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Climate change impact on wildfires: where do the greatest uncertainties lie?

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Climate change impact on wildfires: where do the greatest uncertainties lie ?

PhD realised at the URFM, and
directed by Jean-Luc Dupuy, Nicolas
Martin and François Pimont

Hélène Fargeon
16 October 2017



+ Introduction

Why modeling the impact of climate change on wildfires ?

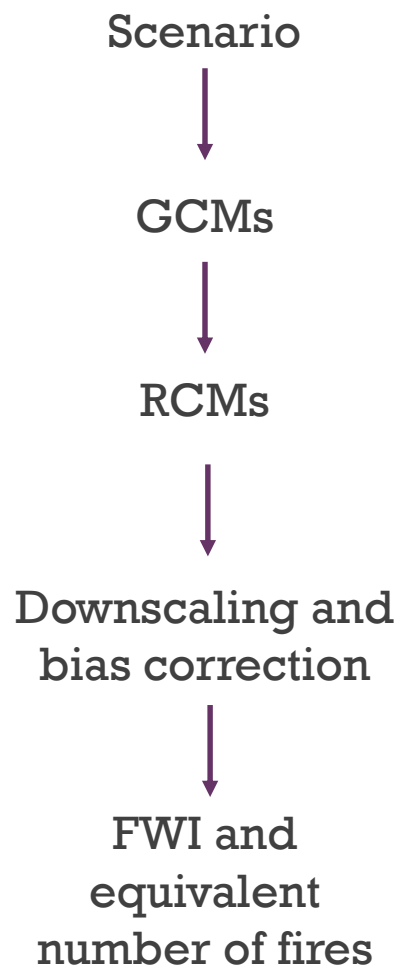
- Climate change will impact wildfires in France
- Higher temperature and longer dry spells are expected



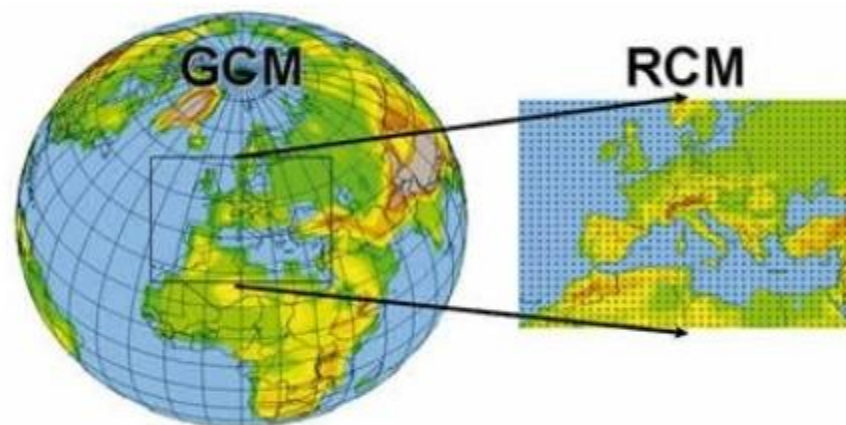
Photo : Lluís Gene

+ The modelling chain

Different layers of uncertainties



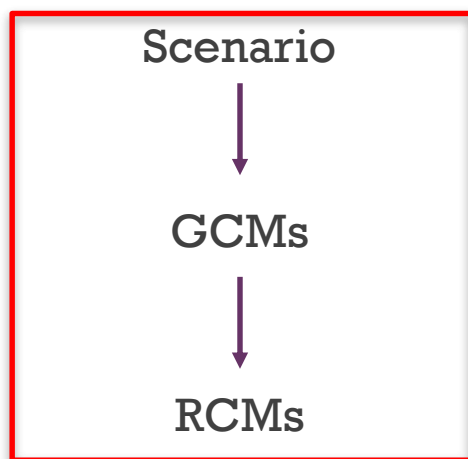
*Adapted from
Lindner et al. (2014)*



Source: climate4change.eu

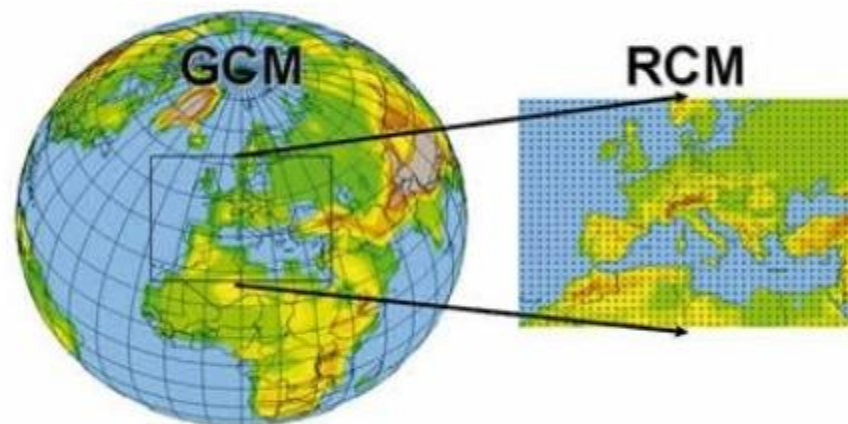
+ The modelling chain

Different layers of uncertainties



Downscaling and
bias correction

FWI and
equivalent
number of fires



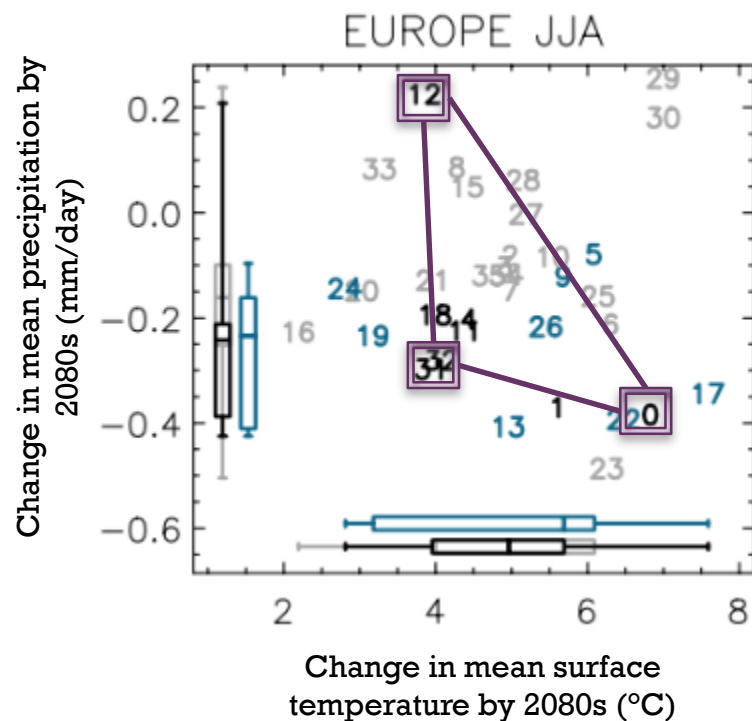
Source: climate4change.eu

Adapted from
Lindner et al. (2014)

+ Climate model choice

Aim : have a maximal spread among the predictions

GCM choice



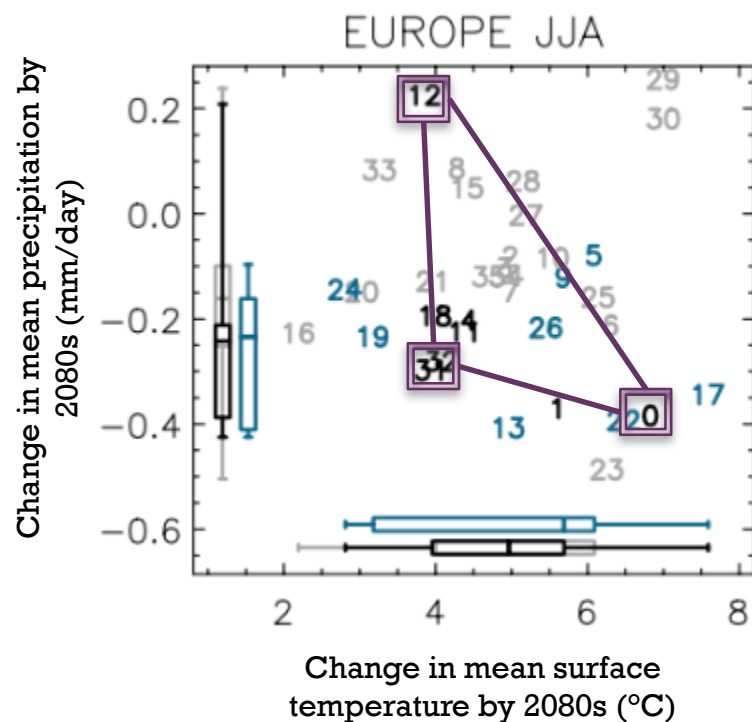
*From McSweeney
et al. (2015)*

- Hypothesis: the major spread in climate simulations comes from the GCMs (*Glotter et al. 2014*)
- Necessity to make a choice :
 - Computing capacity
 - Quality of the models
 - Availability of the data

+ Climate model choice

Aim : have a maximal spread among the predictions

GCM choice



*From McSweeney
et al. (2015)*

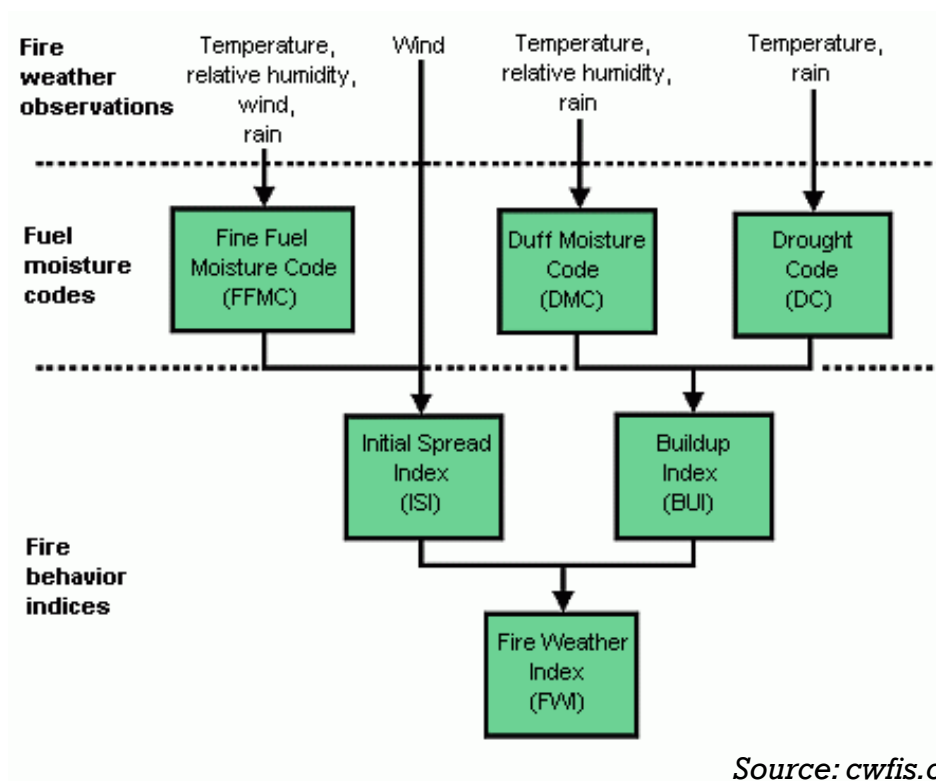
- Hypothesis: the major spread in climate simulations comes from the GCMs (*Glotter et al. 2014*)
- Necessity to make a choice :
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—	CNRM RCA4
—	Hadgem RCA4
—	MPI ESM REMO2009/r1i1p1
—	MPI ESM REMO2009/r2i1p1
—	MPI ESM RCA4

+ Impact on wildfire danger

Transforming climate data into fire hazard

The use of a fire danger index =
Forest fire Weather Index (FWI)

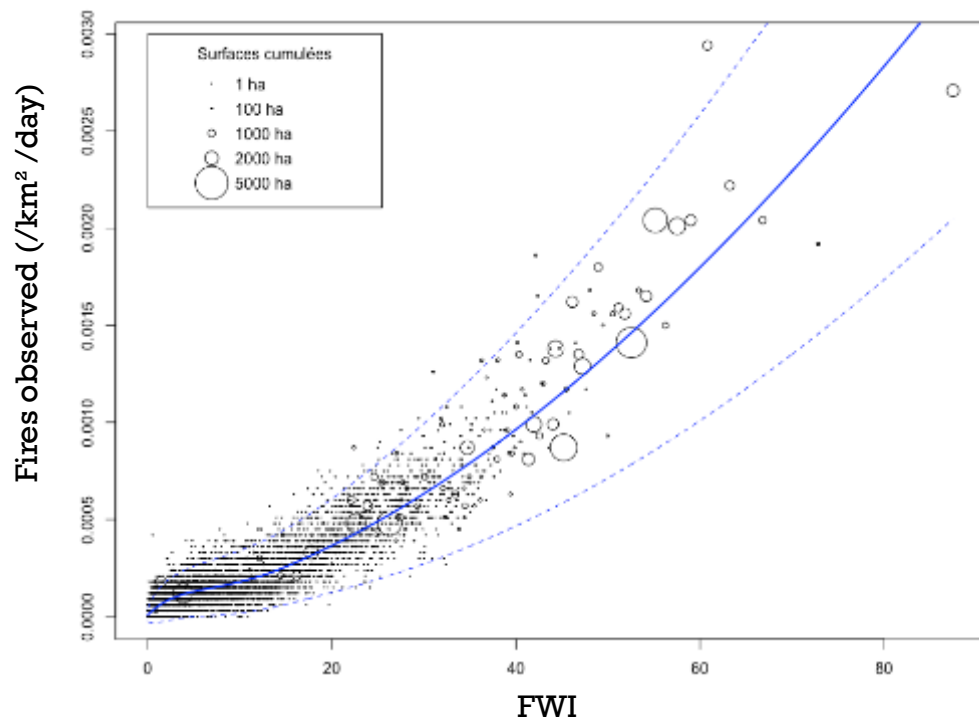


+ Impact on wildfire danger

Transforming climate data into fire hazard

Parameterization of a FWI-fire relationship using a database of past fires on the French Mediterranean area

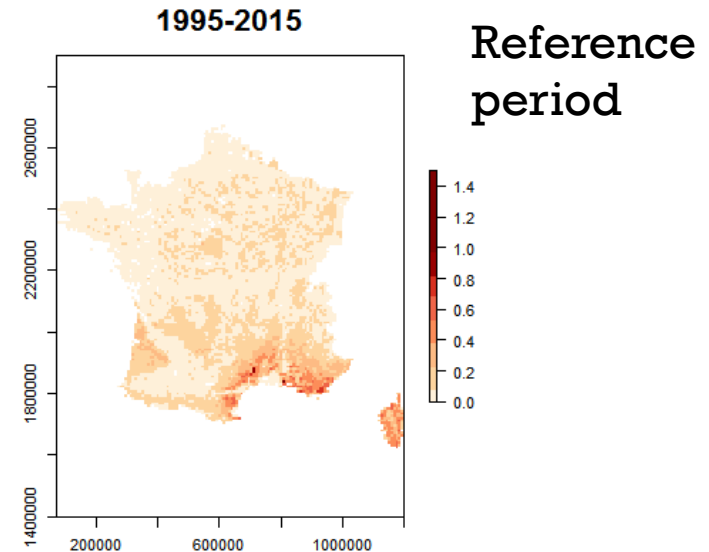
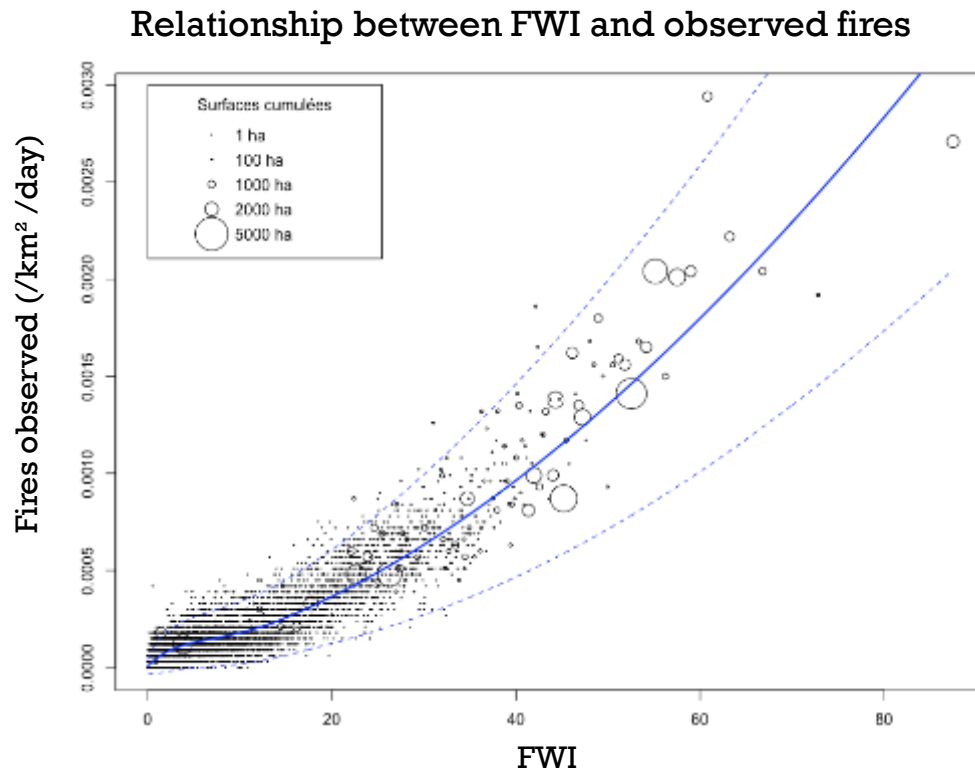
Relationship between FWI and observed fires



+ Impact on wildfire danger

Transforming climate data into fire hazard

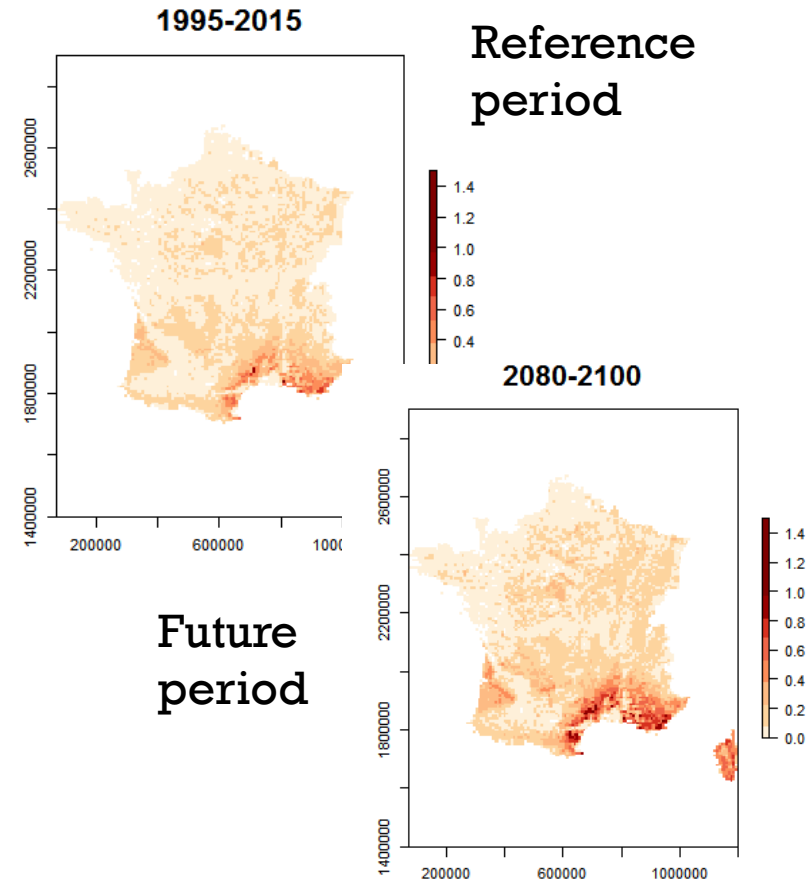
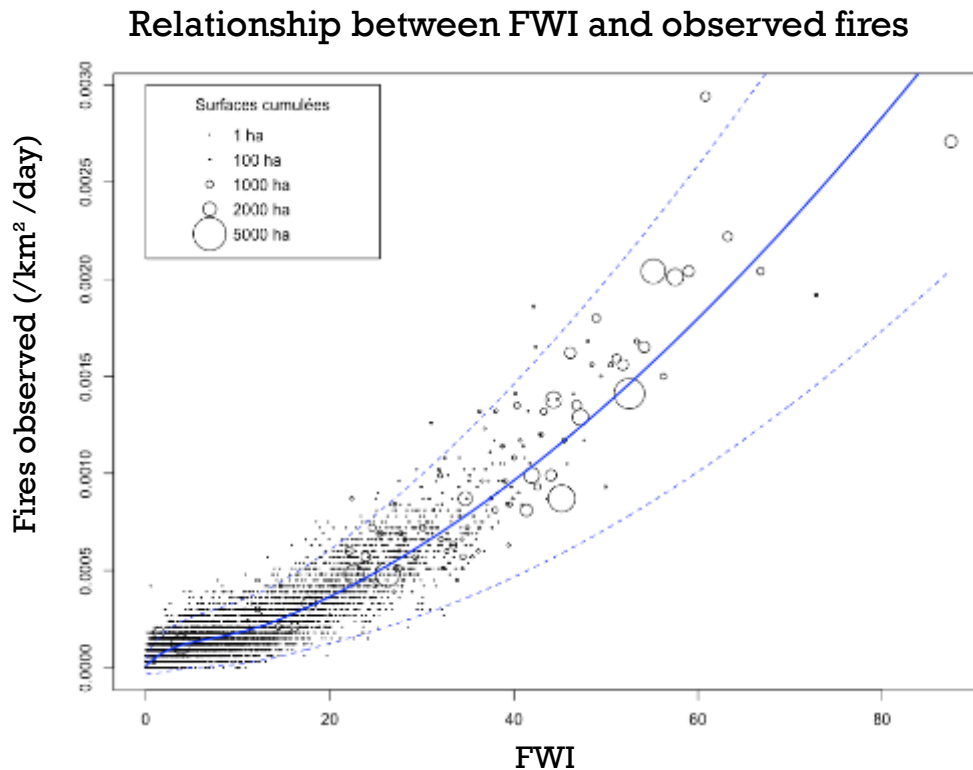
Parameterization of a FWI-fire relationship using a database of past fires on the French Mediterranean area



+ Impact on wildfire danger

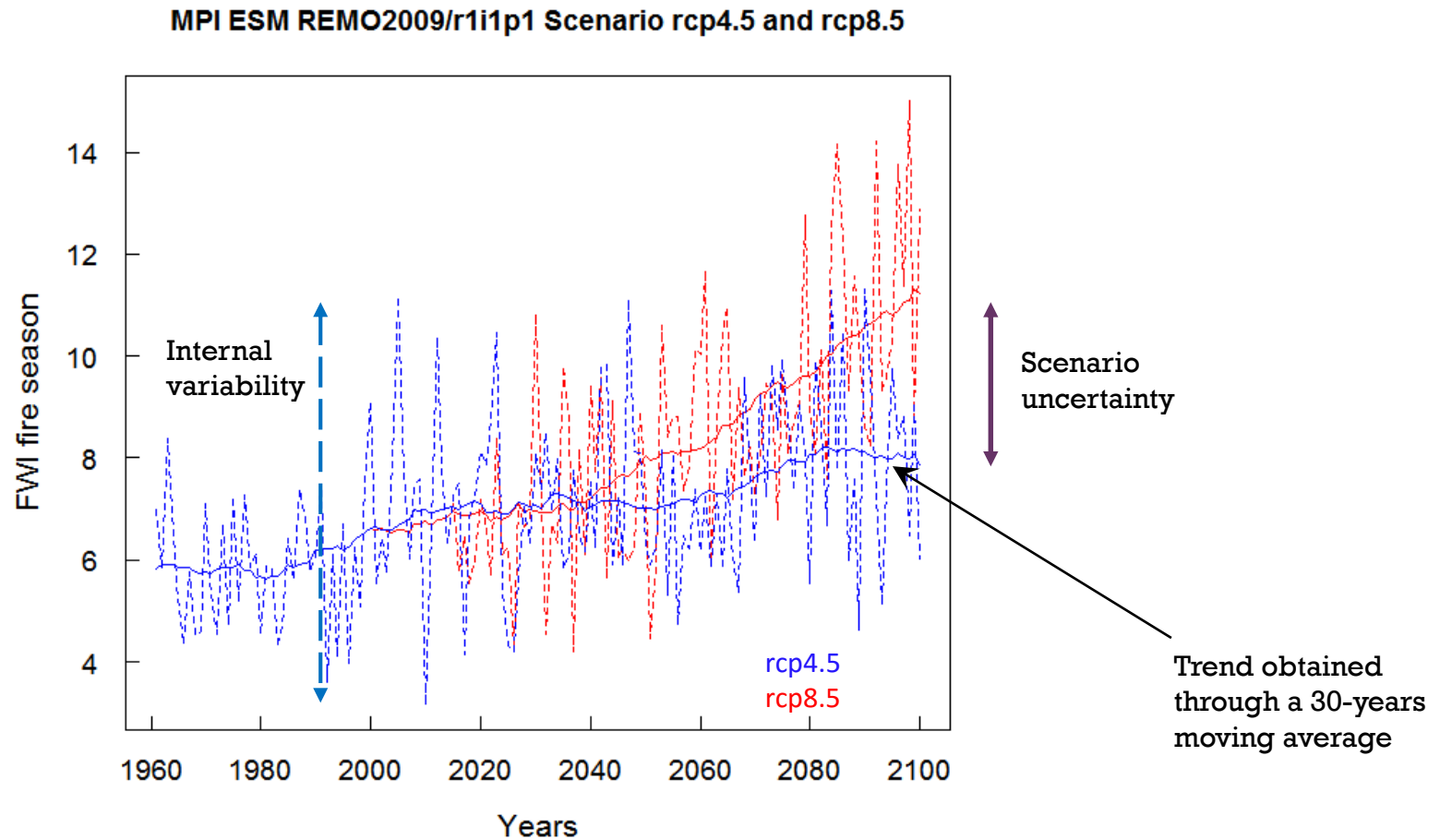
Transforming climate data into fire hazard

Parameterization of a FWI-fire relationship using a database of past fires on the French Mediterranean area



Climate change impact on wildfire danger: where do the greatest uncertainties lie?

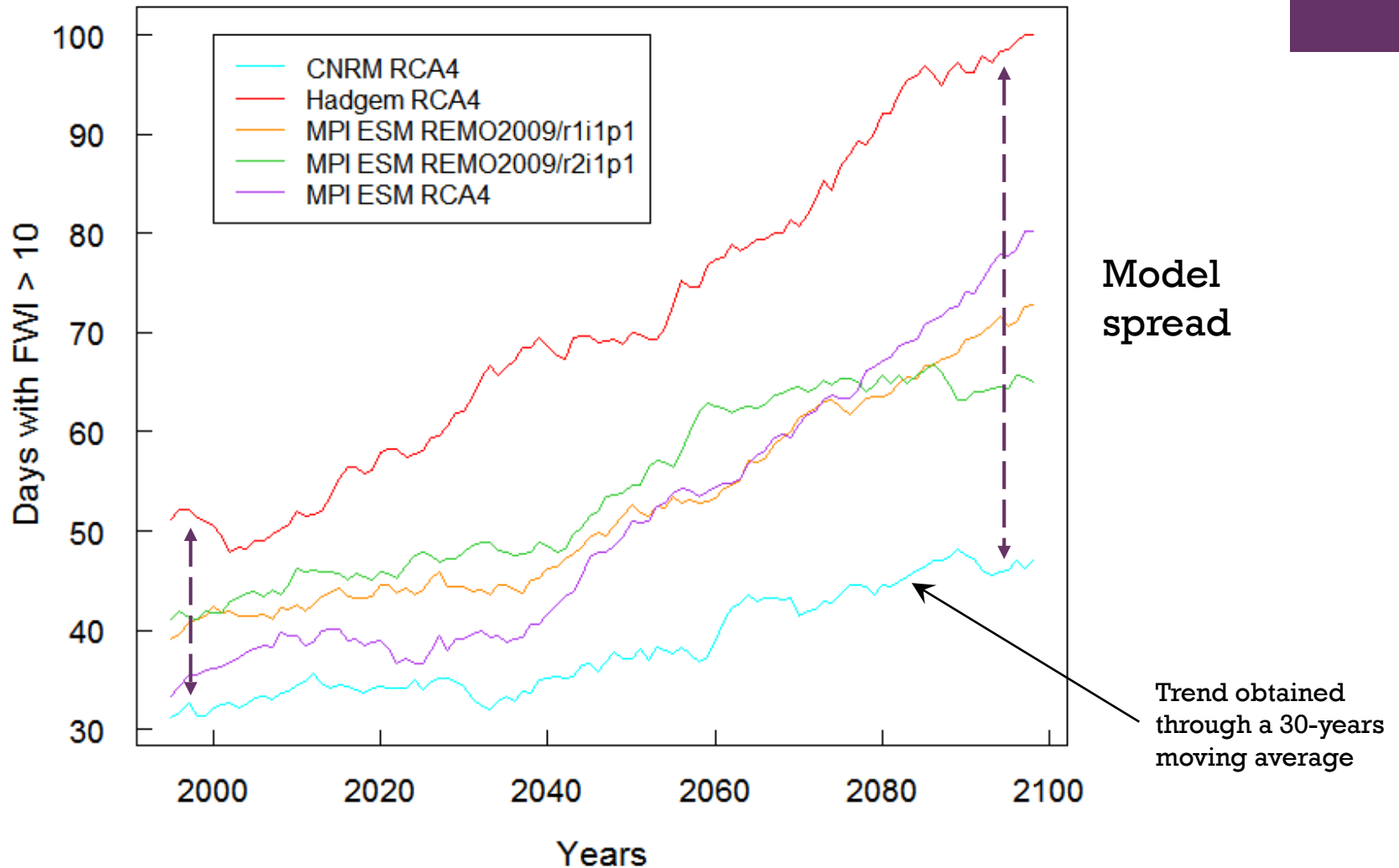
+ Internal variability and scenario uncertainty





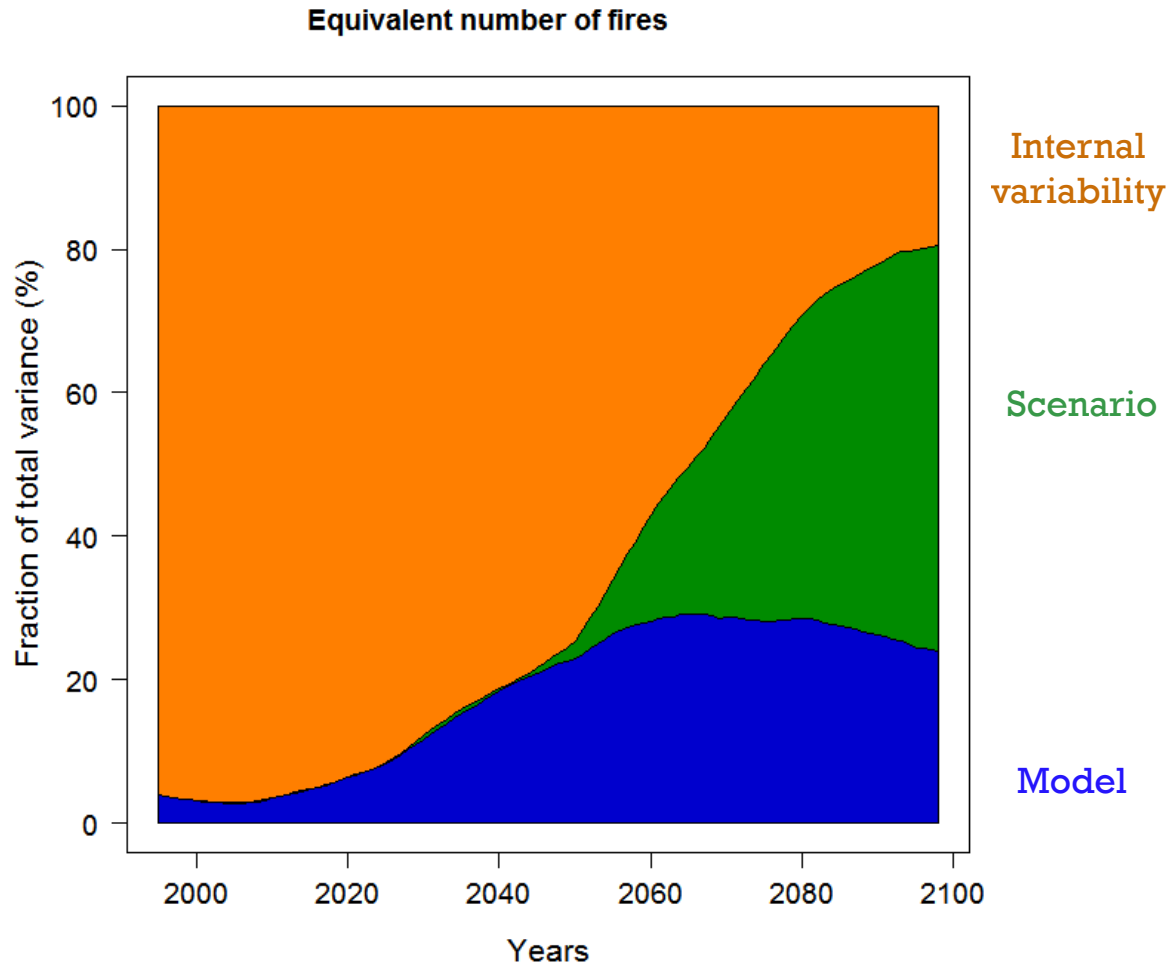
Model uncertainty

Model spread (scenario rcp8.5)



+ Total variance

Contributions from the different uncertainty sources



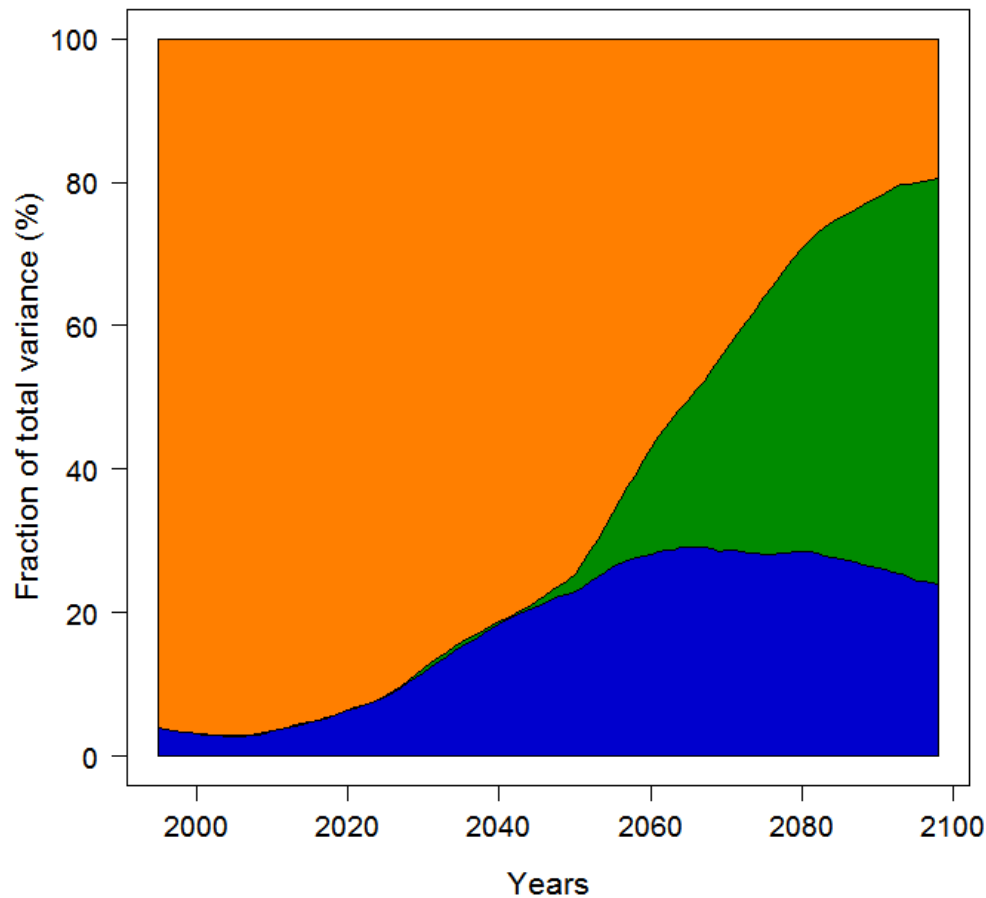
Internal variability is the main source of uncertainty, and will continue to dominate the other sources of uncertainty for long...



Total variance

Contributions from the different uncertainty sources

Equivalent number of fires



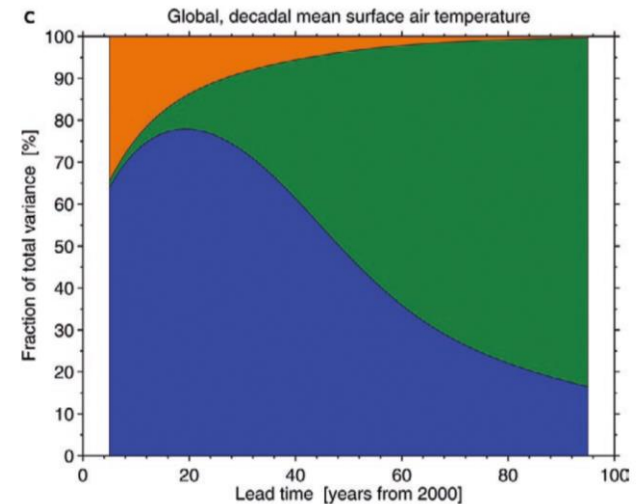
Internal
variability

Scenario

Model

Internal variability is the main source of uncertainty, and will continue to dominate the other sources of uncertainty for long...

From Hawkins & Sutton (2009)



+ Conclusion

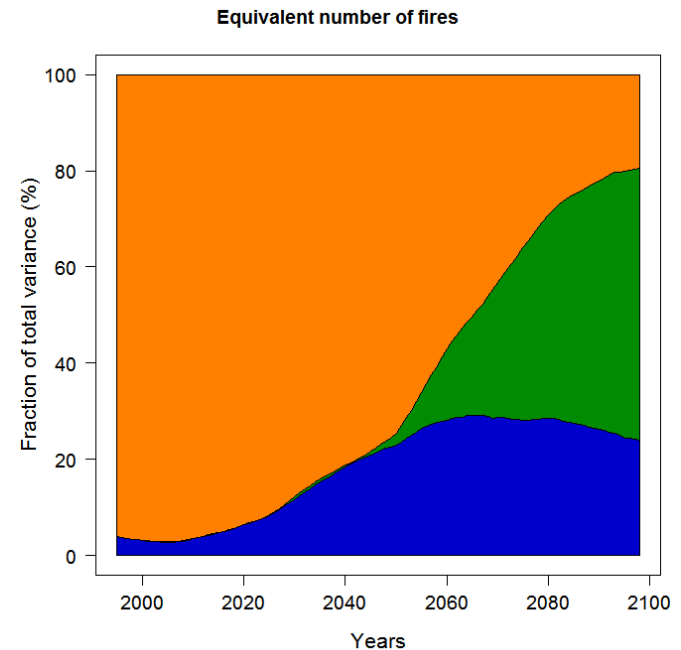
What can we do regarding all these uncertainties?

- Internal variability will dominate for long...
- ... But in 2100, scenario choice explains the major part of the variance in my fire predictions

Internal
variability

Scenario

Model





Thank you for your attention !

Source: URFM

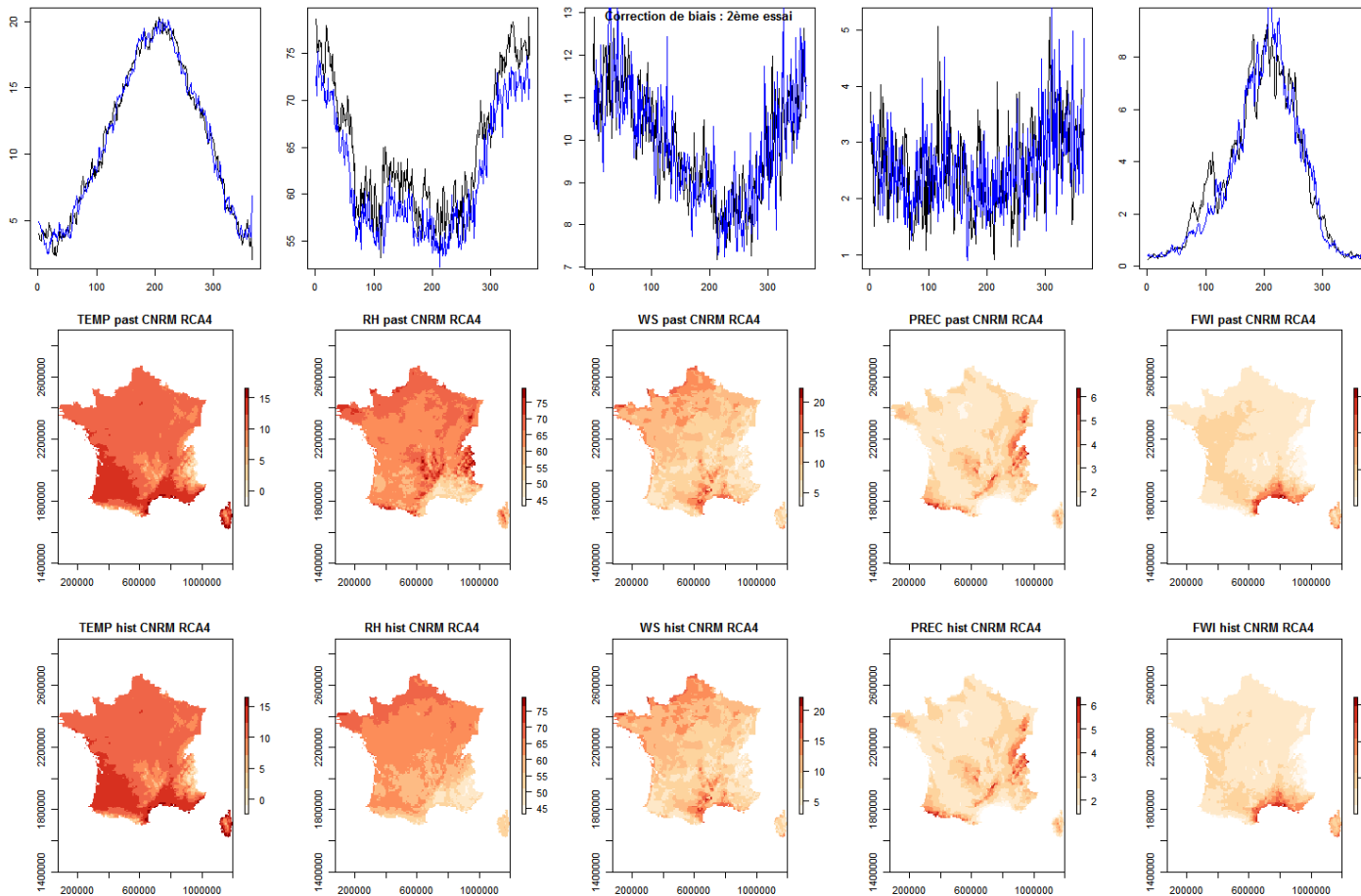


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Validation of the bias correction

Check on the different climatic variables used in the FWI



Intra
annual
dynamic

Spatial
pattern

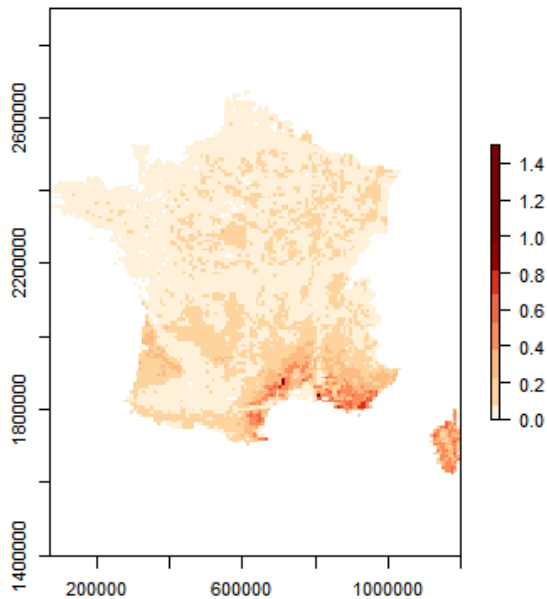
+ And in a spatial way ?

Extension of the hazard area

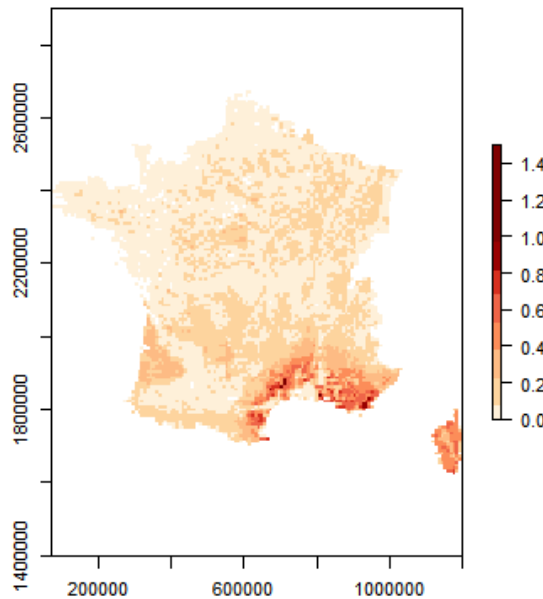
- Multimodel and multiscenario mean to show a general trend = more fires expected
- Especially in the Mediterranean area...

Mean number of fires (> 1 ha)

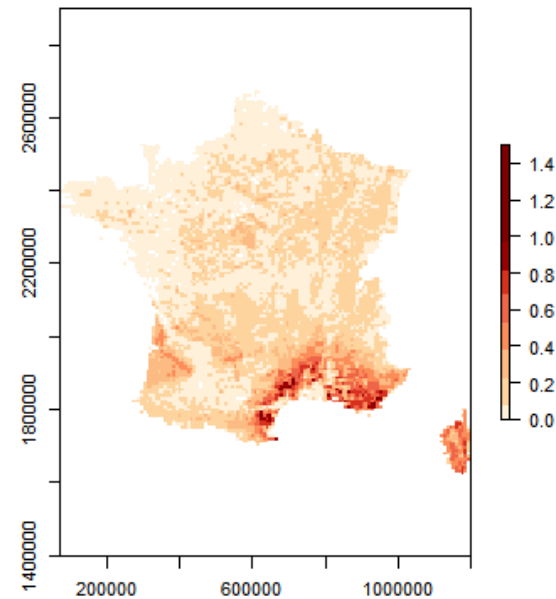
1995-2015



2040-2060



2080-2100

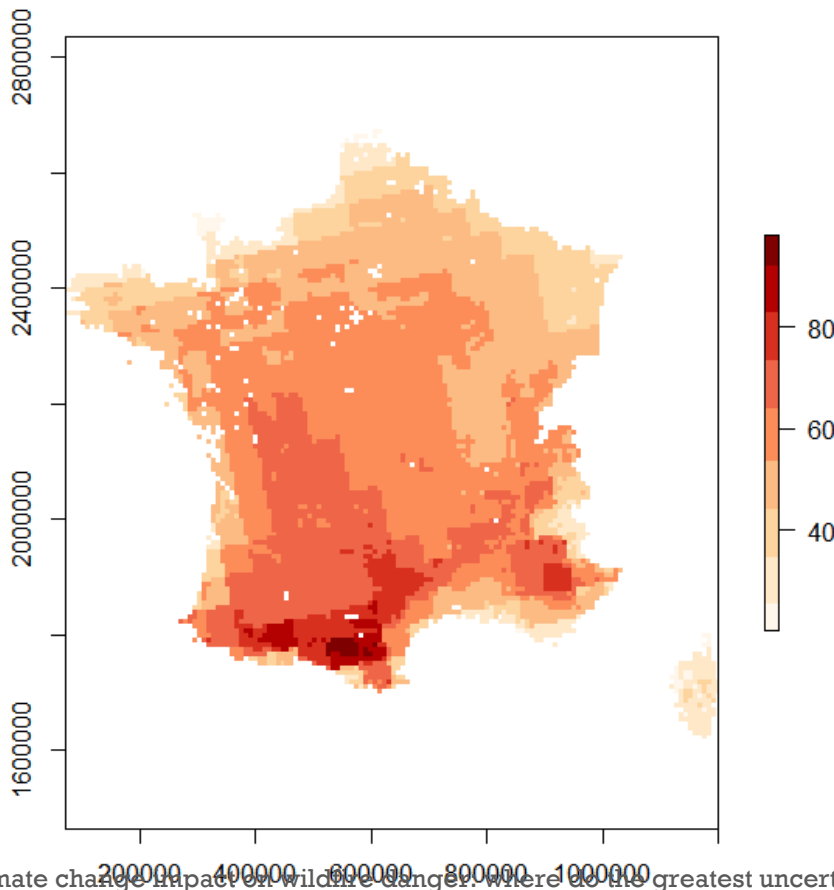


+ And in a spatial way ?

Non linearities in our metrics

2090 vs reference = 2000
(multimodel, multiscenario mean)

Increase in equivalent fires (%)



Increase in equivalent severe fires (%)

