



Wavelet Entropy Energy Measure (WEEM): A multiscale measure to grade a geophysical system's predictability-

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Highlights

1. A novel WEEM metric is proposed for quantification of Intrinsic predictability.
2. The method is applied to synthetic data and relationship between NSE and WEEM is developed.
3. The proposed metric is robust to linear and nonlinear process.

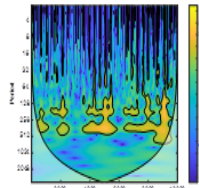
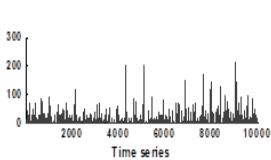
Methodology

Step-1: Develop white noise time series of length similar to signal time series

Step-2: Calculate total wavelet energy of the time series under scale p , $E(p) = \sum |W_p(t, p)|^2$

Step-3: Calculate the Continuous Wavelet entropy for Signal and white noise time series

Step-4: Calculate Wavelet Entropy-Energy Weighted Metric (WEEWM)

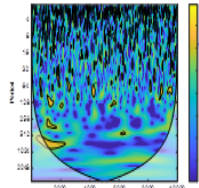
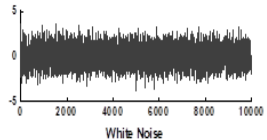


$$IE = -p(x_i) \log p(x_i)$$

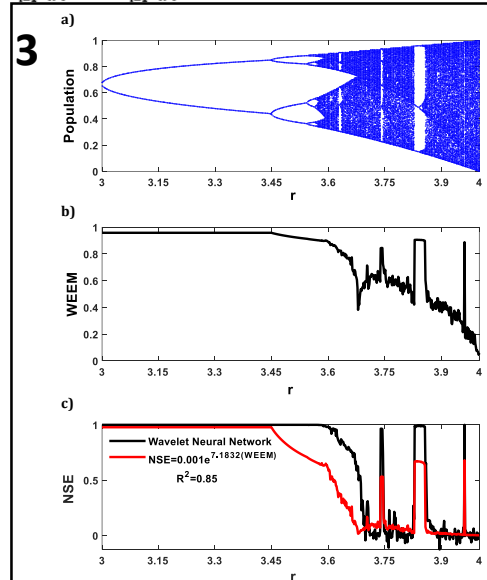
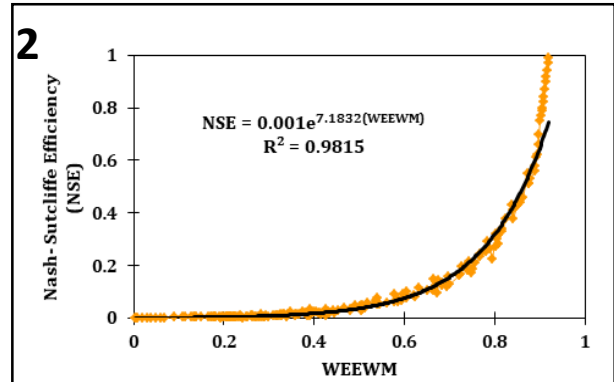
$$CWE_0 = \frac{E_0(p)}{\sum_{i=1}^n E_0(p)} \log_2 \frac{E_0(p)}{\sum_{i=1}^n E_0(p)}$$

WEEWM

$$\frac{(2^{CWE})_R - (2^{CWE})_0}{(2^{CWE})_R}$$

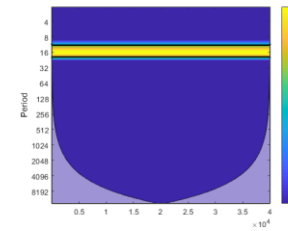


$$CWE_R = \frac{E_R(p)}{\sum_{i=1}^n E_R(p)} \log_2 \frac{E_R(p)}{\sum_{i=1}^n E_R(p)}$$



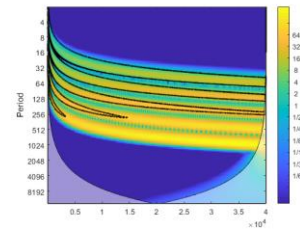
1 Panel I: for case I

(a) Sinusoidal stationary signal



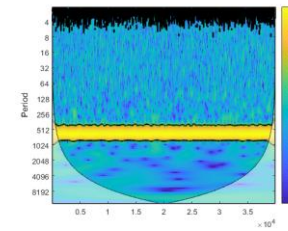
Panel II: for case II

(b) Non-stationary Signal



Panel III: for case III

(a) Sinusoidal stationary signal with $N/S \sim 1$



(b) Sinusoidal stationary signal with $N/S \sim 10$

