

Abstract

The machine learning technique of reservoir computing (RC) is extended to two elementary fluid models of ocean circulation: the well-known double gyre stream function model with time-variable forcing and a one layer quasi-geostrophic (QG) basin model. The models are used to generate stream function flow data that sample a range of possible dynamical behavior for particular flow parameters. In the case of QG, a system of partial differential equations with three physically relevant dimensionless parameters is solved, including Munk and Stommel type solutions.

This thesis seeks to present the effectiveness of this particular RC approach, which has a novel characteristic of learning the flows through the stream function. The results from applying this approach demonstrate its ability to capture the characteristics of these ocean circulation models with limited data, and further assessment of the accuracy and usefulness of the RC approach is conducted through evaluation of the role of both physical and numerical parameters and comparisons to well established descriptive models, including finite time Lyapunov exponents (FTLEs) and proper orthogonal decomposition (POD). Based on the results, the methods outlined in this thesis show great potential for application to future research in oceanic and complex flow modeling.