

**Annex I: Glossary**

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**Notes:** This Glossary defines some specific terms as the Lead Authors intend them to be interpreted in the context of this report.

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**Ablation** All processes that reduce the mass of a glacier or snow pack. The main processes are melting and for glaciers also calving (or, when the glacier nourishes an ice shelf, ice discharge across the grounding line), but other processes such as sublimation and loss of windborne snow can be significant as well. The term is also used to express the mass lost by any of these processes. See also *Calving*, *Glacier*, and *Ice shelf*.

**Abrupt climate change** A large-scale change in the climate system that takes place over a few decades or less, persists (or is anticipated to persist) for at least a few decades, and causes substantial disruptions in human and natural systems. See also *Climate change*, *Human system*, and *Natural systems*.

**Adaptability** See *Adaptive capacity*.

**Adaptation** In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.

**Ecosystem-based adaptation (EBA)** The use of ecosystem management activities to increase the resilience and reduce the vulnerability of people and ecosystems to climate change [based on IUCN definition].

**Evolutionary adaptation** The process whereby a species or population becomes better able to live in a changing environment, through the selection of heritable traits. Biologists usually distinguish evolutionary adaptation from acclimatization, with the latter occurring within an organism's lifetime.

**Incremental adaptation** In some cases, incremental adaptation can accrue to result in transformational adaptation (Tàbara et al., 2018; Termeer et al., 2017). Incremental adaptations to change in climate are understood as extensions of actions and behaviours that already reduce the losses or enhance the benefits of natural variations in climate and extreme events.

**Transformational adaptation** Adaptation responses that will be required in the face of a global failure to mitigate the causes of anthropogenic climate change and are characterized by system-wide change or changes across more than one systems; by a focus on the future and long-term change; or by a direct questioning of the effectiveness of existing systems, social injustices and power imbalances.

**Adaptation limits** The point at which an actor's objectives (or system needs) cannot be secured from intolerable risks through adaptive actions. Hard adaptation limit - No adaptive actions are possible to avoid intolerable risks. Soft adaptation limit - Options may exist but are currently not available to avoid intolerable risks through adaptive action.

See also *Adaptation options*, *Adaptive capacity*, and *Maladaptive actions (Maladaptation)*.

**Adaptation limits** See *Adaptation*.

**Adaptation options.** The array of strategies and measures that are available and appropriate for addressing adaptation. They include a wide range of actions that can be categorized as structural, institutional, ecological or behavioural. See also *Adaptation*.

**Adaptation pathways** See *Pathways*.

**Adaptive capacity** The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. This glossary entry builds from definitions used in previous IPCC reports and the Millennium Ecosystem Assessment (MEA, 2005). See also *Adaptation*.

**Adaptive governance** See *Governance*.

**Aerosol** A suspension of airborne solid or liquid particles, with a typical size between a few nanometres and 10 µm that reside in the atmosphere for at least several hours. The term aerosol, which includes both the particles and the suspending gas, is often used in this report in its plural form to mean aerosol particles. Aerosols may be of either natural or anthropogenic origin. Aerosols may influence climate in several ways: directly through scattering and absorbing radiation, and indirectly by acting as cloud condensation nuclei or ice nuclei, modifying the optical properties and lifetime of clouds or upon deposition on snow or ice covered surfaces thereby altering their albedo and contributing to climate feedback. Atmospheric aerosols, whether natural or anthropogenic, originate from two different pathways: emissions of primary particulate matter (PM), and formation of secondary PM from gaseous precursors. The bulk of aerosols are of natural origin. Some scientists use group labels that refer to the chemical composition, namely: sea salt, organic carbon, black carbon (BC), mineral species (mainly desert dust), sulphate, nitrate, and ammonium. These labels are, however, imperfect as aerosols combine particles to create complex mixtures. See also *Albedo*, *Black carbon (BC)*, and *Precursors*.

**Agreement** In this report, the degree of agreement within the scientific body of knowledge on a particular finding is assessed based on multiple lines of evidence (e.g., mechanistic understanding, theory, data, models, expert judgement) and expressed qualitatively (Mastrandrea et al., 2010). See also *Evidence*, *Confidence*, *Likelihood*, and *Uncertainty*.

**Albedo** The proportion of sunlight (solar radiation) reflected by a surface or object. Clouds, snow and ice usually have high albedo; soils cover the range from high to low, whilst vegetation and the ocean have low albedo.

**Alien (non-native) species** An introduced species (alien species, exotic species, non-indigenous species, or non-native species) living outside its native distributional range, but which has arrived there by human activity, either deliberate or accidental. Non-native species can have various effects and adversely affect the local ecosystem. See also *Endemic species*, and *Invasive species*.

**Anomaly** The deviation of a variable from its value averaged over a reference period. See also *Reference period*.

**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, fertilisation, waste management, and industrial processes. See also *Anthropogenic*, *Greenhouse gas (GHG)*, and *Land use*.

**Anthropogenic** Resulting from or produced by human activities. See also *Anthropogenic emissions*.

**Atlantic Meridional Overturning Circulation (AMOC)** See *Meridional Overturning Circulation (MOC)*.

**Atmosphere** The gaseous envelope surrounding the Earth, divided into five layers — the troposphere which contains half of the Earth's atmosphere, the stratosphere, the mesosphere, the thermosphere, and the exosphere, which is the outer limit of the atmosphere. The dry atmosphere consists almost entirely of nitrogen (78.1% volume mixing ratio) and oxygen (20.9% volume mixing ratio), together with a number of trace gases, such as argon (0.93% volume mixing ratio), helium and radiatively active greenhouse gases such as carbon dioxide (CO<sub>2</sub>, 0.035% volume mixing ratio) and ozone (O<sub>3</sub>). In addition, the atmosphere contains the greenhouse gas water vapour (H<sub>2</sub>O), whose amounts are highly variable but typically around 1% volume mixing ratio. The atmosphere also contains clouds and aerosols. See also *Carbon dioxide (CO<sub>2</sub>)*, *Greenhouse gas (GHG)*, *Hydrological cycle*, and *Ozone (O<sub>3</sub>)*.

**Attribution** See *Detection and Attribution*.

**Biodiversity** or biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of

which they are part; this includes diversity within species, between species and of ecosystems (UN, 1992). See also *Ecosystem*, and *Ecosystem service*.

**Biomass** Living or recently-dead organic material.

**Black carbon (BC)** A relatively pure form of carbon, also known as soot, arising from the incomplete combustion of fossil fuels, biofuel, and biomass. It stays in the atmosphere only for days or weeks. Black carbon is a climate forcing agent with strong warming effect, both in the atmosphere and when deposited on snow or ice. See also *Atmosphere*.

**Blue carbon** In broad terms, the organic carbon that is sequestered in the ocean (for climate-relevant time spans). Further, the concept recognizes "coastal blue carbon" (also known as "coastal wetland blue carbon"; Howard et al. 2017) as the carbon stored in mangroves, tidal salt marshes, seagrass meadows, and other inter-tidal ecosystems within the soil, the living biomass above ground (leaves, branches, stems), the living biomass below ground (roots and rhizomes), and the non-living biomass (litter and dead wood) (Howard et al. 2014). In addition, "ocean blue carbon" includes carbon in ocean sediments, phytoplankton and other forms of stored carbon in the open ocean and deep sea. Some of these stocks and sinks are actionable options through blue carbon mitigation and adaptation options (e.g. conservation, restoration, habitat creation, etc.), and some are not (pending further scientific and technological knowledge, and policy-relevant mechanisms). See also *Ecosystem service*, and *Carbon sequestration*.

**Business as usual (BAU) scenarios** or projections are based on the assumption that operating practices and policies remain as they are at present. Although baseline scenarios could incorporate some specific features of BAU scenarios (e.g., a ban on a specific technology), BAU scenarios imply that no practices or policies other than the current ones are in place. See also *Emission scenario*, *Representative Concentration Pathways* (under *Pathways*), and *Scenario*.

**Calving** The process of mechanical destruction of ice usually typical for marine-terminating glaciers. In the latter case the ice calving lead to the formation of icebergs. See also *Glacier*, and *Marine Ice Cliff Instability (MICI)*.

**Carbon budget** refers to three concepts in the literature: (1) an assessment of carbon cycle sources and sinks on a global level, through the synthesis of evidence for fossil-fuel and cement emissions, land use change emissions, ocean and land CO<sub>2</sub> sinks, and the resulting atmospheric CO<sub>2</sub> growth rate. This is referred to as the global carbon budget; (2) the estimated cumulative amount of global carbon dioxide emissions that is estimated to limit global surface temperature to a given level above a reference period, taking into account global surface temperature contributions of other GHGs and climate forcers; (3) the distribution of the carbon budget defined under (2) to the regional, national, or sub-national level based on considerations of equity, costs or efficiency.

**Carbon cycle** The flow of carbon (in various forms, e.g., as carbon dioxide (CO<sub>2</sub>), carbon in biomass, and carbon dissolved in the ocean as carbonate and bicarbonate) through the atmosphere, hydrosphere, ocean, terrestrial and marine biosphere and lithosphere. In this report, the reference unit for the global carbon cycle is GtCO<sub>2</sub> or GtC (Gigatonne = 1 Gt = 10<sup>15</sup> grams. This corresponds to 3.667 GtCO<sub>2</sub>). See also *Atmosphere*, *Carbon dioxide (CO<sub>2</sub>)*, and *Ocean acidification (OA)*.

**Carbon dioxide (CO<sub>2</sub>)** A naturally occurring gas, CO<sub>2</sub> is also a by-product of burning fossil fuels (such as oil, gas and coal), of burning biomass, of land use changes (LUC) and of industrial processes (e.g., cement production). It is the principal anthropogenic greenhouse gas (GHG) that affects the Earth's radiative balance. It is the reference gas against which other GHGs are measured and therefore has a Global Warming Potential (GWP) of 1. See also *Greenhouse Gas (GHG)*, and *Ocean acidification (OA)*.

**Carbon price** The price for avoided or released carbon dioxide (CO<sub>2</sub>) or CO<sub>2</sub>-equivalent emissions. This may refer to the rate of a carbon tax, or the price of emission permits. In many models that are used to assess the economic costs of mitigation, carbon prices are used as a proxy to represent the level of effort in mitigation policies. See also *Mitigation*.

**Carbon sequestration** See *Sequestration*.

**Carbon sink** See *Sink*.

**Cascading impacts** can occur when societal or infrastructural capacities are exceeded. Initially, vulnerability may be low because critical services and infrastructure required by exposed sectors of society are available. However, vulnerability increases with subsequent events as these services and infrastructure fail. See also *Impacts (consequences, outcomes)*, and *Vulnerability*.

**Climate** in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.

**Climate change** A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes. See also *Climate variability*, *Global warming*, *Ocean acidification (OA)*, and *Detection and Attribution*.

**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. For simplicity, both extreme weather events and extreme climate events are referred to collectively as 'climate extremes'. See also *Extreme weather / climate event*.

**Climate feedback** An interaction in which a perturbation in one climate quantity causes a change in a second and the change in the second quantity ultimately leads to an additional change in the first. A negative feedback is one in which the initial perturbation is weakened by the changes it causes; a positive feedback is one in which the initial perturbation is enhanced. The initial perturbation can either be externally forced or arise as part of internal variability.

**Climate governance** See *Governance*.

**Climate model** A numerical 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 parametrizations are involved. There is an evolution towards more complex models with interactive chemistry and biology scenarios. 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. See also *Earth system model (ESM)*.

**Climate projection** A simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases (GHGs) and aerosols, generally derived using climate models. Climate projections are distinguished from climate predictions by their dependence on the emission / concentration / radiative forcing scenario used, which is in turn based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized.

**Climate-resilient development pathways (CRDPs)** Trajectories that strengthen sustainable development and efforts to eradicate poverty and reduce inequalities while promoting fair and cross-scalar adaptation to and resilience in a changing climate. They raise the ethics, equity, and feasibility aspects of the deep societal transformation needed to drastically reduce emissions to limit global warming (e.g., to 1.5°C) and achieve desirable and liveable futures and well-being for all.

**Climate sensitivity** The change in the annual global mean surface temperature in response to a change in the atmospheric CO<sub>2</sub> concentration or other radiative forcing.

**Equilibrium climate sensitivity** The equilibrium (steady state) change in the annual global mean surface temperature following a doubling of the atmospheric carbon dioxide (CO<sub>2</sub>) concentration. As a true equilibrium is challenging to define in climate models with dynamic oceans, the equilibrium climate sensitivity is often estimated through experiments in AOGCMs where CO<sub>2</sub> levels are either quadrupled or doubled from pre-industrial levels and which are integrated for 100–200 years. The climate sensitivity parameter (units: °C (W m<sup>-2</sup>)<sup>-1</sup>) refers to the equilibrium change in the annual global mean surface temperature following a unit change in radiative forcing.

**Climate system** The highly complex, 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 and anthropogenic forcings such as the changing composition of the atmosphere and land-use change.

**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 to variations in natural or anthropogenic external forcing (forced variability). See also *Climate change*.

**Coast** The land near to the sea. The term ‘coastal’ can refer to that land (e.g., coastal communities), or to that part of the marine environment that is strongly influenced by land-based processes. Thus coastal seas are generally shallow and near-shore. The landward and seaward limits of the coastal zone are not consistently defined, neither scientifically nor legally. Thus coastal waters can either be considered as equivalent to territorial waters (extending 12 nautical miles/22.2 km from mean low water), or to the full Exclusive Economic Zone, or to shelf seas, with less than 200 m water depth.

**Co-benefits** The positive effects that a policy or measure aimed at one objective might have on other objectives, thereby increasing the total benefits for society or the environment. Co-benefits are often subject to uncertainty and depend on local circumstances and implementation practices, among other factors. Co-benefits are also referred to as ancillary benefits.

**Compound events** [PLACEHOLDER FOR FINAL DRAFT]

**Compound risks** arise from the interaction of hazards, which may be characterized by single extreme events or multiple coincident or sequential events that interact with exposed systems or sectors.

**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. In this report, confidence is expressed qualitatively (Mastrandrea et al., 2010). See Section 1.8.3 for the list of confidence levels used. See also *Agreement, Evidence, Likelihood, and Uncertainty*.

**Coral reef** An underwater ecosystem characterized by structure-building stony corals. Warm-water coral reefs occur in shallow seas, mostly in the tropics, with the corals (animals) containing algae (plants) that depend on light and relatively stable temperature conditions. Cold-water coral reefs occur throughout the world, mostly at water depths of 50–500 m. In both kinds of reef, living corals frequently grow on older,

dead material, predominantly made of calcium carbonate. Both warm and cold-water coral reefs support high biodiversity of fish and other groups, and are considered to be especially vulnerable to climate change. See also *Ocean acidification (OA)*.

**Cost-benefit analysis** Monetary assessment of all negative and positive impacts associated with a given action. Cost-benefit analysis enables comparison of different interventions, investments or strategies and reveal how a given investment or policy effort pays off for a particular person, company or country. Cost-benefit analyses representing society's point of view are important for climate change decision making, but there are difficulties in aggregating costs and benefits across different actors and across timescales. See also *Discounting*.

**Cost-effectiveness** A measure of the cost at which policy goal or outcome is achieved. The lower the cost, the greater the cost-effectiveness. See also *Private costs*.

**Coupled Model Intercomparison Project (CMIP)** A climate modelling activity from the World Climate Research Programme (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 SRES scenarios. The CMIP5 data set includes projections using the Representative Concentration Pathways. The CMIP6 phase involves a suite of common model experiments as well as an ensemble of CMIP-endorsed Model Intercomparison Projects (MIPs).

**Cumulative emissions** The total amount of emissions released over a specified period of time. See also *Carbon budget*.

**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 as representations of these conceptual models, and/or; (3) how to value the desirability of alternative outcomes.

**Deforestation** Conversion of forest to non-forest. [Footnote: For a discussion of the term forest and related terms such as afforestation, reforestation and deforestation in the context of National GHG inventories, see the 2006 IPCC Guidelines for National GHG Inventories and information provided by the United Nations Framework Convention on Climate Change (UNFCCC, 2013).] See also *Forest*.

**Detection** See *Detection and Attribution*.

**Detection and attribution** Detection of change is defined as the process of demonstrating that climate or a system affected by climate has changed in some defined statistical sense, without providing a reason for that change. An identified change is detected in observations if its likelihood of occurrence by chance due to internal variability alone is determined to be small, for example, <10%. Attribution is defined as the process of evaluating the relative contributions of multiple causal factors to a change or event with an assignment of statistical confidence (Hegerl et al., 2010).

**Developed / developing countries (Industrialised / developed / developing countries)** There are a diversity of approaches for categorizing countries on the basis of their level of development, and for defining terms such as industrialised, developed, or developing. Several categorizations are used in this report. (1) In the United Nations system, there is no established convention for the designation of developed and developing countries or areas. (2) The United Nations Statistics Division specifies developed and developing regions based on common practice. In addition, specific countries are designated as least developed countries, landlocked developing countries, small island developing states, and transition economies. Many countries appear in more than one of these categories. (3) The World Bank uses income as the main criterion for classifying countries as low, lower middle, upper middle, and high income. (4) The United Nations Development Programme (UNDP) aggregates indicators for life expectancy, educational attainment, and income into a single composite Human Development Index (HDI) to classify countries as low, medium, high, or very high human development.

**Development pathways** See *Pathways*.

**Disaster** The United Nations International Strategy for Disaster Reduction (UNISDR) defines a disaster as a “serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts” (UNISDR\_2017; <https://www.unisdr.org/we/inform/terminology#letter-d>). See also *Exposure*, *Hazard*, *Risk*, and *Vulnerability*.

**Disaster risk management (DRM)** Processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response, and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life, and sustainable development. See also *Disaster*, and *Sustainable development (SD)*.

**Discounting** A mathematical operation that aims to make monetary (or other) amounts received or expended at different times (years) comparable across time. The discounter uses a fixed or possibly time-varying discount rate from year to year that makes future value worth less today (if the discount rate is positive). The choice of discount rate(s) is debated as it is a judgement based on hidden and/or explicit values.

**Discount rate** See *Discounting*.

**Downscaling** A method that derives local- to regional-scale (up to 100 km) 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 quality of the downscaled information. The two methods can be combined, e.g., applying empirical/statistical downscaling to the output of a regional climate model, consisting of a dynamical downscaling of a global climate model. See also *Climate model*.

**Drought** A period of abnormally dry weather long enough to cause a serious hydrological imbalance. Drought is a relative term; therefore any discussion in terms of precipitation deficit must refer to the particular precipitation-related activity that is under discussion. For example, shortage of precipitation during the growing season impinges on crop production or ecosystem function in general (due to soil moisture drought, also termed agricultural drought) and during the runoff and percolation season primarily affects water supplies (hydrological drought). Storage changes in soil moisture and groundwater are also affected by increases in actual evapotranspiration in addition to reductions in precipitation. A period with an abnormal precipitation deficit is defined as a meteorological drought. See also *Soil moisture*, and *Heatwave*.

**Megadrought** A very lengthy and pervasive drought, lasting much longer than normal, usually a decade or more.

**Early warning systems (EWS)** The set of technical, financial and institutional capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare to act promptly and appropriately to reduce the possibility of harm or loss. Dependent upon context, EWS may draw upon scientific and/or Indigenous knowledge. EWS are also considered for ecological applications, e.g., conservation, where the organisation itself is not threatened by hazard but the ecosystem under conservation is (an example is coral bleaching alerts), in agriculture (for example, warnings of ground frost, hailstorms) and in fisheries (storm and tsunami warnings). This glossary entry builds from the definitions used in This glossary entry builds from the definitions used in UNISDR (2009) and IPCC (2012a).



**Earth system model (ESM)** A coupled atmosphere–ocean general circulation model in which a representation of the carbon cycle is included, allowing for interactive calculation of atmospheric CO<sub>2</sub> or compatible emissions. Additional components (e.g., atmospheric chemistry, ice sheets, dynamic vegetation, nitrogen cycle, but also urban or crop models) may be included. See also *Climate model*.

**Ecosystem** A functional unit consisting of living organisms, their non-living environment and the interactions within and between them. The components included in a given ecosystem and its spatial boundaries depend on the purpose for which the ecosystem is defined: in some cases they are relatively sharp, while in others they are diffuse. Ecosystem boundaries can change over time. Ecosystems are nested within other ecosystems and their scale can range from very small to the entire biosphere. In the current era, most ecosystems either contain people as key organisms, or are influenced by the effects of human activities in their environment. See also *Ecosystem services*.

**Ecosystem-based adaptation (EBA)** See *Adaptation*.

**Ecosystem services** Ecological processes or functions having monetary or non-monetary value to individuals or society at large. These are frequently classified as (1) supporting services such as productivity or biodiversity maintenance, (2) provisioning services such as food or fibre, (3) regulating services such as climate regulation or carbon sequestration and (4) cultural services such as tourism or spiritual and aesthetic appreciation. See also *Ecosystem*.

**El Niño-Southern Oscillation (ENSO)** The term El Niño was initially used to describe a warm-water current that periodically flows along the coast of Ecuador and Peru, disrupting the local fishery. It has since become identified with warming of the tropical Pacific Ocean east of the dateline. This oceanic event is associated with a fluctuation of a global-scale tropical and subtropical surface pressure pattern called the Southern Oscillation. This coupled atmosphere-ocean phenomenon, with preferred time scales of two to about seven years, is known as the El Niño-Southern Oscillation (ENSO). It is often measured by the surface pressure anomaly difference between Tahiti and Darwin and/or the sea surface temperatures in the central and eastern equatorial Pacific. During an ENSO event, the prevailing trade winds weaken, reducing upwelling and altering ocean currents such that the sea surface temperatures warm, further weakening the trade winds. This phenomenon has a great impact on the wind, sea surface temperature and precipitation patterns in the tropical Pacific. It has climatic effects throughout the Pacific region and in many other parts of the world, through global teleconnections. The cold phase of ENSO is called La Niña.

**Emission pathways** See *Pathways*.

**Emission scenario** A plausible representation of the future development of emissions of substances that are radiatively active (e.g., greenhouse gases (GHGs), 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. Concentration scenarios, derived from emission scenarios, are often used as input to a climate model to compute climate projections. See also *Mitigation scenario*, *Representative Concentration Pathways (RCPs)*, under *Pathways*, *Shared socio-economic pathways (SSPs)*, under *Pathways*, and *Scenario*.

**Endemic species** Plants and animals that are only found in one geographic region (Gallardo et al. 2018). See also *Invasive species*, and *Alien (non-native) species*.

**Enhanced weathering** A proposed method to increase the natural rate of removal of carbon dioxide from the atmosphere by silicate and carbonate rocks. The active surface area is increased by grinding, before adding these minerals to soil, beaches or the open ocean. See also *Carbon dioxide (CO<sub>2</sub>)*, and *Sequestration*.

**(Model) ensemble** A group of parallel model simulations characterising 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 only characterize the uncertainty associated with internal climate variability, whereas multi-model ensembles including simulations by several models also include the impact 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. See also *Climate projection*.

**Equality** A principle that ascribes equal worth to all human beings, including equal opportunities, rights, and obligations, irrespective of origins.

**Inequality** Uneven opportunities and social positions, and processes of discrimination within a group or society, based on gender, class, ethnicity, age, and (dis)ability, often produced by uneven development. Income inequality refers to gaps between highest and lowest income earners within a country and between countries.

See also *Equity*.

**Equilibrium climate sensitivity** See *Climate sensitivity*.

**Equity** The principle of being fair and impartial and is a basis for understanding how the impacts and responses to climate change, including costs and benefits, are distributed in and by society in more or less equal ways. It is often aligned with ideas of equality, fairness and justice and applied with respect to equity in the responsibility for, and distribution of, climate impacts and policies across society, generations, and gender, and in the sense of who participates and controls the processes of decision-making.

**Distributive equity** Equity in the consequences, outcomes, costs and benefits of actions or policies. In the case of climate change or climate policies for different people, places and countries, including equity aspects of sharing burdens and benefits for mitigation and adaptation.

**Gender equity** Ensuring equity in that women and men have the same rights, resources and opportunities. In the case of climate change, gender equity-recognizes that women are often more vulnerable to the impacts of climate change and may be disadvantaged in the process and outcomes of climate policy.

**Inter-generational equity** Equity between generations that acknowledges that the effects of past and present emissions, vulnerabilities and policies impose costs and benefits for people in the future and of different age groups.

**Procedural equity** Equity in the process of decision-making including recognition and inclusiveness in participation, equal representation, bargaining power, voice and equitable access to knowledge and resources to participate.

See also *Equality*.

**Evidence** Data and information used in the scientific process to establish findings. In this report, the degree of evidence reflects the amount, quality, and consistency of scientific/technical information on which the Lead Authors are basing their findings. See also *Agreement*, *Confidence*, *Likelihood*, and *Uncertainty*.

**Evolutionary adaptation** See *Adaptation*.

**Exposure** The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected. See also *Hazard*, *Risk*, and *Vulnerability*.

**Extratropical cyclone** Any cyclonic-scale storm that is not a tropical cyclone. Usually refers to a middle- or high-latitude migratory storm system formed in regions of large horizontal temperature variations. Sometimes called extratropical storm or extratropical low. See also *Tropical cyclone*.

**Extreme event** See *Extreme weather / climate event*.

**Extreme sea level** See *Storm surge*.

**Extreme weather / climate event** An extreme weather event is 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. 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 total rainfall over a season). See also *Heat wave*, and *Climate extreme (extreme weather or climate event)*.

**Fairness** Impartial and just treatment without favouritism or discrimination in which each person is considered of equal worth with equal opportunity. See also *Equity*, *Equality* and *Ethics*.

**Feasibility** The degree to which climate goals and response options are considered possible and/or desirable. Feasibility depends on geophysical, ecological, technological, economic, social and institutional conditions for change. Conditions underpinning feasibility are dynamic, spatially variable, and may vary between different groups.

*Economic feasibility* An indicator of the benefits and costs of a climate adaptation or response, often expressed as a ratio of the two, used in order to judge whether it is possible or wise to proceed with the option.

*Social and institutional feasibility* Institutional feasibility has two key parts: (1) the extent of administrative workload, both for public authorities and for regulated entities, and (2) the extent to which the policy is viewed as legitimate, gains acceptance, is adopted, and is implemented.

**Feedback** See *Climate feedback*.

**Flood** The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods, and glacial lake outburst floods.

**Food security** A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2001). [Footnote: Whilst the term ‘food security’ explicitly includes nutrition within its ‘dietary needs ... for an active and healthy life’, in the past the term has sometimes privileged the supply of energy, especially to the hungry. Thus, the term ‘food and nutrition security’ is often used (with the same definition as food security) to emphasise that the term food covers both energy and nutrition (FAO, 2009).] See also *Food system*, and *Malnutrition*.

**Food system** The entirety of the production, transport, manufacturing, retailing, consumption, and waste of food, and their impacts on nutrition, health and well-being and the environment.

**Forcing** The driver of a change in the climate system, usually through an imbalance between the radiative energy received and leaving the Earth’s surface. See also *Radiative forcing*.

**Forest** A vegetation type dominated by trees. Many definitions of the term forest are in use throughout the world, reflecting wide differences in biogeophysical conditions, social structure and economics. For a discussion of the term forest and related terms such as afforestation, reforestation and deforestation, see the IPCC Special Report on Land Use, Land-Use Change, and Forestry (IPCC, 2000). [Footnote: See also

information provided by the United Nations Framework Convention on Climate Change (UNFCCC, 2013) and the Report on Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types (IPCC, 2003)]. See also *Deforestation*.

**Fossil fuels** Carbon-based fuels from fossil hydrocarbon deposits, including coal, oil, and natural gas.

**Framework Convention on Climate Change** See *United Nations Framework Convention on Climate Change (UNFCCC)*.

**Frozen ground** Soil or rock in which part or all of the pore water consists of ice.

**Functional diversity** The value and range of the functional traits of the organisms in a given ecosystem (Tilman et al., 1997).

**General circulation model** See *Climate model*.

**Geoengineering** A broad set of methods and technologies that aim to deliberately alter the climate system in order to alleviate the impacts of climate change. Most, but not all, methods seek to either (1) reduce the amount of absorbed solar energy in the climate system (Solar Radiation Management, or Solar Radiation Modification) or (2) increase net carbon sinks from the atmosphere at a scale sufficiently large to alter climate (Carbon Dioxide Removal). Scale and intent are of central importance. Two key characteristics of geoengineering methods of particular concern are that they use or affect the climate system (e.g., atmosphere, land, or ocean) globally or regionally and/or could have substantive unintended effects that cross national boundaries. Geoengineering is different from weather modification and ecological engineering, but the boundary can be fuzzy (IPCC, 2012b, p. 2). See also *Solar radiation modification (SRM)*.

**Glacier**. A perennial mass of ice, and possibly firn and snow, originating on the land surface by the compaction of snow and showing evidence of past or present flow. A glacier typically gains mass by accumulation of snow, and loses mass by melting and ice discharge into the sea or a lake if the glacier terminates in a body of water. Land ice masses of continental size (>50,000 km<sup>2</sup>) are referred to as ice sheets. This definition builds from that of Cogley et al. (2011). See also *Ice sheet*.

**Glacier lake outburst / Glacial lake outburst flood (GLOF)** A sudden release of water from a glacier lake, including any of the following types – a glacier-dammed lake, a pro-glacial moraine-dammed lake or water that was stored within, under or on the glacier. See also *Glacier*.

**Global climate model** See *Climate model*.

**Global mean sea level** [PLACEHOLDER FOR FINAL DRAFT]

**Global sea level** [PLACEHOLDER FOR FINAL DRAFT]

**Global North / Global South** [PLACEHOLDER FOR FINAL DRAFT]

**Global warming** The estimated increase in global mean surface temperature (GMST) averaged over a 30-year period, or the 30-year period centered on a particular year or decade, expressed relative to preindustrial levels unless otherwise specified. For 30-year periods that span past and future years, the current multi-decadal warming trend is assumed to continue. See also *Climate change*, and *Climate variability*.

**Governance** A comprehensive and inclusive concept of the full range of means for deciding, managing, implementing and monitoring policies and measures. Whereas government is defined strictly in terms of the nation-state, the more inclusive concept of governance recognizes the contributions of various levels of government (global, international, regional, sub-national and local) and the contributing roles of the

private sector, of nongovernmental actors, and of civil society to addressing the many types of issues facing the global community.

In the context of this Report, the concept of Governance is discussed in the Cross-Chapter Boxes. The term ‘governance’ is used in diverse and contested ways. In sum, it refers to how the economy and society are governed or ‘steered’; how collective interests are defined, reconciled and institutionalized (Pierre & Peters, 2000). Governance includes exclusive acts by governments (e.g., promulgating climate change legislation); market incentives and interactions to reduce climate change impacts and risks (e.g., risk pricing in the insurance market); and collaborative efforts by local actors to take climate action (e.g., using customary law) as well as multi-level interactions involving actors and networks from government, the private sector and civil society (e.g., the UNFCCC) (Kooiman, 2003; Paavola, 2007).

***Adaptive governance*** An emerging term in the literature for the evolution of formal and informal institutions of governance that prioritize social learning in planning, implementation and evaluation of policy through iterative social learning to steer the use and protection of natural resources, ecosystem services and common pool natural resources, particularly in situations of complexity and uncertainty

***Climate governance*** Purposeful mechanisms and measures aimed at steering social systems towards preventing, mitigating, or adapting to the risks posed by climate change (Jagers and Stripple, 2003).

***Multi-level governance*** Negotiated, non-hierarchical exchanges between institutions at the transnational, national, regional and local levels. Multi-level governance identifies relationships among governance processes at these different levels. Multi-level governance does include negotiated relationships among institutions at different institutional levels and also a vertical ‘layering’ of governance processes at different levels. Institutional relationships take place directly between transnational, regional and local levels, thus bypassing the state level (Peters and Pierre, 2001).

***Participatory governance*** A governance system that enables direct public engagement in decision-making using a variety of techniques for example, referenda, community deliberation, citizen juries or participatory budgeting. The approach can be applied in formal and informal institutional contexts from national to local, but is usually associated with devolved decision making. This definition builds from Fung and Wright (2003) and Sarmiento and Tilly (2018).

**Gravity Recovery And Climate Experiment (GRACE)** A pair of satellites to measure Earth's gravity field anomalies from 2002 to 2017. These fields have been used, among other things, to study mass changes of the polar ice sheets and glaciers. See also *Glacier, Ice sheet, and Marine Ice Sheet Instability (MISI)*.

**Green infrastructure** The interconnected set of natural and constructed ecological systems, green spaces and other landscape features. It includes planted and indigenous trees, wetlands, parks, green open spaces and original grassland and woodlands, as well as possible building and street level design interventions that incorporate vegetation. Green infrastructure provides services and functions in the same way as conventional infrastructure. This definition builds from Culwick and Bobbins (2016).

**Greenhouse gas (GHG)** Greenhouse gases are constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of radiation emitted by the Earth's ocean and terrestrial surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapour (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), methane (CH<sub>4</sub>) and ozone (O<sub>3</sub>) are the primary GHGs in the Earth's atmosphere. Human-made GHGs include sulphur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFCs), chlorofluorocarbons (CFCs) and perfluorocarbons (PFCs); several of these are also ozone-depleting (and regulated through the Montreal Protocol). See also *Atmosphere, Carbon dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), and Ozone (O<sub>3</sub>)*.

**Greenhouse gas removal** Withdrawal of a GHG and/or a precursor from the atmosphere by a sink. See also *Negative emissions*.

**Gross domestic product (GDP)** The sum of gross value added, at purchasers' prices, by all resident and non-resident producers in the economy, plus any taxes and minus any subsidies not included in the value of the products in a country or a geographic region for a given period, normally one year. GDP is calculated without deducting for depreciation of fabricated assets or depletion and degradation of natural resources.

**Grounding line** The junction between a glacier or ice sheet and ice shelf; the place where ice starts to float. This junction normally occurs over a zone, rather than at a line.

**Habitability** The ability of a place to support human life by providing protection from hazards which challenge human survival and by assuring adequate space, food and freshwater.

**Hazard** The potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources. See also *Disaster*, *Exposure*, *Risk*, and *Vulnerability*.

**Heat wave** A period of abnormally hot weather. Heat waves and warm spells have various and in some cases overlapping definitions. See also *Marine heat wave*, *Climate extreme (extreme weather or climate event)*, and *Extreme weather event*.

**Heating.** See *Heating, ventilation, and air conditioning (HVAC)*.

**Heating, ventilation, and air conditioning (HVAC)** Technology used to control temperature and humidity in an indoor environment, be it in buildings or in vehicles, providing thermal comfort and healthy air quality to the occupants. HVAC systems can be designed for an isolated space, an individual building or a distributed heating and cooling network within a building structure or a district heating system. The latter provides economies of scale and also scope for integration with solar heat, natural seasonal cooling/heating etc.

**Holocene** The current interglacial geological epoch, the second of two epochs within the Quaternary period, the preceding being the Pleistocene. The International Commission on Stratigraphy defines the start of the Holocene at 11,650 years before 1950.

**Human behaviour** The responses of persons or groups to a particular situation, here likely to relate to climate change. Human behaviour covers the range of actions by individuals, communities, organisations, governments and at the international level.

*Adaptation behaviour* Human actions that directly or indirectly affect the risks of climate change impacts.

*Mitigation behaviour* Human actions that directly or indirectly influence mitigation.

See also *Adaptation*, and *Mitigation*.

**Human mobility** The permanent or semi-permanent move by a person, at least for one year and involving crossing an administrative, but not necessarily a national, border.

**Human rights** Rights that are inherent to all human beings, universal, inalienable, and indivisible, typically expressed and guaranteed by law. They include the right to life, economic, social, and cultural rights, and the right to development and self-determination (based upon the definition by the UN Office of the High Commissioner).

*Procedural rights* Rights to a legal procedure to enforce substantive rights.

**Substantive rights** Basic human rights, including the right to the substance of being human such as life itself, liberty and happiness.

See also *Wellbeing*, *Equity*, and *Equality*.

**Human security** A condition that is met when the vital core of human lives is protected, and when people have the freedom and capacity to live with dignity. In the context of climate change, the vital core of human lives includes the universal and culturally specific, material and non-material elements necessary for people to act on behalf of their interests and to live with dignity.

**Human system** Any system in which human organizations and institutions play a major role. Often, but not always, the term is synonymous with society or social system. Systems such as agricultural systems, urban systems, political systems, technological systems, and economic systems are all human systems in the sense applied in this report.

**Hydrological cycle** The cycle in which water evaporates from the oceans and the land surface, is carried over the Earth in atmospheric circulation as water vapour, condenses to form clouds, precipitates over the ocean and land as rain or snow, which on land can be intercepted by trees and vegetation, potentially accumulating as snow or ice, provides runoff on the land surface, infiltrates into soils, recharges groundwater, discharges into streams, and ultimately, flows into the oceans as rivers, polar glaciers and ice sheets, from which it will eventually evaporate again. The various systems involved in the hydrological cycle are usually referred to as hydrological systems.

**Ice caps** See *Glacier*.

**Ice core** A cylinder of ice drilled out of a glacier or ice sheet.

**Ice sheet** An ice body that covers an area of continental size, generally defined as covering  $>50,000 \text{ km}^2$ . An ice sheet flows outward from a high central ice plateau with a small average surface slope. The margins usually slope more steeply, and most ice is discharged through fast flowing ice streams or outlet glaciers, in some cases into the sea or into ice shelves floating on the sea. There are only two ice sheets in the modern world, one on Greenland and one on Antarctica. The latter is divided into East Antarctic Ice Sheet (EAIS), West Antarctic Ice Sheet (WAIS) and Antarctic Peninsula ice sheet. During glacial periods there were other ice sheets. See also *Glacier*, *Hydrological Cycle*, *Ice shelf*, *Marine Ice Cliff Instability (MICI)*, *Marine Ice Sheet Instability (MISI)*, and *Sea ice*.

**Ice shelf** A floating slab of ice of considerable thickness extending from the coast (usually of great horizontal extent with a very gently sloping surface), often filling embayments in the coastline of an ice sheet. Nearly all ice shelves are in Antarctica, where most of the ice discharged into the ocean flows via ice shelves. See also *Glacier*, *Hydrological Cycle*, *Ice sheet*, *Marine Ice Cliff Instability (MICI)*, and *Marine Ice Sheet Instability (MISI)*.

**Ice stream** A stream of ice with strongly enhanced flow that is part of an ice sheet. It is often separated from surrounding ice by strongly sheared, crevassed margins. See also *Outlet glacier*.

**Impacts (consequences, outcomes)** The consequences of realized risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather and climate events), exposure, and vulnerability. Impacts generally refer to effects on lives, livelihoods, health and wellbeing, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure. Impacts may be referred to as consequences or outcomes, and can be adverse or beneficial. See also *Adaptation*, *Exposure*, *Hazard*, *Loss and Damage*, and *loss and damages*, and *Vulnerability*.

**Incremental adaptation** See *Adaptation*.

**Indigenous knowledge** The understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For many Indigenous peoples, Indigenous

knowledge informs decision-making about fundamental aspects of life, from day-to-day activities to longer term actions. This knowledge is integral to cultural complexes, which also encompass language, systems of classification, resource use practices, social interactions, values, ritual and spirituality. These distinctive ways of knowing are important facets of the world's cultural diversity. This definition builds on UNESCO (2018).

**Industrial revolution** A period of rapid industrial growth with far-reaching social and economic consequences, beginning in Britain during the second half of the 18th century and spreading to Europe and later to other countries including the United States. The invention of the steam engine was an important trigger of this development. The industrial revolution marks the beginning of a strong increase in the use of fossil fuels, initially coal, and hence emission of carbon dioxide (CO<sub>2</sub>). See also *Pre-industrial*.

**Inequality** See *Equality*.

**Institutions** are rules and norms held in common by social actors that guide, constrain and shape human interaction. Institutions can be formal, such as laws and policies, or informal, such as norms and conventions. Organizations - such as parliaments, regulatory agencies, private firms, and community bodies - develop and act in response to institutional frameworks and the incentives they frame. Institutions can guide, constrain and shape human interaction through direct control, through incentives, and through processes of socialization. See also *Institutional capacity*.

**Institutional capacity** Institutional capacity comprises building and strengthening individual organizations and providing technical and management training to support integrated planning and decision-making processes between organization and people, as well as empowerment, social capital, and an enabling environment, including the culture, values and power relations (Willems and Baumert, 2003). See also *Capacity*, and *Institution*.

**Integrated assessment** A method of analysis that combines results and models from the physical, biological, economic and social sciences and the interactions among these components in a consistent framework to evaluate the status and the consequences of environmental change and the policy responses to it.

**Internal variability** See *Climate variability*.

**Invasive species** A species that is not native to a specific location that has a tendency to spread to a degree believed to cause damage to the environment, human economy or human health.

**Irreversibility** A perturbed state of a dynamical system is defined as irreversible on a given timescale, if the recovery timescale from this state due to natural processes is significantly longer than the time it takes for the system to reach this perturbed state. In the context of this report, the recovery time scale of interest is centennial to millennial. See also *Tipping point*.

**Justice** is concerned with ensuring that people get what is due to them setting out the moral or legal principles of fairness and equity in the way people are treated, often based on the ethics and values of society.

***Climate justice*** Justice that links development and human rights to achieve a human-centred approach to addressing climate change, safeguarding the rights of the most vulnerable people and sharing the burdens and benefits of climate change and its impacts equitably and fairly. This definition builds upon the one used by the Mary Robinson Foundation - Climate Justice.

***Distributive justice*** Justice in the allocation of economic and non-economic costs and benefits across society.

***Inter-generational justice*** Justice in the distribution of economic and non-economic costs and benefits across generations.



**Procedural justice** Justice in the way outcomes are brought about including who participates and is heard in the processes of decision making.

**Social justice** Just or fair relations within society that seek to address the distribution of wealth, access to resources, opportunity, and support according to principles of justice and fairness.

See also *Equity*, and *Human rights*.

**La Niña** See *El Niño-Southern Oscillation*.

**Land** The terrestrial portion of the biosphere that comprises the natural resources (soil, near surface air, vegetation and other biota, and water), the ecological processes, topography, and human settlements and infrastructure that operate within that system. [Footnote: this definition is adapted from FAO (2007) and UNCCD (1994)]

**Land management** Sum of land-use practices (e.g., sowing, fertilizing, weeding, harvesting, thinning, clear-cutting) that take place within broader land-use categories. [Footnote: this definition is adapted from Pongratz et al., (2018)]

See also *Land use*.

**Land restoration** The process of assisting the recovery of a degraded ecosystem, with the aim to enhance ecological function. [Footnote: this definition is adapted from McDonald, et al. (2016)]

**Land use** Total of arrangements, activities and inputs undertaken in a certain land cover type (a set of human actions). The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction, conservation and city dwelling). In national greenhouse gas inventories, land use is classified according to the IPCC land use categories of forest land, cropland, grassland, wetland, settlements, other. See also *Land management*.

**Likelihood** The chance of a specific outcome occurring, where this might be estimated probabilistically. Likelihood is expressed in this report using a standard terminology (Mastrandrea et al., 2010). See Section 1.8.3 for the list of likelihood qualifiers used. See also *Agreement*, *Evidence*, *Confidence*, and *Uncertainty*.

**Livelihood** The resources used and the activities undertaken in order for people to live. Livelihoods are usually determined by the entitlements and assets to which people have access. Such assets can be categorized as human, social, natural, physical, or financial.

**Local knowledge** The understandings and skills developed by individuals and populations, specific to the places where they live. Local knowledge informs decision-making about fundamental aspects of life, from day-to-day activities to longer term actions. This knowledge is a key element of the social and cultural systems which influence observations of, and responses to climate change; it also informs governance decisions. This definition builds on UNESCO (2018).

**Local sea level change** refers to a datum such as present-day mean sea level at spatial scales smaller than 10 km.

**Lock-in** A situation in which the future development of a system, including infrastructure, technologies, investments, institutions, and behavioural norms, is determined or constrained (“locked in”) by historic developments.

**Loss and Damage, and losses and damages** Research has taken Loss and Damage (capitalized letters) to refer to political debate under the UNFCCC following the establishment of the Warsaw Mechanism on Loss and Damage in 2013, which is to “address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change.” Lowercase letters (losses and damages) have been taken to refer broadly to harm from (observed) impacts and (projected) risks (see Mechler et al., 2018).

**Maladaptive actions (Maladaptation)** Actions that may lead to increased risk of adverse climate-related outcomes, including via increased GHG emissions, increased vulnerability to climate change, or diminished welfare, now or in the future. Maladaptation is usually an unintended consequence. See also *Adaptation*, and *Adaptive capacity*.

**Marine heat wave** A marine heatwave is a period of extreme warm near-sea surface temperature that persists for days to months and can extend up to thousands of kilometers. See also *Heat Wave*.

**Marine ice cliff instability (MICI)** A hypothetical mechanism of an ice cliff failure. In case if marine-terminated ice sheet loses its buttressing ice shelf, an ice cliff can be exposed. If the cliff is tall enough (about 800 m of the total height, or about 100 m of the above-water part), the stresses at the cliff face exceed the strength of the ice, and the cliff fails structurally in repeated calving events. See also *Hydrological Cycle*, *Ice shelf*, *Marine Ice Sheet Instability (MISI)*, and *Sea ice*.

**Marine ice sheet instability (MISI)** A mechanism of irreversible (on the decadal to centennial time scale) retreat of a grounding line for the marine-terminating glaciers, in case if the glacier bed slopes towards the ice sheet interior. See also *Hydrological Cycle*, *Ice shelf*, *Marine Ice Cliff Instability (MICI)*, and *Sea ice*.

**Mass balance / budget (of glaciers or ice sheets)** The balance between the mass input to the ice body (accumulation) and the mass loss (ablation and iceberg calving) over a stated period of time, which is often a year or a season. Point mass balance refers to the mass balance at a particular location on the glacier or ice sheet. Surface mass balance is the difference between surface accumulation and surface ablation. The input and output terms for mass balance are:

**Accumulation** All processes that add to the mass of a glacier. The main contribution to accumulation is snowfall. Accumulation also includes deposition of hoar, freezing rain, other types of solid precipitation, gain of wind-blown snow, and avalanching.

**Ablation** Surface processes that reduce the mass of a glacier. The main contributor to ablation is melting with runoff but on some glaciers sublimation, loss of wind-blown snow and avalanching are also significant processes of ablation.

**Discharge / outflow** Mass loss by iceberg calving or ice discharge across the grounding line of a floating ice shelf. Although often treated as an ablation term, in this report iceberg calving and discharge is considered separately from surface ablation.

## Measurement / Measurement, reporting and verification (MRV)

**Measurement** “Processes of data collection over time, providing basic datasets, including associated accuracy and precision, for the range of relevant variables. Possible data sources are field measurements, field observations, detection through remote sensing and interviews.” (UN REDD, 2009)

**Reporting** “The process of formal reporting of assessment results to the UNFCCC, according to predetermined formats and according to established standards, especially the Intergovernmental Panel on Climate Change (IPCC) Guidelines and GPG (Good Practice Guidance).” (UN REDD, 2009)

**Verification** “The process of formal verification of reports, for example, the established approach to verify national communications and national inventory reports to the UNFCCC.” (UN REDD, 2009)

**Meridional Overturning Circulation (MOC)** Meridional (north-south) overturning circulation in the ocean quantified by zonal (east-west) sums of mass transports in depth or density layers. In the North Atlantic, away from the subpolar regions, the MOC (which is in principle an observable quantity) is often identified with the thermohaline circulation (THC), which is a conceptual and incomplete interpretation. It must be borne in mind that the MOC is also driven by wind, and can also include shallower overturning

cells such as occur in the upper ocean in the tropics and subtropics, in which warm (light) waters moving poleward are transformed to slightly denser waters and subducted equatorward at deeper levels.

***Atlantic Meridional Overturning Circulation (AMOC)*** The main current system in the South and North Atlantic Oceans. AMOC transports warm upper-ocean water northwards, and cold, deep water southwards, as part of the global ocean circulation system. Changes in the strength of AMOC can affect other components of the climate system.

**Methane (CH<sub>4</sub>)** One of the six greenhouse gases (GHGs) to be mitigated under the Kyoto Protocol and is the major component of natural gas and associated with all hydrocarbon fuels. Under future global warming, there is risk of increased methane emissions from permafrost, coastal wetlands and sub-sea gas hydrates.

**Migrant** See *Migration*.

**Migration (Human migration)** The International Organization for Migration (IOM) defines migration as the “movement of a person or a group of persons, either across an international border, or within a State. It is a population movement, encompassing any kind of movement of people, whatever its length, composition and causes; it includes migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification.” (IOM, 2018).

**Migrant** The International Organization for Migration (IOM) defines a migrant as “any person who is moving or has moved across an international border or within a State away from his/her habitual place of residence, regardless of (1) the person’s legal status; (2) whether the movement is voluntary or involuntary; (3) what the causes for the movement are; or (4) what the length of the stay is.” (IOM, 2018).

See also *Displacement*, and *Emigration*.

**Mitigation (of climate change)** A human intervention to reduce emissions or enhance the sinks of greenhouse gases.

***Mitigation measures*** In climate policy, mitigation measures are technologies, processes or practices that contribute to mitigation, for example renewable energy (RE) technologies, waste minimization processes, public transport commuting practices. See also *Mitigation options*, and *Policies (for climate change mitigation and adaptation)*.

***Mitigation option*** A technology or practice that reduces GHG emissions or enhances sinks.

***Mitigation scenario*** A plausible description of the future that describes how the (studied) system responds to the implementation of mitigation policies and measures.

See also *Emission scenario*, and *Socio-economic scenarios*.

**Mobility** See *Human mobility*.

**Monitoring and evaluation** Mechanisms put in place at national to local scales to respectively monitor and evaluate efforts to reduce greenhouse gas emissions and/or adapt to the impacts of climate change with the aim of systematically identifying, characterizing and assessing progress over time.

**Motivation (of an individual)** An individual’s reason or reasons for acting in a particular way; individuals may consider various consequences of actions, including financial, social, affective, and environmental consequences. Motivation can arise from outside (extrinsic) or inside (intrinsic) the individual.

**Multi-level governance** See *Governance*.

**Narratives** Qualitative descriptions of plausible future world evolutions, describing the characteristics, general logic and developments underlying a particular quantitative set of scenarios. Narratives are also referred to in the literature as “storylines”. See also *Scenario*, and *Pathways*.

**Nationally determined contributions (NDCs)** A term used under the United Nations Framework Convention on Climate Change (UNFCCC) whereby a country that has joined the Paris Agreement outlines its plans for reducing its emissions. Some countries’ NDCs also address how they will adapt to climate change impacts, and what support they need from, or will provide to, other countries to adopt low-carbon pathways and to build climate resilience. According to Article 4 paragraph 2 of the Paris Agreement, each Party shall prepare, communicate and maintain successive NDCs that it intends to achieve. In the lead up to 21st Conference of the Parties in Paris in 2015, countries submitted Intended Nationally Determined Contributions (INDCs). As countries join the Paris Agreement, unless they decide otherwise, this INDC becomes their first NDC. See also *United Nations Framework Convention on Climate Change (UNFCCC)*, and *Paris Agreement*.

**Natural systems** The dynamic physical and biological components of the environment that would operate in the absence of human impacts. Most, if not all, natural systems are also now affected by human activities to some degree.

**Near-surface permafrost** Permafrost within ~3-4 m of the ground surface. The depth is not precise, but distinguishes that which is highly relevant for people and ecosystems from deeper permafrost. Presence or absence of near-surface permafrost is not the only significant metric of permafrost change, and deeper permafrost may persist when near-surface permafrost is absent.

**Negative emissions** Removal of greenhouse gases (GHGs) from the atmosphere by deliberate human activities, i.e., in addition to the removal that would occur via natural carbon cycle processes. See also *Carbon dioxide removal (CDR)*, and *Greenhouse gas removal (GGR)*.

**Ocean acidification (OA)** A reduction in the pH of the ocean, paralleled by shifts in other physicochemical parameters, over an extended period, typically decades or longer, which is caused primarily by uptake of carbon dioxide (CO<sub>2</sub>) from the atmosphere, but can also be caused by other chemical additions or subtractions from the ocean. Anthropogenic ocean acidification refers to the component of pH reduction that is caused by human activity (IPCC, 2011, p. 37). See also *Carbon dioxide (CO<sub>2</sub>)*, *Climate change*, and *pH*.

**Outburst flood** See *Glacier lake outburst / Glacial lake outburst flood (GLOF)*.

**Outlet glaciers** A glacier, usually between rock walls, that is part of, and drains an ice sheet. See also *Glacier*, *Ice sheet*, *Ice stream*, and *Hydrological Cycle*.

**Overshoot** See *Temperature overshoot*.

**Ozone (O<sub>3</sub>)** Ozone, the triatomic form of oxygen (O<sub>3</sub>), is a gaseous atmospheric constituent. In the troposphere, it is created both naturally and by photochemical reactions involving gases resulting from human activities (smog). Tropospheric ozone acts as a greenhouse gas. In the stratosphere, it is created by the interaction between solar ultraviolet radiation and molecular oxygen (O<sub>2</sub>). Stratospheric ozone plays a dominant role in the stratospheric radiative balance. Its concentration is highest in the ozone layer.

**Paris Agreement** The Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) was adopted on December 2015 in Paris, France, at the 21st session of the Conference of the Parties (COP) to the UNFCCC. The agreement, adopted by 196 Parties to the UNFCCC, entered into force on 4 November 2016 and as of May 2018 had 195 Signatories and was ratified by 177 Parties. One of the goals of the Paris Agreement is “Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels”, recognising that this would significantly reduce the risks and impacts of climate change. Additionally, the Agreement aims to strengthen the ability of countries to deal with the impacts of climate change. The Paris Agreement is intended to become fully effective in 2020. See also

*United Nations Framework Convention on Climate Change (UNFCCC), and Nationally Determined Contributions (NDCs).*

**Participatory governance** See *Governance*.

**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-behavioural trajectories and involve various dynamics, goals, and actors across different scales.

**Adaptation pathways** A series of adaptation choices involving trade-offs between short-term and long-term goals and values. These are processes of deliberation to identify solutions that are meaningful to people in the context of their daily lives and to avoid potential maladaptation.

**Development pathways** Trajectories based on an array of social, economic, cultural, technological, institutional, and biophysical features that characterise the interactions between human and natural systems and outline visions for the future, at a particular scale.

**Emission pathways** Modelled trajectories of global anthropogenic emissions over the 21st century are termed emission pathways. Emission pathways are classified by their temperature trajectory over the 21st century: pathways giving at least 50% probability based on current knowledge of limiting global warming to below 1.5°C are classified as ‘no overshoot’; those limiting warming to below 1.6°C and returning to 1.5°C by 2100 are classified as ‘1.5°C limited-overshoot’; while those exceeding 1.6°C but still returning to 1.5°C by 2100 are classified as ‘higher-overshoot’. See also Emission trajectories, and Temperature overshoot.

**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). 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). RCPs were used to develop climate projections in CMIP5. RCP2.6: One pathway where radiative forcing peaks at approximately 3 W m<sup>-2</sup> and then declines to be limited at 2.6 W m<sup>-2</sup> in 2100 (the corresponding ECP assuming constant emissions after 2100). RCP4.5 and RCP6.0: Two intermediate stabilisation pathways in which radiative forcing is limited at approximately 4.5 W m<sup>-2</sup> and 6.0 W m<sup>-2</sup> in 2100 (the corresponding ECPs assuming constant concentrations after 2150). RCP8.5: One high pathway which leads to >8.5 W m<sup>-2</sup> in 2100 (the corresponding ECP assuming constant emissions after 2100 until 2150 and constant concentrations after 2250). See also *Coupled Model Intercomparison Project (CMIP)*, and *Shared Socio-economic Pathways (SSPs)*.

**Shared socio-economic pathways (SSPs)** were developed to complement the RCPs with varying socio-economic challenges to adaptation and mitigation (O’Neill et al., 2014). Based on five narratives, the SSPs describe alternative socio-economic futures in the absence of climate policy intervention, comprising sustainable development (SSP1), regional rivalry (SSP3), inequality (SSP4), fossil-fueled development (SSP5), and a middle-of-the-road development (SSP2) (O’Neill, 2000; O’Neill et al., 2017; Riahi et al., 2017). The combination of SSP-based socio-economic scenarios and Representative Concentration Pathway (RCP)-based climate projections provides an integrative frame for climate impact and policy analysis.

**Sustainable development pathways (SDPs)** Trajectories aimed at attaining the Sustainable Development Goals (SDGs) in the short term and the goals of sustainable development in the long term. In the context of climate change, such pathways denote trajectories that address social, environmental, and economic dimensions of sustainable development, adaptation and mitigation, and transformation, in a generic sense or from a particular methodological perspective such as integrated assessment models and scenario simulations.

See also *Scenario*, *Emission scenario*, *Mitigation scenario*, and *Narratives*.

**Permafrost** Ground (rock or soil or rock containing ice and organic material) that remains at or below 0°C for at least two consecutive years.

***Permafrost degradation*** Decrease in the thickness and/or areal extent of permafrost.

***Permafrost thaw*** Progressive loss of ground ice in permafrost, usually due to input of heat. Thaw can occur over decades to centuries over the entire depth of permafrost ground, with impacts occurring while thaw progresses. During thaw, temperature fluctuations are subdued because added energy is taken up by phase change from ice to water. After the transition from permafrost to non-permafrost the ground can be described as thawed.

**Permafrost degradation** See *Permafrost*.

**Permafrost thaw** See *Permafrost*.

**pH** A dimensionless measure of the acidity of a solution given by its concentration of hydrogen ions ( $H^+$ ). pH is measured on a logarithmic scale where  $pH = -\log_{10}(H^+)$ . Thus, a pH decrease of 1 unit corresponds to a 10-fold increase in the concentration of  $H^+$ , or acidity. See also *Ocean Acidification (OA)*.

**Plasticity** Change in organismal trait values in response to an environmental cue, and which does not require change in underlying DNA sequence.

**Political economy** The set of interlinked relationships between people, the state, society and markets as defined by law, politics, economics, customs and power that determine the outcome of trade and transactions and the distribution of wealth in a country or economy.

**Poverty** A complex concept with several definitions stemming from different schools of thought. It can refer to material circumstances (such as need, pattern of deprivation or limited resources), economic conditions (such as standard of living, inequality or economic position) and/or social relationships (such as social class, dependency, exclusion, lack of basic security or lack of entitlement).

**Poverty eradication** A set of measures to end poverty in all its forms everywhere. See also *Poverty*, and *Sustainable Development Goals (SDGs)*.

**Precursors** Atmospheric compounds that are not *greenhouse gases (GHGs)* or *aerosols*, but that have an effect on GHG or aerosol concentrations by taking part in physical or chemical processes regulating their production or destruction rates. See also *Aerosol*, and *Greenhouse gas (GHG)*.

**Pre-industrial** The multi-century period prior to the onset of large-scale industrial activity around 1750. The reference period 1850–1900 is used to approximate pre-industrial global mean surface temperature (GMST). See also *Industrial Revolution*.

**Private costs** are carried by individuals, companies or other private entities that undertake an action, whereas social costs include additionally the external costs on the environment and on society as a whole. Quantitative estimates of both private and social costs may be incomplete, because of difficulties in measuring all relevant effect.

**Projection** A potential future evolution of a quantity or set of quantities, often computed with the aid of a model. Unlike predictions, projections are conditional on assumptions concerning, for example, future socio-economic and technological developments that may or may not be realized. See also *Climate projection*, *Scenario*, and *Pathways*.

**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 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.

**Reasons for concern (RFC)** Elements of a classification framework, first developed in the IPCC Third Assessment Report, which aims to facilitate judgments about what level of climate change may be dangerous (in the language of Article 2 of the UNFCCC) by aggregating risks from various sectors, considering hazards, exposures, vulnerabilities, capacities to adapt, and the resulting impacts.

**Reference period** The period relative to which anomalies are computed. See also *Anomaly*.

**Region** A relatively large-scale land or ocean area characterized by specific geographical and climatological features. The climate of a land-based region is affected by regional and local scale features like topography, land use characteristics and large water bodies, as well as remote influences from other regions, in addition to global climate conditions. The IPCC defines a set of standard regions for analyses of observed climate trends and climate model projections (see SR15 Figure 3.2; AR5, SREX).

**Regional sea level change** The changes relative to a datum such as present-day mean sea level at spatial scales of about 100 km.

**Relative sea level** Sea level measured by a tide gauge with respect to the land upon which it is situated. See also *Global mean sea level*, *Global sea level*, *Steric sea level*, *Coast*, *Small Island Developing States (SIDS)*, *Regional sea level*, *Subsidence*, *Local sea level*, and *Sea level*.

**Reporting** See *Measurement / Measurement, reporting and verification (MRV)*.

**Representative concentration pathways (RCPs)** See *Pathways*.

**Resilience** The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation. This definition builds from the definition used in Arctic Council (2013). See also *Hazard*, *Risk*, and *Vulnerability*.

**Restoration** In environmental context, restoration involves human interventions to assist the recovery of an ecosystem that has been previously degraded, damaged or destroyed.

**Risk** The potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain. In the context of the assessment of climate impacts, the term risk is often used to refer to the potential for adverse consequences of a climate related hazard, or of adaptation or mitigation responses to such a hazard, on lives, livelihoods, health, ecosystems and species, economic, social and cultural assets, services (including ecosystem services) and infrastructure. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence.

**Risk assessment** The qualitative and/or quantitative scientific estimation of risks. See also *Risk*, *Risk management*, and *Risk perception*.

**Risk management** Plans, actions, strategies or policies to reduce the likelihood and/or consequences of risks or to respond to consequences. See also *Risk*, *Risk assessment*, and *Risk perception*.

**Risk perception** The subjective judgment that people make about the characteristics and severity of a risk. See also *Risk*, *Risk assessment*, and *Risk management*.

**Runoff** The flow of water over the surface or through the subsurface, which typically originates from the part of liquid precipitation and/or snow/ice melt that does not evaporate, transpire or refreeze, and returns to bodies of water. See also *Hydrological cycle*.

**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. See also *Emission scenario*, *Mitigation scenario*, *Pathways*, and *Projection*.

**Sea ice** Ice found at the sea surface that has originated from the freezing of seawater. Sea ice may be discontinuous pieces (ice floes) moved on the ocean surface by wind and currents (pack ice), or a motionless sheet attached to the coast (land-fast ice). Sea ice concentration is the fraction of the ocean covered by ice. Sea ice less than one year old is called first-year ice. Perennial ice is sea ice that survives at least one summer. It may be subdivided into second-year ice and multi-year ice, where multiyear ice has survived at least two summers. See also *Hydrological Cycle*, *Ice shelf*, *Ice sheet*, *Marine Ice Cliff Instability (MICI)*, and *Marine Ice Sheet Instability (MISI)*.

**Sea level change (sea level rise/sea level fall)** Sea level can change, both globally and locally (relative sea level change) due to (1) a change in ocean volume as a result of a change in the mass of water in the ocean, (2) changes in ocean volume as a result of changes in ocean water density, (3) changes in the shape of the ocean basins and changes in the Earth's gravitational and rotational fields, and (4) local subsidence or uplift of the land. Global mean sea level change resulting from change in the mass of the ocean is called barystatic. The amount of barystatic sea level change due to the addition or removal of a mass of water is called its sea level equivalent (SLE). Sea level changes, both globally and locally, resulting from changes in water density are called steric. Density changes induced by temperature changes only are called thermosteric, while density changes induced by salinity changes are called halosteric. Barystatic and steric sea level changes do not include the effect of changes in the shape of ocean basins induced by the change in the ocean mass and its distribution.

**Sea surface temperature (SST)** The bulk temperature in the top few meters of the ocean, measured by ships, buoys, and drifters. From ships, measurements of water samples in buckets were mostly switched in the 1940s to samples from engine intake water. Satellite measurements of skin temperature (uppermost layer; a fraction of a millimetre thick) in the infrared or the top centimetre or so in the microwave are also used, but must be adjusted to be compatible with the bulk temperature.

**Sendai Framework for Disaster Risk Reduction** The Sendai Framework for Disaster Risk Reduction 2015–2030 outlines seven clear targets and four priorities for action to prevent new, and to reduce existing disaster risks. The voluntary, non-binding agreement recognizes that the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders including local government, the private sector and other stakeholders, with the aim for the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

**Sequestration** The long-term removal of CO<sub>2</sub> or other forms of carbon from the atmosphere, with secure storage on climatically significant time-scales (decadal to century). The period of storage needs to be known for climate modelling and carbon accounting purposes. See also *Carbon sequestration*, *Sink*, and *Uptake*.

**Shared socio-economic pathways (SSPs)** See *Pathways*.

**Shelf seas** Relatively shallow water covering the continental shelf or around islands. The limit of shelf seas is conventionally considered as 200 m water depth at the shelf edge, where there is usually a steep slope to the deep ocean floor. During glacial periods, most shelf seas are lost since they become land.



**Short-lived climate forcers (SLCF)** A set of compounds that are primarily composed of those with short lifetimes in the atmosphere compared to well-mixed greenhouse gases, and are also referred to as near-term climate forcers. This set of compounds includes methane, which is also a well-mixed greenhouse gas, as well as ozone and aerosols, or their precursors, and some halogenated species that are not well-mixed greenhouse gases. These compounds do not accumulate in the atmosphere at decadal to centennial timescales, and so their effect on climate is predominantly in the first decade after their emission, although their changes can still induce long-term climate effects such as sea level change. Their effect can be cooling or warming. A subset of exclusively warming short-lived climate forcers is referred to as short-lived climate pollutants. See also *Aerosol*, *Atmosphere*, *Climate*, *Greenhouse gas (GHG)*, and *Ozone (O<sub>3</sub>)*.

**Sink** A reservoir (natural or human, in soil, ocean, and plants) where a greenhouse gas, an aerosol or a precursor of a greenhouse gas is stored. Note that UNFCCC Article 1.8 refers to a sink as any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere. See also *Sequestration*, and *Uptake*.

**Small Island Developing States (SIDS)**, as recognised by the United Nations OHRLLS (Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States), are a distinct group of developing countries facing specific social, economic and environmental vulnerabilities (UN-OHRLLS, 2011). They were recognized as a special case both for their environment and development at the Rio Earth Summit in Brazil in 1992. Fifty-eight countries and territories are presently classified as SIDS by the UN OHRLLS, with 38 being UN member states and 20 being Non-UN Members or Associate Members of the Regional Commissions (UN-OHRLLS, 2018).

**Social costs** See *Private costs*

**Social-ecological systems** An integrated system that includes human societies and ecosystems, in which humans are part of nature. The functions of such a system arise from the interactions and interdependence of the social and ecological subsystems. The system's structure is characterised by reciprocal feedbacks, emphasising that humans must be seen as a part of, not apart from, nature. This definition builds from Arctic Resilience report (2016) and Berkes and Folke (1998).

**Social learning** A process of social interaction through which people learn new behaviours, capacities, values, and attitudes.

**Soil moisture** Water stored in the soil in liquid or frozen form. Root-zone soil moisture is of most relevance for plant activity. See also *Permafrost*, and *Drought*.

**Solar radiation management:**

See *Solar radiation modification (SRM)*.

**Solar radiation modification (SRM)** The intentional modification of the Earth's shortwave radiative budget with the aim of reducing warming. Artificial injection of stratospheric aerosols, marine cloud brightening and land surface albedo modification are examples of proposed SRM methods. SRM does not fall within the definitions of mitigation and adaptation (IPCC, 2012b, p. 2). Note that in the literature, SRM is also referred to as solar radiation management or albedo enhancement.

**Stabilisation (of GHG or CO<sub>2</sub>-equivalent concentration)** A state in which the atmospheric concentrations of one *greenhouse gas (GHG)* (e.g., *carbon dioxide*) or of a CO<sub>2</sub>-equivalent basket of GHGs (or a combination of GHGs and *aerosols*) remains constant over time. See also *Aerosol*, *Carbon dioxide (CO<sub>2</sub>)*, and *Greenhouse gas (GHG)*.

**Steric sea level change** Changes in sea level due to thermal expansion and salinity variations. Thermal expansion refers to the increase in volume (and decrease in density) that results from warming water. See also *Coast*, *Global mean sea level*, *Global sea level*, *Local sea level*, *Regional sea level*, *Relative sea level*, *Sea level*, *Sea level change Small Island Developing States (SIDS)*, and *Subsidence*.

**Storm surge** The temporary increase, at a particular locality, in the height of the sea due to extreme meteorological conditions (low atmospheric pressure and/or strong winds). The storm surge is defined as being the excess above the level expected from the tidal variation alone at that time and place.

**Subsidence** The motion of a surface (usually, the Earth's surface) as it shifts downward relative to a datum such as sea level, as such it leads to relative sea level change.

**Surface temperature** See *Sea surface temperature (SST)*.

**Sustainability** involves ensuring the persistence of natural and human systems, implying the continuous functioning of ecosystems, the conservation of high biodiversity, the recycling of natural resources and, in the human sector, successful application of justice and equity. See *Sustainable development (SD)*.

**Sustainable development (SD)** Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987) and balances social, economic and environmental concerns. See also *Sustainability*, *Sustainable development goals (SDGs)*, and *Development pathways* (under *Pathways*).

**Sustainable development goals (SDGs)** The 17 global goals for development for all countries established by the United Nations through a participatory process and elaborated in the 2030 Agenda for Sustainable Development, including ending poverty and hunger; ensuring health and wellbeing, education, gender equality, clean water and energy, and decent work; building and ensuring resilient and sustainable infrastructure, cities and consumption; reducing inequalities; protecting land and water ecosystems; promoting peace, justice and partnerships; and taking urgent action on climate change. See also *Sustainable development (SD)*.

**Sustainable development pathways (SDPs)** See *Pathways*.

**Temperature overshoot** The temporary exceedance of a specified level of global warming, such as 1.5°C. Overshoot implies a peak followed by a decline in global warming, achieved through anthropogenic removal of CO<sub>2</sub> exceeding remaining CO<sub>2</sub> emissions globally. See also *Overshoot pathways* (under *Pathways*), and *Non-overshoot pathways* (under *Pathways*).

**Thermokarst** Processes, such as collapse, subsidence and erosion, by which characteristic landforms result from the thawing of ice-rich permafrost (IPA, 1998). See also *Permafrost*.

**Tipping point** A level of change in system properties beyond which a system reorganises, often in a non-linear manner, and does not return to the initial state even if the drivers of the change are abated. For the climate system, the term refers to a critical threshold when global or regional climate changes from one stable state to another stable state. Tipping points are also used when referring to impact: the term can imply that an impact tipping point is (about to be) reached in a natural or human system. See also *Adaptation*, *Human system*, *Impact*, *Irreversibility*, and *Natural Systems*.

**Transformation** A change in the fundamental attributes of natural and human systems.

***Societal (social) transformation*** A profound and often deliberate shift initiated by communities toward sustainability, facilitated by changes in individual and collective values and behaviours, and a fairer balance of political, cultural, and institutional power in society.

***Transformative change*** A system-wide change that requires more than technological change through consideration of social and economic factors that with technology can bring about rapid change at scale.

**Transformational adaptation** See *Adaptation*.

**Transformative change** See *Transformation*.

**Transition** The process of changing from one state or condition to another in a given period of time. Transition can be in individuals, firms, cities, regions and nations, and can be based on incremental or transformative change.

**Tropical cyclone** The general term for a strong, cyclonic-scale disturbance that originates over tropical oceans. Distinguished from weaker systems (often named tropical disturbances or depressions) by exceeding a threshold wind speed. A tropical storm is a tropical cyclone with one-minute average surface winds between 18 and 32 m s<sup>-1</sup>. Beyond 32 m s<sup>-1</sup>, a tropical cyclone is called a hurricane, typhoon, or cyclone, depending on geographic location. See also *Extratropical cyclone*.

**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 behaviour. Uncertainty can therefore be represented by quantitative measures (e.g., a probability density function) or by qualitative statements (e.g., reflecting the judgment of a team of experts) (see IPCC, 2004; Mastrandrea et al., 2010; Moss and Schneider, 2000). See also *Agreement*, *Confidence*, *Deep Uncertainty* and *Likelihood*.

**United Nations Framework Convention on Climate Change (UNFCCC)** The UNFCCC was adopted in May 1992 and opened for signature at the 1992 Earth Summit in Rio de Janeiro. It entered into force in March 1994 and as of May 2018 had 197 Parties (196 States and the European Union). The Convention's ultimate objective is the "stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The provisions of the Convention are pursued and implemented by two treaties: the Kyoto Protocol and the Paris Agreement. See also *Paris Agreement*.

**Uptake** The transfer of substances (such as carbon) or energy (e.g., heat) from one compartment of a system to another; for example, in the Earth system from the atmosphere to the ocean or to the land biosphere. See also *Sequestration*, and *Sink*.

**Vulnerability** The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. See also *Exposure*, *Hazard*, and *Risk*.

**Water cycle** See *Hydrological cycle*.

**Water scarcity** [PLACEHOLDER FOR FINAL DRAFT]

**Wellbeing** A state of existence that fulfils various human needs, including material living conditions and quality of life, as well as the ability to pursue one's goals, to thrive, and feel satisfied with one's life. Ecosystem well-being refers to the ability of ecosystems to maintain their diversity and quality. See also *Human rights*.

**References**

[PLACEHOLDER FOR FINAL DRAFT]