



**Barcelona  
Supercomputing  
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*Centro Nacional de Supercomputación*



EXCELENCIA  
SEVERO  
OCHOA

# Climate services communication & user engagement: A tool to anticipate climate change

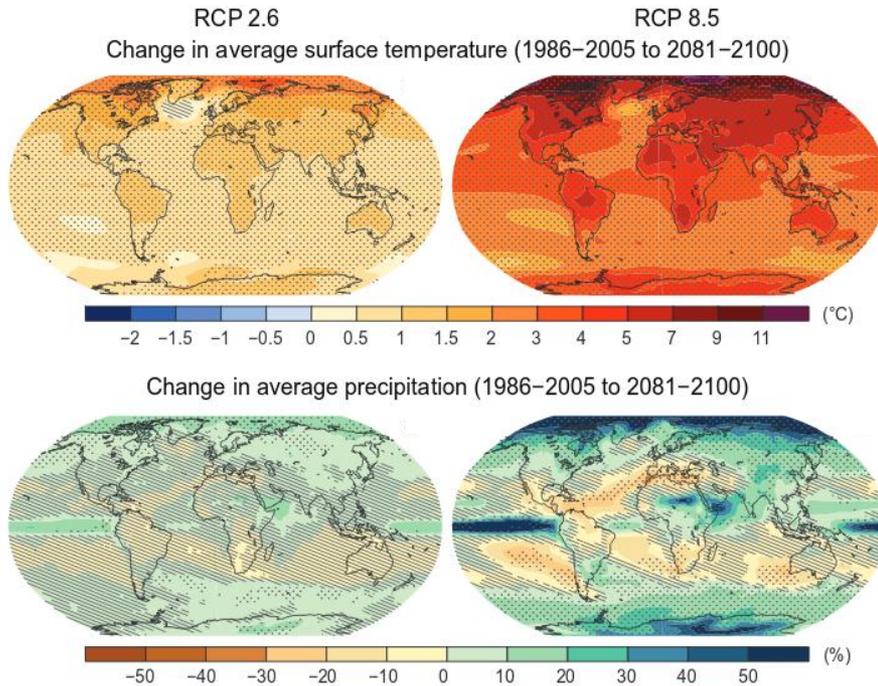
Marta Terrado, Isadora Christel, Dragana Bojovic, Albert  
Soret, Francisco Doblas-Reyes  
Earth Sciences Department, Earth System Services Group



- **Introduction**  
Importance to adapt to medium-range climate change
- **Climate services**
- **Importance of communication for climate services**
- **Climate service “success stories”**
  - Climate service for agriculture – the SECTEUR project
  - Climate service for energy – Project Ukko
  - Climate service for insurance – Seasonal hurricane predictions
- **Conclusions**

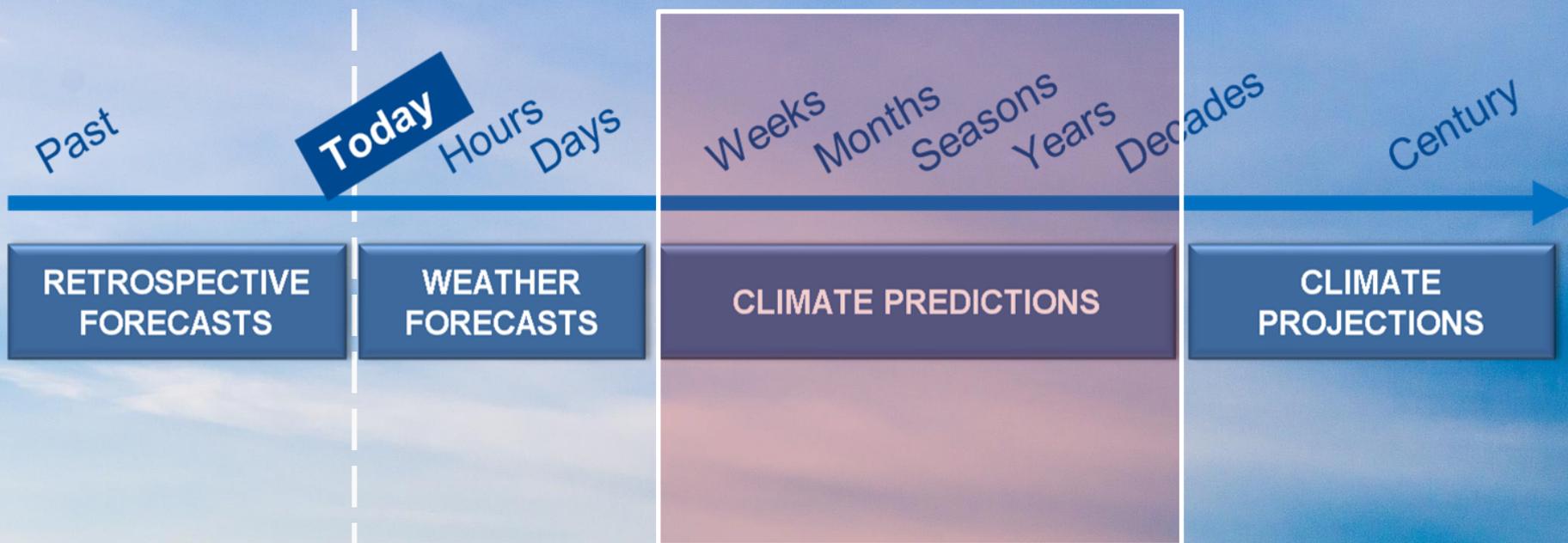
Observed changes in climate, especially warming trends, are considered to be **more apparent and severe at the end of the century**

**BUT... climate is already changing** and medium-range adaptation is unavoidable & an immediate priority across many sectors

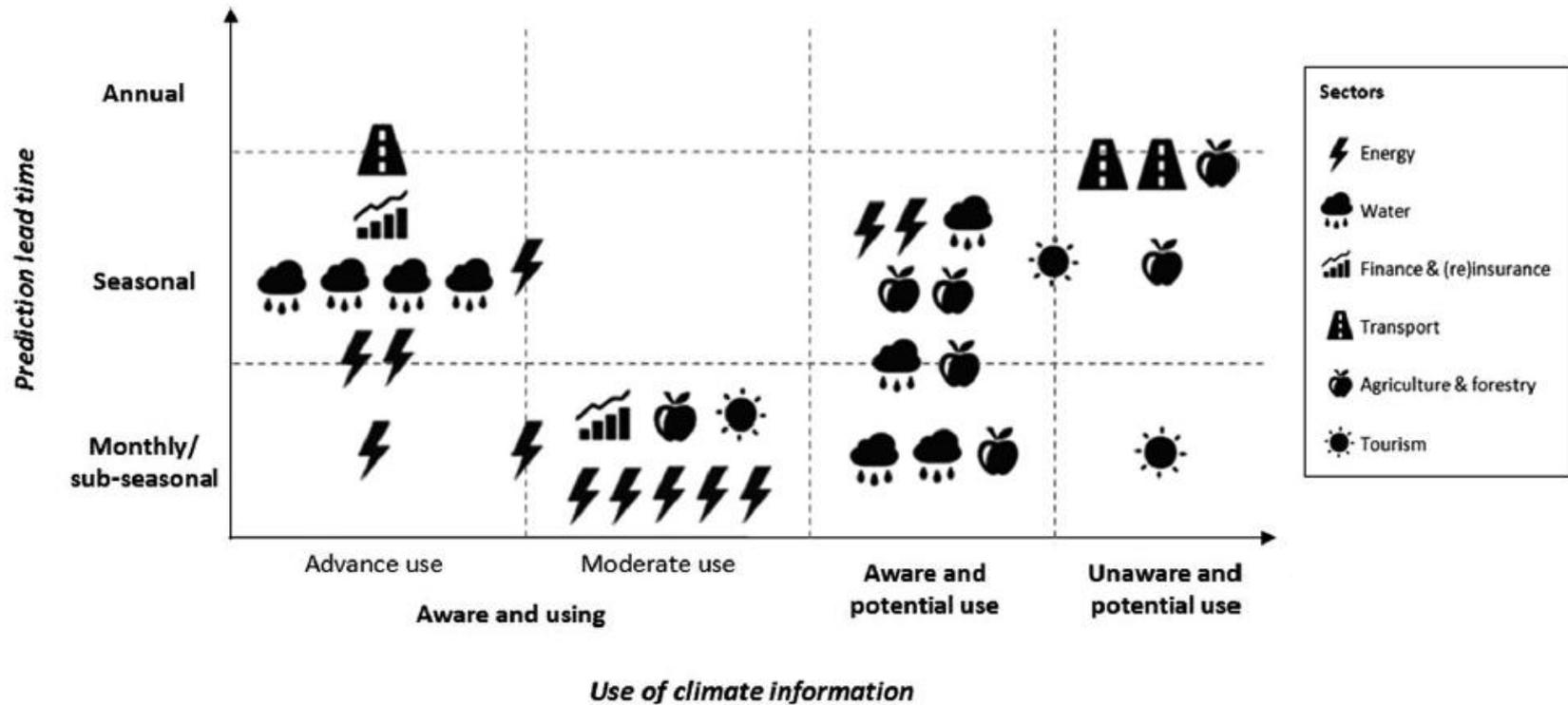


Source: IPCC 2013

# Temporal horizons of climate science



M. Bruno Soares, S. Dessai / *Climate Risk Management* 10 (2015) 8–16



What are the reasons to not using climate predictions?

- Probabilistic information is not easy to understand
- Lack of information on the reliability of the prediction



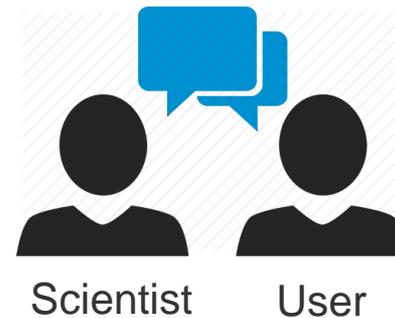
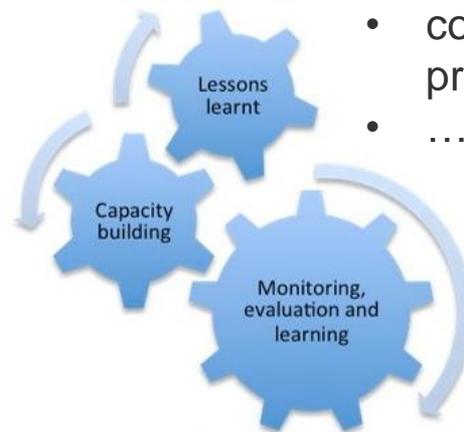
**Need to improve communication**



Supports society & climate-sensitive sectors to adapt to climate change

Customised products, tools and services directed to the users

- predictions
- trends
- economic analyses
- counselling on best practices
- ...



**AGRICULTURE  
& FORESTRY**



**COSTAL AREAS**



**HEALTH**



**INFRASTRUCTURE**



**INSURANCE**



**TOURISM**

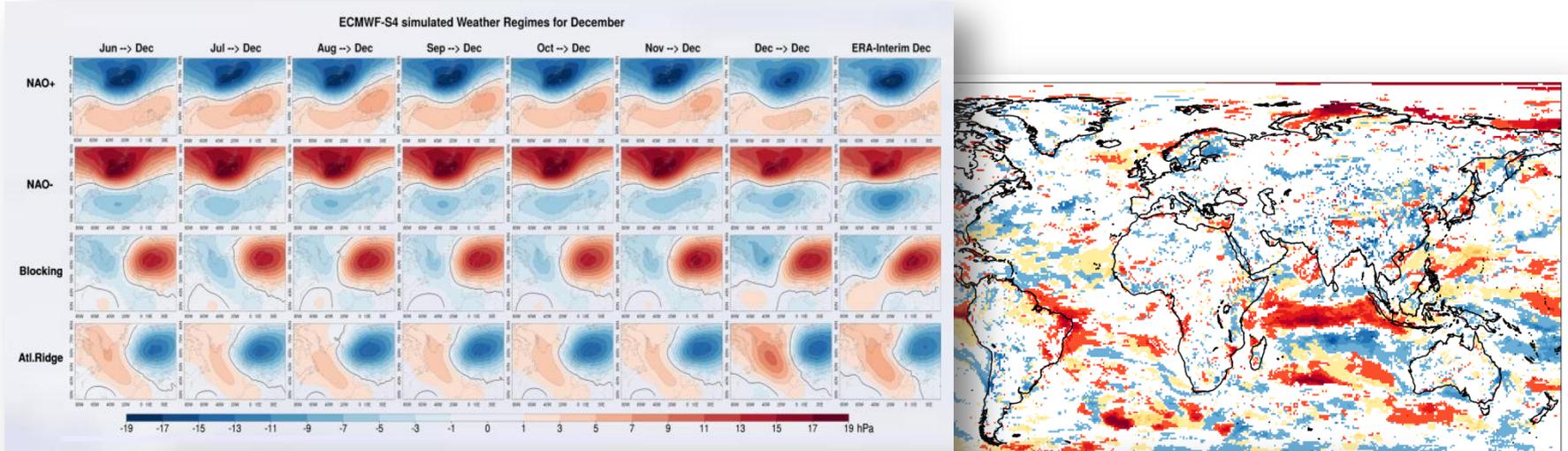
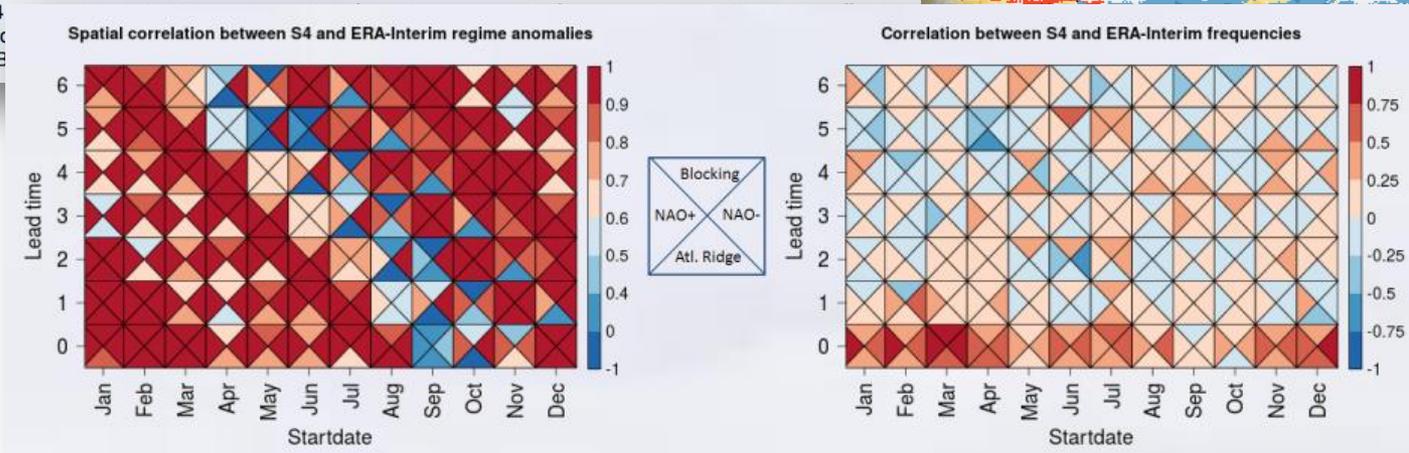


Figure 1. S4 startdates and to the right).



Source: ESS-BSC Catalogue, [www.bsc.es/ESS/catalogue](http://www.bsc.es/ESS/catalogue)

### ASSESSMENT REPORT 3: Dec-Jan-Feb 2014, North-East Brazil

#### Key event characterisation

North-East Brazil ERA-Interim 10m wind speed tercile categories (DJF 2014)

STAKEHOLDER: ALSTOM  
 AREA: North-East Brazil  
 COORDINATES: 5.65°-4.94°S 35.93°-35.23°W  
 SEASON: December, January, February (DJF)  
 YEAR: 2014/15

RESILIENCE seasonal wind speed prediction

Time series of 10-m wind speed calibrated from ECMWF System 4 and ERA-Interim reanalyses (DJF 1981-2014)

Skill assessment and probability function (DJF 2014 prediction)

Skill:  $\text{Corr}=0.616$   $\text{RPSS}=0.248$

Mechanisms driving seasonal wind speed variability

Time series of the Oceanic Niño 3.4 Index (ONI) (DJF 1981-2014)

Impact of the negative phase of the ONI on the 10-m wind speed (DJF)

## Seasonal wind speed predictions

Seasonal wind predictions provide information on how likely it is to be more windy than normal. In order to be useful for the user, the information need to be tailored to the user requirements.

### How do we tailor seasonal wind speed predictions?

**Seasonal wind speed predictions**

We use 10-metre wind speed forecasts from European Centre for Medium Range Weather System 4 forecasts are produced at the beginning of the season by a group of model simulations using slightly different initial conditions based on observations or measurements.

**Prediction bias correction**

Given the sparsity of global wind observations, a simple estimate of wind for validation purposes past meteorological observations with data with no information gaps (Dee et al. 2014). In the forecast system, the prediction of wind speed is corrected in order to statistically resemble observations (Doblas-Reyes et al. 2005). To correct this simple bias correction, calibration using observations is used.

**Prediction quality assessment**

The quality of predictions is assessed by the reanalysis. A skill score (see Fact sheet #4 on predictions) reflect the wind speed prediction reliability.

**Climate services for the wind energy sector**

At the end, the percentage of probability of higher than normal is calculated, according to the obtained results (Figure 1) meaning that they give the probability of deterministic prediction. This information is to support decision-making, sheet #4 on predictions' reliability.

**Applications**

- Mid-term operations & maintenance
- Energy trading & electricity prices
- Estimation of more accurate budgets
- Meet the balance between demand & supply

## Climate services factsheet 7

### Use of climate information in the wind stakeholder chain

The high penetration of wind power in the electricity system provides many challenges mainly due to the unpredictability and variability of wind power generation. Therefore, having accurate forecasts of wind power is becoming increasingly important for many stakeholders in the wind energy sector.

#### Wind farm development

Figure 1: Stages of wind farm development, stakeholders involved at each stage and temporal horizons of climate information used

Prospecting	Pre-construction	Post-construction	End of Lifetime
Climate projections	Climate projections	Climate projections	Weather forecasts
Site selection	Wind turbine manufacturers, Wind farm developers	Wind farm constructors, Operation & energy generation, Maintenance & repairs	Wind farm decommissioning
	Investors, Consultants	Energy traders & producers, Wind farm operators	

**Prospecting**

- Climate projections can be used for site selection according to the predicted wind conditions in a particular location in future decades.

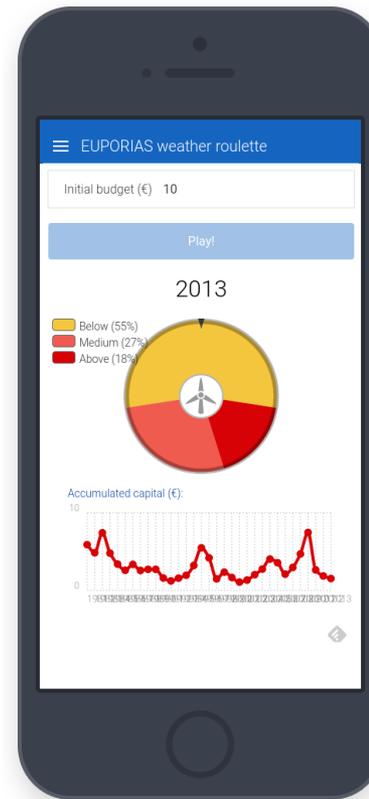
**Pre-construction**

- Climate predictions from years to decades can be relevant to understand and quantify the wind resource. For example, they can inform wind energy investors about the volatility of the resource in the future and how this risk can have an impact on the return on investment.

**Post-construction**

- Weather forecasts below 6h are useful to predict sudden events like ramps that can be managed by turbine and farm control.
- Weather forecasts from 6h to 2-3 days are used by transmission system operators for power system management (scheduling reserves, planning, congestion management). Wind farm operators use day-ahead & intraday forecasts for trading in the energy market.
- Weather forecasts from 2-3 days up to a week are used for operation & maintenance planning of wind farms, conventional power plants and transmission lines.
- Climate predictions from sub-seasons to seasons are particularly interesting to support offshore wind farm servicing logistics and onshore operation and energy generation.
- Climate predictions from seasons to decades are relevant to understand and quantify the wind resource, i.e. inform wind energy investors about the volatility of the resource in the future and how this risk can have an impact on the return on investment.

Participatory approaches for user engagement (workshops, focus groups, interviews, surveys...)



Innovative ways of reaching users

The Weather Roulette app

Source:

<https://play.google.com/store/apps/details?id=es.predictia.weatherroulette&hl=es>





# SUCCESS STORIES

## Participatory approach for user engagement - Survey



### User requirements of climate information and impact indicators: European survey to inform the Copernicus Climate Change Service

#### Aim of the survey

This survey aims to understand your needs of climate information and associated impact indicators. The results from this survey will inform the [Copernicus Climate Change Service](#) and the provision of free climate information and impact indicators to support better-informed planning and decision-making for climate adaptation and mitigation. **This is an opportunity for you to help shape this service according to your needs.**

This survey is being carried out as part of the [SECTEUR](#) project and is particularly focused on the following sectors:



#### Completing the survey

The survey takes on average 10 to 15 minutes to complete. Please work through the survey in one session as there will not be an opportunity to return to the survey at a later date. Please use the back and forward arrows to navigate through the survey.

For further information on **data protection** and who to contact if you have any **queries** please select here.

Thank you for taking the time to complete this survey.

- Inform **adaptation measures to climate change** in agriculture

- Establish a **bidirectional communication** between users and producers of climate information

- Deliver **better-tailored information** that supports decision-making in agriculture

# 1- Climate service for agriculture



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Medium-range climate predictions are **useful for the adaptation of wine producers to climate change**. Applications:

- Decision-making during the growing season (planting and harvesting dates, pruning, planning fungicide acquisition, dealing with excess product availability...)
- Crop trade in the market



# 2- Climate service for energy



PROJECT

## Ukko

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

### SEASONAL WIND PREDICTIONS 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

## On-line visualisation tool for the wind energy sector - Project Ukko

- Joint development between scientists – designers
- Provides robust information on the future variability of wind (probabilistic predictions)

Source: <http://project-ukko.net/>

2.3.0

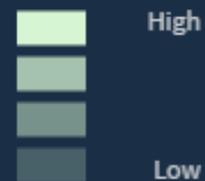
PROJECT

# Ukko

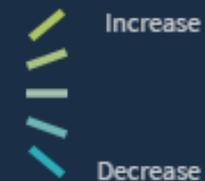


## LEGEND

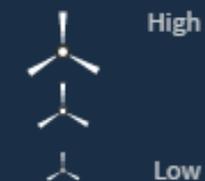
### SKILL



### PREDICTED CHANGE



### INSTALLED WIND POWER



**Transparency:**  
PREDICTION QUALITY  
Only areas with a positive skill  
(improving upon climatology)  
have a visible line

**LEGEND**

**SKILL**

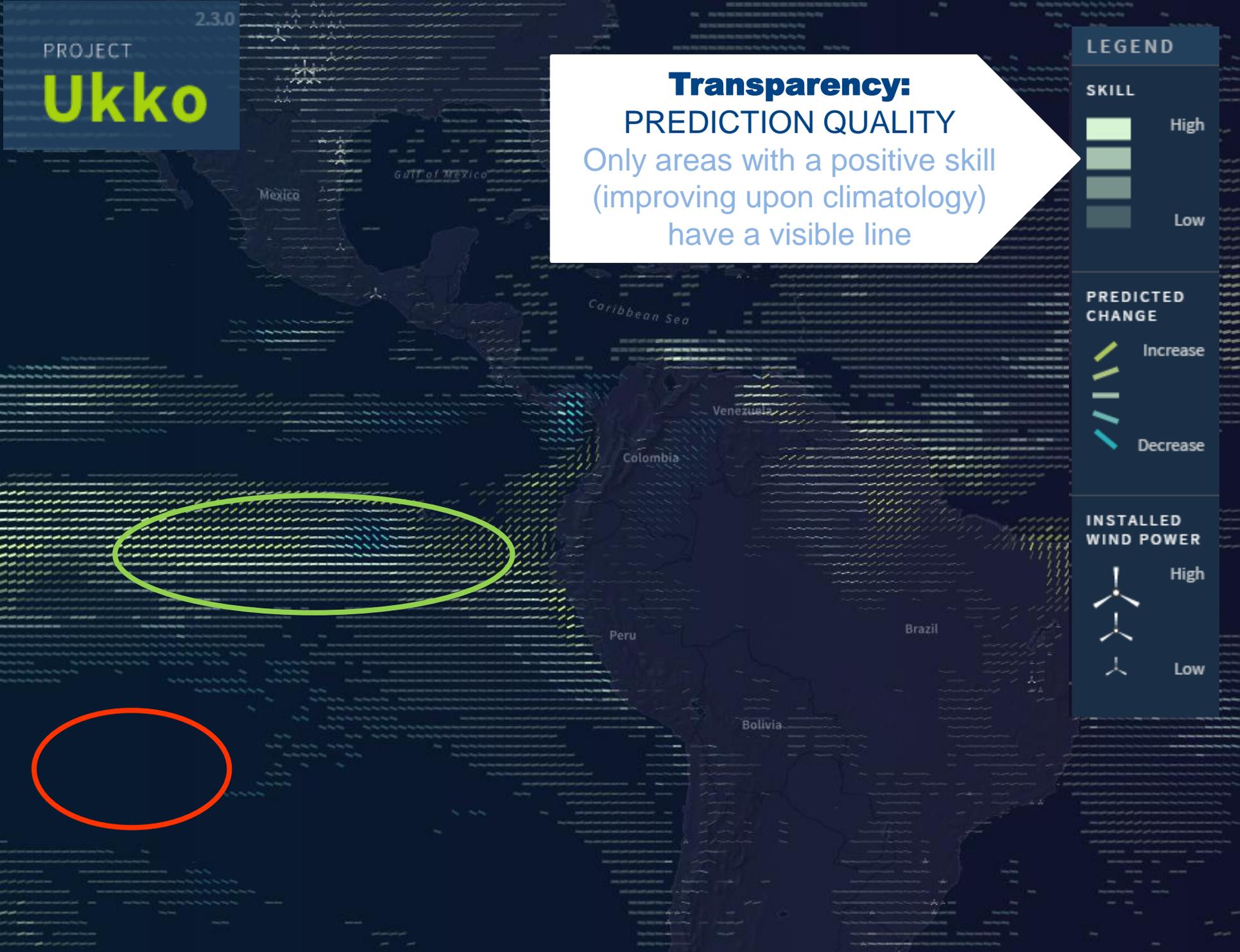
- High
- Low

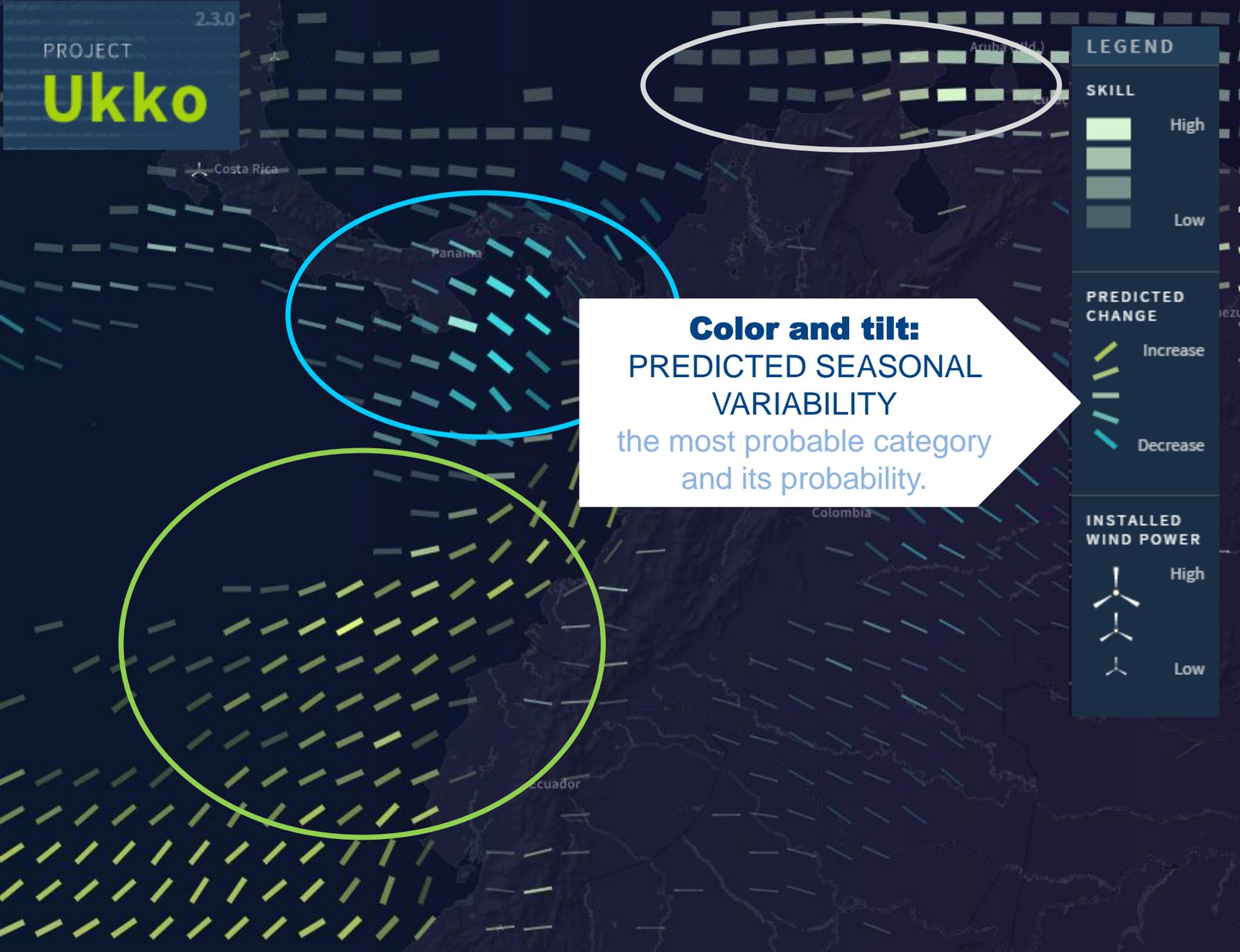
**PREDICTED CHANGE**

- Increase
- Decrease

**INSTALLED WIND POWER**

- High
- Low





**LEGEND**

**SKILL**

- High
- Low

**PREDICTED CHANGE**

- Increase
- Decrease

**INSTALLED WIND POWER**

- High
- Low

**Color and tilt:**  
PREDICTED SEASONAL VARIABILITY  
the most probable category and its probability.

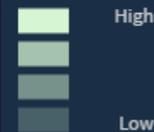
2.3.0

PROJECT

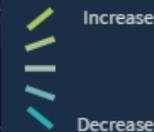
# Ukko

### LEGEND

#### SKILL



#### PREDICTED CHANGE



#### INSTALLED WIND POWER



## OBSERVATIONS

ERA-Interim 10-m wind speed reanalysis

## PREDICTIONS

the most probable category and its probability.

## QUALITY

RPSS skill score



### OBSERVATIONS

Seasonal average wind speeds in m/s



### PREDICTIONS



### SKILL

26.0%

### INSTALLED WIND POWER

0 KW

## 2- Climate service for energy



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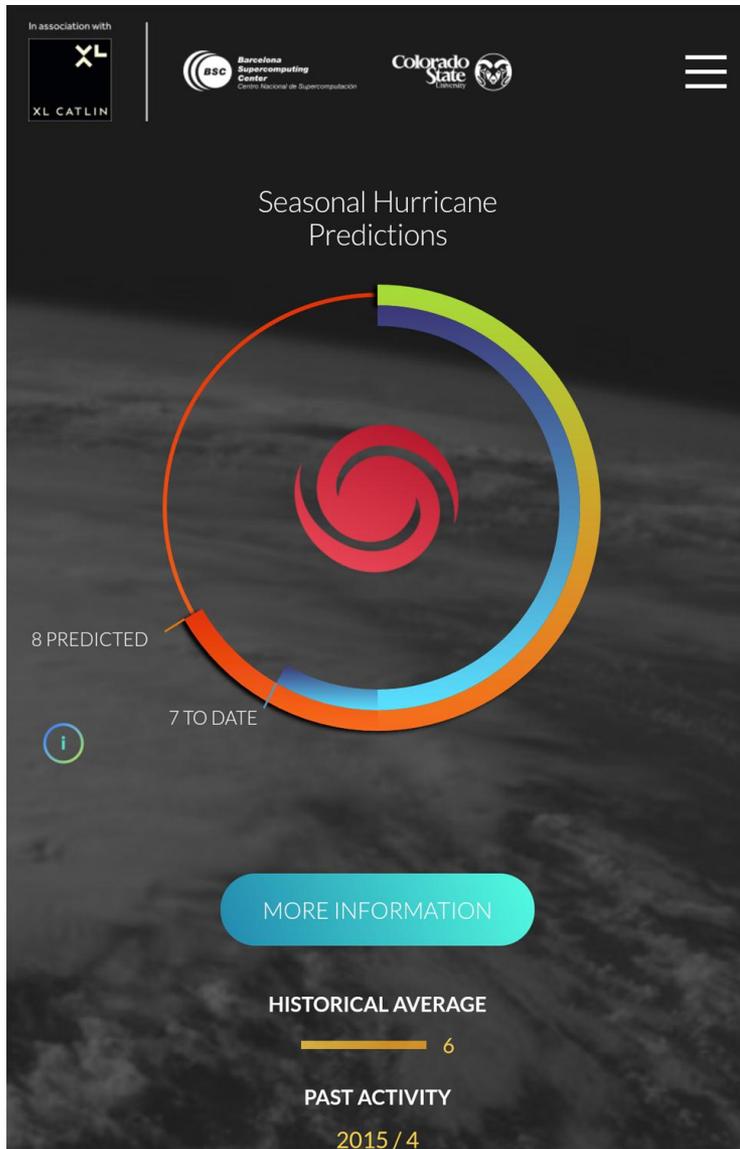


Medium-range climate predictions are **useful for the adaptation of the wind energy sector to climate change.**

Applications:

- Planning maintenance and operations
- Energy trade in the market
- Meet the balance between energy supply and demand





## On-line visualisation platform of the seasonal hurricane activity for the re/insurance sector

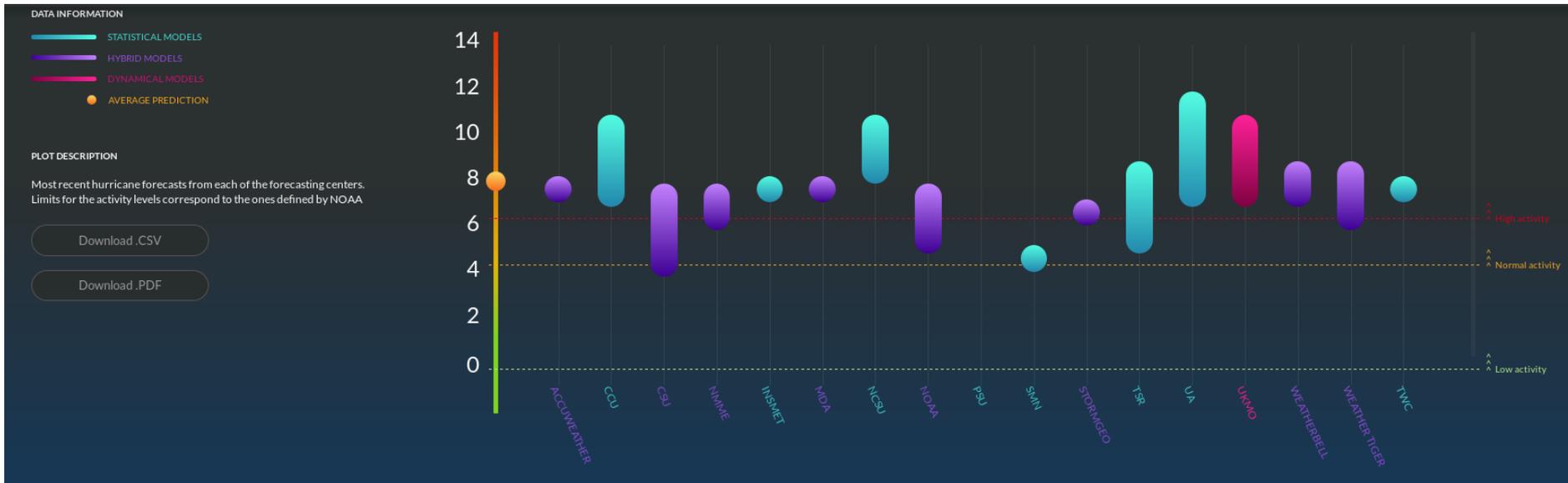
- **Brings together** predictions from different centers that specialize in Atlantic hurricane forecasting
- Developed by a team of scientists, graphic designers and visualisation specialists **together with the user**
- Specific section for the scientific community & **informative section** for the general public

Source: [www.seasonalhurricanepredictions.org](http://www.seasonalhurricanepredictions.org)

# 3- Climate service for insurance



Season 2016



Medium-range climate predictions are **useful for the adaptation of the re/insurance sector to climate change**. Applications:

- Catastrophe evaluation
- Loss estimation / Price determination
- Preparation of the claim team and client warning

# 3- CS for insurance – media coverage

## Barcelona ajuda amb la predicció d'huracans als Estats Units

### Units

El Barcelona Supercomputing Center col·labora en un web que reuneix els pronòstics dels atlàntics i l'evolució de la seva activitat



## NOTICIAS DE SEGUROS

04 de agosto 10:03 2016

### Crean una web que ofrece toda la información sobre huracanes y su evolución



XL Catlin, Barcelona Supercomputing Center y la State University of Colorado conjuntamente con el objetivo de poner una web para hacer un seguimiento de las estaciones de huracanes y la evolución de su actividad.

La web [Seasonal Hurricane Predictions](#) reúne predicciones de los principales centros de predicción de huracanes atlánticos.



DE FIDES » MIEMBROS » REGLAMENTACIÓN » ESCUELAS » LINKS » EVENTOS » NOTICIAS »

Inicio » Noticias » Nace Seasonal Hurricane Predictions, una web de pronósticos de huracanes y su evolución creada para el gran público

## Nace Seasonal Hurricane Predictions, una web de pronósticos de huracanes y su evolución creada para el gran público

Publicado por en **Tweet Activity**

Con el objetivo de la evolución de su Colorado, en colab Hurricane Predicti



**Philip Klotzbach** @philklotzbach  
Excited to announce new website tracking Atlantic seasonal hurricane forecasts:

<http://www.bsc.es/ESS/seasonalhurricanepredictions/>  
... [pic.twitter.com/MIY3DOVA77](https://pic.twitter.com/MIY3DOVA77)



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Impressions	7,748
Total engagements	380
Link clicks	226
Detail expands	50
Likes	47
Retweets	21
Media engagements	15
Profile clicks	12
Replies	9

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## Early, Late, and Far-Flung: The Eclectic 2016 Atlantic Hurricane Season

By Bob Henson and Jeff Masters, 8:11 PM GMT on November 30, 2016

After three relatively quiet seasons, the hurricane-generating waters of the North Atlantic, Gulf of Mexico, and Caribbean returned in 2016 to the busy production schedule they've maintained in most years since the mid-1990s. Assisted by the switch from a record-strong El Niño to a borderline La Niña, which reduced vertical wind shear, the 2016 season ended up above the long-term average for all of the most commonly tracked indices, with the largest number of hurricanes observed since 2012, the most major hurricanes since 2011, and the Atlantic's first Category 5 hurricane since 2007. Persistent dryness in mid-levels of the atmosphere likely kept this season from being even more active, noted Dr. Phil Klotzbach (Colorado State University, CSU) in his end-of-season recap.

Here are the numbers for 2016 through November 30, the official last day of the Atlantic season. In parentheses are the average values for the period 1981 - 2010. Below the tally, you'll find our look at a few noteworthy aspects of this prolonged, wide-ranging season.

- Tropical cyclones (including depressions): 36
- Named storms: 15 [average 12.1]
- Hurricanes: 7 [average 6.4]
- Major hurricanes: 3 [average 2.7]
- Accumulated cyclone energy (ACE), as reported by CSU: 134 units [average 108]



**About Jeff Masters**  
Cat 6 lead author, WU co-founder Dr. Jeff Masters (right), who flew on NOAA Hurricane Hunters 1986-1990, & WU meteorologist Bob Henson, @bbsosweather

### Recent Posts

• Early, Late, and Far-Flung: The Eclectic 2016 Atlantic Hurricane Season

### Local Weather

Annette Island, Alaska  
4°C  
Light Rain

Detailed Conditions & Forecast

JeffMasters's Recent Photos



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Home » [Industry Statements](#) » [Government](#) » BSC Powers New Hurricane Threat Tracker

## BSC Powers New Hurricane Threat Tracker

August 3, 2016 by [Bob Roenker](#)

The Barcelona Supercomputing Center and Colorado State University have launched a new website to track seasonal hurricane forecasts and the evolution of hurricane activity.

Seasonal Hurricane Predictions brings together forecasts from major centers that specialize in Atlantic hurricane forecasting. It also offers extensive information to promote understanding of the factors that contribute to these meteorological phenomena, which can have devastating consequences, and to help explain why different seasonal forecast models can produce different predictions.

Seasonal Hurricane Predictions has been created to pool predictions by university, government and private entities that carry out forecasts for the hurricane season, which officially runs from June 1st to November 30th, and to make them available to the wider public.



The centers whose forecasts are presented on the website are:

### LATEST VIDEO

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### INDUSTRY PERSPECTIVES

**Radio Free HPC Year End Review of 2016 Predictions**  
In this podcast, the Radio Free HPC team looks at how Shahin Khan fared with his OrionX 2016 Technology Issues and Predictions. "Here at OrionX.net, we are fortunate to work with tech leaders across several industries and geographies, serving markets in Mobile, Social, Cloud, and Big Data (including Analytics, Cognitive Computing, IoT, Machine Learning, Semantic Web, etc.), and focused on pretty much every part of the "stack", from chips to apps and everything in between. Doing this for several years has given us a privileged perspective. We spent some time to discuss what we are seeing and to capture some of the trends in this blog." [Read More...](#)

### WHITE PAPERS

- Climate services are useful to improve decision making in the context of climate change but their **use is not widespread due to some barriers:**
  - communication of probabilistic information and prediction reliability
  - user engagement
  - tailoring of climate information
  
- Appropriate application of **participatory approaches and graphical visualisation tools** help to guide climate change adaptation. Examples are the presented climate services for agriculture, energy and re/insurance.
  
- More effort needs to be directed towards the development of **improved ways of communicating climate services to users** and the development of climate services for other climate-sensitive sectors.

# QUESTIONS?

EUPORIAS



RESILIENCE



SECTEUR



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# Thank you!

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