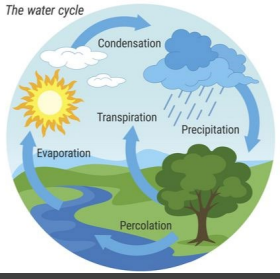
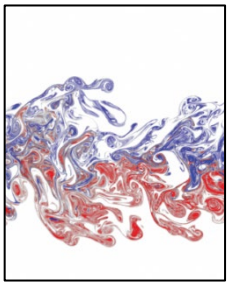
Boase Seminar Series in Hydrology and Water Resources Engineering

Department of Civil, Environmental and Architectural Engineering





Space-Time Bayesian Hierarchical Model for Modern and Holocene Sea Surface Temperatures over Equatorial Pacific Ocean

Mr. Javier Navarro

Visiting MS Student

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Wednesday, September 7, 2021 | 11:15 AM | ECCE 1B41 &
Zoom: https://cuboulder.zoom.us/j/95668504496
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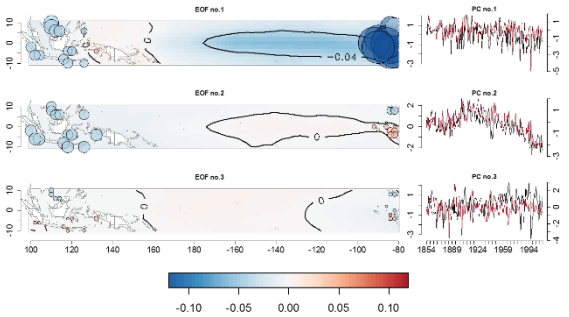
Abstract:



From 10 to 2 k years ago, the entire equatorial Pacific warms, but at a faster rate in the east than the west. This pattern is broadly consistent with previous inferences of reduced El Niño-Southern Oscillation variability associated with a "La Niña-like" state during the early to middle Holocene. Reduced space methods for annual SST reconstruction over the equatorial Pacific have been proposed but their ability to quantify uncertainties is limited. Motivated by this gap, in this study, we proposed a spatial and temporal Bayesian hierarchical model (BHM) to reconstruct annual SST over the equatorial pacific [10ºS to 10ºN and 100ºE to 75ºW (285ºE)] . First, dominant modes of variability of the contemporary (1854 – 2014) SST field over the locations of proxy (i.e. sediment core) data are obtained via Principal Component Analysis. The SST over the entire domain is modeled as a Multivariate Normal distribution in the data layer of the BHM. The mean and standard deviation are modeled to vary spatially as a function of the dominant modes in the process layer. A second process layer involves using Gaussian Kernels to model the spatial covariance. Suitable priors are used and via Markov Chain Monte Carlo (MCMC) posterior distribution of the parameters and consequently, that of the SST fields are obtained for any desired year. The model is developed and validated for the contemporary period and subsequently applied for reconstruction of SST fields during Holocene. Reconstructions are made at several years during the Holocene, and El Nino Southern Oscillation (ENSO) indices, along with uncertainties. The proposed model is one of the first attempts at reconstructing SSTs over the entire equatorial Pacific domain jointly with robust quantification of uncertainties.

Speaker Bios: Javier Gual is a M.Sc. student in Civil Engineering, at Universitat Politecnica de Catalunya (UPC, Spain). He is a visiting student under the Europe-Colorado program since January 2022 and is working on his M.Sc. thesis. Javier has been working on developing Bayesian and semi-Bayesian hierarchical models for large-scale fields covering large spatial domain, especially sea surface temperatures covering the tropical Pacific. His models capture the variability observed during contemporary and is used for reconstruction during Holocene periods. His models enable robust quantification of uncertainties besides offering the potential extensions for other fields such as precipitation, land temperatures, etc.

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