Extreme Wildfire Events Data Hub for Improved Decision Making

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Contributors	Castellnou, M., Nebot, E., Arilla, E., Bachfisher, M., Castellarnau, X., Castellvi, J., Cespedes, J., Dalmau, E., Estivill, L., Ferragut, A., Larrañaga, A., Miralles, M., Pagès, J., Palacios, A., P., Rosell, M., Ruiz, B., (all from CFRS) Guarque, P. (PCF)

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List of Acronyms

ABL	Atmospheric Boundary Layer
AGL	Above Ground Level
BR	Burn Ratio
CFRS	Catalan Fire and Rescue Service
CONAF	Corporación Nacional Forestal - Chile
EWE	Extreme Wildfire Events
EWED	Extreme Wildfire Events Data Hub for Improved Decision Making
FL	Flame Length
FLI	Fire Line Intensity
GRAF	Grup d'Actuacions Forestals; Bombers de la Generalitat de Catalunya
LCL	Lifting Condensation Level
MSL	Mean Sea Level
NIPV	Nederlands Instituut Publieke Veiligheid
PCF	Pau Costa Foundation
ROS	Rate of spread
WDP	Wildfire Data Portal

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Executive Summary

D3.4 Case Studies is a data repository that collates meteorological and fire data gathered from wildfires. The data is organized in a systematic and uniform format to facilitate integration into the Wildfire Data Portal (WDP). This deliverable updates the previous version, **D3.2 Case Studies**, available on the project website and on Zenodo, Like the earlier version, it produces two main outputs: a report document and a dataset containing information from fifteen wildfires.

This document describes the structure and principal formats of the collected data, detailing how they are organized within the dataset. Additionally, it presents a brief analysis of the data, to highlight its potential applications.

This data was collected during 2025 by EWED project partners from various countries: Catalonia (Spain), Greece, the Netherlands and Chile. The latter was made possible by a collaboration between the EWED project and National Forestry Corporation of Chile (CONAF), which enabled the creation of a data collection team and its deployment during the fire season in Chile to collect data from wildfires using the project's methodology.

The data collected processes and methodologies are defined and detailed in **D3.1 Protocols for Data Collection on Extreme Wildfire Events.**

1. Introduction

The Case Studies document and dataset aim to expand the dataset presented in **D3.2 Case Studies**, which compiles data collected during wildfires throughout the project. This expanded dataset will feed the Wildfire Data Portal (D3.3) and enable the simulation and conceptual models to be run and enhanced. **D3.1 Protocols for data collection on extreme wildfire events** [2] describes in detail the data useful for analysis, simulations and wildfire science, and the collection methodology.

As outlined in the D3.1 Protocols for data collection on EWE, this data gathering methodology was initially implemented by the Catalan Fire and Rescue Service (CFRS) during the 2021 fire season. Subsequent to this, the methodology was used in the following years in Catalonia, other regions of Spain and during the 2023 fire season in Chile. By the commencement of the EWED project in 2024, the use of this methodology expands to Greece, the Netherlands and Norway.

The update of the dataset with data collected during 2025 has enabled an increase in the number of countries from which data has been gathered compared to the D3.2. In addition to data from Catalonia and Greece, this deliverable also contains data on fires in the Netherlands and Chile.

The present deliverable is comprised of two separate outputs:

- This report document provides detailed accounts of the data collected, explains the structure of the dataset and a brief analysis of the data gathered in some wildfires. The document is divided into two different sections:
    - **Section 2:** provides an overview of the data format and the structure of the dataset, as well as a detailed account of the data gathered from each case study.
    - **Section 3:** presents a brief analysis of the data collected from the wildfires and prescribed burns introduced at the dataset.

- The second output of this deliverable is the set of data that has been collected and presented properly structured and will be used to add more cases into the **Wildfire Data Portal (WDP).**

2. Dataset

This section of the deliverable outlines the fundamental characteristics of the dataset structure, and the data collected during wildfires that are part of it. This process provides clarity regarding the manner in which data should be input once the Wildfire Data Portal becomes operational, thereby ensuring the consistency and utility of the data entered.

Moreover, the uniform structure of the data collected will facilitate navigation through the dataset, regardless of the country or fire service in which it has been collected or the type of wildfire occurred. In the Wildfire Data Portal, the data that is in the present dataset will be structured in a user friendly and simple way to facilitate the navigation through the data portal.

2.1. Case studies included

The data included in this deliverable were collected during the 2025 fire season in countries where EWED Project partners operated. These regions experienced wildfires with optimal conditions for intense fire behaviour, especially in Catalonia, Greece and the Netherlands.

Data collected during the 2025 fire season in Chile has also been used to update this dataset. In the context of the collaboration between the EWED Project and CONAF, a team from EWED (CFRS, PCF, NIPV) was deployed to Chile for three weeks. The purpose of the collaboration was twofold: firstly, to collect wildfires data, and secondly, to train CONAF staff in the methodology established in D3.1 Protocols for data collection on EWE. This collaboration represents a significant achievement for the project and the future of the WDP, as it commits CONAF to providing data collected during its future wildfire seasons to the WDP.

This methodology is innovative as it goes beyond to the collection of data on surface fire behaviour. It also gathers atmospheric data, both from outside and inside the smoke plumes of the wildfires and prescribed burns. This data allows for an in-depth analysis of these phenomena and can be used to run simulations and support the development of fire behaviour models. The data from prescribed burns, despite there are not actual wildfire, is useful for calibrating simulations and models for the first few tens of meters above the surface.

2.2. Dataset structure

The structure of the D3.4 Dataset is consistent with the structure described in D3.2 Case Studies, which is available on the EWED project website and Zenodo repository. Furthermore, all the cases include in the D3.2 have been incorporated into the WDP in a user-friendly format, retaining all the capabilities offered by the portal.

The designation of the folders containing the files for each of the plume sondes has been modified by the addition of the suffix *Back*, *Flank*, *Head* or *Umbrella*, in order to indicate the launch position of each sonde in relation to the fire.

2.3. Data collected format

The data collected format of the D3.4 dataset is consistent with the formats described in D3.2 Case Studies, which is available on the EWED project website and Zenodo repository. Furthermore, all the cases include in the D3.2 have been incorporated into the WDP in a user-friendly format, retaining all the capabilities offered by the portal.

2.4. Dataset inputs

In accordance with the data structure and formats previously outlined, the data available for each case study is presented below. The data outlined in D3.1 Protocols for data collection has been collected to date; however, the dataset remains open to accommodate the inclusion of additional data sources, if necessary, for specific case studies.

Although the Wildfire Data Portal will feature a section dedicated to simulation and modelling, these are not included in the present dataset. The current dataset exclusively includes data gathered in the field during wildfires.

Table 1. Control table of all the data available in the dataset

Id	LaCapellania25 _W_CHL	ManuelRodriguez25 W_CHL	Patagual25 _W_CHL	VegaHonda25_W _CHL	Junquillos25 _W_CHL	ElValle2-25 _W_CHL	SanPatricio25 _W_CHL	Ede25_W_NDL	Drunen25_W_NDL	Granyena25 _W_CAT	Thimaris25_W_GRE	Guissona25_W_CAT	Etos25_W_GRE	Pauls25 _W_CAT	Lavrio25_W_GRE
GENERAL															
name	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
year	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
country	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
category	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
fire classification	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
description	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
publications															
GEGRAFICAL DATA															
hourly perimeters	X	X	X	X	X	X	X	X	X*	X	X	X	X	X	X
PHOTOS/VIDEOS															
photos	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
videos	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FIRE BEHAVIOR															
start latitude	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
start longitude	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
start date-time	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
burned area	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
mean fire behaviour	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
torch head (%)	X	X	X	X	X	X	X							X	
torch flanks (%)							X							X	
mean FL head	X	X	X	X	X	X	X	X	X	X		X		X	
max FL head	X	X	X	X	X		X	X	X	X		X		X	
mean FL flanks	X	X		X	X	X	X	X	X			X		X	
max FL flanks	X	X		X	X		X	X	X			X		X	
mean spotting				X			X	X		X		X		X	
max spotting	X	X	X	X		X	X	X		X		X		X	
mean ROS	X	X	X	X	X	X		X		X	X	X	X	X	X
max ROS	X	X	X	X	X	X	X	X		X	X	X	X	X	X
mean BR	X	X	X	X	X	X	X	X		X		X		X	
max BR	X	X	X	X	X	X		X		X		X		X	
SOUNDING															
flight history data	X	X	X	X	X	X	X	X		X	X	X	X	X	X
flight track	X	X	X	X	X	X	X	X		X	X	X	X	X	X

* In the case of Drunen25_W_NDL, “hourly perimeters” feature only the final perimeter of the fire.

3. Detailed data from case studies

The following section presents a comprehensive analysis of the data gathered in case studies that will be included in the larger dataset that constitutes this deliverable 3.4. The principal aim is to showcase the full range of capabilities inherent in the data gathered, which will be systematically stored and organised within the WDP.

This analysis will be conducted from the perspective of wildfire management, with the objective of demonstrating the potential of this type of data for decision-making during emergency responses. The analysis is supported by recent findings in the field of understanding atmospheric physics concerning wildfires. These findings have contributed to a reduction in uncertainty regarding pyroconvective phenomena. The purpose of this dataset is also to facilitate future advancements in this field.

For the analysis of wildfires, the data collected detailed in the previous section can be grouped into three different categories: how the fire affected and behaved on the surface, how it spread through the area, and how the fire interacted with the atmosphere. In addition, photos and videos illustrate these data and facilitate reading.

The mentioned data categories constitute the basis for an in-depth analysis of wildfires in terms of fire behaviour and pyroconvection. To provide a comprehensive overview, it would be beneficial to include the operational decisions (strategies, tactics and manoeuvres) taken during the suppression tasks. However, this is beyond the scope of this document.

3.1. Surface fire behaviour

The table below provides a comparative overview of the fire behaviour data collected from some of the most significant wildfires included in the dataset, in terms on high ROS and BR, final area affected or pyroconvection prototype, among others. It helps the final user to better understand the diversity of fire behaviour and the capabilities of the Wildfire Data Portal's data.

Table 2. Fire behaviour comparison between wildfires from the dataset

Id	**Guissona25_W_CAT**	**Granyena25_W_CAT**	**Patagual25_W_CHL**	**VegaHonda25_W_CHL**	**ElValle2-25_W_CHL**	**Lavrios25_W_GRE**
Fire classification	**PyroCb**	**Convective plume**	**Convective plume**	**Convective plume**	**Convective plume,** short-lived overshooting PyroCu	**Convective plume**
Burned area	6 346 ha	516 ha	218 ha	773 ha	4 406 ha	1 600 ha
Mean fire behaviour	Surface, high intensity	Surface, high intensity	Surface, mid intensity	Surface, high intensity	Surface, high intensity	Surface, high intensity
Mean flame length	5 m	5 m	6 m	3 m	4 m	-
Max flame length	10 m	15 m	10 m	10 m	-	-
Spotting distance	750 m (massive 100m)	300 m (massive 50 m)	200 m	1 300 m (massive 250 m)	1 400 m	-
Mean rate of spread	16 000 m/h	1 000 m/h	2 400 m/h	700 m/h	1 200 m/h	1 710 m/h
Max rate of spread	24 000 m/h	3 000 m/h	3 000 m/h	2.800 m/h	4 000 m/h	3 000 m/h
Mean burn ratio	2 500 ha/h	90 ha/h	100 ha/h	60 ha/h	300 ha/h	390 ha/h
Max burn ratio	6 200 ha/h	190 ha/h	230 ha/h	170 ha/h	780 ha/h	780 ha/h

The Guissona fire (Guissona25_W_CAT) exhibited the most extreme behaviour of any fire in the dataset. It burned 6.346 hectares (mainly unharvested cereal fields and little forested areas) in just over two hours. It also interacted with nearby storms, generating a pyrocumulonimbus (PyroCb). The fire's rate of spread (ROS) is noteworthy, with maximum speeds of up to 24.000 m/h and sustained speeds of up to 16.000 m/h, which hindered fire suppression until the fire lost intensity. Additionally, it reached a burn ratio (BR) of up to 6.200 ha/h. Section 3.2 provides details of the changes in direction and behaviour of the fire over time, using hourly perimeter data.

The Granyena fire (Granyena25_W_CAT), located in a similar landscape to that of Guissona in Catalonia, did not exhibit as extreme a behaviour pattern, primarily due to the greater stability of the free atmosphere. However, due to the type of fuel involved, it spread at speeds of up to 3.000 m/h. As normal in cereal fires, the spotting fire facilitated the rapid spread of the fire.

In the Patagual (Patagual25_W_CHL), Vega Honda (VegaHonda25_W_CHL) and El Valle2 (ElValle2-25_W_CHL), relatively similar fire behaviour was observed, with dense, low convective plumes generating high surface propagation speeds (from 2.800 m/h in Vega Honda to 4 km/h at specific moments at El Valle2). Spot fires were also recurrent, especially in the Vega Honda fire (1.300 m, which led to the ignition of a new fire front) and El Valle2, at a distance of 1.400 m, although this was quickly brought under control. A similar fire also occurred in Lavrio (Lavrio25_W_GRE), Greece, which spread over 10 km in just over 5 hours, at an average speed of 1.710 m/h, with peaks of 3.000 m/h.

3.2. Fire spread monitoring

In addition to the numerical data on fire behaviour, it is also important to consider the spatial and temporal characteristics of these fire behaviours. Therefore, it is necessary to map the evolution of the fire perimeter throughout. This allows us to identify changes in direction, the location of significant runs, flank openings, etc., and most importantly, to generate a chronology of the fire based on its movements. Furthermore, it is crucial to understand the behaviour of the fire at the time the vertical profile data of the atmosphere was collected, including the specific location of the fire, the nature of the fuel and fire front dimensions, useful to estimate the amount of heat released. Detailed hourly perimeters can provide this information. In addition, the hourly perimeters permit the extraction of data post-event, including such metrics as ROS and burn ratio BR.

This section provides illustrative examples of hourly perimeters from the D3.4 Case Studies dataset, showcasing the value and application of the data available on the WDP.

As detailed in section 3.1, the Guissona fire behaved extremely, affecting more than 6.000 ha in two hours. The combination of highly available surface fuel and an approaching storm allowed the fire to generate deep pyroconvection (PyroCb). Hourly perimeters (*Figure 1*) allow to observe changes in the direction of fire spread. First, it started in a south-north direction, at speeds below 1 km/h. However, as a storm front passed, the left flank of the fire opened up, generating a fire front width of more than 1 km and spreading at ROS of up to 24.000 m/h, covering 10 km in just over 45 minutes. During this run, the fire generated high intensity, which produced significant vertical development with PyroCb. Due to the interaction with the approaching storm, the fire changed its direction again towards the south, with more moderate speeds than before (around 16.000 m/h), but with a burn ratio that reached 6.200 ha/h.

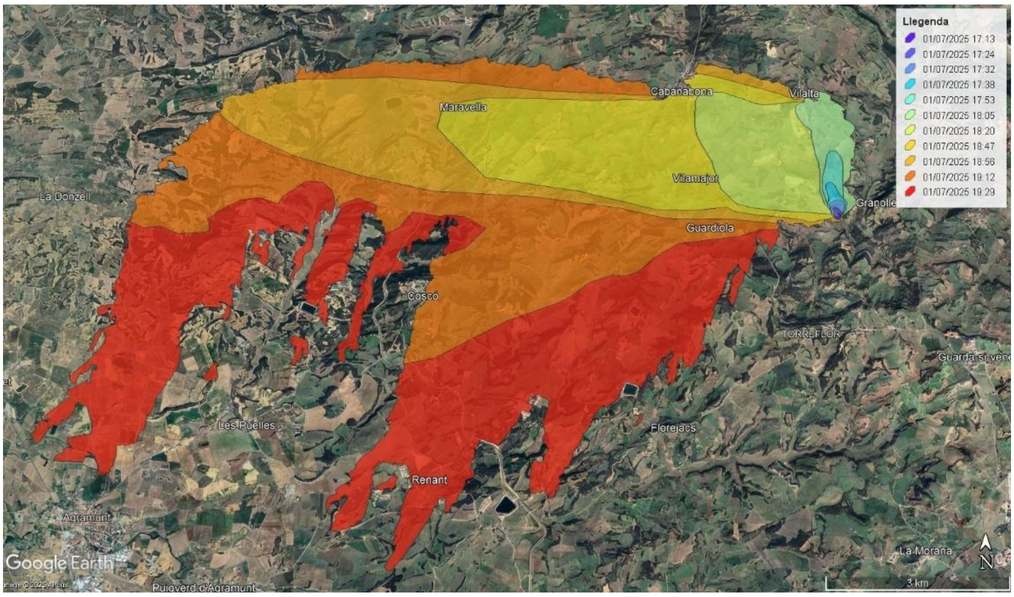

Figure 1. Hourly perimeters from Guissona fire (Catalonia, 01/07/2025)

Other interesting cases that are well reflected in the hourly perimeters are the Patagual and Vega Honda wildfires, in the Ñuble Region, Chile, as it is possible to see a synchrony between them. The Vega Honda fire (the southernmost one, as shown in *Figure 2* on the left) began on the afternoon of the 6th of February, but was suppressed on the same day, affecting an area of approximately 150 ha. During the afternoon of the 8th, the fire reignited, with speeds of up to 2.800 m/h and spotting distance at 350 m, which generated another run of almost 2 km. As it is evident in the hourly perimeters, this movement was synchronous with the Patagual fire, located in less than 10 km to the north, which made a narrow run of 4 km in less than 2 hours. Both fires, with a front of about 800 m, were unable to spread width wise due to the impossibility of vertical growth of the plume (*Figure 2*, right), given the high stability and atmospheric pressure, which created a Venturi effect on the surface, compressing the plume to the surface, thus accelerating the fires.

*Figure 2. **Left**: hourly perimeters from Patagual fire (above) and Vega Honda fire (Región de Ñuble, Chile). **Right**: plume from Vega Honda fire (down right) and Patagual fire (up left) during 8th February afternoon. Source: CONAF*

In the Attica region of Greece, the hourly perimeters of the Lavrios fire illustrate how it spread over 10.5 km in just over 5 and a half hours, with sustained speeds of 1.710 m/h and peaks of up to 3.000 m/h, burning an average of 390 ha/h, with maximums of up to 780 ha/h at 7 p.m. local time. The hourly perimeters (*Figure 3*) demonstrate a significant increase in fire activity during the midday period (2:00 p.m. to 5:00 p.m.), followed by a decline in intensity and improvement in weather conditions after sunset (as shown by hourly perimeters from 8:00 p.m. onward).

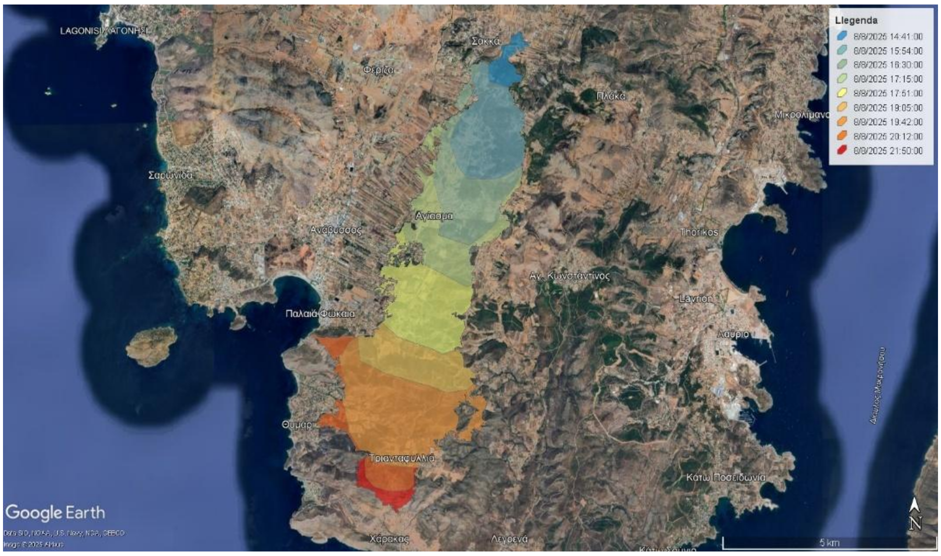

Figure 3. Hourly perimeters from Lavrios fire (Attica, Greece, 08/08/2025)

All of the above cases involved fast-moving fires, in which the perimeter's evolution was mainly mapped based on the reconstruction of images, data and positions provided by teams in the field. This was possible due to the short duration of the fire, which lasted no more than two days. However, in complex topographies, such as mountainous regions, extinguishing operations can extend over several days. In such cases, there is the option of using other data sources to establish hourly perimeters. Examples of such data sources include satellite images or satellite images with hotspot detection (VIIRS or MODIS hotspots, for example), although the time resolution is not as fine. A notable case of this methodology is the San Patricio fire (Ñuble Region, Chile), which lasted almost two weeks. In this instance, both surface and aerial images and in-field data were used to draw up the hourly perimeters for the first two days, and satellite images and hotspots were used to draw up the perimeter for the remaining days (*Figure 4*).

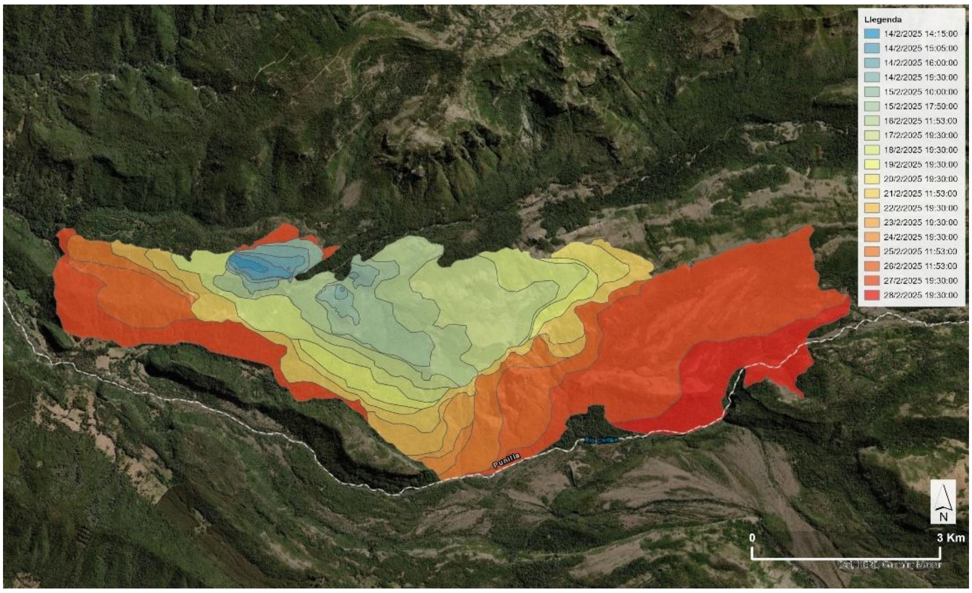

Figure 4. Hourly perimeters from San Patricio fire (Ñuble Region, Chile)

3.3. Data of atmospheric vertical profile

In the study of wildfires, particularly in analysing the relationship between fire and the atmosphere, it is useful to have a complete view of a wildfire's plume. As detailed in D3.1 Protocols for data collection on EWE, it is necessary to continuously collect data on the vertical profile of the atmosphere at different points in relation to the fire and plume: ambient sonde, in-plume sonde (from rear indraft, head indraft or flank indraft) and the sonde under the umbrella (ahead of the fire below the smoke plume).

The table below shows the number of launches of each type for each fire included in the dataset to facilitate analysis of the interaction between fire and atmosphere.

Table 3. Sondes by type of launching

	Ambient	In-plume	Umbrella
LaCapellania25_W_CHL	1	-	1
ManuelRodriguez25_W_CHL	1	3	-
Patagual25_W_CHL	1	2	1
VegaHonda25_W_CHL	1	2	1
Junquillos25_W_CHL	1	2	-
ElValle2-25_W_CHL	2	2	2
SanPatricio25_W_CHL	3	3	-
Ede25_W_NDL	1	2	-
Drunen25_W_NDL	1	1	-
Granyena25_W_CAT	2	1	
Thimaris25_W_GRE	-	1	-
Guissona25_W_CAT	-	2	-
Etos25_W_GRE	-	1	-
Pauls25_W_CAT	2	6	-
Lavrio25_W_GRE	-	1	-

Relative to the in-plume sondes type, it is important to know the relative position of the fire from which the sonde was launched: rear indraft, head indraft or flank indraft. This has an impact on how the data can be used for scientific research and operational decision-making [3].

It is essential to acknowledge that a sonde provides data of a particular moment and a specific trajectory inside the smoke plume (or the environment). Consequently, continuous monitoring of the fire and the atmospheric structure in which it is developed is imperative to obtain a comprehensive understanding of the processes ongoing and potential occurrences.

Nevertheless, sondes can be useful for operational purposes, such as tactical analysis, situational awareness and safety, without the need of a full plume and ambient vertical profile. Using small atmospheric sondes that can perform on-site, real-time analysis means that conclusions can be drawn and contribute to decision-making the moment the sonde is launched. This is a significant advance for fire analysts and incident commanders because provide direct data from the wildfire.

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During the Guissona fire (Catalonia,01/07/2025), a sonde was launched just when the fire front changed direction for the first time. The results (*Figure 5*, left) reveal two significant findings: firstly, the rising speed of the sonde exceeded 14 m/s. There is a direct relationship between the rise speed of the plume and the ROS of the fire, as described in Castellnou et al. (2021) [1]. Therefore, identifying such high vertical speeds helps fire analyst and fire practitioners to predict or anticipate situations in which the fire will accelerate. Secondly, condensation occurs above 2.500 m, resulting in the formation of a pyrocumulus (PyroCu). The readings from this sonde enabled the acceleration of the fire to be monitored, allowing to improve the time to alert the firefighting personnel and nearby residents, thus preventing accidents.

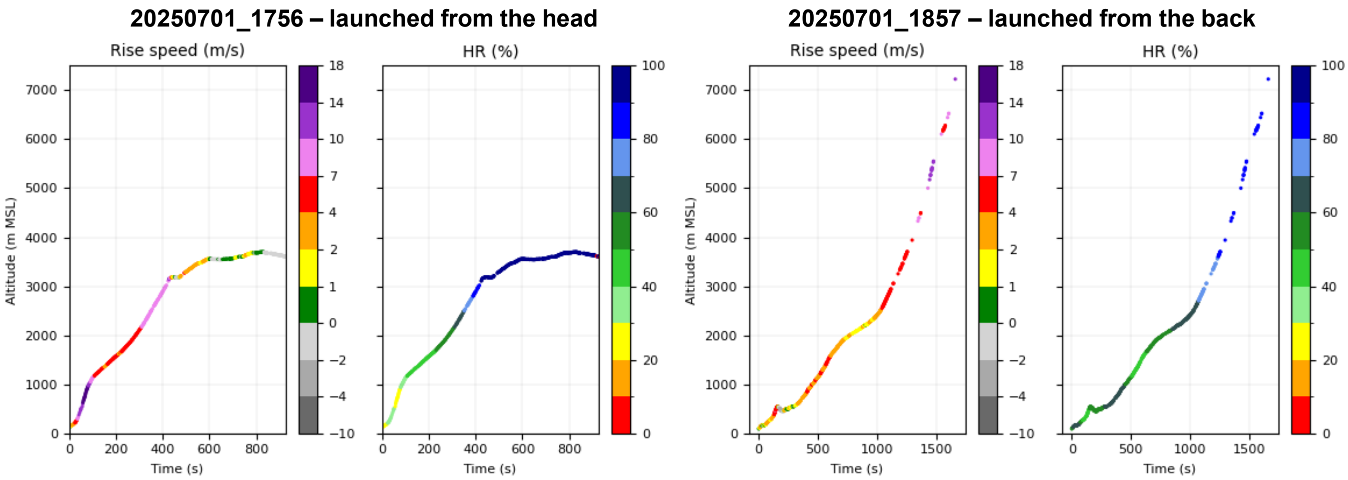

Figure 5. Radiosonde data profiles from Guissona wildfire (Catalonia, 01/07/2025)

An hour later, after the fire had travelled 10 km, another sonde was launched using the rear-indraft of the plume (*Figure 5*, right). Condensation was also observed above 2.500 m, but in this case the vertical development of the pyrocumulus was unlimited and was measured up to 7.000 m. Speeds of up to 14 km/h were recorded within the cumulus. The interaction between the fire and the unstable atmosphere enabled the propagation described in detail in Section 3.2, based on the hourly perimeter of the fire.

Another case in which the launch of sondes enabled operational decisions to be made occurred in Paüls, (Catalonia, 07/07/2025). *Figure 6* (left) shows the profiles of virtual potential temperature, rise speed, relative humidity and wind speed. Some data is missing from the profile due to a loss of connection between the sonde and the receiver, caused by physical obstructions. Applying the sonde analysis methodology during pyroconvective extreme events of Castellnou et al. (2025) [3] to the data reveals that the plume is prevented from rising further due to the stable thermal gradient of the free atmosphere, as illustrated by the virtual potential temperature graph and the increment of wind speed. *Figure 6* (right) shows the fire column lying down due to the W-NW wind, with overshooting pyrocumulus at the top of the plume and no notable vertical growth. Due to the impossibility of overcoming the stable layer, a dense layer of smoke formed several kilometres ahead of the fire.

20250707_1356 – launched from the back **Pauls_1400**

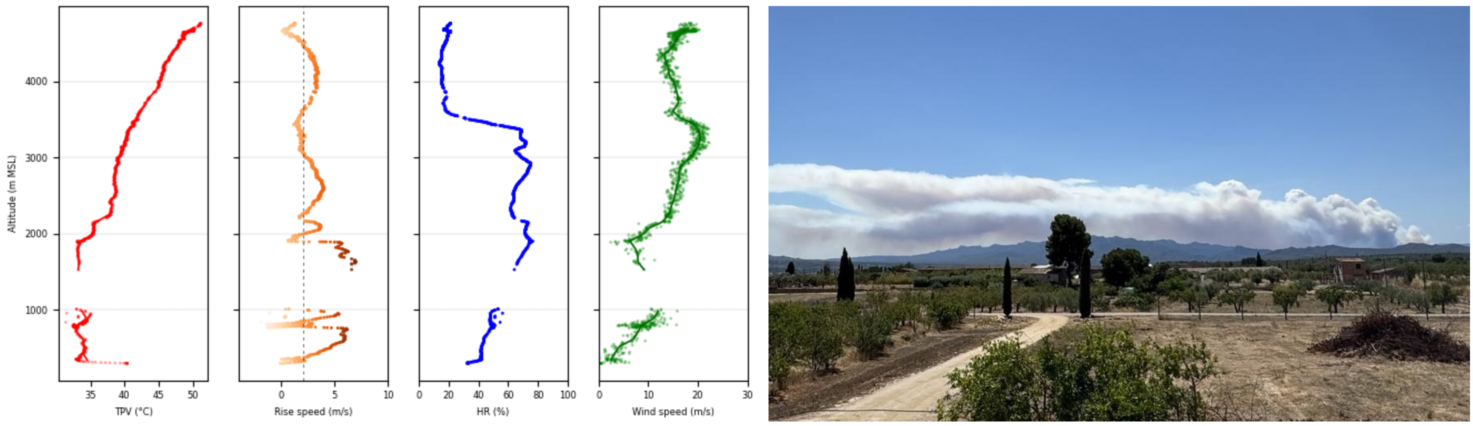

*Figure 6. **Left**. Radiosonde data profile. **Right**: plume of the fire at the moment of the sonde launching. From Paüls fire (Catalonia, 07/07/2025)*

Unlike in the case of Guissona, the sondes launched provided certainty that the fire would not generate significant vertical growth. That allowed fire analysts and the incident commander to adapt their strategy and tactics to what was considered normal behaviour, without having to consider the possibility of unexpected or erratic behaviour due to moist pyroconvection [1][3].

The photographic and video material captured during the fire, both by personnel involved in the fire suppression operations and by external sources, provides a valuable source of information that can be linked with the data collected in the field, as previously described. This facilitates straightforward visualisation and comparison of different types of fires. To achieve this, it is essential to accurately identify the time each photograph or video was taken and its position relative to the wildfire.

The Wildfire Data Portal will facilitate the automatic and efficient execution of this type of analysis, as well as enabling the comparison with previous cases. This will improve the understanding of extreme fire behaviour and enhance the capacity to respond effectively to these wildfires.

4. Conclusions

This deliverable complements the initial set of case studies from the **D3.2 Case Studies** to be introduced in the Wildfire Data Portal, which will serve to establish the fundamental structure of the data hub.

It should be noted that the dataset presented in this deliverable does not contain the same data for all fires The specific data included depends on the country in which the fire or prescribed burn occurred, the type of wildfire, its characteristics, and other factors. This is illustrated in Table 2, which contains the control of case studies entered. This offers a significant amount of information to the portal, but it is essential that the data collection process is standardised (see D3.1 Protocols for Data Collection on EWE [2]) and that it is properly organised.

Also, it is important to consider that the database structure described in this document pertains specifically to the downloadable dataset of D3.2 Case studies and D3.4 Case Studies (update). The data will be organised in a more user-friendly way in the Wildfire Data Portal, thus facilitating searching, reading and analysis. Section 3 of this document demonstrates the potential and capabilities of this archive to analyse the data gathered from an emergency management perspective. Additionally, the Wildfire Data Portal will serve as a good data repository for wildfire science.

The Wildfire Data Portal will incorporate the datasets presented in D3. 2 Case Studies and those added in this D3.4 Case Studies (update), which contain the data collected within the framework of the EWED project, but will be a continuously evolving portal, with data from future fires in different countries (Spain, Greece, Netherlands, Norway, Chile, etc.), as well as from the CFRS fire archive, which has used the methodology described in D3.1 Protocols for Data Collection on EWE since 2021.

5. References

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