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

Primer encuentro científico de innovación tecnológica
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Department of sciences and environmental management

unit: Water - Environment - Development

① Integrated Water Management

② Agro-Meteorology & Crop modelling

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③ Climate change & Food security

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① Different satellite approaches on crop modelling

② AquaCrop: FAO yield response crop model

③ Model coupling

④ 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

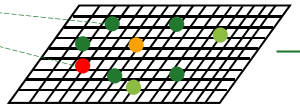
best variables cotton in Burkina:
initial water content
NDVI max
ET_R development phase

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

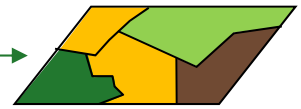
Actual research ...

AQUACROP

climate data
soil date



'point' results



regional yield, water use, ...

2.i AquaCrop

- how does it work? -

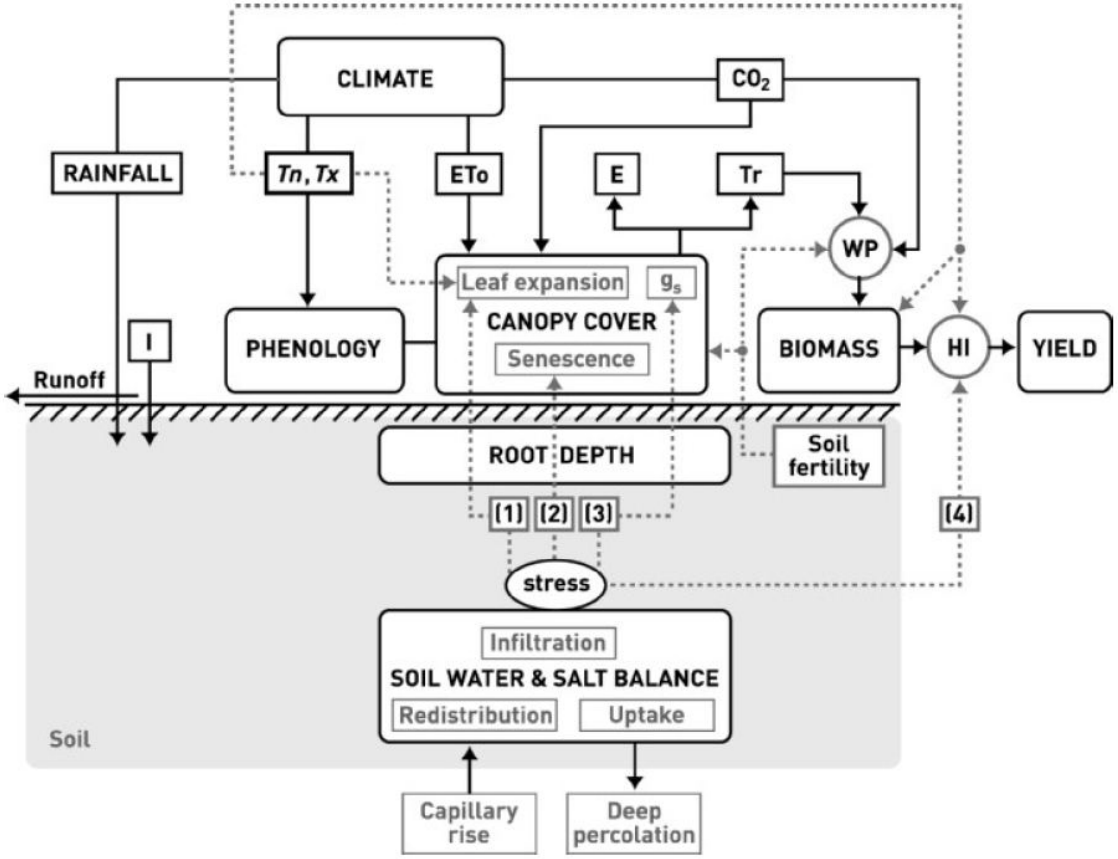
simple & solid

B = WP · ΣTr or Biomass = Water productivity · Sum of transpiration

Y = HI · B or Yield = Harvest index · Biomass

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

On:
- yield;
- water balance;
- …



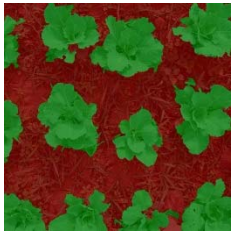
2.ii Crop input

- canopy cover -

1

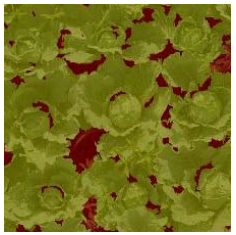
Overhead pictures

08%



44%

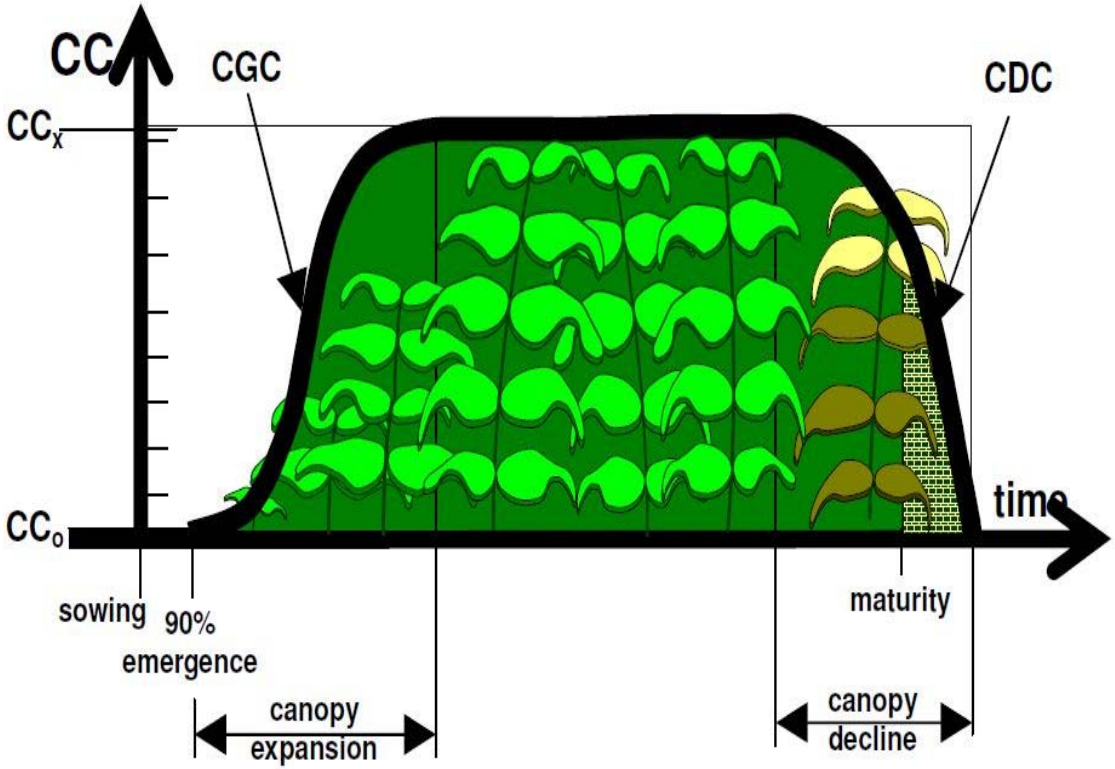
85%



88%

2

Canopy cover (eCognition)



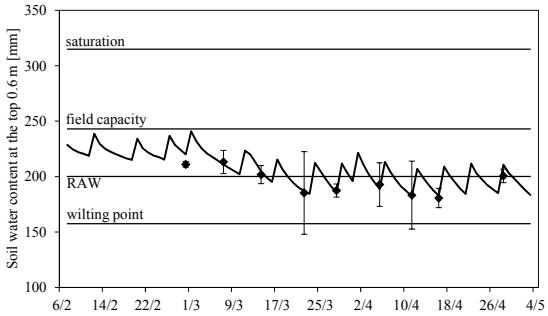
3

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

2.iii Results

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

Observed vs. simulated soil moisture:



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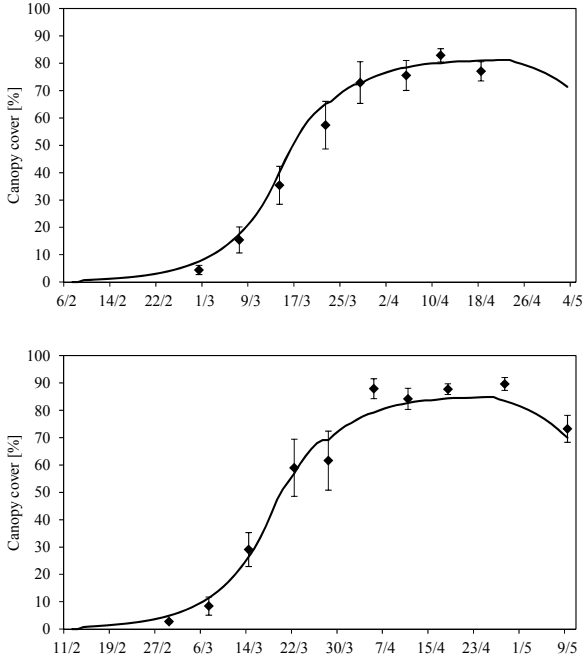
Observed vs. simulated canopy growth cover:



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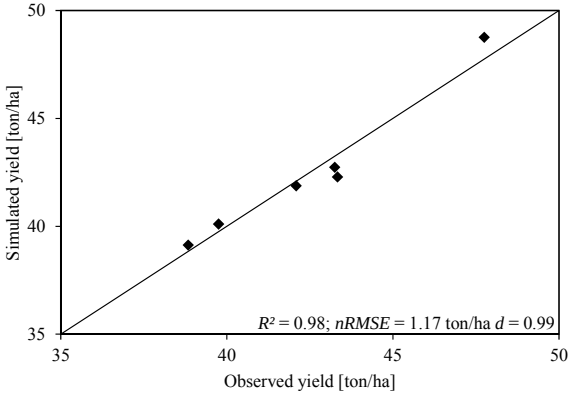
Observed vs. simulated yield:



1

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

2

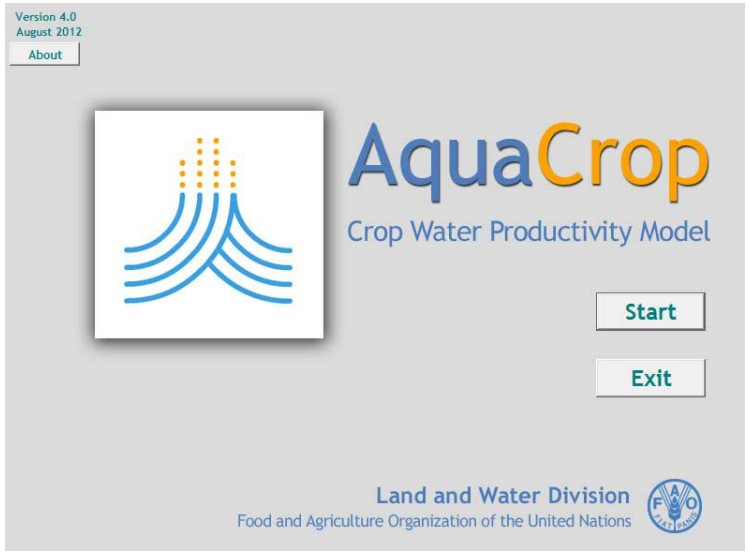
Canopy cover:
- growth & decline coef.;
- plant densities;
- …

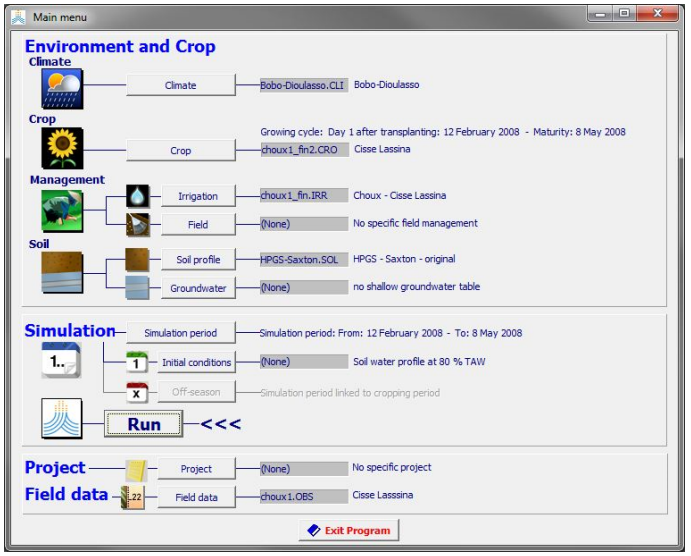
3

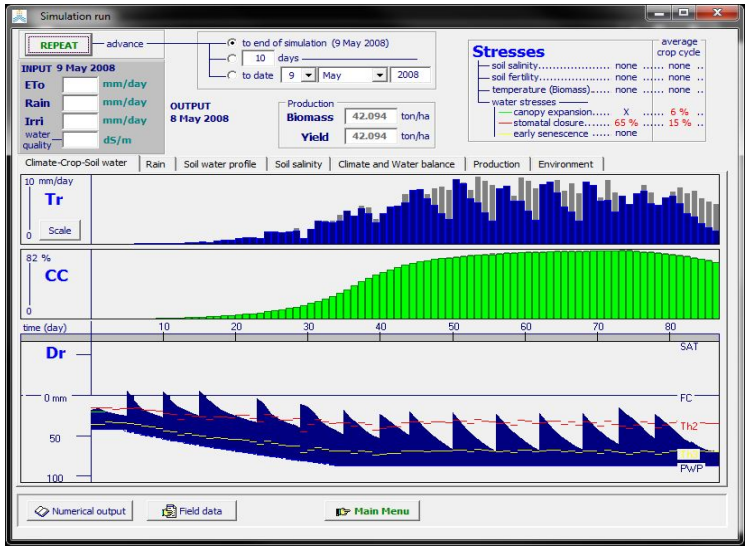
Yield:
- water productivity;
- harvest index.

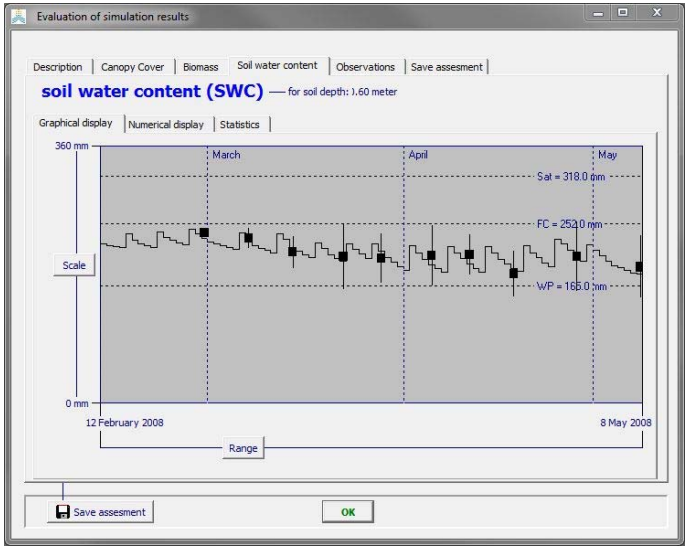
... AquaCrop

- user friendly -



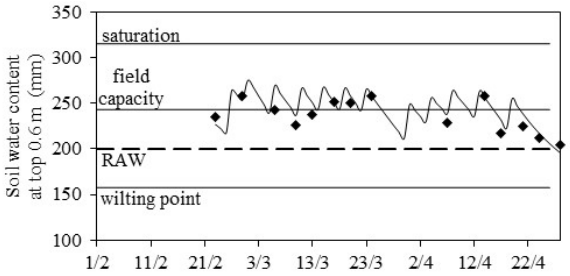






2.iv Application

- irrigation guidelines -



①

Inefficient irrigation,
percolation losses.

Irrigation: 555 mm
Drained: 76 mm
Yield: 52 ton/ha

Irrigation guidelines for:

Cabbage:

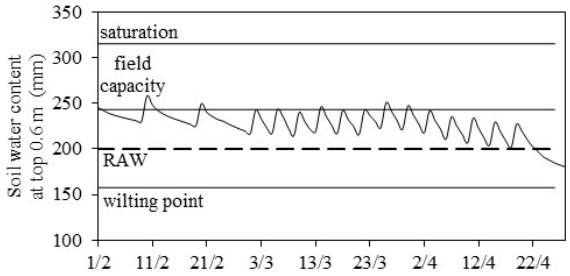
Soil type: clayish alluvial soil
Irrigation application gross depth: 35 mm

month	February			March			April		
decade	1	2	3	1	2	3	1	2	3
interval	10 days			4 days					
	transplanting								harvest
crop stage	initial			canopy development			mid		late

: irrigation dose for field preparation
0.6 field application efficiency (Bos and Nugteren, 1990)

②

Irrigation guidelines chart



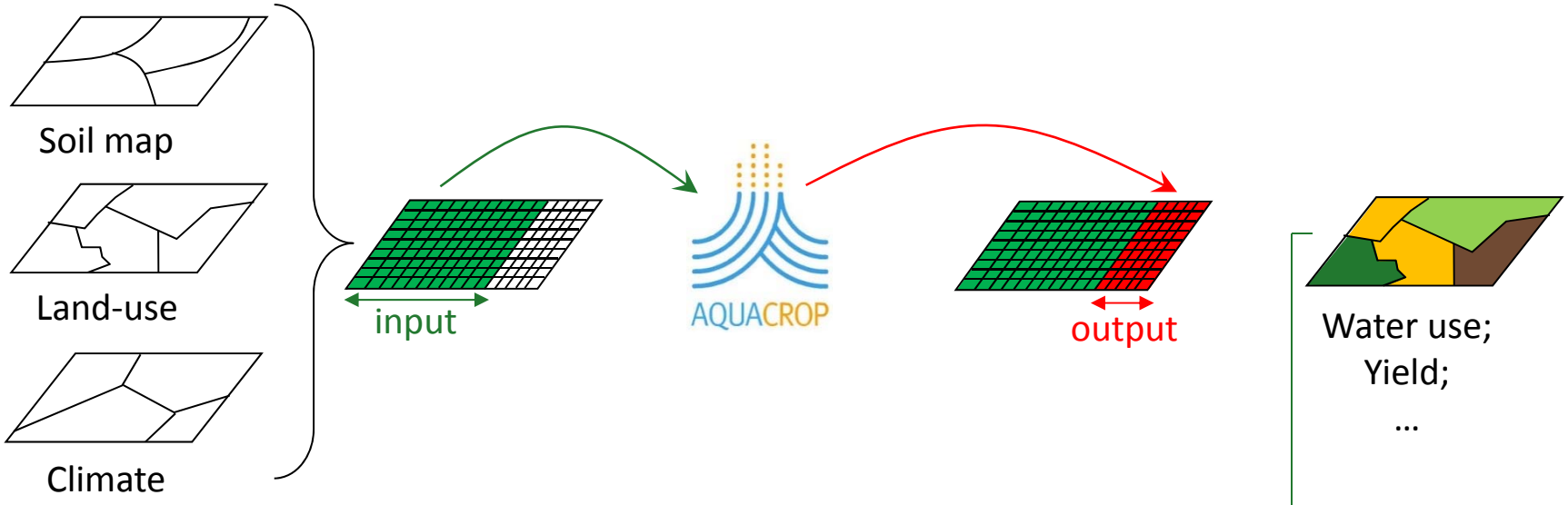
③

Efficient irrigation,
No losses,
Optimal yield.

Irrigation: 455 mm (-18%)
Drained: 1 mm
Yield: 53 ton/ha

3.i Model coupling

- ‘accompanying’ studies -

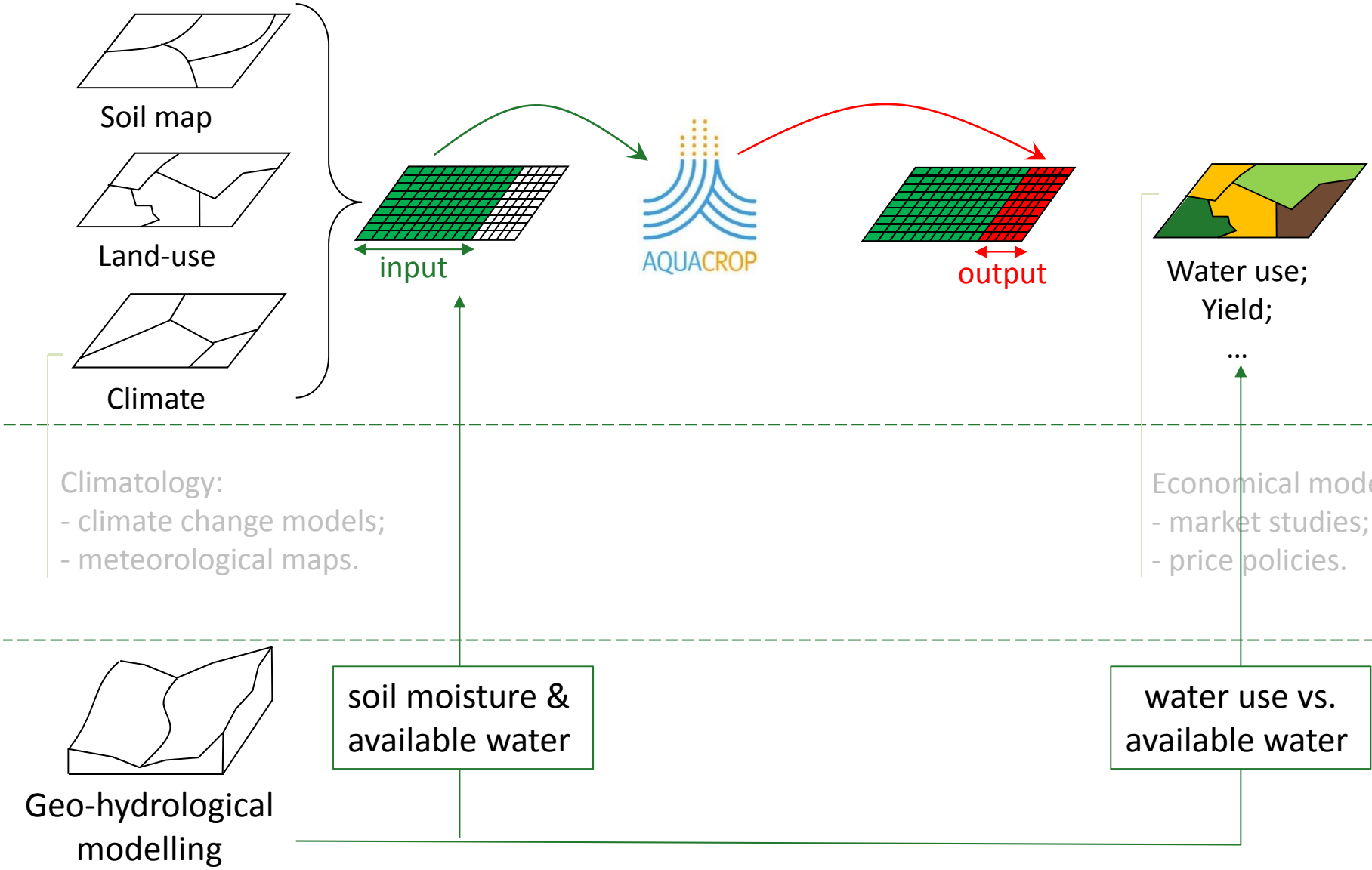


Climatology:
- climate change models;
- meteorological maps.

Economical models:
- market studies;
- price policies.

3.ii Model coupling

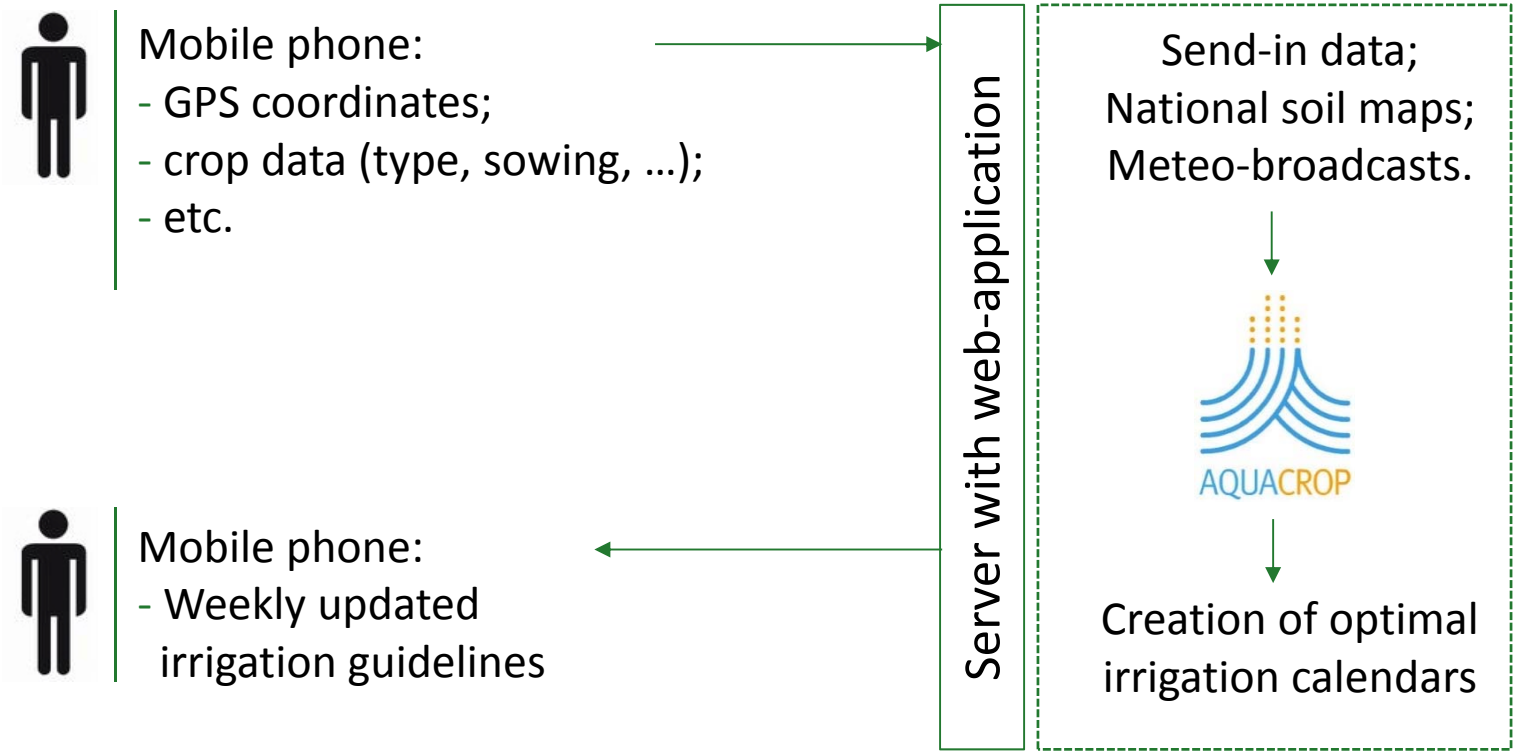
- ‘accompanying’ studies -



... 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!