

Second-order draft

1 **GLOSSARY**

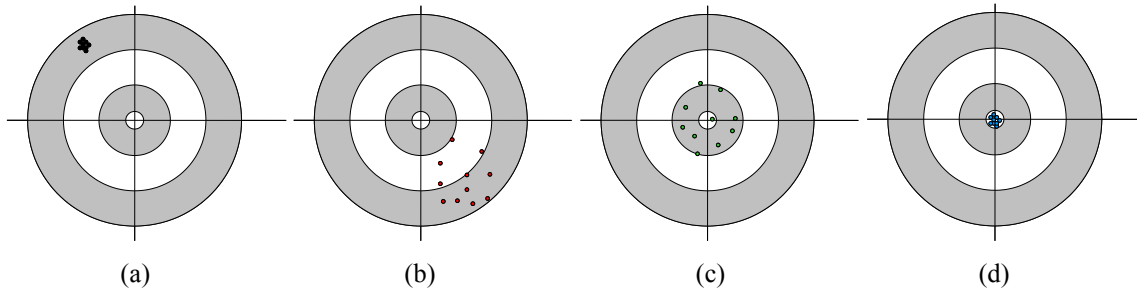
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1 Accuracy

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*.



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 m²) to very large (> 10 km²). <<
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 artificial 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 m²) to (> 10 km²).

39 Arithmetic mean

40 The sum of the values divided by the number of values.

41 Auto producer

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

3 **Autochthonous**

4 Material or formation originating from inside the water body.

5 **Back-casting**

6 The opposite of forecasting. Predicting conditions in the past from current conditions.

7 **Backflows**

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

10 **Base year**

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

12 **Bias**

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

19 **Biochar**

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

24 **Biofuels**

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

27 **Biogenic carbon**

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

30 **Biological treatment of waste**

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

34 **Biomass**

- 35 (1) The total mass of living organisms in a given area or of a given species usually expressed as dry weight.
36 (2) Organic matter consisting of or recently derived from living organisms (especially regarded as fuel) excluding
37 peat. Includes products, by-products and waste derived from such material.

38 **Blowing agent (for foam production)**

39 A gas, volatile liquid, or chemical that generates gas during the foaming process. The gas creates bubbles or cells
40 in the plastic structure of a foam.

41 **Bootstrap technique**

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

44 **Boreal**

45 See *polar/boreal*.

46 **Calcium carbide**

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

4 **Canal**

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

9 **Carbon budget**

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

12 **Carbon dioxide equivalent**

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

16 **Category**

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

20 **Census**

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

22 **Channel**

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

24 **Chlorofluorocarbons (CFCs)**

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

27 **Chronosequence**

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

33 **Climate sub-domain**

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

35 **Coefficient of variation**

36 Statistical definition: The coefficient of variation, v_x is the ratio of the population standard deviation, σ_x , and mean,
37 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
38 standard deviation and sample mean.¹

39 **Cogeneration**

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

41 **Combined heat and power (CHP)**

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

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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1 **Comparability**

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

5 **Completeness**

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

9 **Confidence**

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

14 **Confidence interval**

15 The value of the quantity for which the interval is to be estimated is a fixed but unknown constant, such as the
16 annual total emissions in a given year for a given country. The confidence interval is a range that encloses the true
17 value of a unknown fixed quantity with a specified confidence (probability). Typically, a 95 percent confidence
18 interval is assumed. From a traditional statistical perspective, the 95 percent confidence interval has a 95 percent
19 probability of enclosing the true but unknown value of the quantity. An alternative interpretation is that the
20 confidence interval is a range that may safely be declared to be consistent with observed data or information. The
21 95 percent confidence interval is enclosed by the 2.5th and 97.5th percentiles of the PDF.

22 **Consistency**

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

28 **Correlation**

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

30 **Correlation coefficient**

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

35 **Country-specific data**

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

38 **Cruise**

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

41 **Dam**

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

44 **Degassing emissions**

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

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

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

4 **Decision tree**

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

7 **Diffusive emission**

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

10 **Displaced emission**

11 An emission of greenhouse gases that has been relocated in space (and possibly in time) but unchanged in quantity.
12 For example, remineralisation and emission of CO₂ of 1 kg of soil C assumed to occur in an agricultural field may
13 actually occur downstream in a river, reservoir or ocean if that 1 kg of soil C is carried into the stream network as
14 a consequence of rainfall. The carbon is still converted to CO₂ but enters the atmosphere at a location downstream
15 of the carbon source.

16 **Dissolved Inorganic Carbon (DIC)**

17 Sum of all inorganic carbon species in solution (e.g. carbonate, bicarbonate, carbonic acid, carbon dioxide).

18 **Dissolved Organic Carbon (DOC)**

19 Organic carbon remaining in solution after filtering the sample, typically using a 0.45 micrometer filter.

20 **Distribution function**

21 A distribution function or cumulative distribution function $F(x)$ for a random variable X specifies the probability
22 $P(X \leq x)$ that X is less than or equal to x .

23 **Ditch**

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

26 **Downstream emissions**

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

29 **Drainage channel**

30 A ditch used for drainage.

31 **Drawdown zone**

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

34 **Ebullitive emission**

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

36 **Eddy flux measurement**

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

40 **Emission factor**

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

44 **Emissions**

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

47 **Energy recovery**

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

5 **Enhanced coal bed methane (recovery)**

6 Increased CH₄ recovery produced by the injection of CO₂ into coal seams.

7 **Epilimnetic**

8 Pertaining to the epilimnion of a stratified water body.

9 **Epilimnion**

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

13 **Estimation**

14 The process of calculating emissions and/or removals.

15 **Eutrophication**

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

17 **Evaporative emissions**

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

21 **Excluded carbon**

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

24 **Expert judgement**

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

27 **Feedstock**

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

30 **First use**

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

34 **Flaring**

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

36 **Floating chamber**

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

40 **Flood Control**

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

42 **Flooded land proxy**

43 A proxy for the estimation of anthropogenic emissions and removals from flooded land designated as “managed”
44 land prior to flooding.

45 **Flow rate**

46 The volume of water or gas passing through an imaginary plane at an instant of time [units are length³ time⁻¹:eg,
47 m³ s⁻¹, cfs, ML d⁻¹, Ln min⁻¹].

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1 **Fluorocarbons**

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

4 **Flux**

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

8 (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
9 time. E.g., "Flux of CO₂ absorbed by forests".

10 **Fossil carbon**

11 Carbon derived from fossil fuel or other fossil source.

12 **Fuel**

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

15 **Fuel combustion**

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

18 **Fuel wood**

19 Wood used directly as fuel.

20 **Fugitive Emissions**

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

23 **Funnel trap**

24 A device deployed underwater to capture bubbles.

25 **Global warming potential**

26 Global Warming Potentials (GWP) are calculated as the ratio of the radiative forcing of one kilogramme
27 greenhouse gas emitted to the atmosphere to that from one kilogramme CO₂ over a period of time (e.g., 100 years).

28 **Good Practice**

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

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

35 **Ground truth**

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

38 **G-res**

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

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

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

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1 **Harvested wood products**

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

4 **Hydrocarbon**

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

8 **Hydrochlorofluorocarbons (HCFCs)**

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

11 **Hydrofluorocarbons (HFCs)**

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

14 **Hydrofluoroethers (HFES)**

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

18 **Hypolimnion**

19 The hypolimnion is the region of colder water at the bottom of a thermally stratified water body. It lies below the
20 metalimnion (or thermocline) – the region with the strongest temperature gradient – and it may contain a weak
21 temperature gradient. In many reservoirs, the hypolimnion can be anoxic (no oxygen) for many months each year
22 because vertical transport of dissolved gases from above occurs mainly by slow diffusive processes across the
23 metalimnion. This can lead to the accumulation of large concentrations of dissolved CH₄ released from the bottom
24 sediments.

25 **Hypoxic**

26 Depletion of dissolved oxygen in aquatic environments to levels that are detrimental or fatal to aerobic organisms
27 often caused by eutrophication.

28 **Independence**

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

32 **Inflow**

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

35 **Irrigation channel**

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

37 **Key category**

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

42 **Key source**

43 See *key category*.

44

45

46 **Kilns**

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

4 **Land cover**

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

6 **Land use**

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

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

11 **Landfill gas**

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

17 **Large dams**

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

20 **LTO (landing and take-off) cycle**

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

24 **Lubricants**

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

28 **Manure**

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

31 **Mean**

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

$$36 \quad \bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \quad (\mathbf{x_i, \text{ where } i = 1, \dots, n \text{ are items of a sample}). \mathbf{Measurement-based}$$

37 **approach**

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

39 **Median**

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

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

45 **Methanogenic production**

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

47 **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 **PDF** 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.

7 **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.

12 **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.

17 **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.

26 **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).

29 **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.

34 **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.

39 **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.

45 **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).

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

49 **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

4 **Observational data**

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

7 **Off-gas**

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

11 **Open burning of waste**

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

17 **Outflow**

18 Water discharged from a dam.

19 **Outflow area**

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

22 **Oxic**

23 Containing dissolved oxygen.

24 **Oxidation**

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

26 **Oxycline**

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

29 **Ozone-depleting substances (ODS)**

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

34 **Pasture**

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

36 **PDF**

37 See *Probability density function*.

38 **Peat**

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

41 **Peatland**

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

45 **Percentile**

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

4 The k^{th} population percentile ($0 \leq k \leq 100$) of a population with a distribution function $F(x)$ equals to z where z
5 satisfies $F(z) = k/100$

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

8 **Perfluorocarbons (PFCs)**

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

11 **Plant-mediated emission**

12 Vascular *plants* known to influence the production, transport and oxidation of methane in wetland soils

13

14 **Polar/boreal**

15 Regions where mean annual temperature (MAT) is less than 0 °C.

16 **Ponds**

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

18 **Pool/carbon pool**

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

22 **Population**

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

25 **Precision**

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

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

29 **Primary fuels**

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

31 **Process-based modelling**

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

35 **Probability**

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

40 **Probability density function**

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

47

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1 **Probability distribution**

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

4 **Process emissions**

5 Emissions from industrial processes involving chemical transformations other than combustion.

6 **Pumped storage reservoirs**

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

9 **Quality Assurance**

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

14 **Quality Control**

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

- 17 (i) Provide routine and consistent checks to ensure data integrity, correctness, and completeness;
- 18 (ii) Identify and address errors and omissions;
- 19 (iii) Document and archive inventory material and record all QC activities.

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

24 **RAMSAR**

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

28 **Removals**

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

30 **Reporting**

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

32 **Reservoir**

- 33 (1) A component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas
34 is stored. (UNFCCC Article 1.7)
- 35 (2) Water bodies regulated for human activities (energy production, irrigation, navigation, recreation etc.) where
36 substantial changes in water area due to water level regulation may occur. The water impounded behind a
37 dam.

38 **Residence time**

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

41 **Rice paddies**

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

45 **River emissions**

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

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

4 **Run-of-the-river reservoirs**

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

8 **Secondary fuels**

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

10 **Sequestration**

11 The process of storing carbon in a carbon pool.

12 **Sink**

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

15 **Soil carbon pool**

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

19 **Source**

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

22 **Spill**

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

25 **Spillway**

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

29 **Standard deviation**

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

32 **Storage volume**

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

39 **Surrogate data**

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

43 **Survey data**

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

47 **Systematic and random errors**

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

5 **Systematic error**

6 See *systematic and random errors*.

7 **Temperate, cold**

8 Areas where mean annual temperature (MAT) is between 0 – 10 °C.

9 **Temperate, warm**

10 Areas where mean annual temperature (MAT) is between 10 – 20 °C.

11 **Thin boundary layer model**

12 *The thin boundary layer model expresses the flux of gas across an air-water interface as the product of a gas*
 13 *transfer velocity and the concentration change across the interface. It was originally developed by Liss and Slater*
 14 *(1974).*

15 **Time series**

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

18 **Transparency**

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

22 **Trend**

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

27 **Trophic state**

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

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

34 **Oligotrophic**: an oligotrophic lake or reservoir is characterised by low primary productivity, as a result of
 35 low nutrient content. ($\text{Chl-a} \leq 2.6 \mu\text{g L}^{-1}$.)

36 **Mesotrophic** : mesotrophic lakes or reservoirs are characterised with an intermediate level of productivity ($2.6 \mu\text{g}$
 37 $\text{L}^{-1} < \text{Chl-a} \leq 20 \mu\text{g L}^{-1}$.)

38 **Eutrophic** : a eutrophic lake, pond or reservoir with high biological productivity. Due to excessive nutrients,
 39 especially nitrogen and phosphorus, these water bodies are able to support an abundance of aquatic plants. ($20 \mu\text{g}$
 40 $\text{L}^{-1} < \text{Chl-a} \leq 56 \mu\text{g L}^{-1}$.)

41 **Hypereutrophic**: a hypereutrophic body of water experiences the highest levels of biological productivity. ($56 \mu\text{g}$
 42 $\text{L}^{-1} < \text{Chl-a}$)

43 **Tropical**

44 Areas where mean annual temperature (MAT) is more than 20 °C.

45 **Unbiased estimator**

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

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

4 **Uncertainty**

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

9 **Uncertainty analysis**

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

12 **Validation**

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

17 **Variability**

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

22 **Verification**

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

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

29 **Watercourse**

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

31 **Wetland**

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

35 **Withdrawal**

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