Supplement of Hydrol. Earth Syst. Sci., 24, 5473–5489, 2020
https://doi.org/10.5194/hess-24-5473-2020-supplement

Hydrology and Earth System Sciences
Open Access
EGU

Supplement of

A skewed perspective of the Indian rainfall–El Niño–Southern Oscillation (ENSO) relationship

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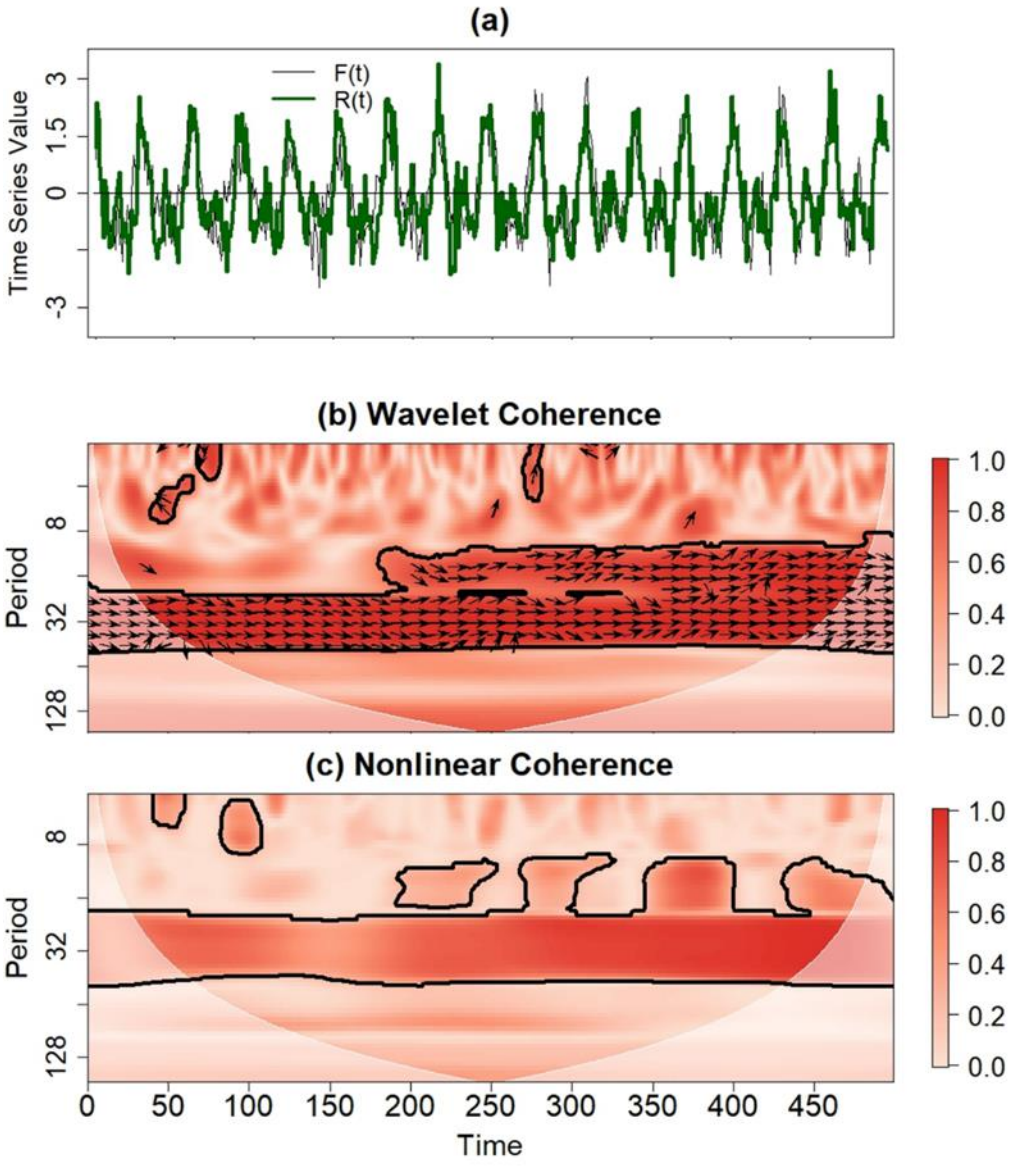

Figure S1. The forcing times series, $F(t)$, from the main text and the response $R(t) = \cos(\frac{2\pi}{p_1} t + \varphi) + \cos(\frac{2\pi}{p_3} t) + W_R(t)$ where $p_1 = 32$, $p_3 = p_1/2 = 16$. (b) Linear coherence and (c) nonlinear coherence between $F(t)$ and $R(t)$. Contours enclose regions of 5% cumulative area-wise significance and the light-shaded region represents the cone of influence. Although linear coherence suggests that $F(t)$ and $R(t)$ are not related at the period $p_3 = 16$ from $t = 0$ to almost $t = 200$, nonlinear coherence shows that they are related, which should be the case by construction because both $R(t)$ and $F(t)$ have cosine functions with period of 16. The time series $F(t)$ and $R(t)$ must be related at $p_3 = 16$ otherwise the relative bi-phase would fluctuate randomly according to Eq. (14), resulting in statistically insignificant nonlinear wavelet coherence at $p_3 = 32$. In other words, $\phi_n^X(32) - \phi_n^Y(32)$ and $\phi_n^X(16) - \phi_n^Y(16)$ do not fluctuate randomly so that K is not a random function of time.

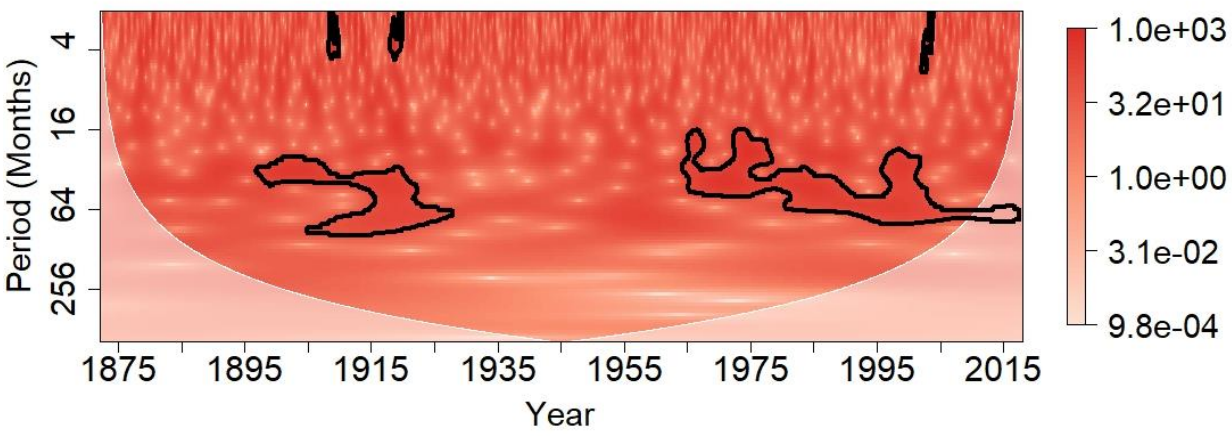

Figure S2. Wavelet power spectrum of Niño 1+2 – AIR. Contours enclose regions of 5% cumulative area-wise significance and the light-shaded region represents the cone of influence.