Annex I

User guide and access to more detailed information

As defined in the IPCC Procedures, the Synthesis Report (SYR) synthesises and integrates material contained within IPCC Assessment Reports and Special Reports. The scope of the SYR of the Fourth Assessment Report includes material contained in the three Working Group contributions to the AR4, and it draws on information contained in other IPCC Reports as required. The SYR is based exclusively on assessments by the IPCC Working Groups, it does not refer to or assess the primary scientific literature itself.

The SYR is largely self-contained but provides only a very condensed summary of the much richer information contained in the underlying Working Group reports. Users may wish to access relevant material at the required level of detail in the following manner:

- The Summary for Policymakers (SPM) of the SYR provides the most condensed summary of our current understanding of scientific, technical and socio-economic aspects of climate change. All references in curly brackets in this Summary for Policymakers refer to numbered sections of this SYR.

- The Introduction and six Topics of this SYR provide more detailed and more comprehensive information than the SYR SPM. References in curly backets in the Introduction and six Topics of this SYR point to chapter sections, Summaries for Policymakers and Technical Summaries of the three underlying Working Group reports of the AR4, and in some instances to other topic sections of the SYR itself. References to the IPCC Third Assessment Report in 2001 (TAR) are identified by adding "TAR" in front of the cited report.

- Users who wish to gain a better understanding of scientific details or access the primary scientific literature on which the SYR is based, should refer to chapter sections of the underlying Working Group reports that are cited in the longer report of the SYR. The individual chapters of the Working Group reports provide comprehensive references to the primary scientific literature on which IPCC assessments are based, and also offer the most detailed region- and sector-specific information.

A comprehensive glossary, list of acronyms, abbreviations and scientific units, and an index are provided below to facilitate use of this report by as wide an audience as possible.

Annex II

Glossary

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This Glossary is based on the glossaries published in the contributions of Working Groups of I, II and III to the IPCC Fourth Assessment Report. Additional work has been undertaken on additions, consistency and shortening of definitions to make this glossary more suitable to a wider audience.

The italics used have the following meaning: *Glossary word reference; Glossary secondary reference* (i.e. terms which are either contained in a glossary of the IPCC Working Group contributions to the AR4, or defined within the text of an entry of this glossary).

A.

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 reorganisation 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.

Absorption, scattering and emission of radiation
Electromagnetic radiation may interact with matter, be it in the form of the atoms and molecules of a gas (e.g. the gases in the *atmosphere*) or in the form of particulate, solid or liquid, matter (e.g. *aerosols*), in various ways. Matter itself ***emits*** radiation in accordance with its composition and temperature. Radiation may be absorbed by matter, whereby the ***absorbed*** energy may be transferred or re-emitted. Finally, radiation may also be deflected from its original path (***scattered***) as a result of interaction with matter.

Activities Implemented Jointly (AIJ)
The pilot phase for *Joint Implementation*, as defined in Article 4.2(a) of the *United Nations Framework Convention on Climate Change (UNFCCC)* that allows for project activity among developed countries (and their companies) and between developed and developing countries (and their companies). AIJ is intended to allow parties to the UNFCCC to gain experience in jointly implemented projects. There is no credit for AIJ during the pilot phase. A decision remains on the future of AIJ projects and how they may relate to the *Kyoto Mechanisms*. As a simple form of tradable permits, AIJ and other market-based schemes represent potential mechanisms for stimulating additional resource flows for reducing emissions. See also *Clean Development Mechanism*, and *Emissions Trading*.

Adaptation
Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected *climate change* effects. Various types of adaptation exist, e.g. *anticipatory* and *reactive*, *private* and *public*, and *autonomous* and *planned*. Examples are raising river or coastal dikes, the substitution of more temperature-shock resistant plants for sensitive ones, etc.

Adaptation benefits
The avoided damage costs or the accrued benefits following the adoption and implementation of *adaptation* measures.

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

Adaptive capacity
The whole of capabilities, resources and institutions of a country or *region* to implement effective *adaptation* measures.

Aerosols
A collection of airborne solid or liquid particles, with a typical size between 0.01 and 10 micrometer (a millionth of a meter) that reside in the atmosphere for at least several hours. Aerosols may be of either natural or *anthropogenic* origin. Aerosols may influence *climate* in several ways: directly through scattering and *absorbing* radiation, and indirectly through acting as cloud condensation nuclei or modifying the optical properties and lifetime of clouds.

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).

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.

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 surface 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.

Albedo feedback
A *climate feedback* involving changes in the Earth's *albedo*. It usually refers to changes in the *cryosphere* which has an albedo much larger (~0.8) than the average planetary albedo (~0.3). In a warming climate, it is anticipated that the cryosphere would shrink, the Earth's overall albedo would decrease and more solar energy would be absorbed to warm the Earth still further.

Algal bloom
A reproductive explosion of algae in a lake, river, or ocean.

Alpine
The biogeographic zone made up of slopes above the tree line, characterised by the presence of rosette-forming herbaceous plants and low shrubby slow-growing woody plants.

Annex I countries
The group of countries included in Annex I (as amended in 1998) to the *United Nations Framework Convention on Climate Change (UNFCCC)*, including all the OECD countries in the year 1990 and countries with economies in transition. Under Articles 4.2 (a) and 4.2 (b) of the Convention, Annex I countries committed themselves specifically to the aim of returning individually or jointly to their 1990 levels of *greenhouse gas* emissions by the year 2000. By default, the other countries are referred to as *Non-Annex I countries.* For a list of Annex I countries, see http://unfccc.int.

Annex II countries
The group of countries included in Annex II to the *United Nations Framework Convention on Climate Change (UNFCCC)*, including all OECD countries in the year 1990. Under Article 4.2 (g) of the Convention, these countries are expected to provide financial resources to assist developing countries to comply with their obligations, such as preparing national reports. Annex II countries are also expected to promote the transfer of environmentally sound technologies to developing countries. For a list of Annex II countries, see http://unfccc.int.

Annex B countries
The countries included in Annex B to the *Kyoto Protocol* that have agreed to a target for their greenhouse-gas emissions, including all the *Annex I countries* (as amended in 1998) except for Turkey and Belarus. For a list of Annex I countries, see http://unfccc.int. See *Kyoto Protocol*

Anthropogenic
Resulting from or produced by human beings.

Anthropogenic emissions
Emissions of *greenhouse gases*, greenhouse gas precursors, and *aerosols* associated with human activities, including the burning of *fossil fuels*, *deforestation*, *land-use changes*, livestock, fertilisation, etc.

Arid region
A land region of low rainfall, where *low* is widely accepted to be <250 mm precipitation per year.

Atmosphere
The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen (78.1% volume mixing ratio) and oxygen (20.9% volume mixing ratio), together with a number of trace gases, such as argon (0.93% volume mixing ratio), helium and radiatively active greenhouse gases such as *carbon dioxide* (0.035% volume mixing ratio) and *ozone*. In addition, the atmosphere contains the greenhouse gas water vapour, whose amounts are highly variable but typically around 1% volume mixing ratio. The atmosphere also contains clouds and *aerosols*.

Attribution
See *Detection and attribution*.

B.

Barrier
Any obstacle to reaching a goal, *adaptation* or *mitigation* potential that can be overcome or attenuated by a policy, programme, or measure. *Barrier removal* includes correcting market failures directly or reducing the transactions costs in the public and private sectors by e.g. improving institutional capacity, reducing risk and uncertainty, facilitating market transactions, and enforcing regulatory policies.

Baseline
Reference for measurable quantities from which an alternative outcome can be measured, e.g. a non-intervention *scenario* used as a reference in the analysis of intervention scenarios.

Basin
The drainage area of a stream, river, or lake.

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

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.

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.

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 characterised by typical communities of plants and animals.

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.

Boreal forest
Forests of pine, spruce, fir, and larch stretching from the east coast of Canada westward to Alaska and continuing from Siberia westward across the entire extent of Russia to the European Plain.

Borehole temperature
Borehole temperatures are measured in boreholes of tens to hundreds of meters depth into the subsurface of the Earth. Borehole temperature depth profiles are commonly used to infer time variations in the ground surface temperature on centennial time scales.

Bottom-up models
Bottom-up models represent reality by aggregating characteristics of specific activities and processes, considering technological, engineering and cost details. See also *Top-down models*.

C.

Carbon (Dioxide) Capture and Storage (CCS)
A process consisting of separation of *carbon dioxide* from industrial and energy-related sources, transport to a storage location, and long-term isolation from the *atmosphere*.

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.

Carbon dioxide (CO_2)
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.

Carbon dioxide (CO_2) fertilisation
The enhancement of the growth of plants as a result of increased atmospheric *carbon dioxide* (CO_2) concentration. Depending on their mechanism of *photosynthesis*, certain types of plants are more sensitive to changes in atmospheric CO_2 concentration.

Carbon intensity
The amount of emission of *carbon dioxide* per unit of *Gross Domestic Product*.

Carbon leakage
The part of emissions reductions in *Annex B* countries that may be offset by an increase of the emissions in the non-constrained countries above their baseline levels. This can occur through (1) relocation of energy-intensive production in non-constrained regions; (2) increased consumption of fossil fuels in these regions through decline in the international price of oil and gas triggered by lower demand for these energies; and (3) changes in incomes (thus in energy demand) because of better terms of trade.

Carbon sequestration
See *Uptake*

Catchment
An area that collects and drains rainwater.

Chlorofluorocarbons (CFCs)
See *Halocarbons*

Clean Development Mechanism (CDM)
Defined in Article 12 of the *Kyoto Protocol*, the CDM is intended to meet two objectives: (1) to assist parties not included in *Annex I* in achieving *sustainable development* and in contributing to the ultimate objective of the convention; and (2) to assist parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments. Certified Emission Reduction Units from CDM projects undertaken in non-Annex I countries that limit or reduce greenhouse gas emissions, when certified by operational entities designated by Conference of the Parties/Meeting of the Parties, can be accrued to the investor (government or industry) from parties in *Annex B*. A share of the proceeds from the certified project activities is used to cover administrative expenses as well as to assist developing country parties that are particularly vulnerable to the adverse effects of *climate change* to meet the costs of *adaptation*.

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 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*. In various parts of this report different averaging periods, such as a period of 20 years, are also used.

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_2 that remains in the atmosphere.

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*, or to persistent *anthropogenic* changes in the composition of the *atmosphere* or in *land use*. Note that the *United Nations Framework Convention on Climate Change (UNFCCC)*, in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes. See also *Climate variability; Detection and Attribution*.

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.

Climate model
A numerical representation of the *climate system* based on the physical, chemical and biological properties of its components, their interactions and *feedback* processes, and accounting for 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 parametrisations 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 WGI 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*.

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. See also *Climate projection, climate scenario*.

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 emphasise 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 realised and are therefore subject to substantial *uncertainty*.

Climate response
See *Climate sensitivity*

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.

Climate sensitivity
In IPCC reports, *equilibrium climate sensitivity* refers to the equilibrium change in the annual mean *global surface temperature* following a doubling of the atmospheric *equivalent carbon dioxide concentration*. Due to computational constraints, the equilibrium climate sensitivity in a *climate model* is usually 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 *transient climate response* is the change in the *global surface temperature*, averaged over a 20-year period, centred at the time of atmospheric carbon dioxide doubling, that is, at year 70 in a 1%/yr compound carbon dioxide increase experiment with a global coupled climate model. It is a measure of the strength and rapidity of the surface temperature response to *greenhouse gas* forcing.

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* behaviour.

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*.

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*.

Cloud feedback

A *climate feedback* involving changes in any of the properties of clouds as a response to other atmospheric changes. Understanding cloud feedbacks and determining their magnitude and sign require an understanding of how a change in *climate* may affect the spectrum of cloud types, the cloud fraction and height, and the radiative properties of clouds, and an estimate of the impact of these changes on the Earth's radiation budget. At present, cloud feedbacks remain the largest source of *uncertainty* in *climate sensitivity* estimates. See also *Radiative forcing*.

CO_2-equivalent

See Box "Carbon dioxide-equivalent (CO_2-eq) emissions and concentrations" in Topic 2 of the Synthesis Report and Working Group I Chapter 2.10.

CO_2-fertilization

See *Carbon dioxide fertilization*.

Co-benefits

The benefits of policies implemented for various reasons at the same time, acknowledging that most policies designed to address *greenhouse gas mitigation* have other, often at least equally important, rationales (e.g., related to objectives of development, sustainability, and equity).

Combined Heat and Power (CHP)

The use of waste heat from thermal electricity generation plants. The heat is e.g. condensing heat from steam turbines or hot flue gases exhausted from gas turbines, for industrial use, buildings or district heating. Also called *co-generation*.

Compliance

Compliance is whether and to what extent countries do adhere to the provisions of an accord. Compliance depends on implementing policies ordered, and on whether measures follow up the policies. Compliance is the degree to which the actors whose behaviour is targeted by the agreement, local government units, corporations, organisations, or individuals, conform to the implementing obligations. See also *Implementation*.

Confidence

The level of confidence in the correctness of a result is expressed in this report, using a standard terminology defined as follows:

Terminology	Degree of confidence in being correct
Very high confidence	At least 9 out of 10 chance of being correct
High confidence	About 8 out of 10 chance
Medium confidence	About 5 out of 10 chance
Low confidence	About 2 out of 10 chance
Very low confidence	Less than 1 out of 10 chance

See also *Likelihood*; *Uncertainty*

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 warm-water corals. See *Coral bleaching*; *Coral reefs*

Coral bleaching

The paling in colour which results if a *coral* loses its symbiotic, energy-providing, organisms.

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.

Cost

The consumption of resources such as labour time, capital, materials, fuels, etc. as a consequence of an action. In economics all resources are valued at their *opportunity cost*, being the value of the most valuable alternative use of the resources. Costs are defined in a variety of ways and under a variety of assumptions that affect their value. Cost types include: *administrative costs*, *damage costs* (to ecosystems, people and economies due to negative effects from *climate change*), and *implementation costs* of changing existing rules and regulation, capacity building efforts, information, training and education, etc. *Private costs* are carried by individuals, companies or other private entities that undertake the action, whereas *social costs* include also the external costs on the environment and on society as a whole. The negative of costs are *benefits* (also sometimes called *negative costs*). Costs minus benefits are *net costs*.

Cryosphere

The component of the *climate system* consisting of all snow, ice and *frozen ground* (including *permafrost*) on and beneath the surface of the Earth and ocean. See also *Glacier*; *Ice sheet*.

D.

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).

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*.

Detection and attribution

Climate varies continually on all time scales. *Detection* of *climate change* is the process of demonstrating that climate has changed in some defined statistical sense, without providing a reason for that change. *Attribution* of causes of climate change is the process of establishing the most likely causes for the detected change with some defined level of *confidence*.

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.

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 judgement about the interests of future generations (*social discount rate*).

Discount rate
See *Discounting*

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.

Dynamical ice discharge
Discharge of ice from *ice sheets* or *ice caps* caused by the dynamics of the ice sheet or ice cap (e.g. in the form of *glacier* flow, ice streams and calving icebergs) rather than by melt or *runoff*.

E.

Economic (mitigation) potential
See *Mitigation potential*.

Economies in Transition (EITs)
Countries with their economies changing from a planned economic system to a market economy.

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.

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*. It is often measured by the surface pressure anomaly difference between Darwin and Tahiti and 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*.

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 (Nakičenovič 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*.

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.

Emission trajectory
A projected development in time of the emission of a *greenhouse gas* or group of greenhouse gases, *aerosols* and greenhouse gas precursors.

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.

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*.

Energy efficiency
Ratio of useful *energy* output of a system, conversion process or activity, to its energy input.

Energy intensity
Energy intensity is the ratio of *energy* use to economic or physical output. At the national level, energy intensity is the ratio of total primary energy use or final energy use to *Gross Domestic Product*. At the activity level, one can also use physical quantities in the denominator, e.g. litre fuel/vehicle km.

Equivalent carbon dioxide concentration
See Box "Carbon dioxide-equivalent (CO_2-eq) emissions and concentrations" in Topic 2 of the Synthesis Report.

Equivalent carbon dioxide emission
See Box "Carbon dioxide-equivalent (CO_2-eq) emissions and concentrations" in Topic 2 of the Synthesis Report and Working Group I Chapter 2.10.

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.

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

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.

Extinction
The complete disappearance of an entire biological species.

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).

F.

F-gases
This term refers to the groups of gases *hydrofluorocarbons*, *perfluorocarbons*, and *sulphurhexafluoride*, which are covered under the *Kyoto Protocol*.

Feedback
See *Climate feedback*.

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.

Forcing
See *External forcing*

Forecast
See *Climate forecast*; *Climate projection*; *Projection*.

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)

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

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

Frozen ground
Soil or rock in which part or all of the pore water is frozen (Van Everdingen, 1998). Frozen ground includes *permafrost*. Ground that freezes and thaws annually is called *seasonally frozen ground*.

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 utilised. See *Combined Heat and Power*.

Fuel switching
In general this is substituting fuel A for fuel B. In the climate change discussion it is implicit that fuel A has a lower carbon content than fuel B, e.g. natural gas for coal.

G.

Glacial lake
A lake formed by *glacier* meltwater, located either at the front of a glacier (known as a *proglacial lake*), on the surface of a glacier (*supraglacial lake*), within the glacier (*englacial lake*) or at the glacier bed (*subglacial lake*).

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. See *Mass balance*

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.

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.

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°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°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*.

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_2O), *carbon dioxide* (CO_2), *nitrous oxide* (N_2O), *methane* (CH_4) and *ozone* (O_3) 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_2, N_2O and CH_4, the *Kyoto Protocol* deals with the greenhouse gases *sulphur hexafluoride* (SF_6), *hydrofluorocarbons* (HFCs) and *perfluorocarbons* (PFCs).

Gross Domestic Product (GDP)

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

H.

Halocarbons

A collective term for the group of partially halogenated organic species, including the chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), halons, methyl chloride, methyl bromide, etc. Many of the halocarbons have large *Global Warming Potentials*. The chlorine and bromine containing halocarbons are also involved in the depletion of the *ozone* layer.

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.

Hydrochlorofluorocarbons (HCFCs)

See *Halocarbons*

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. See *Halocarbons*

Hydrosphere

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

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*.

Hydrological systems

See *Hydrological cycle*

I.

Ice cap

A dome shaped ice mass, usually covering a highland area, which is considerably smaller in extent than an *ice sheet*.

Ice core

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

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. During glacial periods there were others.

(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*.

(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 occ ur after adaptation.

See also *aggregate impacts*, *market impacts*, and *non-market impacts*.

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 programmes that induce changes in the behaviour and decisions of target groups. Target groups then take effective measures of mitigation and adaptation. See also *Compliance*.

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.

Induced technological change

See *technological change*.

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 *pre-industrial* and *industrial* refer, somewhat arbitrarily, to the periods before and after 1750, respectively.

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 stabilised.

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.

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

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*.

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 recognised as an economic good.

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)

J.

Joint Implementation (JI)
A market-based implementation mechanism defined in Article 6 of the *Kyoto Protocol*, allowing *Annex I* countries or companies from these countries to implement projects jointly that limit or reduce emissions or enhance *sinks*, and to share the Emissions Reduction Units. JI activity is also permitted in Article 4.2(a) of the *United Nations Framework Convention on Climate Change (UNFCCC)*. See also *Kyoto Mechanisms*; *Activities Implemented Jointly*.

K.

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).

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.

L.

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).

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).

Last Interglacial (LIG)
See *Interglacial*

Learning by Doing
As researchers and firms gain familiarity with a new technological process, or acquire experience through expanded production they can discover ways to improve processes and reduce cost. Learning by Doing is a type of experience-based technological change.

Level of Scientific Understanding (LOSU)
This is an index on a 5-step scale (high, medium, medium-low, low and very low) designed to characterise the degree of scientific understanding of the *radiative forcing* agents that affect *climate change*. For each agent, the index represents a subjective judgement about the evidence for the physical/chemical mechanisms determining the forcing and the consensus surrounding the quantitative estimate and its *uncertainty*.

Likelihood
The likelihood of an occurrence, an outcome or a result, where this can be estimated probabilistically, is expressed in IPCC reports using a standard terminology defined as follows:

Terminology	Likelihood of the occurrence / outcome
Virtually certain	>99% probability of occurrence
Very likely	>90% probability
Likely	>66% probability
More likely than not	>50% probability
About as likely as not	33 to 66% probability
Unlikely	<33% probability
Very unlikely	<10% probability
Exceptionally unlikely	<1% probability

See also *Confidence*; *Uncertainty*

M.

Macroeconomic costs
These costs are usually measured as changes in *Gross Domestic Product* or changes in the growth of Gross Domestic Product, or as loss of welfare or of consumption.

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.

Market Exchange Rate (MER)
This is the rate at which foreign currencies are exchanged. Most economies post such rates daily and they vary little across all the exchanges. For some developing economies official rates and black-market rates may differ significantly and the MER is difficult to pin down.

Market impacts
Impacts that can be quantified in monetary terms, and directly affect *Gross Domestic Product* – e.g. changes in the price of agricultural inputs and/or goods. See also *Non-market impacts*.

Market potential
See *Mitigation potential*.

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.

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.
See *Sea level change/sea level rise*.

Measures
Measures are technologies, processes, and practices that reduce *greenhouse gas* emissions or effects below anticipated future levels. Examples of measures are *renewable energy technologies*, *waste minimisation processes*, and *public transport commuting practices*, etc. See also *Policies*.

Meridional Overturning Circulation (MOC)
A zonally averaged, large scale meridional (north-south) overturning circulation in the oceans. In the Atlantic such a circulation transports relatively warm upper-ocean waters northward, and relatively cold deep waters southward. The *Gulf Stream* forms part of this Atlantic circulation.

Methane (CH_4)
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.

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).

Metric
A consistent measurement of a characteristic of an object or activity that is otherwise difficult to quantify.

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.

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*.

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.

Mitigation Potential
In the context of *climate change mitigation*, the mitigation potential is the amount of *mitigation* that could be – but is not yet – realised over time.

Market potential is the mitigation potential based on private *costs* and private *discount rates*, which might be expected to occur under forecast market conditions, including policies and measures currently in place, noting that *barriers* limit actual uptake. Private costs and discount rates reflect the perspective of private consumers and companies.

Economic potential is the mitigation potential that takes into account social costs and benefits and social discount rates, assuming that market efficiency is improved by policies and measures and barriers are removed. Social costs and discount rates reflect the perspective of society. Social discount rates are lower than those used by private investors.

Studies of market potential can be used to inform policy makers about mitigation potential with existing policies and barriers, while studies of economic potential show what might be achieved if appropriate new and additional policies were put into place to remove barriers and include social costs and benefits. The economic potential is therefore generally greater than the market potential.

Technical potential is the amount by which it is possible to reduce *greenhouse gas* emissions or improve energy efficiency by implementing a technology or practice that has already been demonstrated. No explicit reference to costs is made but adopting 'practical constraints' may take implicit economic considerations into account.

Model
See *Climate model*; *Bottom-up model*; *Top-down model*

Model hierarchy
See *Climate model*

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.

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 hospitalisation, primary care consultations, disability-days (i.e., days of absence from work), and prevalence of symptoms.

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.

N.

Net market benefits
Climate change, especially moderate climate change, is expected to bring positive and negative impacts to market-based sectors, but with significant differences across different sectors and *regions* and depending on both the rate and magnitude of climate change. The sum of the positive and negative market-based benefits and *costs* summed across all sectors and all regions for a given period is called *net market benefits*. Net market benefits exclude any *non-market impacts*.

Nitrous oxide (N_2O)
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.

Non-governmental Organisation (NGO)
A non-profit group or association organised outside of institutionalised political structures to realise particular social and/or environmental objectives or serve particular constituencies. Source: http://www.edu.gov.nf.ca/curriculum/teched/resources/glos-biodiversity.html

Non-market impacts
Impacts that affect *ecosystems* or human welfare, but that are not easily expressed in monetary terms, e.g., an increased risk of premature death, or increases in the number of people at risk of hunger. See also *market impacts*.

O.

Ocean acidification
A decrease in the *pH* of sea water due to the uptake of *anthropogenic carbon dioxide*.

Opportunities
Circumstances to decrease the gap between the *market potential* of any technology or practice and the *economic potential*, or technical potential.

Ozone (O_3)
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). Troposphere ozone acts as a *greenhouse gas*. In the *stratosphere*, ozone is created by the interaction between solar ultraviolet radiation and molecular oxygen (O_2). Stratospheric ozone plays a dominant role in the stratospheric radiative balance. Its concentration is highest in the ozone layer.

P.

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

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.

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 90^{th} (10^{th}) percentile may be used to refer to the threshold for the upper (lower) extremes.

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.

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) . See also *Frozen ground.*

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.

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.

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. See *Carbon dioxide fertilisation*.

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.

Policies
In *United Nations Framework Convention on Climate Change (UNFCCC)* parlance, policies are taken and/or mandated by a government – often in conjunction with business and industry within its own country, or with other countries – to accelerate *mitigation* and *adaptation* measures. Examples of policies are carbon or other energy *taxes*, fuel efficiency standards for automobiles, etc. *Common and co-ordinated or harmonised policies* refer to those adopted jointly by parties. See also *Measures*.

Portfolio
A coherent set of a variety of measures and/or technologies that policy makers can use to achieve a postulated policy target. By widening the scope in measures and technologies more diverse events and uncertainties can be addressed.

Post-SRES (scenarios)
Baseline and mitigation *emission scenarios* published after completion of the IPCC Special Report on Emission Scenarios (*SRES*) (Nakičenovič and Swart, 2000), i.e. after the year 2000.

Pre-industrial
See *Industrial revolution*.

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 emphasise that projections involve assumptions concerning, for example, future socio-economic and technological developments that may or may not be realised, and are therefore subject to substantial *uncertainty*. See also *Climate projection; Climate prediction*.

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 industrialised countries and raise per capita GDPs in developing countries.

R.

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.

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)

Region
A region is a territory characterised by specific geographical and climatological features. The *climate* of a region is affected by regional and local scale forcings like topography, *land-use* characteristics, lakes etc., as well as remote influences from other regions.

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-organisation, and the capacity to adapt to stress and change.

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.

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. See *Hydrological cycle*

S.

Salinisation
The accumulation of salts in soils.

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 land-based 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*).

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*. See also *SRES scenarios*; *Climate scenario*; *Emission scenarios*.

Sea-ice biome
The *biome* formed by all marine organisms living within or on the floating sea ice (frozen seawater) of the polar oceans.

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 (*land-fast 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.

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 land-based 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. See also *Mean Sea Level*, *Thermal expansion*.

Seasonally frozen ground
See *Frozen ground*

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.

Singularity
A trait marking one phenomenon or aspect as distinct from others; something singular, distinct, peculiar, uncommon or unusual.

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*.

Snow pack
A seasonal accumulation of slow-melting snow.

Soil temperature
The temperature of the ground near the surface (often within the first 10cm).

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

Solar radiation
Electromagnetic radiation emitted by the Sun. It is also referred to as *shortwave radiation*. Solar radiation has a distinctive range of wavelengths (spectrum) determined by the temperature of the Sun, peaking in visible wavelengths. See also *Thermal infrared radiation*, *Total Solar Irradiance*

Source
Source mostly refers to any process, activity or mechanism that releases a *greenhouse gas*, an *aerosol*, or a precursor of a greenhouse gas or aerosol into the *atmosphere*. Source can also refer to e.g. an *energy* source.

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^2), through regional (100,000 to 10 million km^2) to continental (10 to 100 million km^2). *Temporal scales* may range from seasonal to geological (up to hundreds of millions of years).

SRES scenarios
SRES scenarios are *emission scenarios* developed by Nakičenovič and 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 Nakičenovič 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 Nakičenovič 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.

Stabilisation
Keeping constant the atmospheric concentrations of one or more *greenhouse gases* (e.g. *carbon dioxide*) or of a *CO2-equivalent* basket of greenhouse gases. Stabilisation analyses or *scenarios* address the stabilisation of the concentration of greenhouse gases in the atmosphere.

Stakeholder
A person or an organisation that has a legitimate interest in a project or entity, or would be affected by a particular action or *policy*.

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.

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.

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

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.

Streamflow
Water flow within a river channel, for example expressed in m^3/s. A synonym for *river discharge*.

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, systems transformations whereby some components are either replaced or potentially substituted by other ones.

Sulphurhexafluoride (SF_6)
One of the six *greenhouse gases* to be curbed under the *Kyoto Protocol*. It is largely used in heavy industry to insulate high-voltage equipment and to assist in the manufacturing of cable-cooling systems and semi-conductors.

Surface temperature
See *Global surface temperature*.

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.

T.

Tax
A *carbon tax* is a levy on the carbon content of *fossil fuels*. Because virtually all of the carbon in fossil fuels is ultimately emitted as *carbon dioxide*, a carbon tax is equivalent to an emission tax on each unit of *CO2-equivalent emissions*. An *energy tax* - a levy on the energy content of fuels - reduces demand for energy and so reduces carbon dioxide emissions from fossil fuel use. An *eco-tax* is designed to influence human behaviour (specifically economic behaviour) to follow an ecologically benign path. An *international carbon/emission/energy tax* is a tax imposed on specified sources in participating countries by an international agreement. A *harmonised tax* commits participating countries to impose a tax at a common rate on the same sources. A *tax credit* is a reduction of tax in order to stimulate purchasing of or investment in a certain product, like GHG emission reducing technologies. A *carbon charge* is the same as a carbon tax.

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.

Technology
The practical application of knowledge to achieve particular tasks that employs both technical artefacts (hardware, equipment) and (social) information ('software', know-how for production and use of artefacts).

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.

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. See *Sea level change*.

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 colour 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.

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. See *Sea level change/sea level rise*.

Top-down models
Top-down model apply macroeconomic theory, econometric and optimization techniques to aggregate economic variables. Using historical data on consumption, prices, incomes, and factor costs, top-down models assess final demand for goods and services, and supply from main sectors, like the energy sector, transportation, agriculture, and industry. Some top-down models incorporate technology data, narrowing the gap to *bottom-up models*.

Total Solar Irradiance (TSI)
The amount of *solar radiation* received outside the Earth's *atmosphere* on a surface normal to the incident radiation, and at the Earth's mean distance from the sun. Reliable measurements of solar radiation can only be made from space and the precise record extends back only to 1978. The generally accepted value is 1,368 Watts per square meter (W m^{-2}) with an accuracy of about 0.2%. Variations of a few tenths of a percent are common, usually associated with the passage of sunspots across the solar disk. The solar cycle variation of TSI is on the order of 0.1%. Source: AMS, 2000.

Tradable permit
A tradable permit is an economic policy instrument under which rights to discharge pollution – in this case an amount of *greenhouse gas* emissions – can be exchanged through either a free or a controlled permit-market. An *emission permit* is a non-transferable or tradable entitlement allocated by a government to a legal entity (company or other emitter) to emit a specified amount of a substance.

Tropopause
The boundary between the *troposphere* and the *stratosphere*.

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

U.

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 behaviour. 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). See also *Likelihood; Confidence*.

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 "stabilisation 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. See *Kyoto Protocol*.

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*.

Urbanisation
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 centres*.

V.

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

Voluntary action
Informal programmes, self-commitments and declarations, where the parties (individual companies or groups of companies) entering into the action set their own targets and often do their own monitoring and reporting.

Voluntary agreement
An agreement between a government authority and one or more private parties to achieve environmental objectives or to improve environmental performance beyond *compliance* to regulated obligations. Not all voluntary agreements are truly voluntary; some include rewards and/or penalties associated with joining or achieving commitments.

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*.

W.

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.

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^3/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.

Z.

Zooplankton

See *Plankton*

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Annex III

Acronyms, chemical symbols; scientific units; country groupings

III.1 Acronyms and chemical symbols

A1	A family of scenarios in the IPCC Special Report on Emission Scenarios; *see glossary under SRES scenarios*
A1T	One of the six SRES marker scenarios; *see glossary under SRES scenarios*
A1B	One of the six SRES marker scenarios; *see glossary under SRES scenarios*
A1FI	One of the six SRES marker scenarios; *see glossary under SRES scenarios*
A2	A family of scenarios in the IPCC Special Report on Emission Scenarios; also one of the six SRES marker scenarios; *see glossary under SRES scenarios*
AOGCM	Atmosphere-Ocean General Circulation Model; *see glossary under climate model*
B1	A family of scenarios in the IPCC Special Report on Emission Scenarios; also denotes one of the six SRES marker scenarios; *see glossary under SRES scenarios*
B2	A family of scenarios in the IPCC Special Report on Emission Scenarios; also denotes one of the six SRES marker scenarios; *see glossary under SRES scenarios*
CH_4	Methane; *see glossary*
CFC	Chlorofluorocarbon; *see glossary*
CO_2	Carbon dioxide; *see glossary*
EIT	Economies in transition; *see glossary*
EMIC	Earth Model of Intermediate Complexity
ENSO	El Niño-Southern Oscillation; *see glossary*
F-Gases	Fluorinated gases covered under the Kyoto Protocol; *see glossary under F-Gases*
GDP	Gross Domestic Product; *see glossary*
HCFC	Hydrochlorofluorocarbon; *see glossary*
HFC	Hydrofluorocarbon; *see glossary*
LOSU	Level of scientific understanding; *see glossary*
MOC	Meridional overturning circulation; *see glossary*
N_2O	Nitrous oxide; *see glossary*
OECD	Organisation for Economic Cooperation and Development; see www.oecd.org
PFC	Perfluorocarbon; *see glossary*
pH	*See glossary under pH*
PPP	Purchasing Power Parity; *see glossary*
RD&D	Research, development and demonstration
SCM	Simple Climate Model
SF_6	Sulfur hexafluoride; *see glossary*
SRES	Special Report on Emission Scenarios; *see glossary under SRES scenarios*
UNFCCC	United Nations Framework Convention on Climate Change; see www.unfccc.int

III.2 Scientific units

SI (Système Internationale) units

Physical Quantity	*Name of Unit*	*Symbol*
length	metre	m
mass	kilogram	kg
time	second	s
thermodynamic temperature	kelvin	K

Fractions and multiples

Fraction	*Prefix*	*Symbol*	*Multiple*	*Prefix*	*Symbol*
10^{-1}	deci	d	10	deca	da
10^{-2}	centi	c	10^{2}	hecto	h
10^{-3}	milli	m	10^{3}	kilo	k
10^{-6}	micro	μ	10^{6}	mega	M
10^{-9}	nano	n	10^{9}	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f	10^{15}	peta	P

Non-SI units, quantities and related abbreviations

°C	degree Celsius (0°C = 273 K approximately); temperature differences are also given in °C (=K) rather than the more correct form of "Celsius degrees"
ppm	mixing ratio (as concentration measure of GHGs): parts per million (10^6) by volume
ppb	mixing ratio (as concentration measure of GHGs): parts per billion (10^9) by volume
ppt	mixing ratio (as concentration measure of GHGs): parts per trillion (10^{12}) by volume
watt	power or radiant flux; 1 watt = 1 Joule / second = 1 kg m^2 / s^3
yr	year
ky	thousands of years
bp	before present
GtC	gigatonnes (metric) of carbon
$GtCO_2$	gigatonnes (metric) of carbon dioxide (1 GtC = 3.7 $GtCO_2$)
CO_2-eq	carbon dioxide-equivalent, used as measure for the emission (generally in GtCO2-eq) or concentration (generally in ppm CO_2-eq) of GHGs; see Box "Carbon dioxide-equivalent emissions and concentrations" in Topic 2 for details

III.3 Country groupings

For the full set of countries belonging to UNFCCC Annex I, non-Annex I, and OECD, see http://www.unfccc.int and http://www.oecd.org.

Where relevant in this report, countries have been grouped into regions according to the classification of the UNFCCC and its Kyoto Protocol. Countries that have joined the European Union since 1997 are therefore still listed under EIT Annex I. The countries in each of the regional groupings employed in this report include:*

- **EIT Annex I:** Belarus, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russian Federation, Slovakia, Slovenia, Ukraine
- **Europe Annex II & M&T:** Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom; Monaco and Turkey
- **JANZ:** Japan, Australia, New Zealand.
- **Middle East:** Bahrain, Islamic Republic of Iran, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates, Yemen
- **Latin America & the Caribbean:** Antigua & Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Lucia, St. Kitts-Nevis-Anguilla, St. Vincent-Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela
- **Non-Annex I East Asia:** Cambodia, China, Korea (DPR), Laos (PDR), Mongolia, Republic of Korea, Viet Nam.
- **South Asia:** Afghanistan, Bangladesh, Bhutan, Comoros, Cook Islands, Fiji, India, Indonesia, Kiribati, Malaysia, Maldives, Marshall Islands, Micronesia (Federated States of), Myanmar, Nauru, Niue, Nepal, Pakistan, Palau, Papua New Guinea, Philippine, Samoa, Singapore, Solomon Islands, Sri Lanka, Thailand, Timor-L'Este, Tonga, Tuvalu, Vanuatu
- **North America:** Canada, United States of America.
- **Other non-Annex I:** Albania, Armenia, Azerbaijan, Bosnia Herzegovina, Cyprus, Georgia, Kazakhstan, Kyrgyzstan, Malta, Moldova, San Marino, Serbia, Tajikistan, Turkmenistan, Uzbekistan, Republic of Macedonia
- **Africa:** Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Democratic Republic of Congo, Côte d'Ivoire, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Togo, Tunisia, Uganda, United Republic of Tanzania, Zambia, Zimbabwe

*A full set of data for all countries for 2004 for all regions was not available.

Annex IV

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Annex V

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Consistent with IPCC Rules and Procedures, the draft SYR was sent for formal review to over 2,400 individual experts as well as to the 193 member governments of the IPCC. This appendix lists the individual experts (with affiliations at the time of submission of comments) and international organisations who submitted review comments on the draft SYR, and whose comments were considered by the Core Writing Team in its revision of the draft report.

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Publications by the Intergovernmental Panel on Climate Change

Assessment Reports

Fourth Assessment Report

Climate Change 2007: The Physical Science Basis
Contribution of Working Group I to the Fourth Assessment Report

Climate Change 2007: Impacts, Adaptation and Vulnerability
Contribution of Working Group II to the Fourth Assessment Report

Climate Change 2007: Mitigation of Climate Change
Contribution of Working Group III to the Fourth Assessment Report

Climate Change 2007: Synthesis Report
Contribution of Working Groups I, II and III to the Fourth Assessment Report

Third Assessment Report

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Contribution of Working Group I to the Third Assessment Report

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2006 IPCC Guidelines for National Greenhouse Gas Inventories (5 Volumes) 2006

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IPCC Technical Paper 5, 2002

Implications of Proposed CO_2 Emissions Limitations
IPCC Technical Paper 4, 1997

Stabilisation of Atmospheric Greenhouse Gases: Physical, Biological and Socio-Economic Implications
IPCC Technical Paper 3, 1997

An Introduction to Simple Climate Models Used in the IPCC Second Assessment Report
IPCC Technical Paper 2, 1997

Technologies, Policies and Measures for Mitigating Climate Change
IPCC Technical Paper 1, 1996

Supplementary material

Global Climate Change and the Rising Challenge of the Sea
Coastal Zone Management Subgroup of the IPCC Response Strategies Working Group, 1992

Emissions Scenarios
Prepared by the IPCC Response Strategies Working Group, 1990

For a more comprehensive list of supplementary material published by the IPCC (workshop and meeting reports), please see www.ipcc.ch or contact the IPCC Secretariat.