Zephyr: Wind Forecasts for Energy Applications
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Introduction
The objective of this research is to get the best possible wind forecasts for the wind energy industry using dynamical and statistical post-processing methods.

Zephyr Forecasts

Dynamical Downscaling
The European Centre for Medium-Range Weather Forecasts produces an ensemble of 51 global forecasts twice daily. In the Zephyr project we are downscaling these ensembles to a region around Ireland using two Limited Area Models (LAM's), WRF and COSMO.

Statistical Downscaling
Using Bayesian Model Averaging (BMA) these forecasts are further downscaled to specific wind farm locations around Ireland.

Verification
Our results are then compared to observed windspeeds to determine their accuracy.

Zephyr Domains

Where the weight, \( w_k \), is the posterior probability of forecast \( k \) being the best one, based on its relative performance over a training period.

EnsembleBMA Package
We are using a contributed R package developed by Fraley et al. known as ensembleBMA. This package takes probabilistic forecasts and performs ensemble post-processing via Bayesian Model Averaging.

Summary
Accurate forecasting of available wind energy is crucial for the efficient management and use of wind power in the national grid.

We are developing the BMA technique to obtain more accurate, site specific wind forecasts for Irish wind farms.

References


How does BMA work?
The BMA predictive probability density function (PDF) is:

\[
p(y | f_1, \ldots, f_K) = \sum_{k=1}^{K} w_k h_k(y | f_k),
\]