

Reference Sheet of Climate Adaptation Terms

The following list of terms are [defined](#) by the Intergovernmental Panel on Climate Change [Sixth Assessment Report](#) unless otherwise stated. Energy Division provides this list of terms for reference purposes only in advance of October 2, 2023, Phase II Procedural workshop.

1. **Business-As-Usual (BAU)** The term Business-As-Usual scenario has been used to describe a scenario that assumes no additional policies beyond those currently in place and that patterns of socio-economic development are consistent with recent trends. The term is now used less frequently than in the past.
2. **Cascading impacts** Cascading impacts from extreme weather/climate events occur when an extreme hazard generates a sequence of secondary events in natural and human systems that result in physical, natural, social or economic disruption, whereby the resulting impact is significantly larger than the initial impact. Cascading impacts are complex and multi-dimensional, and are associated more with the magnitude of vulnerability than with that of the hazard.
3. **Climate extreme (extreme weather or climate event)** The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense. When a pattern of extreme weather persists for some time, such as a season, it may be classified as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., high temperature, drought or heavy rainfall over a season). For simplicity, both extreme weather events and extreme climate events are referred to collectively as climate extremes.
4. **Climate model:** A qualitative or quantitative representation of the climate system based on the physical, chemical and biological properties of its components, their interactions and feedback processes and accounting for some of its known properties. The climate system can be represented by models of varying complexity; that is, for any one component or combination of components, a spectrum or hierarchy of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical or biological processes are explicitly represented, or the level at which empirical parametrisations are involved. There is an evolution towards more complex models with interactive chemistry and biology. Climate models are applied as a research tool to study and simulate the climate and for operational purposes, including monthly, seasonal and interannual climate predictions.
5. **Climate prediction:** A climate prediction or climate forecast is the result of an attempt to produce (starting from a particular state of the climate system) an estimate of the actual evolution of the climate in the future, for example, at seasonal, interannual or decadal time scales. Because the future evolution of the climate system may be highly sensitive to initial conditions, such predictions are usually probabilistic in nature.

6. **Climate projection:** Simulated response of the climate system to a scenario of future emissions or concentrations of greenhouse gases (GHGs) and aerosols and changes in land use, generally derived using climate models. Climate projections depend on an emission/concentration/radiative forcing scenario, which is in turn based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized.
7. **Climate simulation ensemble:** A group of parallel model simulations characterizing historical climate conditions, climate predictions or climate projections. Variation of the results across the ensemble members may give an estimate of modelling-based uncertainty. Ensembles made with the same model but different initial conditions characterize the uncertainty associated with internal climate variability, whereas multi-model ensembles including simulations by several models also include the effect of model differences. Perturbed parameter ensembles, in which model parameters are varied in a systematic manner, aim to assess the uncertainty resulting from internal model specifications within a single model. Remaining sources of uncertainty unaddressed with model ensembles are related to systematic model errors or biases, which may be assessed from systematic comparisons of model simulations with observations wherever available.
8. **Climate system:** The global system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the lithosphere and the biosphere and the interactions between them. The climate system changes in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions, solar variations, orbital forcing, and anthropogenic forcings such as the changing composition of the atmosphere and land-use change.
9. **Climate variability:** Deviations of some climate variables from a given mean state (including the occurrence of extremes, etc.) at all spatial and temporal scales beyond that of individual weather events. Variability may be intrinsic, due to fluctuations of processes internal to the climate system (internal variability), or extrinsic, due to variations in natural or anthropogenic external forcing (forced variability).
10. **Climatic driver (Climate driver):** A changing aspect of the climate system that influences a component of a human or natural system.
11. **Confidence:** The robustness of a finding based on the type, amount, quality and consistency of evidence (e.g., mechanistic understanding, theory, data, models, expert judgment) and on the degree of agreement across multiple lines of evidence.
12. **Coupled Model Intercomparison Project (CMIP):** A climate modeling activity from the World Climate Research Program (WCRP) which coordinates and archives climate model simulations based on shared model inputs by modelling groups from around the world. The CMIP3 multi-model data set includes projections using Special Report on Emissions Scenarios (SRES) scenarios. The CMIP5 data set includes projections using the

Representative Concentration Pathways (RCP). The CMIP6 phase involves a suite of common model experiments as well as an ensemble of CMIP-endorsed Model Intercomparison Projects (MIPs).

13. **Downscaling:** A method that derives local- to regional-scale information from larger-scale models or data analyses. Two main methods exist: dynamical downscaling and empirical/statistical downscaling. The dynamical method uses the output of regional climate models, global models with variable spatial resolution or high-resolution global models. The empirical/statistical methods are based on observations and develop statistical relationships that link the large-scale atmospheric variables with local/regional climate variables. In all cases, the quality of the driving model remains an important limitation on the quality of the downscaled information. The two methods can be combined, for example, applying empirical/statistical downscaling to the output of a regional climate model, consisting of a dynamical downscaling of a global climate model.
14. **Emissions:**
 - a. **Anthropogenic emissions:** Emissions of greenhouse gases (GHGs), precursors of GHGs and aerosols caused by human activities. These activities include the burning of fossil fuels, deforestation, land use and land-use changes (LULUC), livestock production, fertilization, waste management and industrial processes.
 - b. **Fossil-fuel emissions:** Emissions of greenhouse gases (in particular, carbon dioxide), other trace gases and aerosols resulting from the combustion of fuels from fossil carbon deposits such as oil, gas and coal.
 - c. **Non-CO2 emissions and radiative forcing:** Non-CO2 emissions included in this report are all anthropogenic emissions other than CO2 that result in radiative forcing. These include short-lived climate forcers, such as methane (CH4), some fluorinated gases, ozone (O3) precursors, aerosols or aerosol precursors, such as black carbon and sulphur dioxide, respectively, as well as long-lived greenhouse gases, such as nitrous oxide (N2O) or other fluorinated gases. The radiative forcing associated with non-CO2 emissions and changes in surface albedo is referred to as non-CO2 radiative forcing.
15. **Extreme weather event:** An event that is rare at a particular place and time of year. Definitions of ‘rare’ vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense.
16. **Global mean surface temperature (GMST):** The estimated global average of near-surface air temperatures over land and sea ice, and sea surface temperature (SST) over ice-free ocean regions, with changes normally expressed as departures from a value over a specified reference period.

17. **Global warming:** Global warming refers to the increase in global surface temperature relative to a baseline reference period, averaging over a period sufficient to remove interannual variations (e.g., 20 or 30 years). A common choice for the baseline is 1850–1900 (the earliest period of reliable observations with sufficient geographic coverage), with more modern baselines used depending upon the application.
18. **Likelihood:** The chance of a specific outcome occurring, where this might be estimated probabilistically.
19. **Low-likelihood, high-impact outcomes:** Outcomes/events whose probability of occurrence is low or not well known (as in the context of deep uncertainty) but whose potential impacts on society and ecosystems could be high. To better inform risk assessment and decision-making, such low-likelihood outcomes are considered if they are associated with very large consequences and may therefore constitute material risks, even though those consequences do not necessarily represent the most likely outcome. See also Impacts.
20. **Pathways:** The temporal evolution of natural and/or human systems towards a future state. Pathway concepts range from sets of quantitative and qualitative scenarios or narratives of potential futures to solution-oriented decision-making processes to achieve desirable societal goals. Pathway approaches typically focus on biophysical, techno-economic and/or socio-behavioral trajectories and involve various dynamics, goals and actors across different scales.
 - a. **Representative Concentration Pathways (RCPs):** Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases (GHGs) and aerosols and chemically active gases, as well as land use/land cover (Moss et al., 2008; van Vuuren et al., 2011). The word ‘representative’ signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics. The term pathway emphasizes the fact that not only the long-term concentration levels, but also the trajectory taken over time to reach that outcome are of interest (Moss et al., 2010; van Vuuren et al., 2011). RCPs usually refer to the portion of the concentration pathway extending up to 2100, for which integrated assessment models produced corresponding emission scenarios. Extended concentration pathways describe extensions of the RCPs from 2100 to 2300 that were calculated using simple rules generated by stakeholder consultations, and do not represent fully consistent scenarios. Four RCPs produced from integrated assessment models were selected from the published literature and are used in the Fifth IPCC Assessment and are also used in this Assessment for comparison, spanning the range from approximately below 2°C warming to high (>4°C) warming best-estimates by the end of the 21st century: RCP2.6, RCP4.5 and RCP6.0, and RCP8.5.
 - i. RCP2.6: One pathway where radiative forcing peaks at approximately 3 W m⁻² and then declines to be limited at 2.6 W m⁻² in 2100 (the corresponding Extended Concentration Pathway, or ECP, has constant emissions after 2100).

- ii. RCP4.5 and RCP6.0: Two intermediate stabilisation pathways in which radiative forcing is limited at approximately 4.5 W m^{-2} and 6.0 W m^{-2} in 2100 (the corresponding ECPs have constant concentrations after 2150).
 - iii. RCP8.5: One high pathway which leads to $>8.5 \text{ W m}^{-2}$ in 2100 (the corresponding ECP has constant emissions after 2100 until 2150 and constant concentrations after 2250).
 - b. ***Shared socio-economic pathways (SSPs)***: Shared socio-economic pathways (SSPs) have been developed to complement the Representative Concentration Pathways (RCPs). By design, the RCP emission and concentration pathways were stripped of their association with a certain socio-economic development. Different levels of emissions and climate change along the dimension of the RCPs can hence be explored against the backdrop of different socio-economic development pathways (SSPs) on the other dimension in a matrix. This integrative SSP-RCP framework is now widely used in the climate impact and policy analysis literature (see, e.g., <http://iconics-ssp.org>), where climate projections obtained under the RCP scenarios are analysed against the backdrop of various SSPs. As several emission updates were due, a new set of emission scenarios was developed in conjunction with the SSPs. Hence, the abbreviation SSP is now used for two things: On the one hand SSP1, SSP2, ..., SSP5 is used to denote the five socio-economic scenario families. On the other hand, the abbreviations SSP1-1.9, SSP1-2.6, ..., SSP5-8.5 are used to denote the newly developed emission scenarios that are the result of an SSP implementation within an integrated assessment model. Those SSP scenarios are bare of climate policy assumption, but in combination with so-called shared policy assumptions (SPAs), various approximate radiative forcing levels of 1.9, 2.6, ..., or 8.5 W m^{-2} are reached by the end of the century, respectively.
21. **Percentiles**: A partition value in a population distribution that a given percentage of the data values are below or equal to. The 50th percentile corresponds to the median of the population. Percentiles are often used to estimate the extremes of a distribution. For example, the 90th (10th) percentile may be used to refer to the threshold for the upper (lower) extremes.
22. **Predictability**: The extent to which future states of a system may be predicted based on knowledge of current and past states of the system. Because knowledge of the climate system's past and current states is generally imperfect, as are the models that utilise this knowledge to produce a climate prediction, and because the climate system is inherently nonlinear and chaotic, the predictability of the climate system is inherently limited. Even with arbitrarily accurate models and observations, there may still be limits to the predictability of such a nonlinear system (AMS, 2000).
23. **Radiative forcing**: The change in the net, downward minus upward, radiative flux (expressed in W m^{-2}) at the tropopause or top of atmosphere due to a change in an (external) driver of climate change, such as a change in the concentration of carbon dioxide (CO_2), the concentration of volcanic aerosols or the output of the Sun. The traditional

radiative forcing is computed with all tropospheric properties held fixed at their unperturbed values, and after allowing for stratospheric temperatures, if perturbed, to readjust to radiative-dynamical equilibrium. Radiative forcing is called instantaneous if no change in stratospheric temperature is accounted for. The radiative forcing once rapid adjustments are accounted for is termed the effective radiative forcing. Radiative forcing is not to be confused with cloud radiative forcing, which describes an unrelated measure of the impact of clouds on the radiative flux at the top of the atmosphere.

24. **Resolution:** In climate models, this term refers to the physical distance (meters or degrees) between each point on the grid used to compute the equations. Temporal resolution refers to the time step or time elapsed between each model computation of the equations.
25. **Scenario:** A plausible description of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces (e.g., rate of technological change (TC), prices) and relationships. Note that scenarios are neither predictions nor forecasts but are used to provide a view of the implications of developments and actions.
 - a. **Baseline (or Reference) Scenario:** The scenario used as starting or reference point for a comparison between two or more scenarios. [**Note 1:** In many types of climate change research, reference scenarios reflect specific assumptions about patterns of socio-economic development and may represent futures that assume no climate policies or specified climate policies, for example those in place or planned at the time a study is carried out. Reference scenarios may also represent futures with limited or no climate impacts or adaptation, to serve as a point of comparison for futures with impacts and adaptation. These are also referred to as baseline scenarios in the literature. **Note 2:** Reference scenarios can also be climate policy or impact scenarios, which in that case are taken as a point of comparison to explore the implications of other features, for example, of delay, technological options, policy design and strategy or to explore the effects of additional impacts and adaptation beyond those represented in the reference scenario. **Note 3:** The term Business-As-Usual scenario has been used to describe a scenario that assumes no additional policies beyond those currently in place and that patterns of socio-economic development are consistent with recent trends. The term is now used less frequently than in the past. **Note 4:** In climate change, attribution or impact attribution research reference scenarios may refer to counterfactual historical scenarios assuming no anthropogenic greenhouse gas emissions (climate change attribution) or no climate change (impact attribution)].
 - b. **Concentration scenario:** A plausible representation of the future development of atmospheric concentrations of substances that are radiatively active (e.g., greenhouse gases (GHGs), aerosols, tropospheric ozone), plus human induced land-cover changes that can be radiatively active via albedo changes, and often used as input to a climate model to compute climate projections.
 - c. **Emission scenario:** A plausible representation of the future development of emissions of substances that are radiatively active (e.g., greenhouse gases (GHGs) or aerosols) based on a coherent and internally consistent set of assumptions about

driving forces (such as demographic and socio-economic development, technological change, energy and land use) and their key relationships.

- d. ***Socio-economic scenario***: A scenario that describes a possible future in terms of population, gross domestic product (GDP), and other socio-economic factors relevant to understanding the implications of climate change.
26. **Spatial and temporal scales**: Climate may vary on a large range of spatial and temporal scales. Spatial scales may range from local (less than 100,000 km²), through regional (100,000 to 10 million km²) to continental (10–100 million km²). Temporal scales may range from seasonal to geological (up to hundreds of millions of years).
27. **Uncertainty**: A state of incomplete knowledge that can result from a lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from imprecision in the data to ambiguously defined concepts or terminology, incomplete understanding of critical processes or uncertain projections of human behavior. Uncertainty can therefore be represented by quantitative measures (e.g., a probability density function) or by qualitative statements (e.g., reflecting the judgement of a team of experts) (Moss and Schneider, 2000; IPCC, 2004; Mastrandrea et al., 2010).
- a. ***Deep uncertainty***: A situation of deep uncertainty exists when experts or stakeholders do not know or cannot agree on: (1) appropriate conceptual models that describe relationships among key driving forces in a system, (2) the probability distributions used to represent uncertainty about key variables and parameters and/or (3) how to weigh and value desirable alternative outcomes (Lempert et al., 2003).