



# UERRA WP2 Overview

Dale Barker, 2<sup>nd</sup> UERRA General Assembly, Tortosa, Spain  
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# UERRA Work Packages

WP Number <sup>53</sup>	WP Title	Type of activity <sup>54</sup>	Lead beneficiary number <sup>55</sup>	Person-months <sup>56</sup>	Start month <sup>57</sup>	End month <sup>58</sup>
WP1	Data Rescue and development, gridded and observational datasets	RTD	7	97.00	1	36
WP2	Ensemble Data Assimilation Regional Reanalysis Dataset	RTD	4	348.00	1	48
WP3	Assessing uncertainties by evaluation against independent observational datasets	RTD	10	85.00	1	48
WP4	Facilitating downstream services (data, derived products and outreach)	RTD	3	64.00	1	48
WP5	Consortium Management	MGT	1	8.00	1	48
WP6	Scientific Coordination	RTD	1	9.00	1	48
WP7	Dissemination & Outreach	OTHER	1	13.00	1	48
WP8	User feedback	OTHER	3	12.00	1	48
WP9	Overarching Coordination FP7 Copernicus climate change projects	OTHER	3	8.00	1	48
<b>Total</b>				<b>644.00</b>		



# UERRA WP2 Tasks



- T2.1: Ensemble-Variational DA Reanalysis (**Met Office**).
- T2.2: Deterministic Reanalysis (**SMHI**).
- T2.3: Downscaling of ensemble and deterministic RA to provide km-scale European-wide reanalysis datasets (**Meteo-France**).
- T2.4: Cloud Fraction Reanalysis (**SMHI**)
- T2.5: Ensemble Nudging DA Reanalysis (**UBonn**).
- T2.6: Reanalysis Cross Evaluation (**Met Office**).

# UERRA WP2 Deliverables

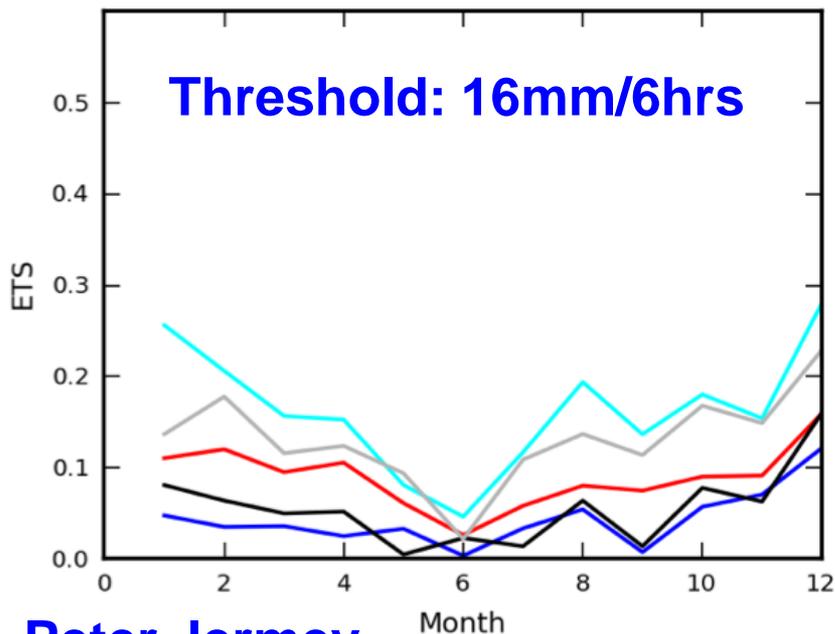
Deliverable Number <sup>61</sup>	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature <sup>62</sup>	Dissemination level <sup>63</sup>	Delivery date <sup>64</sup>
D2.1	Ensemble Variational DA development	4	50.00	Report	PU	21
D2.2	Ensemble Variational DA observations	4	30.00	Report	PU	24
D2.3	Ensemble Variational DA diagnostics	4	50.00	Report	PU	30
D2.4	Ensemble Variational DA documentation	4	30.00	Report	PU	42
D2.5	HARMONIE physics ensemble	1	12.00	Report	PU	12
D2.6	HARMONIE initial production	1	36.00	Report	PU	30
D2.7	HARMONIE production datasets	1	25.00	Report	PU	45
D2.8	MESCAN downscaling	2	40.00	Report	PU	45
D2.9	MESCAN ensemble	2	10.00	Report	PU	30
D2.10	MESCAN cloud analysis	1	7.00	Report	PU	24
D2.11	Kalman Filter Ensemble DA observations	12	10.00	Report	PU	15
D2.12	Kalman Filter Ensemble DA development	12	20.00	Report	PU	21
D2.13	Kalman Filter Ensemble DA diagnostics	12	14.00	Report	PU	45
D2.14	RA uncertainty evaluation	4	14.00	Report	PU	45
			<b>Total</b>	<b>348.00</b>		



# EURO4M: Value Of Regional Reanalysis

(note: Precipitation observations not yet directly assimilated)

## 2008 ETS for Europe area



UM 4DVar Regional Reanalysis

UM Downscaler (ECMWF BCs)

HIRLAM 3DVar Regional Reanalysis

ERA-INTERIM Global Reanalysis

UM Climate Run (No analysis)

Peter Jermey

**UERRA Challenge: Maintaining value wrt future global reanalysis e.g. ERA-5**



Met Office

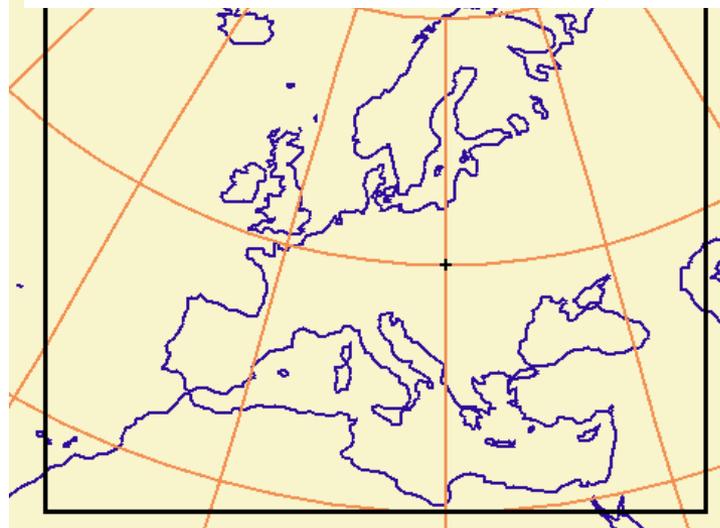
# UERRA Task 2.1 (MO):

## *Ensemble Variational DA Reanalysis*

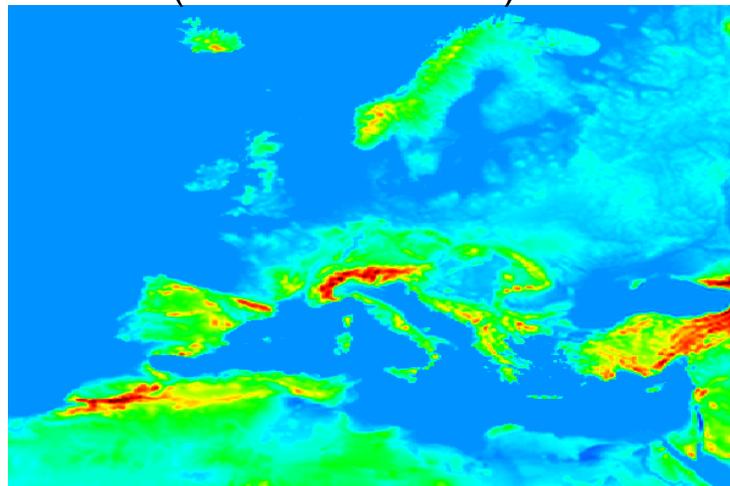


- EURO4M project (2010-2014):  
4DVar-based Unified Model regional reanalysis, tested in pilot 2 year period (2008-2009).
- UERRA project (2014-2018):  
Multi-decadal, satellite-era (1979 – present) ensemble reanalysis.
- Resolution: 12km model, 24-36km DA (4D-Var, hybrid EnDA)
- Lateral boundary conditions: ERA (-Interim). ERA/**UERRA** observations.

EURO4M domain:



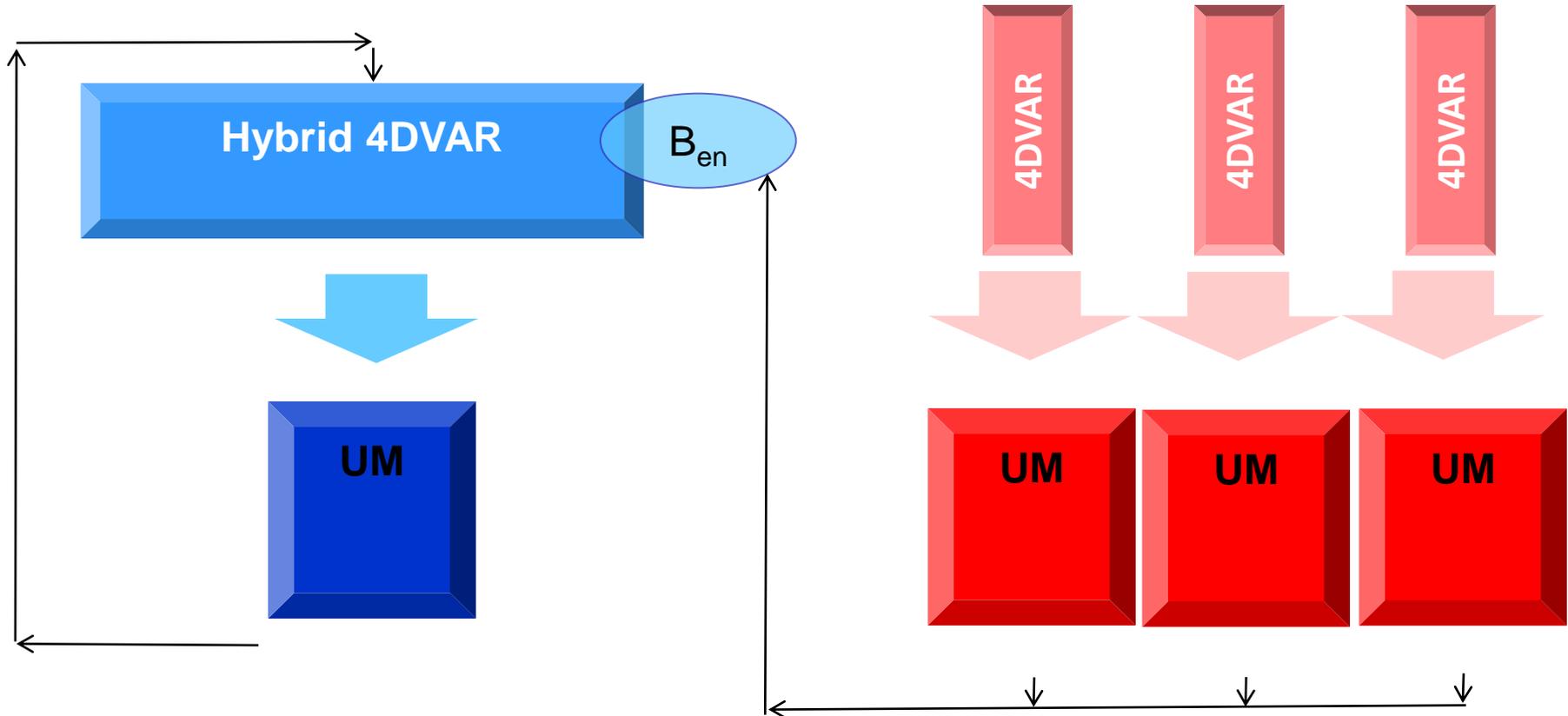
UERRA (EURO CORDEX) domain:



# MO System Overview

EDA – “hybrid” 4DVAR – weighted sum of background error covariances ( $B = \beta_f B_f + \beta_{en} B_{en}$ )

Ensemble of reanalyses using 4DVAR – (En4DVAR)



Peter Jermey

# UERRA Task 2.2 (**SMHI, Meteo-France**): *Deterministic Reanalysis*

SMHI/MF

HARMONIE 3D-VAR

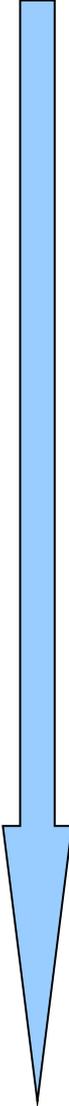
1 member 11 km 65 levels  
2 members physics 5 years  
“mini” ensemble

~1961 - 2013

Conventional observations,  
Large scale constraint from  
ERA

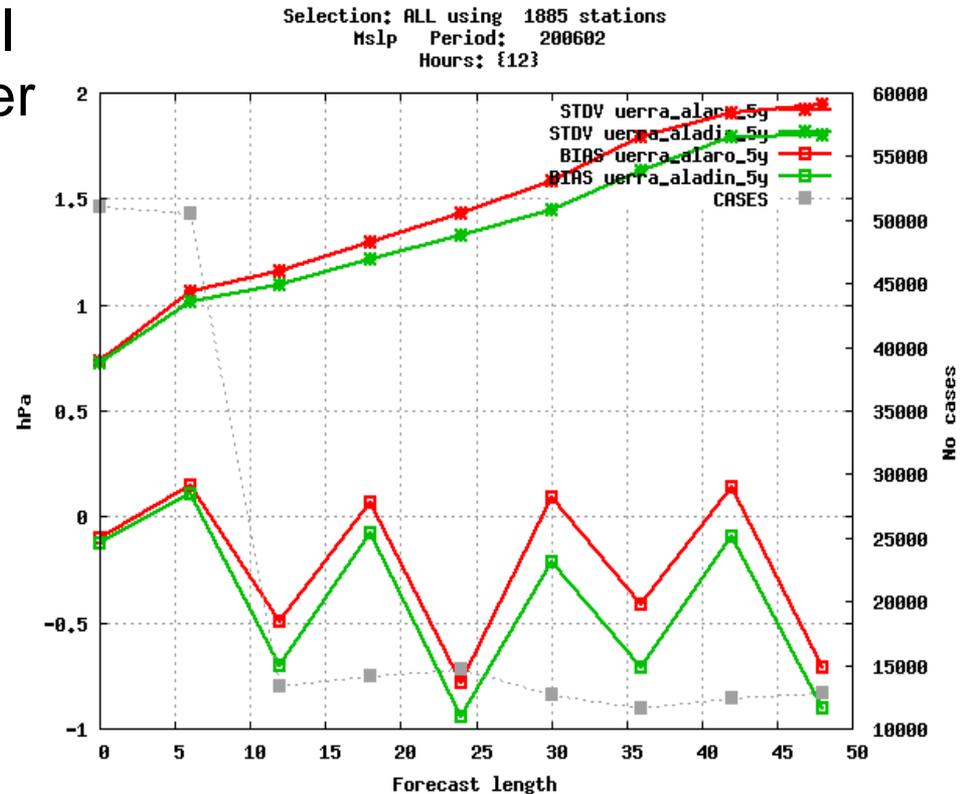
# UERRA Task 2.2 (**SMHI, Meteo-France**):

## *Deterministic Reanalysis*

- 
- ALADIN and ALARO model physics CY38h1.1 and SURFEX v7. Domain like CORDEX 65 levels.
  - Technical and met tests and MF tests in parallel. Surface and precipitation issues investigated together.
  - Parallel tests of ALADIN and ALARO for winter and summer months
  - Both model versions perform well, ALADIN advantage for several parameters/periods
  - Archiving in MARS not solved yet, common UERRA GRIB2, see WP4, ecfs for the time being

# UERRA Task 2.2 (**SMHI, Meteo-France**): *Deterministic Reanalysis*

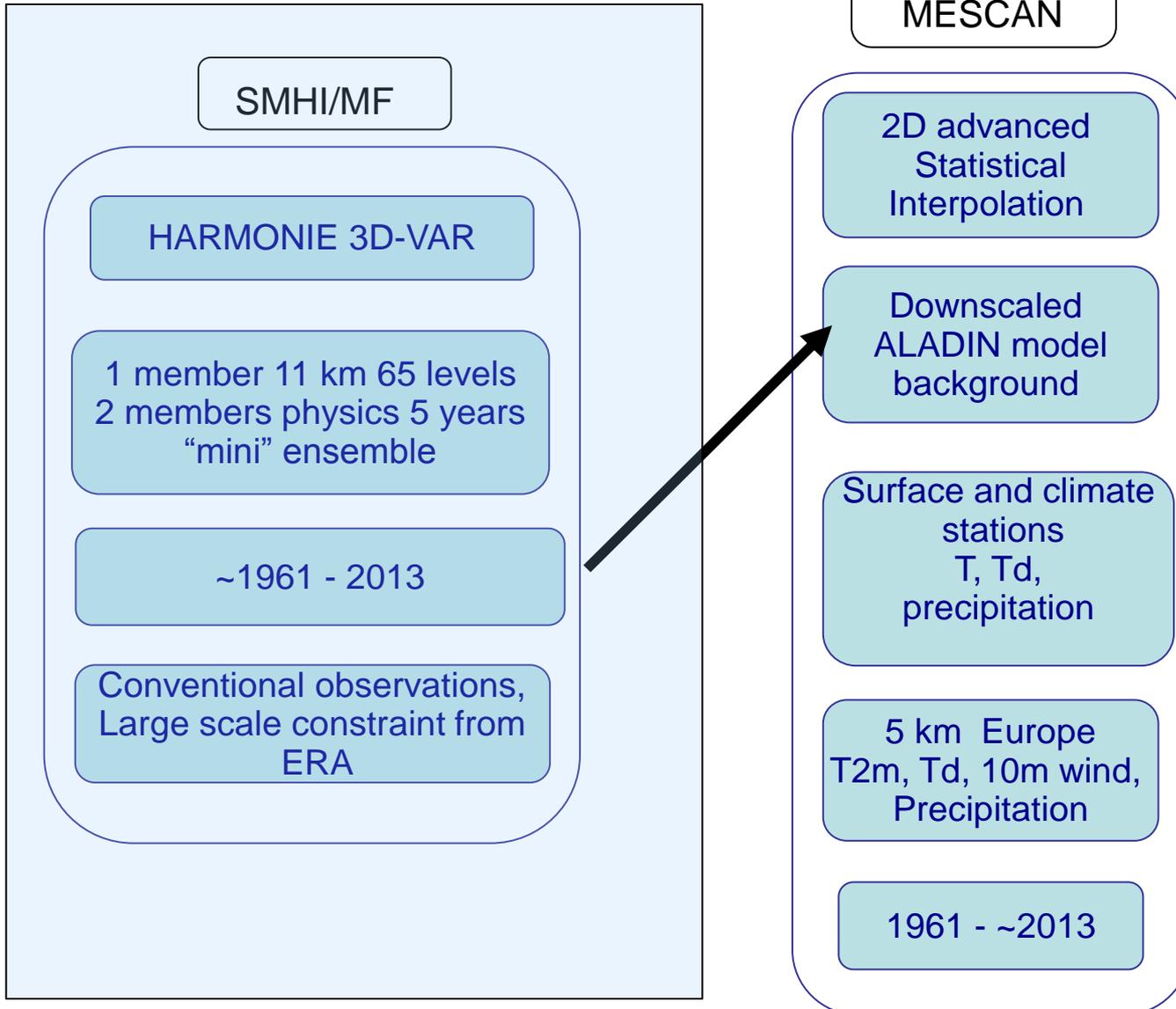
- Parallel two physics 5 year runs started, 2006-2010
- System efficiency being improved, more in parallel -> need to run a month per day!
- ALADIN still performs somewhat better especially in winter



Per Unden

# UERRA Task 2.3 (**Meteo-France**):

## *Downscaling Reanalysis*

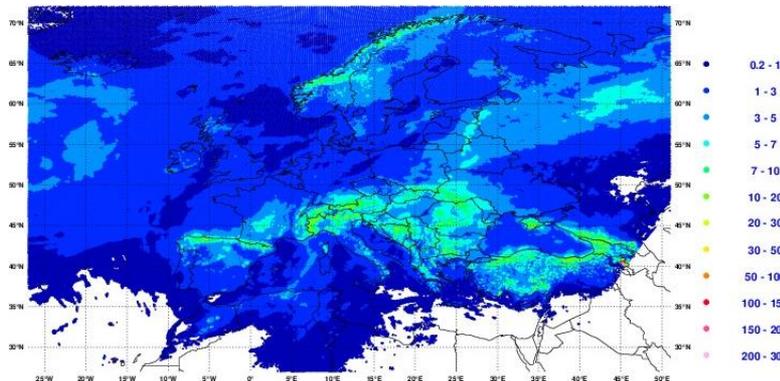


# UERRA Task 2.3 (**Meteo-France**):

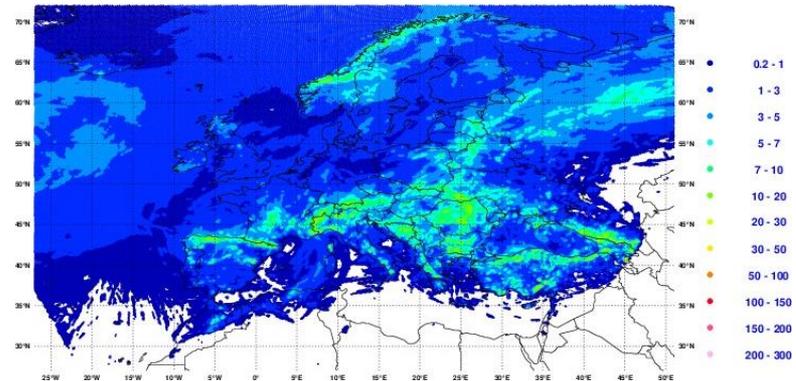
## *Downscaling Reanalysis* **Eric Bazille**

- Experiment at 5.5km with ARPEGE-ALADIN and ALARO physics and 2 surface schemes. Comparison with the 11Km experiment and with a static downscaling at 5.5km. Precipitation fields are different with more small scale or noise (?). The T2m bias are also different.

**ARPEGE/ALADIN June 2010 Total RR**



**ALARO June 2010 Total RR**



Horizontal grid (km)	ARPEGE/ALADIN			ALARO		
	Bias (mm)	RMSE (mm)	SD (mm)	Bias (mm)	RMSE (mm)	SD (mm)
11	0.35	3.99	3.87	0.30	4.89	4.75
5.5	0.43	4.21	4.08	0.23	4.83	4.70

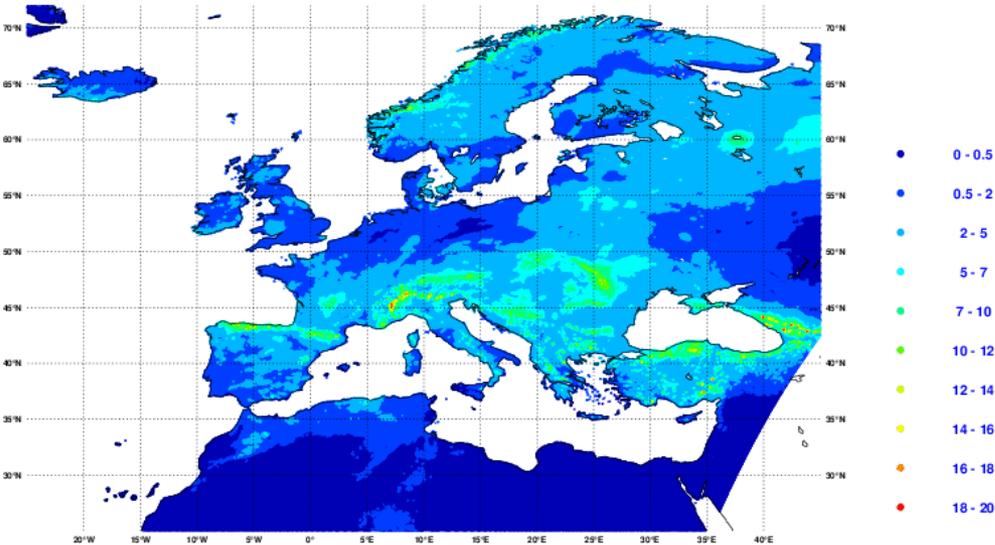
Verification vs EURO4M analysis over Europe June 2010

# UERRA Task 2.3 (Meteo-France):

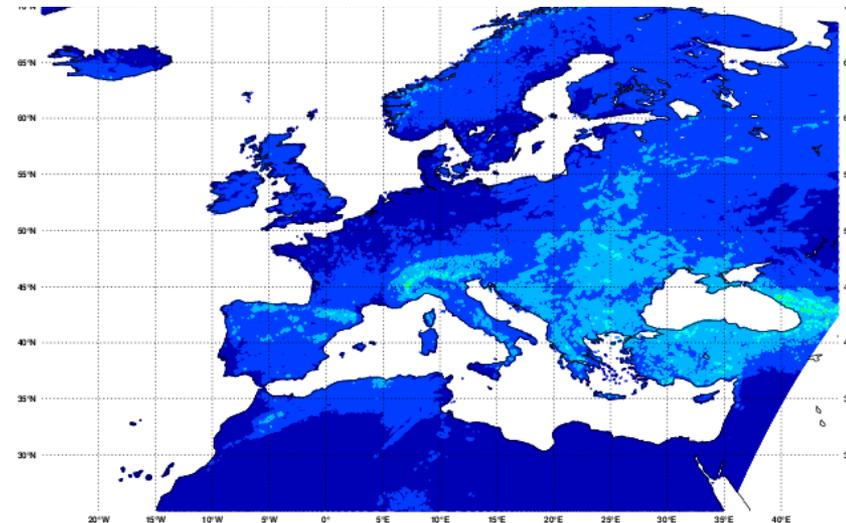
## Downscaling Reanalysis Eric Bazille

- Very preliminary result with a “mini-ensemble” precipitation analysis with MESCAN over EUROPE:
  - 6 members = 6 backgrounds from 3 forecasts at 5.5km and 3 from a static downscaling from 11km to 5.5km
  - same tuning for MESCAN and same observation network
  - Comparison with EURO4M analysis
- Impact of the physics package: different bias of T2m, significant impact on the radiative fluxes (SWd) → impact on SURFEX simulation especially for snow characteristics and surface fluxes.
- For 2015: mini-ensemble surface analysis for T2m, sensitivity test to the density network and MESCAN tuning, start the production of the 5 years for the uncertainties. Impact of the “pseudo T2M” in MESCAN (Besson’s talk)

Mean Ensemble MESCAN-RR June 2010 mm/day

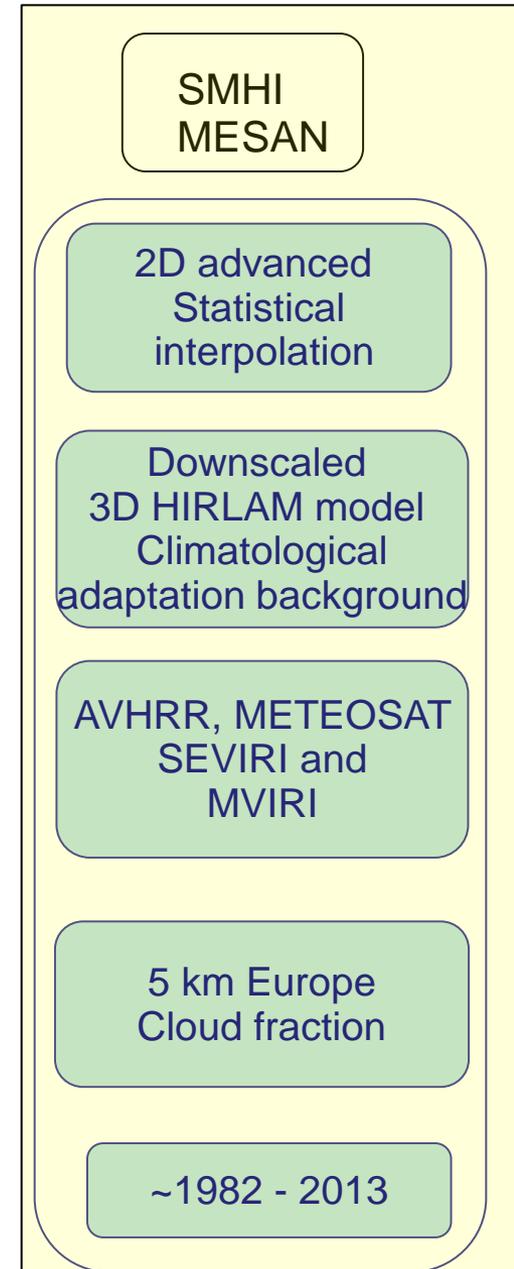
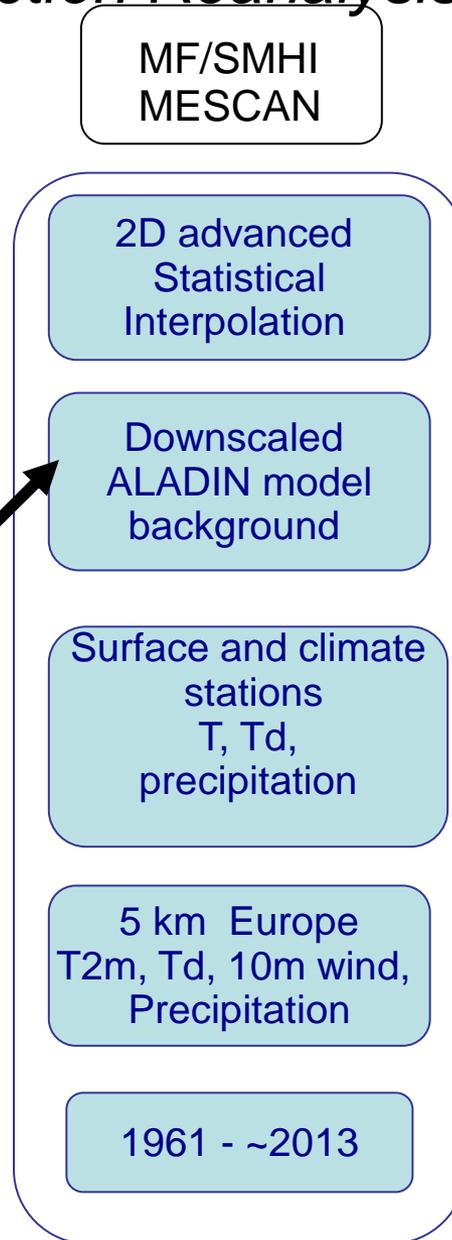
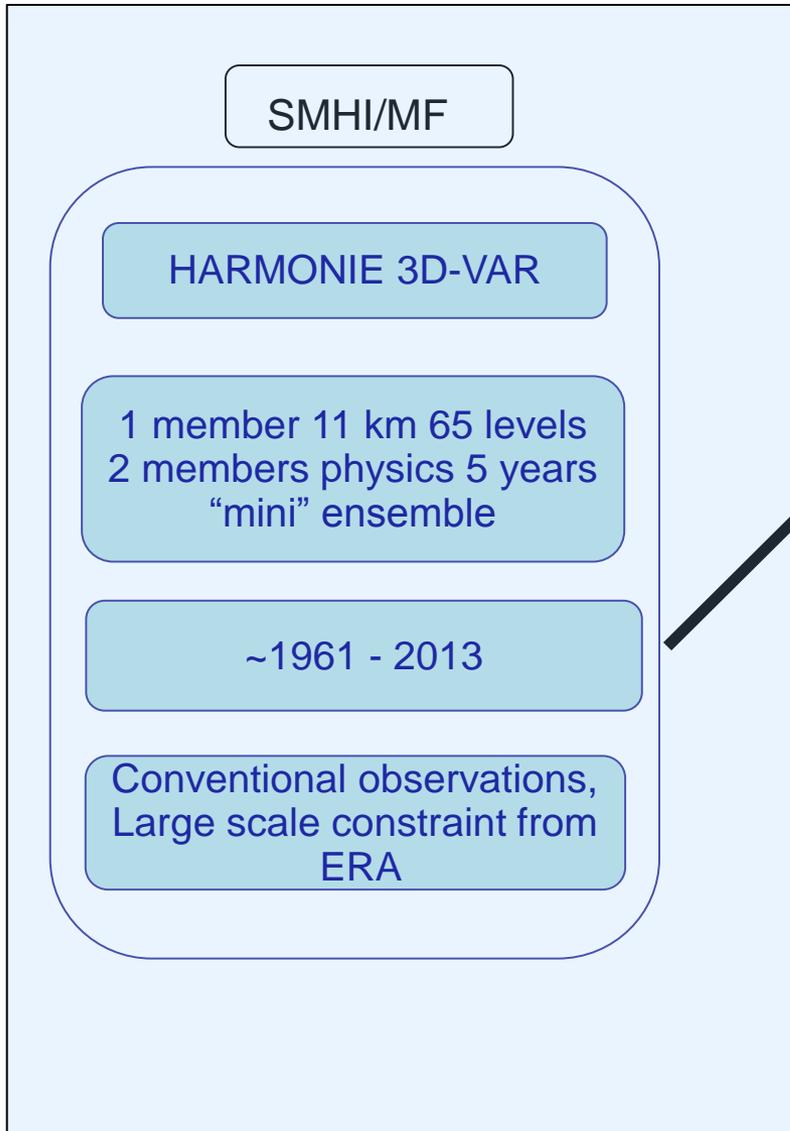


Mean daily STD of Ens-MESCAN-RR June 2010 mm/day



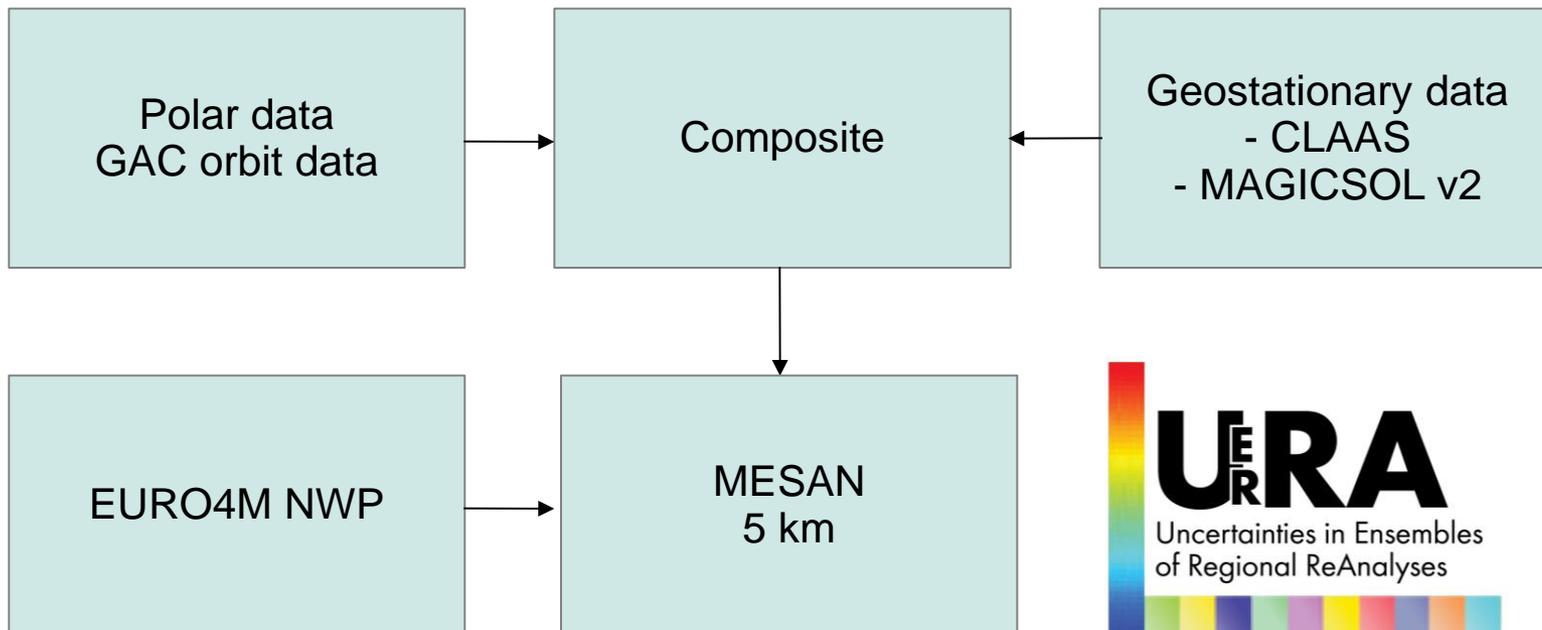
# UERRA Task 2.4 (SMHI):

## *Cloud Fraction Reanalysis*



# UERRA Task 2.4 (**SMHI**): *Cloud Fraction Reanalysis*

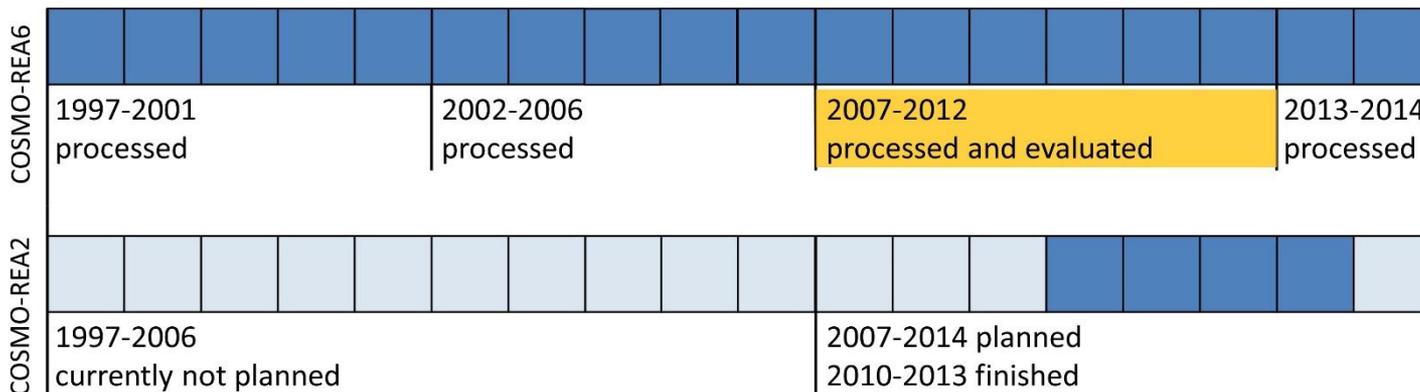
**SMHI during 2015: 2D cloud analysis 1982 – 2013 (hourly)**



# UERRA Task 2.5 (**UBonn**): *Ensemble Nudging DA Reanalysis*

## → Deterministic COSMO-Reanalysis for comparison

- 1997 – 2014 available in 6km resolution
- 2010 – 2013 available in 2km resolution
- Comparisons to EURO4M reanalysis datasets



## → Ensemble nudging system

- New system developed for 12km horizontal resolution
- Investigation of observation perturbation strategies
  - Representation of observation uncertainties



# UERRA WP2 Deliverables: Year 1-2



- D2.5 : Report of results and datasets of two physics HARMONIE runs for spread estimation (SMHI, MF) [month 12]. **Delay.**
- D2.11 : Probabilistic observations will be generated for Kalman Filter ensemble DA and a report will be written (UB) [month 15] . **On track?**
- D2.1 : Development of ensemble variational data assimilation capability and report demonstrating ensemble uncertainty products (MO) [month 21]. **On track.**
- D2.12 : The KF ensemble reanalysis (KFENDA) system developed with report demonstrating reanalysis uncertainty capability (UB) [month 21] . **On track**
- D2.2 : Report of observations and datasets assembled for the ensemble-based variational assimilation (MO) [month 24]. **On track.**
- D2.10 : UERRA-MESA-CL 30-year European cloud fraction dataset/report (SMHI) [month 24]. **On track?**



# UERRA WP2 Summary

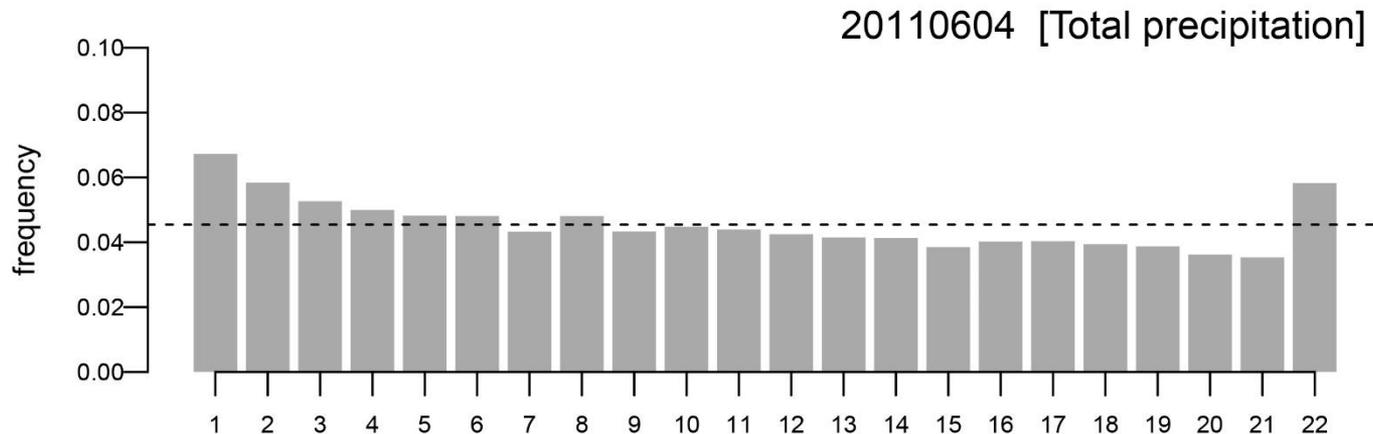


- Good progress in year 1 in most WP2 work tasks – mostly technical/setup so far.
- Unification of UERRA MO/SMHI/MF European domains on CORDEX.
- Delays in initial deliverables (HARMONIE physics ensemble) being discussed.
- Year 2 will provide first datasets and DA frameworks for production runs on year 3-4.
- Now is the time to resolve the WP1->WP2 additional obs for reanalysis!

## Activities 1<sup>st</sup> year

### → Ensemble nudging system (cont'd)

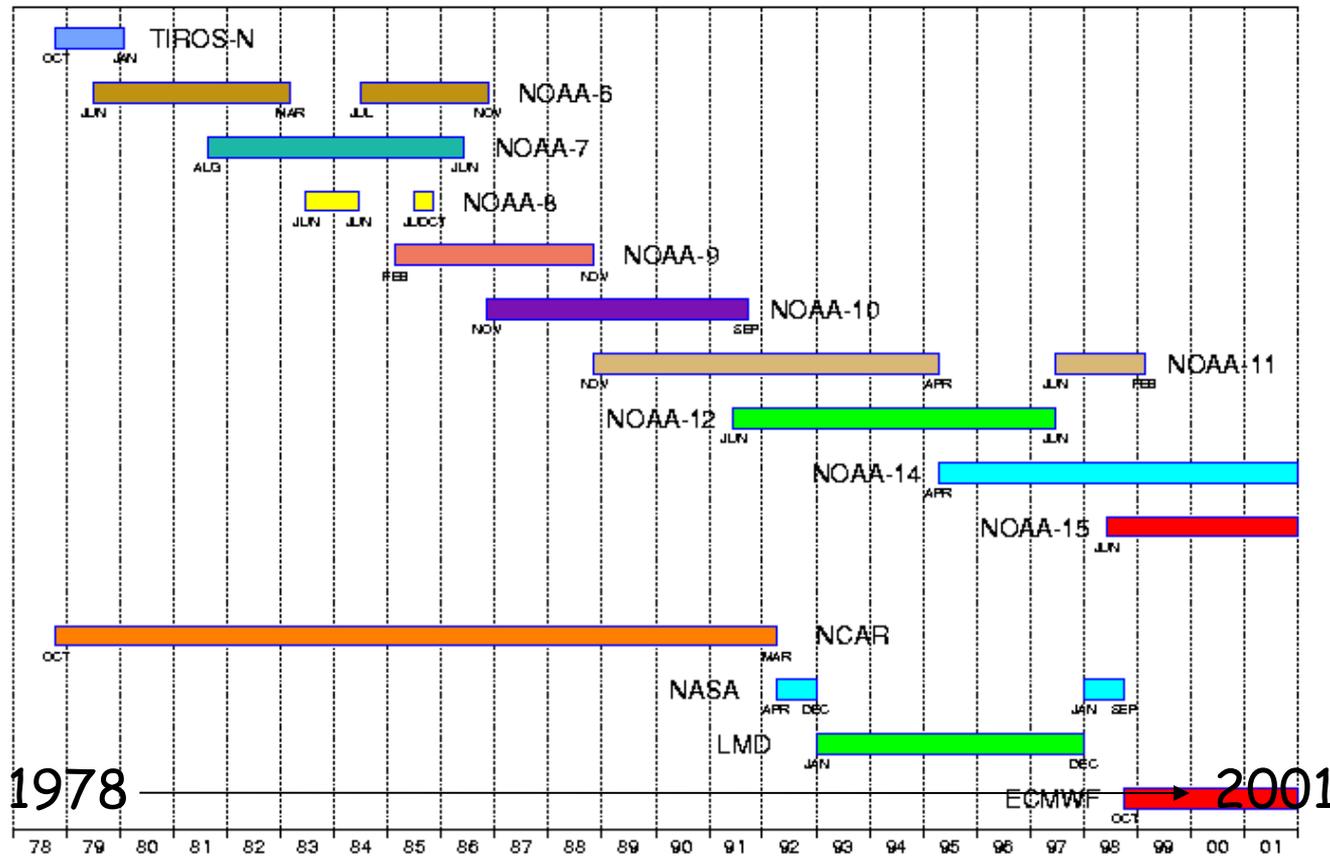
- First experiments run for June 2011 (convective events)



### → Development of pseudo observation strategies

- Idea: Use advanced statistical models to extract information from surface observations for upper-air / boundary layer data assimilation
- Precipitation: Combine rain gauge information and satellite data to 2D precipitation fields → used in LHN

# Satellite Radiance Data



(Amy Doherty)

# EURO4M WP2 Summary

- New reanalysis capabilities built and datasets delivered.
- Research indicates importance of good model, high resolution, advanced DA, assimilation of wide-ranging observations and statistical downscaling.
- Detailed evaluation of reanalyses quality by multiple partners – very promising European climate datasets. Various issues to study further.
- Progress made, but more work to do to homogenize obs datasets.
- Use Of ECMWF MARS allow easy user access to datasets.
- EURO4M provides solid base for UERRA, Copernicus, etc