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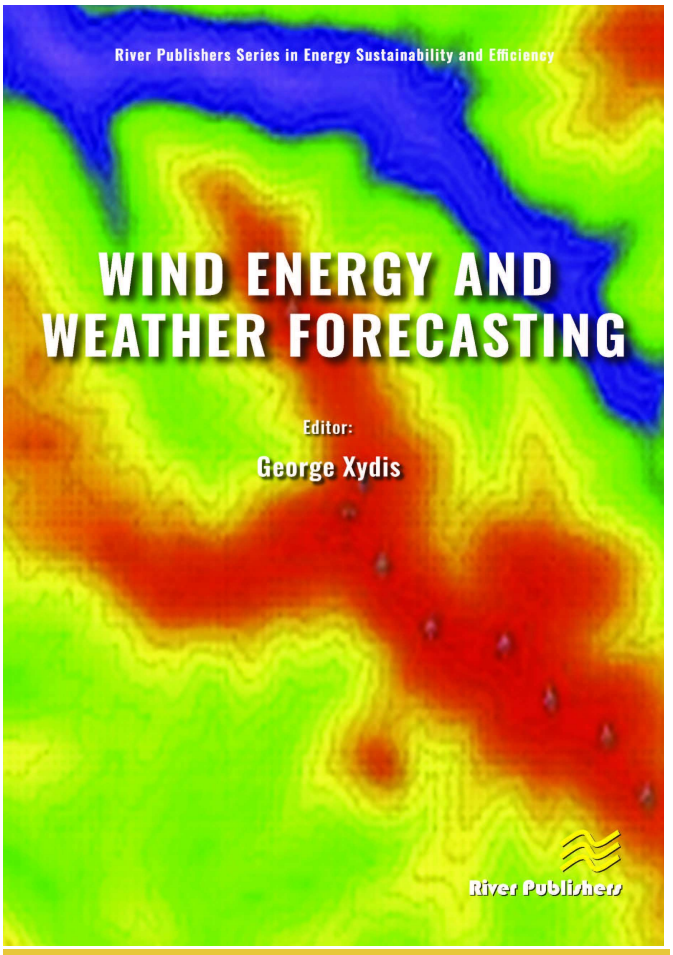
Wind Energy and Weather Forecasting

Editor: George Xydis, Technical University of Denmark, Denmark

Wind energy is a cornerstone of the global transition to renewable power, yet its inherent variability presents major challenges for efficiency, forecasting, and grid integration. This book explores how advanced machine learning techniques can transform the wind energy sector by delivering data-driven solutions that improve predictability, optimize operations, and maximize output. Drawing on cutting-edge research and real-world case studies, the book examines applications ranging from random forest-based power forecasting and cloud-enabled quality management to neural network-driven wind atlas development and LSTM-based demand prediction. It demonstrates how machine learning can reduce uncertainty through advanced weather analysis, support smart site selection by integrating geospatial and environmental data, enhance operational efficiency through automated data management, and improve grid integration and energy distribution using adaptive predictive models. Packed with actionable insights, this book is an essential resource for renewable energy professionals, data scientists, policymakers, and researchers seeking to leverage artificial intelligence for a smarter and more sustainable wind energy future. Whether addressing forecasting challenges or optimizing turbine performance, it provides the tools needed to turn data into real-world impact and drive the renewable energy revolution.

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