

1 **GLOSSARY**

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5 **Accuracy**

6 A relative measure of the exactness of an emission or removal estimate. Estimates should be accurate in the sense
7 that they are systematically neither over nor under true emissions or removals, so far as can be judged.

8 **Activity**

9 A practice or ensemble of practices that take place on a delineated area over a given period of time.

10 **Activity data**

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

14 **Agricultural pond**

15 An artificial storage containing water for agricultural (irrigation) or pastoral (stock watering) uses. They are
16 typically unlined and constructed using a combination of earthen embankments and the natural topography on the
17 landscape. They can range in size from very small farm dams (< 50 m²) to very large (> 10 km²). <<
18 <https://eros.usgs.gov/cubbie-station-queensland-australia-1987-2013> >>.

19 **Allochthonous**

20 Material or formation originating outside the water body.

21 **Allometric model**

22 A formula that quantitatively describes an allometric relationship.

23 **Allometry**

24 The relative dimensional relationships between body parts that grow at different rates.

25 **Anaerobic**

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

29 **Andosol**

30 A soil developed in volcanic ash. Generally andosols have good drainage and are prone to fertility problems.

31 **Aquaculture pond**

32 An artificial storage containing water for the production of aquatic animals or plants. They are typically unlined
33 and constructed using a combination of earthen embankments and the natural topography on the landscape. They
34 can range in size from (< 50 m²) to (> 10 km²).

35 **Arithmetic mean**

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

37 **Auto producer**

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

40 **Autochthonous**

41 Material or formation originating from inside the water body.

42 **Back-casting**

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

44 **Backflows**

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

47 **Base year**

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

49

50 Benthic chlorophyll

51 An indicator of the eutrophication status of a water body based on the presence of microalgae at the sediment-
52 water interface at the bottom of the water body.

53 Bias

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

60 Biochar

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

65 Biofuels

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

68 Biogenic carbon

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

71 Biological treatment of waste

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

75 Biomass

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

79 Blowing agent (for foam production)

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

82 Bootstrap technique

83 Bootstrap technique is a type of computationally intensive statistical methods which uses repeated resampling with
84 replacement from a set of data to assess variability of parameter estimates. Bootstrap technique is a specific case
85 of a Monte Carlo method.

86 Boreal

87 *See polar/boreal.*

88 Calcium carbide

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

92 Canal

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

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- 98 **Carbon budget**
 99 The balance of the exchanges of carbon between carbon pools or within one specific loop (e.g., atmosphere –
 100 biosphere) of the carbon cycle. This is a generic definition of “carbon budget” in the context of national greenhouse
 101 gas inventories. This term may be defined with other specific meaning in the other context. (For example, see the
 102 Glossary of IPCC Special Report “Global Warming of 1.5°C”.)
- 103 **Carbon dioxide equivalent emission**
 104 The amount of carbon dioxide (CO₂) emission that would cause the same integrated radiative forcing or
 105 temperature change, over a given time horizon, as an emitted amount of a greenhouse gas (GHG) or a mixture of
 106 GHGs. There are a number of ways to compute such equivalent emissions and choose appropriate time horizons.
 107 Most typically, the CO₂-equivalent emission is obtained by multiplying the emission of a GHG by its global
 108 warming potential (GWP) for a 100-year time horizon. For a mix of GHGs it is obtained by summing the CO₂-
 109 equivalent emissions of each gas. CO₂-equivalent emission is a common scale for comparing emissions of different
 110 GHGs but does not imply equivalence of the corresponding climate change responses. There is generally no
 111 connection between CO₂-equivalent emissions and resulting CO₂-equivalent concentrations.
- 112 **Carbon sequestration**
 113 The process of storing carbon in a carbon pool.
- 114 **Category**
 115 Categories are subdivisions of the four main sectors Energy; Industrial Processes and Product Use (IPPU);
 116 Agriculture, Forestry and Other Land Use (AFOLU); and Waste. Categories may be further divided into sub-
 117 categories. For details, see Chapter 8 of Volume 1.
- 118 **Census**
 119 A census is a survey conducted on the full set of observation objects belonging to a given population or universe.
- 120 **Channel**
 121 A generic term for a waterway that encompasses creeks, streams, rivers, canals, ditches etc., as applied in the
 122 AFOLU sector for national greenhouse gas inventories.
- 123 **Chlorofluorocarbons (CFCs)**
 124 Halocarbons containing only chlorine, fluorine, and carbon atoms. CFCs are both ozone-depleting substances
 125 (ODSs) and greenhouse gases.
- 126 **Chronosequence**
 127 Chronosequences in this report are used in the context of the AFOLU sector, and consist of a temporal sequence
 128 in land use or management, for example, years since deforestation, which are used to evaluate change over time.
 129 Efforts are made to control all other between-site differences (e.g., by selecting areas with similar soil type,
 130 topography, previous vegetation). Chronosequences are often used as a surrogate for experimental studies or
 131 measurements repeated over time at the same location.
- 132 **Climate sub-domain**
 133 A subset of a climate zone into which lands may be grouped for the purposes of inventory calculations. Used to
 134 provide finer resolution of climate gradients within one of the six climate zones.
- 135 **Co-digestate**
 136 Supplemental material added to anaerobic digesters, in addition to the main digestion material (manure in the case
 137 of agricultural digesters) to increase methane yield.
- 138 **Coefficient of variation**
 139 Statistical definition: The coefficient of variation, v_x is the ratio of the population standard deviation, σ_x , and mean,
 140 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
 141 standard deviation and sample mean.¹
- 142 **Cogeneration**
 143 See: Combined Heat and Power (CHP) generation.
 144

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

145 Combined heat and power (CHP)

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

151 Comparability

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

155 Completeness

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

159 Confidence

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

164 Confidence interval

165 A confidence interval (CI) is a type of interval estimate, computed from the statistics of the observed/estimated
166 data, that might contain the true value of an unknown population parameter. The interval has an associated
167 confidence level that quantifies the level of confidence that the parameter lies in the interval. Most commonly, the
168 95% confidence level is used.

169 Consistency

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

175 Correlation

176 Mutual relationship between two quantities. See *correlation coefficient*.

177 Correlation coefficient

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

182 Country-specific data

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

185 Cruise

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

188 Dam

189 An artificial structure used to contain water in the context of national greenhouse gas inventories for the AFOLU
190 sector. Typically constructed with mineral sediment or concrete. Large dams are defined by the International
191 Commission on Large Dams (ICOLD) to be structures greater than 15 m in height.

192 Degassing emissions

193 Elevated gas emissions that occur as water is released from a dam and experiences sudden changes in pressure,
194 temperature and turbulence. These changes cause air-water exchange processes to occur at much greater rates than
195 in surface waters as the released water approaches a new equilibrium with the environment downstream following

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196 Le Chatelier's principle. In the case of dams the change in the hydrostatic pressure before and after water passing
197 through turbines affects this balance.

198 Also, water released from dams is typically released into a stilling basin designed to dissipate much of the turbulent
199 energy of the flow in order to prevent excessive bank erosion in the natural river channel downstream. The
200 increased water column turbulence greatly increases the air-water gas transfer rate for a given dissolved gas
201 concentration. In some cases, water may be discharged through needle valves into the air, which provides very
202 high air-water contact area leading to rapid gas release.

203 **Decision tree**

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

206 **Denitrification**

207 The microbially facilitated reduction of nitrates or nitrites to molecular nitrogen (N₂) through which the nitrogen
208 is emitted from the substrate to the atmosphere.

209 **Diffusive emission**

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

212 **Displaced emission**

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

218 **Dissolved Inorganic Carbon (DIC)**

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

220 **Dissolved Organic Carbon (DOC)**

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

222 **Distribution function**

223 A distribution function or cumulative distribution function $F(x)$ for a random variable X specifies the probability
224 $P(X \leq x)$ that X is less than or equal to x .

225 **Ditch**

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

228 **Downstream emissions**

229 The total greenhouse gas emissions that occur downstream of a dam including both degassing emissions and the
230 diffusive emission that would not occur in the absence of the reservoir from the river downstream of the dam.

231 **Drainage channel**

232 A ditch used for drainage.

233 **Drawdown zone**

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

236 **Ebullitive emission**

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

238 **Eddy flux measurement**

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

242

- 243 **Emission factor**
244 A coefficient that quantifies the emissions or removals of a gas per unit activity. Emission factors are often based
245 on a sample of measurement data, averaged to develop a representative rate of emission for a given activity level
246 under a given set of operating conditions.
- 247 **Emissions**
248 The release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of
249 time. (UNFCCC Article 1.4)
- 250 **Energy recovery**
251 A form of resource recovery in which the organic fraction of waste is converted to some form of usable energy.
252 Recovery may be achieved through the combustion of processed or raw refuse to produce steam through the
253 pyrolysis of refuse to produce oil or gas; and through the anaerobic digestion of organic wastes to produce methane
254 gas.
- 255 **Enhanced coal bed methane (recovery)**
256 Increased CH₄ recovery produced by the injection of CO₂ into coal seams.
- 257 **Epilimnetic**
258 Pertaining to the epilimnion of a stratified water body.
- 259 **Epilimnion**
260 The uppermost region of a density-stratified reservoir. Frequently defined as the region above the strongest
261 temperature gradient in the water column. It always includes, but is not limited to, the surface mixing layer – the
262 isothermal region of actively turbulent water just below the air-water interface.
- 263 **Estimation**
264 The process of calculating emissions and/or removals.
- 265 **Eutrophication**
266 Natural or anthropogenic process of nutrient enrichment of a water body which leads to increases in algal biomass.
- 267 **Evaporative emissions**
268 Evaporative emissions fall within the class of fugitive emissions and are released from area (rather than point)
269 sources. These are often emissions of Non-Methane Volatile Organic Compounds (NMVOCs), and are produced
270 when the product is exposed to the air – for example in the use of paints or solvents.
- 271 **Excluded carbon**
272 Carbon in non-energy uses of fossil fuels (feed stocks, reductant and non-energy products) excluded from fuel
273 combustion.
- 274 **Expert judgement**
275 A carefully considered, well-documented qualitative or quantitative judgement made in the absence of unequivocal
276 observational evidence by a person or persons who have a demonstrable expertise in the given field.
- 277 **Feedstock**
278 Fossil fuels used as raw materials in chemical conversion processes to produce primarily organic chemicals and,
279 to a lesser extent, inorganic chemicals.
- 280 **First use**
281 Distinguishes first uses (and related emissions) from later non-energy uses of fossil fuels. For example, first-use
282 emissions from lubricants are those which take place as a result of oxidation during use as a lubricant. Used
283 lubricants may be used subsequently for heat raising as waste oils.
- 284 **Flaring**
285 Deliberate burning of natural gas and waste gas/vapour streams, without energy recovery.
- 286 **Floating chamber**
287 Closed container that floats on the surface of the water used to quantifying greenhouse gas emissions from the
288 water surface. The time-dependent change in gas concentration within the floating chamber is a direct
289 measurement of the gas flux.

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290 **Flood control**

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

292 **Flow rate**

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

295 **Fluorocarbons**

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

298 **Flux**

299 (1) The rate of flow of any liquid or gas, across a given area; the amount of this crossing a given area in a given
300 time. E.g., "Flux of CO₂ absorbed by forests".

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

304 **Forest Land**

305 This category includes all land with woody vegetation consistent with thresholds used to define Forest Land in the
306 national greenhouse gas inventory. It also includes systems with a vegetation structure that currently fall below,
307 but in situ could potentially reach the threshold values used by a country to define the Forest Land category.

308 **Fossil carbon**

309 Carbon derived from fossil fuel or other fossil source.

310 **Fuel**

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

313 **Fuel combustion**

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

316 **Fuel wood**

317 Wood used directly as fuel.

318 **Fugitive Emissions**

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

321 **Funnel trap**

322 A device deployed underwater to capture bubbles.

323 **Global warming potential**

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

326 **Good Practice**

327 "*Good practice*" is a key concept for inventory compilers to follow in preparing national greenhouse gas
328 inventories. The key concept does not change in the *2019 Refinement*. The term "*good practice*" has been defined,
329 since 2000 when this concept was introduced², as "*a set of procedures intended to ensure that greenhouse gas*
330 *inventories are accurate in the sense that they are systematically neither over- nor underestimates so far as can*
331 *be judged, and that uncertainties are reduced so far as practicable*". This definition has gained general acceptance
332 amongst countries as the basis for inventory development. This can be also interpreted as "*a set of procedures*
333 *intended to ensure that greenhouse gas inventories are accurate in the sense that they are systematically neither*

² The definition was originally introduced with the *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* published in 2000.

334 *over- nor underestimates so far as can be judged, and that they are precise so far as practicable*" in the context
335 of refinement of Chapter 3 of Volume 1³.

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

339 **Ground truth**

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

342 **G-res**

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

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

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

352 **Harvested wood products**

353 Harvested wood products (HWP) according to the IPCC good practice guidance (2003, 2006) refers to wood and
354 paper products, and includes i) wood products in use (i.e. wood utilised as a material); ii) wood biomass used for
355 energy purposes and iii) wood biomass in solid waste disposal sites.

356 **Hydrocarbon**

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

360 **Hydrochlorofluorocarbons (HCFCs)**

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

363 **Hydrofluorocarbons (HFCs)**

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

366 **Hydrofluoroethers (HFES)**

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

370 **Hypolimnetic**

371 Pertaining to the hypolimnion.

372 **Hypolimnion**

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

378

³ In the 2006 IPCC Guidelines, the term “uncertainty” was used with two meanings – a general one which is associated with both accuracy and precision, and a specific one only as the inverse of precision. This definition text of “*good practice*” which uses the term “precise” instead of “uncertainties” overcomes inconsistencies with general IPCC definition for uncertainty, without changing the original concept of “*good practice*”.

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379 **Hypoxia**

380 Waterbodies where dissolved oxygen has become undersaturated due to natural and/or anthropogenic processes
381 which have led to aerobic biological oxygen consumption rates greater than the rate of re-oxygenation.

382 **Hypoxic**

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

385 **Independence**

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

389 **Inflow, in the context of water bodies**

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

392 **Irrigation channel**

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

394 **Key category**

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

399 **Key source**

400 See *key category*.

401 **Kilns**

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

405 **Land cover**

406 Refers to the bio-physical coverage of land (e.g., bare soil, rocks, forests, buildings and roads or lakes).

407 **Land use**

408 A broad classification of land based on the activities and cover, and in this report refers specifically to six general
409 types including Forest Land, Cropland, Grassland, Wetlands, Settlements and Other Land. Note that a specific
410 parcel of land may have more than one land use, but it is generally the predominant land use that forms the basis
411 for the classification. The land-uses may be considered as top-level categories for representing all land-use areas,
412 with sub-divisions describing specific circumstances significant to emissions estimation.

413 **Landfill gas**

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

419 **Large dams**

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

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

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

426

427 **Lubricants**

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

431 **Manure**

432 Waste materials produced by domestic livestock (vegetative material such as green manures are considered to be
433 crop residues or compost) which can be managed for agricultural purposes. When manure is managed in a way
434 that involves anaerobic decomposition, significant emissions of methane can result.

435 **Mean**

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

$$440 \bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \quad (x_i, \text{ where } i = 1, \dots, n \text{ are items of a sample}).$$

441 **Measurement-based approach**

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

443 **Median**

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

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

449 **Metalimnion**

450 The middle (vertically) region of a density-stratified reservoir characterised by the strongest temperature gradient
451 in the water column. Often referred to as the 'thermocline'.

452 **Methanogenic production**

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

454 **Mode**

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

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

461 **Model**

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

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

466 **Model-based approach**

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

471 **Monte Carlo method**

472 In these guidelines a Monte Carlo method is recommended to analyse the uncertainty of the inventory. The
473 principle of Monte Carlo analysis is to perform the inventory calculation many times by computer, each time with
474 the uncertain emission factors or model parameters and activity data chosen randomly (by the computer) within

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475 the distribution on uncertainties specified initially by the user. Uncertainties in emission factors and/or activity
 476 data are often large and may not have normal distributions. In this case the conventional statistical rules for
 477 combining uncertainties become very approximate. Monte Carlo analysis can deal with this situation by generating
 478 an uncertainty distribution for the inventory estimate that is consistent with the input uncertainty distributions on
 479 the emission factors, model parameters and activity data.

480 **Non-energy products**

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

483 **Non-energy use**

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

488 **Non-marketed lime production**

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

493 **Non-Methane Volatile Organic Compounds (NMVOCs)**

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

499 **Normal distribution**

500 The normal (or Gaussian) distribution has the probability density function (*PDF*) given in the following equation
 501 and is defined by two parameters (the mean μ and the standard σ deviation).

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

503 **Nutrient-impacted**

504 Waterbodies subjected to increased loads of nutrients (organic carbon, nitrogen and phosphorous) originating from
 505 within the system and/or from outside of the system. Nutrient-impacted waters are those with degraded ecosystem
 506 quality, lower biodiversity and are more likely to experience depleted dissolved oxygen levels (hypoxia) and
 507 harmful algal blooms.

508 **Nutrient loading**

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

511 **Observational data**

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

514 **Off-gas**

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

518 **Open burning of waste**

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

- 524 **Outflow, in the context of reservoirs**
525 Water discharged from a dam.
- 526 **Outflow area**
527 The area where water is discharged immediate downstream of a dam. It is characterised by exceptionally high
528 levels of turbulence in the water (see degassing emissions) that directly result from the operation of the dam.
- 529 **Oxic**
530 Containing dissolved oxygen.
- 531 **Oxidation**
532 Chemically transform of a substance by combining it with oxygen.
- 533 **Oxycline**
534 The region of high dissolved oxygen concentration *change* within the water column that separates oxic and anoxic
535 regions.
- 536 **Ozone-depleting substances (ODS)**
537 A compound that contributes to stratospheric ozone depletion. Ozone-depleting substances (ODS) include CFCs,
538 HCFCs, halons, methyl bromide, carbon tetrachloride, and methyl chloroform. ODS are generally very stable in
539 the troposphere and only degrade under intense ultraviolet light in the stratosphere. When they break down, they
540 release chlorine or bromine atoms, which then deplete ozone.
- 541 **Pasture**
542 Area covered with grass or other plants used or suitable for the grazing of livestock; grassland.
- 543 **PDF**
544 See *Probability density function*.
- 545 **Peat**
546 Soft, porous or compressed, sedimentary deposit of plant origin with high water content in the natural state (up to
547 about 90 percent). Countries may define peat according to their national circumstances.
- 548 **Peatland**
549 Peatlands are wetland ecosystems where soils are dominated by peat. In peatlands net primary production exceeds
550 organic matter decomposition as a result of waterlogged conditions, which leads to the accumulation of peat.
- 551 **Percentile**
552 A percentile (or a centile) is a measure used in statistics indicating the value below which a given percentage of
553 observations in a group of observations fall.
- 554 **Perfluorocarbons (PFCs)**
555 Synthetically produced halocarbons containing only carbon and fluorine atoms. They are characterized by extreme
556 stability, non-flammability, low toxicity, zero ozone depleting potential, and high global warming potential.
- 557 **Plant-mediated emission**
558 Flows of greenhouse gas emissions to the atmosphere that are influenced by plants, and such as the production,
559 transport and oxidation of methane in wetland soils.
- 560 **Polar/boreal, dry climate**
561 Regions where mean annual temperature (MAT) is less than or equal to 0 °C, and the ratio of mean annual
562 precipitation to potential evapotranspiration is less than or equal to 1.
- 563 **Polar/boreal, moist climate**
564 Regions where mean annual temperature (MAT) is less than or equal to 0 °C, and the ratio of mean annual
565 precipitation to potential evapotranspiration is greater than 1.
- 566 **Ponds**
567 The water impounded behind a small dam (< 15 m high) or embankment.
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569 **Pool, carbon and nitrogen**

570 A reservoir in the earth system where elements, such as carbon and nitrogen, reside in various chemical forms for
571 a period of time. An example is carbon and nitrogen pools in forest biomass, which are composed of various types
572 of compounds synthesized by trees. A group of pools are linked in a cycle with flows among the pools influenced
573 by both anthropogenic and non-anthropogenic processes. An example is carbon and nitrogen pools in forest
574 biomass, wood products, dead organic matter, soils and the atmosphere, in which flows are influenced by non-
575 anthropogenic drivers such as plant production and microbial decomposition, as well as anthropogenic drivers
576 such as fertilization, land use, tree harvest and product use. The units are in mass.

577 **Population**

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

580 **Precision**

581 Closeness of agreement between independent results of measurements obtained under stipulated conditions. Better
582 precision means less random error.

583 **Primary fuels**

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

585 **Process-based modelling**

586 A mathematical modelling approach based on a theoretical understanding of fundamental ecological, biological,
587 chemical, and physical processes. Typically using differential equations to represent the change over time of
588 parameters of interest, it provides a useful framework to project specific responses to altered environmental
589 conditions. For example, a process-based model might be used to quantify the delivery of organic matter delivered
590 from the catchment and/or produced by primary production within a reservoir, its deposition onto a reservoir's
591 sediment, the degradation of the organic matter aerobically to CO₂ or anaerobically to CH₄ over time, and the
592 emission of these gases across the air-water interface.

593 **Probability**

594 The probability of an event is a measure of the likelihood that the event will occur. The probability of any event
595 can range from 0 to 1. The sum of probabilities of all sample points in a sample space is equal to 1.

596 **Probability density function**

597 A probability density function (PDF) is a function, whose value at any given sample (or point) in the sample space
598 (the set of possible values taken by the random variable) can be interpreted as providing a relative likelihood that
599 the value of the random variable would equal that sample.

600 **Probability distribution**

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

603 **Process emissions**

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

605 **Pumped storage reservoirs**

606 Reservoirs at different elevations that are used to store energy by moving water from the lower to the higher
607 elevation.

608 **Quality Assurance**

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

613 **Quality Control**

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

- 616 (i) Provide routine and consistent checks to ensure data integrity, correctness, and completeness;
- 617 (ii) Identify and address errors and omissions;

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

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

623 **RAMSAR**

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

627 **Removals**

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

629 **Reporting**

630 The process of providing results of the inventory as described in Volume 1 Chapter 8.

631 **Reservoir**

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

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

637 **Rice paddies**

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

641 **River emissions**

642 GHG emissions from the surface of a normally (in a hydraulic sense) flowing river downstream of the
643 exceptionally turbulent region (see outflow area) immediately downstream of the dam. 'Normal flow' refers to the
644 velocity of the flow being solely determined by channel shape and bed slope so that water column turbulence is
645 produced predominantly by natural shear forces at the water-river bed interface.

646 **Run-of-the-river reservoirs**

647 Reservoirs in hydroelectric systems that harvest the energy from flowing water to generate electricity but cannot
648 store more water than one day's annual mean inflow (i.e. annual mean flow / 365).

649 **Secchi depth**

650 A practical measure of aquatic turbidity (versus clarity) based on the depth at which a standard Secchi disc (created
651 by Angelo Secchi) ceases to be visible from the surface of the water body.

652 **Secondary fuels**

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

654 **Sink**

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

657 **Soil carbon pool**

658 A pool of carbon comprised of soil organic matter that is smaller than 2mm in size.

659 **Source**

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

662 **Spill**

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

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665 **Spillway**

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

669 **Standard deviation**

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

672 **Storage volume**

673 The volume of water stored in a water body. The 'active' storage of a reservoir is the volume of water contained
674 between the full supply level (the maximum level at which water may be stored indefinitely) and the lowest outlet
675 level. The 'dead' storage is the volume of water that is below the lowest outlet and therefore cannot be routinely
676 accessed for beneficial use. The 'flood control' storage is the volume of water contained between the full supply
677 level and the top of gates (or other adjustable structures) located on top of the spillway and used to regulate the
678 discharge of floodwaters. The total reservoir storage volume is the sum of dead storage, active storage, and flood
679 control storage capacities.

680 **Surrogate data**

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

684 **Survey**

685 A survey is an investigation about the characteristics of a given population by means of collecting data from a
686 sample of that population and estimating their characteristics through the systematic use of statistical methodology.

687 **Systematic and random errors**

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

692 **Systematic error**

693 See *systematic and random errors*.

694 **Temperate, cold dry climate**

695 Areas where mean annual temperature (MAT) is between 0 – 10 °C, and the ratio of mean annual precipitation to
696 potential evapotranspiration is less than or equal to 1.

697 **Temperate, cold moist climate**

698 Areas where mean annual temperature (MAT) is between 0 – 10 °C, and the ratio of mean annual precipitation to
699 potential evapotranspiration is greater than 1.

700 **Temperate, warm dry climate**

701 Areas where mean annual temperature (MAT) is between 10 – 18°C (or greater than 18 °C with more than 7 days
702 of frost per year), and the ratio of mean annual precipitation to potential evapotranspiration is less than or equal to
703 1.

704 **Temperate, warm moist climate**

705 Areas where mean annual temperature (MAT) is between 10 – 18°C (or greater than 18 °C with more than 7 days
706 of frost per year), and the ratio of mean annual precipitation to potential evapotranspiration is greater than 1.

707 **Thin boundary layer model**

708 The thin boundary layer model expresses the flux of gas across an air-water interface as the product of a gas
709 transfer velocity and the concentration change across the interface. It was originally developed by Liss and Slater
710 (1974).

711 **Tier**

712 A tier represents a level of methodological complexity. Usually three tiers are provided. Tier 1 is the basic method,
713 Tier 2 intermediate and Tier 3 most demanding in terms of complexity and data requirements. Tiers 2 and 3 are
714 sometimes referred to as higher tier methods and are generally considered to be more accurate.

715 Time series

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

718 Transparency

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

722 Trend

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

727 Trophic state

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

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

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

736 **Mesotrophic** : mesotrophic lakes or reservoirs are characterised with an intermediate level of productivity ($2.6 \mu\text{g}$
737 $\text{L}^{-1} < \text{Chl-a} \leq 20 \mu\text{g L}^{-1}$.)

738 **Eutrophic** : a eutrophic lake, pond or reservoir with high biological productivity. Due to excessive nutrients,
739 especially nitrogen and phosphorus, these water bodies are able to support an abundance of aquatic plants. ($20 \mu\text{g}$
740 $\text{L}^{-1} < \text{Chl-a} \leq 56 \mu\text{g L}^{-1}$.)

741 **Hypereutrophic**: a hypereutrophic body of water experiences the highest levels of biological productivity. ($56 \mu\text{g}$
742 $\text{L}^{-1} < \text{Chl-a}$)

743 Tropical, dry climate

744 Areas where mean annual temperature (MAT) is more than 18 °C, with no more than 7 days of frost, and mean
745 annual precipitation less than or equal to 1000mm.

746 Tropical, moist climate

747 Areas where mean annual temperature (MAT) is more than 18 °C, with no more than 7 days of frost, and mean
748 annual precipitation greater than 1000mm and less than or equal to 2000mm.

749 Tropical montane climate

750 Areas where mean annual temperature (MAT) is more than 18 °C, with no more than 7 days of frost, and an
751 elevation greater than 1000m.

752 Tropical, wet climate

753 Areas where mean annual temperature (MAT) is more than 18 °C, with no more than 7 days of frost, and mean
754 annual precipitation greater than 2000mm.

755 Unbiased estimator

756 An unbiased estimator is a statistic whose expected value equals the value of the parameter being estimated. Note
757 that this term has a specific statistical meaning and that an estimate of a quantity calculated from an unbiased
758 estimator may lack bias in the statistical sense, but may be biased in the more general sense of the word if the
759 sample has been affected by unknown systematic error. Thus, in statistical usage, a biased estimator can be
760 understood as a deficiency in the statistical evaluation of the collected data, and not in the data themselves or in
761 the method of their measurement or collection. For example, the arithmetic mean (average) \bar{x} is an unbiased
762 estimator of the expected value (mean).

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764 **Uncertainty**

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

769 **Uncertainty analysis**

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

772 **Validation**

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

777 **Variability**

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

782 **Verification**

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

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

789 **Watercourse**

790 The channel that a flowing body of water follows.

791 **Water residence time**

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

794 **Water withdrawal**

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

799 **Wetland**

800 This category includes land that is covered or saturated by water for all or part of the year (e.g., peatland) and that
801 does not fall into the forest land, cropland, grassland or settlements categories. The category can be subdivided
802 into managed and unmanaged according to national definitions. It includes reservoirs as a managed sub-division
803 and natural rivers and lakes as unmanaged sub-divisions.

804