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Correcting low-frequency variability bias for hydrologic simulations for a future climate

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GCM and RCM simulations for future climates are poor at representing low-frequency variability attributes and their change, a significant concern to hydrologists and water resources managers responsible for maintaining water security in a changing climate. A recent contribution to the literature (Nguyen et al, 2016) was the first ever frequency-domain alternative for correcting low-frequency variability bias in simulated rainfall time series. This alternative, termed Frequency Bias Correction (FBC), quantifies the mismatch in the frequency spectrum between observations and modelled series, formulating a corrective model in the frequency domain which eliminated the bias present. The FBC was shown in (Nguyen et al, 2017) to reduce model structural bias in reservoir storage related attributes across CMIP5 GCMs, addressing a long-standing concern amongst researchers and practitioners on how climate models could simulate wildly varying rainfall when forced using similar initial and boundary forcings on models that simulate the same physical processes.
In this talk we present an extension to the FBC to address two additional problems. The first of these is the difficulty any bias correction alternative faces when focussing on a response representing a mixed probability distribution, such as rainfall. The second extension is an alteration to allow FBC to simulate inter-variable dependence across all frequency scales, thereby enabling it to simulate hydrologically relevant fields at multiple locations or multiple levels of the atmosphere.

References:
Nguyen, H., R. Mehrotra, and A. Sharma (2016), Correcting for systematic biases in GCM simulations in the frequency domain, Journal of Hydrology, 538, 117-126.
Nguyen, H., R. Mehrotra, and A. Sharma (2017), Can the variability in precipitation simulations across GCMs be reduced through sensible bias correction?, Climate Dynamics, in press (available online), 19.