

## Glossary of Climate and Related Impacts

Excerpted directly from the IPCC Fourth Assessment Report and the National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) Climate Prediction Center (CPC) with full references and links at the end of the document.

### Abrupt climate change

The nonlinearity of *the climate system* may lead to abrupt *climate change*, sometimes called *rapid climate change*, *abrupt events* or even *surprises*. The term *abrupt* often refers to time scales faster than the typical time scale of the responsible forcing. However, not all abrupt climate changes need be *externally forced*. Some possible abrupt events that have been proposed include a dramatic reorganization of the thermohaline circulation, rapid deglaciation and massive melting of *permafrost* or increases in soil respiration leading to fast changes in the *carbon cycle*. Others may be truly unexpected, resulting from a strong, rapidly changing, forcing of a non-linear system [1].

### Adaptation

Adjustment in natural or *human systems* in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous, and planned adaptation [2]:

- **Anticipatory adaptation** – Adaptation that takes place before impacts of *climate change* are observed. Also referred to as proactive adaptation.
- **Autonomous adaptation** – Adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or *welfare* changes in *human systems*. Also referred to as spontaneous adaptation.
- **Planned adaptation** – Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state [2]

### Adaptation benefits

The avoided damage costs or the accrued benefits following the adoption and implementation of *adaptation* measures [1,2].

### Adaptation costs

Costs of planning, preparing for, facilitating, and implementing *adaptation* measures, including transition costs [1].

### Adaptive capacity

The whole of capabilities, resources and institutions of a country or *region* to implement effective *adaptation* measures [1].

### Afforestation

Planting of new forests on lands that historically have not contained forests (for at least 50 years). For a discussion of

the term *forest* and related terms such as afforestation, *reforestation*, and *deforestation* see the IPCC Report on Land Use, Land-Use Change and Forestry (IPCC, 2000). 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) [1].

### Aggregate impacts

Total *impacts* integrated across sectors and/or *regions*. The aggregation of impacts requires knowledge of (or assumptions about) the relative importance of impacts in different sectors and regions. Measures of aggregate impacts include, for example, the total number of people affected, or the total economic costs [1].

### Aquaculture

The managed cultivation of aquatic plants or animals such as salmon or shellfish held in captivity for the purpose of harvesting [2].

### **Aquifer**

A stratum of permeable rock that bears water. An unconfined aquifer is recharged directly by local rainfall, rivers and lakes, and the rate of recharge will be influenced by the permeability of the overlying rocks and soils[2].

### **Anthropogenic**

Resulting from or produced by human beings [1].

### **Atmosphere**

The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen and oxygen, together with trace gases including *carbon dioxide* and *ozone* [2].

### **Biodiversity**

The total diversity of all organisms and ecosystems at various spatial scales (from genes to entire *biomes*) [1].

### **Biofuel**

A fuel produced from organic matter or combustible oils produced by plants. Examples of biofuel include alcohol, black liquor from the paper-manufacturing process, wood, and soybean oil [1, 2].

### **Biomass**

The total mass of living organisms in a given area or volume; recently dead plant material is often included as dead biomass. The quantity of biomass is expressed as a dry weight or as the *energy*, carbon, or nitrogen content [1].

### **Biome**

A major and distinct regional element of the *biosphere*, typically consisting of several ecosystems (e.g. *forests*, rivers, ponds, swamps within a *region of similar climate*). Biomes are characterized by typical communities of plants and animals [1, 2].

### **Biosphere (terrestrial and marine)**

The part of the Earth system comprising all *ecosystems* and living organisms, in the *atmosphere*, on land (*terrestrial biosphere*) or in the oceans (*marine biosphere*), including derived dead organic matter, such as litter, soil organic matter and oceanic detritus [1].

### **Breakwater**

A hard engineering structure built in the sea which, by breaking waves, protects a harbour, anchorage, beach or shore area. A breakwater can be attached to the coast or lie offshore [2].

### **Carbon cycle**

The term used to describe the flow of carbon (in various forms, e.g., as *carbon dioxide*) through the *atmosphere*, ocean, terrestrial *biosphere* and lithosphere [1, 2].

### **Carbon dioxide (CO<sub>2</sub>)**

A naturally occurring gas, also a by-product of burning fossil fuels from fossil carbon deposits, such as oil, gas and coal, of burning *biomass* and of *land use changes* and other industrial processes. It is the principal *anthropogenic greenhouse gas* that affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and therefore has a *Global Warming Potential* of 1 [1].

### **Carbon sequestration**

The process of increasing the carbon content of a *reservoir*/pool other than the *atmosphere* [2].

### **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 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*. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization (WMO) [1, 2]. Note that the climate taken over different periods of time (30 years, 1000 years) may be different. The old saying is climate is what we expect and weather is what we get [3].

**Climate Change** - A non-random change in climate that is measured over several decades or longer. The change may be due to natural or human-induced causes [3].

### **Climate change**

Climate change refers to any change in *climate* over time, whether due to natural variability or as a result of human activity. This usage differs from that in the *United Nations Framework Convention on Climate Change (UNFCCC)*, which 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' [2].

### **Climate-carbon cycle coupling**

Future *climate change* induced by atmospheric emissions of *greenhouse gases* will impact on the global *carbon cycle*.

Changes in the global carbon cycle in turn will influence the fraction of anthropogenic greenhouse gases that remains in the atmosphere, and hence the atmospheric concentrations of greenhouse gases, resulting in further climate change. This *feedback* is called *climate-carbon cycle coupling*. The first generation coupled climate-carbon cycle models indicates that global warming will increase the fraction of anthropogenic CO<sub>2</sub> that remains in the atmosphere [1].

### **Climate feedback**

An interaction mechanism between processes in the *climate system* is called a climate feedback when the result of an initial process triggers changes in a second process that in turn influences the initial one. A positive feedback intensifies the original process, and a negative feedback reduces it [1]

**Climate Model** - Mathematical model for quantitatively describing, simulating, and analyzing the interactions between the atmosphere and underlying surface (e.g., ocean, land, and ice) [3]. 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 all or 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 parameterizations are involved. *Coupled Atmosphere-Ocean General Circulation Models (AOGCMs)* provide a representation of the climate system that is near the most comprehensive end of the spectrum currently available. There is an evolution towards more complex models with interactive chemistry and biology (see WG1 Chapter 8). 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* [1].

**Climate Outlook** - A climate outlook gives probabilities that conditions, averaged over a specified period, will be below-normal, normal, or above-normal [3].

### **Climate prediction**

A climate prediction or *climate forecast* is the result of an attempt to produce an estimate of the actual evolution of the *climate* in the future, for example, at seasonal, interannual or long-term time scales. Since the future evolution of the *climate system* may be highly sensitive to initial conditions, such predictions are usually probabilistic in nature [1].

### **Climate projection**

A *projection* of the response of the *climate system* to *emission* or concentration *scenarios* of *greenhouse gases* and *aerosols*, or *radiative forcing* scenarios, often based upon simulations by *climate models*. Climate projections are distinguished from *climate predictions* in order to emphasize that climate projections depend upon the emission/concentration/radiative forcing scenario used, which are based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized and are therefore subject to substantial *uncertainty* [1].

### **Climate scenario**

A plausible and often simplified representation of the future *climate*, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of *anthropogenic climate change*, often serving as input to impact models. *Climate projections* often serve as the raw material for constructing climate scenarios, but climate scenarios usually require additional information such as about the observed current climate. A *climate change scenario* is the difference between a climate scenario and the current climate [1].

### **Climate shift**

An abrupt shift or jump in mean values signalling a change in *climate* regime (see *Patterns of climate variability*). Most widely used in conjunction with the 1976/1977 climate shift that seems to correspond to a change in *El Niño-Southern Oscillation* behavior [1].

**Climate System** - The system consisting of the atmosphere (gases), hydrosphere (water), lithosphere (solid rocky part of the Earth), and biosphere (living) that determine the Earth's climate [3].

### **Climate system**

The climate system is the highly complex system consisting of five major components: the *atmosphere*, the *hydrosphere*, the *cryosphere*, the land surface 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* [1].

**Climate Test Bed** - The Climate Test Bed is an NCEP project, led by NOAA CPC in close collaboration with EMC and open to the climate community inside and outside NOAA. Its mission is to accelerate the transition of research and development into improved NOAA operational climate forecasts, products, and applications. It will support and promote: exchange of climate forecast system software among NCEP, GFDL, NASA, NCAR, COLA, and other potential contributors; multi-model ensembles; community- based, reviewed proposals for specific scientific priorities; potential expansion to experimental use of ECMWF, Canadian, Met Office, MeteoFrance products [3].

### **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*) [1].

**Climatology** - (1) The description and scientific study of climate. (2) A quantitative description of climate showing the characteristic values of climate variables over a region [3].

**Composite** - An average that is calculated according to specific criteria. For example, one might want a composite for the rainfall at a given location for all years where the temperature was much above average [3].

## **Coral**

The term *coral* has several meanings, but is usually the common name for the Order Scleractinia, all members of which have hard limestone skeletons, and which are divided into reef-building and non-reef-building, or cold- and warmwater corals [1].

## **Coral bleaching**

The paling in color which results if a *coral* loses its symbiotic, energy-providing, organisms [1].

## **Coral reefs**

Rock-like limestone structures built by *corals* along ocean coasts (*fringing reefs*) or on top of shallow, submerged banks or shelves (*barrier reefs, atolls*), most conspicuous in tropical and subtropical oceans [1].

**Coupled Model (or coupled atmosphere-ocean model)** - In the context of climate modeling this usually refers to a numerical model which simulates both atmospheric and oceanic motions and temperatures and which takes into account the effects of each component on the other [3].

**Crop Moisture Index** - In 1968, Palmer developed the index to assess short-term crop water conditions and needs across major crop-producing regions. This index is a useful tool in forecasting short-term drought conditions (See Palmer Drought Severity & Crop Moisture Indices) [3].

**Cyclone** - In general use the term cyclone is applied to any storm, especially violent, small scale circulations such as tornados, waterspouts, and dust devils. In meteorology, the term refers to a type of atmospheric disturbance centered around a low-pressure center that often results in stormy weather. In common practice the term cyclone, and low, are used interchangeably and are frequently referred to as storms. In the Northern Hemisphere the air rapidly circulates counterclockwise and in the Southern Hemisphere clockwise. Tropical cyclones with sustained winds above 73 miles per hour are known as hurricanes in the North Atlantic Ocean, Caribbean Sea, Gulf of Mexico and the Eastern North Pacific (east of the date line) and cyclones in the Indian Ocean. They are known as typhoons in other areas or the world. Both mid-latitude and tropical storms serve an important function in transferring warmth away from the tropics to the poles [3].

## **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 Report on Land Use, Land-Use Change and Forestry (IPCC, 2000). 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) [1].

## **Demand-side management (DSM)**

Policies and programmes for influencing the demand for goods and/or services. In the energy sector, DSM aims at reducing the demand for electricity and energy sources. DSM helps to reduce *greenhouse gas emissions* [1].

## **Development path or pathway**

An evolution based on an array of technological, economic, social, institutional, cultural, and biophysical characteristics that determine the interactions between natural and *human systems*, including production and consumption patterns in all countries, over time at a particular scale. *Alternative development paths* refer to different possible trajectories of development, the continuation of current trends being just one of the many paths [1].

## **Discounting**

A mathematical operation making monetary (or other) amounts received or expended at different points in time (years) comparable across time. The operator uses a fixed or possibly time-varying *discount rate* ( $>0$ ) from year to year that makes future value worth less today. In a *descriptive discounting approach* one accepts the discount rates people (savers and investors) actually apply in their day-to-day decisions (*private discount rate*). In a *prescriptive (ethical or normative) discounting*

*approach* the discount rate is fixed from a social perspective, e.g. based on an ethical judgment about the interests of future generations (*social discount rate*) [1].

## Drought

In general terms, drought is a 'prolonged absence or marked deficiency of precipitation', a 'deficiency that results in water shortage for some activity or for some group', or a 'period of abnormally dry weather sufficiently prolonged for the lack of precipitation to cause a serious hydrological imbalance' (Heim 2002). Drought has been defined in a number of ways. *Agricultural drought* relates to moisture deficits in the topmost 1 metre or so of soil (the root zone) that affect crops, *meteorological drought* is mainly a prolonged deficit of precipitation, and *hydrologic drought* is related to below-normal streamflow, lake and groundwater levels. A *megadrought* is a longdrawn out and pervasive drought, lasting much longer than normal, usually a decade or more n [1]. NOAA's defines drought more simply as a deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizeable area. NOAA, together with its partners provides short- and long-term Drought Assessments [3].

**Drought Assessments** - At the end of each month, the NOAA Climate Prediction Center (CPC) issues a long-term seasonal drought assessment. On Thursdays of each week, the CPC together with NOAA National Climatic Data Center, the United States Department of Agriculture, and the National Drought Mitigation Center in Lincoln, Nebraska, issues a weekly drought assessment called the United States Drought Monitor. These assessments review national drought conditions and indicate potential impacts for various economic sectors, such as agriculture and forestry [3].

## Ecosystem

A system of living organisms interacting with each other and their physical environment. The boundaries of what could be called an ecosystem are somewhat arbitrary, depending on the focus of interest or study. Thus, the extent of an ecosystem may range from very small spatial scales to, ultimately, the entire Earth [1].

**El Niño** - El Niño, a phase of ENSO, is a periodic warming of surface ocean waters in the eastern tropical Pacific along with a shift in convection in the western Pacific further east than the climatological average. These conditions affect weather patterns around the world. El Niño episodes occur roughly every four-to-five years and can last up to 12-to-18 months. The preliminary CPC definition of El Niño is a phenomenon in the equatorial Pacific Ocean characterized by a positive sea surface temperature departure from normal (for the 1971-2000 base period), averaged over three months, greater than or equal in magnitude to 0.5°C in a region defined by 120°W-170°W and 5°N-5°S (commonly referred to as Niño 3.4). El Niño, which would appear off the coast of Peru around Christmas time, is Spanish for "the boy" referring to the Christ child [3].

## 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 Perú, disrupting the local fishery. It has since become identified with a basinwide warming of the tropical Pacific 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 collectively known as *El Niño-Southern Oscillation*, or *ENSO*. The Southern Oscillation is measured by the surface pressure anomaly difference between Darwin and Tahiti and the El Niño is primarily measured by 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* [1]. ENSO refers to the combined atmosphere/ocean system during an El Niño warm event. The ENSO cycle includes La Niña and El Niño phases as well as neutral phases, or ENSO cycle, of the coupled atmosphere/ocean system though sometimes it is still used as originally defined. The Southern Oscillation is quantified by the Southern Oscillation Index (SOI) [3].

### **Emission scenario**

A plausible representation of the future development of emissions of substances that are potentially radiatively active

(e.g., *greenhouse gases, aerosols*), based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socioeconomic development, technological change) 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 Emission Scenarios (Nakicenovic and Swart, 2000) new emission scenarios, the so-called SRES scenarios, were published. For the meaning of some terms related to these scenarios, see *SRES scenarios* [1].

### **Emission(s) trading**

A market-based approach to achieving environmental objectives. It allows those reducing *greenhouse gas* emissions below their emission cap to use or trade the excess reductions to offset emissions at another source inside or outside the country. In general, trading can occur at the intra-company, domestic, and international levels. The Second Assessment Report by the IPCC adopted the convention of using permits for domestic trading systems and quotas for international trading systems. Emissions trading under Article 17 of the *Kyoto Protocol* is a tradable quota system based on the assigned amounts calculated from the emission reduction and limitation commitments listed in *Annex B* of the Protocol [1].

### **Energy**

The amount of work or heat delivered. Energy is classified in a variety of types and becomes useful to human ends when it flows from one place to another or is converted from one type into another.

*Primary energy* (also referred to as *energy sources*) is the energy embodied in natural resources (e.g., coal, crude oil, natural gas, uranium) that has not undergone any anthropogenic conversion. This primary energy needs to be converted and transported to become *usable energy* (e.g. light).

*Renewable energy* is obtained from the continuing or repetitive currents of energy occurring in the natural environment, and includes non-carbon technologies such as solar energy, hydropower, wind, tide and waves, and geothermal heat, as well as carbon neutral technologies such as biomass.

*Embodied energy* is the energy used to produce a material substance (such as processed metals, or building materials), taking into account energy used at the manufacturing facility (zero order), energy used in producing the materials that are used in the manufacturing facility (first order), and so on [1].

### **Energy balance**

The difference between the total incoming and total outgoing energy in the *climate system*. If this balance is positive, warming occurs; if it is negative, cooling occurs. Averaged over the globe and over long time periods, this balance must be zero. Because the *climate system* derives virtually all its energy from the Sun, zero balance implies that, globally, the amount of incoming *solar radiation* on average must be equal to the sum of the outgoing reflected solar radiation and the outgoing *thermal infrared radiation* emitted by the climate system. A perturbation of this global radiation balance, be it *anthropogenic* or natural, is called *radiative forcing* [1].

### **Energy efficiency**

Ratio of useful *energy* output of a system, conversion process or activity, to its energy input [1].

### **Erosion**

The process of removal and transport of soil and rock by weathering, mass wasting, and the action of streams, *glaciers*, waves, winds, and underground water [1].

**Evaporation** - The physical process by which a liquid or solid is changed to a gas; the opposite of condensation [3].

### **Evapotranspiration**

The combined process of water evaporation from the Earth's surface and transpiration from vegetation [1].

**Experimental Products** - An experimental product is in the final stages of testing and evaluation. If the product proves accurate and valuable to users then the next step is to make it an operational product [3].

### **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 [1].

### **Extinction**

The complete disappearance of an entire biological species [1] .

### **Extreme weather event**

An event that is rare at a particular place and time of year. Definitions of "rare" vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th *percentile* of the observed probability density function. By definition, the characteristics of what is called *extreme weather* may vary from place to place in an absolute sense. Single extreme events cannot be simply and directly attributed to *anthropogenic climate change*, as there is always a finite chance the event in question might have occurred naturally. 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) [1].

### **Food security**

A situation that exists when people have secure access to sufficient amounts of safe and nutritious food for normal growth, development and an active and healthy life. *Food insecurity* may be caused by the unavailability of food, insufficient purchasing power, inappropriate distribution, or inadequate use of food at the household level [1].

**Forecasts (Synonymous with predictions and outlooks)** - A weather forecast, or prediction, is an estimation based on special knowledge of the future state of the atmosphere with respect to temperature, precipitation, and wind. Weather forecasts are now routinely provided for up to 14 days in advance and outlooks for seasonal and longer timescales [3].

### **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. Particular criteria apply under the *Kyoto Protocol*. 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). 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) [1].

### **Fossil fuels**

Carbon-based fuels from fossil hydrocarbon deposits, including coal, peat, oil, and natural gas [1].

### **Fuel cell**

A fuel cell generates electricity in a direct and continuous way from the controlled electrochemical reaction of hydrogen or another fuel and oxygen. With hydrogen as fuel it emits only water and heat (no *carbon dioxide*) and the heat can be utilized [1].

**GCMs (General Circulation Models)** - These computer simulations reproduce the Earth's weather patterns and can be used to predict change in the weather and climate [3].

### **Glacier**

A mass of land ice which flows downhill under gravity (through internal deformation and/or sliding at the base) and is constrained by internal stress and friction at the base and sides. A glacier is

maintained by accumulation of snow at high altitudes, balanced by melting at low altitudes or discharge into the sea [1].

### **Global surface temperature**

The global surface temperature is an estimate of the global mean surface air temperature. However, for changes over time, only anomalies, as departures from a climatology, are used, most commonly based on the area-weighted global average of the sea surface temperature anomaly and land surface air temperature anomaly [1].

### **Global Warming Potential (GWP)**

An index, based upon radiative properties of well mixed *greenhouse gases*, measuring the *radiative forcing* of a unit mass of a given well mixed *greenhouse gas* in today's *atmosphere* integrated over a chosen time horizon, relative to that of *carbon dioxide*. The GWP represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in absorbing outgoing *thermal infrared radiation*. The *Kyoto Protocol* is based on GWPs from pulse emissions over a 100-year time frame [1].

**Greenhouse Effect** - The atmosphere allows solar radiation to reach the earth relatively easily. The atmosphere absorbs the infrared radiation emitted by the Earth's surface and radiates it back to the Earth in much the same way a greenhouse traps heat as the sun's rays pass through the glass, and the heat generated does not pass back through the glass. The "greenhouse effect" causes the surface of the Earth to be much warmer than it would be without the atmosphere (60°F). Without the greenhouse effect, life as we know it might not exist on Earth [3].

**Greenhouse Gas** - Certain gases, such as water vapor, carbon dioxide, and methane, that more effectively trap heat affecting the Earth's surface temperature [3].

### **Greenhouse effect**

*Greenhouse gases* effectively absorb *thermal infrared radiation*, emitted by the Earth's surface, by the *atmosphere* itself due to the same gases, and by clouds. Atmospheric radiation is emitted to all sides, including downward to the Earth's surface. Thus greenhouse gases trap heat within the surface-*troposphere* system. This is called the *greenhouse effect*. Thermal infrared radiation in the troposphere is strongly coupled to the temperature of the atmosphere at the altitude at which it is emitted. In the troposphere, the temperature generally decreases with height. Effectively, infrared radiation emitted to space originates from an altitude with a temperature of, on average,  $-19^{\circ}\text{C}$ , in balance with the net incoming *solar radiation*, whereas the Earth's surface is kept at a much higher temperature of, on average,  $+14^{\circ}\text{C}$ . An increase in the concentration of greenhouse gases leads to an increased infrared opacity of the atmosphere, and therefore to an effective radiation into space from a higher altitude at a lower temperature. This causes a *radiative forcing* that leads to an enhancement of the greenhouse effect, the so-called *enhanced greenhouse effect* [1].

### **Greenhouse gas (GHG)**

Greenhouse gases are those gaseous constituents of the *atmosphere*, both natural and *anthropogenic*, that absorb and emit radiation at specific wavelengths within the spectrum of *thermal infrared radiation* emitted by the Earth's 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 greenhouse gases in the Earth's atmosphere.

Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the *halocarbons* and other chlorine and bromine containing substances, dealt with under the Montreal Protocol. Beside CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub>, the *Kyoto Protocol* deals with the greenhouse gases *sulphur hexafluoride* (SF<sub>6</sub>), *hydrofluorocarbons* (HFCs) and *perfluorocarbons* (PFCs) [1].

### **Gross Domestic Product (GDP)**

Gross Domestic Product (GDP) is the monetary value of all goods and services produced within a nation [1].

### **Human system**

Any system in which human organisations play a major role. Often, but not always, the term is synonymous with *society* or *social system* e.g., agricultural system, political system, technological system, economic system; all are human systems in the sense applied in the Fourth Assessment Report [1].

**Hurricane** - See Cyclone [3].

### **Hydrofluorocarbons (HFCs)**

One of the six *greenhouse gases* or groups of greenhouse gases to be curbed under the *Kyoto Protocol*. They are produced commercially as a substitute for chlorofluorocarbons. HFCs largely are used in refrigeration and semiconductor manufacturing [1].

### **Hydrosphere**

The component of the *climate system* comprising liquid surface and subterranean water, such as oceans, seas, rivers, fresh water lakes, and underground water [1].

### **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, condensates to form clouds, precipitates again as rain or snow, is 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 (AMS, 2000). The various systems involved in the hydrological cycle are usually referred to as *hydrological systems* [1].

**Hydrology** - The scientific study of precipitation, evaporation, distribution, and effects of water on the Earth's surface, in the soil and rocks, and in the atmosphere [3].

### **Ice sheet**

A mass of land ice that is sufficiently deep to cover most of the underlying bedrock topography, so that its shape is mainly determined by its dynamics (the flow of the ice as it deforms internally and/or slides at its base). An ice sheet flows outwards 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 three large ice sheets in the modern world, one on Greenland and two on Antarctica, the East and West Antarctic Ice Sheet, divided by the Transantarctic Mountains[1].

### **(Climate change) Impact assessment**

The practice of identifying and evaluating, in monetary and/or non-monetary terms, the effects of *climate change* on natural and *human systems* [1].

### **(Climate change) Impacts**

The effects of *climate change* on natural and *human systems*. Depending on the consideration of *adaptation*, one can distinguish between potential impacts and residual impacts:

- *Potential impacts*: all impacts that may occur given a projected change in climate, without considering *adaptation*.
- *Residual impacts*: the impacts of climate change that would occur after adaptation [1].

### **Implementation**

Implementation describes the actions taken to meet commitments under a treaty and encompasses legal and effective phases. *Legal implementation* refers to legislation, regulations, judicial decrees, including other actions such as efforts to administer progress which governments take to translate international accords into domestic law and policy. *Effective implementation* needs policies and programs that induce changes in the behavior and decisions of target groups. Target groups then take effective measures of mitigation and adaptation [1].

### **Indigenous peoples**

No internationally accepted definition of indigenous peoples exists. Common characteristics often applied under international law, and by United Nations agencies to distinguish indigenous peoples include: residence within or attachment to geographically distinct traditional habitats, ancestral territories, and their natural resources; maintenance of cultural and social identities, and social, economic, cultural and political institutions separate from mainstream or dominant societies and cultures; descent from population groups present in a given area, most frequently before modern states or territories were created and current borders defined; and self-identification as being part of a distinct indigenous cultural group, and the desire to preserve that cultural identity [1].

### **Industrial revolution**

A period of rapid industrial growth with far-reaching social and economic consequences, beginning in Britain during the second half of the eighteenth 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*. In this Report the terms *preindustrial* and *industrial* refer, somewhat arbitrarily, to the periods before and after 1750, respectively [1].

### **Inertia**

In the context of *climate change mitigation*, inertia relates to the difficulty of change resulting from pre-existing conditions within society such as physical man-made capital, natural capital, and social non-physical capital, including institutions, regulations, and norms. Existing structures lock in societies making change more difficult. In the context of the *climate system*, inertia relates to the delay in *climate change* after an *external forcing* has been applied, and to the continuation of climate change even after the external forcing has been stabilized [1].

### **Infectious disease**

Any disease caused by microbial agents that can be transmitted from one person to another or from animals to people. This may occur by direct physical contact, by handling of an object that has picked up infective organisms, through a disease carrier, via contaminated water, or by spread of infected droplets coughed or exhaled into the air [1].

### **Infrastructure**

The basic equipment, utilities, productive enterprises, installations, and services essential for the development, operation, and growth of an organization, city, or nation [1].

### **Integrated assessment**

A method of analysis that combines results and models from the physical, biological, economic and social sciences, and the interactions between these components in a consistent framework to evaluate the status and the consequences of environmental change and the policy responses to it. Models used to carry out such analysis are called *Integrated Assessment Models* [1].

### **Integrated water resources management (IWRM)**

The prevailing concept for water management which, however, has not been defined unambiguously. IWRM is based on four principles that were formulated by the International Conference on Water and the Environment in Dublin, 1992: 1) fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment; 2) water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels; 3) women play a central part in the provision, management and safeguarding of water; 4) water has an economic value in all its competing uses and should be recognized as an economic good [1].

### **Interglacials**

The warm periods between ice age glaciations. The previous interglacial, dated approximately from 129,000 to 116,000 years ago, is referred to as *Last Interglacial* (AMS, 2000) [1].

**Intraseasonal Oscillations** - Variability on a timescale less than a season. One example is the Madden-Julian Oscillation [3].

**Jet Stream** - Strong winds concentrated within a narrow zone in the atmosphere in the upper troposphere, about 30,000 feet aloft that generally move in an easterly direction that drive weather systems around the globe. In North America jet streams are more pronounced in winter [3].

**Kelvin Waves** - Fluctuations in wind speed at the ocean surface at the Equator result in eastward propagating waves, known as Kelvin Waves. Kelvin Waves cause variations in the depth of the oceanic thermocline, the boundary between warm waters in the upper ocean and cold waters in the deep ocean. They play an important role in monitoring and predicting El Niño episodes [3].

### **Kyoto Mechanisms (also called Flexibility Mechanisms)**

Economic mechanisms based on market principles that parties to the *Kyoto Protocol* can use in an attempt to lessen the potential economic impacts of *greenhouse gas emission* reduction requirements. They include *Joint Implementation* (Article 6), *Clean Development Mechanism* (Article 12), and *Emissions Trading* (Article 17) [1].

### **Kyoto Protocol**

The Kyoto Protocol to the *United Nations Framework Convention on Climate Change (UNFCCC)* was adopted in 1997 in Kyoto, Japan, at the Third Session of the Conference of the Parties (COP) to the UNFCCC. It contains legally binding commitments, in addition to those included in the UNFCCC. Countries included in *Annex B* of the Protocol (most Organization for Economic Cooperation and Development countries and countries with *economies in transition*) agreed to reduce their *anthropogenic greenhouse gas emissions (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride)* by at least 5% below 1990 levels in the commitment period 2008 to 2012. The Kyoto Protocol entered into force on 16 February 2005 [1].

**La Niña** - La Niña, a phase of ENSO, is a periodic cooling of surface ocean waters in the eastern tropical Pacific along with a shift in convection in the western Pacific further west than the climatological average. These conditions affect weather patterns around the world. The preliminary CPC definition of La Niña is a phenomenon in the equatorial Pacific Ocean characterized by a *negative sea surface temperature* departure from normal (for the 1971-2000 base period), averaged over three months, greater than or equal in magnitude to 0.5°C in a region defined by 150°W-160°E and 5°N-5°S (commonly referred to as Niño 4) [3].

### **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) [1].

**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*, or other properties of the *climate system* and may thus have a *radiative forcing* and/or other impacts on *climate*, locally or globally. See also: the IPCC Report on Land Use, Land-Use Change, and Forestry (IPCC, 2000) [1].

**Madden-Julian Oscillation (MJO)** - Tropical rainfall exhibits strong variability on time scales shorter than the seasonal El Niño-Southern Oscillation (ENSO). These fluctuations in tropical rainfall often go through an entire cycle in 30-60 days, and are referred to as the Madden-Julian Oscillation or intraseasonal oscillations. The intraseasonal oscillations are a naturally occurring component of our coupled ocean-atmosphere system. They significantly affect the atmospheric circulation throughout the global Tropics and subtropics, and also strongly affect the wintertime jet stream and atmospheric circulation features over the North Pacific and western North America. As a result, they have an important impact on storminess and temperatures over the United States. During the summer these oscillations have a modulating effect on hurricane activity in both the Pacific and Atlantic basins [3].

### **Malaria**

Endemic or epidemic parasitic disease caused by species of the genus *Plasmodium* (Protozoa) and transmitted to humans by mosquitoes of the genus *Anopheles*; produces bouts of high fever and

systemic disorders, affects about 300 million and kills approximately 2 million people worldwide every year [1].

### **Mass balance (of glaciers, ice caps or ice sheets)**

The balance between the mass input to an ice body (accumulation) and the mass loss (ablation, iceberg calving). Mass balance terms include the following: *Specific mass balance*: net mass loss or gain over a hydrological cycle at a point on the surface of a *glacier*. *Total mass balance* (of the glacier): The specific mass balance spatially integrated over the entire glacier area; the total mass a glacier gains or loses over a hydrological cycle. *Mean specific mass balance*: The total mass balance per unit area of the glacier. If *surface* is specified (*specific surface mass balance*, etc.) then ice-flow contributions are not considered; otherwise, mass balance includes contributions from ice flow and iceberg calving. The specific surface mass balance is positive in the accumulation area and negative in the ablation area [1].

### **Mean Sea Level**

Mean sea level is normally defined as the average relative sea level over a period, such as a month or a year, long enough to average out transients such as waves and tides. *Relative sea level* is sea level measured by a tide gauge with respect to the land upon which it is situated [1].

**Meteorology** - The scientific study of the physics, chemistry, and dynamics of the Earth's atmosphere, especially weather and climate [3].

### **Methane (CH<sub>4</sub>)**

Methane is one of the six *greenhouse gases* to be mitigated under the *Kyoto Protocol* and is the major component of natural gas and associated with all hydrocarbon fuels, animal husbandry and agriculture. *Coal-bed methane* is the gas found in coal seams [1].

### **Methane recovery**

*Methane* emissions, e.g. from oil or gas wells, coal beds, peat bogs, gas transmission pipelines, landfills, or anaerobic digesters, may be captured and used as a fuel or for some other economic purpose (e.g. chemical feedstock) [1].

### **Millennium Development Goals (MDGs)**

A set of time-bound and measurable goals for combating poverty, hunger, disease, illiteracy, discrimination against women and environmental degradation, agreed at the UN Millennium Summit in 2000 [1].

### **Mitigation**

Technological change and substitution that reduce resource inputs and emissions per unit of output. Although several social, economic and technological policies would produce an emission reduction, with respect to *Climate Change*, mitigation means implementing policies to reduce *greenhouse gas* emissions and enhance *sinks* [1].

### **Mitigative capacity**

This is a country's ability to reduce *anthropogenic greenhouse gas* emissions or to enhance natural *sinks*, where ability refers to skills, competencies, fitness and proficiencies that a country has attained and depends on technology, institutions, wealth, equity, infrastructure and information. Mitigative capacity is rooted in a country's sustainable development path [1].

### **Monsoon**

A monsoon is a tropical and subtropical seasonal reversal in both the surface winds and associated precipitation, caused by differential heating between a continental-scale land mass and the adjacent ocean. Monsoon rains occur mainly over land in summer [1].

### **Morbidity**

Rate of occurrence of disease or other health disorder within a population, taking account of the age-specific morbidity rates. Morbidity indicators include chronic disease incidence/prevalence, rates of

hospitalization, primary care consultations, disability-days (i.e., days of absence from work), and prevalence of symptoms [1].

### **Mortality**

Rate of occurrence of death within a population; calculation of mortality takes account of age-specific death rates, and can thus yield measures of life expectancy and the extent of premature death [1].

**Niño 1+ 2, 3, 3.4, and 4** - In monitoring the equatorial tropical Pacific for the phases of the ENSO cycle, the area has been divided into 4 sections:

- Niño 1+2 (0°-10° South) (90° West-80° West)
- Niño 3 (5° North-5° South) (150° West-90° West)
- Niño 4 (5° North-5° South) (160° East-150° West)
- Niño 3.4 (5° North-5° South) (170°-120° West)

The reason for this is that major atmospheric circulation impacts are related to changes in the pattern of convection in these regions. The Niño 3.4 and Niño 4 regions encompass the area where slight increases or decreases in SSTs can have a big impact on where convection is found in the western and central Pacific and are the key areas for monitoring and predicting ENSO events [3].

### **Nitrous oxide (N<sub>2</sub>O)**

One of the six types of *greenhouse gases* to be curbed under the *Kyoto Protocol*. The main anthropogenic source of nitrous oxide is agriculture (soil and animal manure management), but important contributions also come from sewage treatment, combustion of fossil fuel, and chemical industrial processes. Nitrous oxide is also produced naturally from a wide variety of biological sources in soil and water, particularly microbial action in wet tropical forests [1].

**Normal** - To understand whether precipitation and temperature is above or below normal for seasons and longer timescales, normal is defined as the average weather over 30 years. These averages are recalculated every ten years. The National Weather Service has just recalculated the baseline period for normal from 1961 to 1990 to 1971 to 2000. Since the cool decade of the 1960's has been replaced with the mild 1990's, normal temperatures in many areas have increased [3].

### **Ocean acidification**

A decrease in the *pH* of sea water due to the uptake of *anthropogenic carbon dioxide* [1].

### **Ozone (O<sub>3</sub>)**

Ozone, the tri-atomic form of oxygen, is a gaseous *atmospheric* constituent. In the *troposphere*, ozone is created both naturally and by photochemical reactions involving gases resulting from human activities (smog) [1].

In the *stratosphere*, ozone is created by the interaction between solar ultraviolet radiation and molecular oxygen (O<sub>2</sub>) [1]. Stratospheric ozone plays a dominant role in the stratospheric radiative balance [1]. In the stratosphere, ozone has beneficial properties where it forms an ozone shield that prevents dangerous radiation from reaching the Earth's surface [3]. Troposphere ozone acts as a *greenhouse gas* [1]. Closer to the planet's surface, ozone is considered an air pollutant that adversely affects humans, plants and animals as well as a greenhouse gas [3].

**Ozone Hole** - A severe depletion of stratospheric ozone over Antarctica that occurs each spring. The possibility exists that a hole could form over the Arctic as well. The depletion is caused by a chemical reaction involving ozone and chlorine, primarily from human produced sources, cloud particles, and low temperatures [3].

**Pacific Decadal Oscillation** - A recently described pattern of climate variation similar to ENSO though on a timescale of decades and not seasons. It is characterized by SST anomalies of one sign in the north-central Pacific and SST anomalies of another sign to the north and east near the Aleutians and the Gulf of Alaska. It primarily affects weather patterns and sea surface temperatures in the

Pacific Northwest, Alaska, and northern Pacific Islands. Two main characteristics distinguish PDO from El Niño/Southern Oscillation (ENSO): first, 20th century PDO "events" persisted for 20-to-30 years, while typical ENSO events persisted for 6 to 18 months; second, the climatic fingerprints of the PDO are most visible in the North Pacific/North American sector, while secondary signatures exist in the tropics- the opposite is true for ENSO. Several independent studies found evidence of just two full PDO cycles in the past century: cool" PDO regimes prevailed from 1890-1924 and again from 1947-1976, while "warm" PDO regimes dominated from 1925-1946 and from 1977 through (at least) the mid-1990's. Causes for the PDO are not currently known. Likewise, the potential predictability for this climate oscillation are not known [3].

### **Paleoclimate**

*Climate* during periods prior to the development of measuring instruments, including historic and geologic time, for which only proxy climate records are available [1].

**Palmer Drought Severity Index (PDSI)** - An index that compares the actual amount of precipitation received in an area during a specified period with the normal or average amount expected during that same period. It was developed to measure lack of moisture over a relatively long period of time and is based on the supply and demand concept of a water balance equation. Included in the equation are amount of evaporation, soil recharge, and runoff and temperature and precipitation data [3].

### **Patterns of climate variability**

Natural variability of the *climate system*, in particular on seasonal and longer time scales, predominantly occurs with preferred spatial patterns and time scales, through the dynamical characteristics of the atmospheric circulation and through interactions with the land and ocean surfaces. Such patterns are often called *regimes*, *modes* or *teleconnections*. Examples are the North Atlantic Oscillation (NAO), the Pacific-North American pattern (PNA), the *El Niño- Southern Oscillation (ENSO)*, the Northern Annular Mode (NAM; previously called Arctic Oscillation, AO) and the Southern Annular Mode (SAM; previously called the Antarctic Oscillation, AAO). Many of the prominent modes of climate variability are discussed in section 3.6 of the Working Group I Report [1].

### **Percentile**

A percentile is a value on a scale of zero to one hundred that indicates the percentage of the data set values that is equal to or below it. The percentile is often used to estimate the extremes of a distribution. For example, the 90th (10th) percentile may be used to refer to the threshold for the upper (lower) extremes [1].

### **Perfluorocarbons (PFCs)**

Among the six *greenhouse gases* to be abated under the *Kyoto Protocol*. These are by-products of aluminium smelting and uranium enrichment. They also replace *chlorofluorocarbons* in manufacturing semiconductors [1].

### **Permafrost**

Ground (soil or rock and included ice and organic material) that remains at or below 0°C for at least two consecutive years (Van Everdingen, 1998) [1].

### **pH**

pH is a dimensionless measure of the acidity of water (or any solution). Pure water has a pH=7. Acid solutions have a pH smaller than 7 and basic solutions have a pH larger than 7. pH is measured on a logarithmic scale. Thus, a pH decrease of 1 unit corresponds to a 10-fold increase in the acidity [1].

### **Phenology**

The study of natural phenomena in biological systems that recur periodically (e.g., development stages, migration) and their relation to *climate* and seasonal changes [1].

### **Photosynthesis**

The process by which green plants, algae and some bacteria take *carbon dioxide* from the air (or bicarbonate in water) to build carbohydrates. There are several pathways of photosynthesis with different responses to atmospheric carbon dioxide concentrations [1].

### **Plankton**

Micro-organisms living in the upper layers of aquatic systems. A distinction is made between *phytoplankton*, which depend on photosynthesis for their energy supply, and *zooplankton*, which feed on phytoplankton [1].

### **Projection**

A potential future evolution of a quantity or set of quantities, often computed with the aid of a model. Projections are distinguished from predictions in order to emphasize that projections involve assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized, and are therefore subject to substantial *uncertainty* [1].

### **Purchasing Power Parity (PPP)**

The purchasing power of a currency is expressed using a basket of goods and services that can be bought with a given amount in the home country. International comparison of e.g. *Gross Domestic Products (GDP)* of countries can be based on the purchasing power of currencies rather than on current exchange rates. PPP estimates tend to lower per capita GDPs in industrialized countries and raise per capita GDPs in developing countries [1].

### **Radiative forcing**

Radiative forcing is the change in the net, downward minus upward, irradiance (expressed in Watts per square metre,  $W/m^2$ ) at the *tropopause* due to a change in an external driver of *climate change*, such as, for example, a change in the concentration of *carbon dioxide* or the output of the Sun. 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. For the purposes of this report, radiative forcing is further defined as the change relative to the year 1750 and, unless otherwise noted, refers to a global and annual average value [1].

### **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 Report on Land Use, Land-Use Change and Forestry (IPCC, 2000). 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) [1].

### **Resilience**

The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change [1].

### **Retrofitting**

Retrofitting means to install new or modified parts or equipment, or undertake structural modifications, to existing *infrastructure* that were either not available or not considered necessary at the time of construction. The purpose of retrofitting in the context of *climate change* is generally to ensure that existing infrastructure meets new design specifications that may be required under altered climate conditions [1].

### **Runoff**

That part of precipitation that does not evaporate and is not transpired, but flows over the ground surface and returns to bodies of water [1].

### **Salinization**

The accumulation of salts in soils [1].

**Saltwater intrusion**

Displacement of fresh surface water or groundwater by the advance of saltwater due to its greater density. This usually occurs in coastal and estuarine areas due to reducing landbased influence (e.g., either from reduced *runoff* and associated groundwater recharge, or from excessive water withdrawals from aquifers) or increasing marine influence (e.g., relative *sea-level rise*) [1].

**Scenario**

A plausible and often simplified description of how the future may develop, based on a coherent and internally consistent set of assumptions about driving forces and key relationships. Scenarios may be derived from *projections*, but are often based on additional information from other sources, sometimes combined with a *narrative storyline* [1].

**Sea ice**

Any form of ice found at sea that has originated from the freezing of sea water. 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 (*landfast ice*). Sea ice less than one year old is called *first-year ice*. *Multi-year ice* is sea ice that has survived at least one summer melt season [1].

**Sea level change/sea level rise**

Sea level can change, both globally and locally, due to (i) changes in the shape of the ocean basins, (ii) changes in the total mass of water and (iii) changes in water density. Factors leading to sea level rise under global warming include both increases in the total mass of water from the melting of landbased snow and ice, and changes in water density from an increase in ocean water temperatures and salinity changes. *Relative sea level rise* occurs where there is a local increase in the level of the ocean relative to the land, which might be due to ocean rise and/or land level subsidence [1].

**Sea Surface Temperatures (SSTs)** - The term refers to the mean temperature of the ocean in the upper few meters [3].

**Sensitivity**

Sensitivity is the degree to which a system is affected, either adversely or beneficially, by *climate variability* or *climate change*. The effect may be *direct* (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or *indirect* (e.g., damages caused by an increase in the frequency of coastal flooding due to *sea level rise*). This concept of sensitivity is not to be confused with *climate sensitivity*, which is defined separately above [1].

**Sink**

Any process, activity or mechanism which removes a *greenhouse gas*, an *aerosol* or a precursor of a greenhouse gas or aerosol from the *atmosphere* [1].

**SOI (Southern Oscillation Index)** - SOI is based on the (atmospheric) pressure difference between Tahiti and Darwin, Australia. It is highly correlated with tropical sea surface temperature anomaly indices recorded in Niño3 [3].

**Soil temperature**

The temperature of the ground near the surface (often within the first 10 cm) [1].

**Solar activity**

The Sun exhibits periods of high activity observed in numbers of sunspots, as well as radiative output, magnetic activity, and emission of high energy particles. These variations take place on a range of time-scales from millions of years to minutes [1].

**Solar radiation**

Electromagnetic radiation emitted by the Sun. It is also referred to as *short-wave radiation*. Solar radiation has a distinctive range of wavelengths (spectrum) determined by the temperature of the Sun, peaking in visible wavelengths [1].

**Spatial and temporal scales**

*Climate* may vary on a large range of spatial and temporal scales. *Spatial scales* may range from local (less than 100,000 km<sup>2</sup>), through regional (100,000 to 10 million km<sup>2</sup>) to continental (10 to 100 million km<sup>2</sup>). *Temporal scales* may range from seasonal to geological (up to hundreds of millions of years) [1].

### **SRES scenarios**

SRES scenarios are *emission scenarios* developed by Nakicenovic et Swart (2000) and used, among others, as a basis for some of the *climate projections* used in the Fourth Assessment Report. The following terms are relevant for a better understanding of the structure and use of the set of SRES scenarios: *Scenario Family*: Scenarios that have a similar demographic, societal, economic and technical-change storyline. Four scenario families comprise the SRES scenario set: A1, A2, B1 and B2. *Illustrative Scenario*: A scenario that is illustrative for each of the six scenario groups reflected in the Summary for Policymakers of Nakicenovic et al. (2000). They include four revised 'scenario markers' for the scenario groups A1B, A2, B1, B2, and two additional scenarios for the A1FI and A1T groups. All scenario groups are equally sound. *Marker Scenario*: A scenario that was originally posted in draft form on the SRES website to represent a given scenario family. The choice of markers was based on which of the initial quantifications best reflected the storyline, and the features of specific models. Markers are no more likely than other scenarios, but are considered by the SRES writing team as illustrative of a particular storyline. They are included in revised form in Nakicenovic and Swart (2000). These scenarios received the closest scrutiny of the entire writing team and via the SRES open process. Scenarios were also selected to illustrate the other two scenario groups. *Storyline*: A narrative description of a scenario (or family of scenarios), highlighting the main scenario characteristics, relationships between key driving forces and the dynamics of their evolution [1].

### **Stakeholder**

A person or an organization that has a legitimate interest in a project or entity, or would be affected by a particular action or *policy*[1].

### **Standards**

Set of rules or codes mandating or defining product performance (e.g., grades, dimensions, characteristics, test methods, and rules for use). *Product, technology or performance standards* establish minimum requirements for affected products or technologies. Standards impose reductions in *greenhouse gas emissions* associated with the manufacture or use of the products and/or application of the technology [1].

### **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 [1].

### **Storm tracks**

Originally, a term referring to the tracks of individual cyclonic weather systems, but now often generalized to refer to the *regions* where the main tracks of extratropical disturbances occur as sequences of low (cyclonic) and high (anticyclonic) pressure systems [1].

### **Stratosphere**

The highly stratified region of the *atmosphere* above the *troposphere* extending from about 10 km (ranging from 9 km in high latitudes to 16 km in the tropics on average) to about 50 km altitude [1].

### **Streamflow**

Water flow within a river channel, for example expressed in m<sup>3</sup>/s. A synonym for river discharge [1].

### **Structural change**

Changes, for example, in the relative share of *Gross Domestic Product* produced by the industrial, agricultural, or services sectors of an economy; or more generally, system transformations whereby some components are either replaced or potentially substituted by other ones [1].

### **Sustainable Development (SD)**

The concept of sustainable development was introduced in the World Conservation Strategy (IUCN 1980) and had its roots in the concept of a sustainable society and in the management of renewable resources. Adopted by the WCED in 1987 and by the Rio Conference in 1992 as a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. SD integrates the political, social, economic and environmental dimensions [1].

### **Technological change**

Mostly considered as technological *improvement*, i.e. more or better goods and services can be provided from a given amount of resources (production factors). Economic models distinguish autonomous (exogenous), endogenous and induced technological change. *Autonomous (exogenous) technological change* is imposed from outside the model, usually in the form of a time trend affecting energy demand or world output growth. *Endogenous technological change* is the outcome of economic activity *within* the model, i.e. the choice of technologies is included within the model and affects energy demand and/or economic growth. *Induced technological change* implies endogenous technological change but adds further changes *induced* by policies and measures, such as carbon taxes triggering R&D efforts [1].

### **Technology**

The practical application of knowledge to achieve particular tasks that employs both technical artifacts (hardware, equipment) and (social) information ("software", know-how for production and use of artifacts) [1].

### **Technology transfer**

The exchange of knowledge, hardware and associated software, money and goods among stakeholders that leads to the spreading of *technology* for *adaptation* or *mitigation*. The term encompasses both diffusion of technologies and technological cooperation across and within countries [1].

**Teleconnection** - A strong statistical relationship between weather in different parts of the globe. For example, there appears to be a teleconnection between the tropics and North America during El Niño [3].

### **Thermal expansion**

In connection with *sea-level rise*, 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 [1].

### **Thermal infrared radiation**

Radiation emitted by the Earth's surface, the *atmosphere* and the clouds. It is also known as *terrestrial* or *longwave radiation*, and is to be distinguished from the near-infrared radiation that is part of the solar spectrum. Infrared radiation, in general, has a distinctive range of wavelengths (*spectrum*) longer than the wavelength of the red color in the visible part of the spectrum. The spectrum of thermal infrared radiation is practically distinct from that of shortwave or *solar radiation* because of the difference in temperature between the Sun and the Earth atmosphere system [3].

**Thermocline** - As one descends from the surface of the ocean, the temperature remains nearly the same as it was at the surface, but at a certain depth temperature starts decreasing rapidly with depth. This boundary is called the thermocline. In studying the tropical Pacific Ocean, the depth of 20°C water ("the 20°C isotherm") is often used as a proxy for the depth of the thermocline. Along the equator, the 20°C isotherm is typically located at about 50m depth in the eastern Pacific, sloping downwards to about 150 m in the western Pacific [3].

### **Tide gauge**

A device at a coastal location (and some deep sea locations) that continuously measures the level of the sea with respect to the adjacent land. Time averaging of the sea level so recorded gives the observed secular changes of the relative sea level [1].

**Tropopause**

The boundary between the *troposphere* and the *stratosphere* [1].

**Troposphere**

The lowest part of the *atmosphere* from the surface to about 10 km in altitude in mid-latitudes (ranging from 9 km in highlatitudes to 16 km in the tropics on average), where clouds and weather phenomena occur. In the troposphere, temperatures generally decrease with height [1].

**Typhoon** - See [Cyclone](#) [3].

**Ultraviolet (UV) (or Ultraviolet Radiation)** - Ultraviolet radiation from the sun plays a role in the formation of the ozone layer by acting as a catalyst for a chemical reaction that breaks apart oxygen molecules which then recombine to form ozone. The absorption of UV by stratospheric ozone and atmospheric oxygen prevents very little ultraviolet radiation to reach earth's surfaces where it can detrimental effects on human health and property [3].

**Uncertainty**

An expression of the degree to which a value (e.g., the future state of the *climate system*) is unknown. Uncertainty can result from lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from quantifiable errors in the data to ambiguously defined concepts or terminology, or uncertain *projections* of human behavior. Uncertainty can therefore be represented by quantitative measures, for example, a range of values calculated by various models, or by qualitative statements, for example, reflecting the judgement of a team of experts (see Moss and Schneider, 2000; Manning et al., 2004) [1].

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

The Convention was adopted on 9 May 1992 in New York and signed at the 1992 Earth Summit in Rio de Janeiro by more than 150 countries and the European Community. Its ultimate objective is the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". It contains commitments for all Parties. Under the Convention, Parties included in *Annex I* (all OECD member countries in the year 1990 and countries with *economies in transition*) aim to return *greenhouse gas* emissions not controlled by the Montreal Protocol to 1990 levels by the year 2000. The Convention entered in force in March 1994 [1].

**Uptake**

The addition of a substance of concern to a reservoir. The uptake of carbon containing substances, in particular *carbon dioxide*, is often called (*carbon sequestration*) [1].

**Upwelling** - In ocean dynamics, the upward motion of sub-surface water toward the surface of the ocean. This is often a source of cold, nutrient-rich water. Strong upwelling occurs along the equator where easterly winds are present. Upwelling also can occur along coastlines, and is important to fisheries and birds in California and Peru [3].

**Urbanization**

The conversion of land from a natural state or managed natural state (such as agriculture) to cities; a process driven by net rural-to-urban migration through which an increasing percentage of the population in any nation or region come to live in settlements that are defined as *urban centers* [1].

**Vector**

An organism, such as an insect, that transmits a pathogen from one host to another [1].

**Vulnerability**

Vulnerability is the degree to which a *system* is susceptible to, and unable to cope with, adverse effects of *climate change*, including *climate variability* and extremes. Vulnerability is a function of the character, magnitude, and rate of climate

change and variation to which a system is exposed, its *sensitivity*, and its *adaptive capacity* [1].

### **Water consumption**

Amount of extracted water irretrievably lost during its use (by evaporation and goods production). Water consumption is equal to water withdrawal minus return flow [1].

### **Water stress**

A country is water stressed if the available freshwater supply relative to water withdrawals acts as an important constraint on development. In global-scale assessments, basins with water stress are often defined as having a per capita water availability below 1,000 m<sup>3</sup>/yr (based on long-term average runoff). Withdrawals exceeding 20% of renewable water supply have also been used as an indicator of water stress. A crop is water stressed if soil available water, and thus actual *evapotranspiration*, is less than potential evapotranspiration demands [1].

### **References:**

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[3] National Weather Service Climate Prediction Center. Climate Glossary, <http://www.cpc.ncep.noaa.gov/products/outreach/glossary.shtml>, accessed July 6, 2008.