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1 # GLOSSARY

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1 ### Accuracy
2 Accuracy is a relative measure of the exactness of an emission or removal estimate. Estimates should be accurate
3 in the sense that they are systematically neither over nor under true emissions or removals, so far as can be judged,
4 and that uncertainties are reduced so far as is practicable. Appropriate methodologies conforming to guidance on
5 *good practices* should be used to promote accuracy in inventories. Accuracy should be distinguished from
6 precision as illustrated below.

7 ***Illustration of Accuracy and Precision: (a) inaccurate but precise; (b) inaccurate and imprecise; (c) accurate***
8 ***but imprecise; and (d) precise and accurate.***

9

10   (a)   (b)   (c)   (d)

11
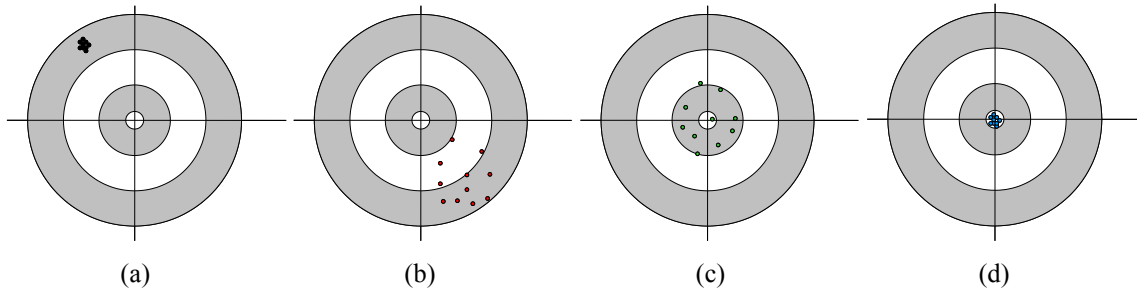
12 ### Activity
13 A practice or ensemble of practices that take place on a delineated area over a given period of time.

14 ### Activity data
15 Data on the magnitude of a human activity resulting in emissions or removals taking place during a given period
16 of time. Data on energy use, metal production, land areas, management systems, lime and fertilizer use and waste
17 arisings are examples of activity data.

18 ### Agricultural Pond
19 An artificial storage containing water for agricultural (irrigation) or pastoral (stock watering) uses. They are
20 typically unlined and constructed using a combination of earthen embankments and the natural topography on the
21 landscape. They can range in size from very small farm dams (< 50 m^2) to very large (> 10 km^2). <<
22 https://eros.usgs.gov/cubbie-station-queensland-australia-1987–2013 >>.

23 ### Allochthonous
24 Material or formation originating outside the water body.

25 **Allometric Model:** An allometric model is a formula that quantitatively describes an allometric
26 relationship.

27 **Allometry:** The term allometry refers to the proportional relationship between the relative dimensional
28 relationships or growth rates.

29 ### Anaerobic
30 Conditions in which oxygen is not readily available. These conditions are important for the production of methane
31 emissions. Whenever organic material decomposes in anaerobic conditions (in landfills, flooded rice fields, etc.)
32 methane is likely to be formed.

33 ### Andosol
34 A soil developed in volcanic ash. Generally andosols have good drainage and are prone to fertility problems.

35 ### Aquaculture Pond
36 An artifical storage containing water for the production of aquatic animals or plants. They are typically unlined
37 and constructed using a combination of earthen embankments and the natural topography on the landscape. They
38 can range in size from (< 50 m^2) to (> 10 km^2).

39 ### Arithmetic mean
40 The sum of the values divided by the number of values.

41 ### Auto producer

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An enterprise which generates electricity or heat for its own use and/or sells it as a secondary activity i.e., not as its main business.

Autochthonous
Material or formation originating from inside the water body.

Back-casting
The opposite of forecasting. Predicting conditions in the past from current conditions.

Backflows
By-product oils from petrochemical processing of refinery products which are generally returned to the refinery for further processing into petroleum products.

Base year
The starting year for the inventory. Currently this is typically 1990.

Bias
A systematic error of the observation method, whose magnitude in most cases is unknown. It can be introduced by using measuring equipment that is improperly calibrated, by selecting items from a wrong population or by favouring certain elements of a population, etc. For example: Estimating the total fugitive emission from gas transport and distribution using only measurements of leakage from high/medium pressure pipelines can lead to bias if the leakage in the lower pressure distribution network (which is significantly more difficult to measure) is neglected.

Biochar
For the purpose of this report, biochar is defined as a solid material generated by heating biomass to a temperature in excess of 300 °C under conditions of controlled and limited oxidant concentrations to prevent combustion. These processes can be classified as either pyrolysis (in which oxidants are excluded), or gasification (in which oxidant concentrations are low enough to generate syngas).

Biofuels
Any fuels derived from biomass, either deliberately grown or from waste products. Peat is not considered a biofuel in these guidelines due to the length of time required for peat to re-accumulate after harvest.

Biogenic carbon
Carbon derived from biogenic (plant or animal) sources excluding fossil carbon. Note that peat is treated as a fossil carbon in these guidelines as it takes so long to replace harvested peat.

Biological treatment of waste
Composting and anaerobic digestion of organic wastes, such as food waste, garden/park waste and sludge, to reduce volume in the waste material, stabilisation of waste, and destruction of pathogens in the waste material. This includes mechanical-biological treatment.

Biomass
(1) The total mass of living organisms in a given area or of a given species usually expressed as dry weight.

(2) Organic matter consisting of or recently derived from living organisms (espically regarded as fuel) excluding peat. Includes products, by-products and waste derived from such material.

Blowing agent (for foam production)
A gas, volatile liquid, or chemical that generates gas during the foaming process. The gas creates bubbles or cells in the plastic structure of a foam.

Bootstrap technique
Bootstrap technique is a type of computationally intensive statistical methods which typically uses repeated resampling from a set of data to assess variability of parameter estimates.

Boreal
See *polar/boreal*.

Calcium carbide

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Calcium carbide is used in the production of acetylene, in the manufacture of cyanamide (a minor historical use), and as a reductant in electric arc steel furnaces. It is made from calcium carbonate (limestone) and carbon-containing reductant (e.g., petroleum coke).

Canal
An artificial waterway typically constructed with a uniform cross-section to provide navigation or to transport water for irrigation, hydropower, town water supplies, etc. They may be earthen structures or they may have concrete linings. "Canals are generally long and narrow, with a uniform width and depth, and have a single outlet." <https://www.ramsar.org/news/ramsar-topics-report-on-canal-estates>> accessed 10 Apr 18

Carbon budget
The balance of the exchanges of carbon between carbon pools or within one specific loop (e.g., atmosphere – biosphere) of the carbon cycle.

Carbon dioxide equivalent
A measure used to compare different greenhouse gases based on their contribution to radiative forcing. The UNFCCC currently (2005) uses global warming potentials (GWPs) as factors to calculate carbon dioxide equivalent (see below).

Category
Categories are subdivisions of the four main sectors Energy; Industrial Processes and Product Use (IPPU); Agriculture, Forestry and Other Land Use (AFOLU); and waste. Categories may be further divided into sub-categories.

Census
Data collected by interrogation or count of an entire population.

Channel
A generic term for a waterway that encompasses creeks, streams, rivers, canals, ditches etc.

Chlorofluorocarbons (CFCs)
Halocarbons containing only chlorine, fluorine, and carbon atoms. CFCs are both ozone-depleting substances (ODSs) and greenhouse gases.

Chronosequence
Chronosequences consist of measurements taken from similar but separate locations that represent a temporal sequence in land use or management, for example, years since deforestation. Efforts are made to control all other between-site differences (e.g., by selecting areas with similar soil type, topography, previous vegetation). Chronosequences are often used as a surrogate for experimental studies or measurements repeated over time at the same location.

Climate sub-domain
The climatic sub-domain into which lands are grouped for the purposes of inventory calculations.

Coefficient of variation
Statistical definition: The coefficient of variation, v_x is the ratio of the population standard deviation, σ_x, and mean, μ_x, where $v_x = \sigma_x / \mu_x$. It also frequently refers to the sample coefficient of variation, which is the ratio of the sample standard deviation and sample mean.[1]

Cogeneration
See: Combined Heat and Power (CHP) generation.

Combined heat and power (CHP)
Combined heat and power (CHP), also known as cogeneration, is the simultaneous production of both electricity and useful heat for application by the producer or to be sold to other users with the aim of better utilisation of the energy used. Public utilities may utilise part of the heat produced in power plants and sell it for public heating purposes. Industries as auto-producers may sell part of the excess electricity produced to other industries or to electric utilities.

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[1] 'Coefficient of variation' is the term, which is frequently replaced by 'error' in a statement like 'the error is 5%'.

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Comparability

Comparability means that estimates of emissions and removals reported by countries in inventories should be comparable among countries. For this purpose, countries should use agreed methodologies and formats for estimating and reporting inventories.

Completeness

Completeness means that an inventory covers all sources and sinks and gases included in the *IPCC Guidelines* for the full geographic coverage in addition to other existing relevant source/sink categories which are specific to individual countries (and therefore may not be included in the *IPCC Guidelines*).

Confidence

The term 'confidence' is used to represent trust in a measurement or estimate. Having confidence in inventory estimates does not make those estimates more accurate or precise; however, it will eventually help to establish a consensus regarding whether the data can be applied to solve a problem. This usage of confidence differs substantially from the statistical usage in the term confidence interval.

Confidence interval

The value of the quantity for which the interval is to be estimated is a fixed but unknown constant, such as the annual total emissions in a given year for a given country. The confidence interval is a range that encloses the true value of a unknown fixed quantity with a specified confidence (probability). Typically, a 95 percent confidence interval is assumed. From a traditional statistical perspective, the 95 percent confidence interval has a 95 percent probability of enclosing the true but unknown value of the quantity. An alternative interpretation is that the confidence interval is a range that may safely be declared to be consistent with observed data or information. The 95 percent confidence interval is enclosed by the 2.5^{th} and 97.5^{th} percentiles of the PDF.

Consistency

Consistency means that an inventory should be internally consistent in all its elements over a period of years. An inventory is consistent if the same methodologies are used for the base year and all subsequent years and if consistent data sets are used to estimate emissions or removals from sources or sinks. An inventory using different methodologies for different years can be considered to be consistent if it has been estimated in a transparent manner taking into account the guidance in Volume 1 on good practice in time series consistency.

Correlation

Mutual dependence between two quantities. See *correlation coefficient*.

Correlation coefficient

A number lying between -1 and $+1$, which measures the mutual dependence between two variables that are observed together. A value of $+1$ means that the variables have a perfect linear relationship; a value of -1 means that there is a perfect inverse linear relation; and a value of 0 means that there is no straight line relation. It is defined as the covariance of the two variables divided by the product of their standard deviations.

Country-specific data

Data for either activities or emissions that are based on research carried out on sites either in that country or otherwise representative of that country.

Cruise

(When applied to aircraft) All aircraft activities that take place at altitudes above 914 metres (3000 feet) including any additional climb or descent operations above this altitude. There is no upper limit.

Dam

A structure used to contain water. Typically constructed with mineral sediment or concrete. Large dams are defined by the International Commission on Large Dams (ICOLD) to be structures greater than 15 m in height.

Degassing emissions

These are the elevated gas emissions that occur as water is released from a dam and experiences sudden changes in pressure, temperature and turbulence. These changes cause air-water exchange processes to occur at much greater rates than in surface waters as the released water approaches a new equilibrium with the environment downstream following Le Chatelier's principle. In the case of dams the change in the hydrostatic pressure before and after water passing throught turbines affects this balance.

Also, water released from dams is typically released into a stilling basin designed to dissipate much of the turbulent energy of the flow in order to prevent excessive bank erosion in the natural river channel downstream. The

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increased water column turbulence greatly increases the air-water gas transfer rate for a given dissolved gas concentration. In some cases, water may be discharged through needle valves into the air, which provides very high air-water contact area leading to rapid gas release.

Decision tree
A decision tree is a flow chart describing the specific ordered steps which need to be followed to develop an inventory or an inventory component in accordance with the principles of *good practice*.

Diffusive emission
The gas flux across the air-water interface governed by diffusion. For measuring diffusive fluxes, the most popular method employs floating chambers. Frequently estimated using the Thin Boundary Layer model of gas transfer.

Displaced emission
An emission of greenhouse gases that has been relocated in space (and possibly in time) but unchanged in quantity. For example, remineralisation and emission of CO_2 of 1 kg of soil C assumed to occur in an agricultural field may actually occur downstream in a river, reservoir or ocean if that 1 kg of soil C is carried into the stream network as a consequence of rainfall. The carbon is still converted to CO_2 but enters the atmosphere at a location downstream of the carbon source.

Dissolved Inorganic Carbon (DIC)
Sum of all inorganic carbon species in solution (e.g. carbonate, bicarbonate, carbonic acid, carbon dioxide).

Dissolved Organic Carbon (DOC)
Organic carbon remaining in solution after filtering the sample, typically using a 0.45 micrometer filter.

Distribution function
A distribution function or cumulative distribution function $F(x)$ for a random variable X specifies the probability $P(X \le x)$ that X is less than or equal to x.

Ditch
A long, narrow excavation dug in the earth, typically unlined, often with a uniform cross-section. They are most often used to provide drainage alongside roadways and from agricultural fields and to convey water for irrigation.

Downstream emissions
The total greenhouse gas emissions that occur downstream of a dam including both degassing emissions and the diffusive emission from the river downstream of the dam.

Drainage channel
A ditch used for drainage.

Drawdown zone
The area around the perimeter of a reservoir or pond that is intermittently exposed to the air as a result of water level changes.

Ebullitive emission
The flux of gas carried by bubbles from sediments through to the water column to the atmosphere.

Eddy flux measurement
The measurement of material fluxes by correlating high-frequency turbulent velocity fluctuations with turbulent concentration fluctuations. Also referred to as eddy correlation i.e. micrometeorological method that uses differences in concentration associated with turbulence in the air to quantify net vertical gas exchange.

Emission factor
A coefficient that quantifies the emissions or removals of a gas per unit activity. Emission factors are often based on a sample of measurement data, averaged to develop a representative rate of emission for a given activity level under a given set of operating conditions.

Emissions
The release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time. (UNFCCC Article 1.4)

Energy recovery

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A form of resource recovery in which the organic fraction of waste is converted to some form of usable energy. Recovery may be achieved through the combustion of processed or raw refuse to produce steam through the pyrolysis of refuse to produce oil or gas; and through the anaerobic digestion of organic wastes to produce methane gas.

Enhanced coal bed methane (recovery)
Increased CH4 recovery produced by the injection of CO_2 into coal seams.

Epilimnetic
Pertaining to the epilimnion of a stratified water body.

Epilimnion
The uppermost region of a density-stratified reservoir. Frequently defined as the region above the strongest temperature gradient in the water column. It always includes, but is not limited to, the surface mixing layer – the isothermal region of actively turbulent water just below the air-water interface.

Estimation
The process of calculating emissions and/or removals.

Eutrophication
Natural or anthropogenic process of nutrient enrichment of a water body which leads to increases in algal biomass.

Evaporative emissions
Evaporative emissions fall within the class of fugitive emissions and are released from area (rather than point) sources. These are often emissions of Non-Methane Volatile Organic Compounds (NMVOCs), and are produced when the product is exposed to the air – for example in the use of paints or solvents.

Excluded carbon
Carbon in non-energy uses of fossil fuels (feed stocks, reductant and non-energy products) excluded from fuel combustion.

Expert judgement
A carefully considered, well-documented qualitative or quantitative judgement made in the absence of unequivocal observational evidence by a person or persons who have a demonstrable expertise in the given field.

Feedstock
Fossil fuels used as raw materials in chemical conversion processes to produce primarily organic chemicals and, to a lesser extent, inorganic chemicals.

First use
Distinguishes first uses (and related emissions) from later non-energy uses of fossil fuels. For example, first-use emissions from lubricants are those which take place as a result of oxidation during use as a lubricant. Used lubricants may be used subsequently for heat raising as waste oils.

Flaring
Deliberate burning of natural gas and waste gas/vapour streams, without energy recovery.

Floating chamber
Closed container that floats on the surface of the water used to quantifying greenhouse gas emissions from the water surface. The time-dependent change in gas concentration within the floating chamber is a direct measurement of the gas flux.

Flood Control
The operation of a reservoir to reduce peaks in river discharge.

Flooded land proxy
A proxy for the estimation of anthropogenic emissions and removals from flooded land designated as "managed" land prior to flooding.

Flow rate
The volume of water or gas passing through an imaginary plane at an instant of time [units are length^3 time^{-1}:eg, $m^3 s^{-1}$, cfs, ML d^{-1}, Ln min^{-1}].

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Fluorocarbons

Halocarbons containing fluorine atoms, including chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

Flux

(1) Raw materials, such as limestone, dolomite, lime, and silica sand, which are used to reduce the heat or other energy requirements of thermal processing of minerals (such as the smelting of metals). Fluxes also may serve a dual function as a slagging agent.

(2) The rate of flow of any liquid or gas, across a given area; the amount of this crossing a given area in a given time. E.g., "Flux of CO_2 absorbed by forests".

Fossil carbon

Carbon derived from fossil fuel or other fossil source.

Fuel

Any substance burned as a source of energy such as heat or electricity. See also *Primary Fuels* and *Secondary Fuels*.

Fuel combustion

Within the Guidelines fuel combustion is the intentional oxidation of materials within an apparatus that is designed to provide heat or mechanical work to a process, or for use away from the apparatus.

Fuel wood

Wood used directly as fuel.

Fugitive Emissions

Emissions that are not emitted through an intentional release through stack or vent. This can include leaks from industrial plant and pipelines.

Funnel trap

A device deployed underwater to capture bubbles.

Global warming potential

Global Warming Potentials (GWP) are calculated as the ratio of the radiative forcing of one kilogramme greenhouse gas emitted to the atmosphere to that from one kilogramme CO_2 over a period of time (e.g., 100 years).

Good Practice

Good Practice is a set of procedures intended to ensure that greenhouse gas inventories are accurate in the sense that they are systematically neither over- nor underestimates so far as can be judged, and that uncertainties are reduced so far as possible.

Good Practice covers choice of estimation methods appropriate to national circumstances, quality assurance and quality control at the national level, quantification of uncertainties and data archiving and reporting to promote transparency.

Ground truth

A term used for data obtained by measurements on the ground, usually as validation for remote sensing, e.g., satellite data.

G-res

A computer modelling tool developed by the International Hydropower Association (IHA) in collaboration with the UNESCO Chair for Global Environmental Change for the assessment of GHG emissions from reservoirs all around the world. Using readily available input data, the tool provides a cost effective way to more accurately assess net GHG emissions.

The G-res tool uses a modelling methodology based on current scientific knowledge and over 500 empirical measurements from more than 200 reservoirs worldwide.

It builds on a conceptual framework developed in cooperation with researchers from the University of Québec at Montreal (UQAM), the Norwegian Foundation for Scientific and Industrial Research (SINTEF) and the Natural Resources Institute of Finland (LUKE). <https://www.hydropower.org/gres>

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Harvested wood products

Harvested wood products (HWP) according to the IPCC good practice guidance (2003) include wood and paper products. It is related to harvest and manufacture of wood products and the use and disposal of wood.

Hydrocarbon

Strictly defined as molecules containing only hydrogen and carbon. The term is often used more broadly to include any molecules in petroleum which also contains molecules with S, N, or O An unsaturated hydrocarbon is any hydrocarbon containing olefinic or aromatic structures.

Hydrochlorofluorocarbons (HCFCs)

Halocarbons containing only hydrogen, chlorine, fluorine and carbon atoms. Because HCFCs contain chlorine, they contribute to ozone depletion. They are also greenhouse gases.

Hydrofluorocarbons (HFCs)

Halocarbons containing only hydrogen, fluorine and carbon atoms. Because HFCs contain no chlorine, bromine, or iodine, they do not deplete the ozone layer. Like other halocarbons, they are potent greenhouse gases.

Hydrofluoroethers (HFEs)

Chemicals composed of hydrogen, fluorine and carbon atoms, with ether structure. Because HFES contain no chlorine, bromine, or iodine, they do not deplete the ozone layer. Like other halocarbons, they are potent greenhouse gases.Hypolimnetic Pertaining to the hypolimnion.

Hympolimnion

The hypolimnion is the region of colder water at the bottom of a thermally stratified water body. It lies below the meatalimnion (or thermocline) – the region with the strongest temperature gradient – and it may contain a weak temperature gradient. In many reservoirs, the hypolimnion can be anoxic (no oxygen) for many months each year because vertical transport of dissolved gases from above occurs mainly by slow diffusive processes across the metalimnion. This can lead to the accumulation of large concentrations of dissolved CH_4 released from the bottom sediments.

Hypoxic

Depletion of dissolved oxygen in aquatic environments to levels that are detrimental or fatal to aerobicorganisms often caused by eutrophication.

Independence

Two random variables are independent if there is a complete absence of association between how their sample values vary. The most commonly used measure of the lack of independence between two random variables is the correlation coefficient.

Inflow

The water that enters a water body (e.g. pond, lake, reservoir). In addition to surface flows (streams, rivers), inflow may also include precipitation and groundwater inputs.

Irrigation channel

An open channel that transports water in order to irrigate agricultural land.

Key category

A key category is one that is prioritised within the national inventory system because its estimate has a significant influence on a country's total inventory of greenhouse gases in terms of the absolute level of emissions and removals, the trend in emissions and removals, or uncertainty in emissions or removals. Whenever the term key category is used, it includes both source and sink categories.

Key source

See *key category*.

Kilns

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A tubular heating apparatus used in the manufacture of cement, lime and other materials. The calcination reaction may take place in the kiln itself, or, where so-equipped, it may partly or completely take place in a preheater and/or precalciner apparatus ahead of the kiln.

Land cover

The type of vegetation , rock, water etc. covering the earth's surface.

Land use

The type of activity being carried out on a unit of land.

Note: in Volume 4 (AFOLU), broad land-use categories are defined in Chapter 2. It is recognized that these categories are a mixture of land cover (e.g., Forest, Grassland, Wetlands) and land use (e.g., Cropland, Settlements) classes.

Landfill gas

Municipal solid waste contains significant portions of organic materials that produce a variety of gaseous products when deposited, compacted, and covered in landfills. Anaerobic bacteria thrive in the oxygen-free environment, resulting in the decomposition of the organic materials and the production of primarily carbon dioxide and methane. Carbon dioxide is likely to leach out of the landfill because it is soluble in water. Methane, on the other hand, which is less soluble in water and lighter than air, is likely to migrate directly to the atmosphere.

Large dams

A dam with a height of 15 metres or greater from lowest foundation to crest or a dam between 5 metres and 15 metres impounding more than 3 million cubic metres. (See ICOLD Constitution, Page 3**)**

LTO (landing and take-off) cycle

All aircraft activities that occur under 914 metres (3 000 feet) including idling aircraft engines, taxi-out, take-off, climb up to 914 metres, descend, approach and taxi-in. Note: some gatherers of statistics count either single take-off or landing as one cycle; however, it is both one take-off and one landing that together define the LTO cycle.

Lubricants

Lubricants are hydrocarbons produced from distillate or residue, and they are mainly used to reduce friction between bearing surfaces. This category includes all finished grades of lubricating oil, from spindle oil to cylinder oil, and those used in greases, including motor oils and all grades of lubricating oil base stocks.

Manure

Waste materials produced by domestic livestock which can be managed for agricultural purposes. When manure is managed in a way that involves anaerobic decomposition, significant emissions of methane can result.

Mean

The mean is a value around which values sampled from a probability distribution tend to lie. The sample mean or arithmetic average is an estimator for the mean. It is an unbiased and consistent estimator of the population mean (expected value) and is itself a random variable with its own variance value. The sample mean is the sum of values divided by the number of values:

$$\bar{x} = \frac{1}{n}\sum_{i}^{n} x_i$$ (**xi, where $i = 1,...., n$ are items of a sample).Measurement-based approach**

The use of direct measurements to compute GHG fluxes from a system.

Median

The median or population median is a value which divides the integral of a probability density function (PDF) into two halves. For symmetric PDFs, it equals the mean. The median is the 50th population percentile.

The sample median is an estimator of the population median. It is the value that divides an ordered sample into two equal halves. If there are $2n + 1$ observations, the median is taken as the $(n + 1)^{th}$ member of the ordered sample. If there are $2n$, it is taken as being halfway between the nth and $(n + 1)^{th}$.

Methanogenic production

Production of methane by microorganisms (methanogenic bacteria) during the decomposition of organic matter.

Mode

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1   The mode of a distribution is the value which has the highest probability of occurrence. Distributions can have one or
2   more modes. In practice, we usually encounter distributions with only one mode. In this case, the mode or population
3   mode of a <u>PDF</u> is the measure of a value around which values sampled from a probability distribution tend to lie.

4   The sample mode is an estimator for the population mode calculated by subdividing the sample range into equal
5   subclasses, counting how many observations fall into each class and selecting the centre point of the class (or
6   classes) with the greatest number of observations.

Model

8   A model is a quantitatively-based abstraction of a real-world situation which may simplify or neglect certain
9   features to better focus on its more important elements.

10 Example: the relationship that emissions equal an emission factor times an activity level is a simple model. The
11 term 'model' is also often used in the sense of a computer software realisation of a model abstraction.

Model-based approach

13 The application of (typically) statistical or process-based models that employ indirect measurements to infer GHG
14 fluxes from a system of interest. For example, a model-based estimate of a pollutant flux could be computed as
15 the product of an assumed concentration and a measured flow rate, whereas the corresponding measurement-based
16 estimate would use a measured concentration and a measured flow rate.

Monte Carlo method

18 In these guidelines a Monte Carlo method is recommended to analyse the uncertainty of the inventory. The
19 principle of Monte Carlo analysis is to perform the inventory calculation many times by computer, each time with
20 the uncertain emission factors or model parameters and activity data chosen randomly (by the computer) within
21 the distribution on uncertainties specified initially by the user. Uncertainties in emission factors and/or activity
22 data are often large and may not have normal distributions. In this case the conventional statistical rules for
23 combining uncertainties become very approximate. Monte Carlo analysis can deal with this situation by generating
24 an uncertainty distribution for the inventory estimate that is consistent with the input uncertainty distributions on
25 the emission factors, model parameters and activity data.

Non-energy products

27 Primary or secondary fossil fuels which are used directly for their physical or diluent properties. Examples are:
28 lubricants, paraffin waxes, bitumen, and white spirits and mineral turpentine (as solvent).

Non-energy use

30 Within the *Guidelines* this term refers to the use of fossil fuels as *Feedstock*, *Reductant* or *Non-energy products*.
31 However, the use of this term differs between countries and sources of energy statistics. In most energy statistics,
32 e.g., of the International Energy Agency (IEA), fuel inputs of *reductants* to blast furnaces are not included but
33 accounted for as inputs to a fuel conversion activity transforming coke and other inputs to blast furnace gas.

Non-marketed lime production

35 Lime production occurring at facilities where the primary purpose is the production of lime as an intermediate
36 input: such as plants that produce steel, synthetic soda ash, calcium carbide, magnesia and magnesium metal, as
37 well as copper smelter and sugar mills. The lime produced by these facilities is often used on site and thus is often
38 not reported in national statistics. Also referred to as in-house lime production.

Non-Methane Volatile Organic Compounds (NMVOCs)

40 A class of emissions which includes a wide range of specific organic chemical substances. Non-Methane Volatile
41 Organic Compounds (NMVOCs) play a major role in the formation of ozone in the troposphere (lower atmosphere).
42 Ozone in the troposphere is a greenhouse gas. It is also a major local and regional air pollutant, causing significant
43 health and environmental damage. Because they contribute to ozone formation, NMVOCs are considered
44 "precursor" greenhouse gases. NMVOCs, once oxidized in the atmosphere, produce carbon dioxide.

Normal distribution

46 The normal (or Gaussian) distribution has the PDF given in the following equation and is defined by two
47 parameters (the mean μ and the standard σ deviation).

48
$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}, \text{ for } -\infty \leq x \leq \infty.$$

Nutrient loading

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1   An increase in levels of nitrogen, phosphorus, and sulfur entering aquatic systems as a result of human activity
2   occurring in the catchment.

3

Observational data
Observational data is empirical data from instrumental (usually monitoring equipment) or manual methods (through counts in a survey or census).

Off-gas
The exhaust gas from a chemical process (combustion or non-combustion). The off gas may be vented to the atmosphere, burned for energy recovery or flared (without energy recovery), or used as a feedstock for another chemical process. Secondary products may also be recovered from the off gas.

Open burning of waste
The combustion of unwanted combustible materials such as paper, wood, plastics, textiles, rubber, and other debris in the open or at an open dump site, where smoke and other emissions are released directly into the air without passing through a chimney or stack. Open burning can also include incineration devices that do not control the combustion air to maintain an adequate temperature and do not provide sufficient residence time for complete combustion.

Outflow
Water discharged from a dam.

Outflow area
The area where water is discharged immediate downstream of a dam. It is characterised by exceptionally high levels of turbulence in the water (see degassing emissions) that directly result from the operation of the dam.

Oxic
Containing dissolved oxygen.

Oxidation
Chemically transform of a substance by combining it with oxygen.

Oxycline
The region of high dissolved oxygen concentration *change* within the water column that separates oxic and anoxic regions.

Ozone-depleting substances (ODS)
A compound that contributes to stratospheric ozone depletion. Ozone-depleting substances (ODS) include CFCs, HCFCs, halons, methyl bromide, carbon tetrachloride, and methyl chloroform. ODS are generally very stable in the troposphere and only degrade under intense ultraviolet light in the stratosphere. When they break down, they release chlorine or bromine atoms, which then deplete ozone.

Pasture
Area covered with grass or other plants used or suitable for the grazing of livestock; grassland.

PDF
See *Probability density function*.

Peat
Soft, porous or compressed, sedimentary deposit of plant origin with high water content in the natural state (up to about 90 percent). Countries may define peat according to their national circumstances.

Peatland
Peatlands are wetland ecosystems where net primary production exceeds organic matter decomposition as a result of waterlogged, cold and acidic conditions, leading into accumulation of peat. They cover ~3% of the Earth's surface and contain about one-third of the global organic soil C.

Percentile

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The kth percentile or population percentile is a value which separates the lowest k^{th} part of the integral of the probability density function (PDF) – i.e., an integral of a PDF tail from the kth percentile towards lower probability densities.

The kth population percentile ($0 \leq k \leq 100$) of a population with a distribution function $F(x)$ equals to z where z satisfies $F(z) = k/100$

Sample k^{th} percentile is an approximation for the population percentile which is derived from a sample. It is the value below which k percent of the observations lie.

Perfluorocarbons (PFCs)
Synthetically produced halocarbons containing only carbon and fluorine atoms. They are characterized by extreme stability, non-flammability, low toxicity, zero ozone depleting potential, and high global warming potential.

Plant-mediated emission
Vascular *plants* known to influence the production, transport and oxidation of methane in wetland soils

Polar/boreal
Regions where mean annual temperature (MAT) is less than 0 ºC.

Ponds
The water impounded behind a small dam (< 15 m high) or embankment.

Pool/carbon pool
A reservoir. A component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored. Examples of carbon pools are forest biomass, wood products, soils and the atmosphere. The units are mass.

Population
The population is the totality of items under consideration. In the case of a random variable, the probability distribution is considered to define the population of that variable.

Precision
Precision is the inverse of uncertainty in the sense that the more precise something is, the less uncertain it is.

Closeness of agreement between independent results of measurements obtained under stipulated conditions (see also *accuracy*).

Primary fuels
Fuels which are extracted directly from natural resources. Examples are: crude oil, natural gas, coals, etc.

Process-based modelling
Process-based models are based on a theoretical understanding of fundamental ecological, biological, chemical, and physical processes. They provide a useful framework to project specific responses to altered environmental conditions.

Probability
A probability is a real number in the scale 0 to 1 attached to a random event. There are different ways in which probability can be interpreted. One interpretation considers a probability as having the nature of a relative frequency (i.e., the proportion of all outcomes corresponding to an event), whilst another interpretation regards a probability as being a measure of degree of belief.

Probability density function
The Probability Density Function (PDF) describes the range and relative likelihood of possible values. The PDF can be used to describe *uncertainty* in the estimate of a quantity that is a fixed constant whose value is not exactly known, or it can be used to describe inherent *variability*. The purpose of the uncertainty analysis for the emission inventory is to quantify *uncertainty* in the unknown fixed value of total emissions as well as emissions and activity pertaining to specific categories. Thus, throughout these guidelines it is presumed that the PDF is used to estimate uncertainty, and not variability, unless otherwise stated.

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Probability distribution
Statistical definition: A function giving the probability that a random variable takes any given value or belongs to a given set of values. The probability on the whole set of values of the random variable equals 1.

Process emissions
Emissions from industrial processes involving chemical transformations other than combustion.

Pumped storage reservoirs
Pumped-storage reservoir are a way of storing energy store and generate energy by moving water between two *reservoirs* at different elevations.

Quality Assurance
Quality Assurance (QA) activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process to verify that data quality objectives were met, ensure that the inventory represents the best possible estimate of emissions and sinks given the current state of scientific knowledge and data available, and support the effectiveness of the quality control (QC) programme.

Quality Control
Quality Control (QC) is a system of routine technical activities, to measure and control the quality of the inventory as it is being developed. The QC system is designed to:

    (i)   Provide routine and consistent checks to ensure data integrity, correctness, and completeness;

    (ii)   Identify and address errors and omissions;

    (iii)   Document and archive inventory material and record all QC activities.

QC activities include general methods such as accuracy checks on data acquisition and calculations and the use of approved standardised procedures for emission calculations, measurements, estimating uncertainties, archiving information and reporting. More detailed QC activities include technical reviews of source categories, activity and emission factor data, and methods.

RAMSAR
The Convention on Wetlands, called the *Ramsar* Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

Removals
Removal of greenhouse gases and/or their precursors from the atmosphere by a sink.

Reporting
The process of providing results of the inventory as described in volume 1 chapter 8.

Reservoir
(1) A component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored. (UNFCCC Article 1.7)

(2) Water bodies regulated for human activities (energy production, irrigation, navigation, recreation etc.) where substantial changes in water area due to water level regulation may occur. The water impounded behind a dam.

Residence time
The average amount of time that water spends in a particular system (lake, reservoir, etc). Defined as the volume of the reservoir divided by the inflow.

Rice paddies
A paddy field is a flooded parcel of arable land used for growing semiaquatic rice. Paddy cultivation should not be confused with cultivation of deep water rice, which is grown in flooded conditions with water more than 50 cm (20 in) deep for at least a month

River emissions
These are GHG emissions from the surface of a normally (in a hydraulic sense) flowing river downstream of the exceptionally turbulent region (see outflow area) immediately downstream of the

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dam. 'Normal flow' refers to the velocity of the flow being solely determined by channel shape and bed slope so that water column turbulence is produced predominantly by natural shear forces at the water-river bed interface.

Run-of-the-river reservoirs

Run-of-the-river hydroelectric systems are hydroelectric reservoir systems that harvest the energy from flowing water to generate electricity. A run-of-the-river reservoir cannot store more water than one day's annual mean inflow.

Secondary fuels

Fuels manufactured from primary fuels. Examples are: cokes, motor gasoline and coke oven gas, blast furnace gas.

Sequestration

The process of storing carbon in a carbon pool.

Sink

Any process, activity or mechanism which removes a greenhouse gas, an aerosol, or a precursor of a greenhouse gas from the atmosphere. (UNFCCC Article 1.8) Notation in the final stages of reporting is the negative (-) sign.

Soil carbon pool

Each of the different carbon pools decomposes, or turns over, at a different rate and is involved in different soil processes, These are expressed as : fast (Active Pool or 0,5 yr turnover time), intermediate (Slow Pool or 20 to 40 yrs of turnover) and long turnover times (Passive Pool or 200 to 1500 yrs)

Source

Any process or activity which releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas into the atmosphere. (UNFCCC Article 1.9) Notation in the final stages of reporting is the positive (+) sign.

Spill

Unregulated discharge from a reservoir that occurs when a reservoir is full and inflow to the reservoir exceeds the regulated outflow causing the water to pass over/through the dam's spillway.

Spillway

An engineered channel used to pass high flows safely past a dam when the reservoir water level is high than the crest of the dam. Note that the maximum water level of a reservoir is frequently higher than the crest because of the use of gates that are on top of the crest.

Standard deviation

The population standard deviation is the positive square root of the variance. It is estimated by the sample standard deviation that is the positive square root of the sample variance.

Storage volume

Storage volume refers to the volume of water stored in a water body. The 'active' storage of a reservoir is the volume of water contained between the spillway crest and the lowest outlet level. The 'dead' storage is the volume of water that is below the lowest outlet and therefore cannot be routinely accessed for beneficial use. The 'flood control' storage is the volume of water contained between the spillway crest and the top of gates (or other adjustable structures) located on top of the spillway and used to regulate the discharge of floodwaters. The total reservoir storage volume is the sum of dead storage, active storage, and flood control storage capacities.

Surrogate data

Surrogate data is data that is used in place of the actual data, where the specific data needed is unobtainable. Often surrogate data is needed to describe changes in an emission source over time, for example population change may be used to approximate change in waste arisings.

Survey data

Survey data is derived from random sampling of a population and does not include real data for the whole population, e.g., the number of animals in a country or region by surveying a discrete selection of farms and groups of farms in a country or region, or using more general surrogate data and assumptions.

Systematic and random errors

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Systematic error (i.e., bias) is the difference between the true, but usually unknown, value of a quantity being estimated, and the mean observed value as would be estimated by the sample mean of an infinite set of observations. The random error of an individual measurement is the difference between an individual measurement and the above limiting value of the sample mean.

Systematic error
See *systematic and random errors*.

Temperate, cold
Areas where mean annual temperature (MAT) is between 0 – 10 ºC.

Temperate, warm
Areas where mean annual temperature (MAT) is between 10 – 20 ºC.

Thin boundary layer model
The thin boundary layer model expresses the flux of gas across an air-water interface as the product of a gas transfer velocity and the concentration change across the interface. It was originally developed by Liss and Slater (1974).

Time series
A time series is series of values which are affected by random processes and which are observed at successive (usually equidistant) points in time.

Transparency
Transparency means that the assumptions and methodologies used for an inventory should be clearly explained to facilitate replication and assessment of the inventory by users of the reported information. The transparency of inventories is fundamental to the success of the process for the communication and consideration of information.

Trend
The trend of a quantity measures its change over a time period, with a positive trend value indicating growth in the quantity, and a negative value indicating a decrease. It is defined as the ratio of the change in the quantity over the time period, divided by the initial value of the quantity, and is usually expressed either as a percentage or a fraction.

Trophic state
The trophic state is a measure of the biological productivity of a water body. It is usually characterized by some combination of nutrients, photosynthetic pigments (Chl-a) and/or water column optical properties. As the ambient nutrient levels increase, primary production (the algal population) increases and the water clarity decreases. As primary production increases, higher levels of biological production are supported and the trophic state increases.

Lakes or reservoirs are usually classified as being in one of four possible trophic states: oligotrophic, mesotrophic, eutrophic, or hypereutrophic. (see e.g., Carlson, 1977)

Oligotrophic: an oligotrophic lake or reservoir is characterised by low primary productivity, as a result of low nutrient content. (Chl-a ≤ 2.6 µg L^{-1}.)

Mesotrophic : mesotrophic lakes or reservoirs are characterised with an intermediate level of productivity (2.6 µg L-1 < Chl-a ≤ 20 µg L-1.)

Eutrophic : a eutrophic lake, pond or reservoir with high biological productivity. Due to excessive nutrients, especially nitrogen and phosphorus, these water bodies are able to support an abundance of aquatic plants. (20 µg L^{-1} < Chl-a ≤ 56 µg L^{-1}.)

Hypereutrophic: a hypereutrophic body of water experiences the highest levels of biological productivity. (56 µg L^{-1} < Chl-a)

Tropical
Areas where mean annual temperature (MAT) is more than 20 ºC.

Unbiased estimator
An unbiased estimator is a statistic whose expected value equals the value of the parameter being estimated. Note that this term has a specific statistical meaning and that an estimate of a quantity calculated from an unbiased estimator may lack bias in the statistical sense, but may be biased in the more general sense of the word if the sample has been affected by unknown systematic error. Thus, in statistical usage, a biased estimator can be

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understood as a deficiency in the statistical evaluation of the collected data, and not in the data themselves or in the method of their measurement or collection. For example, the arithmetic mean (average) $\bar{x}$ is an unbiased estimator of the expected value (mean).

Uncertainty

Lack of knowledge of the true value of a variable that can be described as a probability density function characterizing the range and likelihood of possible values. Uncertainty depends on the analyst's state of knowledge, which in turn depends on the quality and quantity of applicable data as well as knowledge of underlying processes and inference methods. (See Volume 1 Chapter 3.)

Uncertainty analysis

An uncertainty analysis of a model aims to provide quantitative measures of the uncertainty of output values caused by uncertainties in the model itself and in its input values, and to examine the relative importance of these factors.

Validation

Validation is the establishment of sound approach and foundation. In the context of emission inventories, validation involves checking to ensure that the inventory has been compiled correctly in line with reporting instructions and guidelines. It checks the internal consistency of the inventory. The legal use of validation is to give an official confirmation or approval of an act or product.

Variability

This refers to observed differences attributable to true heterogeneity or diversity in a population. Variability derives from processes which are either inherently random or whose nature and effects are influential but unknown. Variability is not usually reducible by further measurement or study, but can be characterised by quantities such as the sample variance.

Verification

Verification refers to the collection of activities and procedures that can be followed during the planning and development, or after completion of an inventory that can help to establish its reliability for the intended applications of that inventory.

Typically, methods external to the inventory are used to check the truth of the inventory, including comparisons with estimates made by other bodies or with emission and uptake measurements determined from atmospheric concentrations or concentration gradients of these gases.

Watercourse

A watercourse is the channel that a flowing body of water follows.

Wetland

A *wetland* is a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the hydric soils.

Withdrawal

The controlled release of water from a dam. Depending on the dam's design, i.e. the number and level of discrete outlets, the withdrawn water may originate solely from specific regions of the water column, i.e. epilimnion, metalimnion and hypolimnion. The withdrawal region for a specific discharge depends strongly on the density stratification of the water body, the outlet dimensions, and the reservoir morphology.