Preface

Many books have already been written on converting the kinetic energy of the wind into mainly electrical energy. This one, written by a meteorologist, will entirely concentrate on the atmospheric features and phenomena influencing the generation of electric power from the wind. Such a book is presently—to my knowledge—unavailable. This book presents part of what is today called 'energy meteorology', a presently emerging new sub-discipline in the field of meteorology.

I thank Springer Science Media for the invitation to write such a book which is designed to fit into the series "Green Energy and Technology" which deals with various aspects on renewable energies. This series already comprises several titles on wind energy. Once again most of these titles are on technical aspects but none of these concentrates on the meteorological boundary conditions for the conversion of energy from the wind. My special thanks go to Claus Ascheron of Springer who accompanied the preparation of the manuscript and gave invaluable advice.

I am working as a scientist in the discipline of meteorology since the 1980s. The field of energy meteorology has found my attention for more than 20 years, although the term 'energy meteorology' is much newer. My interest in this subject was initiated during a sabbatical leave at the Wind Energy Institute of the Danish National Laboratory (today part of the Danish Technical University, DTU) at Risø near Roskilde, Denmark. Here, I met boundary-layer meteorology experts and saw one of the first test sites for wind turbines. Essentially, wind energy meteorology is a special section of boundary-layer meteorology. I still have very fruitful and friendly contacts with this renowned Danish research institute. In 1991 in Risø I also met the late Sten Frandsen for the first time. Discussions with him started my attention to the wind park issue. What is presented here in Chap. 6 in this book is a much more elaborated version of an idea which was born during that first stay in Risø. Thus, I dedicate Chap. 6 to him.

Later I worked many years on acoustic profiling of the atmospheric boundary layer with SODAR devices. These instruments allow for a surface-based detection of the boundary-layer wind profile based on an analysis of the Doppler shift of the backscattered signal. This is a technique, which captured the interest of the wind energy community in the 1990 s. In recent years, my experimental activities and expertise have been complemented by the operation of ceilometers, RASS and wind lidars. In addition, I focussed on the investigation of peculiarities of the marine boundary layer from data from the German offshore measurement platform FINO1 in several research projects. I am a member of the Southern German wind energy research alliance WindForS.

The marine boundary layer projects have been funded through several grants by the German Ministry of the Environment, Nature Protection and Nuclear Safety (BMU, FKZ 032 99 61, 032 50 50, 032 53 04). These projects within the RAVE program (Research at Alpha Ventus) were initiated in order to accompany scientifically the establishment of the first German offshore wind park Alpha Ventus, which is situated in the German Bight roughly 45 km away from the nearest coast in about 30 m deep waters. Six years before the first turbine installation began, a 100 m meteorological measurement tower (FINO1) was erected at the later site of Alpha Ventus in order to facilitate the studies of the marine boundary layer. Much of the information concerning the marine boundary layer presented in this volume is based on data obtained at this tower which has eight measurement platforms between 30 and 100 m. The evaluation of this tower data has mainly been performed by two PhD students of mine; Matthias Türk[1] and Richard Foreman[2]. Further funding is available through a project lead by Sven-Erik Gryning from Risø DTU and which is presently supported by Forsknings—og Innovationsstyrelsen at the Danish Ministeriet for Videnskab, Teknologi og Udvikling (Sagsnr 2104-08-0025) within the project: "Large wind turbines—the wind profile up to 400 m". The results for urban boundary layers are partly based on studies funded by the German Ministry of Education and Research (BMBF) in the framework of the AFO2000 program. The data from Graswang in Figs. A.1 and A.2 in Appendix A have been obtained in the framework of the TERENO programme of the Helmholtz society funded by the BMBF. The studies on flow over complex terrain have partly been made possible through the financial support by several private enterprises.

A draft version of the manuscript has been read by Beatriz Cañadillas, Richard Foreman, Tom Neumann, and Matthias Türk. I thank all of them for their valuable suggestions, help and advice. Nevertheless, it is me to be blamed for any errors or inconsistencies. I hope that this book will help to bring the meteorological part in wind power conversion to a better visibility. We urgently need efficient strategies to generate renewable energies for the energy demand of mankind and a better understanding of the meteorological prerequisites for wind power generation should be part of this strategy.

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[2] Foreman, R.: Improved calculation of offshore meteorological parameters for applications in wind energy. PhD thesis, Faculty of Mathematics and Natural Sciences, University of Cologne (2012)

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