Water–food–energy nexus and water conservation: down to Earth

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The water–food–energy (WFE) nexus has become in an standard conceptual tool to analyse and communicate complex systems interactions and dependences among its elements.

Management - how we adapt what we planned- not included in analyses and critics of public policy.

Management

Water conservation moves trough the whole cycle

Atmosphere

Plant

Soil

Solar radiation

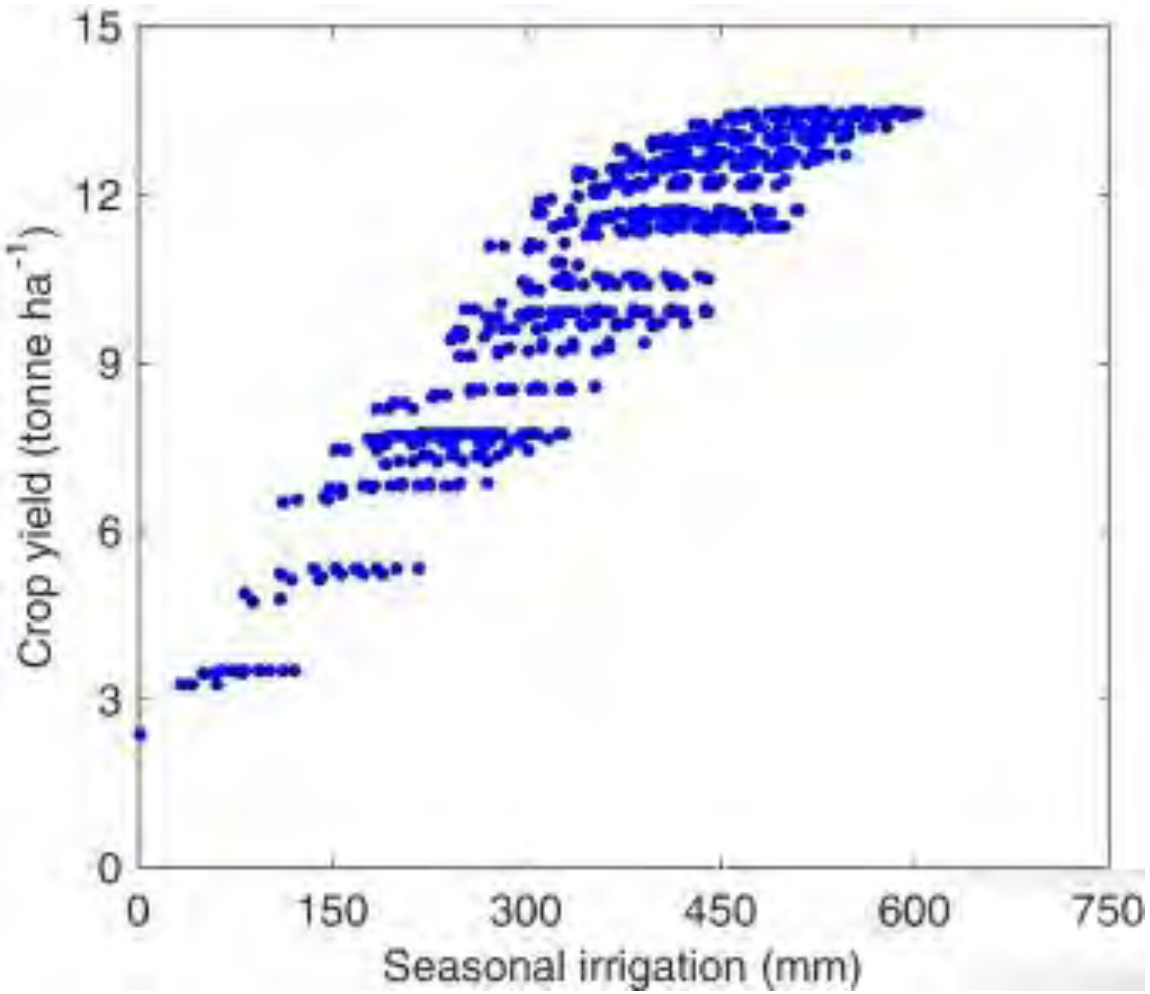
Rainfall

Transpiration → Yield

Evaporation

Irrigation

Percolation

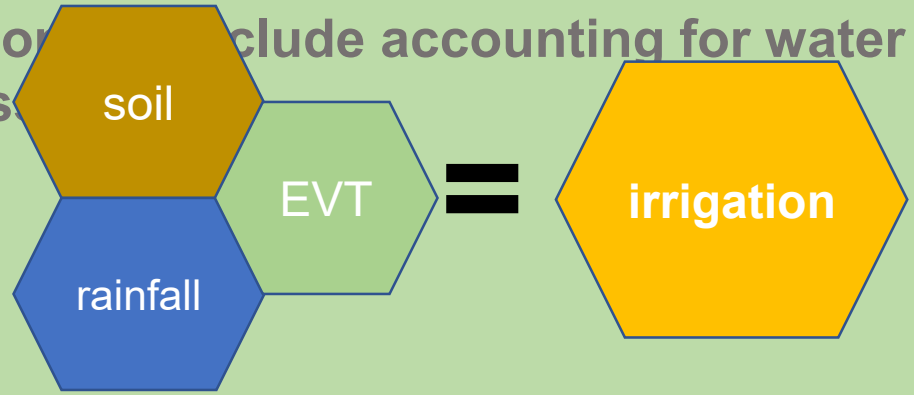


Foster et al. (2017). AquaCrop-OS: An open source version of FAO's crop water productivity model. *Agricultural Water Management*, *181*, 18-22.

Different irrigation strategies lead to different yields

How to maximize yield while minimizing resources

Best o clude accounting for water balance acros



Forecast, monitoring, data science

Effects on costs and profits: energy

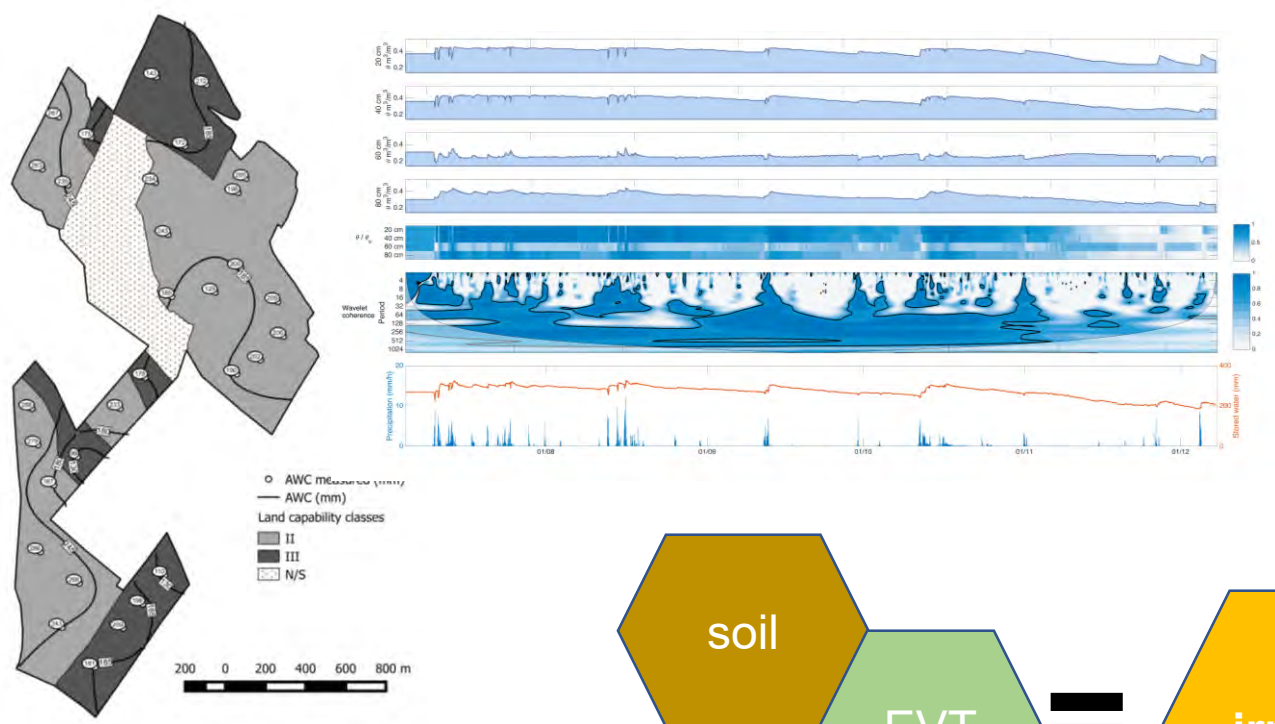
Adaptation to climate change and climate variability

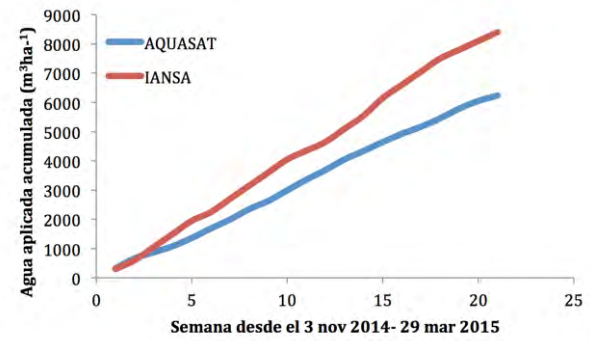
Preceding analyses relies on:

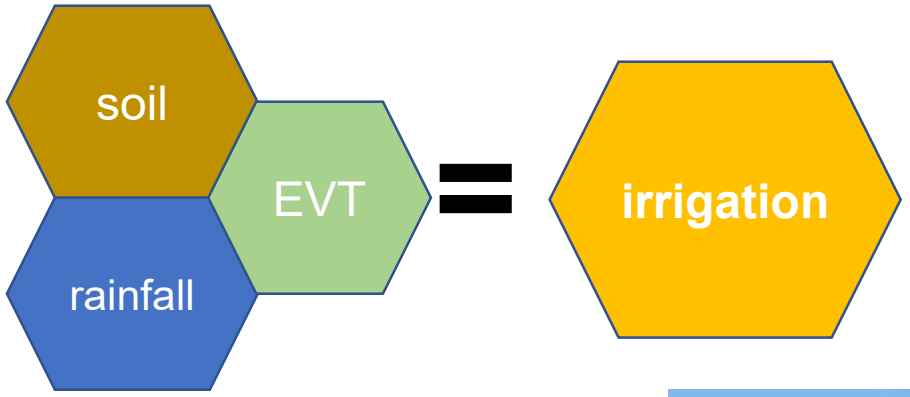
- A single, lumped well-behaved agricultural system
- Static -in time and space- processes and parameters
- Dense and reliable field samples (if you are lucky and rich¡)
- Dense and reliable monitoring networks
- Well-trained operators
- Goog desings

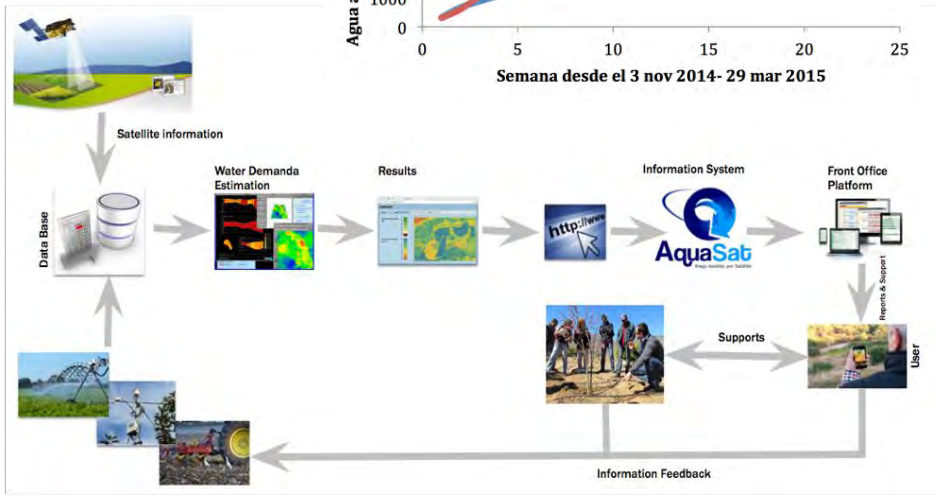
But, one would like to have:

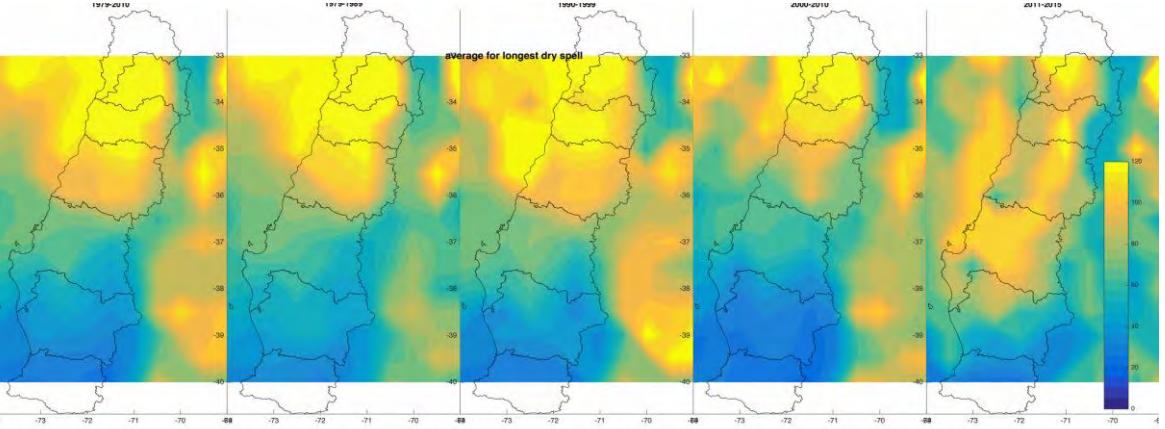
- Denser, reliable and **updated** field **information** for management
- Sensor, actuators and rules for operation
- Avoid operational issues by implementing automatic systems
- Information¡

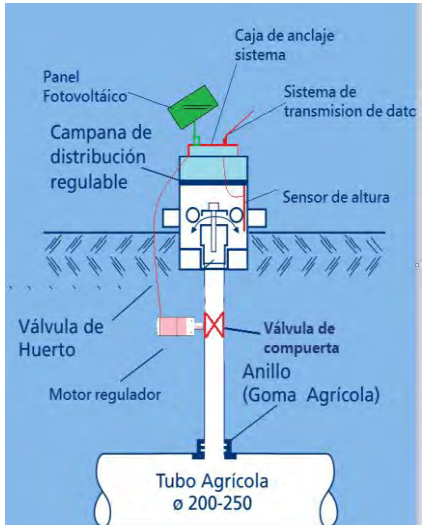

AWC (mm)
Land capability classes
II
III
N/S
200 0 200 400 600 800 m

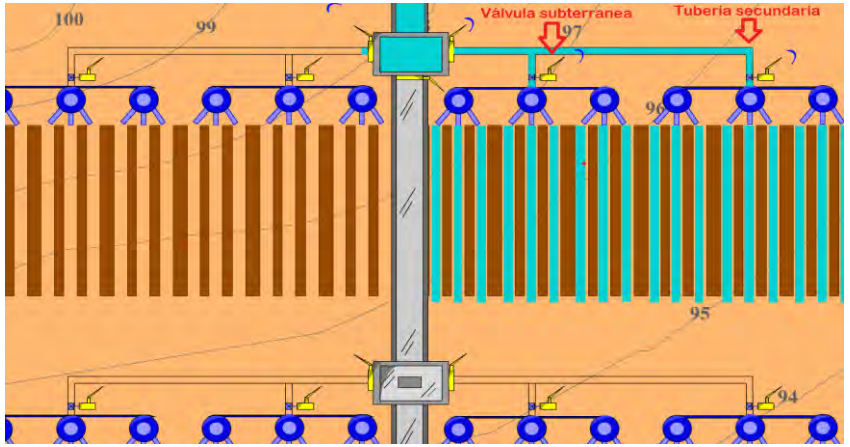

AQUASAT
IANSA
Agua aplicada acumulada (m³ha⁻¹)
Semana desde el 3 nov 2014- 29 mar 2015


soil
EVT
rainfall
=
irrigation


Satellite information
Data Base
Water Demanda Estimation
Results
Information System
AquaSat
Front Office Platform
Supports
User
Information Feedback


average for longest dry spell

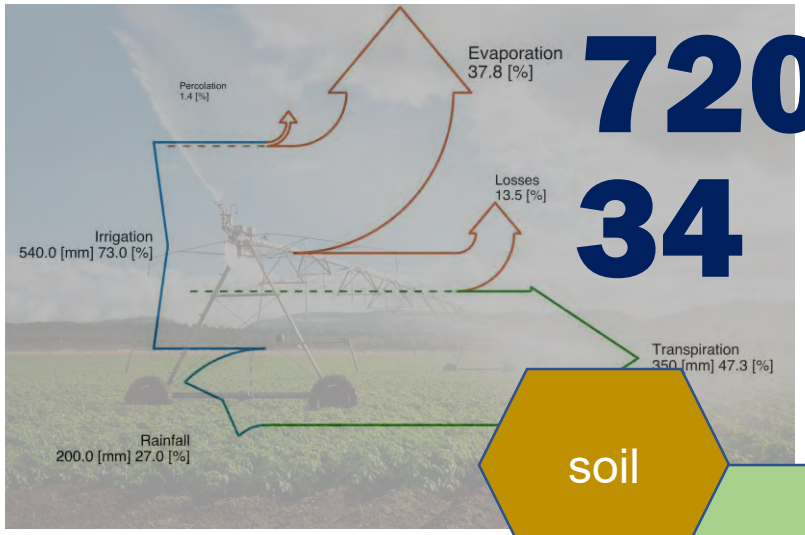

Caja de anclaje sistema
Panel Fotovoltáico
Sistema de transmision de datc
Campana de distribución regulable
Sensor de altura
Válvula de Huerto
Válvula de compuerta
Motor regulador
Anillo (Goma Agrícola)
Tubo Agrícola ø 200-250


Válvula subterránea
Tubería secundaria
100
99
97
96
95
94

presurized

furrow

90 % efficiency



720 L/kg

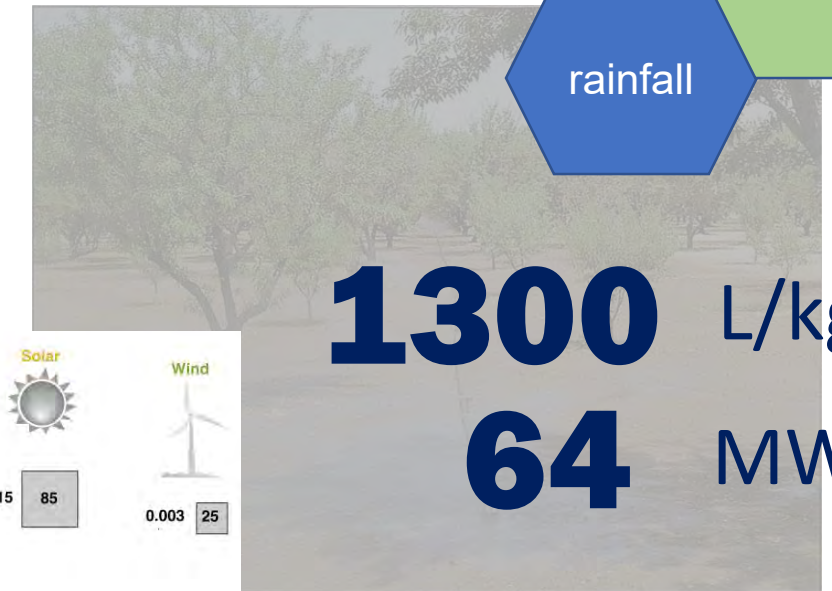
34 MWh

soil + EVT + rainfall = irrigation

720 L/kg

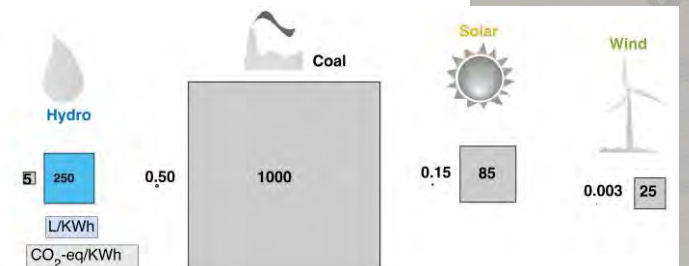
0 MWh

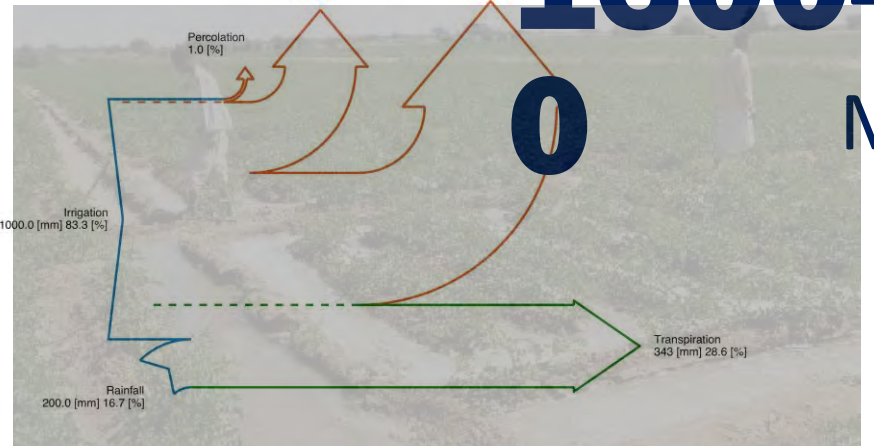
40 % efficiency



1300 L/kg

64 MWh





1300 L/kg

0 MWh

Concluding remarks:

- We do need data infrastructure.
- Avoid old-paradigms.
- Include Life Cycle Assessment approaches.