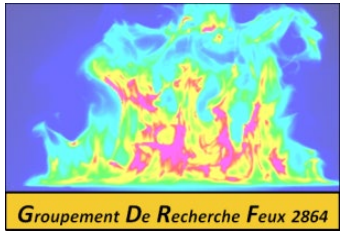


Forest Fire Modelling research done at the CNRS laboratories

P.A. Santoni

Università di Corsica Pasquale Paoli
Laboratoire Sciences pour l'Environnement UMR 6134 SPE
cnrs

The laboratories of the CNRS Fire Research Group

SPE (UMR 6134) University of Corsica

M2P2 (UMR 7340) Aix-Marseille University
Existing collaboration with Victoria University

IUSTI (UMR 7343) Aix-Marseille University

P-PRIME (UPR 3346) ENSMA - Univ of Poitiers

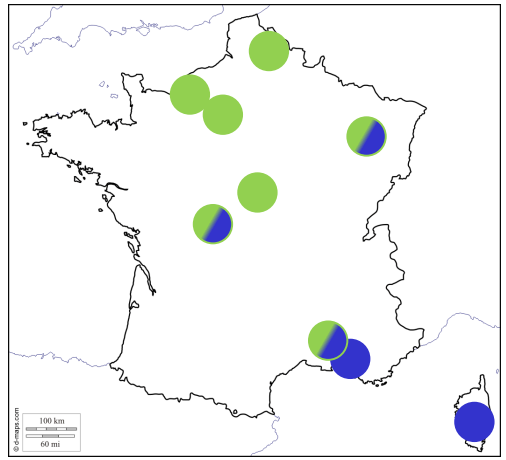
LEMTA (UMR 7563) Université de Lorraine

PRISME (EA 4229) INSA CVL - Univ of Orléans

CORIA (UMR 6614) Univ-INSA of Rouen

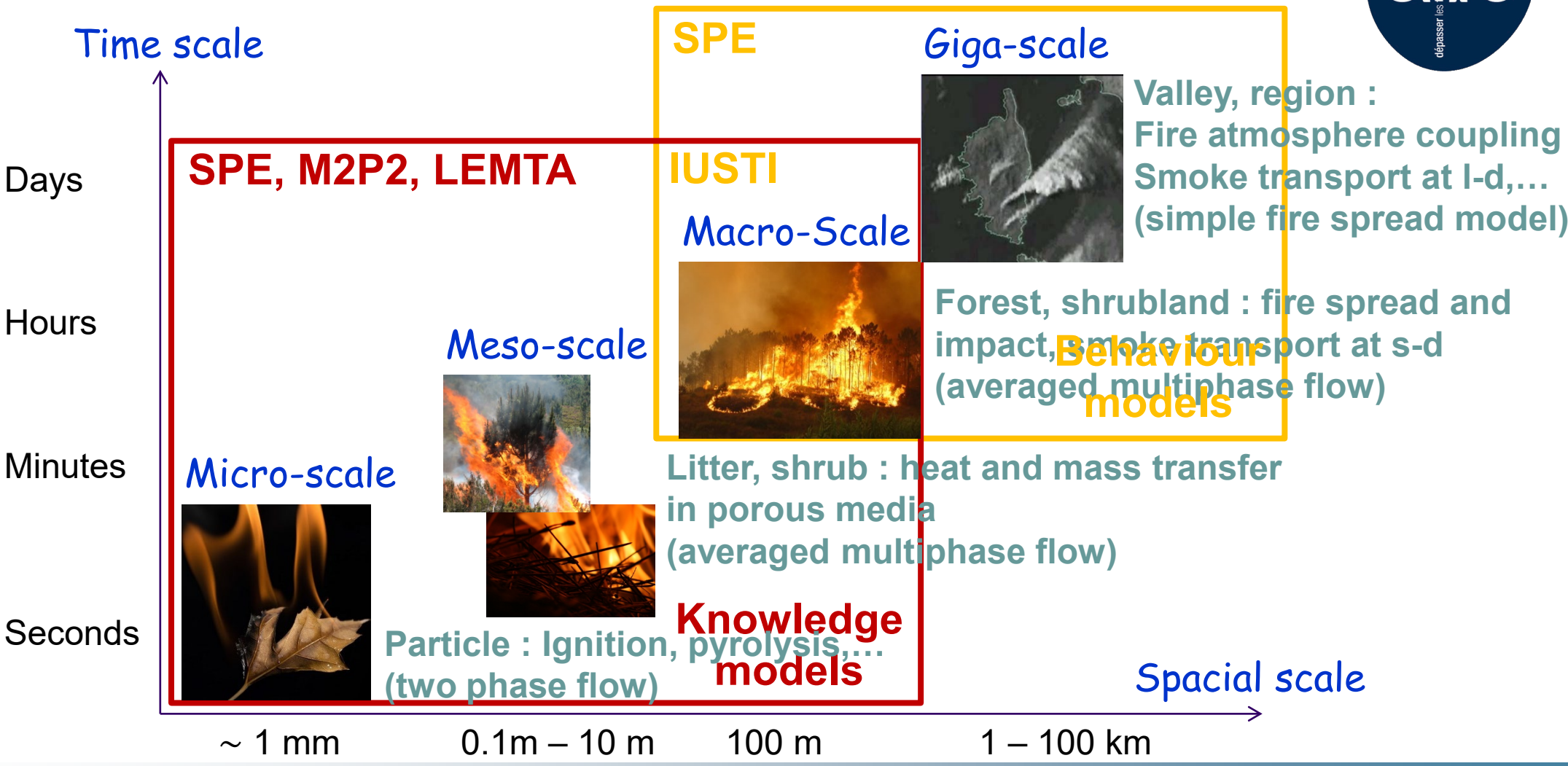
LOMC (UMR 6294) Univ of Le Havre

UMET (UMR 8207) Univ of Lille



- Forest Fires
- Building Fires

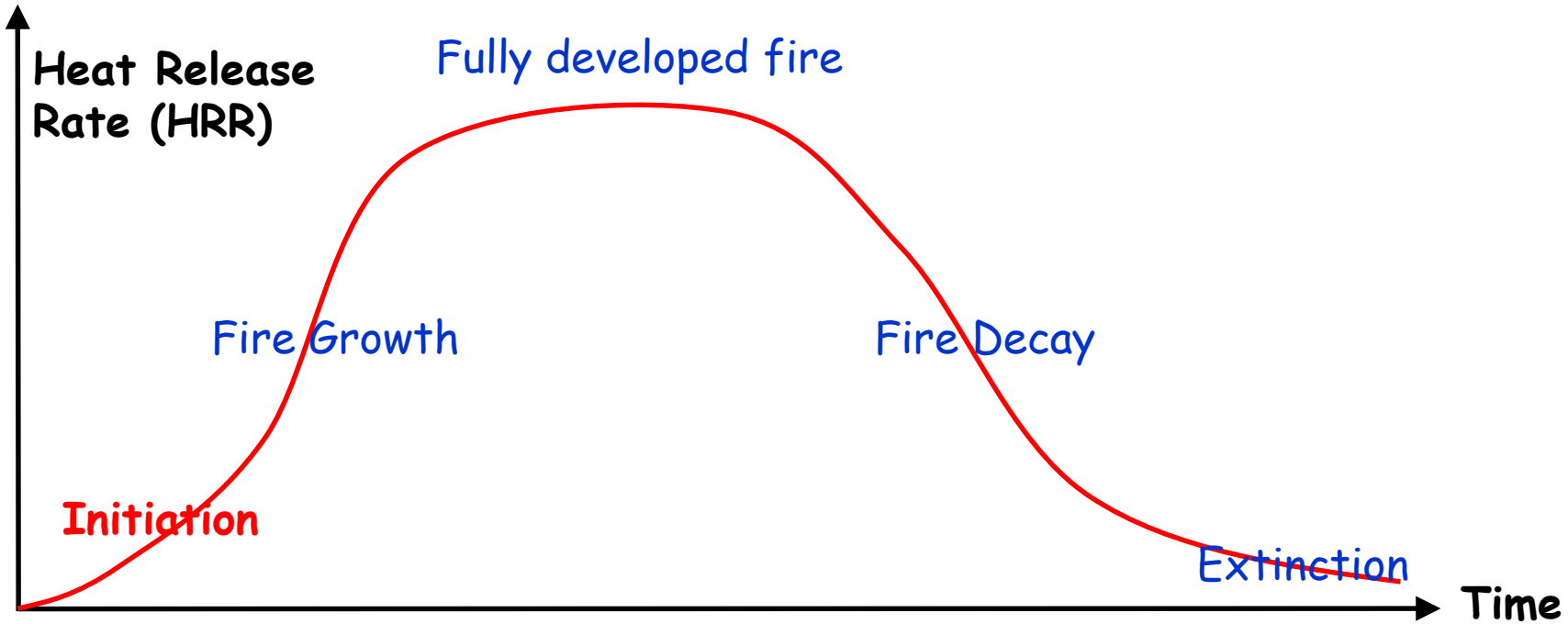
Forest Fires: a multiscale problem



Micro-scale

Initiation is studied at micro-scale

Modelling and experiments to understand the ignition of a vegetative fuel and pyrolysis (released gases)



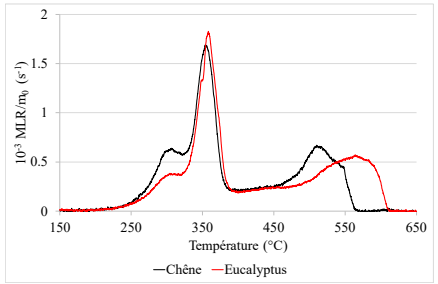
Development of a fire that extinguishes on its own

Micro-scale

Initiation is studied at micro-scale

Modelling and experiments to understand the ignition of a vegetative fuel and pyrolysis (released gases)

TGA (5 mg)



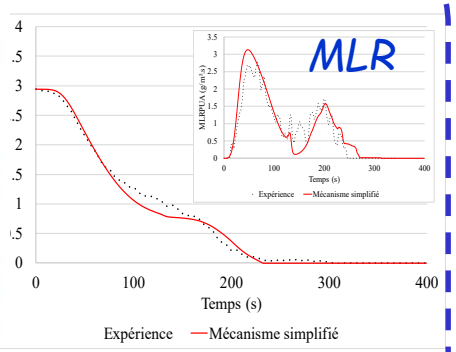
Mecanism → Model for powder

$DW \rightarrow DW_1 + gas_1$

$DW1_1 \rightarrow char + gas_2$

...

Cone calorimeter (15 g)



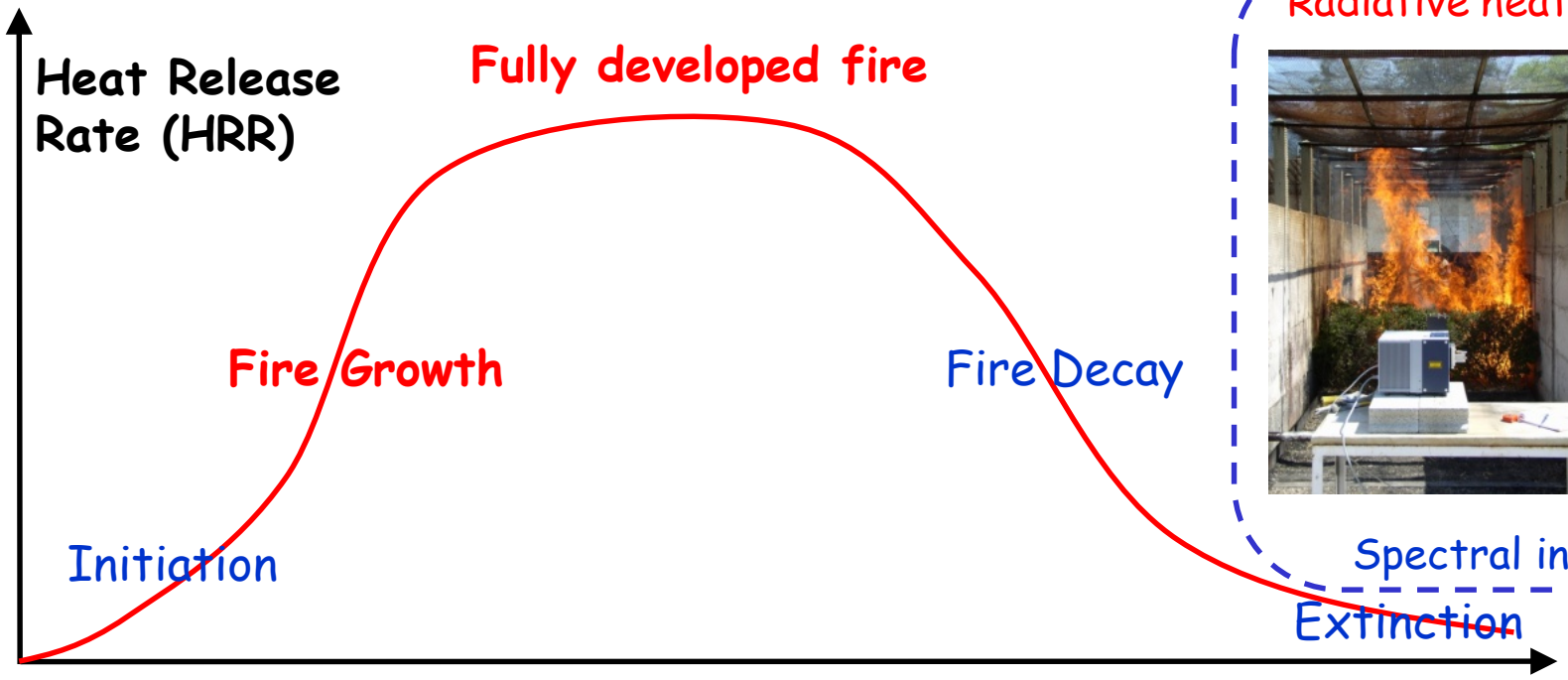
Model tested for particles (leaves, needles,...)

Pyrolysis : source term of gaseous fuel

Meso-scale

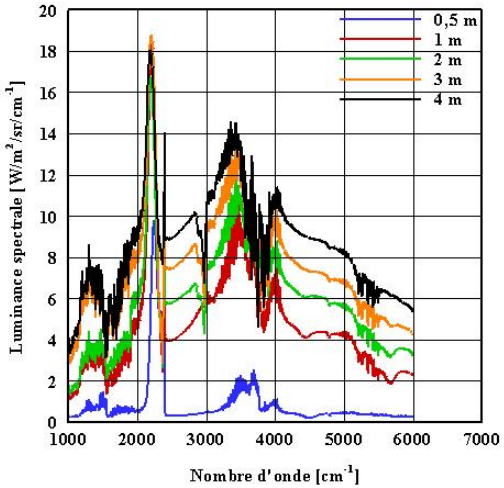
Fire Growth is studied at meso-scale

Modelling and experiments to understand the heat transfer (convection/radiation) between flame and vegetation and predict the HRR



Development of a fire that extinguishes on its own

Radiative heat transfer in vegetation fire

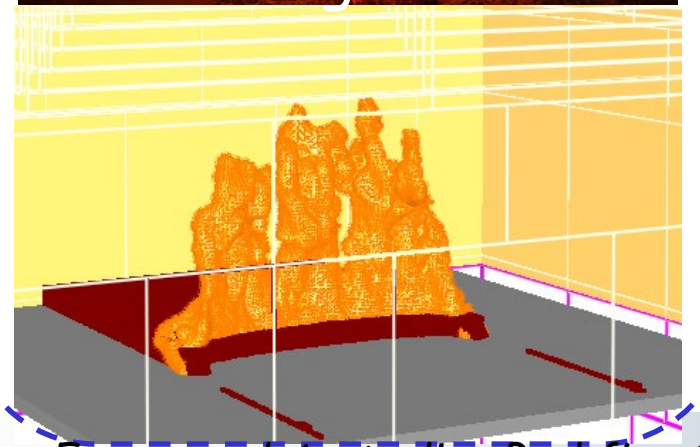


Spectral intensity emitted by flames

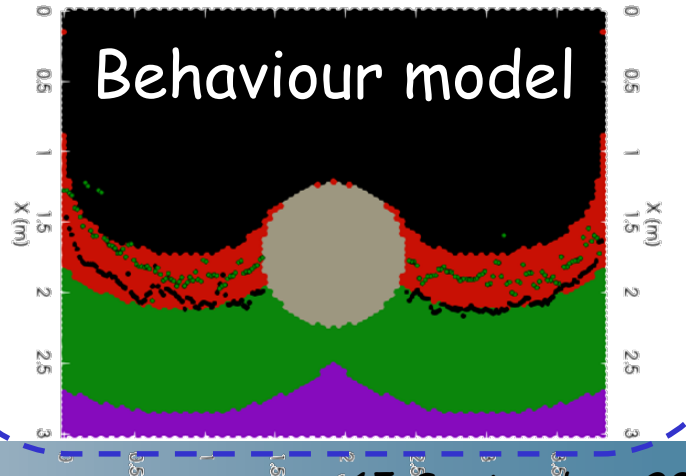
Meso-scale

Fire Growth is studied at meso-scale

Modelling and experiments to understand the heat transfer (convection/radiation) between flame and vegetation and predict the HRR



Modelling of a fire spreading across a liiter

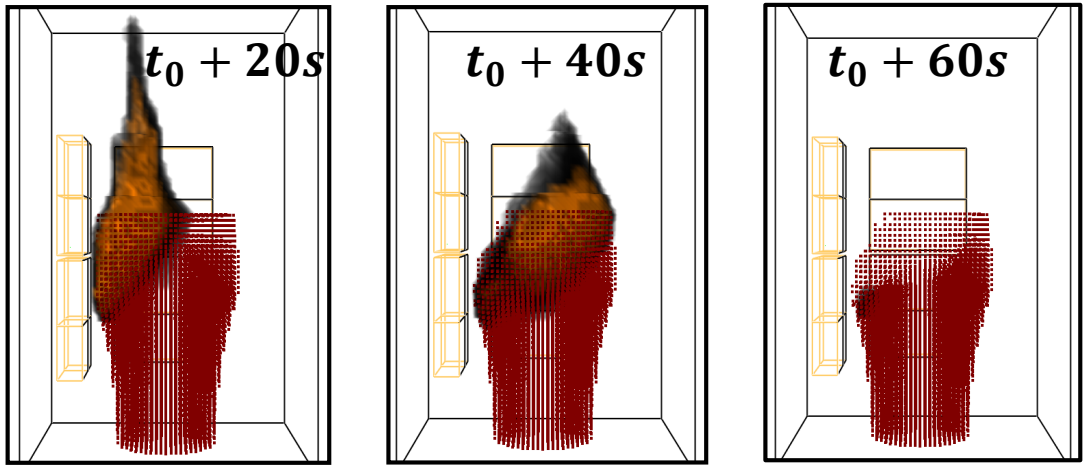


Meso-scale

Fire Growth is studied at meso-scale

Modelling and experiments to understand the heat transfer (convection/radiation) between flame and vegetation and predict the HRR

$200\ kW.m^{-3}$

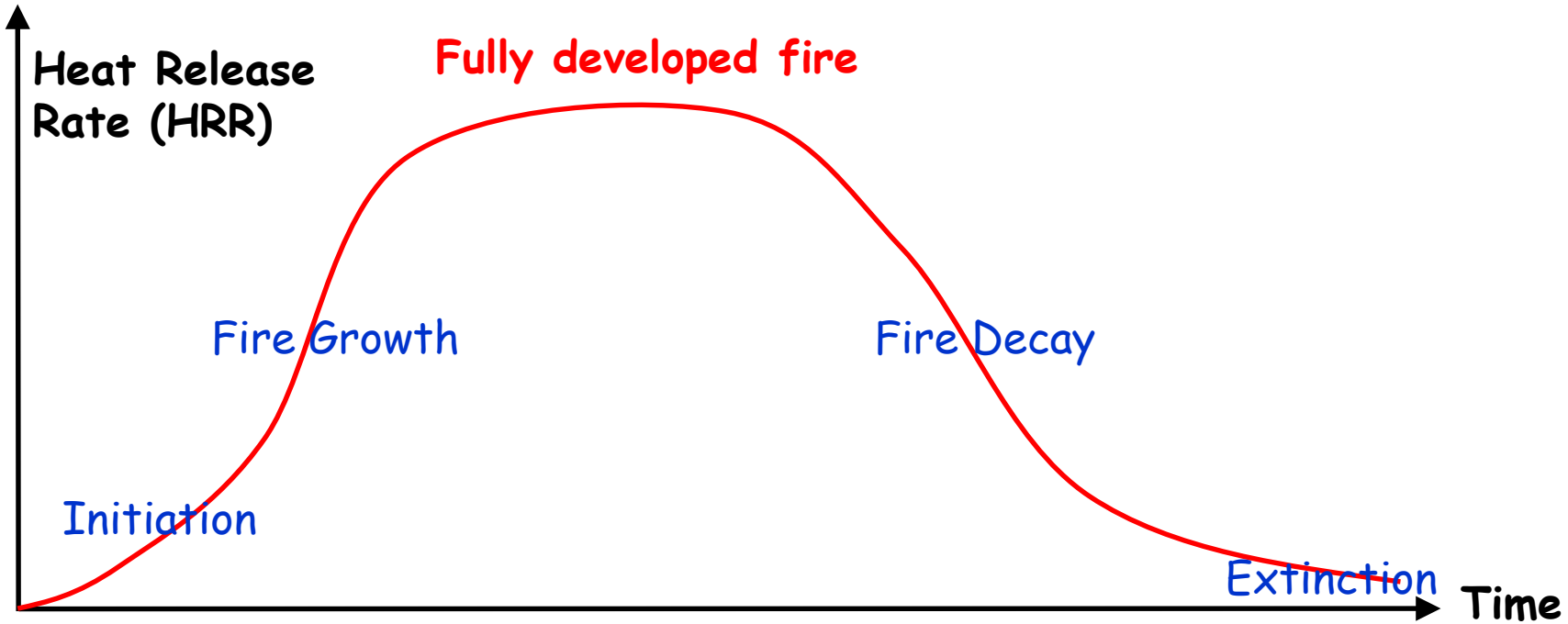


Experiment and simulation of a burning shrub with a knowledge model

Macro-scale

Fully developed fire are studied at macro-scale

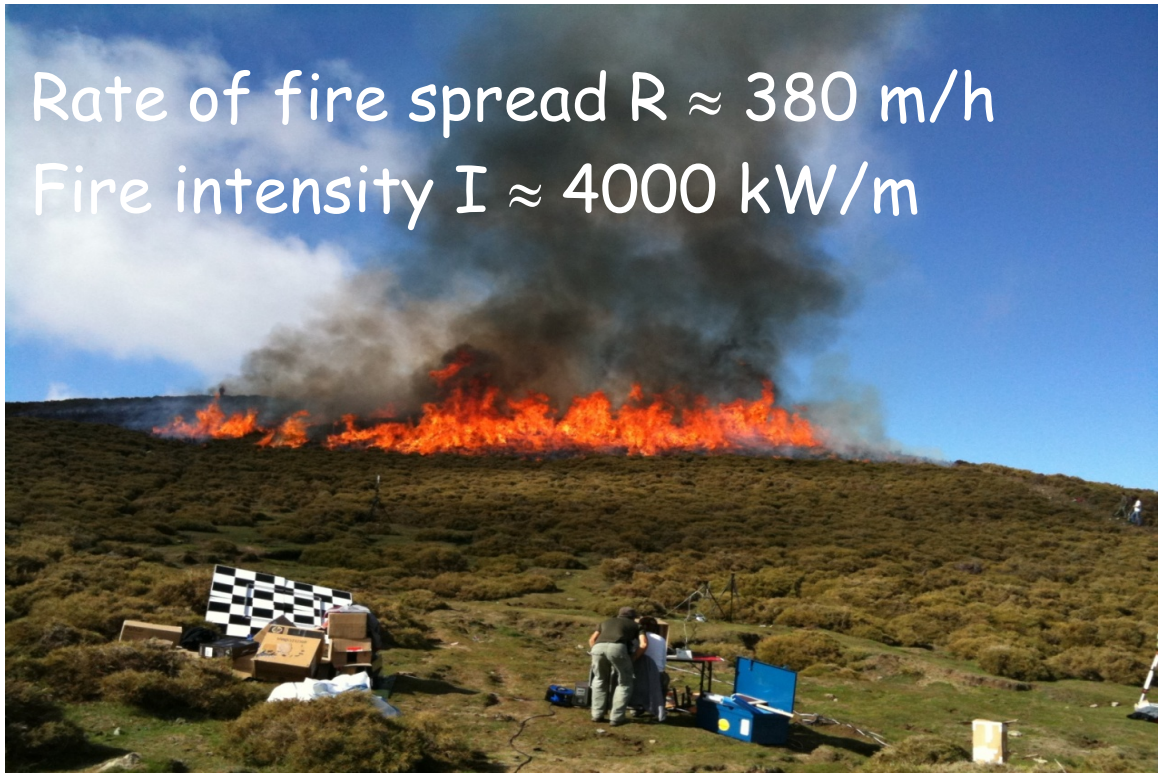
Experiments and simulation at field scale are needed to understand the fire spread and impact



Development of a fire that extinguishes on its own

Macro-scale

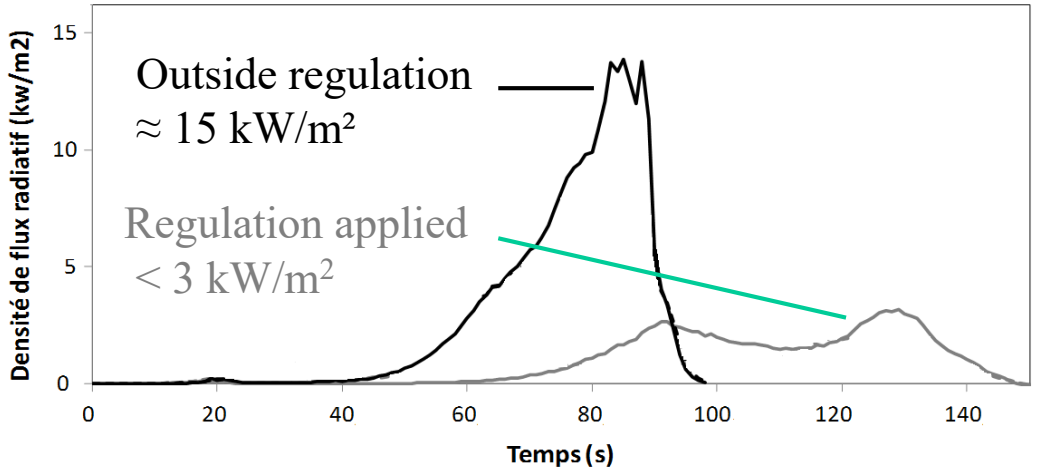
Example of an experiment carried out at macro-scale

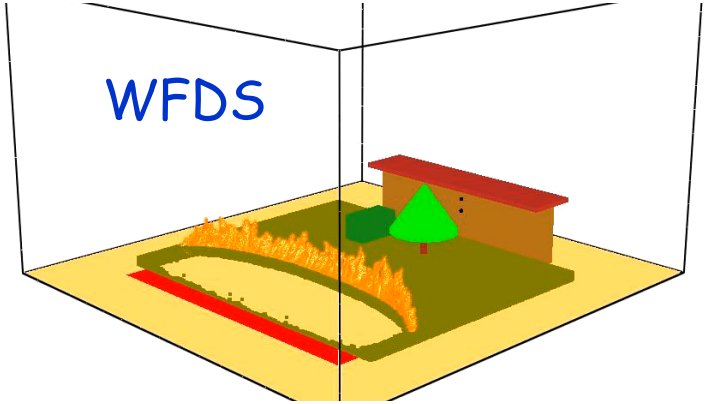


Measurement of fire intensity and impact

Macro-scale

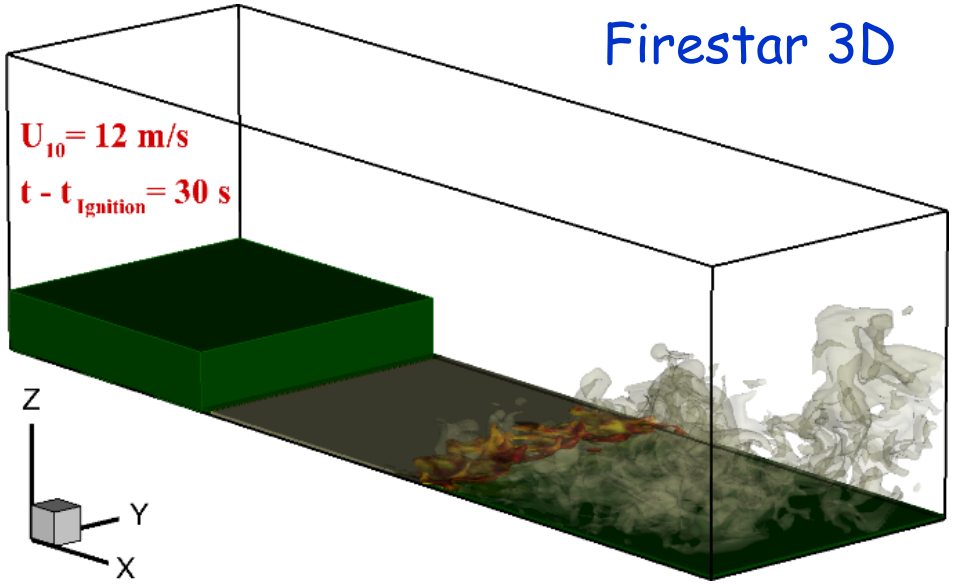
Simulations performed at macro-scale (knowledge model)





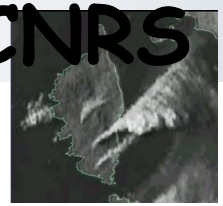
Modelling of a grass fire facing a wall

Firestar 3D



Simulation of a grass fire downstream of a forest (M2P2/Victoria Univ)

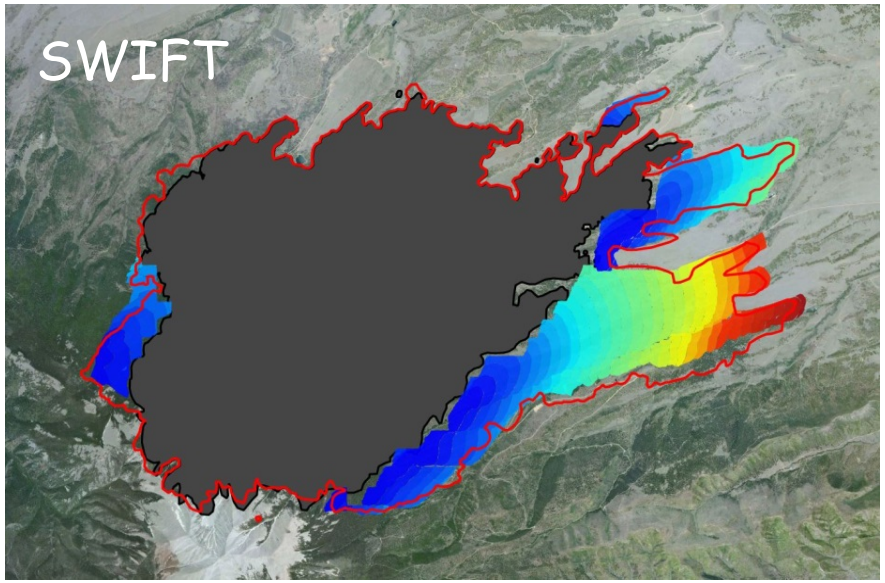
92



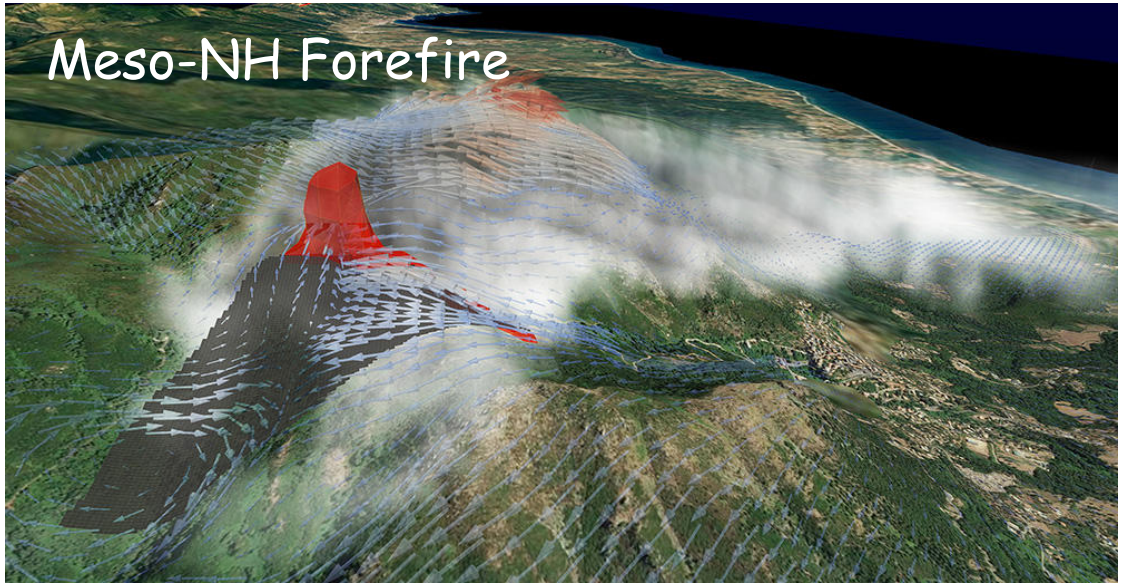
Mega-scale

Forefire (SPE) and SWIFT (IUSTI) : 2 fire spread simulators

From Macro-scale to Mega-scale (regional scale)



Large fire spread simulation
East Peak Fire (Colorado, 2013)
≈ 55 km² and 20 days



Coupled fire-atmosphere simulation
Cervione Fire (Corsica, 2018)
≈ 2000 ha and 2 days

Some challenges

- To understand the transition thresholds between a « normal fire » and an « extrem fire event » (in terms on MC, Wind, RH of air, fuel)
- To understand the effects of climate change on fire dynamics (mainly due to the state of vegetation and meteorological conditions)
- To developp decision support tool for fire safety engineering (size of fuel break, defensible zone,…)
- **To tackle the WUI problem**

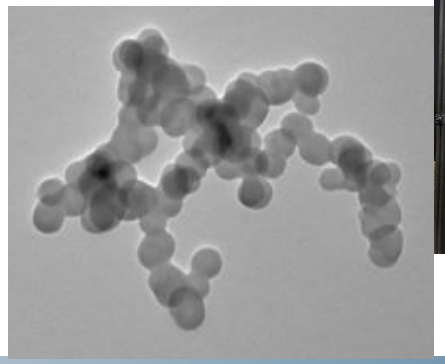
Tackling the WUI fire problem needs joint approach

To elaborate guidance for providing defensible space and more ignition-resistant structures.

- No standard in France for forest fire impact on building elements

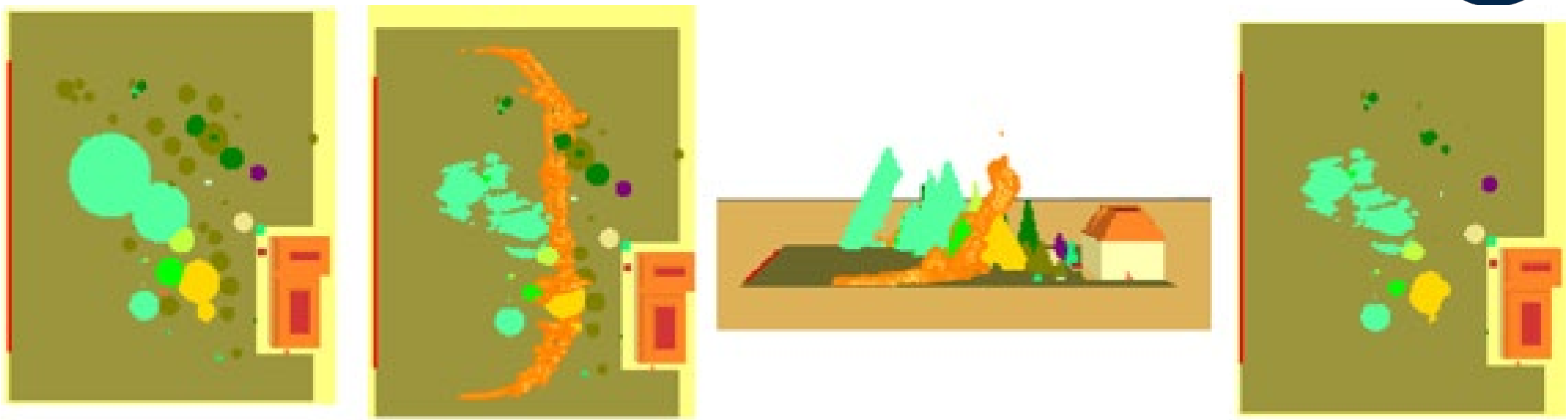
- Experiments in research lab to study :
  - Effects of firebrands on deck
  - Resistance of windows (shutters) to a fire front
  - Smoke analysis and effects

- Development of simulation tool to calibrate defensible zone

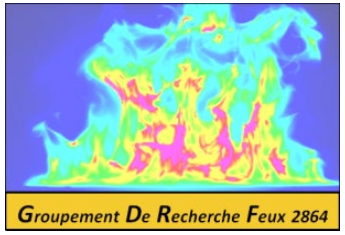


Tackling the WUI fire problem needs joint approach

Simulation tool to calibrate defensible zone



Australia has an extensive experience with BAL regulation. We could benefit from mutual work to face the challenge of WUI



Thank you for your attention