Geophysical Research Abstracts
Vol. 13, EGU2011-10735, 2011
EGU General Assembly 2011

Dynamical downscaling of wind speed in complex terrain of Croatia

Kristian Horvath, Alica Bajić, and Stjepan Ivatek-Šahdan
Meteorological and Hydrological Service, Department for research and numerical modelling group, Zagreb, Croatia

The global model reanalysis, forecast or climate data needs to be downscaled to provide information for regional interpretation. This is especially true in complex terrain of Croatia, where a significant portion of wind energy potential is related to wind systems resulting from interaction of the mountains and the atmosphere, such as bora winds.

Dynamical downscaling was performed with the use of ALADIN model, driven by the ERA-40 reanalysis, at 8 km horizontal grid spacing during a 10-yearly period (1992-2001). Thereupon, a simplified and cost-effective model version, so-called dynamical adaptation, was carried out with a 1-hourly frequency at 2 km horizontal grid spacing. Complimentary statistical and spectral verification, performed on a number of surface stations in different climate regions of Croatia, suggested that downscaling was successful. The greatest average wind speeds are associated with areas where gap flows and gravity-wave breaking take place during bora flows. Systematic errors of 10-m wind speed are close to 1% in flat terrain and reach up to 10 % for coastal stations in the vicinity of Dinaric Alps, the latter due to underestimation of the strongest wind speeds. The shape of kinetic energy spectrum follows theoretical considerations regardless of the season and generally relaxes towards the orography spectrum as approaching the ground. Near the surface, divergent flows show more energetic than rotational at wavelengths smaller than 200 km. The main improvement of the both mesoscale model versions is found for diurnal circulations, while for smaller frequencies dynamical adaptation shows beneficial primarily for winds in cross-mountain direction determined by the strong pressure gradient over the mountain range. Due to underestimation of energy of sub-diurnal motions, further improvement of wind resource assessment in complex terrain may be achieved through the use of higher resolution numerical modeling.