



## Climate Program Opening Workshop August 21-25, 2017

### ***Lecture: A General Framework for Vecchia Approximations of Gaussian Processes***

**Speaker:** Matthias Katzfuss

#### **Abstract:**

Gaussian processes (GPs) are commonly used as models for functions, time series, and spatial fields, but they are, in general, computationally infeasible for large datasets. Focusing on the typical setting of observations from a GP containing a nugget or noise term, we propose a generalization of Vecchia's approximation as a framework for GP approximations. We show that our general Vecchia approach contains many popular existing GP approximations as special cases, allowing a comparison of the different approaches within a unified framework. Representing the models by directed acyclic graphs, we determine the sparsity of the matrices necessary for inference, which leads to new insights regarding the computational properties. Based on these results, we propose a novel sparse general Vecchia approximation, which ensures computational feasibility for large datasets but can lead to tremendous improvements in approximation accuracy over Vecchia's original approach. We provide theoretical results and conduct numerical comparisons. We conclude with guidelines for the use of Vecchia approximations. This project is joint work with Joseph Guinness (NCSU).