

UERRA Regional reanalysis systems

Uncertainties in Ensembles of Regional ReAnalyses

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Project Partners

**Swedish Meteorological and Hydrological
Institute (SMHI)**

Météo France (MF)

**Het Koninklijk Nederlands
Meteorologisch Instituut (KNMI)**

The Met Office (MO)

**Climatic Research Unit, University of
East Anglia (UEA)**

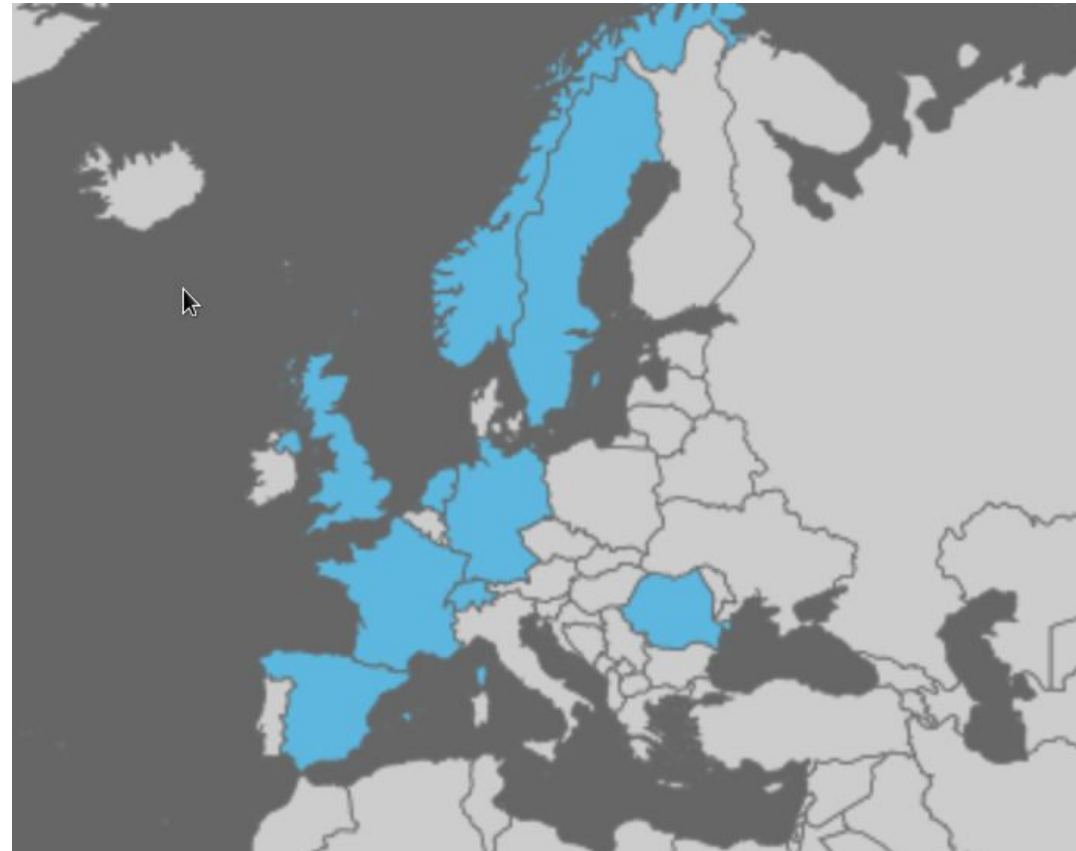
**Federal Office of Meteorology and
Climatology (MeteoSwiss),
subordinated to Eidgenoessisches
Departement des Innern (EDI)**

University Rovira i Virgili (URV)

**National Meteorological Administration
(NMA-RO)**

**European Centre for Medium Range
Weather Forecast (ECMWF)**

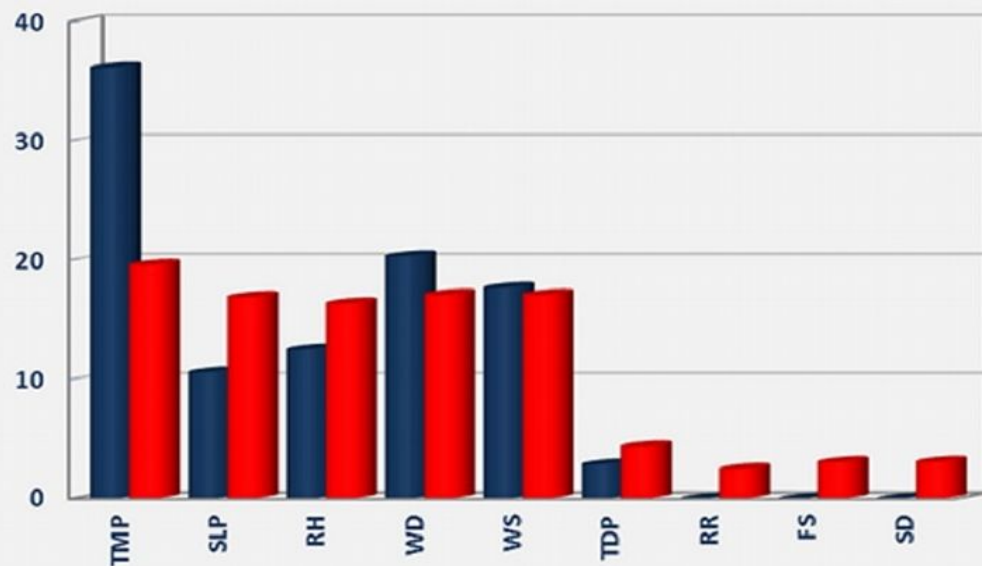
German Meteorological Service -



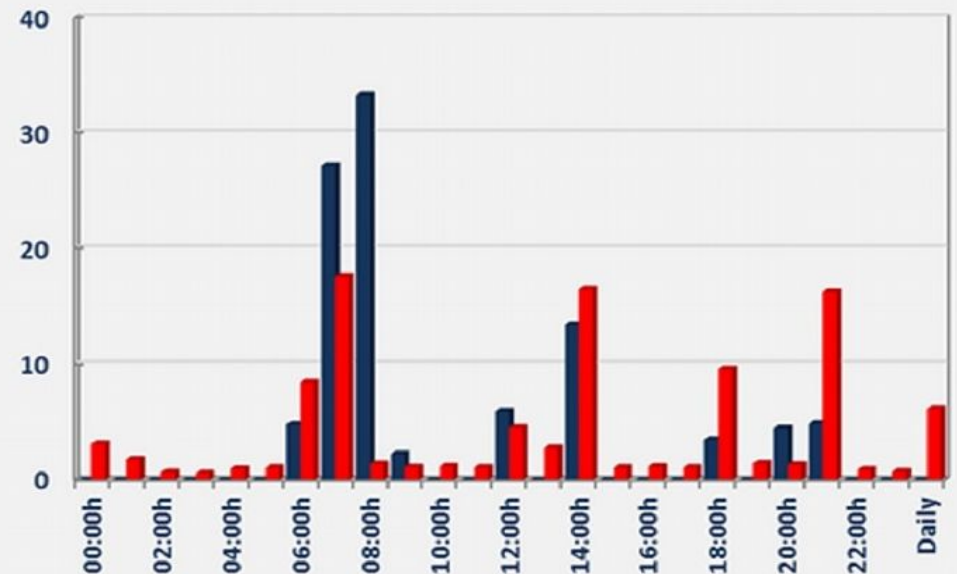
Data rescue of historical observations

- + *More than 8 M data recovered*
- + *Emphasis on sub-daily scale → observation stream for reanalyses*
- + *Comprehensive quality control and data development (correction, homogenisation)*

a) Percentage of digitised values by variable for pre-1961 (blue) & post-1961 (red) periods: ~1M & ~5M station values, respectively

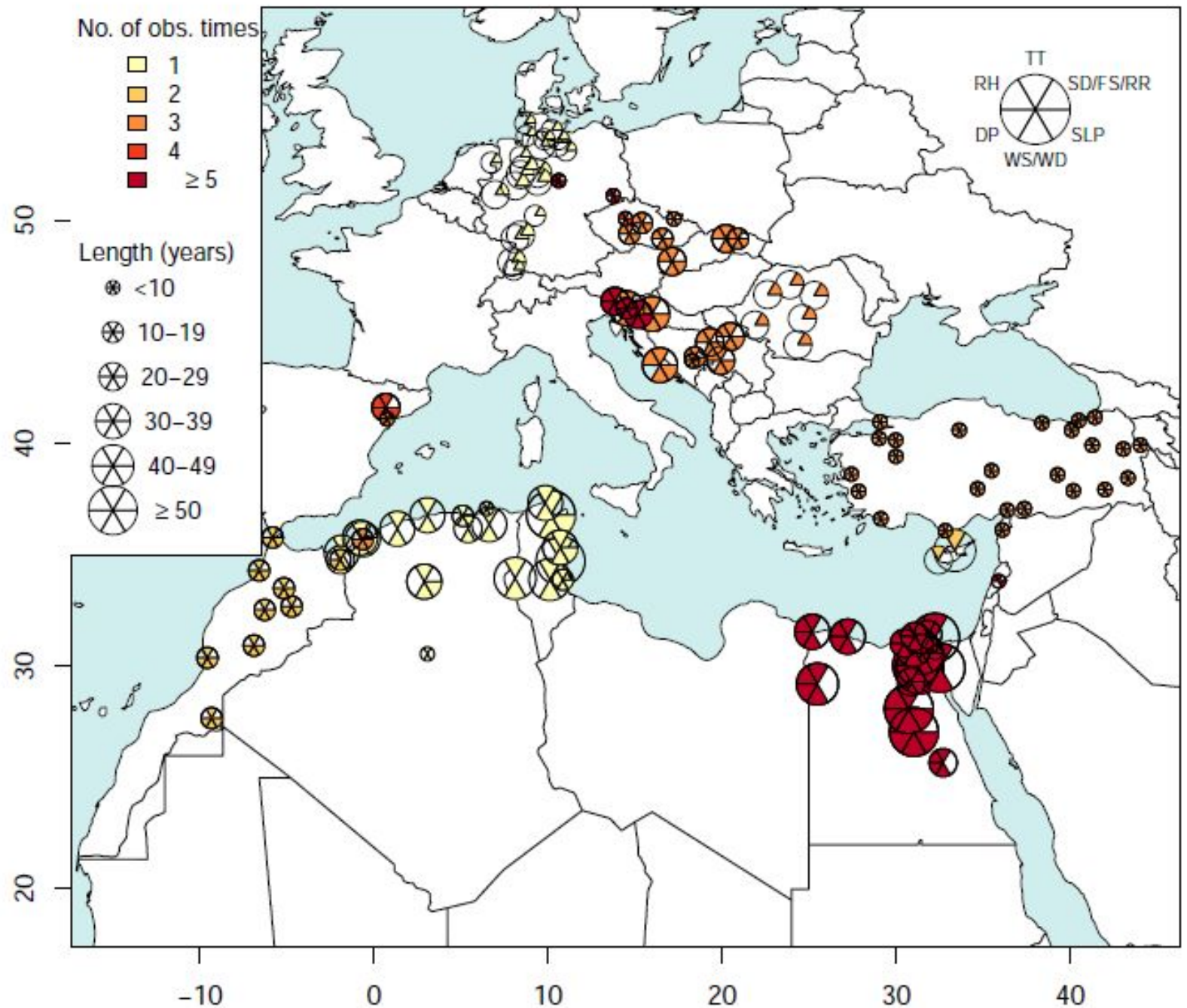


b) Digitised values by observing times for pre-1961 (blue) & post-1961 (red) periods: ~1M & ~5M station values, respectively



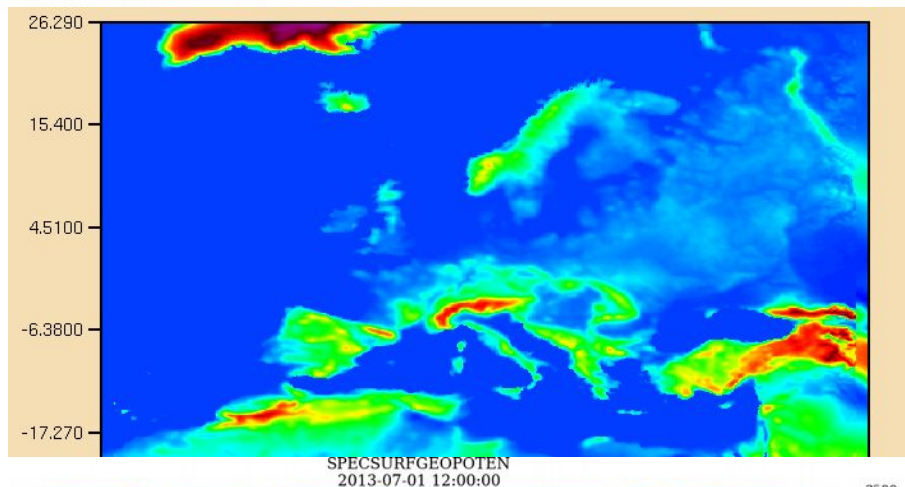
TMP: hourly temperature; SLP: Sea Level Pressure; RH: Relative Humidity; WD: Wind Direction; WS: Wind Speed; TDP: Temperature Dew Point; RR: precipitation; FS: Fresh Snow; SD: Snow-depth

UERRA data sources 1879-2012

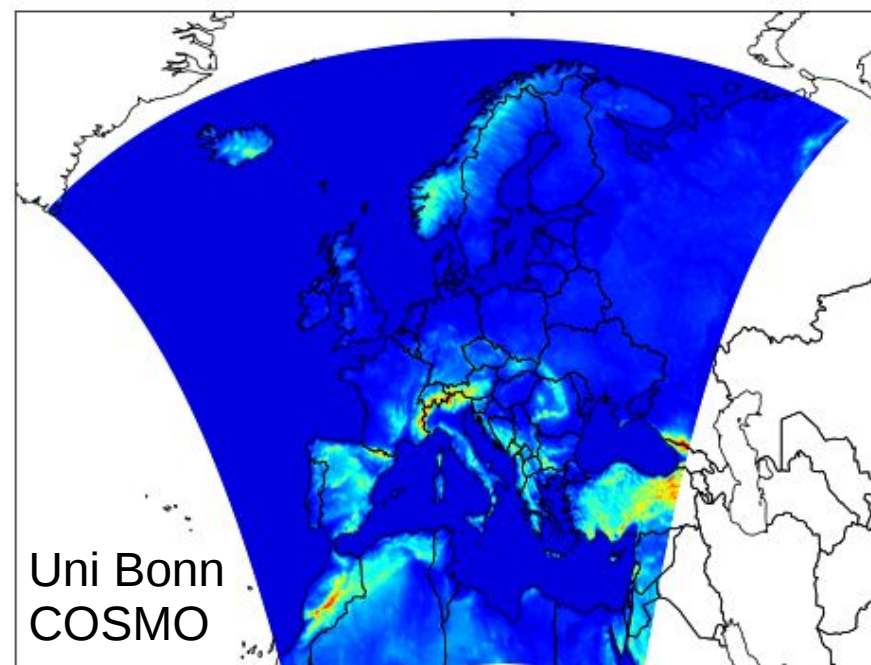
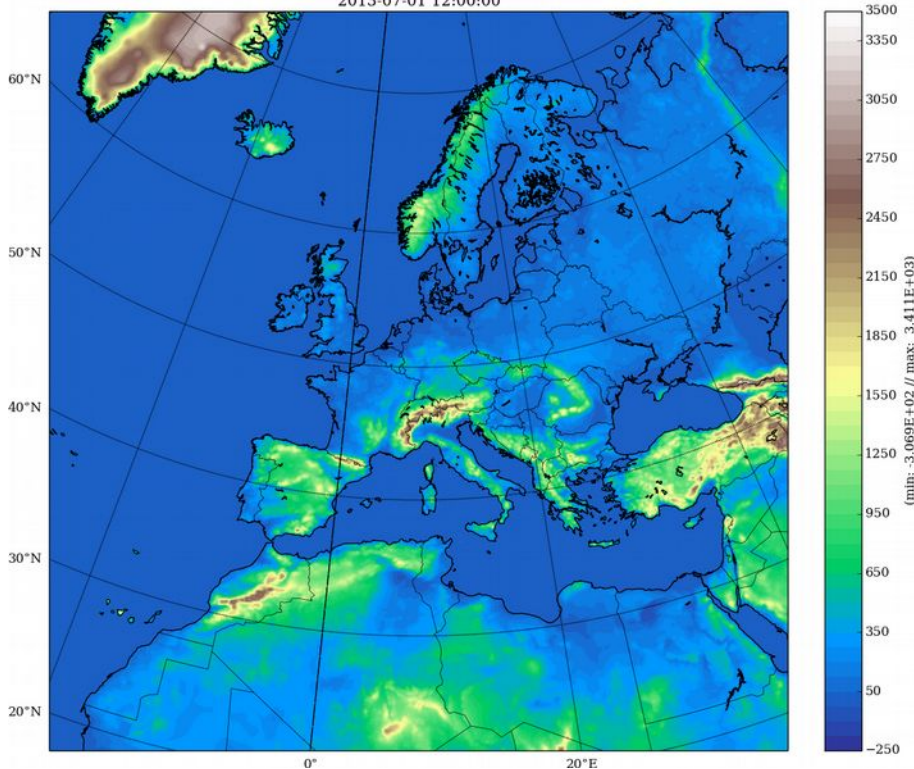


UERRA Domain & projections

Met Office
CORDEX
EU 11 km

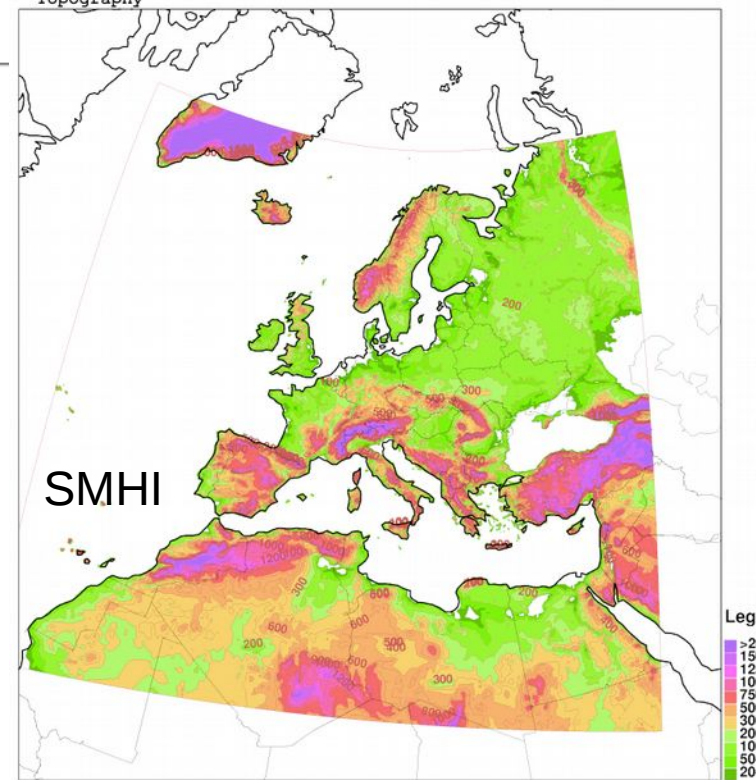


MF



Uni Bonn
COSMO

Alaro UERRA
Topography

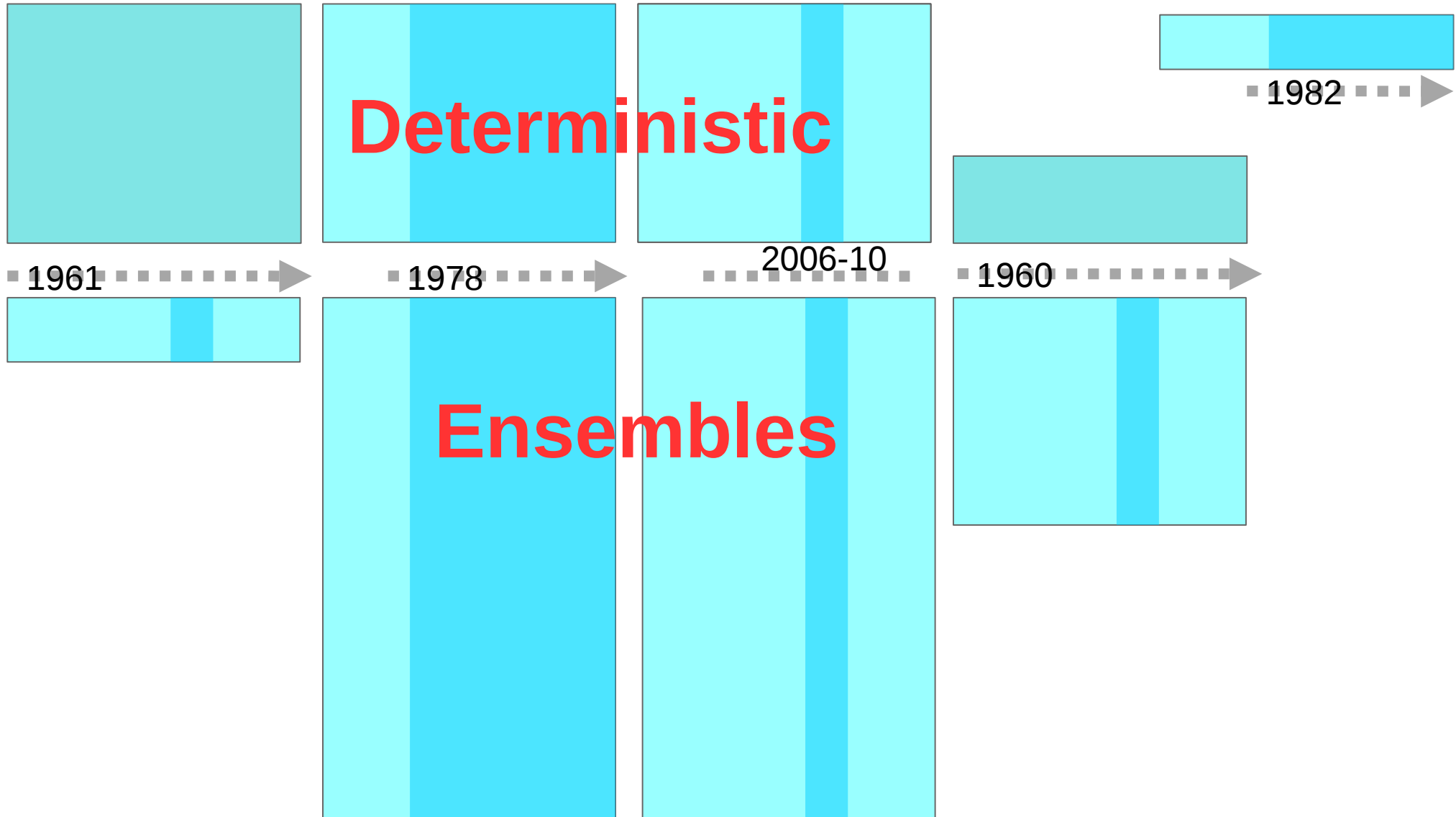


SMHI

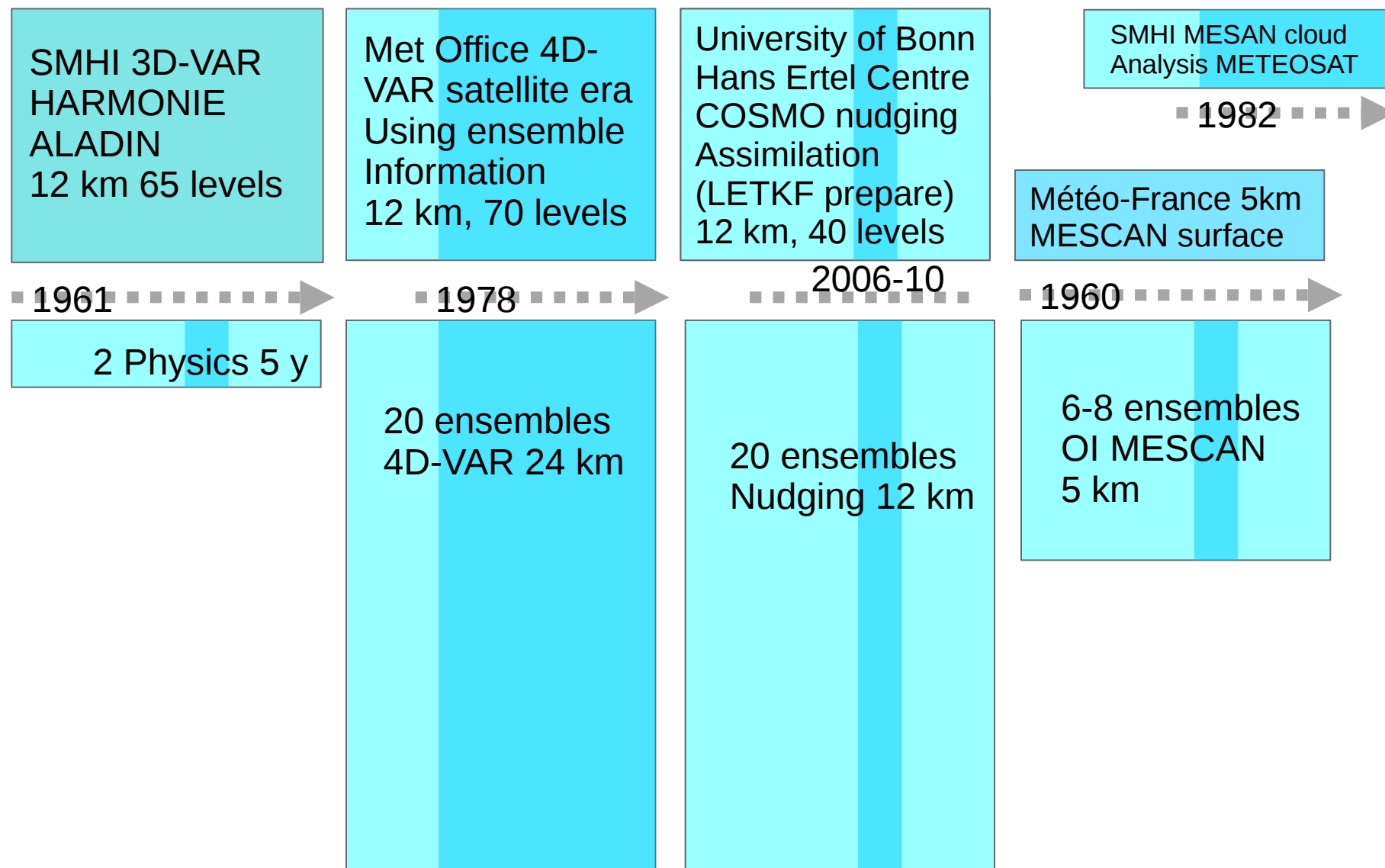
Mon 1 Jul 2013 00Z +06h
valid Mon 1 Jul 2013 06Z

Leg
>2
15
12
10
75
50
30
20
10
50
20

European Area 11 | 5 km || Multi-model
|| 2, 6, 20 Ensembles || 55 | 35 | 30 | 5 y



European Area 11 | 5 km || Multi-model || 2, 6, 20 Ensembles || 55 | 35 | 30 | 5 y



2-D surface fields analyses driven by 3D reanalyses

MF/SMHI
MESCAN

2D advanced
Statistical
Interpolation

Downscaled
ALADIN model
background

Surface and climate
stations
T, Td,
precipitation

5 km Europe
T2m, RH, 24 h
precipitation

1961 - ~2016

SMHI
MESAN

2D advanced
Statistical
interpolation

Downscaled
3D HIRLAM model
Climatological
adaptation background

AVHRR, METEOSAT
SEVIRI and
MVIRI

5 km Europe
Cloud fraction
hourly

~1982 - 2013

SMHI
HYPE

Hydrological
physical
model

ERA, EURO4M and
UERRA reanalyses
Precipitation and
temperature forcing

No input observations
Validation against
discharge data

River discharge
35000 catchments
Europe, median
215 km²

~1979 - 2010

MF SURFEX
and TRIP

Surface flux model
Hydrological physical
model

MESCAN
atmospheric
variables and
precipitation

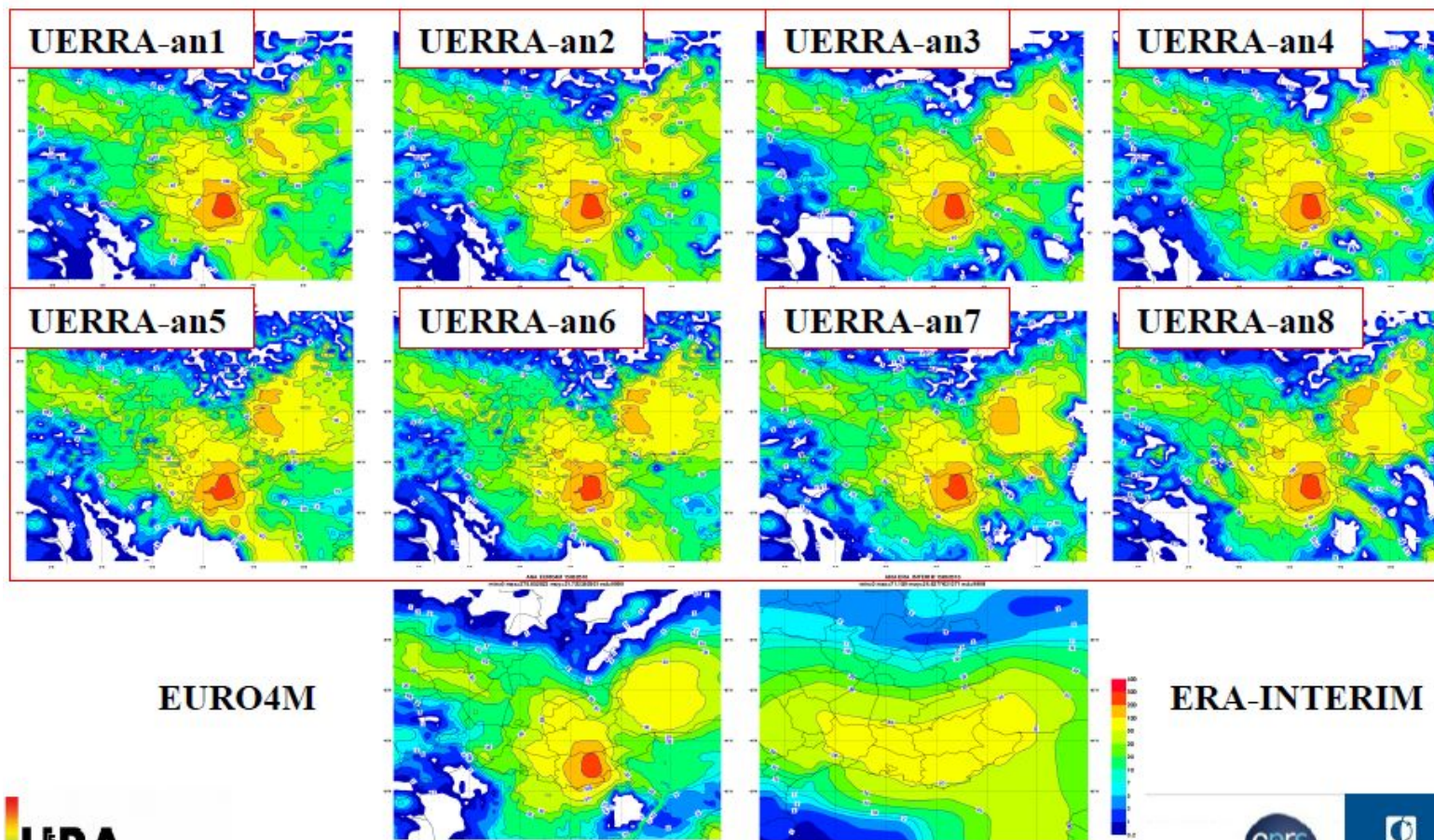
No input observations
Validation against
discharge data

River discharge
25 km -> rivers

~1981 - 2010

Ensemble members due to different model backgrounds

Extreme precipitation events of 15 June 2010
8 members : RR24h UERRA Analysis



• Evaluation of reanalyses and uncertainties

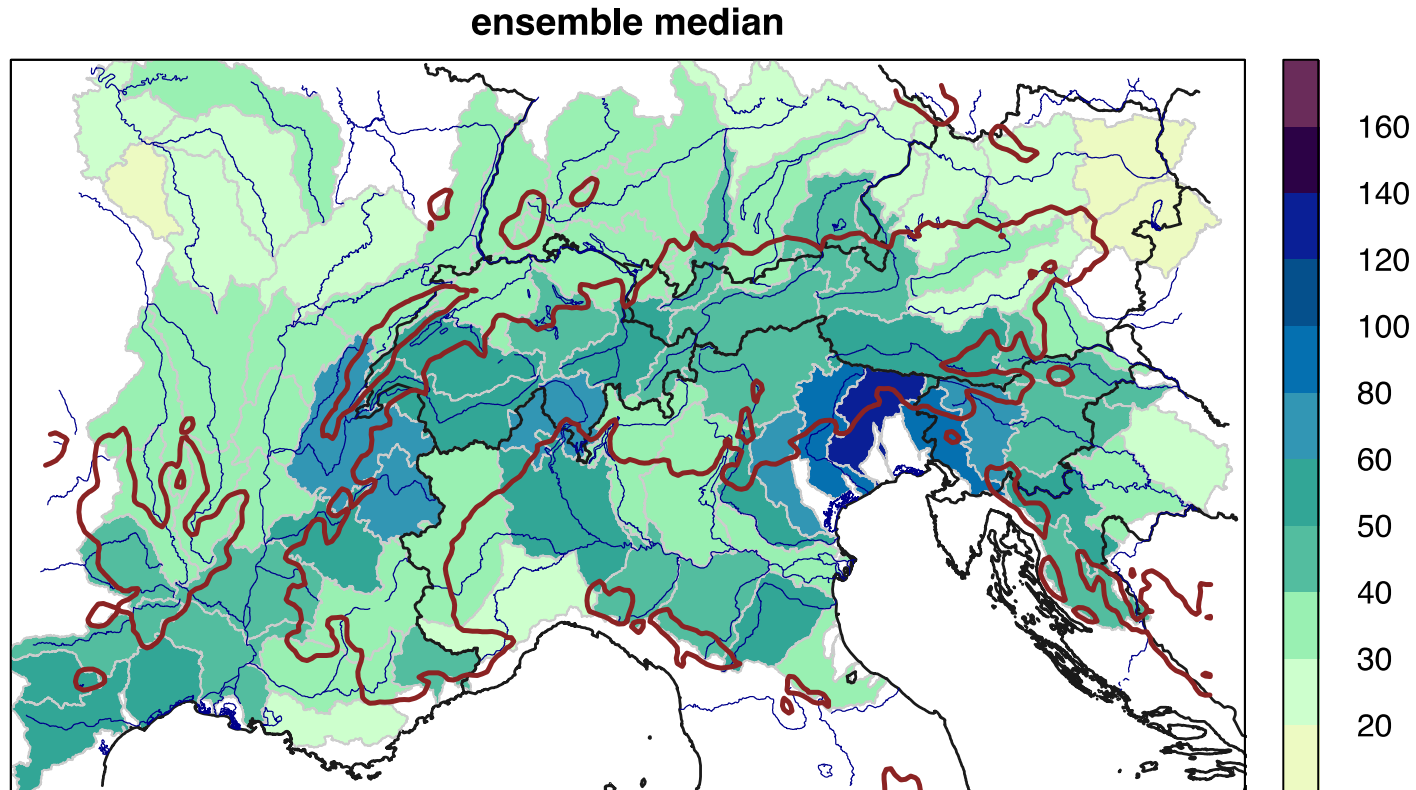
Errors, scales of errors in space and time, exceedance etc.

- Point measurements
 - SYNOP and TEMP data
 - Mast measurements → independent !
- Data assimilation (feedback) statistics
 - Background (forecast) fits to data
- Gridded data sets often at high resolution
 - E-OBS (25 km)
 - Alpine and Nordic (MET Norway) data sets 2 km
 - GPCC (global precipitation)
- Satellite products (SAF and CCI)
- Ensemble reanalyses spread



Uncertainty and Station Density

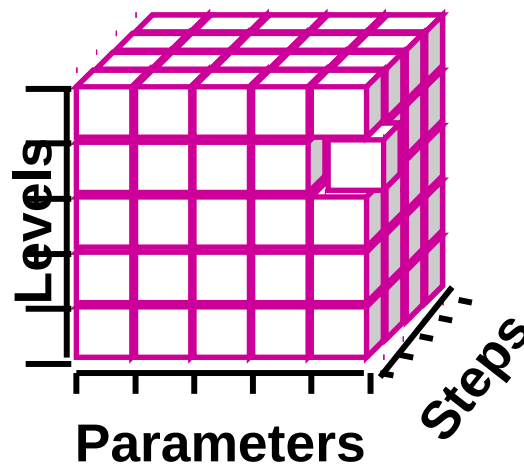
Scale B, largest event per catchment in 1990



ARCHIVING IN MARS

Data Services

- + *The common UERRA archive is MARS at ECMWF*
Common set of parameters chosen for all models
GRIB2 (some new definitions)
- + *Data services from MARS and ESGF interface*
- + *Web Map Servers*
- + *Visualisation through Metview and WMS*



Model levels

Store analysis output every
six hours at
00UTC, 06UTC, 12UTC,
18UTC for all models.

Pressure levels

Pressure levels [hPa]
1000
975
950
925
900
875
850
825
800
750
700
600
500
400
300
250
200
150
100
70
50
30
20
10

Pressure levels

Analysis: six hourly
at 00 UTC, 06 UTC, 12 UTC, 18 UTC (hourly
for COSMO) Forecasts : T+1,2,3,4,5,6,9,12,15,
18,21,24,27,30 started at 00 UTC and 12 UTC
T+1,2,3,4,5,6 started at 06 UTC and 18 UTC

Parameter	UM/4DVar UM/En4DVar (MO)		COSMO COSMO/En (HErZ/UB)		Harmonie/V1 Harmonie/V2 (SMHI)	
	Analysis	Fore- cast	Analysis	Fore- cast	Analysis	Fore- cast
cloud cover	X	X	X	X		X
cloud liquid water content (specific)	X	X	X	X		X
cloud ice content (specific)	X	X	X	X		X
geopotential height	X	X	X	X	X	X
relative humidity	X	X	X	X	X	X
temperature	X	X	X	X	X	X
U component of wind	X	X	X	X	X	X
V component of wind	X	X	X	X	X	X

Height levels

WP3 suggestion [m]
15
30
50
75
100
150
200
250
300
400
500

Surface levels Analysis:

00 UTC, 06 UTC, 12 UTC, 18 UTC

hourly for COSMO, MESAN, SURFEX

Forecast: T+1,2,3,4,5,6,9,12,15,18,21,24,27,30

00 UTC and 12 UTC, T+1,2,3,4,5,6 06 UTC and 18

4.2.1 Precipitation and humidity

Parameter	MF	MES CAN (MF)	SUR FEX (MF)	UM/4DVar UM/En4DVar (MO)		COSMO COSMO/En (HErZ/UB)		Harmonie/V1 Harmonie/V2 (SMHI)	
	For or Bg	Ana	For	Ana	For	Ana	For	Analysis	For
Accumulated total precipitation	X	X		X	X	X	X		X
2m relative humidity	X	X		X	X	X	X		X
Total column water vapour				X	X	X	X	X	X
runoff			X						
drainage			X						

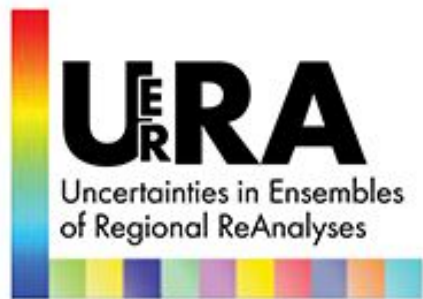
Surface levels

Many more parameters:

Temperature, wind, clouds, fluxes
of sensible and latent heat,
radiation fluxes, snow, rainfall

Soil levels

Temperature and soil water



UERRA user workshop

Participants statistics:

48 participants from 12 countries (*18 from France*)

19 working on applications of re-analyses data

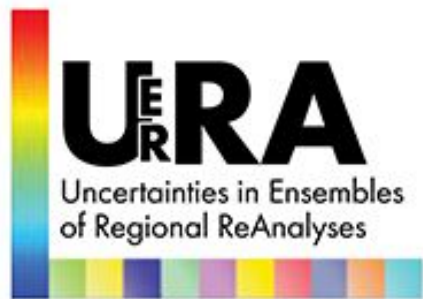
10 not related to UERRA



Applications:

Energy (wind, solar, demand), Insurance,
Transport, Agriculture, Defense, Hydrology,
Climate Impacts, Model evaluation,
Atmospheric physics





UERRA user workshop

- Participants presented their applications and requirements
- About 50% had some experience with re-analyses data
- The list of UERRA data products seems fairly complete
- Time and spatial resolution requested for was very variable; some cannot be provided by UERRA
- Most users were not familiar with 'Feedback' information provided by the re-analyses systems,
- Easy access to re-analyses data is the most important requirement
- Evaluation tools and visualization tools are of interest to a significant number of users



[Link to agenda, presentations and full workshop report: http://www.uerra.eu](http://www.uerra.eu)



Timeline

2015 – HARMONIE 5 years 2 physics

- HARMONIE
- MF MESCAN (5 year 6 member ensemble)
- UM Ensemble 4D-VAR start test only
- MESAN cloud analysis 0 years test

2016 – HARMONIE another 20 y -> 25-30 y 5 streams @ 4-5 years

- MESCAN -> 5 + 25 years
- MESAN cloud analysis 25 years
- UM Ensemble 4D-VARs 20-30 years
- UBO COSMO Ensemble 5 years

2017 – HARMONIE 25 years -> 55 years

- MESCAN 25 years -> 55 years
- UM Ensemble 4DVAR -> 36 years, Hybrid 4D-VAR 36 years
- UBO COSMO diagnostics

End

Read more on www.uerra.eu

www.uerra.eu