

**Indiana University-Purdue University  
Indianapolis**  
**Department of Mathematical Sciences**

STATISTICS SEMINAR

12:15pm—1:15pm, Tuesday, August 23, 2022  
Zoom Meeting: Meeting ID: 845 0989 4694

**Speaker:** Yueying Wang

*Research Scientist at Amazon*

**Title:** Functional Data Fusion of PM2.5 observations and  
Satellite AOD Measurements

**Abstract:**

Monitoring and forecasting PM2.5 is important for countries where air pollution is a serious public health issue. Current PM2.5 forecasts are mainly based on observations from monitoring stations with high temporal frequency but sparse and uneven spatial distribution. On the contrary, Aerosol Optical Depth (AOD) data from satellites such as MODIS has better spatial coverage but low temporal frequency. The fusion of monitoring stations' PM2.5 observations and the AOD data from satellites can provide hourly high-resolution PM2.5 concentration information, which can be beneficial to epidemiological studies on the effect of PM2.5. In this project, we introduce a novel data fusion framework using functional data analysis tools to incorporate information from AOD images. Efficient algorithms are developed to estimate the non-stationary mean and covariance structure borrowing the strength of bivariate spline smoothing and the principal analysis by conditional estimation (PACE) algorithm. The estimates from the AOD data are used to improve the spatial prediction of PM2.5. A point-wise prediction interval is also provided to quantify prediction uncertainty. The proposed method is applied to data in the Beijing area in northern China, and our analysis shows the proposed approach outperforms several existing data fusion methods.

**Bio:**

Dr. Yueying Wang received Ph.D. in Statistics at Iowa State University in July, 2021 under the supervision of Dr. Lily Wang and Dr. Zhengyuan Zhu. Then she joined Herbert Irving Comprehensive Cancer Center at Columbia University and worked as a postdoctoral research scientist in Dr. Jianhua Hu's team for one year. She is currently working at Amazon as a Research Scientist. Her research has been focusing on non-/semi-parametric statistical methods, functional data

analysis, and machine learning techniques as well as their application towards complex data objects in real-world problems, such as 2D/3D imaging data, spatial and spatiotemporal data, microbiome data, etc.