Collaborative Project

CLIM-RUN

Climate Local Information in the Mediterranean region Responding to User Needs

WP 1 – Climate Services Analysis and support

Taks: 1-2 Web-portal and visualization tools

Deliverable 1.2 – Web portal and data transfer guide

Project No. 265192– CLIM-RUN

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SUMMARY

1. Introduction

An "ad hoc" web section has been created within CLIM-RUN project website with the aim to disseminate to the stakeholders and to public at large the results of the many initiatives and workshops held by the Climate Expert Team (CET) (WP2-3) and the Stakeholder Expert Team (SET) (WP4-WP8) in the various sectors of interest of the project: energy, tourism, prevention of wild fires, and integrated coastal management zones.
At this aim the "Case Studies Portal" (link: http://www.climrun.eu/case-studies) was created with the aim to provide a quick access to the most significant results of the different case studies, through a visual and interactive approach.

The Case Studies of CLIM-RUN project are the following:

Energy sector:

1) **Spain:** focused on *hydro-power* and *solar power plants*.
2) **Morocco** focused on *solar power plants,* which play a relevant role in supplying energy to Europe
3) **Cyprus** focused on the *wind* and *solar* power plants.

Tourism Sector

1) **French Alps:** focused on *summer tourism* on climate requirements of nature sports and activities,
2) **Tunisia:** focused on *coastal tourism*, with issues such as sea level rise and beach erosion, or bathing water temperature and quality.
3) **Cyprus:** focused on the *relationship between tourism and heat waves, drought.*

Wild fires

1) **Greece:** focused on evaluating *future fire risk* in the Mediterranean and in specific target regions, for the coming 10 to 50 years.

Coastal Zone Integrated Management (Tourism and energy sectors)

1) **Friuli-Venezia region and municipality of Venice**: focused on analyzing the need of climate information and the effectiveness of climate services for the integrated assessment of climate change impacts on coastal zones at the regional to local scale**.**
2) **Croatia coastline**: focused on climate requirements of tourism, energy sectors, with parameters like water availability in rivers, risk of floods, risks for heat-waves, etc.

Differently from the main website, targeted mainly for scientists and experts already aware of the CLIM-RUN project, the Case Studies Portal offers a quick and visual-based access to the available information with the aid of video resources facilitating the use of the main results of the project to a wide audience: stakeholders, researchers, students, etc.

The Portal is made up of a map of Case Studies with link to information sheets, icons for web applications, movies, as here under reported.

To facilitate the retrieve of information a simple and complementary approach has been identified. The "search" function allows the user to find information through keywords looking through all the documents included in the "products" section: **lectures**, **deliverables**, **publications and articles**, and **presentations and posters**. (see Deliverable 9.2). While the map allows users to explore the available information with a visual approach, the search engine let them to reach directly the information they needs by using key-words which will be retrieved from title, author, and abstract of each document and product in the website.

The movies provide acoustic and visual explanation of CLIM-RUN aims and the achieved goals.

2. The main sections of Case Studies Portal

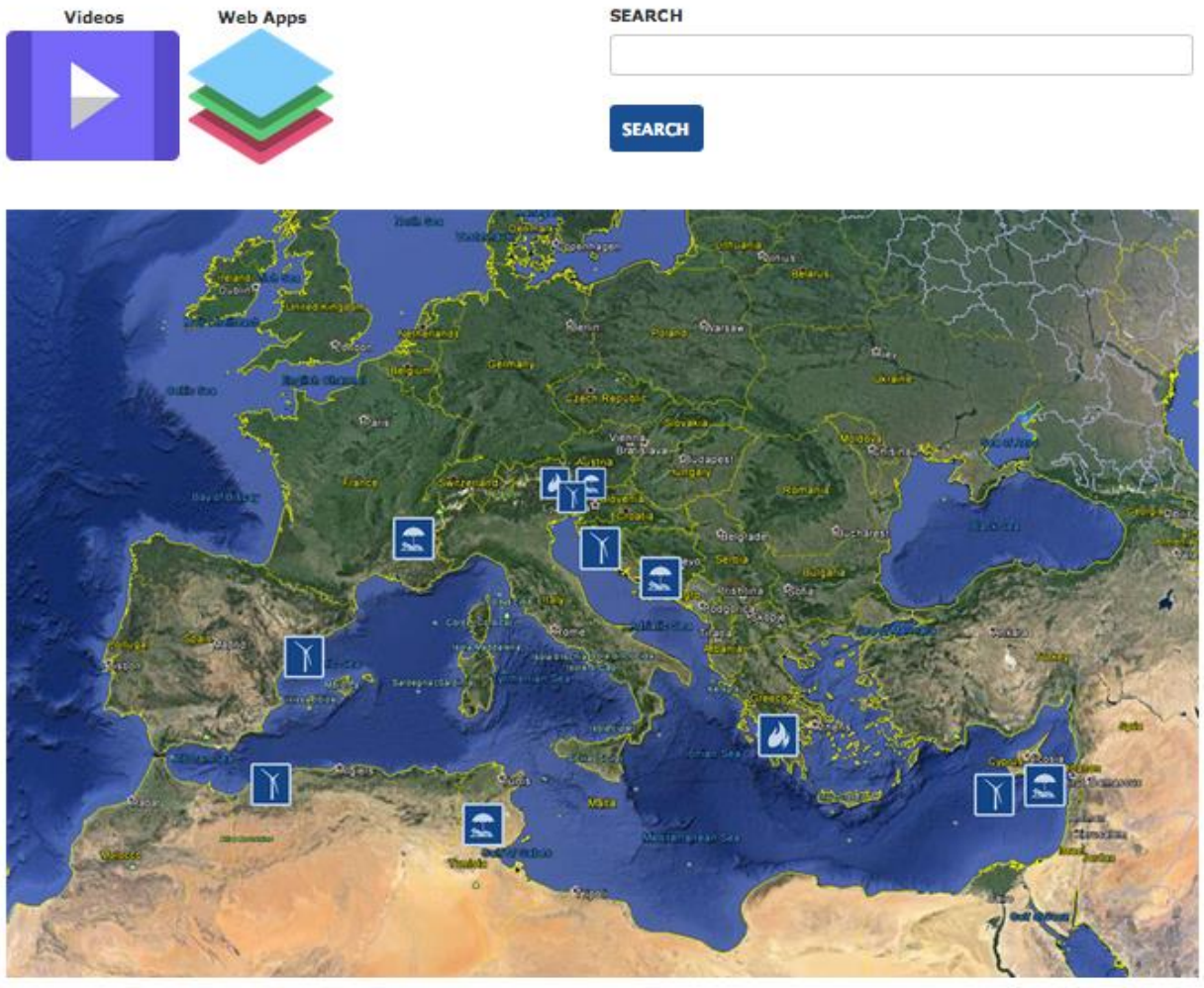

Fig. a): The front-end web interface of the Case-Studies Portal

2.1 Case Studies map and the "Information Sheets"

The Case Studies map represents Europe and North-Africa with all the case studies shown with an icon different for each sector (energy, wild fires, tourism, coastal zones integrated management). Each icon is a shortcut to the list of the information sheets related to the different case study. This approach has to be considered complementary to the use of internal search engine (accessible from the Case Studies Portal) because it allows the users to be informed on a specific case study starting

from its geographical location. Furthermore the map gives a quick glance to the geographical areas involved by CLIM-RUN research.

The "Information sheet" is a two-page document with the following sections:

1. Target groups;
2. Relevance to the case-study requirements;
3. The approach;
4. The product; and,
5. Making the product usable.

Keywords clearly indicate for which sector and cases studies each product is relevant. Contact emails are given on each information sheet in order to give the possibility to obtain more information or to provide some feedback to the authors. The aim of the Case Studies map is to give in a visual and synthetic way information concerning the considered case study and sectors, about the main results achieved in the course of the project. At the end of the project about 30 information sheets will be made available on the Case Studies section and in the Products section of CLIM-RUN web site.

2.2 Web Applications

The following web applications are the main source of interaction and data visualization of Case Studies Portal:

1) Climate Local Information WebGIS on Tourism Index (TCI), Wind Power (WP) and Fire Weather Index (FWI), made by ENEA, Italy
2) WebGIS focused on Greece (environmental information and wild fires), made by NOA, Greece
3) Downscaling Portal for wild fire and tourism studies, made by University of Cantabria, Spain.

A brief description is reported here under.

2.2.1 Climate Local Information WebGIS: Tourism Climatic Index (TCI), Wind Power (WP) and Fire Weather Index (FWI)

By: Emanuela Caiaffa, UTMEA-CLIM

Introduction

CLIM-RUN Project aims at developing a protocol for applying new methodologies and improved modeling and downscaling tools for the provision of adequate climate information at regional to local scale that is relevant to and usable by different sectors of society (policymakers, industry, cities, etc.).
In this perspective, and given the territorial nature of the information to process and manage, it seemed useful to create a webGIS to exchange data and make use of the results between all the project partners. It's important pointing out that the CLIM-RUN WebGIS is not a simple cartographic portal, but it is a product with some of the GIS typical functions.
The main purpose of the CLIM-RUN WebGIS, is to make territorially compatible and easy to handle, the climatic models outputs, that provide data on the current and future scenarios concerning the various themes involved in the project itself. Tourism Climatic Index and Wind Energy are the two themes developed up to now.

The GIS methodologies developed in the framework of the present project activities were aimed at the management of spatial data, the development of spatial analysis (geoprocessing) and the representation of thematic maps. Geospatial data base and maps are processed stored and managed in an appropriate repository: they can be viewed and interrogated mediated application of a desktop GIS or WebGIS by applying expressly developed. This is the interface of some of the major geographical results produced in the project, making them usable in an open and accessible online.

The term WebGIS refers to a collection of technologies that allow to take advantage of GIS capabilities via the Web (Internet / Intranet).
With the use of a WebGis, GIS applications, traditionally developed for stand-alone users, can be implemented on a web server (also called map- server), in order to allow, through the Internet network, the interaction with thematic maps and data associated with it. WebGIS applications are used by internet browsers (Mozilla Firefox, Google Chrome, Internet Explorer , etc. .
When a Geographic Information System is shared through Internet, the information it contains go beyond the physical limits of the container that holds them and assume global proportions.
Among the benefits of using WebGIS technology are: the global sharing of geographic information and geospatial data, ease to use by the Client, data network dissemination and the ability to reach a wider audience of users. The WebGIS tool can be used, therefore, as an information consultation tool enriched by the geospatial component, query and analysis of geographic data and thematic maps. The WebGIS is not a simple extension of a suite of GIS Desktop type, but it is part of the larger category Web Oriented Software. The network is the way for the interchange of data through the Web browser and the communication is based on client-server architecture in which two independent modules interact to perform a task (figure 1).

Development of a WebGIS as well as the implementation of a technology architecture (hardware and software), should also refer to a set of standards, rules and procedures designed to facilitate the availability, consistency and access to geospatial data. This is the case of Spatial Data Infrastructure (Spatial Data Infrastructure, SDI), which is a common platform for research, publication and use of geographic data. An SDI is something more than a set of data: it handles data and its attributes,

metadata, tools for searching and viewing data. An SDI provides an ideal environment to connect applications to data, at the same time influencing the creation of data and the development of applications based on standards and appropriate procedures.

CLIM-RUN WebGIS application

In order to make accessible and available on-line a series of results obtained in the framework of this project, has been designed and developed a WebGIS application, available at http://192.168.128.58/climrun/.

For the development of this application has been chosen to take advantage of packages Free Software / Open Source (FOSS). The logical architecture of the WebGIS is shown in Figure 1 and consists of the operational chain: Data Repository - > Web Server (GeoServer) - > Library (OpenLayers) - > Map Viewer (WebGIS) .

The Repository data identifies the storage area that contains the set of data to be used (in general format GIS) and that allow access only to the devices physically defined at the level of the Storage Area Network, in order to ensure the absolute integrity and consistency of the same.

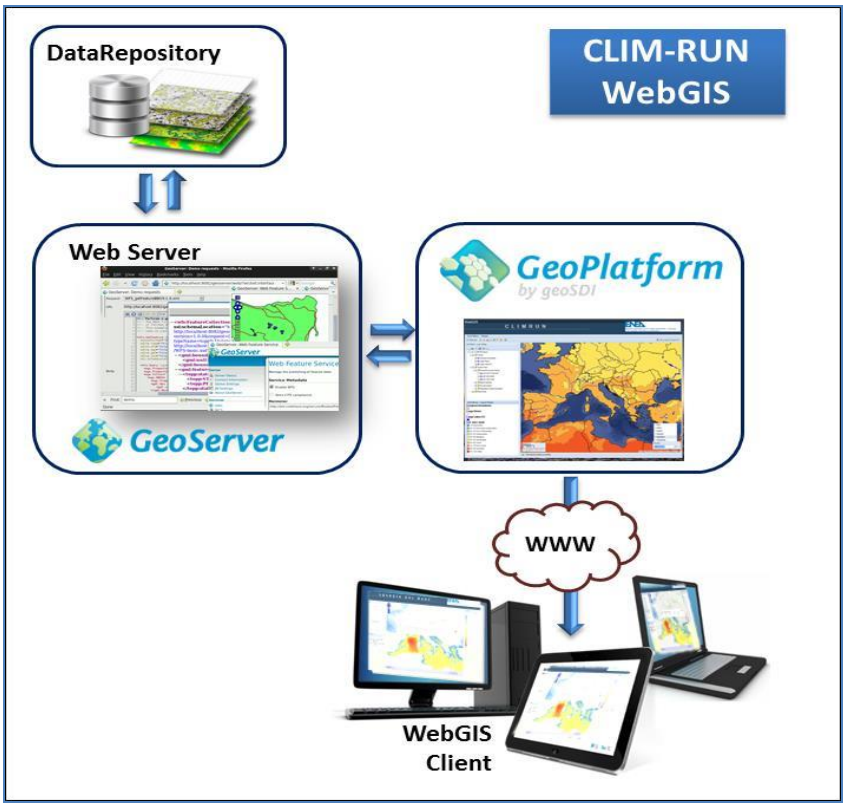

Fig. 1. Logical architecture of implemented WebGIS

Web Server is a set of equipment and related software that allow the system to organize information and make it accessible to the network. In this case, it has been chosen to use GeoServer. It is a web server that can provide maps and data, from a variety of formats, to standard clients, such as web browsers and desktop-like GIS software. This makes it possible to store spatial data in almost any format users prefer. From the technical point of view, GeoServer is the reference implementation of the standards defined by the Open Geospatial Consortium (OGC): Web Feature Service (WFS), Web Coverage Service (WCS) and Web Map Service (WMS).

The Open Geospatial Consortium (formerly the OpenGIS Consortium) is an international non - profit organization based on voluntary consent, which is responsible for defining the technical specifications for geospatial and location services (*location based*). OGC is made up of over 280 members (governments, private industry, universities) with the objective to develop and implement standards for the content, services and the exchange of geographic data that are "open and extensible" and which promotes the interoperability . The specifications defined by OGC are public (PAS), and available for free.

In order to build the WebGIS for Climrun project, it was then decided to use open source software, whose use is governed only by the license GNU General Public License.
The two software environments used are: GeoServer and Geo-Platform by geoSDI.

Software

GeoServer is an open source software server written in Java that allows users to share and edit geospatial data. An important feature it is that GeoServer is designed for interoperability, and it publishes data from any major spatial data source using open standards (http://docs.geoserver.org/2.0.0/user/introduction/index.html).
Being a community-driven project, GeoServer is developed, tested, and supported by a diverse group of individuals and organizations from around the world.
GeoServer is the reference implementation of the Open Geospatial Consortium (OGC) Web Feature Service (WFS) and Web Coverage Service (WCS) standards, as well as a high performance certified compliant Web Map Service (WMS). GeoServer forms a core component of the Geospatial Web.
The main GeoServer mission is continuing to make spatial data more accessible to all.
GeoServer is free software and is licensed under the GNU General Public License.

Geo-Platform

Geo-Platform (http://code.google.com/p/geo-platform/) is an Open Source Framework developed by geoSDI (http://www.geosdi.org/index.php/en/) for creating Rich Web GIS Applications based on geospatial web-based software and using an open source approach.
geoSDI is a research group of the Institute of Methodologies for Environmental Analysis of the National Council of Research (CNR IMAA), which designs, manufactures and distributes geospatial web-based software systems, using an open source approach.
Geo-Platform Framework is able to extend and enhance webGIS applications adding Widgets (e.g. Map feature, Layer tree, Layer properties) that perform functional needs of the end user. Geo-

Platform can be installed locally: it allows to set up different users with roles and every user can have one or more projects associated.
Data can reside locally or on different remote servers (via OGC-compliant services). The use of OGC standards allows to provide heterogeneous Geospatial Data as Geospatial Services. Thus, the Geo-platform interface efficiently allows to retrieve data in geospatial format from Geoserver (via WMS service) and to display them as map layers.

WebGIS CLIMRUN

The WebGIS application can be accessed, as shown in figure 2, at the following address http://192.168.128.58/climrun/ using the following credentials:
username: climrun
password: climrun
The work starts with the elaboration of numerical files coming from provisional model able to provide a scenario current and future for the topics of interest. These numeric files, that give us the present (1961-1990) and future (2021-2050) scenarios for the selected topics, before being usable within the WebGIS, were loaded and processed by a GIS built ad hoc. GIS use enables the creation of a GIS layers series (scenarios), which can be loaded into the WebGIS and become accessible to all.

Figure 2. CLIM-RUN webGIS access page

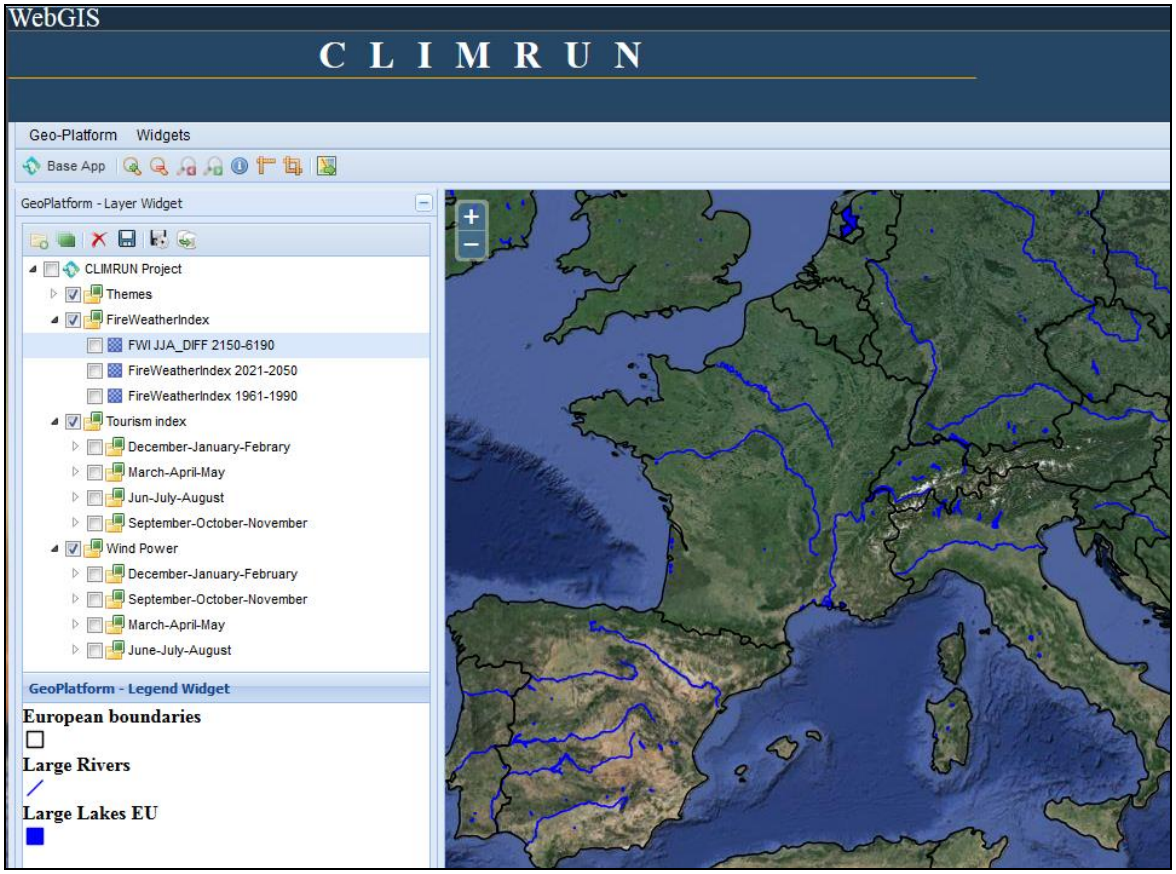

Figure 3. CLIM-RUN webGIS start page

The themes developed up to now are: Tourism Climatic Index (TCI), Wind Power (WP) and Fire Weather Index (FWI) only for the June, July and August period.
In order to make the result more readable, some reference layers were also loaded, like the European countries boundaries, major rivers and large lakes (figure 3).
Once you enter the start page, in order to see the themes represented on the map, it is necessary to activate the desired themes clicking on the small gray rectangle  .

The following figures are to give an idea how the WebGIS works. In figure 4, for example, it is possible to see the values predicted for December - January - February 2021-2050 scenario for TCI divided in some classes.

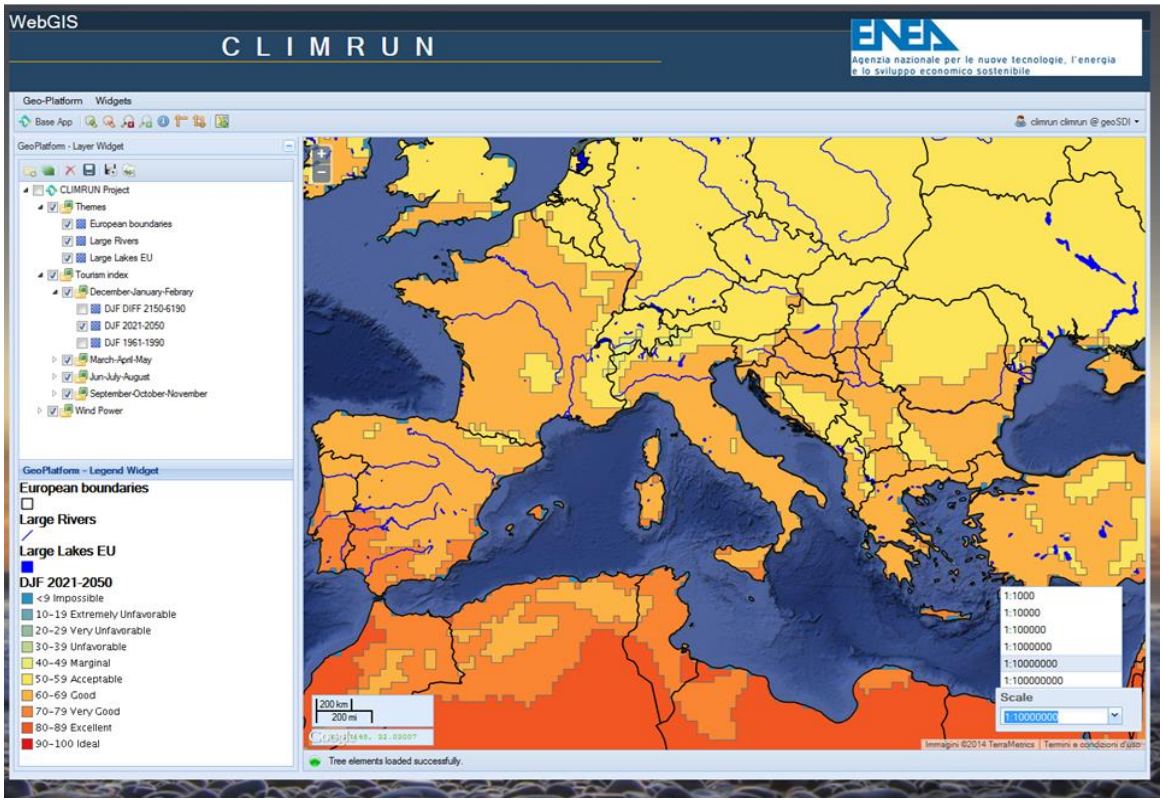

Figure 4. Output showing the values predicted for December - January - February 2021-2050 scenario for TCI

Another example is the figure 5 in which it is possible to see layers combination showing changes in TCI. The shown scenario in figure 5, DJF DIFF 2150 6190, is relative to the difference between the values of the Index of tourism TCI, for the scenario 2021-2050 unless the scenario 1960-1990 for the December-January-February period.

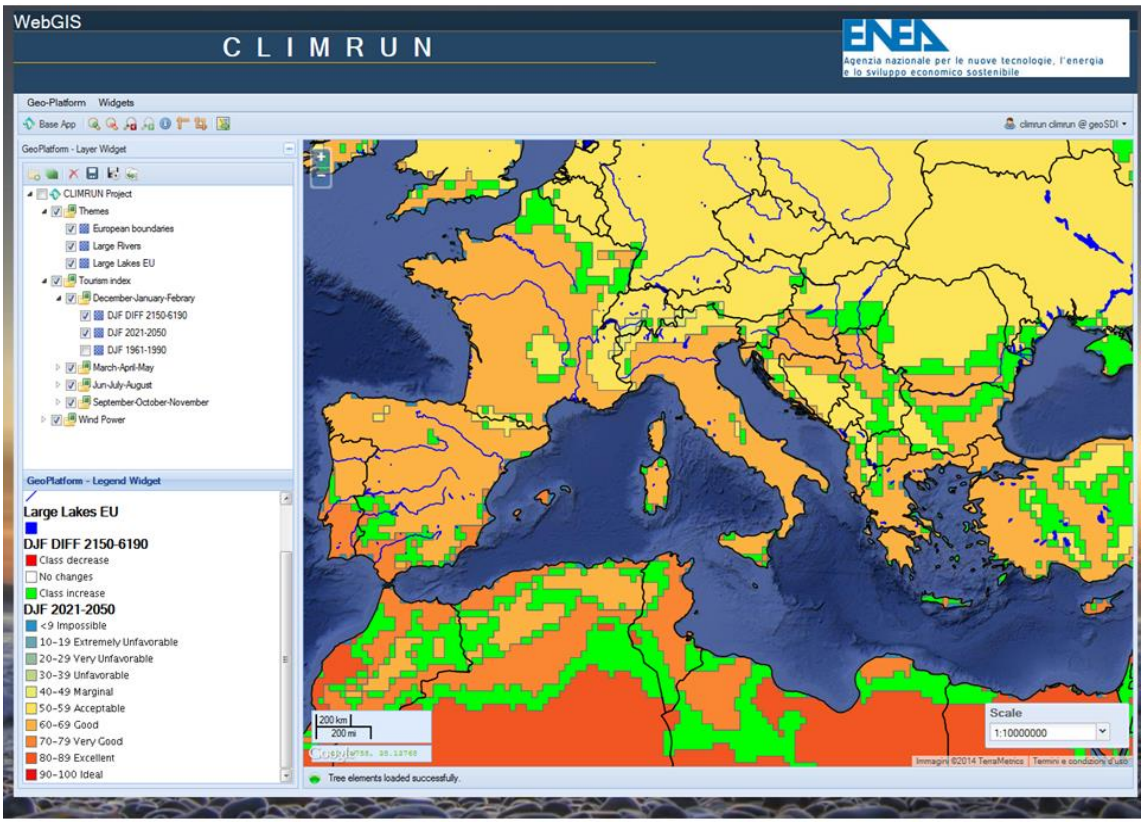

Figure 5. Example of output combination showing changes in TCI

The order in which the layers have been put, one above the other, is not casual. For example, regarding themes related to the TCI (figure 5), the scenario for the 1961-1990 period, it's placed under 2021-2150 scenario predicted by the model. Using the button ☑ turns on / off theme, it's possible to see where and how much the change occurred between the two scenarios. Still above it's placed the layer reporting the difference of the two scenarios, calculated in GIS environment. In this way, it's possible have the idea of the change "quantitatively" and territorially (figure 5).

In the next example of Figure 6, the trend of the scenarios, for the results obtained by analyzing Wind Power data set over the entire European and Mediterranean area, are shown.

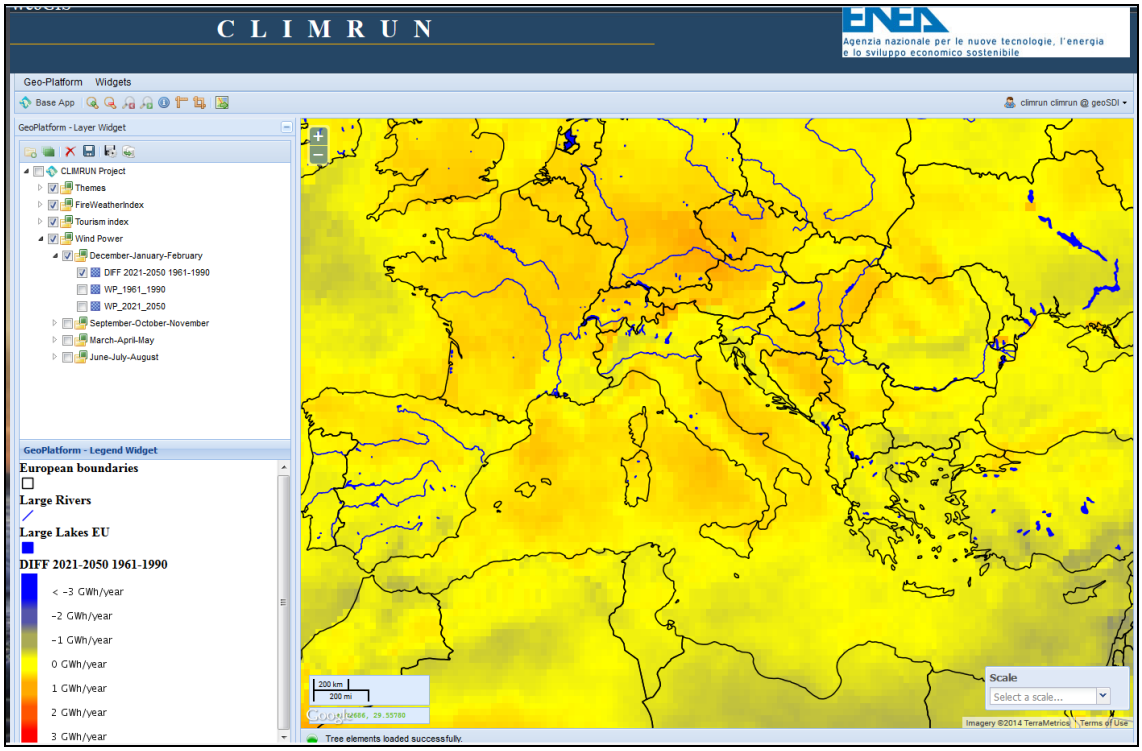

Figure 6. Output showing the values predicted for December - January - February 2021-2050 scenario for WP

In particular in figure 6 is reported the Wind Power theme (DIFF 2021-2050 1961-1990) showing the difference between the two scenarios: WP_2021_2050 scenario unless WP_1961_1990 scenario.
The result shown in figure 7, represent the output obtained thematizing the data relative to the Fire Weather Index 2021-2050 for the June, July and August period.

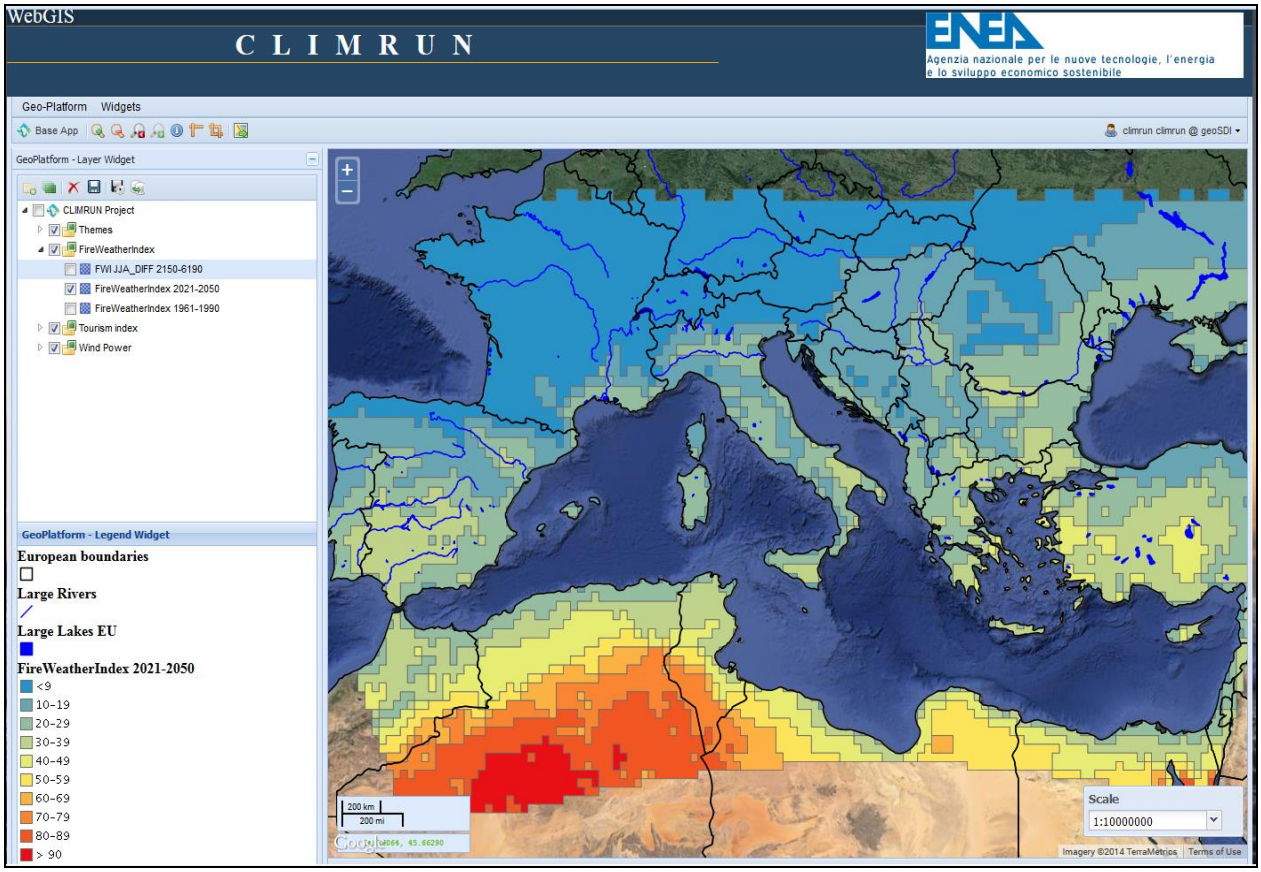

Figure 7. Fire Weather Index 2021-2050 for the June, July and August period.

The following figure 8 is dedicated to show some of the typical GIS function implemented in this webGIS.

Using the function Identify present in the toolbar of the application, as shown in figure 8, it's possible to access the pixel information, in this case related to European boundaries, and, for example Garda lake. Furthermore it is possible to activate a list of territorial scale with which to represent the founded results.

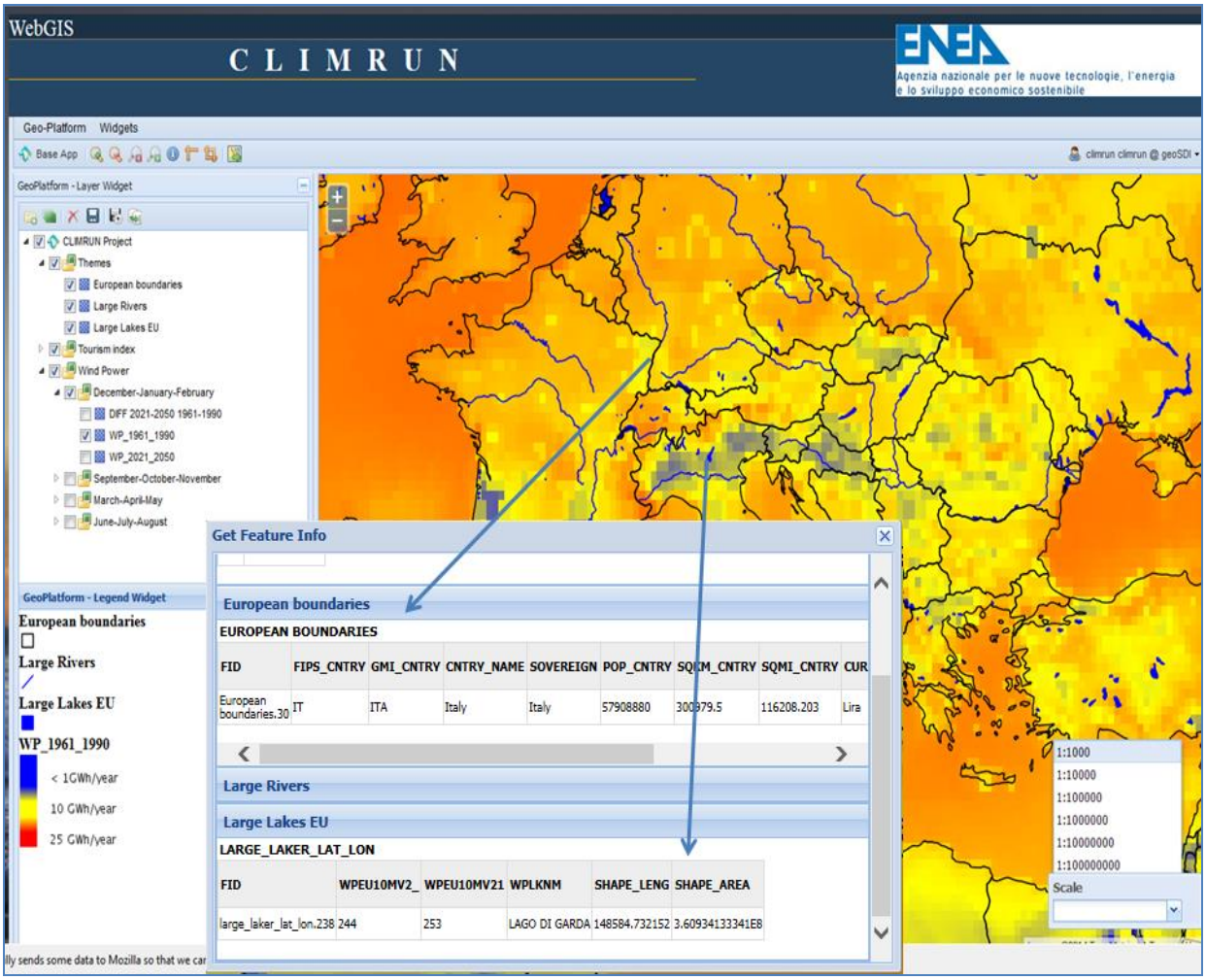

Figure 8. Identify function and territorial scale choice

Conclusions

The work presented in this short report is an attempt to demonstrate the feasibility to build a WebGIS tool useful for publishing and sharing results coming from calculation models and having the possibility to be linked to the territory. This option makes it possible to introduce such data within a GIS. When loaded and made compatible with the formats handled by the GIS, these data become geographic information and from this point onwards can be treated as GIS layers to all effects.

It is necessary, at this point, to emphasize, that, the work done so far, has been an experimental work, which, through the use of new users also, will have to be refined and made applicable to future projects that need the same facilities.
The fact of having used open-source software, simplifies the way for the dissemination and sharing of what we have created

2.2.2 WebGIS Oikoskopio

Author: Christos Giannakopoulus, NOA, Greece

The webGIS (Oikoskopio) is focused on Greece and it provides high resolution environmental information (land cover, protected areas, etc.) combined with a set of indices related to wild fires (e.g. number of days with high fire risk, number of dry days). Indices can be shown for three time frames: 1961-1990, 2021-2050 and 2071-2100.
In collaboration with the World Wide Fund for Nature (WWF) Greece, an interactive Google-maps based application for the estimation of future climate change indices of relevance to fire risk has been realized by NOA. The application is hosted in the WWF Greece website of 'Oikoskopio' http://www.oikoskopio.gr/map/ and in the main websites of NOA www.noa.gr under the 'EcoScope' tab and IERSD/NOA at www.meteo.noa.gr under the 'web-platform for climate change impacts' tab.
Meteorological output from the regional climate model RACMO2 for the control period (1961-1990) as well as for the near (2021-2050) and distant future (2071-2100) was used to examine potential changes in selected climatic indices in Greece and its sub-regions. This model was developed within the framework of the EU project ENSEMBLES (www.ensembles-eu.org) in which the National Observatory of Athens participated. RACMO2 model data were provided by the Royal Netherlands Meteorological Institute (KNMI). The KNMI- RACMO2 regional climate model (Lenderink et al., 2003; van den Hurk et al., 2006) is forced with output from a transient run conducted with the ECHAM5 Global Climate Model. The model uses 40 vertical levels on a horizontal 95x85 (lat x lon) grid and has a horizontal resolution of 25km. The selection of this specific model was based on a model assessment exercise performed within the ENSEMBLES project. The ability of all models to simulate the present climate was assessed and KNMI-RACMO2 was considered to more reliably simulate climate and extremes for the Mediterranean region (see ENSEMBLES Deliverable D3.2.2).

2.2.3 Application of the UC statistical downscaling portal

Author: M. D. Frias (University of Cantabria)

Interactive user-friendly tools are necessary in order to ease the downscaling process for the end users, thus maximizing the exploitation of the available climate projections. The University of Cantabria (UC) has developed a statistical downscaling portalwhich has been adapted to the requirements of the different sectors involved in CLIM-RUN project (energy, wild fires, tourism). The portal, accessible at: www.meteo.unicam.es/downscaling/climrun, has been organized in different windows (tabs) to gradually access the information necessary to define the downscaling tasks. Defining the predictors, choosing the local/regional target variable to be downscaled and creating the downscaling method.

More details about the use of this portal are provided in the user guide (Gutiérrez et al. 2012) available at:
https://www.meteo.unican.es/downscaling/doc/UserGuide.pdf.

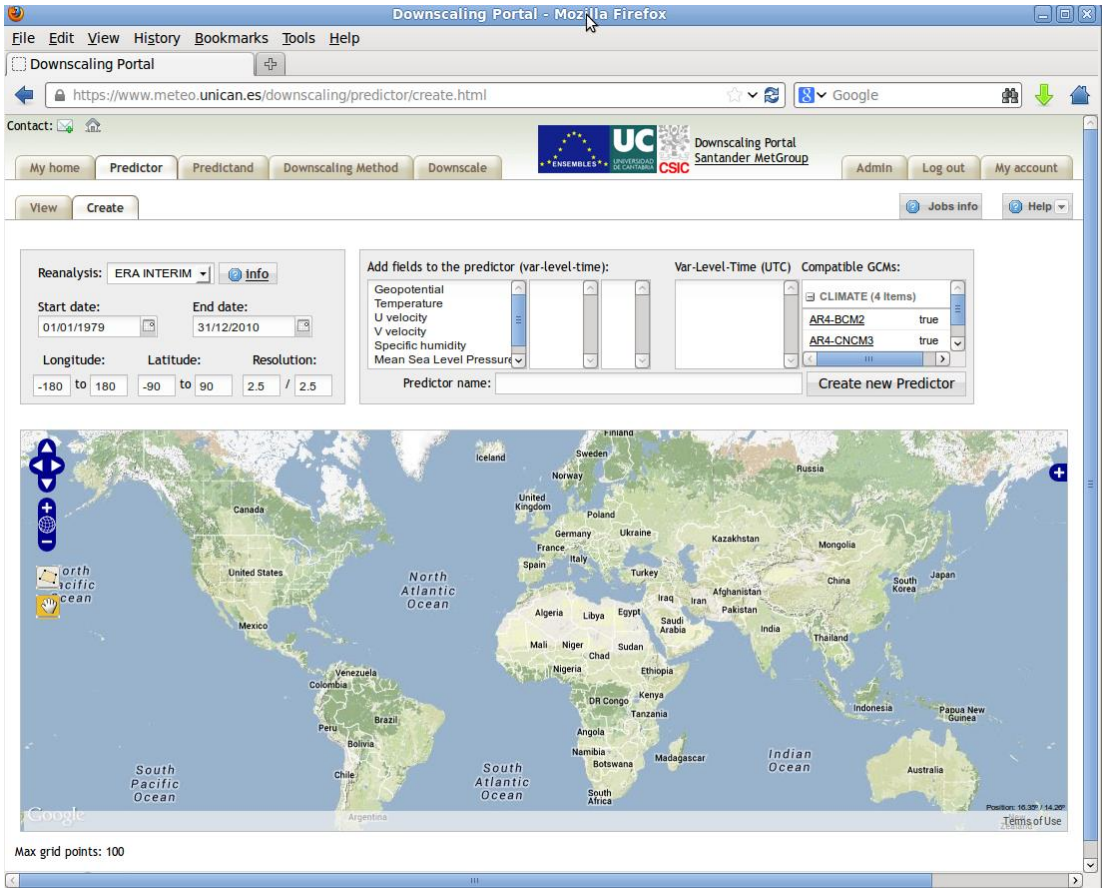

Fig. b) Front-end of the UC Statistical downscaling Portal

2.3 Movies & Animations

Videos and animations are an effective way to disseminate CLIM-RUN results and main message concerning important concepts about climate services. The Case Studies Portal offers five different videos hosted publicly on Youtube and Vimeos:

2.3.1 Climate Local Information in the Mediterranean region Responding to User Needs

The video made by ENEA and CMCC offers an introduction to the project through a series of interviews to climate experts of the CLIM-RUN project who present the project while describing the main aims of the project, the participatory process and stakeholders involvement, the climate models and products, and the case studies developed and analyzed within the project. CLIM-RUN is the first EU project on climate services and aims at developing a protocol for applying new methodologies and improved modeling and downscaling tools for the provision of adequate climate information at regional to local scale that is relevant to and usable by different sectors of society (policymakers, industry, cities, etc.). The project aims therefore at bridging the gap between users and climate science. It's focused on four main areas: tourism, renewable energies, coastal areas and disaster risk reduction.

Link http://www.youtube.com/watch?v=s52cMvCUSlI

2.3.2 Climate services for the North Adriatic coastal zone: a description of the North Adriatic case study

The video is made by CMCC.

Climate experts and stakeholders tell the experience of the integrated North Adriatic case study within the CLIM-RUN project while describing the development of climate services tailored to coastal zone managers' needs, an essential requirement to mainstream climate change adaptation in the definition of sustainable plans, policies and programs.

Link: http://www.youtube.com/watch?v=XDraRXSEZG82.

2.3.3. Climate Forecasting for Renewable Energy:

This video made by IC3 describes the connection between climate and renewable energy

Wind and solar power generation is directly affected by weather, which is known to vary considerably over space and time. When planning and operating these renewable systems, there is therefore a large uncertainty in the amount of power that will be generated over future timescales.

This is particularly true at climate timescales, defined here as the "behaviour" of weather over relatively long periods of time: wind speed or solar power generation is rarely the same from one month or season within a given year, to the same month or season the following year. Likewise, there can be a considerable variation in power generation from one full year or decade to the next. The uncertainty of power variability over time is known as climate risk.

Probabilistic climate forecasts aim to provide robust information of future wind and solar resource variability, including extremes, over climate timescales, to minimise the uncertainty of future renewable power generation. By understanding the expected changes in these resources and the impact on wind and solar power generation, improved, proactive and anticipatory adaptation decisions can be made to manage climate-related risks within renewable power planning and operation strategies.

Link: http://www.youtube.com/watch?v=sv9kUqZTUYI

2.3.4 The uncertainties in climate change scenario.

This movie made by CNRM is an animation introducing the difference between climate and weather and the main sources of uncertainty related to them.

One of the most complicated issues to be understood by stakeholders using climate services is the concept of future climate change scenario uncertainties. Three main causes of uncertainty have been identified in global and regional climate change scenario: (i) climate natural variability, (ii) climate model related uncertainty and (iii) socioeconomic scenario uncertainty. These uncertainties are more and more understood and quantified by the climate modeling community and communication is now possible and needed. For example, it is now clear that the relative weight of those uncertainties in climate change projections strongly depends on the temporal horizon considered. It is also clear that origin and response to each of the uncertainties by citizens and stakeholders must be different: the first uncertainty is intrinsic to climate and cannot be reduced, the second one is due to current scientific limitations and may decrease with improved knowledge and the third uncertainty is linked with human being current and long-term decisions. Moreover, understanding

and quantifying these uncertainties is of first importance when showing climate change scenario results to stakeholders as their decisions may depend on the proposed range of possible. It is also clear now that, despite remaining uncertainties, climate change is occurring worldwide and that it is going to amplify in the coming decades.

Link: http://vimeo.com/81493354

2.3.5 Cherchez les femmes!

A video made by ENEA focused on the important role had by women in CLIM-RUN project has been realized as an ad hoc initiative to raise women visibility in the project.

Seven women participating in the project have been interviewed to talk about their research activity in the project.

Link: http://www.youtube.com/watch?v=2MKqTVBdc9Q

3. Conclusions

All the above indicated products aim at transferring information about climate services from climate scientists to stakeholders and public in general. In particular, videos give the possibility to easily disseminate CLIM-RUN research work on social networks and they can potentially be used also for educational purposes.

The information available are free and open source software have been preferred to facilitate the dissemination of data/information and to encourage the collaboration with other data users/producers.

It has to be pointed out that the documents and data of Case Studies Portal as all the other information contained in CLIM-RUN website have been carried out in the frame of a research project and for this reason they cannot be considered as a practical tool for stakeholders. For any operational use, interaction with the authors and reference people indicated in the various products is necessary. All the products: information sheets, web applications and videos report the indication of the authors and their e-mail address.

CLIM-RUN has been the first European project about Climate Services and it came across in several new challenges related to the climate science and communication with stakeholders. Nevertheless, the CLIM-RUN results can be considered the first step of the European area towards the creation of effective and competitive Climate Services. The Case Study portal may be considered an important prototype of how scientific results related to Climate Services must be disseminated, although at the beginning of the project the complexity of the "communication" part was not completely clear. In spite of the difficulties, CLIM-RUN now provides a set of professional videos explaining scientific results targeted to scientific and non-scientific audience, giving to the climate science community the occasion to describe the urgent need of European Climate Services.

The three web applications : Climate Local Information WebGIS: Tourism Climatic Index (TCI), Wind Power (WP) and Fire Weather Index (FWI), have been completed with the related instruction and guide for transferring data and information.

The Portal can provide useful material for ongoing and future European Projects, such as ECLISE and the European initiative for climate service observation and modelling (ECOMS), together with EUPORIAS, NACLIM, SPECS Projects in view of the creation of the final climate services Platform for the Mediterranean Region.