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Reconstructing Atlantic Multidecadal Variability over the Common Era with Gaussian Process Regression

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We test the ability of Gaussian Process Regression (GPR), a non-linear Bayesian regression method, to reconstruct the Atlantic Multidecadal Variability (AMV) over the last 2000 years (Common Era). The historical observation record is too short to provide a long-term perspective of the AMV. Therefore, drivers of the AMV, its response to external forcing and its timescales are a topic of active research and debate. Reconstructions of the AMV over the Common Era have yielded conflicting results about the stationarity of the AMV timescales. These reconstructions have mostly relied on terrestrial proxy networks and were based on linear regression methods which are known to underestimate the true variability. Combining marine and terrestrial proxies and using non-linear methods could improve the AMV reconstructions. The GPR provides a flexible non-linear framework that can take measurement uncertainties into account and fit networks with a variable number of records in time. As a starting point, we create pseudo-proxies from a coupled Common Era simulation and test the GPR reconstruction of the AMV in this controlled environment. We investigate the effects of different spatial networks, including marine proxy sites from the PAGES2k network, as well as different levels of proxy complexity such as the amount of non-climatic noise or non-linear proxy-temperature relationships.