Combine AZODYN-rapeseed model outputs and climate data to identify and quantify to the main abiotic stresses occurring in an generic multi-environment trials

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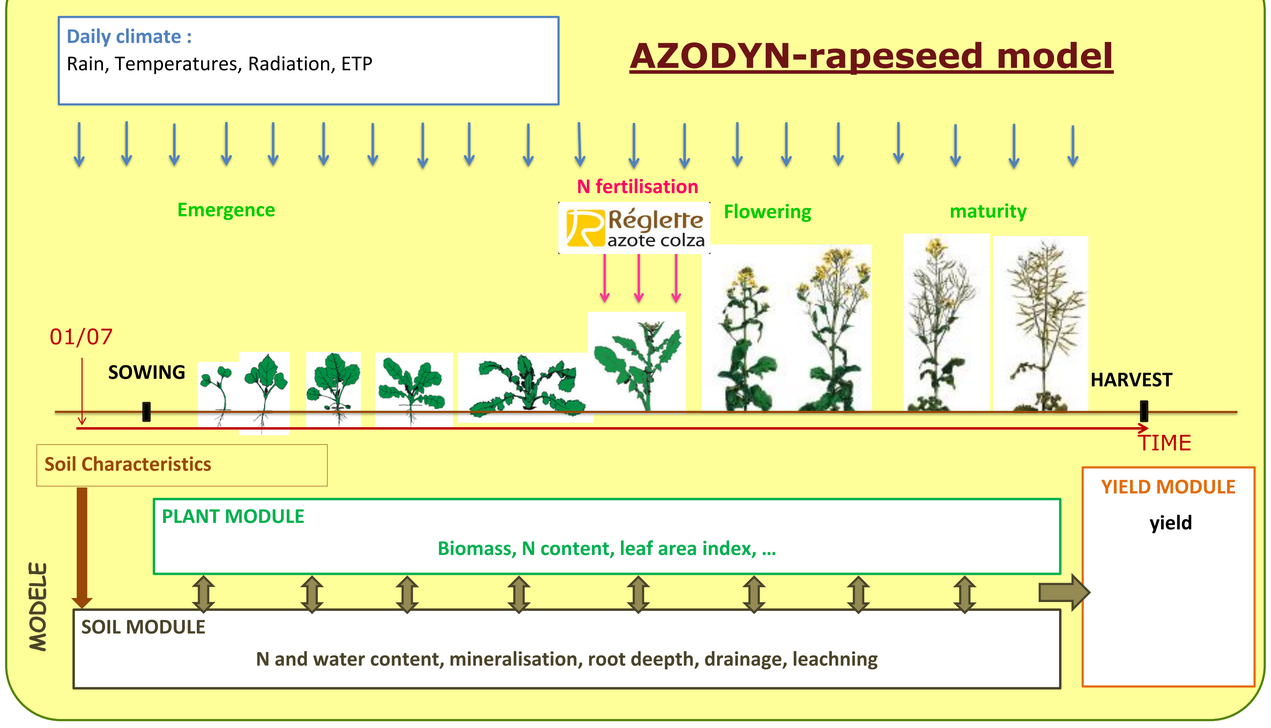
Background: The dynamic crop model AZODYN-rapeseed computes the above-ground biomass production from climate data (radiation, rainfall and temperature), soil characteristics and management practices. It works on a daily time step and describes plant phenology, leaf expansion and biomass production and its allocation to the grain. Rather classically, actual growth depends on potential growth modulated by nitrogen, temperature and radiation. Soil water and nitrogen at sowing were initialized from water balance and nitrogen balance computed by the model from the 1st of July.

Objectives: The present work aimed at identifying, quantifying to the main abiotic stresses occurring in the field (light, temperature, water, nitrogen)



Method : Combine crop model outputs and climate data

to identify and quantify to the main abiotic stresses occurring in the field

Phenology	Selected variables
Sowing / emergence period	mean Temperature mean Rainfall
Autumn	mean Temperature difference between rainfall and ETP
Winter	difference between rainfall and ETP High freezing days (-10°C)
Early Spring	difference between rainfall and ETP
Flowering	difference between rainfall and ETP Mean radiation
Grains filling	Mean temperature difference between rainfall and ETP Mean radiation
Before harvest	difference between rainfall and ETP Mean radiation

Management practices

Soil characteristics

Daily Climate data
ETP
Rainfall,
Radiation

Crop model AZODYN-rapeseed

14 variables selected by experts

3 variables selected by experts

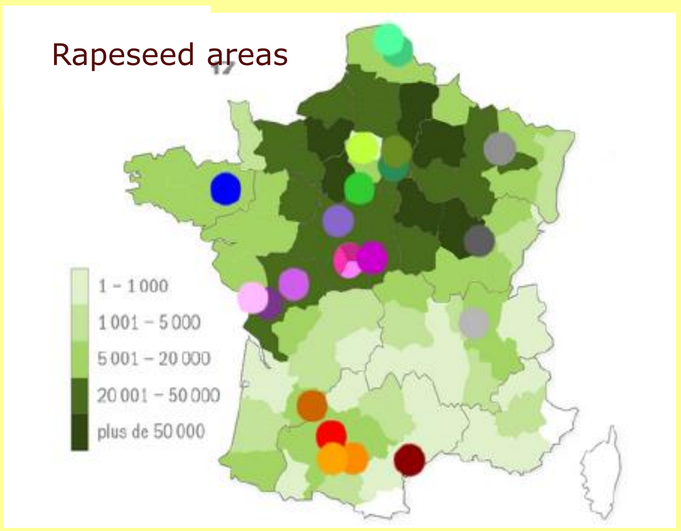
Phenology	Selected variables
End of winter	Nitrogen Nutriment Index
Flowering	Nitrogen Nutriment Index
Between flowering and maturity	Nitrogen Nutriment Index

Statistical methods (Partial Least Square)
Observed Yield = function of 17 selected variables

final parameters selected (the main abiotic stress in these experiments)

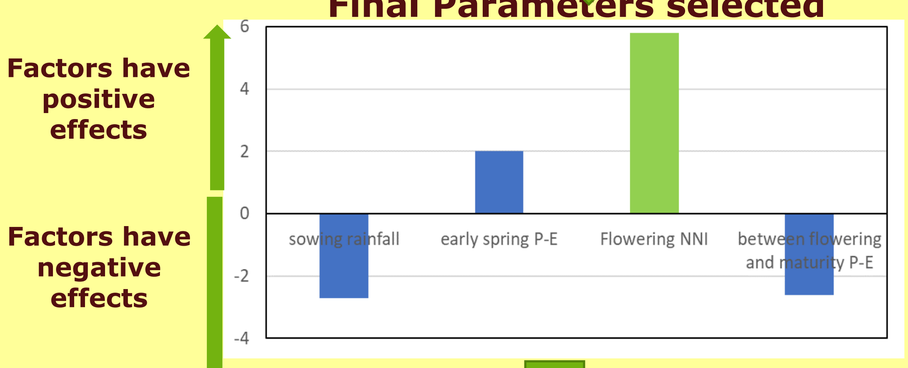
Use the method in an multi-environment trials

Experiments locations



23 sites
2 N fertiliser levels (0 and optimum)

Final Parameters selected



In these dataset, Rainfall amounts have a major impact on rapeseed yields
Sowing rainfall has negative impact in this dataset because rainfall amounts are higher than average

Parameters values in a trials with N fertiliser level optimum

location	year	Sowing rainfall	early spring P-E	Flowering NNI	maturity
CHAMBON(17)	2007-2008				
BEZIERS(34)	2008-2009				
BEZIERS(34)	2010-2011				
VIRSON(17)	2008-2009				
TRONVILLE (54)	2010-2011				
VILLEDIEU(36)	2007-2008				
MARTINCOURT(54)	2007-2008				
CHAMBON(17)	2007-2008				
VIRSON(17)	2008-2009				
BEZIERS(34)	2008-2009				
BEZIERS(34)	2010-2011				
CHAMBON(17)	2012-2013				
MARTINCOURT(54)	2012-2013				
CHAMBON(17)	2013-2014				
MARTINCOURT(54)	2013-2014				
BRETENIERE(21)	2014-2015				
ROSIERES_EN_HAYE(54)	2016-2017				

A overview of main abiotic stress a trials with N fertiliser level optimum

Each trial can be classified / categorized

P or P-E	< 80% mean between 1999 and 2018
	> 120% mean between 1999 and 2018
	< 120% and > 80%
NNI	<0.8
	> 1.2
	<1.2 and >0.8

Terres Inovia l'agronomie en mouvement

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