Guidelines for the use of units, symbols and equations in hydrology[*]

1. Physical dimensions and units

(a) Make sure that all quantities are dimensionally correct and that relationships thereof, expressed in equations, are dimensionally consistent. In particular, distinguish between stocks and fluxes. For example precipitation (P), evaporation (E) and runoff (Q) rates are fluxes [$\mathsf{L^3T^{-1}}$ or $\mathsf{L\,T^{-1}}$], whereas storage (S) is a stock [$\mathsf{L^3}$ or L] and storage variation in time t, $\mathrm{d}S/\mathrm{d}t$, is a flux (so that $\mathrm{d}S/\mathrm{d}t = P - E - Q$ is correct, whereas $\Delta S = P - E - Q$ is not).

(b) Use SI units or SI derived units.

(c) Use s, min, h, and d (rather than sec, mins, hr/hrs, day/days) for second, minute, hour and day respectively. Do not abbreviate week, month or year, which are non SI units.[†]

(d) Multiplication of units should be indicated by a space, e.g. N m, and division either by negative exponents (e.g. $\mathrm{m\,s^{-2}}$) or by use of the solidus (oblique line, e.g. $\mathrm{m/s^2}$); however repeated use of the solidus (e.g. m/s/s) is not permitted. The convention adopted must be used consistently throughout.

(e) Prefixes of units such as M (mega = 10^6) and μ (micro = 10^{-6}) have no space between (e.g. μs, MW). Note that, according to SI, any power to a unit applies also to the prefix. Note also that the prefix kilo is lower case k (e.g. km, not Km—the upper case K is the symbol of the kelvin).

(f) For areas and volumes use $\mathrm{m^2}$ and $\mathrm{m^3}$, if necessary multiplied by a power of 10, using multiples of 3 for the power of 10. Alternatively use prefixed units where appropriate, e.g. $\mathrm{km^2}$ for square kilometres, $\mathrm{km^3}$ (cubic kilometres) for billion cubic metres, etc.; note that a million cubic metres can be written as $1 \times 10^6\ \mathrm{m^3}$ or $1\ \mathrm{hm^3}$ (cubic hectometre) but not $1\ \mathrm{Mm^3}$ (in fact $1\ \mathrm{Mm^3} = 10^{18}\ \mathrm{m^3}$). In addition, the hectare (ha)[†] and the litre (L or l) are also allowed in SI.

(g) All units should be typeset using upright (Roman) fonts, not italic or bold.

(h) Numerals should also be typeset using upright fonts. The symbol for the decimal marker is the dot. To facilitate reading, numbers may be divided in groups of three using a thin space (e.g. 12 345.6). Neither dots nor commas are permitted as group separators. A space is used to separate the unit from the number (e.g. 10 m, not 10m).

2. Symbols and equations

(a) Prefer single-letter variables (if necessary with subscripts, e.g. E_{RMS}) over multi-letter ones (e.g. RMSE). Single-letter variables or parametres and user-defined function symbols should be italic (e.g. x, Y, β, $f(x)$). Multi-letter variables, if cannot be avoided, should not be italic.

(b) Common, explicitly defined, functions should not be italic, whether their symbols are single-letter (e.g. $\Gamma(x)$ for the gamma function, $\mathrm{B}(y, z)$ for the beta function) or multi-letter (e.g. $\ln x$, $\exp(x + y)$).

(c) Textual subscripts or superscripts should not be italic (e.g. $x_{\max}$, $T_{\min}$ where 'max' and 'min' stand for maximum and minimum, respectively).

(d) Mathematical constants should not be italic (e.g. $\mathrm{e} = 2.718\ldots$, $\pi = 3.141\ldots$, $\mathrm{i}^2 = -1$). Also, mathematical operators should not be italic (e.g. $\mathrm{d}x$ in integrals and derivatives, $\Delta\gamma$ for the difference operator on γ).

(e) Vectors, matrices and vector functions should be bold and italic (for single-letter variables). In particular, vectors are usually denoted with lower case letters (e.g. $\boldsymbol{x}$, $\boldsymbol{\omega}$ as vectors; $\boldsymbol{f(x)}$ as a vector function of a vector variable) and matrices with upper case letters (e.g. $\boldsymbol{A}$ as matrix; $\boldsymbol{AB}$ as the product of matrices $\boldsymbol{A}$ and $\boldsymbol{B}$, $\boldsymbol{A}^\mathsf{T}$ as the transpose of $\boldsymbol{A}$, $\det \boldsymbol{A}$ as the determinant of a square matrix $\boldsymbol{A}$).

(f) To distinguish between random variables and their realizations, either use upper case symbols for the former and lower case for the latter (e.g. $P\{X \leq x\}$), or underline the random variables (e.g. $P\{\underline{x} \leq x\}$, the so-called Dutch convention).

(g) Do not use the hyphen (-) as a minus or subtraction sign; use the en-dash (–) instead. Also do not use the letter 'x' or the symbol '*' as a multiplication sign; either use the symbol '×' or middle dot (·) between numerals, or use a thin space (or even no space) between variables.

(h) For simple expressions in the body of the text, use solidus (/) to denote division, e.g. $(x + y)/2\eta$, rather than a fraction with a horizontal division line.

(i) Write complex exponential functions in the form: exp(...), e.g. $\exp((a + by^2)^{1/2})$ rather than as a power of e. Note that nested parentheses are permitted (even recommended) for grouping.

[†] Some journals accept 'a' as a symbol for year, but 'a' is also the symbol of an 'are' which is a unit for area not recommended per se but commonly used in its multiple hectare ($1\ \mathrm{a} = 100\ \mathrm{m^2}$; $1\ \mathrm{ha} = 100\ \mathrm{a} = 10^4\ \mathrm{m^2} = 1\ \mathrm{hm^2}$).