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

SPECS

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

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iCrea

IC3

SPECS motivation

What: to produce quasi-operational and actionable local climate information

Why: need information with improved forecast quality, a focus on extreme climate events and enhanced communication and services for RCOFs, NHMSs and a wide range of public and private stakeholders

How: with a new generation of reliable European climate forecast systems, including initialised ESMs, efficient regionalisation tools and combination methods, and an enhanced dissemination and communication protocol

Where: over land, focus on Europe, Africa, South America

When: seasonal-to-decadal time scales over the longest possible observational period

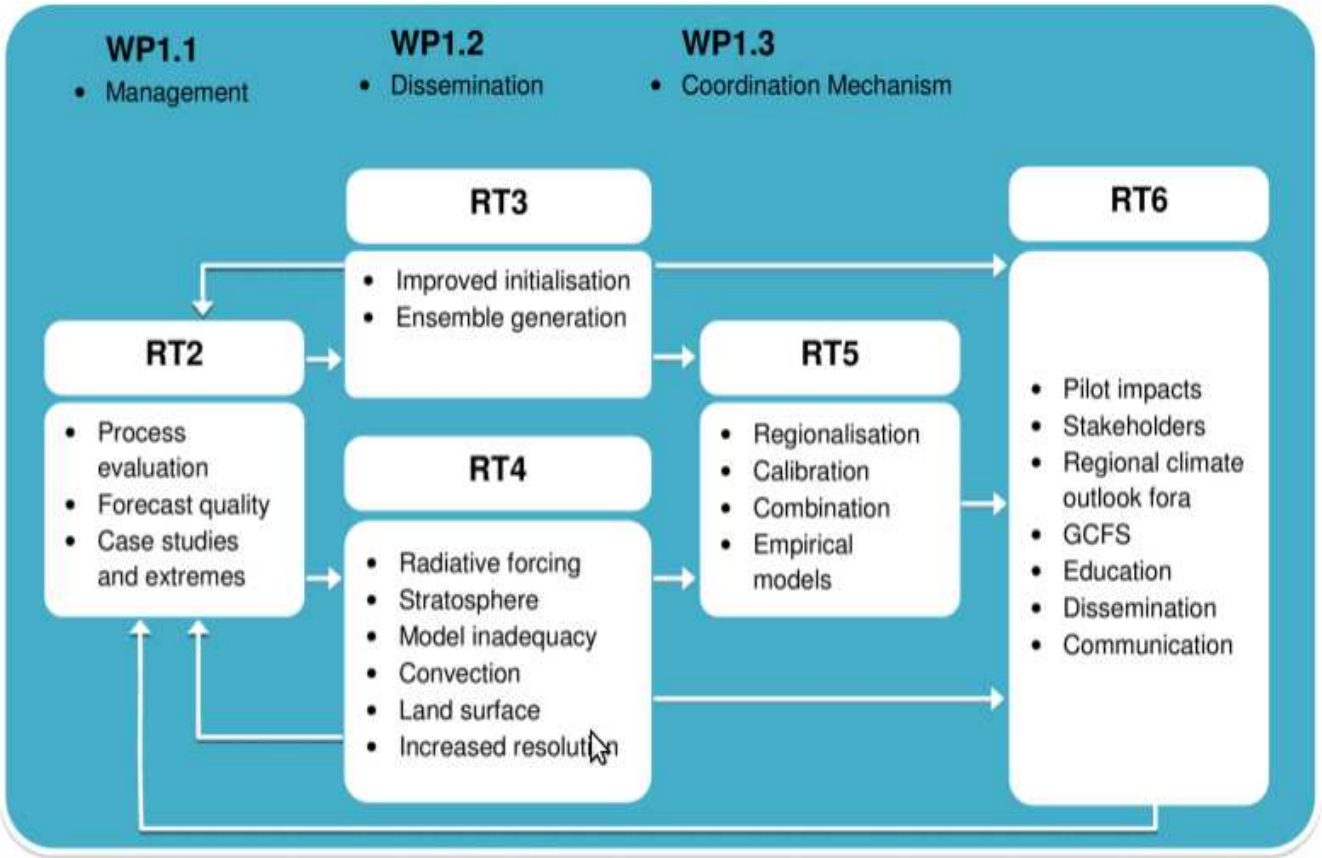
http://www.specs-fp7.eu

SPECS objective

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*.

Overall strategy

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



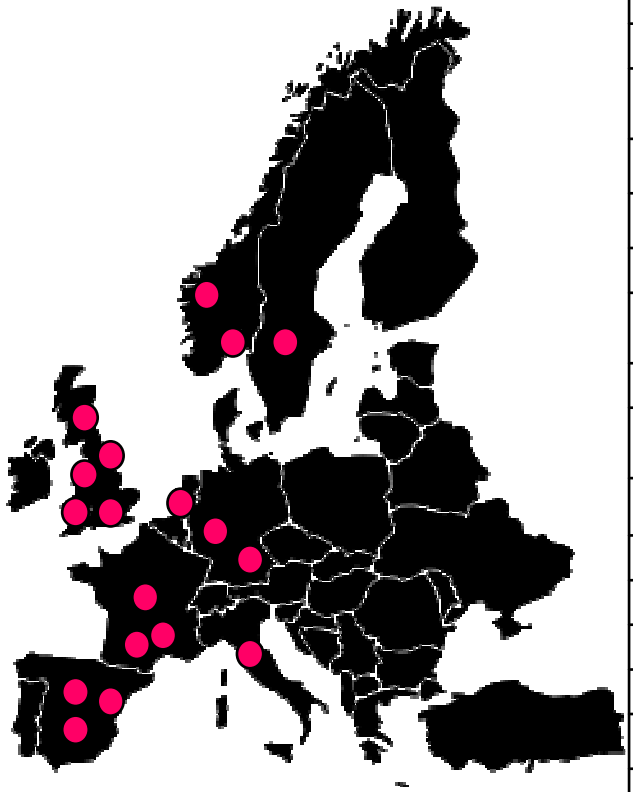
WP1.1: Management
WP1.2: Dissemination
WP1.3: Coordination across EUPORIAS, NACLIM & SPECS
RT2: Evaluation of current s2d forecast systems
RT3: Forecast strategies
RT4: Improved systems
RT5: Calibrated predictions at the local scale

Overarching objectives

- Evaluation of current forecast quality
- Implementation of current model improvements
- Process-based verification
- Innovative methods for forecast quality assessment
- Integration of multidimensional observational data
- Improved forecast quality at regional scales
- Deal with the uncertainties in climate prediction
- Achieve reliable and accurate local-to-regional predictions
- Illustrate the usefulness of climate information
- Support the European contributions to WMO initiatives
- "Operationalization", "climate services" and "reliability" are key concepts of the project.

Consortium

20 partners, coordination IC3



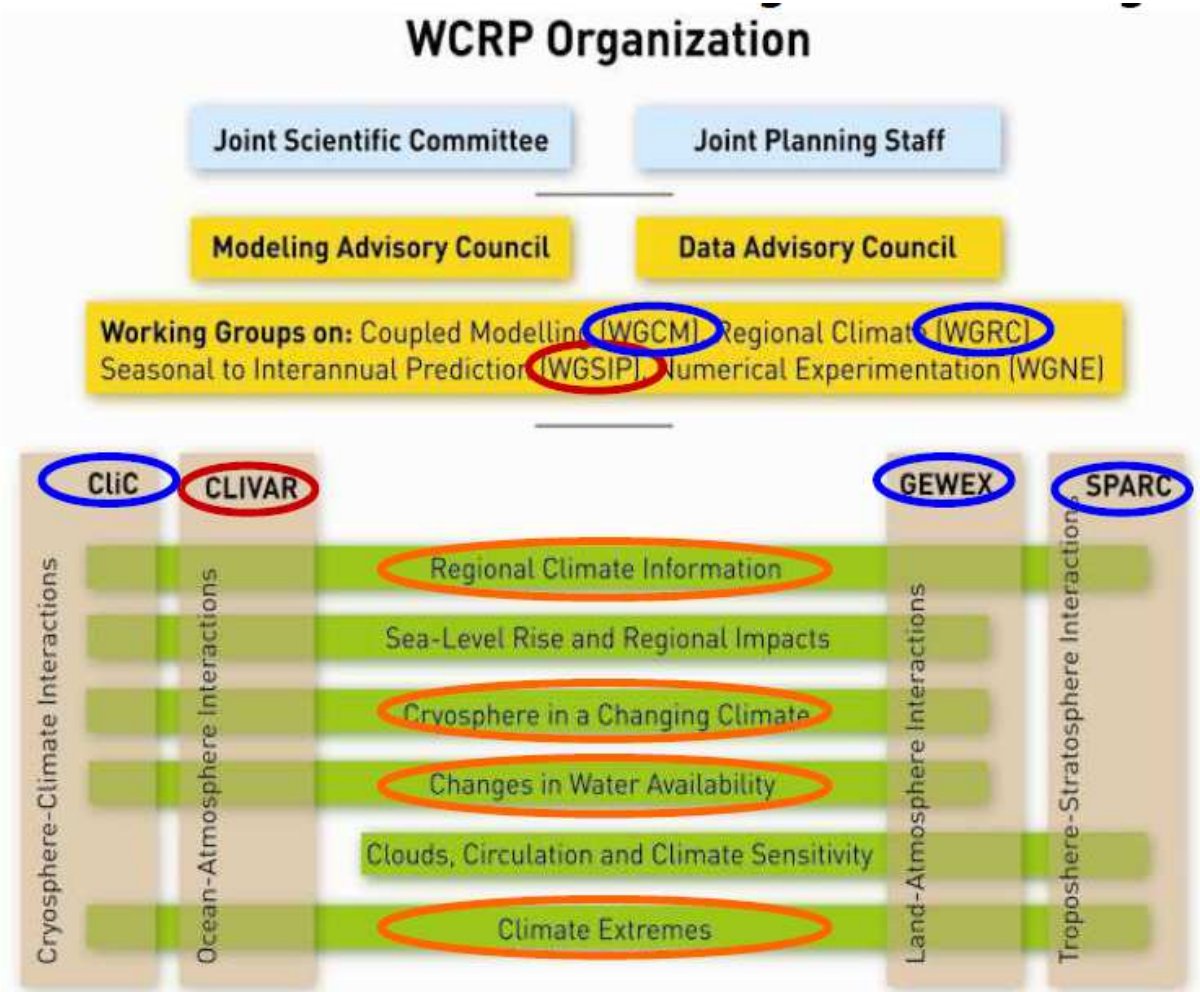
+ Brazil

Long list of affiliated partners and stakeholders, among which GEO

No.	Participant organisation name	Participant legal name	Country
1	Institut Català de Ciències del Clima	IC3	ES
2	Instituto Nacional de Pesquisas Espaciais	INPE	BR
3	Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. represented by Max-Planck-Institut für Meteorologie	MPG	DE
4	Het Koninklijk Nederlands Meteorologisch Instituut	KNMI	NL
5	Atmospheric, Oceanic and Planetary Physics, University of Oxford	UOXF	UK
6	Météo-France	MeteoF	FR
7	Centre Européen de Recherche et Formation Avancée en Calcul Scientifique	CERFACS	FR
8	Norsk Institutt for Luftforskning	NILU	NO
9	Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile	ENEA	IT
10	University of Leeds	UNIVLeeds	UK
11	University of Exeter	UNEXE	UK
12	Meteorologisk Institutt	Met.no	NO
13	Vortex	VORTEX	ES
14	Met Office	METOFFICE	UK
15	Sveriges Meteorologiska Och Hydrologiska Institut	SMHI	SE
16	Institut Pierre et Simon Laplace, Centre National de la Recherche Scientifique	CNRS	FR
17	University of Reading	UREAD	UK
18	Agencia Estatal Consejo Superior de Investigaciones Científicas	CSIC	ES
19	European Centre for Medium-Range Weather Forecasts	ECMWF	UK
20	Universität Hamburg	UniHH	DE

SPECS and WCRP

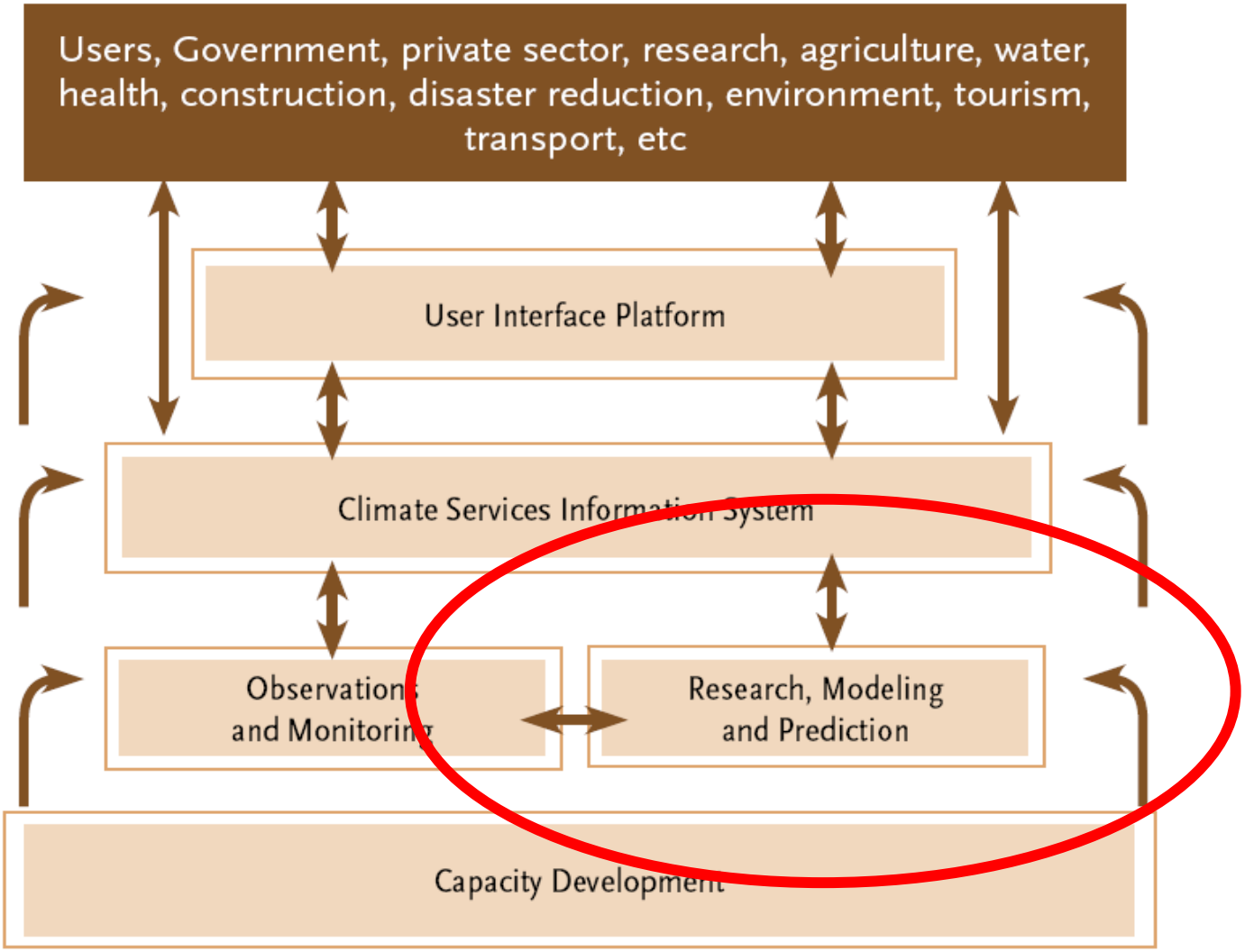
The climate-prediction contribution to all core projects is a key aspect to achieve success in the WCRP grand challenges.



Core projects

Grand challenges

SPECS and GFCS



SPECS is part of ECOMS

European Climate Observations, Modelling and Services (ECOMS) initiative with these objectives:

- ensure close coordination between projects and activities in Europe in the area of seasonal to decadal climate predictions towards climate services
- provide thought leadership to the European Commission on future priorities in the area of seasonal to decadal climate predictions towards climate services.

Three EU projects are the core of ECOMS: EUPORIAS, NACLIM and SPECS, with a total funding of 26 Meuros.

All EU projects related to climate research and climate services are part of ECOMS.

SPECS impact

SPECS and ECOMS bring together several communities: climate modelling, weather and climate forecasting, impact modelling, downscaling.

The main project deliverables are a set of public tools and data from the most ambitious coordinate seasonal-to-decadal global prediction experiments to this date.

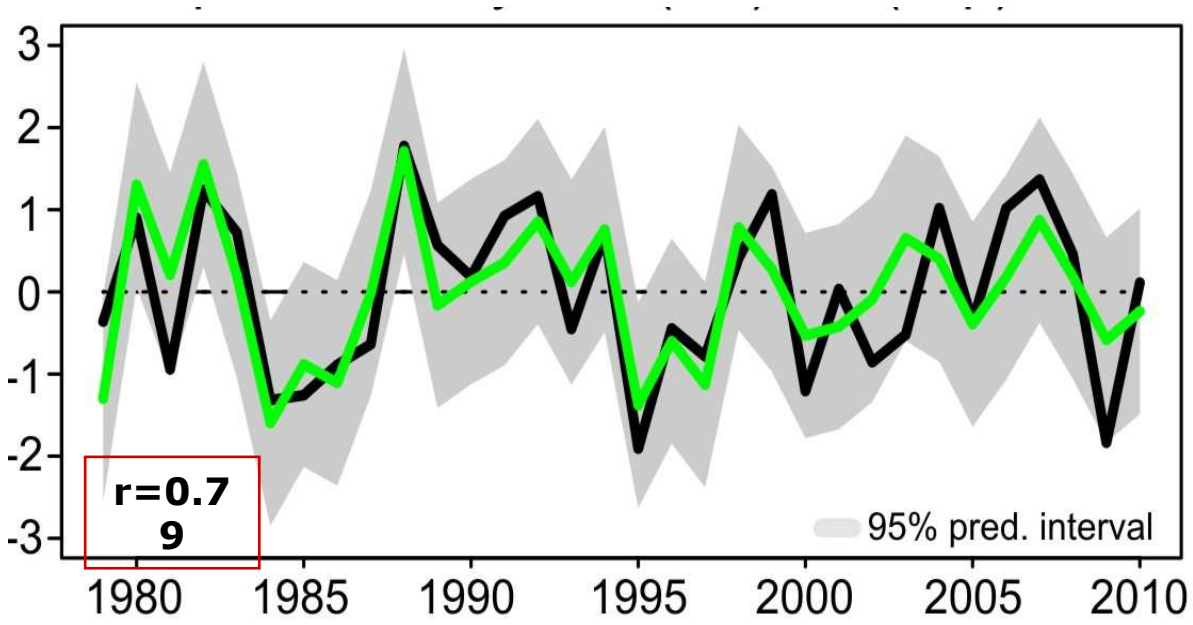
Coordinated experiments

- Core: impact of soil moisture and sea-ice initialization, increased resolution, improved stratosphere and enhanced sample size
- Tier 1: impact of snow initialization, interactive vegetation/phenology, sensitivity to aerosol and solar irradiance.
- Central repository using revised CMIP5/CORDEX standards.

Large number of affiliated partners and stakeholders, including major international programmes.

Predicting NAO

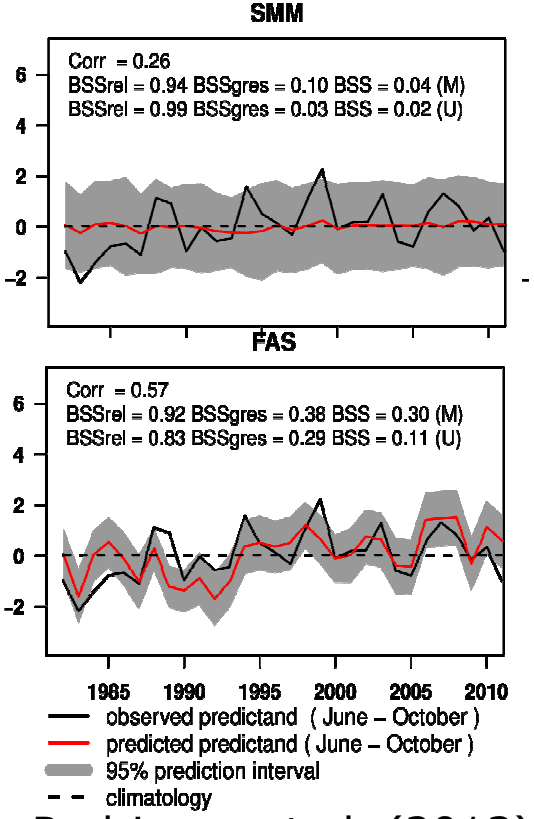
DJF NAO seasonal forecasts using a multiple linear regression method (one-year-out crossvalidation) with the September sea-ice concentration over the Barents-Kara sea and the October snow cover over northern Siberia (one month lead time).

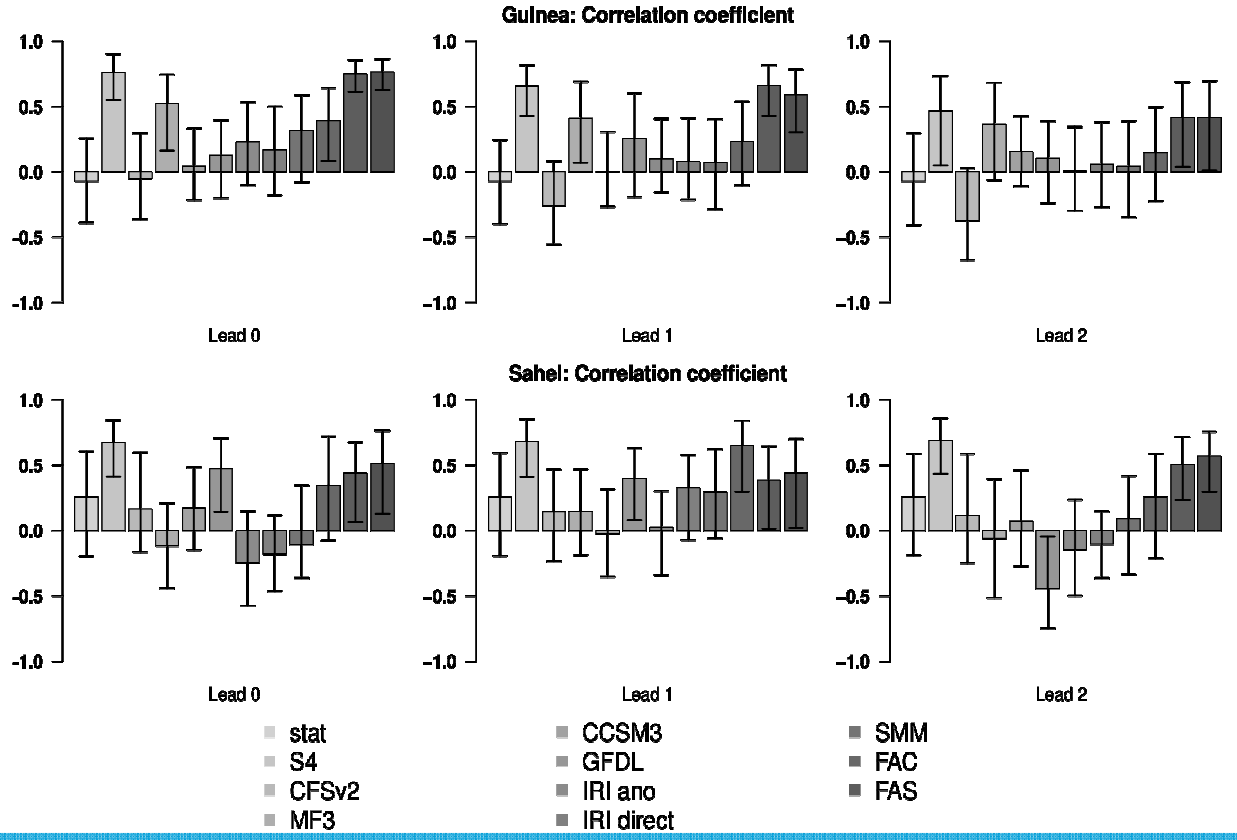


J. García-Serrano (IPSL)

Calibration and combination

(Left) Multi-model seasonal predictions of Sahel precipitation, including its intraseasonal variability from June to October, started in April. (Right) Correlation of the ensemble mean prediction for Guinean and Sahel precip.



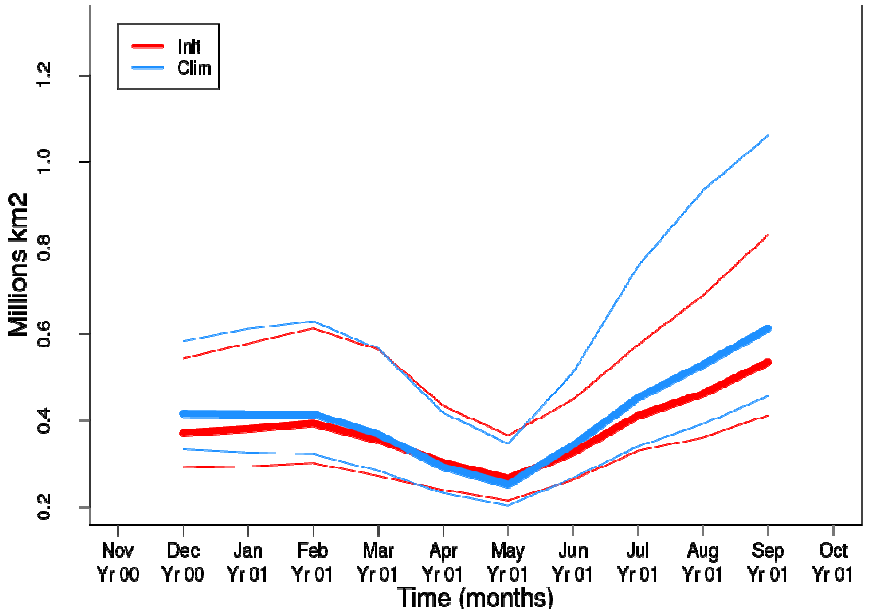


Rodrigues et al. (2013)

Initialisation: sea ice

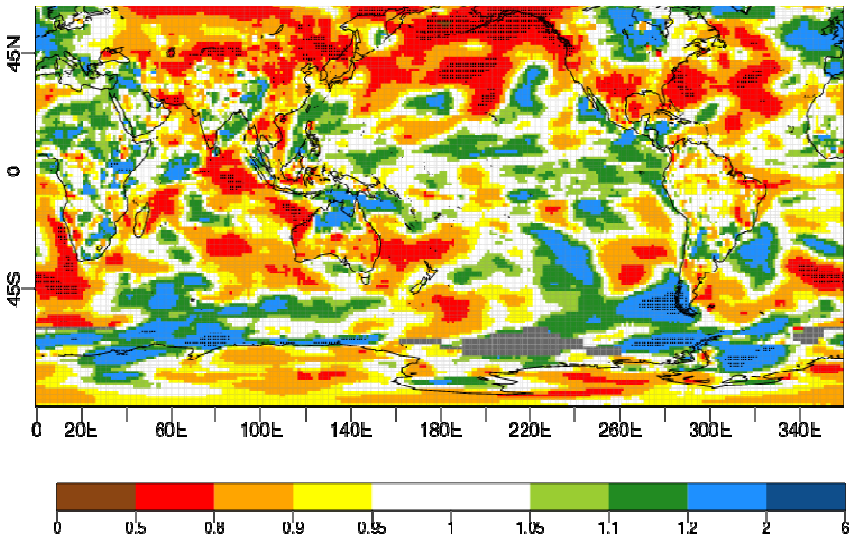
Interannual predictions with EC-Earth2.3 started every November over 1979-2010 with ERAInt and ORAS4 initial conditions, and a sea-ice reconstruction. Two sets, one initialised with realistic and another one with climatological initial conditions. Substantial reduction of temperature RMSE in the northern high latitudes when improving the sea-ice initialisation.

RMSE Arctic sea-ice area



Guemas et al. (2014)

Ratio RMSE Init/RMSE Clim hindcasts two-metre temperature (months 2-4)

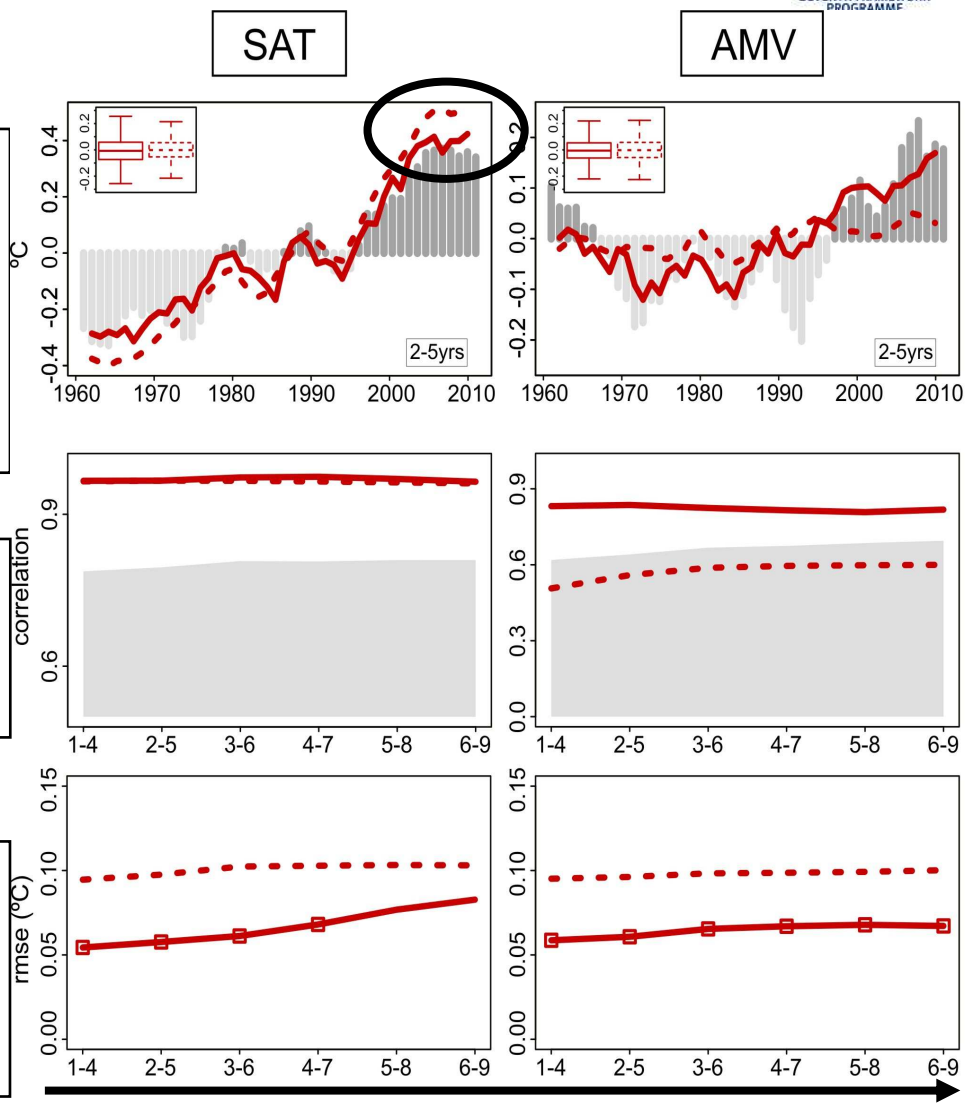


Decadal predictions

Predictions (2-5 forecast years) from the CMIP5 multi-model (6 systems, initialized solid, historical and RCP4.5 dashed) over 1960-2005 for global-mean temperature and the Atlantic multi-decadal variability. GISS and ERSST data used as reference.

Correlation of the ensemble-mean prediction as a function of forecast time. Grey area for the 95% confidence level.

Root mean square error, where dots represent the forecast times for which Init and NoInit are significantly different at 95% confidence level.

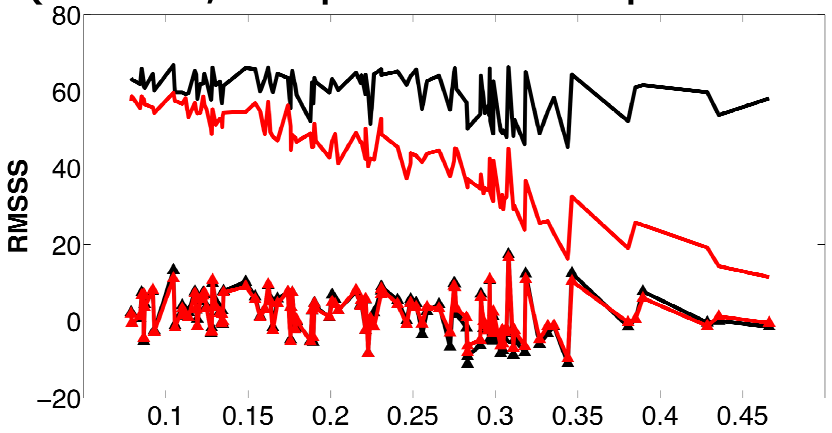


Doblas-Reyes et al. (2013)

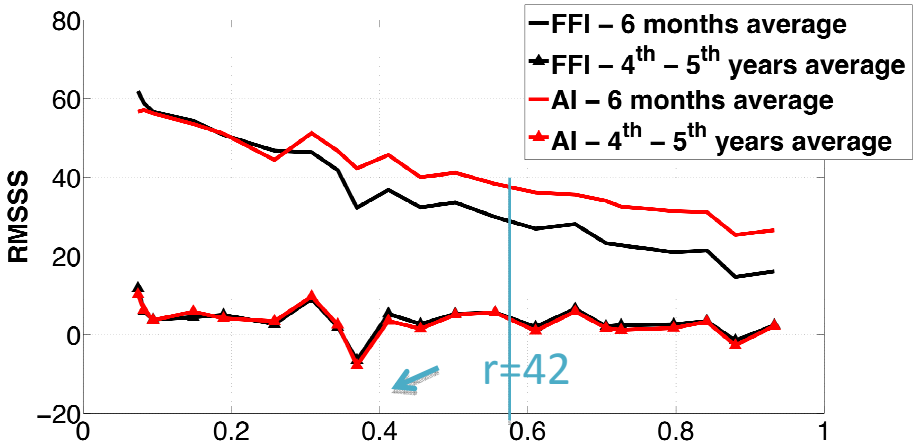
AI/FFI in a simple model

RMSSS of all variables (normalised by their standard deviation) from 360 decadal predictions performed with the 9-variable Lorenz model with three coupled compartments (ocean, tropical atmosphere and extratropical atmosphere).

Model configurations with erroneous atmosphere-ocean coupling parameters c, c_z



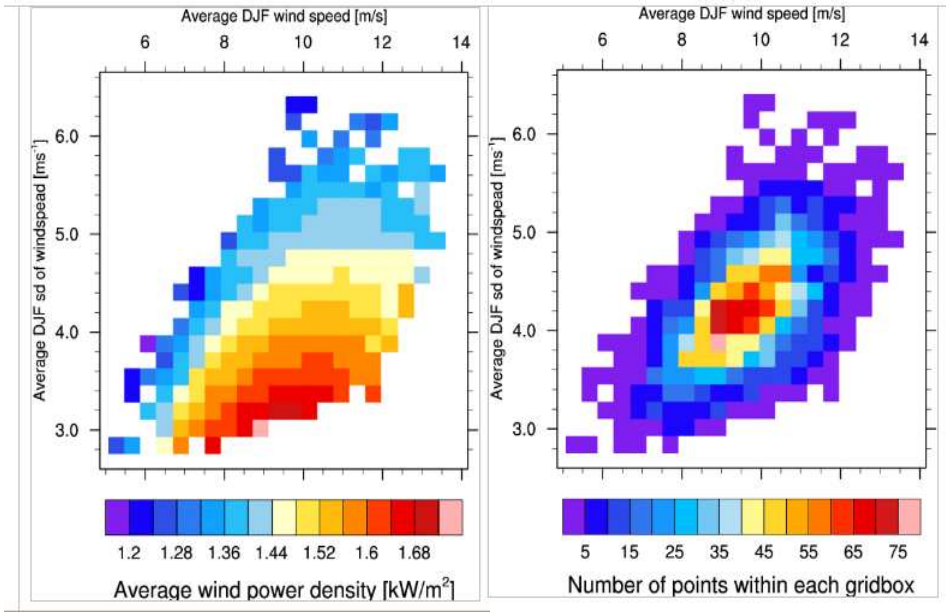
Model configurations with erroneous forcing parameter r



Carrassi et al. (2013)

New user strategies

Impact surfaces of a simple wind-energy model over the North Sea for DJF as a function of the mean seasonal wind and the wind intraseasonal variability. Power density 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.



D. Macleod (Univ. Oxford)

To be done

- Work on initialisation: initial conditions for all components (including better ocean), better ensemble generation, etc. Link to observational and reanalysis efforts.
- Model improvement: leverage knowledge and resources from modelling at other time scales, drift reduction. More efficient codes and adequate computing resources.
- Calibration and combination: empirical prediction (better use of current benchmarks), local knowledge.
- Forecast quality assessment: scores closer to the user, reliability as a main target, process-based verification.
- Improving many processes: sea ice, projections of volcanic and anthropogenic aerosols, vegetation and land, …
- More sensitivity to the users' needs: going beyond downscaling, better documentation (e.g. use the IPCC language), demonstration of value and outreach.