



Wavelet Correlation and Multi-scale Coupling in Geophysical Systems

Erik Casagrande (1,2), Brigitte Mueller (3), Diego Miralles (4,5), Dara Entekhabi (6), Annalisa Molini (1,2)

(1) Dept. of Chemical and Environmental Engineering, Masdar Institute of Science and Technology, Abu Dhabi, United Arab Emirates (amolini@masdar.ac.ae), (2) iWATER, Masdar Institute of Science and Technology, Abu Dhabi, United Arab Emirates, (3) Environment Canada, Toronto (Ontario), Canada, (4) VU University Amsterdam, Earth and Life Sciences, Amsterdam, The Netherlands, (5) Ghent University, Laboratory of Hydrology and Water Management, Ghent, Belgium, (6) Ralph M. Parsons Laboratory for Environmental Science and Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

Multiscale interactions and their inference from observations are the main focus of this contribution. We investigate the potential of continuous wavelet decomposition and wavelet cross-correlation for identifying multiscale interactions, feedback loops and regime shifts characteristic of geophysical systems displaying coupling over a range of different temporal scales. The ability of wavelet cross-correlation to resolve the fast and slow components of coupled systems is tested on synthetic processes of known directionality, and then applied to a classic case-study of interaction between land and atmosphere – the coupling between soil moisture and near ground air temperature. The impact of residual auto-correlation and wavelet localization on the inference of multiscale couplings is also discussed, together with possible extensions of this method to the study of causal relationships.