MAGIC (C3S_34a_Lot 2)

CP4CDS Liaison (8 March 2018)
CRECP SAB (9 March 2018)

Climate Change

Objectives

Status

Examples

Copernicus Europe's eyes on Earth

European Commission

Climate Change

The project

C3S 34a

Global climate projections: data access, product generation and impact of front-line developments

Lot 2: Multi-model product generation

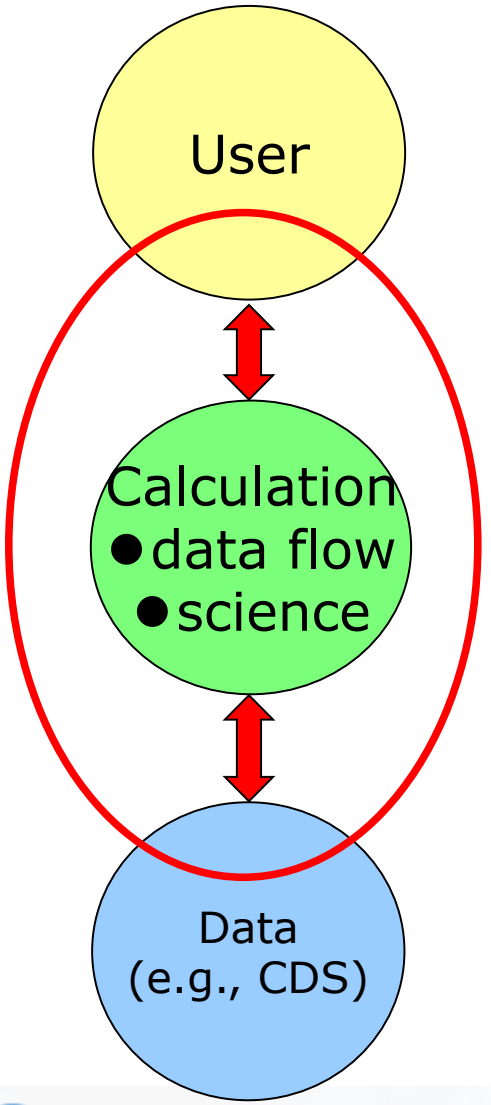
[MAGIC: Metrics and Access to Global Indices for Climate Projections]

- Metrics
- Diagnostics
- Multi-model products
- Tailored software

We are delivering

1. an infrastructure
   user -> data -> calculation -> display result
   (*calculation* also includes pre-processing and keeping provenance)
2. some modules that use the infrastructure (i.e., do calculations)

New modules can be added – various languages possible



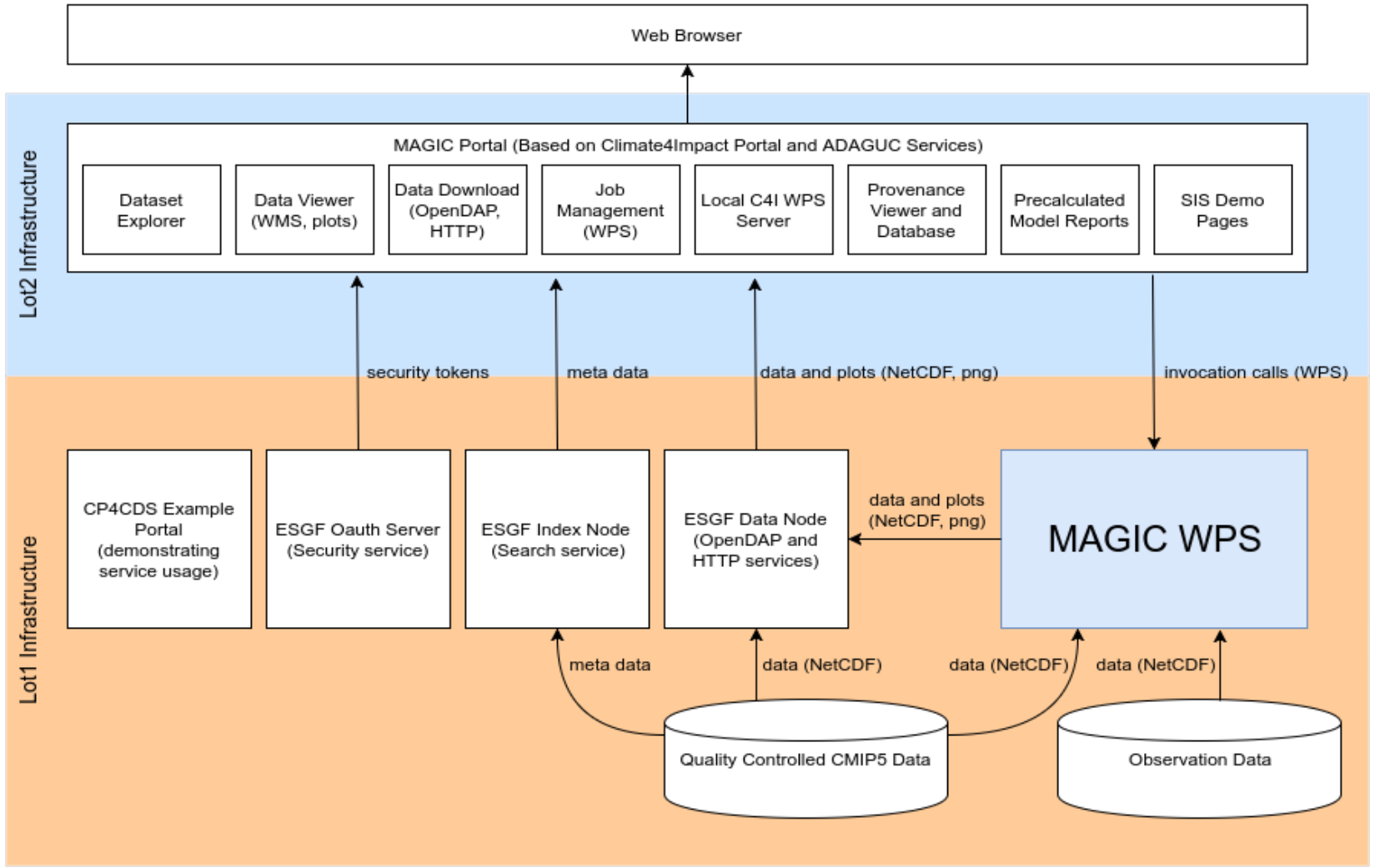
Copernicus Europe's eyes on Earth
European Commission

The infrastructure

Climate Change

Preprocessing
Workflow
Engine
Provenance

ESMValTool
Iris



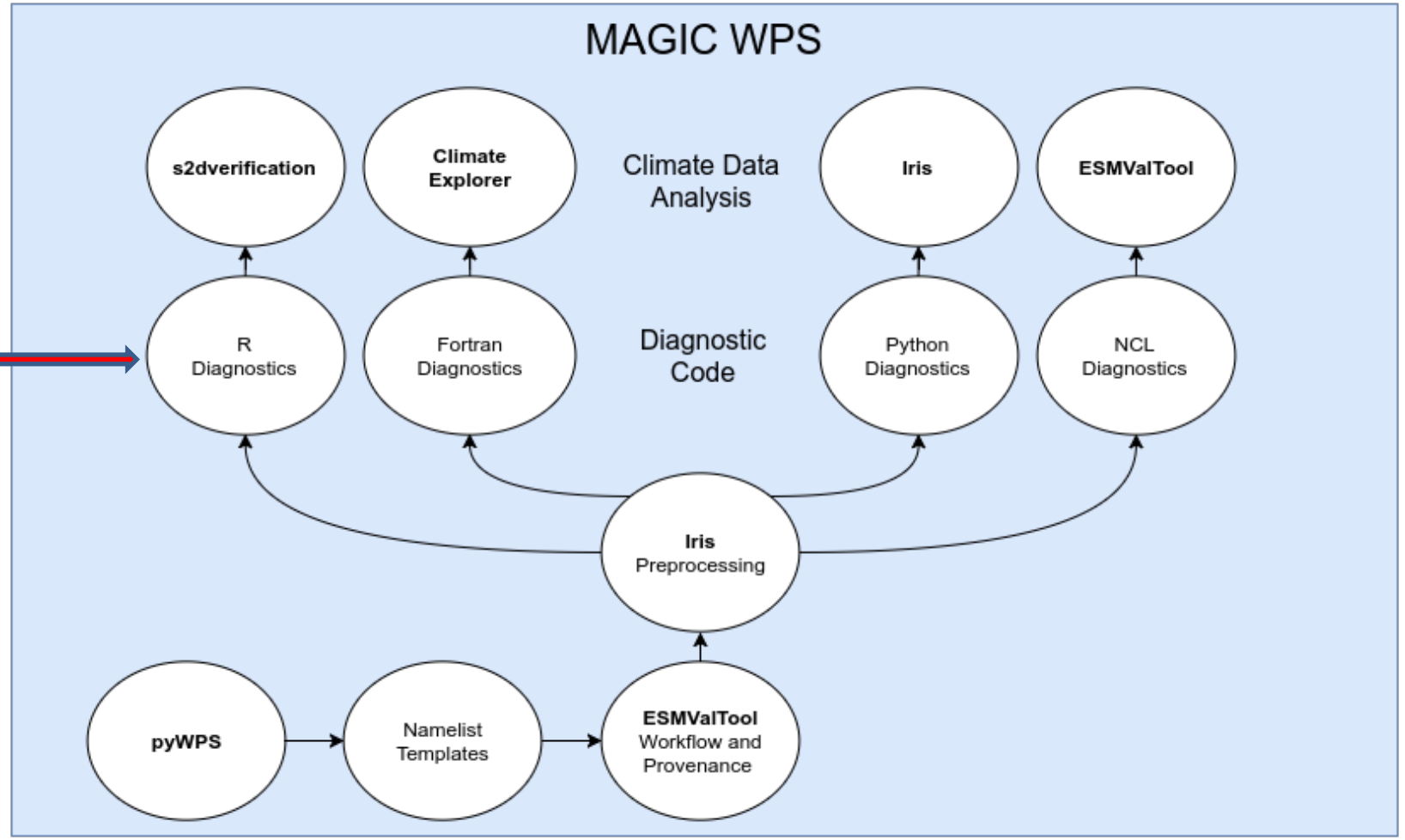
Copernicus Europe's eyes on Earth

European Commission

WP3 Web Processing Service

Climate Change

Different languages possible (Fortran, R, Python, …)

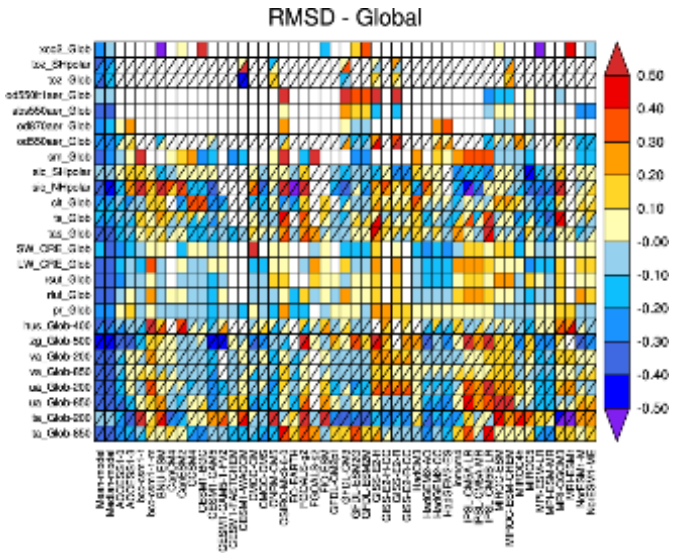


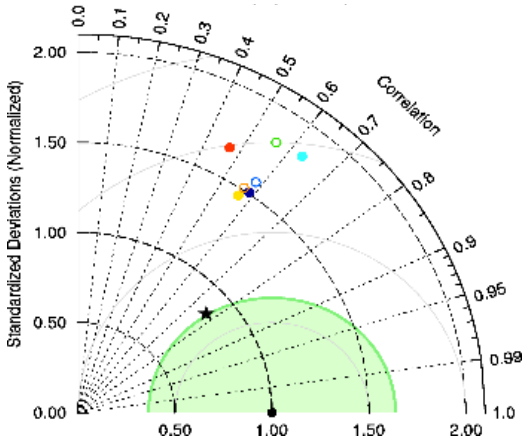
Climate Change

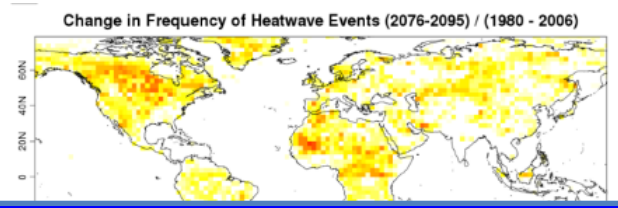
The modules

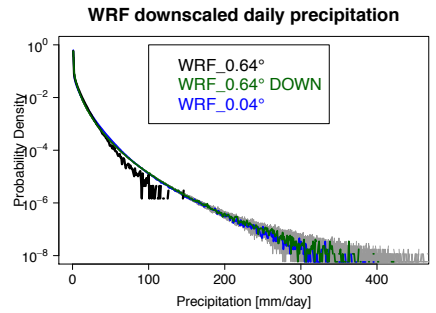
Science Diagnostics

ESMValTool
S2dverification
HyInt
RainFARM
ClimateExplorer
….









Important

- **New modules can be added**
- **Different languages possible (Fortran, R, Python, …)**
- **Not restricted to CMIP5 data**

Copernicus Europe's eyes on Earth
European Commission

Climate Change

The portal

Currently under development

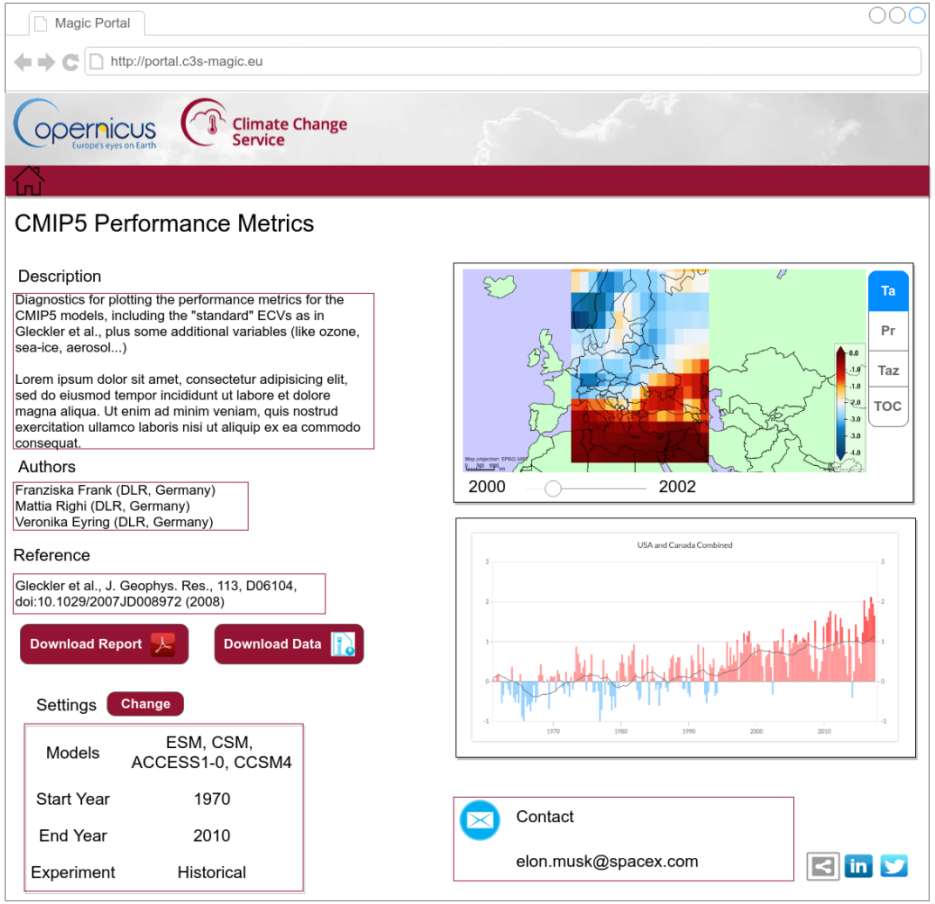
http://portal.c3s-magic.eu

- Choose diagnostic module
- User input
- Save intermediate results
- Receive output

Current state:

- framework, filled with
  - screencasts
  - two partly working modules

We are really working on it …



… it already looks different!

opernicus Europe's eyes on Earth

European Commission

Climate Change

Performance Metrics (WP4)

Main objectives

To develop and deliver an enhanced version of the ESMValTool software that computes and displays a wide set of performance metrics & diagnostics relevant for sectoral information services

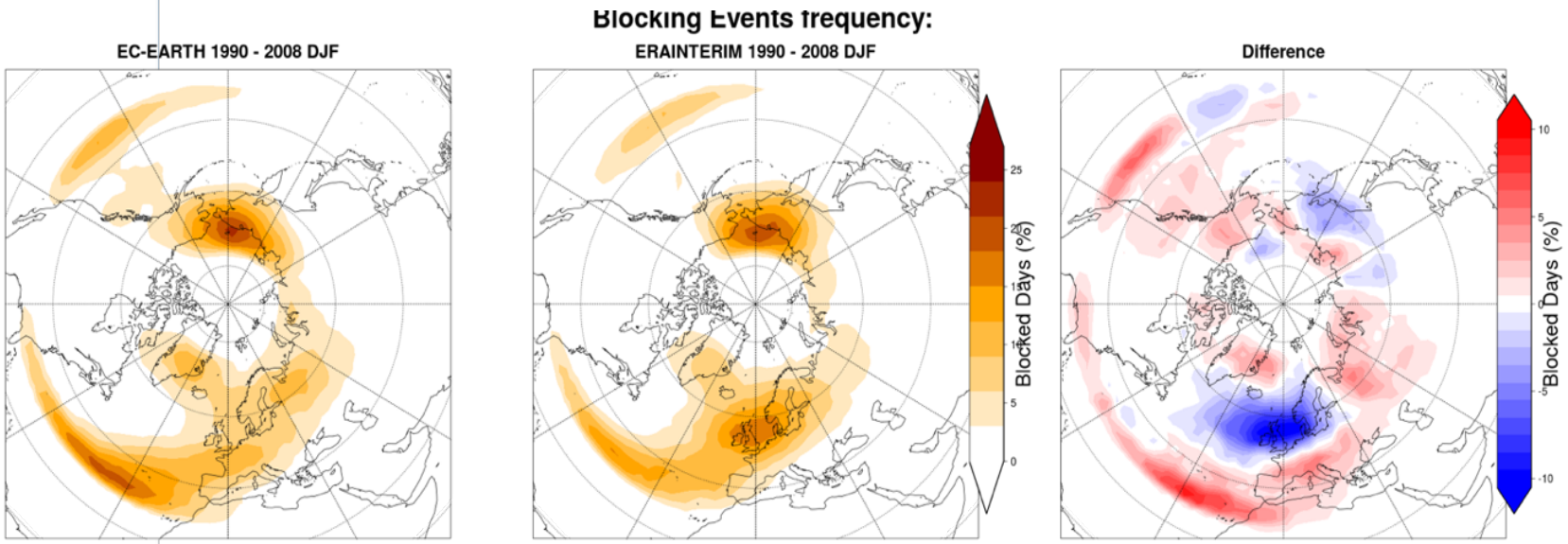
- Combine, extend and consolidate existing software packages using ESMValTool for computation of metrics
- Enhance ESMValTool by integrating other tools and develop new diagnostics:
  - Auto-Assess
  - s2dverification
  - sector-specific calculations
  - KNMI Climate Explorer
  - new namelists for blocking, annular modes, ETCCDI etc.

1. ESMValTool performance metrics
2. Blocking metrics and indices
3. Stratosphere-troposphere coupling
4. Assessment of climate variability and teleconnections

ECMWF Copernicus Europe's eyes on Earth European Commission

Climate Change

Example



2D blocking events frequency for EC-Earth and ERA-interim over 1990-2008 (DJF).

ECMWF Copernicus Europe's eyes on Earth European Commission

Climate Change

Generic Multi-Model Products (WP5)

Main Objectives

- Develop tools for computing and visualizing time series and maps for multi-model products.
- Develop tools to combine and/or synthesize the climate information generated by various climate models into a representative estimate of any future climate signal.

1. Aggregate and combine multi-model climate information into a single best estimate of future climate information
2. Tools to estimate agreement between a selection of climate models on a future signal
3. Teleconnection indices and weather regimes
4. Sub-ensemble selection
5. Hydroclimatic intensity (HyInt)
6. Extremes indices (ETCCDI)

Copernicus Europe's eyes on Earth

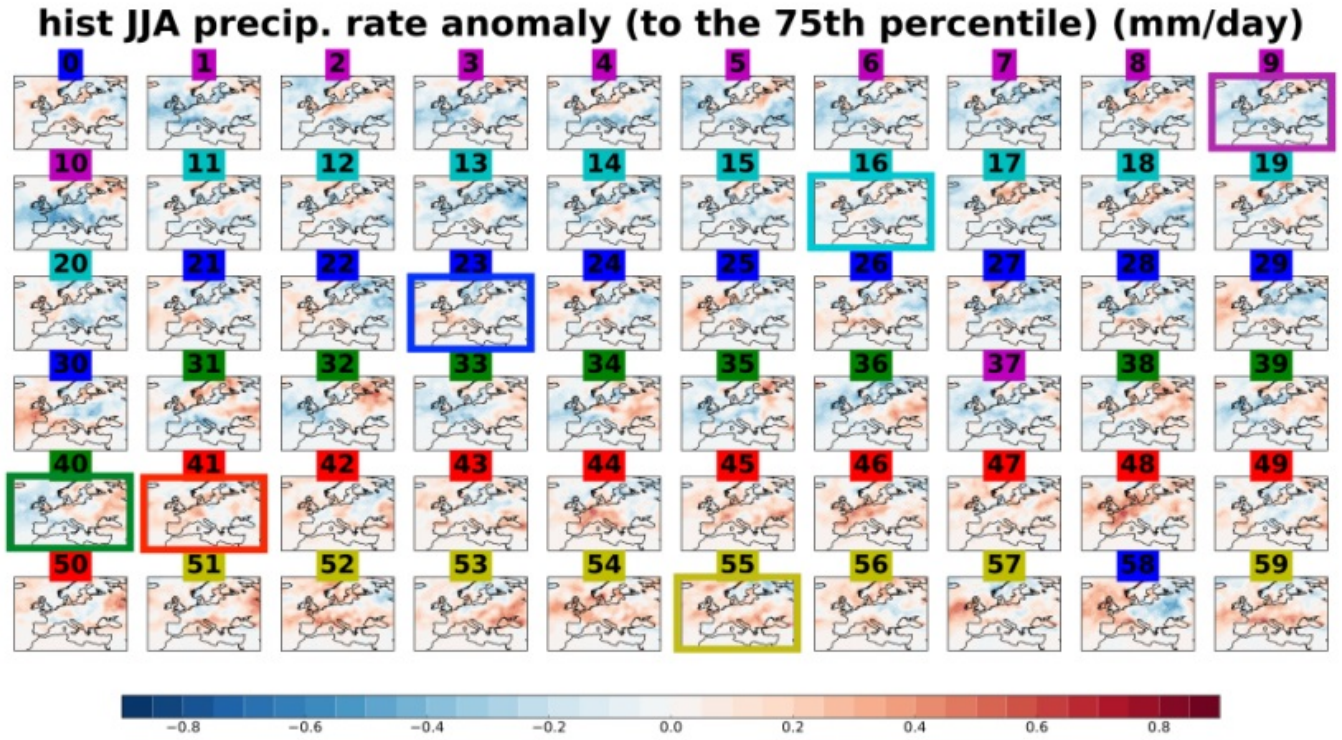
European Commission

Climate Change

Example

Sub-ensemble selection. The diagnostics groups ensemble members according to similar characteristics and selects the most representative member for each cluster based on a k-means algorithm.

Example 1: clustering based on historical JJA precipitation rate (mm/day), 75th percentile, 60 ensemble members, 6 clusters, 80% variance explained by PCs



Closest ensemble members to centroids (representative members):
cluster0 (freq20%) [23], cluster1 (freq15%) [40], cluster2 (freq16.67%) [41], cluster3 (freq16.67%) [16], cluster4 (freq18.3%) [9], cluster5 (freq13.3%) [55]

opernicus Europe's eyes on Earth

European Commission

Climate Change

Climate Index Time Series (WP6)

Main Objective:
To compute single-model and multi-model time series of climate indices, for both pre-defined indices and indices defined interactively by the user

1. Tools to compute single and multi-model indices based on area averages
2. Indices of annular modes
3. Precipitation quantile bias
4. Trend and significance testing

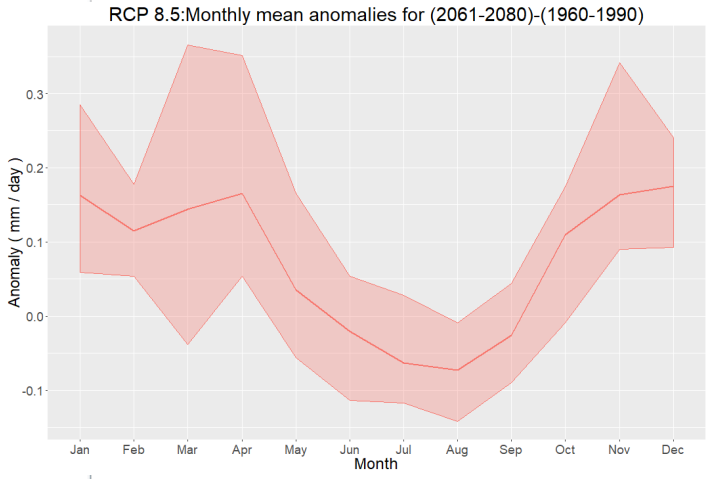
Copernicus Europe's eyes on Earth
European Commission

Climate Change

Example

The following tools have been developed in R, are available on the s2dverification gitlab page (https://earth.bsc.es/gitlab/es/s2dverification), under **develop-MagicWP6** and are being integrated into ESMValTool:

- Module selecting and computing area averages
- Module computing seasonal or multi-year averages
- Module combining climate indices computed from several model into a single climate index based on input weights



Example: EC-Earth area-averaged precipitation anomaly over Europe for RCP 8.5

Climate Change

Tailored products (WP7)

Main objective:
To assure that specific needs of envisaged end users in selected economic sectors are facilitated.

- Coastal Areas
- Water/hydrology
- Energy
- Insurance

1. Surge height estimator
2. Drought indicator
3. Time series of data relevant for the water sector
4. RainFARM stochastic precipitation downscaling
5. Energy supply and demand indicators
6. Actuaries Climate Index

ECMWF Copernicus Europe's eyes on Earth European Commission

Climate Change

Example

- **Purpose**: Extracting timeseries for hydrological impact modelling

- **Background:** User input in the form of a shapefile (polygons) for the hydrological catchment
  Extract climate model grid points within each polygon and output one timeseries per polygon, output as NetCDF or in user requested Excel format

Copernicus Europe's eyes on Earth
European Commission

Climate Change

Summary and more information

Summary

MAGIC:

- An infrastructure
- Some modules to use the infrastructure
- Modular
- Can be extended to non-CMIP5 data

The portal: http://portal.c3s-magic.eu
Details of diagnostics: https://drive.google.com/open?id=1kosCUOo77jneTOXTltk6h4A7BmND8yEg
More information: sterl@knmi.nl

ECMWF Copernicus Europe's eyes on Earth European Commission