UNIVERSITY of WISCONSIN
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Department of
Mathematical Sciences

Graduate Student Colloquium

Mr. Andrew Whetten

University of Wisconsin-Milwaukee

Friday,
April 15, 2022

EMS Building
Room E495
12:30 pm

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Detection of Multidecadal Changes in Vegetation Dynamics and Association with Intra-Annual Climate Variability in the Columbia River Basin

Remotely-sensed Leaf Area Index (LAI) is a useful metric for assessing changes in vegetation cover and greeness over time and space. Satellite-derived LAI measurements can be used to assess these intra- and inter-annual vegetation dynamics and how they correlate with changing regional and local climate conditions. The detection of such changes at local and regional levels is challenged by the underlying continuity and extensive missing values of high-resolution spatio-temporal vegetation data. Here, the feasibility of functional data analysis methods was evaluated to improve the exploration of such data. In this paper, an investigation of multidecadal variation in LAI is conducted in the Columbia River Watershed, as detected by NOAA Advanced Very High-Resolution Radiometer (AVHRR) satellite imaging. The inter- and intra-annual correlation of LAI with temperature and precipitation were then investigated using data from the European Centre for Medium-Range Weather Forecasts global atmospheric re-analysis (ERA-Interim) in the period 1996–2017. A functional cluster analysis model was implemented to identify regions in the Columbia River Watershed that exhibit similar long-term greening trends. Across this region, a multidecadal trend toward earlier and higher annual LAI peaks was detected, and strong correlations were found between earlier and higher LAI peaks and warmer temperatures in late winter and early spring. Although strongly correlated to LAI, maximum temperature and precipitation do not demonstrate a similar strong multidecadal trend over the studied time period. The modeling approach is proficient for analyzing tens or hundreds of thousands of sampled sites without parallel processing or high-performance computing.

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