Vocabulary and Acronyms in the IPCC Synthesis Report

This is a simplified version of the IPCC Glossary. The full version can be found here:

https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_AnnexVII.pdf

Adaptation: how we might adjust to climate change (e.g. how to deal with extra heat and sea level rise).

Albedo: how much an object reflects sunlight (e.g. a mirror has a high albedo). Clouds, snow and ice reflect sunlight and have high albedo. The ocean absorbs sunlight and has a low albedo. To combat global heating, we want sunlight to be reflected away from Earth so we want more surfaces with high albedo.

Anthropocene: a new proposed geological epoch due to the fact that humans have significantly modified the Earth and the atmosphere.

Anthropogenic emissions: greenhouse gas (GHG) emissions caused by humans. These come from the burning of fossil fuels, deforestation, land use and land-use changes, livestock production, fertilization, waste management, and industrial processes.

Anthropogenic removals: humans removing greenhouse gases (GHGs) from the atmosphere. We are not very good at this yet. It is easy to put CO_2 into the atmosphere, but very hard to take it out.

Carbon budget: the total amount of CO_2 emissions that we can put into the atmosphere before we hit a certain temperature. This is referred to as the total carbon budget when expressed starting from the pre-industrial period, and as the remaining carbon budget when expressed from a recent specified date.

Carbon dioxide capture and storage (CCS): A process in which a stream of carbon dioxide (CO_2) from an industrial source is separated (captured), conditioned, compressed and transported to a storage location for long-term isolation from the atmosphere. Sometimes referred to as carbon capture and storage.

Carbon dioxide removal (CDR): Humans removing (CO_2) from the atmosphere and storing it somewhere (in rocks, oceans, or using it to make stuff).

Carbon neutrality: When CO_2 emitted by humans is balanced by CO_2 being removed by humans. This can be on the scale of a company, a district, or a country. For example, UCSC could try and make the campus "carbon neutral".

Carbon sink: something that removes carbon from the atmosphere. Oceans are a carbon sink because they absorb CO_2.

Chlorofluorocarbons (CFCs): A compound that contains chlorine, carbon, hydrogen and fluorine and is used for refrigeration, air conditioning, packaging, plastic foam, insulation, solvents or aerosol propellants. Because they are not destroyed in the lower atmosphere, CFCs drift into the upper atmosphere where they lead to ozone (O_3) depletion. They are some of the greenhouse gases (GHGs) covered under the 1987 Montreal Protocol, as a result of which manufacturing of these gases has been phased out, and they are being replaced by other compounds, including hydrofluorocarbons (HFCs).

C**limate change commitment:** Climate change that is already underway and which cannot be stopped (for example, because the oceans take some time to respond to an increase in CO_2).

Climate feedback: A loop in which two systems interact which each other to amplify climate changes. A negative feedback is one in which the initial perturbation is weakened by the changes it causes; a positive feedback is one in which the initial perturbation is enhanced. As examples, see Cloud feedback and Ice–albedo feedback.

Climate model: a computer based model (simulation) that takes in information about the oceans, the weather, knowledge about the Earth, and predicts what future climates will look like.

Climate projection: taking a climate model and assuming that humans will emit some future amount of CO_2 and predicting what the weather will look like.

Climatic impact-driver (CID): climate events (storms, heat waves, etc) that affect society (i.e., they have an impact) or ecosystems.

CO_2 equivalent (CO_2-eq): Different greenhouse gases have different impacts on the atmosphere (for example, methane has a stronger heating effect than CO_2). This quantity attempts to put all GHGs on the same scale.

Coupled Model Inter-comparison Project (CMIP): Scientists got together to compare different climate models to check when they agreed and when they didn't. This was done several times. For example, CMIP Phase 3 (CMIP3) , Phase 4, Phase 6, etc. This process gave more confidence to the climate models.

Cryosphere: Earth's frozen areas: snow cover, glaciers, ice sheets, ice shelves, icebergs, sea ice, lake ice, river ice, permafrost and seasonally frozen ground.

Direct air capture (DAC): Taking CO_2 directly out of the air. We have methods to do this, but they are not very efficient. This is currently not efficient enough to fix the climate crisis.

Energy balance: The difference between the total incoming (energy from the Sun) and total outgoing energy (reradiated by the Earth). If this balance is positive, warming occurs; if it is negative, cooling occurs.

Global dimming: Global dimming refers to the observed widespread reduction in the amount of solar radiation received at the Earth's surface from the 1950s to the 1980s due to increased air pollution. When we got better at reducing air pollution, this effect went away.

Global mean sea level (GMSL) change: the average height of the water of the ocean.

Global warming potential (GWP): a number that tell us how a substance (e.g. methane) compares in terms of its heating potential to CO_2.

Greenhouse gas neutrality: when the total CO_2 output by humans, is also completely removed by humans. A net zero balance is achieved.

Hydrosphere liquid parts of Earth: liquid surface and subterranean water, oceans, seas, rivers, freshwater lakes, underground water, wetlands, etc.

Ice sheet: thick layer of ice on land that covers an area of continental size, generally defined as covering >50,000 km^2, and that has formed over thousands of years through accumulation and compaction of snow. There are only two ice sheets in the modern world, one on Greenland and one on Antarctica. During glacial periods, there were other ice sheets.

Ice shelf: when an ice sheet extends into the ocean. Nearly all ice shelves are in Antarctica, where most of the ice discharged into the ocean flows via ice shelves.

Ice–albedo feedback: a climate feedback involving changes in the Earth's surface albedo. Snow and ice have an albedo much higher (up to ~0.8) than the average albedo of Earth (~0.3). With increasing temperatures, it is anticipated that snow and ice extent will decrease, the Earth's overall albedo will decrease and more solar radiation will be absorbed, warming the Earth further (and hence the effect get amplified).

Methane (CH_4): The greenhouse gas methane is the major component of natural gas and associated with all fossil fuels. Methane is also emitted by agriculture.

Mitigation (of climate change): humans trying to limit global heating. This could be either by: 1) cutting down how much CO_2 we put into the atmosphere, or 2), removing CO_2 from the atmosphere.

Montreal Protocol: the Montreal agreement adopted in Montreal in 1987 that limited chemicals (e.g., chlorofluorocarbons) that were destroying the zone (O_3) layer.

Negative greenhouse gas emissions: removal of greenhouse gases (GHGs) from the atmosphere by deliberate human activities.

Net zero CO_2 emissions: when CO_2 emitted by humans is balanced by CO_2 removed by humans.

Ocean acidification (OA): a reduction in the pH of the ocean. This is caused primarily because the ocean absorbs CO_2 from the atmosphere.

Palaeocene–Eocene Thermal Maximum (PETM): event that occurred between 55.9 and 55.7 million years ago. During this time, the Earth experience a significant greenhouse effect. The temperature rose to about 4°C–7°C warmer than today and atmospheric CO2 was also very high. The ocean was very acid and many deep-sea species went extinct and tropical coral reefs diminished. This epoch is of great interest to scientists because it gives us clues about what happens when the atmosphere contains a lot of CO2.

Paleoclimate: what the climate was doing in the past. We can get clues about Earth's ancient climate, for example, by studying air bubbles trapped in ice in Antarctica.

Pathways: predictions for what will happen in the future given certain assumptions. For example, what might happen if we continue emitting CO_2? Or what might happen if we stop emitting CO_2?

1.5°C pathway: what we would need to do in order to keep the mean increase in the Earth's temperature below 1.5°C.

Mitigation pathways: predictions for what will happen in the future if we try and stop global heating. For example, what will the future climate looks like if everyone cuts their CO_2 emissions by 50%?

Representative Concentration Pathways (RCPs): scenarios for what future climates might looks depending on how much CO_2 we put into the atmosphere. The RCPs have a number associated with them. This number refers to radiative forcing. This is the energy in-balance expressed in W m^{-2}. A small number is good (we want the incoming energy to be equal to the outgoing energy). A larger number is bad. A large number means there is an unbalance.

- RCP2.6: The energy unbalance is 2.6 W m^{-2} in 2100.
- RCP4.5: The energy unbalance is 4.5 W m^{-2} in 2100
- RCP6.0: The energy unbalance is 6.0 W m^{-2} in 2100
- RCP8.5: The energy unbalance is larger than 8.5 W m^{-2} in 2100. This is a REALLY bad case scenario!

Shared Socio-economic Pathways (SSPs). Another way to think about the RCPs. The SSPs don't just consider the energy imbalance in 2100, they also take into account how we will get there (the socio-economic development). The numbers after the SSPs can be confusing. The abbreviations SSP1, SSP2, ..., SSP5 are used to denote the five socio-economic scenario families (ranging from "good" to "very bad").

- SSP1 is a good path to follow
- SSP5 is really really bad path to follow

Sometimes however, the second number refers to the energy unbalance. For example, SSP1-1.9, SSP1-2.6, ..., SSP5-8.5 refer to radiative forcing levels of 1.9, 2.6, ..., or 8.5 W m^{-2} by 2100.

Polar amplification: the temperature at the North Pole (Arctic amplification) is changing a lot faster than the average temperature on Earth. This is of grave concern, because it means that ice melts faster. And melting ice disrupts ocean currents and cause sea level rise. Melting ice also reduces the Earth's average albedo.

Radiative forcing: when the Earth's climate is stable, the energy received from the Sun is equal to the energy reradiated back into space. However, when we put CO_2 into the atmosphere, this balance is upset. Radiative forcing tells us how strong the energy unbalance is and is expressed in W m^{-2}. When we put more into the atmosphere, this number becomes larger.

Scenario: a plausible description of how the future may develop based on a set of assumptions about things such as technological change (TC), prices, demographic and socio-economic development, energy and land use, etc.

Concentrations scenario: a plausible representation of the future development of atmospheric concentrations of GHGs and changes to the Earth's albedo.

Emissions scenario: a plausible representation of the future atmospheric concentration of GHGs.

Mitigation scenario: a plausible description of the future that describes how the climate responds if we attempt to fix the problem (e.g. if we use more electrical cars, or let forests grow back, etc).

Reference scenario: scenario used as starting or reference point for a comparison between two or more scenarios.

Socio-economic scenario: scenario that describes a plausible future in terms of population, gross domestic product (GDP), and other socio-economic factors relevant to understanding the implications of climate change.

Sea level change (sea level rise/sea level fall): change to the height of sea level. Several factsors impact sea level rise. (i) more water in the ocean (e.g., due to melt of glaciers and ice sheets), (ii) changes in ocean volume as a result of changes in ocean water density (e.g., expansion under warmer conditions).

Sink: any process, activity or mechanism which removes a greenhouse gas or an aerosol from the atmosphere.

Solar activity: general term collectively describing a variety of magnetic phenomena on the Sun such as sunspots, faculae (bright areas), and flares (emission of high-energy particles). It varies on time scales from minutes to millions of years. The solar cycle, with an average duration of 11 years, is an example of a quasi-regular change in solar activity.

Solar cycle (11-year): a quasi-regular modulation of solar activity with varying amplitude and a period of between 8 and 14 years.

Solar radiation: electromagnetic radiation emitted by the Sun with a spectrum close to that of a black body with a temperature of 5770 K. The radiation peaks in visible wavelengths.

Tipping element: A component of the Earth system that is susceptible to a tipping point.

Tipping point: A critical threshold beyond which a system reorganizes, often abruptly and/or irreversibly. Examples of tipping points include the disappearance of the coral reefs. Once they die, it could take thousands to millions of years for new reefs to form. Another example is the melting of the Greenland ice sheet. Once it melts, it will not come back again.