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Wind energy in a changing climate

A.M.R. Bakker and J. Bessembinder
KNMI, climate services, De Bilt, Netherlands (bakker@knmi.nl)

For the planning of new wind farms it is essential to have a good idea of the expected wind yields for the first 10 years. To acquire funding, however, it is just as important to have insight in the full uncertainty of the estimated 10-year energy yields. This uncertainty is partly caused by natural variability and partly by limited information about the PDF of possible 10-year yields.

In practice, the expected yield (p50), some lower limit (p90) and their ratio are often investigated. These characteristics are frequently estimated, from wind records of limited length. Yet, wind climate is usually subject to large annual and decadal variability. As a consequence, the uncertainty can be very large.

It appears that in large parts of Northwestern Europe, a strong linear relation exists between monthly wind yields and monthly average geostrophic wind speed (Ugeo).
This relation enables to estimate long potential wind yield records by simple statistical downscaling. Subsequently, the long yield records can be used to narrow the uncertainty and thus, to reduce the ratio p50/p90.

In addition, this statistical downscaling procedure provides an easy way to estimate monthly potential wind energy yields from GCM's. This is very useful in the assessment of future changes in expected energy yields as well as in the ratio p50/p90 in different climate scenarios.