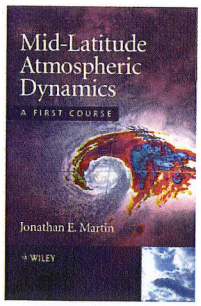
MID-LATITUDE ATMOSPHERIC DYNAMICS: A FIRST COURSE

Jonathan E. Martin, 2006, 336 pp., $178.00, hardbound, Wiley, ISBN 978-0-470-86464-7

The book *Mid-Latitude Atmospheric Dynamics* is a marriage of two of the author's grand passions: synoptic meteorology and teaching. The result is a student-friendly yet rigorous textbook that accomplishes what no other textbook has done before: while the quasigeostrophic (QG) and potential vorticity (PV) frameworks have long been established in the meteorological literature, this is the first textbook that uses these frameworks to diagnose frontal disturbances at a level readily accessible to undergraduate students.



The text is concise, precise, easy to read, and by no means exhaustive. It flows coherently within and across chapters. It is clearly structured, each chapter starting with its objectives and ending with a set of problems. It is written as if the author was teaching this material at his campus in Madison, Wisconsin. Having taught synoptic meteorology, I am inclined to detail and refine at several locations in the book, but Jonathan Martin intentionally paints the big picture. Details and tangents that may lead to confusion are sacrificed in favor of elegant derivations and clearly explained concepts. Clearly, the choice of materials and the explanations have benefited from years of teaching experience. This book can rightly be called a primer or first course. The text is written to be understood, both mathematically and conceptually.

The math is clean, the assumptions are clearly stated, and—especially in the first half of the book—the derivations are as stepwise as they would be on the blackboard. The book starts with a chapter on frequently used mathematical tools that in typical courses are assumed to be on the students' fingertips. This introduction serves as a nice refresher for all and subtly weaves in meteorological concepts. Students can hone their math skills through problems at the end of each chapter. But neither the problem sets nor the text emphasize math competency; they emphasize conceptual understanding. Many students struggle to interpret the physical meaning of terms in an equation, such as the omega equation. Martin explains such interpretations superbly, and often graphically. Most of the figures were specifically drafted for this book, in such a way that minimizes redundant information. Many of the figures masterfully merge real data with conceptual ideas. The figures are of sufficient quality for overhead projection in the classroom, and they are clearly explained in their captions and in the text.

The first five chapters essentially are an introduction to atmospheric dynamics, and thus they can be used to understand atmospheric processes at any scale, on any planet. Chapter 2 deals with the forces acting on an air parcel on the rotating Earth. The fundamental equations of motion are developed in chapter 3, and these are expressed in isobaric and isentropic coordinates in chapter 4. The latter chapter also deals with thermal wind balance and with natural coordinates and balanced flows. Chapter 5 introduces circulation and the vorticity equations. The first five chapters are the building blocks for the last four chapters; however, they are similar to the first four chapters of Holton's *Introduction to Dynamic Meteorology* (fourth edition, 2004), the book that has been the main staple in its field for more than three decades. In fact there are several other textbooks that cover this material in essentially the same logical sequence [e.g., chapters 2–7 in Lynch and Cassano's *Applied Atmospheric Dynamics* (2006)]. Thus, the coverage of these topics may appear redundant. The author does put his own spin on these topics, simplifying them a bit compared to Holton and applying them to real weather rather than to some analytical expression for weather. I