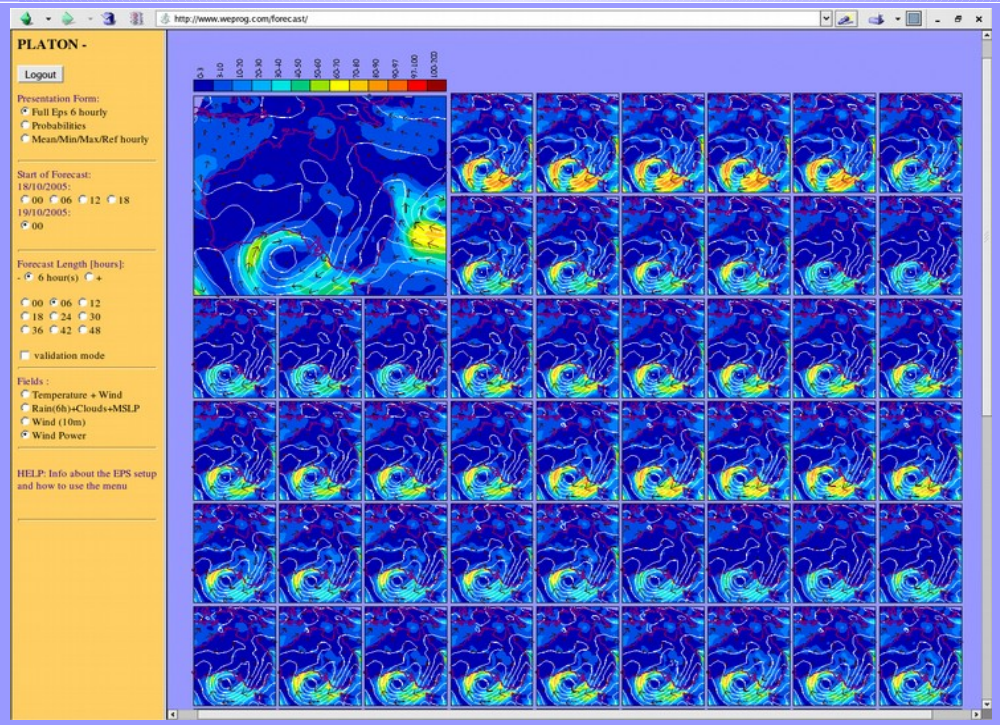
## About us

WEPROG is providing real-time ensemble predictions to the wind energy community and weather forecasts to companies that can improve their efficiency by knowing the uncertainty in the weather and/or specific weather parameters.
Weprog has developed a unique operational short-range ensemble prediction system and is founder of the MSEPS project, which further develops the prediction system and provides data and support to R&D projects.
WEPROG operates and maintains several hundred processors that are continuously producing forecasts. Real-time products are available four times per day (00h, 06h, 12h,18h) and up to 7 days ahead on all continents.



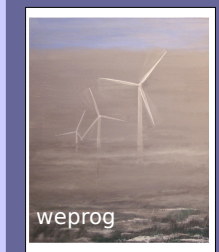

Windpower forecast for Australia (19. Oct 2005). The figure is a screenshot of the graphical user interface, where the large figure on the top left is the Ensemble mean, the small figures display 48 of the 75 individual forecast. The figures on the front page show an example of the entire Ensemble for North America with all 75 forecasts + the Ensemble mean and a probability distribution of the forecasts.

## Contact us for more information:


***Weprog GmbH Germany***
***Dr Corinna Möhrlen***
Eschenweg 8
71155 Altdorf
Germany
Tel. +49 (0)7031 41420
com@weprog.com

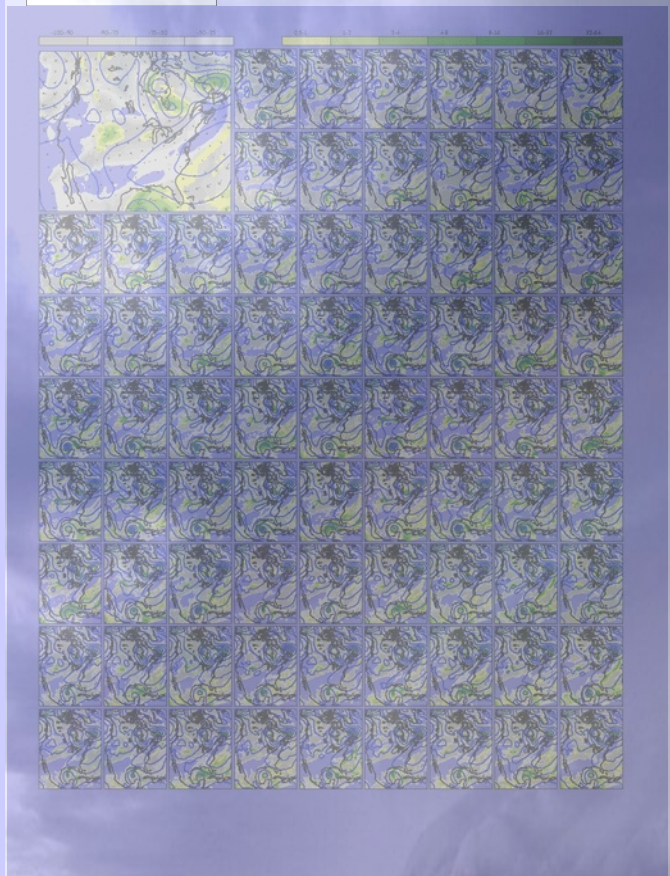
www.weprog.com
APP: weather.weprog.com
info@weprog.com

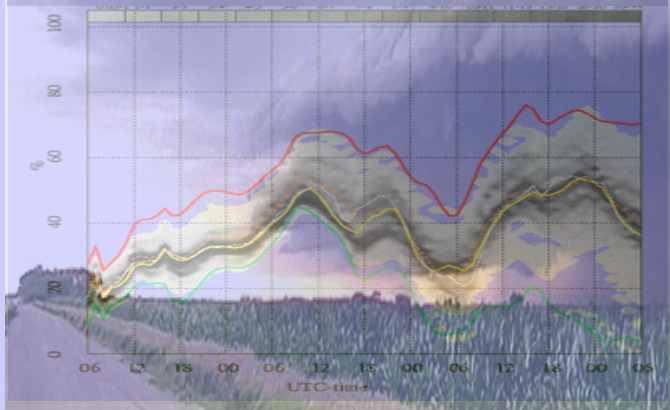
***Weprog ApS Denmark***
***Jess U. Jørgensen***
Drejervænget 8
5610 Assens
DenmarK
Tel: +45 4692 2907


# Weather & Energy PROGnoses

inclusive physical uncertainty from Ensemble Predictions






www.weprog.com

## Why Ensemble Predictions ?

**The background**

the weather changes fast between predictable and non-predictable

subjective methods are not sufficient to estimate predictability

the commercial world suffers from various prediction mistakes

**The method**

run a large number of different model configurations

evaluate the uncertainty directly on the final product

**Real time Ensemble Predictions**

Computation demanding and expensive

technically demanding to administrate

**Ensemble Predictions are a natural evolution**

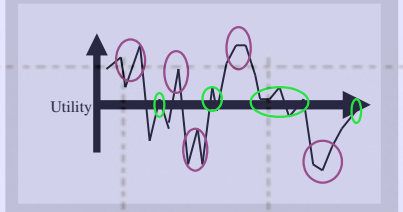
saves labour

allows the expert end-user to take the right decision

increases safety

reduces the economic loss

**Daily error of a 24 hour 00UTC forecast during 1 month**




**The goal is to accuately predict when the forecasts are in the green areas to make wind energy also "green"**

**The forecast error is random and so far very unpredictable**

**The error is partly local and partly large scale**

## The Application Difficulty

**How can the Ensemble Replace the Deterministic Forecast** ?

End users are used to work with one value from deterministic models - for backward compatibility the Ensemble also needs to have a final product

The Ensemble mean is better than a single forecast, but also smoother

All members are independent and selected by quality

The democratic approach, believe in the majority at any time

But we also need continuity in the decision process!

**Solution: Probabilistic Multi Trend Filter (PMT-filter)**

Member equality is default, but the filter allows to set weights on each member

Provides an implicit solution taking the entire ensemble time series into account

Uses also recent observations, if available

Creates easy to interpret graphical presentation of the full ensemble

**Power Curve Shape Generated Problems**

Ensembles have together a positive bias near and under the cut-in wind speed

Ensembles have together a negative bias near and above the full-load wind speed

Ensemble mean in wind speed is not always the best choice when converted to power

# What is the Multi-scheme Ensemble prediction system (MsEps) ?

The Multi-scheme Ensemble prediction system (MsEps) is an integrated weather forecasting system in which traditional weather forecasting, Short-Range Ensemble Prediction, graphical presentation and other applications such as wind power prediction are combined. This system is not limited to usage for weather prediction nor to any of its applications. Currently work is ongoing in a number of disciplines, such as wind power and hydro energy to take advantage of the additional information that the MsEps system provides in comparison to other weather prediction systems.

The MsEps systems target is to generate the best forecasts and especially probabilities of the evolution of the local weather. This is fundamentally different from Global Ensemble forecasts in lower spatial resolution provided by the five largest Meteorological Centres in the world. Such forecasts give a valid probability at day 3-10 (medium range), but suffer from accuracy at forecast day one and two. In addition the Ensemble Spread is often too large and leads to too much uncertainty measured in wind power, as an uncertainty in wind increases non-linearly with the steepness of the power curves. The MsEps system produce less ensemble spread because initially smaller differences are growing in the forecast step, which is opposite to the medium range ensemble prediction systems, where the differences are added only at the outset of the forecast.

The MsEps contains 75 Ensemble members, which are individual forecasts referred to as “members”. They are formed with a multi-scheme approach. This means that each forecast member comprises a different set of equations for certain physical or dynamical processes (called the “parameterisation schemes”). The difference in the equations leads to different methods of solving these equations and thereby different end results. Because all the equations used are describing the same processes, but vary in their assumptions to make them solvable, they in fact describe the physical uncertainty of the weather forecast.

The multi-scheme approach is a very powerful approach in short-range ensemble prediction, as it has the same advantages as the so-called multi-model approach, but without its disadvantages: The multi-scheme approach, like the multi-model approach, creates an uncertainty of the forecasts, that has a physical meaning. The disadvantage of the multi-model approach is the enormous task of maintaining many different forecasting systems and the lack of knowledge about the exact differences of the models. This is not so in the multi-scheme approach, where only selected parts of the forecasting system differ. This eases the maintenance of the forecasting system and enables one to create many more meaningful forecasts (ensembles) than with individual model systems.