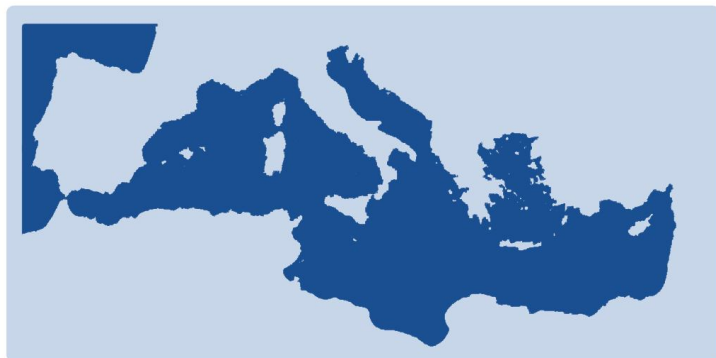


**Climate Local Information in the Mediterranean  
region Responding to User Needs**



**CLIM-RUN**



**Climate change and wildfire  
risk: the route from applied  
research to stakeholder  
services for the case study of  
Greece**

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## CLIMRUN Wild fire case study objectives

- This case study focuses on the analysis of the climate information required in areas where forest fires represent a major hazard through organization of interaction strategies (mainly workshops) with relevant stakeholders.

More info about CLIMRUN in  
Poster Area 2 at Poster FF11

*“New perspectives and products  
from the CLIM-RUN project:  
continuing and developing the  
engagement with Mediterranean  
stakeholders”*

# Motivation: Burnt area in Greece 1955-2012



## 1<sup>st</sup> Workshop objectives

- To present the CLIM-RUN project and the concept of climate services
- To provide an overview of state-of-the-art in climate modelling, observations and impacts analysis on forest fires
- To better understand who are the climate services stakeholders
- To begin to define what you need/want from climate services



## The 'who' and the 'what'

- Who are the climate services stakeholders?
  - Short term fire planning
  - Long term fire policy making
  - Educational stakeholders
- What do you need/want from climate services?
  - Specific data / calculations
  - Web-based analysis tools
  - Guidance and training tools

2<sup>nd</sup> workshop 4 June 2013- Athens



CLIM-RUN



Consolidate requirements and display constructed products



## The wildfire CLIMRUN products

1. **Short term fire risk forecasts** for 3 days to address the needs of short term fire planners
2. **Long term fire risk** and other fire related indices changes due to climate change (time horizon up to 2050 and up to 2100) to address the needs of long term fire policy makers
3. **Educational software tools** to enable calculation of fire risk using user's own data from observations/models and to explore the sensitivity of FWI with meteorological parameters

## **Product:**

# **«Short term fire risk forecast for Greece»**



**Keywords:** fire risk forecast, FWI, land cover, meteorological model

### **Target groups**

- **Short term fire planners**
- **Professional organisations, volunteers and NGOs**
- **Regional authorities and Civil Protection**

### **Relevance to the case-study requirements**

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.

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<sup>2</sup> were destroyed and 84 people lost their lives.

### **The approach**

The Canadian Fire Weather Index FWI is one of the most widely used indices of fire risk and is suitable for use in the Mediterranean area. It takes into account daily noon readings of temperature, humidity, wind speed and 24-hr accumulated precipitation. Noon meteorological output of these parameters produced by the MM5 model are used in order to calculate the fire risk index values.

### **The product**

In collaboration with the weather forecasting team of the National Observatory of Athens (NOA), an application providing fire risk forecast for 3 days based on the MM5 model output was created. MM5 is a non-hydrostatic weather forecasting model that 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>



# Fire risk forecasts on an operational basis for the Greek territory

The fire risk forecast based on FWI values can be found at <http://cirrus.meteo.noa.gr/forecast/bolam/index.htm>

Under  
Forest Fires - CFWI

The screenshot displays the National Observatory of Athens (NOA) website, specifically the BOLAM model forecast page. The page features a navigation menu on the left with options like 'Europe : forecasts', 'Greece : forecasts', and 'Forest fires - CFWI'. The main content area shows a map of Greece with a color-coded fire risk forecast. A sidebar on the right provides additional information, including 'WEATHER FORECASTS ON YOUR MOBILE' and 'WEATHER IN JUNE OVER GREECE'. The bottom of the page includes sections for 'FORECAST PRODUCTS FOR SEA', 'ENJOY ATTICA COASTS', and 'FLASH PROJECT'.

**NATIONAL OBSERVATORY OF ATHENS**  
INSTITUTE FOR ENVIRONMENTAL RESEARCH - WEATHER FORECASTS

**WEATHER FORECASTS ON YOUR MOBILE**  
Ο καιρός τώρα και σε SMS στο 54045  
Using your mobile phone you can get weather forecasts for 200 cities and 25 sea areas over Greece.  
Just send an SMS to **54045**, following the instructions provided [here](#). (0.3 Euro per sms, VAT included).

**WEATHER IN JUNE OVER GREECE**  
June 2012 was a month with temperature much higher than the average values, dry over the major part of the country. For more info, look at the June 2012 bulletin (click on the Monthly bulletins button on the left menu).

**GENERAL INFO**  
Daily forecasts are issued for Europe, Greece and Athens area by three models: **BOLAM**, **MM5** and **WRF**. Detailed forecasts are issued for 40 major Greek cities, as well as for selected locations over the Greek seas (sailing forecasts). Forecasts are presented as maps, time-plots, word text and outlook tables. Surface observations over Europe and Greece, satellite pictures, satellite winds, soundings as well as lightning data from NOA's ZEUS lightning detection system are also presented.

**ABOUT THE MODELS**  
BOLAM, MM5 and WRF models are executed daily at the National Observatory of Athens, using two PC clusters, providing the more detailed weather forecasts available today in Greece. **BOLAM model** was developed at ISAC-Bologna (Italy). **MM5 model** was developed at the Pennsylvania State University. **WRF model** is a next generation mesoscale model, designed to serve both

**FORECAST PRODUCTS FOR SEA**  
NOA distributes wind forecasts in GRIB format, that can be used by special marine software. For subscription information please [click here](#).

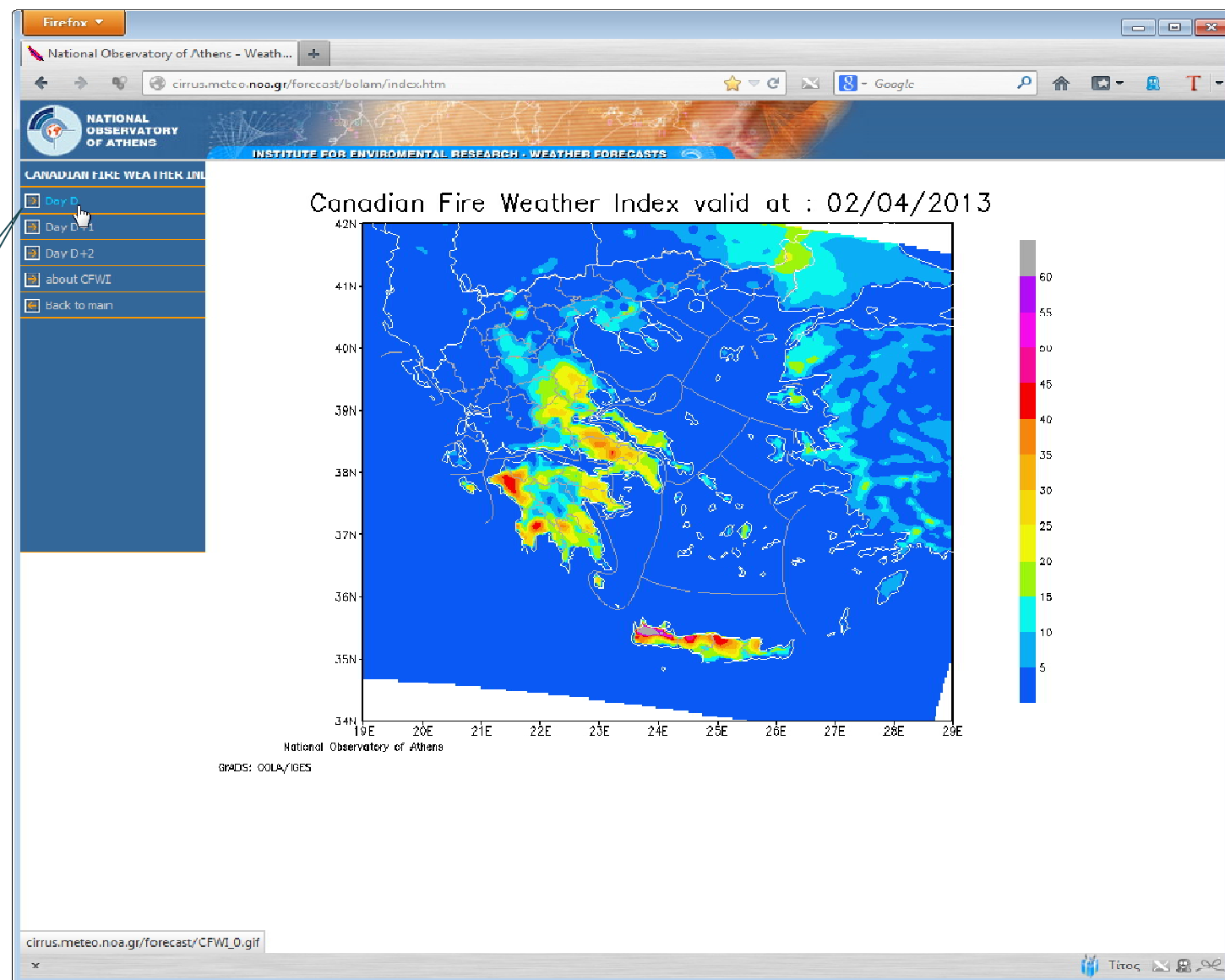
**ENJOY ATTICA COASTS**  
NOA issues detailed weather forecasts for 13 beaches over Attica. In order to view these forecasts, first click on the **MM5 model** above, then click on the **Attica Coasts** button and ...enjoy the sea!

**FLASH PROJECT**  
NOA participates in the EU-funded FLASH project, with the aim to observe, analyse and model lightning activity over the Mediterranean. More info about the project is [given here](#).



# Fire risk forecasts on an operational basis for the Greek territory

DAY D

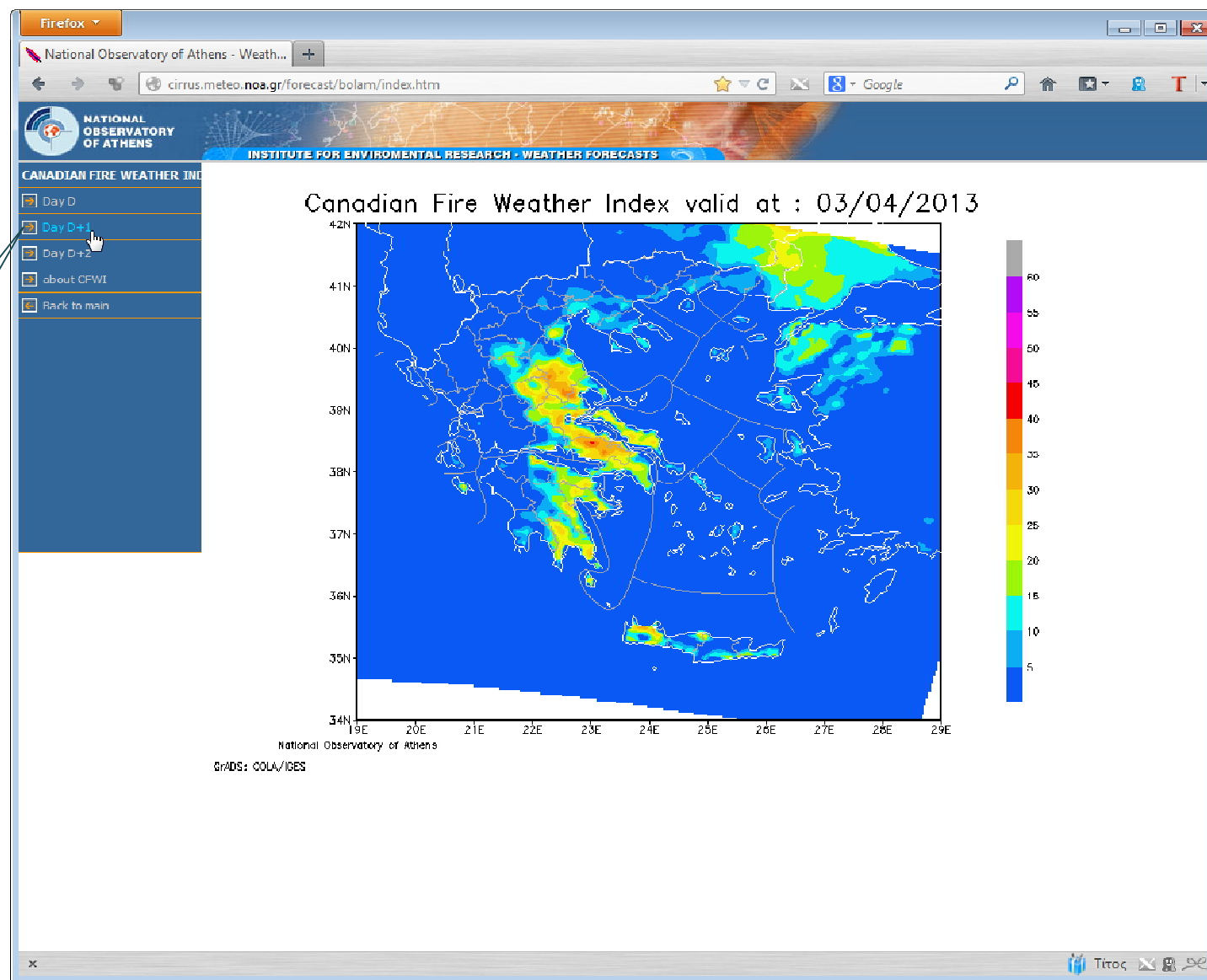






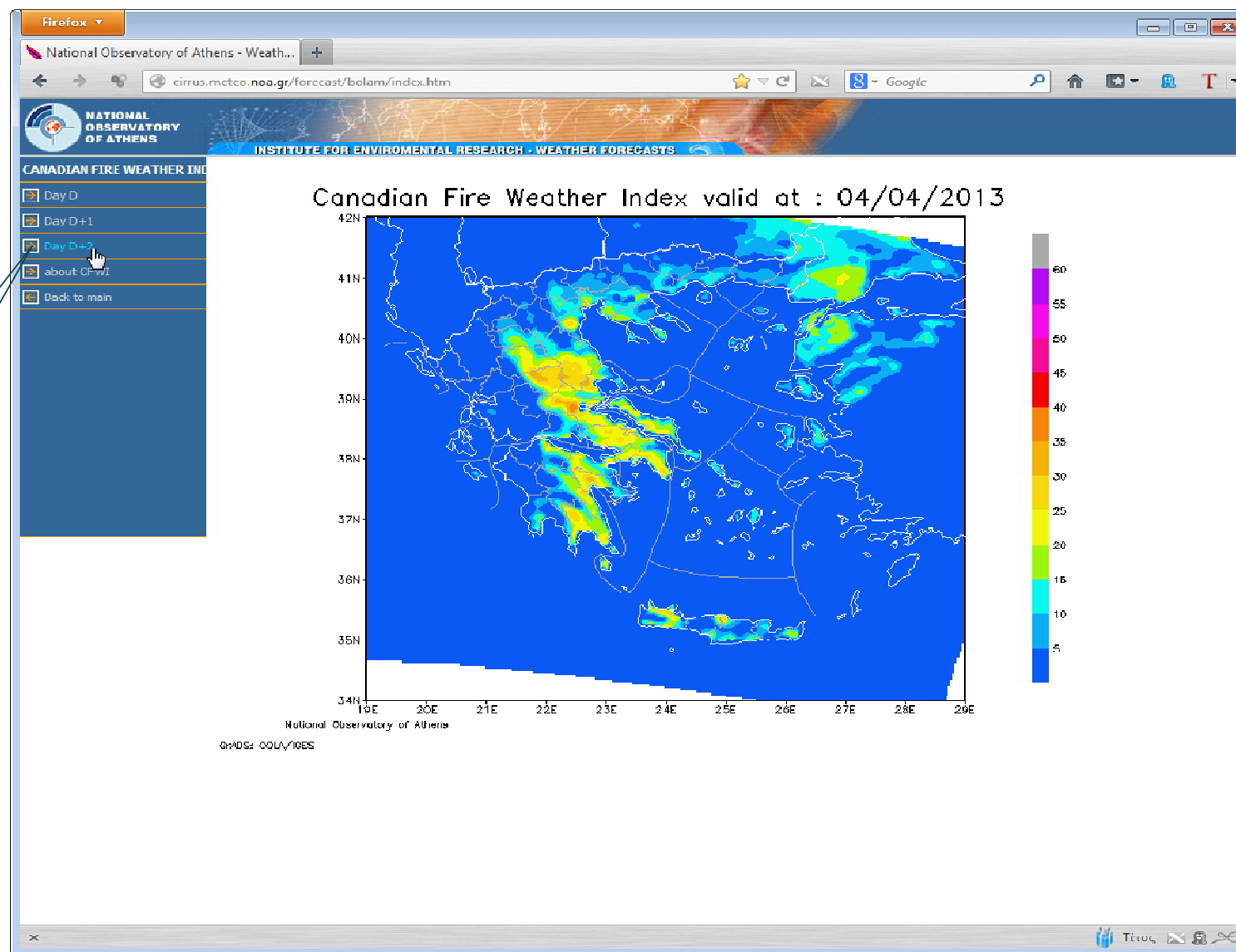
# Fire risk forecasts on an operational basis for the Greek territory

DAY  
D+1



# Fire risk forecasts on an operational basis for the Greek territory

DAY  
D+2





# **Product:**

## **«Future fire risk in Greece and its sub-regions»**



### **Target groups**

- **Long-term fire planners and policy makers**
- **Professional organisations and federations**
- **Ministries and Regional authorities**

### **Relevance to the case-study requirements**

Mediterranean Europe and Greece in particular, is likely to suffer potentially increased fire risk due to changing climatic conditions. Forest fires are highly sensitive to climate change because fire behavior responds immediately to fuel moisture, which is affected by precipitation, relative humidity, air temperature and wind speed. Thus, the projected increase in temperature will increase fuel dryness and reduce relative humidity and this effect will worsen in those regions where rainfall decreases. Accordingly, increases in climate extreme events are expected to have a great impact on forest fire vulnerability.

### **The approach**

The Canadian Fire Weather Index FWI is one of the most widely used indices of fire risk and is suitable for use in the Mediterranean area. It takes into account daily noon readings of temperature, humidity, wind speed and 24-hr accumulated precipitation. Output of these parameters from a regional climate model 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.

### **The product**

In collaboration with WWF, the National Observatory of Athens (NOA) has 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

Annual number of days with moderate/high/extreme fire risk

Annual number of hot days/nights

The user friendly application is hosted in the WWF website of 'oikoskopio'

<http://www.oikoskopio.gr/map/> and in the website of NOA under 'climate change' tab [www.meteo.noa.gr](http://www.meteo.noa.gr)

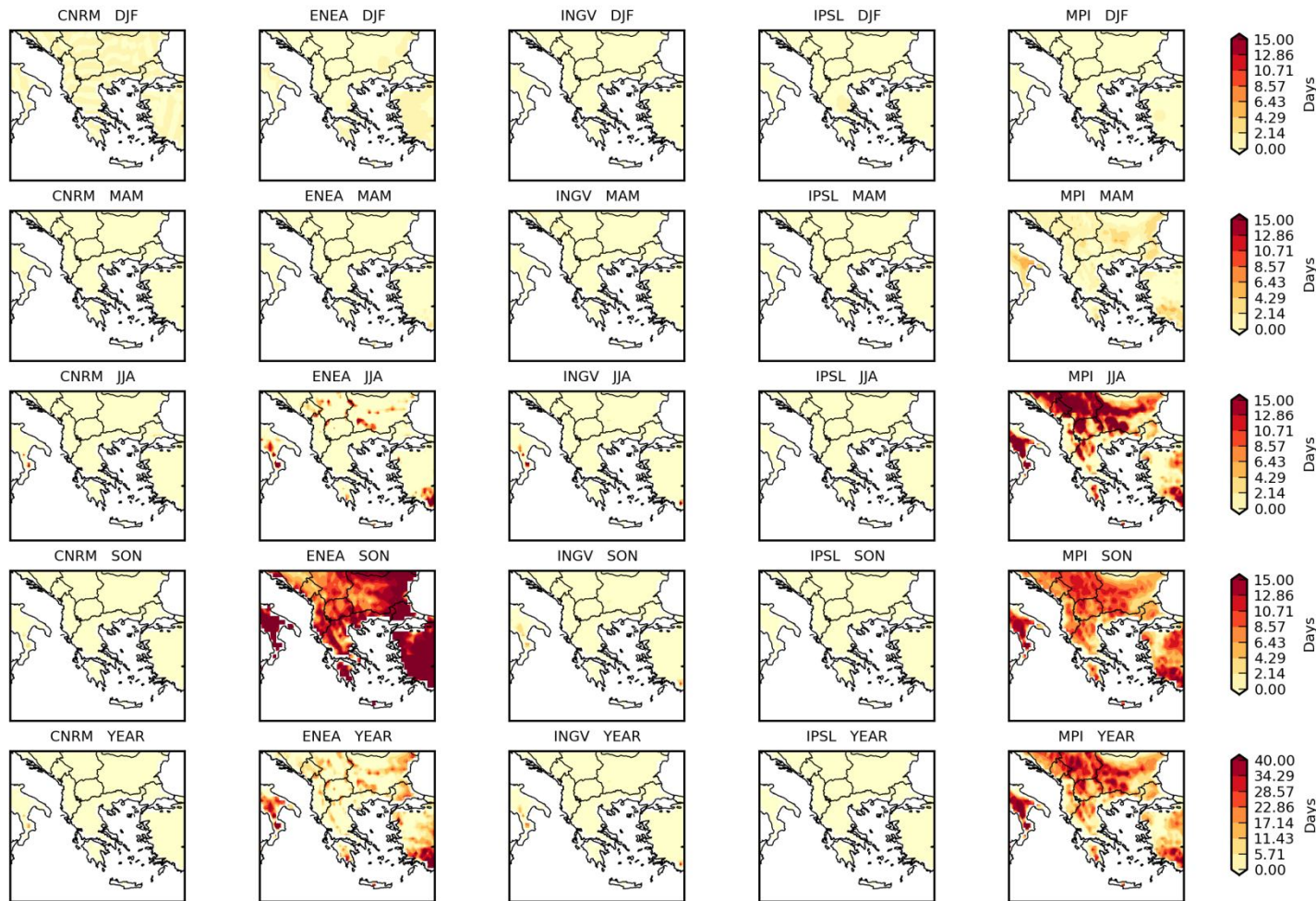




# But how well do these models reproduce present-day observations?



Climrun Index HD  
Model minus observations 1971-2000 average



In this 'like-with-like' comparison, the differences between model and observed values are generally less than +2 days (a slight warm bias) – which helps to increase confidence in the reliability of the projections. But there are a few cases where errors exceed 10 days.

*Note that a different scale is used for each season*

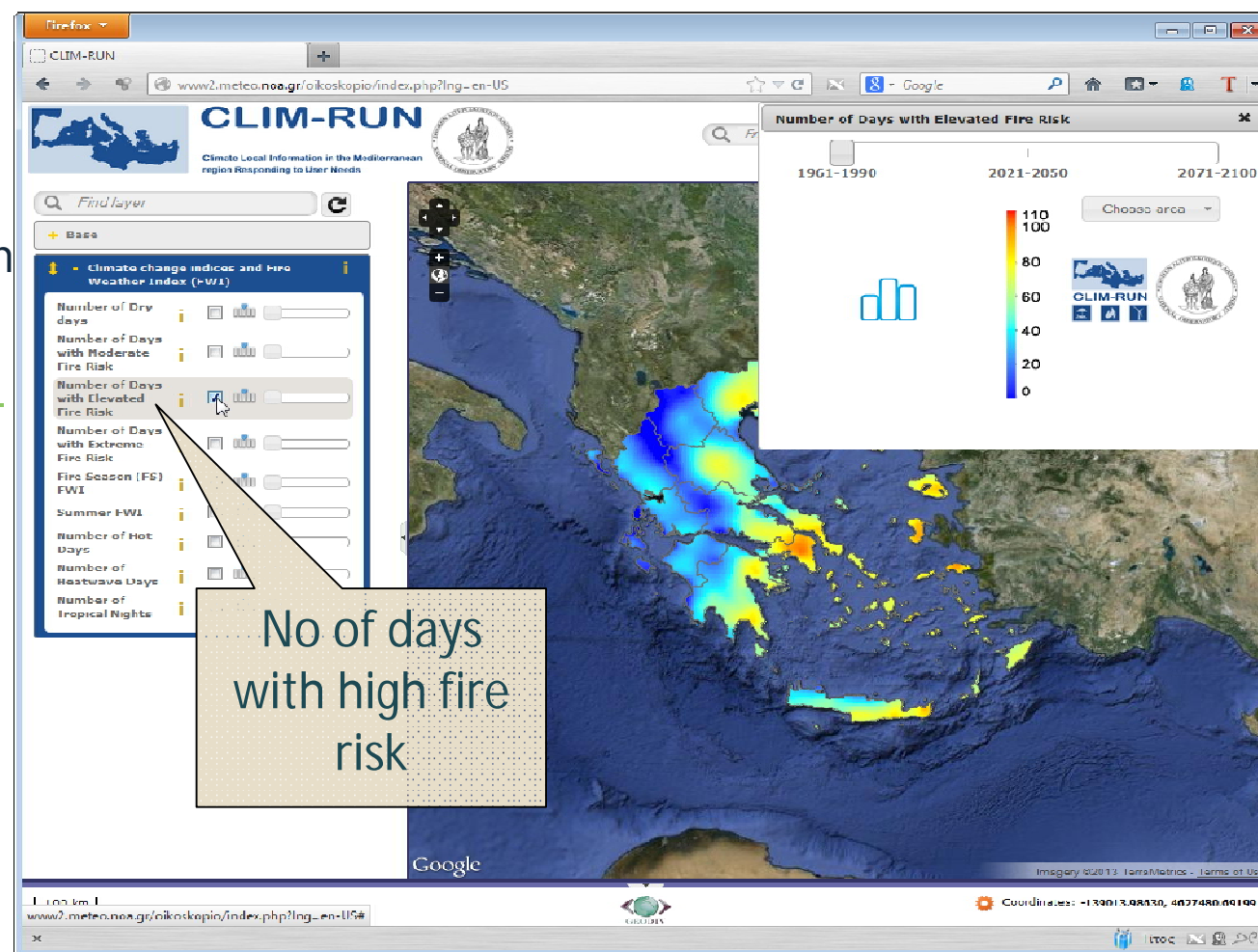


# Web tool for future projections of climate extremes for the Greek territory

The future projections of climate extremes in relation to fire risk can be found at:

<http://www.meteo.noa.gr/oikoskopio/>

Annual number of dry days  
Annual number of days with moderate/high/extreme fire risk  
Annual number of hot days/nights  
....

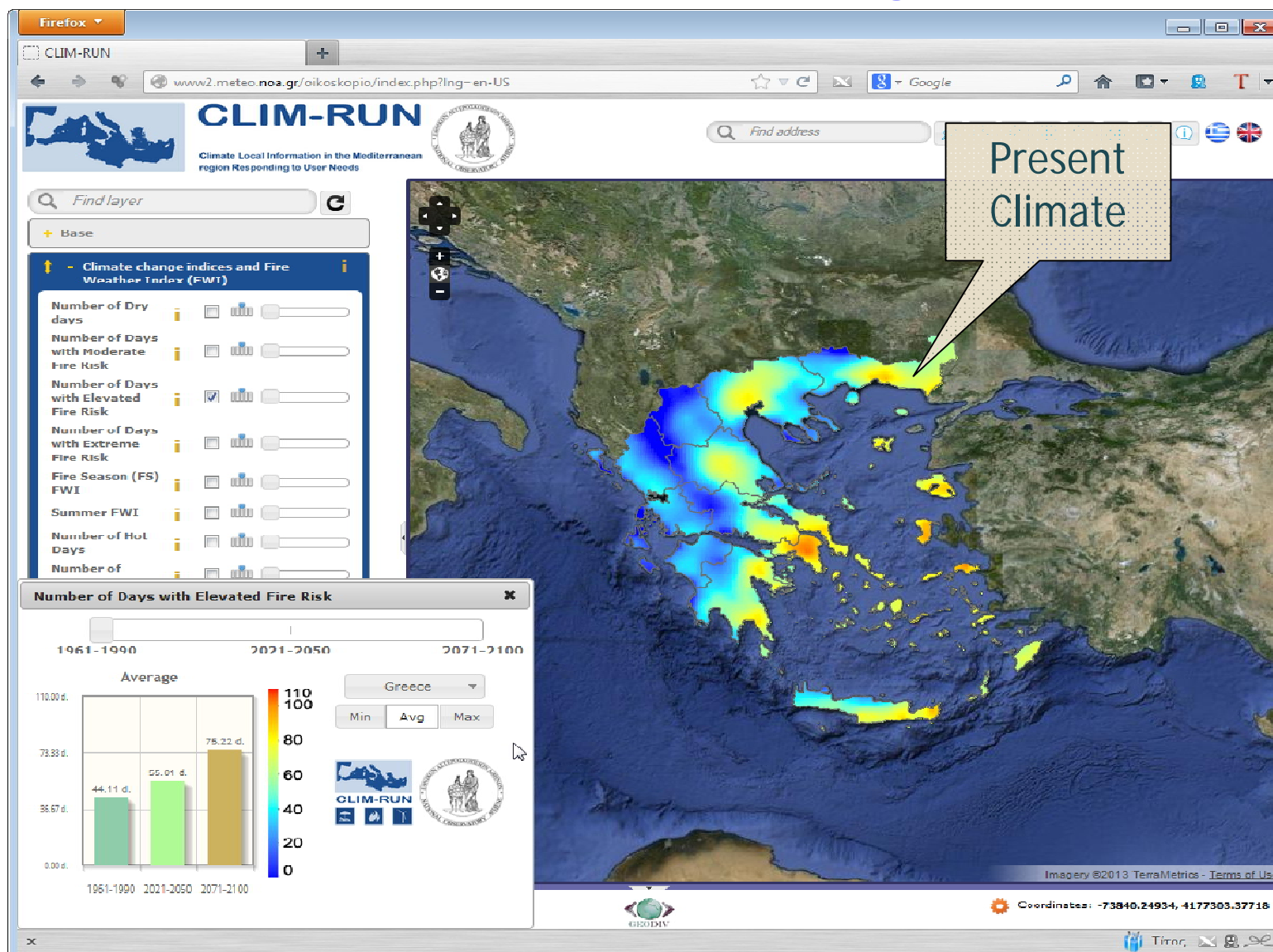






# Web tool for future projections of climate extremes for the Greek territory

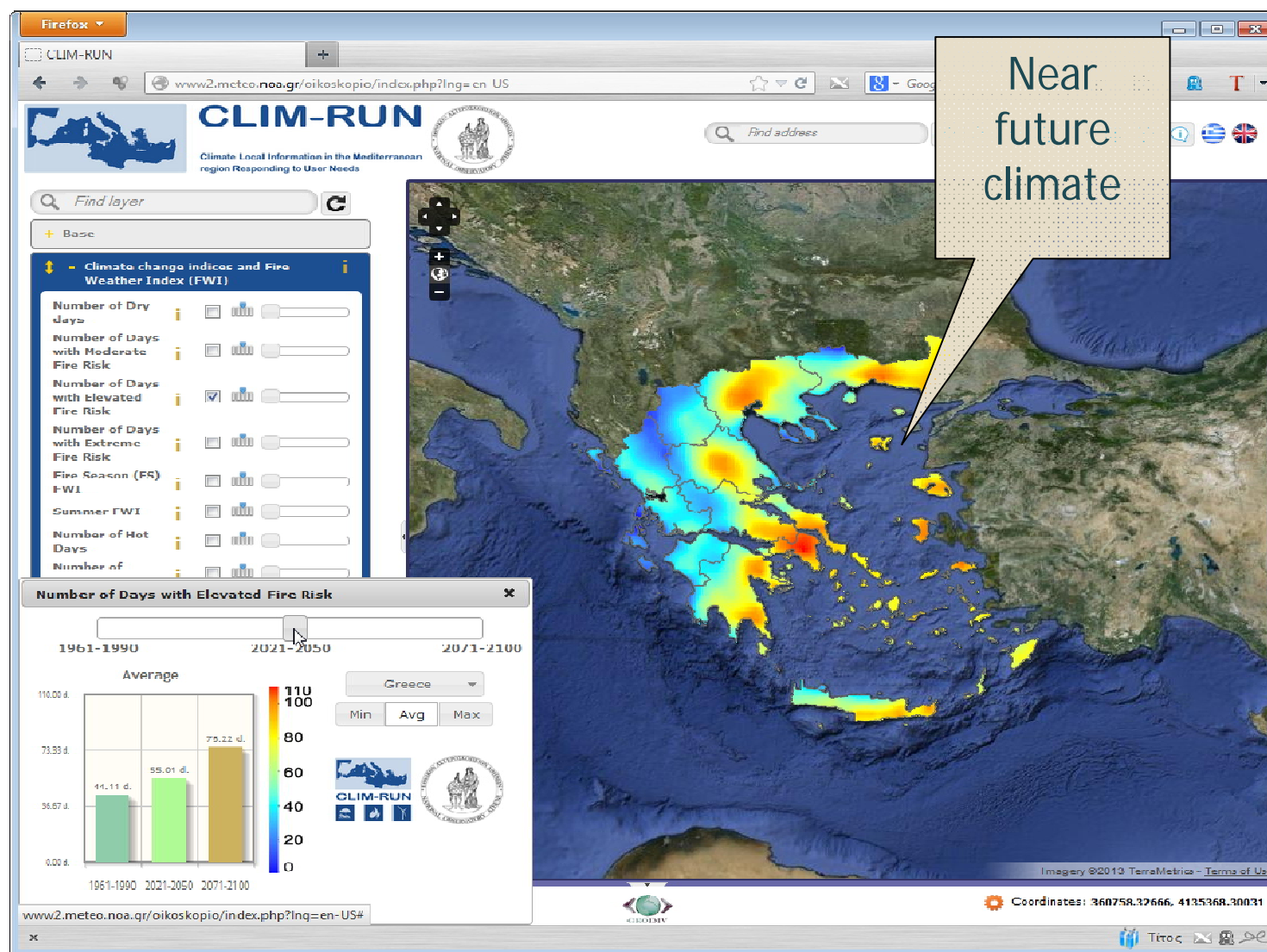
<http://www.meteo.noa.gr/oikoskopio/>





# Web tool for future projections of climate extremes for the Greek territory

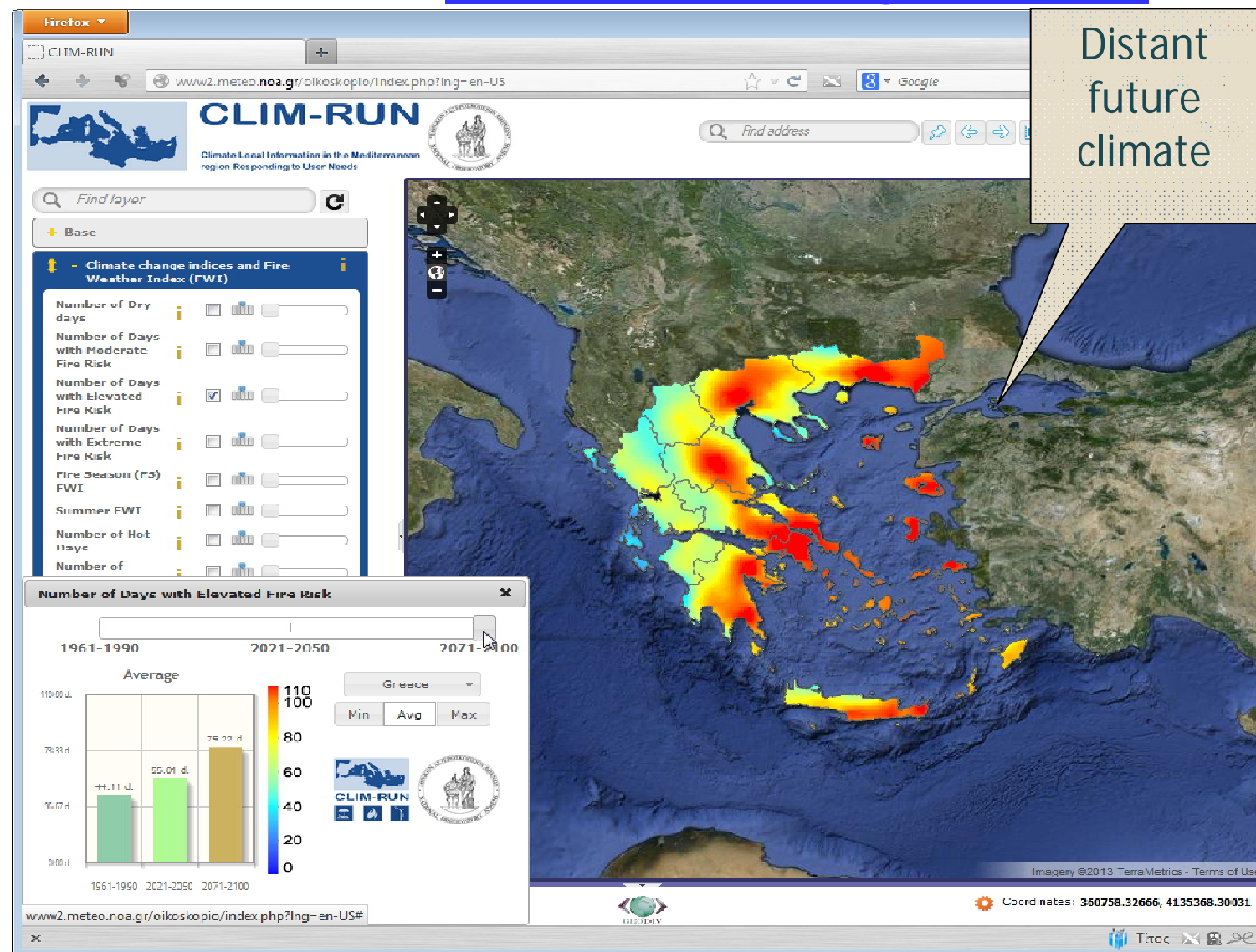
<http://www.meteo.noa.gr/oikoskopio/>





# Web tool for future projections of climate extremes for the Greek territory

<http://www.meteo.noa.gr/oikoskopio/>





# **Product:** **«Educational Software for Fire Weather Index»**



## **Target groups**

- **Educational stakeholders**
- **Professional organisations and federations**
- **Policy makers**

## **Relevance to the case-study requirements**

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 to the wildfires 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), informative training tools need to be developed.

## **The approach**

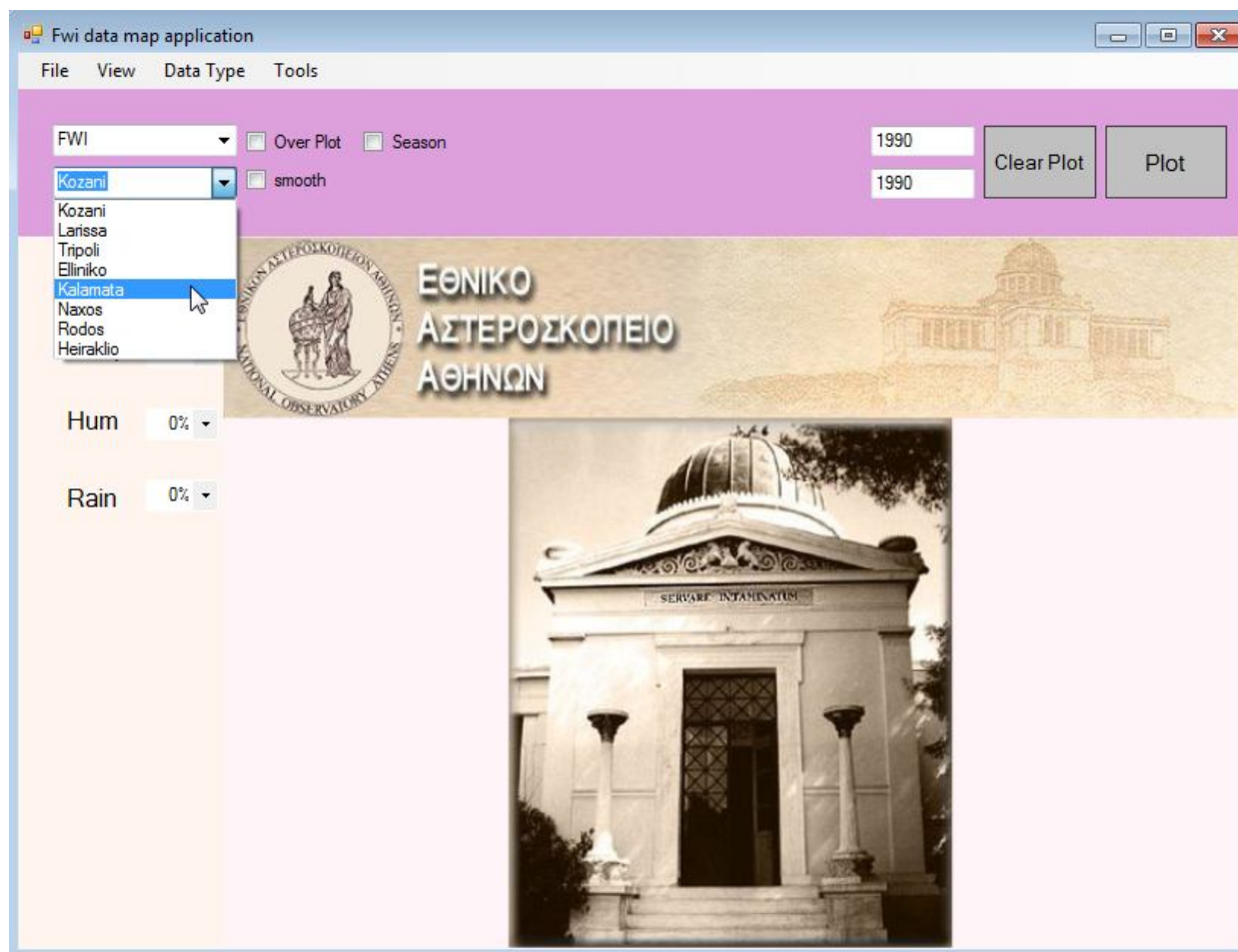
The Canadian Fire Weather Index, FWI, is one of the most widely used indices for fire risk and is suitable for use in the Mediterranean area. It takes into account daily noon readings of temperature, humidity, wind speed and 24-hr accumulated precipitation. These parameters for a number of meteorological station over the Greek territory are used to study the behaviour of fire risk in different sub-regions of Greece.

## **The product**

The National Observatory of Athens (NOA) has developed a interactive user-friendly runtime application for the analysis of the present fire risk for a number for selected locations over Greece. This application can function as an educational software to complement the two web-based applications also developed in the framework of climate information of the fire risk. It further expands knowledge in fire risk addressing the needs for in-depth training of all involved professionals.



# Software tool for Fire Weather Index Using Station/model Data



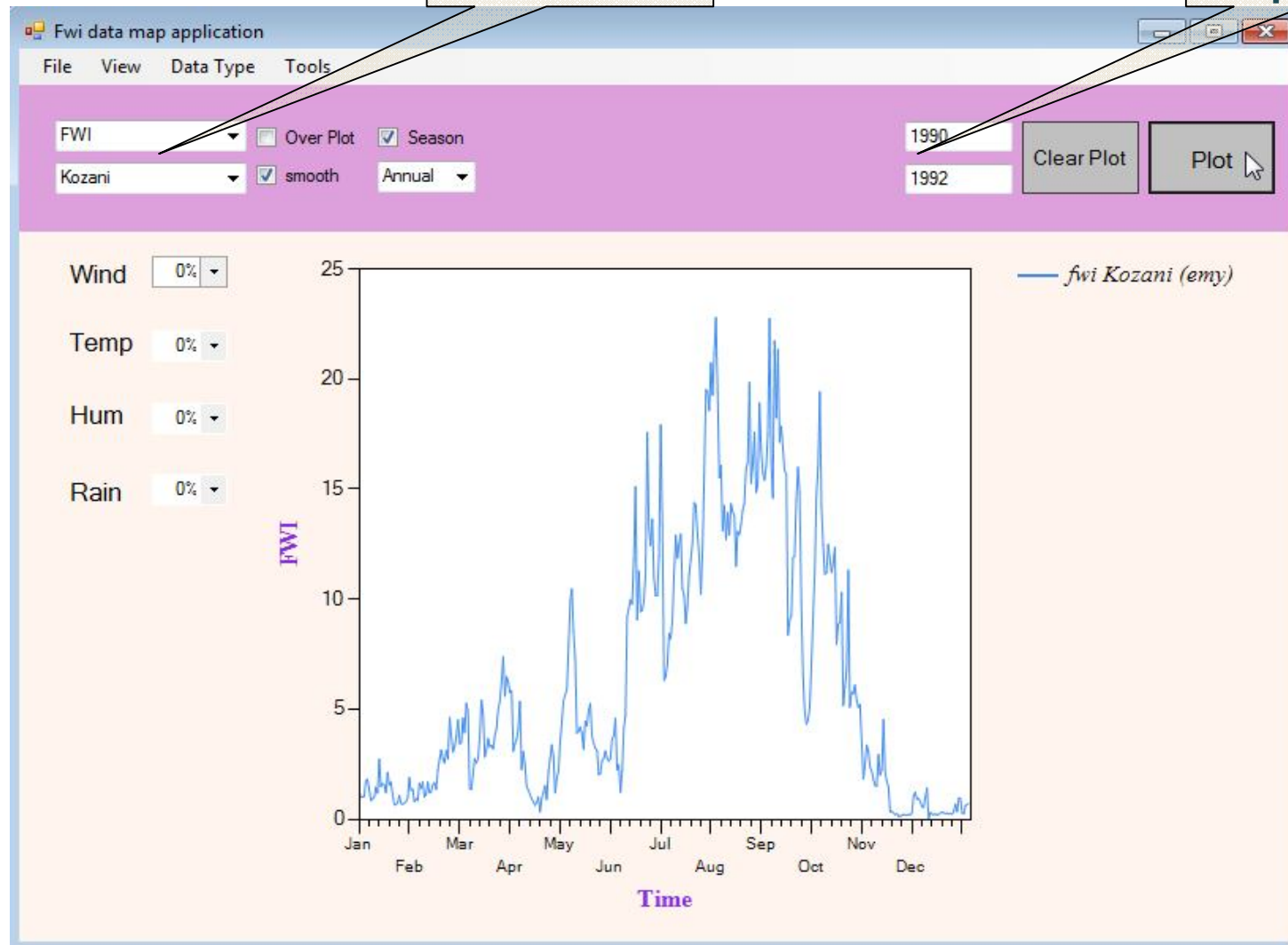




# Educational tool for Fire Weather Index Using Station/model Data

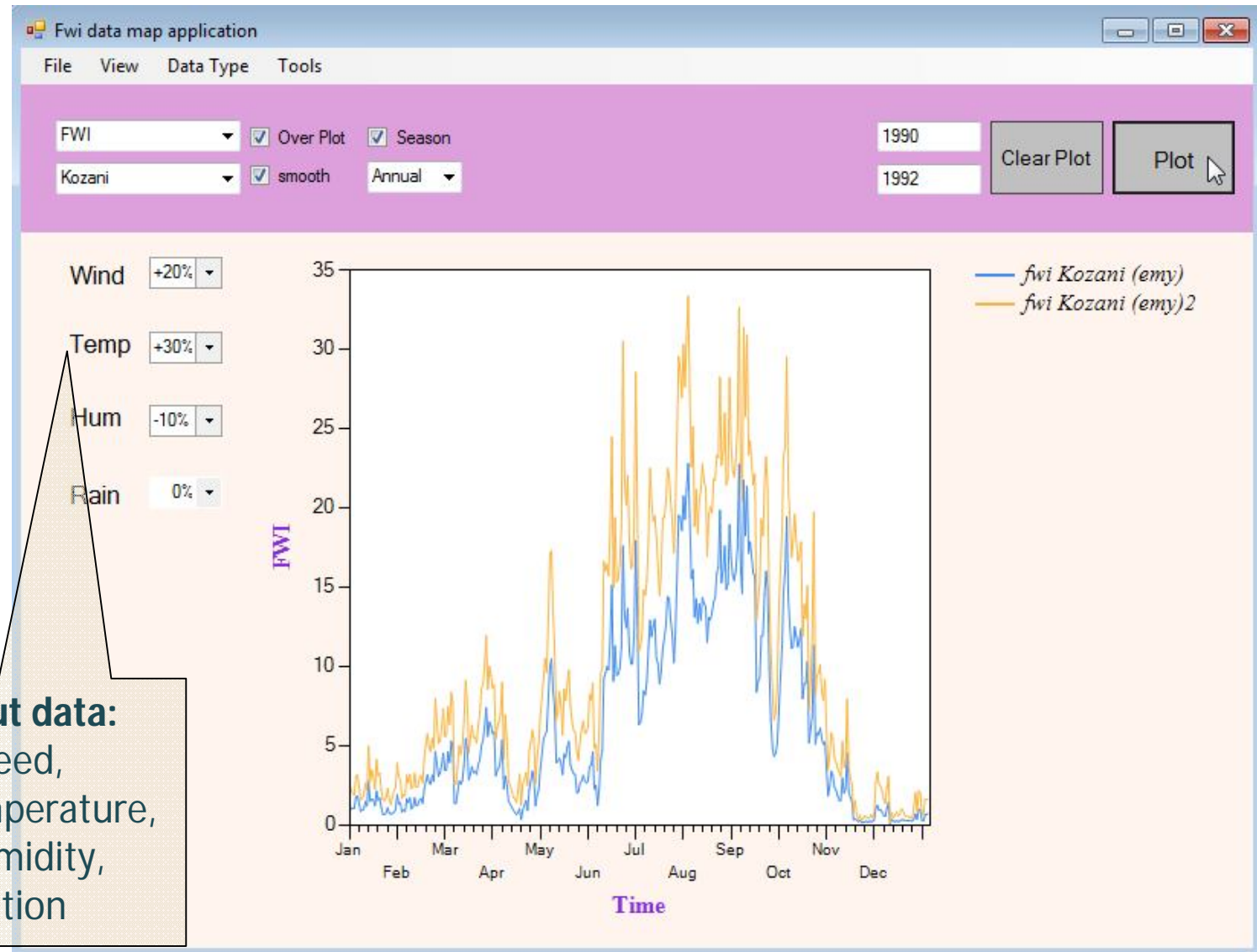
Select Station  
Data

Select time  
period





# Educational tool for Fire Weather Index Using Station/model Data

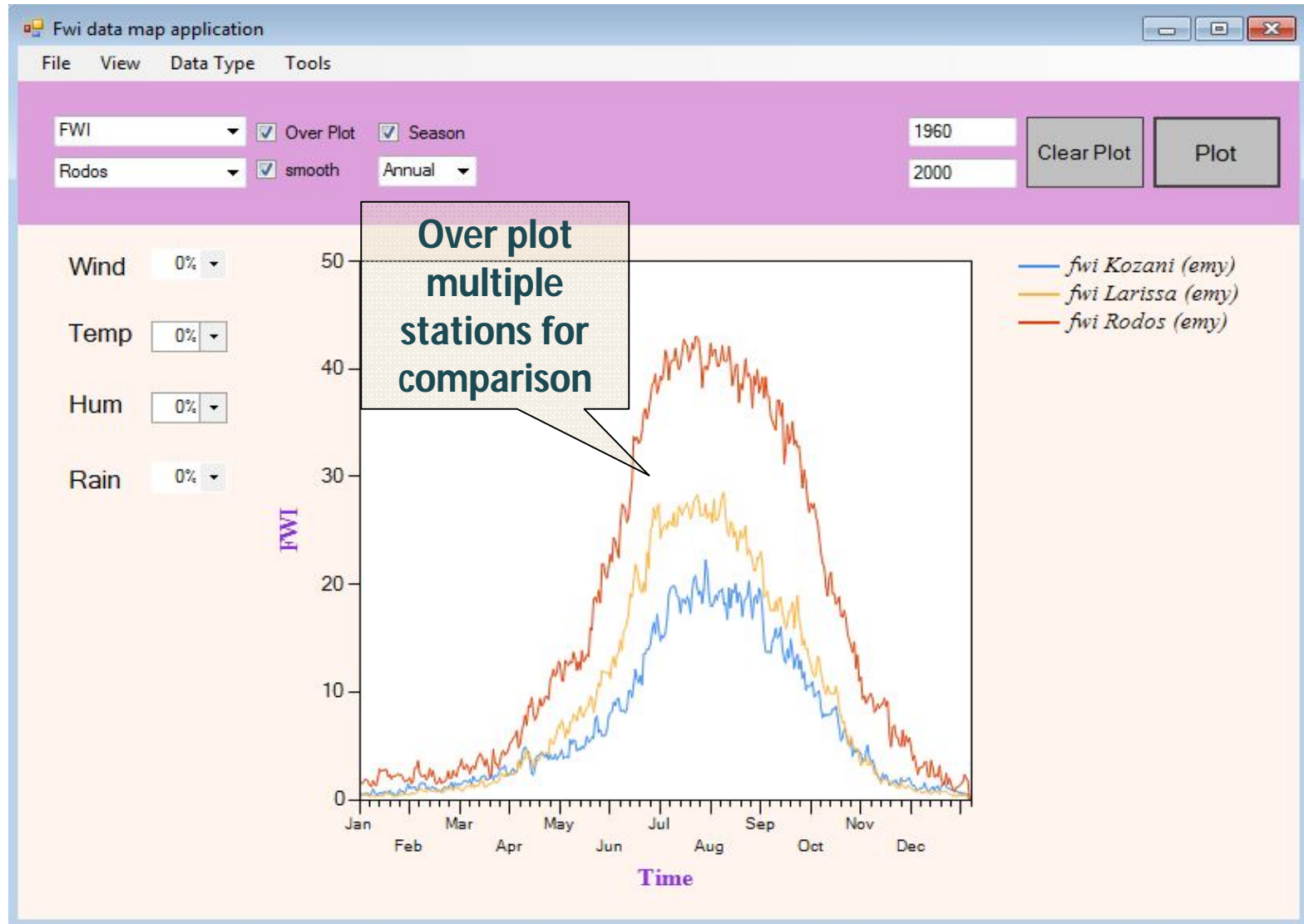


## Modify input data:

Wind speed,  
maximum temperature,  
relative humidity,  
precipitation



# Educational tool for Fire Weather Index Using Station/model Data





# Educational tool for Fire Weather Index Using Station/model Data

Export  
calculated  
indices in  
data files

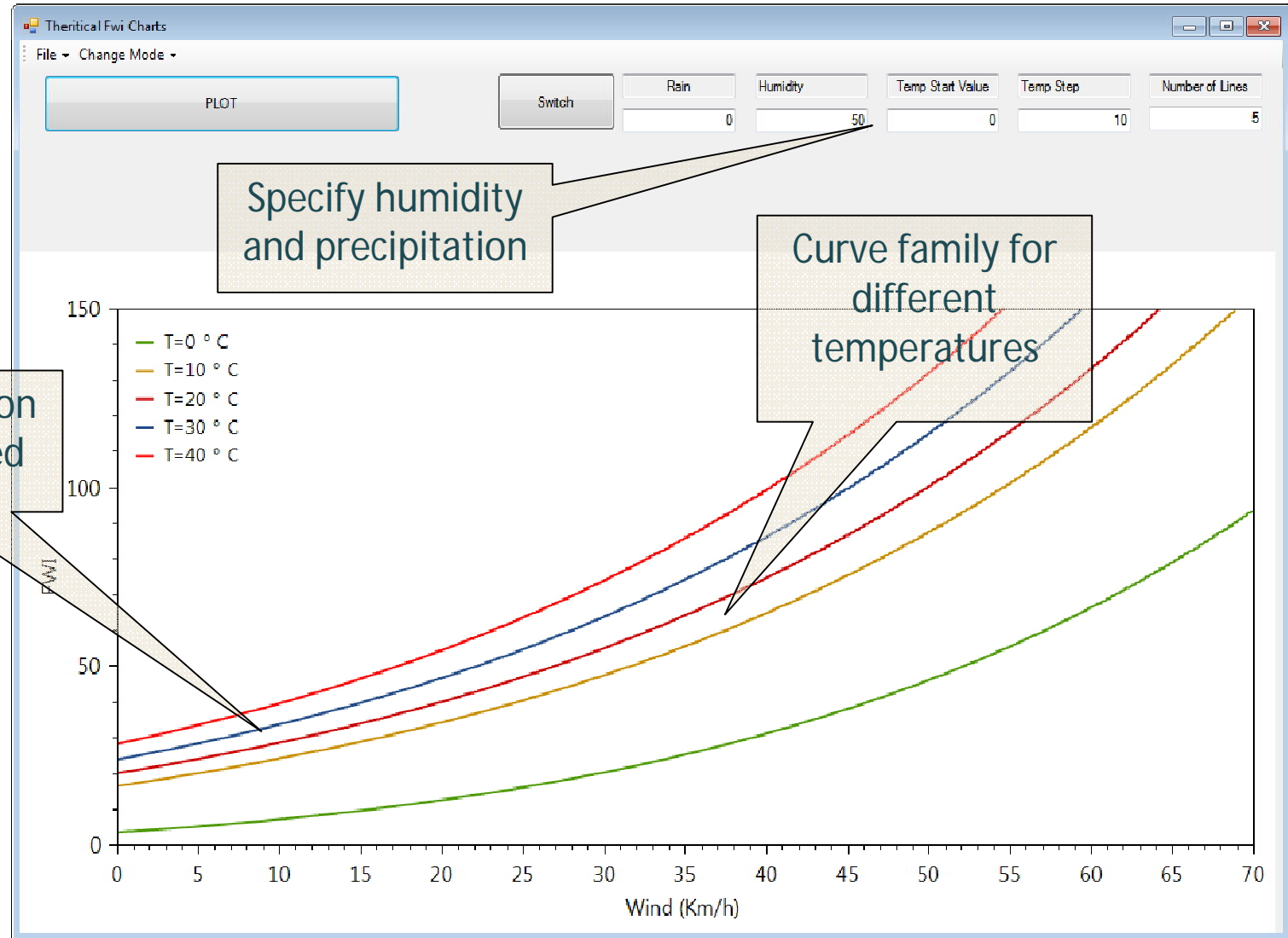
fwi Kozani (emy).txt - WordPad

YEAR	MO	DY	Tmax	Rain	Wind	Hum	ind 1
1960	1	1	1.5	.0	13.3	69.1	0.61
1960	1	2	1.5	.0	.0	79.6	0.56
1960	1	3	2.1	.0	.0	91.7	0.50
1960	1	4	3.0	2.5	6.0	92.1	0.46
1960	1	5	.9	.3	20.7	91.3	0.54
1960	1	6	1.4	.0	8.0	84.6	0.61
1960	1	7	-1.1	.8	29.3	85.4	0.44
1960	1	8	-1.4	.0	.0	75.7	0.56
1960	1	9	.2	.0	.0	86.1	0.98
1960	1	10	5.2	.3	.0	93.8	0.67
1960	1	11	6.1	9.1	.0	96.0	0.50
1960	1	12	7.3	2.3	6.0	91.3	0.52
1960	1	13	5.4	.0	4.7	69.5	0.65
1960	1	14	3.8	.0	4.7	78.2	0.61
1960	1	15	2.0	.0	1.0	72.4	0.58
1960	1	16	1.0	2.8	3.0	97.4	0.78
1960	1	17	4.5	3.5	.0	89.5	0.62
1960	1	18	5.4	11.5	6.0	88.0	0.69
1960	1	19	1.8	.4	11.3	80.7	0.86
1960	1	20	3.5	.0	.0	75.1	0.61
1960	1	21	3.3	.0	9.7	76.8	0.58
1960	1	22	-.2	.0	16.0	69.7	0.41
1960	1	23	-.8	.0	4.7	69.3	0.55
1960	1	24	.2	.0	.0	81.3	0.56
1960	1	25	.5	.0	.0	81.1	0.98
1960	1	26	2.2	.0	.0	86.4	0.75
1960	1	27	7.0	.0	.0	72.9	0.76
1960	1	28	10.2	.0	.0	58.4	0.64
1960	1	29	11.1	.0	3.0	39.3	1.00
1960	1	30	9.6	.0	4.7	34.6	1.45
1960	1	31	6.8	.0	14.0	64.3	1.03
1960	2	1	.5	.0	26.7	73.5	1.19
1960	2	2	-6.2	.0	20.3	56.5	1.09
1960	2	3	-5.9	.0	5.3	56.7	1.21
1960	2	4	-4.9	.0	.0	56.7	0.91
1960	2	5	-5.6	.2	.0	94.5	0.97
1960	2	6	-5.1	.0	.0	93.0	1.45
1960	2	7	-2.9	.0	.0	96.1	1.54
1960	2	8	-1.8	.0	.0	94.1	1.53
1960	2	9	-2.0	.0	.0	97.0	1.51



# Educational tool for Fire Weather Index

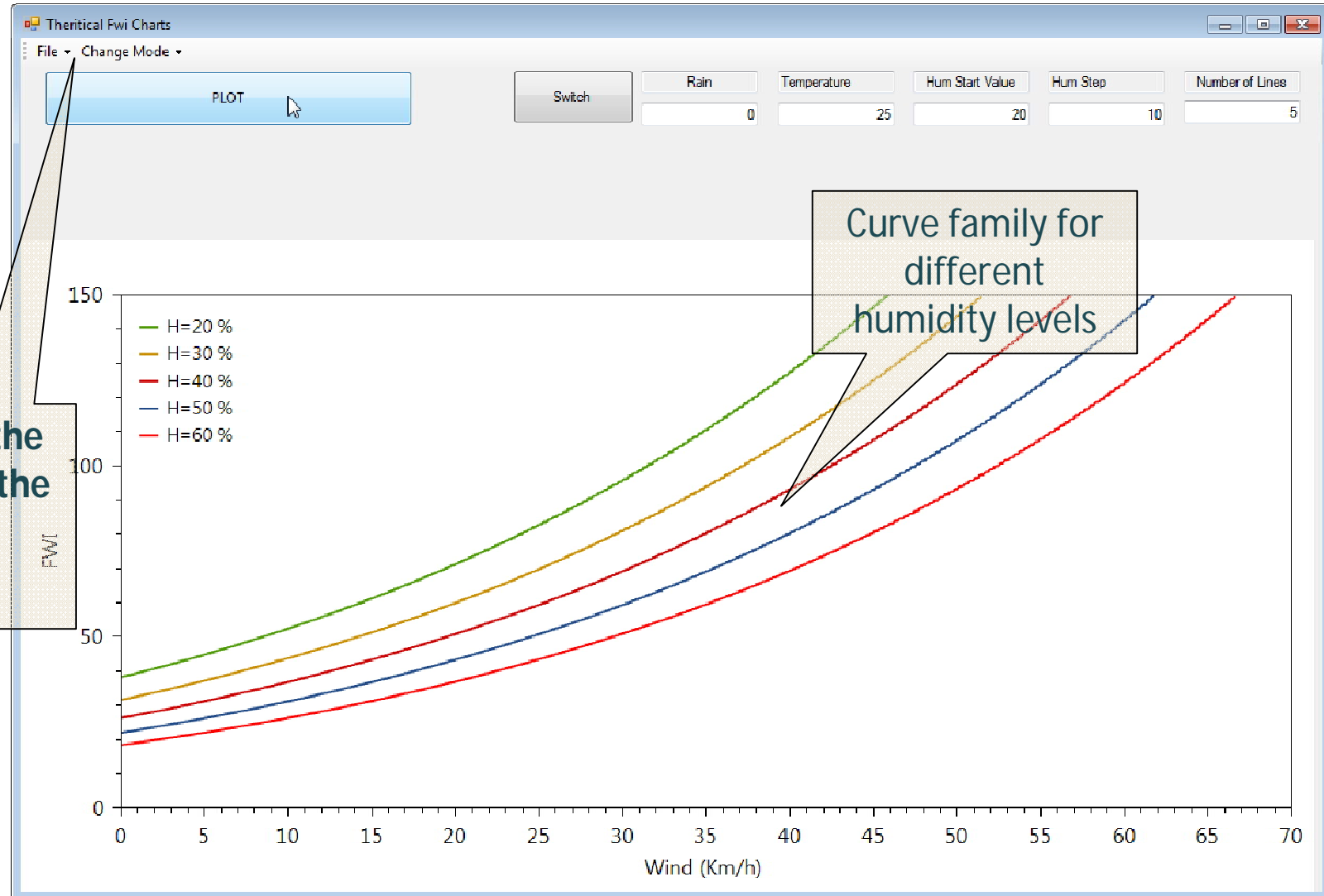
## Studying the FWI sensitivity





# Educational tool for Fire Weather Index

## Studying the FWI sensitivity







# Educational tool for Fire Weather Index

## Studying the FWI sensitivity

Export  
calculated  
indices in  
data files

Wind	T=0	T=10	T=20	T=30	T=40
0	3.65	16.61	20.27	24.06	28.48
0.1	3.68	16.67	20.34	24.14	28.57
0.2	3.71	16.74	20.41	24.22	28.67
0.3	3.74	16.8	20.48	24.3	28.77
0.4	3.77	16.87	20.55	24.39	28.86
0.5	3.8	16.94	20.63	24.47	28.96
0.6	3.83	17.01	20.7	24.56	29.06
0.7	3.86	17.08	20.78	24.64	29.16
0.8	3.89	17.15	20.85	24.73	29.26
0.9	3.92	17.22	20.92	24.81	29.36
1	3.95	17.29	21	24.9	29.46
1.1	3.98	17.36	21.07	24.99	29.56
1.2	4.01	17.43	21.15	25.08	29.66
1.3	4.04	17.5	21.23	25.16	29.76
1.4	4.07	17.57	21.3	25.25	29.86
1.5	4.1	17.64	21.38	25.34	29.96
1.6	4.14	17.71	21.46	25.43	30.07
1.7	4.17	17.78	21.53	25.52	30.17
1.8	4.2	17.85	21.61	25.61	30.27
1.9	4.23	17.92	21.69	25.69	30.37
2	4.26	18	21.76	25.78	30.48
2.1	4.3	18.07	21.84	25.87	30.58
2.2	4.33	18.14	21.92	25.96	30.68
2.3	4.36	18.21	22	26.05	30.79
2.4	4.39	18.28	22.08	26.14	30.89
2.5	4.43	18.36	22.16	26.24	31
2.6	4.46	18.43	22.24	26.33	31.1
2.7	4.49	18.5	22.32	26.42	31.21
2.8	4.53	18.58	22.4	26.51	31.31
2.9	4.56	18.65	22.48	26.6	31.42
3	4.59	18.72	22.56	26.69	31.53
3.1	4.63	18.8	22.64	26.79	31.63
3.2	4.66	18.87	22.72	26.88	31.74
3.3	4.69	18.95	22.8	26.97	31.85
3.4	4.73	19.02	22.88	27.07	31.95
3.5	4.76	19.09	22.96	27.16	32.06
3.6	4.8	19.17	23.04	27.25	32.17
3.7	4.83	19.24	23.12	27.35	32.28
3.8	4.87	19.32	23.21	27.44	32.39
3.9	4.9	19.39	23.29	27.54	32.5
4	4.94	19.47	23.37	27.63	32.6
4.1	4.97	19.55	23.45	27.73	32.71
4.2	5.01	19.62	23.54	27.82	32.82
4.3	5.04	19.7	23.62	27.92	32.93
4.4	5.08	19.77	23.7	28.01	33.05
4.5	5.11	19.85	23.79	28.11	33.16
4.6	5.15	19.93	23.87	28.21	33.27
4.7	5.18	20	23.96	28.3	33.38