Final Technical Report for

AA Fest
General Circulation Model Development: Past, Present and Future. A Symposium in Honor of Professor Akio Arakawa

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Summary

On January 20–22, 1998, *"AA Fest. A Symposium on General Circulation Model Development: Past, Present, and Future"* was held at the NorthWest Campus Auditorium of University of California, Los Angeles, in honor of Professor Akio Arawaka. The Symposium consisted of two-and-a-half-day technical presentations, along with a banquet in the opening evening and a reception during the poster session of the second evening.

AA Fest was attended by over 100 scientific participants. A list of participant is provided in Appendix, a summary article accepted for publication in *BAMS* (Randall *et al.*, 1999). It was a great privilege for the organizers to have the participation of many leading Japanese scientists, as well as the participants from the U.S. and other nations.

The technical presentations were arranged in the three main sessions entitled "The First 37 Years," "Current Research," and "Future Directions" (Appendix). Each session included both invited and contributed papers. The invited papers were presented orally; some of the contributed papers were presented orally, while others were presented in the form of posters. The list of papers presented at the *AA Fest* is included in Appendix.

Professor Akio Arakawa presented two honorary lectures, one at the opening and the

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other as the conclusion of the Symposium. The two lectures were filmed professionally by the UCLA's Audio Video Services. Copies of the VHS have been archived at the Archives and Records Management Program of National Center for Atmospheric Research and several international meteorological research institutes for public records. A copy was provided to Department of Energy. In due course, a book based on the papers presented at the *AA Fest* is being edited by David A. Randall which will be provided to Department of Energy when published.

The AA Fest was organized efficiently via internet, especially by the means of the WWW: *http://www.atmos.ucla.edu/AA_fest*, including program, abstracts, registration and local information. Currently the WWW site hosts a photo gallery from the Symposium.

Publication and Audio Video

Arakawa, A., 1998: *A video of the two lectures,* "A Perspective on the early years of general circulation modeling" and "Future Development of General Circulation Models,", *AA Fest: A Symposium on General Circulation Model Development."* January 1998, Los Angeles. Public archive at National Center for Atmospheric Research, Archives and Records Management Program (information available via WWW at *http://www.dir.ucar.edu/iss/lib/archive/homepage.html*).
– the VHR has been provided to Department of Energy.

Randall, D. A. (Ed.), 1999: *General Circulation Model Development: Past, Present and Future*, Academic Press, *in preparation.*
– to be provided to Department of Energy at the time of publication.

Randall, D. A., K. Ide and R. M. Wakimoto, 1999: Summary of general Circulation Modeling: Past, Present, and Future, A Symposium in Honor of Akio Arakawa. *Bulletin of the American Meteorological Society*, accepted.
– Appendix.

Summary of

General Circulation Modeling: Past, Present, and Future

A Symposium in Honor of Akio Arakawa

David A. Randall[1], Kayo Ide[2], and Roger Wakimoto[2]

Accepted
In preparation for the
Bulletin of the American Meteorological Society

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UCLA
Los Angeles, California

On January 20-22, 1998 a Symposium was held at the Northwest Campus Auditorium on the UCLA[3] campus. The title of the Symposium was "General circulation modeling, past present and future: A symposium in honor of Akio Arakawa." The Symposium, which was informally called the "AA Fest," was organized as a celebration of the career of UCLA's Prof. Akio Arakawa, (***Fig. 1***) who has been among the leaders in the field of atmospheric general circulation model (GCM) development, from its very beginning. The purpose of this brief report is to summarize the Symposium for the benefit of the community at large.

Akio Arakawa obtained his B. Sc. in Physics from Tokyo University, 1950, and his D. Sc. in Meteorology from the same institution in 1961. In the early 1950s, he served for one year on a weather ship in the North Pacific, an experience which made a strong impression on him. Subsequently, still during the 1950s, he conducted forecasting research at the Meteorological Research Institute which is operated by the Japan Meteorological Agency. The first numerical simulation of the general circulation by Phillips (1956) inspired him, and during 1961-1963 he came to UCLA as an Assistant Research Meteorologist, working with Prof. Yale Mintz on the development of what was to become the Mintz-Arakawa GCM (Johnson and Arakawa, 1996). After returning to Japan for two years, he joined the faculty at UCLA in 1965, and has remained there ever since, conducting his wide-ranging research on GCM development and related scientific issues.

Among the most remarkable qualities of his work has been his ability to make major contributions both to the development of new numerical methods, as exemplified by his 1966 paper on the Arakawa Jacobian, and to the development of new physical parameterizations, as exemplified by his 1974 paper with Wayne Schubert on what has become known as the Arakawa-Schubert cumulus parameterization. The fields of numerical analysis on the one hand and physical

[3] University of California at Los Angeles.

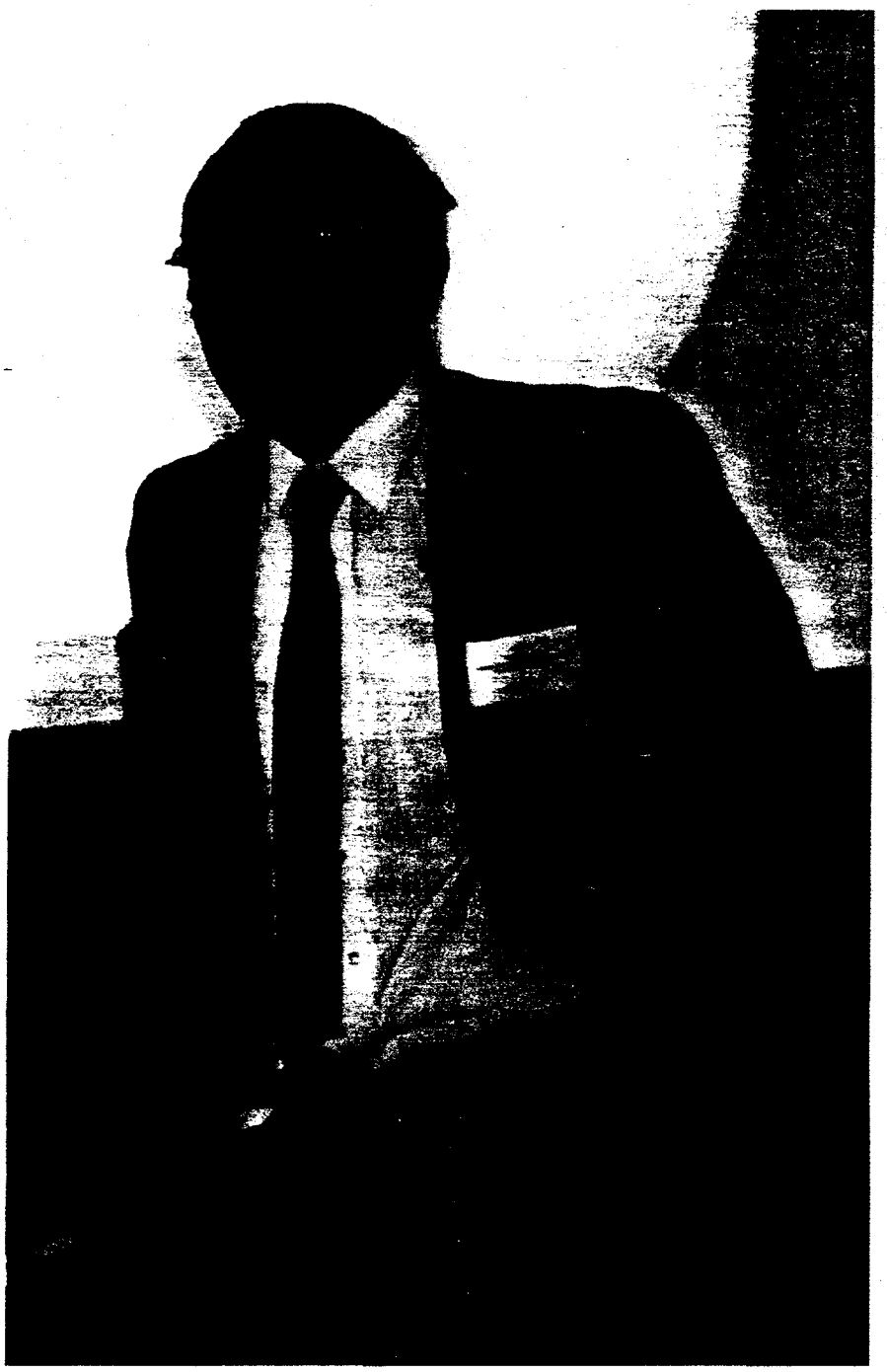

Figure 1: **A photograph of Akio Arakawa taken during one of his lectures at the AA Fest.**

parameterization on the other are so different from each other that it is difficult to believe that one person could excel at both. Akio Arakawa's work has shown not only that the gap between these two disciplines can be bridged with great success, but that it *must* be bridged in order to create a coherent modeling framework. In particular, his work demonstrates that numerical methods can and should be designed from a highly physical perspective which goes far beyond the usual considerations of order of accuracy and linear stability.

Besides his strong research contributions, Prof. Arakawa has been very successful as a teacher, inspiring several generations of graduate students and young post-doctoral colleagues with his enthusiasm and vision.

The AA Fest was organized by a Program Committee, whose members are listed in Table 1. Participants came from the U.S., Japan, Europe, Mexico, South Korea, and Australia. A list of

Table 1: The members of the Program Committee.

Anthony Hollingsworth European Centre for Medium-Range Forecasts, UK
Masahide Kimoto Center for Climate System Research, University of Tokyo, Japan
Carlos Roberto Mechoso Department of Atmospheric Sciences, University of California, Los Angeles, USA
David Randall Department of Atmospheric Science, Colorado State University, USA
Akimasa Sumi Center for Climate System Research, University of Tokyo, Japan
Roger Wakimoto, Chair of the Program Committee Department of Atmospheric Sciences, University of California, Los Angeles, USA
Michio Yanai Department of Atmospheric Sciences, University of California, Los Angeles, USA

participants is given in Table 2. A group photo of the participants is shown in ***Fig. 2***. The

Table 2: A list of the participants.

Name	*Affiliation*
Akio Arakawa	UCLA
Brian Bosart	UCLA
Huaqing Cai	UCLA
June Chang	UCLA
Winston Chao	NASA Goddard Space Flight Center
Baode Chen	UCLA
Jeng-Ming Chen	FNMOC, Naval Research Laboratory
Chia Chou	UCLA
Anindita Datta	UCLA
Anthony Drummond	UCLA
Paul N. Edwards	Stanford University
Annmarie Eldering	UCLA
Kerry Emanuel	Massachusetts Institute of Technology
John Farrara	UCLA
Rick Fort	UCLA
Robert Fovell	UCLA
Blanca Gallego	UCLA
Sylvia George	UCLA
Michael Ghil	UCLA
Milt Halem	NASA Goddard Space Flight Center
David Halpern	UCLA
Robert L. Haney	Naval Postgraduate School
James Hansen	Goddard Institute for Space Studies
Anthony Hollingsworth	European Centre for Medium Range Weather Forecasts
Chih-Wen Hung	UCLA
Kayo Ide	UCLA
Toshiki Iwasaki	Japan Meteorological Agency, Tokyo

Figure 2: A group photo of the Symposium's participants.

Table 2: A list of the participants.

Name	*Affiliation*
Donald Johnson	University of Wisconsin
Joon-Hee Jung	UCLA
Sajal K. Kar	Bureau of Meteorology Research Center, Melbourne, Australia
Mehmet Karaca	UCLA
Akira Kasahara	National Center for Atmospheric Research
Jeong-Woo Kim	Yonsei University, Seoul, South Korea
Young-Joon Kim	UCLA/Jet Propulsion Laboratory
Masa Kimoto	Center for Climate System Research
Akio Kitoh	Meteorological Research Institute, Tsukuba, Japan
Martin Koehler	UCLA
Celal Sukru Konor	UCLA
Seongjoon Koo	UCLA
Steve Krueger	University of Utah
Daniel M. Landau	UCLA
Jeffrey Lew	UCLA
John Lewis	National Severe Storms Laboratory
Jui-Lin Frank Li	UCLA
Chichung Lin	UCLA
Johnny Lin	UCLA
Kuo Nan Liou	UCLA
Chi-Sann Liou	Naval Research Laboratory
Karen Yuezhen Liu	Jet Propulsion Laboratory
Stephen Lord	National Centers for Environmental Prediction
Francois M. Lott	UCLA
Larry Lyons	UCLA
Hsiang Sean Lu	UCLA
Rong Lu	UCLA
Chung-Chun Ma	UCLA

Table 2: A list of the participants.

Name	*Affiliation*
Syukuro Manabe	Frontier Program
Steve L. Marcus	Jet Propulsion Laboratory
Taroh Matsuno	Hokkaido University
C. Roberto Mechoso	UCLA
Fedor Mesinger	National Centers for Environmental Prediction
Kikuro Miyakoda	George Mason University
Chin-Hoh Moeng	National Center for Atmospheric Research
Shrinivas Moorthi	National Centers for Environmental Prediction
David Neelin	UCLA
Atusi Numaguti	Center for Climate System Research
Suzanne Paulson	UCLA
Arturo Quintanar	National Autonomous University of Mexico
David Randall	Colorado State University
Andy Robertson	UCLA
John Kevin Roskovensky	UCLA
Scott Sandgathe	Office of Naval Research
Wayne Schubert	Colorado State University
Albert J. Semtner	Naval Postgraduate School
Richard Somerville	University of California at San Diego
Joe Spahr	UCLA
Pamela Stephens	National Science Foundation
Max Suarez	NASA Goddard Space Flight Center
Akimasa Sumi	Center for Climate System Research
Hsin-Hsin Syu	UCLA
Remi Tailleux	UCLA
Rafael Terra	UCLA
Richard Thorne	UCLA
Yudong Tian	UCLA

Table 2: A list of the participants.

Name	*Affiliation*
Tatsushi Tokioka	Meteorological Research Institute, Tsukuba, Japan
Wen-wen Tung	UCLA
Richard Turco	UCLA
Roger Wakimoto	UCLA
Chih-Ping Wang	UCLA
Morton Wurtele	UCLA
Xiaoqing Wu	National Center for Atmospheric Research
Kuan-Man Xu	Colorado State University
Michio Yanai	UCLA
Jin-Yi Yu	UCLA
Ning Zeng	UCLA

organizers were particularly happy to have the participation of many leading Japanese scientists, as well as participants from the U.S. and the other nations listed in Table 2.

The AA Fest was arranged in three sections entitled "The First 37 Years," "Current Research," and "Future Directions," respectively. Akio Arakawa presented the opening and closing papers of the Symposium. Each session included both Invited Papers and Contributed Papers. Some of the Contributed Papers were presented orally, while others were given in the form of posters. A list of the papers is given in Table 3.

Table 3: A list of the papers presented at the AA Fest. A "*" indicates an invited paper.

Session 1: The First 37 years	
Akio Arakawa*	A Personal Perspective on the Early Years of General Circulation Modeling at UCLA
Fedor Mesinger *	Numerical Methods
Wayne Schubert*	A Retrospective View of Arakawa's Ideas on Cumulus Parameterization
Akira Kasahara	On the Origin of Cumulus Parameterization for Numerical Prediction Models
James Hansen *	Climate Simulation

Table 3: A list of the papers presented at the AA Fest. A "*" indicates an invited paper.

Tatsushi Tokioka *	Climate Services at the Japan Meteorological Agency and General Circulation Models
K. Miyakoda, A. Navarra, and M.N. War*	ENSO-Asian-Monsoon Oscillation System
John Lewis	Clarifying the Dynamics of the General Circulation: Phillips' 1956 Experiment
Robert Haney	The General Circulation of the California Current: Observations and Simulations
Milton Halem, J.Kuoatchou and A. Hudson	A Retrospective Analysis of the Charney et al., 1969 Numerical Experiments With the Mintz-Arakawa General Circulation Model
Masahide Kimoto	The North Pacific Decadal Oscillation Simulated by the CCSR Coupled GCM
Session 2: Current Research	
Taroh Matsuno*	A New Form of the Dynamics Equation of Visco-Elastic Media Suited to Numerical Integration
Anthony Hollingsworth*	Research and Development for Medium and Extended-range Forecasts: Methods, Results and Prospects
Kerry Emanuel*	Quasi-Equilibrium Thinking
Akio Kitoh	SST Variability and Its Mechanism in the MRI Coupled Atmosphere-Ocean GCM and the Coupled Atmosphere-Mixed-Layer Ocean Model
Paul N. Edwards	A GCM Family Tree: The Major Models and Their Descendants
Martin Kohler	On the Decay of Ice Clouds and Its Representation in AGCMs
Richard Somerville	Cloud-Radiation Feedbacks in Climate: Models vs. Observations
Papers presented in the Poster Session	
Winston Chao	The Origin of Monsoon Onset
Anthony Drummond	General Circulation Models and High Performance Computing
John Farrara	Predictions of anomalous winter extratropical circulations associated with the 1997-98 ENSO event using the UCLA AGCM
Toshiki Iwasaki	A Possible Link of Aerosols to Asian Summer Monsoon and Its Implication in Long-Range Numerical Weather Prediction
Sajal Kar	A Semi-Implicit Semi-Lagrangian Formulation of the BMRC Regional Forecast Model
Jeong-Woo Kim	Monsoon and Desert Climates in Asia
Young-Joon Kim	Parameterization of the Effects of Orography in the UCLA AGCM; Past, Present and Future

Table 3: A list of the papers presented at the AA Fest. A "*" indicates an invited paper.

Celal Sukru Konor	Simulations of Extratropical Cyclones Using the Generalized Vertical Coordinate
Jui-Lin Frank Li	The Improvement of Planetary Boundary Layer Moist Processes in the UCLA AGCM
Chichung Lin	Development of an Empirical Cumulus Parameterization
Rong Lu	Global Chemistry Simulations with the Coupled UCLA AGCM/ACTM
Victor Magaña and Arturo Quintanar	Regional Climate Modeling over Mexico
Steve L. Marcus	Extratropical Oscillations in the UCLA GCM: Pacemaker for the Tropics
Shrinivas Moorthi	RAS and the new climate model at EMC
Atusi Numaguti	A Lagrangian View of Water Cycle in the Atmosphere and Land
Arturo Quintanar and Tercio Ambrizzi:	Low latitude forcing of Stationary waves in the Southern Hemisphere
Xiaoqing Wu	Tropical Oceanic Cloud Systems
Kuan-Man Xu	Roles of Cumulus Convection in the Easterly Waves
Jin-Yi Yu	Impact of Stratus Clouds on Tropical Climate
Ning Zeng	The First Quasi-Equilibrium Tropical Circulation Model
End of Poster Session list	
Chin-Hoh Moeng and Bjorn Stevens*	On the Representation of PBL Turbulence and Clouds in GCMs
Michael Ghil*	Solving problems with GCMs
Akimasa Sumi*	Climate Simulations
Max Suarez*	Land Processes
Steve Krueger*	Cloud-Resolving Modeling
Session 3: Future Directions	
David Neelin*	Convective Quasi-Equilibrium and the Tropical Circulation
Donald Johnson*	Entropy, the Lorenz Energy Cycle and Climate
David Randall*	Turbulence and Clouds
C. Roberto Mechoso*	An Atmosphere-Ocean GCM's Pilgrimage from Climate-Catastrophe to Realistic Simulation/Prediction of ENSO
Akio Arakawa*	Future Development of General Circulation Models

A banquet was held on the first evening of the Symposium. Michio Yanai provided an after-dinner talk illustrated with numerous slides. Robert Haney, Wayne Schubert, Syukuro Manabe, and Roberto Mechoso recalled their interactions with Akio Arakawa over the years, and offered interesting and sometimes amusing anecdotes. In addition, Master of Ceremonies Roger Wakimoto read congratulatory letters to Akio Arakawa from Kenneth Bergman, Lawrence Gates, Roger Newson, Ari Patrinos, George Philander, Robert Sadourny, Scott Sandgathe, and Joseph Smagorinsky. All in all, the Banquet speakers provided interesting insights into the history of atmospheric general circulation modeling research at UCLA and elsewhere, as well as a better understanding of Akio Arakawa's career and that of his students and colleagues.

In due course, a book based on papers presented at the Symposium will be published by Academic Press.

Acknowledgements

The Symposium was made possible through generous support from the National Science Foundation (ATM-9724980), the National Aeronautics and Space Administration (NAG 5-713, the Office of Naval Research (N00014-97-1-0983, the Department of Energy (013704), the Center for Climate System Research at the University of Tokyo, and the World Climate Research Program (12.547/S/FCD/V.8268, as well as the College of Natural Sciences at UCLA. Excellent administrative support was provided by the Department of Atmospheric Sciences and the Institute of Geophysics and Planetary Physics, both of UCLA.

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