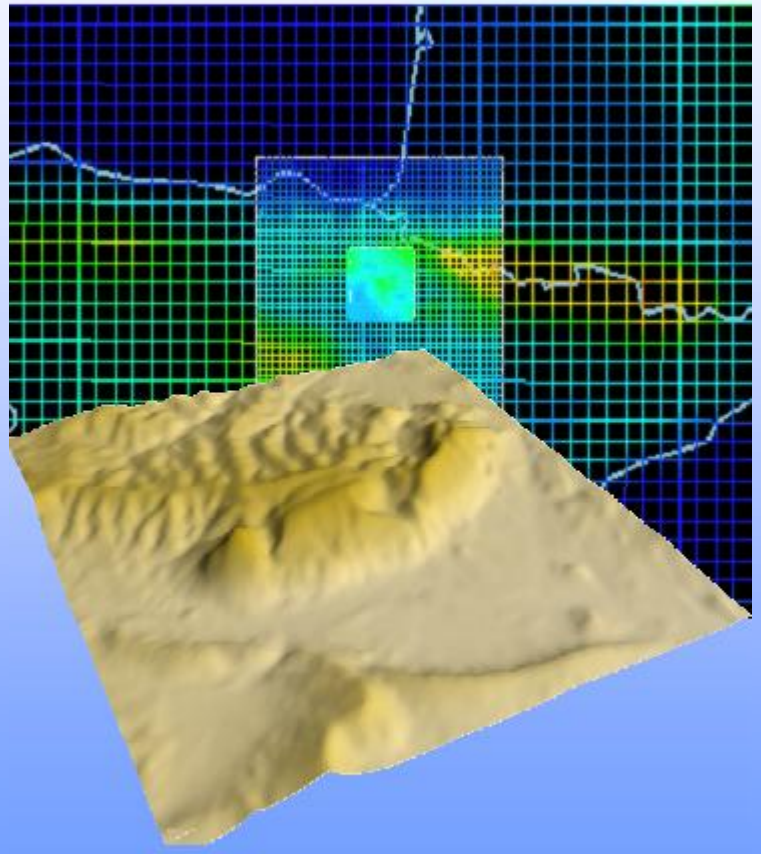
EUROPEAN COMMISSION
Community research



Next Generation Wind Power Forecasting.

Overview of the Anemos Project.

George Kariniotakis,

Ecole des Mines de Paris, France

georges.kariniotakis@ensmp.fr

European Wind Energy Conference

Athens, 27 Feb. – 2 Mar. 2006.

The Consortium

2002-2006

7 countries,
23 partners

End-users (8)

Industry (3)

Meteorologists (2)

Research (5)

Universities (5)

Coordinator:
Dr. George Kariniotakis,
Ecole des Mines de Paris,
ARMINES,
France.

Context of the Project

Ambitious targets for wind energy in the EU* :

2005	2010	2020
40.5 GW	75 GW	180 GW

(*) European Wind Energy Association

However…..

CHALLENGE **Wind is a highly fluctuating resource.**

ANEMOS **Forecasting** contributes to an **economic** and **secure large-scale wind integration in a power system**.

Context of the Project

Ambitious targets for wind energy in the EU* :

2005	2010	2020
40.5 GW	75 GW	180 GW

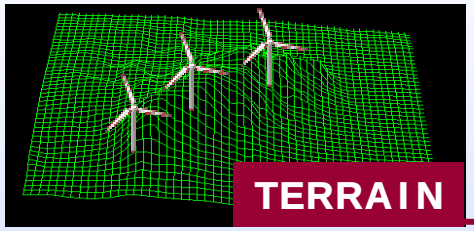
(*) European Wind Energy Association

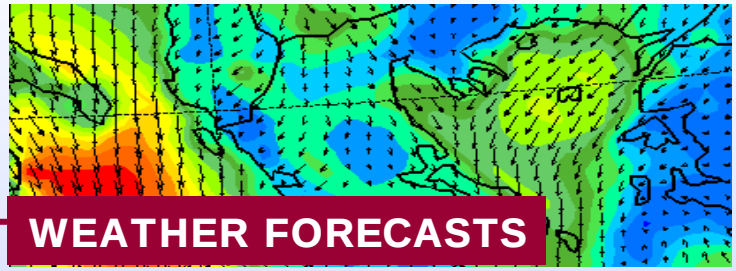
But also…

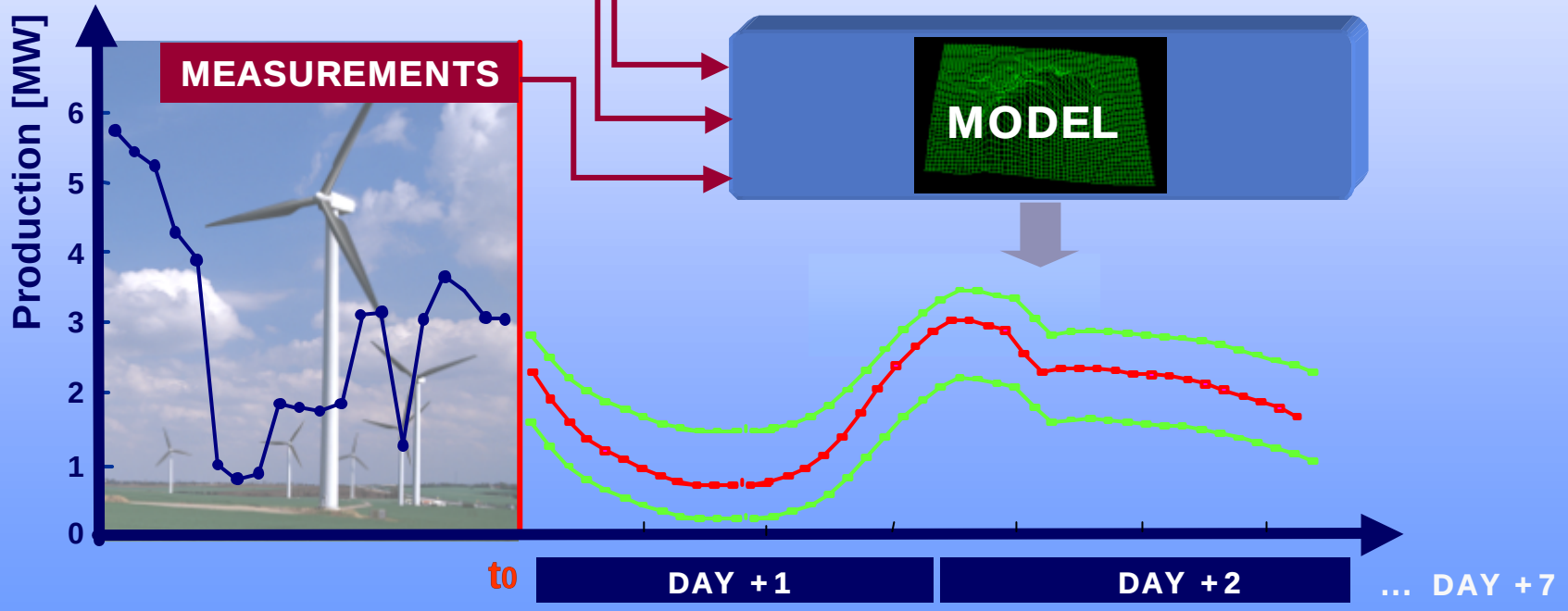
CHALLENGE **Deregulation of electricity markets.**

ANEMOS Forecasting **enhances competitiveness** of wind power compared to other forms of dispatchable generation.

The Principle



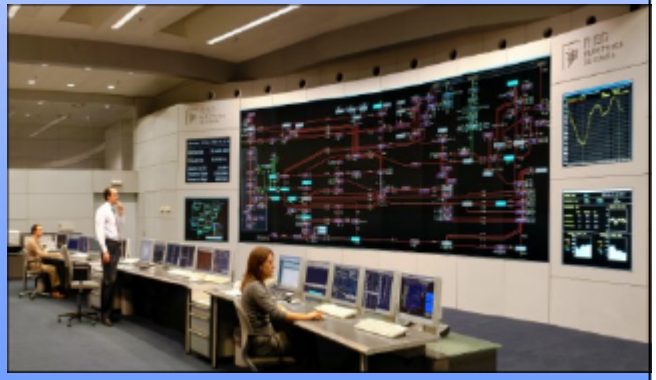




The Project Objectives

- **Accurate short-term forecasting** of wind parks production up to 2-3 days in advance especially for:
  - complex terrain (not easy to predict...),
  - extreme weather conditions (cut-off risk)
  - offshore (high impact to the grid)

- **Demonstrate the economic and technical benefits** from the use of wind prediction tools at national, regional or single wind farm level.



R&D Approach

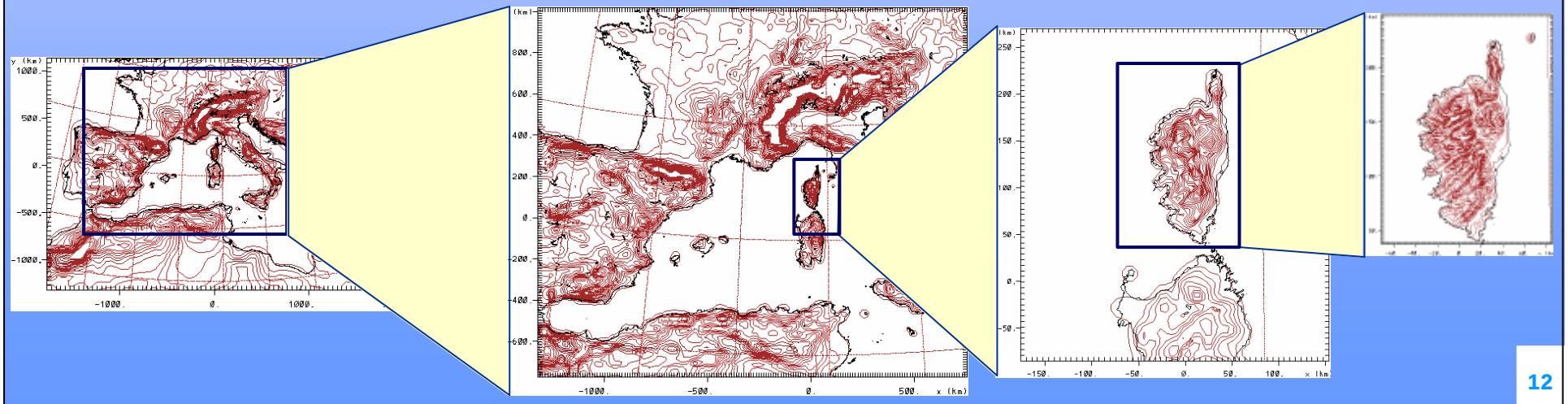
- Broad analysis of needs
- Interaction with research in meteorology
- Pre-standardisation
- Benchmarking of 10 state-of-the-art prediction systems plus models developed in Anemos.

R&D Approach

- **Research on two mainstream approaches:**

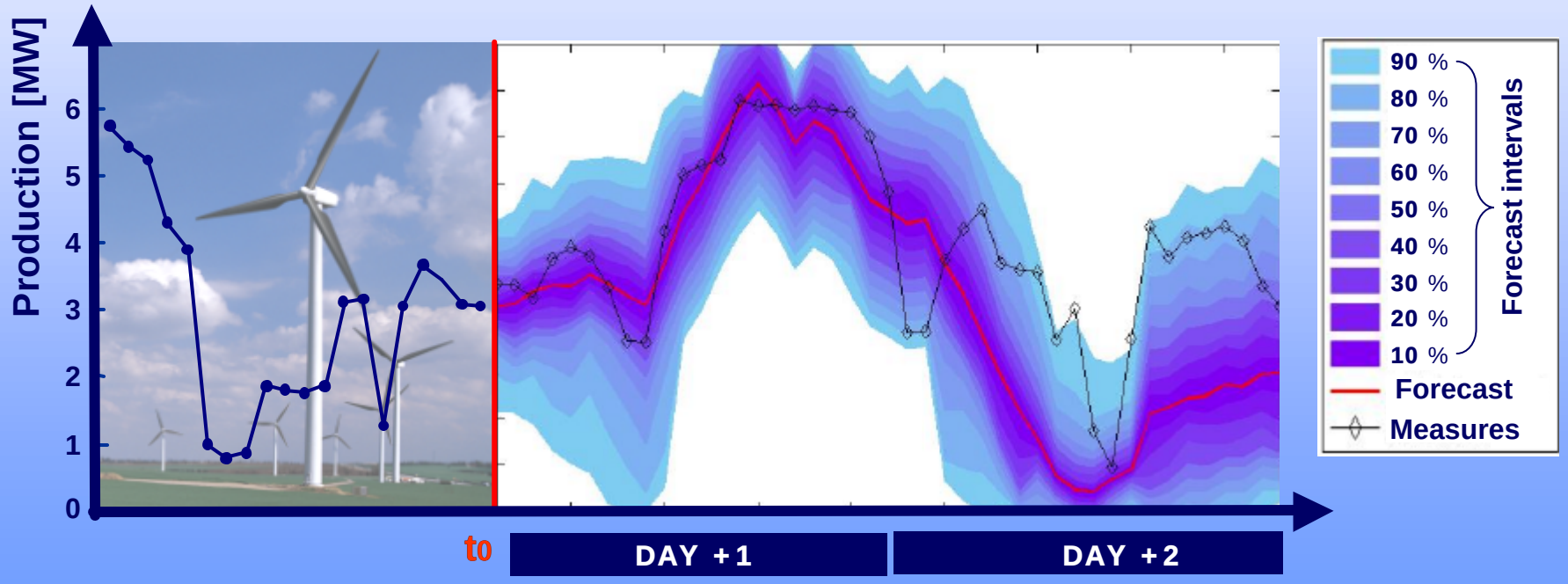
statistical — models try to represent the information in the available data (*i.e.* artificial intelligence techniques)

physical — models try to represent the physical laws (*i.e.* modelling of wind flow on the terrain)



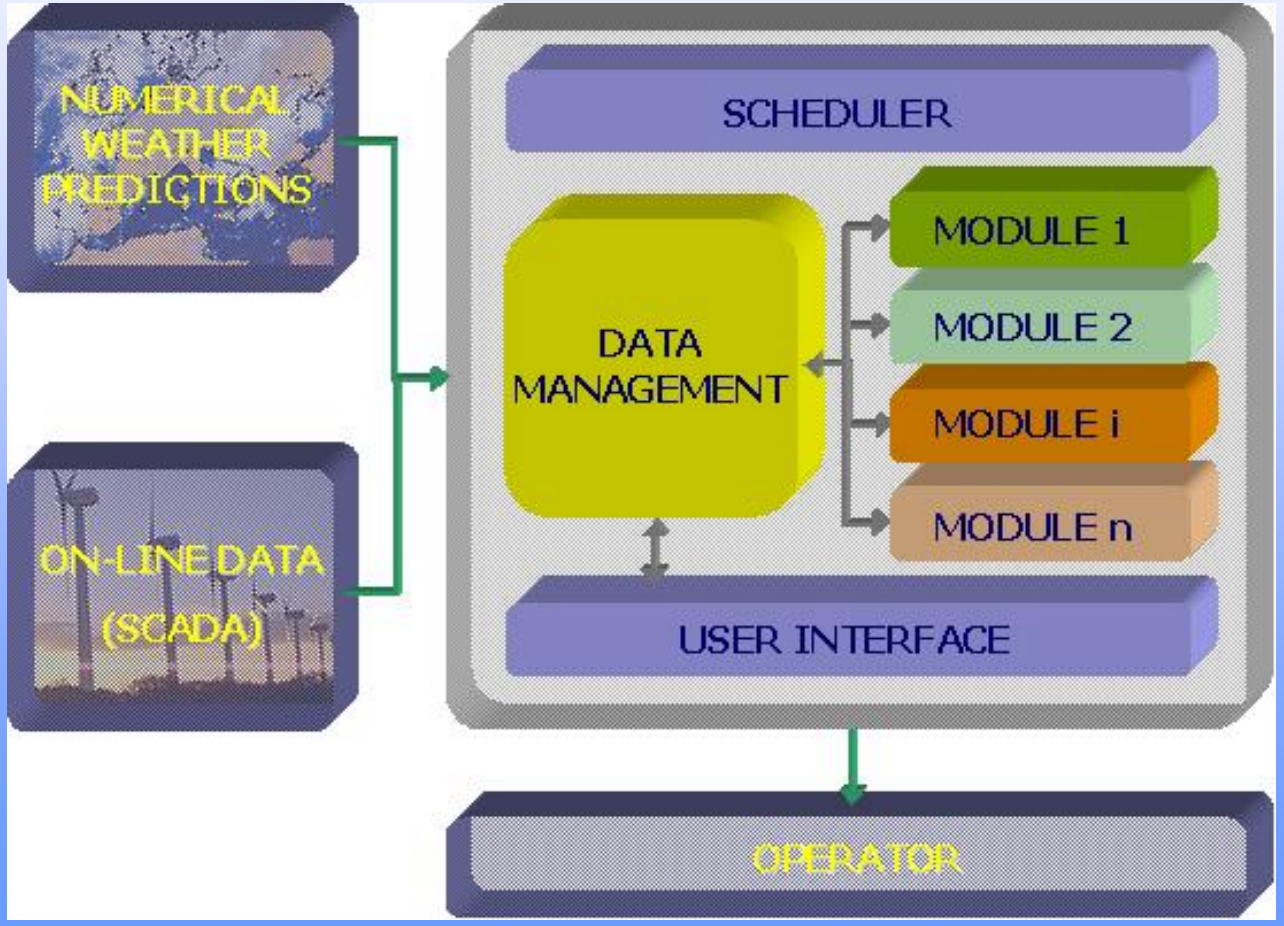
R&D Approach

- **Emphasis on modelling uncertainty in predictions**



R&D Approach

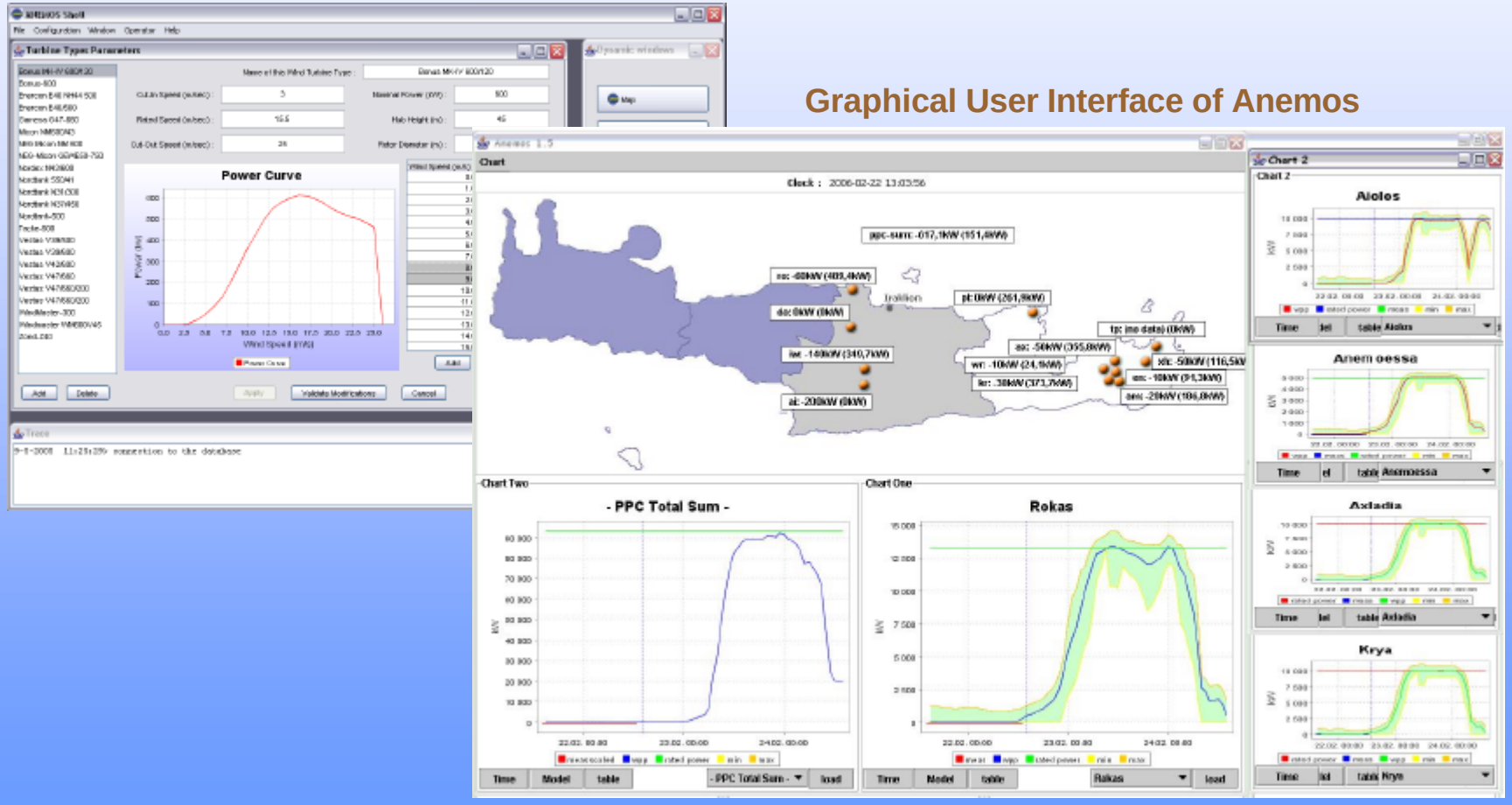
- **Developement of an advanced prediction platform**



Generic configuration of the platform.

R&D Approach

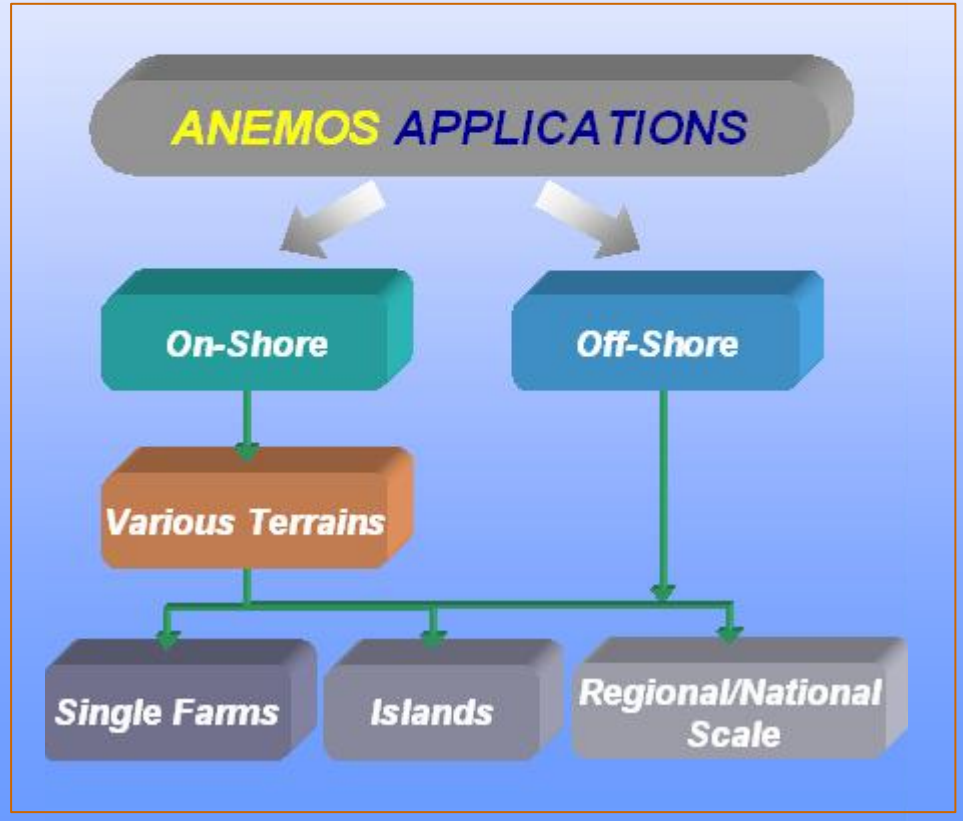
- **Development of an advanced prediction platform**



Graphical User Interface of Anemos

R&D Approach

- **Installed in 7 countries for real-time operation.**



Denmark

France

Germany

Greece

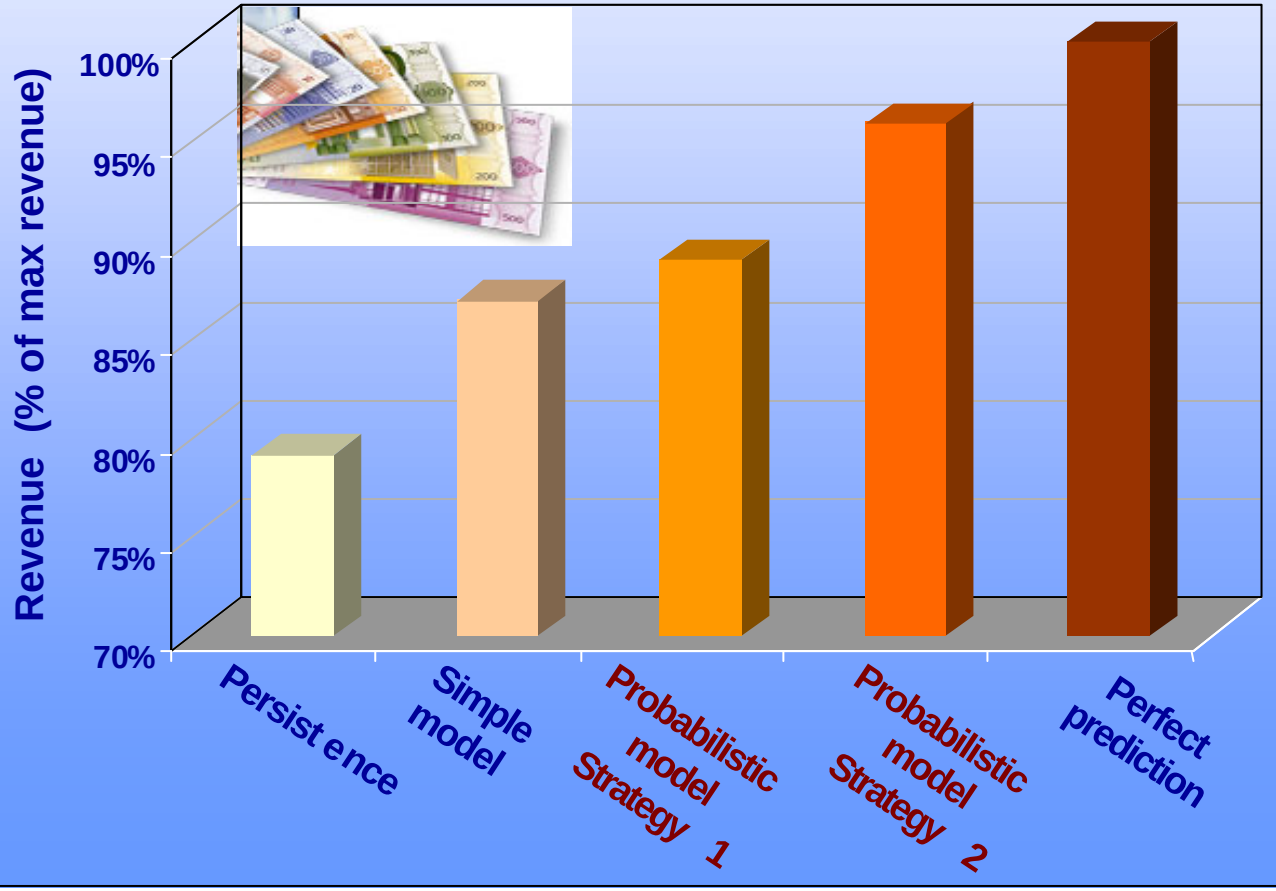
Ireland

Spain

UK

R&D Approach

- **Demonstrate the value of wind prediction**
  - Trading example: Increase benefits by the use of advanced bidding strategies



Impact of the Project

- **Extends technology from :**
  - Deterministic forecasting -> towards probabilistic
  - Classic model chain -> new solutions (combined models, multiple NWPs, ensemble predictions)
  - Accuracy oriented -> Accuracy + value
  - Research tools -> standardized pre-industrial tools

Impact of the Project

- **'Familiarisation' of end-users** with the wind forecasting technology.
- **Accurate 'mapping'** of the wind forecasting technology useful for developping grid and market regulations.
- **New actors** in the marketplace that commercialise the tools:
  - two new spin-off created in DE and DK by partners of ANEMOS
  - Interest from non-EU countries for the ANEMOS products.
  - First commercial installation of Anemos agreed.

Conclusions

- As wind penetration increases, **wind power forecasting** is recognised as a solution for **improving** the **management** of power systems and for **reducing** the **risks** due to variable wind generation in terms of:
  - security of supply
  - public acceptability
  - financial competitiveness

  } higher confidence in wind energy

- The ANEMOS project has managed to provide advanced **operational** wind forecasting solutions and demonstrate the benefits from their application.

Dissemination

- http://anemos.cma.fr

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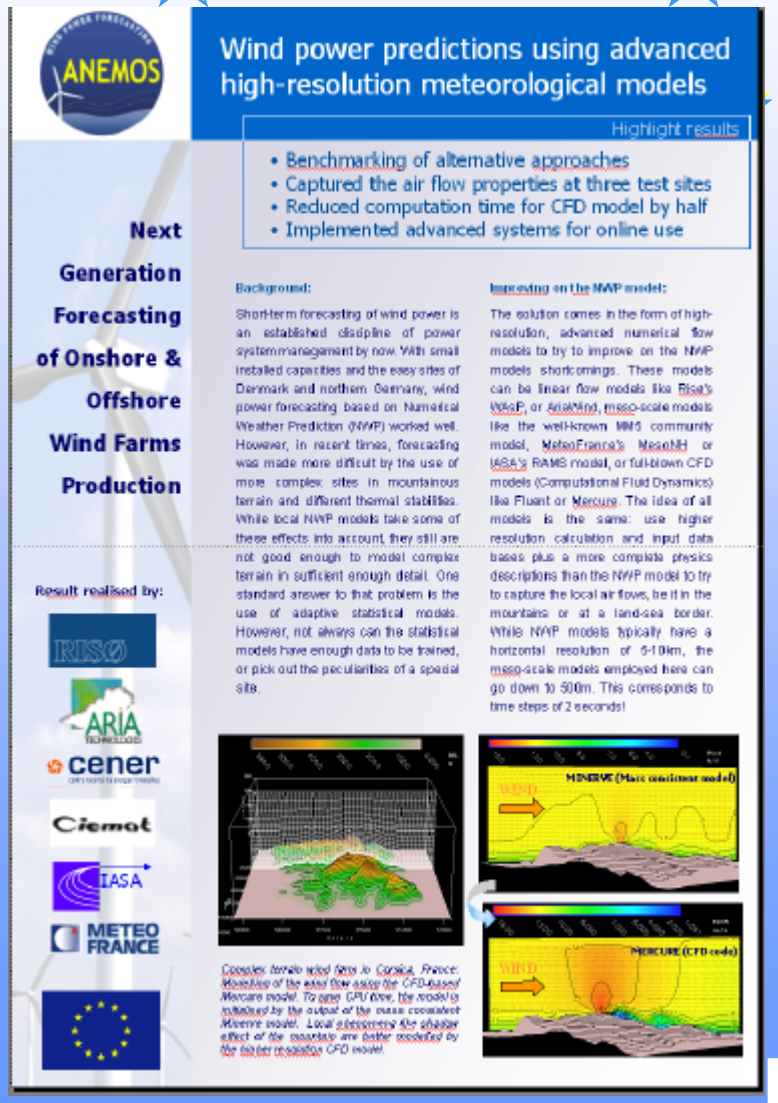
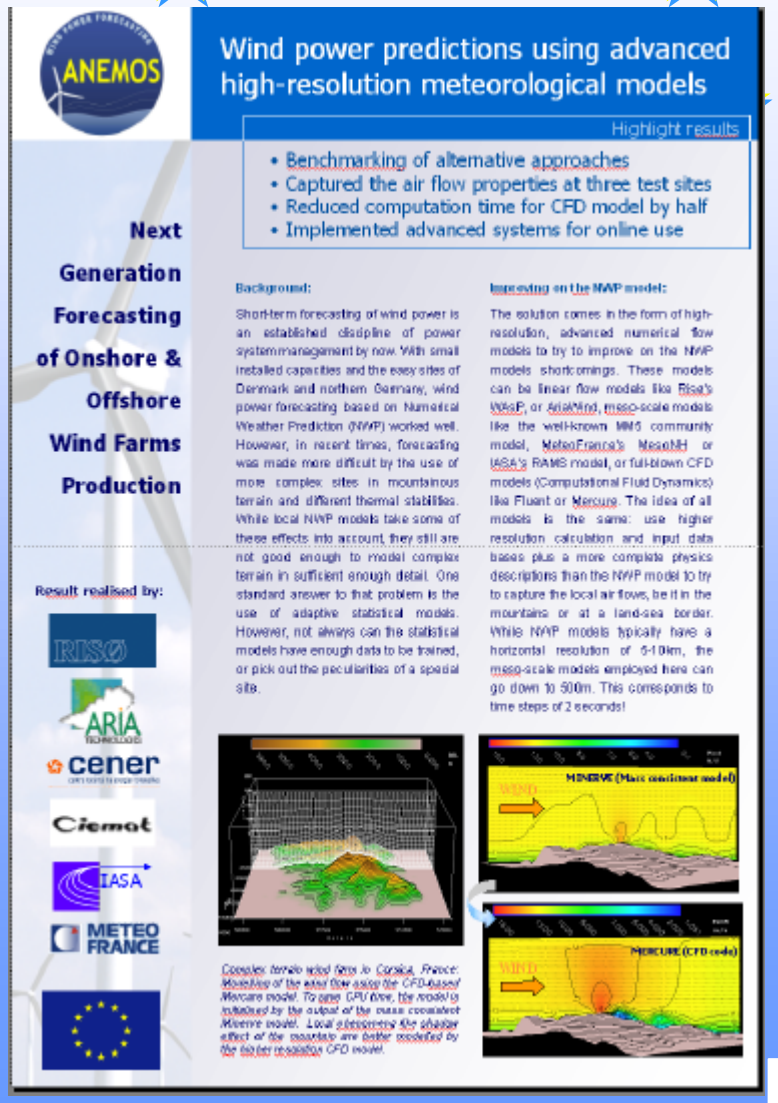
- Highlights



Dissemination

- **http://anemos.cma.fr**
- More than 50 papers
- Highlights
- EES-UETP Course 19-21/6/06
- End-users workshop: (tentative: 7/9/2006)
- EU Project POW'WOW (CA)



The future of wind is...

in the forecast