EO-based Water Management in Agriculture: From Innovation to Practice

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EO-Based Water Management in Agriculture: From Innovation to Practice

1- La Mancha Oriental: A successful groundwater management model for agriculture

2- Irrimaps: EO-assisted irrigation scheduling & advisory

3- Water footprint for Hydrological Planning

Projects ERMOT, DEMETER, PLEIADeS, SIRIUS, DIANA, FATIMA, COALA, REXUS..
AQUIFER IRRIGATION MANAGEMENT & GOVERNANCE (ERMOT)

La Mancha Oriental, Júcar River Basin, SouthEast of Spain
Water management in Mancha Oriental. Júcar River Basin, Spain

Key data
- 120,000 ha of irrigated land (2022)
- 12,000 farmers
- 10,000 groundwater wells
- 275,000 population
- Semiarid conditions (350 mm/year)
- Irrigation represents 20-30% of GDM (main pillar of local economy), fix population and stimulates associated industries (agroindustry,...)

Multiple pressures:
- Imbalance of water abstraction and recharge (90% of water used for irrigation)
- Competition between regions (Valencia, Turia, Albufera, Vinalopó ...)
- Additional environmental impacts due to decreasing groundwater levels
EO & ICT tools for innovating groundwater management

ERMOT since 1996

Information

Communication

Transparency

Junta Central de Regantes Mancha Oriental
EO & ICT tools for innovating groundwater management

“connecting Heaven....

....and Earth”
The water management model implemented in La Mancha Oriental has proven to be effective:

- Compliance with the Annual Cultivation Plan through identification of irrigated areas and estimation of water abstraction: In La Mancha Oriental there are no irrigated areas without water rights
- Groundwater extraction was stabilized.
- An acceptable level of farm income is maintained.
Groundwater consumption in La Mancha Oriental

- Average last 10 years: 290 hm³
- Average last 20 years: 321 hm³
- Groundwater abstraction stabilized.
Enforcement of Annual Exploitation Plan.

- Irrigation Jury for sanctioning exceeding authorized water abstraction

**EVIDENCE FOR IRRIGATION JURY: TIME SERIES OF SENTINEL2**

- Lettuce 3 cycles: 7500 m³/ha
- Lettuce 2 cycles: 5000 m³/ha
- Lettuce, 1 cycles: 2500 m³/ha

The irrigation jury holds a hearing.
Enforcement of Annual Cultivation Plan.

- Irrigation Jury for sanctioning exceeding authorized water abstraction
Managing agriculture's impact on water resources

Key elements

- Tech tools and best scientific knowledge for full enforcement of the Annual Cultivation Plan:
  - Identification and Monitoring of irrigated areas
  - Determination of Water Applied for Irrigation, at right scales
- Well established Water Rights, linked to a delimited land
- Proportionate sanctions in case of infractions (additional benefits if the sanction include water returns)

*Technology is not enough:*

Co-governance of self-organized farmers with water authority is required

Proper administration and management structures

Political will
For more than 25 years, the Júcar River Basin Authority, the Central Irrigation Board of Eastern La Mancha, the University of Castilla La Mancha, and currently AgriSat, have worked together within the framework of the ERMOT project, to assign water rights and for the monitoring of irrigated areas using remote sensing techniques.

The authors express their gratitude for the multiple contributions of people and institutions that make up this presentation. Explicitly mention:

- Junta Central de Regantes de la Mancha Orienta, JCRMO Central Irrigation Board of Eastern La Mancha
- Confederación Hidrográfica del Júcar. MITECO Júcar River Basin Authority
- AgriSat & UCLM
IRRIGATION SCHEDULING & ADVISORY

ADAPT IRRIGATION TO REALITY OF YOUR PLOTS

Now, thanks to satellite remote sensing, you can know the water requirements of your crops, one week in advance, for each sector or irrigation unit, and thus plan the irrigation in the most accurate way possible.

Weekly maps with the water requirements of your crops so you can plan your irrigation better.

OBSERVACIONES:
Sin comentarios

https://irrimaps.com/
WATER ACCOUNTING & FOOTPRINT (REXUS)

Remote Sensing based Water Accounting and Footprint:
- Spatial Extent: Júcar River Basin (42,735 km²)
- Time period: years 2017 (dry) & 2020 (humid)
- Satellite: Sentinel – 2 A&B (spatial resolution 10x10m)
- Water Accounting products: CWU_{blue} & CWU_{green}
- Water Footprint products: WF_{green}, WF_{blue} & WF_{agr}

Setting goals and scope → Water accounting & associated footprint → Water footprint sustainable assessment → Water footprint response formulation

**Agricultural Water Footprint satellite assisted**

\[ WF_{proc} = WF_{proc,green} + WF_{proc,blue} + WF_{proc,grey} \]  [volume/mass]

**Water accounting**

\[ CWU = 10 \times \sum_{d=1}^{lgp} ET \]  [volume/area]

**Associated water footprint**

\[ WF_{proc} = \frac{CWU}{Y} \]  [volume/mass]

Remote Sensing assisted
The Remote Sensing-based Agricultural Water Accounting and Footprint

The use of dense NDVI satellite image time series (Copernicus and Landsat) show an adequate spatio-temporal scale for crop monitoring and water accounting.

Remote Sensing-based Soil Water Balance (RS-SWB) based on FAO56 allows to map at plot scale the Crop Water Use (green & blue) in agricultural crops.

RS-SWB combined with Water Footprint international standard allows to map the Agricultural Water Footprint (green & blue).
Thank you!

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