TAILORING THE FIRE RISK MAPPING PRODUCT TO FOREST MANAGERS

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INTRODUCTION

- Representing **more than 85%** of burned area in Europe, the **Mediterranean** is one of the regions of the world most affected by large wildfires.
- In Mediterranean Europe, fire is a natural phenomenon linking **climate**, **humans** and **vegetation**.
- Fire activity is therefore conditioned by **natural** and **anthropogenic** factors.

INTRODUCTION

- Natural factors include **topography**, **vegetation cover** and prevailing **weather conditions**.
- Weather conditions are linked to several atmospheric mechanisms working at different **temporal** and **spatial** scales.
- **Rainy and mild winters** followed by **warm and dry summers** lead to high levels of **vegetation stress** that make Mediterranean Europe particularly prone to the occurrence of fire events.
- **Extreme weather conditions** (e.g. temperature, wind speed, fuel moisture and relative humidity) play a key role in the ignition and spread of wildfires.

INTRODUCTION

- In Mediterranean Europe, **land management practices** and **inadequate use of fire** are crucial anthropogenic factors being responsible for about 90% of fire ignitions.
- Anthropogenic factors also include **fire management policies** that comprise **fire prevention**, **fire pre-suppression** and **fire suppression measures**, which depend on topography, vegetation cover and prevailing weather conditions, and on **resources employed.**
- **Fire prevention** requires adequate knowledge about **wildfire potential assessment** that comprises **potential fire ignition**, **education**, **law enforcement** and **difficulty of control**.
- Wildfire potential assessment is usually based on **fire danger rating systems** which provide **indices** to be used on an **operational and tactical basis** in wildfire **management decision support systems**.

THE FRM PRODUCT

- The Satellite Application Facility for Land Surface Analysis (LSA SAF) is currently disseminating the **Fire Risk Mapping (FRM)** product.
- The rationale is to provide the **user community** with information on **meteorological risk** that will allow adopting the adequate measures to **mitigate fire damage**.

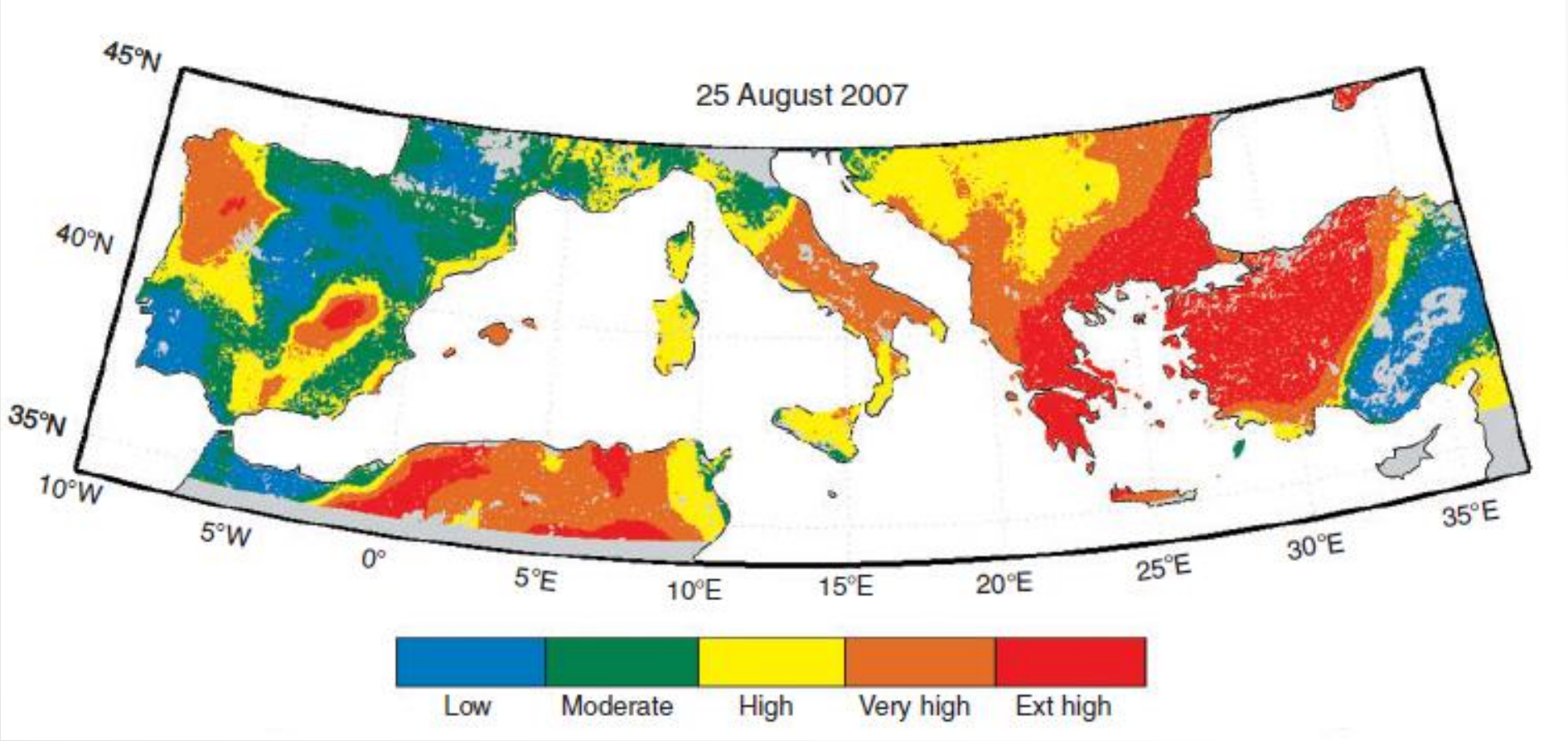
THE FRM PRODUCT

- The FRM product consists of **forecasts of fire danger** over Mediterranean Europe based on a **statistical procedure** that combines information about **fire history** with **daily meteorological data** provided by the **European Centre for Medium-Range Weather Forecasts (ECMWF)**.
- **Historical information** about fire radiative power is available from the Fire Radiative Power (FRP) product of the LSA SAF.

THE FRM PRODUCT

- Meteorological information is used to derive the set of components of the **Canadian Forest Fire Weather Index System (CFFWIS)** that has proven to be especially adequate to rate fire danger over the Mediterranean.
- **Levels of fire danger** are then associated to **probabilities of exceedances** (i.e. of occurrence of fires exceeding specified magnitudes).

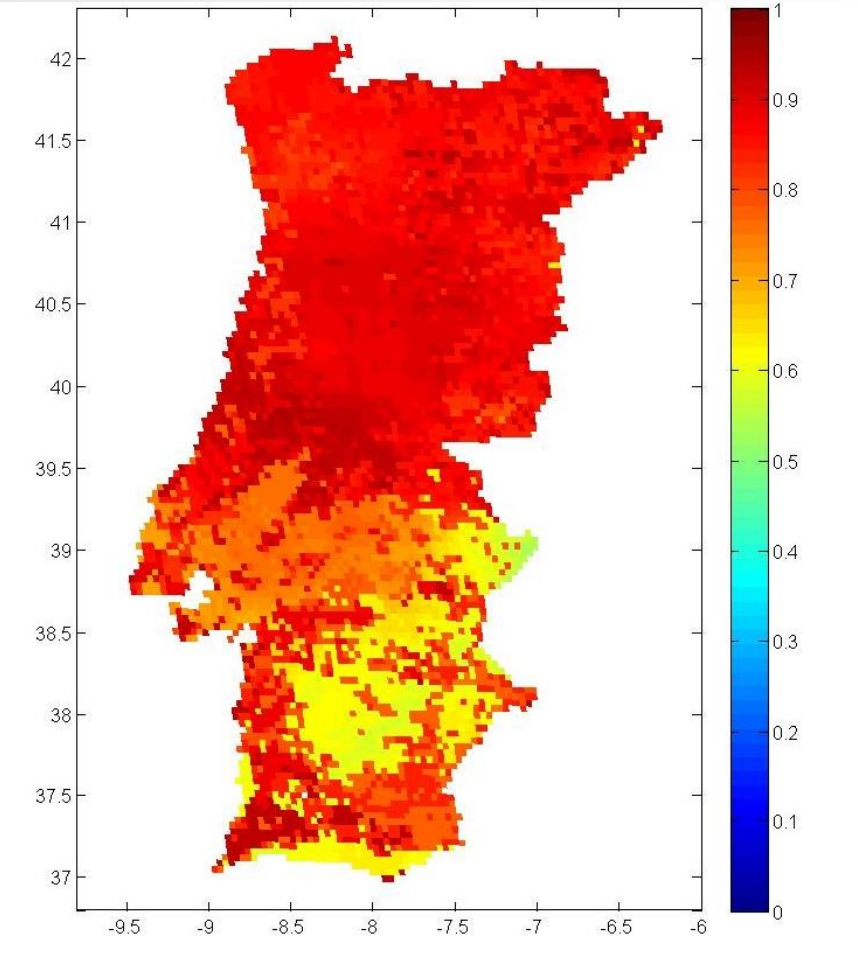
FRM FOR AUGUST 25, 2007

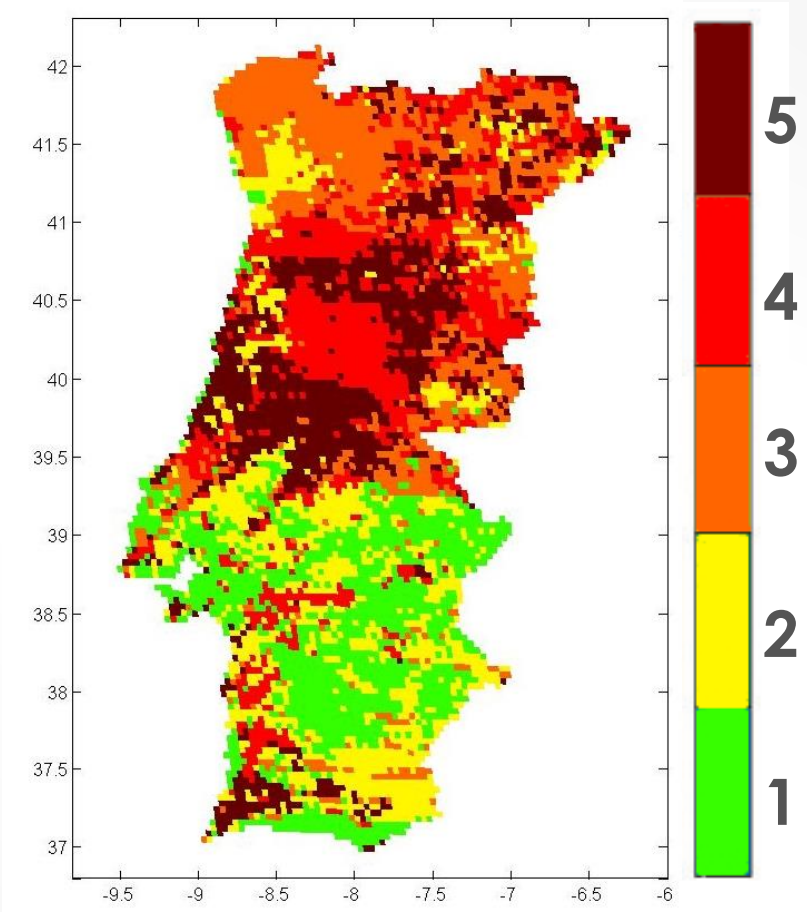


A BRIEF DESCRIPTION OF FRM

- The algorithm to derive FRM consists of **4 main steps**:
- **1st step**: Identification of regions with similar fire behavior.

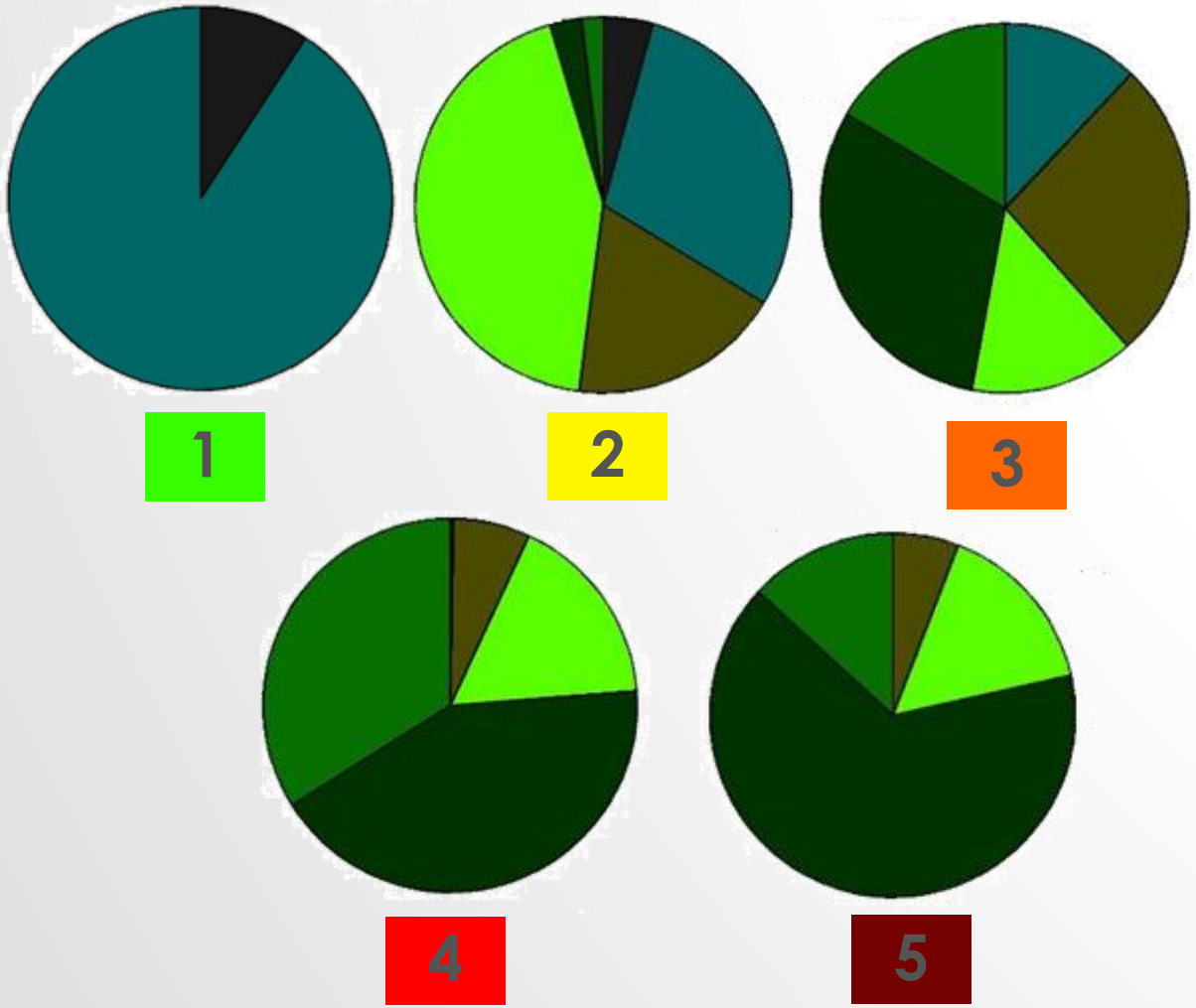
1ST STEP

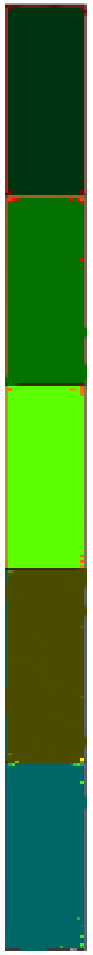




P(X>50 GJ | Event)

1ST STEP





Needle leaved

Broad leaved

Mixed

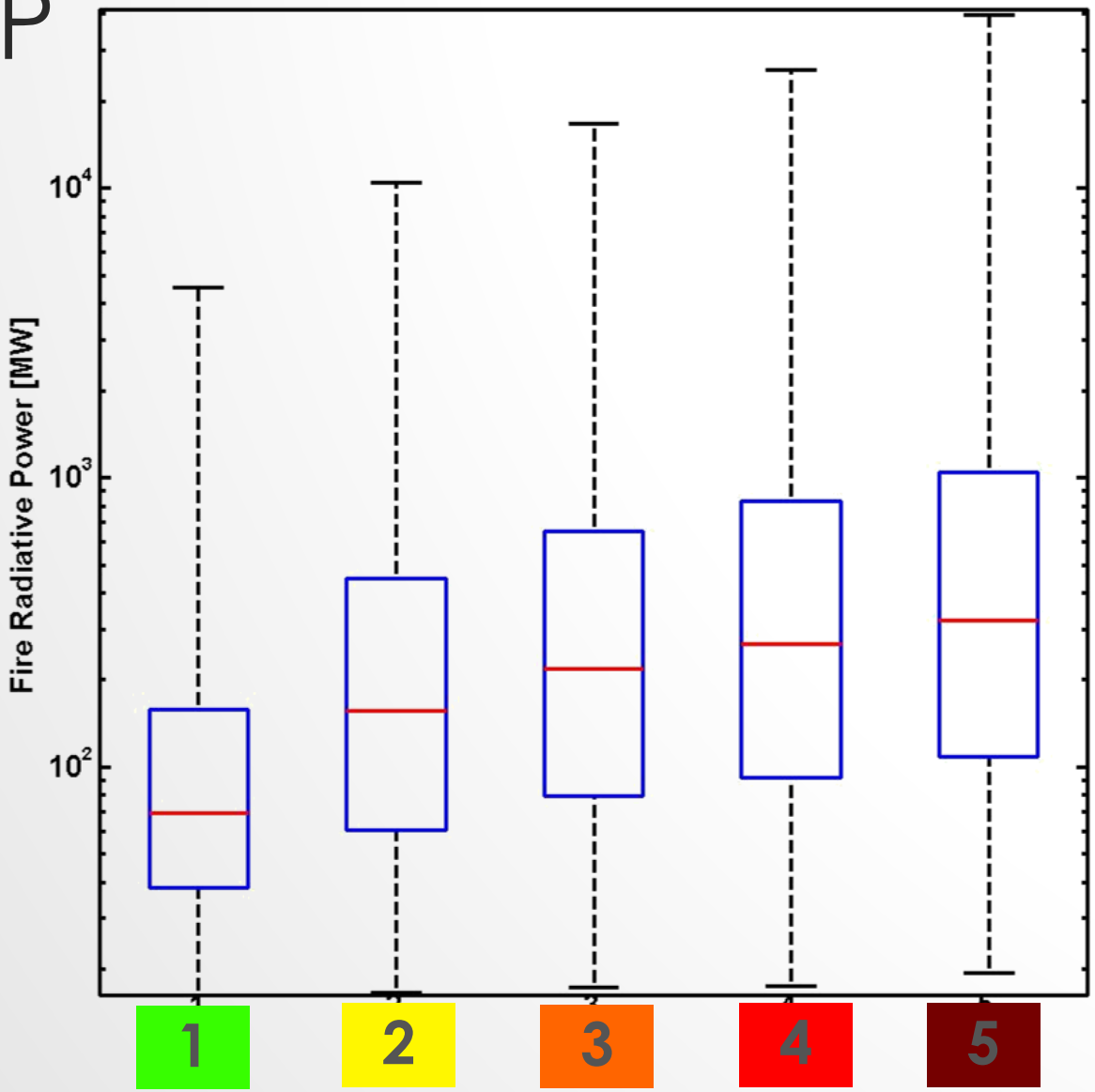
Shrub

Cultivated

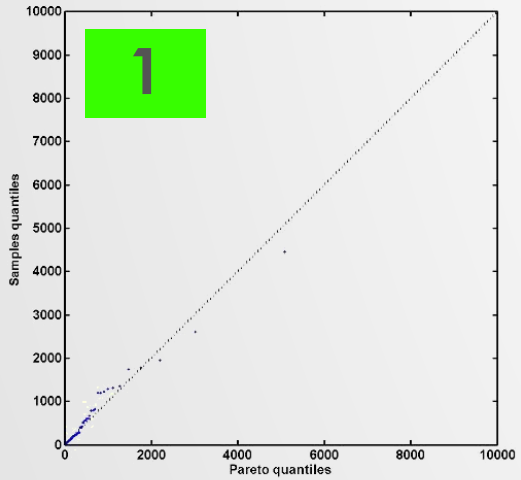
A BRIEF DESCRIPTION OF FRM

- The algorithm to derive FRM consists of 4 main steps:
- 1st step: Identification of regions with similar fire behavior.
- **2nd step**: Fitting of Pareto distributions.

2ND STEP



2ND STEP


1
Samples quantiles
Pareto quantiles
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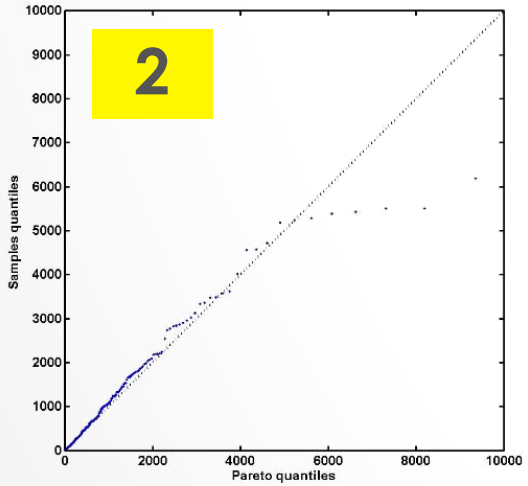
3000
4000
5000
6000
7000
8000
9000
10000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Pareto quantiles
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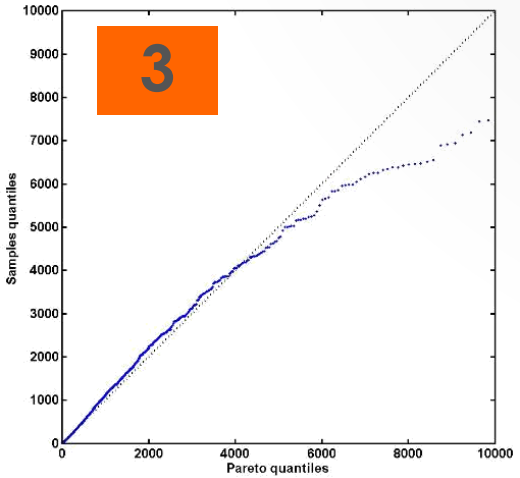
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Pareto quantiles
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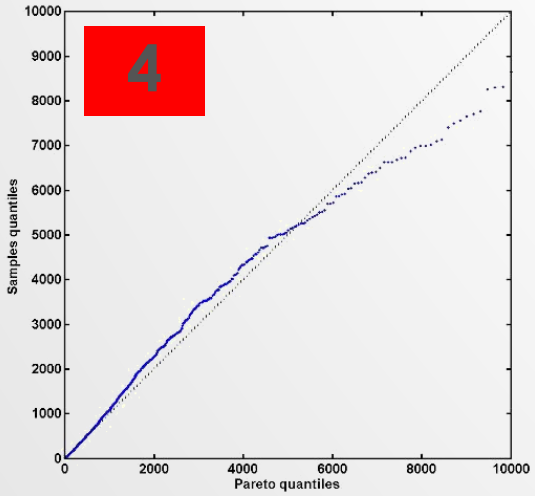
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Samples quantiles
Pareto quantiles
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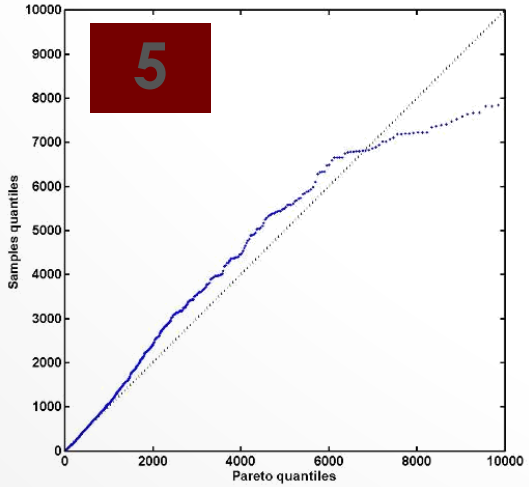
5
Samples quantiles
Pareto quantiles
0
1000
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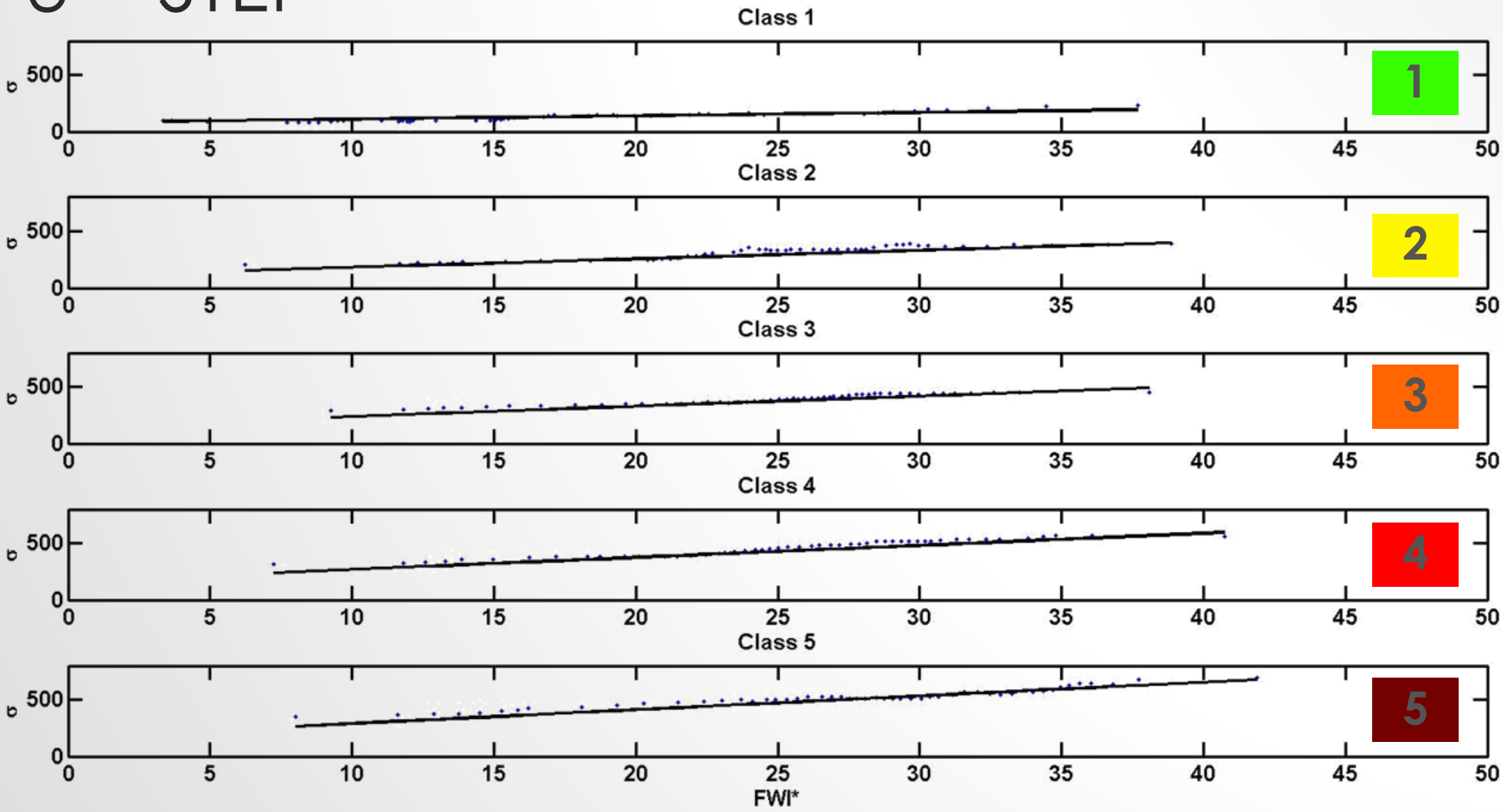
3000
4000
5000
6000
7000
8000
9000
10000

A BRIEF DESCRIPTION OF FRM

- The algorithm to derive FRM consists of 4 main steps:
- 1st step: Identification of regions with similar fire behavior.
- 2nd step: Fitting of Pareto distributions.
- **3rd step**: Introduce FWI as a covariate.

3RD STEP


Class 1
Class 2
Class 3
Class 4
Class 5
σ
500
0
0
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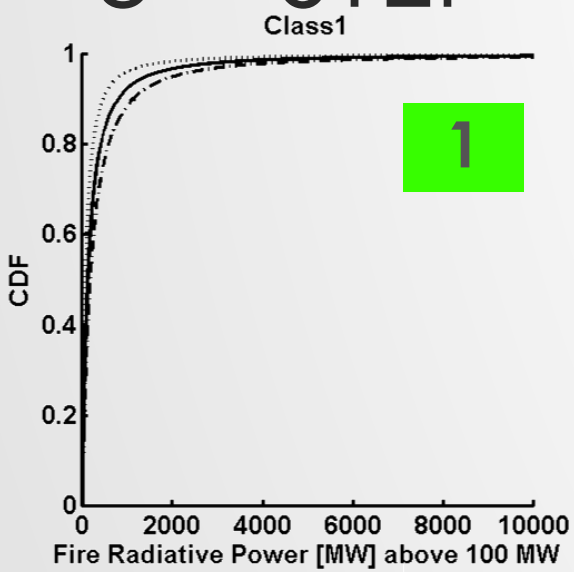
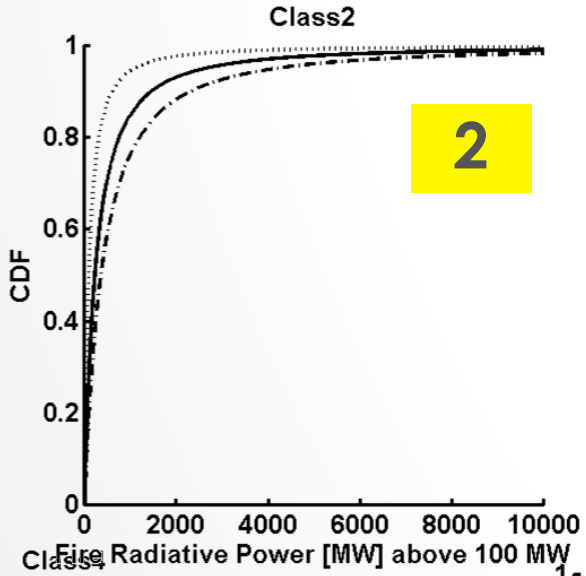
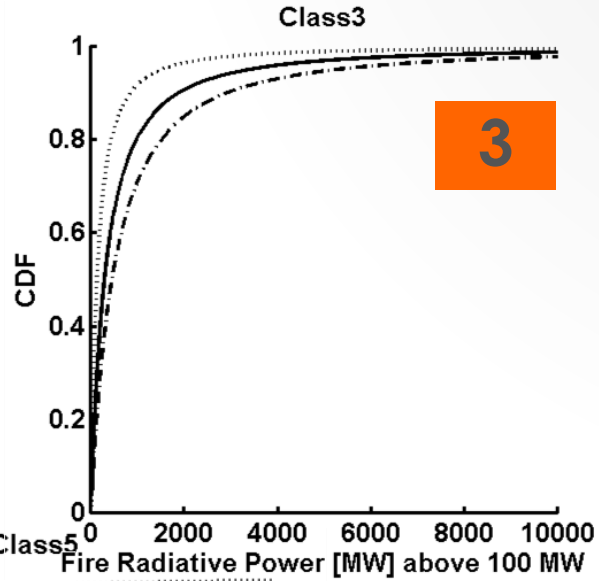
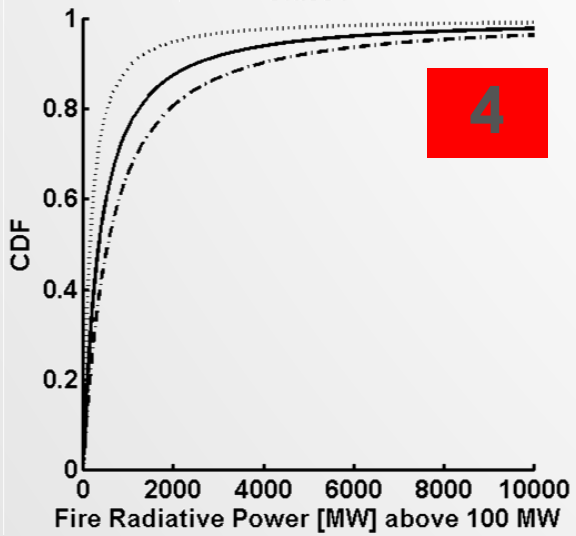
10
15
20
25
30
35
40
45
50
1
2
3
4
5
FWI*

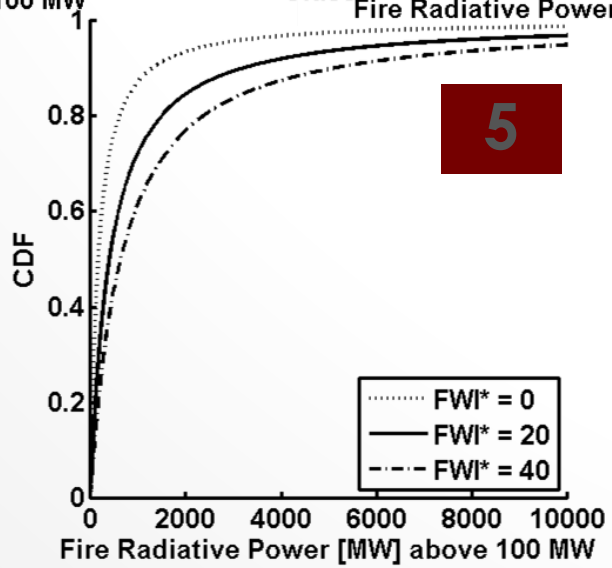
3RD STEP


Class1
CDF
Fire Radiative Power [MW] above 100 MW
1


Class2
CDF
Fire Radiative Power [MW] above 100 MW
2


Class3
CDF
Fire Radiative Power [MW] above 100 MW
3

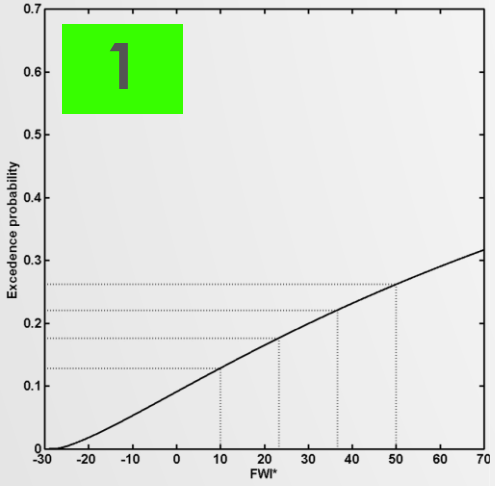

Class4
CDF
Fire Radiative Power [MW] above 100 MW
4

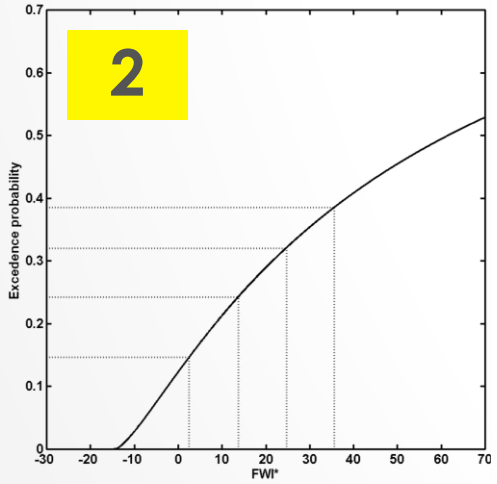

Class5
CDF
Fire Radiative Power [MW] above 100 MW
5
FWI* = 0
FWI* = 20
FWI* = 40

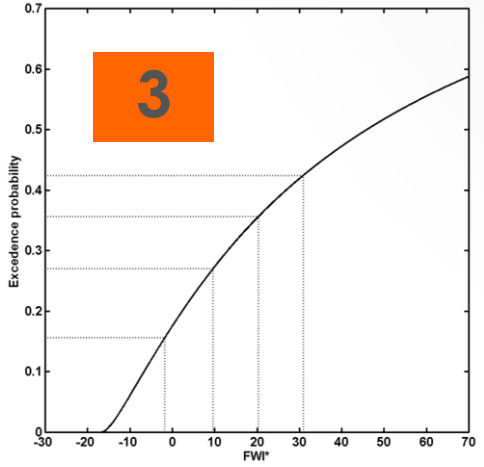
A BRIEF DESCRIPTION OF FRM

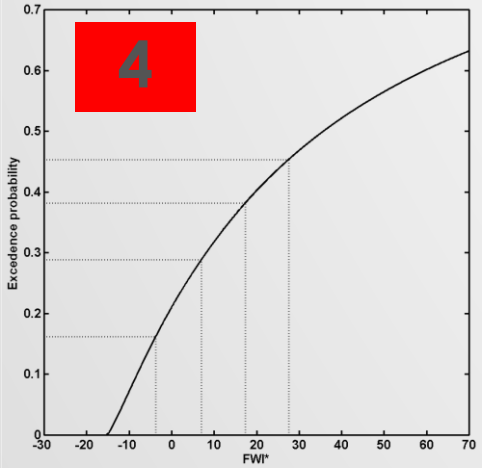
- The algorithm to derive FRM consists of 4 main steps:
- 1st step: Identification of regions with similar fire behavior.
- 2nd step: Fitting of Pareto distributions.
- 3rd step: Introduce FWI as a covariate.
- **4th step**: Compute probabilities of exceedance.

4TH STEP

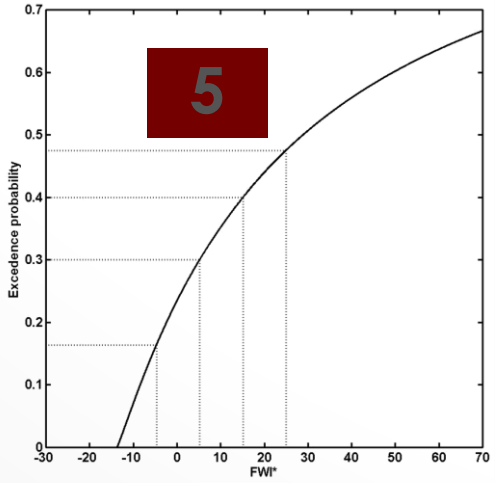




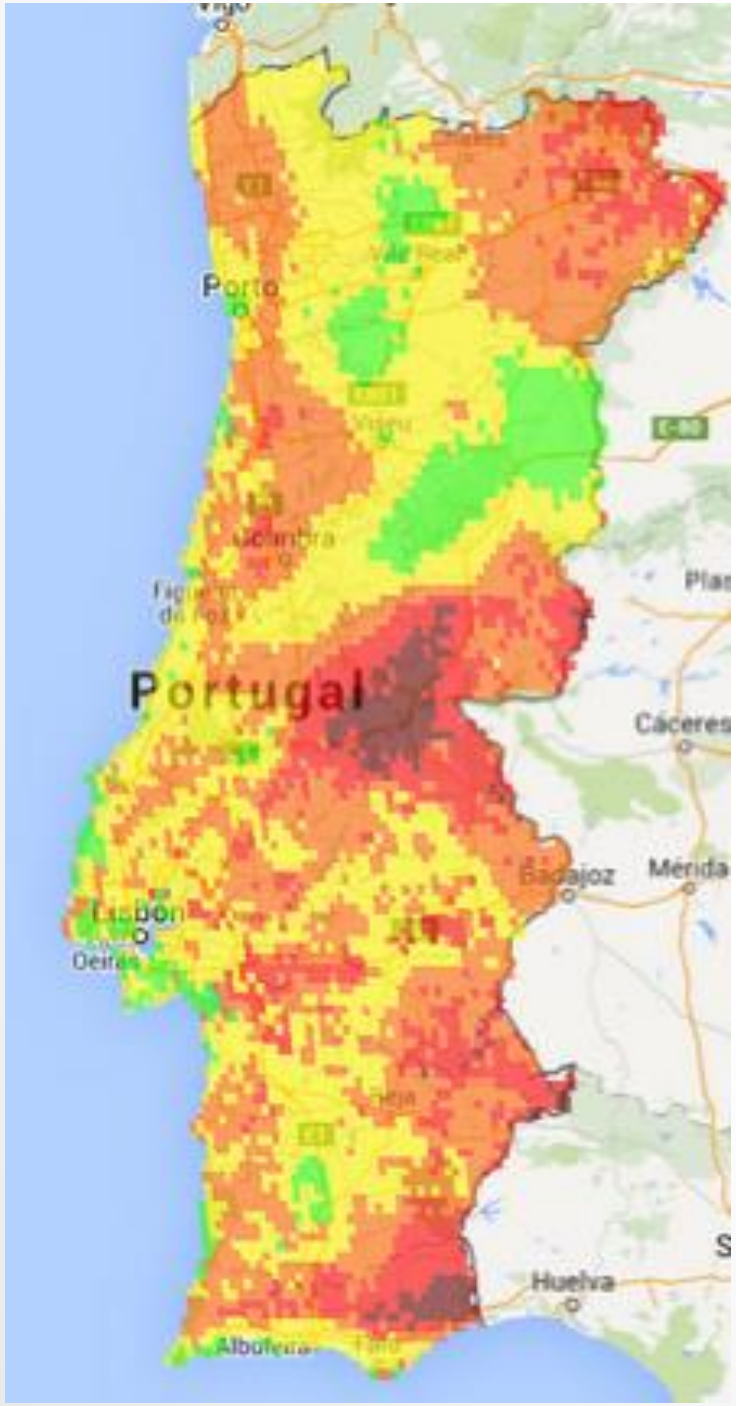




P(X>600 GJ | 100 MJ)



4TH STEP



Fire Danger:

- Extreme
- Very High
- High
- Medium
- Low

APPLICATIONS TO FOREST MANAGEMENT

- **Decision making on burning** within the framework of agricultural and forest management practices is a delicate activity since **wrong or uninformed decisions** may trigger **severe events associated to large damages**.
- The process will greatly benefit from **knowledge about the statistical distributions of exceedances** in fire radiative power, as well as of **meteorological parameters** and derived **indices of fire danger**.

APPLICATIONS TO FOREST MANAGEMENT

- Incorporation of such information into the FRM product is facilitated by the **availability of historical information** about fire radiative power from Fire Radiative Power (FRP) product of the LSA SAF.
- **Long-term information about meteorological parameters** is also available from **ECMWF reanalyses**.

TAILORING THE FRM PRODUCT

LSA SAF

ICNF
Instituto da Conservação da Natureza e das Florestas

Institute for Conservation of Nature and Forests

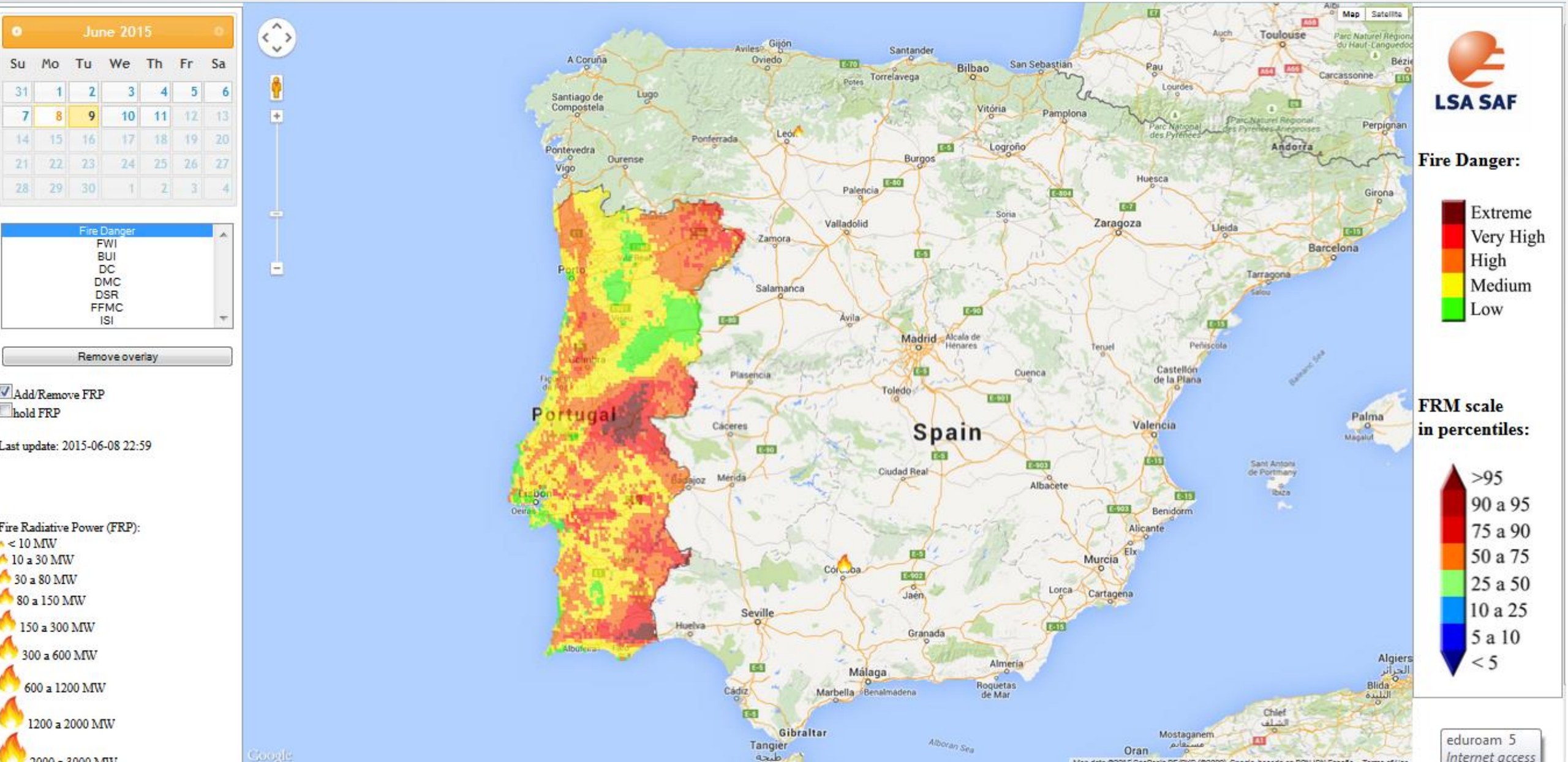
Portucel
grupo Portucel Soporcel

Portucel Soporcel group

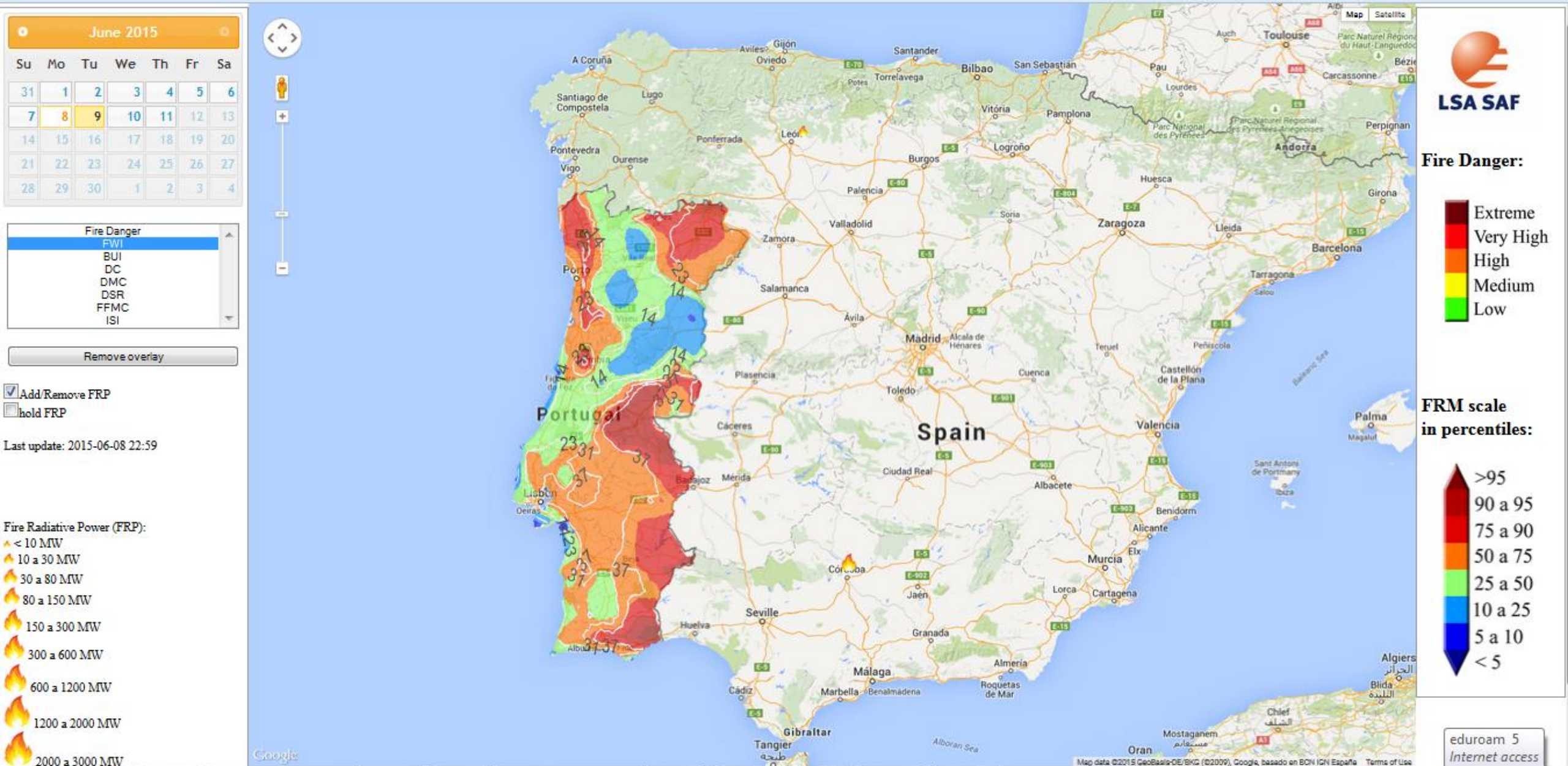
PROTEÇÃO CIVIL • AUTORIDADE NACIONAL •

National Authority for Civil Protection

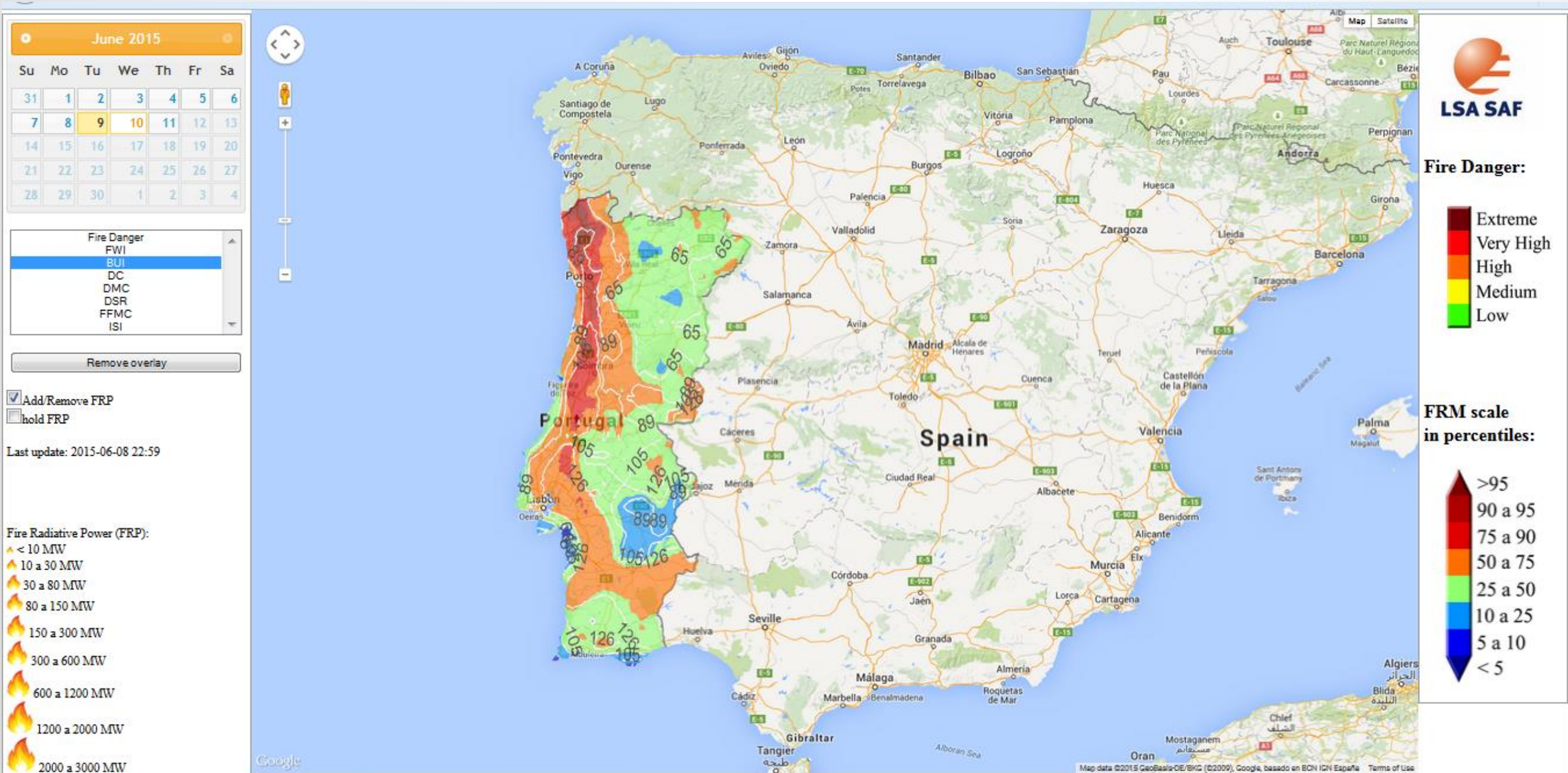
TAILORING THE FRM PRODUCT



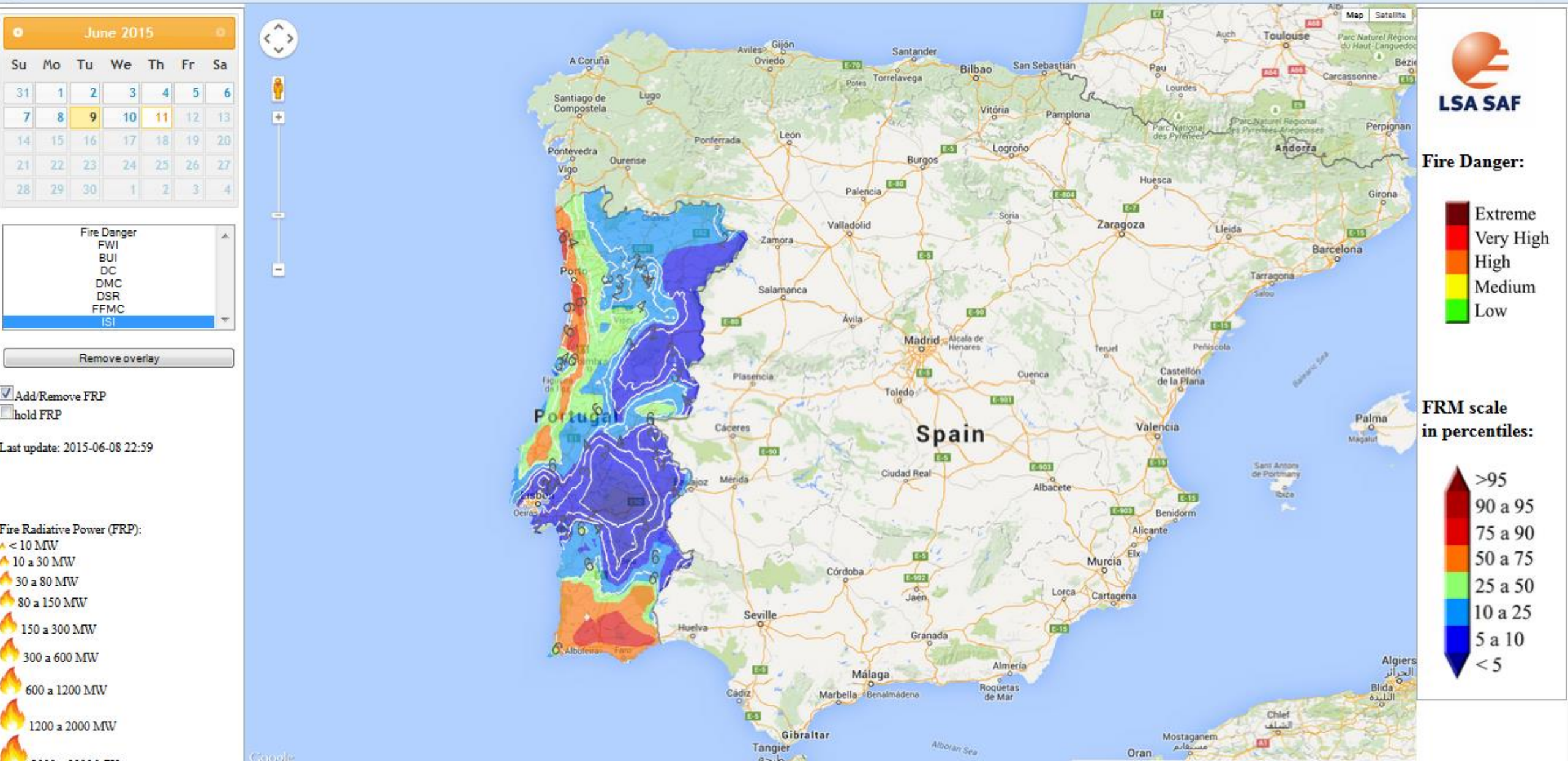
TAILORING THE FRM PRODUCT



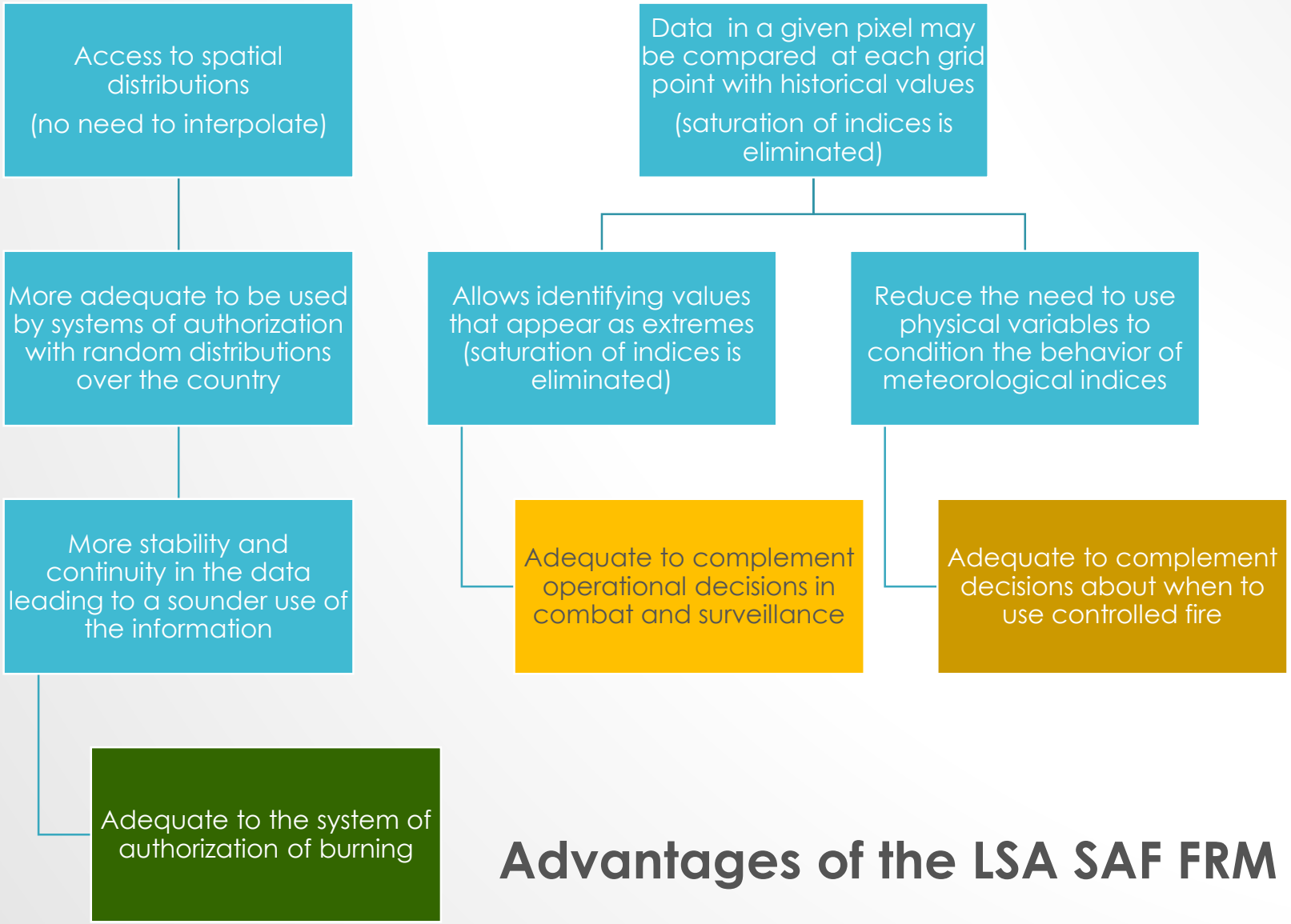
TAILORING THE FRM PRODUCT



TAILORING THE FRM PRODUCT



A FIRST BALANCE



Advantages of the LSA SAF FRM Product







Thank you