UERRA
Uncertainties in Ensembles of Regional ReAnalyses

SEVENTH FRAMEWORK PROGRAMME

Comparisons of European Regional Reanalysis and Uncertainty Estimates in the UERRA project

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Project Partners

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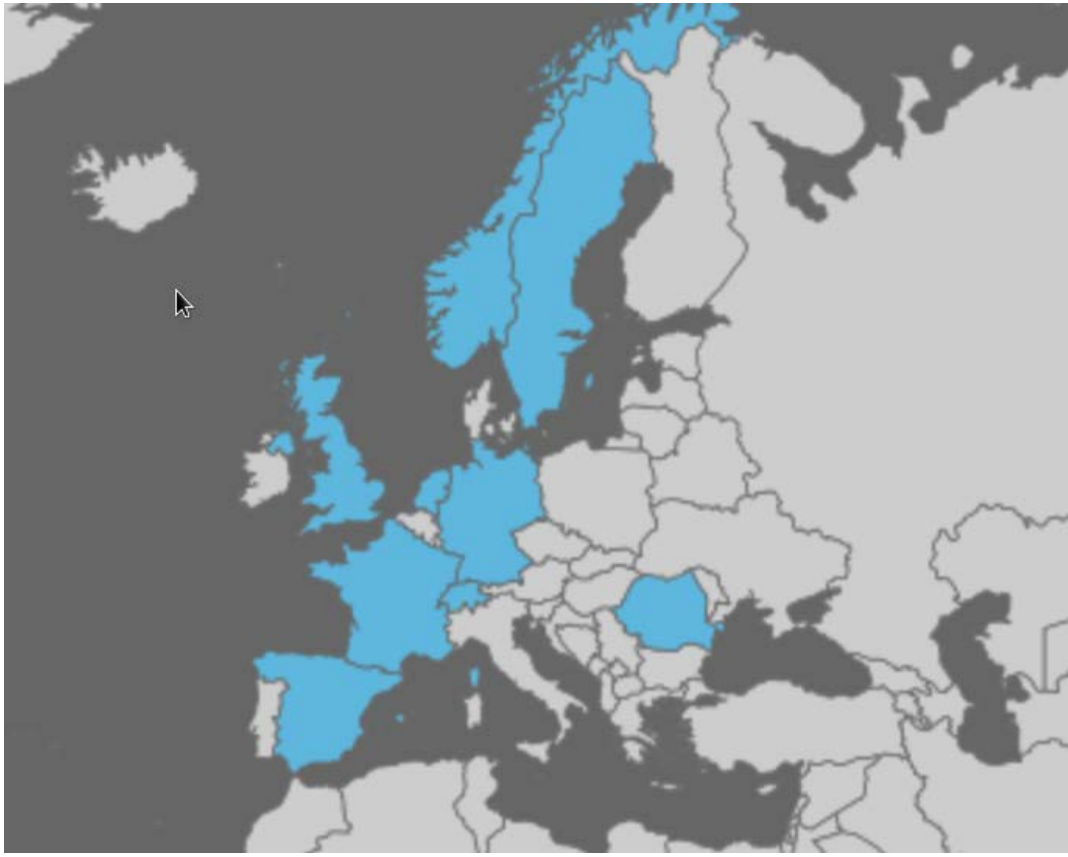
SMHI

METEO FRANCE
Toujours un temps d'avance



Koninklijk Nederlands Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu

UEA
University of East Anglia

Met Office

ECMWF

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

DWD

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Meteorologisk institutt

UNIVERSITAT ROVIRA I VIRGILI

METEO ROMANIA

universitätbonn
Rheinische Friedrich-Wilhelms-Universität Bonn

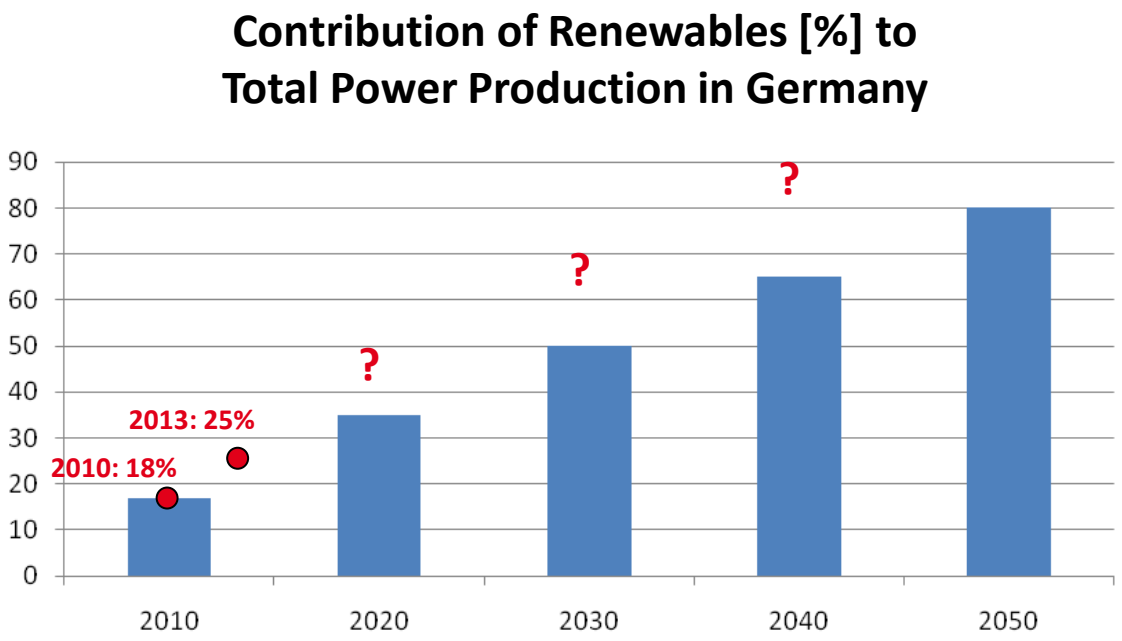
Outline

1. User needs and UERRA objectives
2. UERRA reanalysis products
3. Comparisons and uncertainty estimation

User Motivation

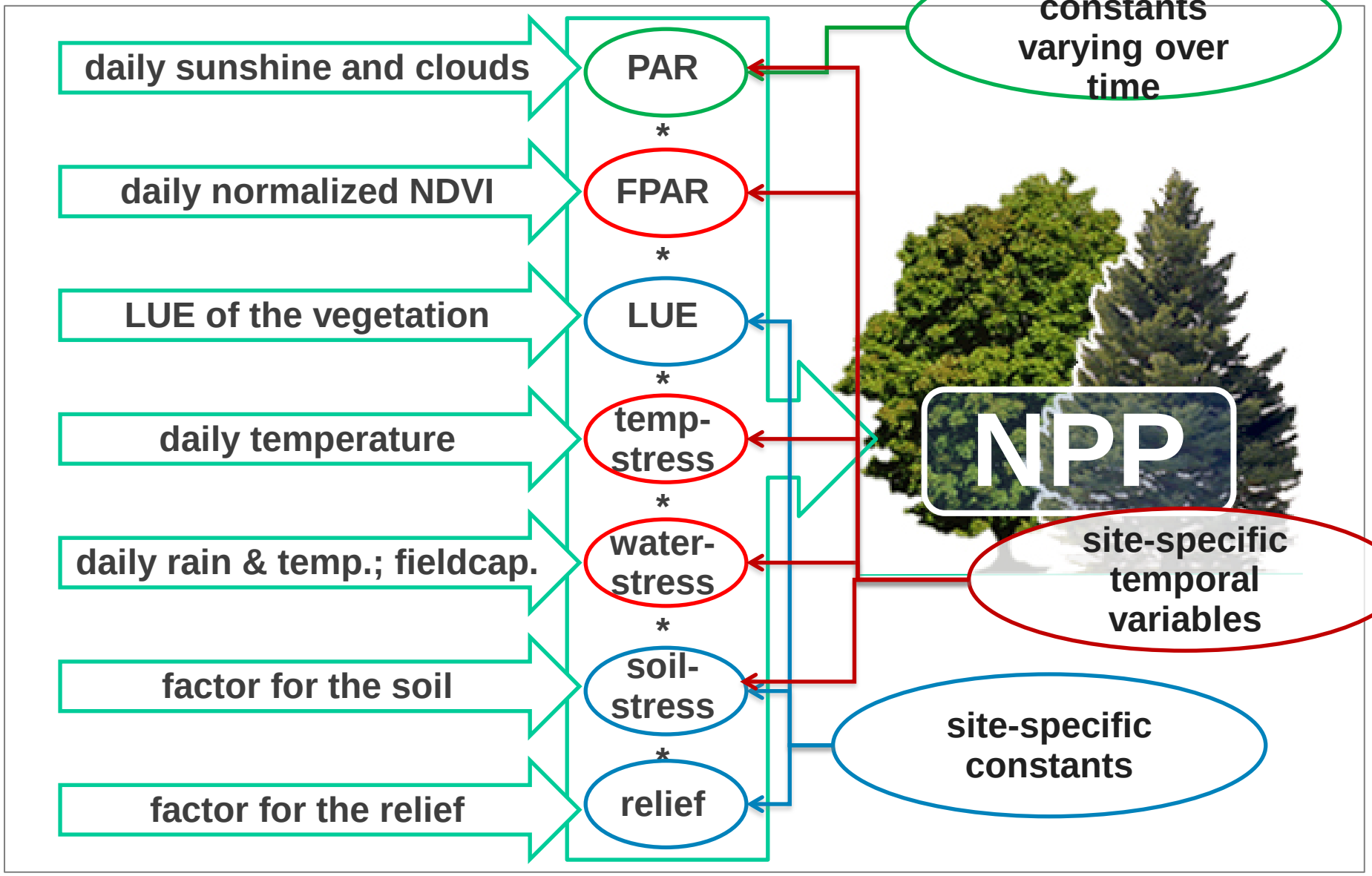
Deutscher Wetterdienst
Wetter und Klima aus einer Hand

- è Moving towards sustainable supply of energy based on renewables



- è Focus on wind- and solar power production
- è Weather dependent, fluctuating power production

Increase of biomass – model approach for the forestry



Objectives of UERRA

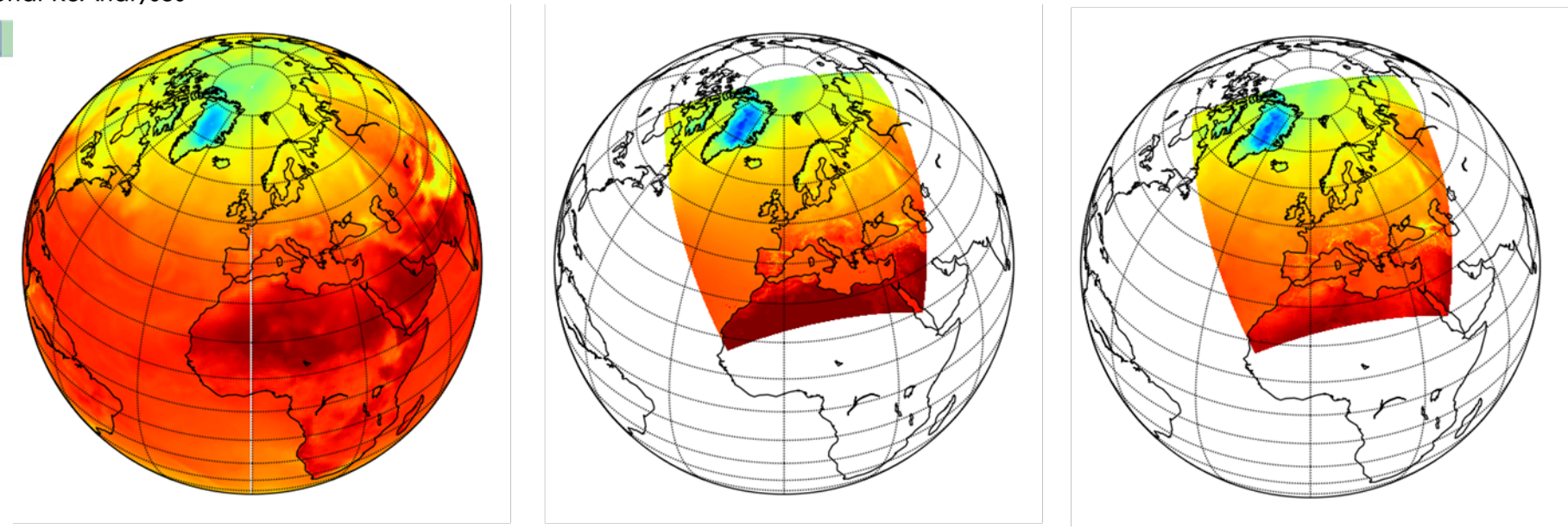
- To produce ensembles of European regional meteorological reanalyses of Essential Climate Variables for several decades.
- To estimate the associated uncertainties in the data sets.

→ Pre-operational Copernicus Climate Change Services 2014-2017

Outline

1. User needs and UERRA objectives
2. **UERRA reanalysis products**
3. Comparisons and uncertainty estimation

UERRA builds on FP7 EURO4M



... and is extending to a multitude of products:

- ✔ Several high resolution “deterministic”
- ✔ Ensembles of reanalyses
- ✔ Surface reanalyses
- ✔ Improved gridded observation data sets

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UERRA is providing data sets and uncertainty estimates, building upon EURO4M and extends in several dimensions:

- Much longer time period – 50+ years or 30 for ensemble
- Higher resolution than ever before
- More digitised observations rescued and provided

- Quality and uncertainty measures
- Comprehensive web based data and visualisation service
- User guidance on user oriented products

3D reanalyses covering the full atmosphere

Met Office	SMHI/MF	HErZ - DWD
Hybrid 4D-Var, Ensemble of 4D-VARs	HARMONIE 3D-VAR	LETKF and Ensemble Nudging
1 Control 12 km 70 levels ~ 20 members 24 km ensemble	1 member 11 km 65 levels 2 members physics	1 Control 12 km 40 levels 10-20 members 12 km ensemble
ensemble ~1978 -2013	deterministic ~1961-2013 5 years ensemble	deterministic 1997-2013 ensemble ~5 years
Conventional obs, satellite data, precip.	Conventional obs, Large scale constraint from ERA	Conventional obs

boundary forcing from global ERA reanalyses
(ERA-40, -Interim, coming –SAT or -5, incl. Ensembles)

2D surface field analyses driven by 3D reanalyses

MF/SMHI MESCAN	SMHI MESAN
2D advanced statistical interpolation	2D advanced statistical interpolation
Downscaled ALADIN model background	Downscaled 3D HIRLAM climatological adaptation background
Surface and climate stations T, Td, precipitation	AVHRR, METEOSAT SEVIRI and MVIRI
5 km resolved T2m, Td, 10m wind, precipitation	5 km Cloud fraction
1961 - ~2013	~1982 - 2013

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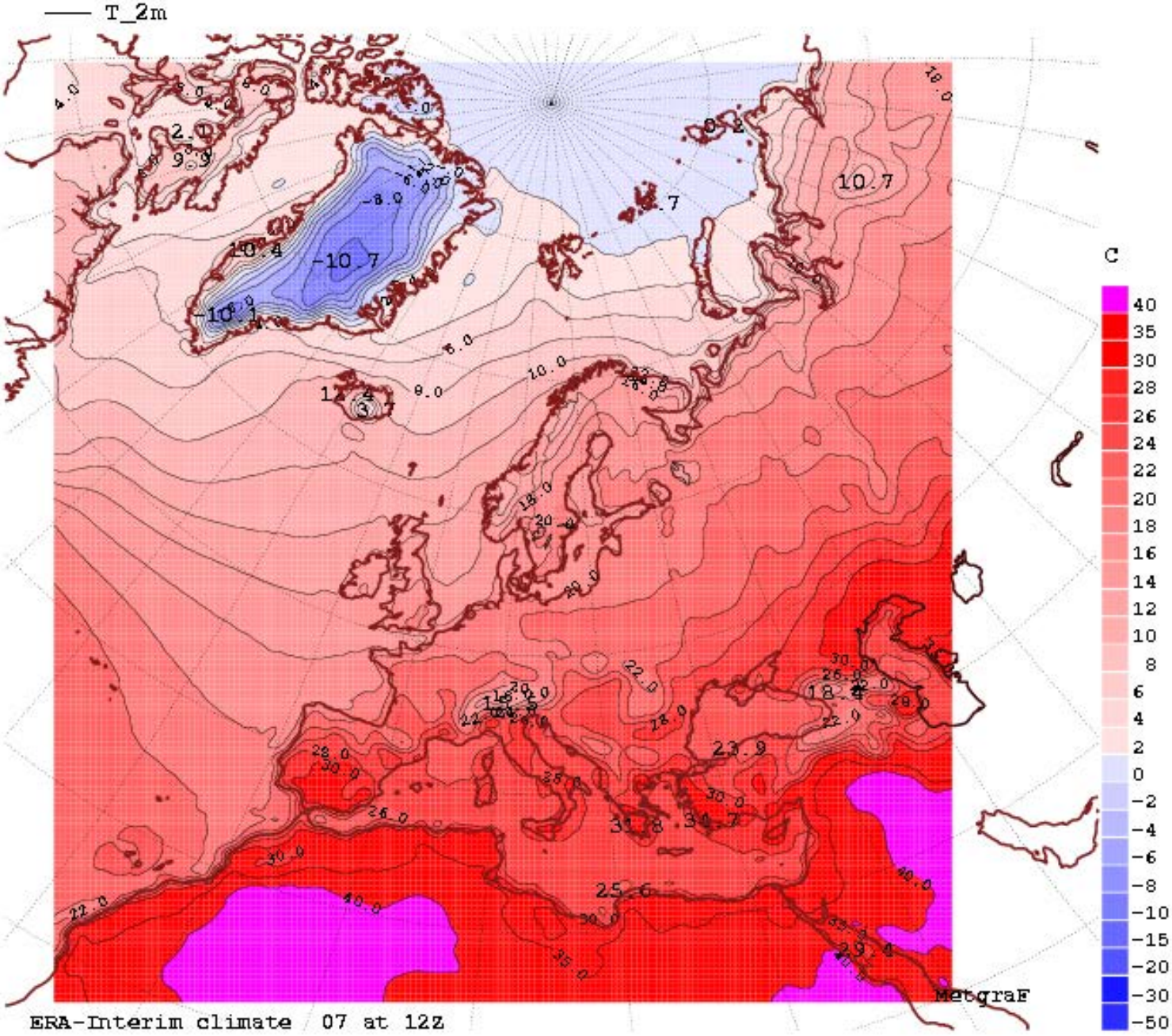
3. **Comparisons and uncertainty estimation**

Comparisons

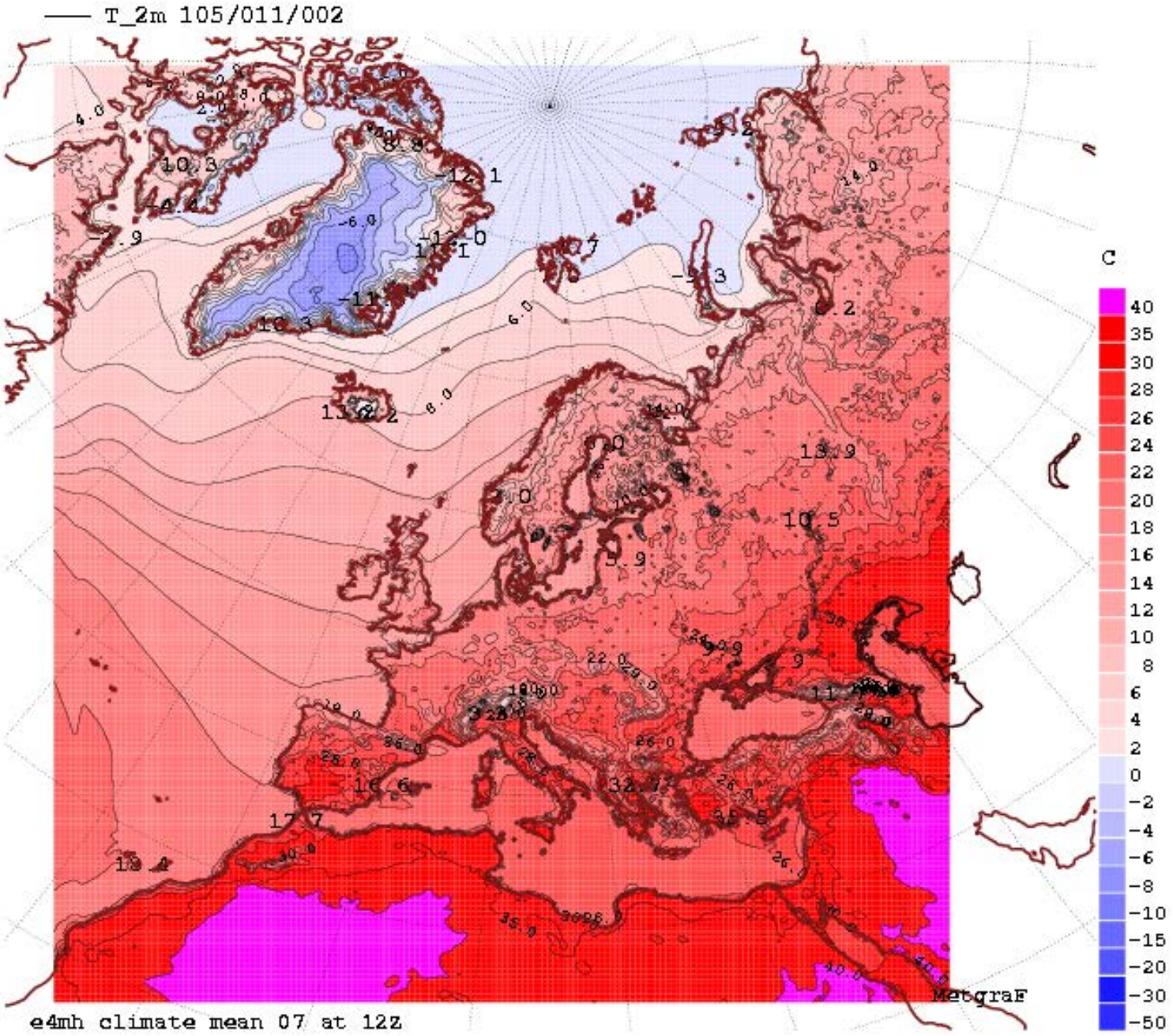
- Between UERRA and Reference data and observations
  - In WP3
- Between UERRA reanalyses and ECMWF ERA
  - By the data producers in WP2
- Between UERRA reanalyses
  - For time periods applicable – by data producers and results from WP3

Adding information wrt ERA-Interim

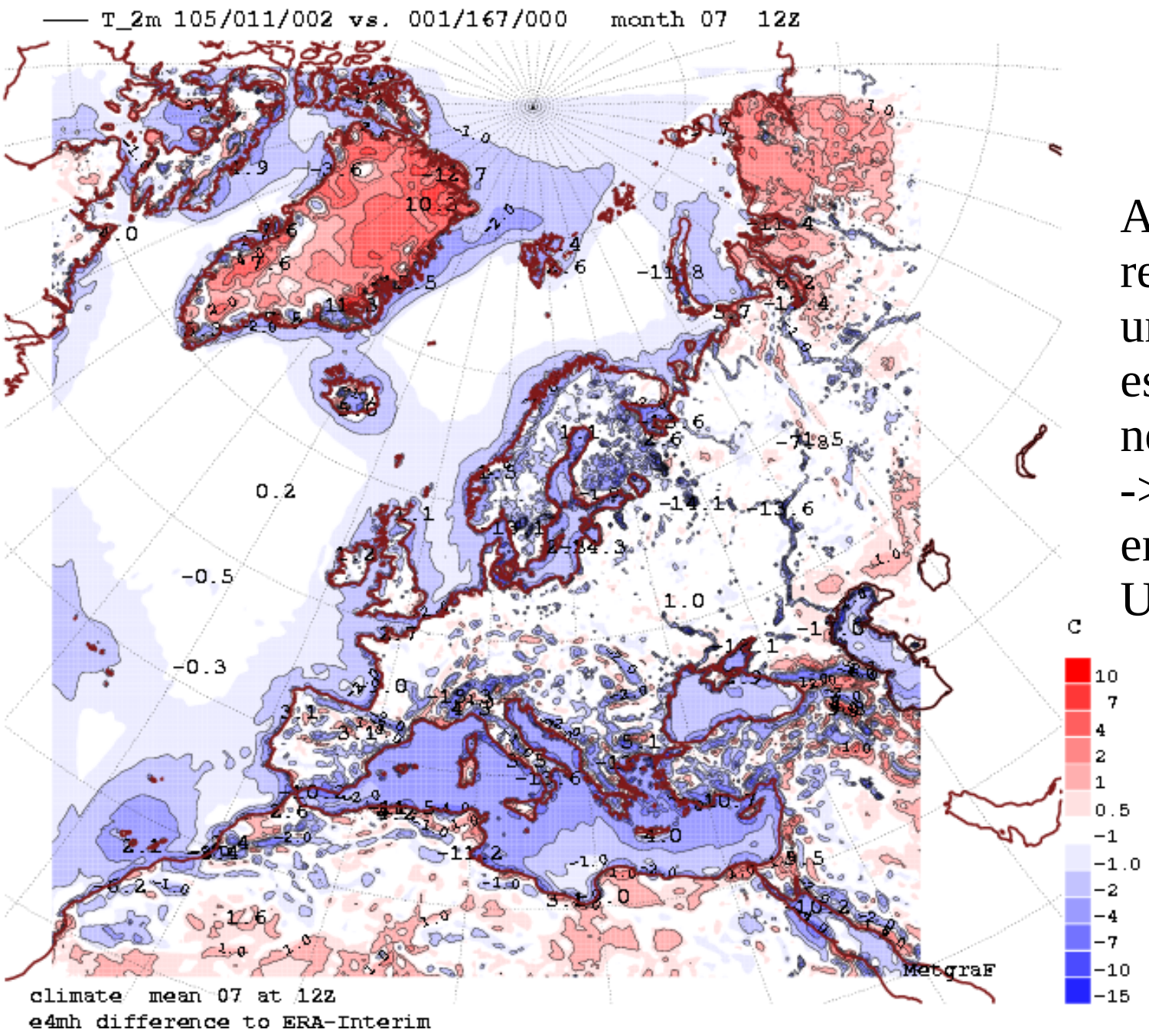


pushing the gap for, e.g., forestry applications

EURO-4M results



adding to ERA-Interim:
higher resolution – important for extrema, rare events, return periods
especially at coasts, mountains



Adding higher resolution: uncertainty estimates are needed
-> approched with ensembles in UERRA

Uncertainty estimations … starting 2015

- To evaluate ensemble reanalyses and downscaled reanalyses through comparison to independent ECV datasets that were derived independently
- To establish a consistent knowledge base on the uncertainty of reanalyses across all of Europe through a common evaluation procedure
- Focus on user interest, scales of variablity, extremes
- User dependent parameters and language adaptation

Evaluation procedures

In addition to user applications

Feedback (obs-background) statistics	Radiosoundings	T, wind, RH	How stable for multi-annual trends?
Point measurements	Mast data Station data	Wind T2m max, min Thresholds	Correlations between RRAs and observations?
Gridded measurements	E-OBS, GPCC, regional Alpine, Nordic	Precipitation Tmin Tmax	What differences when comparing spatial and temporal scales?
Satellite data products	CM-SAF ESA CCI	Radiation, cloud cover, snow	How good fit and quality?
Ensemble based comparisons	Ensemble gridded data, Ensemble RRA	Precipitation, Tmax, Tmin	More detailed or higher quality uncertainties?

Summary

1. Significant user interest (renewable energy, hydrological applications, agriculture and forestry) in high resolution reanalysis.

⟹ three 3D regional reanalyses, and two 2D surface analyses within UERRA

2. User oriented uncertainty estimates required and guidance on spatio-temporal scales.

⟹ UERRA ensembles and independent data comparison provide guidance and enhance confidence for certain products relative to others

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Thank you!

Read more on:

www.uerra.eu

Adjoining FP7 Copernicus Projects:
ERA-CLIM2, CLIPC, QA4ECV, EUCLEIA