UERRA - Uncertainties in Ensembles of Regional ReAnalyses

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SEVENTH FRAMEWORK PROGRAMME

Preparing the Operational Copernicus Climate Change Service

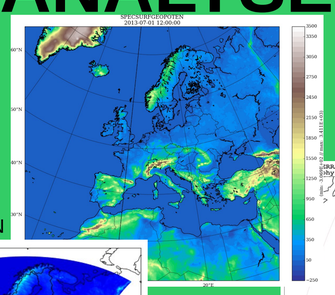
Produce European regional meteorological reanalyses of **E**ssential **C**limate **V**ariables for several decades; provide observations for reanalyses; provide data services and user information

Builds on the previous EURO4M FP7 project but extends in several directions:

Estimate uncertainty; produce ensembles of reanalyses including multiple models; increase grid resolution; extend time spans; extend observation record; improve gridded data sets and estimate underlying uncertainty

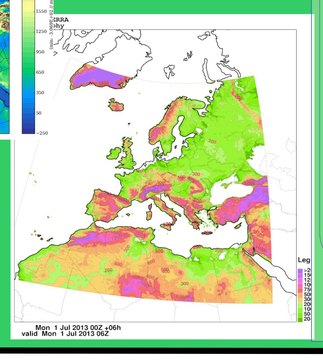
REGIONAL REANALYSES

Domains & orography

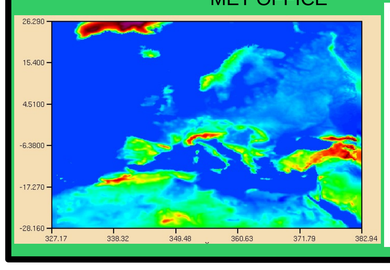


METEO FRANCE

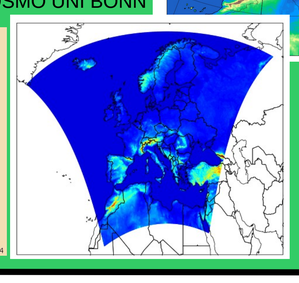
SMHI



MET OFFICE



COSMO UNI BONN



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)

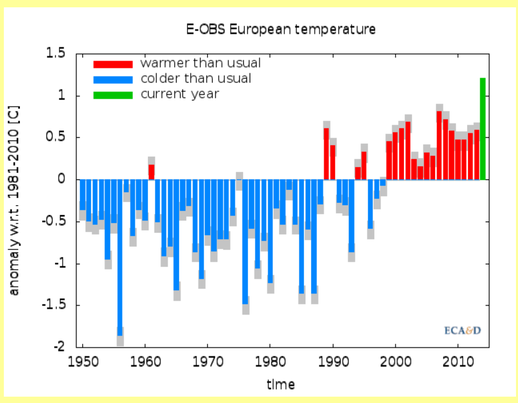
2D surface field analyses driven by 3D reanalyses

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

OBSERVATIONS

Enhancing gridded observations E-OBS

+ Estimate uncertainty arising from heterogeneous observation coverage and interpolation

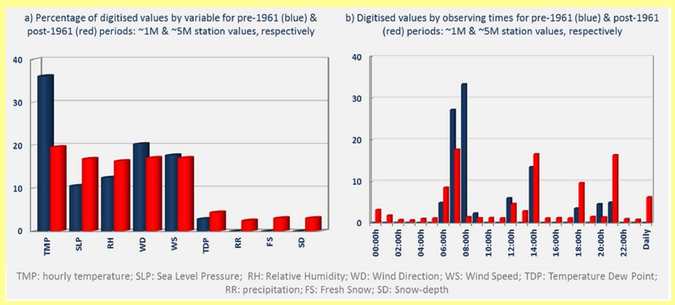


Data rescue of historical observations

+ Already more than 5M data recovered

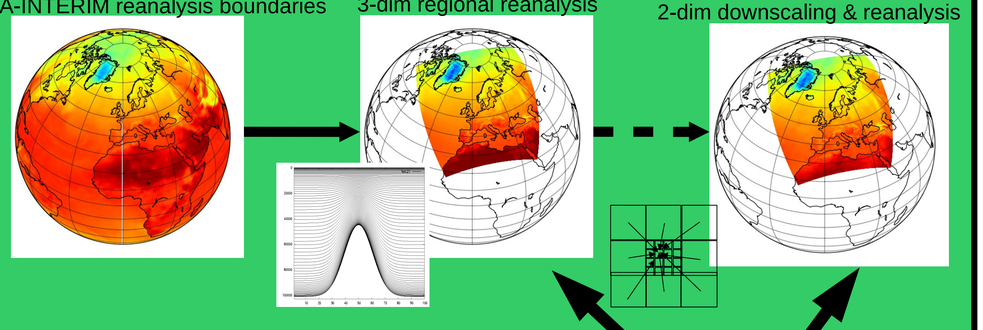
+ Emphasis on sub-daily scale → observation stream for reanalyses

+ Comprehensive quality control and data development (correction, homogenisation)



+ Regional reanalyses driven by global forcing and upper-air and surface observations using frozen systems
+ Multi-model and -technique ensembles of reanalyses
+ Surface and upper-air parameters

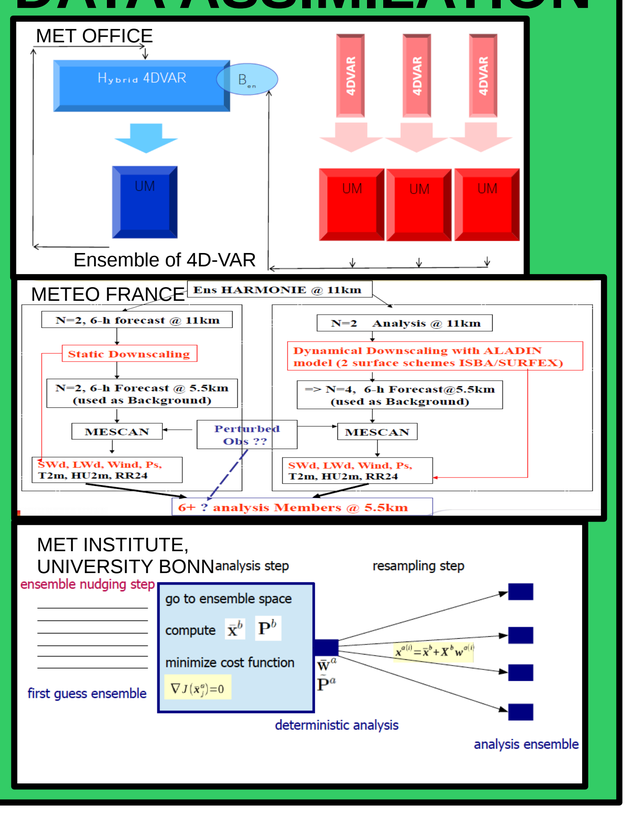
ERA-INTERIM reanalysis boundaries → 3-dim regional reanalysis → 2-dim downscaling & reanalysis



Reanalysis products

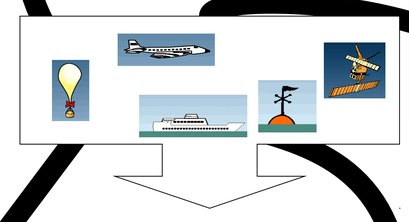
+ Upper air ensemble reanalyses (1978 -)
+ Upper air reanalysis (1961 -)
+ 2D surface reanalysis (1961 -)
+ 3D ensemble reanalysis (5 years)
+ Perturbed physics upper air and 2D surface reanalyses (5 years)

DATA ASSIMILATION



USERS

+ Climate information
+ Bulletins for public
+ Information for policy makers
+ User interaction
+ Evaluation and fit for purpose
+ Information and training



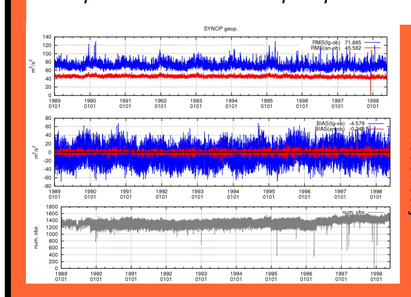
ARCHIVING IN MARS

+ The common UERRA archive is MARS at ECMWF
+ Data services from MARS and ESGF interface
+ Web Map Servers
+ Visualisation through Metview and WMS

ECMWF

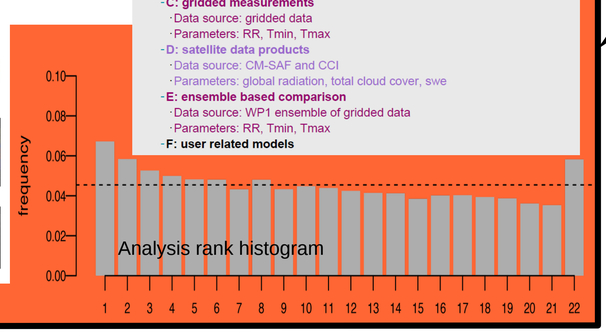
UNCERTAINTY ESTIMATION

+ Use standardized uncertainty measures for all data sets
+ Exploring different methods
+ Investigate spatio-temporal scales and trends
+ Emphasis on the user's perspective



Task 3.1 Coordinated uncertainty evaluation

- D 3.2 Common evaluation procedures (-> data source):
  - **A: feedback statistics**
    - Data source: radiosonde soundings
    - Parameters: T,Ws, RH
  - **B: point measurements**
    - Data source: station data
    - Parametes: Ws, Tmin, Tmax, number of days of threshold exceedance of T and RR
  - **C: gridded measurements**
    - Data source: gridded data
    - Parameters: RR, Tmin, Tmax
  - **D: satellite data products**
    - Data source: CM-SAF and CCI
    - Parameters: global radiation, total cloud cover, swe
  - **E: ensemble based comparison**
    - Data source: WP1 ensemble of gridded data
    - Parameters: RR, Tmin, Tmax
  - **F: user related models**



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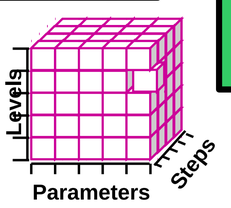
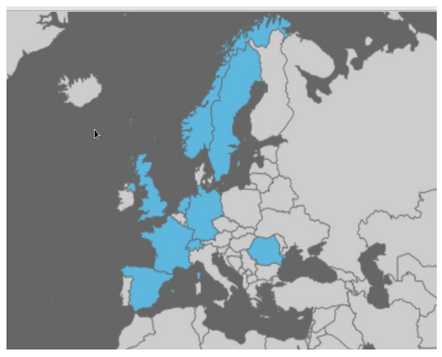


Project partners

SMHI; METEO FRANCE Toujours un temps d'avance; Koninklijk Nederlands Meteorologisch Instituut Ministerie van Infrastructuur en Milieu; University of East Anglia; Met Office; ECMWF; Deutscher Wetterdienst Wetter und Klima aus einer Hand; DWD; Meteorologisk institutt; Universitat Rovira i Virgili; METEO ROMANIA; universitätbonn Rheinische Friedrich-Wilhelms-Universität Bonn



5 precursor FP7 projects

Among 5 pre-operational Copernicus Projects (SPACE 9.1 call)

ERA-CLIM2	European Reanalysis of the Global Climate System
UERRA	Uncertainties in Ensembles of Regional ReAnalyses
QA4ECV	Quality Assurance for Essential Climate Variables
CLIPC	A Climate Information Portal for Copernicus
EUCLEIA	European Climate and weather events: interpretation and attribution

UERRA : Grant Agreement 607193 EU FP7 SPACE 2013-1