**Developing a Climatometer: Toward an Objective Metric for Climate Replication with Machine Learning**

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Reservoir computers (RCs), a type of machine learning scheme, can successfully model systems of differential equations which exhibit chaotic behavior. Good RC prediction performance must meet two criteria: accurate short-term predictions agreeing with test data and long-term climate replication. Climate replication refers to the ability of a RC to learn the general behavior of a system of equations and predict a trajectory which, while diverging from the exact trajectory of the test data, continues to look like a trajectory typical of the system of equations. While short-term performance is easily measured, it is harder to quantify successful long-term climate replication. Good climate replication can be distinguished from poor climate replication visually, but there is no obvious single-number metric for objectively measuring climate replication. We propose a composite metric; by examining a one-step error metric along the predicted trajectory, as well as the variance of the predictions, RCs with good climate replication can be distinguished from RCs with poor climate replication. We employ this composite metric in studying various schemes to improve climate replication.