Stefan Emeis:

**Measurement Methods in Atmospheric Sciences**

In situ and remote

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The book’s chapter 5 (25 pages) contains also the possibilities of measurement of air pollutants and gives the book some extra value. It starting from the Rain gauges (totalisators) and TDR-sondes for soil moisture.

Chapter 4, which contains 9 pages, deals with the measurement of liquid water and ice by the use of different kind of measurement techniques which covers 34 pages. The chapter summarizes different measurement possibilities for temperature, humidity, air pressure, and wind.

The measurement techniques and instruments used for common/traditional meteorological variables are described and analyzed in chapter 3 the required aspects for the characteristics of measurements, techniques, and data.

Chapter 2 defines and describes the basics of the different kinds of measurements on 21 pages. The chapter is comprehensive and includes all expanded.

The book starts with an introduction with focus on necessity, definition of measurements and historical aspects, which in my eyes had to be expanded.

In February 2011, the book has been awarded the 2010 ASLI CHOICE AWARD (alternatively: Am. Met. Soc Blog entry) for Measurement Methods in Atmospheric Sciences for ‘a comprehensive overview of the many atmospheric monitoring and measurement methods and instruments’.


In the era of modeling the importance of measurements seems not to be on the actual agenda. Not many books about measurement methods and techniques exist for atmospheric and related sciences. The present book is based on lectures held by the author for students in meteorology and environmental sciences. It has to be mentioned that the knowledge of meteorological/climatological techniques builds one of the most important targets also in climate and climate impact research. Therefore the present book is warmly welcomed and not only for teaching issues.

Recent and older books are structured in a traditional way explaining in separate chapter’s different relevant meteorological parameters and measurement techniques. Here the author separates from the beginning in “in situ” and “remote techniques”. It has to be mentioned that the author has long experience in experimental meteorology and climatology and is predestinated as an appropriate author for a measurements book.

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The book’s chapter 5 (25 pages) contains also the possibilities of measurement of air pollutants and gives the book some extra value. It contains all the relevant physical and chemical methods and also recommendations of the measurement of gas and particles in the
Measurement Methods in Atmospheric Sciences provides a comprehensive overview of in-situ and remote sensing measurement techniques for probing the Earth's atmosphere. The methods presented in this book span the entire range from classical meteorology via atmospheric chemistry and micrometeorological flux determination to Earth observation from space. Standard instruments for meteorological and air quality monitoring methods, as well as specialized instrumentation predominantly used in scientific experiments, are covered. The presented techniques run from simple mechanical sensors to highly sophisticated electronic devices. Special emphasis is on the rapidly evolving field of remote sensing techniques. Here, active ground-based remote sensing techniques such as SODAR and LIDAR find a detailed coverage. The book conveys the basic principles of the various observational and monitoring methods, enabling the user to identify the most appropriate measurement. An introductory chapter covers general principles (e.g. inversion of measured data, available platforms, statistical properties of data, data acquisition). Later chapters each treat methods for measuring a specific property (e.g. humidity, wind speed, wind direction). Long chapters provide an introductory tabular list of the methods treated. More than 100 figures and 400 references mostly on recent literature and relevant photos complete the book.

In general this can be said to be a comprehensive book about measurement methods, techniques, and possible applications. High emphasis is given on the rapidly evolving experimental fields of remote sensing possibilities. More than 100 figures and 400 references mostly on recent literature and relevant photos complete the book.

For the next edition I would like to recommend several appendices with unit conversions and if possible several full derivations of equations i.e. radiation errors etc. As a colleague mentioned flow chart diagrams of the methods and measurement systems would be helpful.

In general I recommend the books not only for teaching in bachelor and master courses. The books is very informative and can be used also in Biometeorology and related disciplines.

Andreas Matzarakis, Freiburg


**Measurement Methods in Atmospheric Sciences**

ETDE Energy Database DE11G4422
FIZ Karlsruhe - Leibniz-Institut für Informationsinfrastruktur

**Review: Meteorologische Zeitschrift vol. 21, 2012, no. 3**

This book is an excellent reference resource which covers all aspects of measurements of properties of the atmosphere. Although there are small sections on such topics as ionospheric electron density measurements and remote sensing of clouds, this is predominantly a book about measurements of properties of the troposphere. The content is based on a series of lectures by the author at the University of Cologne, but its emphasis is on the principles of measurement and on measurement accuracy rather than detailed mathematical treatment of the measurement physics. This makes the book extremely readable, and also makes it possible to open the book at any section and read about one particular measurement method or how measurements are conducted to estimate one particular atmospheric property. The coverage of measurement technologies is very up-to-date, and a concluding chapter also gives some insights into likely future developments. One feature
of the book is its inclusion of historical context as well as a wealth of citations to the most significant publications relating to each measurement methodology. The text is accompanied by very high quality photographs of instruments, and clear diagrams which help explain measurement principles. Initial chapters take some care in describing what a measurement is, and the main features of making a measurement. Also included is a discussion, with simple examples, of measurement error and ill-posed inversion problems. Such fundamental aspects are often overlooked in other texts. The awareness of the importance of measurement error and uncertainty is carried throughout the book, with estimates of the accuracy of each measurement method. This is a very useful guide to anyone wishing to employ a technology with which they are not familiar. Each section describing methods for measurement of a particular atmospheric property concludes with paragraphs such as “Recommendations for wind measurements”, which also include best-practice guidelines. This allows the reader to obtain some grasp of the pitfalls which might occur if the reader were not well prepared.

Measurement Methods is a very comprehensive coverage of the principles and current instrumentation. One difficulty though is that this does not leave room to describe in much detail the atmosphere itself and the nature and variability of the properties which are being measured. In particular, there is not much coverage of the temporal and spatial scales of variability of the various atmospheric properties. This means that the reader does not necessarily obtain a clear idea of how rapidly measurements should be made or how representative point measurements are.

Given the very wide scope covered in this text, it is arranged in a very clear and logical manner. The most common atmospheric properties are treated first, starting with the simplest measurement methods. In situ measurements of temperature, water vapour, pressure and wind are covered first, followed by in situ measurements of liquid water and ice and trace substances. There follows a chapter on flux measurements, including radiative fluxes. There are then six chapters on remote sensing methods. These include a chapter on remote sensing of surface properties, which are only indirectly related to atmospheric measurements. The remote sensing chapters concentrate mostly on ground-based methods, such as lidar, sodar, radar, ceilometers and scintillometers, and give very good coverage of the principles involved and current state-of-the-art. Treatment of remote sensing of atmospheric properties by satellites is quite brief, but this is an area already comprehensively covered by many other texts.

In summary, Stefan Emeis’ Measurement Methods in Atmospheric Sciences is an extremely readable and comprehensive compendium of all aspects of measurements of atmospheric properties. It should find a place on the bookshelf of anyone involved in meteorological observations as well as being an excellent resource for courses in atmospheric and environmental sciences.

Prof. Stuart Bradley, Physics Department, Faculty of Science, The University of Auckland, New Zealand

Meteorologische Zeitschrift vol. 21, 2012, no. 3

Analyse d’ouvrage: La Météorologie - n° 73 - mai 2011

Les moyens d’observation de l’atmosphère évoluent rapidement, qu’il s’agisse des mesures en surface et en altitude ou bien des mesures par télédétection depuis le sol et depuis l’espace. Ce manuel propose un large tour d’horizon des techniques de mesure, depuis les instruments classiques d’observation météorologique jusqu’aux techniques les plus novatrices utilisées pour la recherche atmosphérique.

La Météorologie n° 73 - mai 2011

Review: Bulletin of the American Meteorological Society, October 2011

If you want to measure something within the atmosphere, Measurement Methods in Atmospheric Sciences is an excellent resource to determine the best technique to use. This book covers a wide range of topics, including classic in situ measurements of the state variables, precipitation, trace-gas and particle measurements, flux measurements, and passive and active remote sensing, as well as lesser-known topics such as olfactometry.

Audience. This book would be useful to any scientist or engineer who desires to have an overview of the current techniques and instrumentation available in the world of atmospheric measurements. It could also be useful to students who are studying measurement techniques. Most of the material is at an undergraduate level.

Strengths. I am not aware of any other book that covers such a complete range of atmospheric measurement techniques. In addition to a summary of the strengths/weaknesses of each technique, most sections include a recommendation of the best one to use. In my opinion, the sections on different remote sensing techniques (i.e., contrasting radar, sodar, lidar, etc.) and trace-gas measurements are particularly insightful. The appendix includes an index of technical standards and guidelines that have been determined by various agencies [such as the Association of German Engineers (VDI), the British Standards Institution (BSI), the International Organization for Standardization (ISO), etc.]. These valuable resources are sometimes overlooked in the scientific community, and are nicely presented in this book.

Weaknesses. Because this book covers such a variety of topics, it doesn’t cover any one topic in great depth. In a class that focuses on one subject (such as remote sensing), additional resources will be needed, and much of the material in this book may not be relevant. Also, I’m not sure if it qualifies as a weakness, but interspersed throughout the book are advertisements from companies that make atmospheric instruments.

Illustrations. The illustrations and photos in the book are all appropriate and useful. I found many of the tables to be particularly well thought-out and helpful.

Bottom Line. As someone who makes atmospheric measurements, I love to have this book on my shelf. When someone asks me, “What’s the best instrument to measure the boundary layer depth?” or “How can I measure ozone?”, this is undoubtedly the first book I would consult to find the answer (or at least find references that will lead me to the answer).

Sean Burns

Bulletin of the American Meteorological Society, October 2011
Das Titelbild zeigt eine in ihren Dimensionen recht raumgreifende Messapparatur, ein SODAR-RASS zur Fernerkundung von Wind- und Temperaturprofilen in der atmosphärischen Grenzschicht. Bei Atmosphärenmessungen geht es aber auch kleiner, z. B. bei der Temperaturmessung mit dem Flüssigkeitsthermometer oder der Bestimmung der Windrichtung und -stärke mit einem Windsack. Diese Beispiele illustrieren die Spanne und Komplexität der Messverfahren. Die Anzahl der in der Atmosphäre messbaren und gemessenen Parameter ist groß und entsprechend vielfältig, die im Laufe der Zeit entwickelte Messtechnik. Prof. Dr. Stefan Emeis vom Institut für Meteorologie und Klimaforschung des Karlsruher Instituts für Technologie (KIT), hat sich die Aufgabe gestellt, diese Vielfalt anschaulich und übersichtlich darzustellen, ohne dabei die fachlichen und technischen Details bis in die letzte Tiefe ausloten zu wollen.


Dieses äußerst informative Buch wird dem eingangs genannten Ziel des Autors voll und ganz gerecht. Sehr empfehlenswert!

Dr. Norbert Höfert
Fachzeitschrift Gefahrstoffe Reinhaltung der Luft 4/2011

Gefahrstoffe Reinhaltung der Luft

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Methods for Actuarial Sciences and Finance. The conference was organised by the Department Mathematical a ... Mathematical Methods for the Physical Sciences.

In summary, Stefan Emeis’ Measurement Methods in Atmospheric Sciences is an extremely readable and comprehensive compendium of all aspects of measurements of atmospheric properties. It should find a place on the bookshelf of anyone involved in meteorological observations as well as being an excellent resource for courses in atmospheric and environmental sciences. Prof. Stuart Bradley, Physics Department, Faculty of Science, The University of Auckland, New Zealand. Meteorologische Zeitschrift vol. 21, 2012, no. 3. Analyse d’ouvrage: La Météorologie - n° 73 - mai 2011

↑ If you want to measure something within the atmosphere, Measurement Methods in Atmospheric Sciences is an excellent resource to determine the best technique to use. It should not be surprising, therefore, that statistical methods have a key role to play in the atmospheric sciences. It is the uncertainty in atmospheric behavior that continues to move research forward and drive innovations in atmospheric modeling and prediction. This revised and expanded text explains the latest statistical methods that are being used to describe, analyze, test and forecast atmospheric data. It features numerous worked examples, illustrations, equations, and exercises with separate solutions. Statistical Methods in the Atmospheric Sciences, Second Edition will help advanced