Barcelona Supercomputing Center
Centro Nacional de Supercomputación

EUPORIAS and the Energy prototype RESILIENCE

Working group on seasonal predictions for wind SP4Wind

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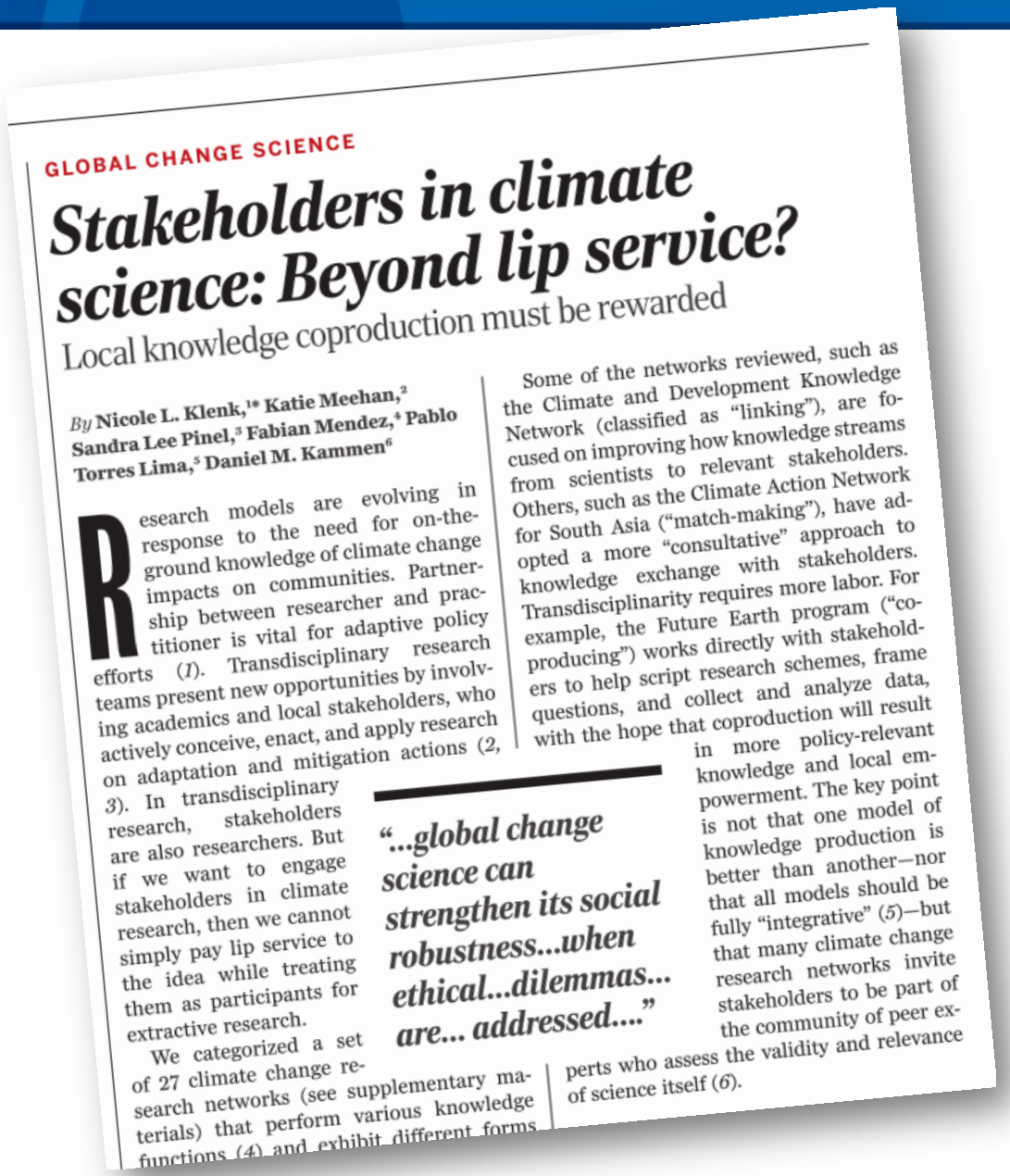
EUPORIAS VISION

Barcelona Supercomputing Center
Centro Nacional de Supercomputación
EXCELENCIA SEVERO OCHOA

EUPORIAS

Our vision is that by developing **end-to-end impact prediction services**, operating on **S2D timescales**, and clearly demonstrating their value in informing decision-making, we will stimulate a market for these new tools.

User engagement with stakeholders



GLOBAL CHANGE SCIENCE

Stakeholders in climate science: Beyond lip service?

Local knowledge coproduction must be rewarded

By **Nicole L. Klenk,[1]* Katie Meehan,[2] Sandra Lee Pinel,[3] Fabian Mendez,[4] Pablo Torres Lima,[5] Daniel M. Kammen[6]**

Research models are evolving in response to the need for on-the-ground knowledge of climate change impacts on communities. Partnership between researcher and practitioner is vital for adaptive policy efforts (*1*). Transdisciplinary research teams present new opportunities by involving academics and local stakeholders, who actively conceive, enact, and apply research on adaptation and mitigation actions (*2*, *3*). In transdisciplinary research, stakeholders are also researchers. But if we want to engage stakeholders in climate research, then we cannot simply pay lip service to the idea while treating them as participants for extractive research.

We categorized a set of 27 climate change research networks (see supplementary materials) that perform various knowledge functions (*4*) and exhibit different forms

Some of the networks reviewed, such as the Climate and Development Knowledge Network (classified as "linking"), are focused on improving how knowledge streams from scientists to relevant stakeholders. Others, such as the Climate Action Network for South Asia ("match-making"), have adopted a more "consultative" approach to knowledge exchange with stakeholders. Transdisciplinarity requires more labor. For example, the Future Earth program ("co-producing") works directly with stakeholders to help script research schemes, frame questions, and collect and analyze data, with the hope that coproduction will result in more policy-relevant knowledge and local empowerment. The key point is not that one model of knowledge production is better than another—nor that all models should be fully "integrative" (*5*)—but that many climate change research networks invite stakeholders to be part of the community of peer experts who assess the validity and relevance of science itself (*6*).

"...global change science can strengthen its social robustness...when ethical...dilemmas... are... addressed...."

Klenk et al.
13 Nov 2015 Science

EUPORIAS – Energy prototype

EUPORIAS

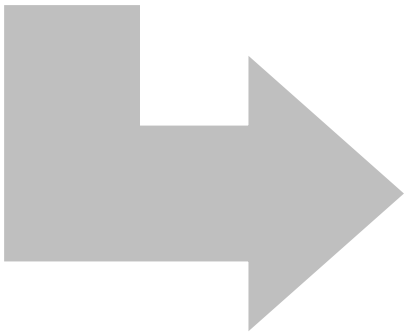
One of the specific objectives of EUPORIAS is:

To develop a few **fully working prototypes** of climate services

addressing the need of **specific users**,

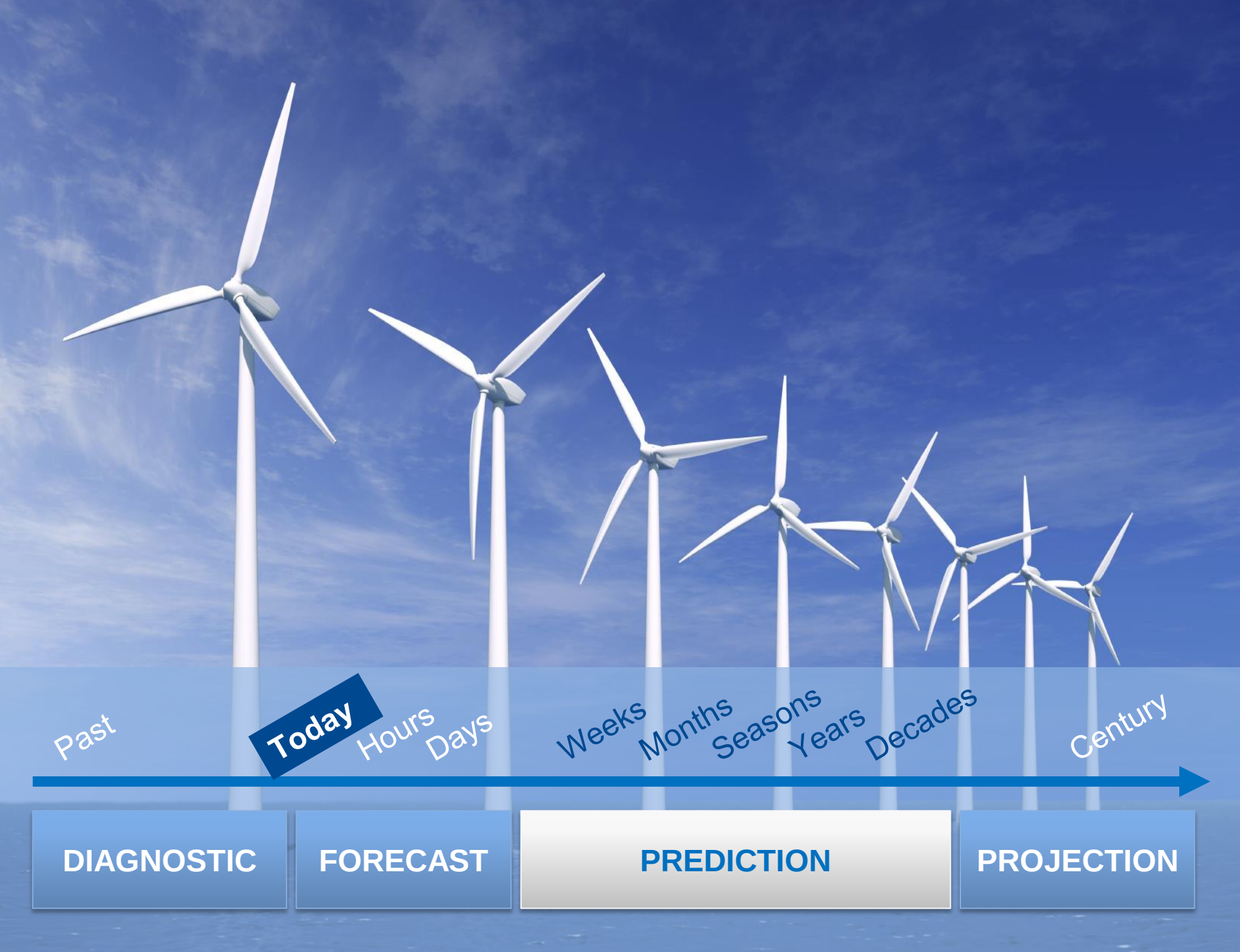
show how climate predictions could **impact their decision-making processes**

and ultimately encourage them to **use the prototypes**.



RESILIENCE

PROTOTYPE


Past
Today
Hours
Days
Weeks
Months
Seasons
Years
Decades
Century
DIAGNOSTIC
FORECAST
PREDICTION
PROJECTION

Climate predictions for wind power

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

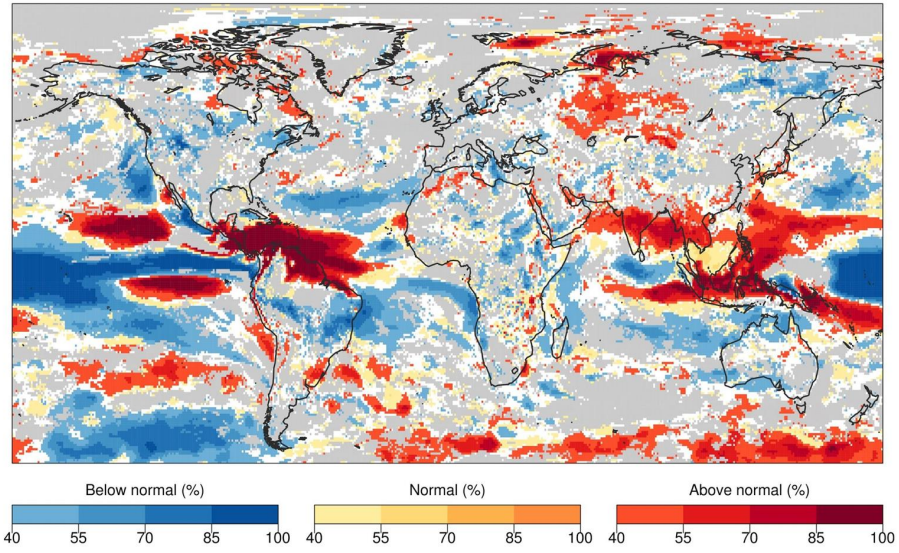
- **Wind farm planners:** Site selection
- **Wind farm investors:** Evaluate return on investments
- **Policy makers:** Understand changes to energy mix

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

RESILIENCE: Seasonal wind speed predictions for the Energy sector

Semi-operational prototype that aims to provide information on **seasonal wind speed** variability based on **probabilistic climate predictions**.

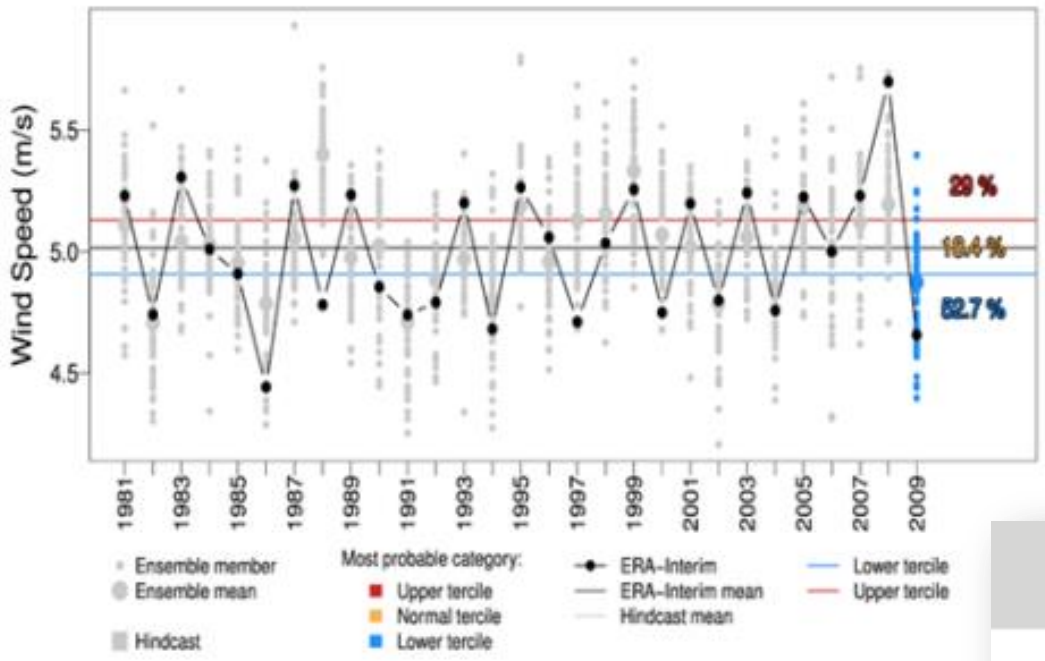


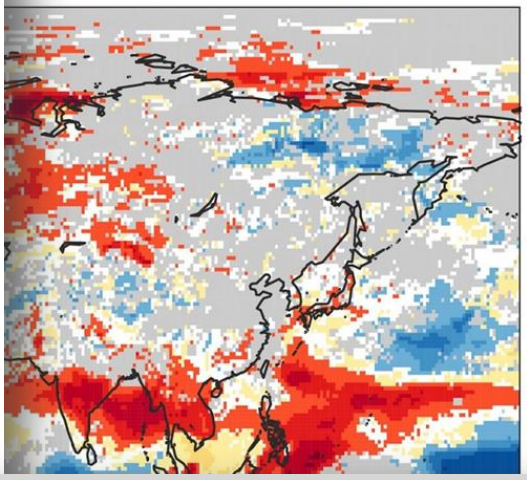
Wind speed prediction for June 1st - August 31st 2015, issued on May 1st 2005.
The most likely wind power category (below normal, normal or above normal), and its percentage probability to occur is shown. "Normal" represents the average of the past. White areas show where the probability is <40% and 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.

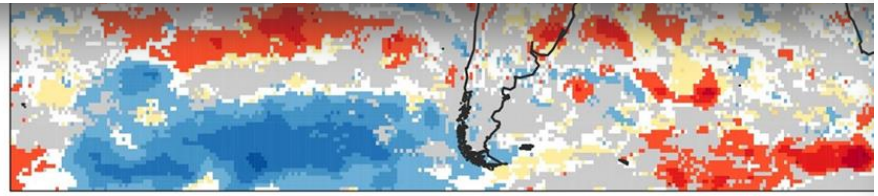
- Data from **ECMWF**, prediction system: System 4. Post-processed and calibrated to produce more accurate predictions
- Global domain
- Aggregated output in **terciles**:
  - Above normal
  - Normal
  - Below normal
- Operational prediction for **Winter 2015/2016**

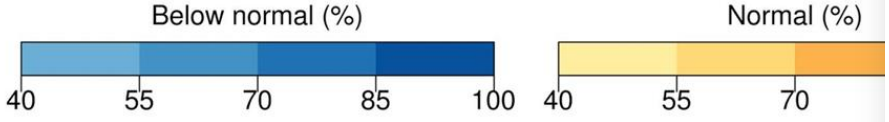
b

Time series of 10–m wind speed calibrated from ECMWF System 4 and ERA–Interim reanalysis (DJF 1981–2009)



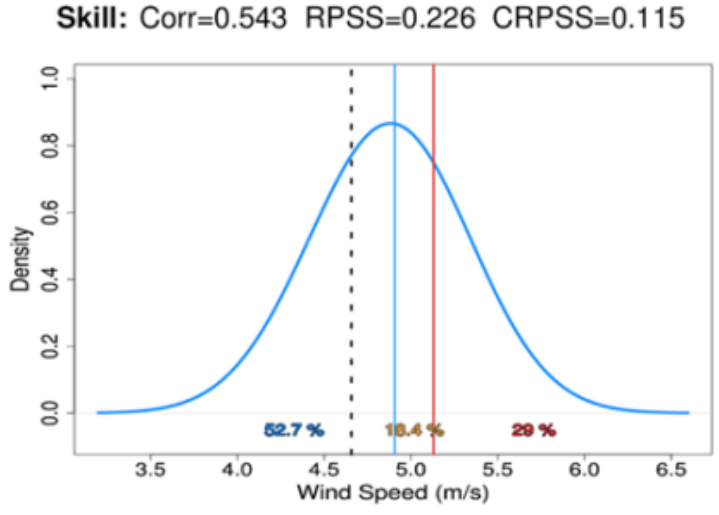






Skill assessment and probability density function (DJF 2009 prediction)

c

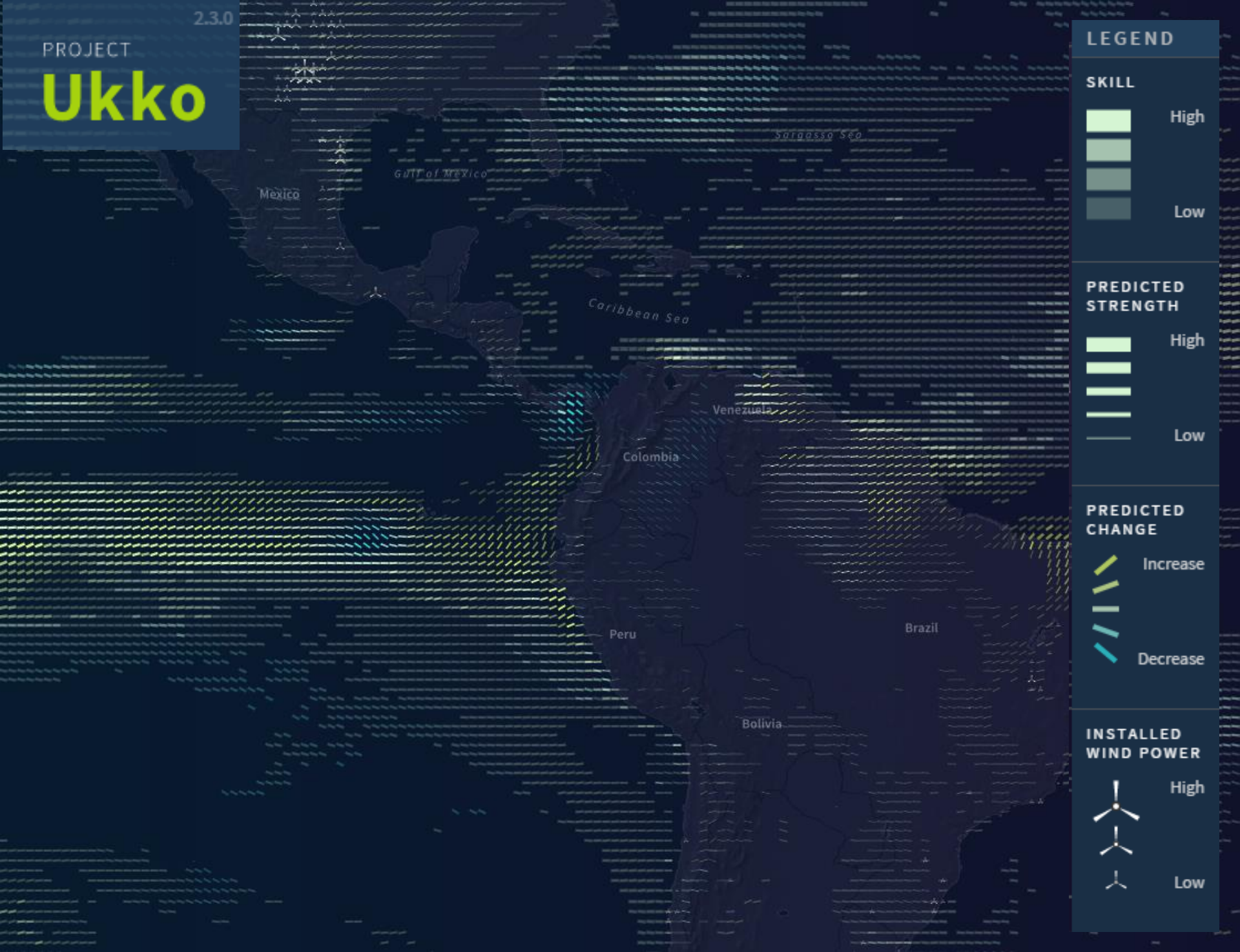


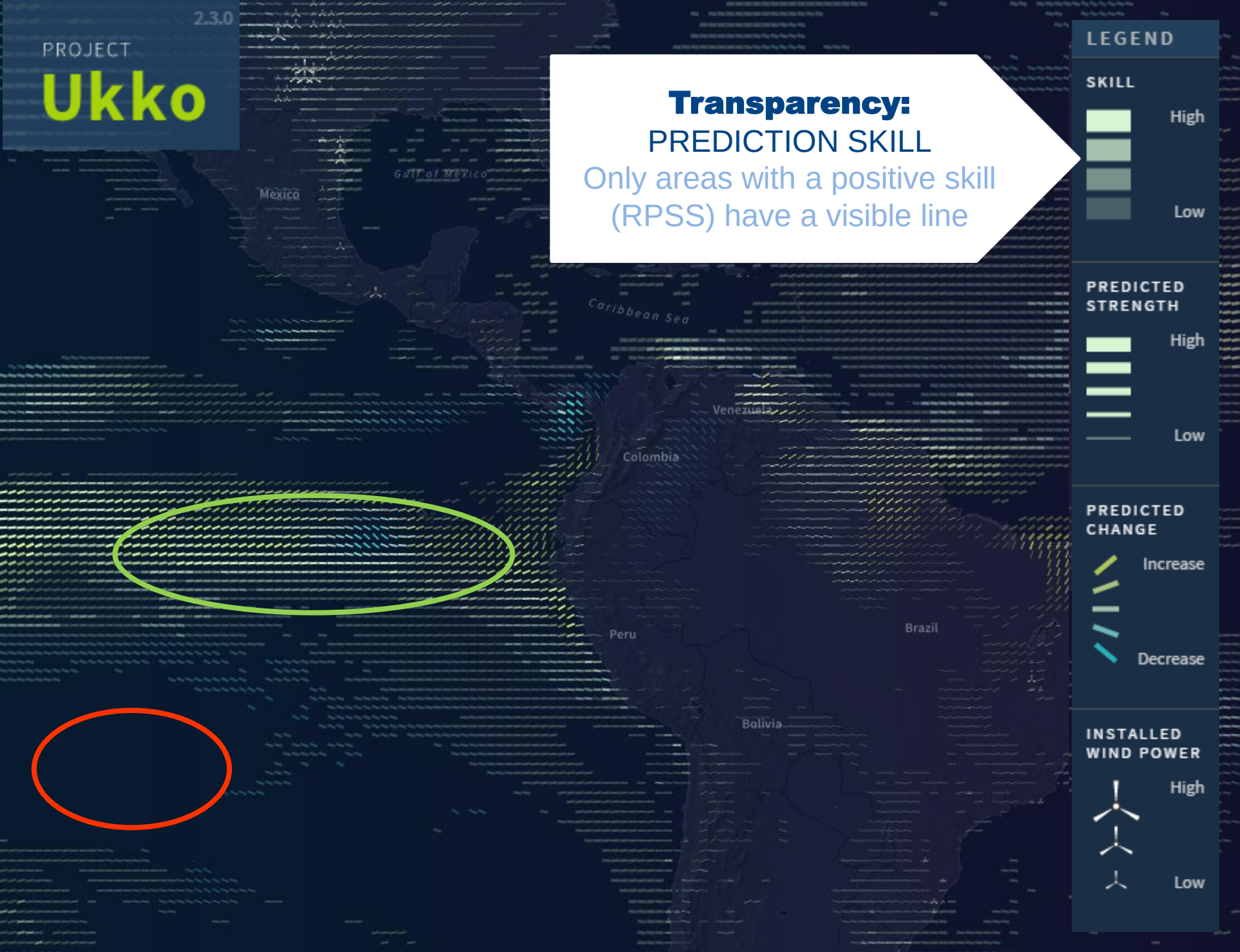
Wind speed prediction for June 1st - August 31s

The most likely wind power category (below normal, normal or above norm
"Normal" represents the average of the past. White areas show where the
categories. Grey areas show where the climate prediction model does not
projects past climate data into the future.

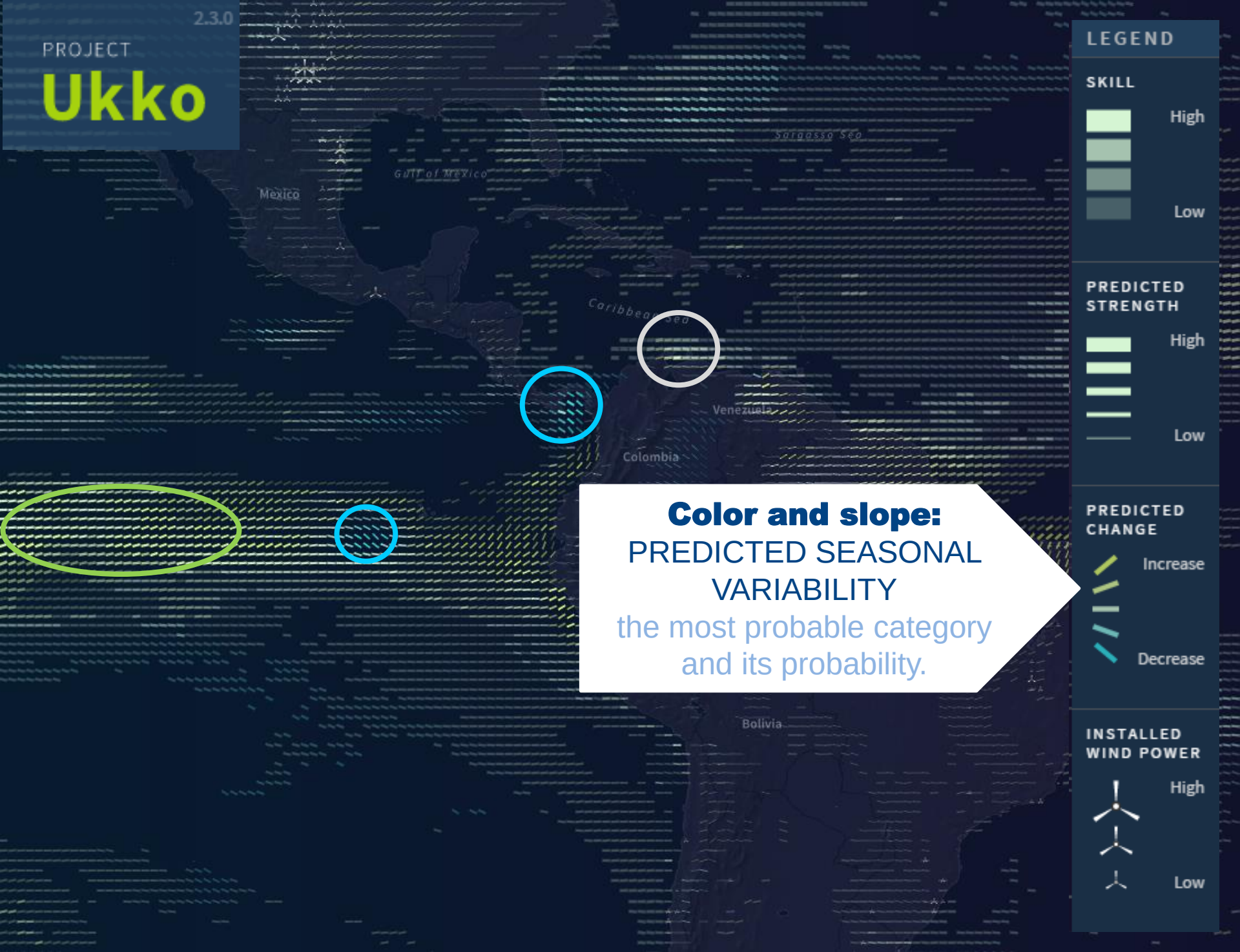
From the 6 prototypes developed within EUPORIAS, our prototype was selected to make a visualisation exercise

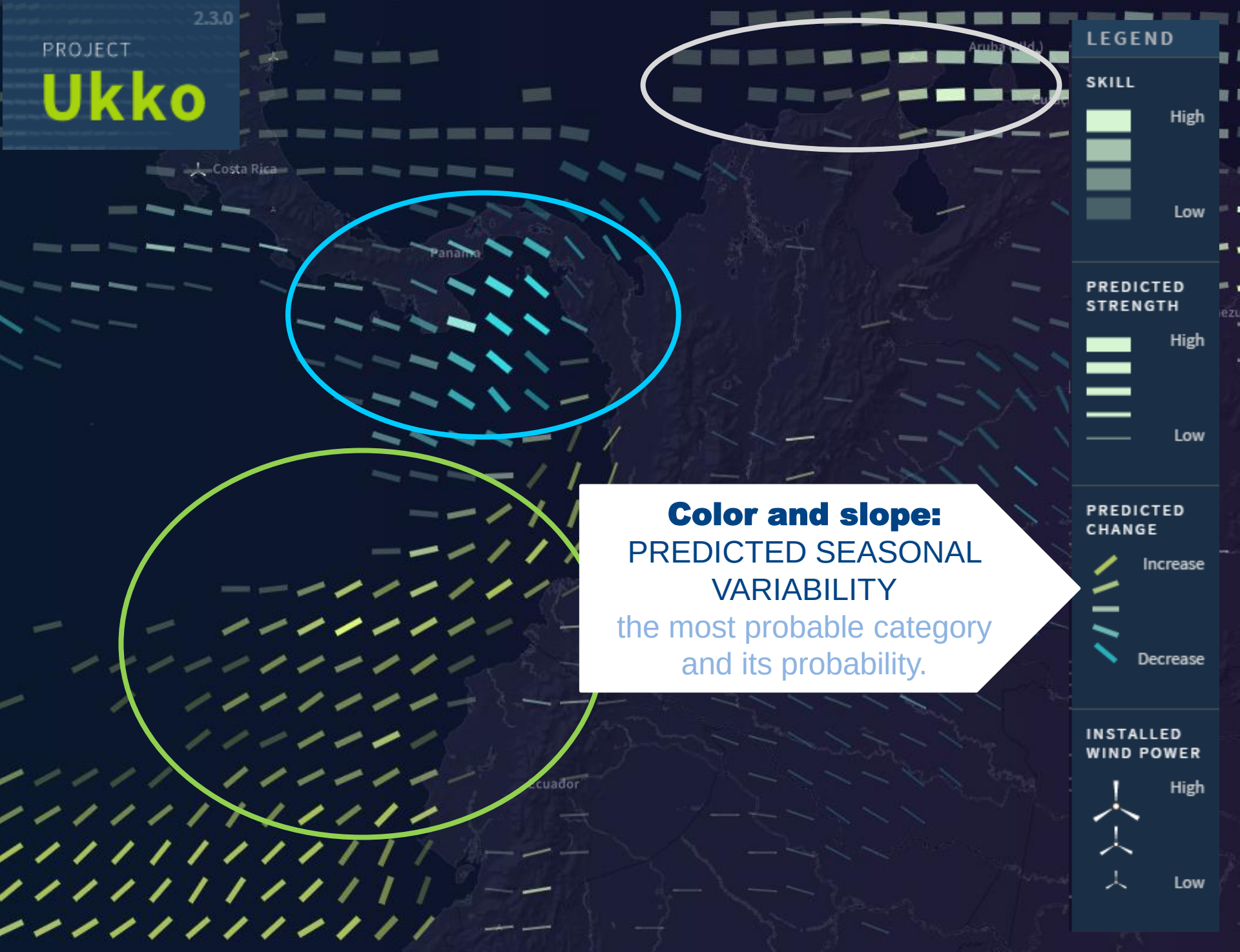
- On-line **visualisation tool** of RESILIENCE
- **Joint development** between scientists and designers
- Renowned data visualiser, **Mortiz Stefaner**
- User Interface Platform (**UIP**)


2.3.0
PROJECT
Ukko
Sargasso Sea
Gulf of Mexico
Mexico
Caribbean Sea
Venezuela
Colombia
Peru
Brazil
Bolivia
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low


2.3.0
PROJECT
Ukko
Transparency:
PREDICTION SKILL
Only areas with a positive skill
(RPSS) have a visible line
LEGEND
SKILL
High
Low
PREDICTED
STRENGTH
High
Low
PREDICTED
CHANGE
Increase
Decrease
INSTALLED
WIND POWER
High
Low
Mexico
Gulf of Mexico
Caribbean Sea
Venezuela
Colombia
Peru
Brazil
Bolivia


2.3.0
PROJECT
Ukko
Caribbean Sea
Venezuela
Colombia
Suriname
Line width:
PREDICTED WIND SPEED
mean wind speed predicted for the coming season.
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low

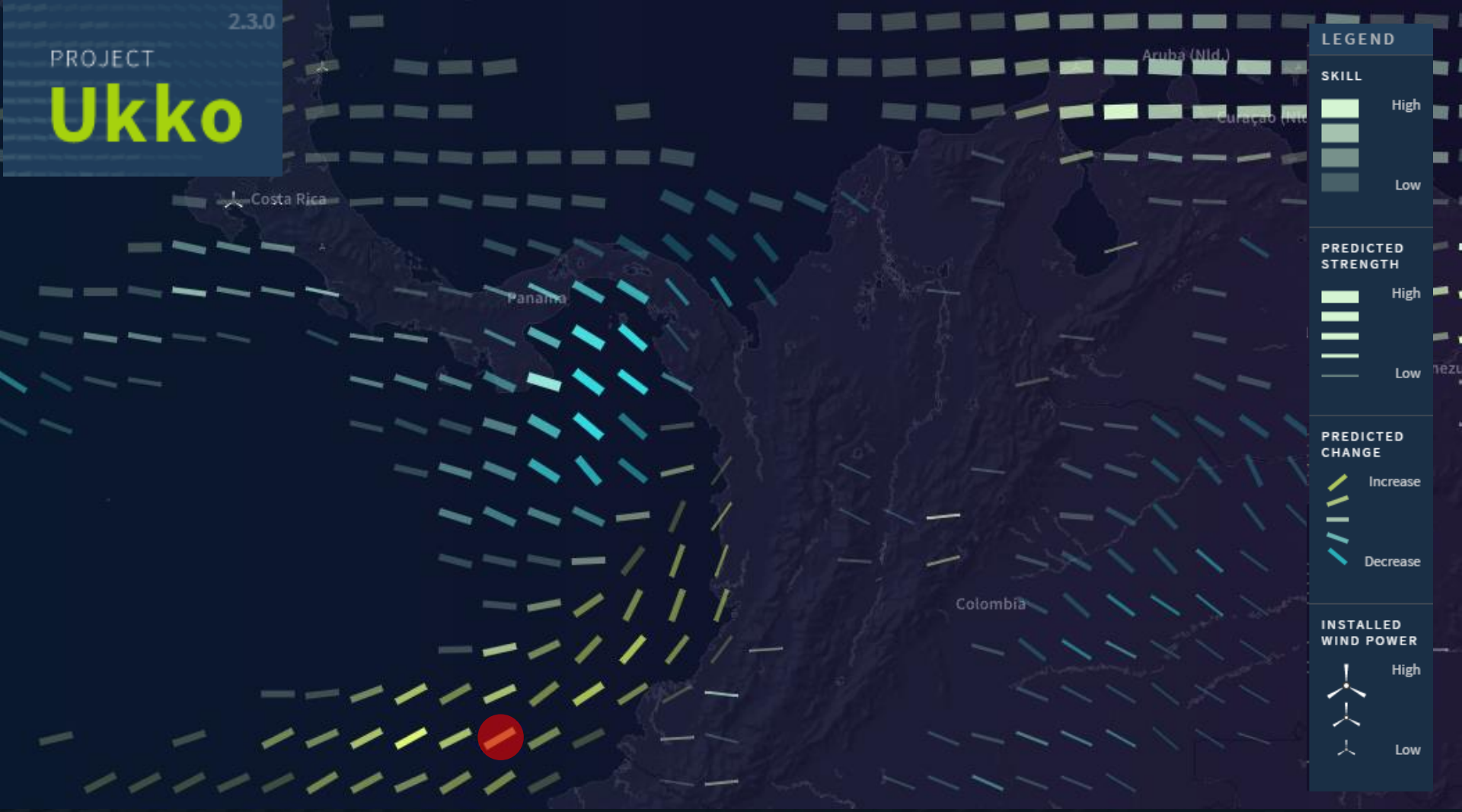

2.3.0
PROJECT
Ukko
Mexico
Gulf of Mexico
Sargasso Sea
Caribbean Sea
Venezuela
Colombia
Bolivia
Color and slope:
PREDICTED SEASONAL VARIABILITY
the most probable category and its probability.
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low


2.3.0
PROJECT
Ukko
Costa Rica
Panama
Ecuador
Color and slope:
PREDICTED SEASONAL VARIABILITY
the most probable category and its probability.
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low

2.3.0

PROJECT

Ukko



OBSERVATIONS

Seasonal average wind speeds in m/s

PREDICTIONS

51.0% UPPER

39.2% MID

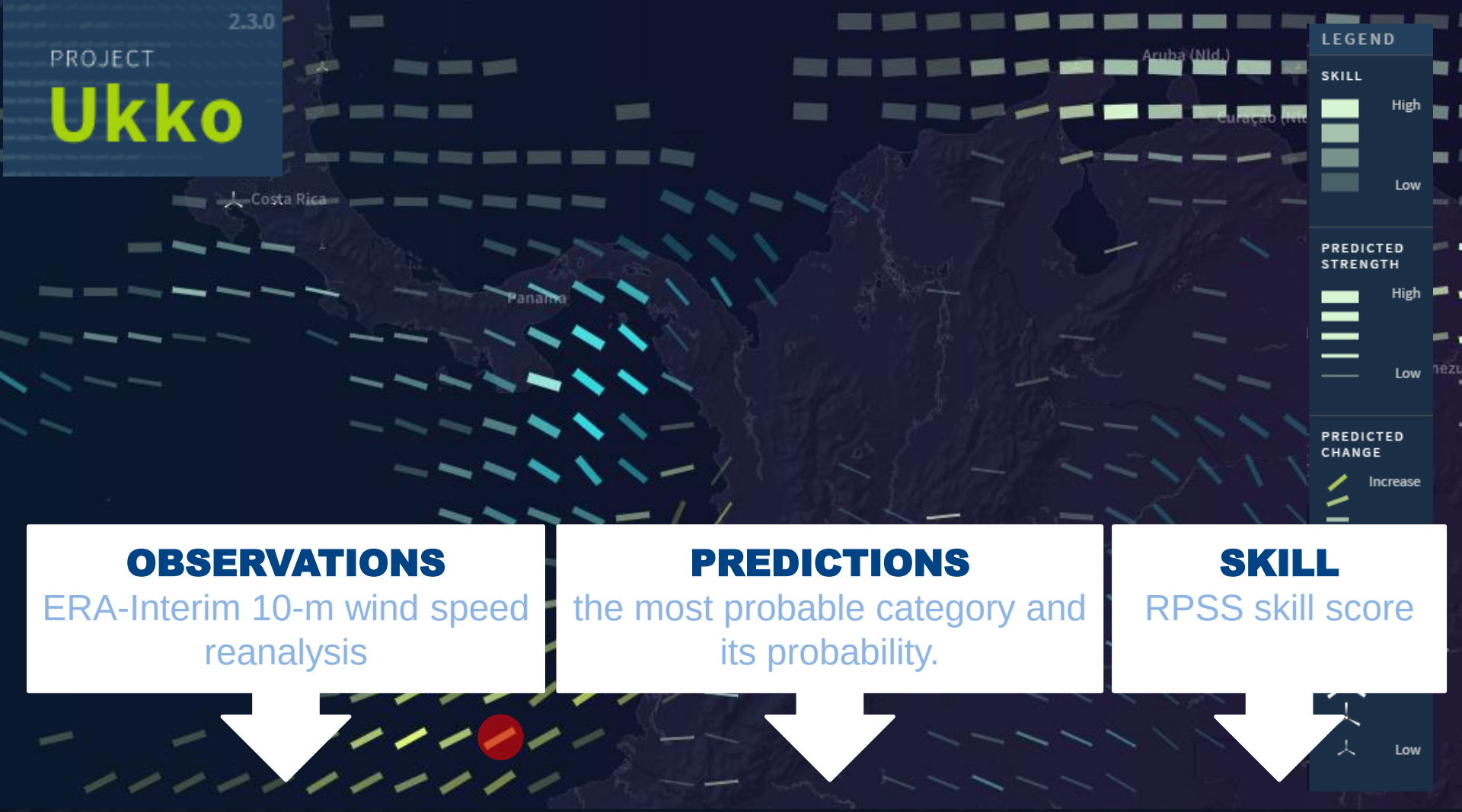
9.8% LOWER

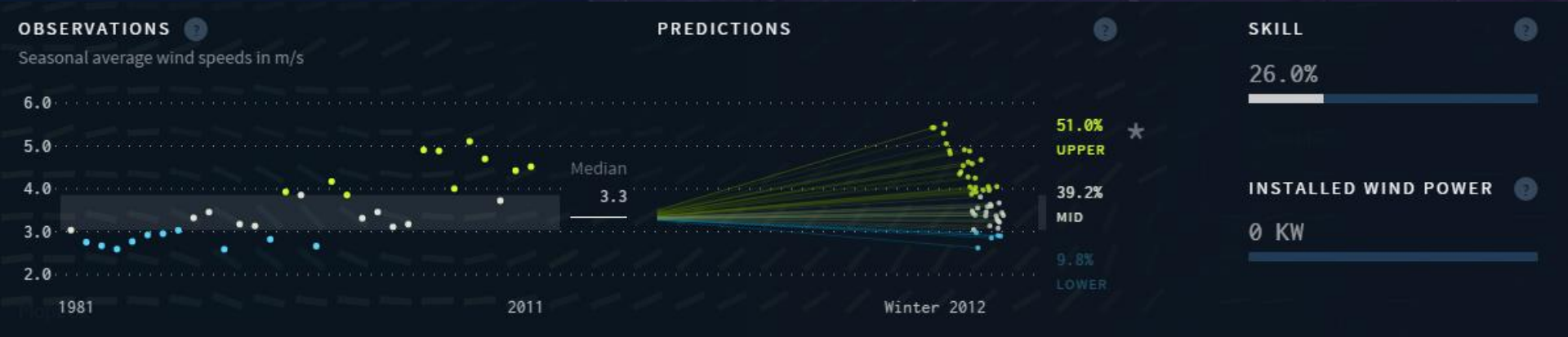
SKILL

26.0%

INSTALLED WIND POWER

0 KW


2.3.0
PROJECT
Ukko
Aruba (Nld.)
Curaçao (Nld.)
Costa Rica
Panama
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Low
OBSERVATIONS
ERA-Interim 10-m wind speed reanalysis
PREDICTIONS
the most probable category and its probability.
SKILL
RPSS skill score


OBSERVATIONS
Seasonal average wind speeds in m/s
6.0
5.0
4.0
3.0
2.0
Median
3.3
1981
2011
PREDICTIONS
51.0%
UPPER
39.2%
MID
9.8%
LOWER
Winter 2012
SKILL
26.0%
INSTALLED WIND POWER
0 KW

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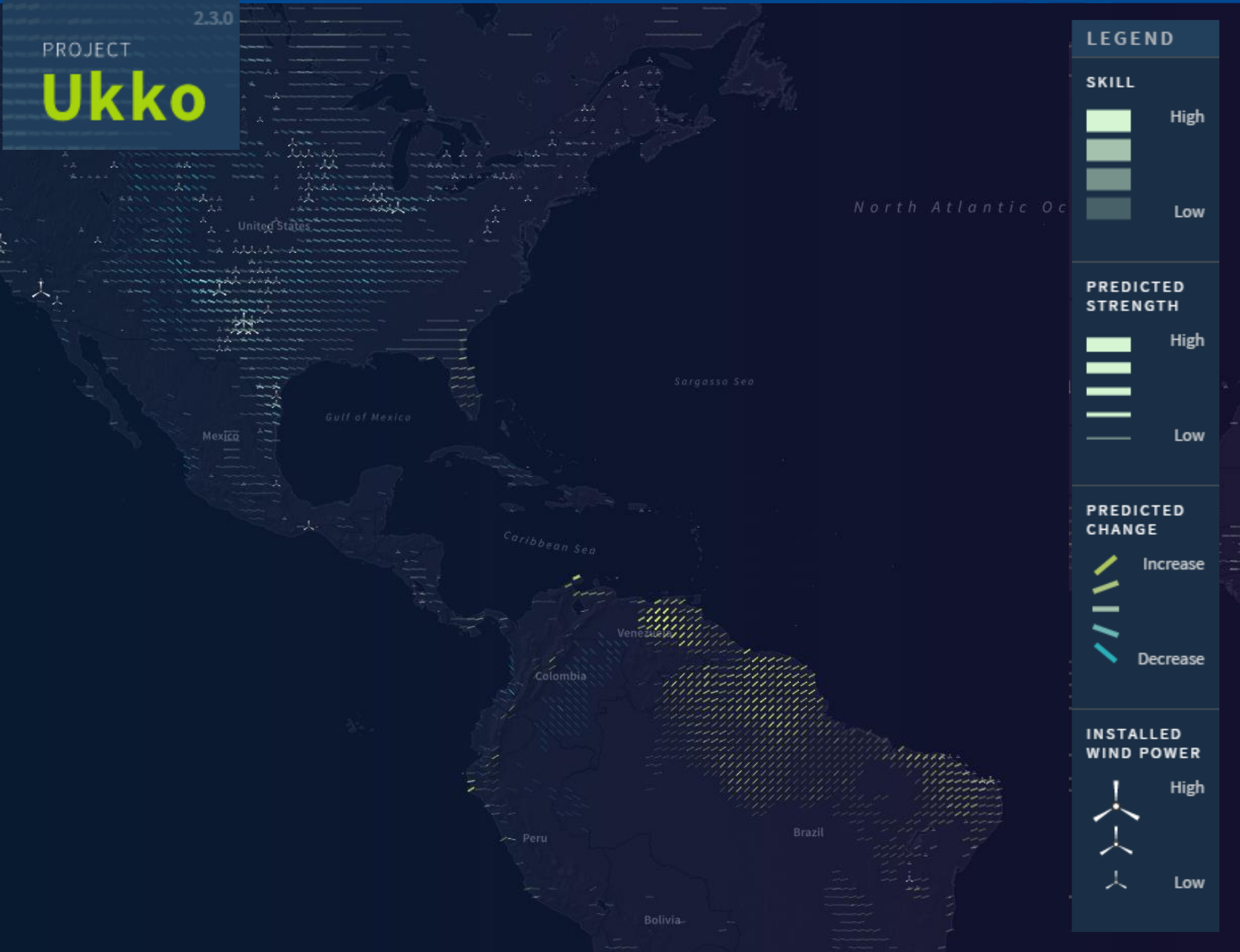
Winter 2015/2016 prediction

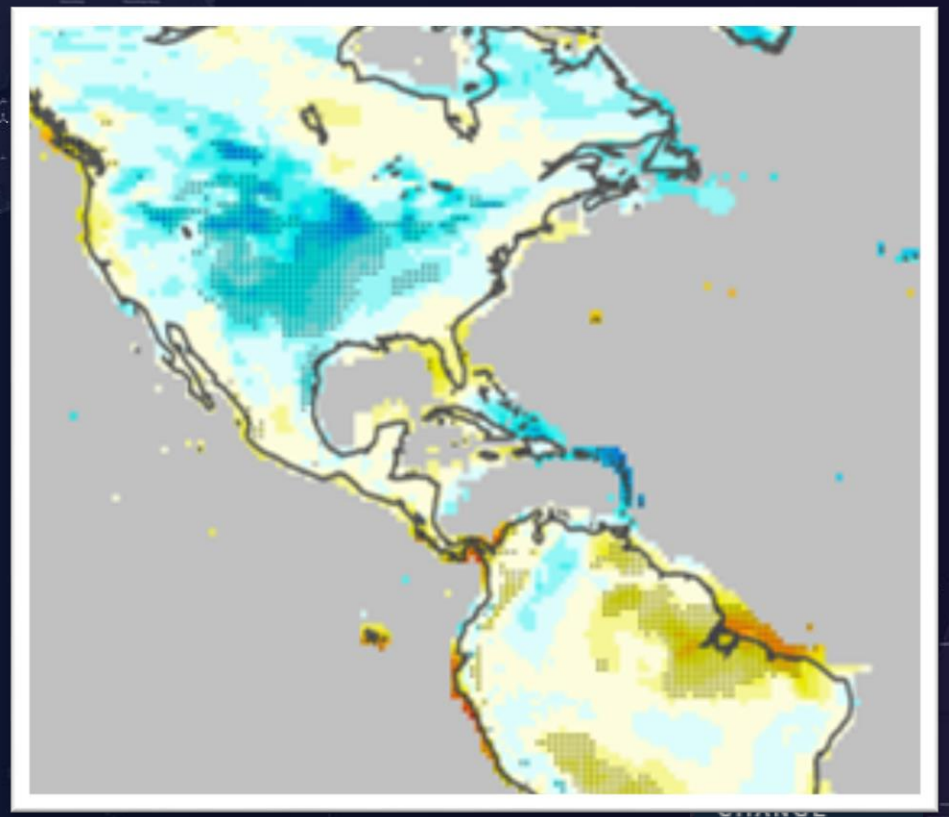
www.project-ukko.net
User: ukko
Password: feic3met

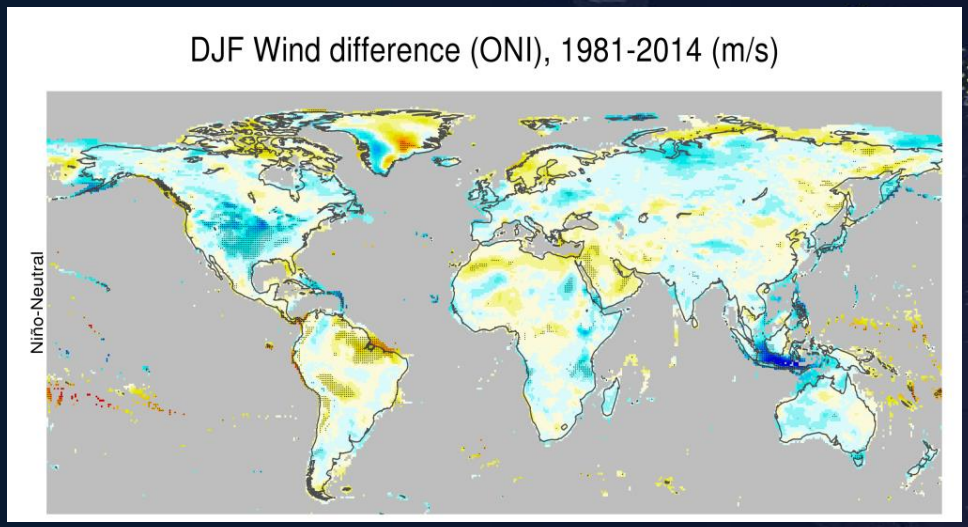

2.3.0
PROJECT
Ukko
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low
North Atlantic Oc
United States
Sargasso Sea
Gulf of Mexico
Mexico
Caribbean Sea
Venezuela
Colombia
Peru
Brazil
Bolivia

2.3.0

PROJECT

Ukko





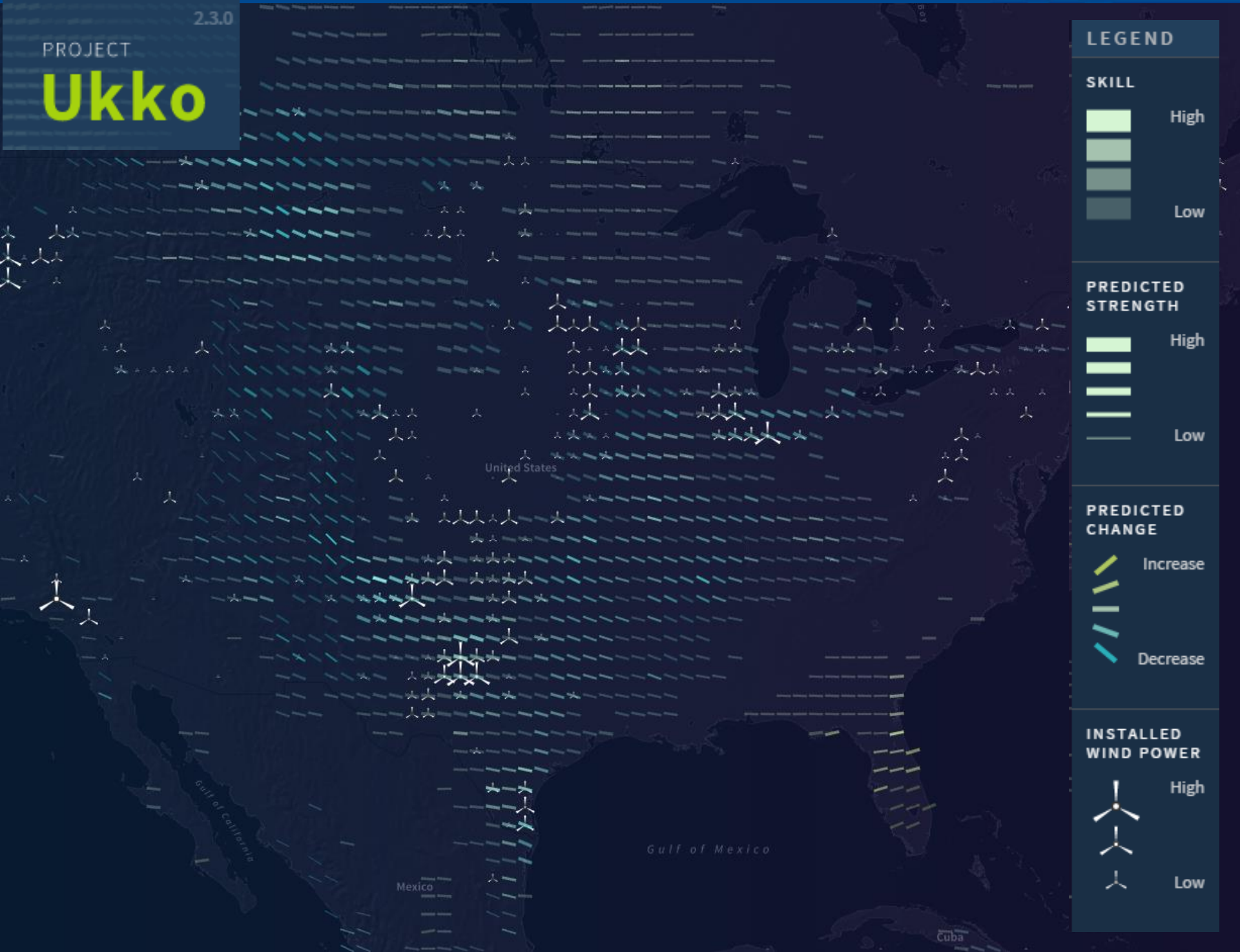
Increase

Decrease

INSTALLED WIND POWER

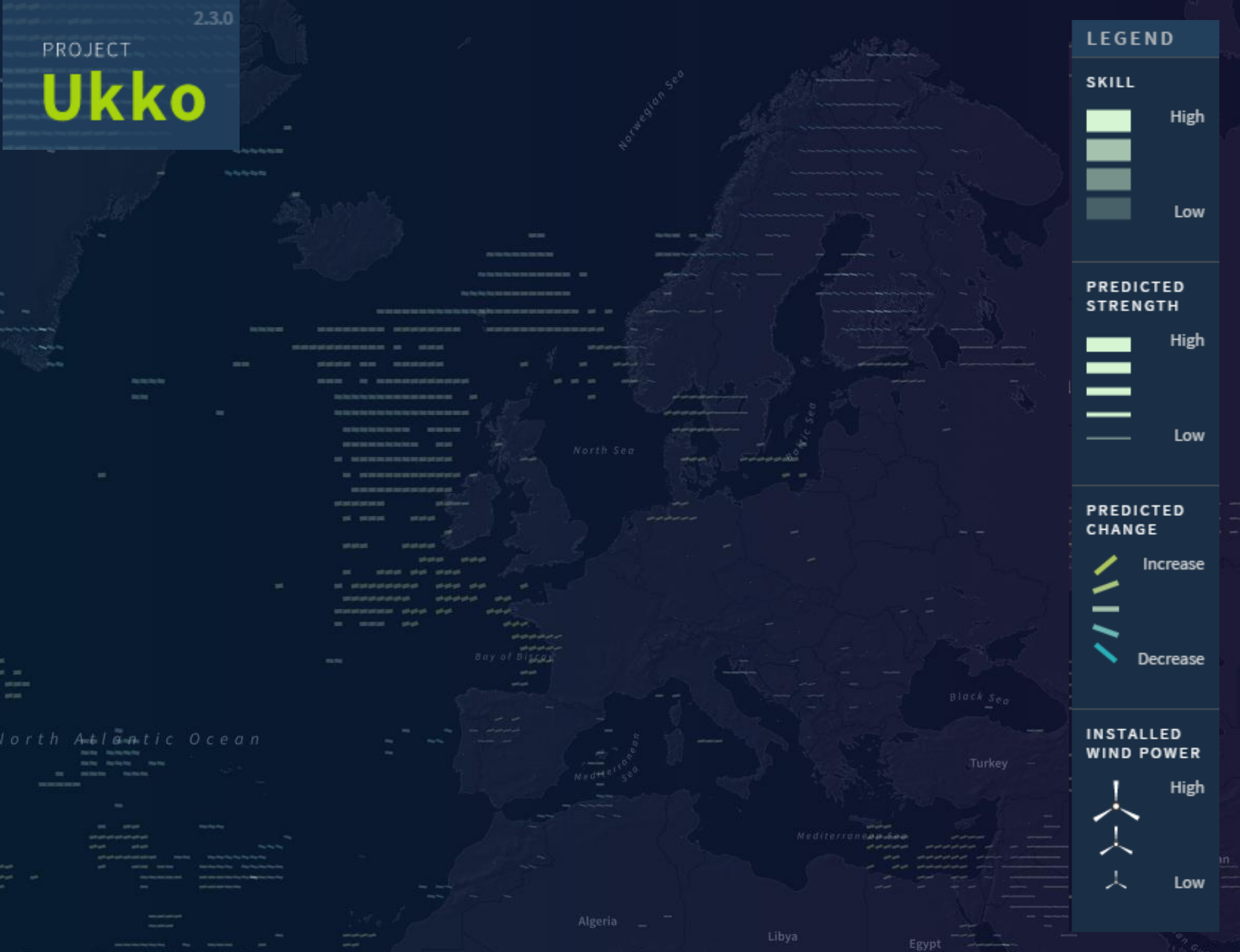
High

Low


2.3.0
PROJECT
Ukko
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low
United States
Gulf of Mexico
Mexico
Cuba

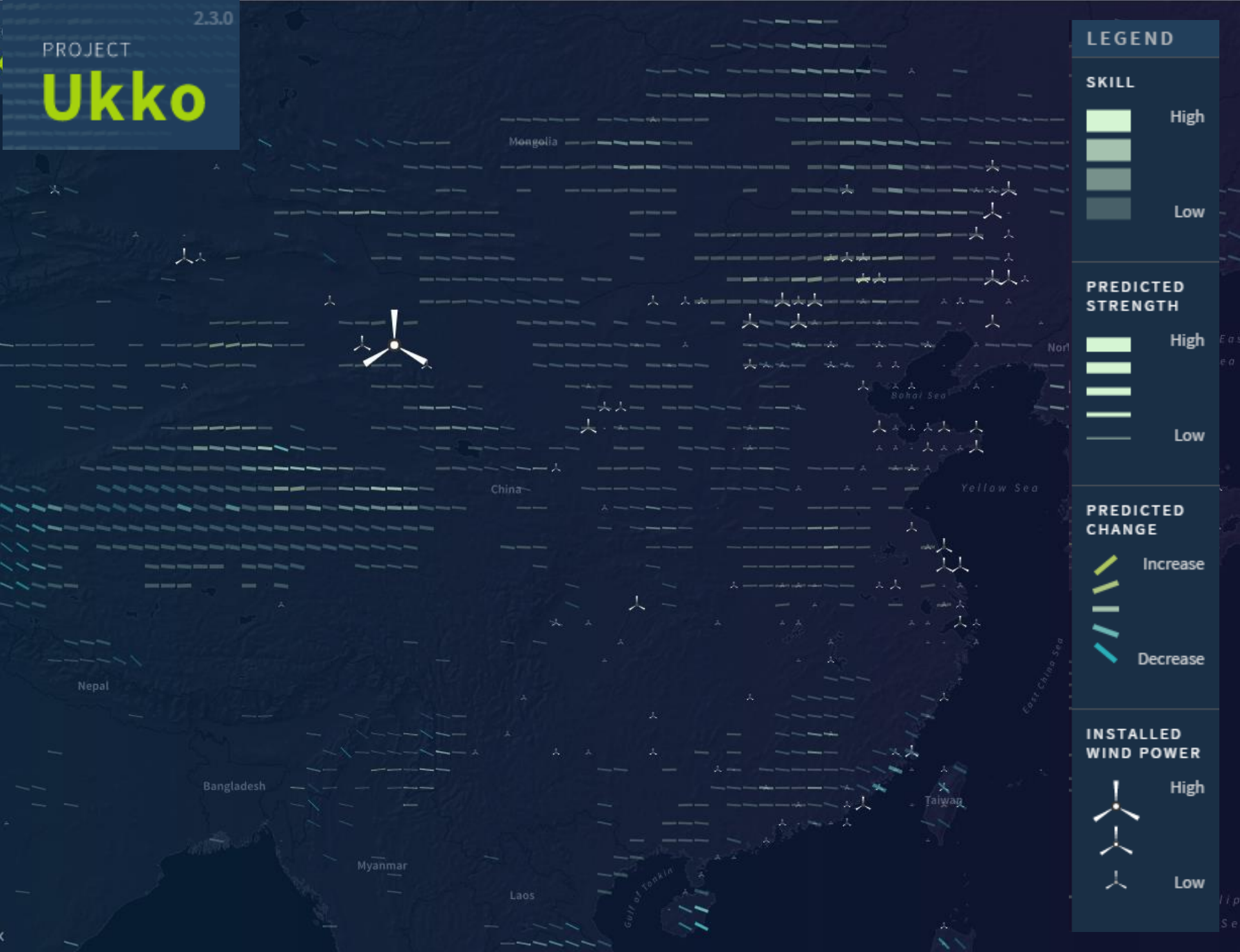

2.3.0
PROJECT
Ukko
Brazil
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low
wind speeds in m/s
PREDICTIONS
Median
5.0
62.7%
UPPER
23.5%
MID
13.7%
LOWER
2014
Winter 2015
SKILL
15.0%
INSTALLED WIND POWER
518,400 KW


2.3.0
PROJECT
Ukko
United States
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low
PREDICTIONS
Median
5.3
19.6%
UPPER
17.6%
MID
62.7%
LOWER
2014
Winter 2015
SKILL
28.0%
INSTALLED WIND POWER
1,565,000 KW


2.3.0
PROJECT
Ukko
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low
Norwegian Sea
North Sea
Baltic Sea
Bay of Biscay
North Atlantic Ocean
Black Sea
Turkey
Mediterranean Sea
Algeria
Libya
Egypt


2.3.0
PROJECT
Ukko
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low
North Sea
United Kingdom
Ireland
Irish Sea
English Channel
France
Germany
Bay of Biscay
Spain
Balearic Sea
Mediterranean Sea
Alboran Sea
Italy
Adriatic Sea
Tunisia


2.3.0
PROJECT
Ukko
North Sea
Denmark
United Kingdom
Irish Sea
The Netherlands
Bristol Channel
Germany
Belgium
English Channel
Luxembourg
Czech Republic
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low
PREDICTIONS
ds in m/s
Median
5.0
52.9%
UPPER
29.4%
MID
17.6%
LOWER
2014
Winter 2015
SKILL
1.0%
INSTALLED WIND POWER
337,290 KW

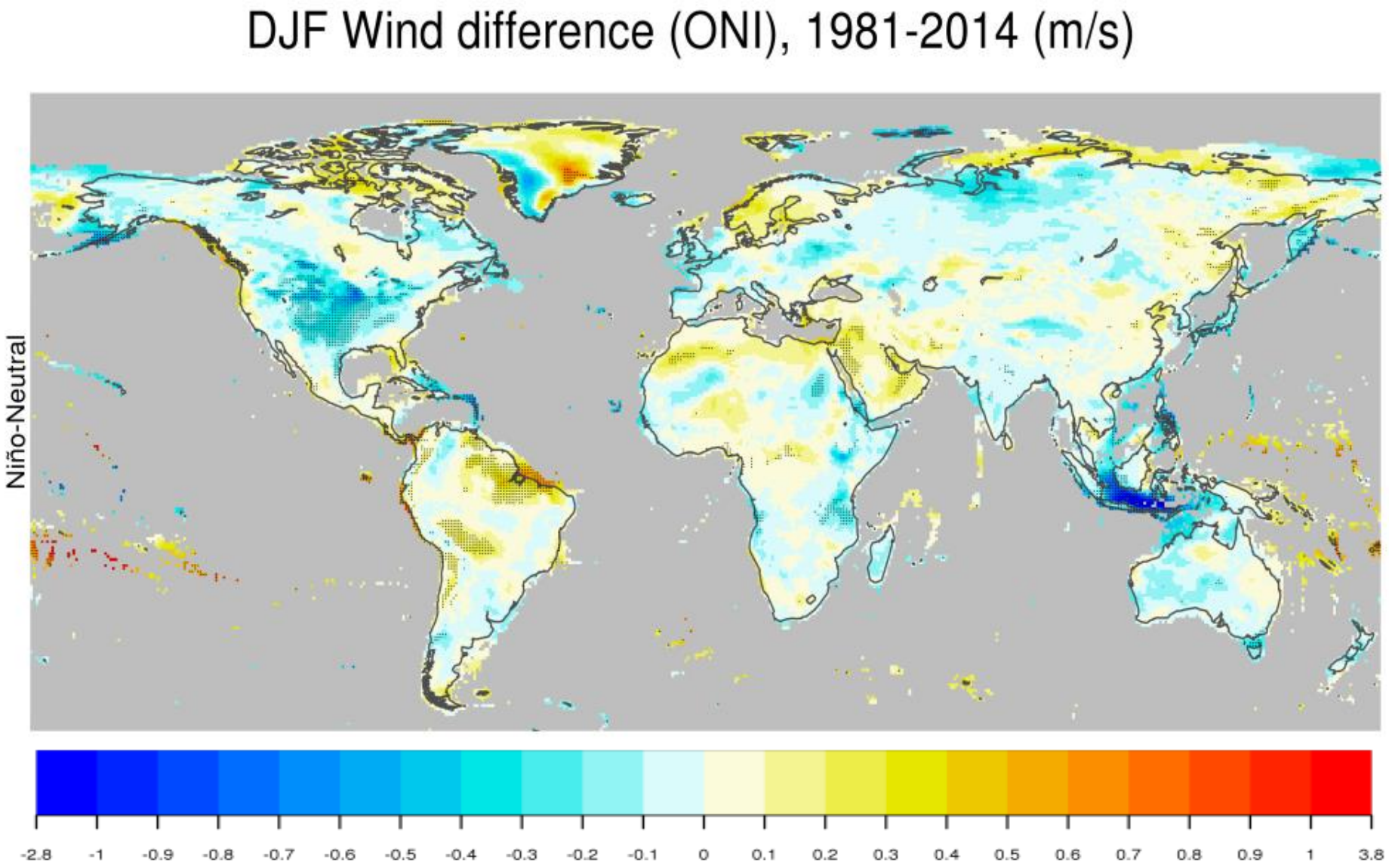

2.3.0
PROJECT
Ukko
Mongolia
China
Nepal
Bangladesh
Myanmar
Laos
Taiwan
Bohai Sea
Yellow Sea
East China Sea
Gulf of Tonkin
LEGEND
SKILL
High
Low
PREDICTED STRENGTH
High
Low
PREDICTED CHANGE
Increase
Decrease
INSTALLED WIND POWER
High
Low

www.bsc.es

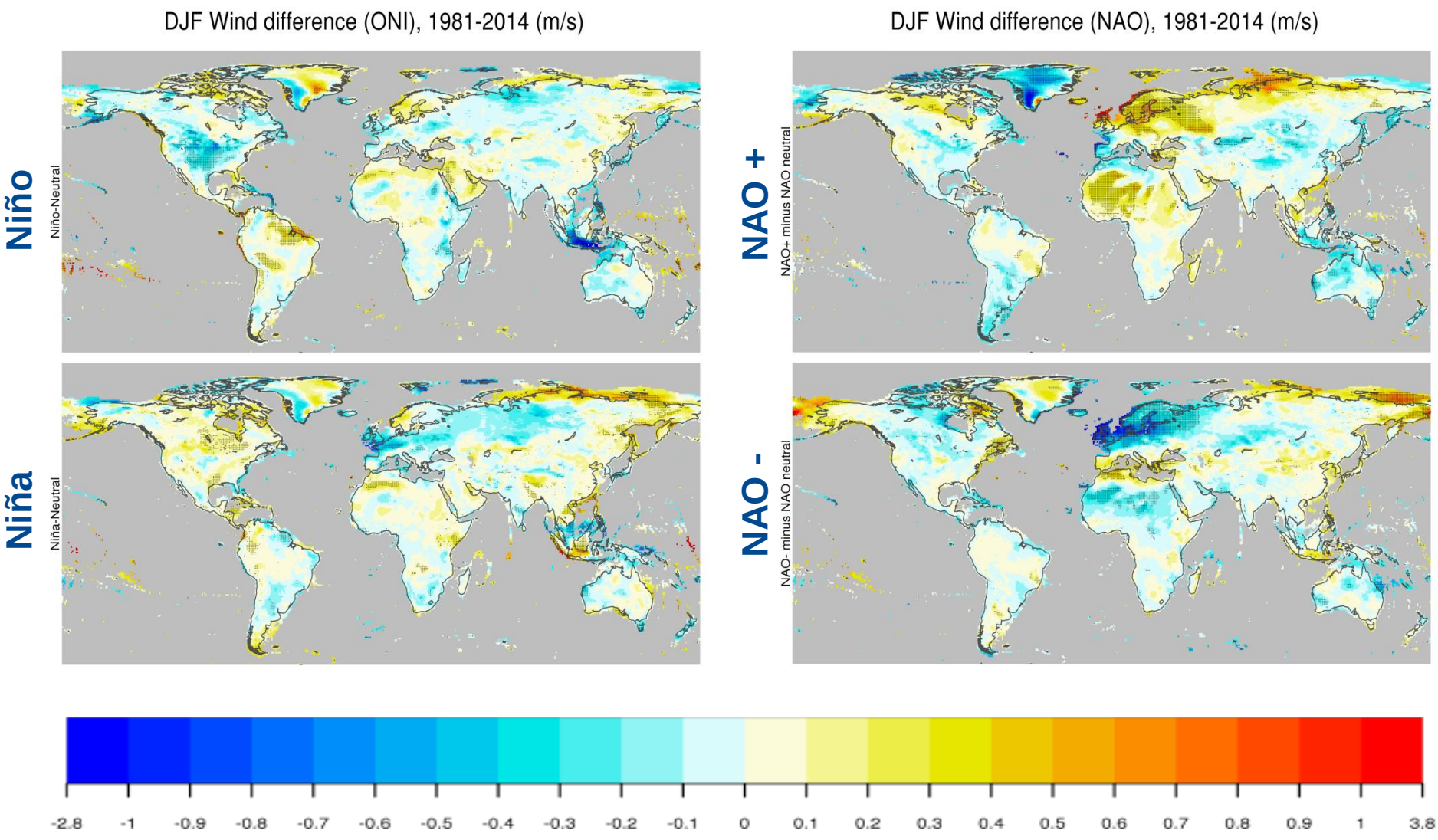
Thank you!

Isadora.jimenez@bsc.es

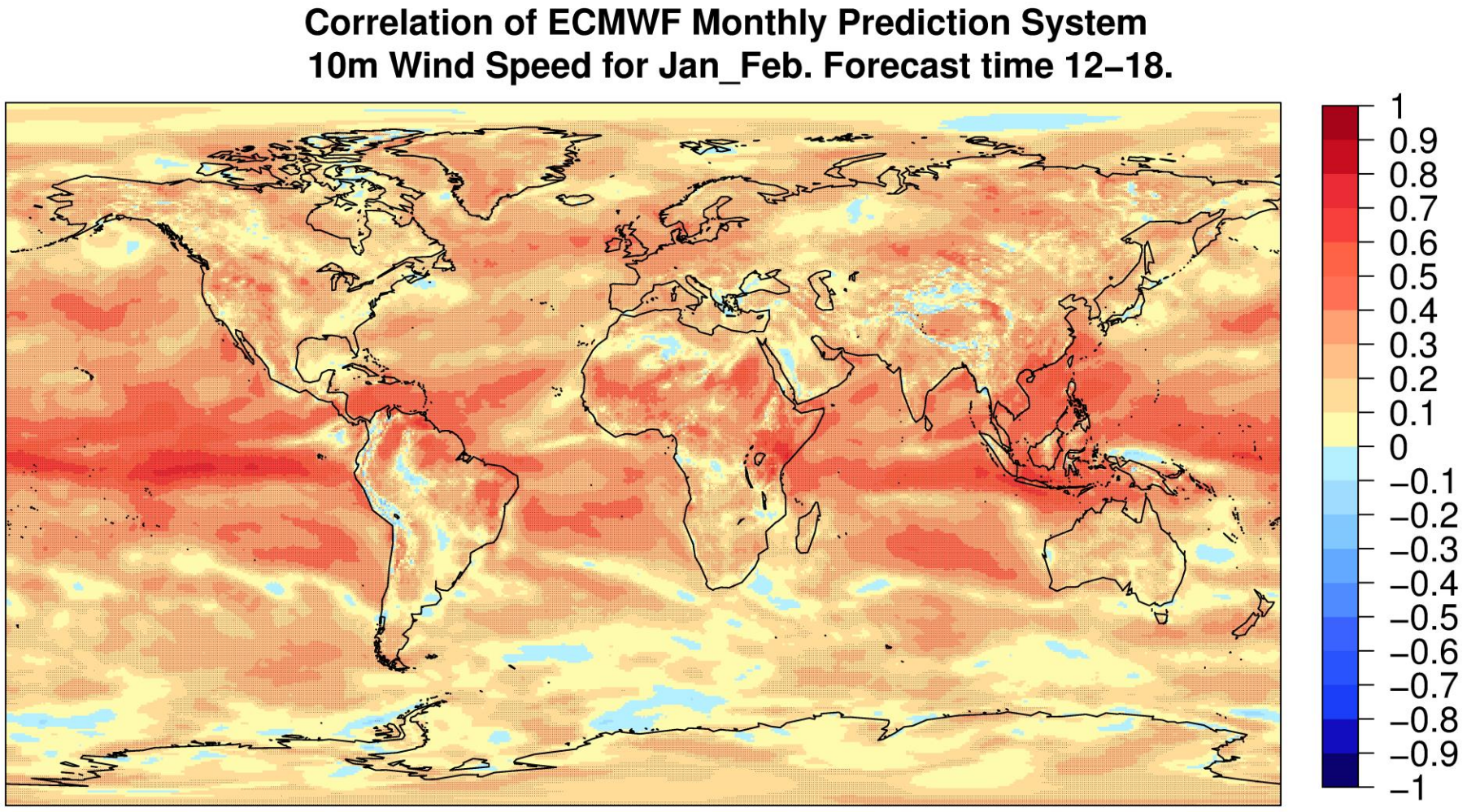
El Niño effect on wind speed



e.g. Climate drivers of seasonal variability



Skill map for sub-seasonal



Climate services for energy

ESS partnership in EU Projects in climate services for the energy sector

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

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

NEWA: New European Wind Atlas

PRIMAVERA: Process-based climate simulation: advances in high-resolution modelling and european climate risk assessment

IMPREX: Improving predictions and management of hydrological Extremes

CLIM4ENERGY: Climate for Energy