Regional crop modelling & yield forecasting:
opportunities in coupling models and satellite data

Building International Cooperation on Arid Zones Research
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Arlon campus environnement

Wallonie - Bruxelles International.be

... hoy

① Different satellite approaches on crop modelling

② AquaCrop: FAO yield response crop model

③ Model coupling

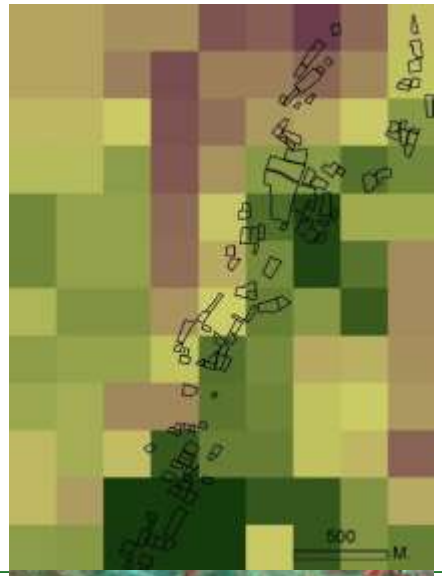
④ Geo-hydrological modelling

⑤ The far future ??

1 'New' approach

- from regional towards field -

Global Monitoring for Food Security



climate data:
rainfall
temperature
ET_0

&

AgroMetShell
agro-meteorological data:
planting
crop cycle
crop coefficients
soil type

multiple regression

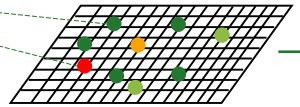
best variables
cotton in Burkina:
initial water content
NDVI max
ET_R development phase

$R^2 = 0,75$
error = 73 kg/ha
(5,9% of 1.120 kg/ha yield)

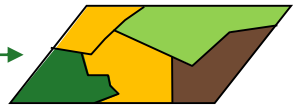
Actual research ...

AQUACROP

climate data
soil date



'point' results



regional yield, water use, ...

2.i AquaCrop

- how does it work? -

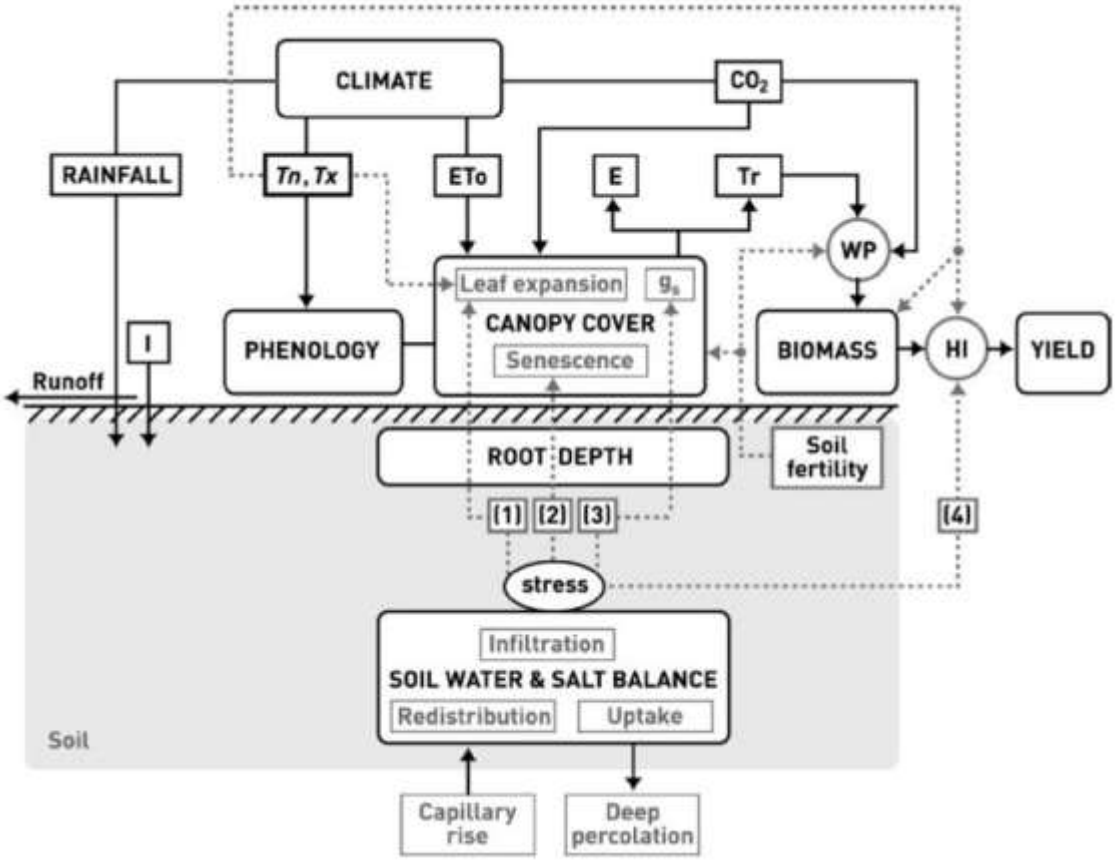
simple & solid

$B = WP \cdot \Sigma Tr$ or Biomass = Water productivity · Sum of transpiration

$Y = HI \cdot B$ or Yield = Harvest index · Biomass

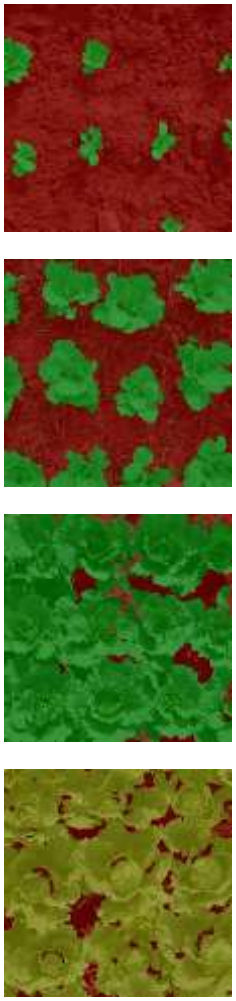
Study effects of:
- climate;
- soil;
- crops;
- irrigation;
- …

On:
- yield;
- water balance;
- …



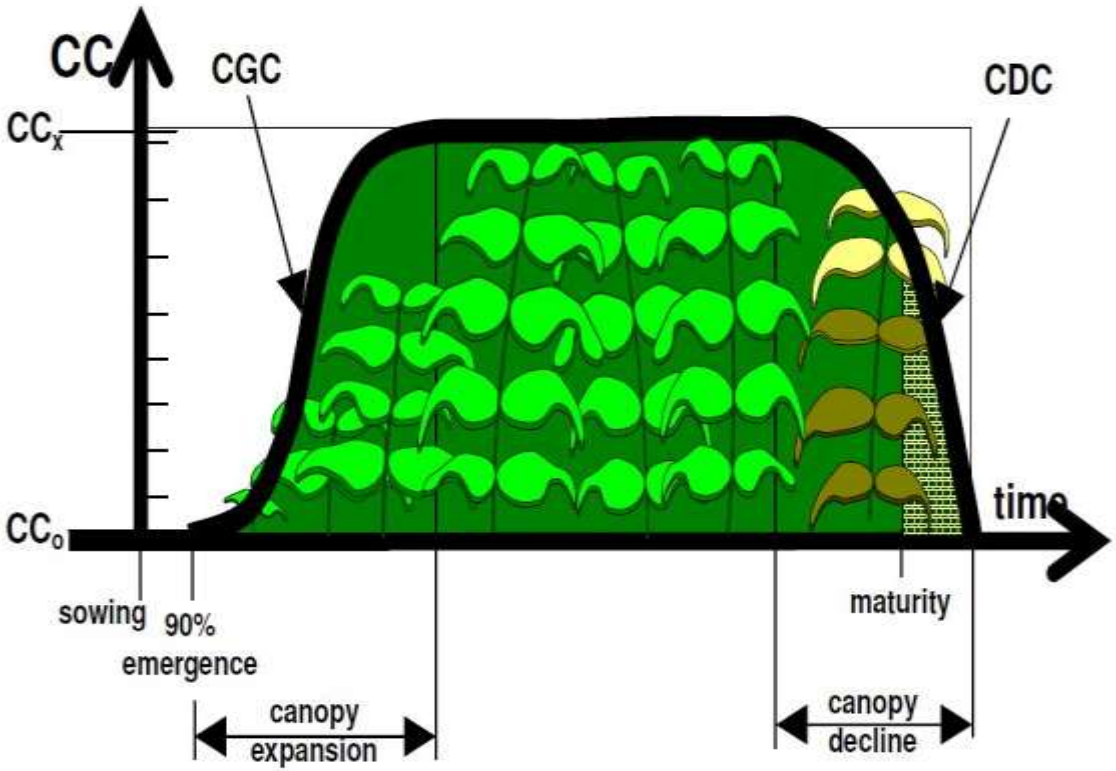
2.ii Crop input

- canopy cover -



1 Overhead pictures

2 Canopy cover (eCognition)



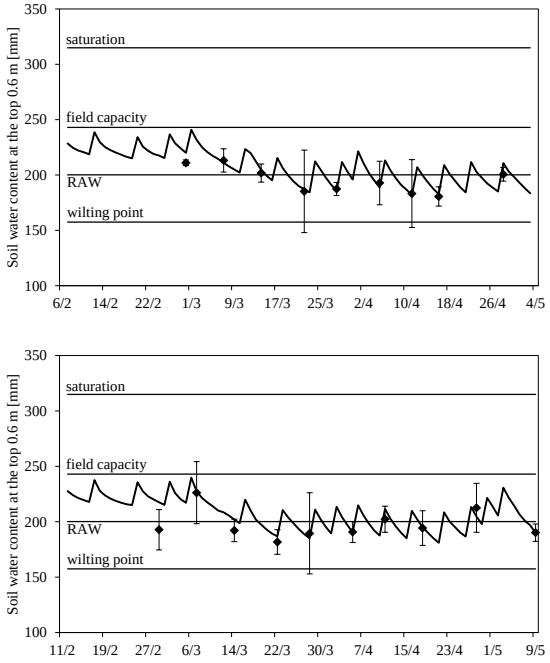
3

Graph: - crop characteristics;
- canopy growth & decline;
- phenological stages.

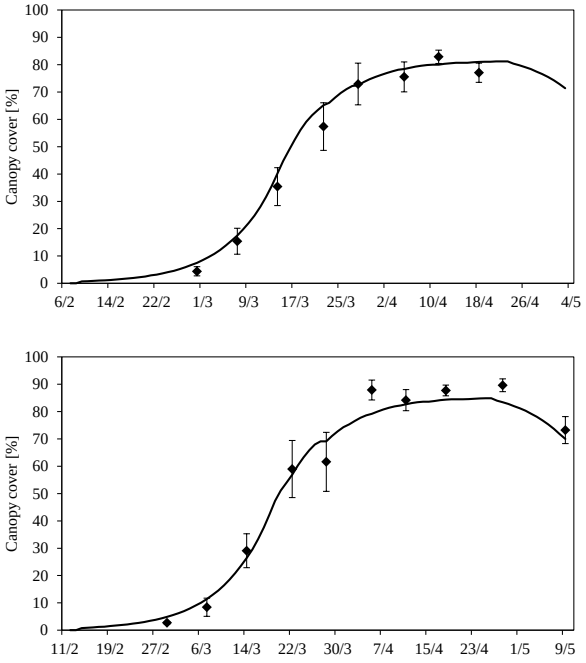
2.iii Results

- soil moisture, canopy growth, yield: e.g. cabbage -

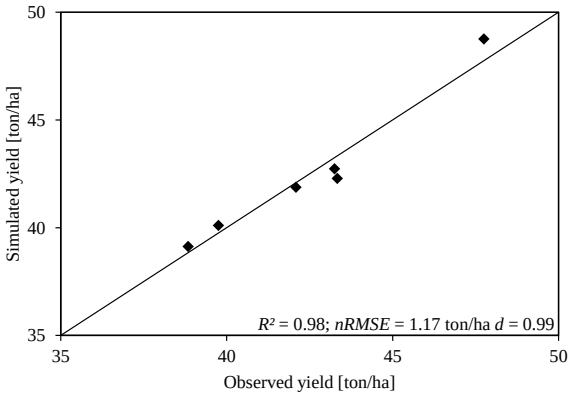
Observed vs. simulated soil moisture:



Observed vs. simulated canopy growth cover:



Observed vs. simulated yield:



1

Soil moisture:
- soil type;
- irrigations;
- …

2

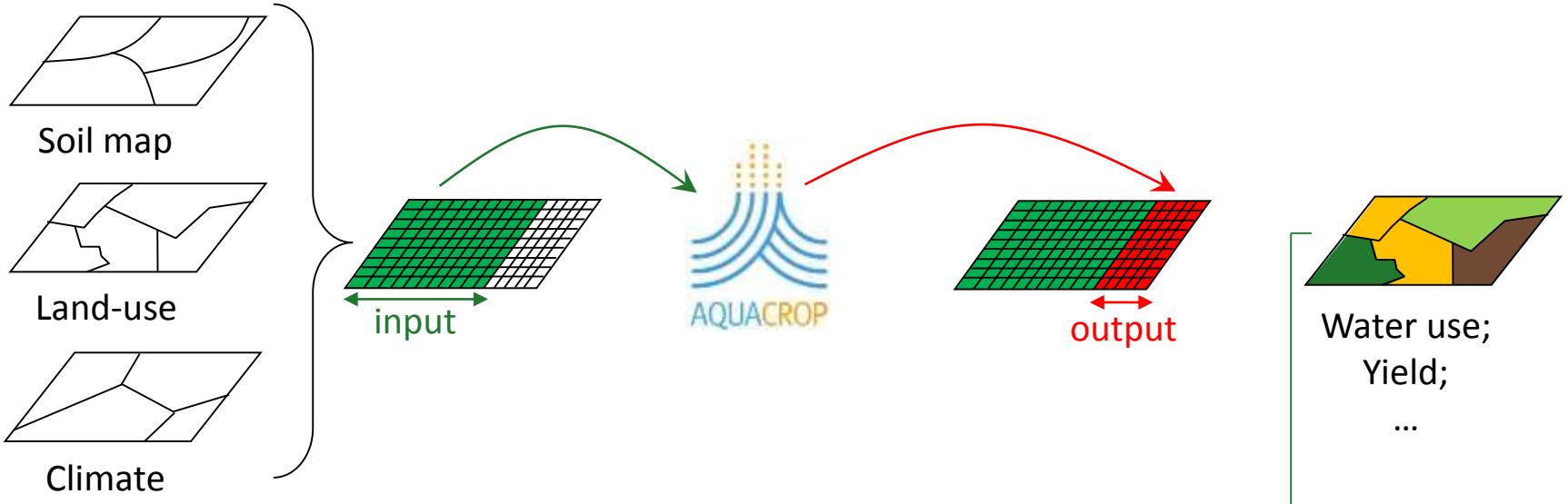
Canopy cover:
- growth & decline coef.;
- plant densities;
- …

3

Yield:
- water productivity;
- harvest index.

3.i Model coupling

- 'accompanying' studies -

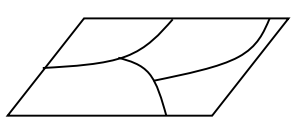


Climatology:
- climate change models;
- meteorological maps.

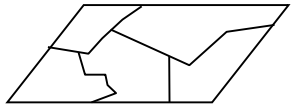
Economical models:
- market studies;
- price policies.

3.ii Model coupling

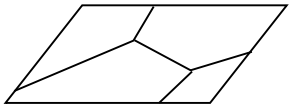
- 'accompanying' studies -



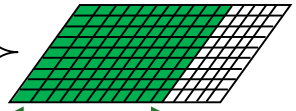
Soil map



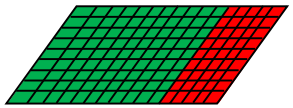
Land-use



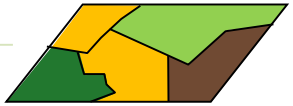
Climate



input



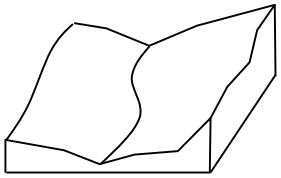
output



Water use;
Yield;
...

Climatology:
- climate change models;
- meteorological maps.

Economical models:
- market studies;
- price policies.



Geo-hydrological modelling

soil moisture & available water

water use vs. available water

4.i Geo-hydrology

- from groundwater characterization to modelling... -

① Hydrogeological mapping / Geophysical survey

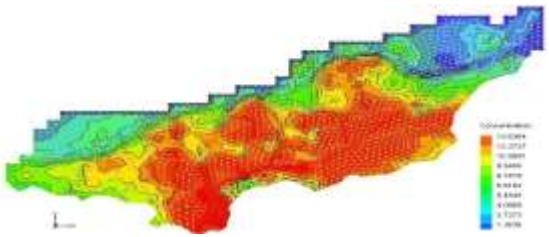
② Soil moisture & Groundwater levels

③ Water balance & groundwater recharge assessment

④ Pumping test / slug test / recovery test / tracer test

⑤ Hydrochemistry

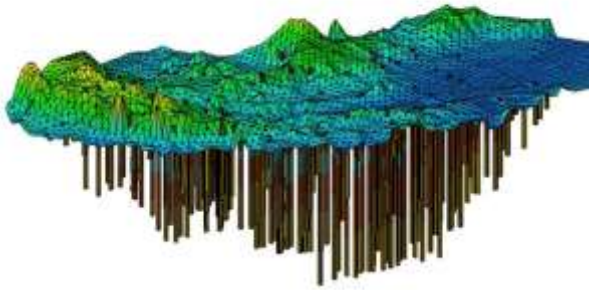
Groundwater modelling…

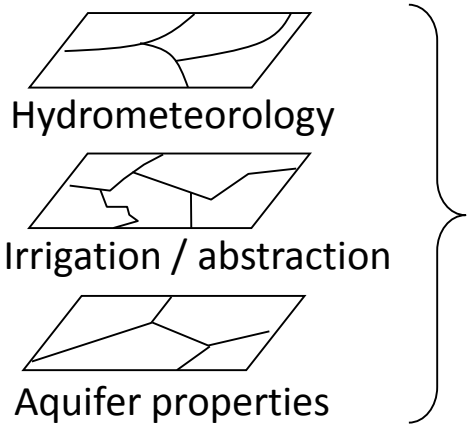


4.ii Geo-hydrology

- Groundwater modelling -

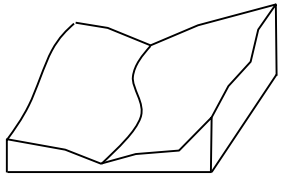
- 1D vertical groundwater flow modelling (unsaturated-saturated)
- 2D groundwater flow modelling
- 3D groundwater flow modelling





input

Groundwater flow model



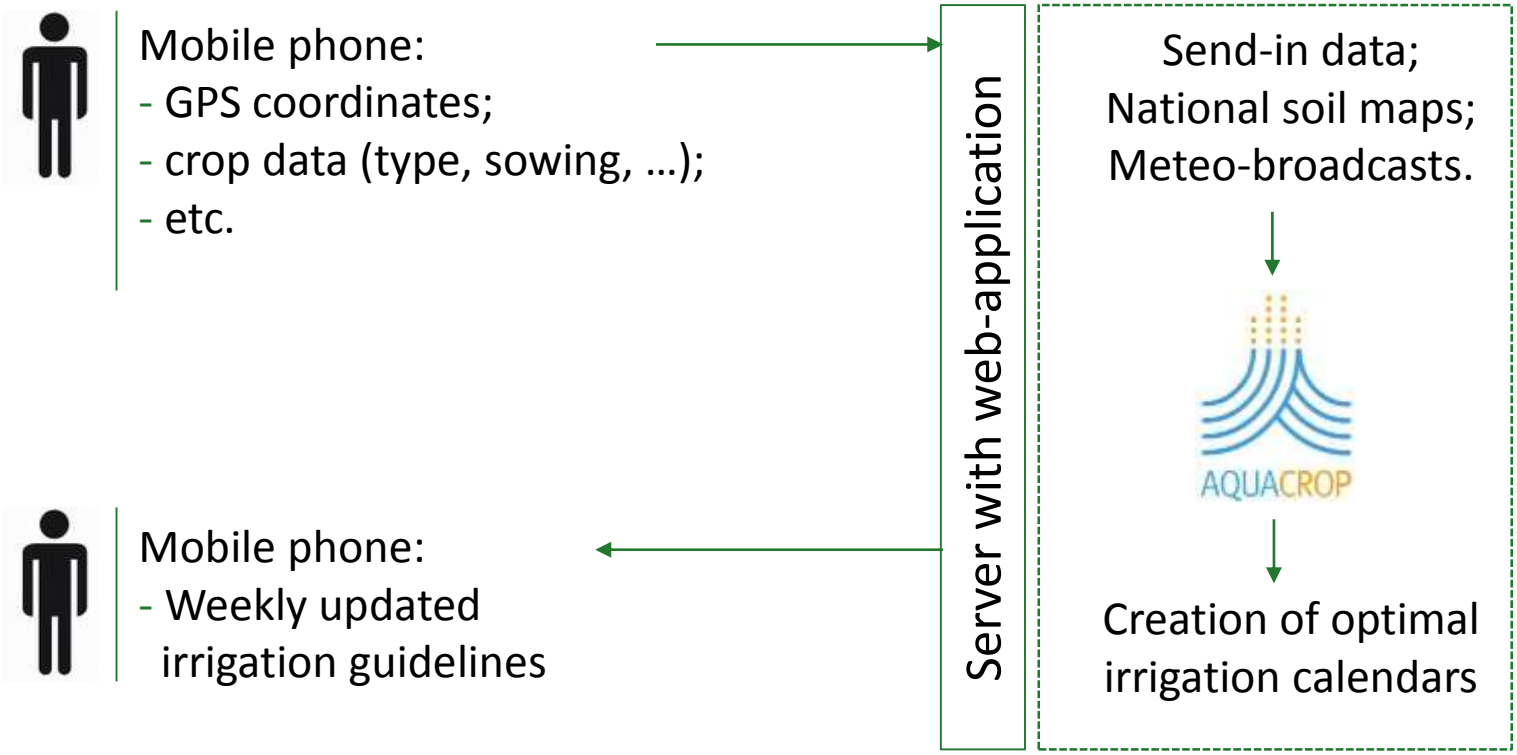
- Available water
- GW fluxes & levels
- GW – SW interactions

output

… Irrigation counselling

- 'modelling for the masses' -

Based on the priorly presented knowledge & expertise:



… Knowledge & Expertise

- partnership in international cooperation programs -

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Gracias!