

INTERNATIONAL  
RAGWEED  
CONFERENCE

March 28-29, 2012



# atopica

atopic diseases in changing  
climate, land use & air quality

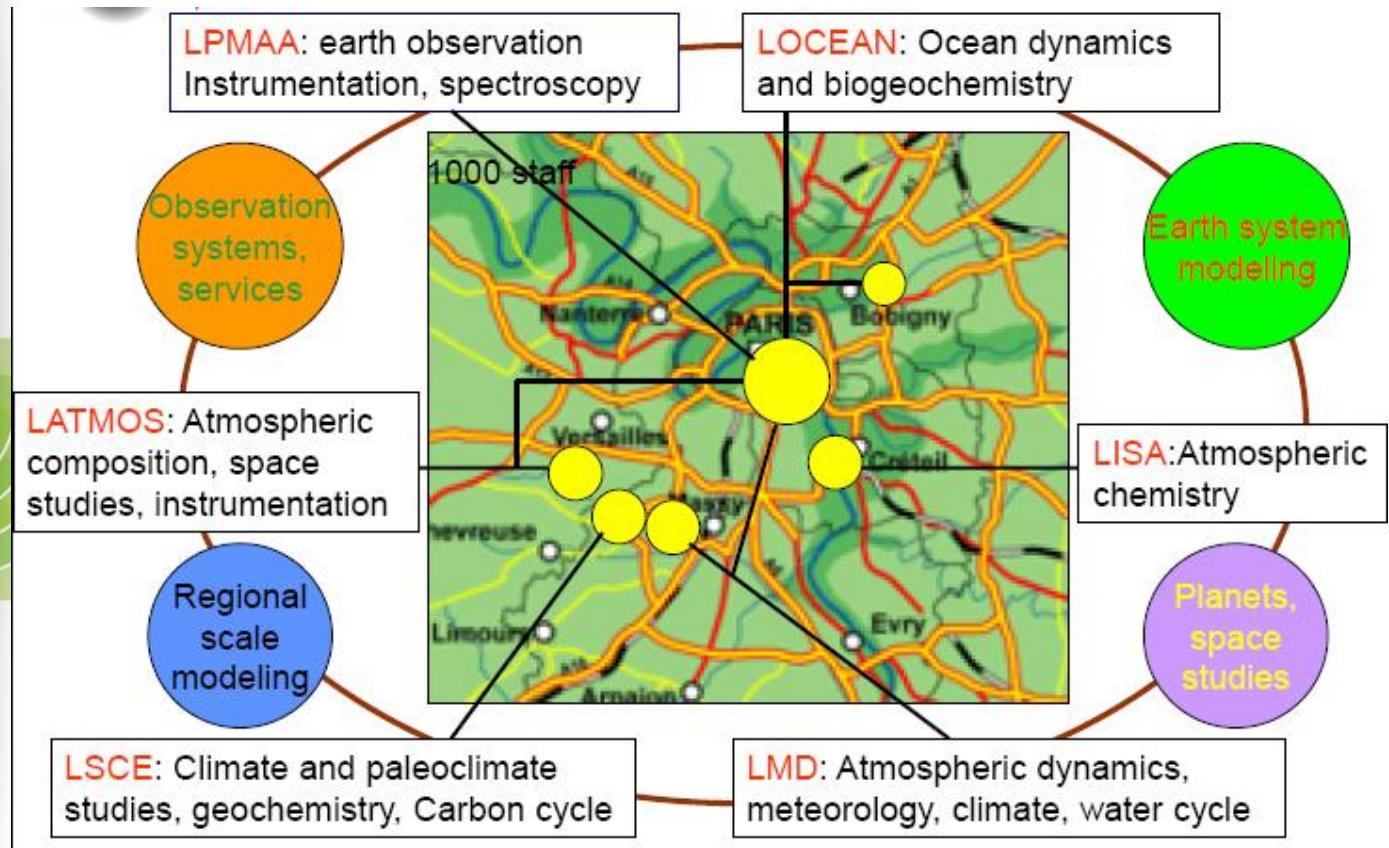
Towards modeling the effect of  
climate, land use changes and air  
pollution on Ambrosia, birch and  
related allergies  
**the ATOPICA project**

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Laboratoire des Sciences du  
Climat et de l'Environnement  
CNRS

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European Commission under the 7th FP



# The Institute Pierre – Simon Laplace



# Acknowledgements

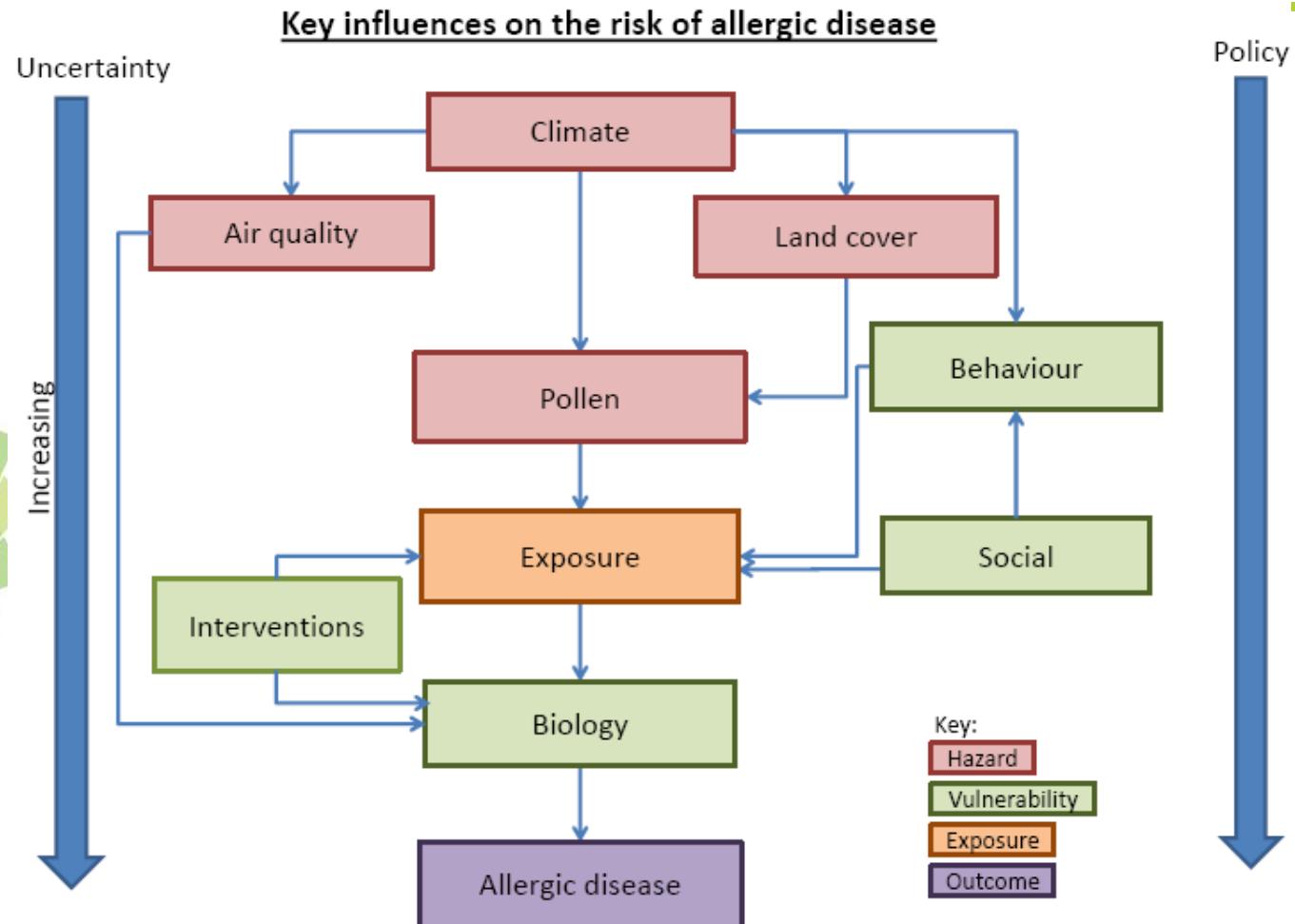
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- ATOPICA project team
  - Laura Vivani (Moverim)
- 
- CNRS (IPSL/CEFE) team
  - Isabelle Chuine
  - Dmitry Khvorostyanov
  - Laurent Menut
  - Aurélie Potier
  - Alice Schaffhauser
  - Robert Vautard
  - Nicolas Viovy

## ATOPICA OVERVIEW

concepts &  
methods

# Project issues



Towards modeling the effect of climate, land use changes and air pollution on Ambrosia, birch and related allergies: the ATOPICA project

# PROJECT OVERVIEW

## concepts & methods

atopica

# Project methods



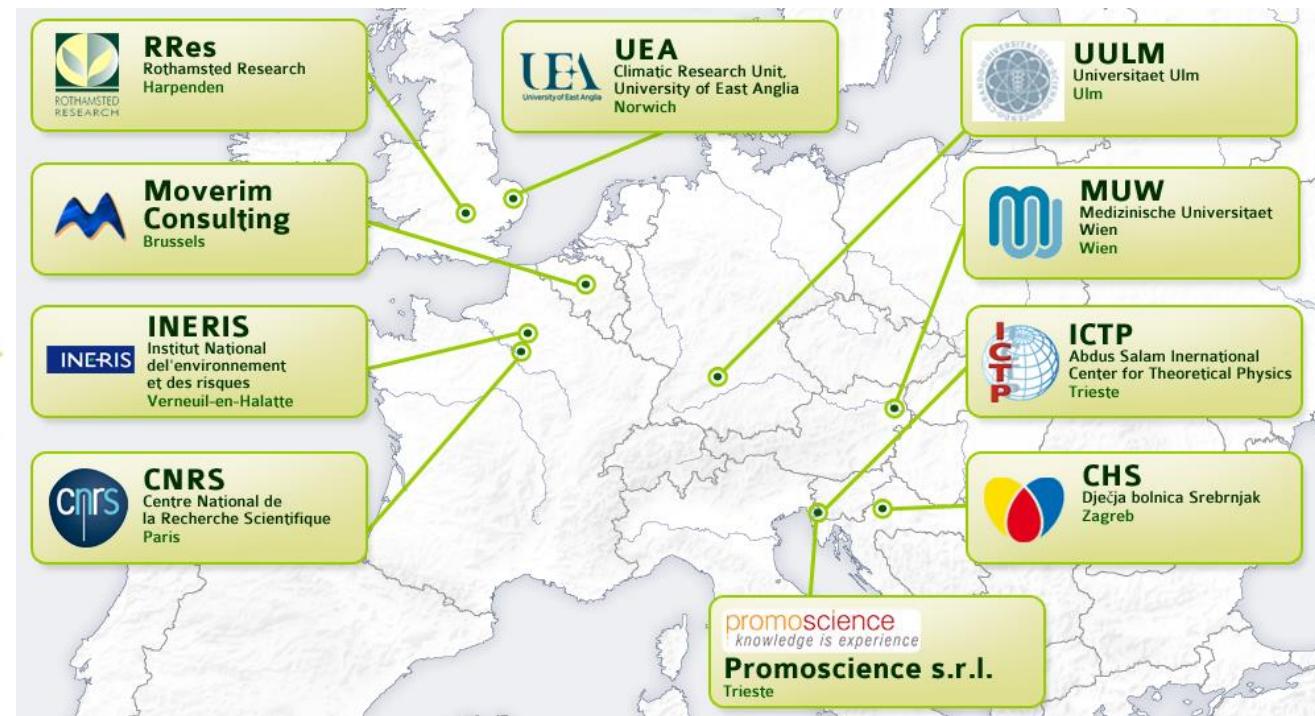
Towards modeling the effect of climate, land use changes and air pollution on Ambrosia, birch and related allergies: the ATOPICA project

## PROJECT PARTNERS

a multidisciplinary  
approach

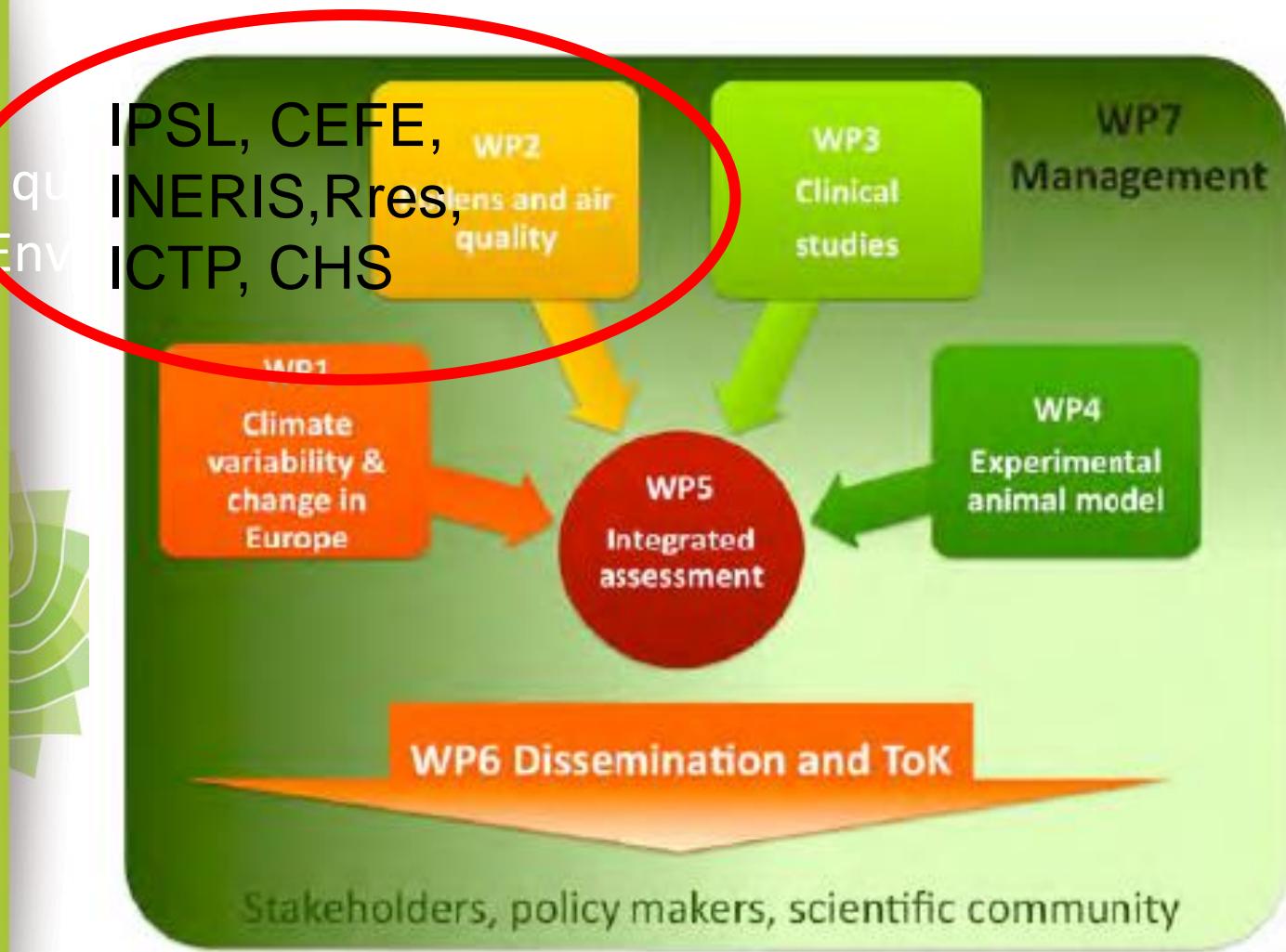
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# Project map

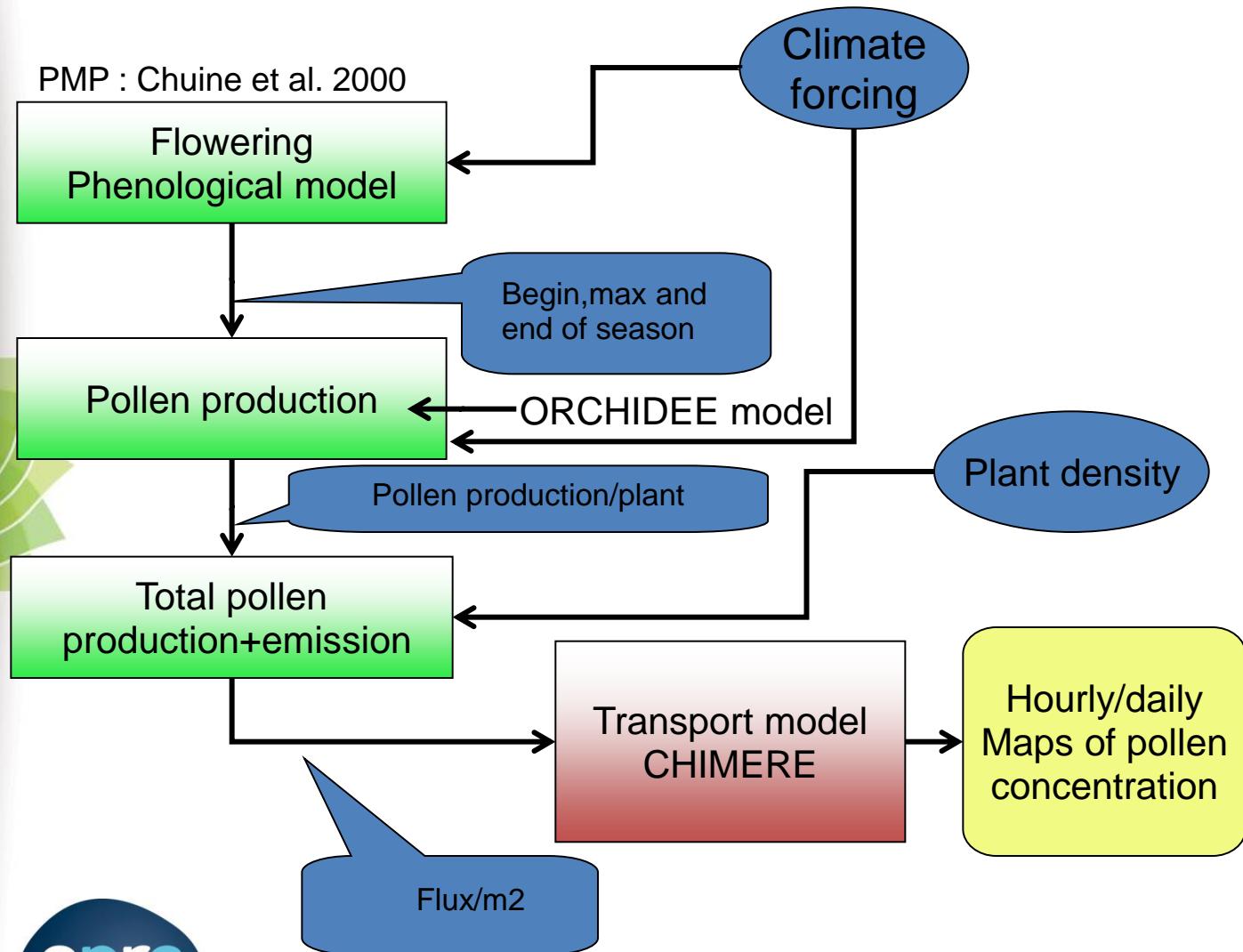


Towards modeling the effect of climate, land use changes and air pollution on Ambrosia, birch and related allergies: the ATOPICA project

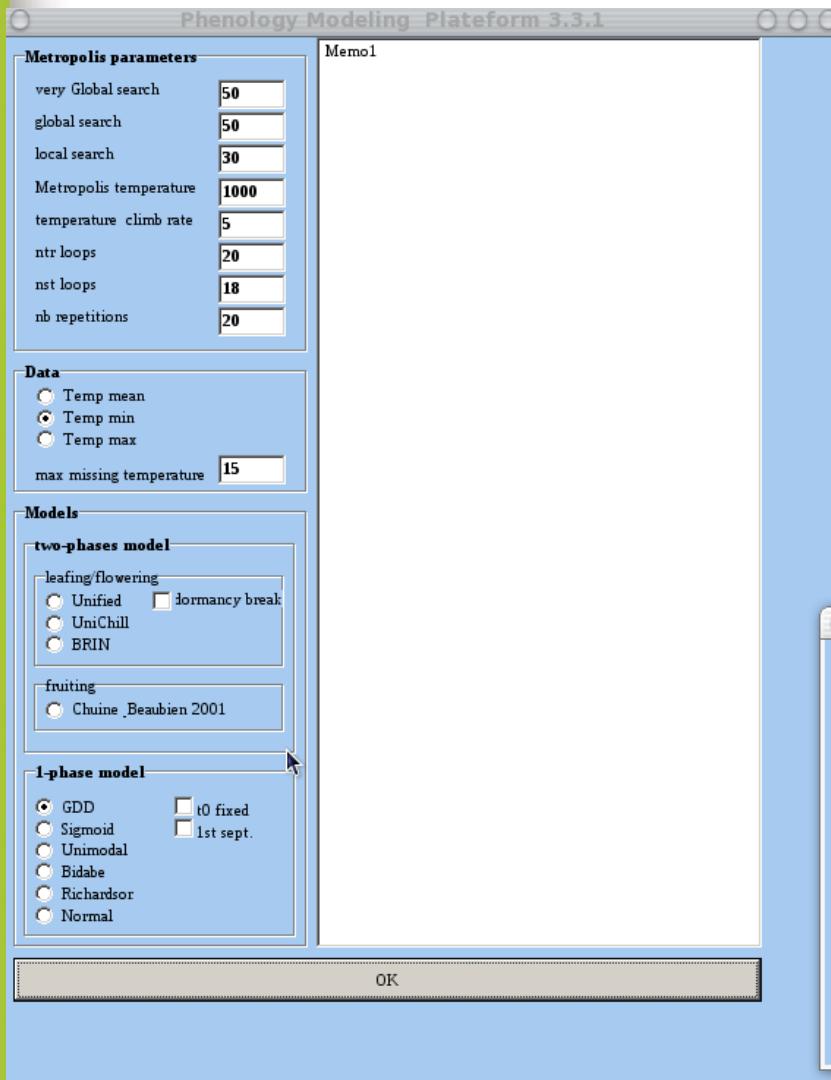
- Observation analysis
- Regional climate modeling, air transport, air pollution
- Pollen production modeling
- Phenology modeling
- Plant distribution modeling



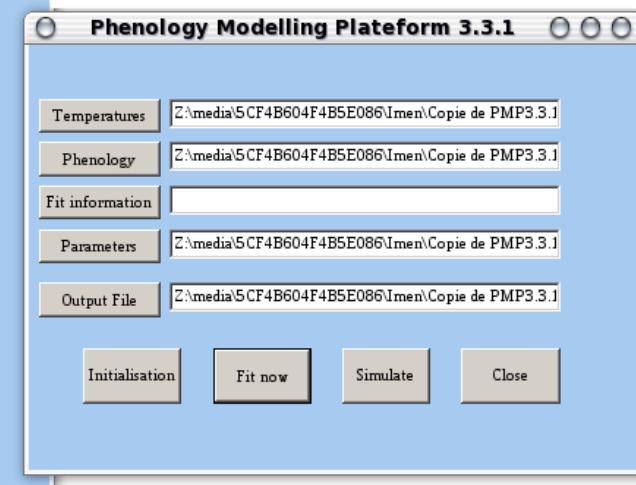
# Modeling platform



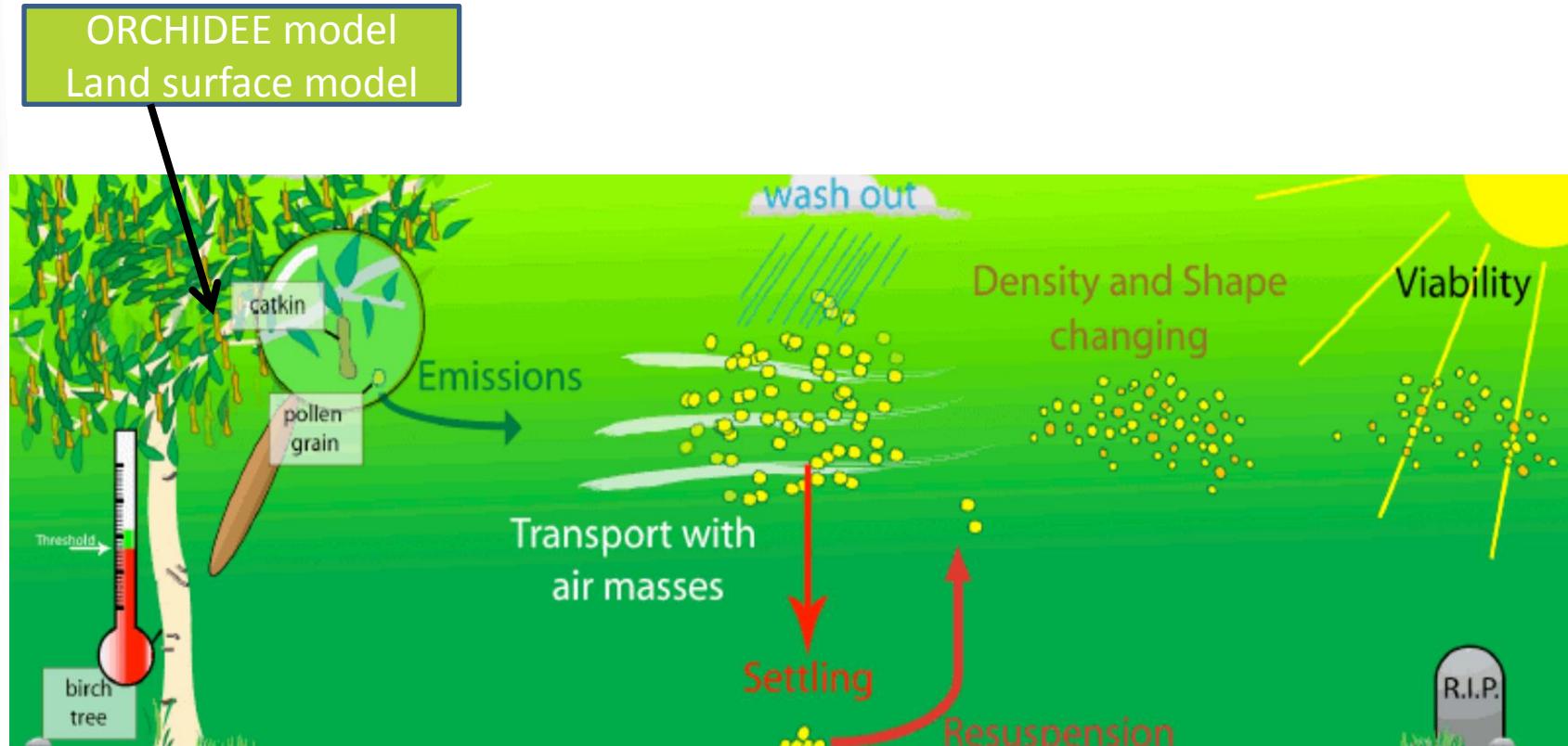
# Phenology modeling platform (PHP: Chuine et al 1999, 2002)



- Combined use of several temperature accumulation models
- Used to estimate phenology
- Cross validation method



# CHIMERE Pollen Transport / deposition model (birch case)



# Simulations (periods of 20 years)

Table of long-term simulations

CTM Model	Period	Global Climate	Regional Climate	Land Use LU0=past; LU1-3 = future <i>Ambrosia</i> models: AM1 or AM2	Simulations			
CHIMERE	1990 - 2010	ERA-interim	WRF	LU0+AM2	AQ+Pollens			
		IPSL-CM		LU0+AM1	Pollens			
	2010 - 2030	IPSL-CM		LU1+AM2	AQ+Pollens			
				LU1+AM1	Pollens			
				LU2+AM1/AM2	Pollens			
	2050 - 2070			LU3+AM1/AM2	Pollens			
				LU1+AM2	AQ+Pollens			
				LU1+AM1	Pollens			
				LU2+AM1/AM2	Pollens			
				LU3+AM1/AM2	Pollens			
RegCM Chem Pol	1990 - 2010	ERA-interim	RegCM	LU0+AM2	AQ+Pollens			
		ECHAM		LU0+AM1	Pollens			
	2010 - 2030	ECHAM		LU1+AM2	AQ+Pollens			
				LU1+AM1	Pollens			
				LU2+AM1/AM2	Pollens			
	2050 - 2070			LU3+AM1/AM2	Pollens			
				LU1+AM2	AQ+Pollens			
				LU1+AM1	Pollens			
				LU2+AM1/AM2	Pollens			
				LU3+AM1/AM2	Pollens			

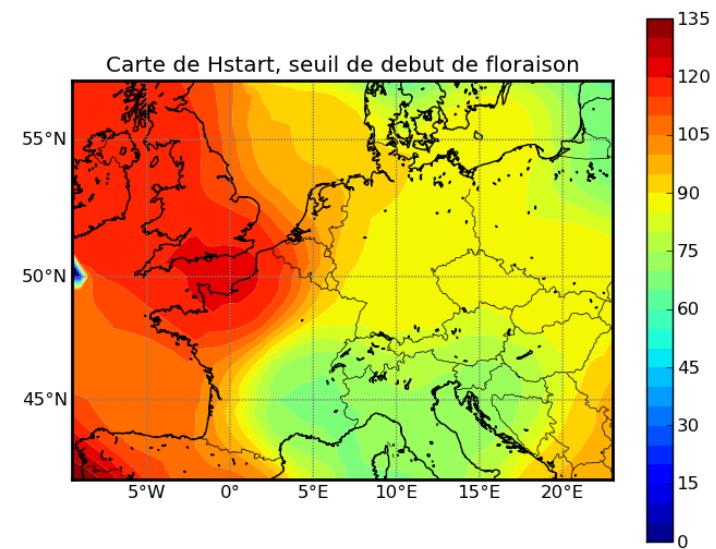
# A double-threshold $T$ sum model for birch

(Linkosalo et al, 2011) => Sofiev et al (2011) pollen emission model

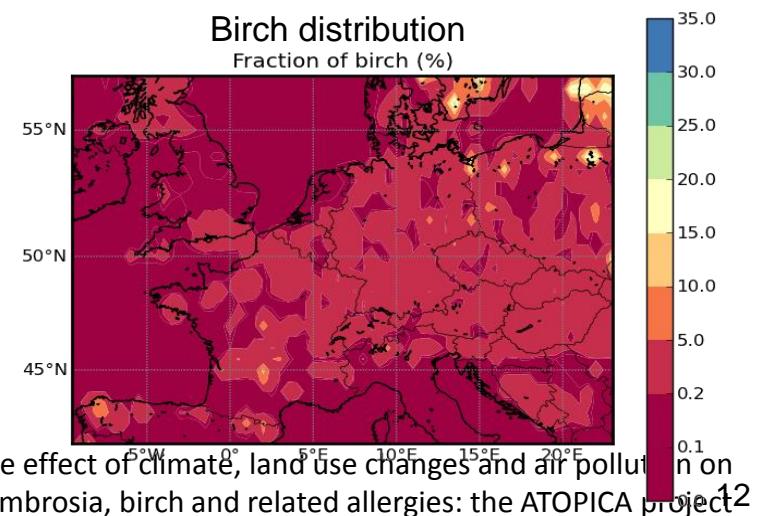
$$S(t) = \int_{t_0}^t r(i) di \cong \sum_{i=t_0}^t (r(i) \cdot \Delta t),$$

$r$  – rate of ontogenetic development  
 $S$  – stage of development or  $T$  sum

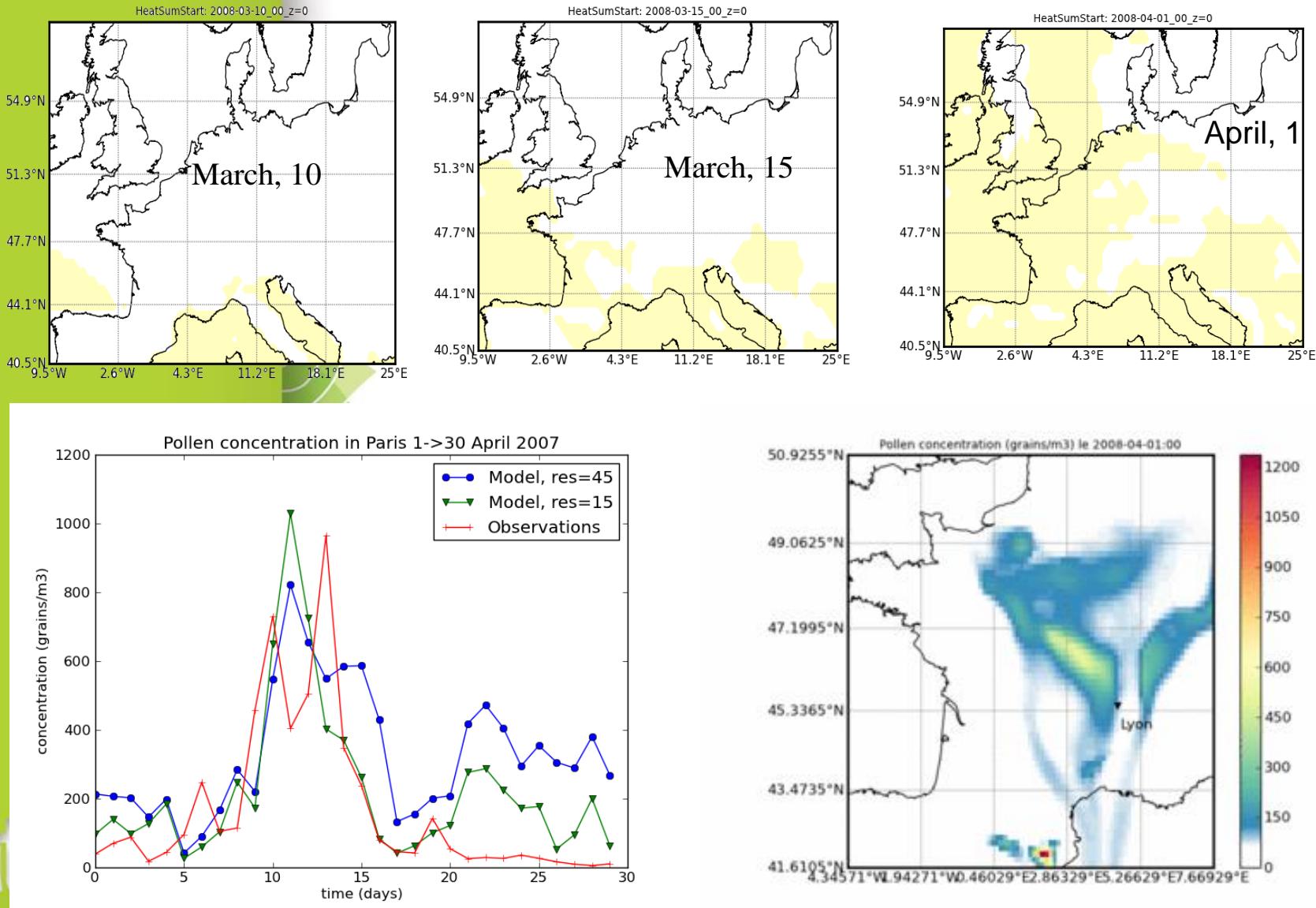
$$R(t) = \begin{cases} 0, & S(t) < S_1 \\ \frac{S(t) - S_1}{S_2 - S_1}, & S_1 \leq S(t) \leq S_2 \\ 1, & S(t) > S_2 \end{cases}$$



Birch distribution map:  
 - forest inventories  
 - satellite images  
 In France:  
 0 to 11,3% birch forest  
Mean : 0,87%



## ■ Example for birch modeling





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Thank you for your attention!