

Accessing UERRA data in ECMWF MARS

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ECMWF MARS

Meteorological Archive and Retrieval System

- GRIB, BUFR and ODB (NetCDF in the very near future)
- Contains about 200 PB of data (30% increase in the last year)
- Easy access to the Archives via a pseudo-meteorological language (MARS keys)
- Managed archive => the data has to follow a certain structure, based on archiving and retrieval patterns
 - needs to know how the data is going to be produced/used before deciding how to store it
- Tape based



<https://software.ecmwf.int/wiki/display/UDOC/MARS+user+documentation>

Monthly statistics

- 300TB to 400TB delivered to users
- ~4 million requests
- ~3 billion fields
- Up to 5000 active users

Happy user

- Knows how to access data efficiently
 - Reads **efficient retrievals** pages!
- Happy user = happy MARS support

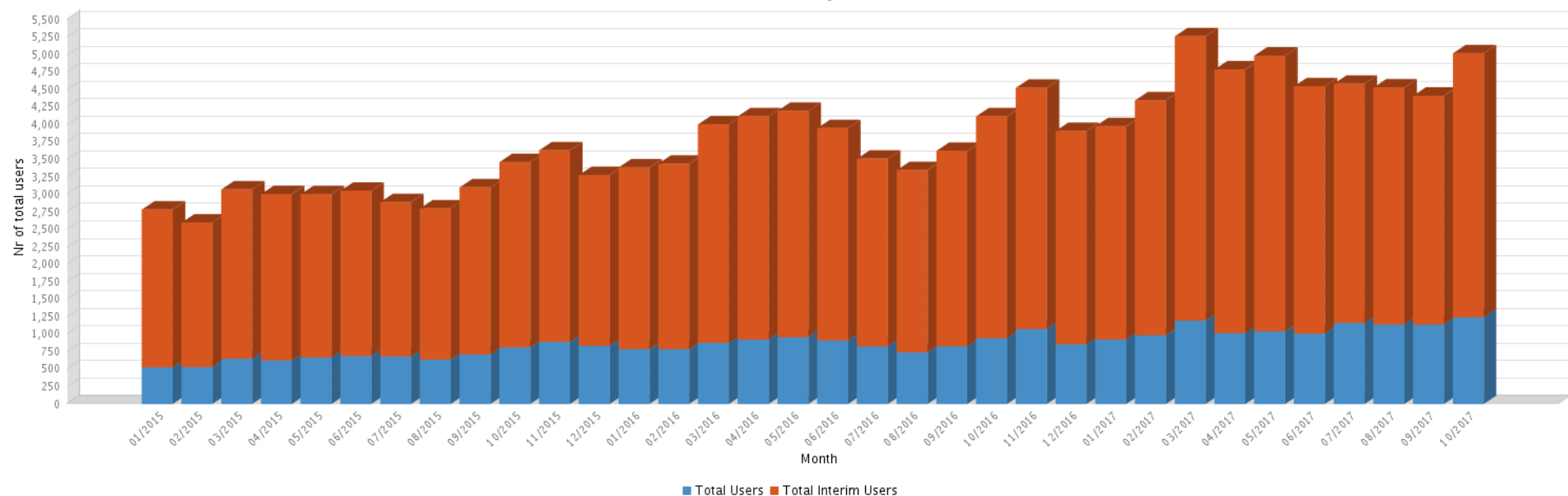


ECMWF MARS

Delivered Volume in TB



Nr of total users per month



<https://software.ecmwf.int/wiki/display/UDOC/MARS+user+documentation>

UERRA datasets

- 9 production datasets from 5 models and 4 centres
 - Deterministic and ensemble reforecasts and reanalysis outputs
 - Different models have slightly different domains
- UERRA common definitions for all parameters
 - Data in WMO compliant GRIB2 format
 - Exact list of run times, steps, levels specified for each output type (an/fc)
- 5 of 9 UERRA datasets fully archived
 - Grand total: 762,937,000,463,558 (693.887 Tbytes)
 - Number of fields: 3,637,248,971
- 3 datasets being archived
 - UM datasets - by January 2018
 - MESAN/V2 and MESCAN-SURFEX - by Xmas 2017

UERRA datasets (MARS set up)

		MARS keys (class=ur)				
		origin	stream	type	number	remarks
Production datasets (expver=prod)						
1	COSMO	edzw	oper	an/fc	-	Out of scope
2	COSMO/En	edzw	enda	an/fc	1..20	Archived
3	HARMONIE/V1	eswi	oper	an/fc	-	Archived
4	HARMONIE/V2	eswi	enda	an/fc	1	Archived; not real eps
5	MESAN /V1	eswi	oper	oi	-	Archived; only tcc
6	MESAN /V2	eswi	enda	oi	1	Xmas 2017; only tcc; not real eps
7	MESCAN-SURFEX	lfpw	oper	an/fc	-	Xmas 2017
8	MESCAN-SURFEX/En	lfpw	enda	an/fc	1..8	Archived
9	UM	egrr	oper	an/fc	-	Jan 2018
10	UM/En	egrr	enda	an/fc	1..20	Jan 2018

- New type=oi created for MESAN data in MARS (using external non-ECMWF GRIB exploring tools it will look like type=an)

UERRA parameters

The screenshot shows the ECMWF UERRA parameters page for 'Surface air relative humidity'. The browser address bar shows the URL: <https://software.ecmwf.int/wiki/display/UER/Surface+air+relative+humidity>. The page header includes the ECMWF logo, navigation links (Spaces, Calendars, Create), and a search bar. The left sidebar lists various parameters, with 'Surface air relative humidity' highlighted. The main content area shows the title 'Surface air relative humidity', created by Richard Mladek, last modified on Sep 22, 2016. It includes a 'GRIB-API definition' table with columns for name, abbreviation, 2r, unit, and paramId. Below this is a 'UERRA details' table with rows for Definition, Validity, and Comment. At the bottom, there is a 'WMO GRIB2 definition' table with columns for Discipline, Parameter Category, and Parameter Number, and a 'Level' table with columns for Type of first fixed surface and specified height level above ground (m).

Pages / ... / Surface level parameters

Surface air relative humidity

Created by Richard Mladek, last modified on Sep 22, 2016

GRIB-API definition

name	2 metre relative humidity	Abbreviation	2r	Unit	%	paramId:	260242
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UERRA details

Definition	The ratio of the partial pressure of water vapour to the equilibrium vapour pressure of water at the same temperature near the surface .
Validity	instantaneous
Comment	Please note that the specific height level above ground might vary from one Centre to another.

WMO GRIB2 definition

Discipline	0	meteorological products
Parameter Category	1	moisture
Parameter Number	1	relative humidity

Level

Type of first fixed surface	103	specified height level above ground (m)

Model specific features

- Model levels
 - COSMO: 1..40
 - HARMONIE: 1..65
 - UM: 1..63
- Soil levels
 - COSMO: 8 soil layers
level borders at 0, 0.01, 0.03, 0.09, 0.27, 0.81, 2.43, 7.29, 21.87 m
 - HARMONIE: 3 soil levels/layers (sot on levels, vsw on layers)
level depths are grid dependent
 - MESCAN-SURFEX: 14 soil layers (only 6 layers for preliminary shorter re-analysis runs)
level borders at 0, 0.01, 0.04, 0.1, 0.2, 0.4, 0.6 m
 - UM: 4 soil layers
level borders at 0, 0.1, 0.35, 1 and 3 m

Model specific features

Surface level parameters output frequencies

<https://software.ecmwf.int/wiki/display/UER/Description>

● Analysis:

- UM, HARMONIE, MESCAN-SURFEX
 - ❖ analysis output in six hourly intervals (at 00/06/12/18UTC)
- MESCAN-SURFEX
 - ❖ precipitation analysis (24 h accumulation from 06 UTC to 06 UTC of next day) output at 06TC
- COSMO, MESAN
 - ❖ hourly analysis outputs for 1..23UTC runs

● Forecast:

- UM, COSMO
 - ❖ forecast output at T+1,2,3,4,5,6,9,12,15,18,21,24,27,30 started at 00 UTC and 12 UTC
 - ❖ forecast output at T+1,2,3,4,5,6 started at 06 UTC and 18 UTC
- HARMONIE (started at 00/06/12/18UTC):
 - ❖ sd, sr, al, rsn, slhf, sshf parameters (derived from ALADIN model driving SURFEX) at T+1,2,3,4,5,6 only
 - ❖ all other parameters at T+1,2,3,4,5,6,9,12,15,18,21,24,27,30
- MESCAN-SURFEX (started at 00/06/12/18UTC):
 - ❖ parameters sp,tp,2r,2t,10si,10wdir, tidirswrf from forecast output at T+6 only (fields from ALADIN model driving SURFEX)
 - ❖ all other parameters from forecast output at T+1,2,3,4,5,6

Model specific features

- COSMO
 - Model levels above 100 hPa not available
 - Step 0 not available in forecasts ("fc") because of nudging
- MESCAN-SURFEX
 - Contains analysis of total precipitation accumulated between 6H of the previous day and 6H of the day encoded in the GRIB2
 - 7 parameters sp, tp, 2r, 2t, 10si, 10wdir, tidirswrf from forecast output archived at T+6 only (fields from ALADIN model driving SURFEX)
- HARMONIE
 - Steps only up to +6H available for parameters derived from ALADIN model driving SURFEX
- UM
 - Model level increases with height MO (opposite to other models)

UERRA web pages at ECMWF

- **Static pages**

- Data portal (not fully updated for datasets with ongoing archiving)
- Issues with data (identified problems)
- UERRA retrieval efficiency (important)
- Support (Contacts, FAQ, Forum..)
- Description of project, parameters, datasets..
- Resources (info from development phase; info about data interpolation/visualization etc)



- **Tracking actual state**

- Progress status (archiving progress)
- Parameter availability
- Data production and archiving schedule (overview of completed and still expected periods to be archived)

Issues with data

Created by Richard Mladek, last modified yesterday at 11:21 AM

- [SMHI datasets \(HARMONIE/V1, HARMONIE/V2\)](#)
 - [Wrong 0% values in relative humidity, cloud cover and albedo fields](#)
 - [Missing values in surface sensible heat flux and surface latent heat flux fields](#)

SMHI datasets (HARMONIE/V1, HARMONIE/V2)

Wrong 0% values in relative humidity, cloud cover and albedo fields

Description:

There are some isolated spots of one or a few grid points with wrong zero values in the fields of relative humidity (both at 2m and on pressure levels). It happened because of a wrong algorithm used for re-computation of the values from 0-1 interval to 0-100% (the supersaturation was set to 100% instead of 0% value).

The same issue can be probably found in cloud cover and albedo fields as well but its extent there is not known.

Missing values in surface sensible heat flux and surface latent heat flux fields

Description:

The sensible heat flux and surface latent heat flux fields appear to have missing values over the land and because of that should not be used.

Like Be the first to like this

No labels



Write a comment...

MARS access to UERRA data

Public users

- **Via dedicated web data portal**
 - Data discovery for specific datasets (ERA, TIGGE, UERRA..)
 - Retrieval of smaller samples up to 1 month
- **Via web MARS catalogue**
 - Hierarchical access to partial data in MARS
 - Retrieval of smaller samples up to 1 month
- **Via ECMWF Web API**
 - Recommended way for downloading of bigger data amount in a programmatic way via internet for use outside the ECMWF

Restricted access (account at ECMWF needed)

- All previous options (full MARS access)
- Via MARS batch requests (command line or Web API)
 - Traditional the most common way in the past (unix shell) for bigger retrievals used within ECMWF's LAN



Type of level

[Soil levels](#)

[▶ Surface](#)

Type

[▶ Analysis](#)

[Forecast](#)

Models

[HARMONIE/V1](#)

[HARMONIE/V2](#)

[UM/4dvar](#)

[UM/En4dvar](#)

[COSMO/En](#)

[MESAN/V1](#)

[MESCAN-SURFEX](#)

[MESCAN-SURFEX/En](#)

About

[Conditions of use](#)

[Documentation](#)

Navigation

[Home](#)

[Public Datasets](#)

[Web-API Activity](#)

[Job list](#)

See also...

UERRA, MESCAN-SURFEX/En

Select a month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		2007	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2008	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		2009	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2010	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Select time

☐ 00:00:00 ☐ 06:00:00 ☐ 12:00:00 ☐ 18:00:00

[Select All](#) or [Clear](#)

Select number

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8

[Select All](#) or [Clear](#)

Select parameter

☐ 2 metre relative humidity ☐ 2 metre temperature ☐ 10 metre wind direction ☐ 10 metre wind speed

☐ Land-sea mask ☐ Orography ☒ Total Precipitation

[Select All](#) or [Clear](#)

[View the MARS request](#) [Retrieve GRIB](#)

[View the MARS request](#) [Retrieve GRIB](#)

Web API

Set of services developed by ECMWF to allow users from the outside to access some internal features and data of the centre.

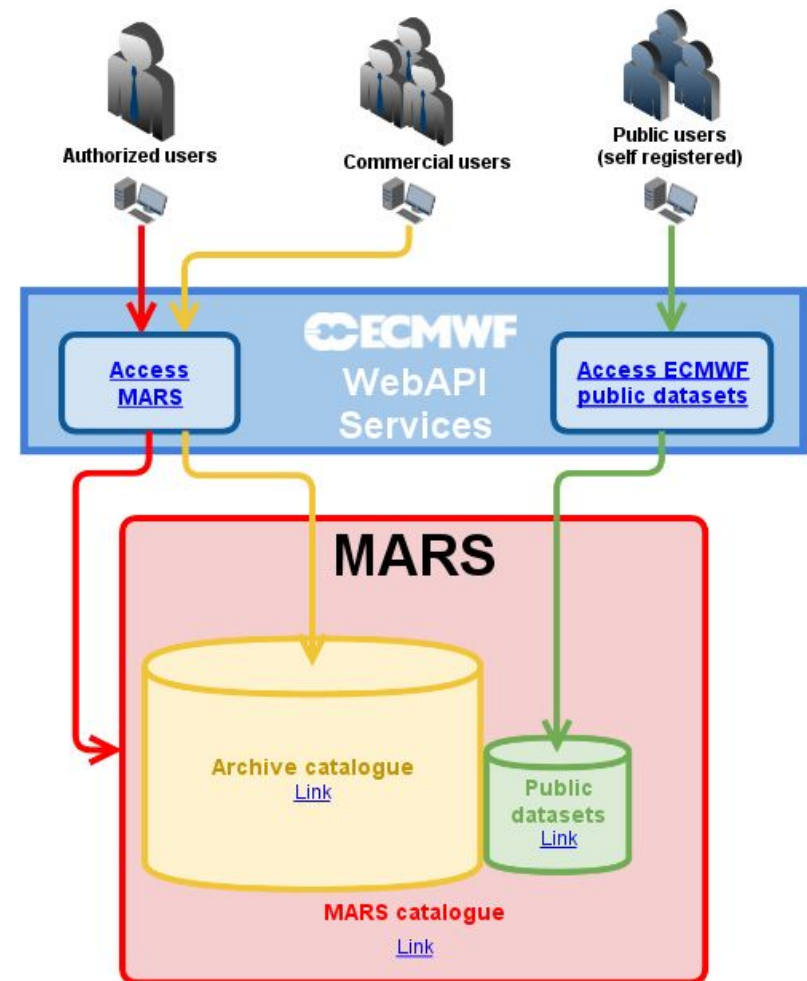
So far 2 services

1. Access MARS

- Most general
- Account at ECMWF required

2. Access ECMWF public datasets

- Public access
- TIGGE, ERA40, S2S, UERRA...



Accessing UERRA via Web API

1. Install ECMWF Web API

- Follow step-by-step guide at <https://software.ecmwf.int/wiki/display/WEBAPI/Access+ECMWF+Public+Datasets>
- Supported only on UNIX platforms (with Python) but generally might be installed and used on any platform
- Examples how to access various public datasets provided

2. Check data availability

- Browse UERRA data portal to check the content
- Click “View the MARS request button”
- Copy the corresponding data retrieval request (python script)

3. Get the data

- **Read UERRA retrieval efficiency page first!**
- Run the python script from the previous step
- Modify and run it for other data request as needed

Accessing UERRA via Web API – Efficient retrievals

- The **data volume** to be retrieved should be **sensible**
 - up to **20GB** per request
- Check that your computer **resources** and limits are **adequate** for the amount of data to retrieve
- The **number of fields** to be retrieved should be also a **sensible** number
 - up to **600.000 fields** per request.

Please read efficient retrieval pages dedicated to datasets like UERRA

Bad practice examples:

- Looping over ensemble members
- Looping over parameters or even steps

Good practice examples:

- Get ALL required ensemble members (when looping over period)
- Get ALL required parameters and steps (when looping over period)

Accessing UERRA via Web API – example

```
#!/usr/bin/env python
from ecmwfapi import ECMWFDataServer
server = ECMWFDataServer()
server.retrieve({
    "class": "ur",
    "dataset": "uerra",
    "date": "2008-01-01",
    "expver": "prod",
    "levtype": "sfc",
    "origin": "eswi",
    "param":
"33/134/151/167/172/173/207/235/3073/3074/3075/228002/228141/228164/260057/260242/260260
/260509",
    "stream": "oper",
    "time": "00:00:00/06:00:00/12:00:00/18:00:00",
    "type": "an",
    "target": "out.grib",
})
```

Output: out.grib



ECMWF tools

ECCODES (successor of GRIB-API)

- Tool for encoding and decoding WMO GRIB1 GRIB2 messages
 - Application program interface accessible from C, FORTRAN and Python programs
 - Contain set of command line tools to give quick access to GRIB messages
- ECCODES v. 18.0 or higher must be used for UERRA

```
--> grib_ls uerra-sample.grib2
```

```
uerra-sample.grib2
```

edition	centre	date	dataType	gridType	stepRange	typeOfLevel	level	shortName	packingType
2	eswi	20100101	an	lambert	0	hybrid	50	t	grid_simple
2	eswi	20100101	an	lambert	0	heightAboveGround	100	t	grid_simple
2	eswi	20100101	an	lambert	0	isobaricInhPa	500	t	grid_simple
2	eswi	20100101	an	lambert	0	heightAboveGround	2	2t	grid_simple

```
4 of 4 grib messages in uerra-sample.grib2
```

```
4 of 4 total grib messages in 1 files
```

Manuals & installation package <https://software.ecmwf.int/wiki/display/ECC>

ECMWF tools

Data interpolation

- Part of ECCODES and used by MARS
- Interpolation of rotated lat-lon or Lambert conformal model outputs used in UERRA not fully supported yet
- New ECMWF's MIR (Meteorological Interpolation and Regridding) tool in preparation

- External interpolation package might be used:

<https://software.ecmwf.int/wiki/display/UER/Data+interpolation+and+visualization>

Conversion to NetCDF

- Part of ECCODES and used by MARS
- Direct conversion UERRA GRIB2 to NetCDF not fully working yet
 - Will be implemented in some future ECCODES version
 - cdo tool compiled with ECCODES works but is not CF compliant

Links

- UERRA at ECMWF: <https://software.ecmwf.int/wiki/display/UER>
- UERRA retrieval efficiency :
<https://software.ecmwf.int/wiki/display/UER/UERRA+retrieval+efficiency>
- UERRA data portal: <http://apps.ecmwf.int/datasets/data/uerra>
- Parameter list: <https://software.ecmwf.int/wiki/display/UER/Parameters>
- Parameter availability:
<https://software.ecmwf.int/wiki/display/UER/Parameter+availability>
- Data interpolation and visualization:
<https://software.ecmwf.int/wiki/display/UER/Data+interpolation+and+visualization>
- ECMWF Web API tutorial: <https://software.ecmwf.int/wiki/display/WEBAPI>
- ECMWF ECCODES: <https://software.ecmwf.int/wiki/display/ECC>
- MARS web catalogue: <http://apps.ecmwf.int/mars-catalogue>
- MARS documentation:
<https://software.ecmwf.int/wiki/display/UDOC/MARS+user+documentation>