

# Preface

Since the first session for data assimilation (DA) had been organized at the Asia Oceania Geosciences Society (AOGS) Annual Meeting in 2005, we have conducted several successful sessions under the title of “Yoshi K. Sasaki Symposium on Data Assimilation for Atmospheric, Oceanic and Hydrologic Applications.” It was to honor Prof. Yoshi K. Sasaki of the University of Oklahoma for his lifelong contributions to DA in geosciences. Yoshi had introduced the variational method to meteorology as early as the 1950s, and since then DA has developed into an utmost important technique in modern numerical prediction in various disciplines of geosciences.

The first volume of this book, under the same title of the Sasaki Symposium, has been published in March 2009 with a collection of notable invited papers along with those selected from previous symposiums up to 2008. Among them, John M. Lewis, one of Yoshi’s students, contributed a chapter titled “Sasaki’s Pathway to Deterministic Data Assimilation.” I. Michael Navon provided a thorough review of variational DA for numerical weather prediction, while Yoshi himself introduced a new theory based on the entropic balance. Milija and Dusanka Zupanski discussed some issues in ensemble DA, and Zhaoxia Pu overviewed the effect of satellite DA to improve forecasts of tropical cyclones. A coastal application of the ocean DA was reviewed by Xiaodong Hong and colleagues, and the variational approach to hydrologic DA was discussed by Francois-Xavier Le Dimet. Rolf H. Reichle and colleagues addressed recent advances in land data assimilation at the NASA/GMAO, and Nasim Alavi and colleagues surveyed assimilation of soil moisture and temperature into land surface models. As demonstrated, the previous volume covered important topics on DA in meteorology, oceanography, and hydrology, by dealing with both theoretical and practical aspects.

It has been more than 3 years since the first volume has been published. Since then we had three successful symposiums - held at Singapore in August 2009, at Hyderabad in July 2010, and at Taipei in August 2011, each with about 30 presentations. Therefore we decided to publish the second volume under the same title, again by collecting both invited papers and selected papers from the three symposiums. This volume includes excellent overviews of estimation theory,

nudging and variational methods, and Markov chain Monte Carlo methods. Most prominently, Yoshi has extended his entropy balance theory for tornado DA from the previous volume.

In this volume, theoretical and methodological aspects encompass estimation and entropic balance theory, variational and ensemble methods, nudging and representer methods, Monte Carlo and ensemble adaptive methods, the maximum likelihood ensemble filter, the local ensemble transform Kalman filter, micro-genetic algorithm, etc., with applications to oceanic, meteorological, and hydrologic DA; radar/lidar/satellite assimilation; parameter estimation; adjoint sensitivity; and adaptive (targeting) observations.

This book will be useful to individual researchers as well as graduate students as a reference to the most recent progresses in the field of data assimilation. We appreciate Boon Chua at Naval Research Laboratory and Francois-Xavier Le Dimet, who have served as the co-conveners of the Sasaki Symposium. We are very honored to dedicate this book to Yoshi Sasaki and the late Roger Daley for their significant contributions in data assimilation.

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