Application of multiple wavelet coherence for revealing multivariate relationships between soil water and environmental factors

Dr. Wei Hu[1], Dr. Bing Si[2]
[1]*Plant And Food Research, New Zealand,* [2]*University of Saskatchewan*

Multiple wavelet coherence has been recently developed for examining scale-specific and localized multivariate relationships in geosciences. It has been shown that multiple wavelet coherence outperforms other common multivariate methods. Soil water content (SWC) is usually controlled by multiple environmental factors, and their controls may vary with scale and location. However, there is poor understanding on the multi-scale and multivariate controls of soil water in the landscape. The multiple wavelet coherence method was applied to examine multivariate controls of SWC at a scale-location domain in a hummocky landscape of North America. Bivariate wavelet coherence showed that depth to CaCO3 layer and cos(aspect) were the best single factor for explaining SWC variations in the spring and summer, respectively. Multiple wavelet coherence showed that a combination of the best single factor (i.e., CaCO3 layer in spring and cos(aspect) in summer) with soil organic carbon content resulted in the greatest fraction of area of significant coherence to the total scale-location domain. This indicates that these two factors are optimal for developing scale-specific prediction of SWC in the hummocky landscape. This method can be applied in water resources science, hydrology, and many other subject areas where a variable of interest is controlled by many factors at different scales and spatial/temporal locations.