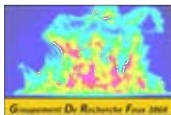


Programme ANR FireCaster, développements

Jean Baptiste Filippi, Yolanda Perez

GDR Feux - DGA TA, Toulouse

11 Octobre, 2017





11 Aug 2017. 1800 Ha, Cap Corse



11 Aug 2017. 1800 Ha, Cap Corse

FireCaster

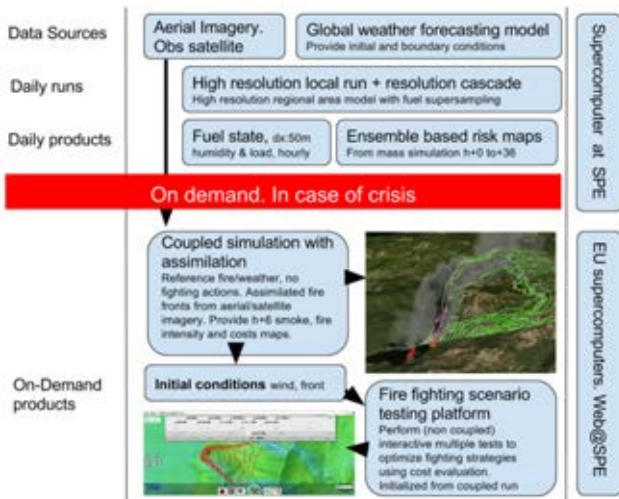
- FIRE, foreCASTing and Emergency Response platform
- CNRS LISA, SPE (Corse), LA, INRIA, SUC/Cerfacs, CNRM



- **Start 01/01/2017**, 42 month
- **Funding from ANR**, coordination University of Corsica
- Targeted at testing new Decision Supports tools in operational context
- Scientific problems : up scaling temporal and spatial resolution of **Fuels**, **Risk** forecasts and **FIRE/Atmosphere** interaction.

Firecaster actions

High resolution simulation chain - MesoNH at the core

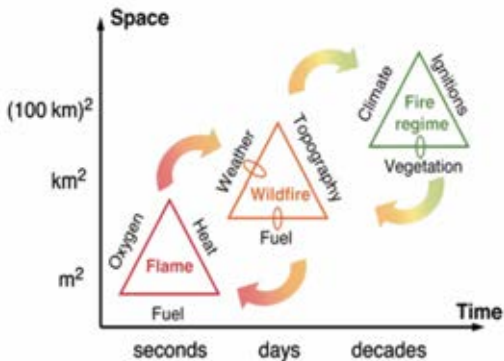


Wildfire

Problem of Fuels

Fuels

- Spatial and temporal variability of **Fuel** properties directly influences the **development** and **propagation** of wildfires
- **Fuel** ⇒ Flammable live and dead biomass



Fuels

- Understanding **Vegetation as Fuel** is fundamental to a wide range of fire management activities :
 - Assessment of **Fire Risk**
 - Predicting the **Fire Behaviour** and **Growth**
 - Managing **Smoke Emissions**

Goal

- To characterize Fuel state dynamics (spatial and temporal evolution)
- To develop a Fuel Description System to match the largest number of Fire Behaviour Models

LANDFIRE - Landscape Fire and Resource Management Planning Tools

- **Maps** and **Data** describing vegetation, wildland fuel, fire regimes and ecological departure from historical conditions (USA)
- The LANDFIRE **fuel data products** have been incorporated into the Wildland Fire Decision Support System - **WFDSS**
- **WFDSS** ⇒ spatially explicit, web-based **decision support application** that facilitates tactical decisions during wildland fire events



(Source : <https://www.landfire.gov>)

Fuel Products - 30 m resolution

- Fire Behavior Fuel Models (13 Anderson ; 40 Scott and Burgan)
- Fuel Characteristic Classification System Fuelbed
- Forest Canopy Cover, Height, Bulk density, Base Height

LANDFIRE - Landscape Fire and Resource Management Planning Tools

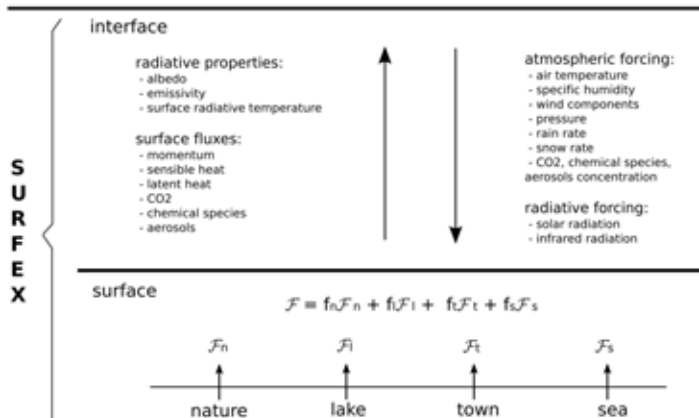


SURFEX - ISBA

SURFEX Surface Externalisée

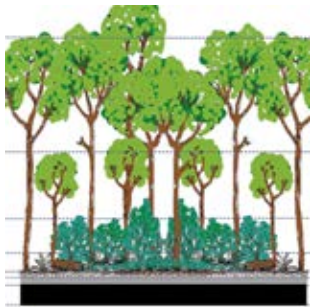
- Physical models for land surface, urban and sea
- No water in plant, only stress and ground reservoir

ATMOSPHERE



Fuel Description System

- Fuel stand composed by **Fuel Layers**
- **Fuel Layer** : Pseudo-homogeneous structural layer of fuel particle arrangements (Ground fuels, litter, woody, herbaceous...)



(Source : Gould et al., 2011)

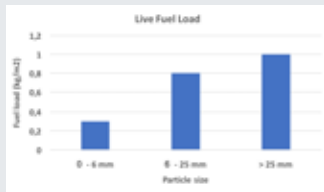
Fuel layer variables

- Live Water Load [$\text{kg water}\cdot\text{m}^{-2}$]
- Dead Water Load [$\text{kg water}\cdot\text{m}^{-2}$]
- Live Fuel Load [$\text{kg dry fuel}\cdot\text{m}^{-2}$]
- Dead Fuel Load [$\text{kg dry fuel}\cdot\text{m}^{-2}$]
- Base height [m]
- Top height [m]
- Cover [% area covered by fuel/total area]
- Age [years]
- Table index [-]

Example - Mediterranean Maquis

Layer 1 Shrub

- Live Water Load
- Dead Water Load
- Live Fuel Load
- Dead Fuel Load
- ...



Layer 2 Litter

- ...

Layer 3 Herbaceous

- ...

Targeted resolutions

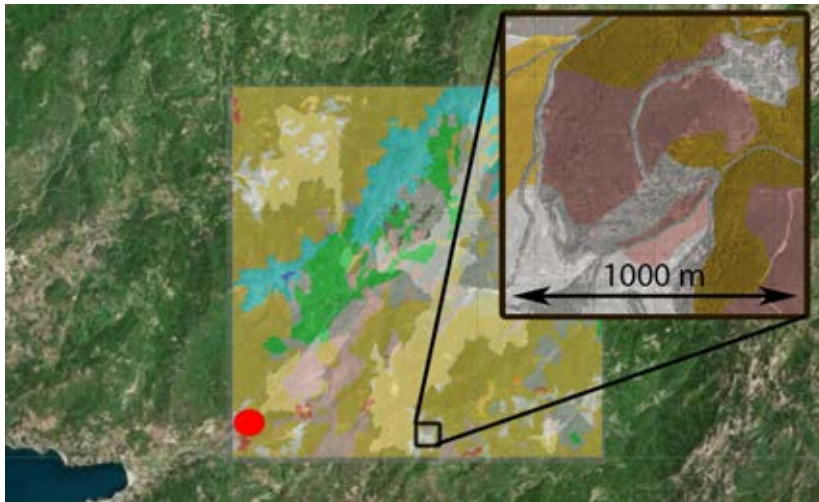
Model	Spatial	Temporal
Boundary : Arome	1.3km	daily
Atmospheric/smoke	800m	hourly
Fuel	5m	hourly
Fire	5m	on-demand 10 mins

TABLE – Targeted resolution, fuel model

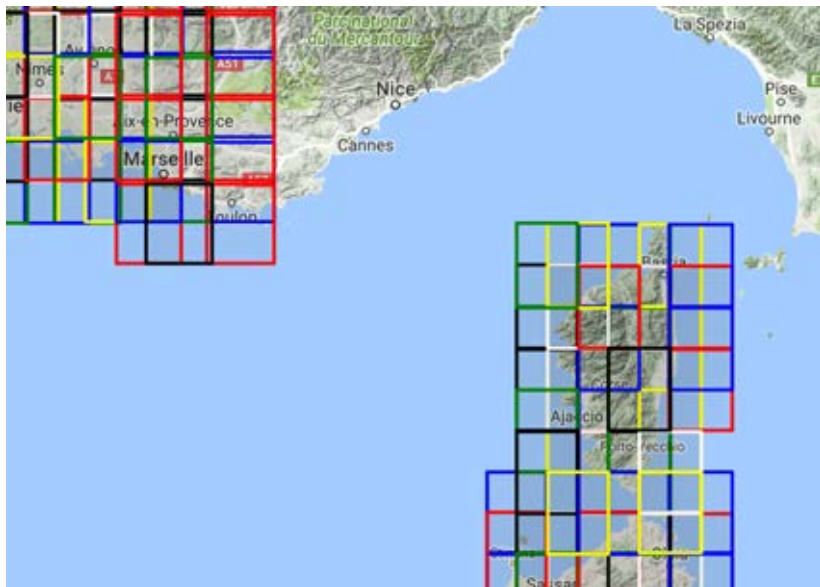
- Downscaled from Surface model ISBA
- Matching local parameters from land portions (hourly moisture content), WIP for fuel moisture.
- Fuel distribution from high-res land use map

Computation cost : daily 1 Tbyte, 2 hours, 240 CPUs for 200km by 200km 48h forecast, Output file every 120s for offline.

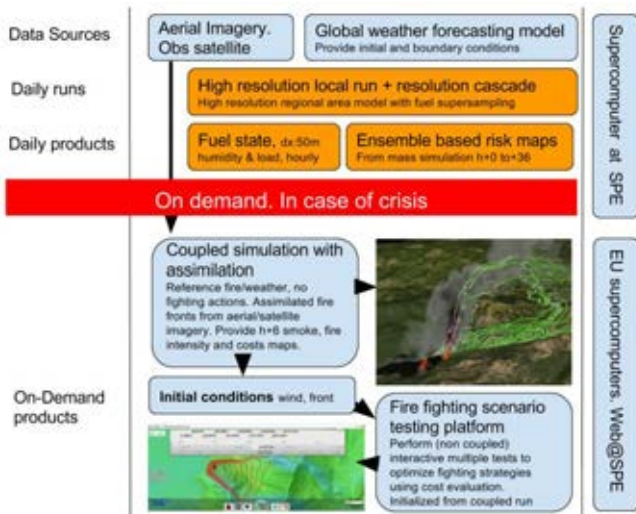
Fuel downscaling / supersampling



Fuel downscaling / tiling



Operational chain



Wildfire risk

Existing : Fire Weather Index

- Created for station data.
- Developed by Canada, 1980's.



Carte du risque incendie pour les activités de pleine nature

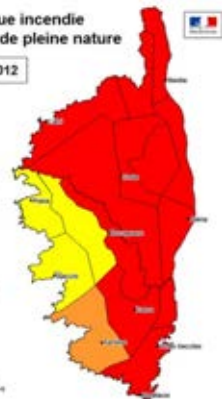
31/08/2012

ATTENTION

FERMETURE
par arrêté préfectoral
des massifs :

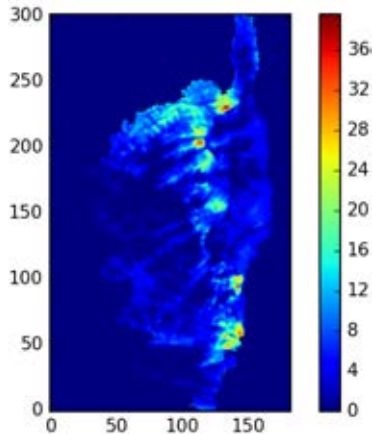
- AGRATES
- BONFATO
- FANGO
- MANGANELLU
- VERGHELLU

du 30 août - 20h
au 1er septembre - 6h

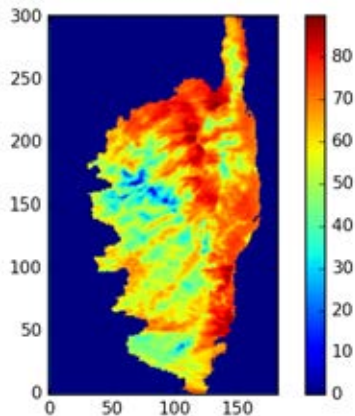


MesoNH resolution

Fire Weather Index



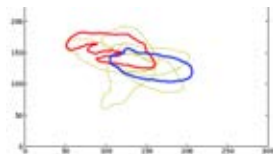
Fine Fuel Moisture Code



Fire size based risk

A different definition of risk

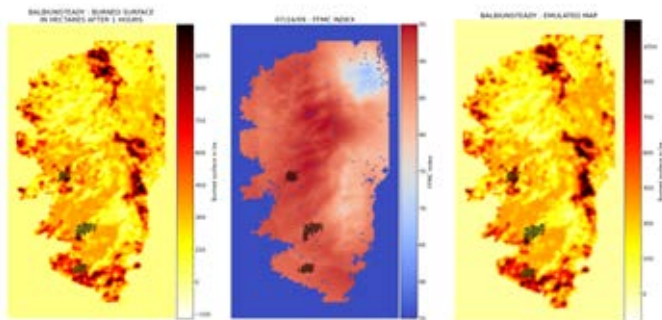
- Based on Fire Size.
- Ensembles around ignition point.
- Ignition on every point on 100m grid.
- Costing of fire - economic value.



Highly distributed computation

- Daily map based on thousands of simulations.
- Every simulations performed with different initial conditions.
- Still strong computational constraints : meta-model emulation.

Fire size based risk, emulation



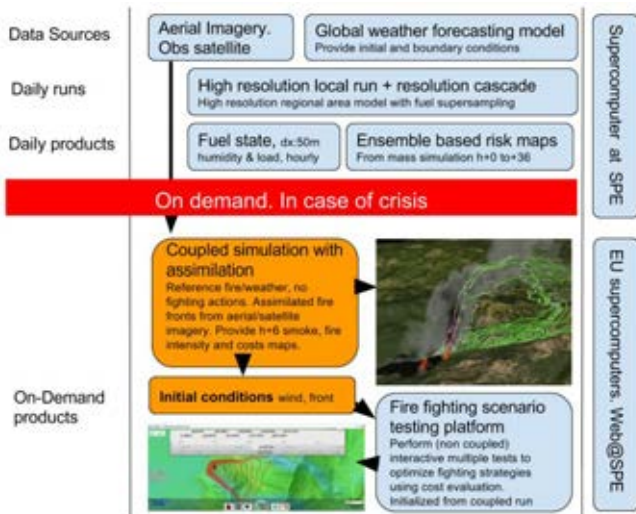
Multi (Rothermel/Balbi) ROS model, Forefire solver : Emulated map, FFMCO, simulated map. Observed fires in gray.

Crisis

Crisis

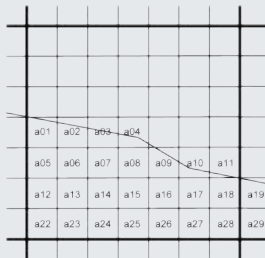
Crisis

Simulation Map



Fire Simulation

- MesoNH/ForeFire code.
- Ignition point from fire service information feed,
- Map of Arrival time to compute fluxes.

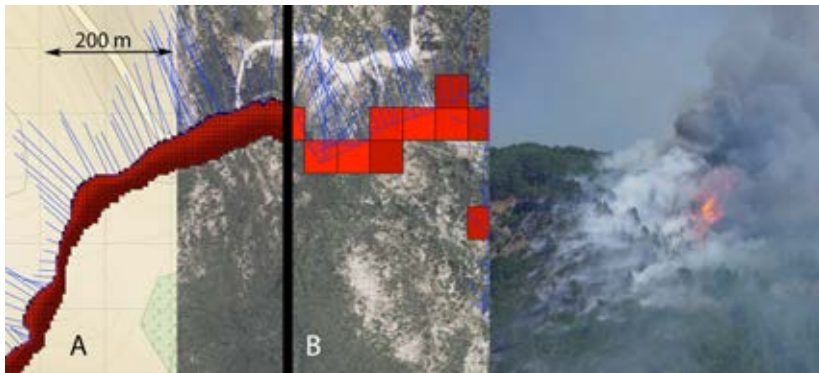


Fluxes layers

- Different layer for each variable, compound.
- Diagnosed as a function of actual and arrival time.
- Coupled in a reference simulation with emission.



Coupling models at different scales



Fire resolution (5m, A), Atmospheric LAM resolution (50m, B)

Intro

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Firecaster

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Fuel

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Fuel

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Risk

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Crisis

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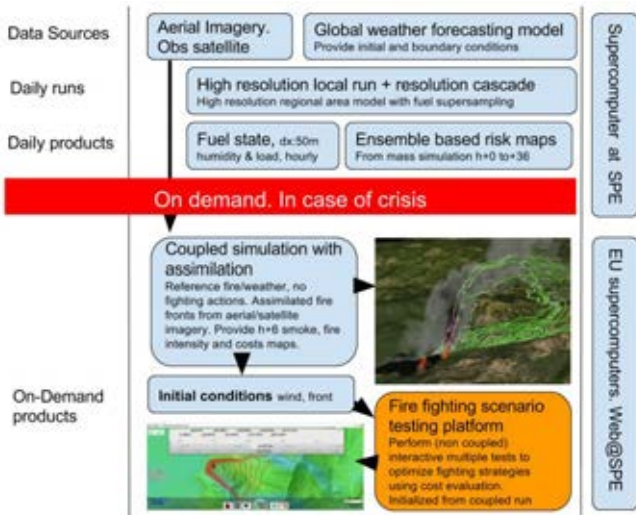
Summer

○○○○○○○○○○○○○○

Simulation

Incendies de 2009

Crisis



Crisis management

Mass simulation on-demand platform.
Operational and scripted with API web REST

The screenshot displays a web-based simulation interface. On the left, there is a 'Simulation' tab with a form for entering simulation parameters. The form includes fields for 'N° Promethes', 'Intervention' (with a 'Citer' button), 'Cause', 'Dst Habit (m)', 'Dst Voie (m)', 'Code Postal' (29134), 'Commune' (Palmece), 'Département' (Corse-du-Sud), 'Lieu-dit/Route' (069), 'Code Insee' (2A200), 'Carreau DFCI' (N00003AB), and 'Surface brûlée' (18.76). Below the form are fields for 'Validateur' (Tigali) and 'Password', and a 'Valider' button. A message states 'Si vous avez sauvegardé vous pouvez' followed by download and import options: 'Télécharger : KMZ NC' and 'Importer : Shapefile'. The main area is a map showing a fire simulation with concentric red and blue rings emanating from a central point. The map includes a Google logo, a 'Plan' button, and a timestamp '04/08/2017 à 13:06'. The bottom right corner shows navigation icons.

Fire Weather **Fire Weather and incidents 2017**

Fire intense summer

Severe fire weather

- No rain since early june,
- 5 major fires,
- 6000 Ha burnt,

MesoNH Use

- Daily simulation humidity,
- Zoom in case of crisis,
- One way coupled with surface weather for simulation runs,



Intro
○○

Firecaster
○○○○

Fuel
○○

Fuel
○○○○○○○

Risk
○○○○○

Crisis
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Summer
●○○○○○○○○○○○○

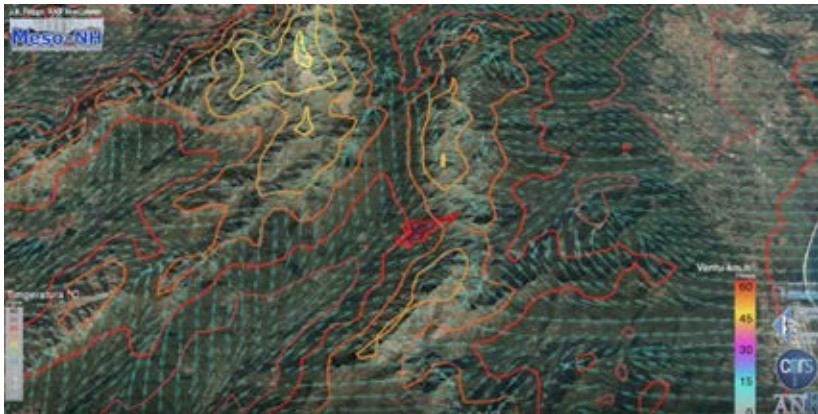
Biguglia

Biguglia

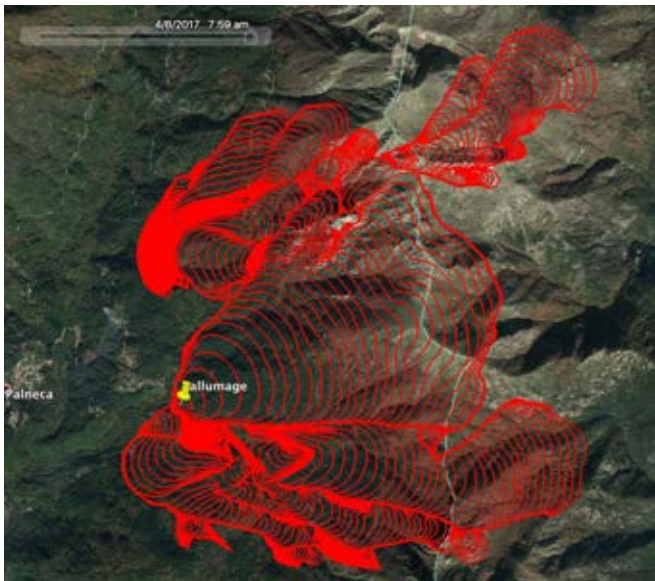
Palneca

Palneca

Palneca



Palneca



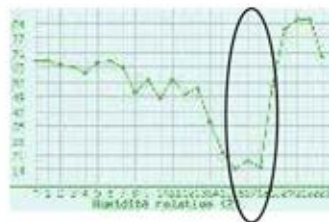
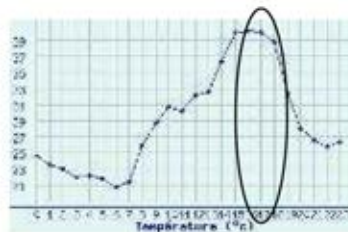
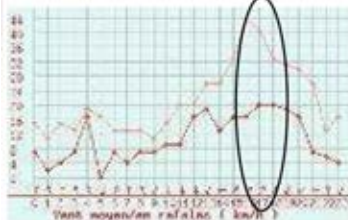
Calenzana

Calenzana

Calenzana

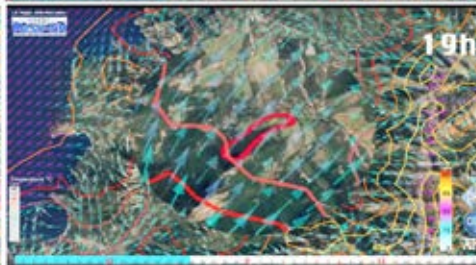
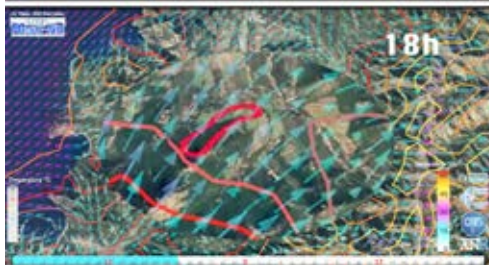
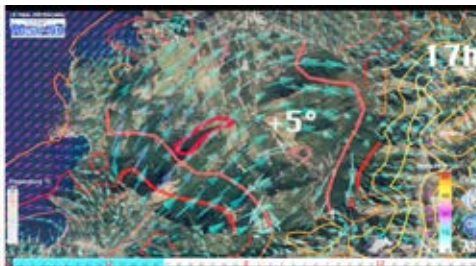
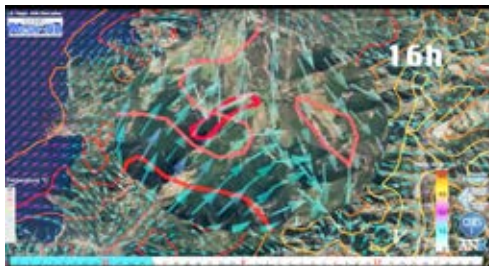


Calenzana



Calenzana

Calenzana



Online

Web

<http://firecaster.univ-corse.fr/>

Simulation (beta)

<http://forefire.univ-corse.fr/sim/dev/>

Merci

FCaster

urisé https://firecaster.universita.corsica/article.php?id_art=1867&id_rub=5285&lang=fr



Projet ANR FireCaster | UMR SPE 61



ACTUALITÉS

PROJET FIRECASTER

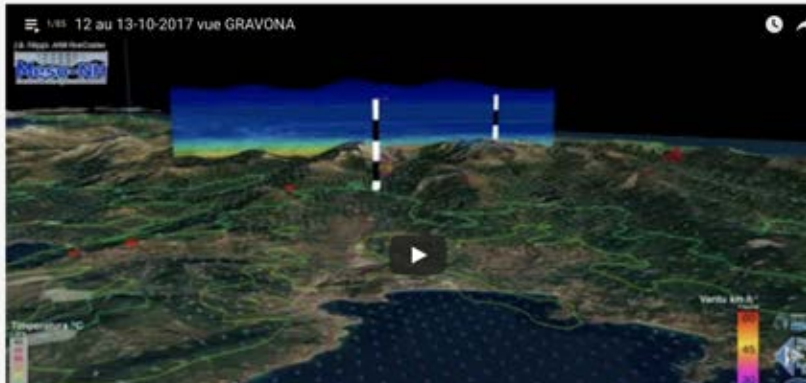
MÉTÉO HD

PUBLICATIONS

L'ÉQUIPE

CONTACT

Gravona



FCaster

