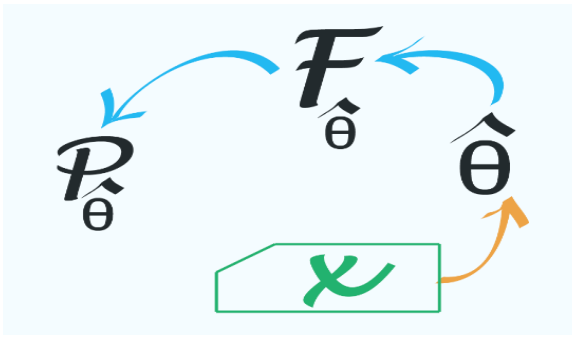
STATISTICAL PREDICTION OF 20th CENTURY EUROPEAN SUMMER TEMPERATURES BASED ON ERA-20C REANALYSIS DATA



Maria Pyrina, Sebastian Wagner, Eduardo Zorita

Helmholtz-Zentrum Geesthacht
Institute of Coastal Research

EGU 2020

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MOTIVATION: SEASONAL PREDICTION

Seasonal forecasting methods

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I. Statistical empirical approaches

- Since1950, use of lag correlations or analogs

II. Dynamical models

- Employed by government forecast centers since 1990

! Model errors mask potential skill due to boundary forcings

Inhererent dynamical model skill derived from accurate ENSO prediction

! ENSO is related to only a part of the variability

! ENSO is *weak in boreal summer months,* especially in Eurasia

STATISTICAL EMPIRICAL APPROACHES

Exploitation of boundary forcings

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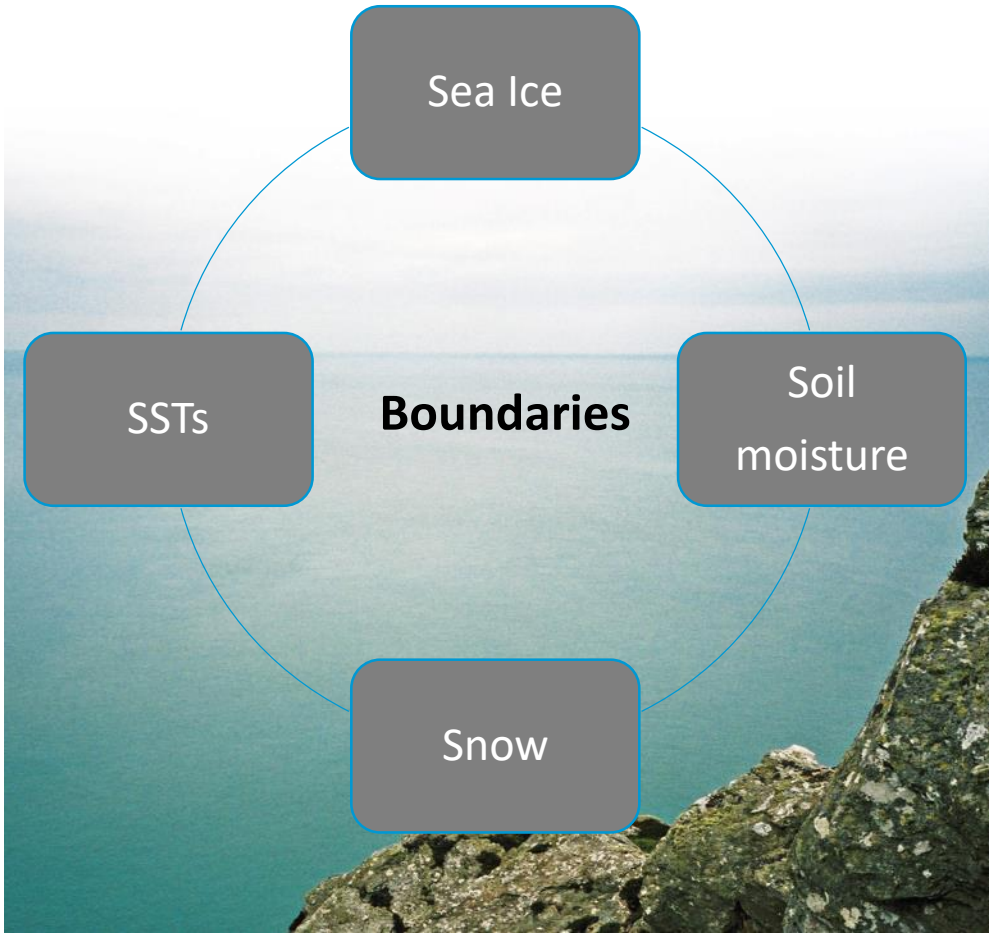
EXPLOITING the sensitivity of the atmosphere to boundary conditions

Statistical approaches for SEASONAL PREDICTION



DATA

ERA-20C reanalysis data 1900 – 2010

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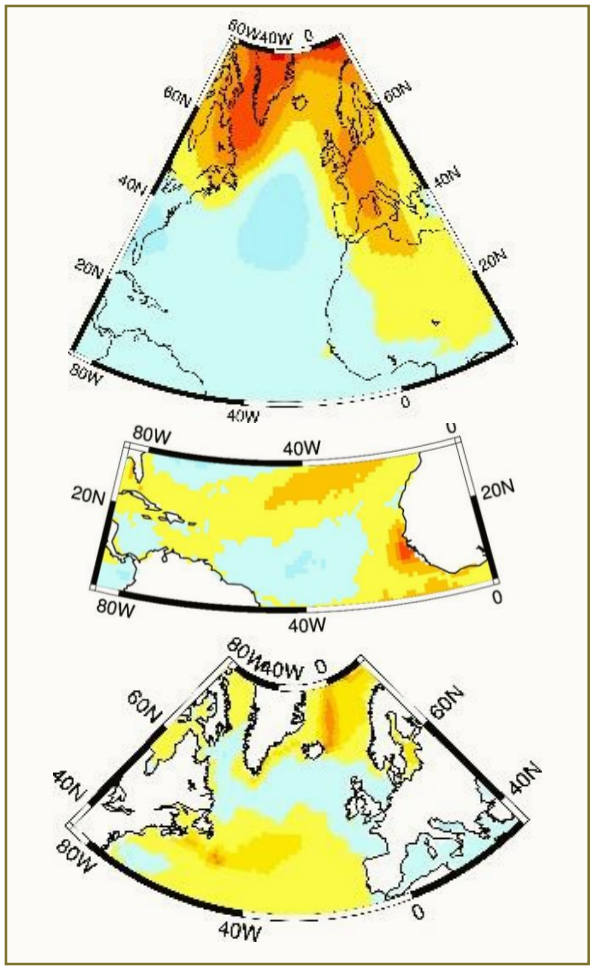
Testing different SST regions

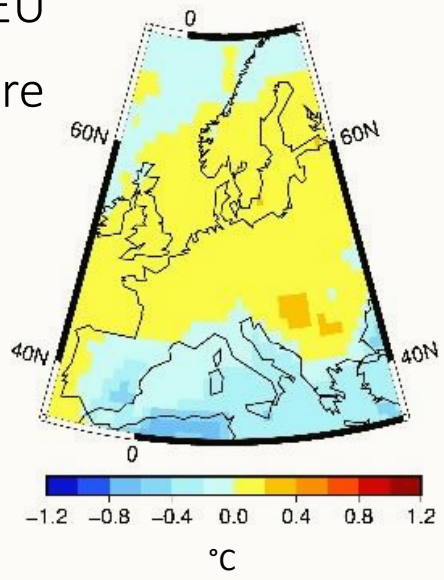


Regions of predictor data

Test utility of spring boundary forcings

- Soil moisture: EU
- Sea Level Pressure (SLP): North Atlantic – EU
- Sea Surface Temperature (SST): three regions

Summer temperature Prediction →



METHODOLOGY

CCA – LR

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Methods	
Diagnostic method – Canonical Correlation Analysis (CCA)	• Identify co-variability patterns between spring time predictor variables and summer T2m • Select those patterns with optimal temporal correlation coefficient
Statistical Downscaling method – Linear regression	• Establish a relationship between the temporal evolution of the CCA pattern pairs (1900-1950) • Predict T2m during 1951-2010

RESULTS

Prediction of summer T2m during 1951—2010

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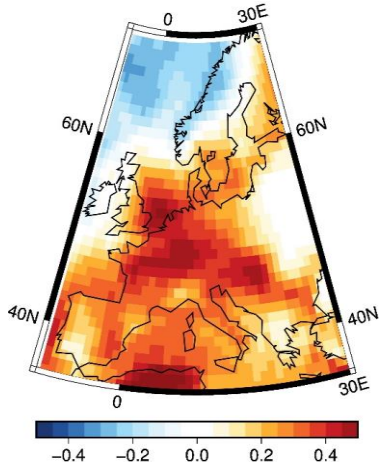
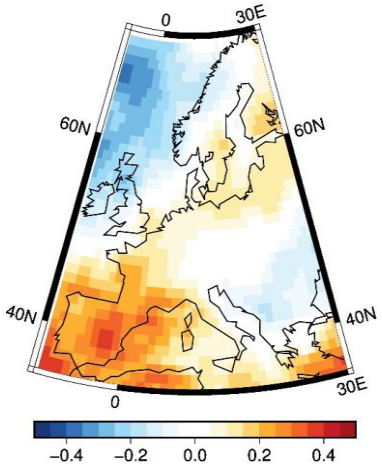
ACC – Anomaly Correlation Coefficient



ACC skill

T2m Prediction from

Soil Moisture (SM)



ACC skill

T2m Prediction from

Sea Level Pressure

- Skillful prediction of central and west EU summer mean temperature
- Strongest impact of SM on fluxes of **transitional wet/dry** regimes i.e. Central Europe (Seneviratne et al., 2010)
- Especially in these regimes there is large climate model uncertainty in future temperature projections (Seneviratne et al., 2012)

Seneviratne et al., 2010 https://doi.org/10.1016/j.earscirev.2010.02.004
Seneviratne et al., 2012 https://doi.org/10.1017/CBO9781139177245.006

RESULTS

Prediction of summer T2m during 1951—2010

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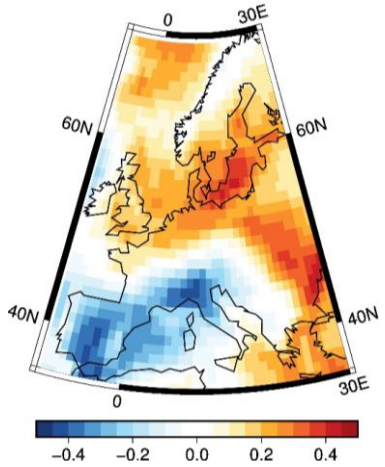
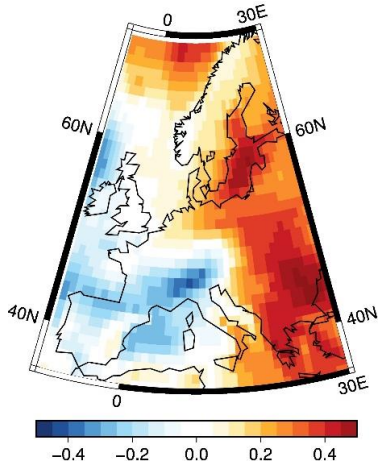


ACC skill

T2m Prediction from

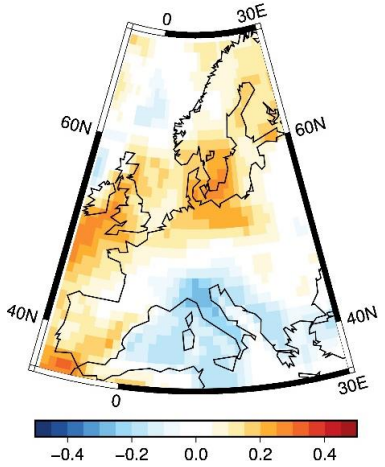
North Atlantic (NA) SSTs



ACC skill

T2m Prediction from

Extratropical NA SSTs



ACC skill

T2m Prediction from

Tropical NA SSTs

Skillful summer T2m prediction over east EU from extratropical spring SSTs

RESPECTIVE RESULTS

Using the output of historical CMIP5 simulations

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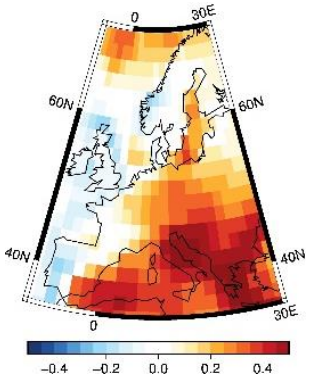
ACC skill
T2m Prediction from

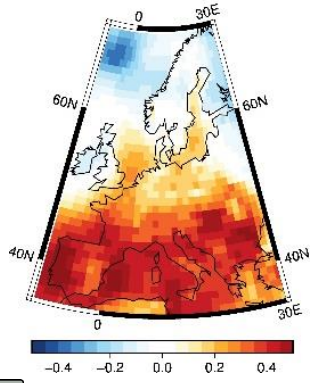
MPI-ESM model

Soil Moisture



CCSM4 model

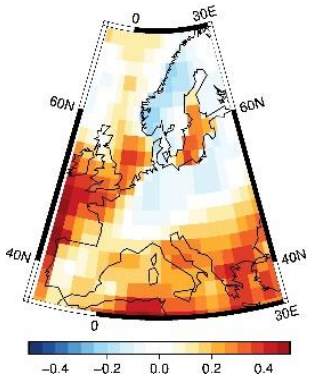
Soil Moisture



ACC skill
T2m Prediction from

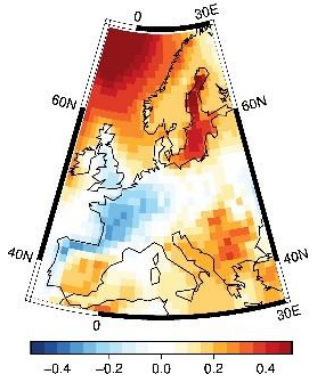
MPI-ESM model

Extratropical NA SSTs



CCSM4 model

Extratropical NA SSTs



Possible reasons for the differences to the results from the ERA-20c reanalysis data

- Land surface sub-models, physical mechanisms that propagate the skill due to SSTs, results based on single ensemble member (effect of internal variability).

FOR PEOPLE AND THEIR
FUTURE ENVIRONMENT

THANK YOU!

Maria Pyrina

Sebastian Wagner

Eduardo Zorita

Helmholtz-Zentrum
Geesthacht
Centre for Materials and Coastal Research