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.

WILLIAM D. SMYTH is Professor of Oceanography at Oregon State University. He teaches courses in fluid dynamics, geophysical waves, descriptive oceanography, dynamic meteorology, climate science, and stability of geophysical flows. He studies complex phenomena in nature, especially fluid turbulence. He is working to untangle the relationship between turbulence, waves, and instability in the upper equatorial oceans. He has twice received the Pattullo Award for excellence in teaching. He has been honoured with the Kirby Liang Fellowship from Bangor University and with a Distinguished Visitor Fellowship from Xiamen University, China.

JEFFREY R. CARPENTER is a physical oceanographer at the Institute of Coastal Research, Helmholtz-Zentrum Geesthacht, Germany, where he is the leader of the Small Scale Physics and Turbulence Group. His work focuses on the fluid mechanics of physical process in natural water bodies, and his research interests include turbulent mixing in stable density stratification, shear flows, instability and wave interactions, double-diffusive convection, heat fluxes and eddy formation in the Arctic Ocean, turbulence measurements using ocean gliders, and the impacts of offshore wind farms on the coastal ocean.
INSTABILITY IN GEOPHYSICAL FLOWS

WILLIAM D. SMYTH
Oregon State University

JEFFREY R. CARPENTER
Helmholtz-Zentrum Geesthacht

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