DISCRETE INVERSE AND STATE ESTIMATION PROBLEMS

With Geophysical Fluid Applications

The problems of making inferences about the natural world from noisy observations and imperfect theories occur in almost all scientific disciplines. This book addresses these problems using examples taken from geophysical fluid dynamics. It focuses on discrete formulations, both static and time-varying, known variously as inverse, state estimation or data assimilation problems. Starting with fundamental algebraic and statistical ideas, the book guides the reader through a range of inference tools including the singular value decomposition, Gauss–Markov and minimum variance estimates, Kalman filters and related smoothers, and adjoint (Lagrange multiplier) methods. The final chapters discuss a variety of practical applications to geophysical flow problems.

Discrete Inverse and State Estimation Problems: With Geophysical Fluid Applications is an ideal introduction to the topic for graduate students and researchers in oceanography, meteorology, climate dynamics, geophysical fluid dynamics, and any field in which models are used to interpret observations. It is accessible to a wide scientific audience, as the only prerequisite is an understanding of linear algebra.

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CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo

Cambridge University Press
The Edinburgh Building, Cambridge CB2 2RU, UK

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

www.cambridge.org
Information on this title: www.cambridge.org/9780521854245

First published in print format 2006

ISBN-13 978-0-511-53594-9 OCeISBN

ISBN-13 978-0-521-85424-5 hardback
ISBN-10 0-521-85424-5 hardback

To Walter Munk for decades of friendship and exciting collaboration.