Score Type Names for the Imprex Verification Scoreboard

Version: 09/06/2017

(*) this is what you have to enter as identification of the name of the score in the input files to the scoreboard

ScoreType (*)	Description	Formula (see for reference: cawr[1])
MAE	Mean Absolute Error	$MAE = \frac{1}{N}\sum_{i=1}^{N}\lvert F_i - O_i\rvert$
ME	Mean Error	$ME = \frac{1}{N}\sum_{i=1}^{N}(F_i - O_i)$
RMSE	Root Mean Square Error	$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(F_i - O_i)^2}$
CC	Pearson correlation coefficient	$r = \frac{\sum(F-\bar{F})(O-\bar{O})}{\sqrt{\sum(F-\bar{F})^2}\sqrt{\sum(O-\bar{O})^2}}$
R2	Coefficient of determination	$\mathrm{R2} = \frac{\text{Sum of squares due to regression (i.e., sum of squares of residuals)}}{\text{Sum of squares about the mean}}$
AC	Anomaly correlation	$AC = \frac{\sum(F-C)(O-C)}{\sqrt{\sum(F-C)^2}\sqrt{\sum(O-C)^2}}$
KGE	Kling Gupta Efficiency	Gupta et al., 2009.[2] [3] $\mathrm{KGE} = 1 - \sqrt{(r-1)^2 + (\beta-1)^2 + (\alpha-1)^2}$
KGEM	Modified Kling Gupta Efficiency	Kling et al., 2012.[4] $\mathrm{KGEM} = 1 - \sqrt{(r-1)^2 + (\beta-1)^2 + (\gamma-1)^2}$
KGE_BR	Kling Gupta Efficiency Decomposition: bias ratio	Gupta et al., 2009. $\beta = \frac{\mu(Q_{sim})}{\mu(Q_{obs})}$
KGE_SDR	Kling Gupta Efficiency Decomposition: alpha standard deviation ratio	Gupta et al., 2009. $\alpha = \frac{\sigma(Q_{sim})}{\sigma(Q_{obs})}$
KGE_CVR	Kling Gupta Efficiency Decomposition: gamma coefficient of variation ratio	Kling et al., (2012). $\gamma = \frac{CV(Q_{sim})}{CV(Q_{obs})}$

[1] http://www.cawcr.gov.au/projects/verification/
[2] Gupta et al., 2009. Decomposition of the mean squared error and NSE performance criteria: Implications for improving hydrological modelling. Journal of Hydrology, 377 (1-2): 80-91.
[3] For Kling Gupta Efficiency Decomposition: correlation coefficient (*r*), see score CC in the table. Gupta et al., 2009.
[4] Kling et al., 2012. Runoff conditions in the upper Danube basin under an ensemble of climate change scenarios. Journal of Hydrology, 424-425: 264-277.

CRPS	Continuous Rank Probability Score	$CRPS = \int_{-\infty}^{\infty} (P_f(x) - P_o(x))^2 dx$
CRPS_POT	Potential CRPS	CRPS (Resolution - Uncertainty)
CRPS_REL	Reliability term of the CRPS	
RPS	Ranked Probability Score	$RPS = \frac{1}{M-1}\sum_{m=1}^{M}\left[\left(\sum_{k=1}^{m} p_k\right) - \left(\sum_{k=1}^{m} o_k\right)\right]^2$
BS<XX>	Brier Score for quantile X% *(ex.: median: BS50; upper tercile: BS66; lower tercile: BS33; quantile 80%: BS80, etc.)*	$BS = \frac{1}{N}\sum_{i=1}^{N}(p_i - o_i)^2$
BS<XX>_REL	Brier Score for quantile X% - Reliability term	$\frac{1}{N}\sum_{k=1}^{K} n_k (p_k - \overline{o}_k)^2$
BS<XX>_RES	Brier Score for quantile X% - Resolution term	$\frac{1}{N}\sum_{k=1}^{K} n_k (\overline{o}_k - \overline{o})^2$
BS<XX>_UNC	Brier Score for quantile X%- Uncertainty term	$\overline{o}(1-\overline{o})$
Skill Scores:		$Score = 1 - \frac{score_{forecast}}{score_{reference}}$
CRPSS_CLI	Continuous Rank Probability Skill Score	Reference = Climatology
CRPSS_ESP	Continuous Rank Probability Skill Score	Reference = ESP
BSS<XX>_CLI	Brier Skill Score for quantile X%	Reference = Climatology
BSS<XX>_ESP	Brier Skill Score for quantile X%	Reference = ESP

Scores derived from the contingence table:

		OBSERVED		
		YES	**NO**	Total
FORECAST	**YES**	Hits	False alarms	**Forecast yes**
	NO	Misses	Correct negatives	**Forecast no**
Total		**Observed yes**	**Observed no**	

ScoreType	**Description**	**Formula (see for reference: cawr[5])**

[5] http://www.cawcr.gov.au/projects/verification/

BIAS	Bias score (frequency bias)	$BIAS = \frac{hits + false\ alarms}{hits + misses}$
POD	Probability of detection (hit rate)	$POD = \frac{hits}{hits + misses}$
FAR	False alarm ratio	$FAR = \frac{false\ alarms}{hits + false\ alarms}$
POFD	Probability of false detection (or false alarm rate)	$POFD = \frac{false\ alarms}{correct\ negatives + false\ alarms}$
SR	Success ratio	$SR = \frac{hits}{hits + false\ alarms}$
TS	Threat score (or Critical Success Index)	$TS = \frac{hits}{hits + misses + false\ alarms}$
AUC	Area under the ROC	*The relative operating characteristic (ROC) curve plots the probability of detection (POD) versus the probability of false detection (POFD), as a decision threshold is varied across the full range of a continuous forecast quantity The AUC is the area under the curve. An AUC of 0.5 reflects random forecasts, while AUC = 1 implies perfect forecasts.*
V<XX>	Relative value for C/L = X.X	$V = \begin{cases} \dfrac{\frac{C}{L}(hits + false\ alarms - 1) + misses}{\frac{C}{L}(P_{c\,lim} - 1)} & if\ \frac{C}{L} < P_{c\,lim} \\ \dfrac{\frac{C}{L}(hits + false\ alarms) + misses - P_{c\,lim}}{P_{c\,lim}\left(\frac{C}{L} - 1\right)} & if\ \frac{C}{L} \geq P_{c\,lim} \end{cases}$