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Spatial analysis of solar energy potential at global level. Evidences from a new high-resolution worldwide climate database

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The use of solar energy is currently considered a highly promising strategy for a worldwide clean energy transition and for the sustainable development of human society. However, the large-scale implementation of this renewable energy is largely conditioned by the available information on the distribution and intensity of existing solar resources, which so far have been insufficiently thoroughly explored globally. This paper aims to investigate the solar energy potential at global scale, using representative spatial data on global horizontal irradiation (GHI, relevant parameter for assessing energy generation via photovoltaics/PV technologies) and direct normal irradiation (DNI, important parameter for the development of concentrating solar power/CSP systems), which have recently become available globally, at high spatial resolution. Based on the recent data, the paper essentially aims to map and statistically analyze the solar energy potential globally, continentally and nationally, using geostatistical methods applied via Geographical Information Systems. Our findings indicated the existence of 6 major global GHI (western South America, northern, eastern and southwestern Africa, the Arabian Peninsula and Australia), and DNI (southwestern North America, western South America, southwestern Africa, northwestern Arabian Peninsula, Tibetan Plateau and Australia) hotspots, characterized by peak annual energy potential values, i.e. >2200 kWh/m² (for GHI) and >2500 kWh/m² (DNI), respectively. It was found that these regions with abundant solar resources covered a vast global area (~15 mil km²/10% of the world's land area, for GHI, and ~8 mil km²/5%, for DNI), across numerous countries, most of which in Africa and Asia. Our results therefore showed that that many countries worldwide hold the much-needed solar resources for a large-scale implementation of PV and CSP systems, the most important worldwide technologies currently used in solar electricity generation.

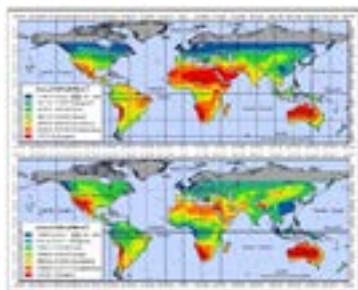


Figure 1: Global spatial representation of global horizontal irradiation (GHI) and direct normal irradiation (DNI)

Biography

Remus Prăvălie is an assistant professor at the University of Bucharest, Faculty of Geography. His interdisciplinary research is concerned with the field of global environmental issues such as climate change, impact of climate change on environmental systems or environmental pollution, but also with the solutions of these environmental issues, like renewable energies. He has completed his PhD at the age of 27 years at the University of Bucharest and is currently manager of a postdoctoral project at the same university. Remus Prăvălie has published more than 20 papers in prestigious journals in the field of environmental sciences.