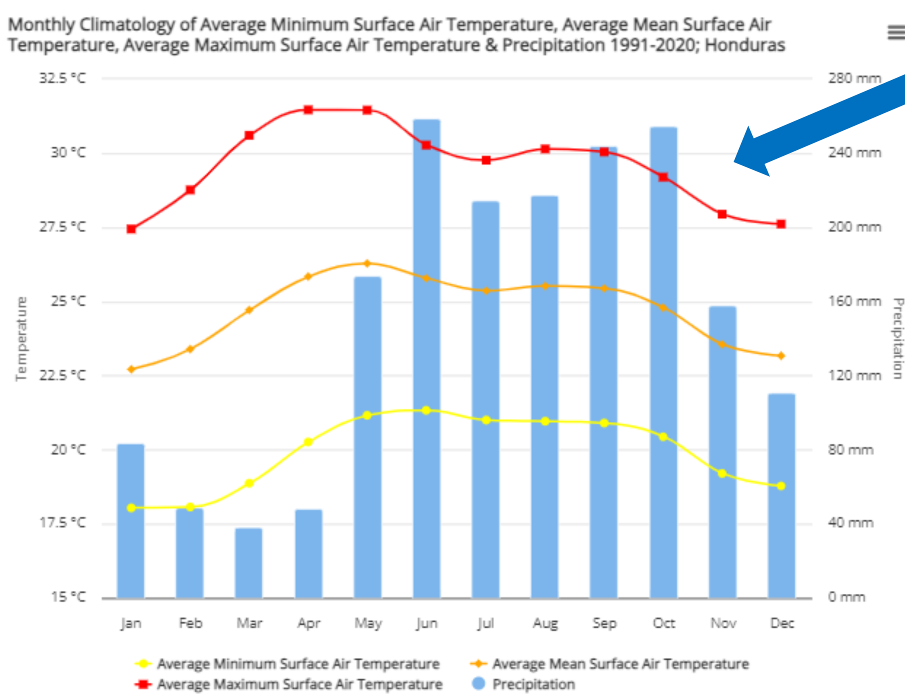
Figure A. Köppen-Geiger Climate Classification, 1991-2020 for China



Click the three bars to download underlying data or this image.

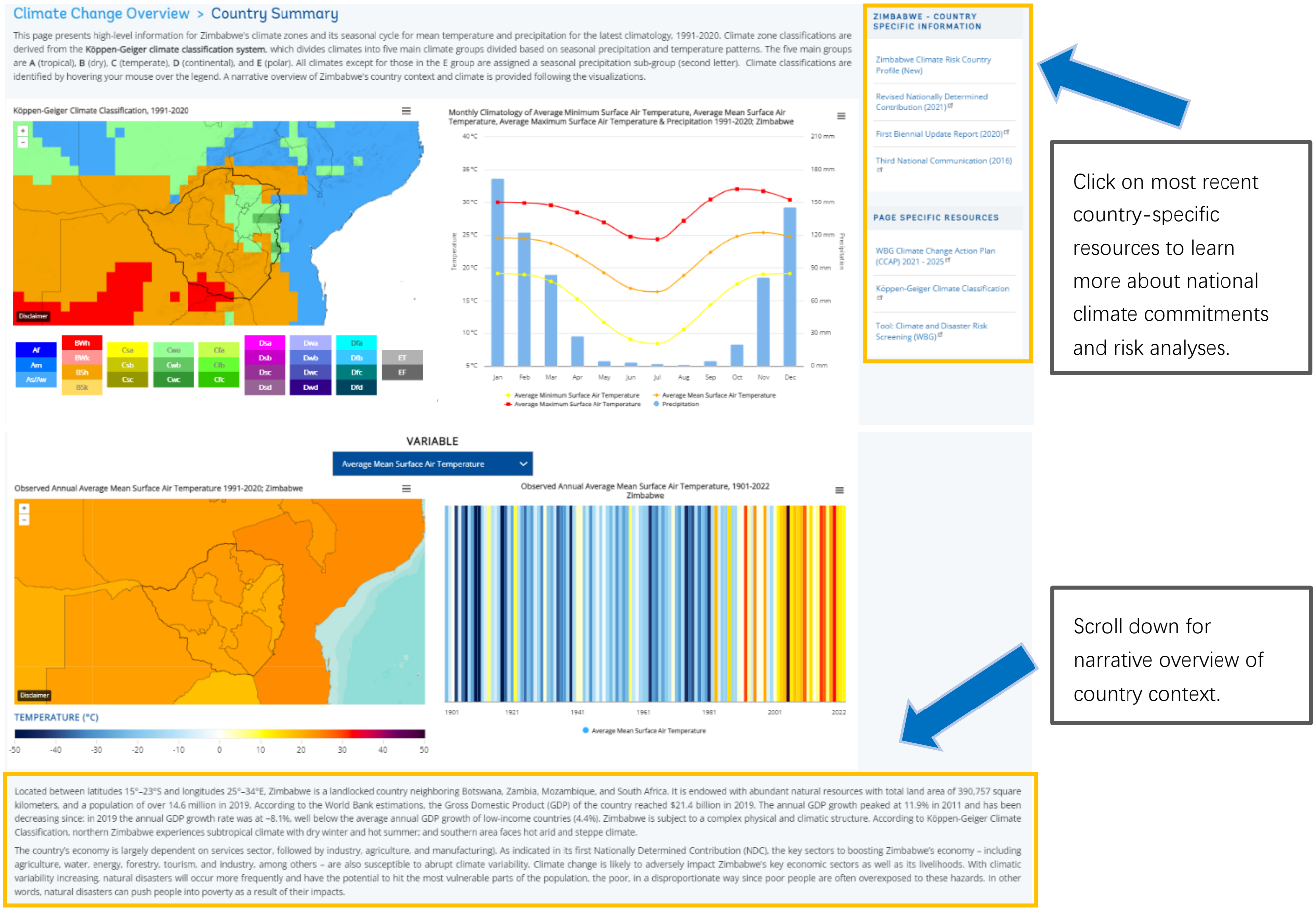
Hover over color-coded tags to view classification.

Figure B. Seasonal Cycle of Mean Temperature and Precipitation in Honduras from 1991-2020

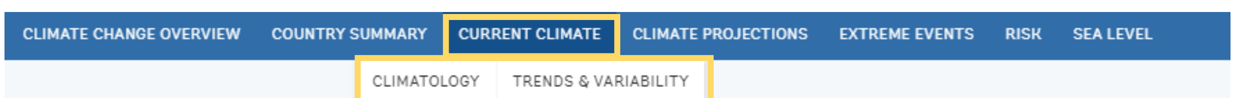


Data presents the monthly climatology, or average values for a specific month over a 30-yr period. This figure helps to contextualize seasons for a given location.

Figure C. Tailored Country Narratives and General Resources Toolbox



6. CLIMATE DATA: CURRENT CLIMATE

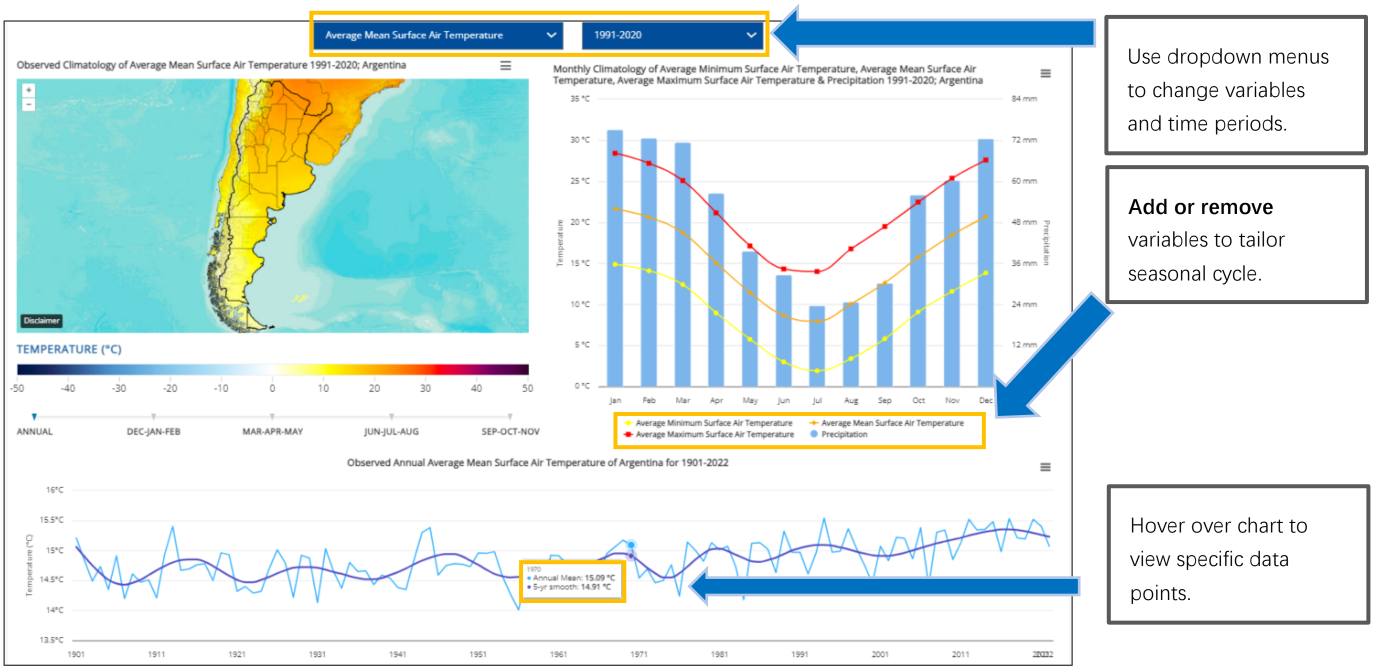


CLIMATOLOGY

The **Current Climate -** *Climatology* tab presents observed, historical data. Historical data originates from observational datasets and allow users to understand past and current climate contexts. Observed, historical climate data is generated from thousands of weather stations worldwide, which are collecting temperature and rainfall data in a continuous manner or from satellite. Observed data presents mean, minimum and maximum temperatures and precipitation. Users can view annual and seasonal climate information: December-January-February, March-April-May, June-July-August, and September-October-November. On this page, observational data is sourced from the Climatic Research Unit (CRU) of the University of East Anglia. CRU provides gridded historical datasets derived from observational data and quality-controlled temperature and rainfall data as well as derivative products such as monthly and long-term historical climatologies. CRU data is widely accepted as reference datasets in climate research. Observed data is presented at a spatial resolution, 0.5º x 0.5º (50km x 50km). The *Climatology* tab allows users to explore historical data for annual and seasonal temperature and precipitation for selected climatologies. Data is aggregated at the national- and sub-national level for each variable.

By default, data is presented at national aggregation for the current climatology: 1991-2020. Users have the ability to add and subtract variables in order to tailor the seasonal cycle visualization. Historical data visualizations are also presented geospatially, showing the climatological average of a selected indicator or as a long-term time series, 1901-2022 (**Figure D**). Information can be tailored by location, variable and time period through the dropdown lists. Sub-national aggregations can be shown by clicking on a specific unit, in which all other visuals will automatically populate. Information can be viewed easily by hovering the mouse over a specific unit, as shown below.

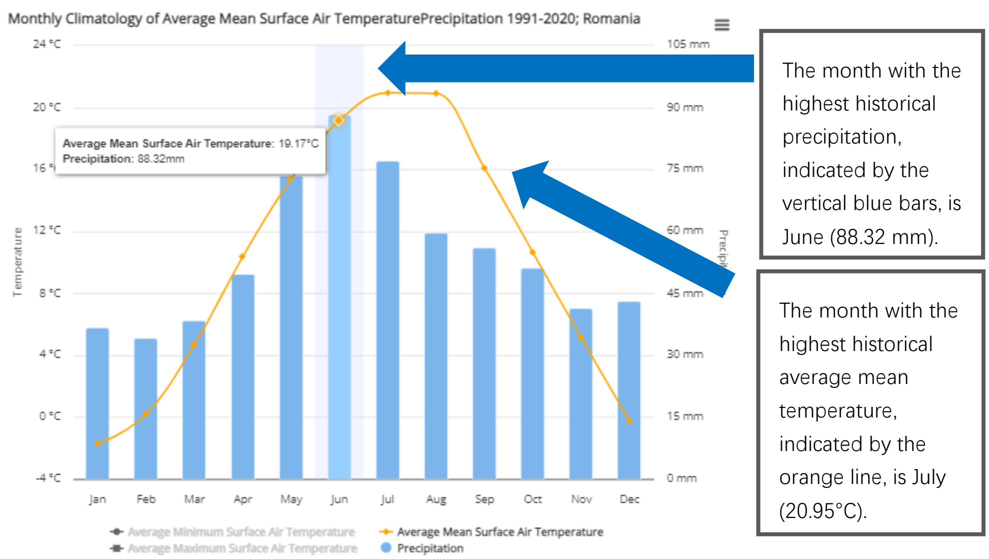
Figure D. Observed, Historical Climate Data Presentations



Example: Analyzing the Seasonal Cycle. Understanding Observed Data for Romania

Romania has historically experienced the most rain in June (88.32 mm). The country experiences the least amount of rain in February (34.23 mm). As seen in **Figure E**, mean temperatures start to decrease after August, with the coldest temperatures experienced between December to February. The coldest month is January (-1.72°C). The hottest months are in July and August (20.95°C and 20.91°C, respectively).

Figure E. Seasonal Cycle of Monthly Mean Temperature and Precipitation in Romania (1991-2020)



TRENDS & VARIABILITY

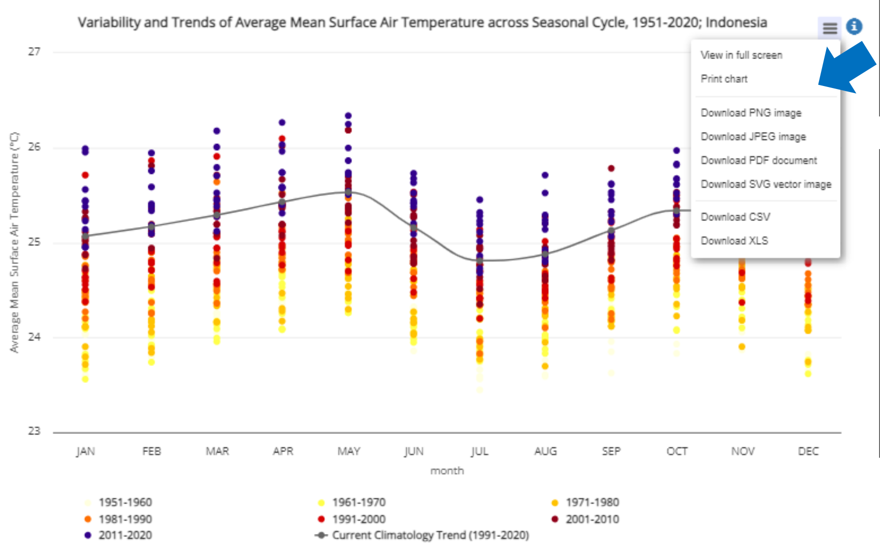
The **Current Climate –** *Trends & Variability* tab presents historical climate trends and significant change against natural variability using ERA5 reanalysis data, a satellite derived dataset (here used at 0.25º x 0.25º resolution). On this page, users can explore historical data for annual and seasonal temperature and precipitation-derived products associated with selected climatologies across 30-year, 50-year, and 70-year time periods. The three sections on the page present different aspects of how variability might need to be taken into account through multidecadal, interannual, seasonal, and significance trends that provide insight into robustness of change trends beyond natural variability.

Data is aggregated at the national- and sub-national level for each variable. Information can be tailored by location, variable and time period through the dropdown lists. Sub-national aggregations can be shown by clicking on a specific unit, in which all other visuals will automatically populate. Information can be viewed easily by hovering the mouse over a specific unit, as shown below.

Example: Analyzing and Understanding Historical Climate Trends and Variability for Indonesia

Indonesia has historically experienced a range of monthly mean temperatures between 1951-2020. **Figure F** illustrates interannual variability by representing each month. Each decade is a color intended to provide insight into changing trends over the 70-year time period. Comparison can be made against the current climatology (1991-2020), represented by the gray line. As conveyed in the chart, each month observed a range of mean temperature variability from 1951-2020. Temperatures recorded in earlier decades (yellow and orange points on the chart), while variable (i.e., years per decade are not sequential), typically present cooler periods as compared to the most recent decade (2011-2020, dark purple points), which tend to surpass monthly temperatures recorded for previous decades. These observed dark purple points also tend to surpass the current 30-year climatology trend (gray line) for each month. Such a pattern suggests a sustained warming trend amidst interannual variability. Note precipitation trends often present much greater variability than temperature.

Figure F. Variability and Trends of Monthly Mean Temperature across Season Cycle in Indonesia (1951-2020)



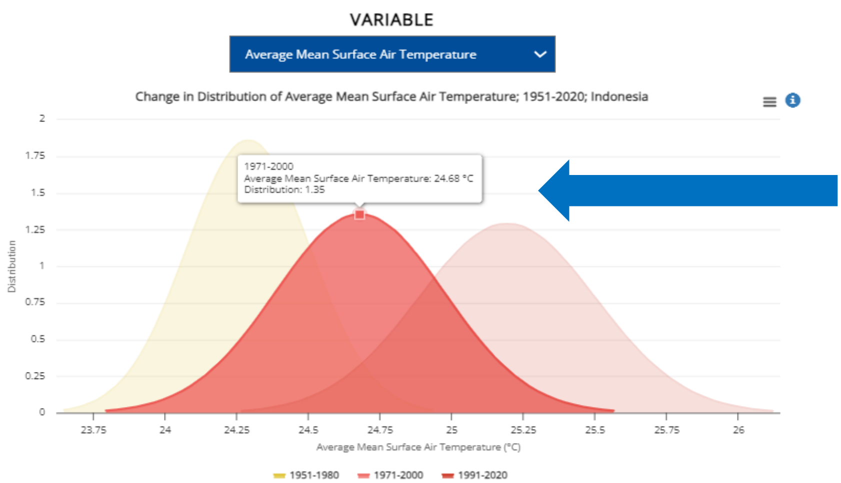
Directly download this visual or the specific underlying data in the following formats.

Historical mean temperatures for each month during the color-coded time period indicated appear as points plotted against the current climatology trend. Hover over each point to view mean temperature.

Example: Analyzing and Understanding Historical Climate Trends and Variability for Indonesia

The historical trend for mean temperature in Indonesia can be visualized in several other ways. **Figure G** illustrates the change in distribution of historical average temperature over 30-year climatologies through histogram. Taller distributions (e.g., 1951-1980 in yellow) indicate a narrower range of temperature variability, while wider and flatter distributions (e.g., more recent climatologies in pink and red) reflect a larger range of temperature variability. Higher distribution values indicate greater number of points reaching a specific threshold. Users may select or remove datasets displayed by clicking on the respective icon in the legend below the chart.

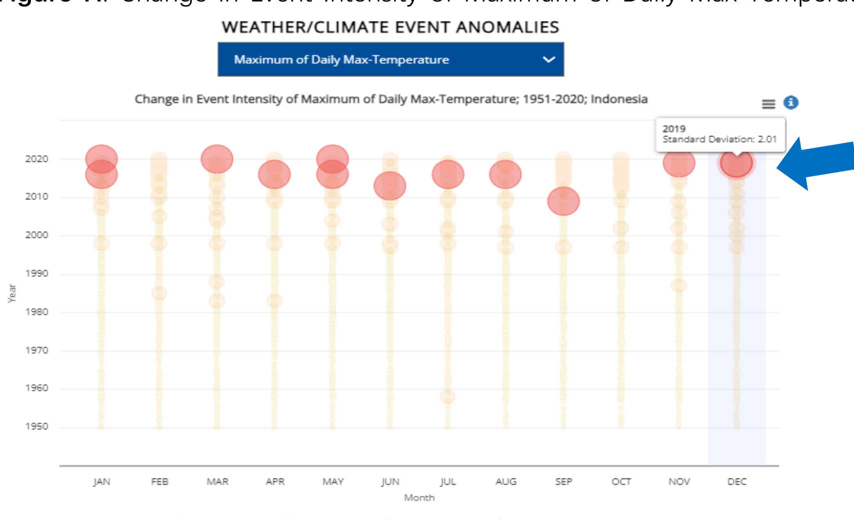
Figure G. Change in Distribution of Mean Temperature in Indonesia (1951-2020)



Hover over points along the distribution to view the proportion of historical data at each temperature threshold. For example, Indonesia's average annual mean temperature between 1971-2000 (middle pink histogram) has a distribution with a center around 24.68°C.

Figure H illustrates the most anomalous historical events, calculated as standard deviations from the mean, over the 1951-2020 time period, associated with maximum of daily maximum temperature. The most anomalous temperatures, greater than 2.5 standard deviations from the mean, occur primarily between 2011-2020, clearly showing a trend that the hottest events are occurring more frequently and more intensely in the more recent past.

Figure H. Change in Event Intensity of Maximum of Daily Max Temperature (1951-2020) in Indonesia



Hover over datapoints along the plot to view the distribution range associated with each anomalous temperature event. For example, Indonesia's maximum of daily max temperature in December 2019 was >2.0 standard deviations from the entire distribution's mean.

Example: Analyzing and Understanding Historical Climate Trends and Variability for Indonesia

The historical trends for mean temperature in Indonesia can be visualized using line charts or heat plots. Tooltips offer insight into the significance of the trend, (>95% is considered statistically significant for the specific trendline for variable selected and time period). **Figure I** illustrates the historical trends per decade for mean temperature according to 30-year, 50-year, and 70-year climatologies plotted against the annual (gray) means. Users may select or remove datasets displayed by clicking on the respective icons in the legend below the chart.

Figure I. Annual Mean Temperature Trends with Significance per Decade in Indonesia (1951-2020)

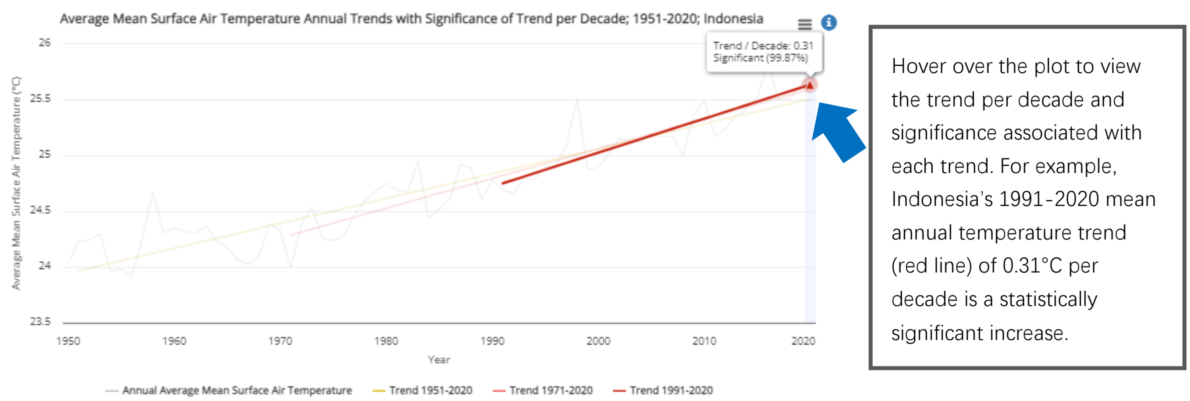
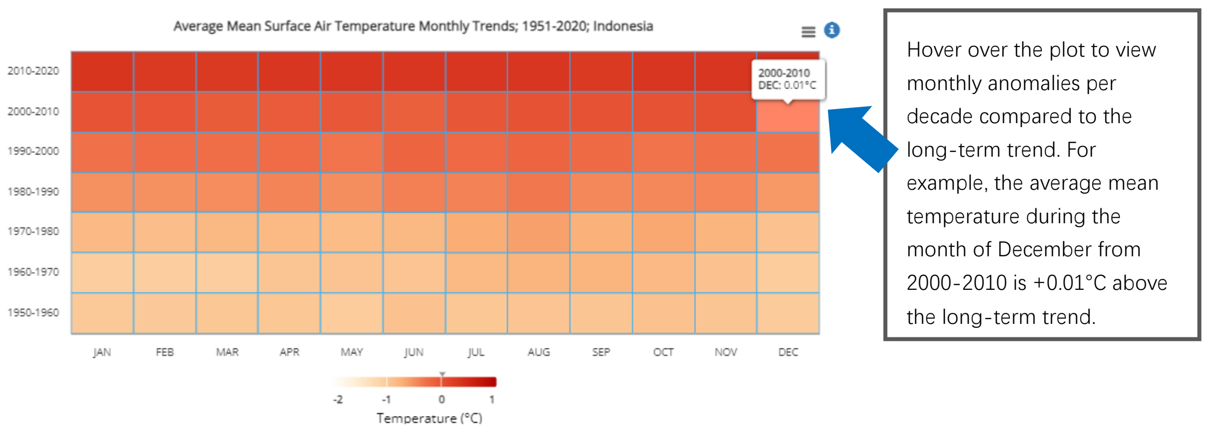
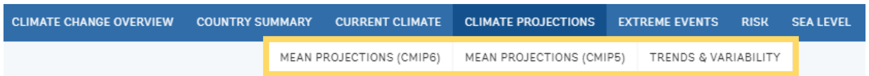


Figure J illustrates the trends per decade showcased in Figure I through a heatplot, which accentuate monthly anomalies (change) above or below the long-term trend. The heatplot's shading, according to the legend below the plot, indicates seasonal rates of change (e.g., warming trend per decade) that the long-term trends in Figure I do not reveal. Users can hover over monthly averages per decade to view the positive or negative anomaly compared to the 1951-2020 trend.

Figure J. Heatplot of Mean Monthly Temperature Trend (1951-2020) in Indonesia



7. CLIMATE DATA: CLIMATE PROJECTIONS



MEAN PROJECTIONS

The **Climate Projections** – *Mean Projections* tabs (CMIP6 and CMIP5 data pages) provide users the opportunity to investigate climate projections across smoothed climatological averages. CCKP's Mean Projection pages provide the most commonly used indicators, presented as multi-model ensembles. Climate projection data is modeled data, derived from the Coupled Model Inter-comparison Projects. CCKP's General page presents the latest CMIP collection: CMIP6, initially released August 2021. CMIP data is the foundational data used in the IPCC Assessment Reports; CMIP6 supports the IPCC's Sixth Assessment Report, initial release August 2021. Projection data according to CMIP6 is presented at 0.25º x 0.25º (25km x 25km) spatial resolution.

The scientific community uses scenarios to characterize the range of plausible climate futures and to illustrate the consequences of different pathways (policy choices, technological changes, etc). They are chosen to span a wide range without any tie to likelihood. The scenarios serve as 'what if' cases. The approach to formulating the different 'scenarios' has evolved from a climate-centric to an increasingly societal development-centric concept, albeit with the same underlying goal of providing insight into a range of plausible climate outcomes. The Shared Socioeconomic Pathways (SSPs) are introduced in CMIP6 and replace the Representative Concentration Pathways (RCPs) which were presented in CMIP5.

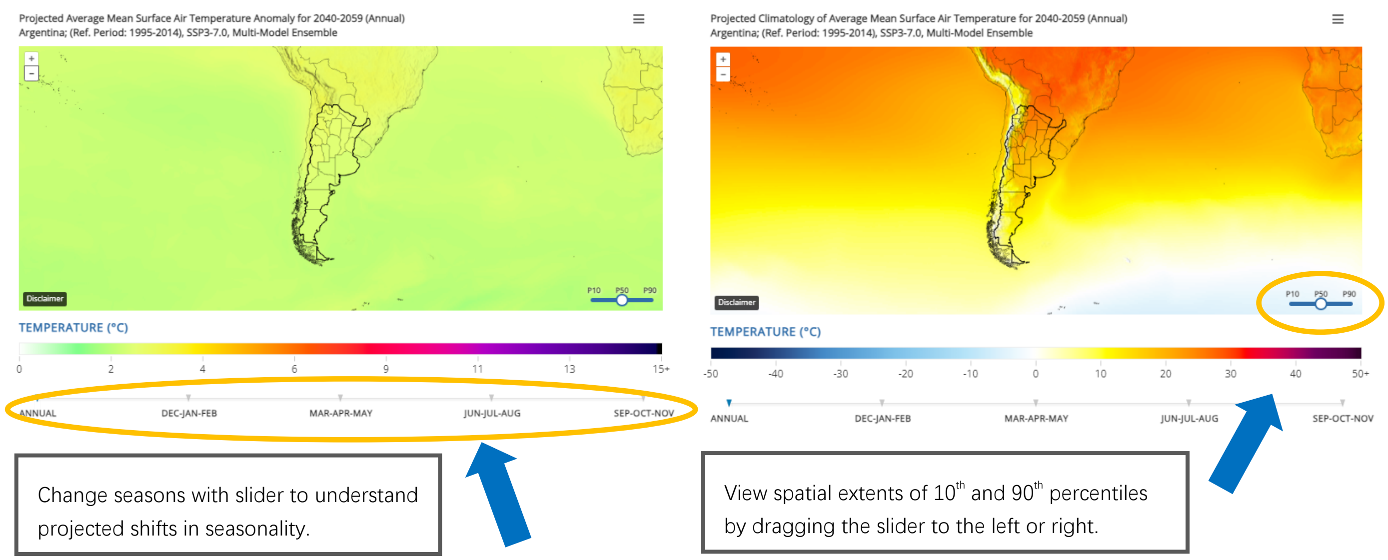
In CMIP6, future climate scenarios are presented through five SSPs: SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5, which present different societal development pathways. The total radiative forcing level by 2100 (the cumulative measure of GHG emissions from all sources) is presented at the end of each pathway (i.e., -1.9, -2.6, -4.5, -7.0, -8.5, etc.). CMIP6 includes scenarios with high and very high GHG emissions (SSP3-7.0 and SSP5-8.5) and CO_2 emissions that roughly double from current levels by 2100 and 2050, respectively, scenarios with intermediate GHG emissions (SSP2-4.5) and CO_2 emissions remaining around current levels until the middle of the century, and scenarios with very low and low GHG emissions and CO2 emissions declining to net zero around or after 2050, followed by varying levels of net negative CO_2 emissions (SSP1-1.9 and SSP1-2.6). Emissions vary between scenarios depending on socio-economic assumptions, levels of climate change mitigation and, for aerosols and non-methane ozone precursors, air pollution controls. Alternative assumptions may result in similar emissions and climate responses, but the socio-economic assumptions and the feasibility or likelihood of individual scenarios are not part of the assessment. For further detail on CMIP6 scenarios, see the section on CCKP's 'Climate Change Overview' page entitled 'Understanding Future Climate Scenarios.'

CCKP enables users to explore future climate scenarios and projected physical climate risks through a wide variety of indicators, for different SSPs, and across different projected climatologies (2020–2039, 2040–2059, 2060–2079, and 2080 – 2099). Projected change is calculated against the modeled, CMIP6 Historical Reference Period, 1995-2014. Data is presented at national and sub-national aggregations, as annual and seasonal climatologies and as either mean or anomaly (change), which can be viewed by sliding the Mean/Anomaly toggle to the right (mean) and left (change) (**Figure K**).

Figure K. Analysis Options for Future Climate Projections, CMIP6 data

Future climate projections are presented through four primary visualizations: (i) geospatial representation (**Figure L**); (ii) seasonal cycle showing either anomaly and mean, (**Figure M**); (iii), time series showing *mean* projections of the multi-model ensembles for a selected variable per each SSP through the end of the century (**Figure N**); and (iv) heatplot showing *anomaly* projections, which present seasonality across longer-term time horizons (**Figure O**). Map and seasonal cycle can be viewed as either mean (projected 'new normal') or anomaly (change).

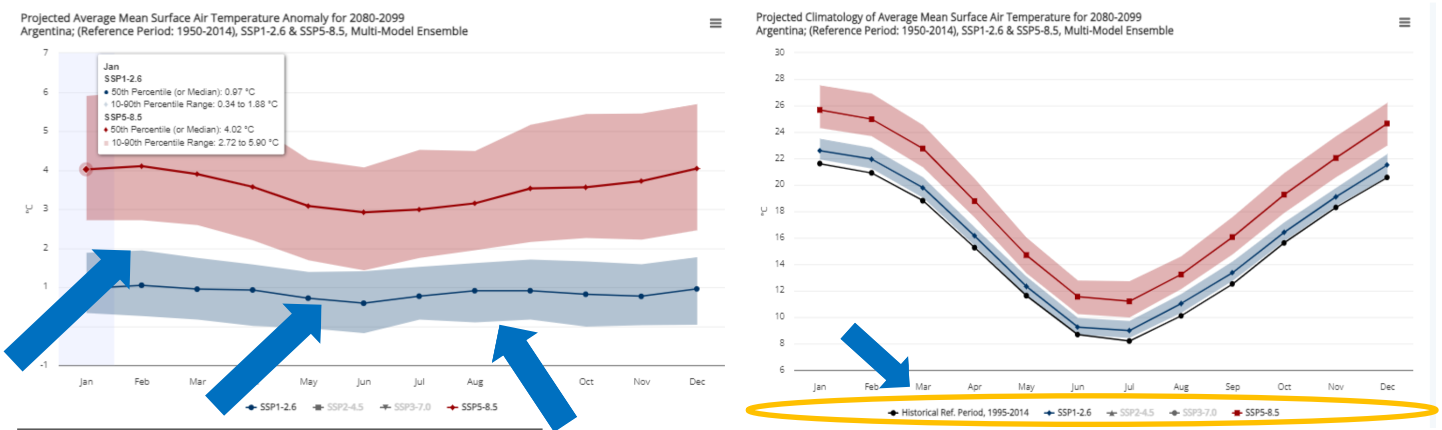
Figure L. Spatial Variation and Change; anomaly (left) and mean (right)



Data is shown as both anomaly and mean. As seen above, anomaly (left) is presented through block colors to present the projected anomaly value, gridded data color gradation is kept for surrounding region to demonstrate regional change. Mean data (right) shows the color gradation across the sub-national units to reflect conditions across an area; the data values presented reflect aggregation for sub-unit or country.

When analyzing and interpreting climate change projections from multi-model ensembles, outputs are presented as a range, which represents model spread. CCKP identifies the range of 10th and 90th percentiles, and median (or 50th percentile). The 10th percentile indicates that just 10% of simulation outputs fall below this result. The 90th percentile means that 90% of all simulation outputs fall below this result.

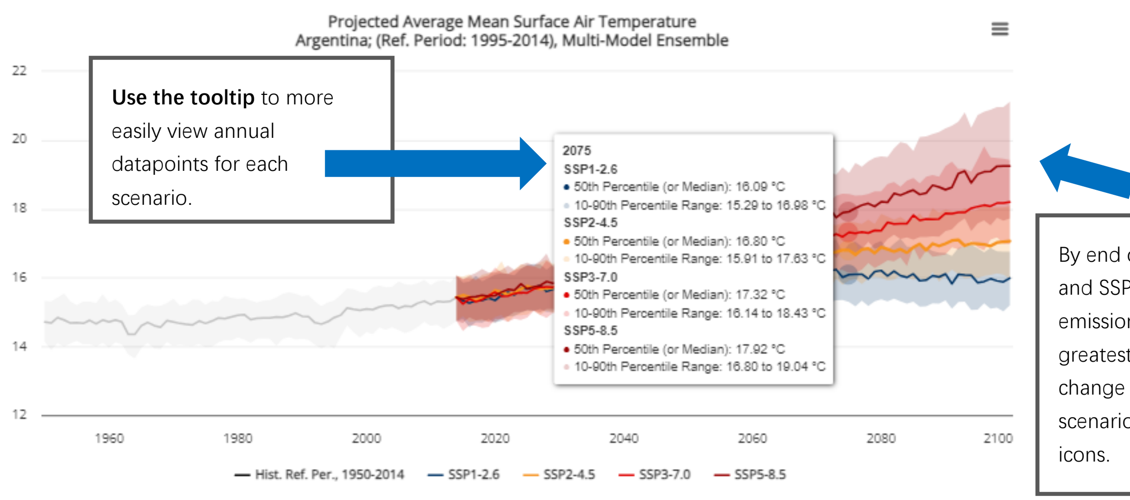
Figure M. Seasonal Cycle Under SSP1-2.6 (blue) and SSP5-8.5 (red), shown as anomaly (left) and mean (right)



Projection range depicts model spread through 10th percentile (far right arrow), 90th percentile (far left arrow), and median (solid line). Hover over datapoints to reveal tooltip.

Add or remove historical and projected scenarios by clicking them. Note larger increase in mean from historical reference (black) under SSP5-8.5 compared to SSP1-2.6.

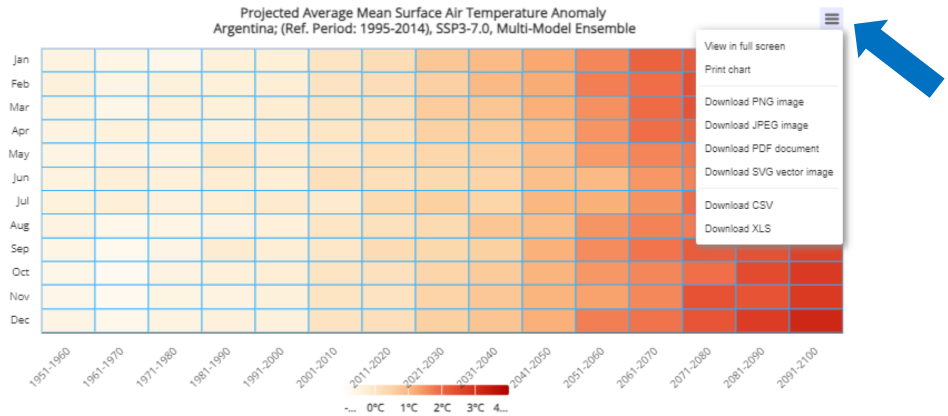
Figure N. Projected Time Series of Multi-model Ensemble for Selected Variable



Use the tooltip to more easily view annual datapoints for each scenario.

By end of century, SSP3-7.0 and SSP5-8.5, the highest emission pathways, show the greatest magnitudes of change Add or remove scenarios using the legend icons.

Figure O. Heatplot of Mean Average Temperature Anomaly Projections for Argentina. Note that a heatplot represents anomalies calculated against the historical reference period. Thus, it is feasible to see negative values for earlier time periods (i.e., 1950s, 1960s, etc.) in the heatplot.



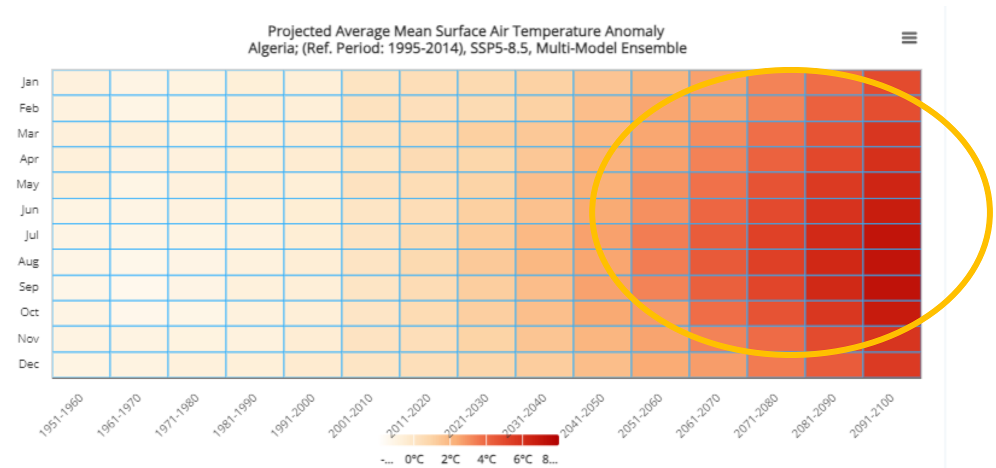
Directly download this visual or the specific underlying data. Hover over plot squares to view monthly average projected change for each decade.

Note general increase in temperature anomaly across time periods, indicated by shift from white to red colors in the heatplot.

Example: Algeria – Projected Seasonal Anomaly, Mean Temperature

Under higher-emission scenario SSP5-8.5, average mean temperatures in Algeria are expected to increase rapidly by midcentury, with continued significant and rapid increase through the end of the century (see darker squares inside the circled area). As seen in **Figure P**, increased thresholds are resulting in an emergence of a significantly hotter summer season due to the increase in the number of hot day anomalies – in July, August, and September, starting midcentury. 'Traditional hot seasons' are expected to start earlier, last longer, and become more intense, as illustrated by critically hotter anomalies projected every month year-round by 2100 according to this scenario. Increased heat conditions will result in significant implications for human and animal health, agriculture, ecosystems as well as energy generation.

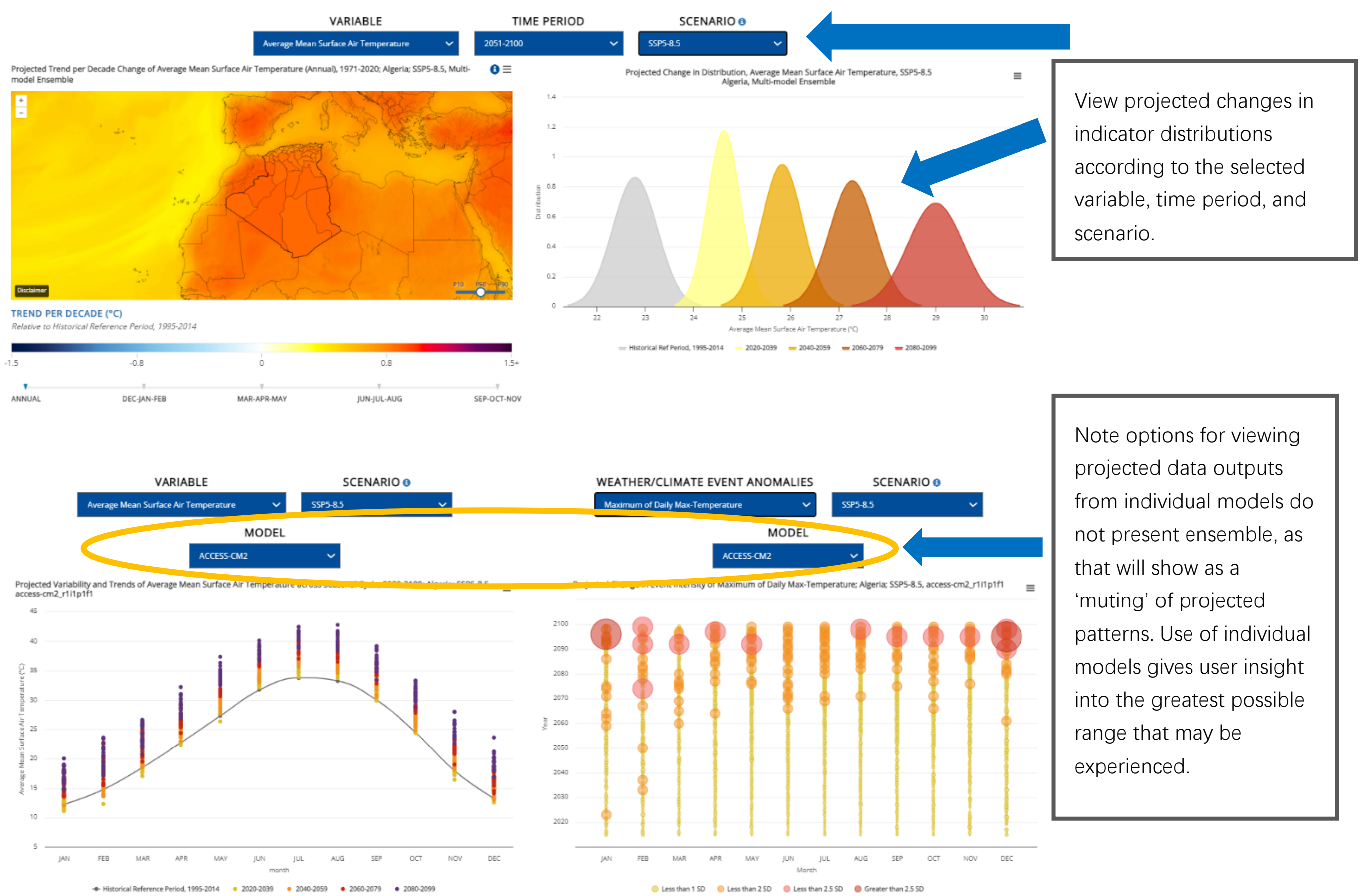
Figure P. Projected Change in Mean Temperature across Algeria



MEAN PROJECTIONS – TRENDS & VARIABILITY

Data presented on the ***Mean Projections – Trends & Variability*** tab presents projected climate trends and significant change against natural variability. On this page, users can explore projected data for annual and seasonal temperature and precipitation indicators associated with selected time periods - either according to individual models or multi-model ensemble. CCKP prioritizes multi-model ensemble. Unless a strong understanding of individual model bias and underlying assumptions, CCKP recommends always using the multi-model ensemble for analysis. All visualizations and data presentations remain the same as the ‘mean projections’ tabs and tools on this page also enable users to investigate CMIP6 datasets by Shared Socioeconomic Pathways (SSPs) [SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5]. New data products continue to be added as we are able to produce them. The three sections on the page present different aspects of how variability might need to be taken into account through multidecadal, interannual, seasonal, and significant trends that provide insight into patterns beyond natural variability.

Figure Q. Using CCKP’s Tools on ‘Projected Trends and Significant Change against Natural Variability’ Page



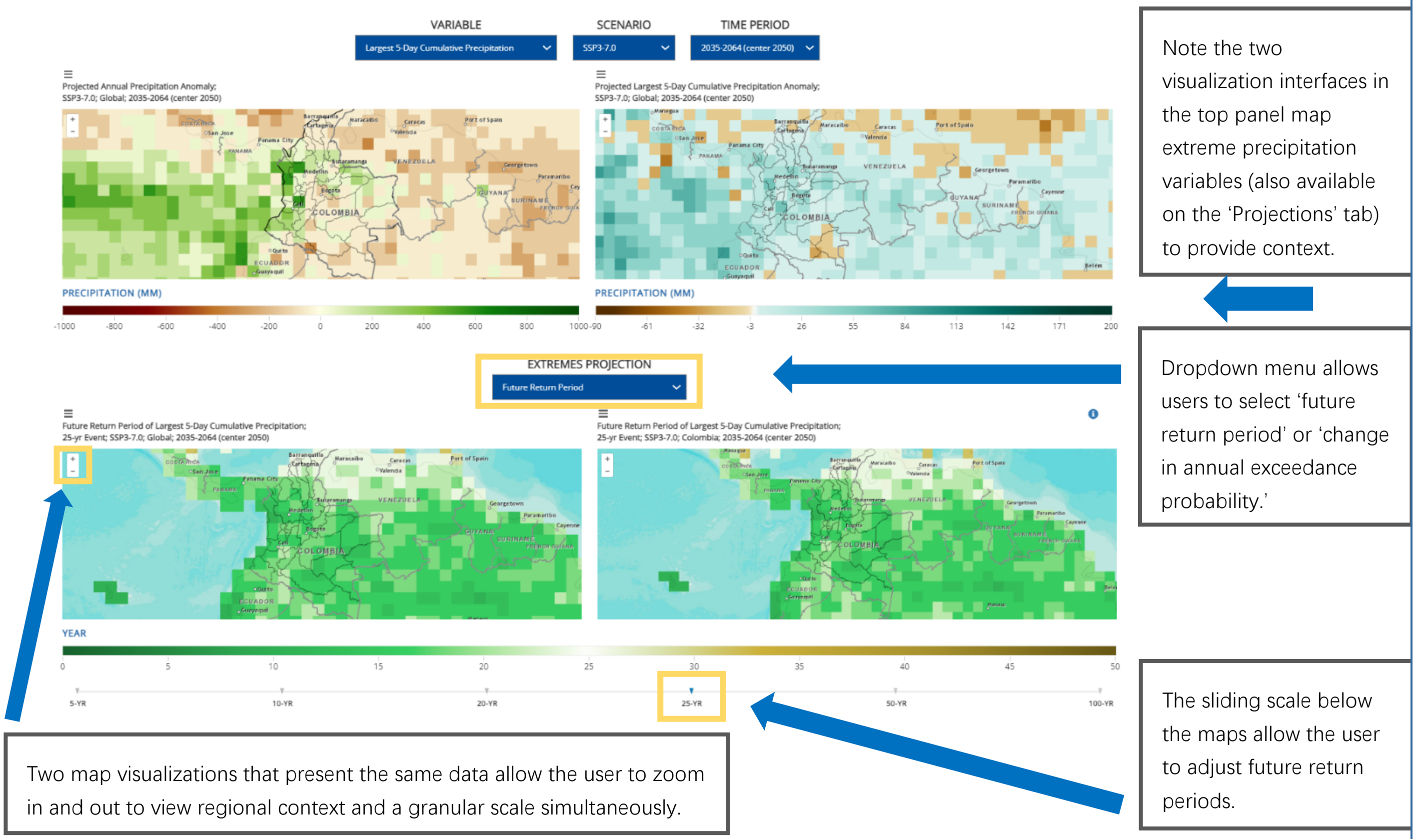
8. Extreme Events

EXTREME EVENTS

This page is designed to offer insight into extreme events at global and country scales, and how extreme events differ from mean climate. The first of two visualization sections present different perspectives on historical conditions as well as future scenarios of mean precipitation as a comparator to understanding of shifts in extreme events presented later in the page (**Figure R**). The baseline climate (Historical Period, 1985-2014, centered on 2000) can be compared with future time periods and scenarios, centered on 2025, 2050, 2075 as well as 2085 (using data to 2099). Please note, the presented extreme indicators offer qualitative projection results, which directly reflect global model output, and should not be mistaken for location-specific ("station-level") extremes. Projections for extreme precipitation events use data presented at a 1.00º x 1.00º (100km x 100km) resolution.

Users can choose from two options in the dropdown menu for 'Extremes Projections': 'Future Return Period' and 'Change in Annual Exceedance Probability.' A return period estimates the interval of time between two extreme event occurrences at a certain threshold of intensity. Comparing historical return periods (measured in years) of extreme precipitation events at a fixed magnitude or return level (measured in millimeters) with projected return periods at equivalent return levels over the same geographic area yields insights into potentially changing frequencies of extreme events. For example, a 20-year extreme precipitation event, or event with a specified 20-year return level during the historical period, may be projected to occur more frequently (green colors in Figure R) or less frequently (brown colors in Figure R) in the future. Such projections are shown on the 'Extreme Events' page as future return periods (measured in years) relative to the present-day reference. One can also examine the inverse of a return period – annual exceedance probability, or the expected number of events above a certain threshold magnitude annually – especially if noticeable shifts from historical to projected future return periods are evident. The 'Change in Annual Exceedance Probability' associated with a certain historical return level can be expressed as a 'Change Factor,' or the likelihood that an event with a historical return period will occur in the future. A demonstration of how one can interpret data on the 'Extreme Events' page for Colombia is presented below.

Figure R. Extreme Precipitation Context and Projections for Colombia



The second visualization section on the page (**Figure S**) presents data graphically through charts that estimate the frequency of rare, high-magnitude events by illustrating: (1) the process of fitting a continuous generalized extreme value function to the data as represented in form of a histogram (number of sample in different magnitudes bins), and (2) a comparison of the quantiles between empirical (actual model values) and their function-fitted representation (Density Plot). While hard to see in the histogram, the QQ-Plot highlights the challenges towards the highest, most extreme values. The Return Level Plot offers the link between frequency (return periods) and the magnitude of events (return levels).

Figure S. Distribution-to-Return-Period Data Presentations for Colombia

Example: Colombia – Historical and Projected Future Extreme Precipitation Events

On the 'Extreme Events' page for Colombia, below the Section II visuals (Figure S), users will find data tables helpful for analyzing extreme event statistics. Upon choosing a variable in the Section II dropdown menu (e.g., largest 1-day precipitation amount), the tables automatically populate with data for each SSP scenario across the historical reference period (**Figure T**), followed by data for future projected time periods (**Figure U**). Note historical return levels (mm) for a 20-year interval (median of 83.88 mm) when viewing regional-level projection maps. The return period of a 100 mm event had a median of 73.28 years over the historical period, or a 0.03 median annual exceedance probability.

Figure T. Data Tables for Largest 1-Day Precipitation for Colombia (1985-2014, center 2000)

Return Levels, Historical: 1985-2014 (center 2000) (mm)							
10-yr			20-yr			25-yr	
10th	median	90th	10th	median	90th	10th	median
41.50	74.33	150.66	46.00	83.88	174.28	47.45	86.99

Return Period, Historical: 1985-2014 (center 2000) (years)						
50mm			100mm			
10th	median	90th	10th	median	90th	10th
0.39	1.78	53.43	2.73	73.28	7552.04	14.38

Annual Exceedance Probability, Historical: 1985-2014 (center 2000) (occurrence/year)						
	50mm			100mm		
90th	10th	median	90th	10th	median	90th
7.28	0.05	0.67	3.07	0.00	0.03	0.59

Example: Colombia – Historical and Projected Future Extreme Precipitation Events

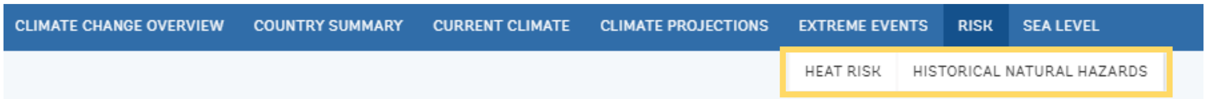
By contrast, the projected future return period for a 20-year interval event by 2070-2099 (center 2085) becomes much more frequent. The median future return period for a 20-year interval event decreases to 15.23 years under SSP1-1.9 and 7.32 years under SSP5-8.5, and therefore equivalent events from the reference period become more frequent. This translates into change factors of increasing frequency – a median of 1.35 times more likely under SSP1-1.9 and 3.01 times more likely under SSP5-8.5. Maps (Figure R) illustrate the spatial extent of this shift, generally greater for scenarios with higher emissions and larger event intervals (e.g., 100-year events). The yellow arrows orient the user to this shift on data tables for future projections (**Figure U**).

Figure U. Data Tables for Largest 1-Day Precipitation for Colombia (2070-2099, center 2085)

	Future Return Period, 2070-2099 (center 2085) (years)					
Event	20-yr			25-yr		
	10th	median	90th	10th	median	90th
SSP1-1.9	6.24	15.23	27.04	7.35	18.88	34.75
SSP1-2.6	5.07	13.21	27.13	5.91	16.24	34.60
SSP2-4.5	3.91	9.88	24.45	4.49	12.00	31.02
SSP3-7.0	3.32	8.88	23.07	3.79	10.65	29.11
SSP5-8.5	2.45	7.32	23.19	2.76	8.74	29.04

	Change in Annual Exceedance Probability, 2070-2099 (center 2085) (change factor for occurrence/ year)					
Event	20-yr			25-yr		
	10th	median	90th	10th	median	90th
SSP1-1.9	0.62	1.35	2.39	0.61	1.37	2.53
SSP1-2.6	0.68	1.45	3.58	0.67	1.47	3.85
SSP2-4.5	0.78	1.99	4.74	0.77	2.05	5.13
SSP3-7.0	0.81	2.43	5.81	0.80	2.55	6.37
SSP5-8.5	0.84	3.01	8.34	0.85	3.18	9.30

9. Risk



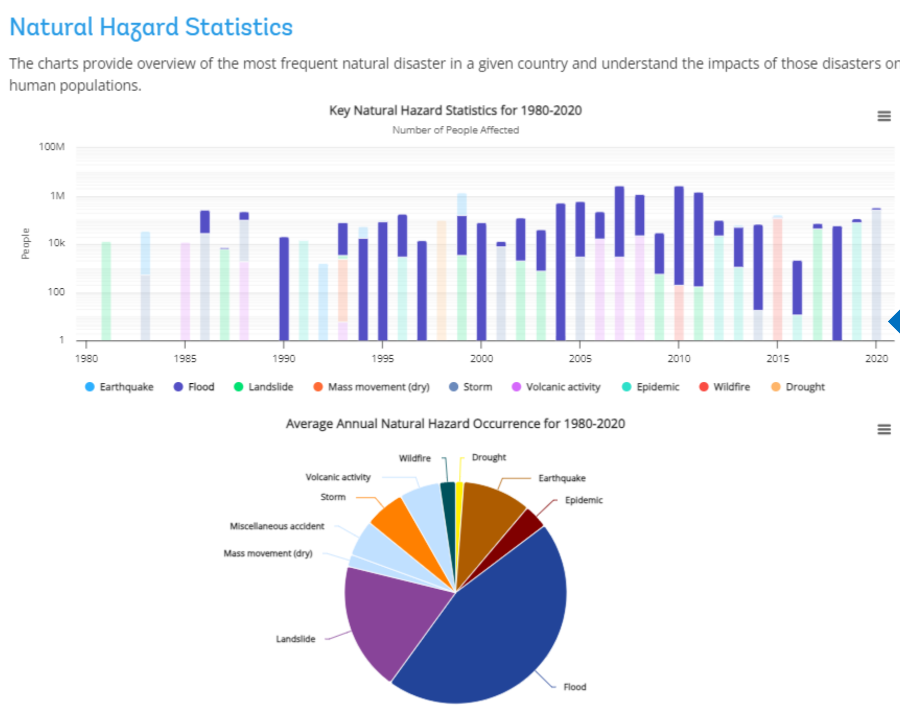
RISK

The **Risk** tab provides a brief review on country-specific climate-related hazards and facilitates the understanding of the relationship between hazards and socioeconomic development. This tab includes a page focused on heat risk and on historical natural hazards.

HISTORICAL NATURAL HAZARDS

This page presents an overview of how climate change may affect a country. It includes information on country specific climate-related hazards and risks. Data on key natural hazard statistics and average annual natural hazard occurrence for 1980 – 2020 (**Figure V**) are presented. Data presentation on climate-related hazards and risks allows users to understand country's historical vulnerability to specific natural hazards. This also provides users another key element of information to further develop and understand a country's context when accessing climate data. It is important to recognize that while climate change is expected to impact natural hazards most likely through increasing intensity and duration, frequency of occurrence is not linear.

Figure V. Key Natural Hazard Statistics for 1980 – 2020

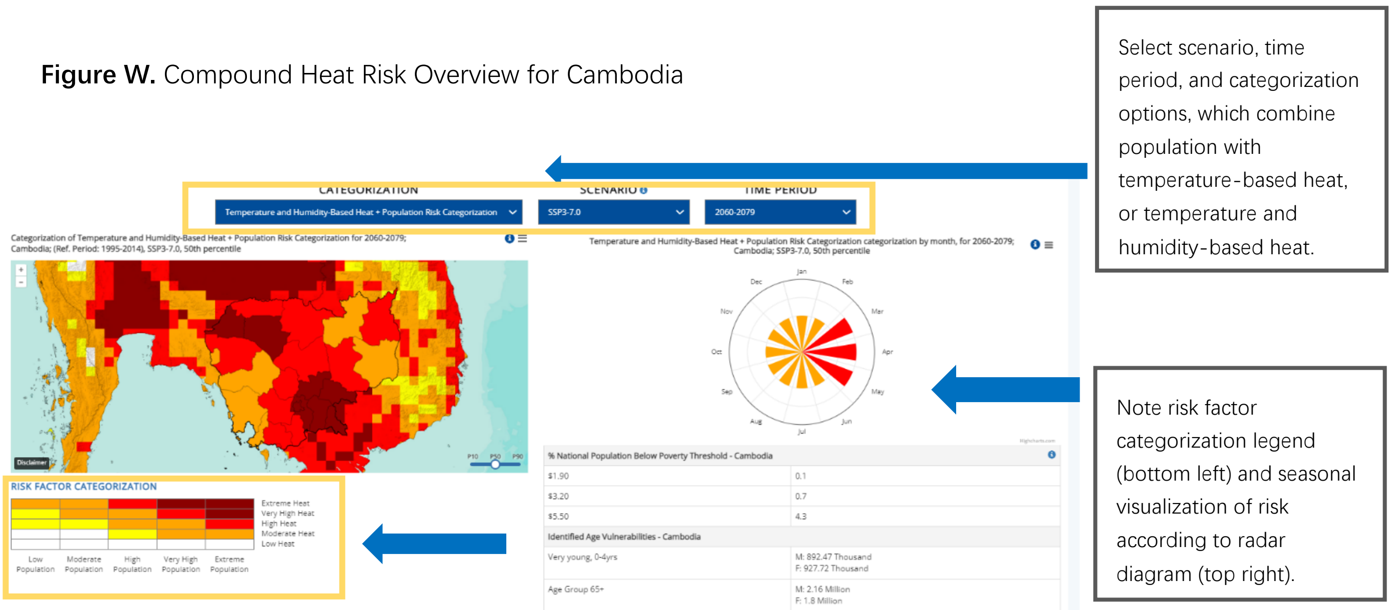


Hover over hazard variables in the chart for more detail.

HEAT RISK

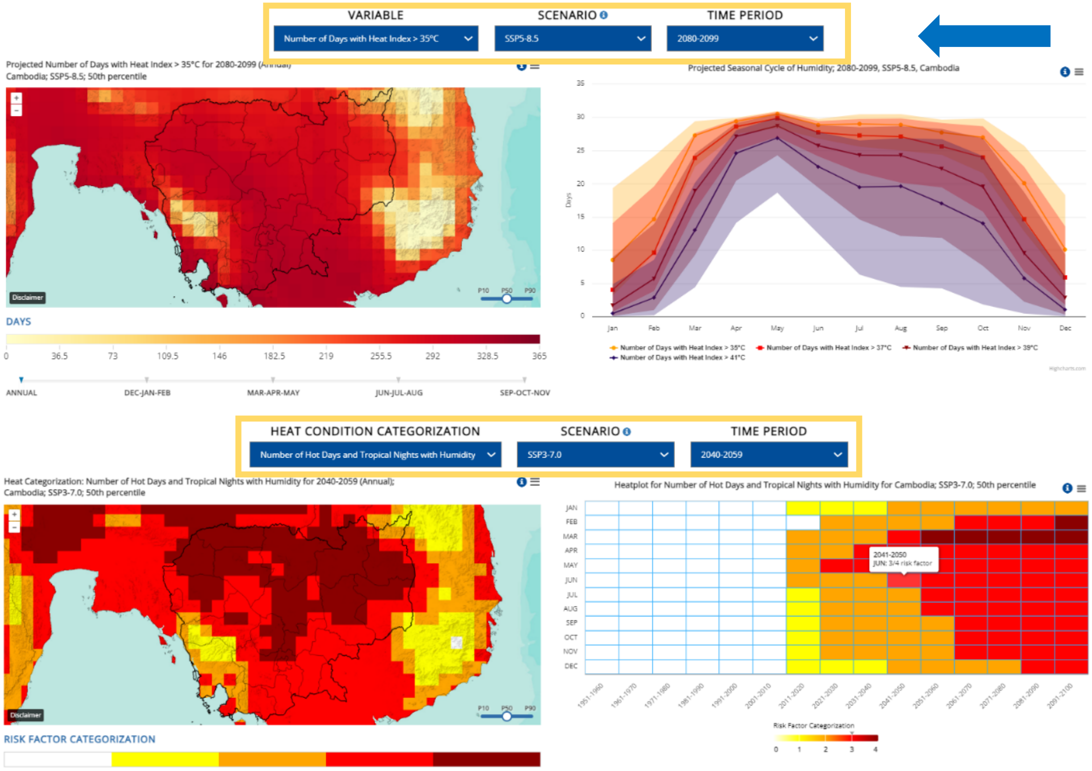
This page presents tools for understanding how different elements of heat risk may affect a country and how demographic and socioeconomic data can help identify critical areas of focus (**Figure W**). The overview section presents compounded heat risk on a relative numerical scale (0-4) by combining temperature-based heat or temperature and humidity-based heat with areas of greater population. Compound risk presentation can be investigated spatially via the map (depicting the maximum heat risk categorization across the year). Investigations in the specific seasonality of risk based on monthly categorizations is shown via the radar diagram. Individual elements contributing to the compound risk (i.e., heat conditions and population) are presented separately in the following two sections, including different risk categorizations i.e. with/ without humidity.

Figure W. Compound Heat Risk Overview for Cambodia



The first section of the ‘heat risk’ page presents multi-threshold metrics for daytime maximum temperatures, nighttime minimum temperatures, and a combined heat index (a measure of air temperature and humidity) as a baseline to evaluate changing and intensifying heat risk conditions for an area. Key is to understand where extreme heat conditions are more likely to occur, and when in the seasonal cycle as well as over time higher heat conditions are to be expected. The top panel presents the mean number of days for each of the heat thresholds spatially by map and graphically by line chart, while the bottom panel condenses the different threshold information into systematic categories (0-4) spatially by map and graphically using a heatplot (**Figure X**).

Figure X. Historical and Projected Extreme Heat Conditions for Cambodia

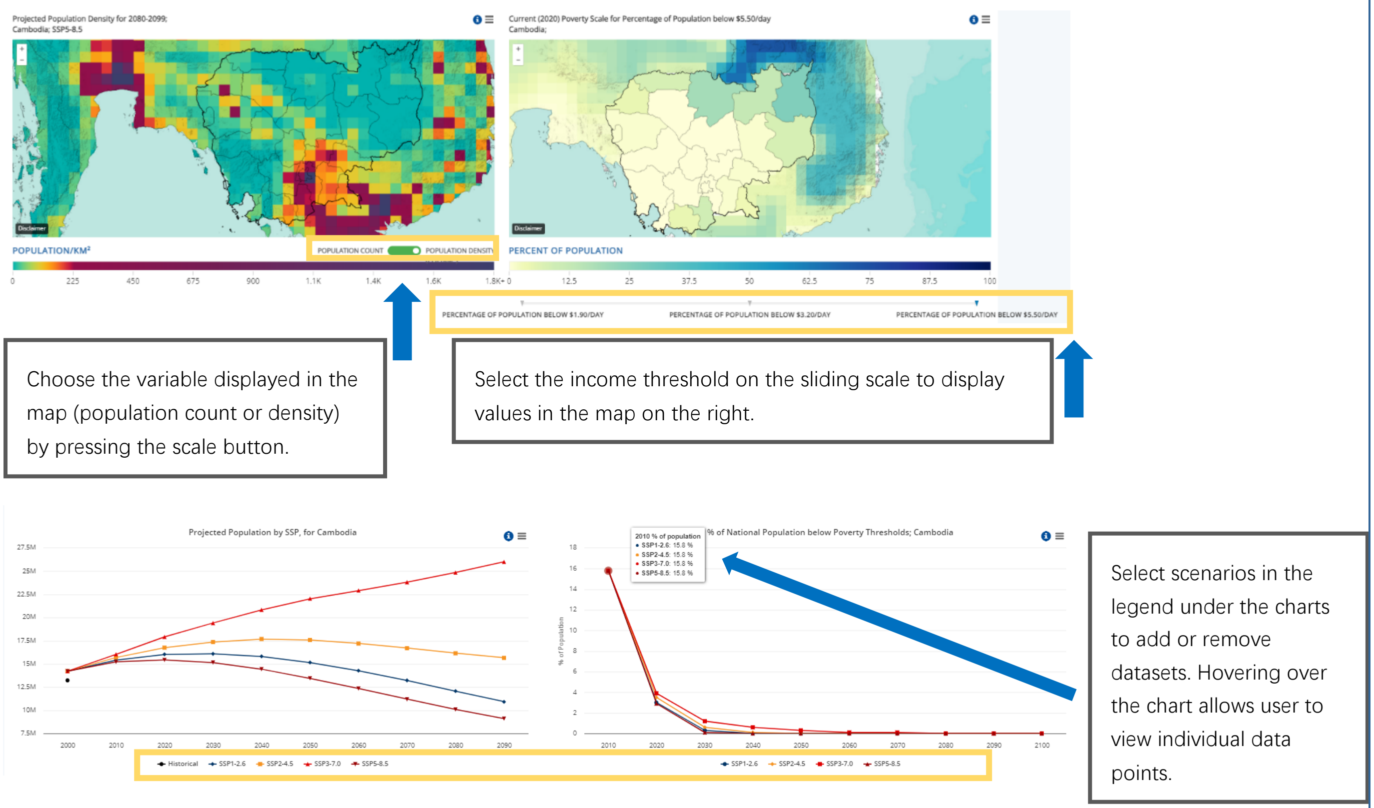


Heat risk variables (also provided on CCKP's 'Projections' tab) and other parameters in dropdown menus allow user to explore spatial and seasonal patterns factored into categorizations in the bottom panel. Note number of Heat Index days above different thresholds in the line chart by end of century.

Heatplot populates with data from chosen variable, seasonally illustrating categories of heat risk displayed spatially on the left.

The page's second section explores the socio-economic backdrop against which one needs to assess critical heat risks (**Figure Y**). Presented spatially with maps are: population (density: persons/ km2 and counts) and poverty classifications. Understanding where populations are located, and a relative level of poverty (using percentage of population below poverty classifications at thresholds: $1.90, $3.20, $5.50 of income per day), can aid decision-makers in identifying key areas of need and resource allocation. Population data for the historical reference period (1995-2014) in the first panel of Figure Y were derived from the Center for International Earth Science Network and projection data were derived from Jones and O'Neill (2020). Future projections until the year 2100 were crafted in association with the formulation of societal development narratives under the Shared Socioeconomic Pathways (SSPs). Data presented below depicts population growth, poverty scales, and age and sex classifications per each SSP graphically. The second panel of graphics estimates total population size and age and sex structure for each country at 'present' level from 2010 U.N. assessment projections. The method used for carrying out projections by age, sex, and educational attainment level is a generalization of the standard cohort-component method of population projections.

Figure Y. Population and Poverty Dynamics for Cambodia. Note population calculations displayed per grid area may suffer from lack of precision over small spatial entities such as islands.



Future projections were crafted in association with the formulation of societal development narratives under the Shared Socioeconomic Pathways (SSPs). The goal of the SSPs is to depict a range of plausible societal futures where different technological, political and environmental trajectories are described. Within each of these storylines, a trajectory of demographic changes is generated, informed by different levels of population growth, fertility, mortality, migration, and urbanization for each country grouped by income. Then, based on an assumption of technologies, the demographic trajectory will lead to likely emissions patterns to reflect each pathway scenario. Note that the SSPs, apart from SSP3, assume a decline in global poverty conditions, which is why poverty graphs display assumed future poverty rates near 0%. For more information on scenario development, see O'Neill et al. 2017.

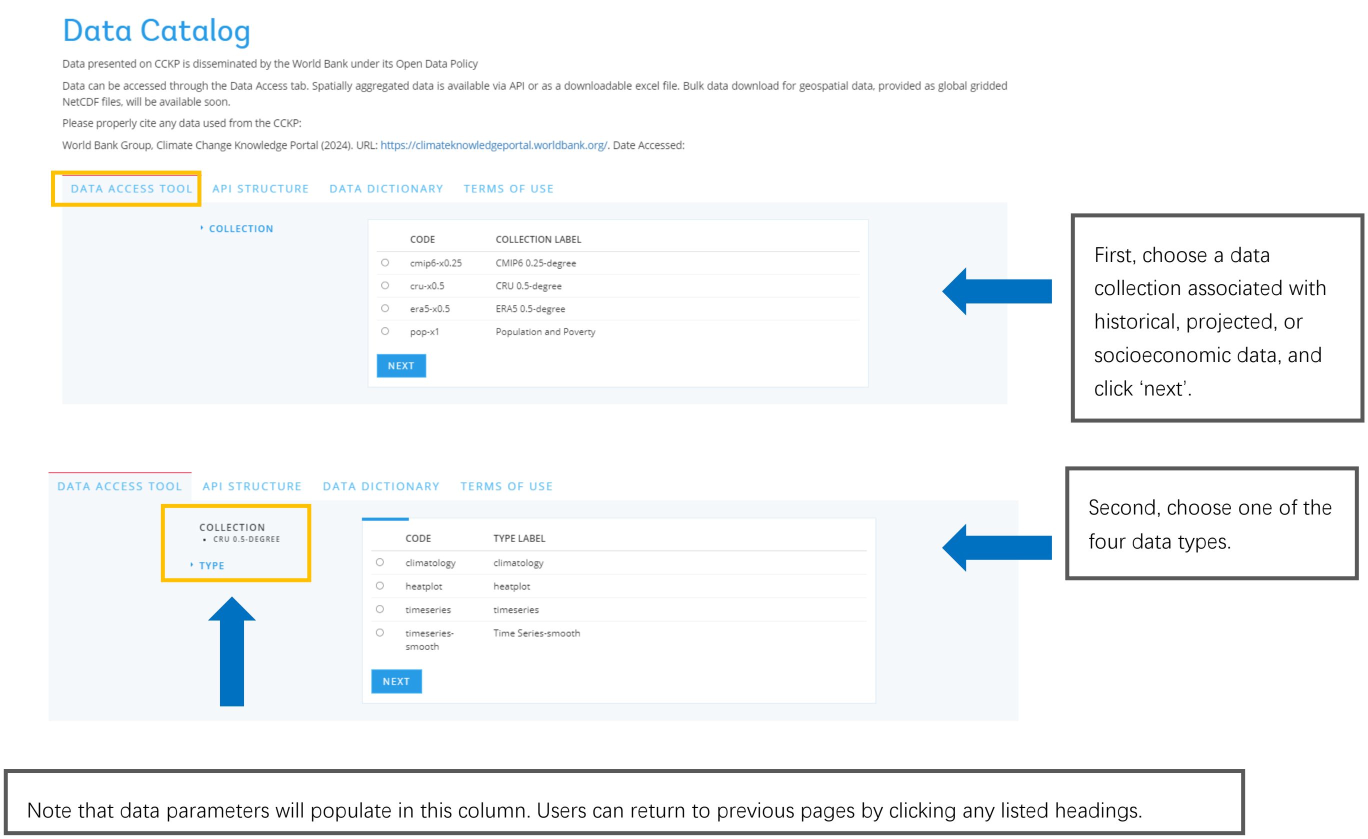
10. DOWNLOAD DATA

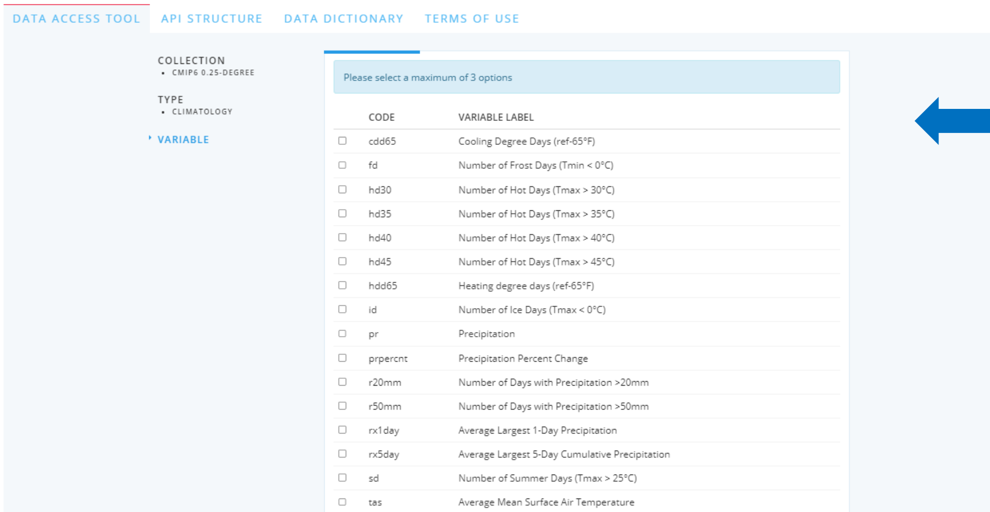
All CCKP data is freely and publicly available and can be downloaded directly from the *Download Data* link. Users can tailor specific download needs by completing the requests for each download tab. Data can be selected for download in four forms: (i) Map; (ii) Climatology; (iii) Timeseries; and (iv) Heatplot. Spatial data is provided as a global NetCDF file, with Climatology, Timeseries and Heatplot data is provided as a CSV file. Tailored data can be downloaded by country, sub-national unit or coordinates.

Please cite all data used from the Climate Change Knowledge Portal.

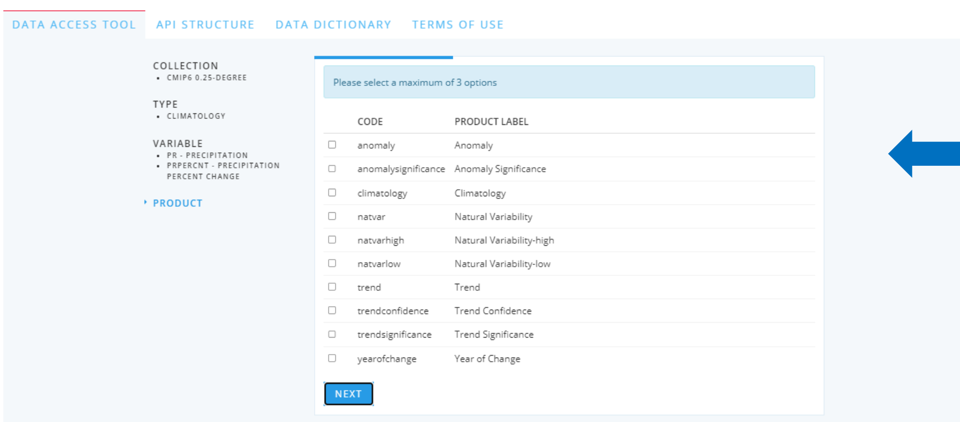
Upon clicking the 'Download Data' tab and registering with the CCKP system, users can select parameters for their desired datasets by following the prompts illustrated below (**Figure Z**).

FIGURE Z. Download Data Prompts



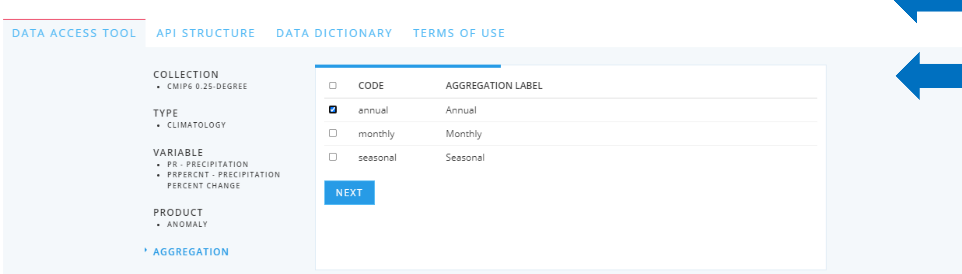


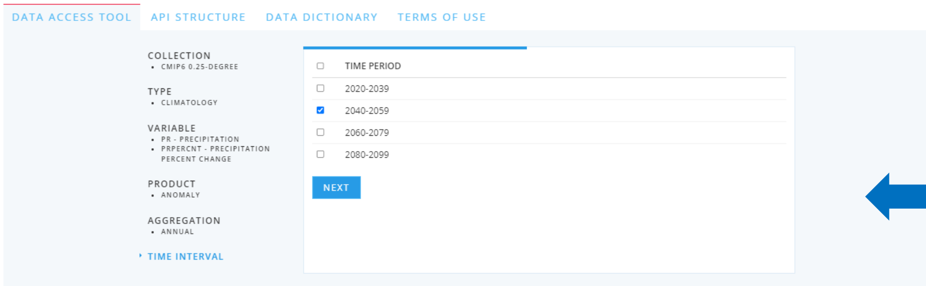
Third, select up to three data variables offered for the particular data collection.



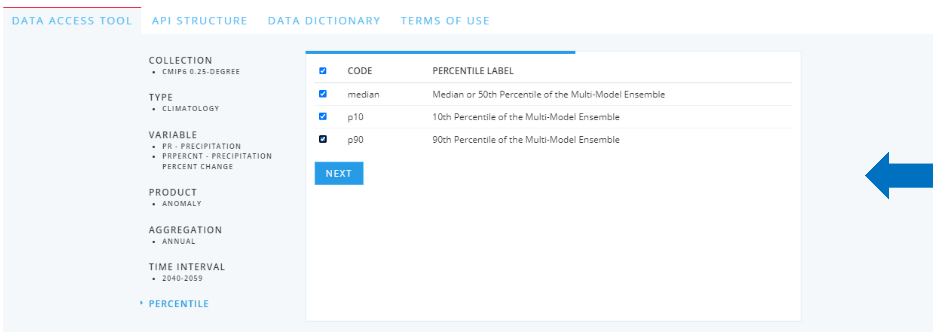
Fourth, depending on the data collection selected, users can select up to three products to analyze data.

Fifth, select the parameters for temporally aggregating the dataset.

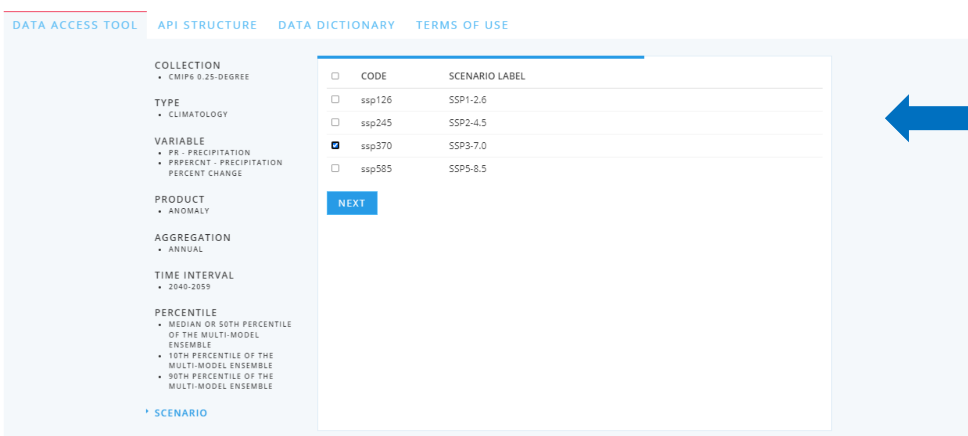




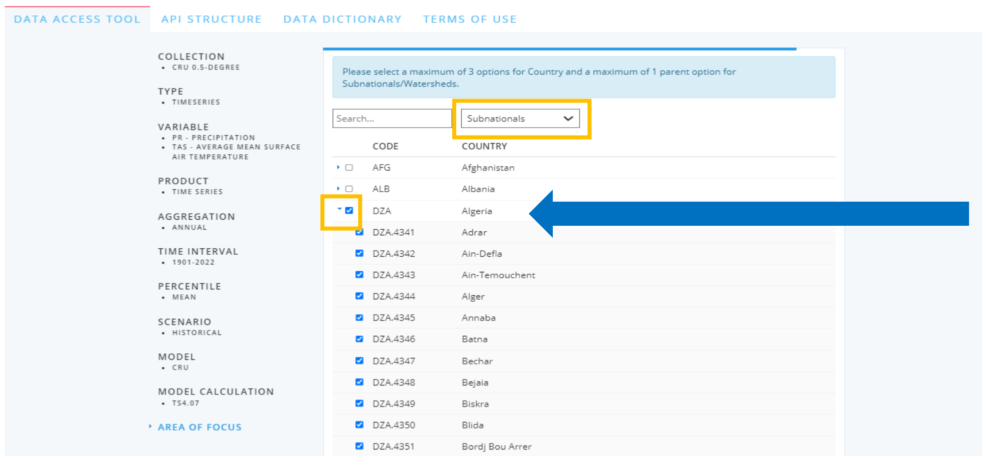
Sixth, depending on the data collection and type selected (e.g., CMIP6 projected climatology), users can indicate desired time intervals for their dataset.



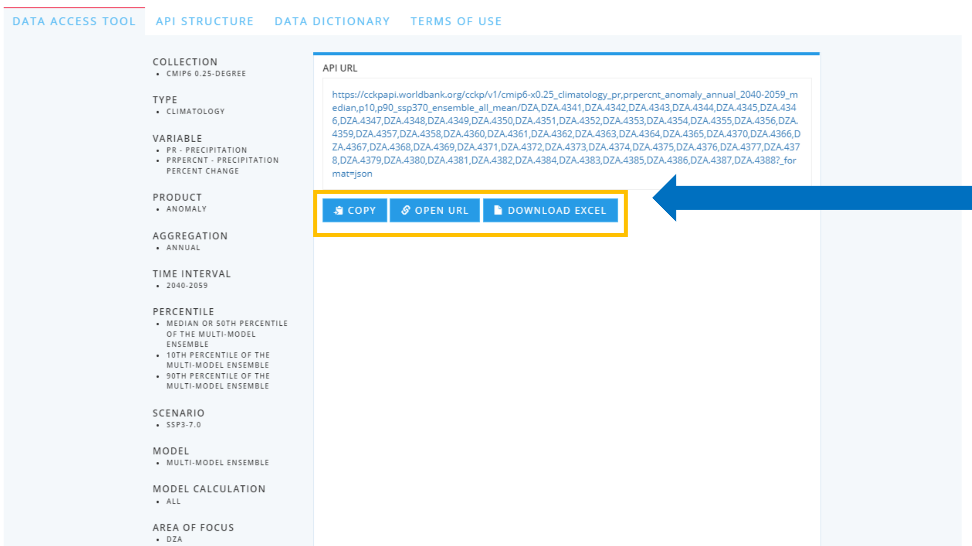
Seventh, depending on the data collection and type selected, users will be prompted to select percentiles for their desired dataset.



Eighth, depending on the data collection selected, users can choose projection scenarios.



Finally, the system will prompt users to select a geographic area of focus. Subnational units or watersheds may be selected from the dropdown menu, Subnational units are listed under their respective country, which can be further refined by clicking on the arrow next to the country checkbox.



Access tailored dataset through these buttons.