

European Wind Atlas

Troen and E.L. Petersen (1989). *European Wind Atlas*. Published for the Commission of the European Communities by Risø National Laboratory, Roskilde, Denmark. Hardback book of 656 pages with 16 colour maps and a data disk. ISBN 87-550-1482-8.

The European Wind Atlas is:

- A *data bank* of European wind climate: it contains comprehensive wind statistics from more than 200 stations covering the entire EC, plus colour maps of the wind resources of each EC country.

- A *handbook* for regional wind resource assessment and the local siting of wind turbines, including computational procedures for the effects of shelter, roughness and orography on power production.

- The *basis* for reliable estimates of the wind resources in the EC countries, whether on a regional scale or at a specific site.

Contents of the Atlas

The Atlas is divided into three parts, each intended for readers with different areas of interest - from laymen to professional meteorologists:

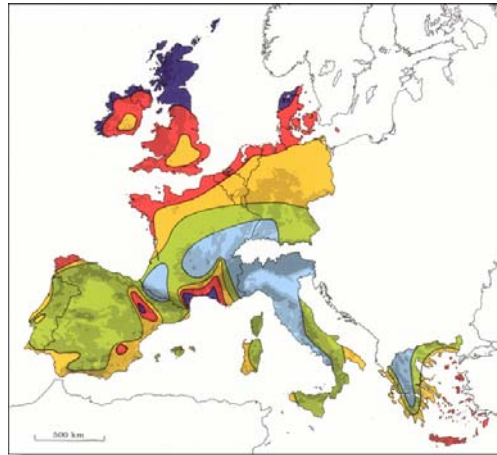
Part 1: The Wind Resource provides an overall view of the wind climate and magnitude and distribution of wind resources in the European Community countries. This part of the Atlas is intended to be useful to politicians, planners and laymen in general. The descriptions, figures, tables and colour maps permit a first, rapid identification of regions with favourable wind resources.

The wind climate of Europe • Wind resource maps.

Part 2: Determining the Wind Resource gives explanations and information needed for the purpose of regional wind resource assessments and the local siting of wind turbines. In addition, it contains descriptions, raw statistics, and wind atlas statistics for 220 meteorological stations in the EC. It also includes methods for calculating the influence on the wind resource of various features in the landscape such as coastlines, forests, hills, and buildings.

General concepts • The roughness of a terrain • Shelter behind obstacles • The effect of height variations in the terrain • Regional wind energy potential • Use of the wind resource maps • Siting • Selection of wind climatology for a site • Roughness classification • Calculation of statistics for a site • Calculation of shelter • Orography • Power production • Determination of mean power production • Power density function • Power duration curve • Op-

timisation of power production • Station statistics and climatologies • Station description • Raw data summary • Regional climatology and mean values • Wind-climatological fingerprints • Station statistics and climatologies • Radiosonde statistics.



Part 3: The Models and the Analysis explains in detail the meteorological background for the Wind Atlas. It describes how the analysis was performed from the data and station information, and discusses the physical and statistical basis for the Wind Atlas models. The validity of the models and the analysis is demonstrated through a number of comparisons between measured and modelled wind statistics.

The physical basis • Surface-layer similarity laws • The geostrophic drag law and the geostrophic wind • The stability model • The roughness change model • The shelter model • The orographic model • The statistical basis • The Wind Atlas analysis model • The Wind Atlas application model • Meteorological data and station description • Radiosonde statistics • Limitations of data and models • Verification of the Wind Atlas methodology • Station inter-comparisons • Validation against high meteorological masts • References • List of symbols • Auxiliary tables • Selection criteria and questionnaire • The data disk.

Non-English translations

The text of the Atlas has been translated into French, German, Italian, and Spanish. These translations contain the entire text of the Atlas as well as the statistical tables of the French, German, Italian, and Spanish stations, respectively. One non-English edition may be supplied free of charge when purchasing the English reference edition.

Application of the Atlas

The Atlas is the meteorological basis for estimating the wind climate and wind energy resources of any particular site in the EC. The

Wind Energy Department
Risø National Laboratory
Technical University of
Denmark (DTU)
P.O. Box 49, VEA-118
4000 Roskilde
Denmark

Phone +45 4677 5097
Fax +45 4677 5970
wasp@risoe.dk
www.wasp.dk
www.windatlas.dk

Visiting address
Frederiksborgvej 399
Roskilde • Denmark

application of the Atlas as a siting handbook is explained in detail in the Atlas.

To facilitate resource calculations and specific siting of wind turbines, the Wind Atlas is furnished with a disk containing all the regional statistics. The disk files can be used directly with the "Wind Atlas Analysis and Application Program" (WASP), which was especially developed for the production of the Wind Atlas and for use in practical siting. The WASP program is not included in the Atlas, but can be obtained from Risø National Laboratory.

Data disk

The observed and model-derived wind statistics from the 220 meteorological stations are furnished on a CD-R together with the Atlas. The data consists of the observed and modelled wind rose and wind speed distributions for each station; an example from the Danish station of Kastrup is given below.

From the Foreword

"The European Wind Atlas is a major outcome of the European Communities' overall effort to promote the market for electricity production from the wind resource in Europe and to develop the technologies and systems associated with it.

This Atlas completes the information previously published in several national wind atlases, and it will doubtless become an essential tool for all planners of wind energy applications in the Community. The data in this new European Atlas are far more comprehensive than those given in previous works. Moreover, this Atlas provides for the first time a coherent overview of all the EC countries, including the large regions with complex terrain. The latter was a major achievement because reliable computer codes had to be developed especially for this task...

I trust that all those interested in the future development of wind energy utilisation in Europe will appreciate this vast work and benefit from the comprehensive information it provides in their future activities."

– Dr. W. Palz, *Commission of the European Communities (DGXII)*

The reviewers wrote...

"This book is a welcome attempt to quantify the meteorological aspects of the wind power available within the parts of Europe belonging to the European Community. The economic viability of generating electricity from the wind is very dependent on not only the mean wind speed but also the distribution of the wind speed at a location. This book addresses this with an examination of 10 years' data from 220 meteorological stations across Europe."

– K.L. Simms, *Weather*¹

"The European Wind Atlas ... uses high quality surface wind observations as its primary data source. The key factor in the development of the atlas has been to transform the measured winds at specific sites into regionally representative values and climatologies. It is this step which sets this work apart from most other wind energy resource studies and has led to a consistent and reliable atlas ...

Notwithstanding the weight, I strongly recommend the Atlas to all interested in wind energy and wind climatologies and, for other readers of *Boundary-Layer Meteorology*, I commend this as an example of the successful, well documented analysis of a complex micro-meteorological issue."

– P. Taylor, *Boundary-Layer Meteorology*²

"While wind energy research in the United States starved from lack of funding during the last decade, progress continued in Europe. Denmark established a reputation for designing and manufacturing the world's finest modern wind turbines. The publication of the European Wind Atlas by the Risø Laboratory now confirms Denmark as a world leader in wind resource assessment as well. ... As the twenty-first century approaches and the environmental wounds of fossil fuel consumption become more severe, wind and solar energy alternatives will certainly become more attractive. The European Wind Atlas is an important contribution toward the utilization of a major renewable energy resource. It is an essential reference for scientists and engineers involved with wind energy work in Europe as well as for serious students of Europe's climate. It can also serve world-wide as a guide for sophisticated wind energy resource assessment."

– B. Martner, *Bulletin of the American Meteorological Society*³

Further information

Please visit www.windatlas.dk for more information on the wind atlas methodology and wind atlases of the world.

The European Wind Atlas, as well as the Russian Wind Atlas and the Wind Atlas for the Gulf of Suez, Egypt, may be ordered from Risø National Laboratory, Technical University of Denmark (DTU), see the reverse side for contact details.

(1) *Weather* is published by the Royal Meteorological Society.

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