

University of Bucharest
Faculty of Geography

**THEORETICAL AND METHODOLOGICAL FRAMEWORK FOR
INTERDISCIPLINARY APPROACHES IN GEOGRAPHY**

Habilitation dissertation
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SUMMARY

This paper is the result of research conducted over recent years, after having defended my doctoral thesis, both individually and as manager or member of several research teams. The scientific activities were conducted by the research teams of the Meteorology and Hydrology Department, and by the Coastal Research Center for Environmental Protection of the Geography Faculty, which I have been managing since 2011, as well as by the Sfântu Gheorghe Marine and Fluvial Research Station (Danube Delta) – all of which belong to the University of Bucharest. Moreover, I have also been involved in the following research units which are not affiliated with the University of Bucharest: the Laboratory of Aerodynamics and Wind Engineering attached to the Department of Hydraulics and Environmental Protection of the Technical University of Civil Engineering in Bucharest; Constanța Diving Center of the Naval Forces, and the "Grigore Antipa" National Institute for Marine Research and Development in Constanța.

The research activities mainly consisted in: scientific research grants awarded in national environmental protection competitions, funded by the Balkan Environmental Association; working as coordinator/manager or research team member in various international projects, as well as in projects/national contracts accessed in national competitions.

The scientific activity – i.e. publications and conference presentations – mainly consisted in: articles published in ISI indexed journals, articles published in ISI indexed proceedings; articles/studies published in IDB indexed journals with a B+ CNCSIS rating; articles published in university journals with scientific reviewers and ISSN; book chapters published abroad and indexed in International Databases; specialized books published in CNCSIS-accredited publishing houses; extensive publications in major international conferences; an original map of Romania's site placement-based wind potential.

It is noteworthy that my scientific work followed two main directions:

Research domain A: *Synthetic Analyses of the characteristics of renewable energy sources and of their power-generating potential;*

Research domain B: *An interdisciplinary approach to analysis and research on environmental components.*

With research domain A, my efforts focused on addressing the theory stating that the new energy economy will rely far less on combustion energy, and increasingly more on direct exploitation of wind, solar and geothermal energy. In this respect, Romania, now a member of the European Union, needs to intensify its efforts in order to meet the commitments made on environmental protection and renewable energy sources. Our country agreed to increase the national renewable electric energy consumption up to 38% by 2020.

It should be noted that Romania joined the Partnership for Renewable Energy and Energy Efficiency, which commands that the shares of renewable energy our country produces be 17% for wind, and 12% from solar sources.

The research I conducted took into consideration the fact that the medium and long-term national energy development strategy includes objectives related to renewable energy sources such as:

- promoting new solar and wind-based energy sources, while setting a high priority for energy production from renewable energy sources in island energy systems;
- ensuring environmental protection according to relevant treaties which Romania has ratified;
- ensuring a sustainable energy development;
- providing free and regulated access of renewable source-based energy to public networks;

- covering additional costs for renewable source-based energy from special funds, so that the price consumers pay be consistent with previous electricity market values;
- increasing the use of renewable sources in order to ensure building energy autonomy.

Research domain A involved the following three main study areas on topics which were thoroughly analyzed:

Research field I.1: *Studies and research on wind characteristics, power-generating potential and modeling.*

Research field I.2: *Studies and research on wind waves characteristics, power-generating potential and modeling.*

Research field I.3: *Studies on solar radiation characteristics, and the associated energy potential.*

Within the main topics of Research field I.1, through conducted studies, the published articles, and the papers presented at national and international conferences, the following issues were addressed:

- wind characteristics based on a vast number of statistically processed data, as a result of extensive measuring campaigns;
- wind power-generating potential, as a result of the statistical processing of available data, and of appropriate probabilistic computing methods;
- the influence of natural wind turbulent structure on wind power-generating potential;
- the experimental modeling of the interaction between wind and wind turbines, using aerodynamic tests in an aerodynamic boundary layer wind tunnel, simulated for both average speed profile and turbulent structure.

The research carried out on the various topics of Research field I.2 addressed a number of important issues:

- characteristics of wind waves in terms of height and duration, by statistically processing a massive database resulting from measurements recorded over periods of at least 5 years;
- wind wave power-generating potential, as a result of database statistical processing;
- wind channel experimental wind wave modeling, with records on the interaction between waves and wave-energy capture facilities.

The research I conducted materialized into articles and papers, presented at national and international conferences, which represent valid, original contributions to the field.

The research conducted over the various topics of the Research field I.3 covered a series of important issues concerning:

- characteristics of solar radiation based on extensive data resulting from the correlation of field measurements and theoretical elements;
- solar energy potential for various site location/placement conditions;
- the possibility of converting solar radiant energy in order to cover the energy needs assessed based on environmental factors;
- the correlation of energy needs and converted energy, considering individual household-applicable appliances.

In Research domain B, I tackled two main fields:

Research field II.1: *Quantitative and qualitative models for dynamic geographic systems;*

Research field II.2: *Numerical and experimental modeling of dynamic geographic system components.*

Within the main topics of Research field II.1, through the conducted research, the published ISI indexed articles and the papers presented at national and international conferences, the following issues were addressed:

- characteristics of interannual, seasonal and annual variations of the potential evapotranspiration, and the design of an evolutionary model;
- research on hydrothermal variations using statistical parameters, and the identification of variability curves;
- studies based on the spatialization of climatic water deficit values;
- studies on the influence of marine meteorological factors on rocky shore landforms

The research conducted over the various topics of Research field II.2 covered a series of important issues concerning:

- dynamic and thermal boundary layer characteristics, and its meteorological aerodynamic tunnel simulation;
- average speed profiles and turbulent intensity profiles of the atmospheric boundary layer, and the aerodynamic tunnel experimental vein simulation;
- the transfer and gradual transformation of certain contaminants found in permeable media, and ensuring groundwater protection against hydrocarbon-based contaminants.

The scientific results have been and will continue to be used for didactic purposes. The experience I have benefitted from has led to the introduction of subjects such as *The geography of marine energy resources/ Marine energy potential/ Renewable energy and the environment/ The ocean-atmosphere interaction* in the curriculum of the Meteorology and Hydrology, and Environmental Geography sections, and the appropriate study support materials were published for each course. It is also noteworthy that these subjects are included in other European universities' curricula.