Book review
Tomas Foken's book Micrometeorology (Second Edition) 2017

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This book is a revised edition (second English language Edition, translated by Dr. Carmen Nappo and Prof. Dr. Petra Klein from the third German language edition for the book "Applied Meteorology-Micrometeorological Methods") to one of the essential texts in the field of micrometeorology. Thomas Foken is one of the leading scientists in the field and his work has influenced many of the recent developments, especially related to his work on the effect of landscape heterogeneity. He has been involved in many of the major international flux tower networks such as CARBOEurope where he developed of many of the quality assurance/quality control (QA/QC) processes. His parameterisations, corrections and analyses are included in commonly used flux processing software, *inter alia* EddyPro and EddySoft.

The book covers a comprehensive theory of atmospheric processes in the first three chapters, and the three subsequent chapters (experimental methods, modelling and measurements techniques) are concise and consistent with the theory chapters. Thus, this book is valuable both as a text book for students and the development of teaching material in micrometeorology and can serve as a reference to practitioners in disciplines that require the use of micrometeorology or the incorporation of micrometeorological concepts. While the audience of this book is primarily the eddy co-variance flux measurement community, I believe it will hold great value for air quality practitioners, including those involved in dispersion and atmospheric chemistry modelling, the air pollution measurement community, and regulators who need to understand the atmospheric processes that affect the movement and dispersion of atmospheric pollutants.

The new edition includes an update of the references and the inclusion of new topics relevant to micrometeorological investigations, such as the soil chamber measurements, local climates and land use change.

The book is divided into 8 chapters, including:

General basics: this chapter covers the basic concepts of micrometeorology such as atmospheric scales, processes within the atmospheric boundary layer, the energy balance at the earth's surface and how this drives (the air pollution relevant processes of) turbulence.

Basic equations of atmospheric turbulence: this chapter covers the equations necessary to understand turbulence in the lower atmosphere, including; the equations of motion, turbulence kinetic energy, flux-gradient similarity (including the Monin-Obokov similarity theory and the Bowe-Ratio Similarity), flux-variance similarity, the turbulence spectrum and equations of the atmospheric boundary layer. Although the level of mathematics involved is not really difficult, its presentation requires devoted reading, otherwise, this chapter may be more useful as a refresher to a reader who has completed introductory course related to atmospheric processes.

Specifics of the near-surface turbulence: this chapter assesses the important surface characteristics that affect the turbulence and mixing in the lowest atmospheric levels. This includes; discussion of the surface properties (e.g. the surface roughness, the zero-plane displacement and profiles within plant canopies), the development and characteristics of internal boundary layers, the effect of obstacles on air flow and turbulence; the use and application of footprint models; the impact of high vegetation; the impact of advection, and (of importance to the South African situation) conditions under stable stratification.

Experimental methods for estimating the fluxes of energy and matter: this chapter focuses on the most commonly used methodologies for estimating the fluxes of greenhouse gases water and matter. The methods covered include: the profile method, the eddy covariance method, flux variance relations, accumulation methods, and (of importance to the Air pollution and ecological communities) the wet and dry deposition of nitrogen and sulphur containing compounds.

Modelling of energy and matter exchange: this chapter examines the methods employed for modelling the exchange of matter and energy between the surface and the atmosphere. Techniques covered include: energy balance methods, hydrodynamical multilayer models, use of the resistance approach, boundary layer modelling, modelling in large scale models, large eddy simulations, and methods for area averaging.

Measurement techniques: the chapter on measurement techniques provides essential information for anyone

undertaking meteorological measurements and the principals are directly transferable to air quality measurements. The chapter covers the following sections; the principals of data collection (with specific reference to signal sampling, the transfer functions and inertia in the measurement systems), the measurement of essential meteorological parameters, and processes for quality assurance and quality control of meteorological (and other) measured data. The chapter also draws important distinction in flux processing methods which is more suitable for eddy covariance audience. The section includes a detailed comparison of different flux measurement techniques and makes recommendations on the right correction methods based on the site and instruments being used.

Microclimatology: this section examines the importance and mechanisms of small scale climates. This includes; climatological scales, the generation of local climates, microclimate relevant circulations (such as the land-sea and mountain-valley circulations), cold air flows, and the impacts of land use change on local climates.

Applied Meteorology: this chapter focuses on the practical applications of micrometeorology many of which are relevant for the NACA community. Specific applications include; air pollution, sound propagation (noise pollution), wind energy use, and human biometeorology.

Appendix: I found the appendices very useful as they provide a quick reference guide to the correct SI units, important constants and parameters, important functions and equations, parameters required at various types of meteorological stations, and a detailed comparison of eddy covariance software.

Micrometeorology Second Edition by Thomas Foken is published by Springer (Berlin). It is available from the publisher (http://www.springer.com/gp/book/9783642254390) as either an eBook or Hardcover, individual chapters can be bought from the Springer website.