EUROGEO WORKSHOP 2023

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

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eurac research

Institute of Atmospheric Pollution Research
National Research Council of Italy

European Commission

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

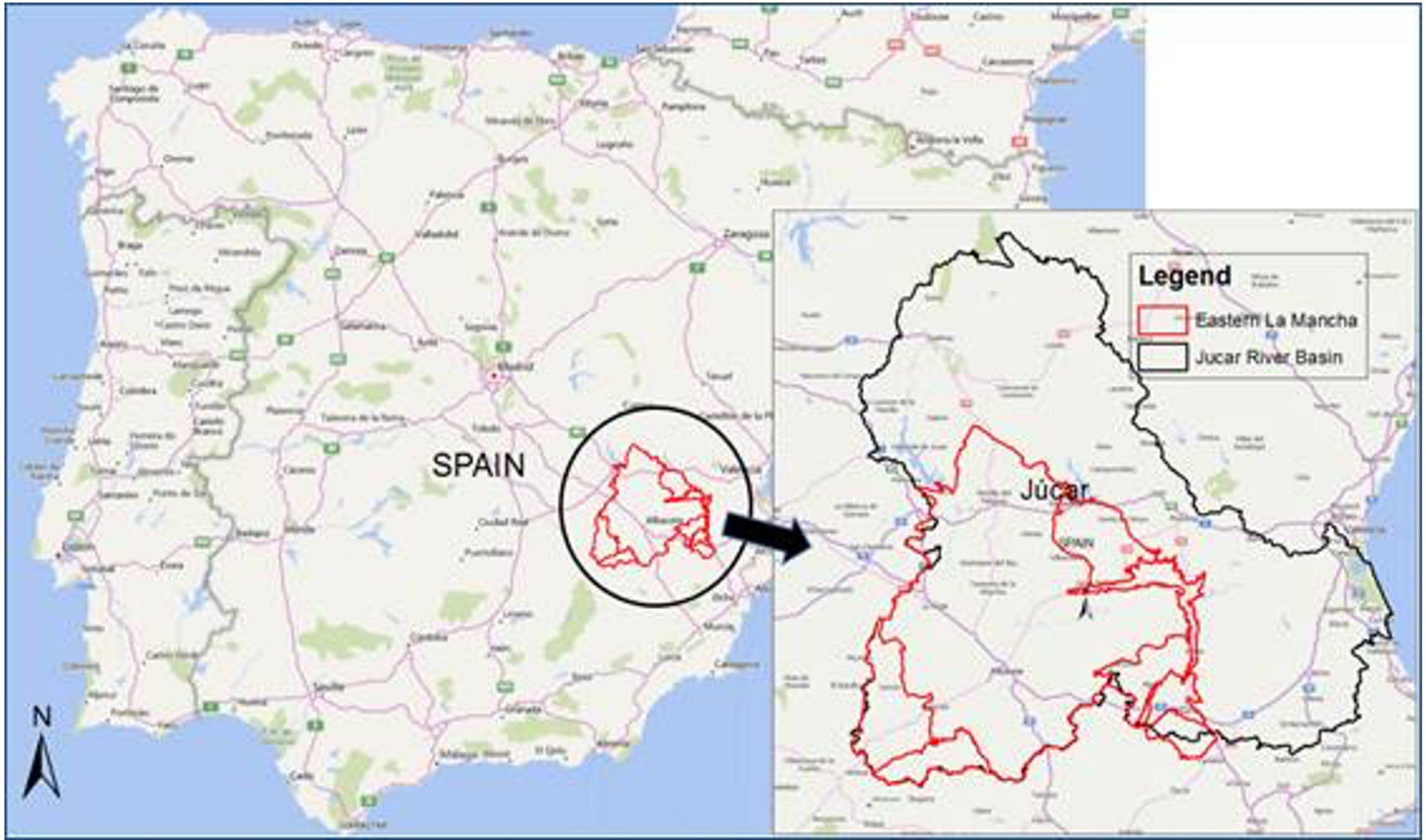
1- La Mancha Oriental: A successful groundwater management model for agriculture

2- Irrimaps: EO-assisted irrigation scheduling & advisory

3- Water footprint for Hydrological Planning

Projects ERMOT, DEMETER, PLEIADeS, SIRIUS, DIANA, FATIMA, COALA, REXUS..

La Mancha Oriental, Júcar River Basin, SouthEast of Spain



Water management in Mancha Oriental. Júcar River Basin, Spain

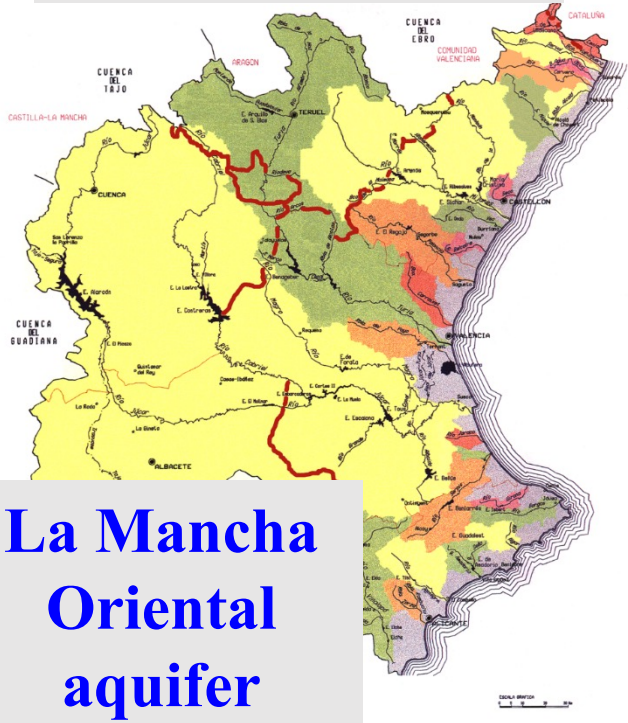
Key data

- 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:

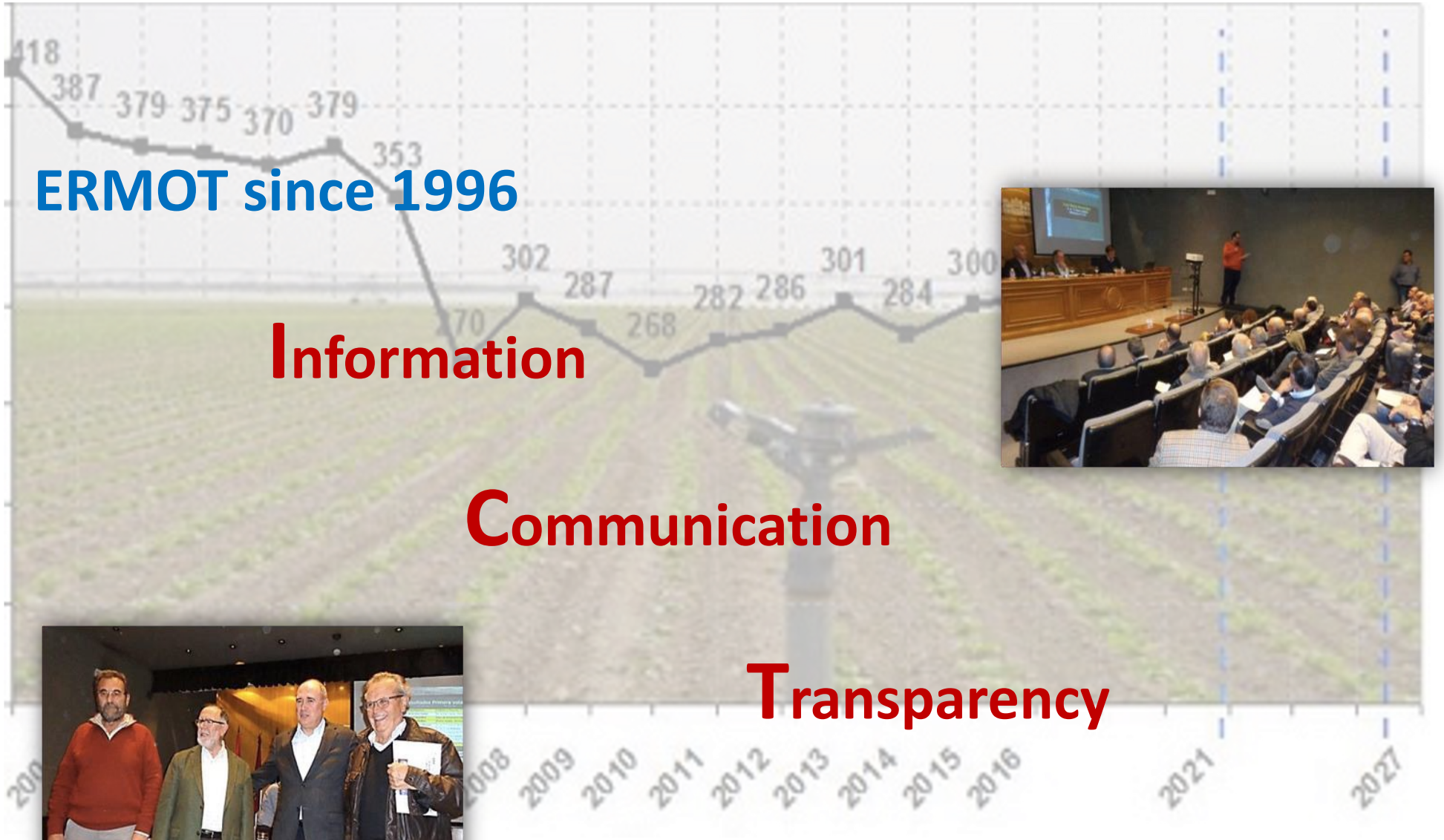
- ➢ Imbalance of water abstraction and recharge (90% of water used for irrigation)
- ➢ Competition between regions (Valencia, Turia, Albufera, Vinalopó …)
- ➢ Additional environmental impacts due to decreasing groundwater levels

Júcar river basin



La Mancha Oriental aquifer

EO & ICT tools for innovating groundwater management



ERMOT since 1996

Information

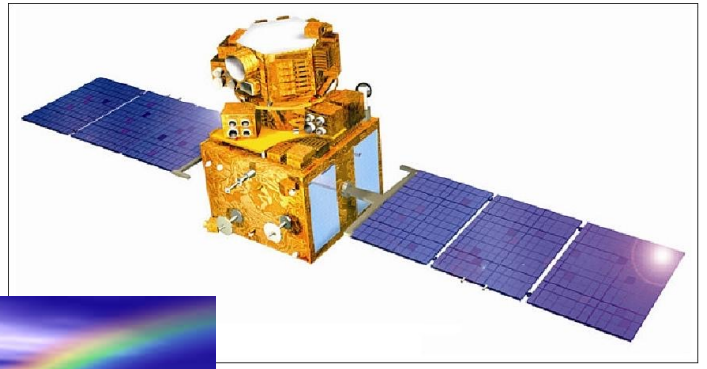
Communication

Transparency

Junta Central de Regantes Mancha Oriental

EO & ICT tools for innovating groundwater management

"connecting Heaven….



….and Earth"

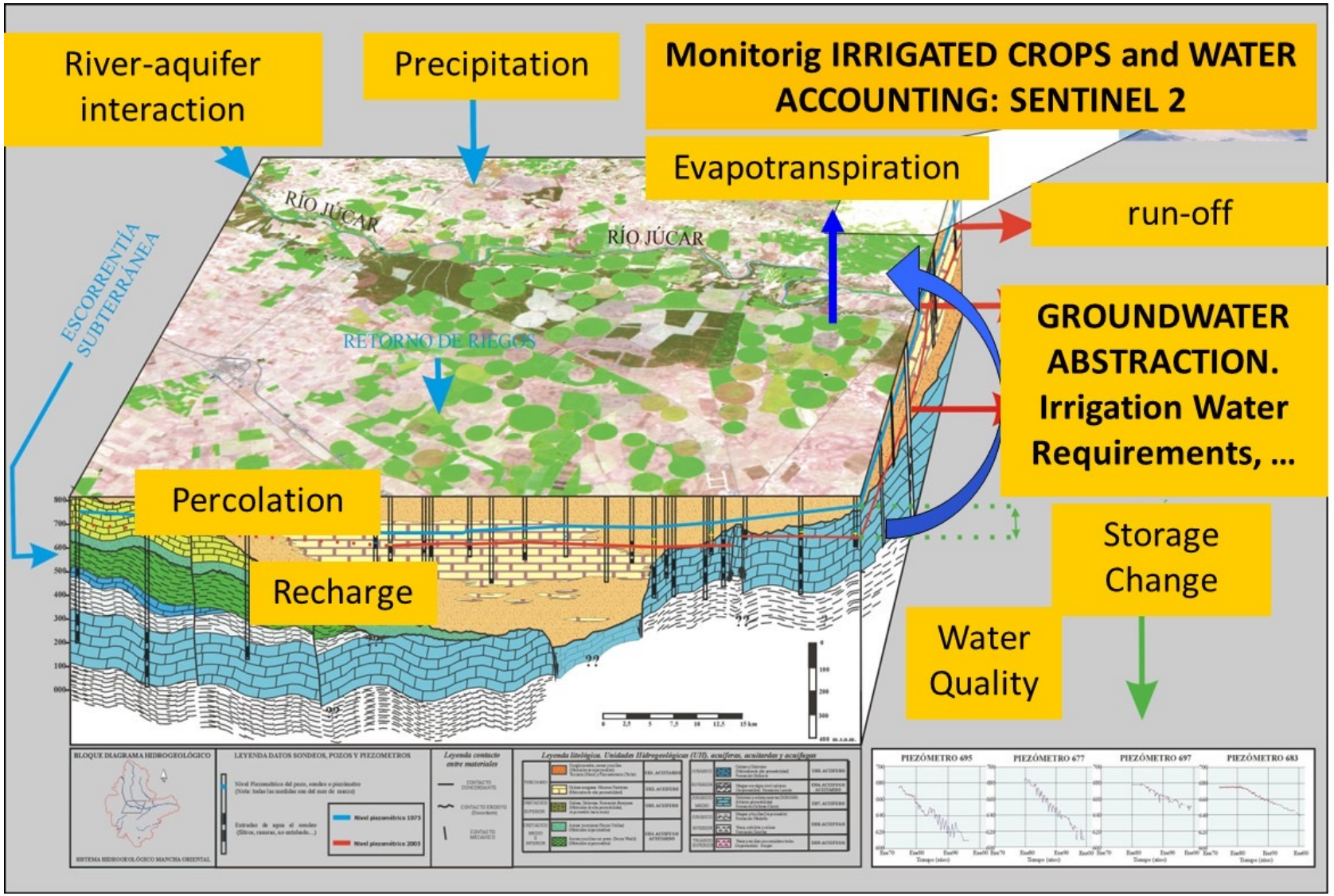
DIANA

FATIMA

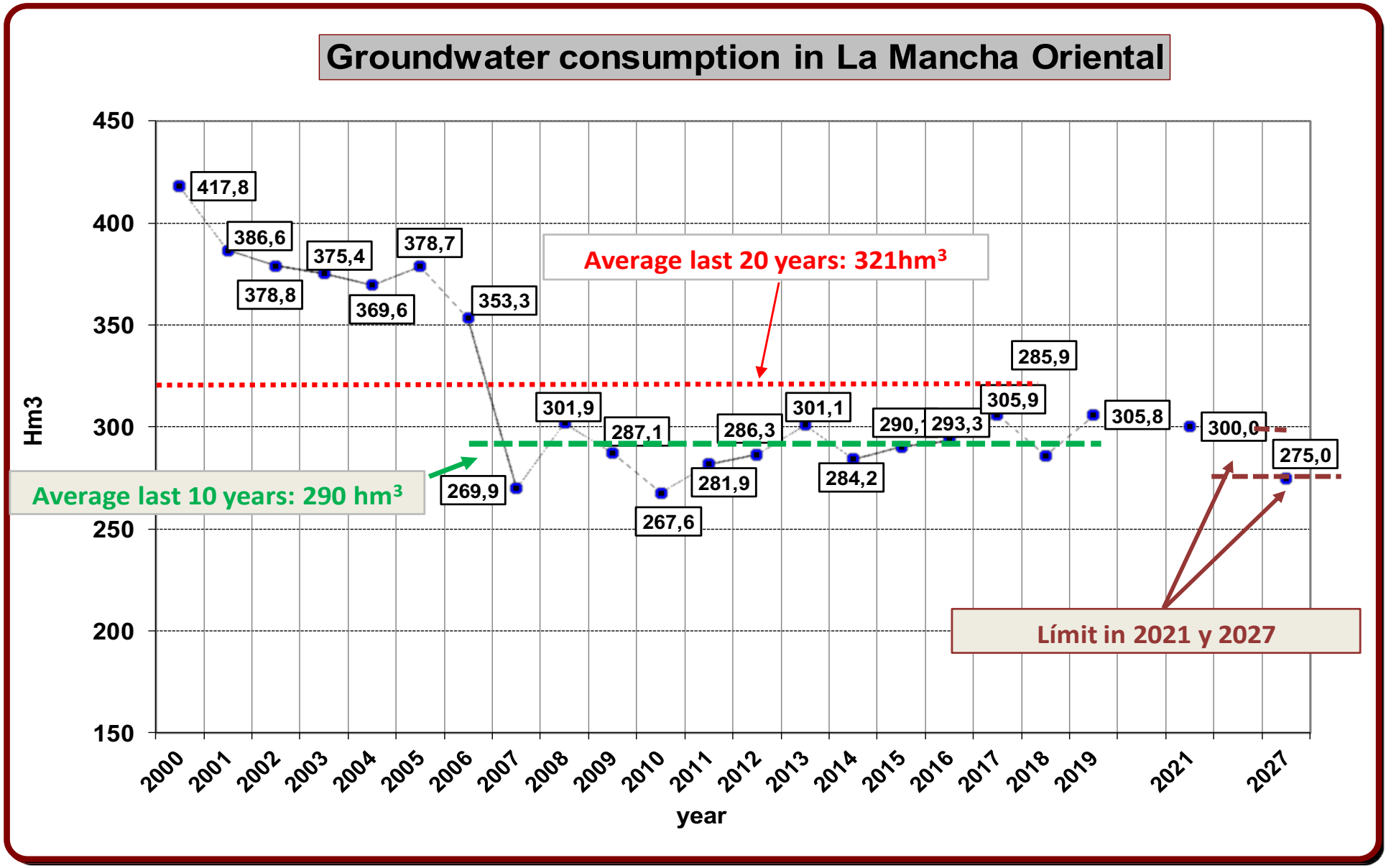
Water management in the Mancha Oriental: A success case

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 abstraction stabilized.

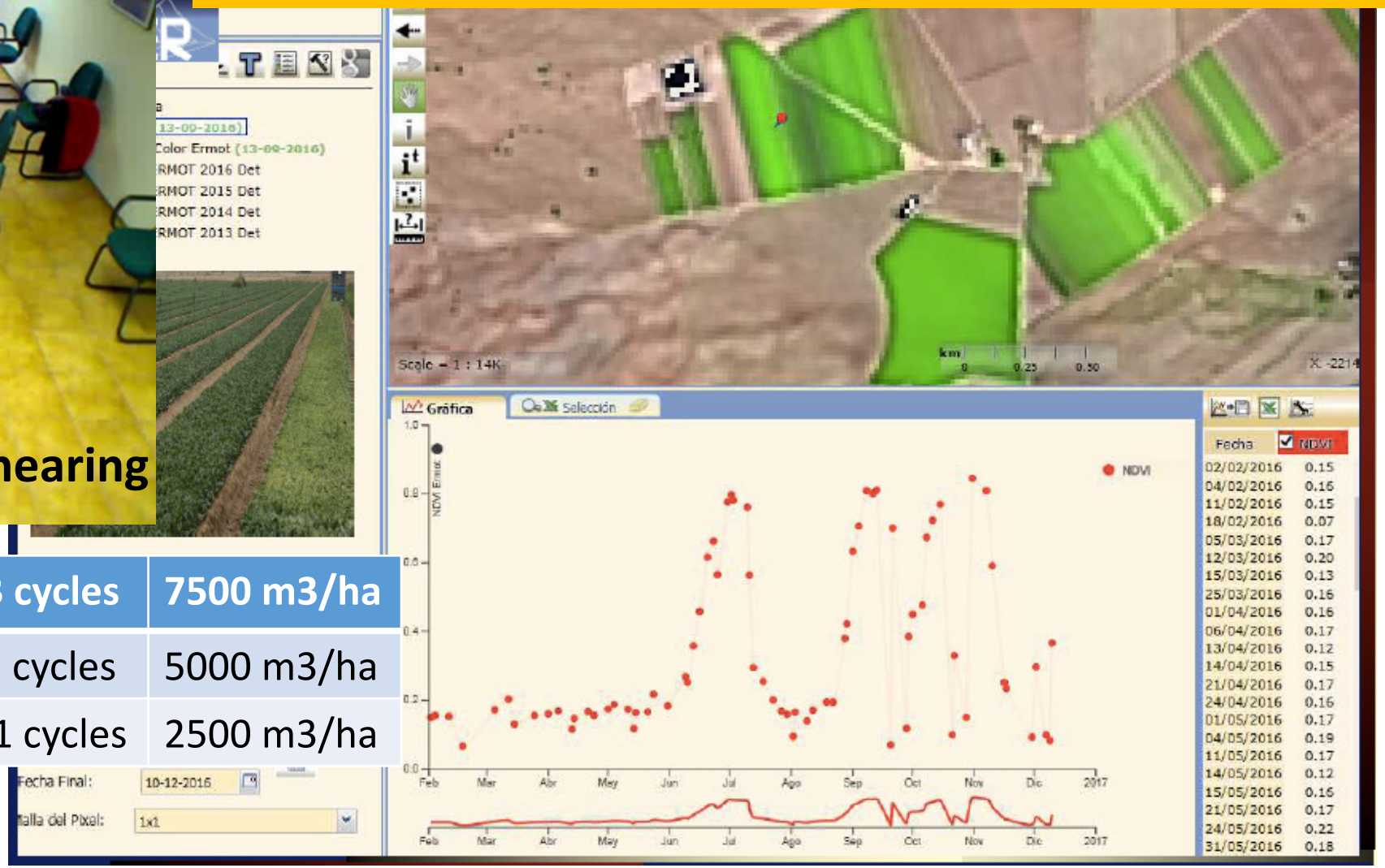


Enforcement of Annual Exploitation Plan.

➢ Irrigation Jury for sanctioning exceeding authorized water abstraction

The irrigation jury holds a hearing

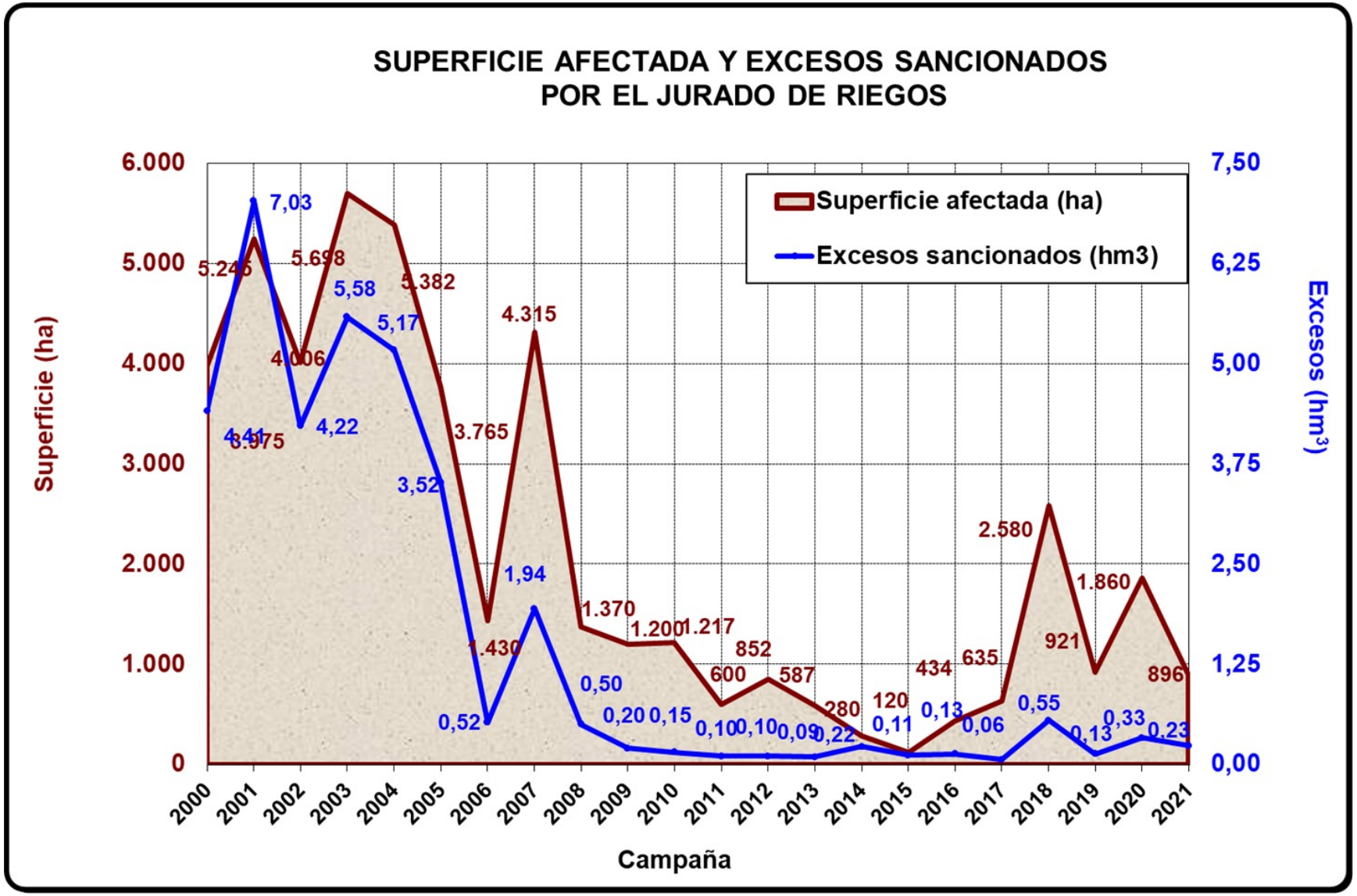
EVIDENCE FOR IRRIGATION JURY: TIME SERIES OF SENTINEL2



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

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, l**inked 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

The authors expresses 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

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.

GOBIERNO DE ESPAÑA
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO

C[redacted]H[redacted]A.

agriSat Iberia, S.L.

JUNTA CENTRAL DE REGANTES DE LA MANCHA ORIENTAL

UCLM
CAMPUS DE EXCELENCIA INTERNACIONAL

Universidad de Castilla-La Mancha

Teledetección y SIG
Instituto de Desarrollo Regional
Universidad Castilla-La Mancha

IRRIGATION SCHEDULING & ADVISORY

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Riego eficiente
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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

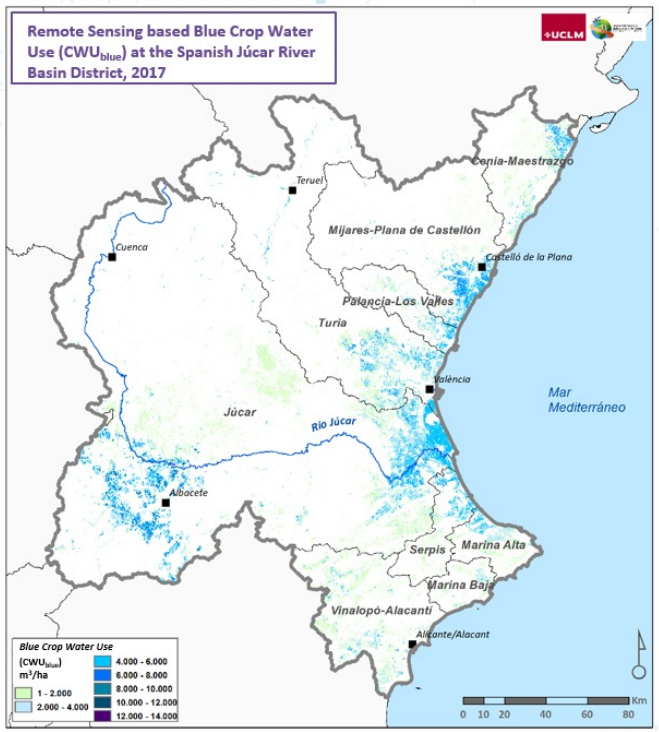
Predicción de Necesidades Hídricas Netas (mm)
24 marzo 2022 - 30 marzo 2022
La Choriza

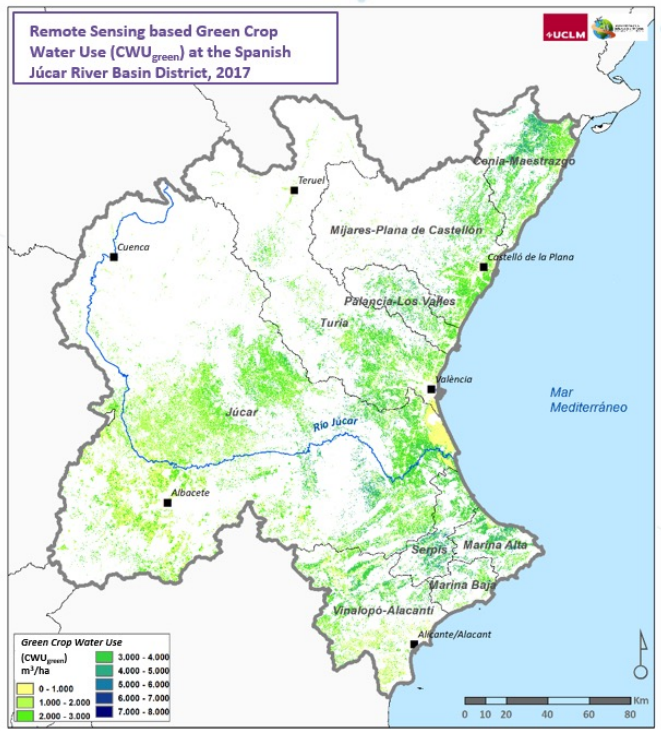
irrimaps® Riego eficiente agriSat Iberia, s.l.

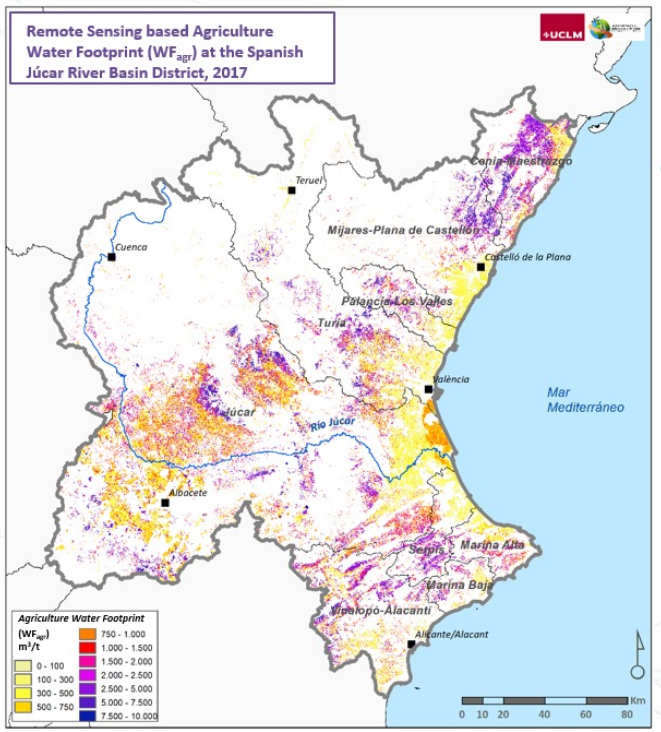
Predicción de la próxima semana en mm
Desviación de la predicción de la semana anterior en (mm)

OBSERVACIONES:
Sin comentarios

WATER ACCOUNTING & FOOTPRINT (REXUS)







Remote Sensing based Water Accounting and Footprint:

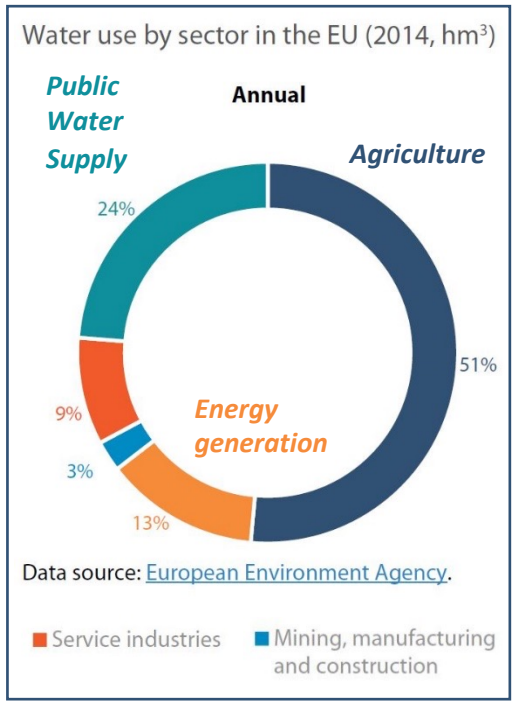
- Spatial Extent: Júcar River Basin (42,735 km²)
- Time period: years 2017 (dry) & 2020 (humid)
- Satellite: Sentinel – 2 A&B (spatial resolution 10x10m)
- Water Accounting products: CWU_{blue} & CWU_{green}
- Water Footprint products: WF_{green}, WF_{blue} & WF_{agr}

https://www.chj.es/es-es/medioambiente/planificacionhidrologica/Documents/Plan-Hidrologico-cuenca-2021-2027/PHC/Documentos/PHJ2227_Anejo03_UsosDemandas_20220329.pdf

Progress – Methodology – Outcomes

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

REXUS Water footprint assessment phases adapted from Hoekstra et al (2011)



Agricultural Water Footprint satellite assisted

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

Water accounting

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

Associated water footprint

$$WF_{proc} = {}^{CWU}/_{Y} \quad \text{[volume/mass]}$$

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)

from Nexus **Thinking** to Nexus **Doing**

REXUS

Thank you!

@rexusproject

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