

# Predicting wind power markets: A new generation of climate risk management tools

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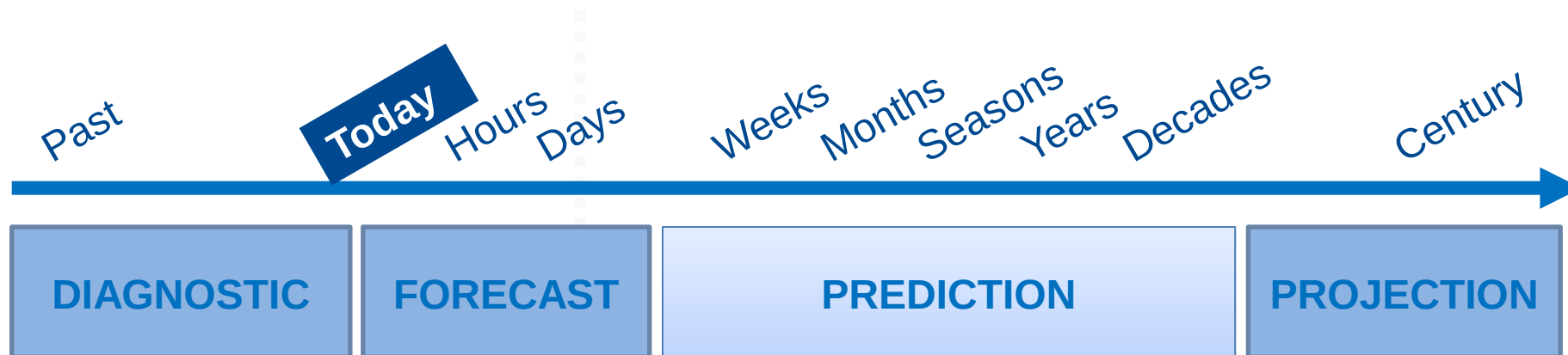
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International colloquium on “Large Wind-power plants: Interaction, control and integration”  
8-10 July 2015, Leuven, Belgium



Worldwide only **IC<sup>3</sup><sub>R</sub>** & **Met Office** work in this timeframe

Partners in European projects (FP7 and H2020) in collaboration with private wind sector (EDPF, Vortex, EDPR...)





**SPECS:** Seasonal-to-decadal climate Prediction for the improvement of European Climate Services

<http://www.specs-fp7.eu/>

**EUPORIAS**



**EUPORIAS:** EEuropean Provision Of Regional Impact Assessment on a Seasonal-to-decadal timescale

<http://www.euporias.eu/>

NEW EUROPEAN WIND ATLAS  
**newa**



**NEWA:** New European Wind Atlas

<http://euwindatlas.eu/>

Wind power markets have traditionally used the **retrospective wind speed climatology**, assuming that the past would also represent the future.

## Hydroelectric power management

INTERNATIONAL JOURNAL OF CLIMATOLOGY  
*J. Climatol.* 27: 1691–1705 (2007)  
Published online in Wiley InterScience  
(www.interscience.wiley.com) DOI: 10.1002/joc.1608



### Forecasting precipitation for hydroelectric power management: how to exploit GCM's seasonal ensemble forecasts

Marta Benito García-Morales\* and Laurent Dubus  
EDF Research and Development Division, Electricité de France, France

García-Morales & Dubus 2007

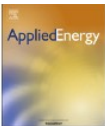
## Electricity demand



Contents lists available at ScienceDirect

Applied Energy

journal homepage: [www.elsevier.com/locate/apenergy](http://www.elsevier.com/locate/apenergy)



Seasonal climate forecasts for medium-term electricity demand forecasting



Matteo De Felice<sup>a,\*</sup>, Andrea Alessandri<sup>a,b</sup>, Franco Catalano<sup>a</sup>

<sup>a</sup>Casaccia R.C., ENEA Energy and Environment Modelling Technical Unit, Rome, Italy  
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#### HIGHLIGHTS

• During the ten years, seasonal climate forecasts have improved their skill.

De Felice, Alessandri & Catalano 2015

## Pre-Construction Decisions: **Annual to Decadal** Timescales

- **Wind farm planners:** Site selection
- **Wind farm investors:** Evaluate return on investments
- **Policy makers:** Understand changes to energy mix

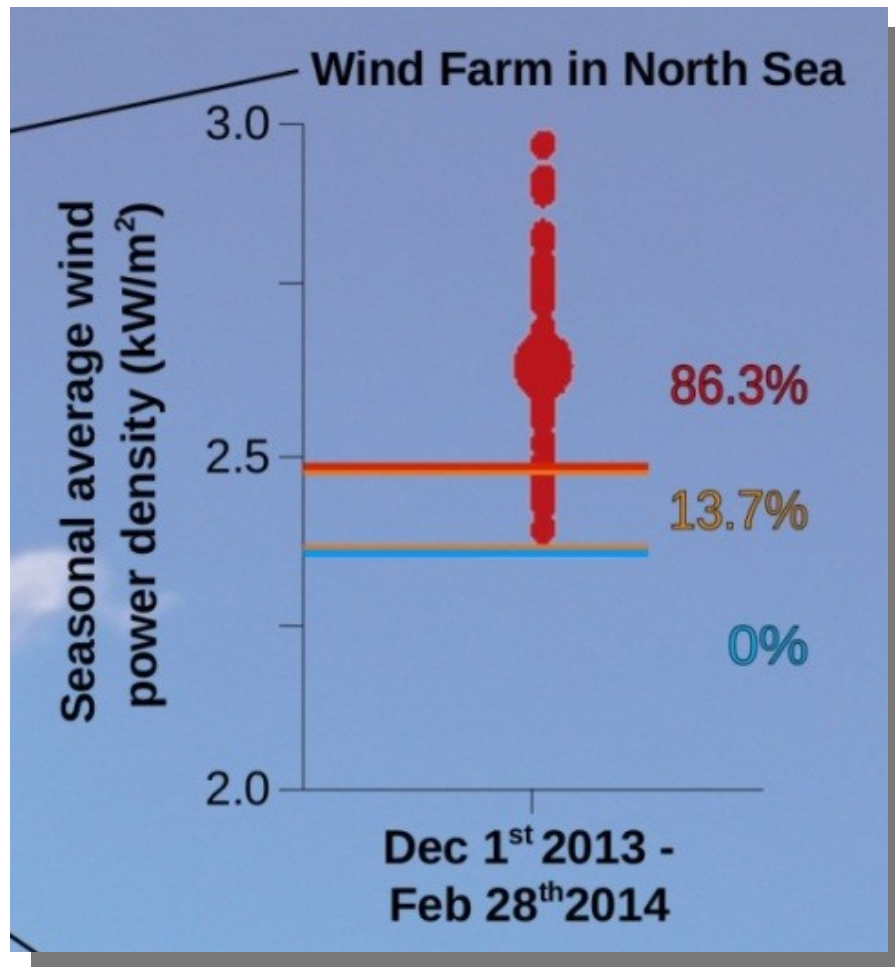
## Post-Construction Decisions: **Monthly to Seasonal** Timescales

- **Energy producers:** Resource management strategies
- **Energy traders:** Resource effects on markets
- **Wind farm operators:** Planning for maintenance works
- **Wind farm investors:** Optimize return on investments

## Climate predictions for wind power markets:

- Wind speed
- Capacity factor
- NAO+ and NAO- seasons and correlation with wind and Capacity factor

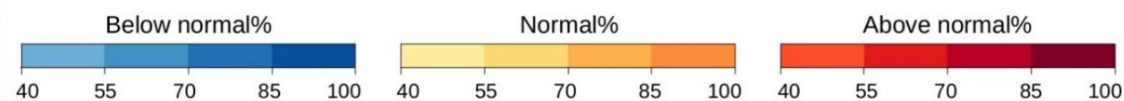
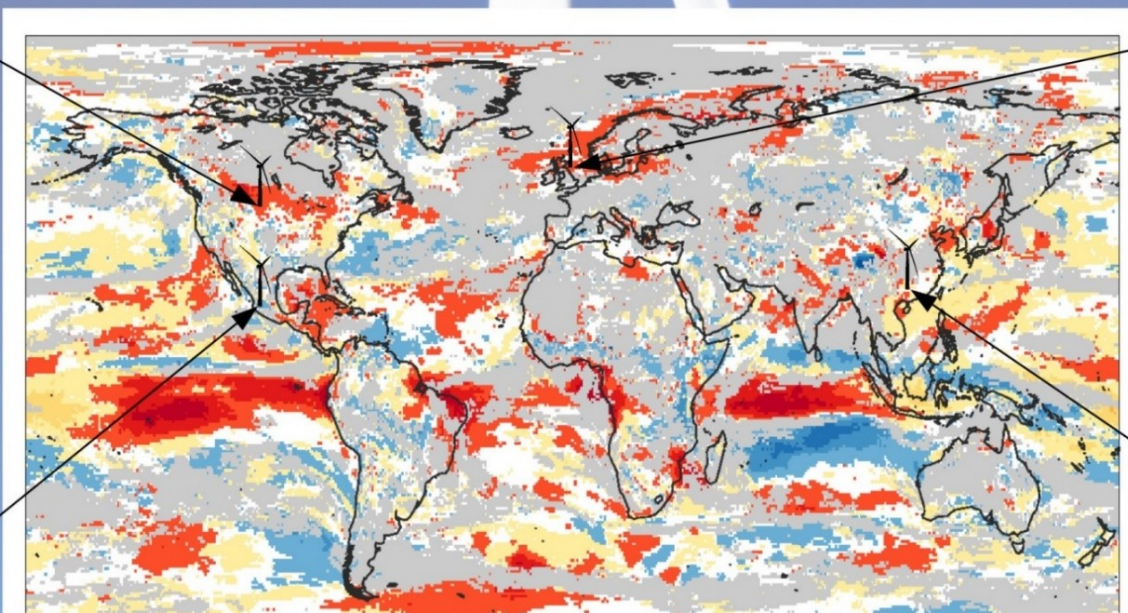
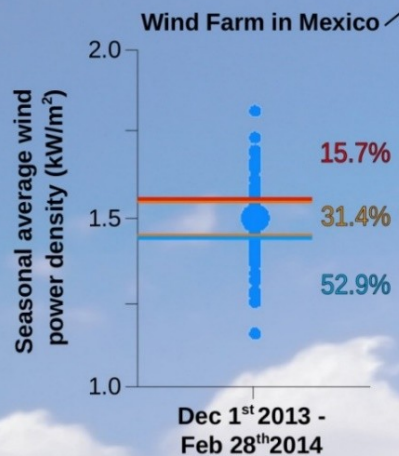
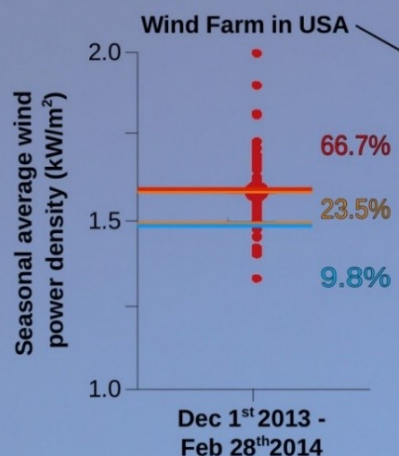
## Seasonal wind power predictions: **probabilistic predictions**



- **We don't provide** deterministic predictions
- Data from **ECMWF** (European Centre for Medium-Range Weather Forecasts)
- We run multiple models and assess the global behaviour providing a **probabilistic predictions**
- Aggregated output in **terciles**:
  - Above normal
  - Normal
  - Below normal

# Seasonal wind power predictions: probabilistic predictions

## Illustrative examples of seasonal wind power predictions

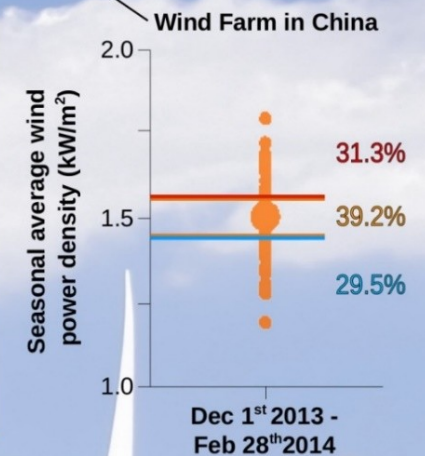
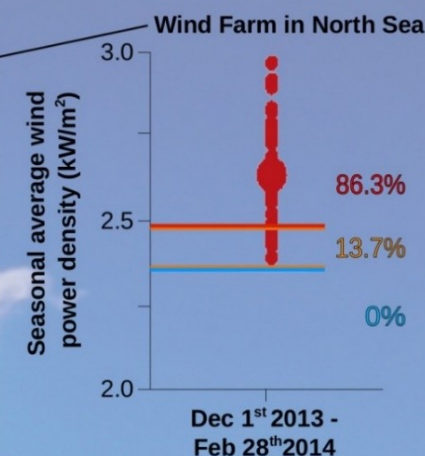


Wind power prediction for December 1<sup>st</sup> 2013 - February 28<sup>th</sup> 2014, issued on November 1<sup>st</sup> 2013.

The most likely wind power category (**below normal**, **normal** or **above normal**), and its percentage probability to occur is shown. "Normal" represents the average of the past 30 years.

White areas demonstrate where the probability is <40% and approximately equal for all three categories.

Grey areas show where the climate prediction model does not improve upon the standard and current approach, which projects past climate data into the future.







# RESILIENCE

PROTOTYPE



EUPORIAS

Aimed at the wind energy sector, RESILIENCE goal is to provide **user-friendly tools** to produce information of the future variability in **wind speed and wind power resources** based on **probabilistic climate predictions**

# RESILIENCE

PROTOTYPE

PROJECT

# UKKO

PROJECT  
**UKKO**

Developed as part of the  
**RESILIENCE PROTOTYPE**  
in the EUPORIAS project

SEASONAL WIND FORECASTS  
FOR THE ENERGY SECTOR



#### WHY?

Weather forecasts predict future wind conditions only in the range of weeks. Climate predictions look at big changes over years and decades. However, for energy traders, wind farm managers and many others, it would be crucial to understand wind conditions in the next few months.

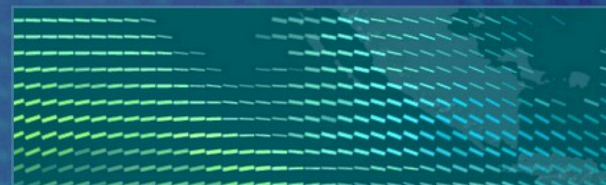
[LEARN MORE](#)



#### HOW?

Based on sophisticated climate models, we are now able to provide new ways to forecast wind conditions in the next few months.

[LEARN MORE](#)



#### TRY IT OUT

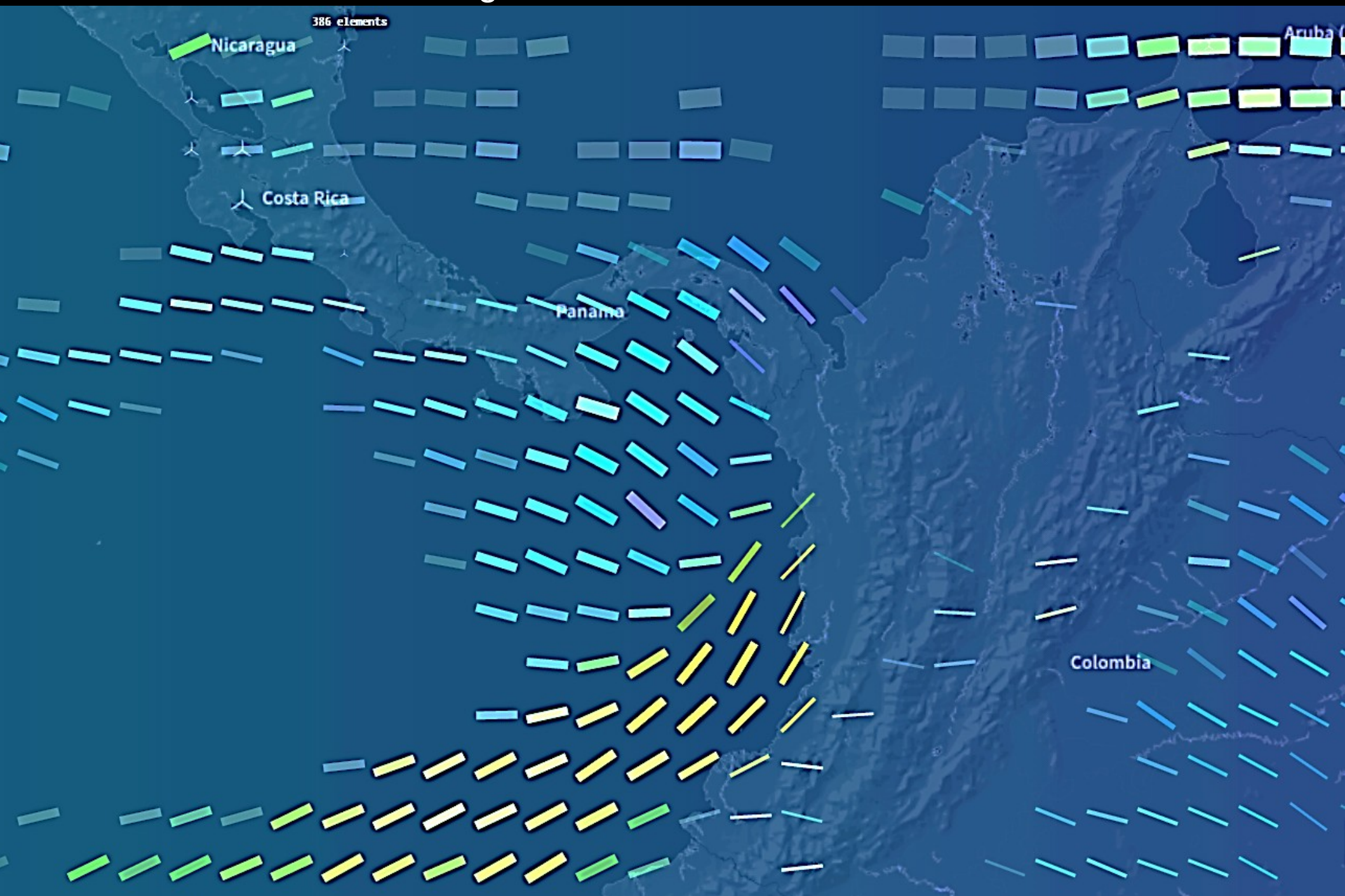
Our interactive browser application allows you to explore the data. Which regions might experience unusual changes in wind activity in the coming months? Find out what our models can tell you.

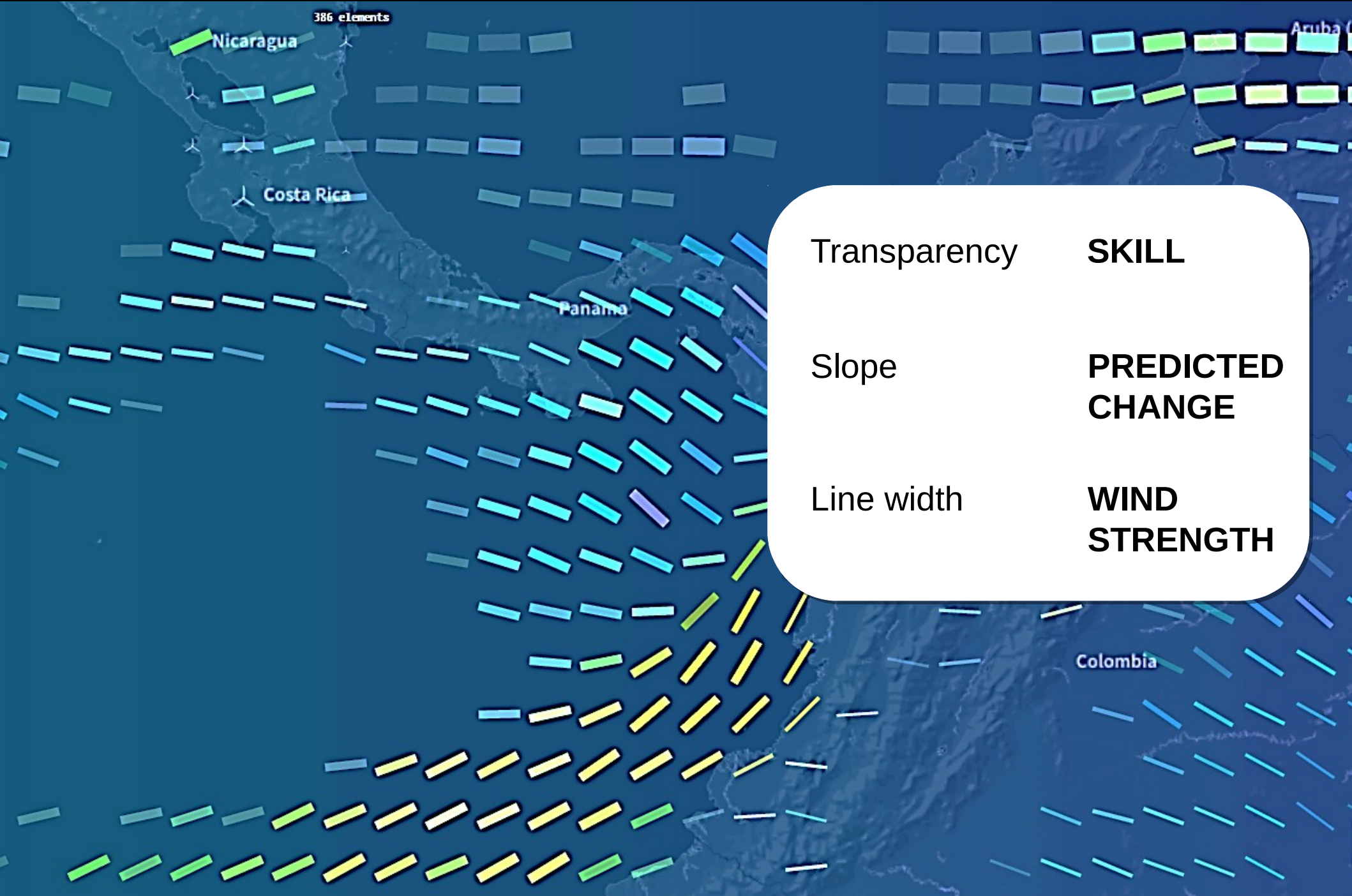
[→ GO](#)

PROJECT

# UKKO







386 elements

Nicaragua

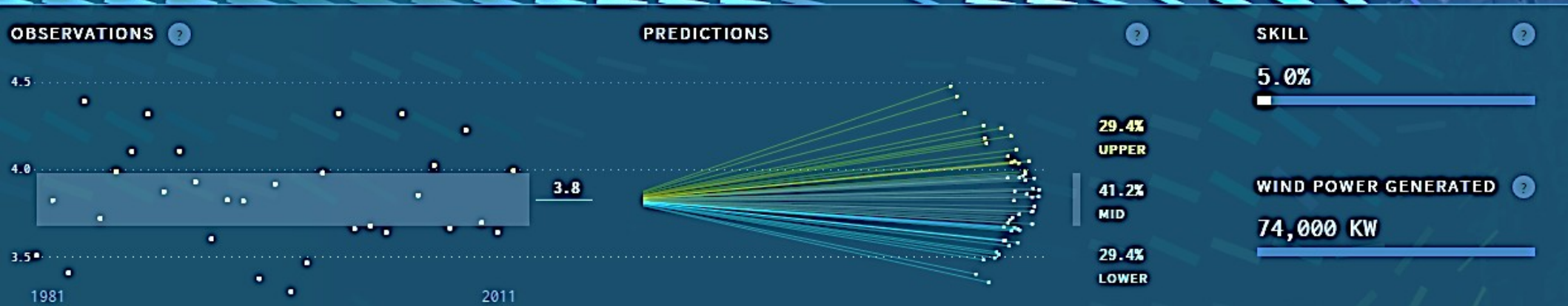
Costa Rica

Panama

Colombia

Aruba

Transparency	<b>SKILL</b>
Slope	<b>PREDICTED CHANGE</b>
Line width	<b>WIND STRENGTH</b>



HISTORICAL  
OBSERVATIONS

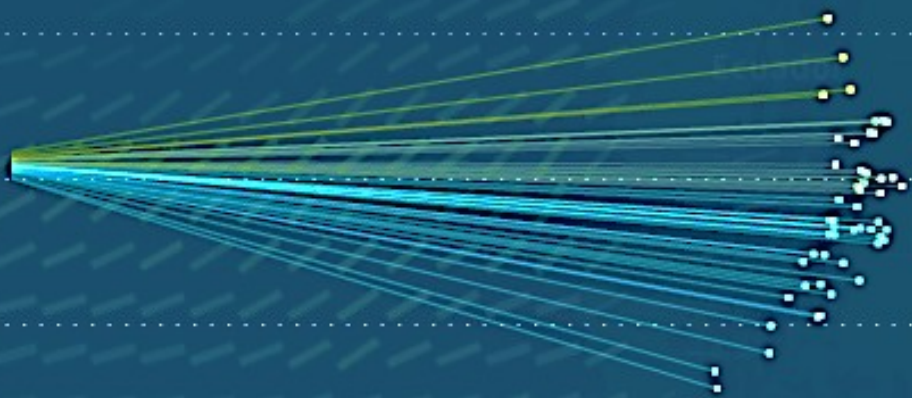
PROBABILISTIC  
PREDICTIONS

SKILL  
+  
WIND POWER  
GENERATED



Lower tercile example

PREDICTIONS



- ? 7.8% UPPER
- 33.3% MID
- 58.8% LOWER

SKILL

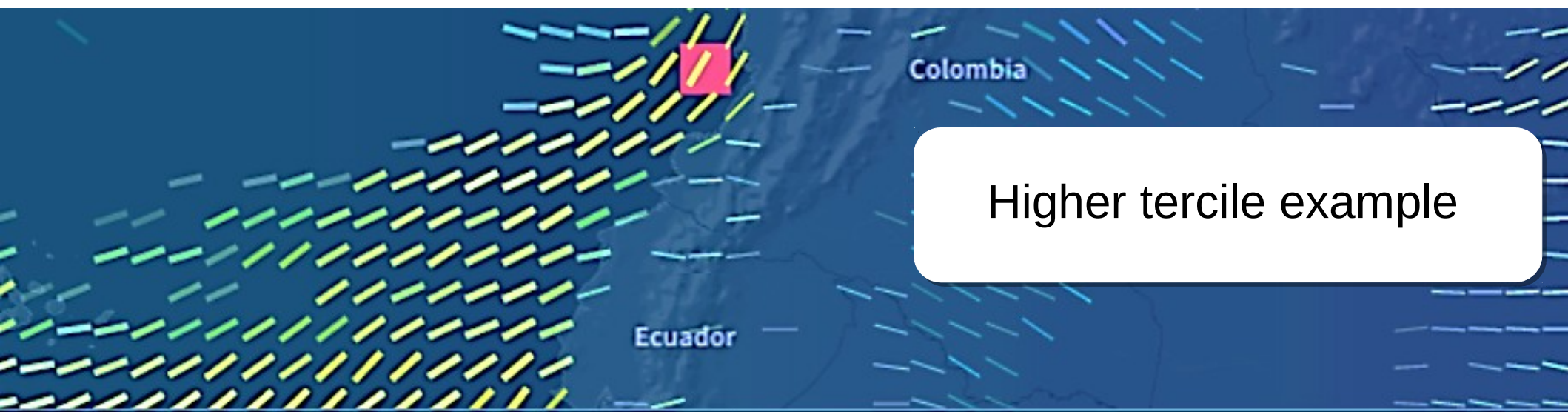
51.0%



WIND POWER GENERATED

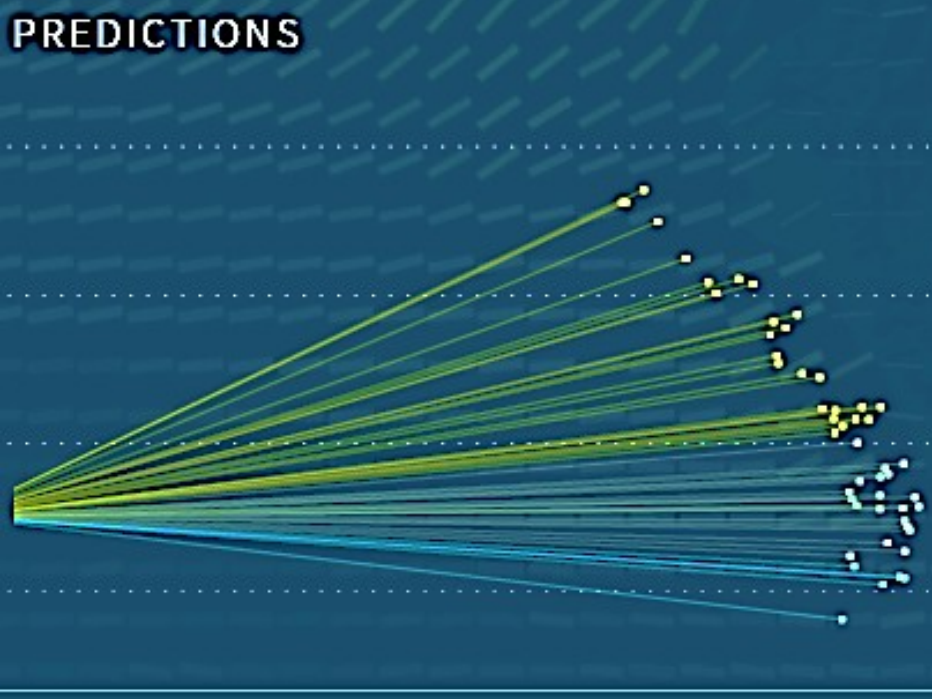
0 KW





Higher tercile example

PREDICTIONS



?

SKILL

?

27.0%



51.0%

UPPER

WIND POWER GENERATED

?

39.2%

MID

0 KW



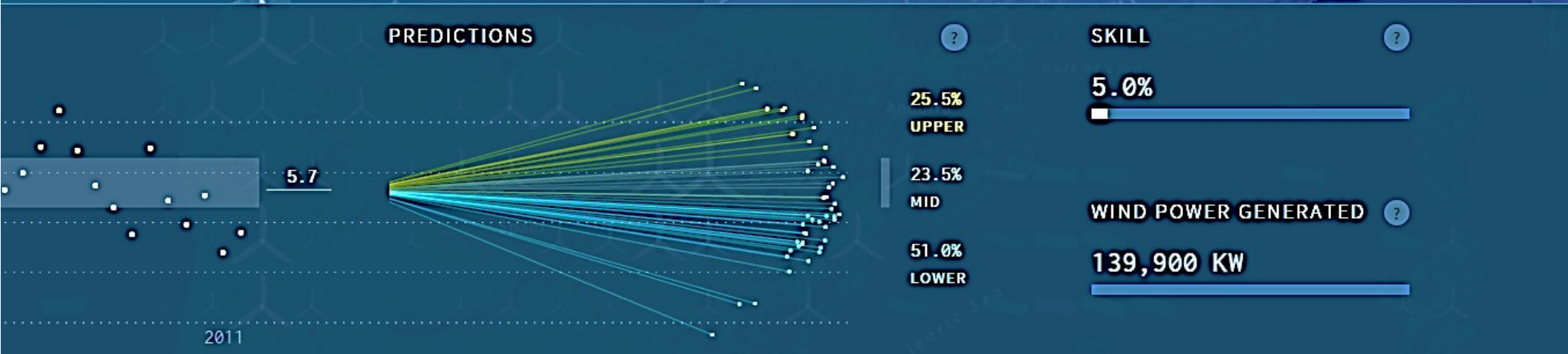
9.8%

LOWER





In Europe there are large areas without skill



If you are interested we will present  
an operative version at:

**EWEA Technology Workshop:  
Wind Power Forecasting 2015  
Meeting end-users needs**

1-2 October 2015  
Leuven, Belgium



**EWEA 2015**  
PARIS  
EUROPE'S PREMIER WIND ENERGY EVENT

**17 - 20 NOVEMBER**

**Always  
aim  
high**



# Thank you!

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[info-services-es@bsc.es](mailto:info-services-es@bsc.es)

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