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Collaborative Project

CLIM-RUN

Climate Local Information in the Mediterranean region Responding to User Needs

WP 6 – Wild Fires Case Study
Task 6.1 - Organization of periodic meetings and surveys

Deliverable 6.2: 2nd Workshop report

Project No. 265192– CLIM-RUN

Start date of project: 1st March 2011 Duration: 36 months

Organization name of lead contractor for this deliverable: **National Observatory of Athens** (NOA)

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1. Introduction

The work package WP6 focuses on the analysis of the climate information required in areas where forest fires represent a major hazard. This package will evaluate future fire risk in the Mediterranean and in specific target regions, mainly Greece, for the next 10 to 50 years. The WP6 will illustrate how climate information can play an important role in the identification of vulnerable regions and in the management of existing and new forests.

As a first step, bearing in mind that the CLIM-RUN project has adopted the method of an active participation early in the research on behalf of the end users, a workshop with forest fire stakeholders was organized by the National Observatory of Athens (NOA) in Athens in September of 2011.

Following this event, the second workshop was carried out in June of this year, at the premises of NOA in Athens. In this workshop, participants from public services and research institutes attended.

The aim of this deliverable is to provide an overview of the second stakeholders' workshop. A description of the applications (products) developed during the project is discussed first followed by suggestions and next steps needed in order to refine these products further. The proceedings of the workshop are presented next, followed by conclusive comments, references and annexes.

2. Products

During the framework of the project three products were developed in order to meet the needs of stakeholders concerning the wild fires case study.

These products were designed after the interaction between scientists and stakeholders and were presented during the second stakeholders' w

orkshop. It is worth mentioning here that mainly three groups of fire stakeholders were taken into consideration during the products' development. These groups were established in earlier stages of the project after the first workshop and constitute the following: the short term fire planners, the long term policy makers as well as the educational stakeholders. In the following paragraphs the main characteristics of each product, the scientific methodology followed and future work will be discussed.

All products developed to assess fire risk are based upon the Canadian Fire Weather Index (FWI). Briefly, FWI is a daily meteorological-based index used worldwide including the Mediterranean basin to estimate fire danger in a generalized fuel type. The FWI System provides numerical ratings of relative fire potential based solely on weather observations (van Wagner, 1987). The meteorological inputs to the FWI System are daily noon values of temperature, air relative humidity, 10m wind speed and precipitation during the previous 24 hours.

2.1. Product 1: Educational Software for Fire Weather Index

Mediterranean Europe and Greece in particular, are regions vulnerable to increased fire risk due to changing climatic conditions. The analysis of the fire risk for regions where forest fires represent a major hazard can provide the wildfire stakeholders a better understanding of what they need from climate services. To demonstrate the value of the climate services to a broad audience (i.e. short term fire planning, long term fire policy making and educational stakeholders), an informative training tool is required.

For this reason the National Observatory of Athens (NOA) has developed two interactive user-friendly runtime applications.

The first application calculates theoretical values of the FWI index and plots them accordingly. The user can only change one or two meteorological parameters at a time quickly affecting the plot of the

index, thus receiving a first understanding on the physics behind the calculation of the FWI index. An example is shown in Figure 1 that follows. The user can easily see the influence of temperature and wind on FWI fluctuations.

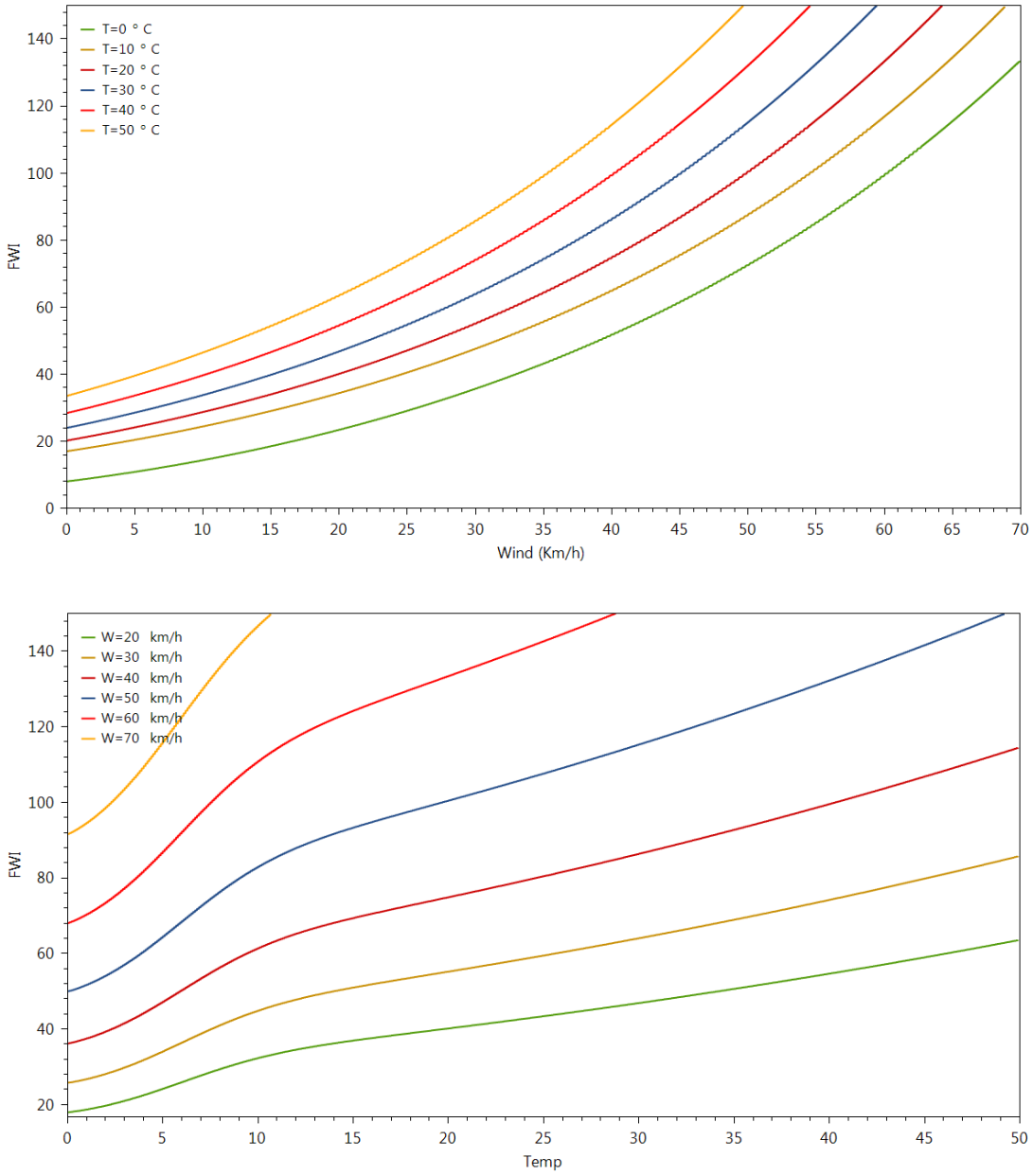

Figure1: Theoretical curve families for different temperatures and wind speed values.

The second application runs on real data. The choices of data include either data from the National Meteorological Service of Greece or data from a regional climate model such as RACMO2-KNMI or even the user's own data. The user can focus on the fire weather index or on each one of its components and display them on graphs for the location of interest. The graph inset can show the time evolution of an index component for a certain period of time (data series available for 1960-2000), as well as its daily means on an annual or seasonal basis. Once the desired plot is generated, the user can change the four meteorological parameters affecting FWI, thus receiving a second insight into the physical inner workings of the index. An example is given in Figure 2. The educational relevance of the tool is based on the user's ability to manually adjust the meteorological parameters over a range of values, giving him the opportunity to study the behaviour of the fire index under different climatic conditions.

Both of the aforementioned applications can function as educational software tools and complement the two web-based applications also developed in the framework of climate services for fire risk described later on in this deliverable.

We anticipate that these interactive software tools will be a useful tool in the hands of policy makers and local Government Officials who wish to gain training on the behaviour of fire risk indices and to calculate fire risk for their region of interest using their own meteorological data.

Moreover, as the second application is now only focusing on a selected number of locations with available meteorological measurements, we plan to expand the present database using gridded observational data together with regional climate model output, thus providing a broad selection of locations for the potential user covering the entire Greek and/or Mediterranean domain upon request.

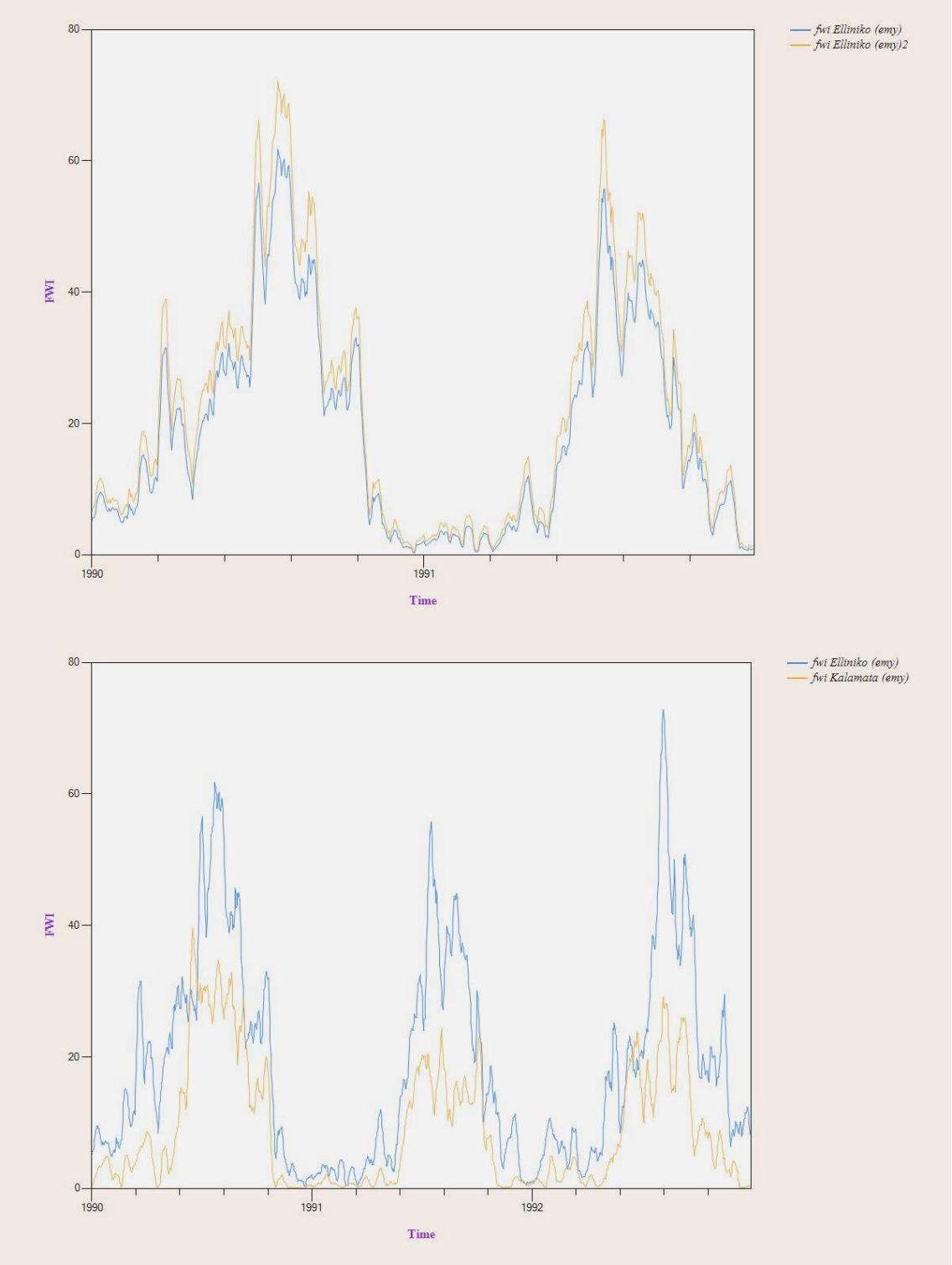

Figure 2: Mean FWI values for the same station by modifying the meteorological input data (top) and over-plotting two stations for comparison (bottom).

2.2. Product 2: Future fire risk in Greece and its sub-regions

Greece is likely to suffer potentially increased fire risk due to changing climatic conditions. Forest fires are highly sensitive to climate change because fire behaviour responds immediately to fuel moisture, which in turn is affected by precipitation, relative humidity, air temperature and wind speed (Stocks et al., 2001). Therefore, the projected increase in temperature will lead to an increase of fuel dryness and a reduction of relative humidity. This effect will probably be worse in those regions where rainfall decreases. Accordingly, increases in climate extreme events are expected to have a great impact on forest fire vulnerability (Beniston, 2003).

In the second product, meteorological output from the regional climate model RACMO2 for the near (2021-2050) and distant future (2071-2100) was used to examine potential changes in fire risk in Greece and its sub-regions. This model was developed within the framework of the EU project ENSEMBLES (www.ensembles-eu.org) where the National Observatory of Athens participated. RACMO2 model data were provided by the Royal Netherlands Meteorological Institute widely known as 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 95*85 (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 found to more accurately simulate climate and extremes for the Mediterranean region (ENSEMBLES Deliverable D3.2.2).

In collaboration with the World Wide Fund for Nature (WWF) Greece, we have developed an interactive Google-maps based application for the estimation of future climate change indices of relevance to fire risk. The indices include:

- Annual number of dry days (PP<0.5mm)
- Annual number of days with moderate (FWI>15)/high (FWI>30)/extreme (FWI>45) fire risk
- Mean annual Fire Weather Index (FWI) during fire season (May-October) and summer
- Annual number of hot days (Tmax>30◦C) and heatwave days (Tmax>35◦C)
- Annual number of tropical nights (Tmin>20◦C)

The application is hosted in the WWF Greece website of 'oikoskopio' (http://www.oikoskopio.gr/map/) and in the website of NOA under 'climate change' tab (www.meteo.noa.gr).

The user can focus on his chosen climatic index and display its values on the map for the region of interest. A graph inset is also presented showing the variation of its selected climatic index for the chosen region for the present (1961-1990), near future (2021-2050) and the distant future period (2071-2100). An example of a user generated map is illustrated in Figure 3.

This interactive application will certainly be a useful tool in the hands of policy makers and local Government officials who wish to have access to easy-to-get information about climate change parameters in their region of interest. However, these projections have been produced using output from a single regional climate model and hence they are subject to uncertainties. In the future, we plan to use output from a selection of regional climate models in order to reduce uncertainty in our projections as well as to add more climatic indices of interest to stakeholders and policy decision makers.

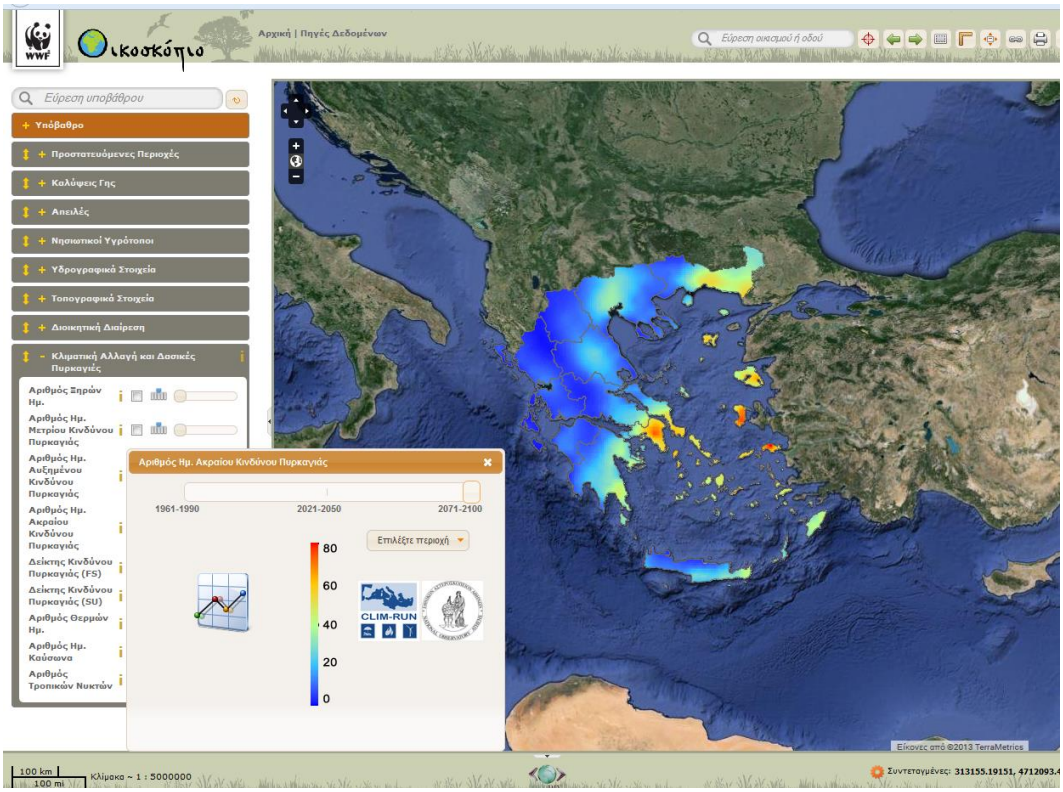

Figure 3: Mean number of days with FWI> 45 for the period 2071-2100 for the entire domain.

2.3. Product 3: Short term fire risk forecast for Greece

Mediterranean forests are vulnerable to fire, primarily due to the long, hot and dry summers, the mild winters, the strong winds prevailing especially during the summer season, the intense terrain as well as the flammable xerophytic vegetation.

A tragic event demonstrates this vulnerability when during the summer of 2007 Greece experienced two extreme and unprecedented events. The first was the occurrence of three extreme heat waves that hit the country from late June to the end of August. The extremely high temperatures combined with a prolonged dry period triggered the ignition of the most extensive and destructive forest fires in the country's modern history. During that period a total of 2700 km^2 were destroyed and 84 people lost their lives. As extreme as this event may be, it is not unique; making the preparedness of civil protection services a high priority.

In this view, and in collaboration with the weather forecasting team of the National Observatory of Athens, an application providing fire risk forecast for the following 3 days was created. This application is based on the MM5 model output. The MM5 is a limited-area, non-hydrostatic, terrain-following sigma-coordinate model designed to simulate or predict mesoscale atmospheric circulation. MM5 has been developed at Penn State and NCAR as a community mesoscale model with contributions from users worldwide and is used operationally at NOA since 2002. This application is hosted in the forecast website of the National Observatory of Athens (http://www.noa.gr/forecast/bolam/index.htm).

The user has the capability to view the forecast map of the FWI index for the Greek territory of the current day (DAY D) as well as for the two following days (DAY D+1 and DAY D+2) as seen in Figure 4.

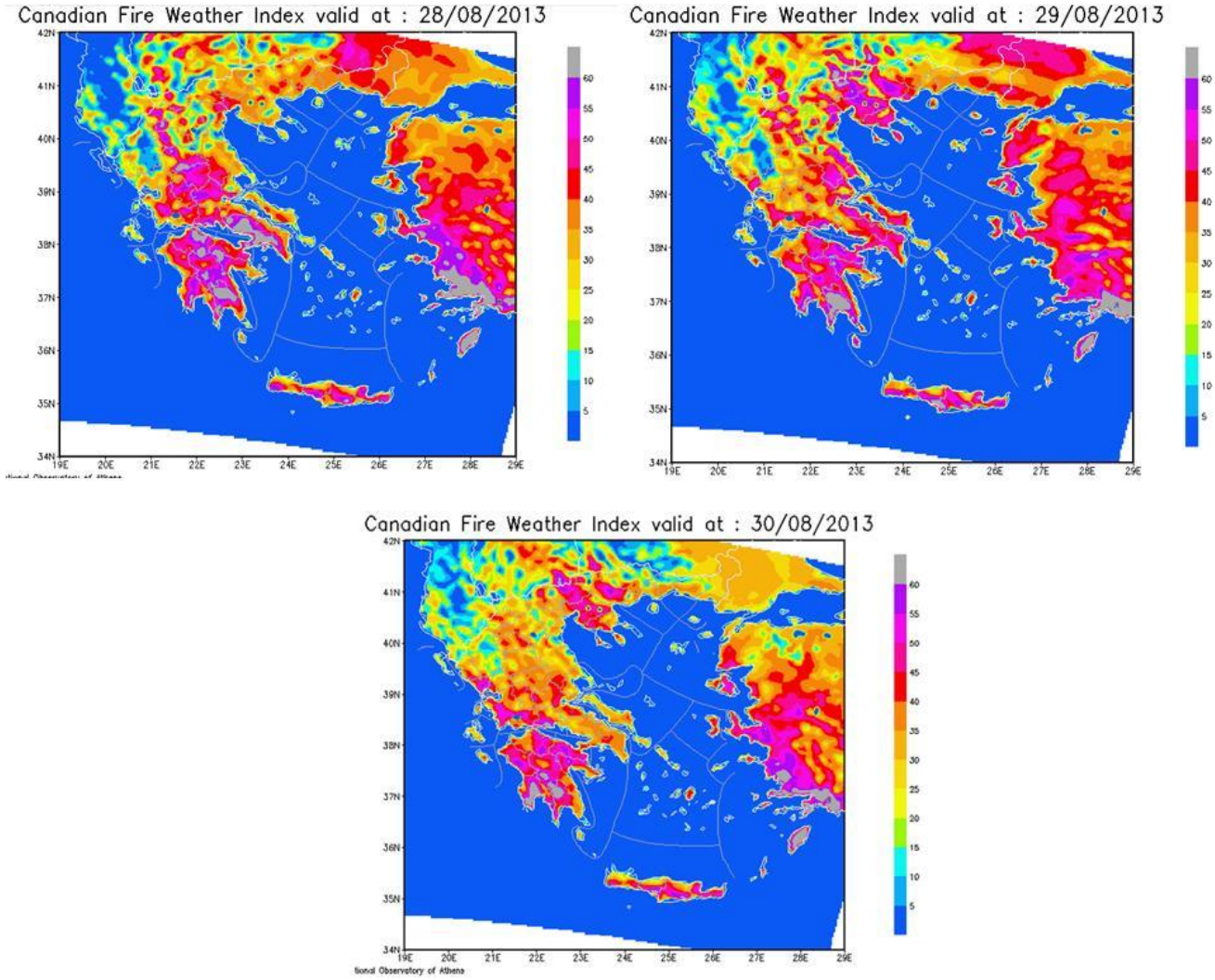

Figure 4: Maps illustrating daily FWI values for Greece for three consecutive days (28/08-30/08).

We anticipate that this application will be a useful tool in the hands of short term fire planners especially during the fire season and the fire and civil protection services as it will allow for a more effective way of fire prevention and forest protection management.
However, as already mentioned Fire Weather Index takes into account only the meteorology of the area excluding other important parameters contributing to fire ignition such as land cover. For this reason we plan to explore the use of a more integrated index, combining the meteorology (FWI) with other parameters such as vegetation categories and altitude.

3. The stakeholders' second workshop

The second workshop for the wild fires case study entitled "Effects of Climate Change on Forest Fires and Forest Ecosystems", took place on June 4, 2013 at the premises of the National Observatory of Athens. The workshop was held in the Greek language, except from one presentation that was given in English with concurrent translation. The workshop brought together 19 academics and public sector representatives who are involved in the fields of forest fires and ecosystems. A significantly increased number – compared to the first workshop – of participants were occupied in the educational sector, either as teachers/professors or in administrative positions in education.

Invitees were carefully selected in the scope of the CLIM-RUN objectives. Not only should they be actively involved in forest fire issues or other relevant environmental issues, but they should also carry the potential to eagerly undertake initiatives towards the use of meteorological data and software produced in the context of CLIM-RUN project. The list of the participants can be found in Table 1. Some of the participants were given the opportunity to present their own work during the workshop.

Immediately after registration, each invitee was provided with the educational software related to the Fire Weather Index (FWI). They were also given instructions how to install the software which usage was later explicitly explained.

The workshop was divided in two sessions during which presentations and discussion among the working group of NOA/IERSD and the participants took place. The first session comprised of introductory presentations, on the FWI, and part of the educational software concerning the sensitivity of the index to the different meteorological conditions and on educational issues.

The second session focused on short term prediction of FWI, future fire risk projections, the statistical downscaling portal, as well as forest fires management. The program of the workshop can be found in Annex 5.1. It is also important to note that each presentation refers to a different area of scientific interest, yet all of them have similar, connected or even overlapping fields of research and applications, which resulted in extensive discussions during and after the presentations.

The first session began with the welcoming of the participants by the WP6 leader, Christos Giannakopoulos. He made a brief introduction to the CLIM-RUN project, presenting key stages of the project and also explaining the concept of climate services. Furthermore, he gave an overview of the goals of the project, both inside the NOA/IERSD team, as well as in collaboration with the stakeholders.

Following Dr. Giannakopoulos' introduction and welcome address, Ms. Karali introduced the Canadian Fire Weather Index to the participants, pointing out some of the essentials on FWI theory, how it is calculated and which meteorological parameters are necessary. Furthermore, an evaluation of FWI for Greece was shown. The evaluation was undertaken with Fire data covering the 1983 to 1997 period. This procedure led to the division of Greece into three distinct areas of fire risk behaviour. The next presentation was given by Dr. Giannakopoulos who explained the usage and functionality of the educational software tool. Participants were particularly interested in the in-depth knowledge of the interconnections of variables used in FWI calculation as well as in the ability to use this software providing their own meteorological data.
The next speaker was Mrs. Katsigianni from the Environmental Training Centre of Argyroupolis. She presented a regional thematic network on forest fires that was the main topic covered by the Training Centre. In her presentation, Mrs. Katsigianni gave a concise and clear view on how the Environmental Training Center of Argyroupolis operates, what are the goals of their thematic network and how these goals are met by actions carried out in schools.

During the second session of the workshop, Dr. Giannakopoulos gave a presentation on climate change in Greece and the effects on risk from forest fires. Key points in this presentation were the results from regional climate models and how their projected values will affect forest fires in the near and more distant future. He also presented an evaluation of the regional climate models, using results provided by Dr. Clare Goodess from the UEA.
Part of the presentation was also a reference to the summer of 2007, a summer with extreme weather conditions, which resulted in unprecedented human casualties and huge burnt areas. Subsequently, Dr. Giannakopoulos presented the second application related to future fire risk projections in Greece and its sub- regions.

The following presentation was given online via Skype, by Dr. Frias, from the University of Cantabria. The presentation was given in English, with simultaneous translation. The slides of the presentation had been translated in Greek before the presentation in order to facilitate the participants. The presentation topic was the statistical downscaling methods focusing on the statistical downscaling portal which was developed within the framework of the project.
After this presentation, Mrs. Karali continued on the downscaling topic presenting applications of statistical downscaling in Greece. She presented the precise methodology a user must follow in order to produce more accurate data for Greece, when no observational data are readily available.

The next presentation was given by Dr. Giannakopoulos, on the topic of short term prediction of forest fire risk in Greece, essentially the third fire product developed within CLIMRUN.
Dr. Xanthopoulos followed, presenting key points on the evolution and management of forest fires in Greece. He gave some overall results of forest fires caused catastrophes, including human loss and extensive burnt areas. He also showed data related to the evolution of forest fires, using suppression mechanism equipment and financial requirements of this mechanism through the years.
The last presentation was given by Dr. Kontoes who showed GMES crisis management services using satellite remote sensing. He showed how valuable GMES can be on crisis management, giving some examples from previous catastrophic forest fires in Greece.
The workshops ended with an invited speaker presentation Prof. Menas Kafatos from Chapman University in California, USA who talked about the similarities in terms of fire vulnerability and risk of the Greek and Californian ecosystems and explained the impacts of climate change on droughts/fires and other sectors.
After the end of the presentations, extensive discussion followed between the organizers and the stakeholders. The products received much attention and were the main topic of the discussion.

Table 1: Workshop participants

Name	Institution	E-MAIL
Dr. Dimitris Kazanis	*University of Athens , Faculty of Biology,Dept of Ecology & Systematics*	dkazanis@biol.uoa.gr
Dr. Vassiliki Gouma	*Forest Service of Pendeli*	goumavas@yahoo.gr
Aphrodite Katsigianni	*Environmental Training Center of Argyroupolis*	akatsigi2012@yahoo.gr
Vasileios Kapelios	*Fire Service*	bkapelios@yahoo.gr
Christos Golfinos	*Fire Service*	aps_x@psnet.gr
Dr. Gavriil Xanthopoulos	*Institute of Mediterranean Forest Ecosystems and Forest Products Technology, NAGREF*	gxnrtc@fria.gr
Konstantinos Kaoukis	*Institute of Mediterranean Forest Ecosystems and Forest Products Technology, NAGREF*	kako@fria.gr
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Eirini Aleksiou		e.alexiou@prv.ypeka.gr
Dr. Ioannis Mitsopoulos	*Global Fire Monitoring Center*	im@fiactu.org
Eleni Paraskeyopoulou	*GEITONAS School-Athens*	eparask62@gmail.com
Christos Tsartsarakos	*GEITONAS School-Athens*	etsa@otenet.gr
Dr. Charalampos Kontoes	*Institute for Space Applications and Remote Sensing - National Observatory of Athens*	kontoes@noa.gr
Prof. Menas Kafatos	*Chapman University, Orange, California, USA*	kafatos@chapman.edu

4. Conclusions

The second workshop for the wild fires case study entitled "Effects of Climate Change on Forest Fires and Forest Ecosystems", took place on June 4, 2013 at the premises of the National Observatory of Athens. The workshop was held in the Greek language, except from one presentation that was given in English with concurrent translation. The workshop brought together 19 academics and public sector representatives who are involved in the fields of forest fires and ecosystems.

During the framework of the project three products were developed in order to meet the needs of stakeholders concerning the wild fires case study.

1. In collaboration with the forecasting team at the National Observatory of Athens, an application providing fire risk forecasts for the following 3 days was developed, to address the needs of short term fire planners.
2. A web-based application providing long term fire risk and other fire related indices changes due to climate change (time horizon up to 2050 and up to 2100) was developed in collaboration with the Greek WWF office, to address the needs of long term fire policy makers.
3. Finally, an educational tool was built in order to complement the two web-based tools and to further expand knowledge into the physics of fire risk to address the needs for in-depth training.

5. References

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6. Annexes

6.1.Programme

2nd STAKEHOLDERS' WORKSHOP

EFFECTS OF CLIMATE CHANGE ON FOREST FIRES AND FOREST ECOSYSTEMS

June 4, 2013, 10.00 am

Institute for Environmental Research and Sustainable Development

National Observatory of Athens

The National Observatory of Athens, in the framework of the EU project CLIMRUN (www.climrun.eu) will organize on June 4, 2013, a workshop on the Effects of Climate Change on forest fires and forest Ecosystems.
CLIMRUN attempts to develop a bottom-up protocol directly involving stakeholders early in the process with the aim of identifying well defined needs at regional and local scale.
The workshop will be held in the seminar room "AIMILIOS HARLAFTIS" at the premises of the National Observatory of Athens, (I. Metaxa and V. Pavlou, P.Penteli, Athens) in the Greek language.
The conference will bring together academics and representatives from the public and private sector who are involved in the fields of forest fires and ecosystems. Your participation will boost constructive dialogue between scientists and stakeholders allowing scientists to better understand stakeholders' needs and data requirements.

Arrival – Registration	10:00-10:15
Installation of Educational Software	10:15-10:30
Anna Karali, National Observatory of Athens *Introduction to Canadian Fire Weather Index*	10:30-10:45
Dr. Christos Giannakopoulos, National Observatory of Athens *Demonstration of 1st Application: Educational Software on FWI*	10:45-11:30
Aphrodite Katsigianni, Environmental Training Center of Argyroupolis *Regional Thematic Network: Forest Fires at the Center of Environmental Education of Argyroupolis*	11:30-11:45
Coffee Break	11:45-12:15
Dr. Christos Giannakopoulos, National Observatory of Athens *Climate change in Greece and the effects on Risk from Forest Fires*	12:15-12:30
Dr. Christos Giannakopoulos, National Observatory of Athens *Demonstration of 2nd Application: Future Risk from Forest Fires in Greece*	12:30-12:45
Dr. Maria Dolores Frias, Santander Meteorology Group, University of Cantabria, Spain *Internet Portal of Statistical Downscaling*	12:45-13:00
Anna Karali, National Observatory of Athens *Applications of Statistical Downscaling in Greece*	13:00-13:15
Dr. Christos Giannakopoulos, National Observatory of Athens *Demonstration of 3rd Application: Short Term prediction of Forest Fire Risk in Greece*	13:15-13:30
Dr. Gavriil Xanthopoulos, Institute of Mediterranean Forest Ecosystems and Forest Products Technology, Hellenic Agricultural Organization "DEMETER" *Comments on the evolution and management of forest fires in Greece*	13:30-13:45
Dr. Charalampos Kontoes *GMES crisis management services using satellite remote sensing; Forest fire management support in Greece.*	13:45-14:00
INVITED TALK: Prof. Menas Kafatos *Climate change, hazards and regional impacts. Focus on ecosystems*	14:00-14:30