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Barcelona, 14 January 2016

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

EXCELENCIA SEVERO OCHOA

EARTH SYSTEM SERVICES

Earth Sciences Department at BSC

Francisco Doblas-Reyes, Albert Soret Miravet, Isadora Christel

Barcelona Supercomputing Center

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EXCELENCIA SEVERO OCHOA

- Created in 2005; 450 employees
- Research, develop and manage information technology
- Facilitate scientific progress and its application in society

Earth Sciences Department

- Merging process between

Climate Forecasting Unit

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

- New structure: 4 groups (~ 50 people)

COMPUTATIONAL EARTH SCIENCES

ATMOSPHERIC COMPOSITION

CLIMATE PREDICTIONS

EARTH SYSTEM SERVICES

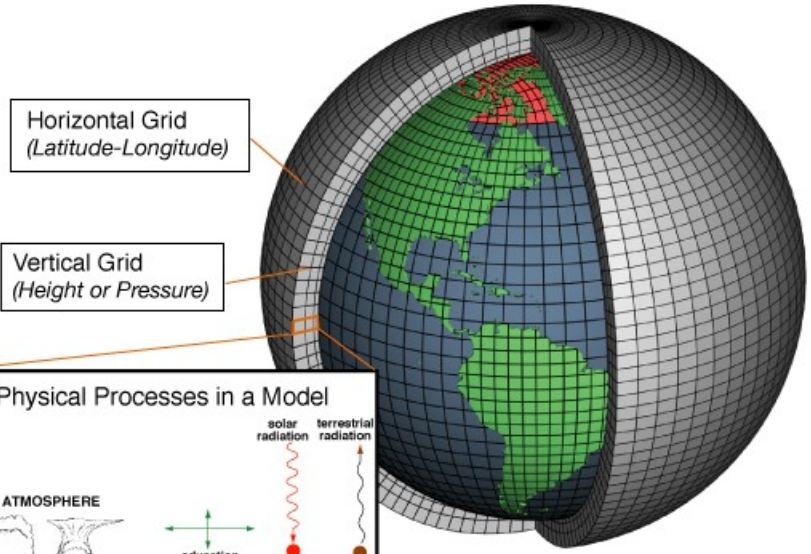
Earth System Services

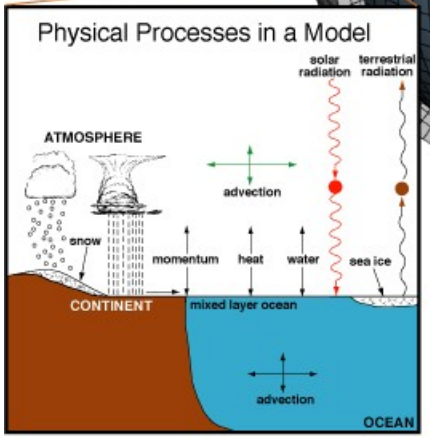
OUR OBJECTIVE:

Facilitate technology transfer of state-of-the-art research from local, national to international levels in five areas:

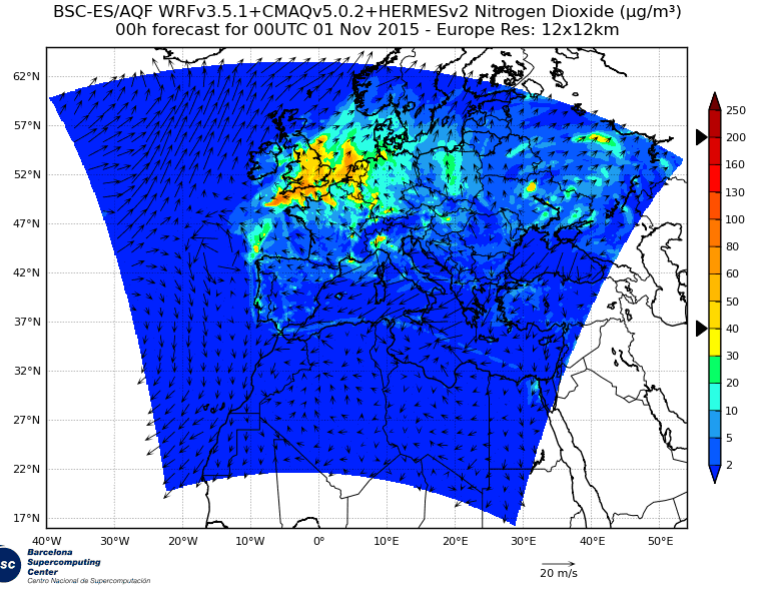
- Air quality assessments
- Mineral Dust modelling
- Weather forecasting
- Climate predictions
- Computational Earth Services

Earth sciences modelling: climate and air quality modelling



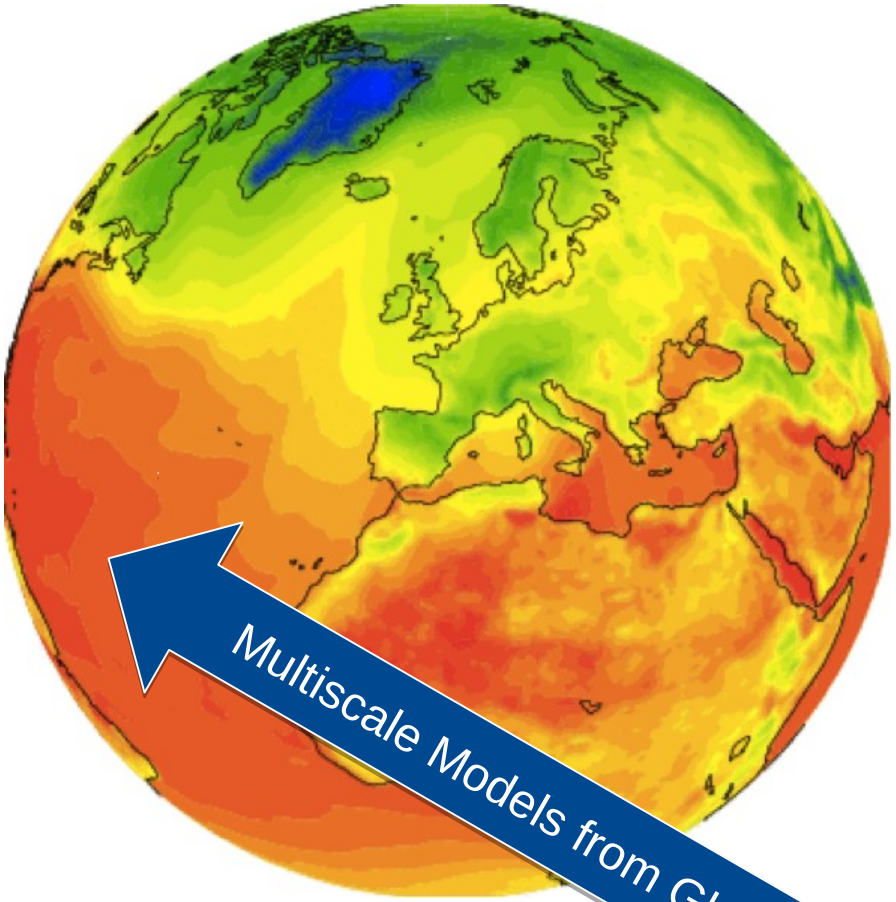


Towards modelling the Earth system

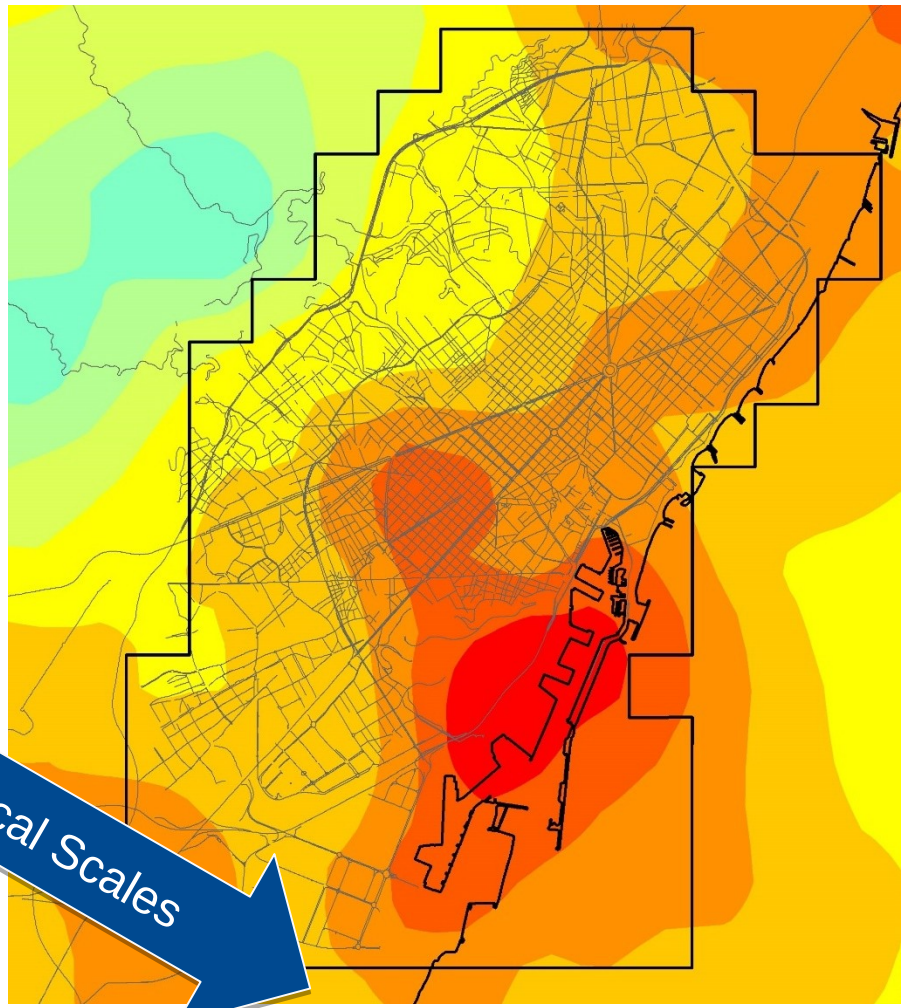


Spatial scales

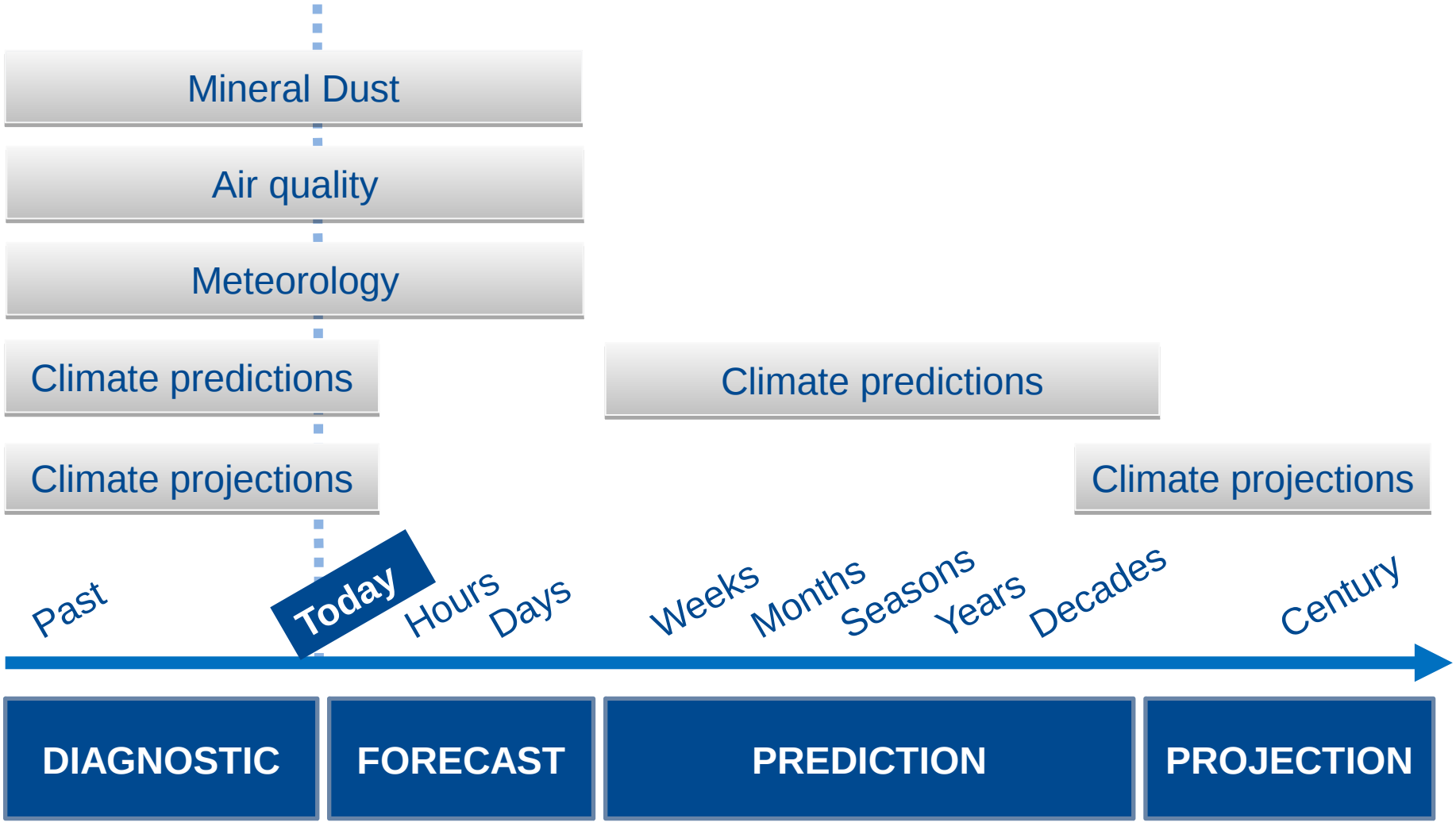
Multi-scale models from global to local scales



Multiscale Models from Global to Local Scales



Temporal scales



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Air quality management

CALIOPE air quality operational forecasts

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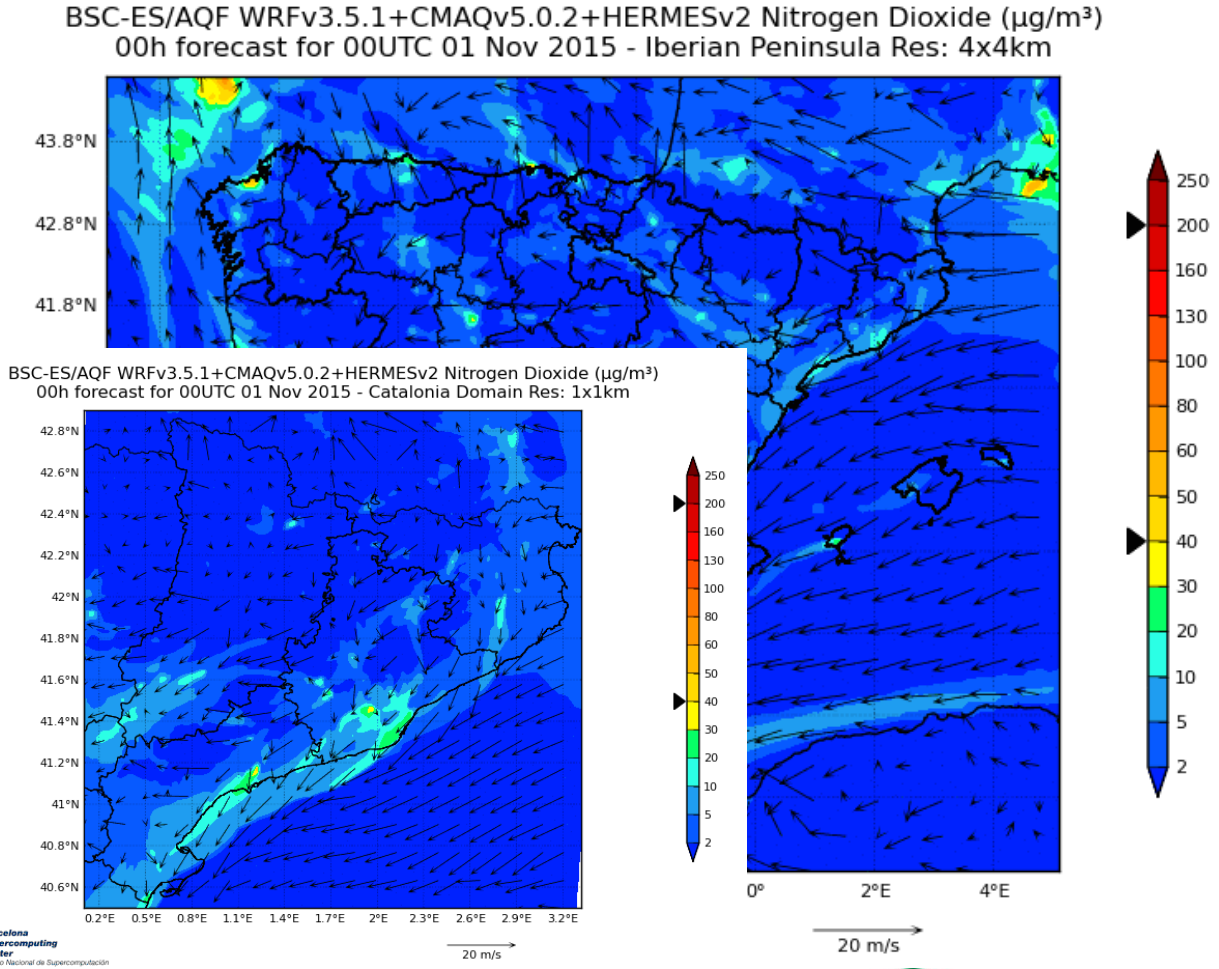
Provides air quality related information for the coming days and for the application of short term action plans for air quality managers.



Information is delivered using both online or custom applications:

www.bsc.es/caliope

ANDROID APP ON Google play

Available on the App Store

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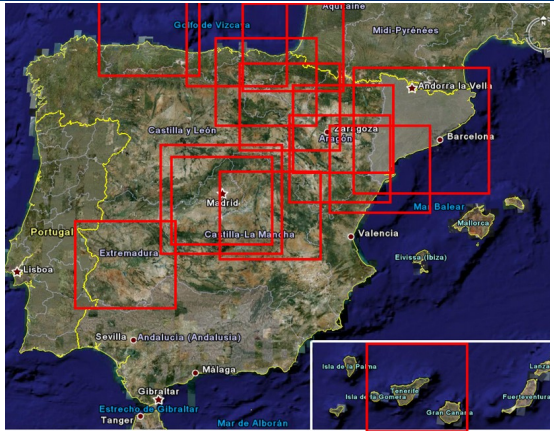
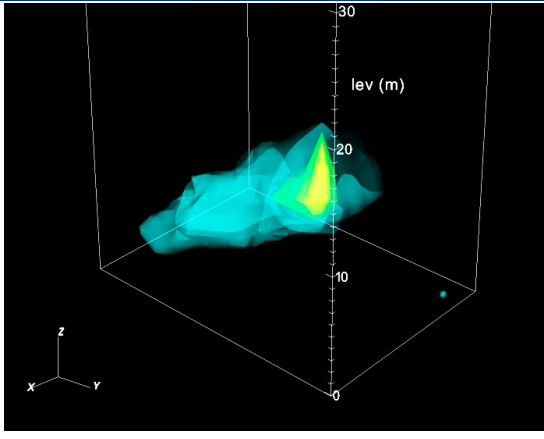
GOBIERNO DE ESPAÑA · MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE · JUNTA DE ANDALUCIA · Gobierno de Canarias

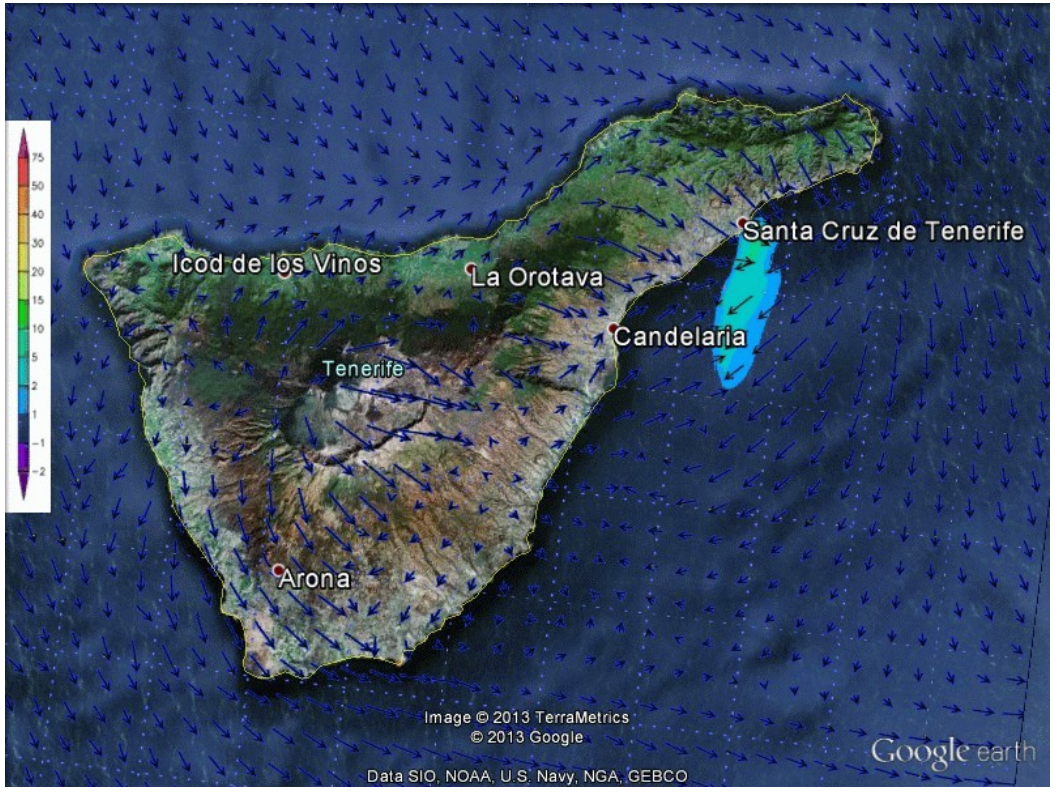
Air quality management: point sources



Air quality impact studies performed in different regions and terrains.



Development of tools to meet user requirements.



Study of the refinery of Santa Cruz de Tenerife included in the AQ plan


Gobierno de Canarias
Consejería de Educación, Universidades y Sostenibilidad
Dirección General de Protección de la Naturaleza

PLAN DE CALIDAD DEL AIRE EN LA AGLOMERACIÓN DE SANTA CRUZ DE TENERIFE-SAN CRISTÓBAL DE LA LAGUNA POR DIÓXIDO DE AZUFRE RELATIVO A LA EVALUACIÓN DE LA CALIDAD DEL AIRE DEL AÑO 2011.

ÍNDICE

1. Antecedentes
2. Localización de la superación
3. Información general
4. Autoridades responsables
5. Naturaleza y evaluación de la contaminación
6. Origen de la contaminación
7. Análisis de la situación
8. Detalles de las medidas o proyectos de mejora existentes
9. Información sobre las medidas o proyectos del plan de calidad del aire
10. Información sobre las medidas o proyectos a largo plazo previstos o considerados
11. Lista de las publicaciones, documentos, trabajos, etc.
12. Procedimientos para el seguimiento de su cumplimiento y revisión
Anexo. Modelización de la calidad del aire en Santa Cruz de Tenerife en 2011

Air quality management. Fleet electrification

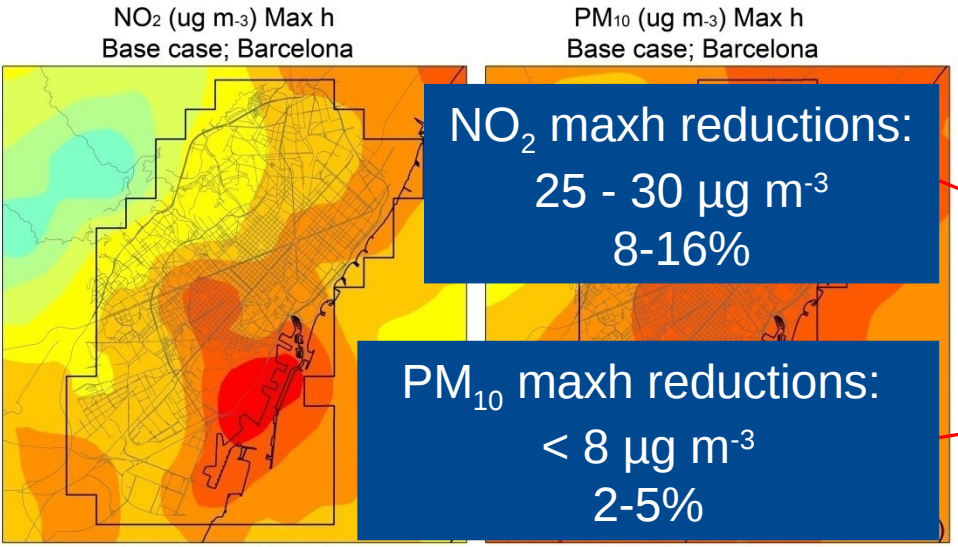
Fleet electrification: Replacement of internal combustion vehicles by electric vehicles

Hybrid electric vehicles (HEV)

Plug-in electric vehicle (PHEV)

Battery electric vehicle (BEV)

Air quality management. Fleet electrification



NO_2 maxh reductions:
25 - 30 µg m^{-3}
8-16%

PM_{10} maxh reductions:
< 8 µg m^{-3}
2-5%

NO_2 maxh reductions:
30 - 35 µg m^{-3}
8-16%

PM_{10} maxh reductions:
< 6 µg m^{-3}
2-4%

Main source:	Exhaust emissions	Exhaust and resuspension

(Soret et al., 2014)

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Short term forecast for solar energy

Mineral Dust Services for solar energy

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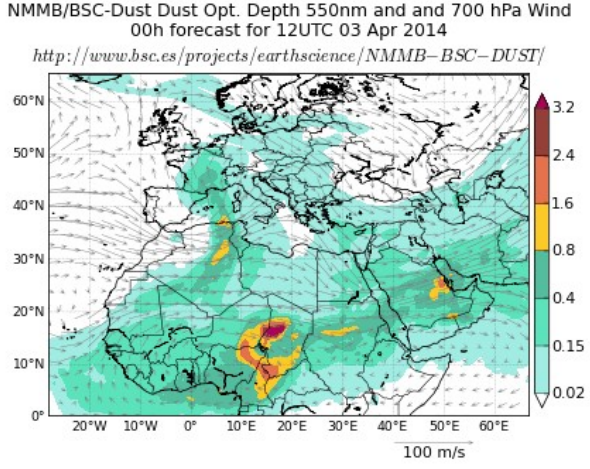
1. Mineral dust assessment

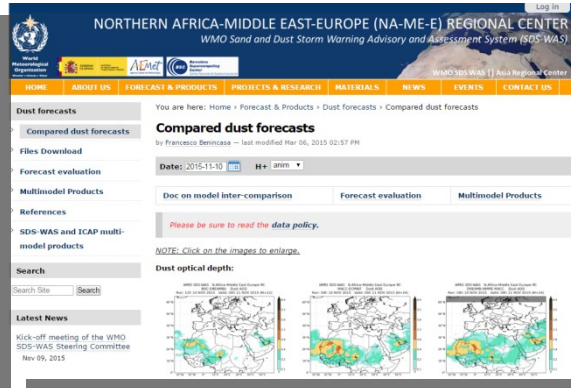
BSC has developed in collaboration with NCEP the NMMB/BSC-Dust model.

- Regional and global scales
- On-line feedbacks: Dust-Radiation interaction

2. Forecast system

Provides early-warning information about current and future dust concentration and derived parameters critical for specific sectors.





http://sds-was.aemet.es

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Climate predictions for wind energy

Climate services for wind 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

e.g. Seasonal wind speed predictions

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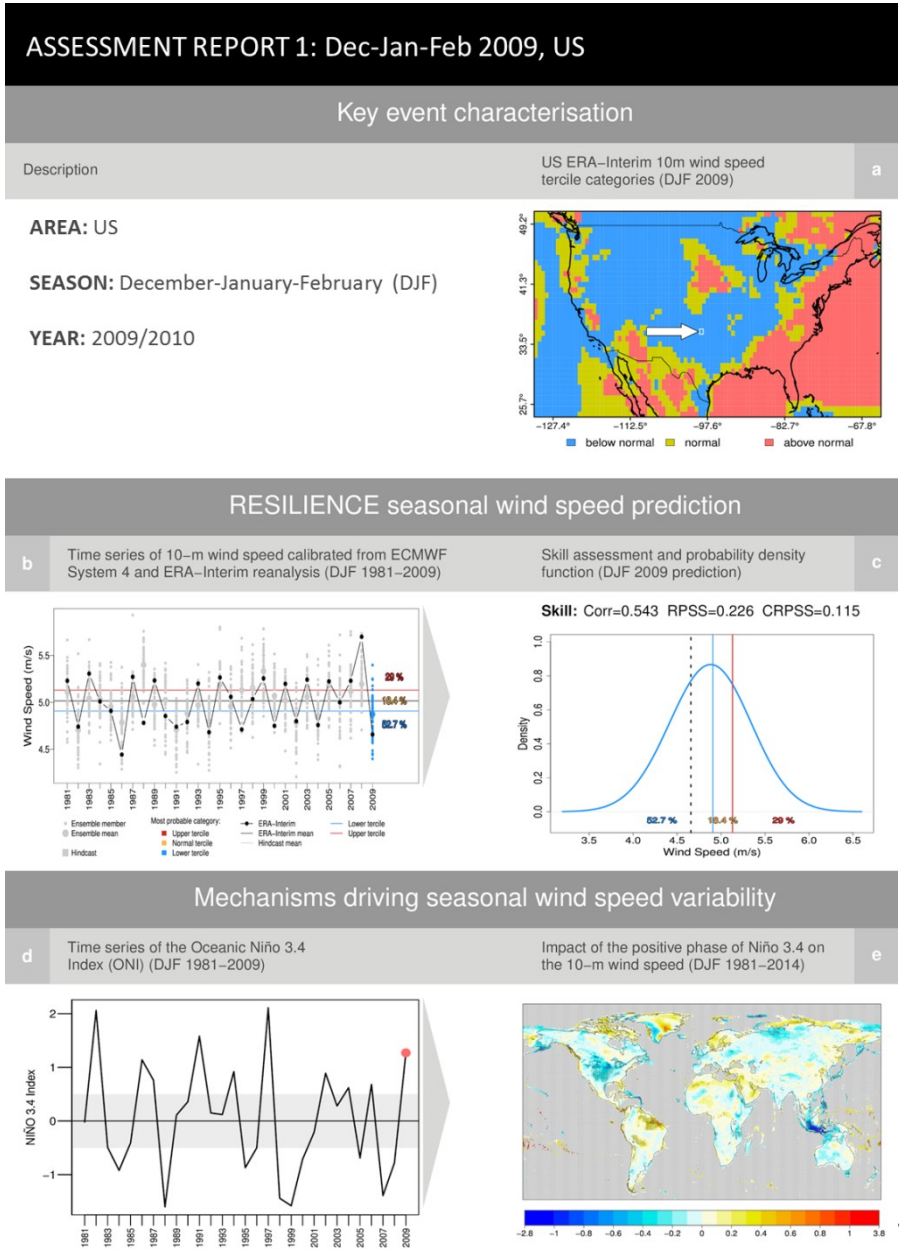
RESILIENCE PROTOTYPE

- Data from **ECMWF** (European Centre for Medium-Range Weather Forecasts)
- We assess the global behavior providing **probabilistic predictions**
- Aggregated output in **terciles**:
  - Above normal
  - Normal
  - Below normal



e.g. Seasonal wind speed predictions

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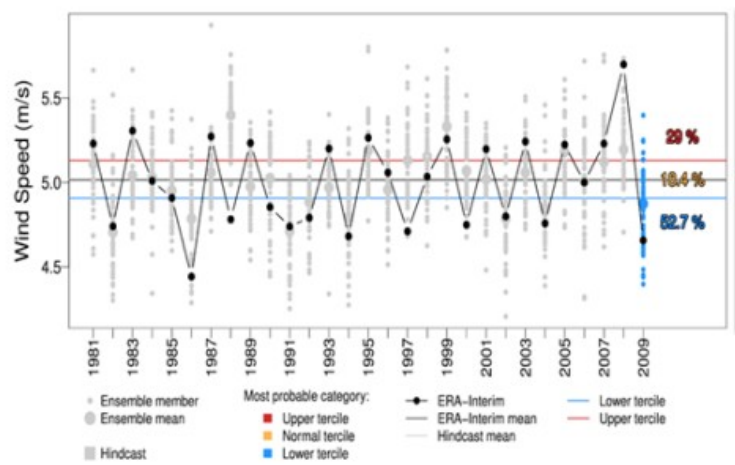
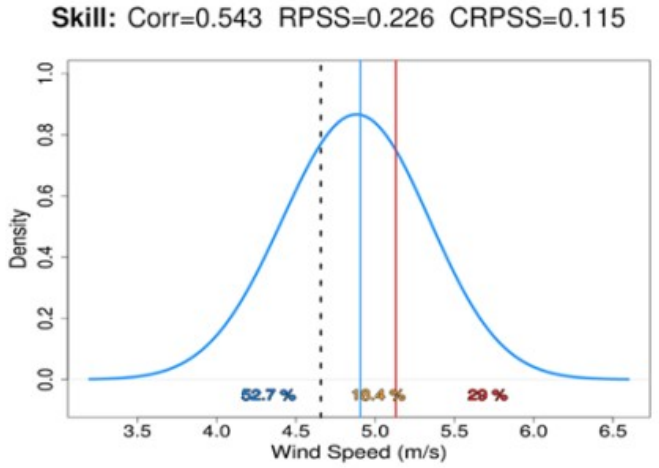
RESILIENCE seasonal wind speed prediction

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





PROJECT UKKO

EUPORIAS

On-line visualisation tool for the RESILIENCE prototype

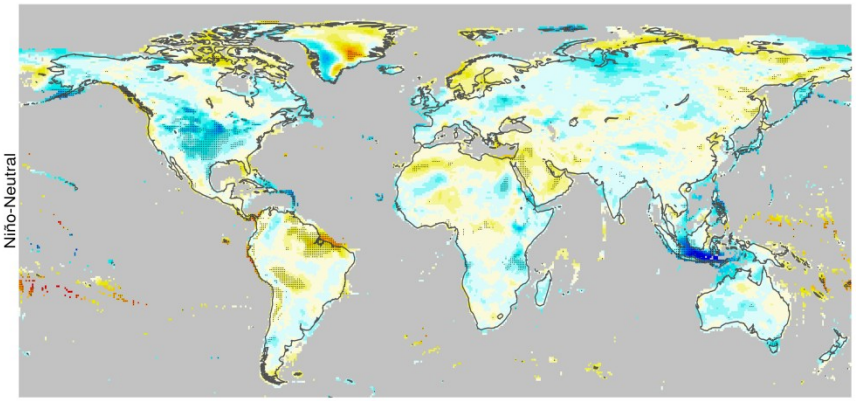
e.g. Climate drivers of seasonal variability

DJF Wind difference (ONI), 1981-2014 (m/s)

DJF Wind difference (NAO), 1981-2014 (m/s)

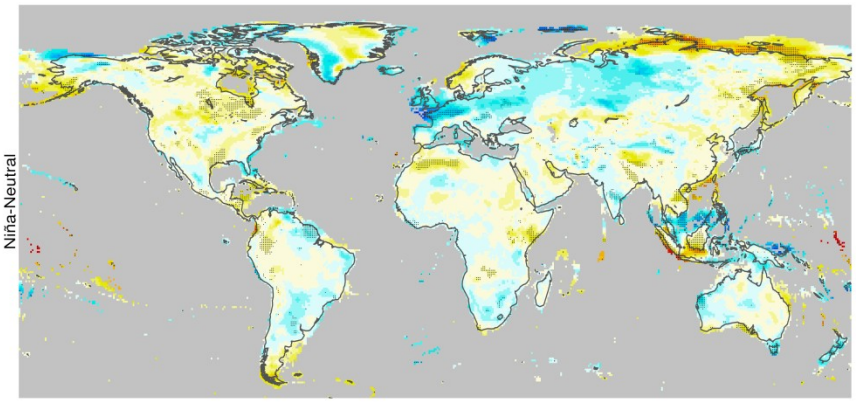
Niño

Niño-Neutral



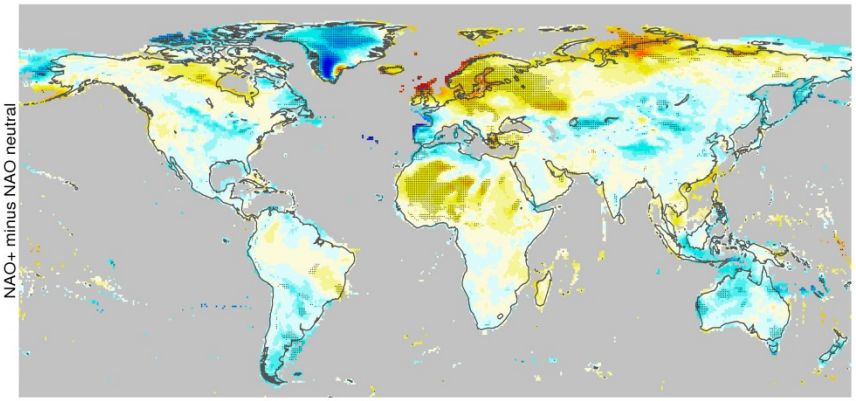
Niña

Niña-Neutral



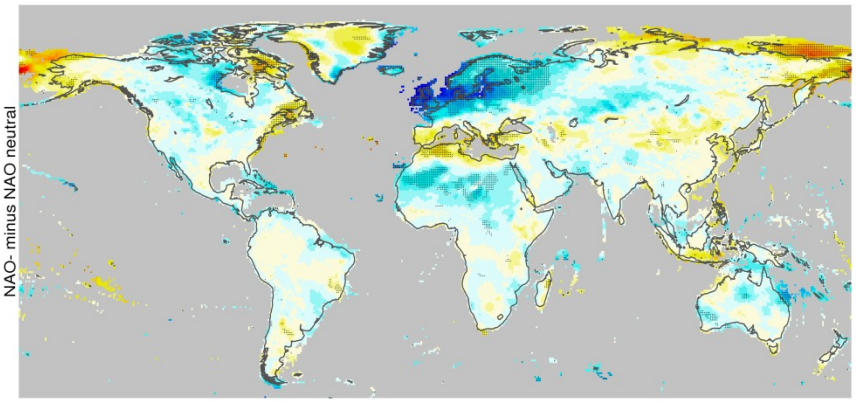
NAO +

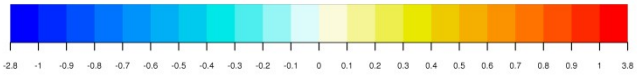
NAO+ minus NAO neutral



NAO -

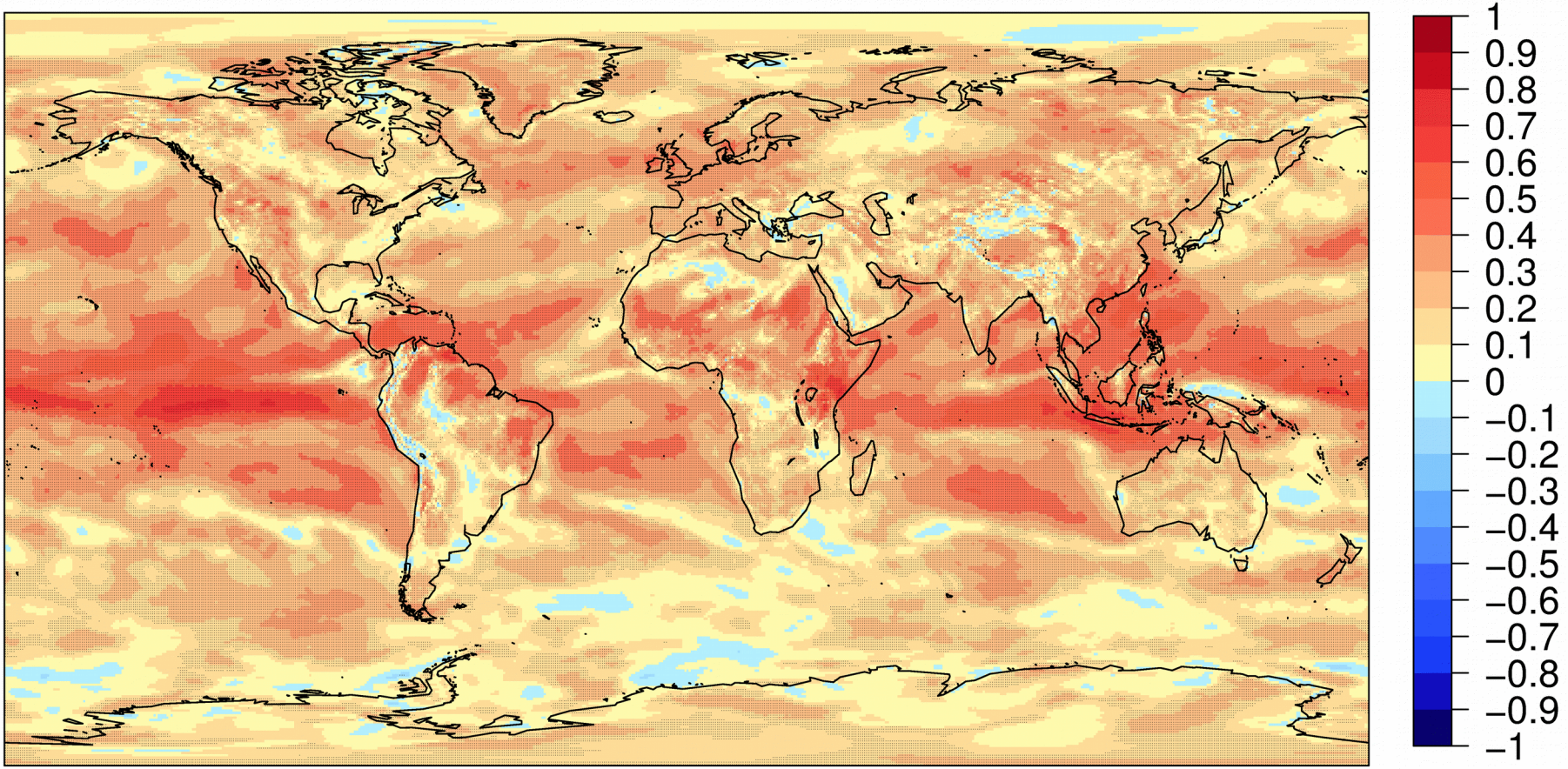
NAO- minus NAO neutral



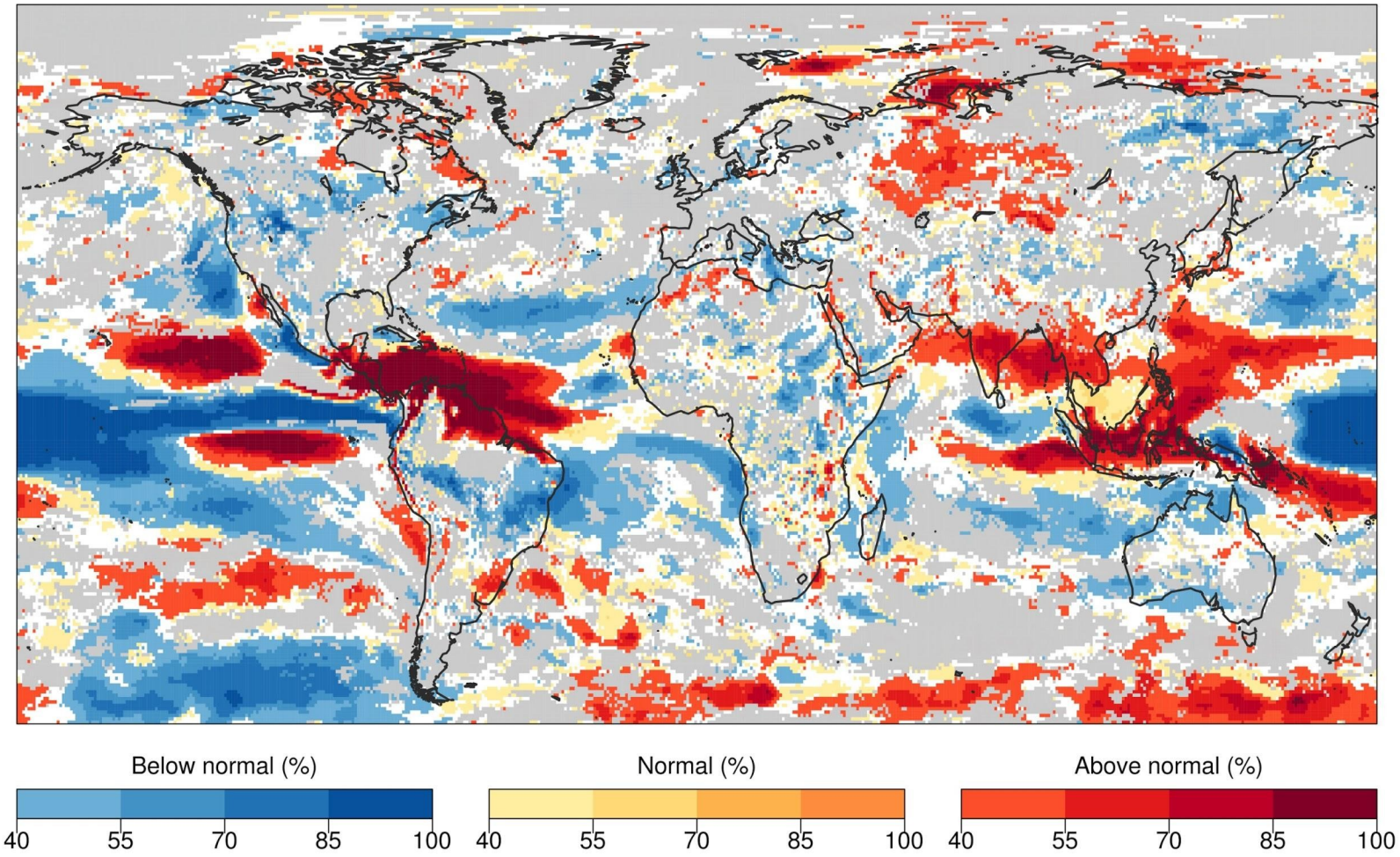


Skill map for sub-seasonal

Correlation of ECMWF Monthly Prediction System
10m Wind Speed for Jan_Feb. Forecast time 12–18.



Summer 2015 prediction with verification



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.

Climate predictions for wind power

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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

National and International collaborations

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Research centers

Local administrations and international organizations

Meteorological offices

National and International collaborations

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Industrial partners. Air quality

vodafone, RACC, SEAT, Applus IDIADA, BCN ECOLOGIA Agència d'Ecologia Urbana de Barcelona, oca group, inLab FIB talent & tech, IBM, METEO SIM, inypsa, prysma Calidad y MedioAmbiente, SGS, fundación gasNatural fenosa

Industrial partners. Energy

edp renewables, EnBW, EDF, ALSTOM, CENER NATIONAL RENEWABLE ENERGY CENTRE, IBERDROLA, AWS Truepower, Nnergix Energy Forecasting Services, saetayield

Industrial partners. Agriculture

JRC EUROPEAN COMMISSION, TORRES 1870, SOGRAPE VINHOS

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Thank you!

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