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Using MNWP models of different horizontal resolution to estimate available wind power resources at specific locations

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Knowing the wind climate is crucial in estimating wind energy potential and its effective utilization. The quality of wind power assessment depends on the capability of chosen probability density function (PDF) to describe measured or modeled wind speed frequency distribution. In the complex terrain of Croatia and relatively sparse measuring network it is beneficial to test the capability of progressively finer MNWP models to reproduce relevant wind speed distribution. The principal questions we adress here are i) whether is the two-parameter Weibull PDF appropriate to fit wind speed frequency distributions in different climate regions and ii) are MNWP models of different horizontal resolution or forecasting setups reliable tool for estimating the wind energy potential at locations without measurements?

To answer the above raised questions we have used 10 m wind speed measurements from several stations in different climate regions and wind forecasts from ALADIN MNWP model with 8 km horizontal grid spacing in period 2010-2012. Those forecasts were further refined to 2 km grid spacing using i) full-physics model and ii) so-called dynamical adaptation method (DADA) over subdomain that covers broader area around Croatia. Weibull PDF parameters for modelled and measured data were estimated using maximum likelihood method, while goodness of fit was performed with Chi-squarre, Kolmogorov-Smirnov and Anderson-Darling tests.

Two-parameter Weibull PDF has proven to be unsuccessful in describing measured and modelled wind speed frequency distributions at the majority of stations. However, using the wind speed frequency histogram method we have found that ALADIN 8 km forecasts can be used as reliable tool for estimation of wind energy potential in flatter continental part of Croatia, while the same applies to DADA 2 km forecasts in steeper coastal part.