PROJECT FINAL REPORT

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Summary report

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Executive summary

The Mediterranean and the Middle East are expected to experience substantial climate changes and associated adverse impacts of these changes in the 21st century. This will result in major challenges related to energy- as well as water demand and supply, to name but two of the major issues. It will be essential to deal with the undesirable economical and societal consequences of these impacts and to develop and manage appropriate mitigation and adaptation strategies cooperatively in the region. These challenges are increasingly recognized as a high priority policy issues and will require engaging relevant national, regional and international entities into an integrated study of regional climate change, its impact and associated policy issues related to mitigation and adaptation. One of the prerequisites to do so is the availability of data and information on current conditions as well as on future projections in the fields of climate, energy and water. The main goal of the DARECLIMED project lies in the preparation towards the implementation of a regional data infrastructure devoted to climate, water, energy and related topics.

To this end the project has set up expert groups and carried out studies and networking activities aimed at regional climate stakeholders (research institutions, public authorities, relevant state agencies, NGOs, etc.), in the region in order to raise awareness and engage key actors. This is meant to enable addressing more specific objectives including:

i. creating the appropriate conditions for the formation of a regional data infrastructure devoted to climate, energy and water related data;

ii. contributing to a climate change study through sharing and comparing numerical climate model results;

iii. develop capacity building initiatives and incubation activities for future collaborative climate research in the eastern Mediterranean.

DARECLIMED focused on the eastern Mediterranean and major institutions in southeastern Europe, the Middle East and North Africa. While many of the objectives set for the project have been reached, we faced a number of major challenges that were both somewhat unforeseen and clearly beyond the influence of the coordinator and the consortium partners, including:

i. the limited experience of some of the partners in carrying out EU-funded research in general and an unfamiliarity of the concepts of digital data repositories, in particular;

ii. the legal limitations as to the possible provision of data by stakeholders and data-holding agencies in the countries addressed, particularly with regard to the water- and energy sector;

iii. the openly expressed reluctance to cooperate in the context of DARECLIMED because of the membership of Israeli partners in the project consortium;

iv. the significant repercussions of "Arab-Spring-" related transformations on the functioning of institutions and agencies and their resultant inability/reluctance to cooperate with DARECLIMED.

Despite of these challenges, we were able to finalize all of the planned deliverables and to hold a series of workshops in a number of countries in the region. The final conference on "Sharing data and information in the Eastern Mediterranean and the Middle East" in Chania, Crete, Greece on 23-25 July 2013 was an impressive demonstration of the willingness of the participants to engage in the difficult but ultimately rewarding task of compiling and maintain a data repository on climate, water and energy in the Eastern Mediterranean. The Chania Declaration, which resulted from this conference, is a lasting testimonial to this determination and a significant result of the DARECLIMED project.

Summary description of project context and objectives

Background and Introduction

Recent climate projections have highlighted the Eastern Mediterranean, the Middle East and North Africa as a region particularly affected by an increase of anthropogenic greenhouse gases and future climate change (Giorgi, Geophys. Res. Lett. 33, L08707, doi:10.1029/2006GL025734, 2006, Diffenbaugh et al., Geophys. Res. Lett. 34, L11706, doi:10.1029/2007GL030000, 2007). Manifestations of such changes include a strong increase in summer temperatures, heat wave intensities and duration, decreasing precipitation and prolonged drought periods, with severe consequences for environments and societies in the region. These comprise for example threatened environmental integrity and loss of biodiversity, challenges to maintaining food security, water quantity and quality, air quality, public safety and health hazards. The economic consequences of such impacts may significantly affect the economic development of the countries in the region and may enhance societal and political tensions.

Figure 1: *Approximate delineation of the DARECLIMED study region*

Given the current consensus as to the strong signals of current climate change, there is an urgent need to address climate change impacts through appropriate and effective adaptation and mitigation strategies. More detailed, regional climate modeling (through, e.g., regional climate models or statistical downscaling algorithms) reveals distinct patterns of climate change and its manifestations in the study region (Figure 1). Therefore, adaptation strategies will have to be tailored to emerging impacts on a sub-regional or national scale. This, in turn, may have far-reaching consequences for European and international policymaking, as individual countries may request or demand assistance and/or coordination of adaptation policies.

Ever since the project started, some of the countries of the Middle East and North Africa, which form an integral part of DARECLIMED have seen dramatic political and societal transformations, commonly coined "Arab Spring". These transformations not only add a completely new dimension to what has been outlined above, they also have strongly affected work in DARECLIMED. With the priorities and attention of government institutions shifting towards the rapid changes in structures and policies, the receptiveness of these institutions to engage in discussions on data exchange and data provision has rapidly deteriorated. This had significant repercussions on the progress and the results attained in DARECLIMED, as described in more detail below.

Climate Research and Climate Data in the MENA Region[2]

Climate research -by definition- relies on continuous data records for at least several decades (the World Meteorological Organization, WMO, requires at least 30 years). However, extended data records are also needed in order to specify the current and past climate conditions of a region in terms of trends, means, variability and extremes. This is required to define the so-called baseline scenarios, which also serve as the starting point for comparisons with future climate scenarios as derived from numerical climate models. The reconstruction and interpretation of temporal and spatial patterns of climate in earlier centuries is a prerequisite for assessing the degree to which the industrial period is unusual in comparison to natural climate variability. Thus, in order to delineate possible changes in climate characteristics of a region, its current climate and that of the recent past has to be known with certainty. While numerical climate projections usually cover a given study area on a regular grid, climate data are often provided with a much sparser, irregular coverage. Thus, every effort will have to be spent to provide as much data coverage as possible to enable comparability between observational data and climate projections.

Despite the fact that Eastern Mediterranean (Figure 1) offers of a significant range of documentary data as well as high and low spatio-temporally resolved natural marine and terrestrial proxies (tree rings, speleothems, corals and boreholes, etc.), climate data for longer time spans with adequate spatial and temporal coverage as well as of sufficiently high quality are scarce (e.g. Xoplaki 2002, PhD thesis; http://www.giub.unibe.ch/klimet/docs/phd_xoplaki.pdf). While this is not a problem specific to

[2] Middle East and North Africa

the present study region, which is shared in many other parts of the world, the cultural background and the history of science in some of the countries of the study region accentuate the issue of data scarcity at least for some of the sectors under consideration. A widespread reluctance to share data between different organizations and national meteorological and hydrological services within and between countries of the region also is not unprecedented. However, these facts represent important obstacles for effective climate research and planning.

The World Meteorological Organization (WMO) in Geneva has adopted two resolutions on the international exchange of meteorological and hydrological data and products. While they are not binding, they represent an internationally agreed framework for this kind of exchange (Res40Cg-XII *WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities* and ANNEX 4 TO WMO RESOLUTION 40 *(Cg-XII) definitions of terms in the practice and guidelines*).

These documents state: "As a fundamental principle of the World Meteorological Organization (WMO), and in consonance with the expanding requirements for its scientific and technical expertise, WMO commits itself to broadening and enhancing the free and unrestricted exchange of meteorological and related data and products"

However, data remain the property of the countries that generated them, which have the right of taking any decision concerning their dissemination and distribution.

Moreover, the harmonization of atmospheric variables to detect and attribute past and present climate trends and to predict scenarios of future meteorological extreme events is a crucial issue for the reliability of analysis results. However, commonly accepted "good practices" for quality control, artificial breakpoint detection and homogenization in the region have only recently been applied (e.g. Kuglitsch et al., J. Geophys. Res., 114, D15108, doi:10.1029/2008JD011606, 2009).

This is a particularly critical as well as an extremely demanding issue (see Kuglitsch et al. 2009). However, without agreed protocols on data quality and data harmonization (i.e., with regard to measurements of a given quantity through different methods and/or instruments), any exchange of data remains less meaningful. In addition, data will have to be represented on a common platform in the framework of a dedicated Geographical-Information-System (GIS) application. This will enable, e.g., the detection of statistical or physically based relationships between individual parameters that would otherwise remain unnoticed.

Present climate conditions as well as future climate development is but one of the determining factors for the future of the countries in the present study region. Two sectors of immediate interest and considerable importance with regard to the impacts of possible climate changes are the energy and the water sectors.

Water is of relevance in the physical, biological and socio-economic systems and is an essential resource for human populations and for animal and plant communities. It directly influences the energy supply, tourism, forestry and agriculture and services from natural and semi-natural ecosystems. Anticipated changes in summer temperatures and decreasing precipitation will have direct consequences for energy demand. In order to maintain sufficient comfort in indoor spaces, increasing cooling and air-conditioning will be needed. The growing gap between needed potable water and reduced water availability will require additional energy consumption for seawater desalination. Satisfying these additional needs through conventional, hydrocarbon energy sources will result in enhanced greenhouse gas emissions and will constitute an undesirable positive feedback to climate change.

What has been outlined above with regard to climate data can similarly be said for data on water availability and water use as well as for energy production and consumption. Thus, given the need to not only consider climate change as a phenomenon of regional importance but even more so to assess the impacts of such changes, basic data on the water and energy sectors should be compiled, compared, harmonized and made available by the countries of the region under consideration.

State-of-the art climate research relies on access to significant computer resources for data storage, handling, analysis and distribution as well as for numerical modeling and the generation of climate projections for the study region. To that end, results of global climate models (GCMs) need to be down-scaled in order to derive information suitable to assessments of possible climate change impacts. Depending on the methodology employed (statistical or dynamical downscaling or regional climate models – RCMs), this implies computation-intensive activities and sufficient computational resources capable of high-performance computing. In the Eastern Mediterranean, such resources are scarce as well, they are not widely shared between regional actors and their use is not coordinated.

As mentioned above, RCMs are currently employed in order to derive sufficiently detailed climate projections in the region. However, similar to GCM simulations, results of different RCMs when employed for a given region often show significant differences in terms of variability, mean and trends. This calls for a thorough inter-comparison between different regional models in order to derive more consistent and more reliable projections of climate development over the coming decades. While this has been carried out for large parts of Europe by, e.g., the EU PRUDENCE project (http://prudence.dmi.dk/), the region comprising the Eastern Mediterranean, the Middle East and North Africa have not yet been covered. Thus, there is a clear need to

develop a framework for such inter-comparison activities including an objective probabilistic estimate of uncertainty in future climate for the study region (Figure 1).

A number of existing European or global projects with goals related to or overlapping with those of DARECLIMED will be taken into account; coordination and cooperation will be ensured, in order to create maximal synergies. This will concern notably:

- GEO, the intergovernmental Group on Earth Observations, was established in 2005 to support the implementation of a Global Earth Observation System of Systems (GEOSS; Figure 2). The vision for this GEOSS is to realize a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations and information. Consistently, GEO has initiated a series of actions to improve monitoring of the state of the Earth, increase understanding of Earth processes, and enhance prediction of the behavior of the Earth system. As a sustainable, comprehensive and coordinated observation "system of systems", GEOSS will work with and build upon existing national, regional, and international systems to provide comprehensive, coordinated Earth observations, transforming the data they collect into vital information for society.

Figure 2: *Overall framework of the Global Earth Observation System of Systems (GEOSS)*

- The MEditerranean climate DAta REscue project (MEDARE; http://www.omm.urv.cat/MEDARE/index.html) is an initiative, initiated under the auspices of the World Meteorological Organization, with the main objective to develop, consolidate and progress climate data and metadata rescue activities across the Greater Mediterranean Region (GMR). Its long-term goals comprise the development of a high quality instrumental climate dataset for the Greater Mediterranean Region (GMR). MEDARE aims to achieve a number of sustainable development goals by providing Decision and Policy makers in all climate sensitive sectors in the region with the most scientifically sound and longest climate data sets. These include, for example, access to longer time series for assessing impact/sector models. Ultimately, MEDARE products will be used in defining and/or adopting optimal strategies to mitigate climate change, and for improving and/or developing plans, activities and operations in adapting to climate change impacts across the GMR.
- In the context of the project Climate Change and Impact Research: the Mediterranean Environment (CIRCE; http://www.circeproject.eu/) investigations on climate change based on scientific data and also in connection with economic and social impacts are being carried out. The project involves 64 partners from Europe, the Middle East and North Africa, (61 of which are research institutions), working together to evaluate the best strategies of adaptation to the impacts of climate change in the Mediterranean. The project started in 2007 and will end in 2011. In CIRCE, the role of public engagement is regarded as fundamental, especially at the local level. Case studies and specific participative methods are designed to achieve this result. CIRCE performs and analyzes climate model simulations in the Mediterranean area in view of global climatic change, to assess the evolution of radiative fluxes, the water cycle, cloudiness, aerosol pollution and extreme events (e.g. intense precipitation, floods). CIRCE estimates impacts on agriculture, ecosystems, forests, air quality and human health. Special emphasis is placed on economical and societal consequences, e.g. regarding tourism, energy markets and migration. CIRCE is a European "integrated project", funded under the Sixth Framework Programme (FP6), coordinated by the National Institute of Volcanology and Geophysics (INGV, Italy).
- The project Linking Scientific Computing in Europe and the Eastern Mediterranean (LinkSCEEM; www.linksceem.eu) carries out networking and prospective activities for the development and engagement of a community of HPC users in the Eastern Mediterranean, in parallel to the planned development of an HPC facility at the Cyprus Institute. A follow-up proposal has very recently been submitted to the FP7-INFRA-2010-Call 2, by a consortium of European and regional institutions coordinated by the Cyprus Institute; the LinkSCEEM-2 proposal includes a strong component specifically aimed at the climate community, creating obvious synergies with the present project.

Goals

Given the above considerations, the major goals/aims of DARECLIMED can be summarized as follows:

i. To create an appropriate environment for the formation of a regional data infrastructure devoted to paleo-, current- and future climate, energy and water related data

ii. To improve the availability of data relevant to climate change assessments for the Eastern Mediterranean region and the Middle East, aiming for standards comparable to those of Western Europe, thereby achieving a more balanced territorial development

iii. To identify and engage stakeholders in the region that have access to, own or have collected relevant data

iv. To define conditions under which data can be shared while protecting the rights and interests of all stakeholders

v. To develop broadly accepted quality control standards and procedures for all data types

vi. To agree on minimal information, harmonization procedures and common representations of the data, so as to make them interoperable

vii. To develop a framework and capacity for comparison and integration of climate projections for the region derived from multiple datasets and models

viii. To support the build-up and integration of a regional infrastructure for climate research, with an emphasis on computing resources, through networking and prospective activities that will also facilitate the incubation of future collaborative climate research

ix. To assess the current use of computer resources by the regional climate community

x. To promote sharing of RCM models and RCM simulation results (including the creation of adequate repositories), in order to advance the optimal use of computational resources and enable the emergence of a broadly accepted scientific consensus on regional climate modeling and resulting climate projections.

It should be noted –and is being emphasized here- that DARECLIMED did **not aim to actually build-up a repository** of climate-, energy- and water data. The main aim of the project was rather related to ***paving the way*** or to ***laying the ground*** for the later implementation of such a repository. This had always to be made clear in our contacts with various data-holders and stakeholders, as their initial assumption was that DARECLIMED was about building up a data base. Such an undertaking would have required significantly more time and resources than were made available to the project. This notwithstanding, DARECLIMED did reach most of its goals as will be described in more detail in a later section of this report.

Activities

In order to reach the goals of the proposed project, the following activities were carried out throughout the duration of the project:

1) Organization of local stakeholder meetings and scientific workshops in the study region

a) A major prerequisite for any activities related to the current project are meetings that brought together the relevant stakeholders involved in the collection, analysis and dissemination of data in the fields of climatology, water and energy. These meetings were organized initially on a national level, but were intended to also be enlarged to embrace selected stakeholders from all countries of the study region at a later stage of the project (or in the framework of a follow-on project).

b) The major purpose of these meetings had been to

i. Take stock of available data and their accessibility,

ii. Assess the methodologies employed to generate the data, their overall quality and reliability and their current representation,

iii. Explore the possibilities for making these data available firstly for quality control, homogenization and harmonization and secondly for their (later) inclusion in the data repository.

iv. Establish a regional network of researchers and stakeholders to stimulate the implementation of quality control procedures and the use of measurement results and model output.

c) In these meetings, basic policies for the quality control and harmonization of the relevant data and their possible provision to the data repository have been discussed.

2) Initiation of a Task Force for preparing the necessary steps towards a regional data infrastructure covering climate, energy and water related data

a) In selecting the members of the Task Force, care was taken to ensure that all of the relevant expertise needed in the project had been represented. Moreover the members of the Task Force were intended to enable appropriate contacts to relevant regional stakeholders in the study region.

b) The Task Force addressed a number of relevant issues including:

i. data collection

ii. quality control,

iii. normalization/harmonization/homogenization,

iv. technical aspects of the data repository

v. access/sharing of data

vi. user interface design

vii. database of climate models and climate change simulation results

3) Coordination and cooperation with other European and international projects with related of overlapping objectives.

a) The above stated objectives of GEOSS are fully compatible with those outlined for the current project, i.e., "…to provide comprehensive, coordinated Earth observations, transforming the data they collect into vital information for society…". Thus, we established linkages with relevant institutions involved in GEOSS in order to ensure synergy and exchange between GEOSS and the current project, particularly with regard to the transfer and dissemination of numerical climate models and their results to stakeholders in the region.

b) The close match between the objectives of MEDARE and the aims of DARECLIMED strongly suggested that we established close collaboration with this project. We therefore contacted the project coordinator in order to explore possible avenues for fruitful cooperation throughout (and beyond) the present project. Such contacts were expected to include all issues related to the provision of broader and more reliable data to the climate community.

c) Coordination with CIRCE primarily concerned the use and analysis of climate data. One of the limitations in the CIRCE project is the availability of meteorological data for the eastern Mediterranean and Middle East, and DARECLIMED may very well be in the position to improve this situation. In fact, CIRCE does not include a data infrastructure component. DARECLIMED can thus extend and enhance the CIRCE research efforts with a sub-regional focus, probably in a follow-on stage of the project. The climate model simulations performed within CIRCE encompass only the southern and eastern Mediterranean margins, i.e. they do not include the Middle East. The Cyprus Institute and Tel Aviv University are members of the CIRCE consortium, and will contribute to the coordination efforts.

d) Coordination with LinkSCEEM for access to computational resources for climate research. As mentioned above, the availability of adequate high-performance computational infrastructures in the region is currently limited. This represents a major obstacle for effective data storage, analysis and dissemination on a regional scale as envisioned by DARECLIMED. We therefore developed close links with existing projects and initiatives aimed to remedy this situation by creating appropriate computational infrastructures in the region, primarily with the LinkSCEEM project.

4) Exploring strategies for building-up a regional repository of climate and air quality models and simulation results

a) In order to avoid undue duplication of efforts, to promote the optimal use of computational resources and to prepare a framework for model inter-comparison activities in the field of RCM simulations for the region, we intend to organize workshops aimed at:

i) Bringing together the climate specialists currently involved in RCM studies in the region under consideration, with the aim of preparing the creation of a repository of RCMs and related simulation results;

ii) Enabling discussions and exchange between groups currently involved in such studies in order to consider the methodologies employed and their advantages and disadvantages, to discuss possible synergistic potentials between the groups and to prepare the ground for model inter-comparison activities.

5) Organization of an International Conference

a) The conference, which was planned to take place close to the end of the project was intended to showcase the progress made with regard to creating a data infrastructures as a basis for Climate Change Impact Assessments and the scoping of adequate adaptation/mitigation strategies in the Mediterranean.

b) The conference had been considered a follow-up to the highly successful conferences organized by the Accademia dei Lincei in 2008 and by the Cyprus Institute in 2010 (Energy, Water & Climate Change in the Mediterranean & Middle East, EWACC2010; http://ewacc.cyi.ac.cy/) and will constitute a "special edition" in this series of high-level events, focusing on climate, energy and water data related issues.

Description of the main S&T results/foregrounds

Preface

As already mentioned above, DARECLIMED did **not aim to actually build-up a repository** of climate-, energy- and water data. Its major aim was related to ***paving the way,*** or to ***laying the ground*** for the later implementation and maintenance of such a repository. While this may sound less ambitious, it should be noted that a data repository as envisioned here is –to our knowledge- hardly available for the region under consideration, i.e., the Middle East and North Africa (in this document abbreviated as MENA Region) or the wider Eastern Mediterranean. Given the importance of this region for the Mediterranean Basin as a whole and its already mentioned exposure to particularly severe climate changes, this seems somewhat surprising. However, and as mentioned before, the cultural background and the history of science in some of the countries of the study region accentuate the issue of data scarcity and the absence of a well-developed data repository, at least for some of the sectors under consideration. A widespread reluctance to share data between different organizations and national meteorological and hydrological services within and between countries of the region is also not unprecedented. This is particularly relevant for data from the water sector, which is regarded as "state secret" in some of the countries of the region. Therefore, actually requesting data and information from government agencies would have been a rather futile undertaking, given the short time span of the project and the relative scarcity of resources available.

Thus, in our discussions with stakeholders and data-holders, it had always to be made explicit that DARECLIMED was not about collecting data and building up of a database, which usually was their initial assumption when establishing contacts

In addition, and because of major political and societal transitions in the region throughout the duration of DARECLIMED posed a number of severe challenges. Although the project work was progressing as planned during the earlier period, the project coordinator had to cope with the withdrawal of the potential Egyptian partner from the Botany Department of the Faculty of Sciences at Cairo University, Egypt from the project. Starting from the first months of the project, and with significant efforts expanded by the project coordinator, communication with the Egyptian partner was difficult and challenging. The Cyprus Institute struggled to find concrete solutions by trying to involve the Egyptian partner; however, these efforts ultimately failed. As a result, the Cyprus Institute requested Cairo University to identify a possible/suitable person to replace the initial partner in DARECLIMED. Unfortunately, the University of Cairo eventually declined its participation in the project altogether. Therefore, we also approached the Academy of Scientific Research and Technology in Egypt in order to solicit ideas for a possible replacement of the initial partner. This led to a very positive reply and a letter expressing strong support for the project. The Academy is prepared to provide support to DARECLIMED by assisting to organize a foreseen workshop in Egypt, in addition to supporting on regional networking in general. However, the efforts to secure Egyptian participation in DARECLIMED had to be abandoned.

Consequently, the Cyprus Institute explored alternative ways to find other organizations in the MENA region to replace Cairo University. Discussions with two organizations resulted in an agreement between them and the Cyprus Institute to replace the Egyptian partner in the project.

1) The Jordan Ministry of Transport as represented by the Jordan Meteorological Department (JMD, www.Jometeo.gov.jo) which adopted one part of the Egyptian tasks of the project, as a full project participant.

2) The Earth Link and Advanced Resources Development (ELARD, http://www.elard-group.com/) group from Lebanon will took over the remaining tasks of the Egyptian component as a subcontractor to the Cyprus Institute. ELARD is a regional consultancy group delivering excellence in environmental and water management for over a decade in the Middle-East, North Africa and the Gulf.

Given these obstacles and despite significant challenges throughout the project, DARECLIMED did reach most of its goals as will be described in more detail below.

Main Results of DARECLIMED

In order to reach the goal to create an appropriate environment for the formation of a regional data infrastructure, a sequence of steps were specified and carried out during the project, which are graphically depicted in Figure 3.

The major methodological components of DARECLIMED comprised:

i. Research and investigation on the overall issues related to the creation of a data repository

ii. Stakeholder engagement in the countries of the project partners involved (and beyond)

iii. Identification and engagement of data holders in these countries

iv. Dialog with institutions and individuals engaged in the creation and operation of large data repositories

v. Engaging experts:

   a. Technical (IT) specialists

   b. Scientists from the principle disciplines/sectors: climate, energy, water

   c. Database experts

   d. Experts on data harmonization and quality control

   e. Scientists and experts engaged in (regional) climate modeling

   f. Legal experts and specialists on IP issues

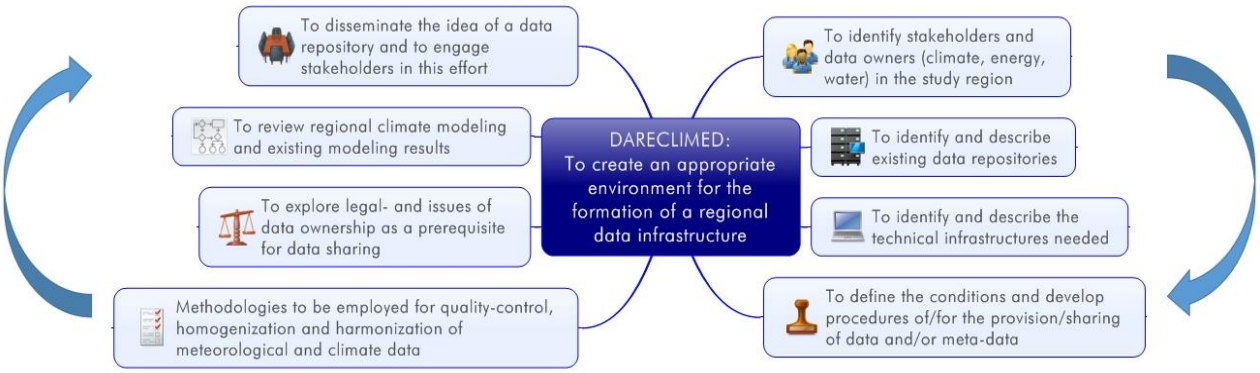

Figure 3: *Schematic depiction of major project elements in DARECLIMED*

These methods and the steps depicted in Figure 3 provided the rationale for the Activities outlined above and the results obtained in DARECLIMED. DARECLIMED was carried out in the context of the following work packages (WP):

WP1: Management

WP2: Identification and structure of existing data repositories

WP3: Data repository, quality and procedures

WP4: Data ownership, security, intellectual property, sharing mechanisms

WP5: Coordination of supporting infrastructures

WP6: International Conference on Data Infrastructures for Climate Change Research

WP7: Dissemination and outreach

In the framework of these work packages, activities in DARECLIMED can be schematically divided in two categories:

1. Those of scientific and/or technical nature (in the broadest sense, i.e., including not only climate science per se, but also all related fields, in their technical, legal, economical, or infrastructural aspects); for these the project relied mostly on the internal expertise provided by consortium members, augmented by that of internationally recognized experts.
2. Networking/awareness activities that primarily relied on the organization of stakeholder meetings/workshops. These have been held in various countries of the region, aimed at the climate science community and at other relevant stakeholders (e.g., international organizations, state agencies, etc.). Workshops had been organized, either separately or jointly, within WPs 2, 4, 5 and 7, and included activities aimed at assessing existing data resources (WP2), focused workshops (WP4), sharing/coordination of infrastructures (WP5), outreach activities and public lectures aimed at the general public (WP7).

In the early phase of the project, the workshops and other activities had a stronger emphasis on WP2 activities aimed at a survey of existing data resources, which provided crucial input to other Work Packages. At a later stage the policy issues related to WP4 and the infrastructural issues

related to WP5 have been given primary emphasis, while the outreach/awareness activities of WP7 have been carried out throughout the project.

The overarching goal of the activities pursued in DARECLIMED is to ensure that at the conclusion of the project the objective conditions and the necessary procedures for the creation of a regional data infrastructure for climate change as well as for the energy and water sectors in countries of the study region have been identified and described. This includes:

- data sources have been identified,
- procedures for controlling and integrating them have been agreed upon,
- issues of ownership and sharing have been explored,
- the necessary e-infrastructures are well defined, and
- a critical mass of relevant stakeholders are both informed and involved.

It was emphasized right from the start of the project that this represents a rather formidable task in a region as complex as the Eastern Mediterranean, and that the inclusion in our consortium of partners from four major cultures of the region (Greek, Arab, Jewish and Turkish) will be a crucial asset for making it achievable.

Identify stakeholders and existing data holdings in the study region

The first steps that needed to be taken in the project concern the identification of stakeholders and existing data holdings, both on the national and on the international/regional level in the study region. This was pursued through research leading to deliverable D2.3: *Report on the overall availability and characteristics of existing data repositories* and through the first two workshops.

The first workshop took place in Athens, Greece on July 14th, 2011 and was focused on the identification of existing data repositories and aimed at contacting of and coordinating with representatives of international organizations and other relevant projects. The aim of the workshop was to learn from the experience of existing projects, and also to establish connections so as to use the already available data repositories and agreements to DARECLIMED advantage. Thus the workshop brought together specialists from the following organizations:

- World Meteorological Organization coordinator of the pilot regional climate centres (RCCs) network.
- Representative of the Greek Group on Earth Observation (GEO) office.
- Head of the technical unit of the Euro-Mediterranean Information System on know-how in the Water sector (EMWIS).
- Representative of the MEDARE initiative from the Centre for Climate Change in the University Rovira i Virgili.

Figure 4: *Some of the participants of the First DARECLIMED Workshop at the Athens Observatory, Greece*

In addition to the presentations of international data repositories, a substantial part of the workshop was devoted to discussions related to important issues including data sharing, security, intellectual property, sharing mechanisms. After an introductory presentation by Prof. Zerefos (Athens, Greece), the discussions centred on issues concerning suitable strategies as to how to address stakeholders and data owners and the readiness –or the lack thereof- of national institutions to making data and information relevant to DARECLIMED available. The problems of obtaining even meta-data, especially from governmental data-owners, was discussed with examples given by the participants based on their personal experiences.

The **second workshop** took place in Nicosia, Cyprus on 15-16 December 2011. The workshop was dedicated to meeting with representatives of large data repositories. Concretely, we attempted to meet with high-ranking representatives National Meteorological and Hydrological Services (NMHS), and government energy-infra-structure ministries.

Participants included the head of the Cyprus Meteorological Service, the vice-director of the General Jordanian Meteorological Department, a representative of the Jordanian Ministry of Water and Irrigation, representatives from the Hellenic National Meteorological Service, a representative from the Turkish State Meteorological Service, and representatives of the Cyprus Ministry of Agriculture Water Department, the Cyprus Ministry of Commerce Industry and Tourism Energy Service Department, and the Electricity Authority of Cyprus. A number of informative presentations were given, addressing the following topics:

a. Climate Data in Cyprus and Greece
b. Climate Data in Jordan and Turkey
c. Water Data in Cyprus
d. Climate and Water Data in Israel
e. Water Data in Jordan

f. Energy Data in Cyprus

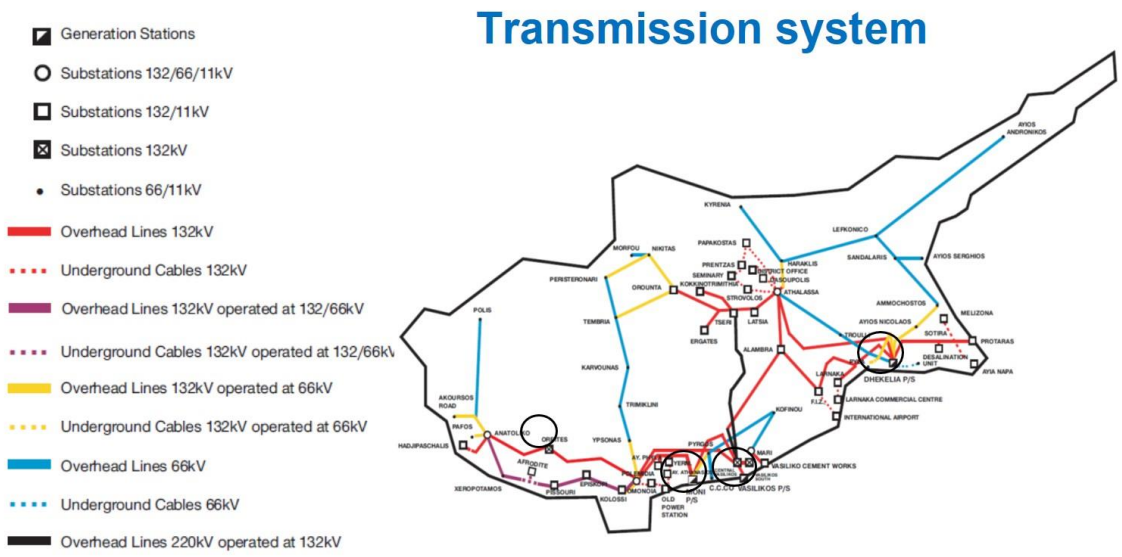

Figure 5: *Example figure from the presentation on "Energy Data in Cyprus" depicting the electrical transmission system in Cyprus*

In addition, the workshop also addressed the issue of facilitating collaboration with national data holders and the drafting of a Memorandum of Understanding (MoU) between DARECLIMED and government agencies that is intended to prepare the ground for the provision of data or meta-data on climate, energy and water. These discussions were intensified at a later stage in the project in the context of Work Package 3 and culminated in deliverable D3.2: *Working document including a draft/template MoU*.

Detailed tables providing data on

- Contact information of persons with access to regional climate data in the Eastern Mediterranean and Middle East,
- Contact information of persons with access to regional water data in the Eastern Mediterranean and Middle East and
- Contact information of persons with access to regional energy data in the Eastern Mediterranean and Middle East

Are presented in deliverable D3.2: *Working document including a draft/template MoU on the requirements for formal agreements between main data suppliers and the DARECLIMED consortium*.

The Presentations of both Workshops are available at the DARECLIMED website. A more detailed description of the workshop and the main results obtained are provided in deliverable D2.2: *Report on workshops*.

Identify and describe the technical infrastructure needed

Extensive studies were carried out to investigate all issues related to the technical infrastructure of the envisioned data repository. The third DARECLIMED workshop, which took place in Istanbul, Turkey on June 13 and 14, 2012 addressed the topic: *Technical requirements necessary for creating and maintaining a data repository for energy, water and climate related data in the Mediterranean and Middle East*. The workshop explored the hardware and software requirements necessary for creating and maintaining a data repository for energy, water and climate related data in the Mediterranean and the Middle East.

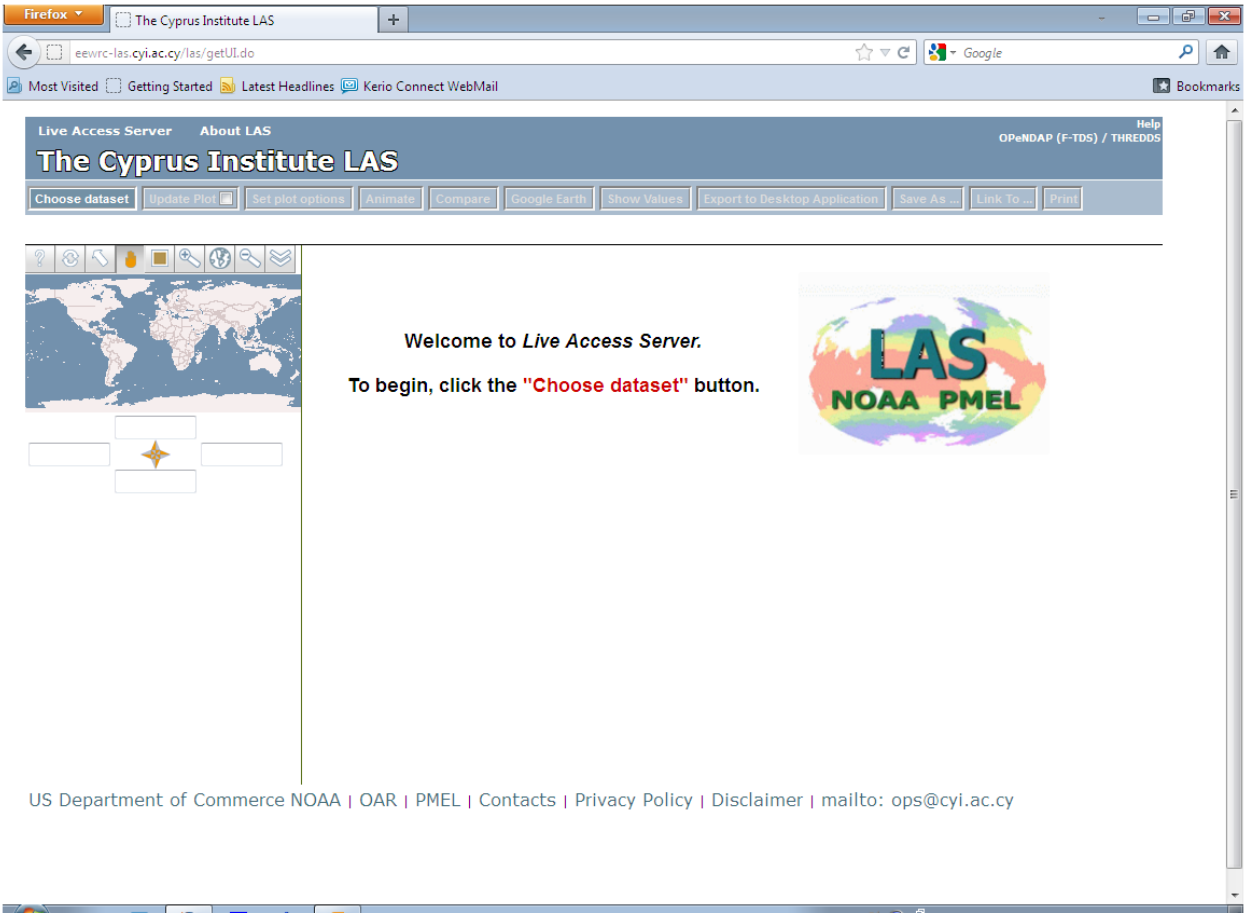

Figure 6: *Screenshot of the opening page of the Cyl-LAS*

The results of the research carried out and of the workshop in Istanbul are presented as a technical report (deliverable 3.1: *Technical report on the technical infrastructure*). In the same report, a user-friendly software for data mining and analysis is described, named Live Access Server (LAS). The main objective of a LAS is to break through the data access barriers of file size, location, and format by providing three key areas of functionality: visualization, sub-setting, and reformatting. A LAS has been adapted and installed at the Cyprus Institute. Several datasets are made available at the server for public use and more datasets will follow gradually (http://eewrc-las.cyi.ac.cy/las/getUI.do).

To define the conditions and develop procedures of/for the provision/sharing of data and/or meta-data

Having identified data sources, both nationally and internationally, the next step in DARECLIMED dealt with exploring and specifying conditions of as well as developing procedures for the provision/sharing of data and/or meta-data. This has –again- to be seen in light of the overall objective of DARECLIMED, i.e., to ***paving the way*** or to ***laying the ground*** for a later implementation of a repository comprising climate-, energy- and water data of countries in the Eastern Mediterranean.

This was primarily pursued in Work Package 3 by defining the standards and procedures needed in order to reach to formal agreements between regional or National Meteorological and Hydrological Services (NMHS) and other main regional data suppliers on the one hand and the DARECLIMED consortium, on the other. These procedures have been described in detail in deliverable D3.2: *Working document including a draft/template MoU on the requirements for formal agreements between main data suppliers and the DARECLIMED consortium*.

After long thoughtful discussions and exchange of ideas between the DARECLIMED partners, the partners, the following procedure was established and implemented:

i. Creation of a pool with the contact information details of the regional data owners in the Eastern Mediterranean and Middle East.

ii. Invitation of regional data owners to DARECLIMED workshops

iii. Sending Letter of Introduction of the DARECLIMED project to the data suppliers in order to approach them and encourage them to share their data. The Letter of Introduction will be accompanied by a). a Questionnaire regarding their data, the characteristics and their accessibility and b). a Data Policy document that assures the rational use of the data

iv. Sending the MoU and the Data Sharing Protocol to the data owners that accepted collaboration with DARECLIMED project.

The above-mentioned pool of detailed contact information, the draft letter of introduction of the project, the MoU and a draft template of the data availability questionnaire are presented in Deliverable 3.2.

Methodologies for enabling quality-control, homogenization and harmonization of meteorological and climate data

Once agreement is reached on the provision of data or meta-data on climate, energy and water from individual national or international institutions/organizations, the next step relates to the issue of data quality and inter-comparability between different data sets. This usually represents a formidable task that requires substantial personnel- and financial resources. Again, DARECLIMED did not attempt to actually work with observational data. Instead, we tried to explore suitable and most effective methodologies that might be employed in building-up a data repository for the eastern Mediterranean.

This issue was one of the major topics of the Fourth DARECLIMED Workshop on *Data Quality, Homogenization and Harmonization* that took place in Amman, Jordan on 21 – 22 March

2013. An excellent presentation by Dr. Else van den Besselaar on *Maintaining Data Quality and Achieving Homogenization and Harmonization of Large Data Sets* provided profound information on the strategies and methods that are employed by a large international data-base project, the European Climate Assessment & Dataset (ECA&D; http://www.ecad.eu) at the Royal Netherlands Meteorological Institute (KNMI). Her presentation included details from their experience working with open access data and the challenges they face with the use of open access daily data, Meta data, and the different measurement methods used. Figure 7 represents an example for the results of a homogeneity-check on precipitation data from Limassol, Cyprus.

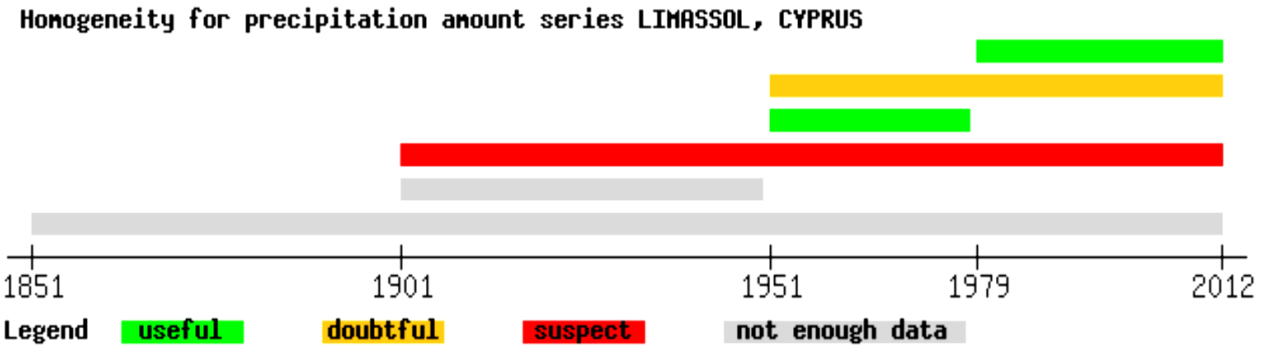

Figure 7: *Results of a homogeneity-check on precipitation data from Limassol, Cyprus (source: ECA&D and priv. communication)*

In the discussions at the workshop, the participants agreed that the procedures and methods used by ECA&D provide an excellent starting point to be adopted by a later data repository for the Eastern Mediterranean.

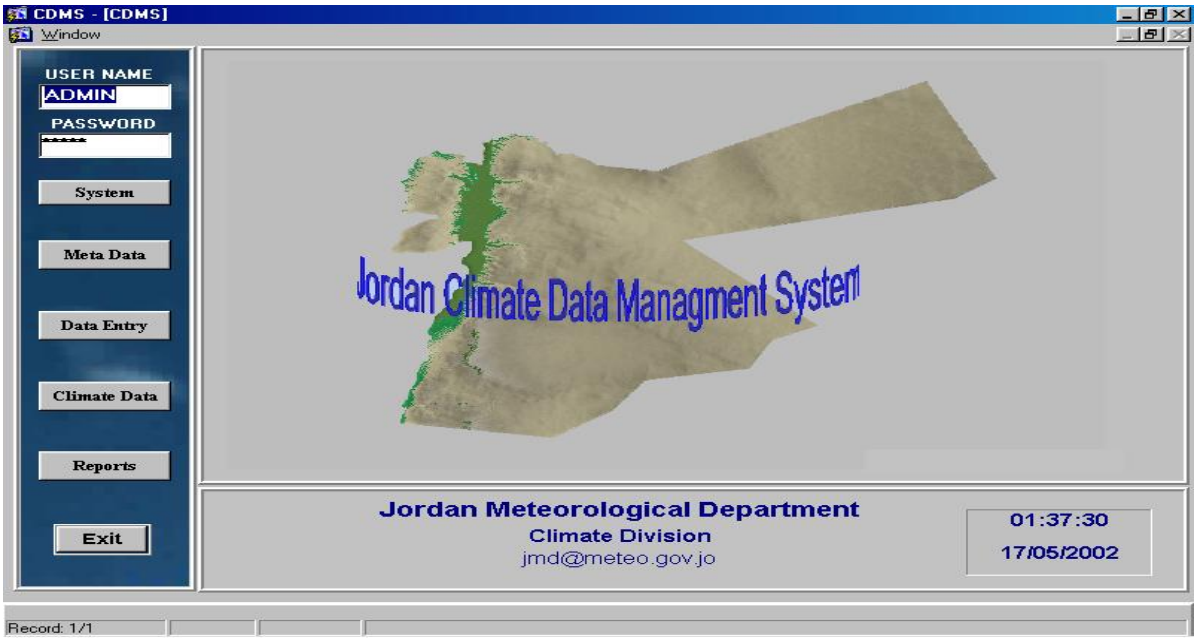

Figure 8: *Screenshot of the Jordan Climate Data Management System that is provided and maintained by the Jordan Meteorological Department*

In addition, Eng. Haziymeh from the Jordan Meteorological Department gave an overview of the Department's efforts and the methods to homogenize observation data and the measures taken to carry out a thorough data quality control (Figure 8).

A second important component of the workshop related to the introduction to- and the discussions on a Task Force for preparing the creation of a regional data infrastructure and drafting of the "Terms of Reference" for this Task Force covering climate, energy and water related data.

The Task Force was to address all relevant issues related to this objective.IN the discussion a number of issues were identified, including:

i. Data collection: This involves an assessment on the kind of data that exists in the region and its accessibility (partly covered by WP3). Furthermore, information on data owners and their readiness to make data available should be compiled. In cases where direct access to data is not possible, the foreseen repository should include meta data on existing data sets..

ii. Quality control: Data homogenization and quality control to be pursued as discussed above. A major challenge –not only for the MENA region- is the lack of homogeneity of observational data. This may be caused by having observations of a given quantity being obtained from different instruments throughout the observational period or the fact that data is stored in different formats.

iii. Technical aspects of the data repository: the technical infrastructure for the envisioned repository may readily be provided by The Cyprus Institute and the Istanbul Technical

University. Both institutions may join forces in providing the technical infrastructure, through the utilization of currently available computational systems.

iv. Access/sharing of data and user interface design: The Task Force should provide guidance and recommendations that enable maximum access of the envisioned data repository to relevant regional academic and non- academic stakeholders in the study region.

v. Regional Climate Models: The results of the EU-ENSEMBLES project may provide a model for a regional-climate-model repository. This should not only include the models itself (i.e., mostly RCMs), but also representative model-simulation results.

The members of this Task Force comprise:

- Manfred Lange, taking the lead, Cyl
- Nuzhet Dalfes, ITU
- Firas Haziymeh, JMD/MOT
- Amnon Stuppe, TAU
- Kostas Eleftheroes, BRF-AA
- Rana Zbeidy, ELARD Consulting Firm
- Jens Wiegand or George Tsoulloupas, Technical Infrastructure support, Cytera, Cyl
- Two potential members: Euro-Mediterranean Information System on know-how in the Water sector (EMWIS) and Ministry of Water and Irrigation in Jordan (Mohamed Atrash)
- Energy sector: potential institution to be contacted: Observatoire Méditerranéen de l'Energie (OME)
- A specialist on legal issues of data sharing

While constructive discussions by Task-Force members started during the workshop and have been continued until the end of the project, the limited time available did not enable comprehensive results on all of the points mentioned above.

Explore legal- and issues of data ownership as a prerequisite for data sharing

Sharing data involves in many cases the issue of intellectual property rights, data ownership and the legal conditions for the sharing of and/or access to this data. These issues have been addressed during the Fifth DARECLIMED Workshop in Chania, Crete on July 22, 2013. The discussions were initiated by an excellent presentation of Dr. Friederike Eggert (ELARD, Amman, Jordan). Her contributions are presented in Her contributions are presented in an additional and in the original Description of Work of the project not foreseen deliverable: D4.3: *Data ownership, security, intellectual property, sharing mechanisms*.

As an example for a more progressive way of dealing with meteorological- and climate data accessibility Pinhas Alpert and Amnon Stupp from the The Porter School of Environmental Studies of Tel-Aviv University, Israel gave a presentation on *Free Access to Meteorological Data:*

Case of Israel, which led to lively discussions on the possible adoption of such a policy in other countries of the study region.

While the workshop presented a very fruitful starting point on the discussion of legal and procedural limitations of data exchange and data sharing, it was obvious at that this discussion would need more time and more deliberations. However, it was also noted that limitations posed by legal considerations differ from sector to sector. Thus, it became quite obvious that the provision of climate and meteorological data is less restricted than they are pertaining to energy and water. This is most likely due to the fact that water and energy are often linked to private sector operations. Moreover, and as mentioned before, water energy are quite sensitive issues in some of the countries of the study region. For instance, we were told that information on water are considered a state secrets in Egypt and are therefore copied the excluded from any exchange or disclosure with organizations outside Egypt. This notwithstanding, the participants of the workshop and the partners in the DARECLIMED Consortium are confident that these issues can be resolved, once stakeholders and data owners are identified and are engaged in a constructive dialogue.

Review regional climate modeling and existing modeling results

Collecting, archiving and making available climate and weather data is one of the ultimate goals of the project. However, decision-makers and communities alike often desired to be informed also about the prospective development and climatic conditions in their communities or their countries. Therefore, it was decided early on that the project will also look into the availability of climate projections that have been obtained through numerical climate modeling. While global climate models provide valuable insight into the larger scale development of climate in the region, devising adaptation and mitigation strategies often require information on a much higher spatial scale. In order to address this requirement, regional climate models (RCMs) have been developed that are able to provide data on scales it down to a few kilometers.

A review of existing regional climate models and their results has been part of the work in a work package three. Deliverable D3.4: *Technical Report on existing RCMs* summarizes all work on exploring the range of available regional climate models that cover the study region. Results of regional climate models, specifically the PRECIS model of the UK met service are available on the project LAS server (see above). In addition, and as mentioned above, the EU–CIRCE project (http://www.circeproject.eu/) as well as the EU-ENSEMBLE project provide valuable insight into the current state of knowledge on future climate development in Europe and the Mediterranean.

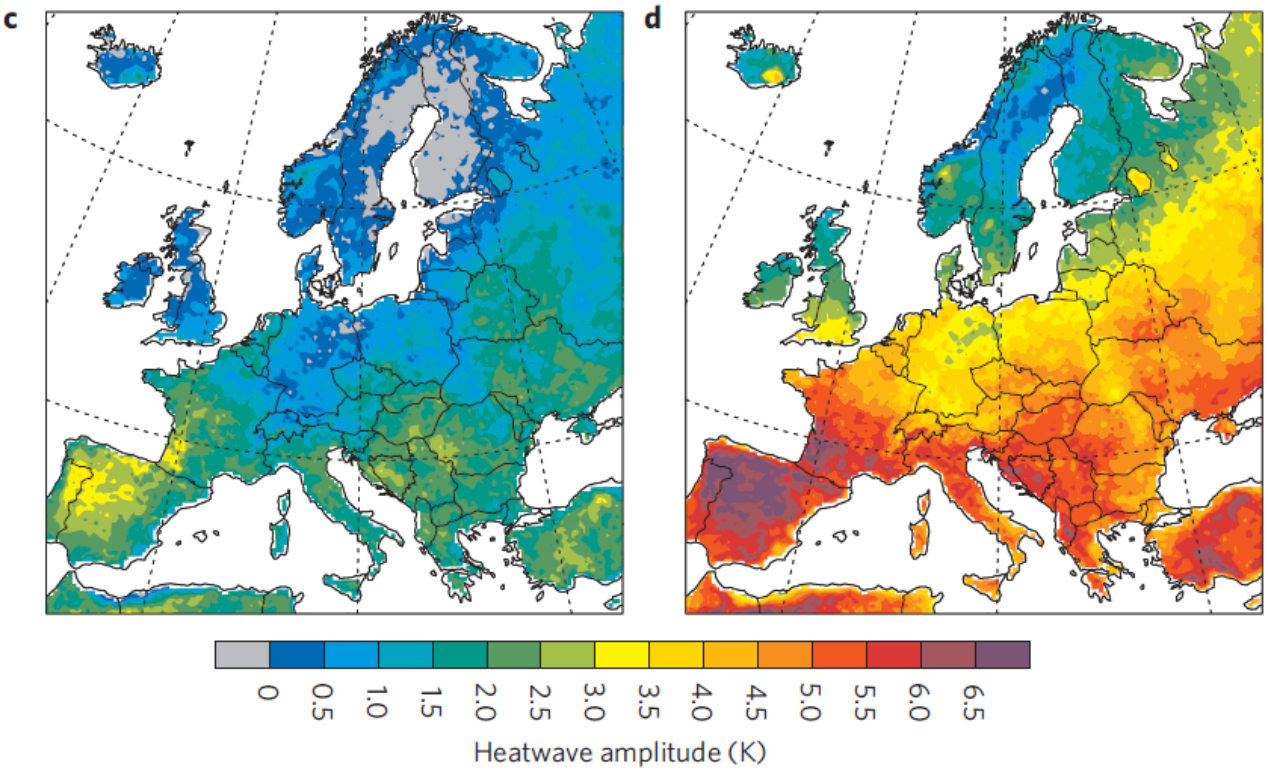

Figure 9: *Projected changes in heat-wave amplitude in degrees Celsius for the period 2021–2050 (c) and 2071–2100 (d), respectively relative to the reference period 1961–1990 as derived by the ENSEMBLES project; source: Fischer, E. M., & Schär, C. (2010). Consist geographical patterns of changes in high-impact european heatwaves. Nature Geoscience, 3 (6), 398-403*

Disseminate the concepts of a data repository and to engage stakeholders in this effort

In order to gain support but also to inform stakeholders and the interested public about the project, a number of measures have been taken throughout the duration of the project. The starting point was that the creation of an effective website that takes the user through the project and through some of its major results and products. The deliverable D71: DARECLIMED website describes in detail the rationale and the various components of the website (http://www.cyi.ac.cy/dareclimed-welcome.html). One of the means to disseminate data from different sectors, including climate that has not been mentioned before is the page on "Data repositories" (http://www.cyi.ac.cy/dareclimed-data-repository.html). This page not only offers access to the Cyprus Institute LAS server but also offers access to a large number of resource websites providing information on different sectors such as water, energy, land use and agriculture, fire emission and population and economy (Figure 10).

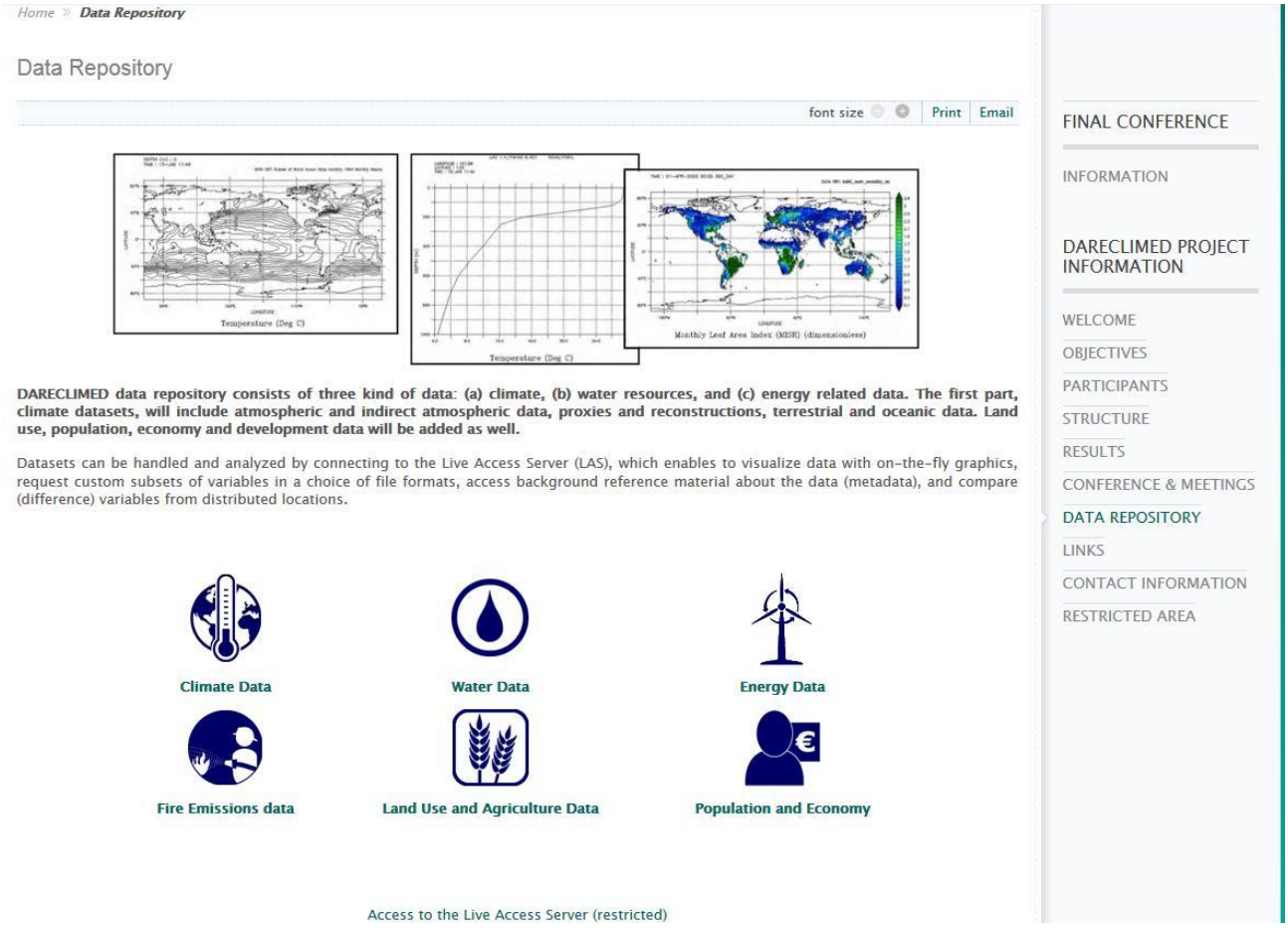

Figure 10: *Screenshot of the "Data Repository" page of the DARECLIMED web-site*

The project was also presented in an attractive leaflet that has been distributed widely. It has been sent to various stakeholders and institutions in the region.

A particular highlight with regard to the dissemination of results as well as for exploring new and strengthening existing relationships was the DARECLIMED Final Conference (Conference Website: http://www.cyi.ac.cy/dareclimed-2013-conference.html). The Conference under the title "Sharing data and information in the Eastern Mediterranean and the Middle East" took place in Chania, Crete, Greece from 23-25 July 2013. The conference was planned well in advance. The final program, after thorough discussion between the project partners and the Scientific Program Committee has been submitted as deliverable D6.1: *Programme of the International Conference*.

The main objective of this conference was to disseminate the results of the various activities conducted in the framework of the DARECLIMED project. The conference targeted the regional and international scientific community in the fields of climatology, energy and water, as potential users of the prospective data repository, major stakeholders in the regional scientific and administrative community and EU and regional decision-makers in academic, economic and political circles.

The main topics of the conference comprised:

- The need for environmental data from the Eastern Mediterranean & the Middle East
- Water resources in the region
- Major scientific challenges related to meteorological observations and climate change in the region
- Information on the energy sector
- National data repositories & relevant initiatives in the region
- Legal, institutional and technical requirements for a common repository
- Data harmonization and data quality

The conference consisted of the following elements:

- Invited presentations
- Oral presentations
- Poster presentations
- Round Table Discussions.

The conference was attended by some 50 participants from the MENA region and Europe. The proceedings of the conference which constitutes deliverable 6.2 contain all information on the conference program, the invited speakers and the round-table participants as well as the major conclusions of the round-table discussions. A press release was issued at the commencement of the conference and drew substantial media attention.

A particular highlight of the conference, also documented in the proceedings is the Chania Declaration. The Declaration emphasized the need for comprehensive information on climate, energy and water in the MENA region as a prerequisite for the specification of effective and well-founded mitigation- and adaptation strategies. The declaration states that "…the participants of the International Conference on Sharing data and information in the Eastern Mediterranean and the Middle East call upon governments, other relevant authorities and the providers of data and information on climate, energy and water:

i. To acknowledge shared issues on water, climate and energy that require enhanced collaboration across the region.

ii. To enhance the free and unrestricted access to data and information on climate, energy and water, thereby benefitting from established international mechanisms and initiatives.

iii. To ensure, where applicable, that data ownership and intellectual property rights - while strictly observed – do not limit the appropriate use of data and information.

iv. To support and advance internationally agreed quality standards and guidelines, and implement measures enabling the harmonization of data, in order to facilitate the inter-comparison of data and information.

v. To join forces in advancing research on climate change, its impacts and inter-linkages with the water and energy sectors in the Eastern Mediterranean region. This should be pursued through collaborative observational and climate modeling endeavors, including capacity building by institutions in the region and beyond."

The Declaration was formerly adopted by all conference participants and thus represents a lasting legacy of the conference as well as the DARECLIMED project.

Discussions and Conclusions

While the need for comprehensive data and information on climate, energy and water for the meaningful specification of adequate and effective mitigation- and adaptation strategies is apparently undisputed, the willingness and determination to enable the build-up of a data repository providing such information remains less unanimous. This was and is the starting point of the DARECLIMED project, which aimed at ***paving the way*** or at ***laying the ground*** for the later implementation of such a repository. It needs to be emphasized here –again- that DARECLIMED did **not aim to actually build-up a repository** of climate-, energy- and water data, a fact that had often to be made clear in our contacts with various data-holders and stakeholders, as their initial assumption was that DARECLIMED was about building up a data base.

While this seems to be a somewhat too modest goal for an EU-funded project, our experiences throughout the duration of the project taught us that even this objective may have been –at least in part- overambitious. In the following, we will present somewhat of a "score-card" of the original goals (see above) of the project and to what extent they have been reached (Table 1).

Table 1: *Goals of DARECLIMED and degree to which they have been reached (appropriate box shaded)*

Nr.	Goals	Degree reached			
		not at all	some-what	almost	com-pletely
i	To create an appropriate environment for the formation of a regional data infrastructure devoted to paleo-, current- and future climate, energy and water related data			■	
ii	To improve the availability of data relevant to climate change assessments for the Eastern Mediterranean region and the Middle East, aiming for standards comparable to those of Western Europe, thereby achieving a more balanced territorial development		■		-
iii	To identify and engage stakeholders in the region that have access to, own or have collected relevant data			■	
iv	To define conditions under which data can be shared while protecting the rights and interests of all stakeholders			■	

Nr.	Goals	Degree reached			
		not at all	some-what	almost	com-pletely
v	To develop broadly accepted quality control standards and procedures for all data types		■		
vi	To agree on minimal information, harmonization procedures and common representations of the data, so as to make them interoperable			■	
vii	To develop a framework and capacity for comparison and integration of climate projections for the region derived from multiple datasets and models		■		
viii	To support the build-up and integration of a regional infrastructure for climate research, with an emphasis on computing resources, through networking and prospective activities that will also facilitate the incubation of future collaborative climate research	■			
ix	To assess the current use of computer resources by the regional climate community		■		
x	To promote sharing of RCM models and RCM simulation results (including the creation of adequate repositories), in order to advance the optimal use of computational resources and enable the emergence of a broadly accepted scientific consensus on regional climate modeling and resulting climate projections	■			

In the following, we will briefly discuss and assess the reasons that lead to the scores shown in Table 1 above.

i. The overarching goal to "…create an appropriate environment for the formation of a regional data infrastructure…" in the MENA region, though not completely reached, significant progress was made in DARECLIMED. This can be seen primarily in deliverables 2.1, 2.3, 3.1, 3.3 and 6.2.

ii. This notwithstanding, the availability of data relevant to climate change assessments for the Eastern Mediterranean region and the Middle East and even more so the availability of data from the energy and water sectors in the countries remains a major challenge. To make more progress in this field requires a significantly longer approach and additional resources. The latter may also be needed to purchase data sets that remain otherwise fully disclosed.

iii. Deliverable D2.3 *Report on the overall availability and characteristics of existing data repositories and the identification of major stakeholders* in the Middle Eastern countries (as presented in reports by our sub-contractors) can be considered a remarkable

achievement. Particularly so in light of the difficult working conditions in these countries after the "Arab Spring" underlines that we have made significant progress with regard tour second goal.

iv. In specifying the conditions under which data can be shared in the study region (D2.3) considerable progress was made in DARECLIMED. However, as noted above, given the rapid pace of political, structural and societal changes in the region, some of the results achieved may not be valid anymore. Thus, a reassessment would be in order, if a follow-on to DARECLIMED is being considered.

v. In order to develop broadly accepted quality control standards and procedures for all data types, significantly more time and effort would have to be spent. While identifying datasets and information repositories in the study region, the degree of insight gained into these datasets is only marginally sufficient to understand and assess the quality, homogeneity and reliability of these datasets.

vi. Throughout the project, information, harmonization procedures and common representations of the data have been explored and largely specified. This was pursued also with the help of colleagues who have implemented and operate large data repositories (workshop 1, 2 and D3.3).

vii. To develop a framework and capacity for comparison and integration of climate projections for the region, we can rely to some extent on work and results done in previous EU-projects (ENSEMBLE, CIRCE). However, given the scarcity of RCM results covering the MENA region, this issue would have to be addressed more rigorously than done in DARECLIMED, where the time and resources just did not suffice to do so.

viii. The build-up and integration of a regional infrastructure for climate research, with an emphasis on computing resources clearly did not progress as swiftly as originally planned (see general note below). Having said this, projects such as LinkSCeem II, with which we collaborated closely, may indeed pave the way towards creating such an infrastructure in a possible follow-on project.

ix. Workshop 3 and constructive help from colleagues of LinkSceem II enabled us to gain significant insight into the current use of computer resources by the regional climate community. However, this community, similarly to the scientific community at large suffers significantly from the aforementioned political and societal transitions in the MENA countries.

x. This has also repercussions and adverse effects with regard to the sharing of RCM models and RCM simulation results. While in some countries of the region, e.g., in Egypt, regional climate modeling is actively being pursued, most of the other countries are still in their infancy with regard to numerical climate modeling.

On a **general note**, it should be emphasized that the unsatisfactory degree to which goals have been achieved in DARECLIMED is not a result of the limited ability or a lack of determination of the consortium as a whole or individual partners. Instead, this is more a consequence the overall state of scientific activities in the MENA countries, which are –given the present situation- just not amenable for such activities. Thus, the conditions envisioned when writing and submitting the

proposal have changed so dramatically that rendered some of the goals and objectives unachievable.

This notwithstanding and in summary, we are confident that DARECLIMED has and will continue to make a difference with regard to the design, implementation and ultimately operation of a comprehensive repository od climate, energy and water data in the MENA region. The final conference and the Chania Declaration are lasting proof that progress has been made and that the countries in the study region not only understand the need for such a repository but are also determined to facilitate its development. This may be pursued in a follow-on project and once the political and economic situation in these countries have stabilized.

Potential impact

The potential impacts of the DARECLIMED project are difficult to assess. According to the 2010 FP7-Capacities-Research Infrastructures Work Programme, the expected impact of Activity 1.3 "Support for policy development and programme implementation, including support to emerging needs" is as follows:

"Support measures are expected to strengthen the development of a European policy for research infrastructures and to address specific needs for international cooperation in this field, thus achieving critical mass and driving global policies. Furthermore, support measures in the field of e-services are expected to contribute to the emergence of sustainable approaches for the provision of cross-disciplinary research services as well as to encourage the pooling of resources between infrastructure operators at European level in order to face future challenges and to foster a culture of co-operation between them, spreading good practices and encouraging infrastructures to develop in complementary ways."

Based on these objectives, it was expected that DARECLIMED would make a significant contribution to the development of a coordinated policy for research infrastructures in the field of climate research, and in particular of climate data, for the South-Eastern part of the European Research Area (including Member States, such as Greece and Cyprus, and Associated countries such as Turkey and Israel).

In addition, the project was to address the following objectives relevant to Activity 1.3 and Topic INFRA-2010-3.2: "the coordination of national and/or regional policies and programmes in the field of research infrastructures", through networking and coordination activities involving stakeholders on a regional scale, and also through the links that will be created with projects addressing related issues at the regional (CIRCE; MEDARE) or global (GEOSS) level; "pooling talent, maximizing resources, and ensuring the best outcome of rationalized research investments", "achieving critical mass", "pooling [of] resources between infrastructure operators", through the development, coordination and integration of climate data resources, the coordination of computational resources for climate research, and the promotion of a framework for the sharing and coordination of RCM resources.

While –as explained above- the first objective/impact was only marginally reached, the coordination of national and/or regional policies and programs in the field of research infrastructures was attained to a significant degree. Not making more progress with regard to the former can largely be attributed to the already explained challenging conditions in the study region throughout the duration of the project.

In contrast, as a result of the workshops in the partner countries and as documented in our deliverables, we established constructive contacts both to national data holders in the region as well as to a number of regional and international initiatives and programs of relevance to DARECLIMED. Thus, despite the somewhat difficult conditions the project had to be working under, we feel confident that our activities will have resulted in razing the awareness for the usefulness of promoting and ultimately implementing of a framework for the sharing and

coordination of data and information on climate, energy and water in the eastern Mediterranean.

Project public website

The publicly accessible web site of the Project is found at:
http://www.cyi.ac.cy/index.php/dareclimed-welcome.html

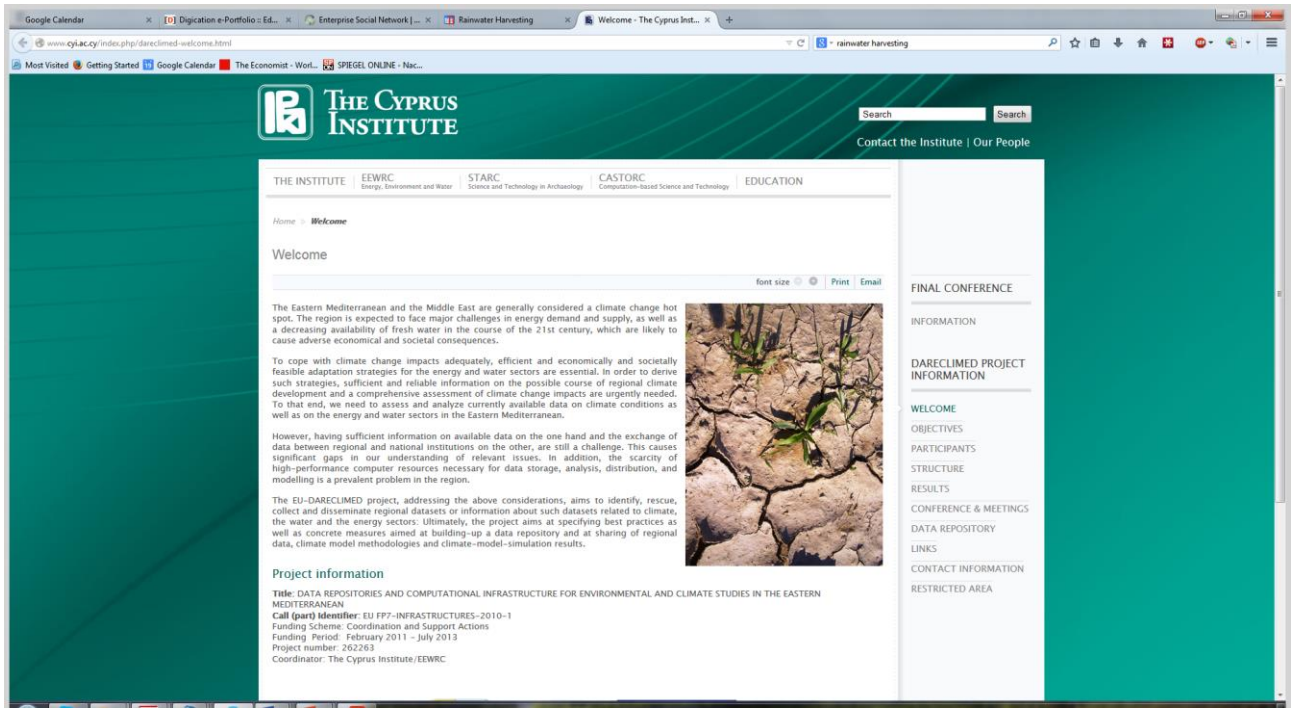

Figure 11: *Starting page of the DARECLIMED web-site*

As described above, the web-site not only provides an overview of the project itself, but also offers a wealth of information on climate, energy, water and other issues of relevance in the MENA region.

Use and dissemination of foreground

A plan for use and dissemination of foreground (including socio-economic impact and target groups for the results of the research) shall be established at the end of the project. It should, where appropriate, be an update of the initial plan in Annex I for use and dissemination of foreground and be consistent with the report on societal implications on the use and dissemination of foreground (section 4.3 – H).

The plan should consist of:

- Section A

This section should describe the dissemination measures, including any scientific publications relating to foreground. **Its content will be made available in the public domain** thus demonstrating the added-value and positive impact of the project on the European Union.

- Section B

This section should specify the exploitable foreground and provide the plans for exploitation. All these data can be public or confidential; the report must clearly mark non-publishable (confidential) parts that will be treated as such by the Commission. Information under Section B that is not marked as confidential **will be made available in the public domain** thus demonstrating the added-value and positive impact of the project on the European Union.

Section A (public)

Template A1: list of scientific (peer reviewed) publications, starting with the most important ones

No.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher/doi.	Place of publication	Year of publication	Relevant pages	Permanent identifiers[3] (if available)	Is/Will open access[4] provided to this publication?
1	*Air temperature trends related to changes in atmospheric circulation in the wider area of Greece*	*Nastos, P.T.*	*Int. J. of Rem. Sens.*	*Vol. 32, 3,*	*10.1080/01431161. 2010.517796*		*2011*	*737-750*		yes/no
2	Three-year ground based measurements of Aerosol Optical Depth over the Eastern Meditterranean: the urban environment of Athens	Geraso-poulos, E.	*Atmos. Chem. Phys.*	Vol. 11			2011	2145-2159		
3	Present climate trend	Poupkou,	*Theor. Appl.*		10.1007/s00704-		2011			

[3] A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).

[4] Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

No.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher/doi.	Place of publication	Year of publication	Relevant pages	Permanent identifiers[3] (if available)	Is/Will open access[4] provided to this publication?
	analysis of the Etesian winds in the Aegean Sea	A.	*Climatol.*		011-0443-7					
4	Long term precipitation trends and variability within the Mediterranean region	Philan-dras, C.M.	*Nat. Hazards Earth Syst. Sci*	Vol 11			2011	3235-3250		
5	Evidence of a possible turning point in solar UV-B over Canada, Europe and Japan	Zerefos, S.C,	*Atmos. Chem. Phys.*	Vol. 12			2012	2469–2477		
6	Impact of the 2009 Attica wild fires on the air quality in urban Athens	Amiridis, V.	*Atmos. Envir.*		10.1016/j.atmosenv. 2011.07.056		2012			
7	Economic Crisis Detected from Space: Air Quality observations over Athens/Greece	Geophys. Res. Lettr.	*Vol. 40, 1-6*		10.1002/grl.50118		2013			

Template A2: list of dissemination activities

NO.	Type of activities[5]	Main leader	Title	Date/Period	Place	Type of audience[6]	Size of audience	Countries addressed
1	*DARECLIMED Kick-off Workshop*	*K. Eleftheratos*	DARECLIMED WP4 Data ownership, security, intellectual property, sharing mechanisms	12-13 April 2011	Nicosia, Cyprus	Specialists and stakeholders	≈20	MENA countries
2	*DARECLIMED Kick-off Workshop*	*K. Eleftheratos*	Atmospheric Environment Division of BRFAA	12-13 April 2011	Nicosia, Cyprus	Specialists and stakeholders	≈20	MENA countries
3	*DARECLIMED Kick-off Workshop*	M.A. Lange	Project Background and Objectives	12-13 April 2011	Nicosia, Cyprus	Specialists and stakeholders	≈20	MENA countries
4	MedCLIVAR session at 12th Plinius Conference on precipitation over the Mediterranean region: identification and recovery of long time series	P. Alpert	A new daily data-base over the E. Mediterranean and the Middle-East	1-4 Septmeber 2010	Corfu Island, Greece	Scientists and stakehoolders	≈50	Mediterranean Basin countries

[5] A drop down list allows choosing the dissemination activity: publications, conferences, workshops, web, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters, Other.

[6] A drop down list allows choosing the type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias, Other ('multiple choices' is possible).

NO.	Type of activities[5]	Main leader	Title	Date/Period	Place	Type of audience[6]	Size of audience	Countries addressed
5	Invited presentation	P. Alpert	The 10th Herzliya Conference - 2010, Adjusting to Climate Change: A National Security Dimension	2010	Campus of the Interdisciplinary Center (IDC) Herzliya, Israel	Scientists and stakehoolders	≈50	Israel and MENA countries
6	Invited presentation, The Hellenic Foundation for European and Foreign Policy (ELIAMEP)	P. Alpert	The Impact of Climate Change in the Mediterranean: Designing Adaptation and Implementation Strategies	2011	Athens, Greece	Scientists and stakehoolders	≈40	
7	Invited presentation; Seminar in Karlsruher Institute for Technology,	P. Alpert	Climatic Trends and Regional Modeling over the Mediterranean Recent Observations and Future Projections	2012	Karlsruhe, Germany	Scientists and stakehoolders	≈40	
8	Invited presentation, Herzlia Conference, Mid-East Scenarios	P. Alpert	Key-Driver: Climate	2013	Herzlia, Israel	Scientists and stakehoolders	≈50	Israel and MENA countries
9	Brief presentation	C. S. Zerefos	Round table discussion – Climate Introductory thoughts	2013	Chania, Greece	Scientists and stakehoolders	≈100	Mediterranean Basin
10ff	Invited presentations	various partners in DARECLIMED	various topics addressed	2013	Chania, Greece	Scientists and stakehoolders	≈100	Mediterranean Basin

Section B (Confidential[7] or public: confidential information to be marked clearly)

Part B1

The applications for patents, trademarks, registered designs, etc. shall be listed according to the template B1 provided hereafter. This is **not applicable** in the case of DARECLIMED and will therefore be **omitted**.

TEMPLATE B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.					
Type of IP Rights[8]:	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Application reference(s) (e.g. EP123456)	Subject or title of application	Applicant (s) (as on the application)

[7] Note to be confused with the "EU CONFIDENTIAL" classification for some security research projects.

[8] A drop down list allows choosing the type of IP rights: Patents, Trademarks, Registered designs, Utility models, Others.

Part B2

Please complete the table hereafter:

This is **not applicable** in the case of DARECLIMED and will therefore be **omitted**.

Type of Exploitable Foreground[9]	Description of exploitable foreground	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application[10]	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
	Ex: New superconductive Nb-Ti alloy			*MRI equipment*	*1. Medical* *2. Industrial inspection*	*2008* *2010*	*A materials patent is planned for 2006*	*Beneficiary X (owner)* *Beneficiary Y, Beneficiary Z, Poss. licensing to equipment manuf. ABC*

[19] A drop down list allows choosing the type of foreground: General advancement of knowledge, Commercial exploitation of R&D results, Exploitation of R&D results via standards, exploitation of results through EU policies, exploitation of results through (social) innovation.

[10] A drop down list allows choosing the type sector (NACE nomenclature) : http://ec.europa.eu/competition/mergers/cases/index/nace_all.html

Report on societal implications

A General Information *(completed automatically when Grant Agreement number is entered.*

Grant Agreement Number:	262263
Title of Project:	Data Repository and Computational Infrastructure for environmental and climate studies in the Eastern Mediterranean
Name and Title of Coordinator:	Manfred A. Lange, Prof., Director, The Cyprus Institute

B Ethics

1. Did your project undergo an Ethics Review (and/or Screening)? • If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 *'Work Progress and Achievements'*	*0Yes 0No*
2. Please indicate whether your project involved any of the following issues (tick box) :	*NO*
RESEARCH ON HUMANS	
• Did the project involve children?	
• Did the project involve patients?	
• Did the project involve persons not able to give consent?	
• Did the project involve adult healthy volunteers?	
• Did the project involve Human genetic material?	
• Did the project involve Human biological samples?	
• Did the project involve Human data collection?	
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	
• Did the project involve Human Foetal Tissue / Cells?	

• Did the project involve Human Embryonic Stem Cells (hESCs)?	
• Did the project on human Embryonic Stem Cells involve cells in culture?	
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	
PRIVACY	
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	
• Did the project involve tracking the location or observation of people?	
RESEARCH ON ANIMALS	
• Did the project involve research on animals?	
• Were those animals transgenic small laboratory animals?	
• Were those animals transgenic farm animals?	
• Were those animals cloned farm animals?	
• Were those animals non-human primates?	
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	
DUAL USE	
• Research having direct military use	0 Yes 0 No
• Research having the potential for terrorist abuse	

C Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator	2	1
Work package leaders	3	3
Experienced researchers (i.e. PhD holders)	4	4
PhD Students	1	1
Other	3	1

4. How many additional researchers (in companies and universities) were recruited specifically for this project?	**4**
Of which, indicate the number of men:	1

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project?	○	Yes
	⊗	No

6. Which of the following actions did you carry out and how effective were they?

	Not at all effective				Very effective
❑ Design and implement an equal opportunity policy	○	○	○	○	○
❑ Set targets to achieve a gender balance in the workforce	○	○	○	○	○
❑ Organise conferences and workshops on gender	○	○	○	○	○
❑ Actions to improve work-life balance	○	○	○	○	○

○ Other:

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

○ Yes- please specify

⊗ No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

○ Yes- please specify

⊗ No

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

○ Yes- please specify

⊗ No

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

○	Main discipline[11]: 1.4		
○	Associated discipline[11]: 5.4	○	Associated discipline[11]:

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? *(if 'No', go to Question 14)*	○ ⊗	Yes No

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

- ⊗ No
- ○ Yes- in determining what research should be performed
- ○ Yes - in implementing the research
- ○ Yes, in communicating /disseminating / using the results of the project

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	○ ⊗	Yes No

12. Did you engage with government / public bodies or policy makers (including international organisations)

- ○ No
- ⊗ Yes- in framing the research agenda
- ⊗ Yes - in implementing the research agenda
- ⊗ Yes, in communicating /disseminating / using the results of the project

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

- ○ Yes – as a **primary** objective (please indicate areas below- multiple answers possible)
- ⊗ Yes – as a **secondary** objective (please indicate areas below - multiple answer possible)
- ○ No

13b If Yes, in which fields?

[11] Insert number from list below (Frascati Manual).

Agriculture		Energy		Human rights	
Audiovisual and Media		Enlargement		Information Society	X
Budget		Enterprise		Institutional affairs	
Competition		Environment	X	Internal Market	
Consumers		External Relations		Justice, freedom and security	
Culture		External Trade		Public Health	
Customs		Fisheries and Maritime Affairs		Regional Policy	
Development Economic and Monetary Affairs		Food Safety		Research and Innovation	X
		Foreign and Security Policy		Space	
Education, Training, Youth		Fraud		Taxation	
Employment and Social Affairs		Humanitarian aid		Transport	

13c If Yes, at which level?

- ○ Local / regional levels
- ⊗ National level
- ○ European level
- ○ International level

H Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?		7
To how many of these is open access[12] provided?		
How many of these are published in open access journals?		
How many of these are published in open repositories?		
To how many of these is open access not provided?		
Please check all applicable reasons for not providing open access:		
☒ publisher's licensing agreement would not permit publishing in a repository ❑ no suitable repository available ❑ no suitable open access journal available ❑ no funds available to publish in an open access journal ❑ lack of time and resources ❑ lack of information on open access ❑ other[13]: ……		
15. How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*		n/a
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	n/a
	Registered design	n/a
	Other	n/a
17. How many spin-off companies were created / are planned as a direct result of the project?		n/a

[12] Open Access is defined as free of charge access for anyone via Internet.

[13] For instance: classification for security project.

Indicate the approximate number of additional jobs in these companies:	

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

❑	Increase in employment, or	❑	In small & medium-sized enterprises
❑	Safeguard employment, or	❑	In large companies
❑	Decrease in employment,	☒	None of the above / not relevant to the project
❑	Difficult to estimate / not possible to quantify		

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs:	*Indicate figure:*
	6.67 FTEs
Difficult to estimate / not possible to quantify	❑

I Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?

○ Yes ⊗ No

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

○ Yes ⊗ No

22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

☒	Press Release	❑	Coverage in specialist press
☒	Media briefing	☒	Coverage in general (non-specialist) press
☒	TV coverage / report	☒	Coverage in national press
☒	Radio coverage / report	❑	Coverage in international press
☒	Brochures /posters / flyers	❑	Website for the general public / internet
❑	DVD /Film /Multimedia	❑	Event targeting general public (festival, conference, exhibition, science café)

23 In which languages are the information products for the general public produced?

❑	Language of the coordinator	☒	English
❑	Other language(s)		

Question F-10: Classification of Scientific Disciplines according to the Frascati Manual 2002 (Proposed Standard Practice for Surveys on Research and Experimental Development, OECD 2002):

FIELDS OF SCIENCE AND TECHNOLOGY

1. NATURAL SCIENCES

1.1 Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]

1.2 Physical sciences (astronomy and space sciences, physics and other allied subjects)

1.3 Chemical sciences (chemistry, other allied subjects)

1.4 Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, oceanography, vulcanology, palaeoecology, other allied sciences)

1.5 Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences)

2 ENGINEERING AND TECHNOLOGY

2.1 Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)

2.2 Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]

2.3. Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3. MEDICAL SCIENCES

3.1 Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immunohaematology, clinical chemistry, clinical microbiology, pathology)

3.2 Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)

3.3 Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4. AGRICULTURAL SCIENCES

4.1 Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)

4.2 Veterinary medicine

5. SOCIAL SCIENCES

5.1 Psychology

5.2 Economics

5.3 Educational sciences (education and training and other allied subjects)

5.4 Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary , methodological and historical S1T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6. HUMANITIES

6.1 History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)

6.2 Languages and literature (ancient and modern)

6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group]

Final Report on the Distribution of the European Union Financial Contribution[14]

This report shall be submitted to the Commission within 30 days after receipt of the final payment of the European Union financial contribution.

Report on the distribution of the European Union financial contribution between beneficiaries

Name of beneficiary	Final amount of EU contribution per beneficiary in Euros
1.	
2.	
n	
Total	

[14] As indicated above, this report will be submitted at a later stage