ANNEX II

Glossary

Glossary Editors
Katharine J. Mach (USA), Serge Planton (France), Christoph von Stechow (Germany)

Glossary Contributors
Myles R. Allen (United Kingdom), John Broome (United Kingdom), John A. Church (Australia), Leon Clarke (USA), Piers Forster (United Kingdom), Pierre Friedlingstein (United Kingdom/Belgium), Jan Fuglestvedt (Norway), Gabriele Hegerl (United Kingdom/Germany), Blanca Jiménez Cisneros (Mexico/UNESCO), Vladimir Kattsov (Russian Federation), Howard Kunreuther (USA), Leo Meyer (The Netherlands), Jan Minx (Germany), Yacob Mulugetta (Ethiopia), Karen O'Brien (Norway), Michael Oppenheimer (USA), Gian-Kasper Plattner (Switzerland), Andy Reisinger (New Zealand), Robert Scholes (South Africa), Melinda Tignor (Switzerland/USA), Detlef van Vuuren (The Netherlands)

TSU Facilitation
Noëmie Leprince-Ringuet (France)

This annex should be cited as:

IPCC, 2014: Annex II: Glossary [Mach, K.J., S. Planton and C. von Stechow (eds.)]. In: *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, pp. 117-130.

This glossary defines some specific terms as the Core Writing Team of the Synthesis Report intends them to be interpreted in the context of this report. Red, italicized words indicate that the term is defined in the glossary. The references to Working Groups (WG) I, II and III in italics at the end of each term in this glossary refer to the AR5 WG glossaries and should be read as: WGI (IPCC, 2013a), WGII (IPCC, 2014a), and WGIII (IPCC, 2014b).

Abrupt change/abrupt climate change
Abrupt change refers to a change that is substantially faster than the rate of change in the recent history of the affected components of a system. Abrupt *climate change* refers to 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. *{WGI, II, III}*

Adaptation
The process of adjustment to actual or expected *climate* and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected *climate* and its effects[1]. *{WGII, III}*

Adaptation deficit
The gap between the current state of a system and a state that minimizes adverse *impacts* from existing *climate* conditions and variability. *{WGII}*

Adaptation limit
The point at which an actor's objectives (or system needs) cannot be secured from intolerable *risks* through adaptive actions. *{WGII}*

Hard adaptation limit
No adaptive actions are possible to avoid intolerable *risks*.

Soft adaptation limit
Options are currently not available to avoid intolerable *risks* through adaptive action.

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[2]. *{WGII, III}*

Adverse side effects
The negative effects that a policy or measure aimed at one objective might have on other objectives, irrespective of the net effect on overall social welfare. Adverse side effects are often subject to *uncertainty* and depend on local circumstances and implementation practices, among other factors. See also *Co-benefits* and *Risk*. *{WGIII}*

Afforestation
Planting of new *forests* on lands that historically have not contained *forests*. 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, 2000b). 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). *{WGI, III}*

Agriculture, Forestry and Other Land Use (AFOLU and FOLU/LULUCF)
AFOLU plays a central role for *food security* and *sustainable development*. The main *mitigation* options within AFOLU involve one or more of three strategies: prevention of emissions to the atmosphere by conserving existing carbon pools in soils or vegetation or by reducing emissions of methane and nitrous oxide; *sequestration*—increasing the size of existing carbon pools and thereby extracting carbon dioxide (CO_2) from the atmosphere; and substitution—substituting biological products for fossil fuels or energy-intensive products, thereby reducing CO_2 emissions. Demand-side measures (e.g., reducing losses and wastes of food, changes in human diet, or changes in wood consumption) may also play a role.

FOLU (Forestry and Other Land Use)—also referred to as LULUCF (Land Use, Land-Use Change, and Forestry)—is the subset of AFOLU emissions and removals of greenhouse gases (GHGs) resulting from direct human-induced *land use, land-use change,* and forestry activities excluding agricultural emissions. *{WGIII}*

Albedo
The fraction of solar radiation reflected by a surface or object, often expressed as a percentage. Snow-covered surfaces have a high albedo, the albedo of soils ranges from high to low and vegetation-covered surfaces and oceans have a low albedo. The Earth's planetary albedo varies mainly through varying cloudiness, snow, ice, leaf area and land cover changes. *{WGI, III}*

Altimetry
A technique for measuring the height of the Earth's surface with respect to the geocentre of the Earth within a defined terrestrial reference frame (geocentric sea level). *{WGI}*

Ancillary benefits
See *Co-benefits*. *{WGII, III}*

Attribution
See *Detection and attribution*. *{WGI, II}.*

Baseline/reference
The baseline (or reference) is the state against which change is measured. A baseline period is the period relative to which anomalies are computed. In the context of *transformation pathways*, the term *baseline*

[1] Reflecting progress in science, this glossary entry differs in breadth and focus from the entry used in the Fourth Assessment Report and other IPCC reports.

[2] This glossary entry builds from definitions used in previous IPCC reports and the Millennium Ecosystem Assessment (MEA, 2005).

scenarios refers to scenarios that are based on the assumption that no *mitigation* policies or measures will be implemented beyond those that are already in force and/or are legislated or planned to be adopted. Baseline scenarios are not intended to be predictions of the future, but rather counterfactual constructions that can serve to highlight the level of emissions that would occur without further policy effort. Typically, baseline scenarios are then compared to *mitigation scenarios* that are constructed to meet different goals for greenhouse gas (GHG) emissions, atmospheric concentrations or temperature change. The term *baseline scenario* is used interchangeably with *reference scenario* and *no policy scenario*. In much of the literature the term is also synonymous with the term *business-as-usual (BAU) scenario*, although the term *BAU* has fallen out of favour because the idea of *business as usual* in century-long socio-economic *projections* is hard to fathom. See also *Emission scenario*, *Representative Concentration Pathways (RCPs)* and *SRES scenarios*. *{WGI, II, III}*

Biodiversity
The variability among living organisms from terrestrial, marine and other *ecosystems*. Biodiversity includes variability at the genetic, species and *ecosystem* levels[3]. *{WGII, III}*

Bioenergy and Carbon Dioxide Capture and Storage (BECCS)
The application of *Carbon Dioxide Capture and Storage (CCS)* technology to bioenergy conversion processes. Depending on the total life-cycle emissions, including total marginal consequential effects (from *indirect land-use change (iLUC)* and other processes), BECCS has the potential for net carbon dioxide (CO_2) removal from the atmosphere. See also *Sequestration*. *{WGIII}*

Burden sharing/effort sharing
In the context of *mitigation*, burden sharing refers to sharing the effort of reducing the sources or enhancing the *sinks* of greenhouse gases (GHGs) from historical or projected levels, usually allocated by some criteria, as well as sharing the cost burden across countries. *{WGIII}*

Cancún Agreements
A set of decisions adopted at the 16th Session of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC), including the following, among others: the newly established Green Climate Fund (GCF), a newly established technology mechanism, a process for advancing discussions on *adaptation*, a formal process for reporting *mitigation* commitments, a goal of limiting global mean surface temperature increase to 2°C and an agreement on MRV—Measurement, Reporting and Verification for those countries that receive international support for their *mitigation* efforts. *{WGIII}*

Cancún Pledges
During 2010, many countries submitted their existing plans for controlling greenhouse gas (GHG) emissions to the Climate Change Secretariat and these proposals have now been formally acknowledged under the United Nations Framework Convention on Climate Change (UNFCCC). Developed countries presented their plans in the shape of economy-wide targets to reduce emissions, mainly up to 2020, while developing countries proposed ways to limit their growth of emissions in the shape of plans of action. *{WGIII}*

Carbon cycle
The term used to describe the flow of carbon (in various forms, e.g., as carbon dioxide (CO_2)) through the atmosphere, ocean, terrestrial and marine biosphere and lithosphere. In this report, the reference unit for the global carbon cycle is $GtCO_2$ or GtC (Gigatonne of carbon = 1 GtC = 10^{15} grams of carbon. This corresponds to 3.667 $GtCO_2$). *{WGI, II, III}*

Carbon Dioxide Capture and Storage (CCS)
A process in which a relatively pure stream of carbon dioxide (CO_2) from industrial and energy-related sources is separated (captured), conditioned, compressed and transported to a storage location for long-term isolation from the atmosphere. See also *Bioenergy and Carbon Dioxide Capture and Storage (BECCS)* and *Sequestration*. *{WGIII}*

Carbon Dioxide Removal (CDR)
Carbon Dioxide Removal methods refer to a set of techniques that aim to remove CO_2 directly from the atmosphere by either (1) increasing natural *sinks* for carbon or (2) using chemical engineering to remove the CO_2, with the intent of reducing the atmospheric CO_2 concentration. CDR methods involve the ocean, land and technical systems, including such methods as iron fertilization, large-scale *afforestation* and direct capture of CO_2 from the atmosphere using engineered chemical means. Some CDR methods fall under the category of *geoengineering*, though this may not be the case for others, with the distinction being based on the magnitude, scale and impact of the particular CDR activities. The boundary between CDR and *mitigation* is not clear and there could be some overlap between the two given current definitions (IPCC, 2012b, p. 2). See also *Solar Radiation Management (SRM)*. *{WGI, III}*

Carbon intensity
The amount of emissions of carbon dioxide (CO_2) released per unit of another variable such as Gross Domestic Product (GDP), output energy use or transport. *{WGIII}*

Carbon price
The price for avoided or released carbon dioxide (CO_2) or *CO_2-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. *{WGIII}*

Carbon tax
A levy on the carbon content of fossil fuels. Because virtually all of the carbon in fossil fuels is ultimately emitted as carbon dioxide (CO_2), a carbon tax is equivalent to an emission tax on CO_2 emissions. *{WGIII}*

Climate
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

[3] This glossary entry builds from definitions used in the Global Biodiversity Assessment (Heywood, 1995) and the Millennium Ecosystem Assessment (MEA, 2005).

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*. *{WGI, II, III}*

Climate change
Climate change refers to 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 *Detection and Attribution*. *{WGI, II, III}*

Climate extreme (extreme weather or climate event)
See *Extreme weather event*. *{WGI, II}*

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. In the Fifth Assessment Report, a somewhat narrower definition is often used in which the climate quantity that is perturbed is the global mean surface temperature, which in turn causes changes in the global radiation budget. In either case, the initial perturbation can either be externally forced or arise as part of *internal variability*. *{WGI, II, III}*

Climate finance
There is no agreed definition of climate finance. The term *climate finance* is applied both to the financial resources devoted to addressing *climate change* globally and to financial flows to developing countries to assist them in addressing *climate change*. The literature includes several concepts in these categories, among which the most commonly used include: *{WGIII}*

Incremental costs
The cost of capital of the *incremental investment* and the change of operating and maintenance costs for a *mitigation* or *adaptation* project in comparison to a reference project. It can be calculated as the difference of the net present values of the two projects.

Incremental investment
The extra capital required for the initial investment for a *mitigation* or *adaptation* project in comparison to a reference project.

Total climate finance
All financial flows whose expected effect is to reduce net greenhouse gas (GHG) emissions and/or to enhance *resilience* to the *impacts* of *climate variability* and the projected *climate change*. This covers private and public funds, domestic and international flows and expenditures for *mitigation* and *adaptation* to current *climate variability* as well as future *climate change*.

Total climate finance flowing to developing countries
The amount of the *total climate finance* invested in developing countries that comes from developed countries. This covers private and public funds.

Private climate finance flowing to developing countries
Finance and investment by private actors in/from developed countries for *mitigation* and *adaptation* activities in developing countries.

Public climate finance flowing to developing countries
Finance provided by developed countries' governments and bilateral institutions as well as by multilateral institutions for *mitigation* and *adaptation* activities in developing countries. Most of the funds provided are concessional loans and grants.

Climate model (spectrum or hierarchy)
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. Coupled Atmosphere–Ocean *General Circulation Model*s (AOGCMs) provide a representation of the *climate system* that is near or at the most comprehensive end of the spectrum currently available. There is an evolution towards more complex models with interactive chemistry and biology. Climate models are applied as a research tool to study and simulate the *climate* and for operational purposes, including monthly, seasonal and interannual climate predictions. *{WGI, II, III}*

Climate projection
A climate projection is the 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 socio-economic and technological developments that may or may not be realized. *{WGI, II, III}*

Climate-resilient pathways
Iterative processes for managing change within complex systems in order to reduce disruptions and enhance opportunities associated with *climate change*. *{WGII}*

Climate response
See *Climate sensitivity*. *{WGI}*

Climate sensitivity
In IPCC reports, *equilibrium climate sensitivity* (units: °C) refers to the equilibrium (steady state) change in the annual global mean surface

temperature following a doubling of the atmospheric *equivalent carbon dioxide (CO_2) concentration*. Owing to computational constraints, the *equilibrium climate sensitivity* in a *climate model* is sometimes estimated by running an atmospheric *general circulation model* coupled to a mixed-layer ocean model, because *equilibrium climate sensitivity* is largely determined by atmospheric processes. Efficient models can be run to equilibrium with a dynamic ocean. The climate sensitivity parameter (units: °C ($W\ m^{-2}$)$^{-1}$) refers to the equilibrium change in the annual global mean surface temperature following a unit change in *radiative forcing*.

The *effective climate sensitivity* (units: °C) is an estimate of the global mean surface temperature response to doubled CO_2 concentration that is evaluated from model output or observations for evolving non-equilibrium conditions. It is a measure of the strengths of the *climate feedbacks* at a particular time and may vary with forcing history and *climate* state and therefore may differ from *equilibrium climate sensitivity*.

The *transient climate response* (units: °C) is the change in the global mean surface temperature, averaged over a 20-year period, centered at the time of atmospheric CO_2 doubling, in a *climate model* simulation in which CO_2 increases at 1%/yr. It is a measure of the strength and rapidity of the surface temperature response to greenhouse gas (GHG) forcing. *{WGI, II, III}*

Climate system
The climate system is the highly complex 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 evolves 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*. *{WGI, II, III}*

Climate variability
Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the *climate* on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the *climate system* (*internal variability*), or to variations in natural or anthropogenic *external forcing* (external variability). See also *Climate change*. *{WGI, II, III}*

CO_2-equivalent (CO_2-eq) concentration
The concentration of carbon dioxide (CO_2) that would cause the same *radiative forcing* as a given mixture of CO_2 and other forcing components. Those values may consider only greenhouse gases (GHGs), or a combination of GHGs, aerosols and surface *albedo* change. CO_2-equivalent concentration is a metric for comparing *radiative forcing* of a mix of different forcing components at a particular time but does not imply equivalence of the corresponding climate change responses nor future forcing. There is generally no connection between *CO_2-equivalent emissions* and resulting CO_2-equivalent concentrations. *{WGI, III}*

CO_2-equivalent (CO_2-eq) emission
The amount of carbon dioxide (CO_2) emission that would cause the same integrated *radiative forcing*, over a given time horizon, as an emitted amount of a greenhouse gas (GHG) or a mixture of GHGs. The CO_2-equivalent emission is obtained by multiplying the emission of a GHG by its *Global Warming Potential (GWP)* for the given time horizon (see WGI Chapter 8, Table 8.A.1 and WGIII Annex II.9.1 for *GWP* values of the different GHGs used here). For a mix of GHGs it is obtained by summing the CO_2-equivalent emissions of each gas. CO_2-equivalent emission is a common scale for comparing emissions of different GHGs but does not imply equivalence of the corresponding climate change responses. There is generally no connection between CO_2-equivalent emissions and resulting *CO_2-equivalent concentrations*. *{WGI, III}*

Co-benefits
The positive effects that a policy or measure aimed at one objective might have on other objectives, irrespective of the net effect on overall social welfare. 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*. *{WGII, III}*

Confidence
The validity 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. In this report, confidence is expressed qualitatively (Mastrandrea et al., 2010). See WGI AR5 Figure 1.11 for the levels of confidence; see WGI AR5 Table 1.2 for the list of *likelihood* qualifiers; see WGII AR5 Box 1-1. See also *Uncertainty*. *{WGI, II, III}*

Cost-effectiveness
A policy is more cost-effective if it achieves a given policy goal at lower cost. *Integrated models* approximate cost-effective solutions, unless they are specifically constrained to behave otherwise. Cost-effective *mitigation scenarios* are those based on a stylized implementation approach in which a single price on carbon dioxide (CO_2) and other greenhouse gases (GHGs) is applied across the globe in every sector of every country and that rises over time in a way that achieves lowest global discounted costs. *{WGIII}*

Decarbonization
The process by which countries or other entities aim to achieve a low-carbon economy, or by which individuals aim to reduce their consumption of carbon. *{WGII, III}*

Deforestation
Conversion of *forest* to non-*forest*. 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, 2000b). 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). *{WGI, II}*

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). *{WGI, II}*

Detection of impacts of climate change
For a natural, human or managed system, identification of a change from a specified *baseline*. The *baseline* characterizes behavior in the absence of *climate change* and may be stationary or non-stationary (e.g., due to *land-use change*). *{WGII}*

Disaster
Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery. *{WGII}*

Discounting
A mathematical operation making 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 (>0) from year to year that makes future value worth less today. *{WGII, III}*

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. A megadrought is a very lengthy and pervasive drought, lasting much longer than normal, usually a decade or more. For the corresponding indices, see WGI AR5 Box 2.4. *{WGI, II}*

Early warning system
The set of 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[4]. *{WGII}*

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_2 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*. *{WGI, II}*

Ecosystem
An ecosystem is 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. *{WGI, II, III}*

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, fiber or fish, (3) regulating services such as *climate* regulation or carbon *sequestration* and (4) cultural services such as tourism or spiritual and aesthetic appreciation. *{WGII, III}*

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 a basin-wide 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 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 event 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*. For the corresponding indices, see WGI AR5 Box 2.5. *{WGI, II}*

Emission scenario
A plausible representation of the future development of emissions of substances that are potentially 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 used as input to a *climate model* to compute *climate projections*. In IPCC (1992) a set of emission scenarios was presented which were used as a basis for the *climate projections* in IPCC (1996). These emission scenarios are referred to as the IS92 scenarios. In the IPCC Special Report on Emissions Scenarios (IPCC, 2000a) emission scenarios, the so-called *SRES scenarios*, were published, some of

[4] This glossary entry builds from the definitions used in UNISDR (2009) and IPCC (2012a).

which were used, among others, as a basis for the *climate projections* presented in Chapters 9 to 11 of IPCC WGI TAR (IPCC, 2001a) and Chapters 10 and 11 of IPCC WGI AR4 (IPCC, 2007) as well as in the IPCC WGI AR5 (IPCC, 2013b). New emission scenarios for *climate change*, the four *Representative Concentration Pathways*, were developed for, but independently of, the present IPCC assessment. See also *Baseline/reference*, *Mitigation scenario* and *Transformation pathway*. *{WGI, II, III}*

Energy access
Access to clean, reliable and affordable energy services for cooking and heating, lighting, communications and productive uses (AGECC, 2010). *{WGIII}*

Energy intensity
The ratio of energy use to economic or physical output. *{WGIII}*

Energy security
The goal of a given country, or the global community as a whole, to maintain an adequate, stable and predictable energy supply. Measures encompass safeguarding the sufficiency of energy resources to meet national energy demand at competitive and stable prices and the *resilience* of the energy supply; enabling development and deployment of technologies; building sufficient infrastructure to generate, store and transmit energy supplies and ensuring enforceable contracts of delivery. *{WGIII}*

Ensemble
A collection of model simulations characterizing a *climate* prediction or *projection*. Differences in initial conditions and model formulation result in different evolutions of the modeled system and may give information on uncertainty associated with model error and error in initial conditions in the case of *climate* forecasts and on *uncertainty* associated with model error and with internally generated *climate variability* in the case of *climate projections*. *{WGI, II}*

Equilibrium climate sensitivity
See *Climate sensitivity*. *{WGI}*

Eutrophication
Over-enrichment of water by nutrients such as nitrogen and phosphorus. It is one of the leading causes of water quality impairment. The two most acute symptoms of eutrophication are hypoxia (or oxygen depletion) and harmful algal blooms. *{WGII}*

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. *{WGII}*

External forcing
External forcing refers to a forcing agent outside the *climate system* causing a change in the *climate system*. Volcanic eruptions, solar variations and anthropogenic changes in the composition of the atmosphere and *land-use change* are external forcings. Orbital forcing is also an external forcing as the insolation changes with orbital parameters eccentricity, tilt and precession of the equinox. *{WGI, II}*

Extreme weather 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 classed as an *extreme climate event*, especially if it yields an average or total that is itself extreme (e.g., *drought* or heavy rainfall over a season). *{WGI, II}*

Feedback
See *Climate feedback*. *{WGI, II}*

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

Food security
A state that prevails when people have secure access to sufficient amounts of safe and nutritious food for normal growth, development and an active and healthy life. *{WGII, III}*

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, 2000b). 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). *{WGI, III}*

Fuel poverty
A condition in which a household is unable to guarantee a certain level of consumption of domestic energy services (especially heating) or suffers disproportionate expenditure burdens to meet these needs. *{WGIII}*

Geoengineering
Geoengineering refers to 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 (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). *{WGI, II, III}*

Global climate model (also referred to as general circulation model, both abbreviated as GCM)
See *Climate model*. *{WGI, II}*

Global Temperature change Potential (GTP)
An index measuring the change in global mean surface temperature at a chosen point in time following an emission of a unit mass of a given substance, relative to that of the reference substance, carbon dioxide (CO_2). The Global Temperature change Potential (GTP) thus represents the combined effect of the differing times these substances remain in the atmosphere, their effectiveness in causing *radiative forcing* and the response of the *climate system*. The GTP has been defined in two different ways:

- Fixed GTP: based on a fixed time horizon in the future (such as GTP_{100} for a time horizon of 100 years)
- Dynamic GTP: based on a target year (such as the year when global mean temperature is expected to reach a target level). In the dynamic GTP, the time horizon reduces over time as the target year is approached and hence the GTP value changes for emissions occurring further in the future. *{WGI Chapter 8}*

Global warming
Global warming refers to the gradual increase, observed or projected, in global surface temperature, as one of the consequences of *radiative forcing* caused by anthropogenic emissions. *{WGIII}*

Global Warming Potential (GWP)
An index measuring the *radiative forcing* following an emission of a unit mass of a given substance, accumulated over a chosen time horizon, relative to that of the reference substance, carbon dioxide (CO_2). The GWP thus represents the combined effect of the differing times these substances remain in the atmosphere and their effectiveness in causing *radiative forcing*. *(WGI, III}*

Hazard
The potential occurrence of a natural or human-induced physical event or trend or physical *impact* 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. In this report, the term *hazard* usually refers to *climate*-related physical events or trends or their physical *impacts*. *{WGII}*

Heat wave
A period of abnormally and uncomfortably hot weather. *{WGI, II}*

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 ocean and land as rain or snow, which on land can be intercepted by trees and vegetation, provides runoff on the land surface, infiltrates into soils, recharges groundwater, discharges into streams and ultimately flows out into the oceans, from which it will eventually evaporate again. The various systems involved in the hydrological cycle are usually referred to as hydrological systems. *{WGI, II}*

Impacts (consequences, outcomes)
Effects on natural and human systems. In this report, the term *impacts* is used primarily to refer to the effects on natural and human systems of *extreme weather and climate events* and of *climate change*. Impacts generally refer to effects on lives, livelihoods, health, *ecosystems*, economies, societies, cultures, services and infrastructure due to the interaction of *climate changes* or hazardous climate events occurring within a specific time period and the *vulnerability* of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of *climate change* on geophysical systems, including *floods*, *droughts* and sea level rise, are a subset of impacts called physical impacts. *{WGII}*

Indirect emissions
Emissions that are a consequence of the activities within well-defined boundaries of, for instance, a region, an economic sector, a company or process, but which occur outside the specified boundaries. For example, emissions are described as indirect if they relate to the use of heat but physically arise outside the boundaries of the heat user, or to electricity production but physically arise outside of the boundaries of the power supply sector. *{WGIII}*

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 and emission of, in particular, fossil carbon dioxide (CO_2). In this report the terms *pre-industrial* and *industrial* refer, somewhat arbitrarily, to the periods before and after 1750, respectively. *{WGI, II, III}*

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. See also *Integrated models*. *{WGII, III}*

Integrated Coastal Zone Management (ICZM)
An integrated approach for sustainably managing coastal areas, taking into account all coastal habitats and uses. *{WGII}*

Integrated models
Integrated models explore the interactions between multiple sectors of the economy or components of particular systems, such as the energy system. In the context of *transformation pathways*, they refer to models that, at a minimum, include full and disaggregated representations of the energy system and its linkage to the overall economy that will allow for consideration of interactions among different elements of that system. Integrated models may also include representations of the full economy, *land use and land-use change (LUC)* and the *climate system*. See also *Integrated assessment*. *{WGIII}*

Internal variability
See *Climate variability*. *{WGI}*

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 substantially longer than the time it takes for the system to reach this perturbed state. In the context of this report, the time scale of interest is centennial to millennial. See also *Tipping point*. *{WGI}*

Land use and land-use change
Land use refers to the 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 and conservation). In urban settlements it is related to land uses within cities and their hinterlands. Urban land use has implications on city management, structure and form and thus on energy demand, greenhouse gas (GHG) emissions and mobility, among other aspects. *{WGI, II, III}*

Land-use change (LUC)
Land-use change refers to a change in the use or management of land by humans, which may lead to a change in land cover. Land cover and land-use change may have an impact on the surface *albedo*, evapotranspiration, sources and *sinks* of greenhouse gases (GHGs), or other properties of the *climate system* and may thus give rise to *radiative forcing* and/or other *impacts* on *climate*, locally or globally. See also the IPCC Special Report on Land Use, Land-Use Change, and Forestry (IPCC, 2000b).

Indirect land-use change (iLUC)
Indirect land-use change refers to shifts in land use induced by a change in the production level of an agricultural product elsewhere, often mediated by markets or driven by policies. For example, if agricultural land is diverted to fuel production, *forest* clearance may occur elsewhere to replace the former agricultural production. See also *Agriculture, Forestry and Other Land Use (AFOLU)*, *Afforestation*, *Deforestation* and *Reforestation*.

Leakage
Phenomena whereby the reduction in emissions (relative to a *baseline*) in a jurisdiction/sector associated with the implementation of *mitigation* policy is offset to some degree by an increase outside the jurisdiction/sector through induced changes in consumption, production, prices, *land use* and/or trade across the jurisdictions/sectors. Leakage can occur at a number of levels, be it a project, state, province, nation or world region.

In the context of *Carbon Dioxide Capture and Storage (CCS)*, *CO_2 leakage* refers to the escape of injected carbon dioxide (CO_2) from the storage location and eventual release to the atmosphere. In the context of other substances, the term is used more generically, such as for *methane (CH_4) leakage* (e.g., from fossil fuel extraction activities) and *hydrofluorocarbon (HFC) leakage* (e.g., from refrigeration and air-conditioning systems). *{WGIII}*

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), defined in WGI AR5 Table 1.2 and WGII AR5 Box 1-1. See also *Confidence* and *Uncertainty*. *{WGI, II, III}*

Lock-in
Lock-in occurs when a market is stuck with a standard even though participants would be better off with an alternative. In this report, lock-in is used more broadly as path dependence, which is the generic situation where decisions, events or outcomes at one point in time constrain *adaptation*, *mitigation* or other actions or options at a later point in time. *{WGII, III}*

Low regrets policy
A policy that would generate net social and/or economic benefits under current *climate* and a range of future *climate change* scenarios. *{WGII}*

Marine-based ice sheet
An ice sheet containing a substantial region that rests on a bed lying below sea level and whose perimeter is in contact with the ocean. The best known example is the West Antarctic ice sheet. *{WGI}*

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. *{WGI, II}*

Mitigation (of climate change)
A human intervention to reduce the sources or enhance the *sinks* of greenhouse gases (GHGs). This report also assesses human interventions to reduce the sources of other substances which may contribute directly or indirectly to limiting *climate change*, including, for example, the reduction of particulate matter emissions that can directly alter the radiation balance (e.g., black carbon) or measures that control emissions of carbon monoxide, nitrogen oxides, Volatile Organic Compounds and other pollutants that can alter the concentration of tropospheric ozone which has an indirect effect on the *climate*. *{WGI, II, III}*

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 *Baseline/reference*, *Emission scenario*, *Representative Concentration Pathways (RCPs)*, *SRES scenarios* and *Transformation pathway*. *{WGIII}*

Net negative emissions
A situation of net negative emissions is achieved when, as result of human activities, more greenhouse gases (GHGs) are sequestered or stored than are released into the atmosphere. *{SYR Box 2.2, footnote 29}*

Ocean acidification
Ocean acidification refers to a reduction in the *pH* of the ocean over an extended period, typically decades or longer, which is caused primarily

by uptake of carbon dioxide (CO_2) 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). *{WGI, II}*

Overshoot pathways
Emissions, concentration or temperature pathways in which the metric of interest temporarily exceeds, or *overshoots* the long-term goal. *{WGIII}*

Oxygen Minimum Zone (OMZ)
The midwater layer (200–1000 m) in the open ocean in which oxygen saturation is the lowest in the ocean. The degree of oxygen depletion depends on the largely bacterial consumption of organic matter and the distribution of the OMZs is influenced by large-scale ocean circulation. In coastal oceans, OMZs extend to the shelves and may also affect benthic *ecosystems*. *{WGII}*

Permafrost
Ground (soil or rock and included ice and organic material) that remains at or below 0°C for at least two consecutive years. *{WGI, II}*

pH
pH is a dimensionless measure of the acidity of water (or any 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. *{WGI}*

Poverty
Poverty is 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). *{WGII}*

Pre-industrial
See *Industrial Revolution*. *{WGI, II, III}*

Private costs
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 effects. *{WGIII}*

Projection
A projection is 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*. *{WGI, II}*

Radiative forcing
The strength of drivers is quantified as Radiative Forcing (RF) in units watts per square meter (W/m^2) as in previous IPCC assessments. RF is the change in energy flux caused by a driver and is calculated at the tropopause or at the top of the atmosphere. *{WGI}*

Reasons For Concern (RFCs)
Elements of a classification framework, first developed in the IPCC Third Assessment Report (IPCC, 2001b), which aims to facilitate judgments about what level of *climate change* may be *dangerous* (in the language of Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC)) by aggregating *impacts*, *risks* and *vulnerabilities*. *{WGII}*

Reducing Emissions from Deforestation and Forest Degradation (REDD)
An effort to create financial value for the carbon stored in *forests*, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to *sustainable development* (SD). It is therefore a mechanism for *mitigation* that results from avoiding *deforestation*. REDD+ goes beyond *reforestation* and *forest* degradation and includes the role of conservation, sustainable management of *forests* and enhancement of *forest* carbon stocks. The concept was first introduced in 2005 in the 11th Session of the Conference of the Parties (COP) in Montreal and later given greater recognition in the 13th Session of the COP in 2007 at Bali and inclusion in the Bali Action Plan which called for 'policy approaches and positive incentives on issues relating to reducing emissions from *deforestation* and *forest* degradation in developing countries (REDD) and the role of conservation, sustainable management of *forests* and enhancement of *forest* carbon stock in developing countries'. Since then, support for REDD has increased and has slowly become a framework for action supported by a number of countries. *{WGIII}*

Reforestation
Planting of *forests* on lands that have previously contained *forests* but that have been converted to some other use. 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, 2000b). See also information provided by the United Nations Framework Convention on Climate Change (UNFCCC, 2013). See also 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). *{WGI, II, III}*

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 that not only the long-term concentration levels are of interest, but also the trajectory taken over time to reach that outcome (Moss et al., 2010).

RCPs usually refer to the portion of the concentration pathway extending up to 2100, for which Integrated Assessment Models produced corresponding *emission scenarios*. Extended Concentration Pathways (ECPs) describe extensions of the RCPs from 2100 to 2500 that were

calculated using simple rules generated by stakeholder consultations and do not represent fully consistent scenarios.

Four RCPs produced from *Integrated Assessment Models* were selected from the published literature and are used in the present IPCC Assessment as a basis for the *climate* predictions and *projections* presented in WGI AR5 Chapters 11 to 14 (IPCC, 2013b):

RCP2.6
One pathway where *radiative forcing* peaks at approximately 3 W/m^2 before 2100 and then declines (the corresponding ECP assuming constant emissions after 2100).

RCP4.5 and RCP6.0
Two intermediate stabilization pathways in which *radiative forcing* is stabilized at approximately 4.5 W/m^2 and 6.0 W/m^2 after 2100 (the corresponding ECPs assuming constant concentrations after 2150).

RCP8.5
One high pathway for which *radiative forcing* reaches >8.5 W/m^2 by 2100 and continues to rise for some amount of time (the corresponding ECP assuming constant emissions after 2100 and constant concentrations after 2250).

For further description of future scenarios, see WGI AR5 Box 1.1. See also van Vuuren et al., 2011. *{WGI, II, III}*

Resilience
The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for *adaptation*, learning and *transformation*[5]. *{WGII, III}*

Risk
The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability or *likelihood* of occurrence of hazardous events or trends multiplied by the *impacts* if these events or trends occur. In this report, the term *risk* is often used to refer to the potential, when the outcome is uncertain, for adverse consequences on lives, livelihoods, health, *ecosystems* and species, economic, social and cultural assets, services (including environmental services) and infrastructure. *{WGII, III}*

Risk management
The plans, actions or policies to reduce the *likelihood* and/or consequences of *risks* or to respond to consequences. *{WGII}*

Sequestration
The uptake (i.e., the addition of a substance of concern to a reservoir) of carbon containing substances, in particular carbon dioxide (CO_2), in terrestrial or marine reservoirs. Biological sequestration includes direct removal of CO_2 from the atmosphere through *land-use change (LUC)*, *afforestation*, *reforestation*, revegetation, carbon storage in landfills and practices that enhance soil carbon in agriculture (cropland management, grazing land management). In parts of the literature, but not in this report, (carbon) sequestration is used to refer to *Carbon Dioxide Capture and Storage (CCS)*. *{WGIII}*

Sink
Any process, activity or mechanism that removes a greenhouse gas (GHG), an aerosol or a precursor of a GHG or aerosol from the atmosphere. *{WGI, II, III}*

Social cost of carbon
The net present value of climate damages (with harmful damages expressed as a positive number) from one more tonne of carbon in the form of carbon dioxide (CO_2), conditional on a global emissions trajectory over time. *{WGII, III}*

Social costs
See *Private costs*. *{WGIII}*

Solar Radiation Management (SRM)
Solar Radiation Management refers to the intentional modification of the Earth's shortwave radiative budget with the aim to reduce *climate change* according to a given metric (e.g., surface temperature, precipitation, regional *impacts*, etc.). Artificial injection of stratospheric aerosols and cloud brightening are two examples of SRM techniques. Methods to modify some fast-responding elements of the long wave radiative budget (such as cirrus clouds), although not strictly speaking SRM, can be related to SRM. SRM techniques do not fall within the usual definitions of *mitigation* and *adaptation* (IPCC, 2012b, p. 2). See also *Carbon Dioxide Removal (CDR)* and *Geoengineering*. *{WGI, III}*

SRES scenarios
SRES scenarios are *emission scenarios* developed by IPCC (2000a) and used, among others, as a basis for some of the *climate projections* shown in Chapters 9 to 11 of IPCC WGI TAR (IPCC, 2001a), Chapters 10 and 11 of IPCC WGI AR4 (IPCC, 2007), as well as in the IPCC WGI AR5 (IPCC, 2013b). *{WGI, II, III}*

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. *{WGI, II}*

Structural change
Changes, for example, in the relative share of gross domestic product (GDP) produced by the industrial, agricultural, or services sectors of an economy, or more generally, systems *transformations* whereby some components are either replaced or potentially substituted by other components. *{WGIII}*

Sustainability
A dynamic process that guarantees the persistence of natural and human systems in an equitable manner. *{WGII, III}*

[5] This definition builds from the definition used in Arctic Council (2013).

Sustainable development
Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). *{WGII, III}*

Thermal expansion
In connection with sea level, this refers to the increase in volume (and decrease in density) that results from warming water. A warming of the ocean leads to an expansion of the ocean volume and hence an increase in sea level. *{WGI, II}*

Tipping point
A level of change in system properties beyond which a system reorganizes, often abruptly, and does not return to the initial state even if the drivers of the change are abated. For the *climate system*, it refers to a critical threshold when global or regional *climate changes* from one stable state to another stable state. The tipping point event may be irreversible. See also *Irreversibility*. *{WGI, II, III}*

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

Transformation pathway
The trajectory taken over time to meet different goals for greenhouse gas (GHG) emissions, atmospheric concentrations, or global mean surface temperature change that implies a set of economic, technological and behavioural changes. This can encompass changes in the way energy and infrastructure are used and produced, natural resources are managed and institutions are set up and in the pace and direction of technological change (TC). See also *Baseline/reference*, *Emission scenario*, *Mitigation scenario, Representative Concentration Pathways (RCPs)* and *SRES scenarios*. *{WGIII}*

Transient Climate Response to Cumulative CO_2 Emissions (TCRE)
The transient global average surface temperature change per unit cumulated CO_2 emissions, usually 1000 PgC. TCRE combines both information on the airborne fraction of cumulated CO_2 emissions (the fraction of the total CO_2 emitted that remains in the atmosphere) and on the transient climate response (TCR). *{WGI}*

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, 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 Moss and Schneider, 2000; Manning et al., 2004; Mastrandrea et al., 2010). See also *Confidence* and *Likelihood*. *{WGI, II, III}*

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. *{WGII}*

References

AGECC, 2010: *Energy for a Sustainable Future.* United Nations Secretary General's Advisory Group on Energy and Climate (AGECC), New York, NY, USA, 24 pp.

Arctic Council, 2013: Glossary of terms. In: *Arctic Resilience Interim Report 2013*. Stockholm Environment Institute and Stockholm Resilience Centre, Stockholm, Sweden, p.viii.

Hegerl, G. C., O. Hoegh-Guldberg, G. Casassa, M. P. Hoerling, R. S. Kovats, C. Parmesan, D. W. Pierce and P. A. Stott, 2010: Good practice guidance paper on detection and attribution related to anthropogenic climate change. In: *Meeting Report of the Intergovernmental Panel on Climate Change Expert Meeting on Detection and Attribution of Anthropogenic Climate Change* [Stocker T. F. , C. B. Field, D. Qin, V. Barros, G.-K. Plattner, M. Tignor, P. M. Midgley and K. L. Ebi (eds.)]. IPCC Working Group I Technical Support Unit, University of Bern, Bern, Switzerland, 8 pp.

Heywood, V. H. (ed.), 1995: *The Global Biodiversity Assessment.* United Nations Environment Programme, Cambridge University Press, Cambridge, United Kingdom, 1152 pp.

IPCC, 1992: *Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment* [Houghton, J. T., B. A. Callander and S. K. Varney (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 116 pp.

IPCC, 1996: *Climate Change 1995: The Science of Climate Change. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J. T., L. G. Meira, A. Callander, N. Harris, A. Kattenberg and K. Maskell (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 572 pp.

IPCC, 2000a: *Emissions Scenarios*. *Special Report of Working Group III of the Intergovernmental Panel on Climate Change* [Nakićenović, N. and R. Swart (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 599 pp.

IPCC, 2000b: *Land Use, Land-Use Change, and Forestry. Special Report of the Intergovernmental Panel on Climate Change* [Watson, R. T., I. R. Noble, B. Bolin, N. H. Ravindranath, D. J. Verardo and D. J. Dokken (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 377 pp.

IPCC, 2001a: *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J. T., Y. Ding, D.J. Griggs, M. Noquer, P. J. van der Linden, X. Dai, K. Maskell and C. A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 881 pp.

IPCC, 2001b: *Climate Change 2001: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change* [McCarthy, J., O. Canziani, N. Leary, D. Dokken and K. White (eds.)],Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1032 pp.

IPCC, 2003: *Definitions and Methodological Options to Inventory Emissions from Direct Human-Induced Degradation of Forests and Devegetation of Other Vegetation Types* [Penman, J., M. Gytarsky, T. Hiraishi, T. Krug, D. Kruger, R. Pipatti, L. Buendia, K. Miwa, T. Ngara, K. Tanabe and F. Wagner (eds.)]. The Institute for Global Environmental Strategies (IGES), Japan, 32 pp.

IPCC, 2007: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor and H. L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.

IPCC, 2011: *Workshop Report of the Intergovernmental Panel on Climate Change Workshop on Impacts of Ocean Acidification on Marine Biology and Ecosystems* [Field, C. B., V. Barros, T. F. Stocker, D. Qin, K. J. Mach, G.-K. Plattner, M. D. Mastrandrea, M. Tignor and K. L. Ebi (eds.)]. IPCC Working Group II Technical Support Unit, Carnegie Institution, Stanford, CA, USA, 164 pp.

IPCC, 2012a: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* [Field, C. B., V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G.-K. Plattner, S. K. Allen, M. Tignor and P. M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, 582 pp.

IPCC, 2012b: *Meeting Report of the Intergovernmental Panel on Climate Change Expert Meeting on Geoengineering* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, C. Field, V. Barros, T. F. Stocker, Q. Dahe, J. Minx, K. J. Mach, G.-K. Plattner, S. Schlömer, G. Hansen and M. Mastrandrea (eds.)]. IPCC Working Group III Technical Support Unit, Potsdam Institute for Climate Impact Research, Potsdam, Germany, 99 pp.

IPCC, 2013a: Annex III: Glossary [Planton, S. (ed.)]. In: *Climate Change 2013: The Physical Science Basis*. *Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T. F., D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P. M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1447–1466, doi:10.1017/CBO9781107415324.031.

IPCC, 2013b: *Climate Change 2013: The Physical Science Basis*. *Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T. F., D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P. M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp., doi:10.1017/CBO9781107415324.

IPCC, 2014a: Annex II: Glossary [Agard, J., E. L. F. Schipper, J. Birkmann, M. Campos, C. Dubeux, Y. Nojiri, L. Olsson, B. Osman-Elasha, M. Pelling, M. J. Prather, M. G. Rivera-Ferre, O. C. Ruppel, A. Sallenger, K. R. Smith, A. L. St. Clair, K. J. Mach, M. D. Mastrandrea and T. E. Bilir (eds.)]. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Barros, V. R., C. B. Field, D. J. Dokken, M. D. Mastrandrea, K. J. Mach, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea and L. L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1757–1776.

IPCC, 2014b: Annex I: Glossary, Acronyms and Chemical Symbols [Allwood, J. M., V. Bosetti, N. K. Dubash, L. Gómez-Echeverri and C. von Stechow (eds.)]. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J. C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1251–1274.

Manning, M. R., M. Petit, D. Easterling, J. Murphy, A. Patwardhan, H.-H. Rogner, R. Swart and G. Yohe (eds.), 2004: *IPCC Workshop on Describing Scientific Uncertainties in Climate Change to Support Analysis of Risk of Options*. Workshop Report. Intergovernmental Panel on Climate Change, Geneva, Switzerland, 138 pp.

Mastrandrea, M. D., C. B. Field, T. F. Stocker, O. Edenhofer, K. L. Ebi, D. J. Frame, H. Held, E. Kriegler, K. J. Mach, P. R. Matschoss, G.-K. Plattner, G. W. Yohe and F. W. Zwiers, 2010: *Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties*. Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland, 4 pp.

MEA, 2005: Appendix D: Glossary. In: *Ecosystems and Human Well-being: Current States and Trends. Findings of the Condition and Trends Working Group, Vol.1* [Hassan, R., R. Scholes, and N. Ash (eds.)]. Millennium Ecosystem Assessment (MEA), Island Press, Washington, DC, USA, pp. 893-900.

Moss, R. and S. Schneider, 2000: Uncertainties in the IPCC TAR: Recommendations to Lead Authors for More Consistent Assessment and Reporting. In: *IPCC Supporting Material: Guidance Papers on Cross Cutting Issues in the Third Assessment Report of the IPCC* [Pachauri, R., T. Taniguchi and K. Tanaka (eds.)]. Intergovernmental Panel on Climate Change, Geneva, Switzerland, pp. 33–51.

Moss, R., M. Babiker, S. Brinkman, E. Calvo, T. Carter, J. Edmonds, I. Elgizouli, S. Emori, L. Erda, K. Hibbard, R. Jones, M. Kainuma, J. Kelleher, J. F. Lamarque, M. Manning, B. Matthews, J. Meehl, L. Meyer, J. Mitchell, N. Nakicenovic, B. O'Neill, R. Pichs, K. Riahi, S. Rose, P. Runci, R. Stouffer, D. van Vuuren, J. Weyant, T. Wilbanks, J. P. van Ypersele and M. Zurek, 2008: *Towards new scenarios for analysis of emissions, climate change, impacts and response strategies*. IPCC Expert Meeting Report, 19-21 September, 2007, Noordwijkerhout, Netherlands, Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland, 132 pp.

Moss, R., J. A., Edmonds, K. A. Hibbard, M. R. Manning, S. K. Rose, D. P. van Vuuren, T. R. Carter, S. Emori, M. Kainuma, T. Kram, G. A. Meehl, J. F. B. Mitchell, N. Nakicenovic, K. Riahi, S. J. Smith, R. J. Stouffer, A. M. Thomson, J. P. Weyant and T. J. Wilbanks, 2010: The next generation of scenarios for climate change research and assessment. *Nature*, **463**, 747–756.

UNFCCC, 2013: *Reporting and accounting of LULUCF activities under the Kyoto Protocol.* United Nations Framework Convention on Climatic Change (UNFCCC), Bonn, Germany. Available at: http://unfccc.int/methods/lulucf/items/4129.php

UNISDR, 2009: *2009 UNISDR Terminology on Disaster Risk Reduction*. United Nations International Strategy for Disaster Reduction (UNISDR), United Nations, Geneva, Switzerland, 30 pp.

van Vuuren, D. P., J. Edmonds, M. Kainuma, K. Riahi, A. Thomson, K. Hibbard, G. C. Hurtt, T. Kram, V. Krey, J. F. Lamarque, T. Masui, M. Meinshausen, N. Nakicenovic, S.J. Smith and S.K. Rose, 2011: The Representative Concentration Pathways: an overview. *Climatic Change*, **109**, pp. 5–31.

WCED, 1987: *Our Common Future*. World Commission on Environment and Development (WCED), Oxford University Press, Oxford, UK, 300 pp.