DOUBLE-DIFFUSIVE CONVECTION

Double-diffusive convection is a mixing process driven by the interaction of two fluid components that diffuse at different rates. This phenomenon has important ramifications in oceanography and in numerous other fields, from crystal growth to magma chambers and stellar interiors. Nevertheless, several aspects of double-diffusive convection still remain unclear and controversial.

Leading expert Timour Radko presents the first systematic overview of the classical theory of double-diffusive convection, in a coherent narrative which brings together the disparate literature in this developing field. The book begins by exploring idealized dynamical models and illustrating key principles through examples of oceanic phenomena. Building on the theory, it then explains the dynamics of structures resulting from double-diffusive instabilities, such as the little-understood phenomenon of thermohaline staircases. The book also surveys non-oceanographic applications, such as industrial, astrophysical and geological manifestations, and discusses the climatic and biological consequences of double-diffusive convection.

Providing a balanced blend of fundamental theory and real-world examples, this is an indispensable resource for academic researchers, professionals and graduate students in physical oceanography, fluid dynamics, applied mathematics, astrophysics, geophysics and climatology.

TIMOUR RADKO teaches courses in ocean dynamics, circulation analysis and wave motion at the Oceanography Department of the Naval Postgraduate School. Previously, he worked as a research scientist at the Department of Earth, Atmospheric and Planetary Sciences (EAPS) at the Massachusetts Institute of Technology. He has been active in the area of double-diffusive convection for over fifteen years and was closely involved in developing the theory surrounding this topic. Dr. Radko has authored numerous papers on physical oceanography and fluid mechanics, and has received the prestigious NSF CAREER award in 2006, the NPS Merit Award for Research in 2008, and the Schieffelin (2010) and Griffin (2011) Awards for Excellence in Teaching.

DOUBLE-DIFFUSIVE CONVECTION

TIMOUR RADKO

CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE
UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

Published in the United States of America by Cambridge University Press, New York

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning and research at the highest international levels of excellence.

www.cambridge.org
Information on this title:www.cambridge.org/9780521880749

First published 2013

Printed in the United Kingdom by TJ International Ltd. Padstow Cornwall

A catalogue record for this publication is available from the British Library

Library of Congress Cataloguing in Publication data
Radko, Timour.
Double-diffusive convection / Timour Radko.
pages cm
Includes bibliographical references and index.
ISBN 978-0-521-88074-9 (hardback)
1. Oceanic mixing. 2. Turbulence. 3. Salinity. I. Title.
GC299.R34 2013
551.46′2 – dc23 2013017280

ISBN 978-0-521-88074-9 Hardback