SafeWind End-users workshop

"Towards Improved Wind Power Forecasting Technology with Focus on Extremes"

2 March 2012, Fredericia, DK

SafeWind End-users Workshop, 2nd March 2012, Energinet, Fredericia (DK)

Overview of the SafeWind Project

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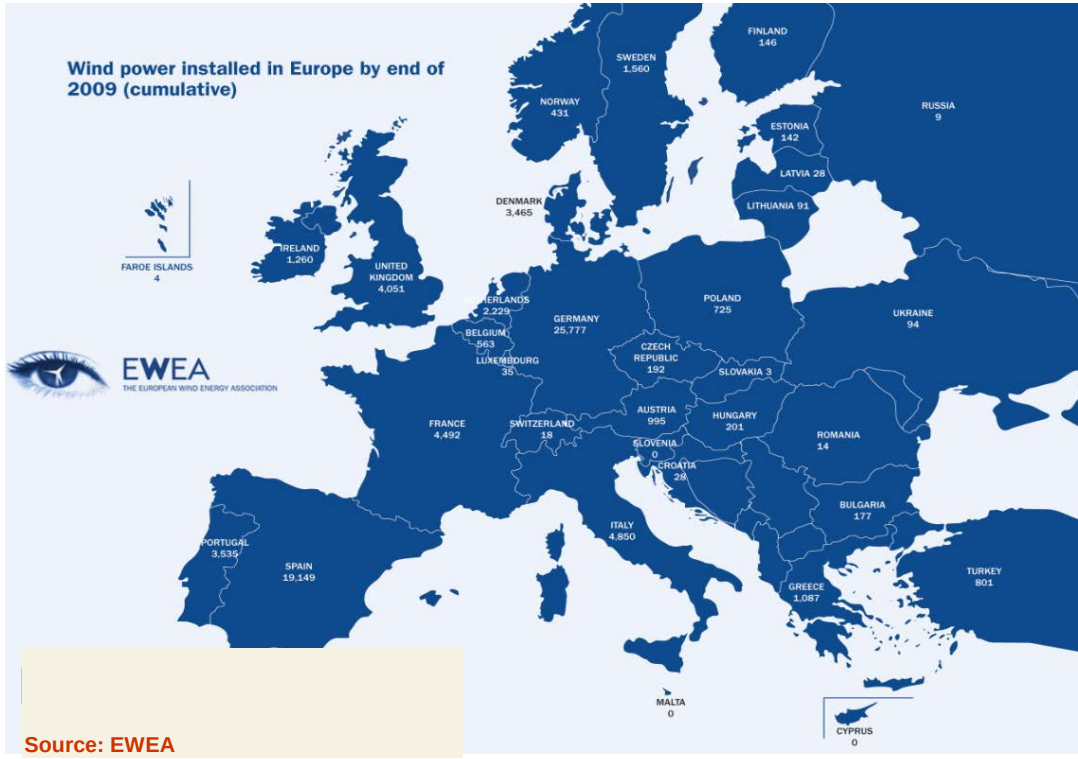
Introduction

2002 **20 GW**

2010 **74.7 GW**

2020 **230 GW (!!)**



Source: EWEA

Challenges

- **Reliable large-scale integration**
- **Economic and secure management of a power system**
- **Competitiveness of wind energy in a liberalised electricity market**

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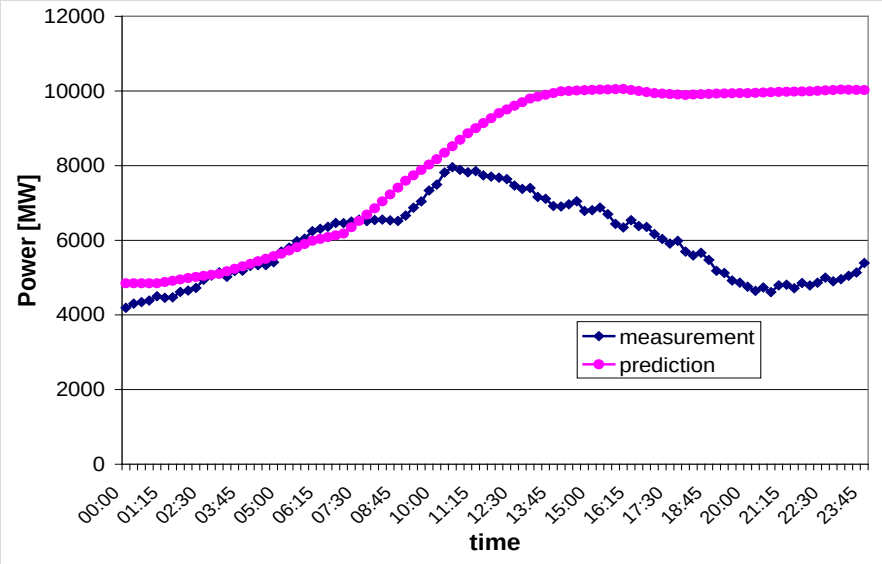
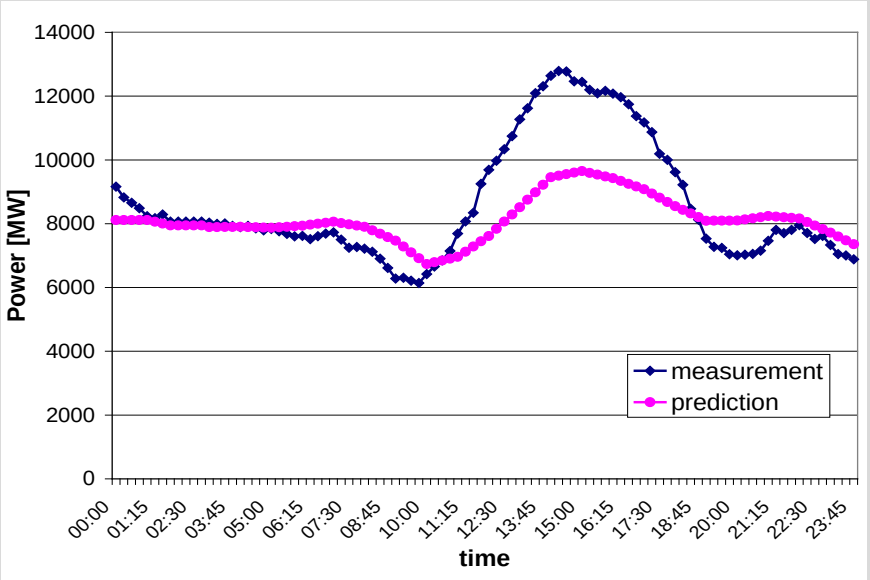
Introduction

- Short-term forecasting of wind production is recognised as a prerequisite for efficient management of wind generation.
- The actual wind power forecasting technology is quite mature.
- However, in some situations forecasting errors may have an important impact on the power system operation (security, economics,…)



(A) Path of low-pressure system was different than predicted, maximum error: 5500 MW could have been avoided by extreme event correction.



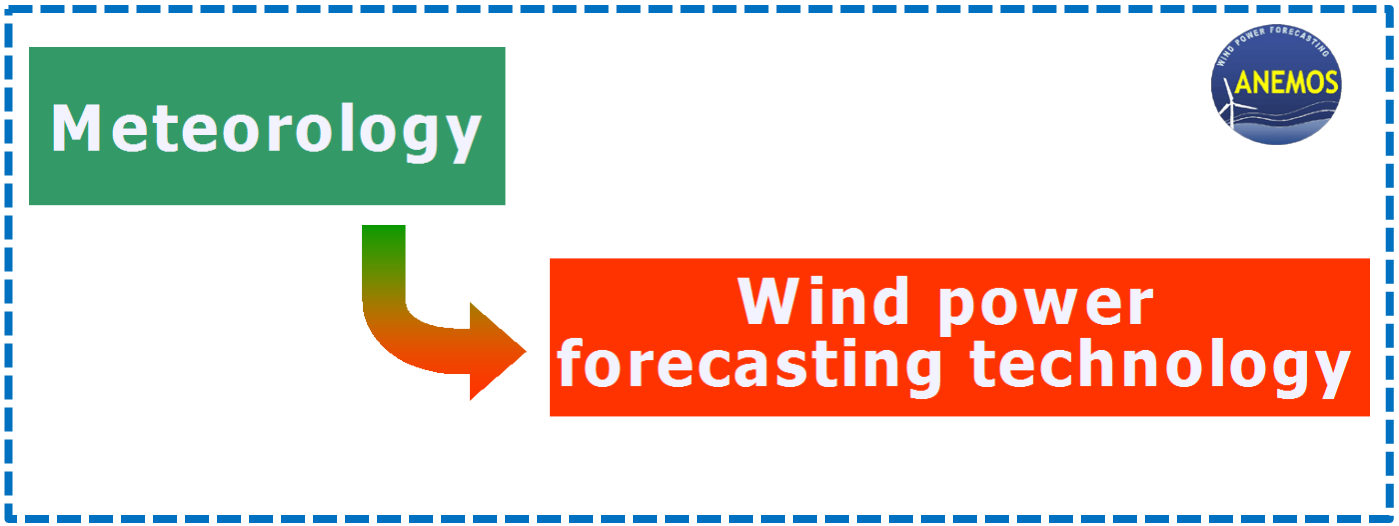
(B) Unexpected rise in pressure gradient in high-pressure situation. Maximum error: 2300 MW could have been avoided.

Research in Wind Power Forecasting

- Considerable research carried out in the last 20 years

HIGHLIGHT PROJECTS :

ANEMOS : FP5, 2002-2006



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ANEMOS : FP5, 2002-2006

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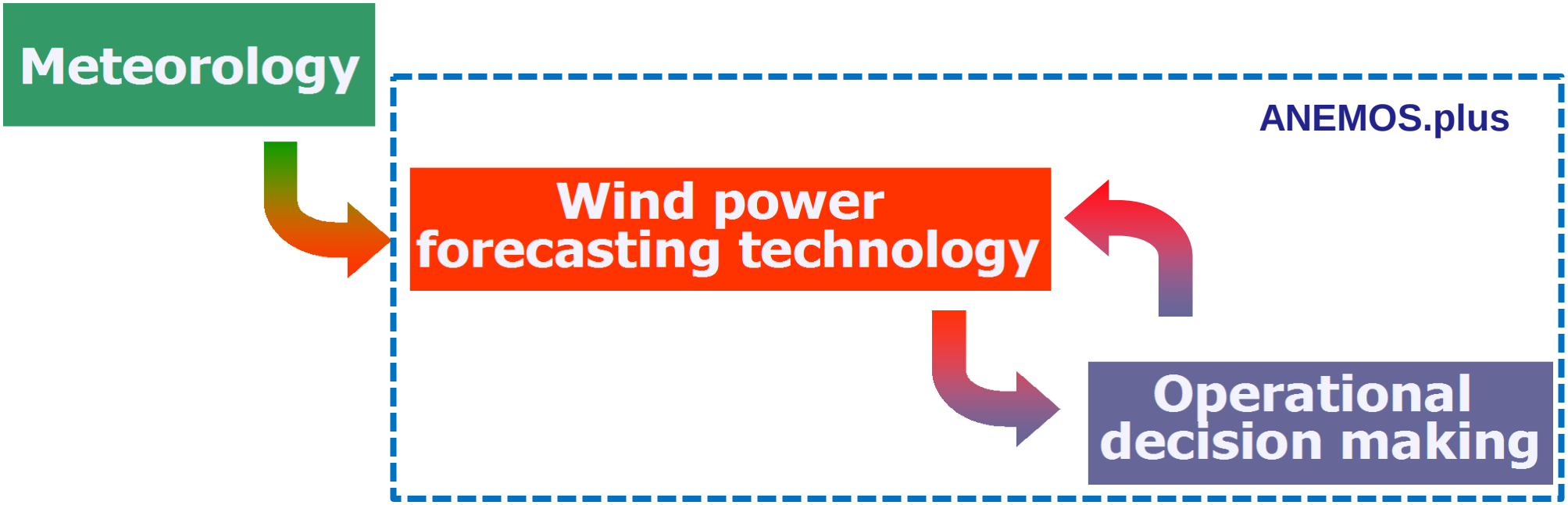


Research in Wind Power Forecasting

- Considerable research carried out in the last 20 years

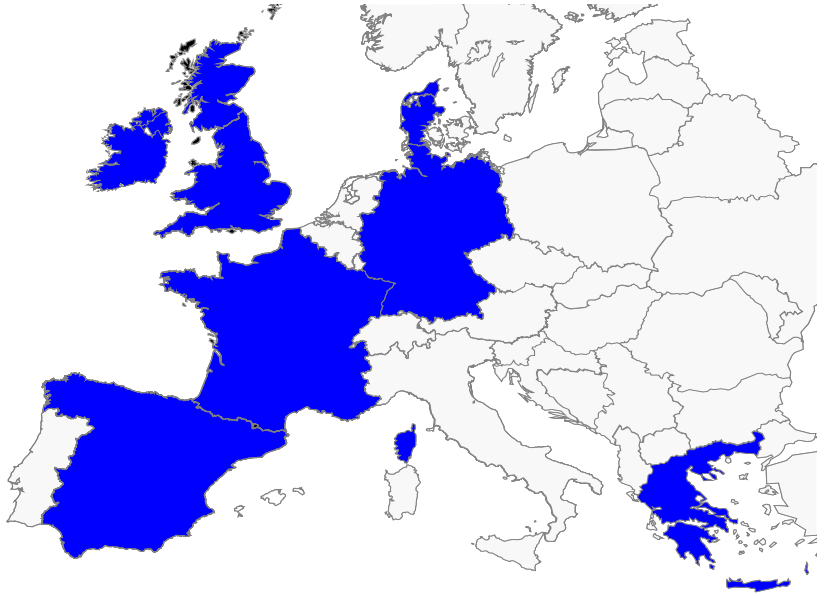
HIGHLIGHT PROJECTS :

ANEMOS : FP5, 2002-2006

SafeWind : FP7, 2008-2012

ANEMOS.plus : FP6, 2008-2011

The SafeWind project



INTERNATIONAL, INDIA

2008-2012

9 countries, 22 partners

End-users

Industry

Research

Universities

Meteorologists

SEVENTH FRAMEWORK PROGRAMME

Budget: 5.6 Mio€

Duration: 4 years

Resources: 512 PMs

Vision of SafeWind

Contribute to a smooth and smart integration of large shares of wind power into European power systems.

Prepare the way for the coordinated management of 200.000+ MW wind generation at European Scale.

Towards breakthroughts in wind power forecasting.

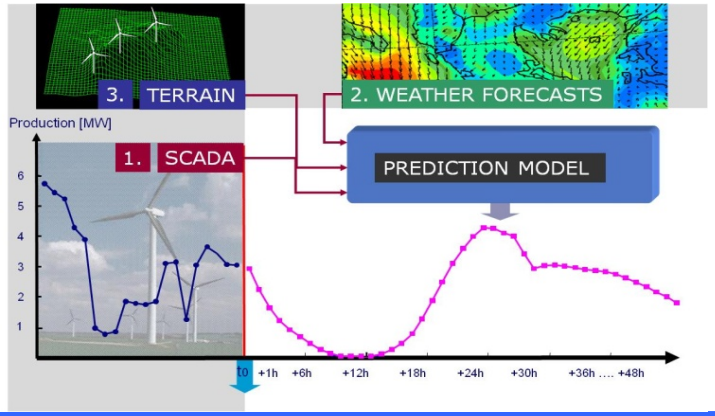
- Significantly reduce error
- Contribute to the "3% vision" of TPWind.

Therefore, TPWind proposes an ambitious long-term '3% vision'. Current techniques must be improved so that given the geographic coordinates of any wind farm (flat terrain, complex terrain or offshore; or in a region covered by extensive data sets or largely unknown), predictions **with an uncertainty of less than 3%** can be made concerning:

- the annual energy production ('resource')[5];
- the wind conditions that will affect the design of the turbine ('design conditions'); and
- a short-term forecasting scheme for power production and wind conditions.

Vision of SafeWind: create the path

Deterministic approaches

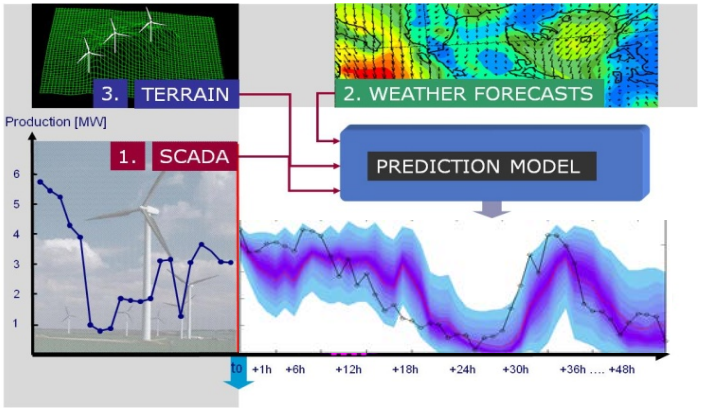


Next generation of tools

Diversify predicted information

Portfolio of products

1990 2002 Anemos 2008 SafeWind 2012



Probabilistic view

?

Scientific & Technical Objectives (1)

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.

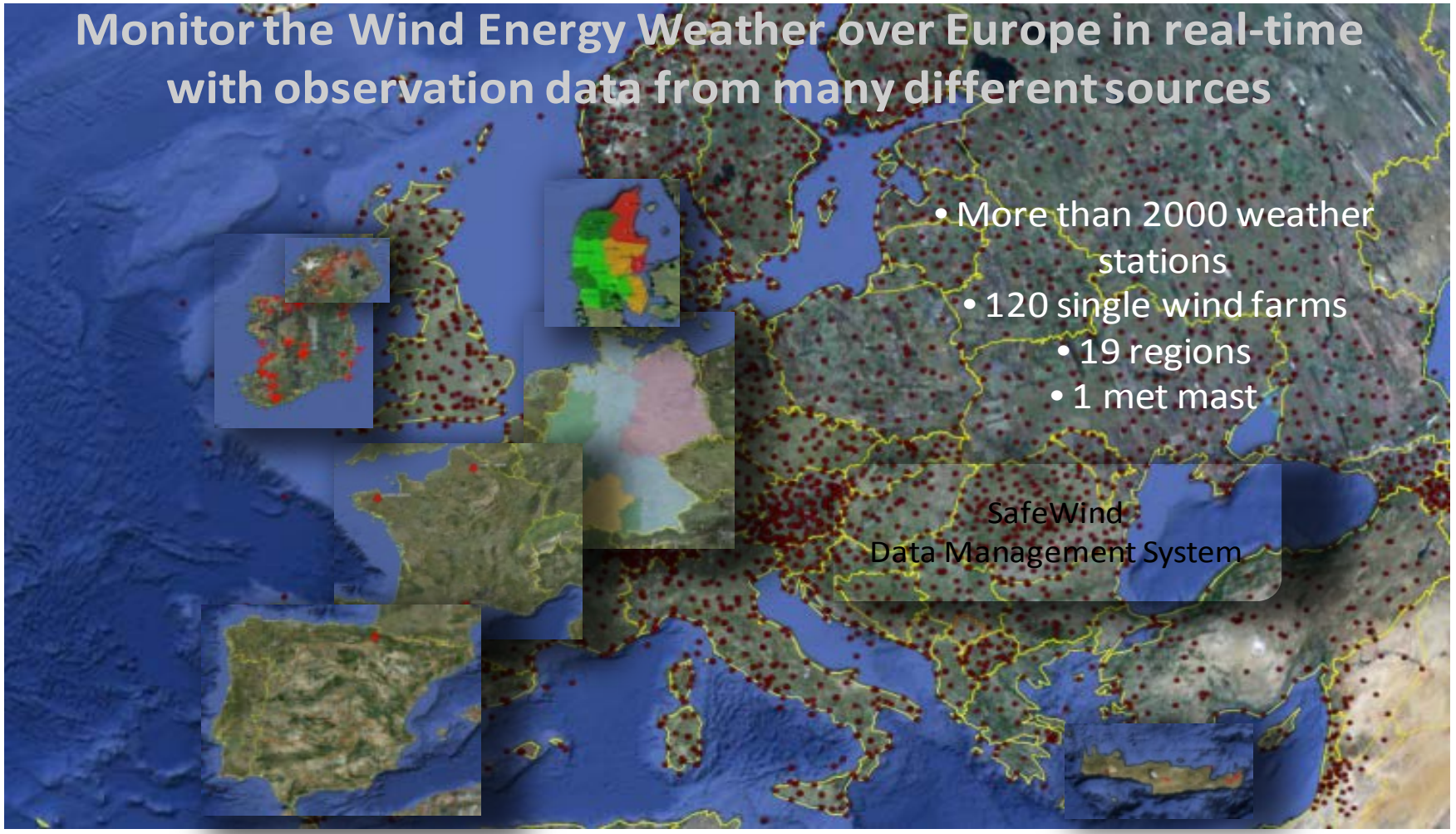
Scientific & Technical Objectives (2)

- New **forecasting** methods for wind generation focusing on uncertainty and challenging situations/extremes;
- Models for "**alarming**": providing information for the level of predictability in the **very short-term**.
  - They use near-real time online observations for alerts on potential extreme prediction errors and for immediate updates of short-term (0-6h) wind power predictions on regional and local scale;
- 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.

Scientific & Technical Objectives (3)

- Develop a **European vision** for wind power forecasting
- 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.

Example results

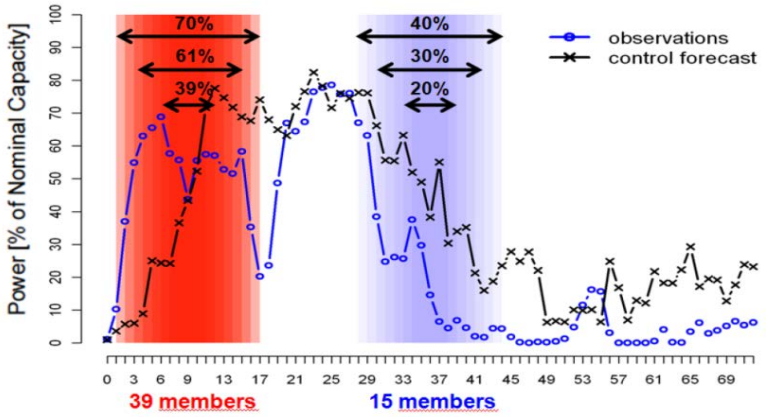


Example results

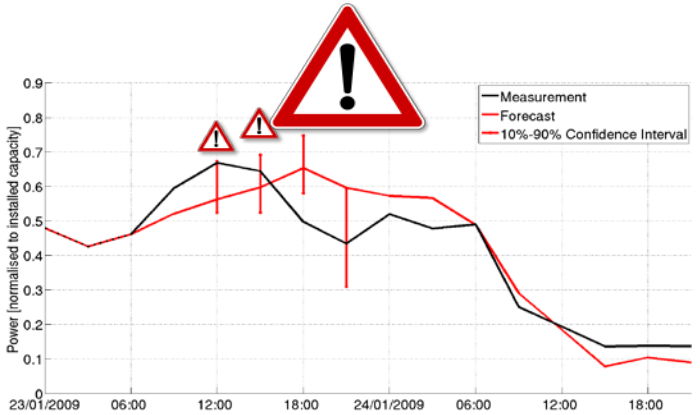
Høvsøre Large Wind Turbine Test Facility

Lidar measuring campaigns at flat terrain (Denmark) and complex terrain (Spain)

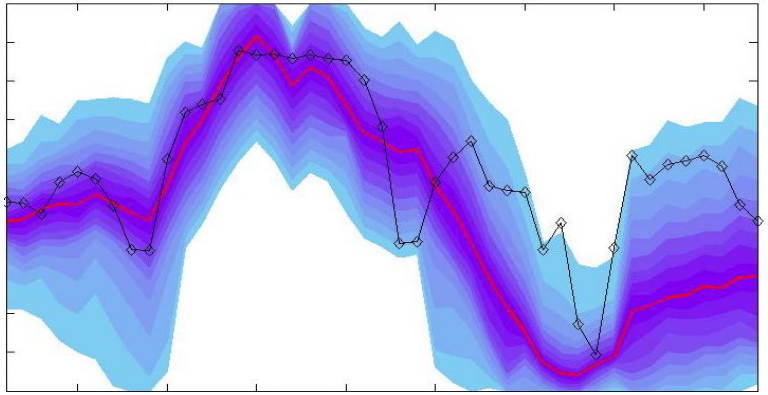
Example results



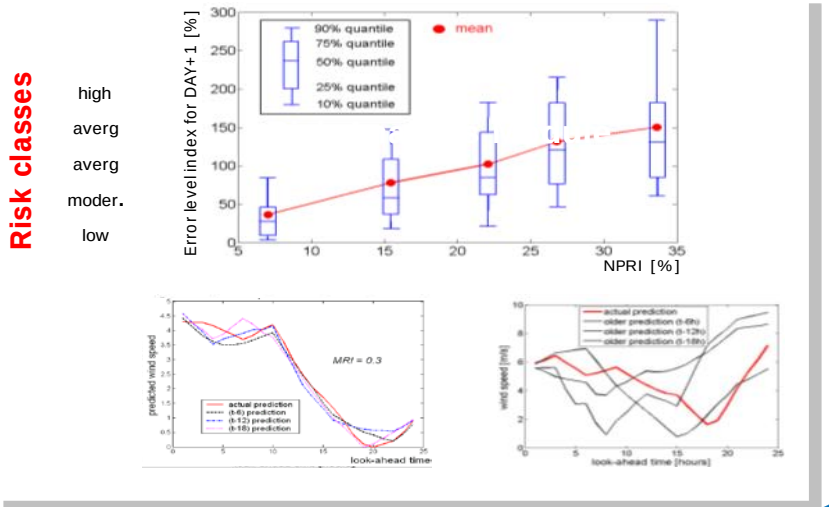
Ramps forecasting



Large error alerting



Improved probabilistic predictions



Prediction risk indices

FINAL Project Workshop: 31 August 2012, Paris

Thank you for your attention

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Overview of the needs

Forecasts of the production of the wind farms for the near future (hours, days) and estimations of the uncertainty are needed :

TSO, DSOs

- For **economic dispatch (**set points to conventional units and wind farms**)**
- **Scheduling/Unit commitment of the power system generators**.
- **Planning reserves to compensate wind fluctuations.**
- **Congestion management**
- **Planning the use of energy (hydro) storage.**
- **Planning power exchanges/flows/maintenance with interconnections.**

IPPs, etc

- **Planning maintenance of the wind farms for the next days (offshore).**
- **Making bids in an electricity market**
- **etc.**