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Solar and wind energy resources in Northern Hungary, including bi-variate distribution and long-term tendencies

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Spatial interpolation and mapping of renewable energy resources is an important task of potential estimation in case of atmospheric renewable energy sources. Its first steps, concerning global radiation measured at horizontal surfaces (not on optimally tilted ones) and near-surface wind speed measured at 10 m height above the surface (not at 60-120 m of contemporary wind-turbines). Based on these standard meteorological observations, experts of the Hungarian Meteorological Service elaborated a series of digital maps with 0.1 x 0.1 deg resolution compiled in the framework of the CarpatClim Project (www.carpatclim-eu.org). The grid-point values are based on homogenised data using MASH theory and software (SZENTIMREY, 1999). The interpolation has been performed by the MISH theory and software (SZENTIMREY and BIHARI, 2006).
The study tackles the solar and wind energy in four aspects. Firstly, a trial for validation of the gridded data is provided by comparison a single station, Eger for 2001-2010 (global radiation) and 1996-2010 (wind speed cube). The horizontal distance between the closest grid-point and the station is less than 1 km. Gridded global radiation data perform very well comparing to the observations, based on various statistical parameters of the distribution, whereas for the wind speed cube, used as indicator of available energy, there is a considerable bias between the two sets of data. Secondly, the annual cycles of the area-mean global radiation and wind-speed are presented, based on the gridded data of a selected ca. 50x50 km2 (6x8 grid-points) region. Both the averages and standard deviations of the diurnal mean values are presented for the 1981-2010 reference period. Presenting the maps of the distribution within this area is our third aspect, considering both averages and standard deviations.
Finally the point-wise trends are drown for both energy sources in the single grid-point used in the aspect one in 1981-2010, and also in the nearby located station for comparison. The trend of solar energy is positive, whereas the trend for wind energy (speed cube) is negative in the given 30 year period. Since these three decades exhibited mainly warming in the Northern Hemisphere, these trends might also be interpreted as responses to the large-scale forcing, though the observed behaviour does not necessarily mean causal relationship with the global tendencies. After these univariate analyses, correlation The study has been supported by the TÁMOP-4.2.2.A-11/1/KONV-2012-0016 Project in Hungary.
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