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

This book describes the history of early emergence of atmospheric general circulation models (AGCMs) before 1960s, their later evolution and current status. It was written by a group of major players in the field. 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 the AGCMS and perspectives for the future. The book therefore spans the entire life of AGCMs.

This is a book for people who want to know how atmospheric general circulation models were first conceived and propelled by a few key players. It is also a book for those who want to get a glimpse of the future. When I opened the book, I cannot help but to read it from the beginning to the end in a single stretch.

The history is a record of imagination and pursuits, expectations and disappointments, reinvigoration and triumph. Many of them are relevant today, especially with the current research on anthropogenic climate change. A quote of Winston Churchill is relevant here: “The farther backward you can look, the farther forward you are likely to see”. How individuals shaped the sciences, and people,

The book connected the a few important dots in the historical chain of events, which illuminated some key individuals and events in the early years besides the well known von Nuemann, Jule Charney, and Norman Phillips: the Vladimir Zworykin of the electronic company RCA, who invented television transmitting and receiving devices, wrote the “Modern Computing devices” and the flamboyant “Outline of Weather Proposal” in 1945 imaging human intervention of weather and climate guided by computer calculations (this is at the time of the nuclear bomb – the Mahanttan Project); John Mauchly of the University of Pennsylvania, who invented the computer, went to the Weather Bureau in 1945 to seek examples of difficult sorting and applications using the EDVAC computer; Reichelderfer, chief of the weather bereau, visited RCA in Princeton to inquire about the subject and arranged a subsequent meeting in January 1946 of himself and Zworykin, von Newmann, Wexeler in Washington DC; Wexler’s Professor at MIT, Carl Rossby, started to interact with von Neumann in early 1946, suggested the Institute of Advanced Study (IAP) to submit a proposal to ORI and provided an outline of proposal; von Newmann submitted the proposal on May 7th 1946 and ORI funded it on July 19th, 1946. The content of the proposal, significantly influenced by Rossby to put emphasis 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, and by the end of 1947, the project waned down. It was at this point, von Neumann and Wexler, working with Rossby, added Jule Charney and a few other new people to the project. This infusion of young talents worked: Charney, Fjortoft and von Neumann demonstrated the first numerical prediction of the 500 hPa in 1950, which changed the history of weather prediction, while Norman Phllips demonstrated the simulation of the general circulation in 1955, which started 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 a spatial grid of 16 by 17 grids with two layers for a beta-plane channel of the whole atmosphere. Both models used equations of balanced flows, taking the bitter lessons of Richardson in directly using the primitive equations . Charney’s work prompted the establishment of the Joint Numerical Weather Prediction Unit of (JNWPU) of the Weather Services in Maryland, the predecessor of the National Center for Environmental Prediction (NCEP); Phiilips 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.

IPCC (Bolin) and the digital future “dim”

Equally interesting are the timely topics on NWP, the observations.

The book has coupling with ocean, land surface, but not atmospheric chemistry and geochemistry.

what is bad

This is not a text book, but a good reference book for students and, for….

Better