INSTABILITY IN GEOPHYSICAL FLOWS

Instabilities are present in all natural fluids from rivers to atmospheres. This book considers the physical processes that generate instability from a geophysical perspective. The classical analytical approaches are covered, while emphasizing numerical methods that enable prediction of stability or instability in a system quickly, and with minimal mathematics. The first part of the book describes the normal mode instabilities important to geophysical applications, including convection, shear instability, and baroclinic instability. The second part introduces more advanced ideas, including nonmodal instabilities, the relationships between instability and turbulence, self-organized criticality, and advanced numerical methods. Featuring numerous mathematical and computational exercises, suggestions for projects, and MATLAB coding examples online, it is ideal for advanced students wishing to understand flow instability and apply it in their research, and can be used to teach courses in oceanography, atmospheric science, and environmental science. Also available as Open Access on Cambridge Core at doi.org/10.1017/9781108640084.

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