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PRIMER:

USING CLIMATE INFORMATION FOR CLIMATE RISK MANAGEMENT

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INTRODUCTION

Information about climate variability and change is used for many purposes. USAID, other donors, and development practitioners use climate information for climate risk management (CRM), which helps safeguard and enhance investments by building resilience to climate impacts. These organizations also use climate information to support programs that help countries contribute to climate change mitigation, adapt to climate change impacts, or both.

National and local governments, communities and individuals also use climate information to inform decision-making and to support climate adaptation and disaster risk reduction.

CLIMATE INFORMATION includes information on climate variability and change, including variables such as temperature, precipitation, etc.

CLIMATE RISK MANAGEMENT (CRM) is the process of assessing, addressing and adaptively managing climate risks. See *USAID's guidance on CRM* for details.

This primer focuses on the use of climate information by USAID and implementing partners for CRM, but is also relevant for other purposes.

UNDERSTANDING UNCERTAINTY

As you read through the tips for using climate information, it will be helpful to keep in mind the distinction between uncertainty and lack of information. Uncertainty should not be equated with a lack of information nor should it be a barrier to action. Although climate information contains uncertainties about warming, shifting rainfall patterns, sea level rise and how those changes will interact with other variables, the level of uncertainty is actually lower than uncertainties affecting other key public policy decisions (e.g., military procurement and financial system regulation). In fact, credible information about the past, recent trends, likely future trajectories and potential impacts can strengthen design and implementation of development programs. This information can help us design and manage as well as possible given that the past is no longer a reliable predictor of the future. That said, as in other areas, there are special considerations for using information that contains uncertainties.

OTHER CLIMATE INFORMATION NEEDS AND USES important to design teams and implementers are detailed in the *Climate-Resilient Development (CRD) Framework* and its *Climate Vulnerability Assessment Annex*, and in the resources on *climate risk management*.

PUBLIC POLICY DECISION-MAKING in other key areas will be affected by climate uncertainties. See Mabey et al. (2011). *Degrees of Risk: Defining a Risk Management Framework for Climate Security*.

IN THIS PRIMER

This primer contains recommended practices, important considerations and information sources to help you make the best use of climate information. The primer is organized in three sections: Recommended Practices; Considerations for Conducting or Commissioning Assessments; and Information Sources. Key points in each section are summarized below with links to details.

RECOMMENDED PRACTICES

The first and most fundamental step is to understand the development question or need so that the climate information you obtain is tailored to fit your purpose. This and other key recommendations are summarized in this section.

- Begin with an understanding of the development question or need.
- Review existing analyses relevant for the location and/or sectors of interest.
- Identify the type and depth of analyses required for different problems.
- Identify the depth of analysis required for different stages of development programs.
- Identify the appropriate timescale.
- Account for potential sources of uncertainty in climate information and in your system.
- Recognize that uncertainty about the future climate does not mean lack of information.
- Consult with a climate science expert if you're in doubt.

CONSIDERATIONS FOR CONDUCTING OR COMMISSIONING ASSESSMENTS

Additional considerations for using climate information in assessments you may conduct or commission are listed in this section.

- Identify key climate variables and metrics.
- Begin assessments by looking at historical climate patterns and variability.
- Use the most appropriate information about past climate variability.
- Use an appropriate duration of the climate record.
- Use the most appropriate information about future climate.
- Consider a range of climate scenarios and use multiple climate models in estimating future conditions.
- Consider the pros and cons of using downscaled climate information in relation to the decisions that need to be informed by the assessment.
- Recognize that uncertainties differ among climate variables.

INFORMATION SOURCES

This section contains an annotated list of illustrative climate information resources we consider credible.

- Assessments, profiles and tools
- Historical climate information and future projections
- Regional climate platforms

RECOMMENDED PRACTICES

CLARIFY DEVELOPMENT OBJECTIVES

Adopt a 'development-first' approach and begin with an understanding of the development objectives, questions or needs.

The universe of climate information is vast. To decide what information to use, it is important to start with the development questions or decisions the information will inform. Undervaluing this step is common and can lead to spending scarce resources on detailed climate information that does not lead to feasible actions. Clarifying your questions and decisions can help identify relevant aspects of climate variability and change that may need to be addressed to achieve the development objectives.

Illustrative questions may help you identify the metrics most relevant to your development question or need. See USAID's review of Climate Vulnerability Assessments and also the Climate Risk Screening and Management (CRM) Tool and Sector Annexes.

FOR EXAMPLE, detailed projections of temperature or precipitation increases may not be necessary if your program is building institutional capacity and only needs to know whether it should be developing strategies for warmer or wetter or drier conditions. However, information about changes in the onset, duration and geographic distribution of rainy seasons may inform efforts to control vector-borne diseases or guide planting in areas with predominantly rain fed agriculture.

START WITH EXISTING STUDIES

Review existing assessments, climate impact reports, and other studies relevant for the location and/or sectors of interest.

Using existing assessments is less costly than analyzing raw climate information. Considerable information on climate impacts and vulnerabilities has been generated; relevant climate reports of some kind may already exist.

As you review the data, approaches used, assumptions and conclusions in these assessments and reports, you may find that they meet your needs.

THE INFORMATION SOURCES section may be useful in locating existing studies.

DURING YOUR REVIEW of existing materials, be sure to understand how uncertainties are treated.

TAILOR ANALYSES TO PROBLEMS

Identify the type and depth of analyses required for different problems. Don't use or conduct unnecessarily detailed analyses that are not tailored to your needs.

The amount of detailed information should match the scale of the problem so that the information sought and used can help you adequately assess climate risks to your development objectives.

In many cases, a review of climate risks from existing profiles and assessments may suffice. If after careful consideration, you determine that in-depth analysis is appropriate or that existing analyses are not appropriate for the development question or need, you may want to consult with someone with relevant climate expertise from within USAID, a consultancy, or a university about finding or collecting the information cost-effectively.

TAILOR ANALYSES TO PROGRAM STAGES

Identify the depth of analysis required for different stages of development programs.

The depth of analysis may vary at different stages throughout the program cycle. At early stages of program design, you may only need a general understanding of the extent to which climate variability and change may affect the development objectives (e.g., to note how much rising temperatures and shifting rainfall patterns may impact water and food security objectives). During activity design and implementation, more detailed, focused and quantitative analyses may be needed at the local level (e.g., to overlay infectious disease surveillance data with relevant climate information to understand potential or observed disease spread) or for specific project decisions like crop types or infrastructure siting.

PROGRAM CYCLES include planning, implementation, evaluation and learning, and adaptive management, and may include, at different stages, high-level strategy development and detailed planning of interventions. For example, USAID's *program cycle* is an operational model for planning, delivering, assessing, and adapting development programming for effective and sustainable results.

CONSIDER THE TIMESCALE

Identify the appropriate timescale.

It is important to understand how climate extremes (and/or averages) will change over the lifetime of the impacts of the program you are designing. Even if your activity will only take a few years to implement, its impact on a community or ecosystem may persist for decades.

You should consider how climate may vary in the near-term during the implementation phase, as well as how it may change over the full lifetime of the implemented aspects of the program.

THE TIMESCALE of the climate information you use should pertain to the lifetime of the decision. In some cases, seasonal information is appropriate (e.g., when to plant). In other cases, information covering longer time scales may be most appropriate (e.g., changing to a crop better suited to the projected growing conditions of the next 10-20 years).

ACCOUNT FOR SOURCES OF UNCERTAINTY

Recognize and account for the sources of uncertainty in climate information. Don't ignore uncertainties associated with climate change projections or fail to account for the fullest range of climate variability and extremes possible.

Three key sources of uncertainty are:

- Natural climate variability;
- Limitations of the models used to represent the climate system; and
- Uncertainty around future emissions—future emissions scenarios are used to generate climate projections.

You should acknowledge, account for, and communicate these uncertainties (e.g., by reporting ranges, not averages) when drawing conclusions, and when making recommendations for program design and management of climate risks.

In general, uncertainties are lower for climate projections based on multiple models and scenarios.

THE MODELS ARE GOOD and getting better, but are not perfect. For example, challenges remain in representing the naturally-occurring, seasonal-to-decadal variability in long-term projections. Future emissions may increase, stabilize or decrease depending on policies, actions and a host of assumptions (e.g., changing demographics, technologies and economics). In addition, there are data gaps and imperfect knowledge regarding the current climate conditions that serve as an input for projections.

NOTE THAT UNCERTAINTY ≠ LACK OF INFORMATION

Recognize that uncertainty about future climate conditions does not indicate a lack of information.

Don't assume that there is no useful information about the future climate just because of uncertainty.

Where model results for given scenarios differ substantially, you may want to promote policies that are robust to a wide range of future conditions, and to design flexible interventions that can be adaptively managed as conditions change.

Even where uncertainties are lower (e.g., where model results are similar), flexible policies and actions that are robust to a range of future climate conditions may yield the most lasting benefits.

FOR EXAMPLE, a food security program planned to account for uncertainty over whether a given location will be wetter or drier will be more robust and better informed than one that assumes conditions will remain the same.

CONSULT AN EXPERT

Consult with a climate science expert if you're in doubt.

If the information you need is available in an existing assessment, you may not need to consult a climate scientist (i.e., an expert who studies climate systems and their dynamics or an expert who studies climatic change). However, if you can't find the climate information you think you need, you don't understand how to use the information you find, or you can't determine what climate information you need, you should consult a climate expert.

CONTACT US at *climatechange@usaid.gov* and we will connect you with the appropriate expertise.

CONSIDERATIONS FOR CONDUCTING OR COMMISSIONING ASSESSMENTS

SELECT RELEVANT VARIABLES AND METRICS

Identify key climate variables and metrics.

If an existing assessment cannot meet your needs, you should establish which climate variables are most important to use in your own assessment. These variables may include temperature, precipitation, wind, and the level of a river, lake or ocean, among other things.

USAID's CRM tool annexes and other tools identified in the Information Sources section can help you determine the variable(s) most important to your development questions or decisions. Depending on the development questions and challenges, considering the extremes of these variables is nearly always more valuable than using long-term averages.

INFORMATION on shifting rainfall patterns (including periods of heavy precipitation, drought, seasonal onset, etc.) in a specific region will likely be more useful to program designers, implementers and beneficiaries than a general projection about an increase or decrease in annual average precipitation across the country.

BEGIN WITH HISTORICAL INFORMATION

Begin assessments by looking at historical climate patterns and variability

Understanding the impact of past weather and climate variations on your program can provide insight into how sensitive it may be to future climate variations. However, the past is an imperfect guide to the future, due in part to the possibility that future climate change may introduce conditions not previously experienced by the system. Changes unrelated to climate change (e.g., changing socioeconomic conditions, urbanization, etc.) may also make the past an unreliable guide.

ONE WAY to begin your retrospective assessment is to ask stakeholders and analysts about the extent to which they observed the impacts of past weather and climate variations, if there were differential impacts, and if/how they adapted.

SELECT THE RIGHT SOURCES OF HISTORICAL INFORMATION

Use the most appropriate information about past climate variability.

Information about past climate variability can be obtained from weather stations, remote sensing, and indigenous knowledge. Each has its strengths and weaknesses, which should be carefully weighed in the context of your specific needs.

WEATHER STATIONS

Weather stations record temperature, precipitation, wind and humidity at thousands of locations around the world. When aggregated over time, these weather data can be used to understand the climate and its variations. Weather station data often undergo some form of quality control and are relatively easy to analyze. However, they are not available in the form of a long-term, consistent record for all locations, particularly in remote parts of the world.

RAPID CLIMATE SCREENING ASSESSMENTS will typically use observations from weather stations for their historical information.

REMOTE SENSING

Remotely sensed observations of weather and climate data (e.g., from satellites) can be helpful because there is often global coverage. However, it important that these observations come from a trusted source and that their spatial resolution matches the development question or need (i.e., decision context). In addition, these observations may be more difficult to interpret than weather station data and their availability may be limited to the recent past. Combining weather station and remotely sensed observations may result in promising applications.

THE International Research Institute's *ENACTS Approach: Transforming Climate Services in Africa One Country at a Time* is one example of combining data from multiple sources.

INDIGENOUS KNOWLEDGE

Indigenous knowledge about weather extremes and climate variability from a variety of local sources (e.g., informal written or oral records) can extend back decades and even centuries. Used alone indigenous knowledge may be too imprecise and unreliable; and it may be challenging to compare people's memories of past events. However, when combined with scientific knowledge and data to generate a shared understanding of trends and anticipated changes between scientists and community members (e.g., as done in USAID's Mekong ARCC project), synergies can result in which both indigenous and scientific knowledge are enhanced.

INDIGENOUS RECORDS (e.g., of planting, budding, and harvest dates and the onset of the rainy season) may be highly trusted by local stakeholders.

CONSIDER THE TIMEFRAME OF THE CLIMATE RECORD

Use an appropriate duration of the climate record.

Some historical climate records are too short to reveal highly infrequent but extremely damaging climate extremes (e.g., 1 in 100-year floods or droughts). In addition, hydrometeorological records may mask or under-represent extreme events making it difficult to discern patterns and probability of occurrence from existing records. If your planning is sensitive to extremes not captured in short records, you may want to consult with a climate expert to help you better consider the probability of extreme events.

THIRTY YEARS OF CLIMATE DATA is the minimum recommended when it is most important to understand average climate conditions.

CONSIDER APPROPRIATE CLIMATE ASPECTS

Use the most appropriate information about future climate.

The extremes resulting from climate variability may be greater than those due to climate change, particularly over the next few years to decades. Ensuring resilience to climate variability is an important first step. If the impacts of your program are expected to persist for a decade or more, it may be important to consider information based on climate models. For programs with desired impacts in the 10-20 year timeframe, you should consider using the available climate information to customize scenarios of plausible climate futures. You can use the scenarios to assess potential risks from changes (percent increases or decreases) in key climate variables (dry and wet season duration and onset, daily precipitation, daily minimum and maximum temperatures, etc.).

IF the expected duration of the impacts of the program will be a decade or less, it may suffice to simply use an understanding of past climate variability and current trends as an approximation of near-future climate conditions.

CONSIDER A RANGE OF SCENARIOS

Consider a range of climate scenarios and use multiple climate models in estimating future climate conditions.

Different climate scenarios and models may provide different outputs. To bracket uncertainties in projections—and obtain a representative picture of the range of possible climate futures—climate scientists run a range of scenarios through multiple models numerous times. Be sure to consider all of these outputs and use a range of values to communicate understanding of likely futures accurately. Consideration of the full range of model outputs enables planning and programming that is robust to multiple possible futures. An appropriate range of scenarios is captured in USAID's national-level Climate Risk Profiles.

UNCERTAINTY IS LOWER when multiple models generate similar results for a particular scenario.

AVOID the scientifically indefensible temptation to identify a single, probable "best estimate" or to average outputs.

CONSIDER THE PROS AND CONS OF DOWNSCALED INFORMATION

Consider the pros and cons of using downscaled climate information in relation to the decisions that need to be informed by the assessment.

Global climate models produce information at roughly 100 km resolution. If it is important to have finer-scale information to inform your programming, consider using downscaled climate information. At the same time, it is important to recognize that downscaling may increase rather than decrease uncertainty, particularly in countries with poor hydrometeorological records, in small island states (which may be smaller than the resolution of most models), and at the local or city levels. Likewise, downscaling may increase uncertainty when simulating variations in extreme events.

The techniques for downscaling can produce high-resolution information, but it is important not to confuse that resolution with greater accuracy. Downscaling can be costly, time-consuming, and dependent on data quality and availability.

DOWNSCALING can generate climate information at resolutions as fine as 1-2 km, which can be particularly useful near coastlines and in mountainous regions where local climate and changes in topography may have a big impact on the projections.

FOR MORE DETAILS, see *USAID's review of downscaling methods* for climate projections.

CONSIDER UNCERTAINTIES OF DIFFERENT CLIMATE VARIABLES

Recognize that uncertainties differ among climate variables.

Model projections of future precipitation tend to have greater uncertainty than projections of future temperature. Projections from some models may even indicate that a particular location will become wetter while other models indicate the same location will become drier.

Pitfalls to Avoid When Using Climate Information

- Conducting or commissioning climate analyses that are too detailed or not tailored for the decisions they are meant to inform distracts from effectively managing climate risks and takes time and resources that could be dedicated to improving design or implementation.
- Using single, best-guess estimates of future conditions fails to consider a range of future scenarios as well as uncertainties, which in turn could lead to poor preparation, design and low resilience.
- Failing to account for the range of climate variability and extremes could likewise lead to spurious conclusions and designs that are not robust to a range of future conditions.
- Attributing observed impacts, trends or events to climate change based only on anecdotal evidence could lead to ineffective management of other risks and inefficient use of resources for design and implementation.
- Assuming that the uncertainties associated with climate change means that there is no useful climate information.

INFORMATION SOURCES

The tables that follow contain annotated lists of illustrative, credible climate information resources.

- **Assessments, Profiles and Tools**
  One of the best ways to quickly understand the nature of climate variability and change and their impacts is to review existing assessments, reports, and other studies that address your region and/or sector of interest.

- **Historical Climate Information and Future Projections**
  Various portals and web pages provide climate data and other related information. Some sources have curated the information making it easier to access and digest. The sources listed below are global in scope, but some focus on specific issues like drought and flood monitoring.

- **Regional Climate Platforms**
  Various national and regional platforms provide climate and related information and services. Three platforms are provided for illustration.

EASE OF USE refers to how much prior experience potential users will need to find, obtain and make good use of the climate information available through the site.

EASY means users need little prior experience and finding relevant information is quick and straightforward.

HARD means that the user must do some searching on the site to find useful / relevant information or that the user should have experience accessing and working with climate data to benefit from the site.

ASSESSMENTS, PROFILES AND TOOLS

One of the best ways to quickly understand the nature of climate variability and change and their impacts is to review existing assessments, reports, and other studies that address your region and/or sector of interest.

INFORMATION TYPE	SOURCE, LINK, ACCESS DATE	FORMAT	BRIEF DESCRIPTION	UPDATE FREQUENCY	EASE OF USE
Assessments, information and tools	**USAID** 10/12/17	Various	Various climate assessments, information fact sheets, and tools are available at Climatelinks.	Rolling	Easy
Country risk profiles	**USAID** 10/12/17	Brief profile	Brief, national-level summaries compiled from existing climate information, including brief analysis for select sectors.	Rolling	Easy
Climate risk management tools and sector annexes	**USAID** 10/12/17	Spreadsheet with annexes	Sector-specific annexes to USAID's CRM tools provide overviews and illustrative risks for 9 sectors.	Periodic	Easy
Country profiles	**World Bank** 10/12/17	Map interface with underlying data	The Climate Change Knowledge Portal provides climate risk and adaptation profiles for many countries. The portal also provides historical climate information (see below) as well as links to other sources of climate information and tools.	Periodic	Easy
Country profiles, data and adaptation plans	**World Bank** 10/12/17	Web page with summary and links to country plans	The Pilot Program for Climate Resiliency provides information on climate vulnerabilities of pilot countries as well as some useful socio-economic data and adaptation plans.	Periodic	Easy
Country profiles of natural hazards	**ThinkHazard!** 12/18/17	Web-based tool with country maps and narratives	ThinkHazard! enables non-specialists to consider potential impacts of disasters on new development projects. The tool provides a general view of climate and non-climate hazards, for a given location, that should be considered in project design and implementation to promote disaster and climate resilience. The tool highlights the likelihood of different natural hazards affecting project areas (very low, low, medium and high), provides guidance on how to reduce the impact of these hazards, and where to find more information.	Periodic	Easy

INFORMATION TYPE	SOURCE, LINK, ACCESS DATE	FORMAT	BRIEF DESCRIPTION	UPDATE FREQUENCY	EASE OF USE
National assessments	**UNFCCC** 10/12/17	Links to national communications	Member countries of the UN Framework Convention on Climate Change include national assessments in their periodic national communications. Although the technical quality of these reports is inconsistent, they may be relevant for development planning.	Rolling	Easy
International climate assessments	**IPCC** 10/12/17	Links to reports, graphics and presentations	Intergovernmental Panel on Climate Change (IPCC) assessments are the 'gold standard' for climate information. However, they do not provide country specific data, and are highly technical. Physical climate change is assessed in IPCC's Working Group (WG) I reports. Climate impacts and adaptation in the WG II reports.	Every few years	Hard
Country adaptation profiles	**UNDP** 10/12/17	Map interface	The Adaptation Learning Mechanism is a platform for sharing and learning on Global Environment Facility (GEF) financed adaptation projects. The nature of the resources varies, and the platform requires searching. Advanced search option may help if you are looking for a particular report or project.	Rolling	Hard
National adaptation plans	**UNFCCC** 10/12/17	Web site with links	NAP Central provides a repository of national adaptation plans (NAPs), but to date only a few developing countries have submitted their plans. The NAP Global Network is another source of national adaptation plans.	Periodic	Easy
Regional climate observations, projected changes, and impacts	**Asian Development Bank** 10/12/17	Report and Infographic	The Asian Development Bank and Potsdam Institute for Climate Impact Research report, A Region at Risk, provides an update on climate trends and projections for Asia and the Pacific. The report and associated infographic provide: a climate snapshot for the region, knowledge gaps for researchers, and insights to scale up efforts to build resilience. (Note: Similar reports are available for other regions; this is just an example).	N/A	Easy

HISTORICAL CLIMATE INFORMATION AND FUTURE PROJECTIONS

Various portals and web pages provide climate data and other related information. Some sources have curated the information making it easier to access and digest. The sources listed below are global in scope, but some focus on specific issues like drought and flood monitoring.

INFORMATION TYPE	SOURCE, LINK, ACCESS DATE	FORMAT	BRIEF DESCRIPTION	UPDATE FREQUENCY	EASE OF USE
Temperature and precipitation data and projections	**World Bank** 10/12/17	Map interface with links to data and graphics	The Climate Change Knowledge Portal provides monthly average temperature and precipitation data for many countries; the portal also provides global and downscaled climate model data from several climate models and for several greenhouse gas emission scenarios.	Periodic	Easy
Temperature and precipitation data and projections	**UNDP** 10/12/17	Web page summary with links to reports and observed and modeled data	The UNDP provides historical and projected temperature and precipitation data for 52 countries. The profiles include brief narratives as well as data tables, graphs, and maps, which summarize and illustrate the trends and projections. The web page also provides a link to documentation regarding the data included in the profiles.	N/A	Easy
Temperature and precipitation data	**ClimDex** 10/12/17	Web page with links to datasets and software	ClimDex provides data on temperature and precipitation extremes. However, the interface requires some familiarity with using large datasets and its main purpose is to facilitate research.	Periodic	Hard
Tropical cyclones	**NOAA** 10/12/17	Searchable map interface with filters	The National Oceanic and Atmospheric Administration (NOAA) provides track information on tropical cyclones in a map interface. This information may be useful for assessing tropical cyclone risk.	Rolling	Easy
Drought and flood data	**WMO and Global Water Partnership** 10/12/17	Searchable, sortable web database with links to drought indices	The Integrated Drought Management Program provides a wide array of global drought and flood information resources including a page on which indicators and indices may be most relevant for specific contexts and applications. Some searching is needed to obtain information you may want.	Periodic	Hard
Climate and land surface data and analytical services for decision support	**SERVIR** 10/12/17	Web portal with access to imagery, data, tools, products and maps	SERVIR, a joint program of NASA and USAID, provides remotely sensed data for a range of climate and land surface variables as well as products and services requested in USAID countries. The analytical services aim to provide decision support regarding specific questions for agriculture, water resources, and land use requested by target countries and partners. To access relevant information from the main site, select 'data and maps'.	Periodic	Hard

INFORMATION TYPE	SOURCE, LINK, ACCESS DATE	FORMAT	BRIEF DESCRIPTION	UPDATE FREQUENCY	EASE OF USE
Coastal flooding data	**Climate Central** 10/12/17	Visualization tool	Graphical interface provides visualizations of coastal flooding extent; provides links to similar tools for river floods, droughts, and other climate hazards.	Last updated Nov 2016	Easy
Sea level trends	**NOAA** 10/12/17	Map interface with trend data in summary and graph form	The US National Oceanic and Atmospheric Administration (NOAA) provides historical information on sea level trends in an easy-to-use map interface that provides quick links to underlying data for select coastal cities globally. Although this site is now a bit dated, it is included here because it is easy to use.	Last updated Oct 2013	Easy
Drought monitoring data	**U.S. Geological Survey** 10/12/17	Web platform with geospatial data, images and products	The Famine Early Warning Systems Network (FEWS NET) Data Portal provides access to geo-spatial data, satellite image products, and derived data products for use in food security monitoring with the goal of lowering the incidence of drought- or flood-induced famine.	Periodic	Hard
Climate data	**KNMI Explorer** 10/12/17	Tool for statistical analysis	This web application provides an interface for visualization and statistical analysis of climate data. It is mainly for research purposes; experience using models and understanding of climate variables are needed to obtain useful information from the tool. The Climatic Research Unit of the University of East Anglia and NASA's Goddard Institute for Space Studies provide similar data and tools.	Periodic	Hard
Climate data and projections	**Germany's International Climate Initiative** 10/12/17	Web-based platform	The Climate Impacts Global and Regional Adaptation Support Platform (CI: GRASP) aims to serve as a comprehensive climate information service platform to support adaptation planning. Substantial experience using models, impact chains, and understanding of climate variables are needed to obtain useful information from this site. We recommend limiting use of this site to the modules on climate stimuli and impact chains.	Periodic	Hard
Climate data	**Columbia University** 10/12/17	Portal with links to data and maps	Columbia's International Research Institute Climate Data Library contains hundreds of earth science and climate-related datasets. Experience using models and understanding of climate variables are needed to obtain useful information from the library.	Periodic	Hard
River discharge data	**Germany's Institute of Hydrology** 10/12/17	Web platform with links to datasets	The Global Runoff Data Center provides daily and monthly time series of river discharge on a global scale. Data downloads possible after official request from GRDC and are best used with GIS systems.	Rolling	Hard

REGIONAL CLIMATE PLATFORMS

Various national and regional platforms provide climate and related information and services. Three platforms are included here for illustration.

INFORMATION TYPE	SOURCE, LINK, ACCESS DATE	FORMAT	BRIEF DESCRIPTION	UPDATE FREQUENCY	EASE OF USE
Climate and hydrological observations and projections	**ICPAC** 11/3/17	Web portal with links to data, maps, tools	The Intergovernmental Authority on Development (IGAD) in Eastern Africa's Climate Prediction and Applications Centre (ICPAC) provides climate, hydrological, and other information and services to support development and build climate resilience in the Greater Horn of Africa.	Regular	Easy
Climate information meta-data about EAC countries	**EAC CC Knowledge Portal** 11/3/17	Meta-database with links to online climate information	The East African Community's Climate Change Knowledge Portal provides a variety of curated climate information as well as links to sources of climate data and related maps.	Periodic	Easy
Climate and hydrological observations and projections	**Centro Clima** 11/3/17	Web portal with links to data, maps, tools	Centro Clima is a regional portal managed by the Regional Committee of Hydrological Resources and the Meteorological Services of Central American countries and Dominican Republic. It provides climate and hydrological information from these countries and services as well as tools to apply the information to key sectors including agriculture, biodiversity, energy, fisheries, water, and risk management. Portal is in Spanish.	Regular	Easy