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Applying Spatial Analog Matching to Discern Late Oligocene Paleo-Monsoon Climatology in Southern China

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Understanding the Cenozoic evolution of monsoon conditions in Asia is hampered by a substantial data gap from Oligocene paleoclimate records. Previous research suggests a pre-Miocene establishment of the Indian Monsoon (IM), which is primarily driven by seasonal migration of the Inter-tropical Convergence Zone. However, disagreements exist as to the initiation of the East Asian Monsoon (EAM), which is enhanced by summertime heating of the Tibetan Plateau. In this study, we applied spatial analog matching to place late Oligocene paleoclimate estimates from southern China into a modern climate framework. Our technique compares paleoclimate estimates to the mean values observed at modern weather stations, thereby matching a suite of paleoclimate values to potential modern analog locations. We utilized the following paleoclimate estimates: 1) seasonal rainfall based on intra-ring $\delta^{13}C$ variations in fossil evergreen wood from Nanning, China, and a range of 2) mean annual precipitation (MAP) and 3) mean annual temperature (MAT) values from late Oligocene fossil floras in nearby Ningming, China. These data form the basis of a paleoclimate "station" that was matched to standardized mean climate values from a global data set of over 5,000 modern weather stations using the Euclidean distance formula. Preliminary results suggest that paleo-Nanning had a strong summer monsoon with a similar climate to stations at the latitude of modern-day Nanning. The best modern analogs are located in the central transitional area between the EAM and IM and in the southwestern EAM region, but also include monsoon regions at a higher mean elevation than present-day Nanning. Future work will 1) improve our analog matching methods, 2) quantify the sensitivity of individual paleoclimate estimates on modern analog placement, and 3) apply similar methodology to other Cenozoic paleoclimate "stations".