Regional assessment of monthly and seasonal forecast ensemble products

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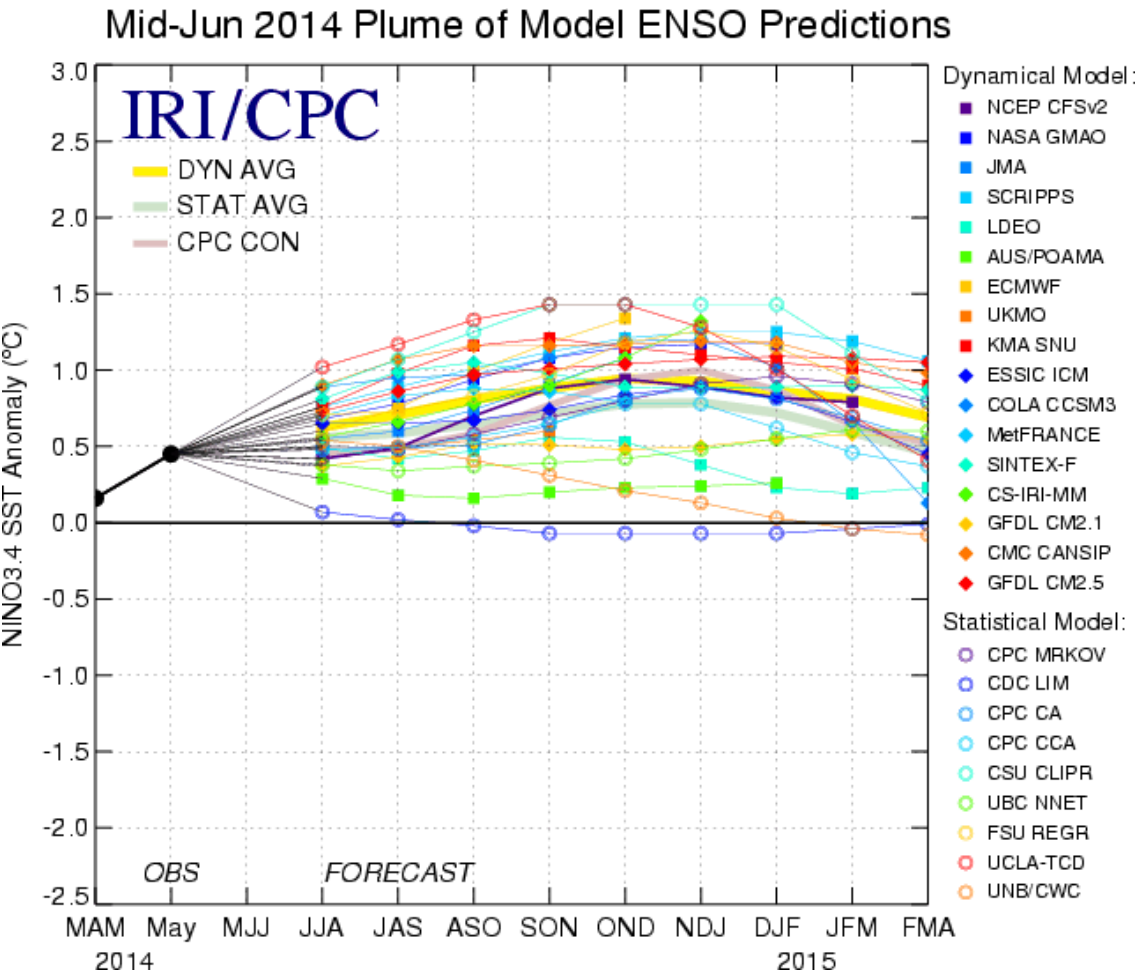
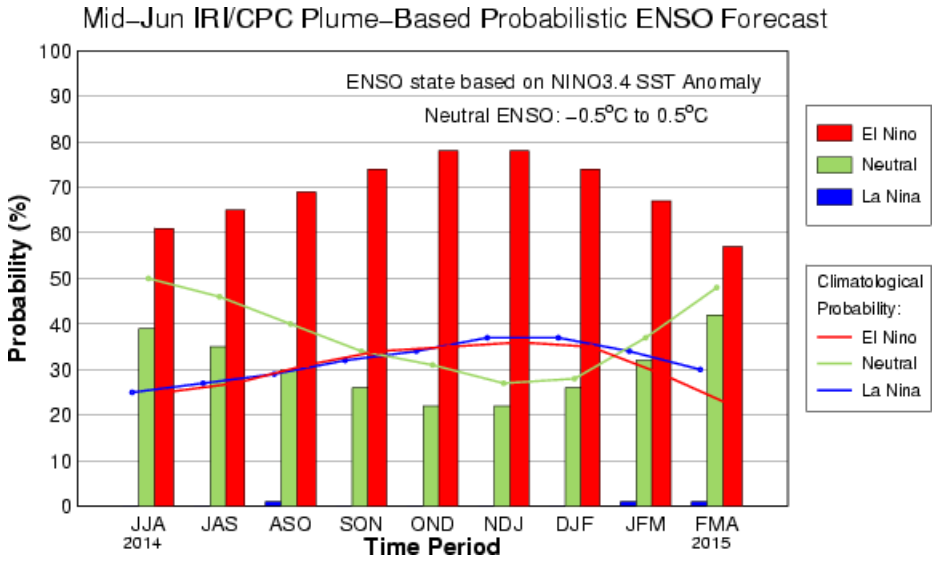
Climate forecasting

2014 ENSO predictions: June start date

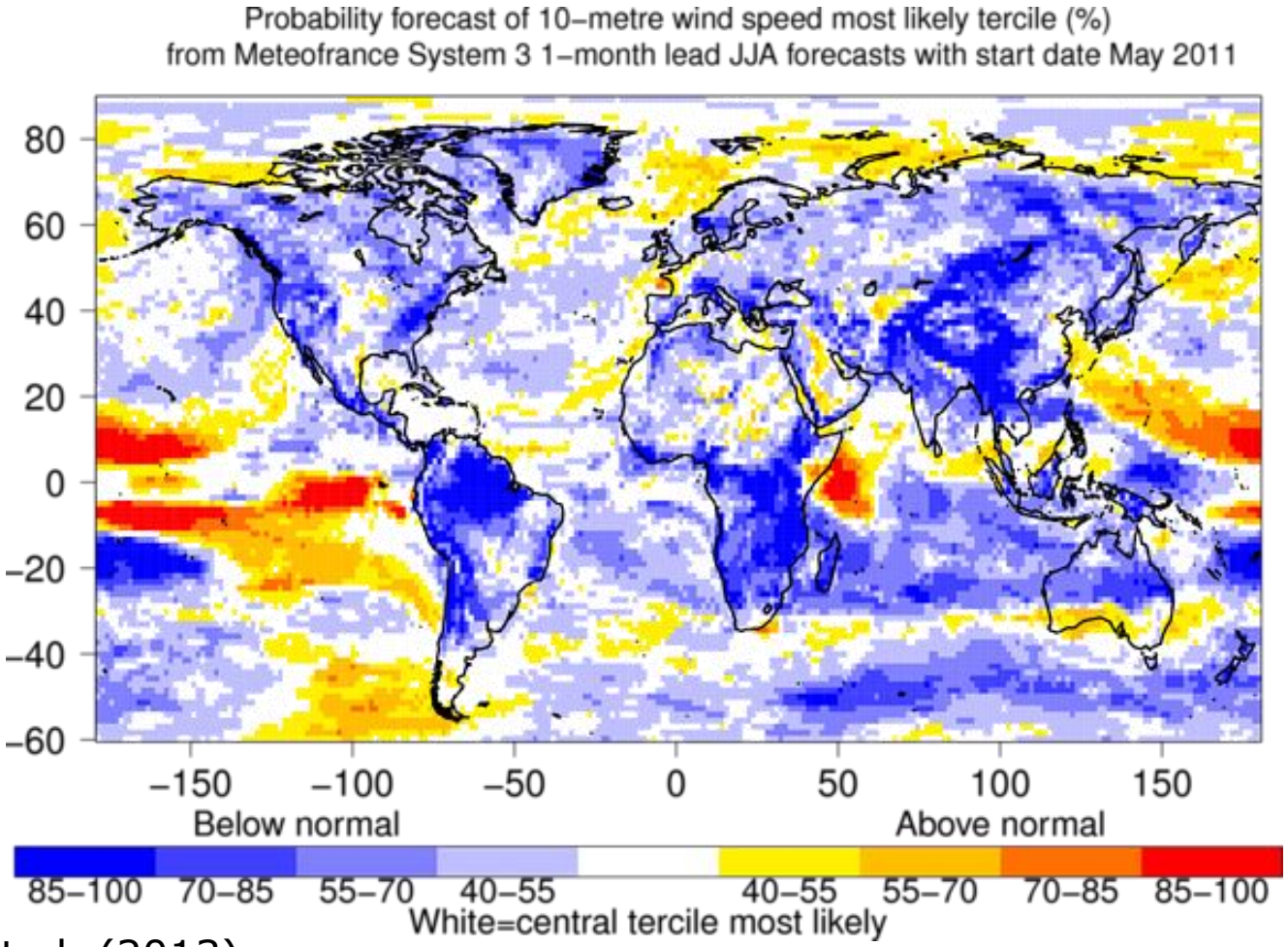




- Community effort
- Probabilistic character, lack of consistency
- Link to operations
- Communication issues

Climate services: wind energy

What climate forecasters traditionally offered



Doblas-Reyes et al. (2013)

Climate services: wind energy

What is actually requested in terms of forecasts:

- Forecasts for locations where the mean is large (wind speed above a threshold), and both variability (something to predict) and skill (something useful to say) are high
- Need energy generated over a period (month, season, etc), with uncertainty estimates, at the wind farm level
- Information for off-shore maintenance (at least 3 weeks lead time)
- Also, energy and consumption in other regions to balance network
- Take into account
  - Management strategies
  - Development plans

Some of the things missing

- Better understanding of the impact models, and the best way to adapt them to the useful climate information available
- Bias correction, calibration and combination
- Downscaling, when necessary
- Documentation (some stakeholders are used to the IPCC calibrated language, which is different to the climate forecasting language), demonstration of value and outreach
- The EUPORIAS FP7 project, working alongside the SPECS project, is considering solutions to address some of these problems.

EUPORIAS: prototypes

- EUPORIAS intends to maximise the societal benefit of climate prediction technologies and, hence, increase the resilience of European society to climate change by demonstrating how climate information becomes usable.
- A set of prototypes, examples of a climate service for s2d time scales in Europe, are the main project outcome.
- Six proposals selected by an external panel based on value to the users, skill in the predictions, stakeholder engagement, robustness of the impact model:
  - Outlook for UK winter conditions to inform transport industry
  - Food security in East Africa for WFP
  - Winter land management for Clinton Devon Estate
  - Renewable energy management (RESILIENCE)
  - River management in two French catchment areas
  - Hydroelectric production in Sweden

EUPORIAS

Back to the wind energy problem

To satisfy the users' requirements for sub-seasonal to seasonal forecast information:

- High-frequency wind forecasts at ~100 metre height
- Bias corrected forecast data, i.e. whose statistical properties mimic those of the data measured at the wind turbine height -> Bias correcting and calibrating high-frequency data is extremely complicated and destroys the little skill available

On top of this:

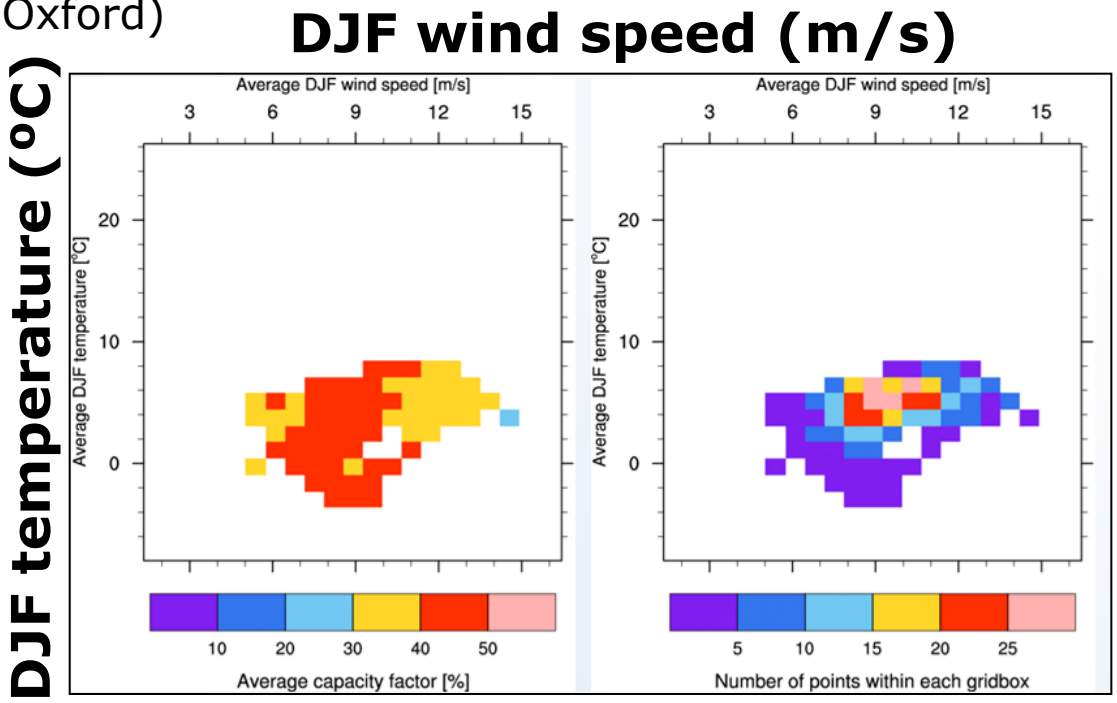
- Local measurements are not long
- They are not even made available

Adapting impact models

Impact surfaces of a simple wind-energy model over the North Sea for DJF as function of the mean seasonal 10 m wind speed and temperature.

(Left) Capacity factor (average power generated divided by the maximum power of a specific turbine) estimates obtained using the XXth Century Reanalysis, a Rayleigh function to estimate high-frequency winds from mean daily values and a wind profile power law to obtain 100 m winds from 10 m winds. (Right) Frequency of occurrence of each bin.

D. MacLeod (Univ. Oxford)



It only needs seasonal-average bias-corrected forecast data to make predictions of the capacity factor!

Bias correction of averaged data

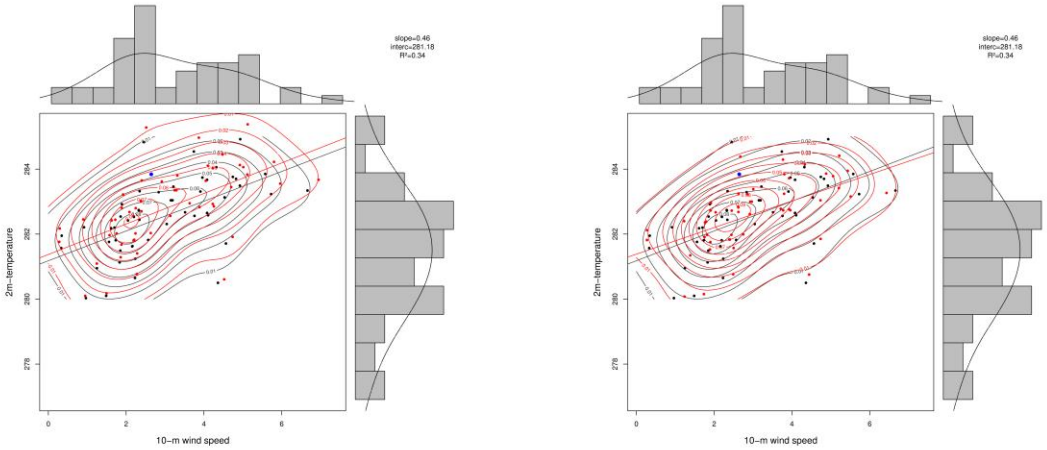
Bias correction is unavoidable, but it has an impact on skill.

Bias-corrected ECMWF S4 forecasts for November with start date in November over 1981-2012. One-year-out cross-validation applied.

SIMPLE BIAS CORRECTION

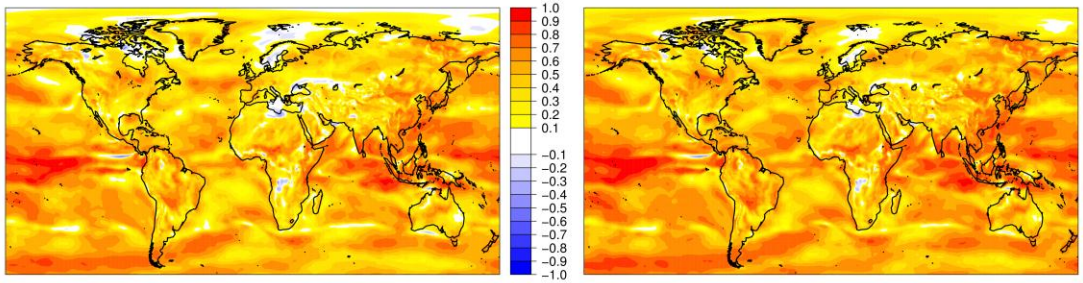
PERCENTILE BIAS CORRECTION

SCATTER PLOTS WITH MARGINAL DISTRIBUTIONS. 10-m wind speed and 2-m temperature for ECMWF S4 with 0-lead. November (2011). London



CORRELATION SKILL

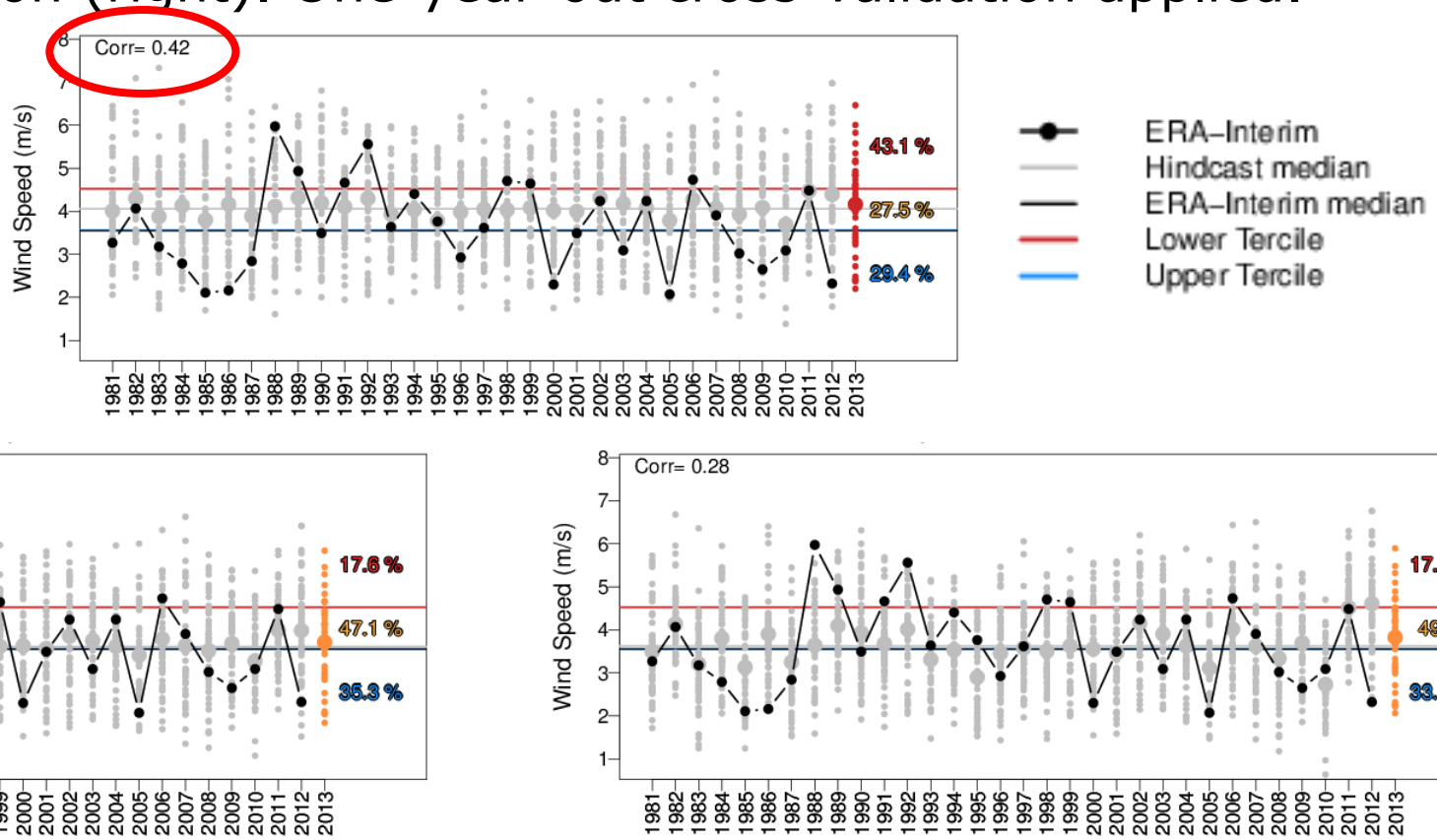
10-m wind speed between ECMWF S4 ensemble mean and ERA INTERIM for November with start dates once a year on first of November from 1981 to 2012



V. Torralba (IC3)

Bias correction and calibration

Bias correction and calibration have different effects. ECMWF S4 predictions of 10 m wind speed over the North Sea for DJF starting in November. Raw output (top), bias corrected (simple scaling, left) and ensemble calibration (right). One-year-out cross-validation applied.

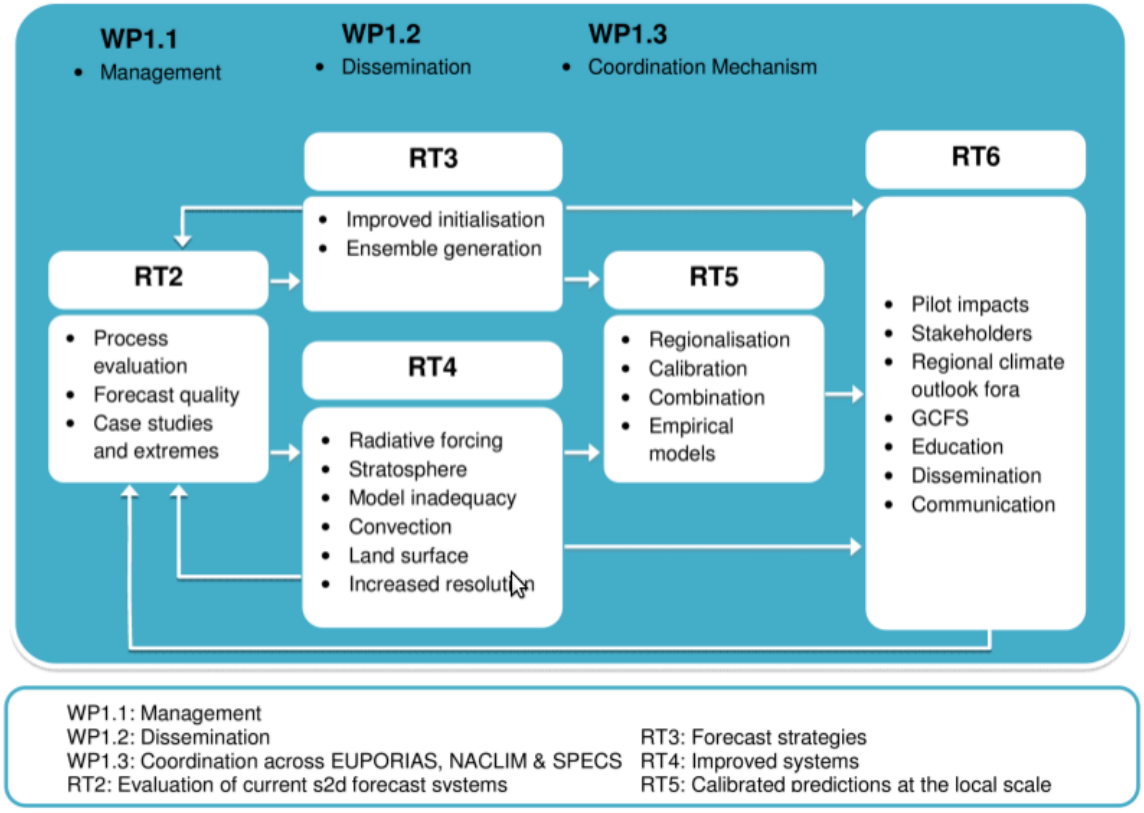


V. Torralba (IC3)

SPECS FP7

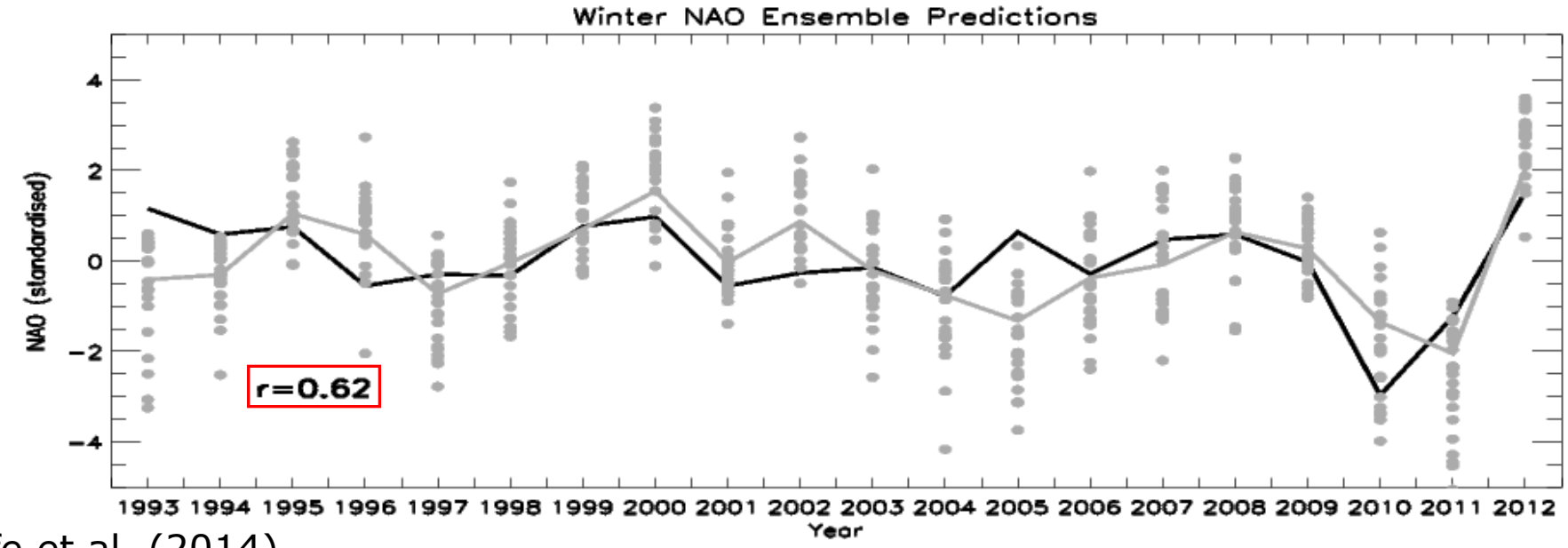
SPECS will deliver *a new generation of European climate forecast systems, including initialised Earth System Models (ESMs) and efficient regionalisation tools to produce quasi-operational and actionable local climate information over land at seasonal-to-decadal time scales with improved forecast quality and a focus on extreme climate events, and provide an enhanced communication protocol and services to satisfy the climate information needs of a wide range of public and private stakeholders*.

Forecast System	Project Partners
CNRM-CM5	CNRM, CERFACS
EC-Earth	KNMI, SMHI, IC3, ENEA
IFS/NEMO	ECMWF, UOXF
IPSL-CM5	CNRS
MPI-ESM	MPG, UniHH
UM	UKMET



Predicting NA atmospheric circulation

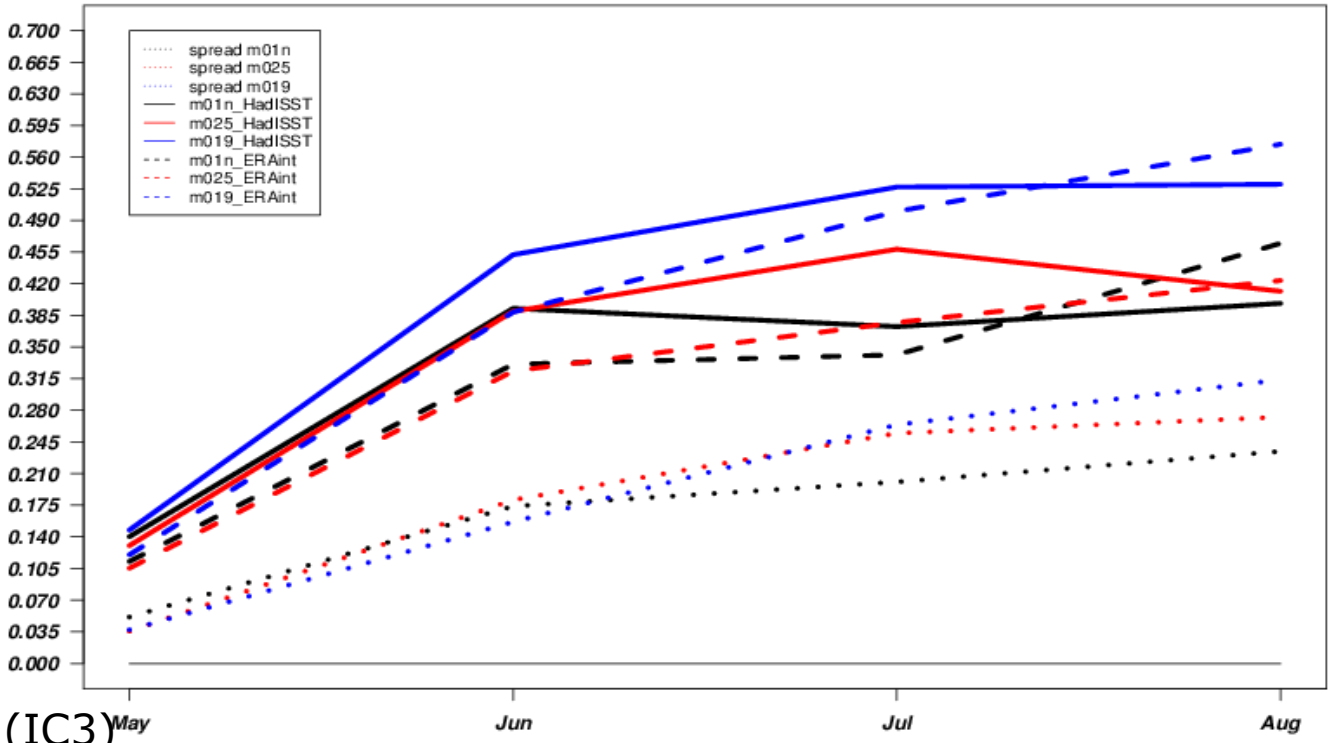
DJF NAO Met Office operational seasonal forecasts with HadGEM3H N216L85O(0.25) with initial conditions from operational atmospheric analyses and NEMOVAR, 24 members, start date around the 1st of November (lagged method). Winter NAO correlation significant at the 98% confidence level.



Scaife et al. (2014)

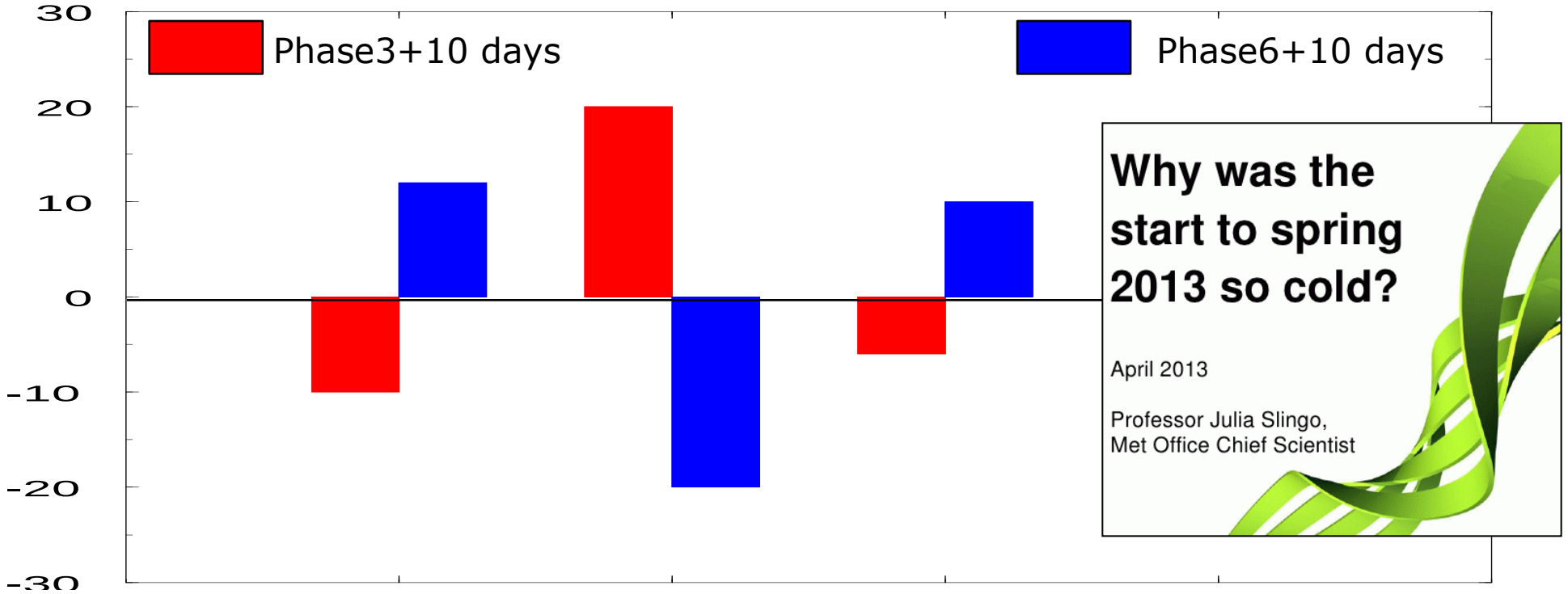
Increase in resolution: ENSO skill

RMSE and spread of Niño3.4 SST (versus HadISST-solid and ERAInt-dashed) from four-month EC-Earth3 simulations: **T255/ORCA1**, **T255/ORCA025** and **T511/ORCA025**. May start dates over 1993-2009 using ERA-Interim and GLORYS initial conditions and ten-member ensembles.



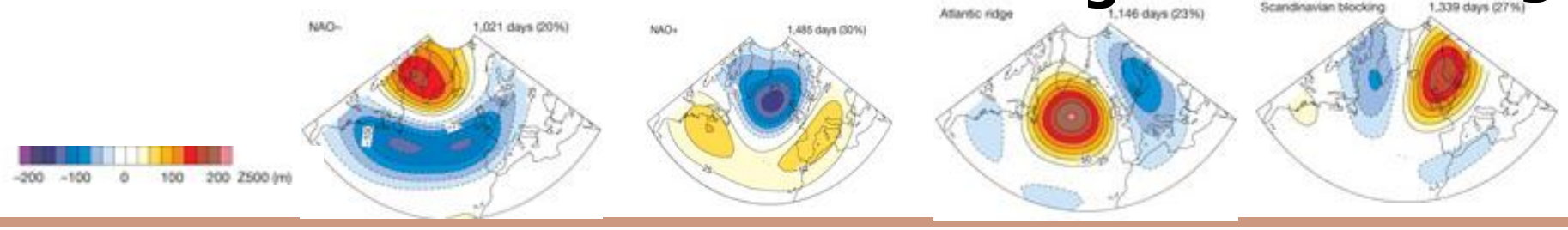
C. Prodhomme (IC3)

S2S: MJO and European weather types



F. Vitart, A. Robertson

NAO- **NAO+** **Atlantic ridge** **Scandinavian blocking**



Summary

- Sub-seasonal and seasonal forecasting (s2s) are becoming well established operational activities with a solid research base and an increasing application in climate services and adaptation.
- The demand of action-relevant climate information on s2s time scales is growing. However, what forecasters provide is far from users' demand (even in the absence of skill).
- Bias correction, calibration and combination are essential in the successful application of s2s climate information.
- EUPORIAS and SPECS, along with the WWRP and WCRP initiatives (S2S, WGSIP, PPP), work together to bridge the gap and illustrate usefulness.