**Review of “The Development of Atmospheric General Circulation Models” by Leo Donner, Wayne Schubert, and Richard Somerville**

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This book describes the history of the emergence of atmospheric general circulation models (AGCMs), their later evolutions, and their current status. It was written by a group of major players in the field of atmospheric modeling. The book contains a fascinating account of what happened at the dawn of numerical weather prediction, most of which are not easily found in the literature. It also contains discussions of the current course of AGCM developments and perspectives for the future.

This is a book for general readers who want to know the history of atmospheric general circulation models: how they were first conceived and how their developments were propelled by rigorous people and sciences. It is also a book for researchers who want to know a glimpse of present AGCMs and a hint of their future. When I opened the book, I cannot help but to read it from the beginning to the end in a single stretch. By and large, this is a book on science history.

The book connected a few important dots in the historical chain of events of atmospheric model development, which illuminated some key individuals and events in the early years besides the well known von Nuemann, Jule Charney, and Norman Phillips: In 1945, Vladimir Zworykin of the electronic company RCA, inventor of television transmitting and receiving devices, imagined human intervention of weather and climate guided by computer calculations in his “Modern Computing Devices” and the flamboyant “Outline of Weather Proposal” (this is at the time of the nuclear bomb – the Mahanttan Project); John Mauchly of the University of Pennsylvania, inventor of computers, went to the Weather Bureau in 1945 to seek examples of weather applications using the EDVAC computer; Francis Reichelderfer, chief of the weather bureau, visited RCA in Princeton to inquire about the subject and convened a subsequent meeting in January 1946 of himself , Zworykin, von Newmann, and Wexeler among a few others; Wexler’s Professor at MIT, Carl Rossby, started to interact with von Neumann in early 1946, and suggested the Institute of Advanced Study (IAS) to submit a proposal to the Navy Office of Research and Invention (ORI) which he outlined; von Newmann submitted the proposal on May 7th and ORI funded it on July 19th, 1946. The content of the proposal, significantly influenced by Rossby with emphasis on science rather than premature applications, is still amazingly relevant to what is occurring at present: “to examine the foundations of meteorology, to solve the basic problems of the general circulation, and to improve our understanding of atmospheric processes.” Also relevant to the present is the underestimation of the complexity of the problem at that time, because by the end of 1947, the project on numerical prediction waned down. It was at this point of time, von Neumann and Wexler, working with Rossby, added Jule Charney and a few other young people to the project. This infusion of new talents worked. Charney, Fjortoft and von Neumann demonstrated the first numerical prediction of the 500 hPa geppotential height in 1950, thereby changing the history of weather prediction, while Norman Phillips demonstrated the simulation of the general circulation in 1955, thereby poineering the atmospheric general circulation modeling. Charney’s model used 19 by 16 grid points with spatial resolution of 736 kilometers and one single layer; Phillips model used 16 by 17 grid points with two layers for a beta-plane channel of the whole atmosphere. Both models used equations of balanced flows, after taking the bitter lessons of Richardson in directly solving the primitive equations for the tasks. Charney’s work prompted the establishment of the Joint Numerical Weather Prediction Unit of (JNWPU) of the weather bureau and the military Weather Services -- predecessor of the National Center for Environmental Prediction (NCEP); Phillips worked prompted the establishment of the General Circulation Research Section in Princeton, now the Geophysical Fluid Dynamics Laboratory (GFDL). The rest is well known history in the meteorological community.

This history is a record of imagination and pursuits, expectations and disappointments, reinvigoration and triumph. The process of how sciences are shaped by individual people and events is vividly described in the book. For people who wonder about the future direction of current research on anthropogenic climate change, this book should be a useful source of reflection and inspiration, just as Winston Churchill said: “The farther backward you can look, the farther forward you are likely to see.”

The book also contains a chapter on the co-evolution of climate models with the Intergovenmental Panel on Climate Change (IPCC). Like the giants in early history, it is the courage and foresight of a few key individuals that initiated the IPCC -- another era in atmospheric modeling. One of these giants was Bert Bolin, who served as chairman of IPCC between 1988 and 1997. Twenty days before his death, the Norwegian Nobel Committee awarded the 2007 Nobel Peace Prize to the IPCC.

The book included some modern topics on the crossing paths of numerical weather prediction and climate modeling, the evolution of using observational data to constrain models, and numerical techniques in the digital age. These chapters are good references for people engaged in active research. They can be read separately as standalone materials. The book also included descriptions of the development trajectory of the coupling of atmospheric models with the oceans, and coupling with the land surfaces, but these are relatively brief.

This is not a text book. The scope and depth of the chapters are uneven. Some chapters are easy to follow by any novice readers; others contain sophisticated materials as review articles in peer-reviewed journals. By necessity, the book cannot cover all topics on the development of atmospheric models. But in view of the current activities in Earth System Modeling, it would be nice for future editions of the book to include accounts of the development of atmospheric chemistry and aerosols models and to expand on the current materials about the coupling of atmospheric models with biogeophysical and biogeochemistry models.