



Seventh Framework Programme  
Theme 6 [SPACE]



**Project: 607193 UERRA**

Full project title:  
**Uncertainties in Ensembles of Regional Re-Analyses**

**Deliverable D8.1**  
**Initial review of User requirements**

|                                    |  |
|------------------------------------|--|
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## Introduction

The goal of this document is to prepare and plan for the involvement of third-party data providers and climate service developers as users of the main results of the UERRA project: the ensembles of regional re-analyses, including the associated uncertainties. User involvement is needed in order to assess whether the datasets qualify for the intended use, to prepare guidelines for its use, as well as for users to get acquainted to RA products and their uncertainties.

Within the project external partners are given early access to the UERRA and EURO4M data in order to evaluate the use of regional reanalysis data and products. In many cases these third-parties are data providers and climate service developers themselves. Third-parties are for example the National Meteorological Services which collaborate in the former EUMETNET climate programme, or other registered users of existing reanalyses or observation-based datasets. Dedicated data evaluation workshops will be organized to get feedback from these experienced users ('early adopters'). The workshops will provide guidance and feedback on the use of the ensembles of reanalyses including the associated uncertainty products.

As a potential future Copernicus service on climate change monitoring, UERRA must interface directly with the full range of intermediate- and end-user from sectors like disaster prevention, health, energy, water resources, ecosystems, forestry agriculture, transport, tourism and biodiversity. The needs of the stakeholders (e.g. the impact community and decision makers) for climate data and products cover a large range of raw or derived variables, indicators, spatial and temporal scales, and uncertainty quantifications at various levels of complexity. The stakeholder community however is diverse and in many cases not well organized. This makes it difficult to obtain uniform feedback for the multi-purpose products. For this reason it was decided for this user feedback activity of the project to focus on only a few specific user groups instead of trying to reach all users.

### **Third-party workshops to evaluate re-analyses data and products**

Two workshops will be organized within UERRA to facilitate early access to the UERRA and EURO4M data for external partners in order to evaluate the use of regional RA data. A first workshop will be organized by KNMI together with DWD for the evaluation and feedback from early adopters, approximately in the middle of the project, and using mostly the reanalysis products from EURO4M (listed in the ANNEX 1 to this document).

Policy makers and stakeholders at national as well as European levels will be invited to the workshop to get early indications of the user requirements. On the basis of the evaluation material and guidance developed in WP3, this effort will assess whether the reanalysis data are fit for their intended use. A second workshop will be held during the last year of the project in order to embrace the feedback from users into a guidance on the use of the RA data.

In part 1 of this document a review of existing user consultations performed by EURO4M and other related projects is given.

The plan for the first workshop is outlined in part 2. The workshops also provide the opportunity to facilitate evaluation of the reanalysis ensemble using independent (and often access restricted) national observational data brought in by third-party participants. Together with WP3, this effort will assess whether the reanalysis data are fit for their intended use.



## Part 1-Review of existing user consultation reports

Several European projects included efforts to assess the requirements of users of climate information, some specifically focusing on re-analyses. Some of the results of these efforts provide useful background information for the UERRA Work package 8 (User Feedback). The results of these efforts have been analyzed and are briefly summarized below.

### **EURO4M: Main conclusions from: “Meta user requirements document for the user needs across the range of user communities”, and “Two workshops to support user feedback and dissemination of EURO4M products and services”**

In two documents produced by the EURO4M project the following feedback from users was reported:

- Full free and easy access to climate data is the requirement with the highest priority for most of the users;
- User guidance and training clearly needed. Setting up a User Forum was suggested as a way to more directly share experiences and feedback.
- Next to the comprehensive documentation of datasets, short (say 3-page max) documentation would be helpful for user for the first step to select a useful datasets for a specific user.
- Users would appreciate well documented, basic tools to manipulate, analyse, and present the data. This would also help user evaluation of the dataset for specific use.
- Information on the homogeneity of the data (especially from satellite instruments) that cover several decades and different sensors, is a key requirement, especially when users are interested in trends
  - Some users, e.g. working in the solar energy sector, hydrology, and climate (impact) monitoring expressed a need for HR regional climate information, with sustained regular future updates;
  - Several users focus on weather extremes, which often requires high resolution data in both space and time (e.g. 25km/daily resolution or higher). Putting recent observed extremes in historical perspective requires a timely delivery of the re-analysis product (one week to a few months after the extreme occurred) and the availability of long term reference dataset.
  - Multiple datasets of the same variable are useful to assess the uncertainties, but the differences between the datasets should be well documented.

### **CORE-CLIMAX workshops and survey**

As part of the CORE-CLIMAX project an extended survey was held to assess the benefits and gaps in re-analyses as part of growing climate services. About 2500 users responded, the majority working in the field ‘climate’. Many of them used primarily the global re-analyses products from ERA-Interim. This survey revealed that nearly half of the respondents were not well informed about the observations that were used as input to the re-analyses. Most of them were not aware of the observation feedback archive facility that was prepared as part of the ERA-Clim project. Providing proper documentation/guidance and easy access to these observation and feedback data could therefore be a significant improvement of the service.

In this survey, users indicated that the three products they want most are:

- Gridded data sets based on observations;
- Statistics based on observations;
- Homogenized weather station data.



The survey was based on an exceptionally large group of respondents. Collaboration with representatives from this group could be helpful to further developments of re-analysis based climate services.

Another user-oriented activity of CORE-CLIMAX project was the development of the 'Maturity Matrix' for climatological datasets. This matrix facilitates users who want to assess the quality and reliability of the of climate data. 'Mature' does not necessarily imply a high quality dataset, but it means that certain information is in place that allows users to assess whether a dataset is fit for a certain application. The criteria to assign a high level of 'maturity' to a specific dataset can therefore be interpreted as additional user requirements for data products.

These criteria for 5 different aspects are summarized below.

- Software readiness: compliant with standards, user documentation, security
- Metadata: compliant with standards, discovery metadata, frequent updates
- User Documentation: papers on methodology, user guidance, validation, and uncertainty
- Uncertainty characterization: traceability, intercomparison studies, quantitative information
- Public Access, Feedback, Update: source code availability, full version control, fast update/response to feedback

**CLIPC: Conclusions from the project deliverable 'User requirements, part 1: Strategies for user consultation and engagement and user requirements: Synthesis from past efforts'**

This document already provides a summary of user consultations done by a large number of European, regional, and national projects: these will not be repeated here.

Goal of CLIPC is to create a well-functioning user-oriented portal for climate observations and projections data and an impact indicator toolbox. Although this is quite different from the goal of the UERRA project, which is to produce an ensemble of regional re-analyses, some conclusions of this CLIPC report is relevant for the User Feedback workpackage of UERRA.

Since there is a wide variety of users of climate information, CLIPC distinguishes, for practical reasons, four categories of users, i.e. *Climate Scientists, Impact Researchers, Intermediaries, Societal end users*. The first two categories, *Climate scientists and climate impact researchers*, generally have a relatively high level of knowledge about climate change and the possibilities and limitations of climate data. Impact researchers are interested in the effects of hydrology, ecosystems, agriculture, health, etcetera. Processed data, like climate impact indices, are relevant for impact researchers intermediaries and societal end users. Particularly, indices on extreme events and on worst or best case scenarios appear to be relevant from an impact perspective. Only the more advanced users are familiar with e.g. frequencies of extremes and uncertainties (the focus of UERRA). Although the ambition is to serve all four user categories, for the development of the service UERRA will therefore in first instance focus on climate and impact scientists.

Since a focus of UERRA is the quantification of uncertainty in the data, the following conclusion from the CLIPC report is very relevant:

*"Users require information about uncertainty (e.g., types of uncertainty included, quantification of uncertainties and/or qualitative information, etc.), information on biases in the data and on robustness. However, the 'climate scientists' category is also likely to have a different perception of the concept of 'uncertainty', meaning areas for further research, whereas the other three categories may view the different aspects of uncertainty as more undesirable and problematic. The term uncertainty is a catch-all phrase, itself often with a vague definition. There is experience with some*



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*infographic presentation of uncertainty for e.g. weather forecasts (green, yellow, and red colouring). Climate adapt provides useful guidelines on dealing with uncertainty.”*

**CLIPC: Conclusions from the project deliverable ‘User requirements, part 2: Climate (impact) data requirements of different user groups’**

This report contains an assessment of user requirements for the CLIPC information portal and the impact indicators toolbox, based on an online user survey with 90 respondents, 25 interviews, and a user requirements workshop with 38 participants.

Some conclusions are relevant for the UERRA User Feedback workpackage:

- 1 A majority of the respondents go to the national meteorological services to retrieve climate data and climate impact indicators.
- 2 For 25% of all respondents “information on uncertainty” was a major weakness of climate data portals (higher percentages for the categories “climate scientists” and “impact researcher”, lower percentages for the others). This was consistent with the requirement for uncertainty information in the meta data and on maps of the data.
- 3 Guidance is needed on the quality of the datasets (‘known limitations’, bias corrections), and on the interpretation of uncertainty information



## **PART 2 - Plan for the User Feedback Workshops**

As part of Workpackage 8.1 (User Feedback) of UERRA two user workshops will be organized, one half way, and one at the end of the project. Both workshops will be different in set-up, since at the time of the first workshop the UERRA data products will not yet be delivered. However, for both workshops the goal is to serve both users and providers.

### **Goals of the Workshops**

For users:

- Sharing experiences with other users and providers of re-analyses data
- Getting advice from the producers of re-analysis datasets for specific applications
- Learning about qualities and deficiencies of (regional) re-analyses data
- Getting informed on future re-analyses products
- Learning how to use of uncertainty information
- Learning how to assess the value of re-analyses data in a user environment
- Learning how to assess fitness for a specific purpose
- Tips&Tricks&Tools for using and evaluating re-analyses
- Improving (future) support for users of re-analyses data

For providers:

- Preparing for better services to users of re-analyses data
- Stimulating (proper) use of the data
- Contributions to the assessment of user needs (data specification, tools, guidance,...)
- The possibility to find new independent observations that can be used for validation

An addition, a goal of the first workshop is also to collect ideas for an effective second user workshop at the end of the UERRA project.

### **-Below an outline is sketched for the first user workshop-**

#### **Programme**

Ideally, the workshop should be a combination of short (e.g. 10 min.) presentations by users: showing how re-analyses data was used, results from validation work in 'user space', illustrating specific user needs; and by providers: providing background information on data assimilation, uncertainty estimation, validation activities and future UERRA products. A significant part of the time should be dedicated to discuss the issues user bring up during their presentations. Providers/users exchange experiences using/producing regional re-analyses from the EURO4M project, as well as discuss the future use of UERRA results.

#### **Participants**

In order to meet the workshop goals for both providers and users, finding experienced users of re-analyses data is important. Most of the data providers within the project keep track of users of the regional re-analyses data through registration, data downloads, or otherwise. These users may be invited to participate in this workshop. Another possibility is to select (e.g. within the EUMETNET network) NMHSs using re-analyses for their services. The success of the workshop most likely depends more on the number of (experienced) users actively participating and less on the total number of participants. When all users give a short presentation on their experience using re-analyses data, the optimal number of users would be between 10 and 15.



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### **When & Where**

It is proposed to extend the third UERRA General Assembly (1-3 February 2016) with one (or one and a half) day to make room for this first workshop (e.g. start of the workshop on Wednesday afternoon 3 February, after the end of the GA, and continue Thursday 4 February until noon. The collocation of the workshop with the GA limits the travel of the UERRA partners contributing to the workshop.

### **Resources needed**

All partners of UERRA consortium should participate in the workshop, presenting and discussing EURO4M and expected UERRA re-analyses products and services with users. There should be a few more general 'lectures' providing background information on (regional) re-analyses, validation methods, and uncertainty estimations.

A lecture room (30-40 people) should be available at Météo France Toulouse.

In order to stimulate sufficient user participation, some financial support for non-UERRA participants would be helpful (<10k€ in total).

### **Time schedule**

April 2015 - The UERRA project management agree to the approach and set-up of the first workshop

June 2015 - More detailed workshop programme

August 2015 - List of potential participants

September 2015 – Invitations & Flyer

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## ANNEX 1 - Overview of available datasets from EURO4M

The Global Climate Observing System (GCOS) established a list of Essential Climate Variables (ECV's) that need to be measured in order to monitor the climate effectively.

The table gives pointers to the observation datasets and the reanalyses datasets of several atmospheric ECV's which have been developed as part of EURO4M.

|    | <u>Essential Climate Variable</u>                             | Datasets  | Res. Inst. | Area  | Spatial Res.       | Temporal Res. | Period                   | Form at | Reference   |
|----|---|---|------------|---|--------------------|---------------|--------------------------|---------|---|
| 1* | Precipitation   | <a href="#">Alpine precipitation grid dataset (EURO4M-APGD)(D1.1)</a>           | MS         | European Alps and adjacent flatland           | 5 km               | daily         | 1971-2008                | NedC DF | <p><a href="#">Factsheet: Alpine Precipitation Grid Dataset.</a> </p> <p><a href="#">Isotta, F.A. et al., 2013: The climate of daily precipitation in the Alps: development and analysis of a high-resolution grid dataset from pan-Alpine rain-gauge data. Int. J. Climatol., 34 (5), 1657-1675.</a></p>                                |
| 2* | Atmospheric surface variables                                 | <a href="#">European Climate Assessment &amp; Dataset (ECA&amp;D).</a>          | KN MI      | Europea, North Africa and the Middle East     | point data         | daily         | 1775-present             | ASCII   | <p><a href="#">Factsheet: Daily station data - ECA&amp;D (European Climate Assessment &amp; Dataset).</a> </p> <p><a href="#">Klein Tank, A.M.G. and Coauthors, 2002. Daily dataset of 20th-century surface air temperature and precipitation series for the European Climate Assessment. Int. J. of Climatol., 22, 1441-1453.</a></p> |
| 3  | Air temperature, pressure, precipitation                      | <a href="#">Updated and merged Mediterranean station dataset (D1.12, D1.13)</a> | URV        | All countries bordering the Mediterranean Sea | point data         | daily         | 1850-1970                | ASCII   | <p><a href="#">Factsheet: Merged climate dataset for the Mediterranean.</a> </p>   |
| 4  | Air temp., Surface soil temperature, Precipitation, Sea level | <a href="#">Daily gridded datasets Romania</a>                                  | NM A-RO    | Romania                                       | 0.10 x 0.10 degree | daily         | 1961-01-01 to 2013-12-31 | netC DF | <p><a href="#">Factsheet: Daily gridded datasets Romania.</a> </p>   |



|    |   |  |       |   |                |         |              |  |
|----|---|--|-------|---|----------------|---------|--------------|--|
|    | pressure, Cloud cover, Sunshine duration, Relative humidity |  |       |   |                |         |              |  |
| 5* | Air temperature, pressure, precipitation                    | <a href="#">E-OBS gridded dataset (D1.4).</a>  | KN MI | Europea, North Africa and the Middle East | 25 km or 50 km | daily   | 1950-present | NetC DF<br><br><a href="#">Factsheet: E-OBS gridded dataset (D1.4).</a><br><br><a href="#">Haylock, M.R., N. Hofstra, A.M.G. Klein Tank, E.J. Klok, P.D. Jones and M. New. 2008: A European daily high-resolution gridded dataset of surface temperature and precipitation. J. Geophys. Res (Atmospheres), 113, D20119, doi:10.1029/2008JD10201</a><br><br><a href="#">Besselaar, E.J.M. van den, M.R. Haylock, A.M.G. Klein Tank en G. van der Schrier, A European Daily High-resolution Observational Gridded Data set of Sea Level Pressure J. Geophys. Res., 2011, 116, D11110, doi:10.1029/2010JD015468</a> |
| 6* | Air temperature, pressure, precipitation, water vapour      | <a href="#">CRU/UEA gridded data products (D1.6).</a>  | UEA   | Global (European window available)        | 0.5 degree     | monthly | 1901-2011    | ASCII<br><br><a href="#">Factsheet: CRU/UEA Data Products</a>  |
| 7  | Precipitation   | <a href="#">Global Precipitation Climatology Centre (GPCC) full data reanalysis version 5 (D1.3)</a> | DWD   | Global (European window available)        | 0.5 degree     | monthly | 1901-2009    | ASCII<br><br><a href="#">Becker, A. et al., 2013: A description of the global land-surface precipitation data products of the Global Precipitation Climatology Centre with sample applications including centennial (trend) analysis from 1901-present.</a>  |



|     |   |   |            |  |             |  |   |        |  |
|-----|---|---|------------|--|-------------|--|---|--------|--|
|     |   |   |            |  |             |  |   |        | <a href="#">Earth Syst. Sci. Data, 5, 71-99, doi:10.5194/essd-5-71-2013</a>  |
| 8*  | Precipitation   | <a href="#">Integrated HOAPS/GPCC precipitation gridded dataset (D1.8).</a>                 | DWD        | Global (European window available)       | 0.5 degree  | monthly                                    | 1987-2008   | NetCDF | <a href="#">Factsheet: Integrated HOAPS/GPCC precipitation data.</a>   |
| 9*  | Surface radiation budget  | <a href="#">Surface solar irradiance (SIS) gridded dataset (D1.7).</a>                      | DWD        | Europe, North Africa and the Middle East | 0.03 degree | monthly                                    | 1983-2005   | NetCDF | <a href="#">Factsheet: Surface solar irradiance (SIS).</a>   |
| 10* | Water vapour  | <a href="#">ATOVS water vapour gridded dataset (D1.9).</a>                                  | DWD        | Global (European window available)       | 90 km       | monthly                                    | 1999-2012   | NetCDF | <a href="#">Factsheet: ATOVS-based gridded dataset of Integrated Water Vapor.</a>  |
| 11  | Surface radiation, precipitation, cloud properties                                  | <a href="#">MSG-based gridded datasets of clouds, precipitation and radiation (D1.10).</a>  | KNMI       | Europe, incl. North Africa               | 3 km        | 15 minutes                                 | 2005-present  | NetCDF | <a href="#">Factsheet: High-resolution datasets of precipitation, SSI and cloud properties for the MSG period (2005-present).</a>  |
| 12  | - Daily surface min. and max. temperature,<br>- Daily and monthly sunshine duration | <a href="#">SEVIRI-based gridded datasets of temperature and sunshine duration (D1.11).</a> | Met Office | Europe                                   | ~4-10 km    | Temperature: daily<br>Sunshine: 15 minutes | Temperature: 2012-2013<br>Sunshine: 2009 - early 2012 | NetCDF | <a href="#">Factsheet: SEVIRI Daily Minimum and Maximum Surface Temperature.</a><br><a href="#">Factsheet: SEVIRI Daily and Monthly Sunshine Duration.</a><br><a href="#">Report: Daily Minimum and Maximum Surface Temperatures from SEVIRI.</a><br><a href="#">Good, E., Estimating daily sunshine duration over the UK from geo-stationary satellite dataVIRI Daily Minimum and</a> |



|     |   |   |            |  |             |          |           |        |   |
|-----|---|---|------------|--|-------------|----------|-----------|--------|---|
|     |   |   |            |  |             |          |           |        | <p><a href="#">Maximum Surface Temperature, Weather, December 2010, Vol. 65, No. 12, 324-328. doi: 10.1002/wea.619</a></p> <p> _</p> <p><a href="#">Kothe, S., Good, E., Obregón, A., Ahrens, B., Nitsche, H., 2013, Satellite-Based Sunshine Duration for Europe. Remote Sens. 2013, 5, 2943-2972; doi:10.3390/rs5062943</a></p> <p></p> |
| 13* | Atmospheric surface and upper-air variables | <a href="#">4D-VAR regional reanalysis (D2.1)</a>               | Met Office | Europe, North Africa and the Middle East | 12 km       | 6 hourly | 2008-2009 | NetCDF | <p><a href="#">Factsheet: Met Office 4D-VAR Reanalysis.</a></p> <p></p>  |
| 14* | Atmospheric surface and upper-air variables | <a href="#">3D-VAR regional reanalysis (D2.3)</a>               | SMHI       | Europe, North Africa and the Middle East | 0.2 degree  | 6 hourly | 1989-2010 | GRIB   | <p><a href="#">Factsheet: HIRLAM 3D-VAR dynamical downscaling re-analysis.</a></p> <p></p>   |
| 15  | Atmospheric surface variables               | <a href="#">MESAN 2D surface downscaling reanalysis (D2.4)</a>  | SMHI       | Europe, North Africa and the Middle East | 0.05 degree | daily    | 1989-1997 | GRIB   | <p><a href="#">Factsheet: MESAN 2D surface downscaling re-analysis.</a></p> <p></p>  |
| 16  | Atmospheric surface variables               | <a href="#">MESCAN 2D surface downscaling reanalysis (D2.6)</a> | MF         | Europe                                   | 0.05 degree | 6 hourly | 2007-2010 | netCDF | <p><a href="#">Factsheet: Surface downscaling reanalysis.</a></p> <p></p>  |