SPECS (**S**easonal-to-decadal climate **P**rediction for the improvement of **E**uropean **C**limate **S**ervices) and **ECOMS**

F. J. Doblas-Reyes

ICREA & IC3, Barcelona, Spain

To be taken into account for next version

- draw constellation of affiliated initiatives, projects, etc
- add budget (EU contribution and total cost), call title, type of partners and number of countries
- add overhead with titles and objectives of each WP

Climate affects investments

Influence of climate resource variability on investment. A fictional example: planning of a solar power plant in Spain

- Typical size: 50 MW, cost €300 million
- Guaranteed price per unit of electricity generated: 0.20 €/kWh
- This provides an annual revenue of €31 million

Assumption: small solar irradiance sudden change wrt normal climate. A variation of 1% leads to:

- Annual increase or decrease of total revenue = €310,000
- Across the investment return period (20 years) = €8 million or ~ 15% investment

Climate information for energy

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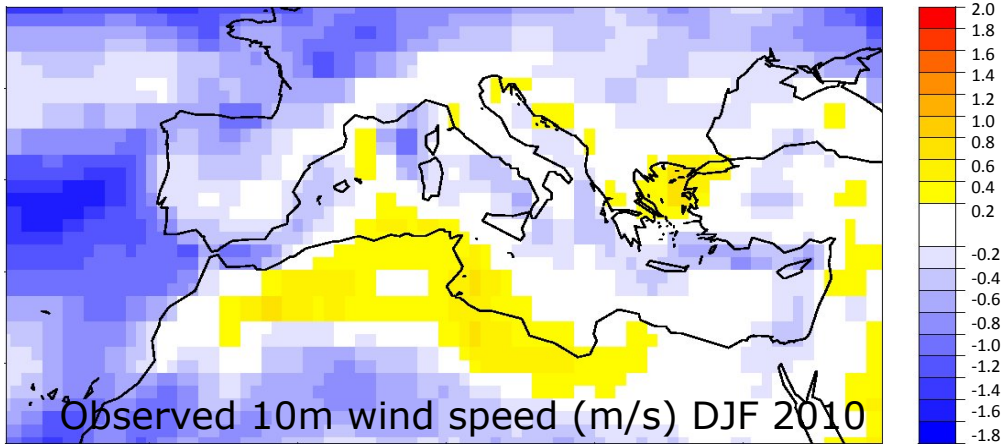
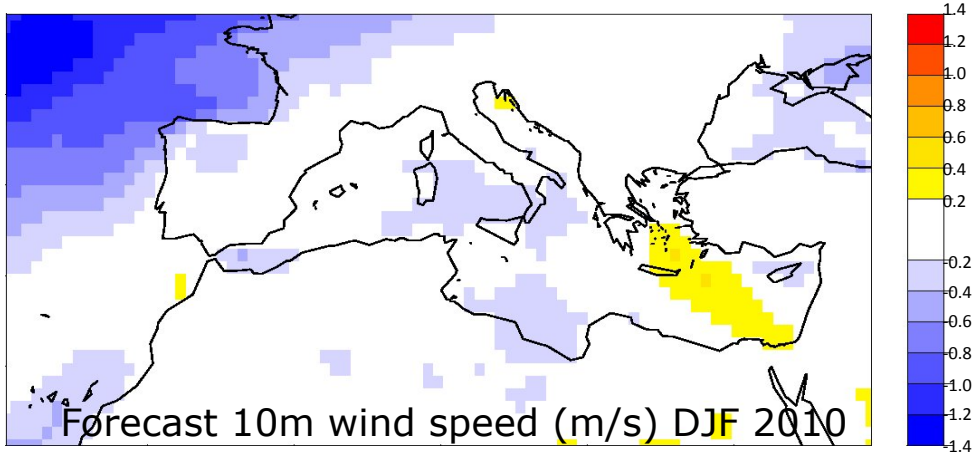
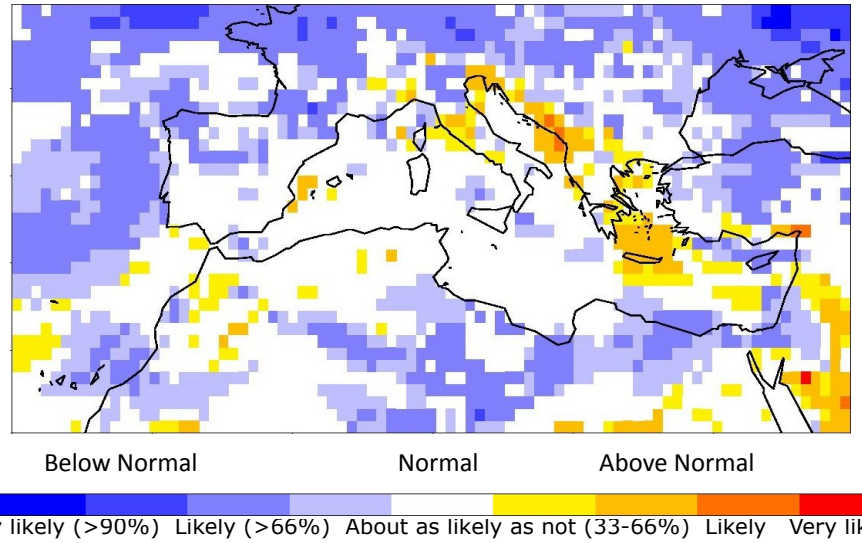




Seasonal predictions of 10-metre wind speed from ECMWF System 4 from the November 2010 start date, with the climatology computed from 1981-2010. Reference from ERA Interim.

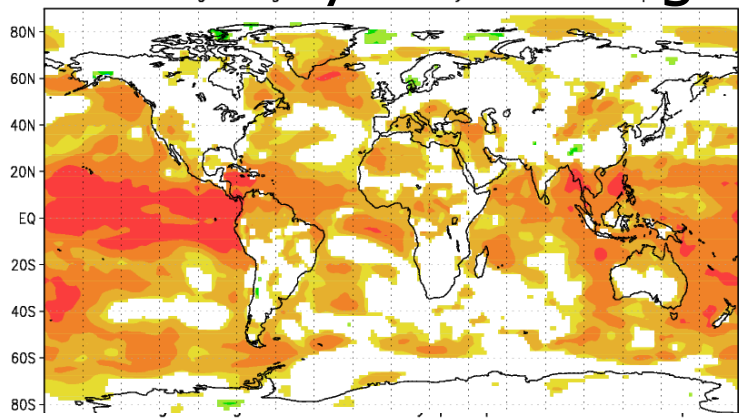
Probability most likely tercile (%) DJF 2010



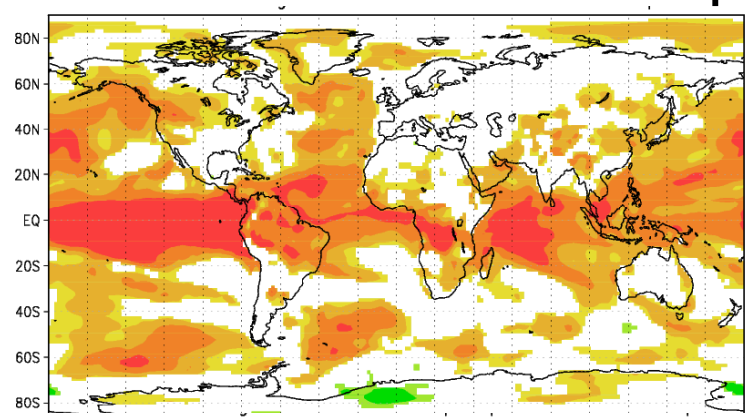
Skill

Correlation of System 3 seasonal forecasts of temperature (top) and precipitation (bottom) wrt GHCN and GPCC over 1981-2005. Only values significant with 80% conf. plotted.

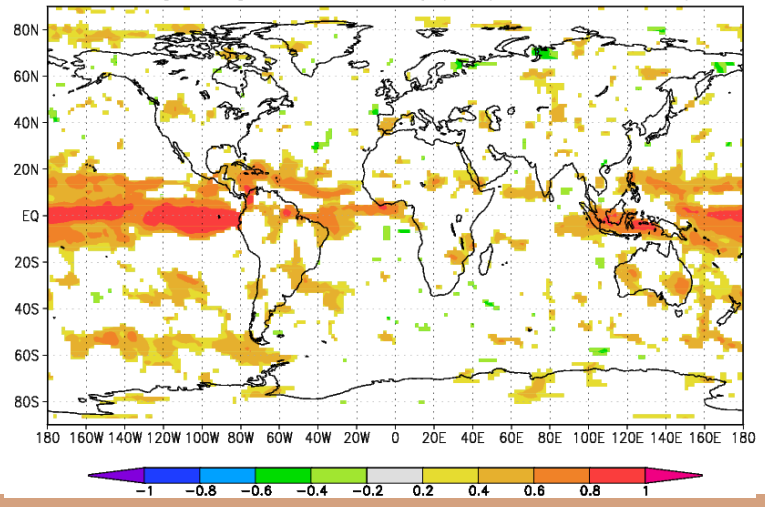
JJA T2m



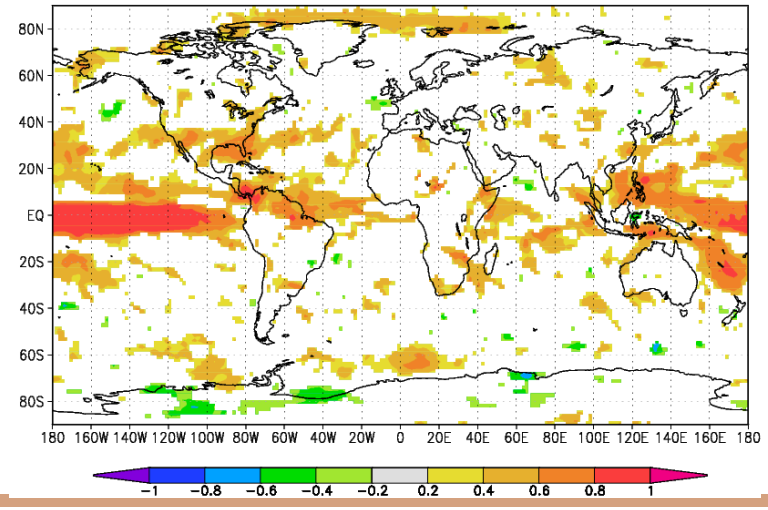
DJF T2m



JJA Prec



DJF Prec



ECMWF System 3 skill

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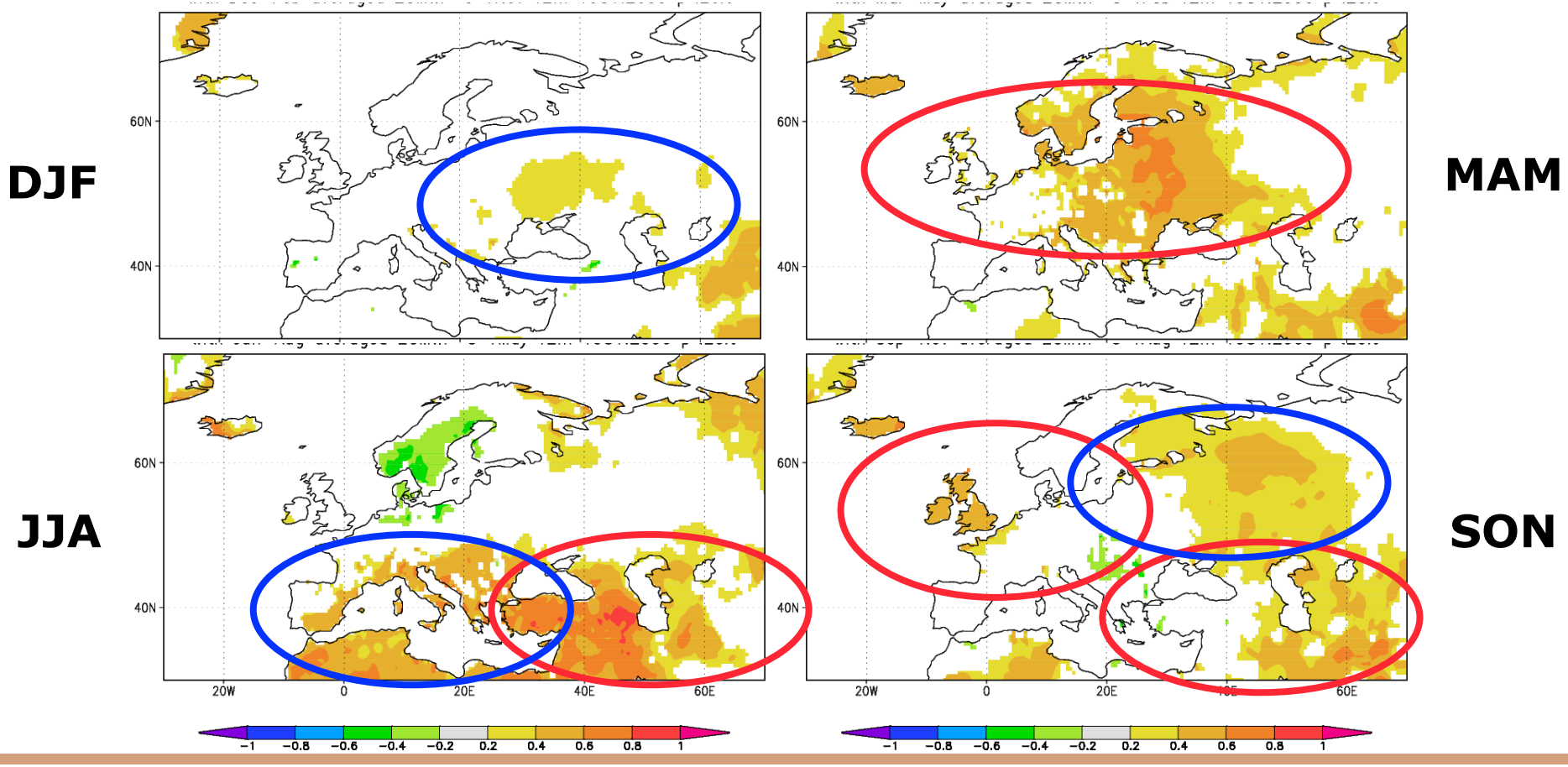
Correlation of System 3 seasonal forecasts of temperature wrt GHCN over 1981-2005. Only values statistically significant with 80% confidence are plotted.



Systematic errors

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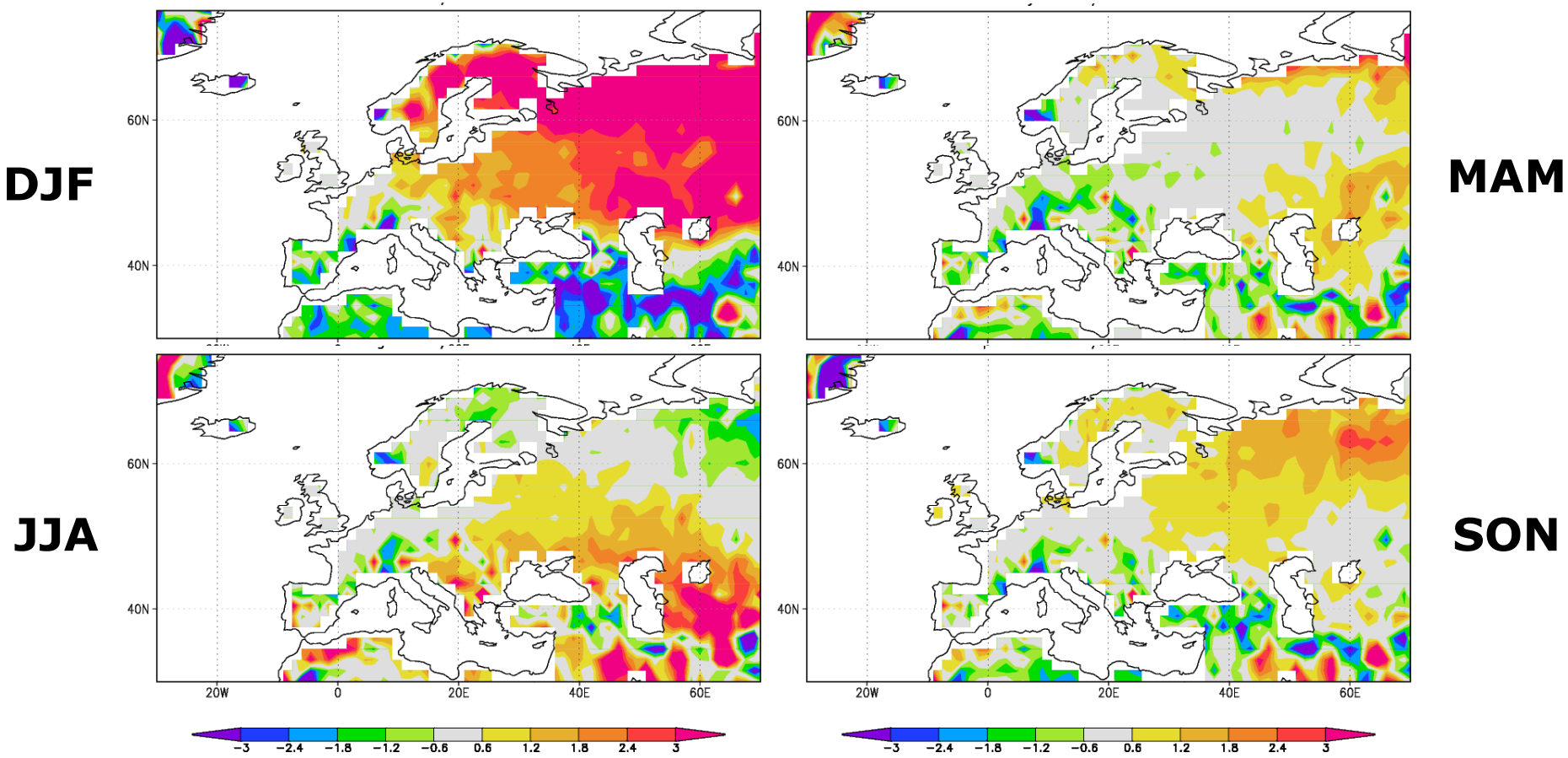
System 3 one-month lead near-surface air temperature (K) bias wrt GHCN over 1981-2005.



CMIP5 decadal predictions

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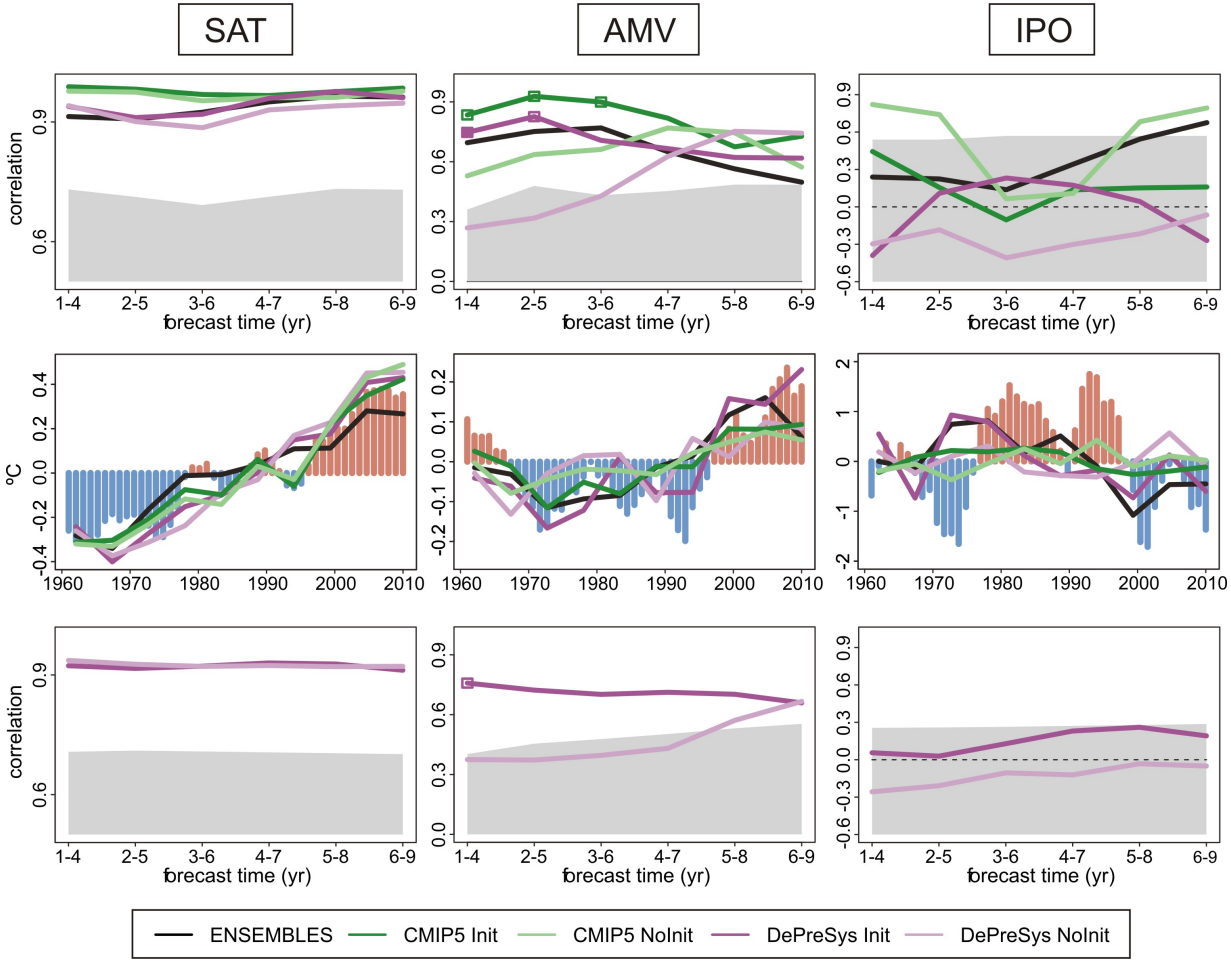
Decadal predictions from DePreSys_PP, ENSEMBLES and CMIP5 multi-models over 1960-2005. GISS and ERSST data used as reference. Grey area for the 95% confidence level.

Ensemble-mean correlation

Time series

Ensemble-mean correlation (1 year start date interval)



CMIP5 decadal predictions

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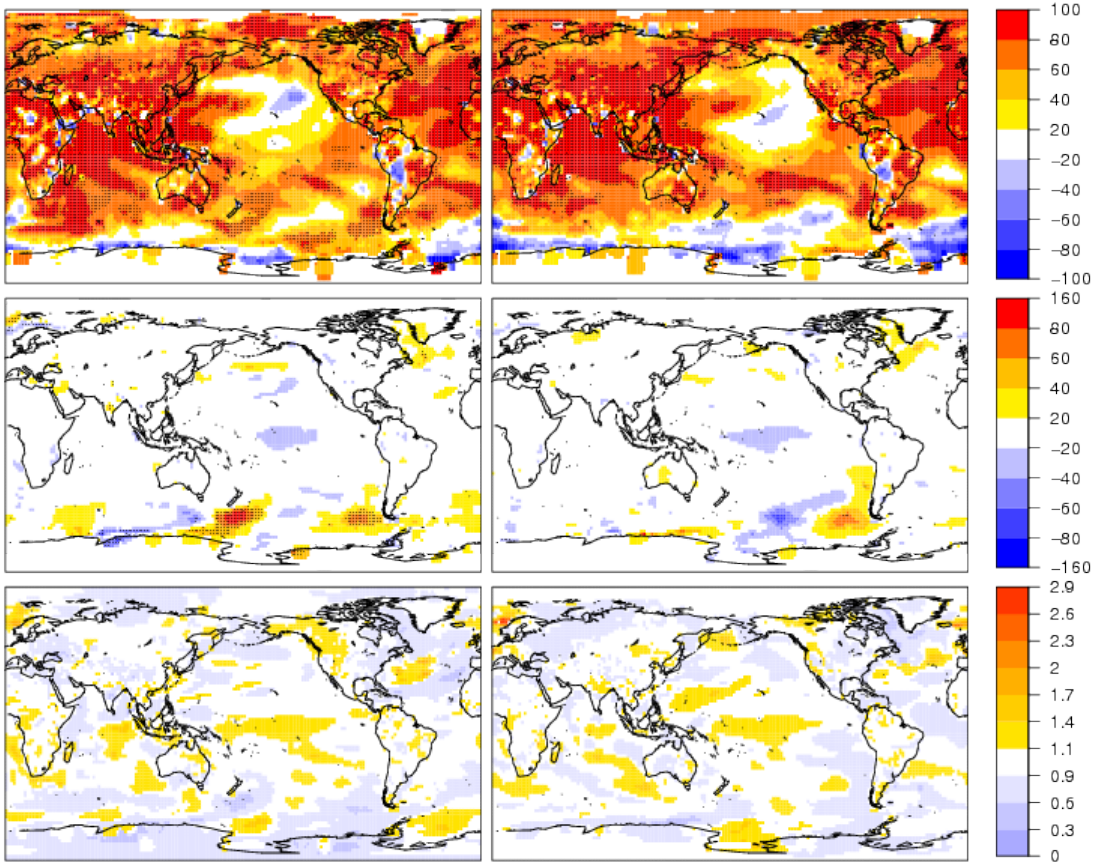
(Top) Near-surface temperature multi-model ensemble-mean correlation from CMIP5 decadal initialised predictions (1960-2005); (middle) correlation difference with the uninitialised predictions; (bottom) spread ratio of 2-5 year (left) and 6-9 year (right) wrt ERSST and GHCN.

Init ensemble-mean correlation

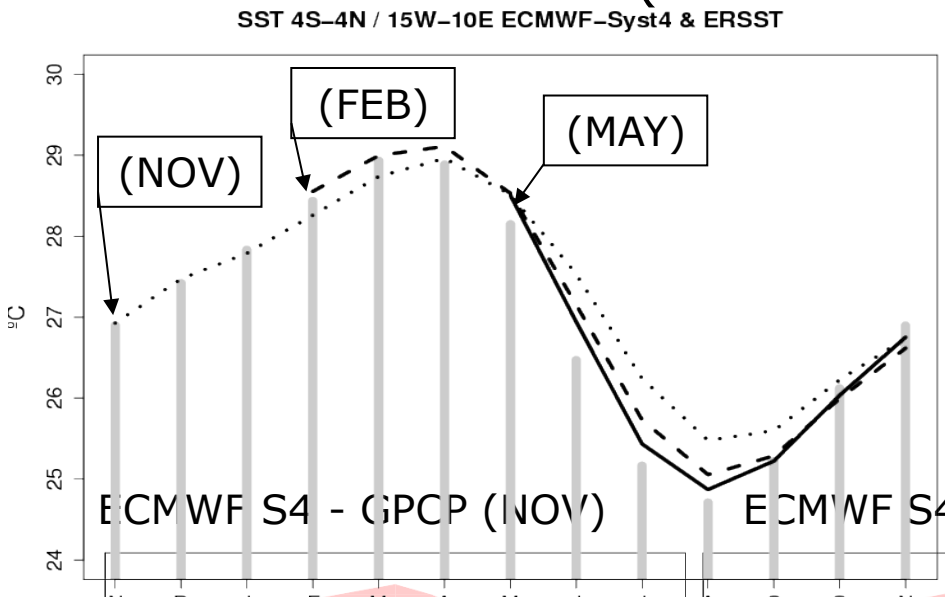
Init minus NoInit ensemble-mean correlation difference

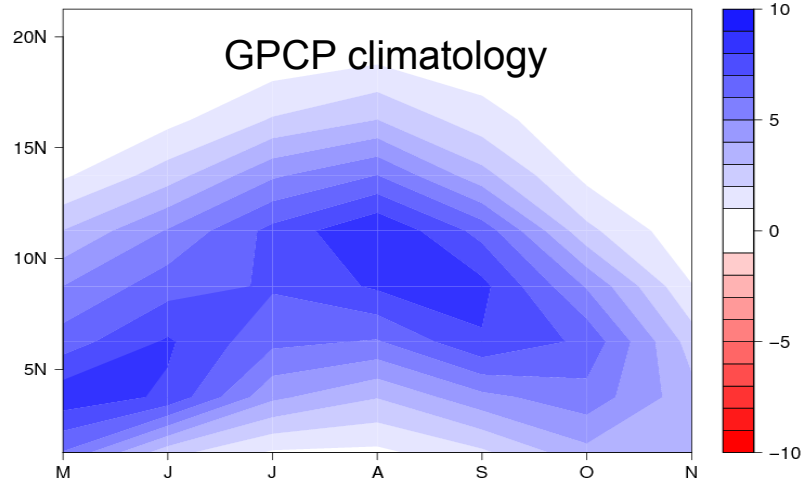
Spread ratio between Init and NoInit

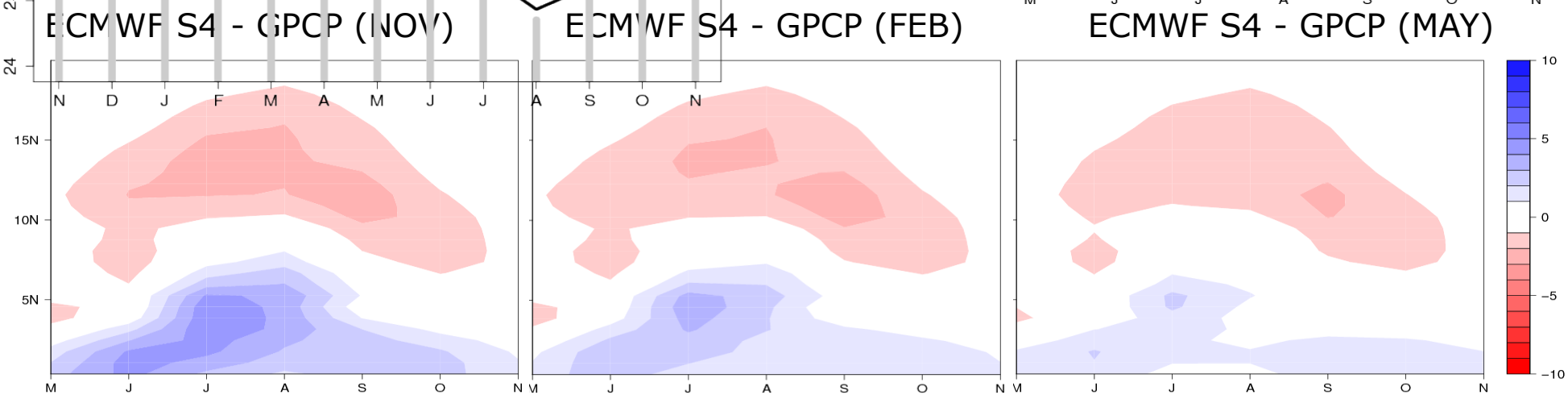


Systematic error: WAM

Averaged precipitation over 10ºW-10ºE for the period 1982-2008 for GPCP (climatology) and ECMWF System 4 (systematic error) with start dates of November (6-month lead time), February (3) and May (0).

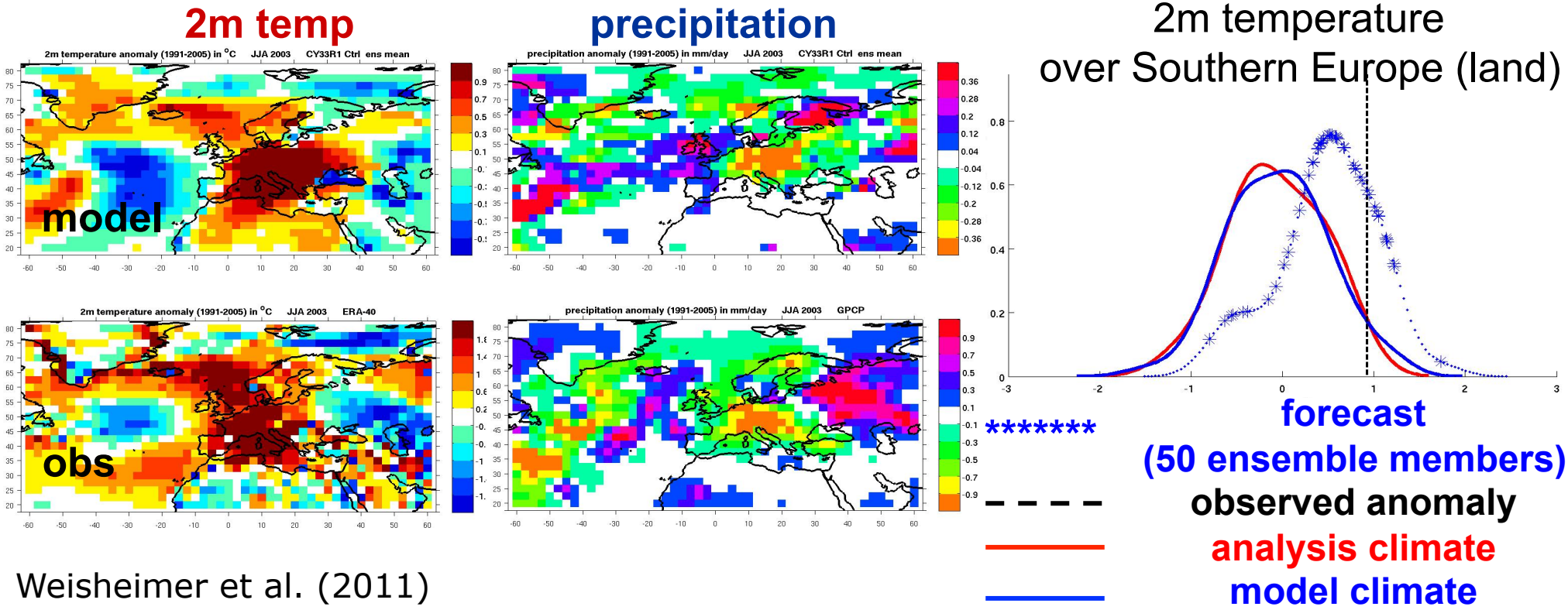






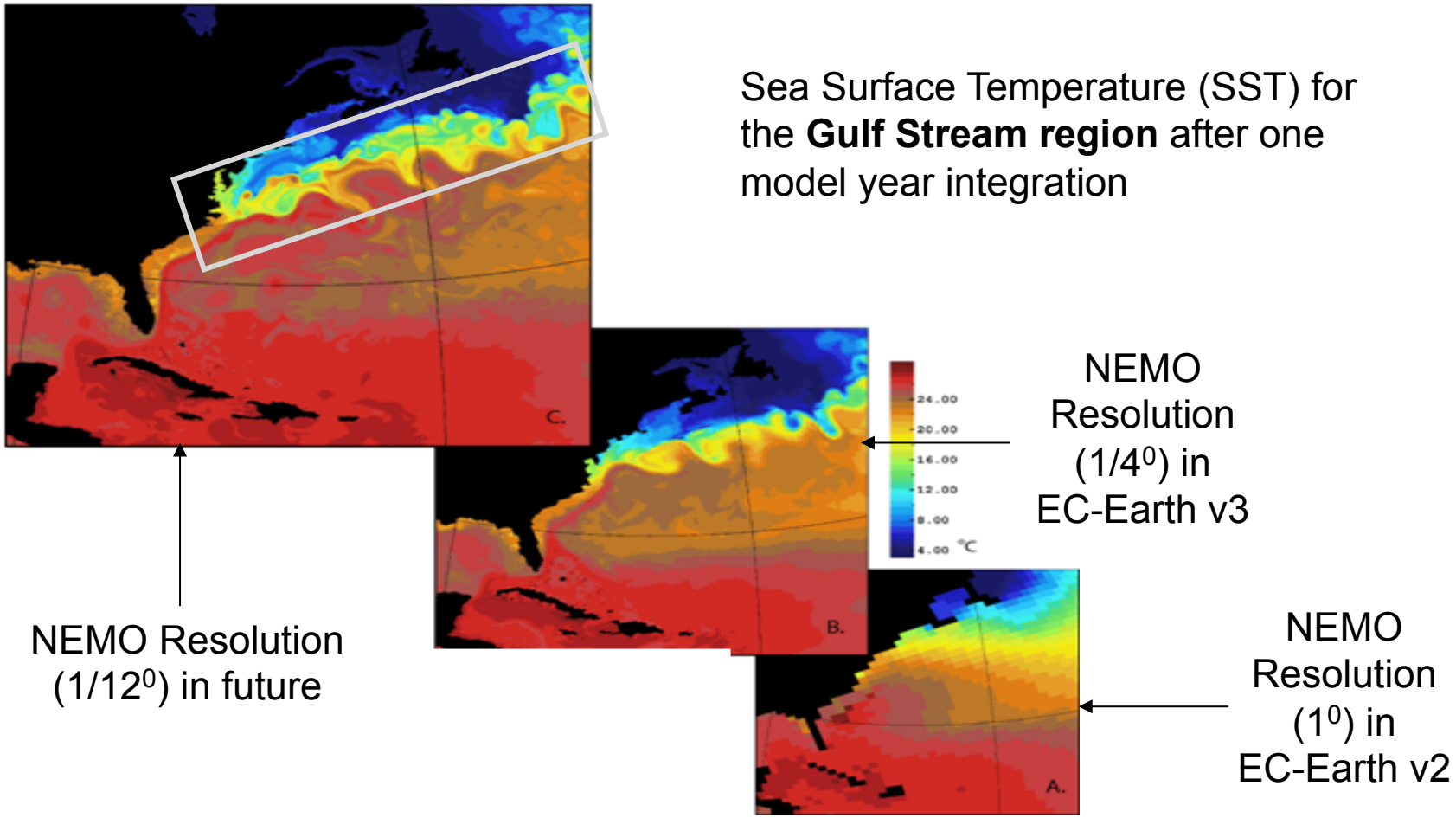
Model improvement: extremes

Seasonal prediction with improved ECMWF system (changes in radiation, soil scheme and convection) for summer 2003 with May start date. Anomalies wrt period 1991-2005.



Weisheimer et al. (2011)

Increasing model resolution



Sea Surface Temperature (SST) for the **Gulf Stream region** after one model year integration

NEMO Resolution ($1/4^0$) in EC-Earth v3

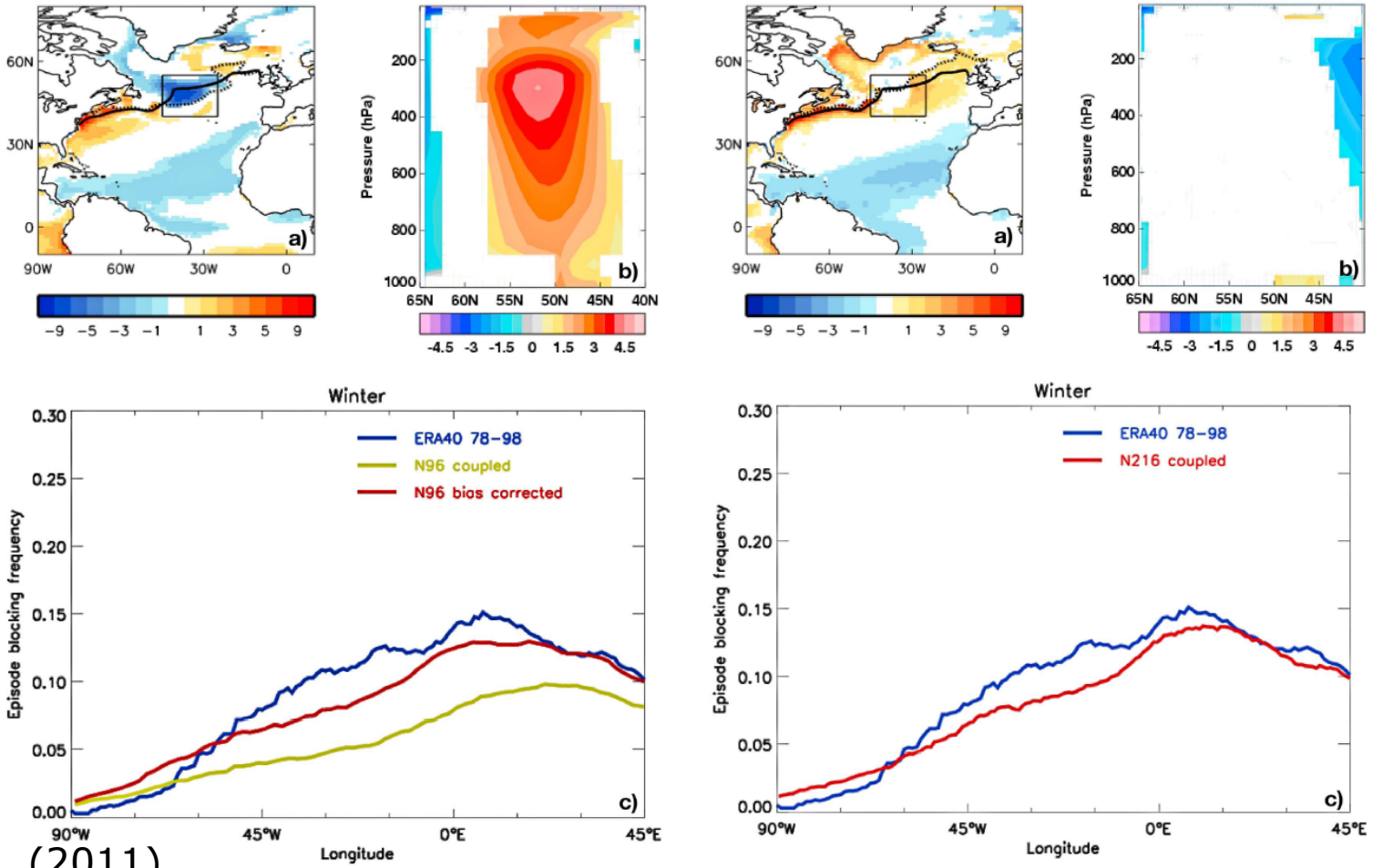
NEMO Resolution ($1/12^0$) in future

NEMO Resolution (1^0) in EC-Earth v2

http://noc.ac.uk/science-technology/climate-sea-level/changing-circulation/high-resolution-global-modelling

Impact of model resolution

SST (with North Atlantic Current path) and North Atlantic zonal wind bias, plus winter blocking frequency for HadGEM3 using the (left) standard (1º) and (right) high-resolution (0.25º) ocean components.



Scaife et al. (2011)

Sources of skill: snow cover

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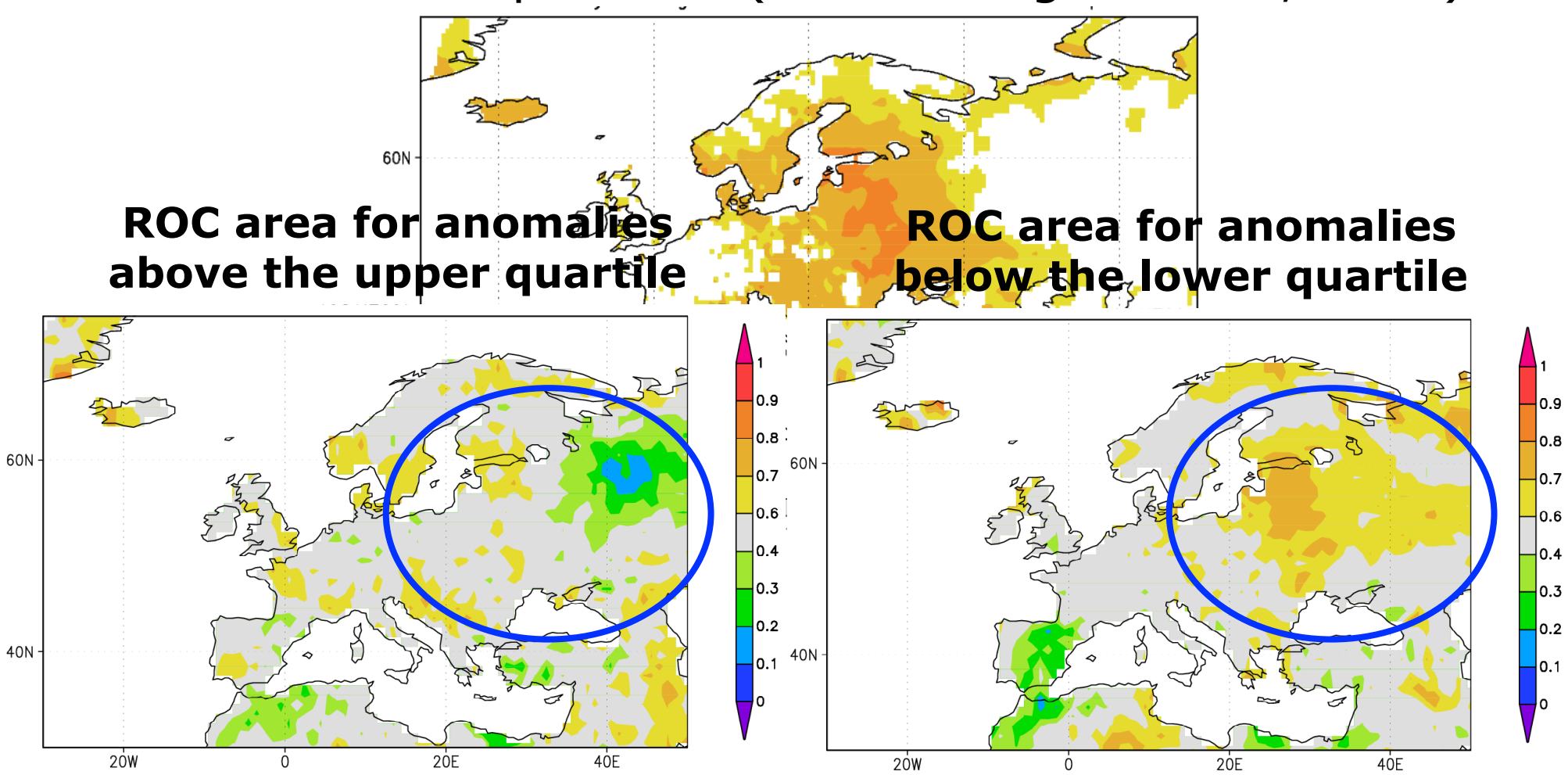
Correlation for System 3 MAM temperature over 1981-2005 wrt to GHCN temperature (after Shongwe et al., 2007).

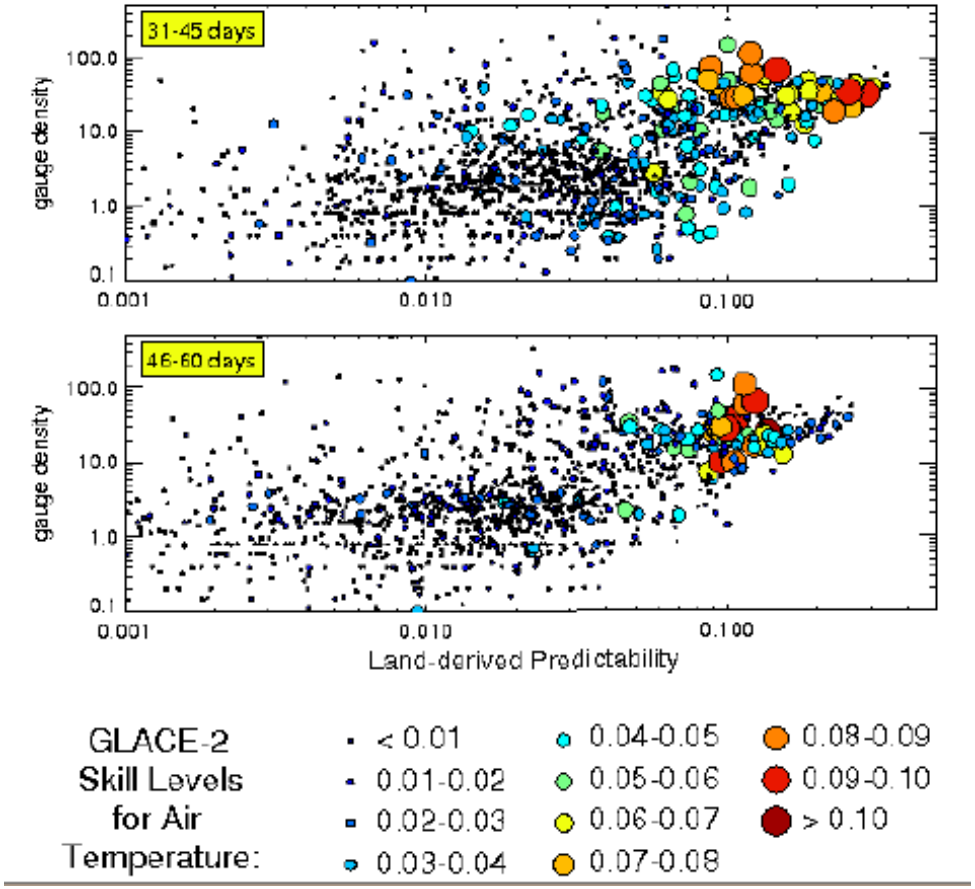


ROC area for anomalies above the upper quartile

ROC area for anomalies below the lower quartile

Sources of skill: soil moisture

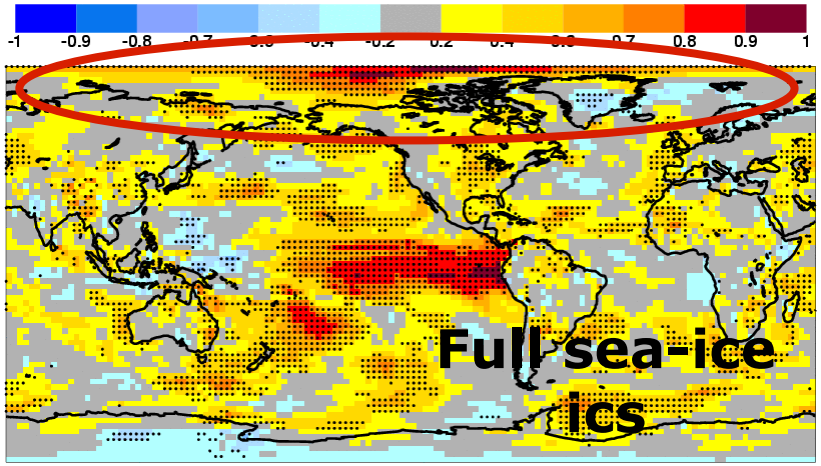
GLACE2 multi-model Series 1 skill as a function of the R2 difference between Series 1 and Series 2 (horizontal axis) and the gauge density (vertical axis). The size of the dots corresponds to the local Series 1 skill.

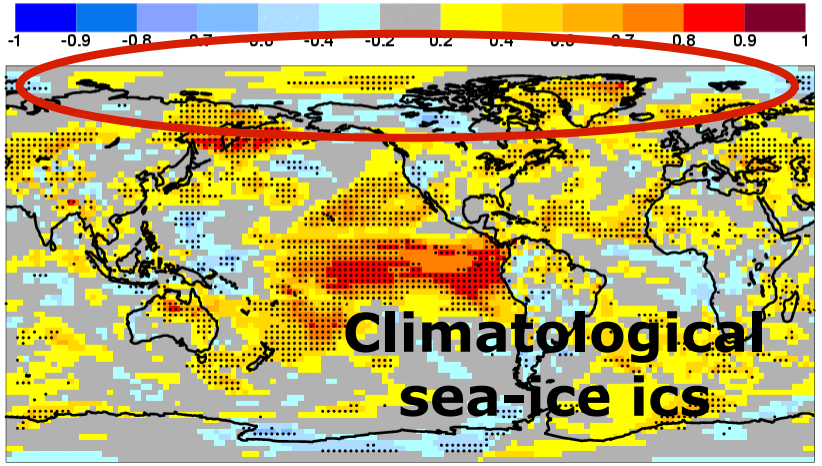


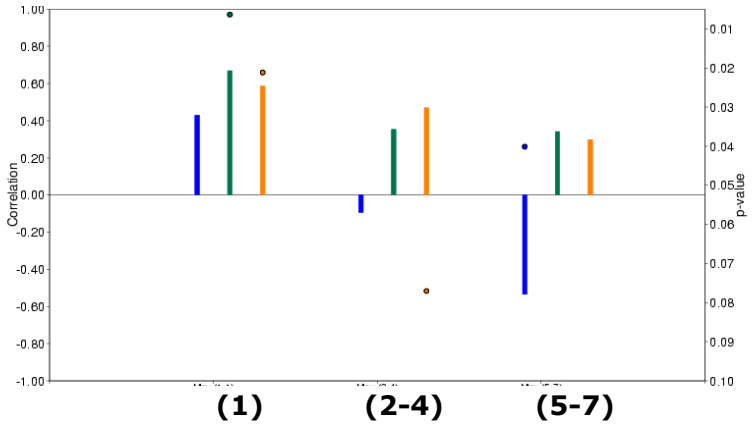
Koster et al. (2011)

Sources of skill: sea-ice

Ensemble-mean correlation of EC-Earth near-surface air temperature 5-7 month (SON) re-forecasts wrt ERA40/Int over 1991-2005. Dots for values statistically significant with



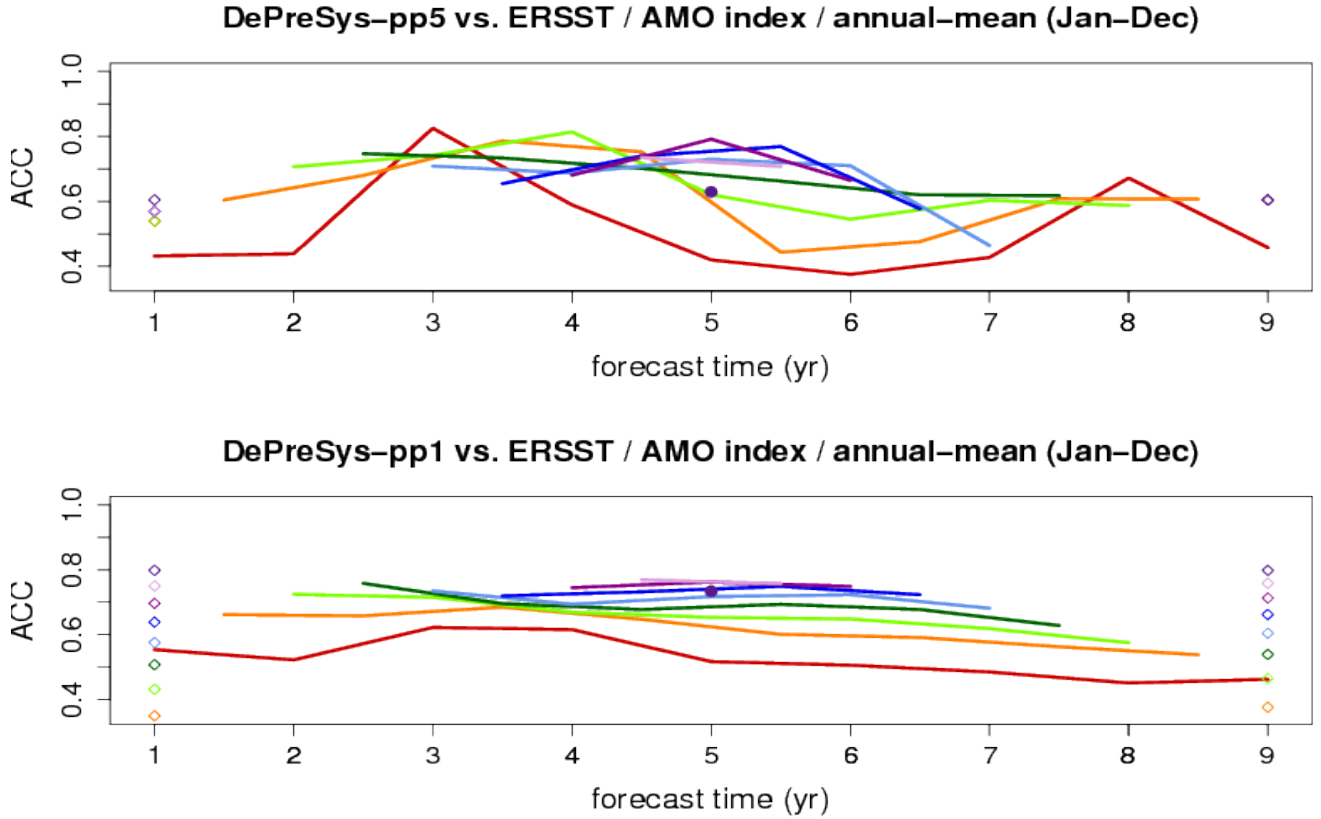




Correlation for NAO EC-Earth, System 3 and EC-Earth/clim. sea-ice ics May start date re-forecasts

Influence of start date frequency

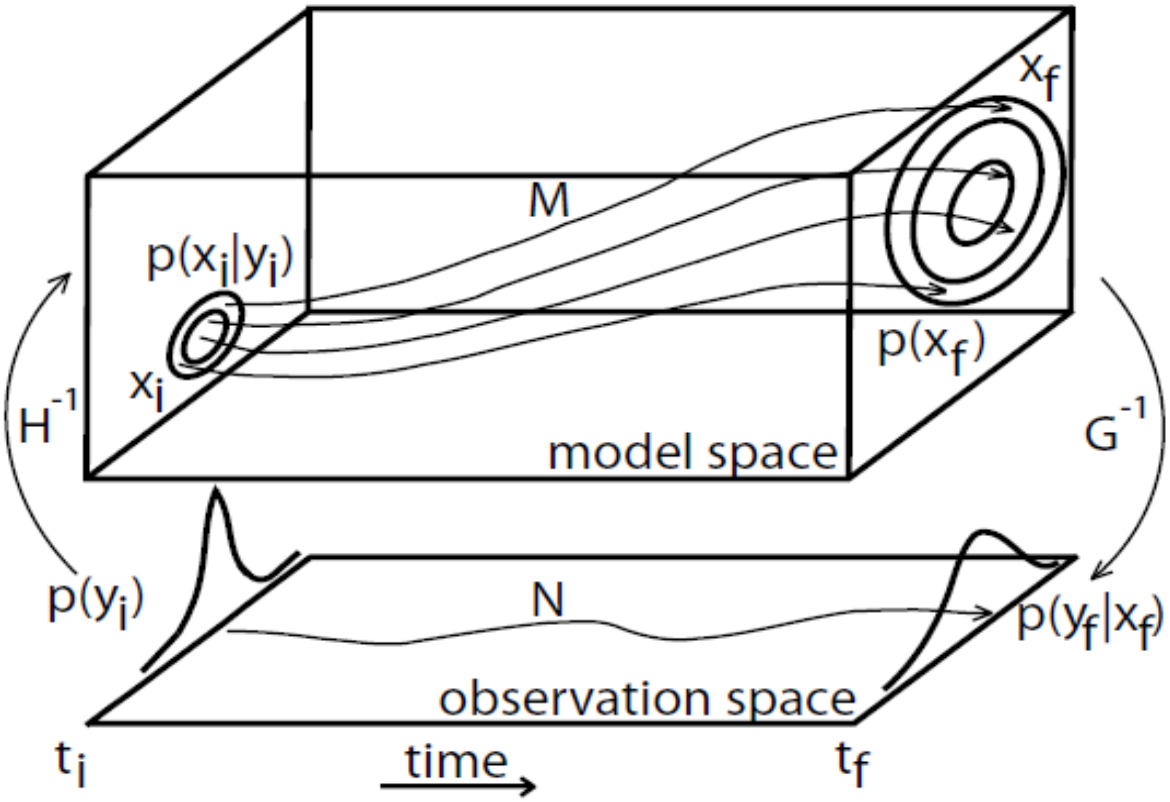
Ensemble-mean correlation for annual AMV between DePreSys-Init and ERSST with 5-year (top) and 1-year (bottom) intervals between start dates. Each colour shows the result for a different degree of averaging, from red (one year) to purple (nine years).



García-Serrano and Doblas-Reyes (2012)

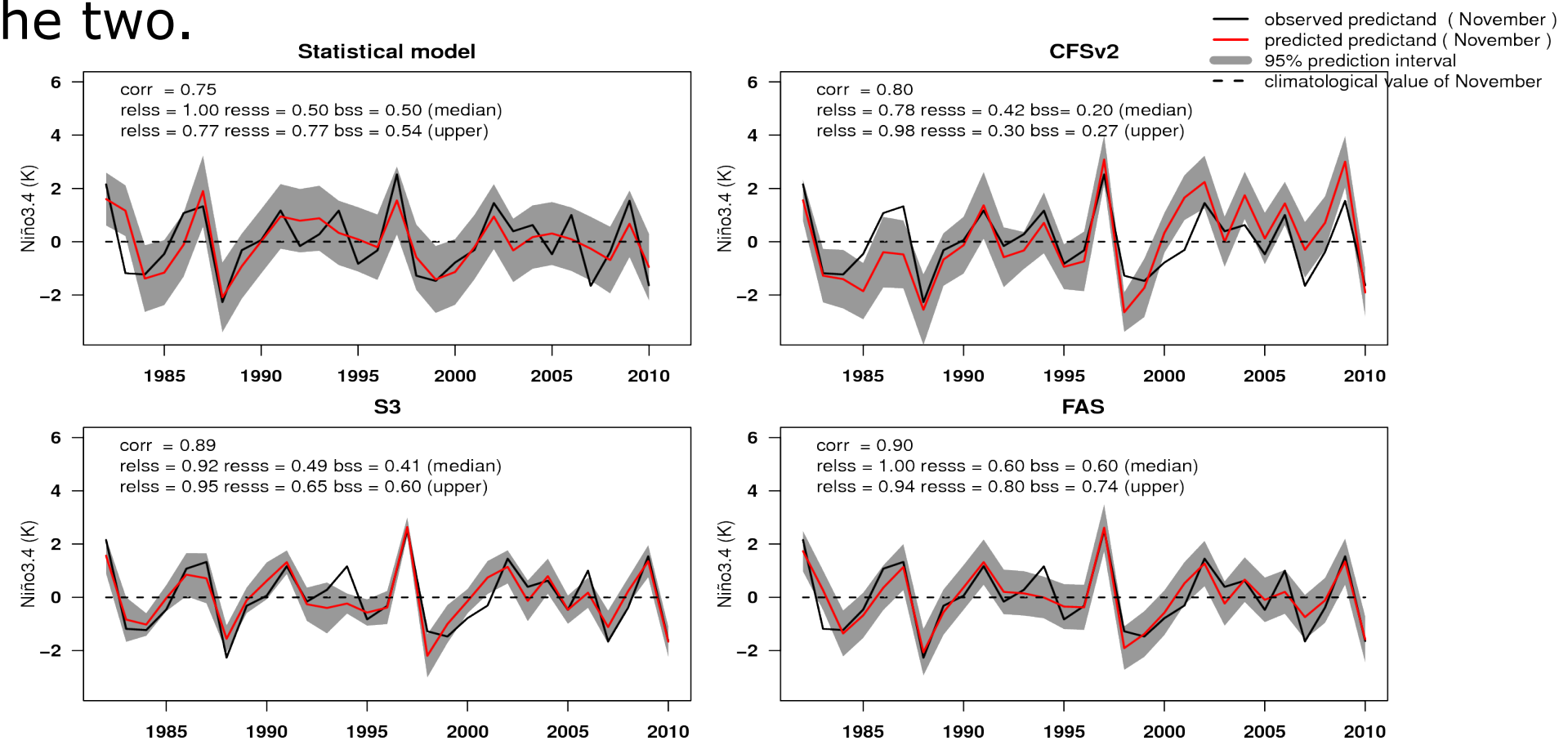
Calibration and combination

Forecast assimilation (Stephenson et al., 2005): y for observations and x for model output.



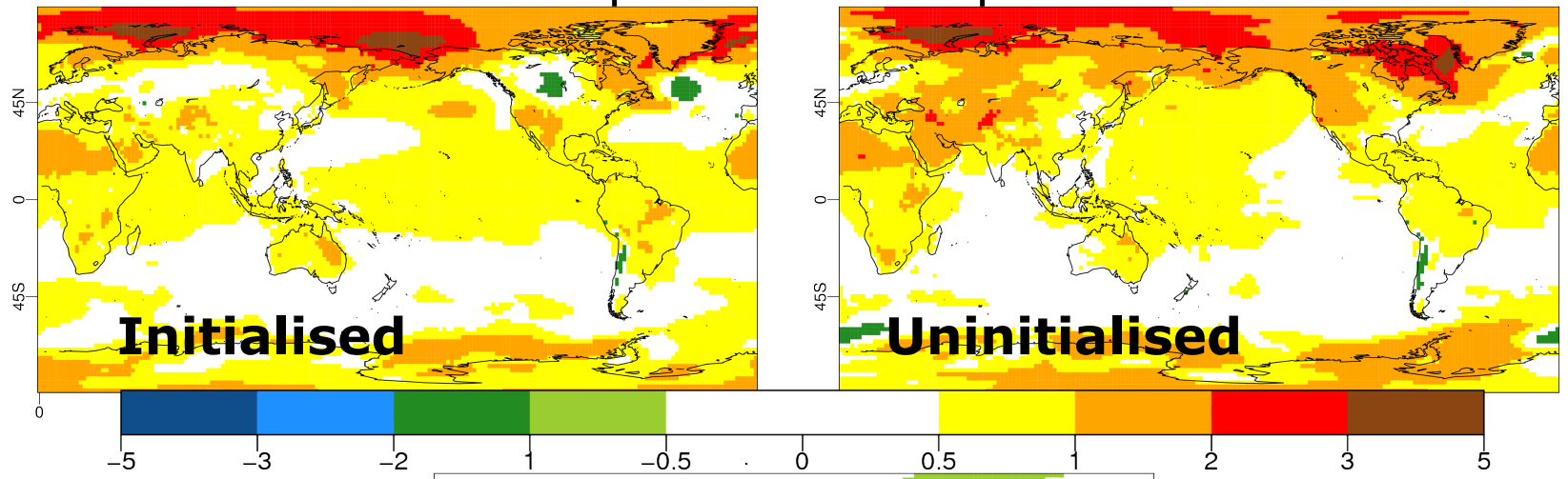
Multiple forecast systems available

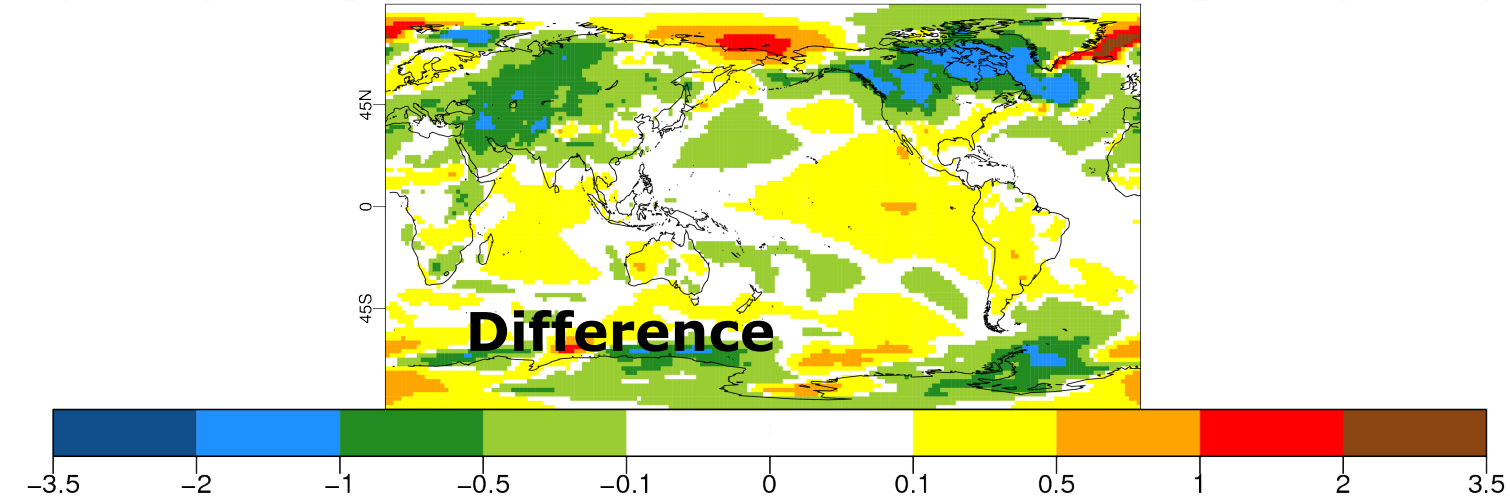
Seasonal forecasts of November Niño3.4 ERSST (four-month lead) with a persistence-based statistical model, the ECMWF System 3 and CFSV2 forecast systems and the combination of the two.



Quasi-operational decadal predictions

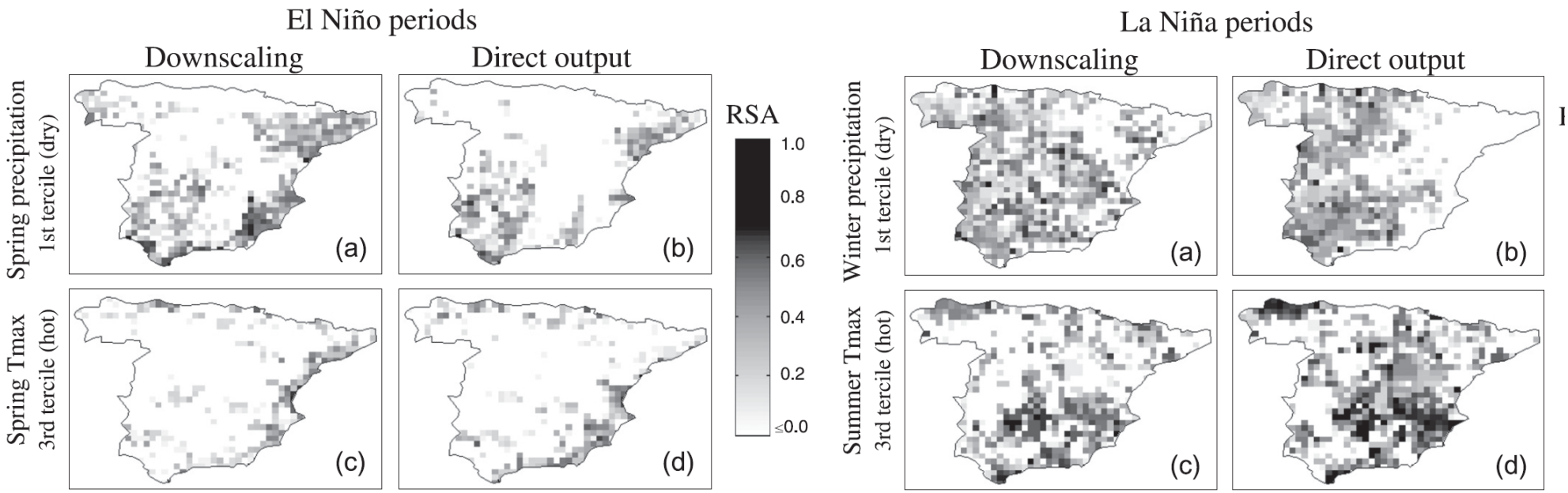
EC-Earth 2-5 year near-surface air temperature ensemble-mean predictions started in November 2011 (verification in 2013-2016) .
Anomalies are computed with respect to 1971-2000.





Downscaling

ROC area of the (left column) statistically downscaled and (right column) original DEMETER seasonal predictions for several events where the years verified are segregated depending on the ENSO phase. Only values statistically significant with 90% confidence level are shown.



Frías et al. (2010)

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

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*.

ECOMS

European Climate Observations, Modelling and Services 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.

Overarching objectives

1. Evaluation of current forecast quality
2. Implementation of current model improvements
3. Process-based verification
4. Innovative methods for forecast quality assessment
5. Integration of multidimensional observational data
6. Improved forecast quality at regional scales
7. Deal with the uncertainties in climate prediction
8. Achieve reliable and accurate local-to-regional predictions
9. Illustrate the usefulness of climate information
10. Support the European contributions to WMO initiatives

"Operationalization", "climate services" and "reliability" are key concepts of the project.

Genealogy

Seasonal

- PROVOST (FP4), DEMETER (FP5), ENSEMBLES (FP6), AMMA (FP6), APPOSITE (NERC), EUROSIP (operational)

Decadal

- ENSEMBLES (FP6), THOR (FP7), COMBINE (FP7), EPIDOM (France), Miklip (Germany), RUCSS (Spain), CMIP5

Impacts and climate services

- DEMETER (FP5), QWeCI (FP7), CLIM-RUN (FP7), ECLISE (FP7), EQUIP (NERC)

Downscaling and calibration

- DEMETER (FP5), ENSEMBLES (FP6), QWeCI (FP7), EUROBRISA (Leverhulme)

Infrastructure

- IS-ENES (FP7), PRACE (FP7)

Consortium

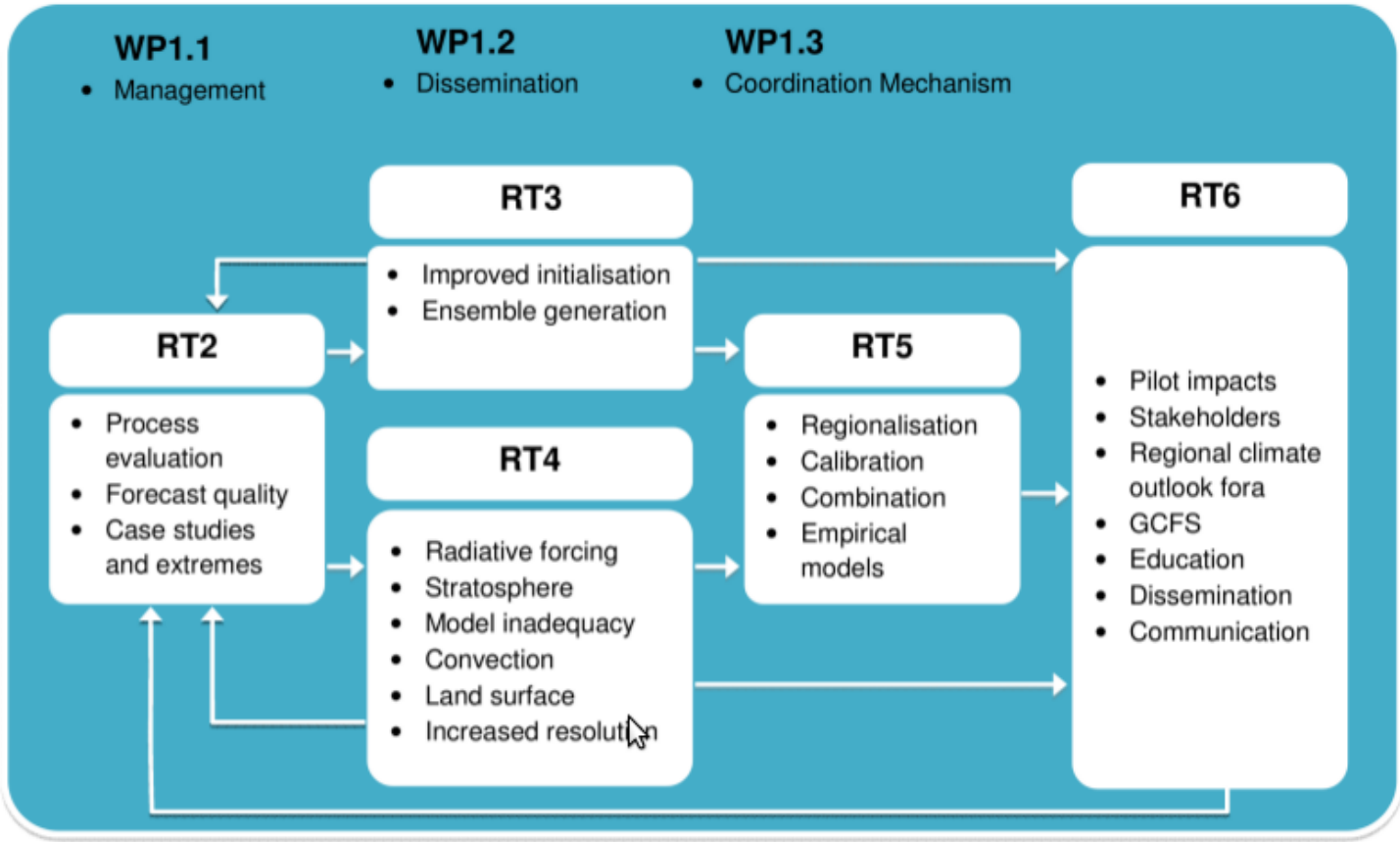
20 partners, coordination IC3

+ Brazil

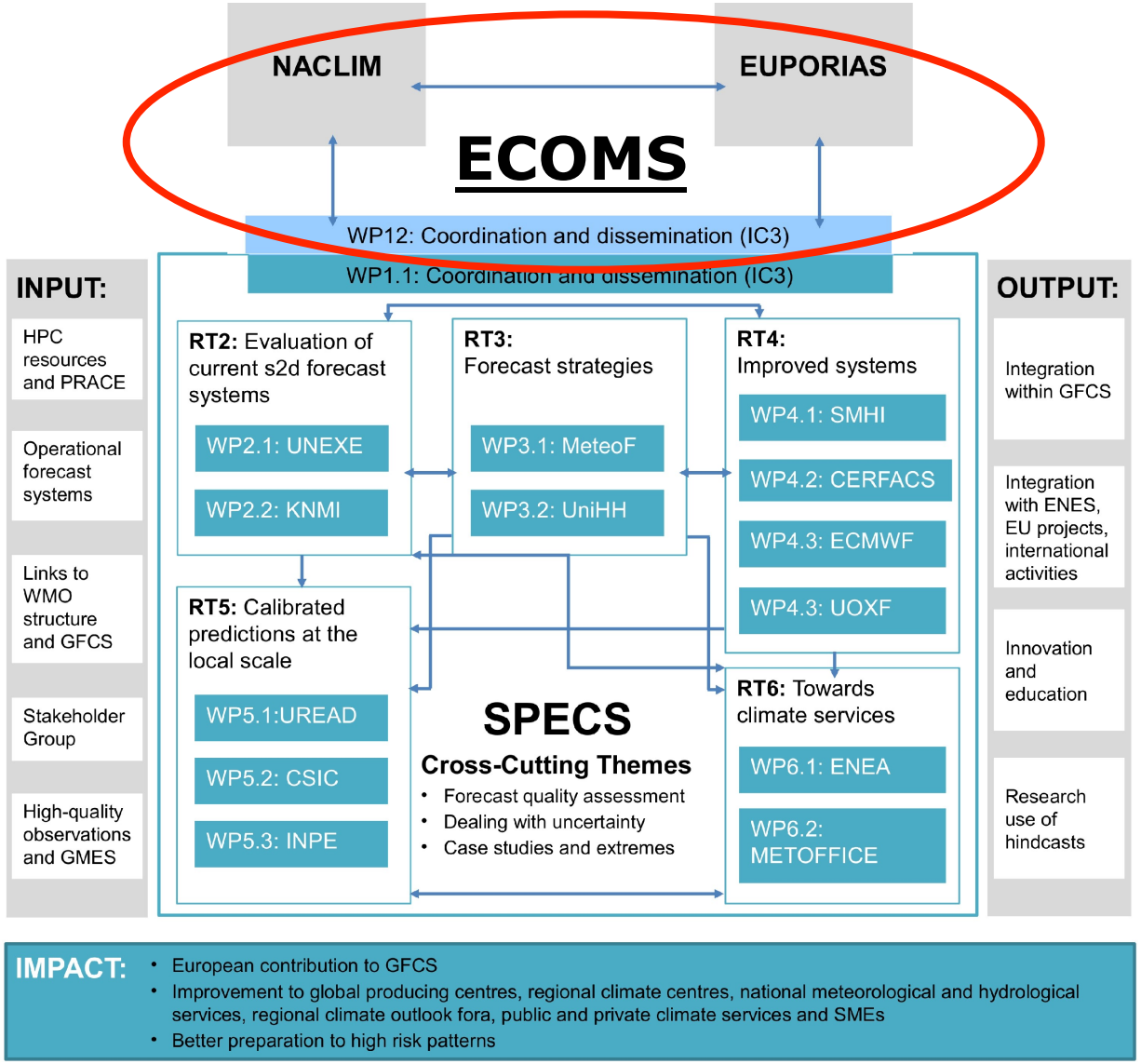
No.	Participant organisation name	Participant legal name	Country
1	Institut Català de Ciències del Clima	IC3	ES
2	Instituto Nacional de Pesquisas Espaciais	INPE	BR
3	Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. represented by Max-Planck-Institut für Meteorologie	MPG	DE
4	Het Koninklijk 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

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



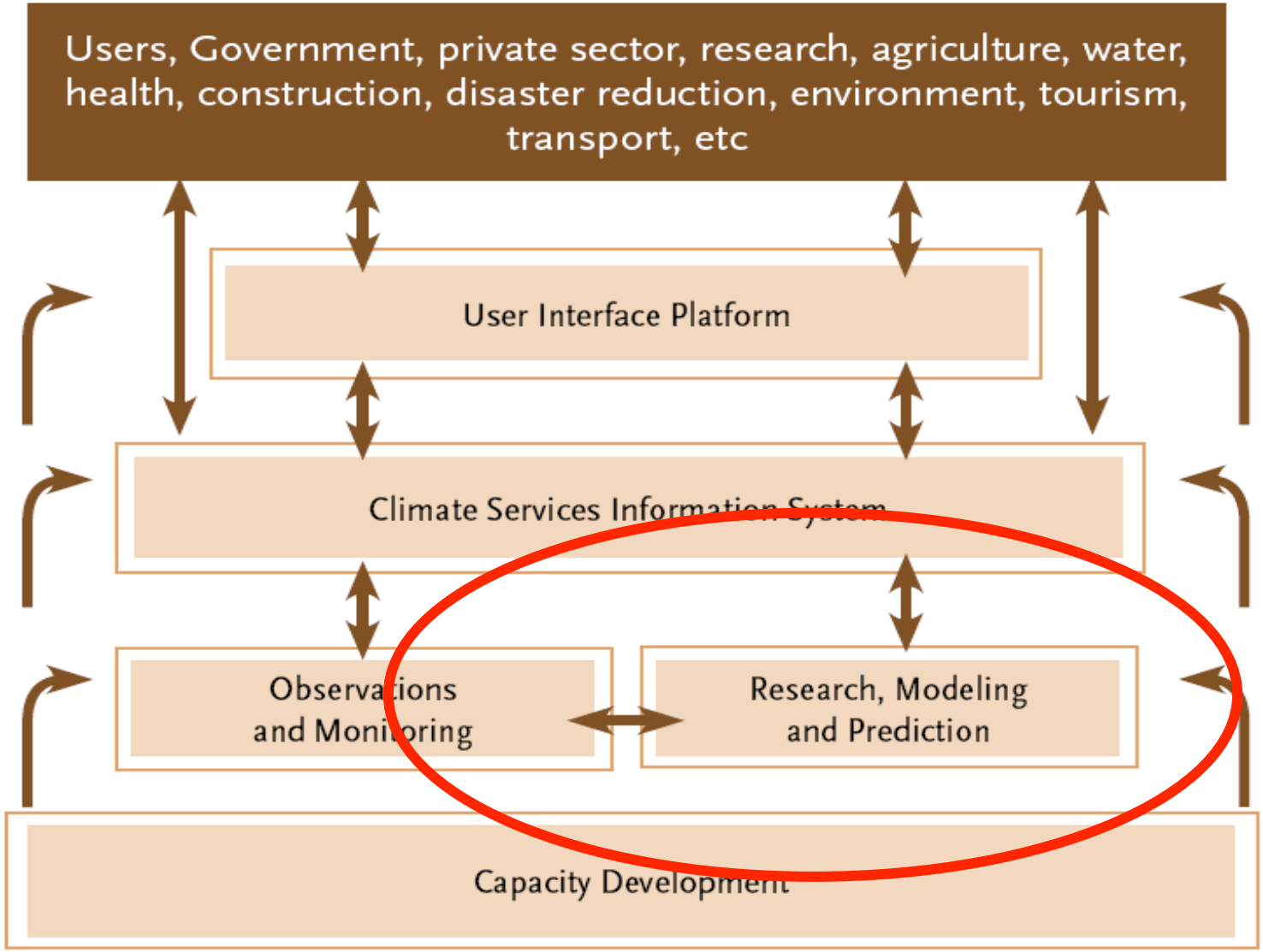
Dependencies



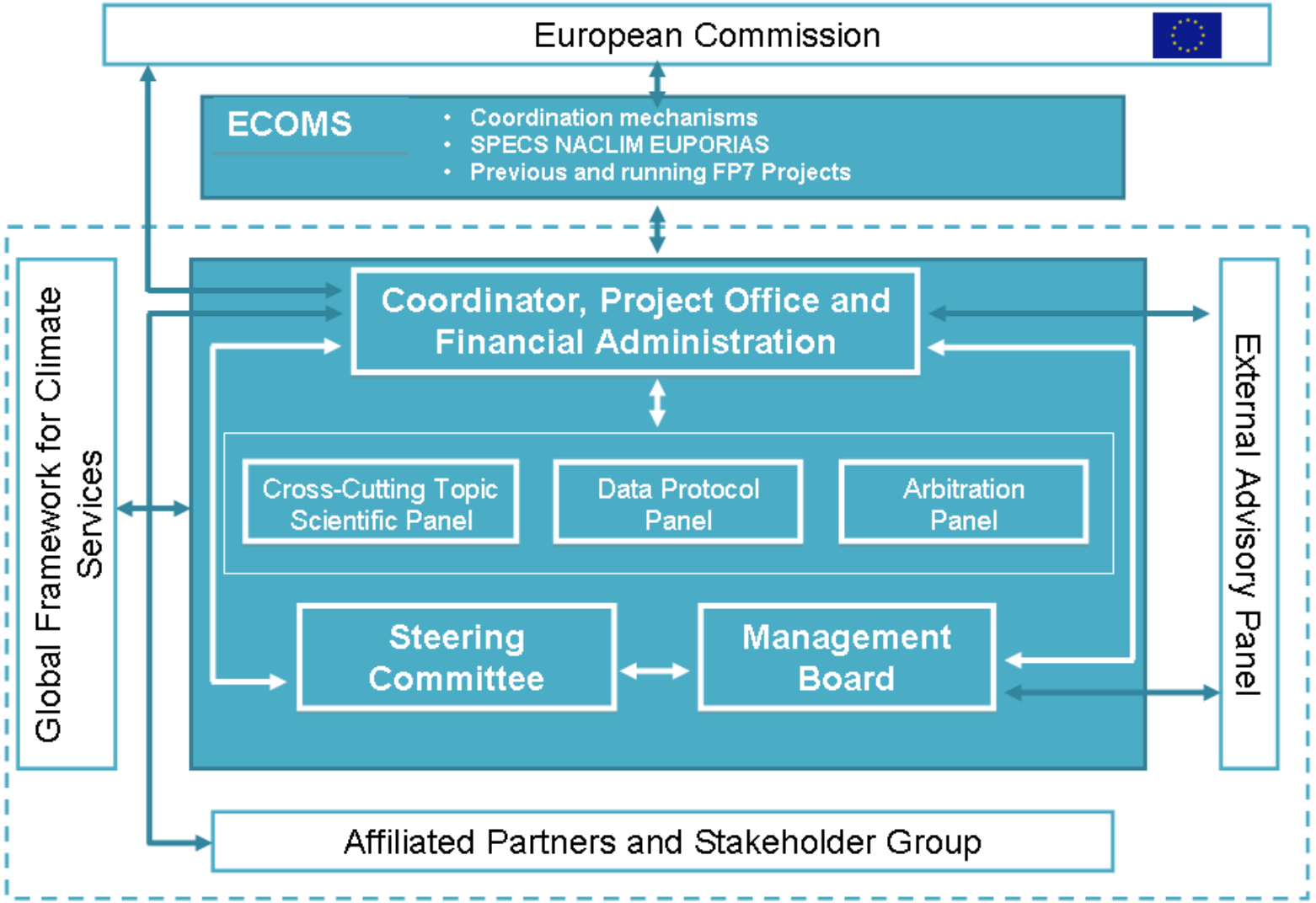
SPECS impact

- SPECS and ECOMS bring together several communities: climate modelling, weather and climate forecasting, impact modelling, downscaling.
- The project deliverables are, especially, a set of public tools and data from coordinated experiments.
- 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 CMIP5 standards at BADC.

SPECS and GFCS



Management structure



Affiliated partners and stakeholders

Stakeholders

- European RCOFs (SEECOF), AMMA, ACMAD, JRC-MARS, IDAE (Spain), EWEA, Alstom Wind, TERNA (Italy), ONS (Brazil), PRIMET, Willis Research Network

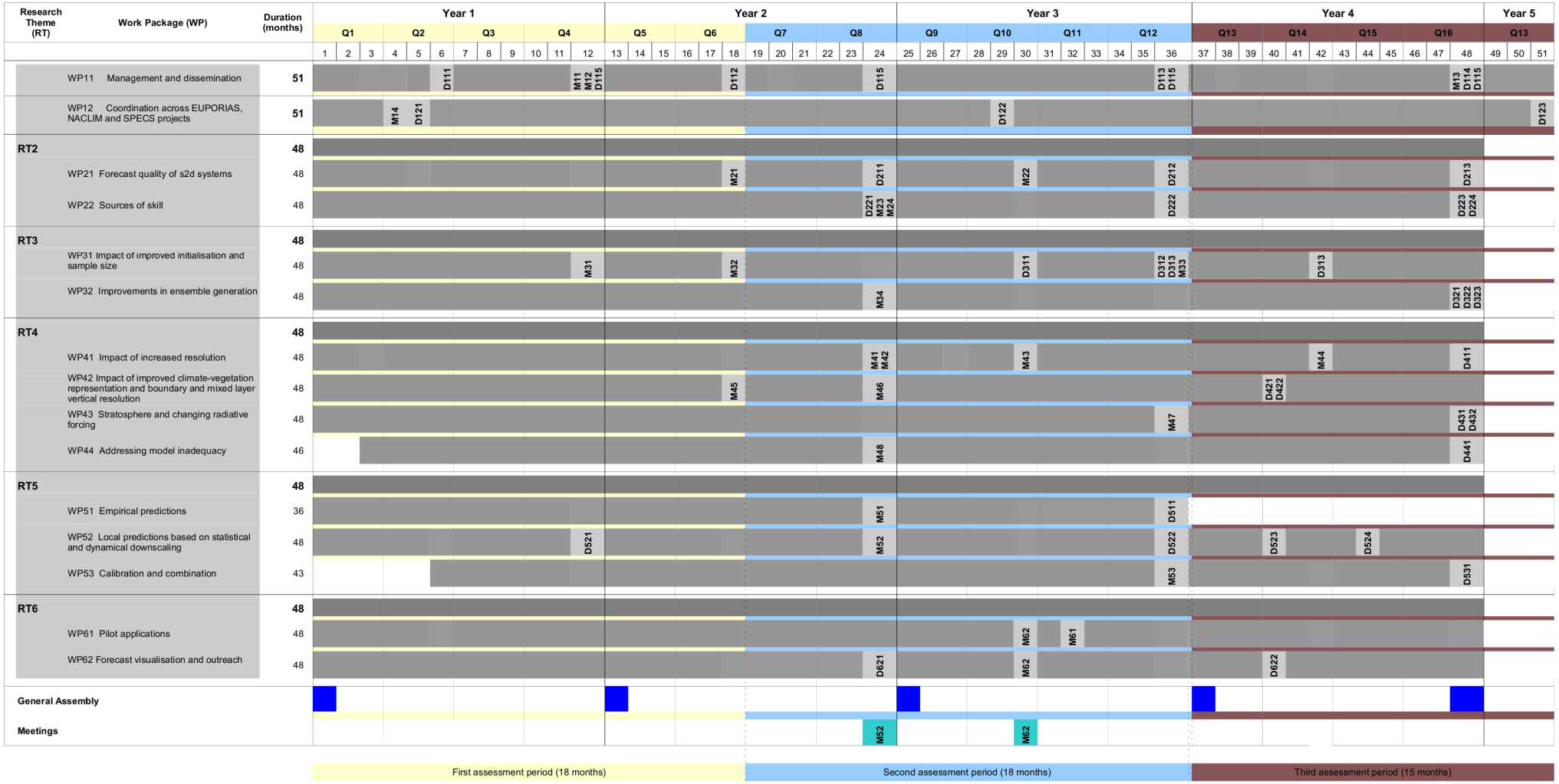
Affiliated partners

- GFCS, WCRP (WMAC, WGSIP, DIG), WMO's LC-LRFMME, WMO's RAVI RCC, ESA's CMUG, JPI-Climate, APCC, PRACE, GAW, WWRP (PPP, SSP), GEO, GMES-Climate, NOAA-MAPP

Kick-off

- Joint meeting of the three core projects and the ECOMS board in Barcelona 6-9 November 2012.
- Open to interested parties.
- Web site:

Schedule


Research Theme (RT)
Work Package (WP)
Duration (months)
Year 1
Year 2
Year 3
Year 4
Year 5
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q13
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51
WP11 Management and dissemination 51
D111 M11 M12 D115 D112 D115 D113 D115 M13 D114 D115
WP12 Coordination across EUPORIAS, NACLIM and SPECS projects 51
M14 D121 D122 D123
RT2 48
WP21 Forecast quality of s2d systems 48
M21 D211 M22 D212 D213
WP22 Sources of skill 48
D221 M23 M24 D222 D223 D224
RT3 48
WP31 Impact of improved initialisation and sample size 48
M31 M32 D311 D312 D313 M33 D313
WP32 Improvements in ensemble generation 48
M34 D321 D322 D323
RT4 48
WP41 Impact of increased resolution 48
M41 M42 M43 M44 D411
WP42 Impact of improved climate-vegetation representation and boundary and mixed layer vertical resolution 48
M45 M46 D421 D422
WP43 Stratosphere and changing radiative forcing 48
M47 D431 D432
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WP52 Local predictions based on statistical and dynamical downscaling 48
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WP53 Calibration and combination 43
M53 D531
RT6 48
WP61 Pilot applications 48
M62 M61
WP62 Forecast visualisation and outreach 48
D621 M62 D622
General Assembly
Meetings
M52 M62
First assessment period (18 months)
Second assessment period (18 months)
Third assessment period (15 months)