

EWEC 2009 – Marseille, France

SafeWind

Wind power forecasting for extreme situations

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ARMINES

**MINES
ParisTech**

Context – Research in Wind Power Forecasting

- Latest European Projects

ANEMOS : FP5, 2002-2006

Meteorology



**Wind power
forecasting technology**

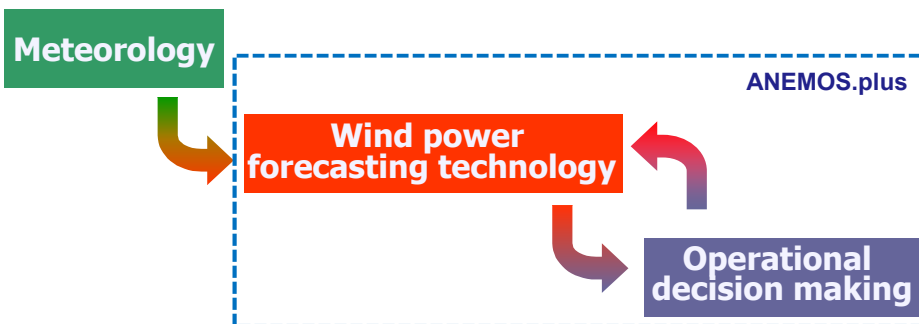


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ANEMOS.plus : FP6, 2008-2011



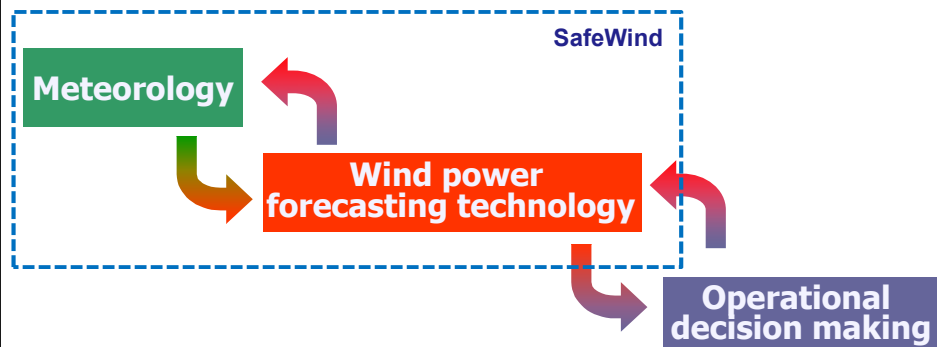
Context – Research in Wind Power Forecasting

- Latest European Projects

ANEMOS : FP5, 2002-2006

SAFEWIND : FP6, 2008-2012

ANEMOS.plus : FP6, 2008-2011



The SafeWind Consortium

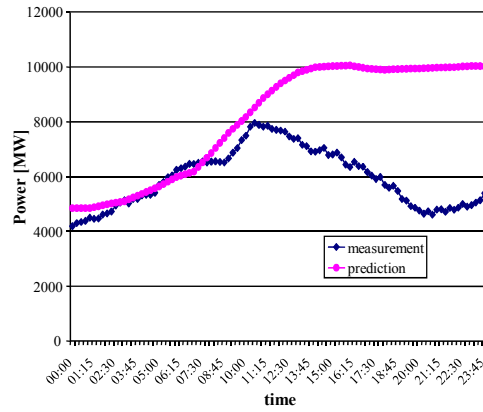
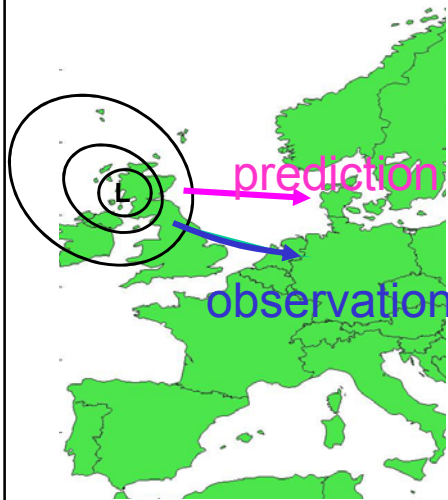


SafeWind objectives

First step : Definition & identification of extremes :

- **Extreme meteorological events**
 - High wind speeds (cut-off events)
 - Thunderstorms
 - Consider regional effects
- **Extreme forecasting errors**
- **Extreme small scale events (Remote Sensing)**
- **Errors with an extremely high impact in the grid management or market participation.**
 - Costs (Balancing, intraday markets)
 - Grid congestion
 - Connector capacity
 - Coincidence with load, ramping capabilities
- ...

Example: low pressure took path further to the South

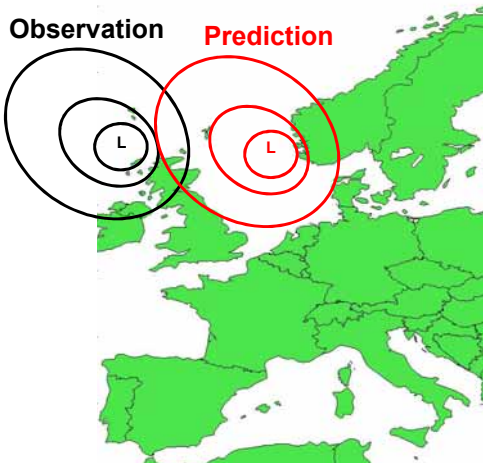


Predictions for Germany : Path of low pressure system was different than predicted, maximum error: 5500 MW could have been avoided by extreme event correction.

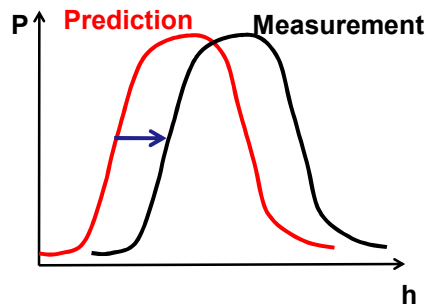
Source : Emsys



Example: Phase error in ramp events



Movement of low or fronts faster/slower



Source : Emsys



SafeWind objectives

Improve wind predictability with focus on **extremes** :

- at various **temporal** scales
 - Very short-term (order of 5 min)
 - Short term (hours to days)
 - Longer term (beyond few days ahead)
- at various **spatial** scales :
 - **local scale**: Extreme gusts or shears.
 - **regional scale**: Extreme events (like thunderstorms) can cause the loss of significant amounts of wind energy with potential impact on the grid management.
 - **continental (European) scale**: Extreme weather situations (like fronts) can propagate causing impacts in different member states.

SafeWind objectives

- Models for "**alarming**": **very short-term (0-6 h)**.

- Develop methods to adequately monitor and assess the **wind energy weather** situation over Europe in order to **detect severe deviations** in the wind power forecast due to extreme events.
- React on such deviations by **issuing suitable alerts** to users that a forecast error is occurring.
- **Produce improved updates** of the prediction in the short-term

SafeWind objectives

- Models for "**warning**": providing information for the level of predictability in the **medium-term** (next day(s)).
 - Such tools, based on ensemble weather forecasts and weather pattern identification, can be used to moderate risks in decision making procedures related to market participation, reserves estimation etc.

SafeWind objectives

- Develop a "**European vision**" for wind power forecasting
 - Prepare the way for the coordinated management of 100+ GW wind generation at European Scale.



i.e. Data from Synoptic Stations in Europe

Creation of a Data Information System for centralising information useful for

- large scale forecasting and
- continuously monitor "energy weather" over Europe

SafeWind objectives

- Develop research in meteorology oriented to wind forecasting.
 - Improve ensemble forecasts (wind & wind power) (i.e. ECMWF's Ensemble Prediction System (EPS))
 - Evaluate various EPS configurations
 - Produce optimally combined forecast products

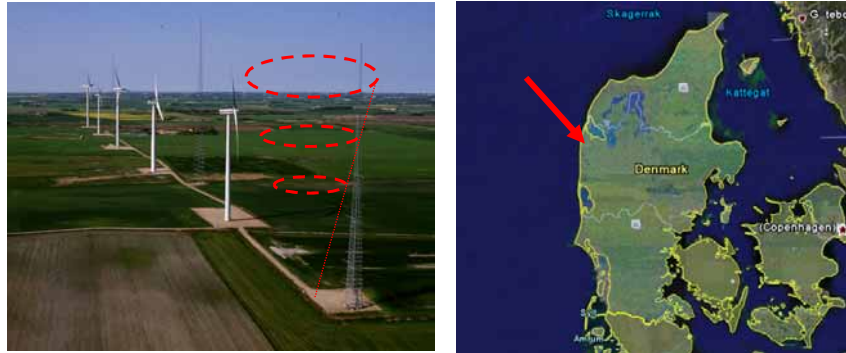
SafeWind objectives

- Link resource assessment to wind predictability.

- Analyse how **new measurement technologies** like Lidars can be beneficial for better evaluation of external conditions, resource assessment and forecasting purposes.

SafeWind objectives

Planned measurement campaigns at flat (DK) and complex (ES) terrains



Høvsøre Large Wind Turbine Test Facility



SafeWind objectives

- Develop research in meteorology orientated to wind forecasting.
- Link resource assessment to wind predictability.
- Analyse how **new measurement technologies** like Lidars can be beneficial for better evaluation of external conditions, resource assessment and forecasting purposes.
- Demonstrate the operational benefits from new models.



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Conclusions

- The SafeWind project develops synergies among different disciplines and actors to improve actual wind power forecasting technology;
- The work methodology is designed to enable quick transfer of results for operational use by industrial stakeholders.
- Expected impact :
 - Economy :
 - Increased competitiveness of wind energy in markets
 - Reduced project risk due to better site selection
 - Technology :
 - New or improved software tools
 - Better "operational" decision making for wind energy management
 - Maintain excellence of European R&D in the field

www.safewind.eu



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Thank you for your attention



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