Paleo-environmental spatio-temporal hierarchical modelling workshop
Contact: Yucheng Lin and Juliet Sefton
yc.lin@rutgers.edu and juliet.sefton@unimelb.edu.au

A major challenge for paleo-environmental modelling is reconstructing a continuous signal from geological records which are characterized by sparsity, geochronological uncertainty, and indirect relationships between proxies and environmental variables. Spatiotemporal hierarchical models provide a conceptually straightforward framework to rigorously infer the underlying signal with robust uncertainty estimates.

PALSEA and Rutgers Earth System Science & Policy Lab is offering a 2 half-day virtual workshop about spatio-temporal hierarchical modelling on 11-12th or 18-19th June 2024, which will be followed by another 2-hour drop-in session for any additional questions, if required.

This workshop will use PaleoSTeHM, a fully open-sourced hierarchical modelling framework we developed for paleo-environmental data. It contains multiple modelling choices, including temporal and spatio-temporal Gaussian Process models which are now commonly used in the field of Earth science. This workshop will focus on applying spatiotemporal hierarchical modelling techniques on reconstructing paleo sea-level change, from a practitioner point of view, using easy-to-use API from PaleoSTeHM. Basic information about hierarchical modelling and Gaussian Process will be provided.

This workshop will rely on programing language python, and Jupyter Notebook, an open-sourced software for interactive computing. We expect basic understanding of python and python modules including numpy and matplotlib. If you do not familiar with them, it will be helpful to go through following tutorials for Juputer Notebook, numpy and matplotlib.

We will seek to provide PaleoSTeHM in a Google Colab environment, so you don't need to install anything. But if you would like to use PaleoSTeHM on your computer, please make sure you have installed Anaconda Navigator and git. You can also install VScode, a popular coding IDE which I will use for illustration.

Please drop Yucheng an email if you have any problems installing this on your computer.

Proposed schedule:

1. Introduction on paleo sea level, Bayesian statistics, hierarchical modelling
2. Process/Analysis level choices for temporal data; temporal Gaussian Process basics
3. Temporal Gaussian Process: kernel operations and incorporating temporal uncertainty.
4. Spatio-temporal Gaussian Process: basics, usage of multiple kernels, signal decomposition
5. Common Era global sea level curve reconstruction
6. Try your own data!