Barcelona Supercomputing Center
Centro Nacional de Supercomputación

EXCELENCIA SEVERO OCHOA

SPECS

Predict and understand heat waves

A case study of summer 2003 and 2010

C. Prodhomme, F. Doblas-Reyes, O. Bellprat, E. Dutra

HEPEX workshop, Norrköping, SMHI, 22/09/2015

IC3 Climate Forecasting Unit

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

SEVENTH FRAMEWORK PROGRAMME

PI: Francisco Doblas-Reyes

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

SPECS aims to identify the main problems in climate prediction and investigate a battery of solutions from a seamless perspective

Met Office
NILU
SMHI
INPE
CERFACS
UH Universität Hamburg
Royal Netherlands Meteorological Institute
Ministry of Infrastructure and the Environment
ENEA
Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile
MAX-PLANCK-GESELLSCHAFT
CSIC
Consejo Superior de Investigaciones Científicas
UNIVERSITY OF EXETER
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ECMWF
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Toujours un temps d'avance
UNIVERSITY OF OXFORD
VORTEX

2003 and 2010 heat waves

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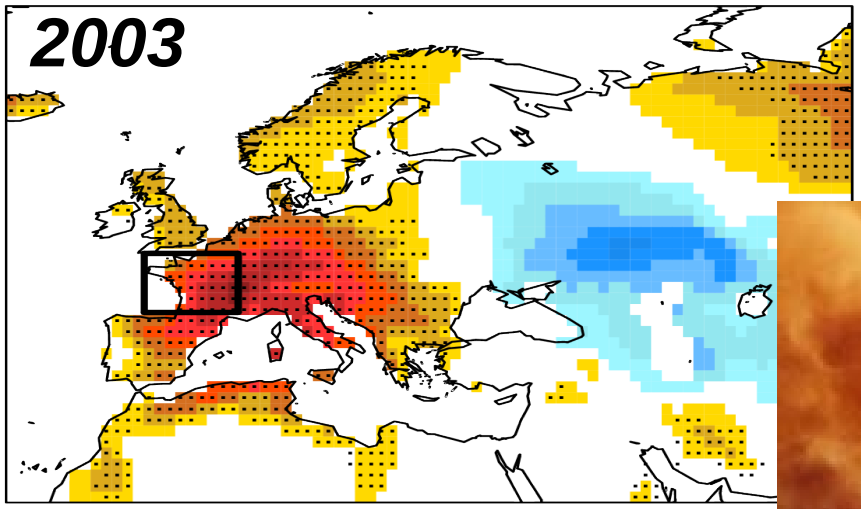
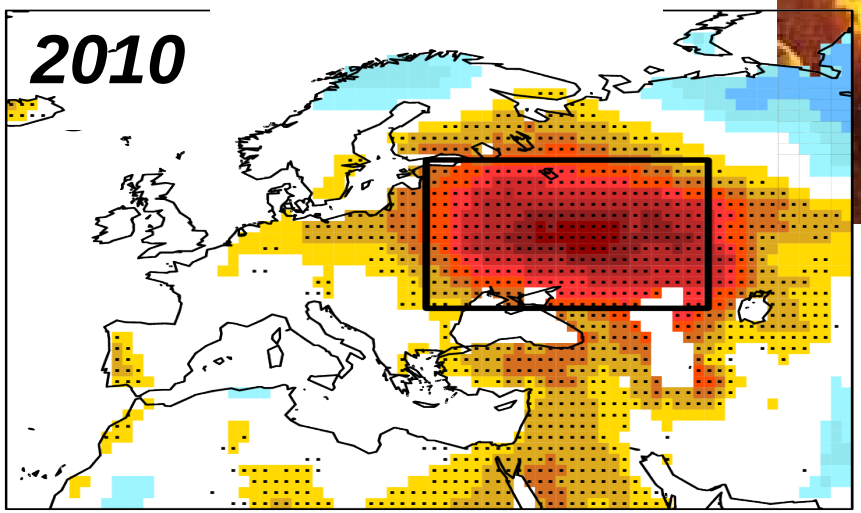
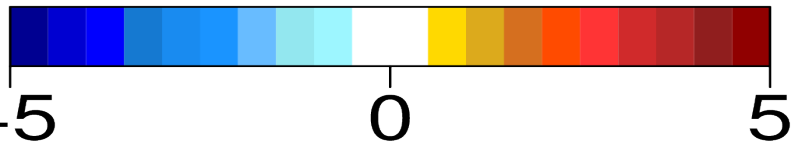
2m-Temperature anomalies



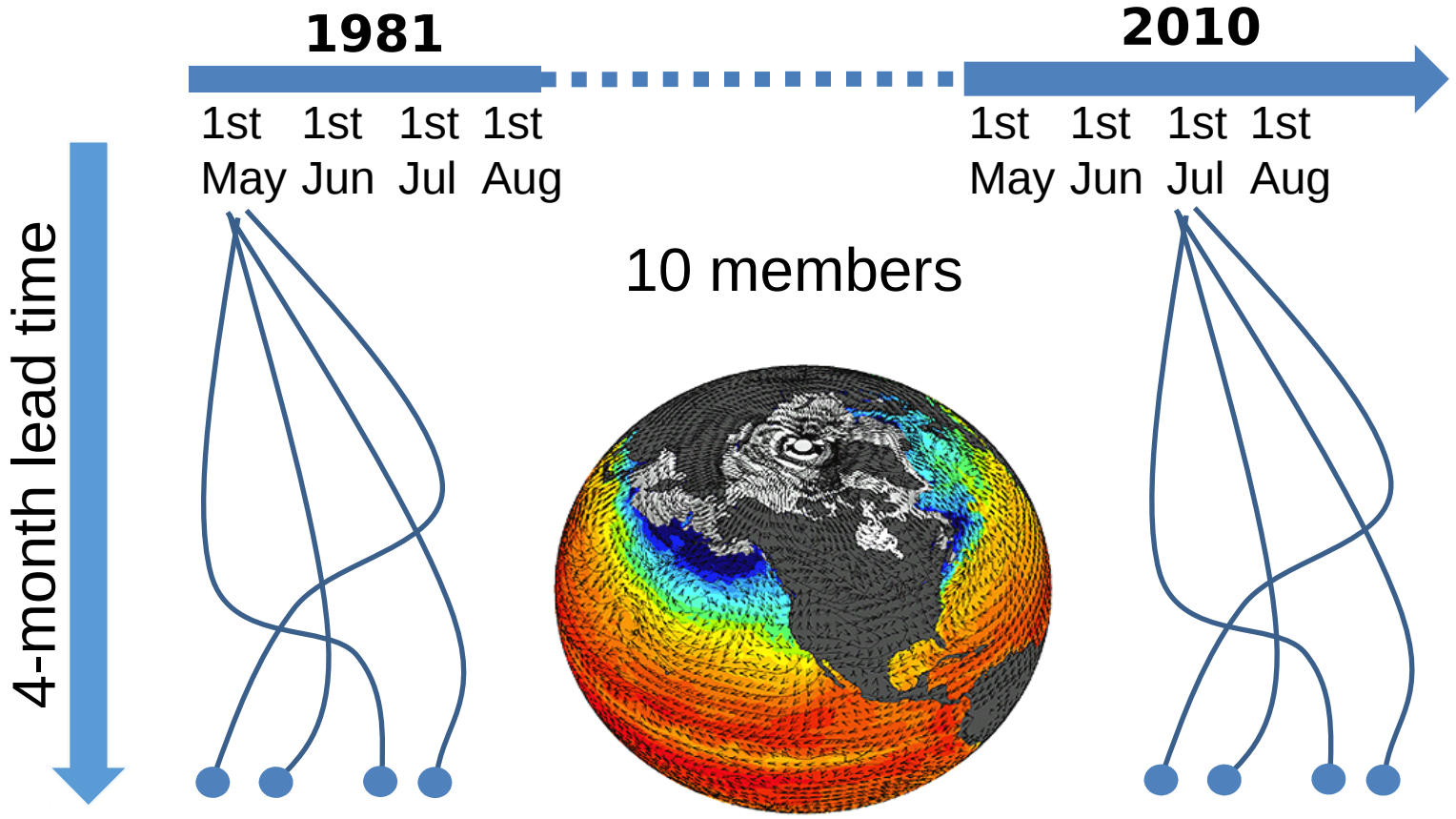




The European heat-wave of 2003 caused the death of 35,000 people and damages of $15 billion.

Experiment description

Model	Start dates	Land IC	Atm IC	Oce/Ice IC
EC-Earth 2.3	**May**, June, July, August	**ERA-Land**	ERAInt	ORA-S4



Are they predictable?

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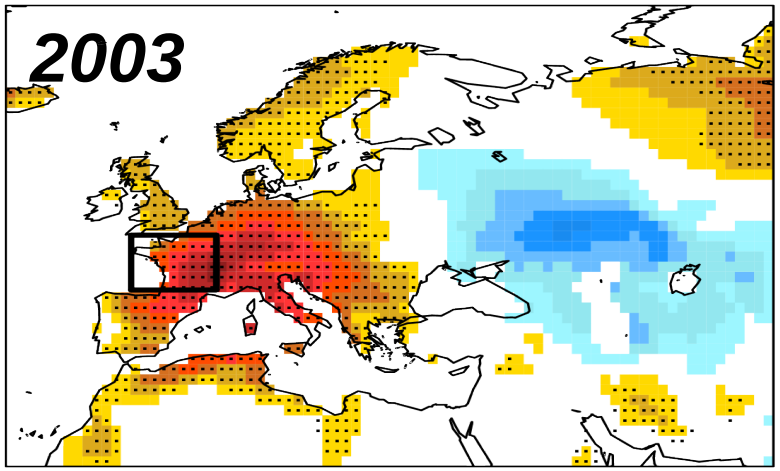
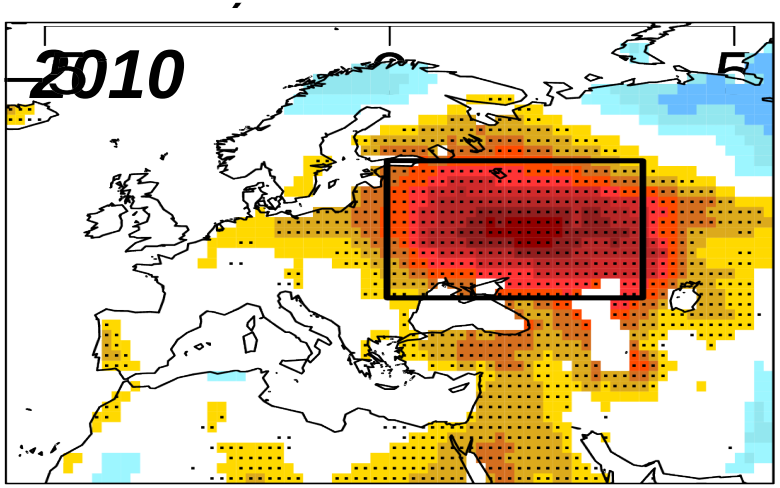
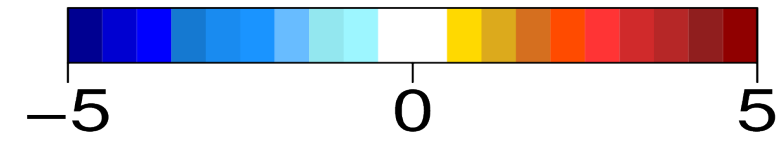
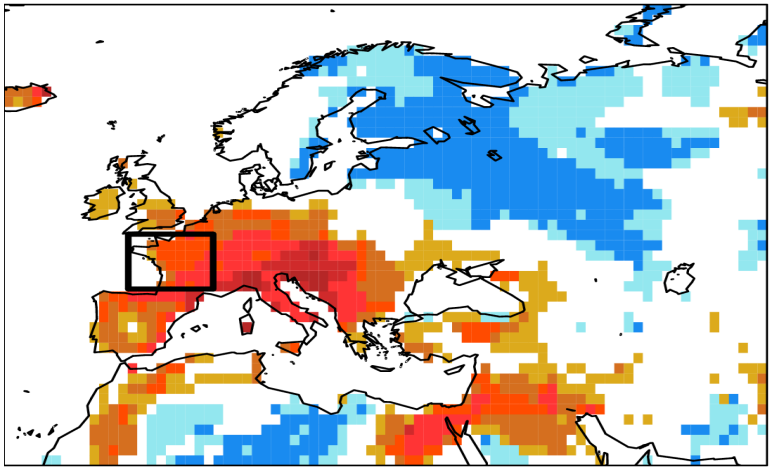
2m-Temperature anomalies

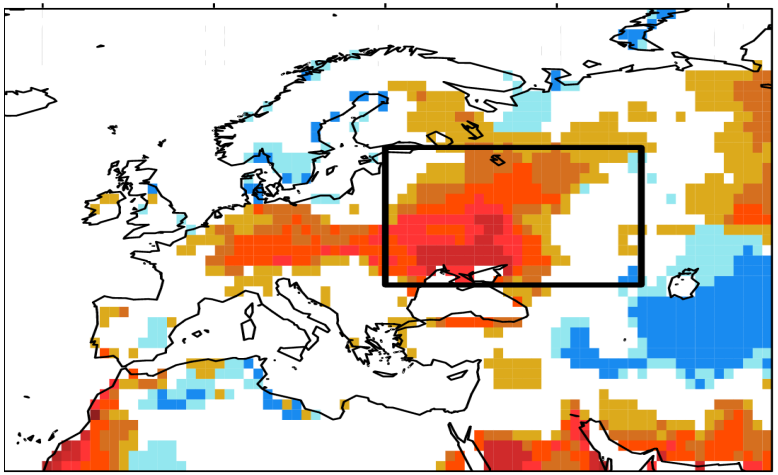


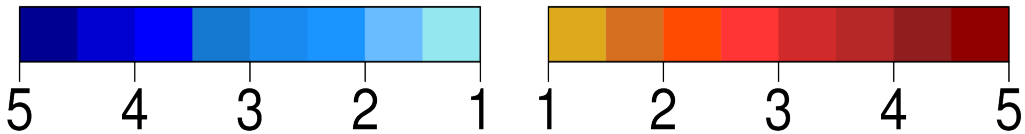




Odds Ratio





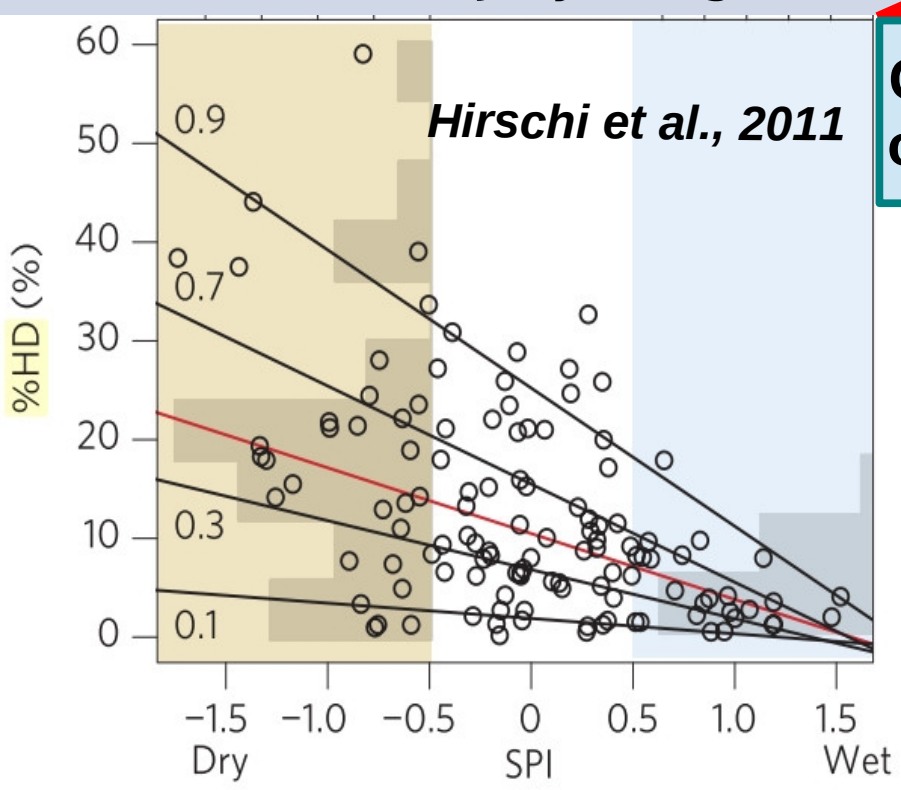


Why are they predictable?

Large scale vs local processes

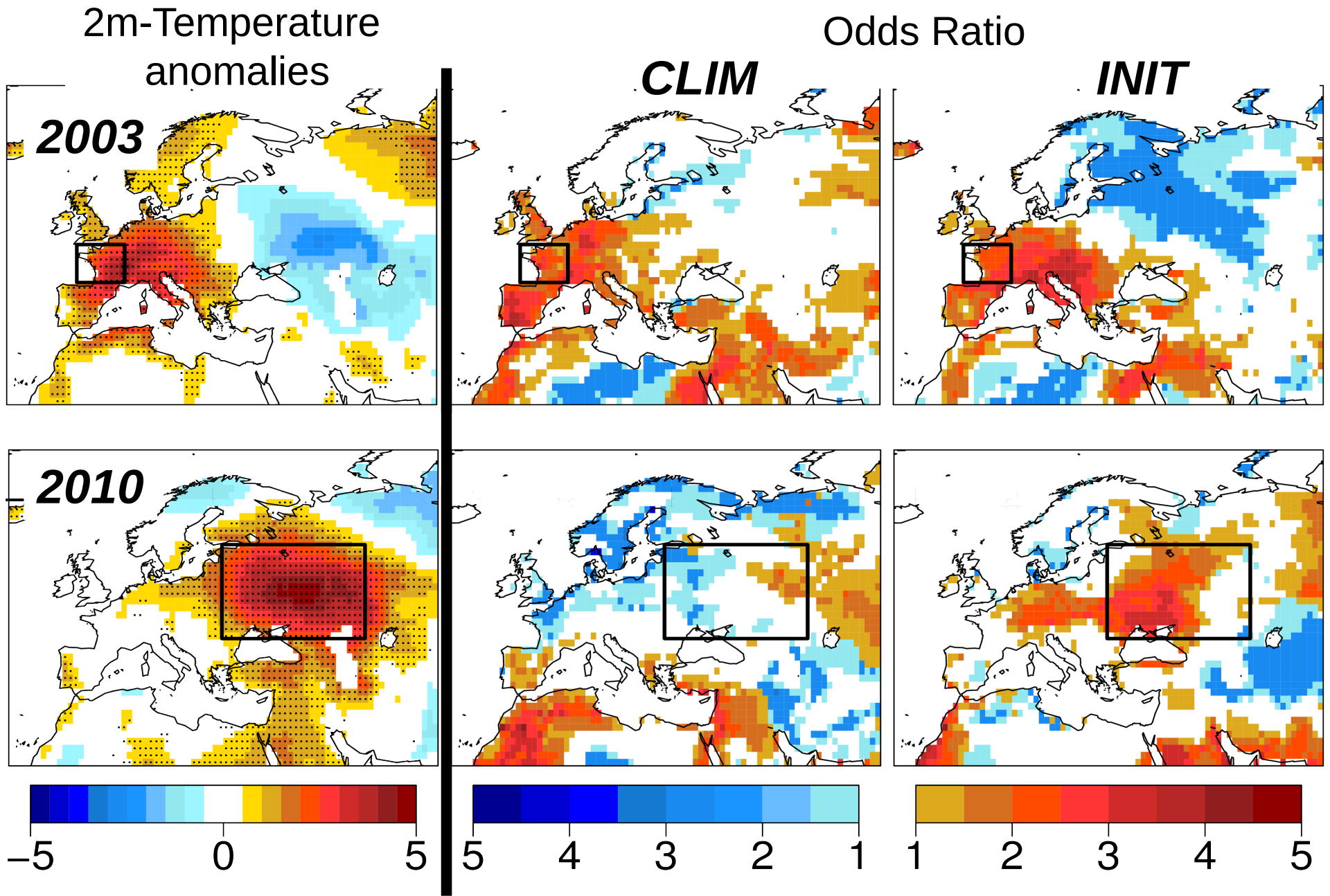
Model	Start dates	Land IC	Atm IC	Oce/Ice IC
EC-Earth 2.3	**May**, June, July, August	**ERA-Land**	ERAInt	ORA-S4

Climatology of ERA-Land

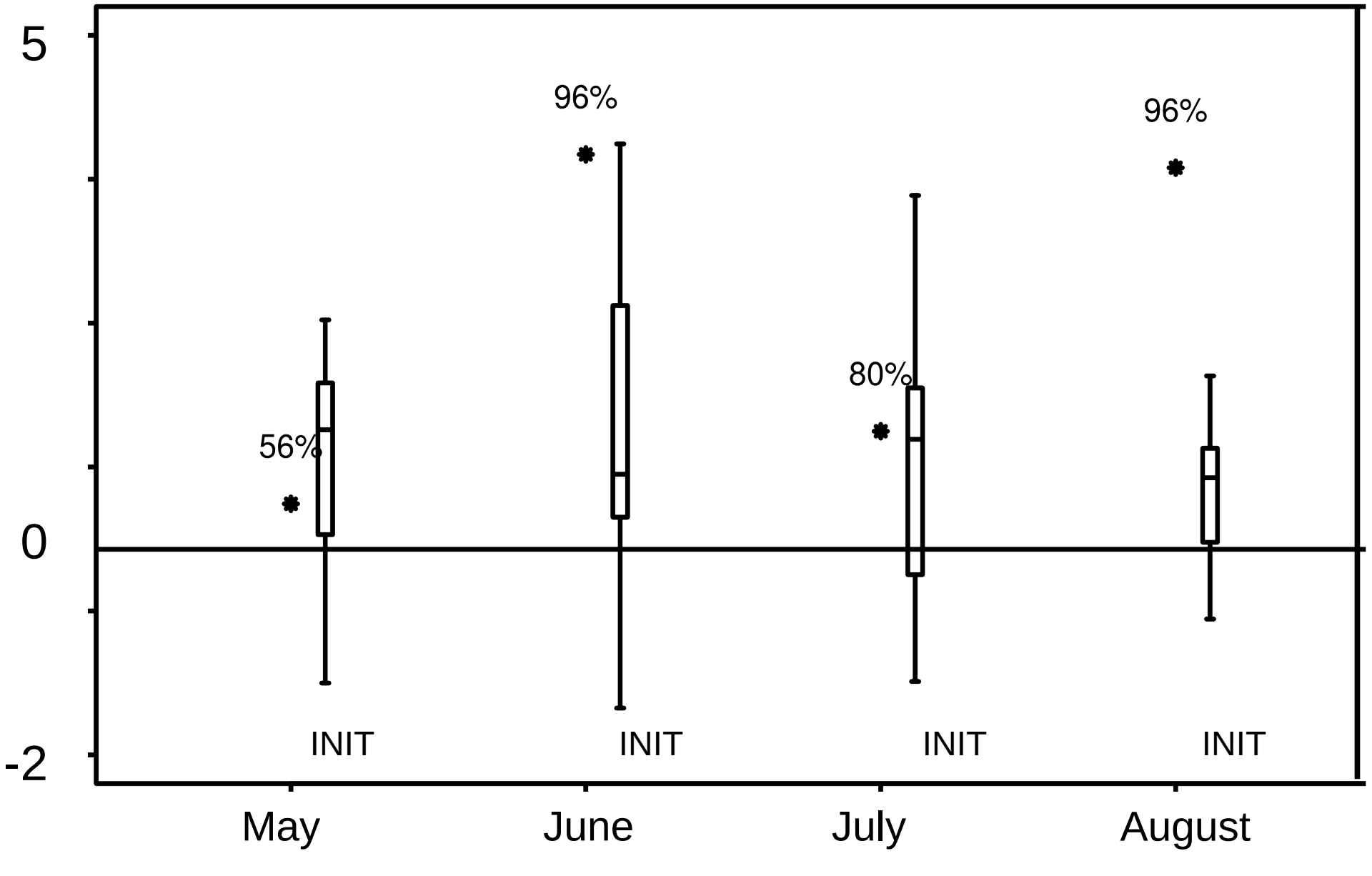


Percentage of Hot Days (%HD) vs the Standardized Precipitation Index (SPI) in the southeast European domain (1961–2000 period).

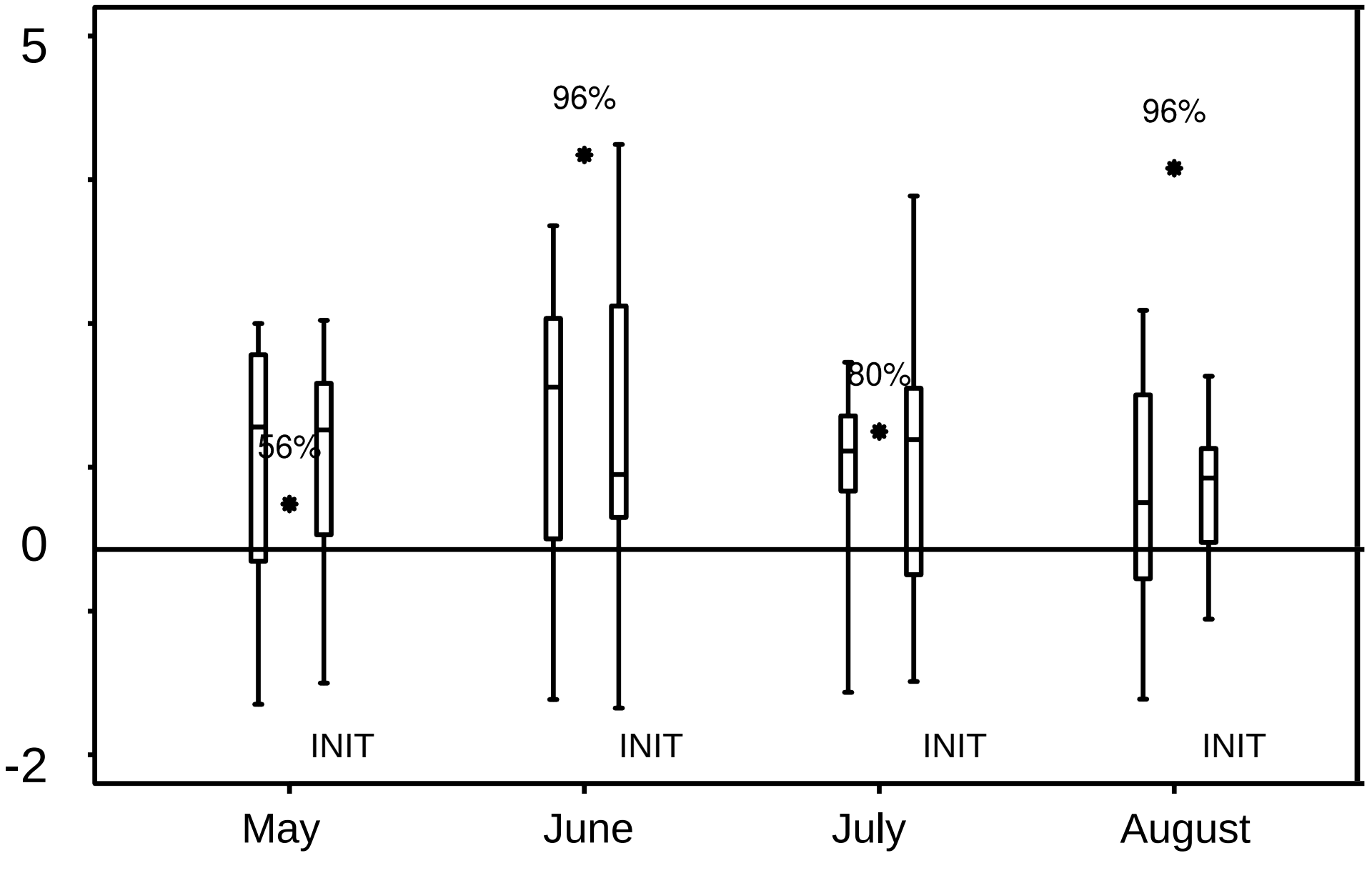
Land IC contribution



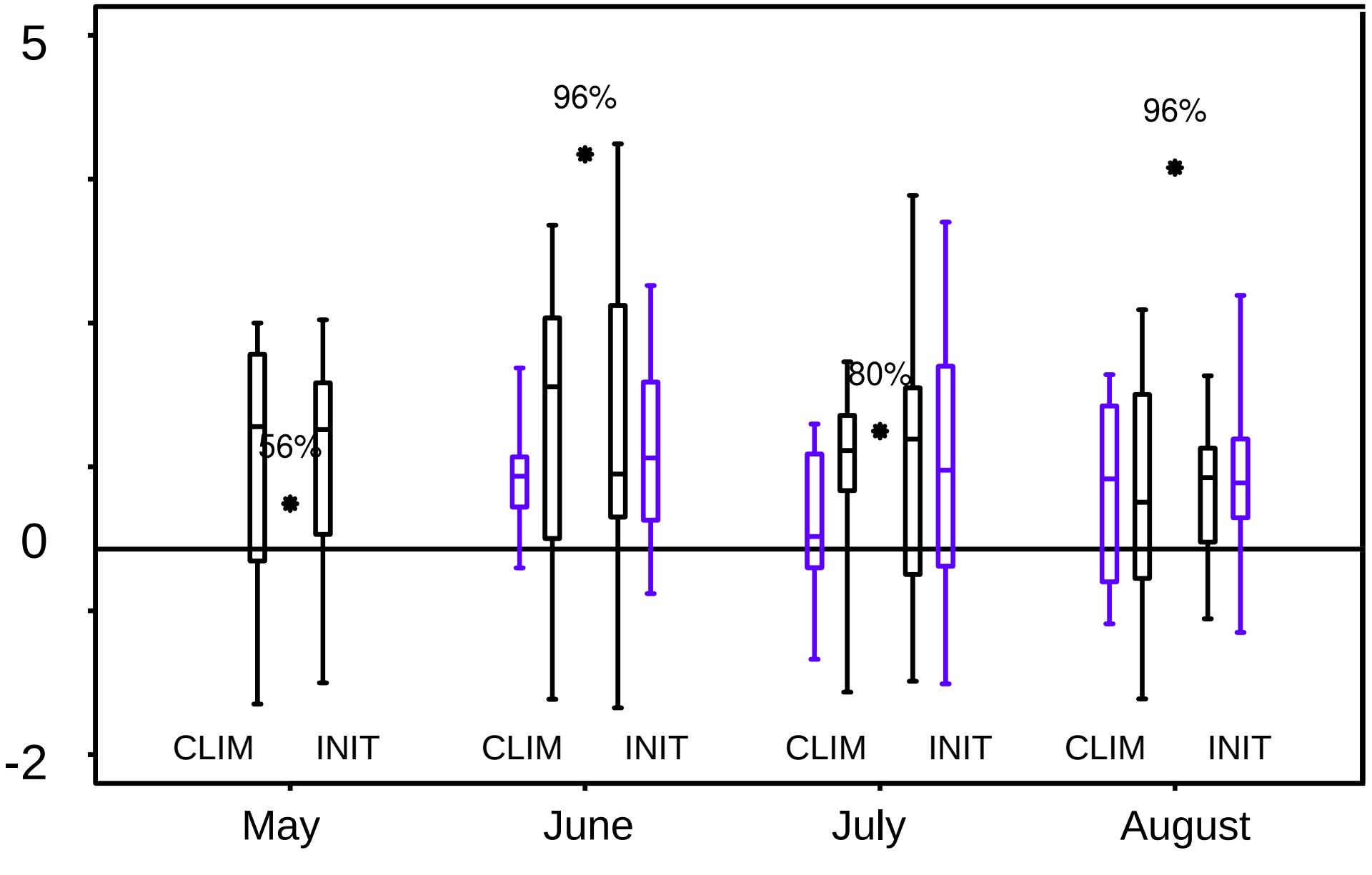
Intra-seasonality of the 2003 heat wave



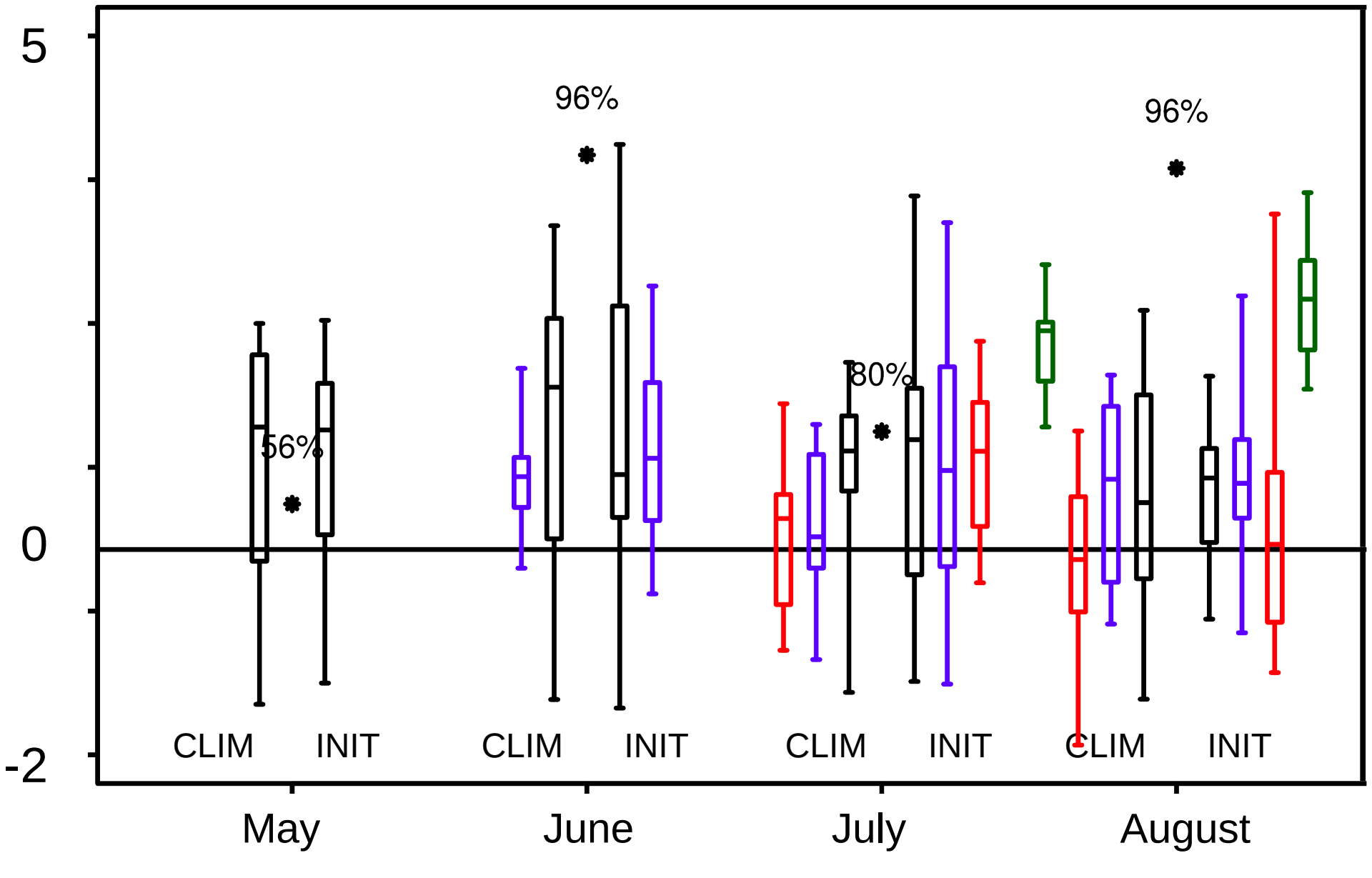
Intra-seasonality of the 2003 heat wave



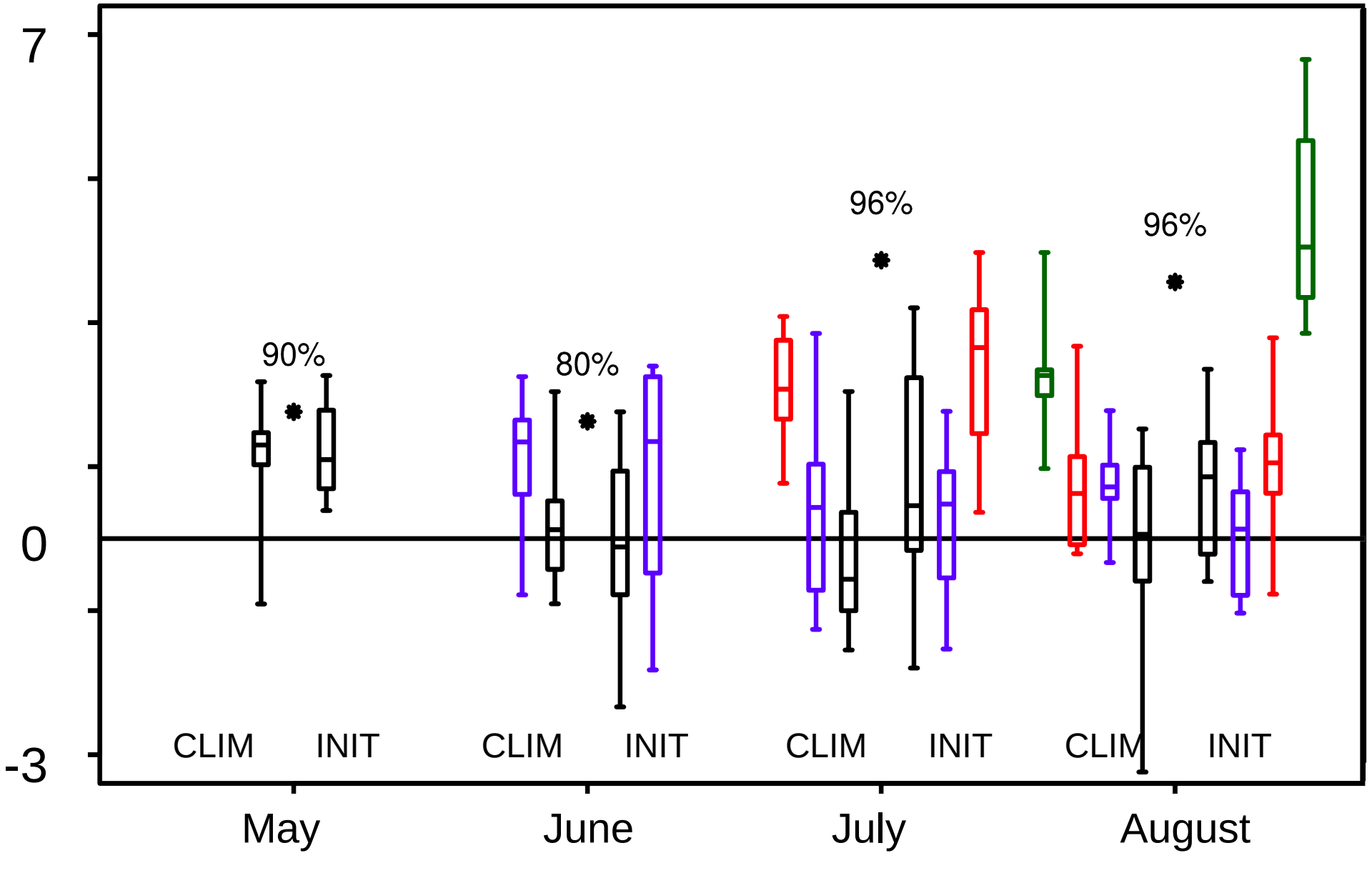
Intra-seasonality of the 2003 heat wave



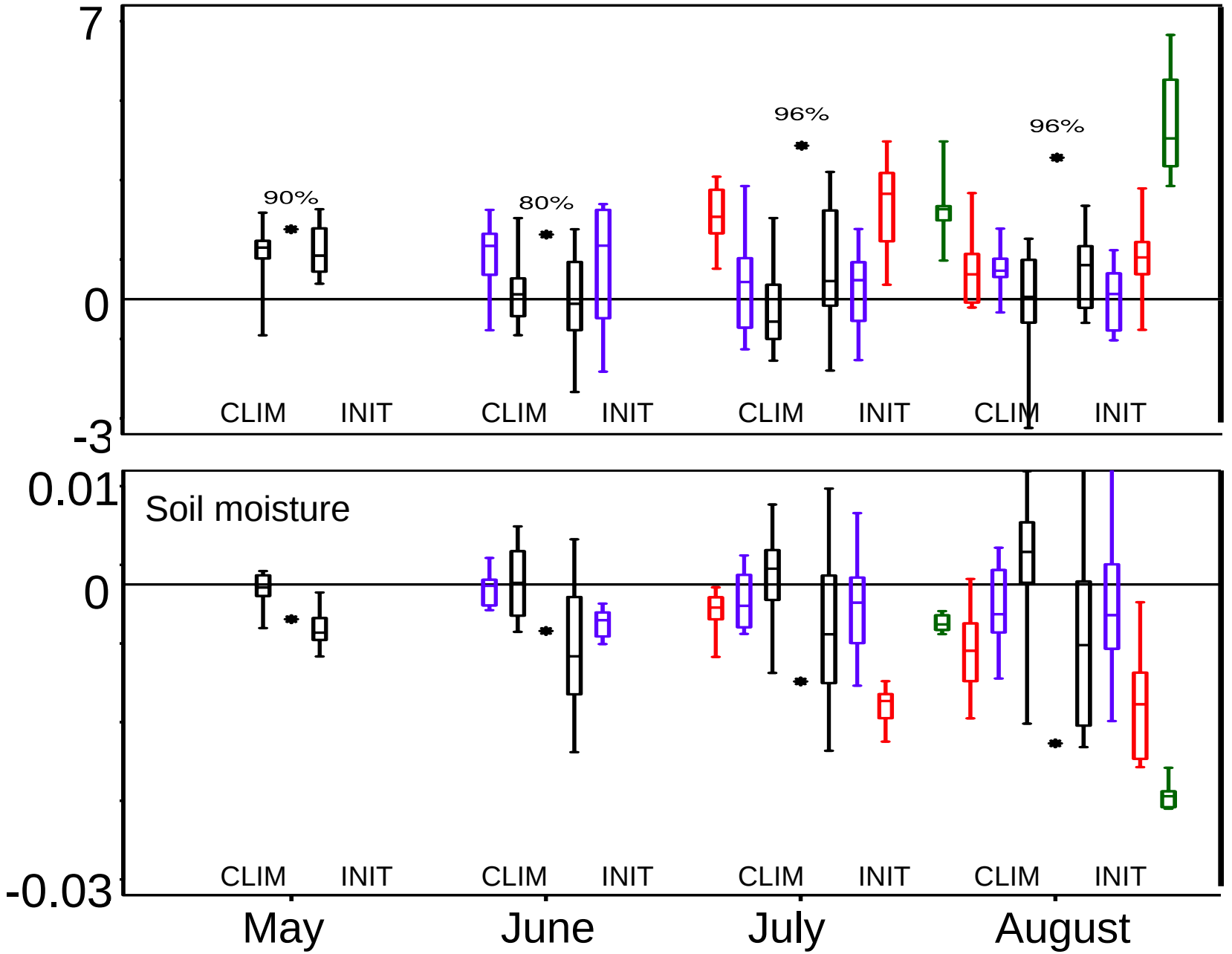
Intra-seasonality of the 2003 heat wave



Intra-seasonality of the 2010 heat wave



Land – atmosphere coupling



Conclusions

- Both 2003 and 2010 heat waves were predictable.

- 2003 seems to be mainly large scale driven.

- Realistic dry soil initial conditions are necessary to reproduce the 2010 heat wave 2-3 month ahead.

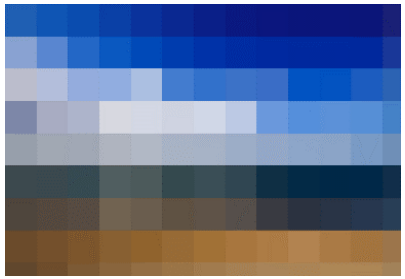
- August 2010 temperature was highly sensitive to soil conditions.

Prodhomme C., Doblas-Reyes F., Bellprat O., Dutra E., 2015: Impact of land-surface initialization on sub-seasonal to seasonal forecasts over Europe. Clim. Dyn., Under Minor Revision

Impact of resolution

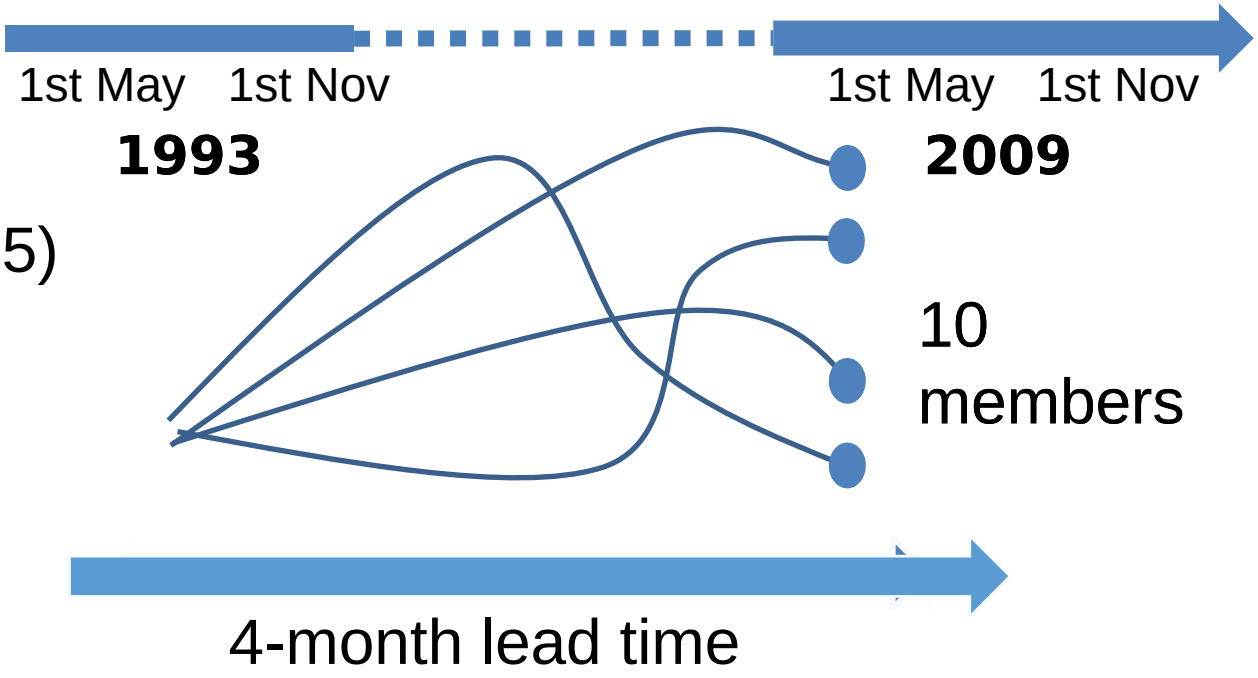
Model	Start date	Land IC	Atm IC	Oce/Ice IC
EC-Earth 3.1	May, Nov	ERA-Land	ERAInt	GLORYS

SRes (T255/ORCA1)



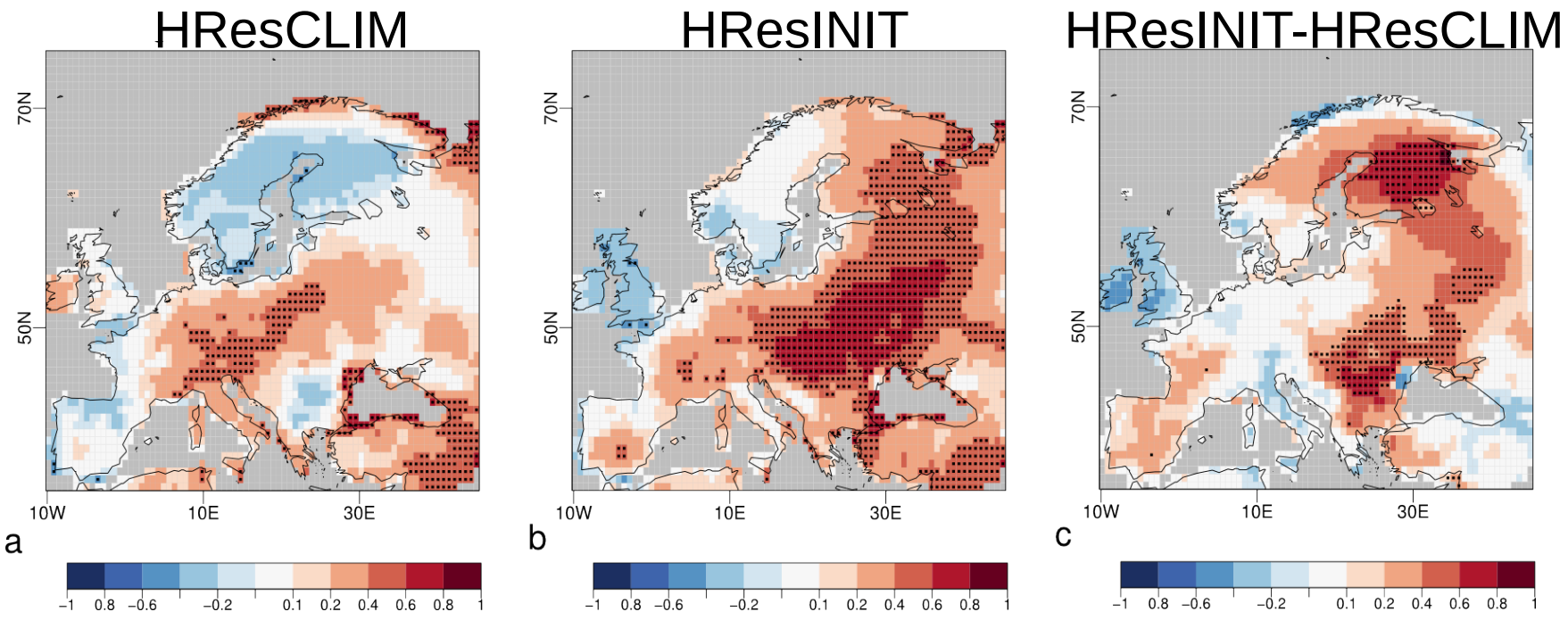
HRes (T511/ORCA025)

Climatology of ERA-Land



On going work...

Effect of land-surface initialization in summer (JJA) 2m-temperature prediction using high-resolution hindcasts (EC-Earth 3.1 T511ORCA025)



Correlation of summer prediction with ERA-Interim

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