

AS-313: NONLINEAR MODELS IN CLIMATE SCIENCES

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An introduction to nonlinear dynamics: linearization, bifurcation, chaos; Galerkin projection and model reduction; Derivation and analysis of low order models for the atmosphere, ocean, climate dynamics, and geophysics (e.g., Rayleigh-Bénard convection, vorticity, general circulation, ocean thermohaline circulation, planetary dynamos, energy balance and global warming, ice sheets, ENSO, carbon cycle, examples from paleoclimate); Special topics (data driven methods; dynamics on networks).

Primary references:

A Provenzale and N Balmforth, Chaos and Structures in Geophysics and Astrophysics

H Dijkstra, Nonlinear Climate Dynamics

M Ghil and S Childress, Topics in Geophysical Fluid Dynamics: Atmospheric Dynamics, Dynamo Theory, and Climate Dynamics

Course notes

Additional references:

S Strogatz, Nonlinear Dynamics and Chaos

E Ott, Chaos in Dynamical Systems

M Golubitsky and I Stewart, Dynamics and Bifurcation in Networks: Theory and Applications of Coupled Differential Equations