KU LEUVEN

UPSCALING AQUACROP V7.0 TOWARDS SATELLITE-BASED DATA ASSIMILATION

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Tunis, 12 December 2022

Regional gathering
Tunis, 12 – 16 December 2022

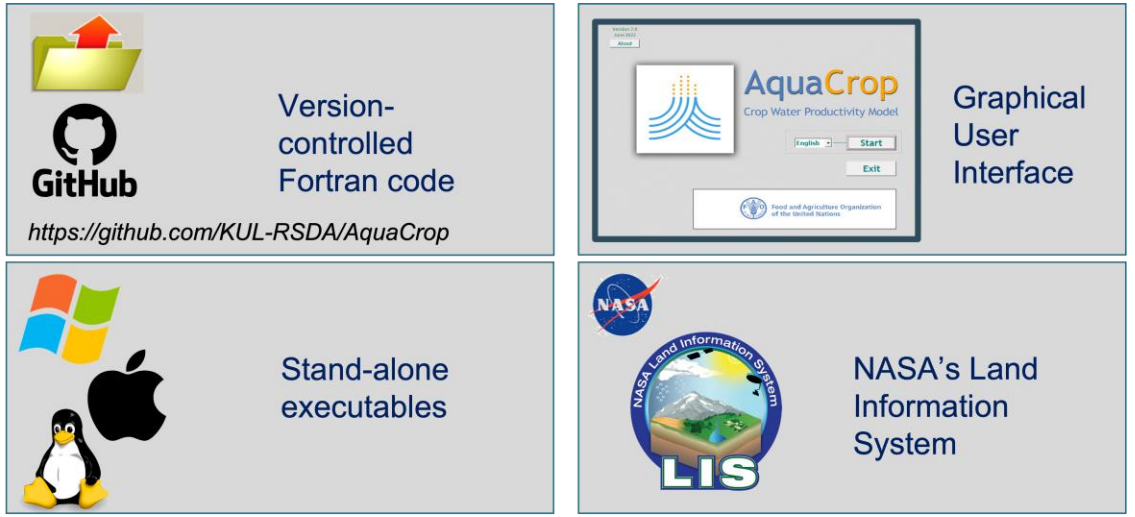
ITALIAN AGENCY FOR DEVELOPMENT COOPERATION

AQUACROP V7.0 IN NASA LIS

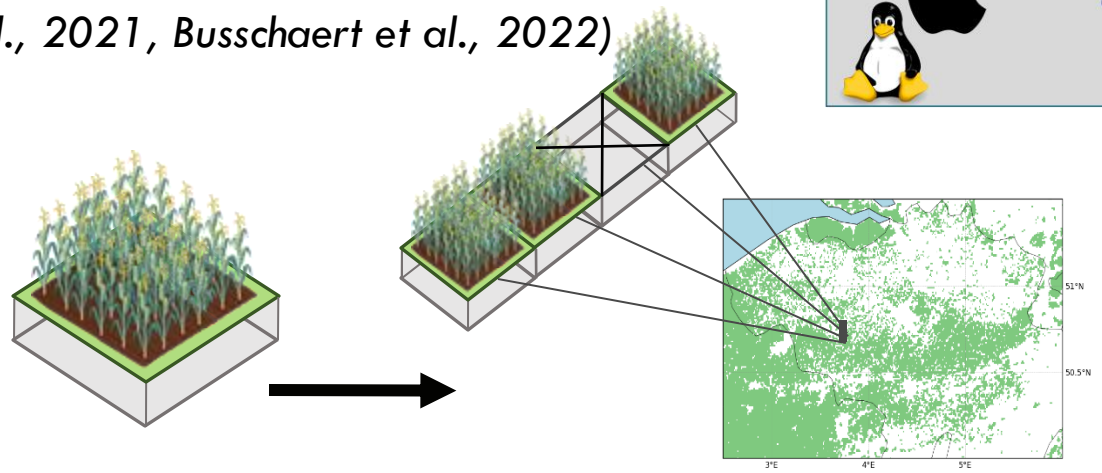
- AquaCrop model: water-driven crop growth (not radiation), robust, agricultural management

- Field to continental scale

  (de Roos et al., 2021, Busschaert et al., 2022)



AQUACROP

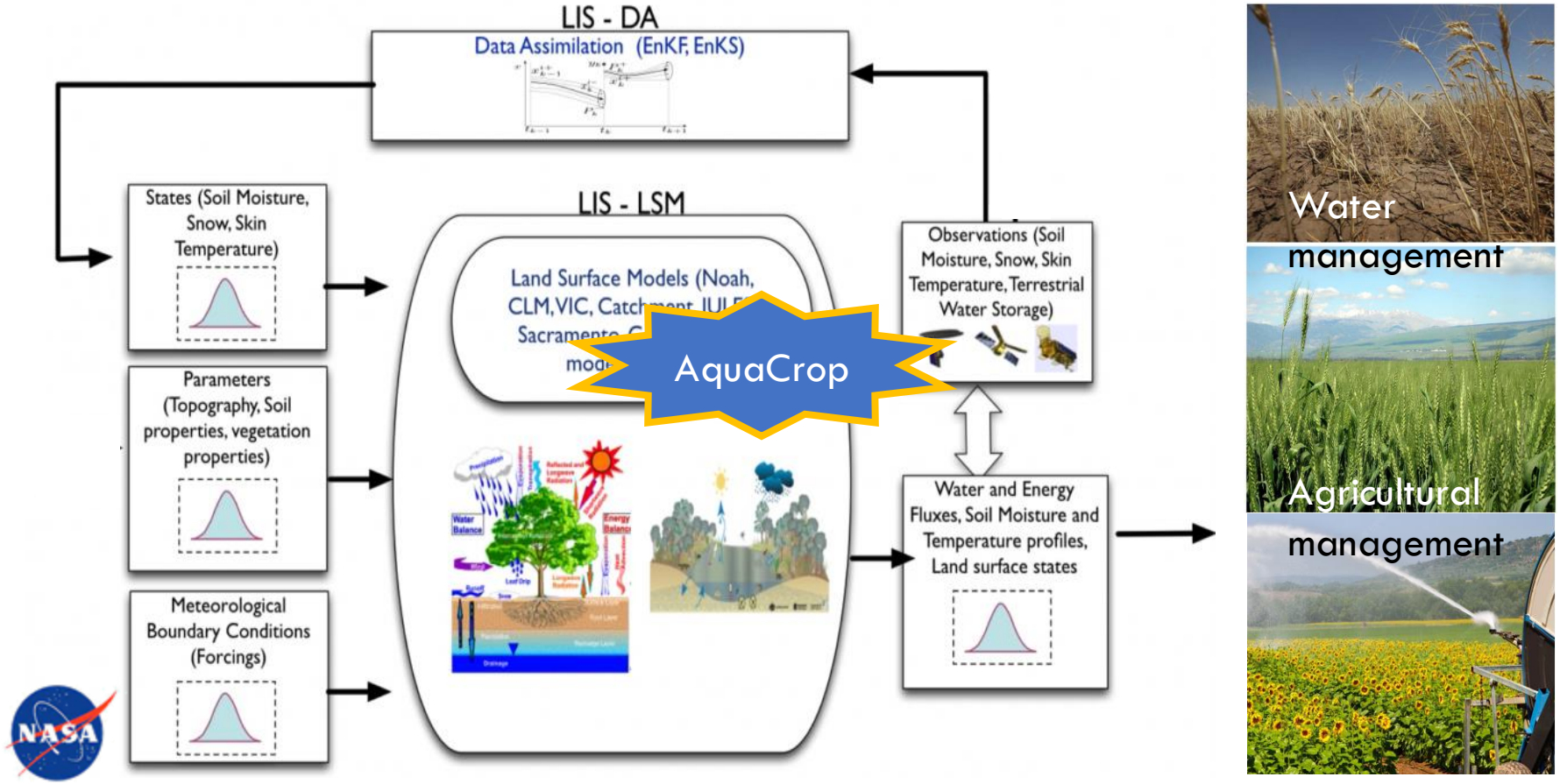


https://www.fao.org/aquacrop/en/

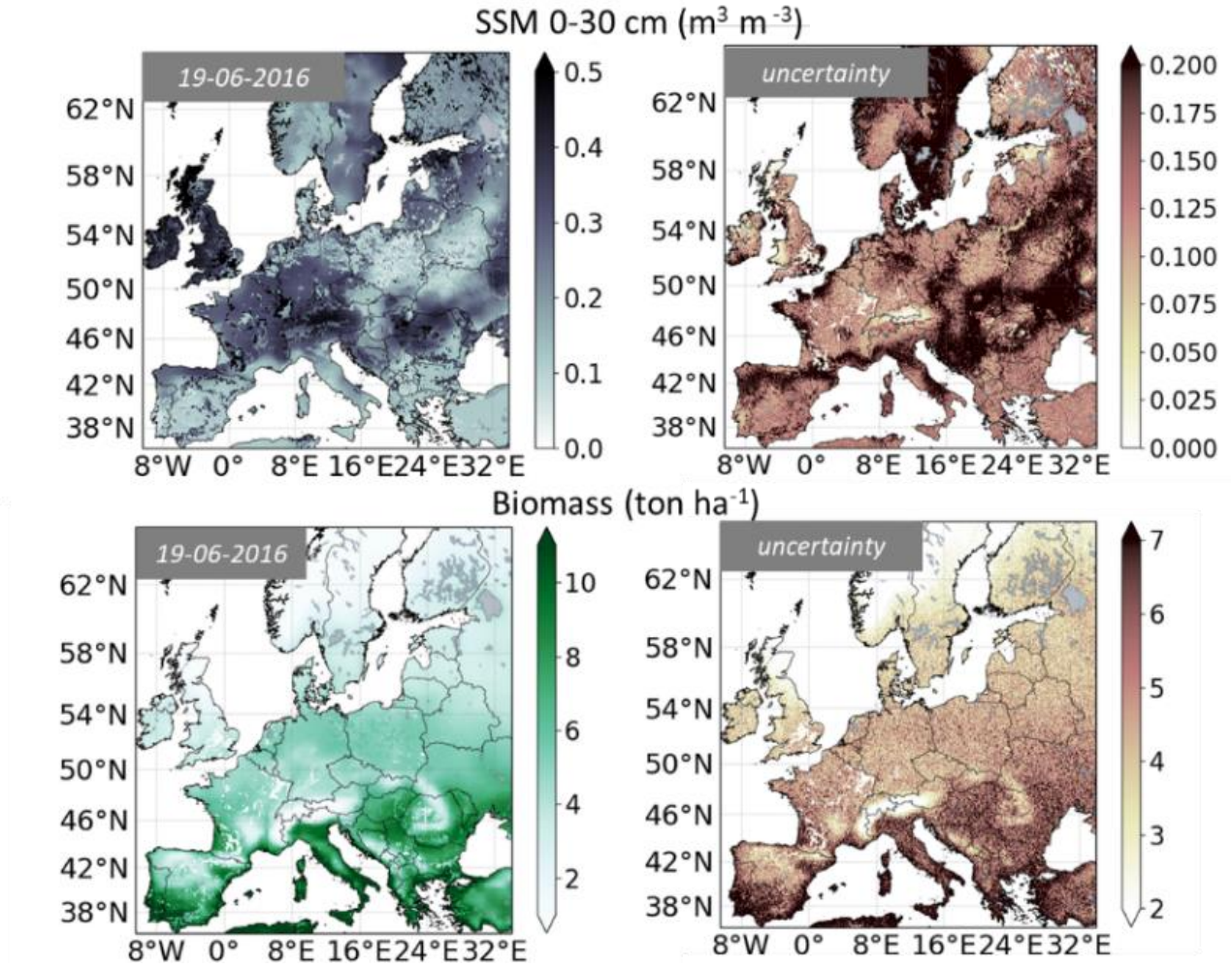
Released open source: Sept 2022

aquacrop@fao.org

AQUACROP V7.0 IN NASA LIS

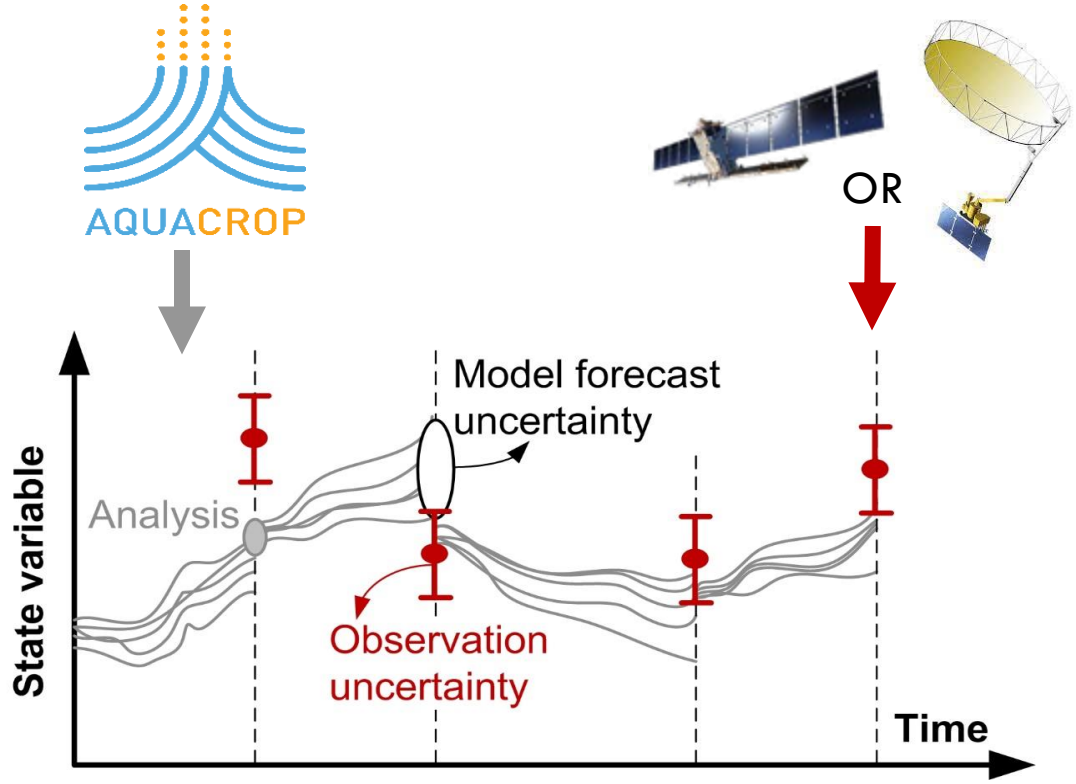


AQUACROP V7.0 IN NASA LIS



The boundaries and names shown and the designations used on these map(s) do not imply the expression of any opinion concerning the delimitation of its frontiers and boundaries.

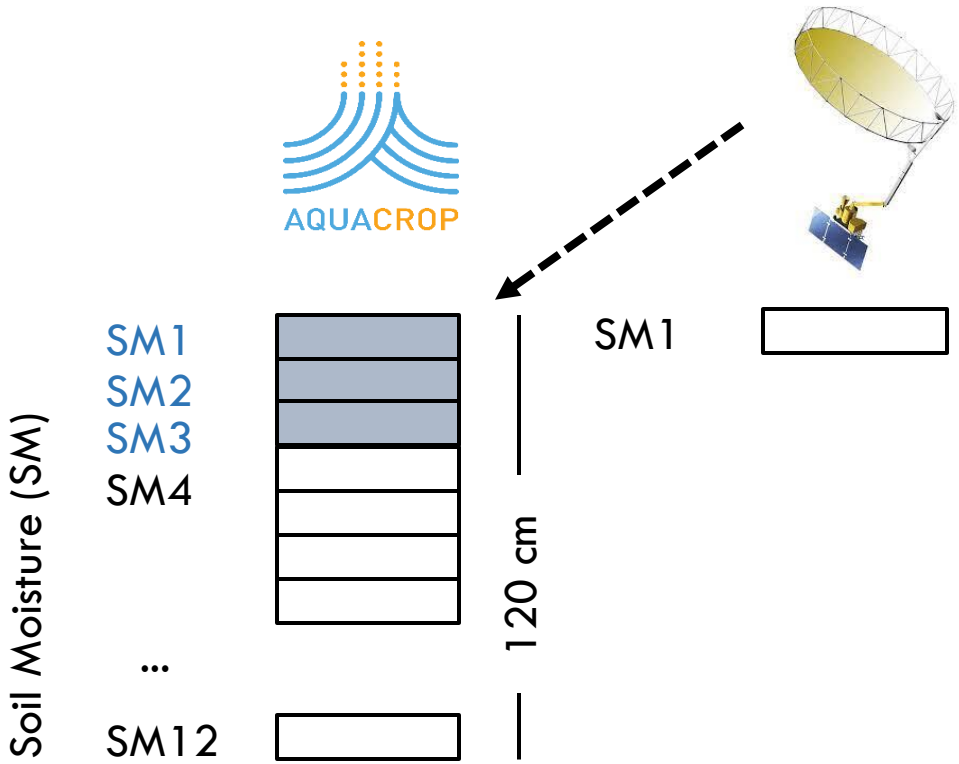
DATA ASSIMILATION (DA) EXPERIMENTS

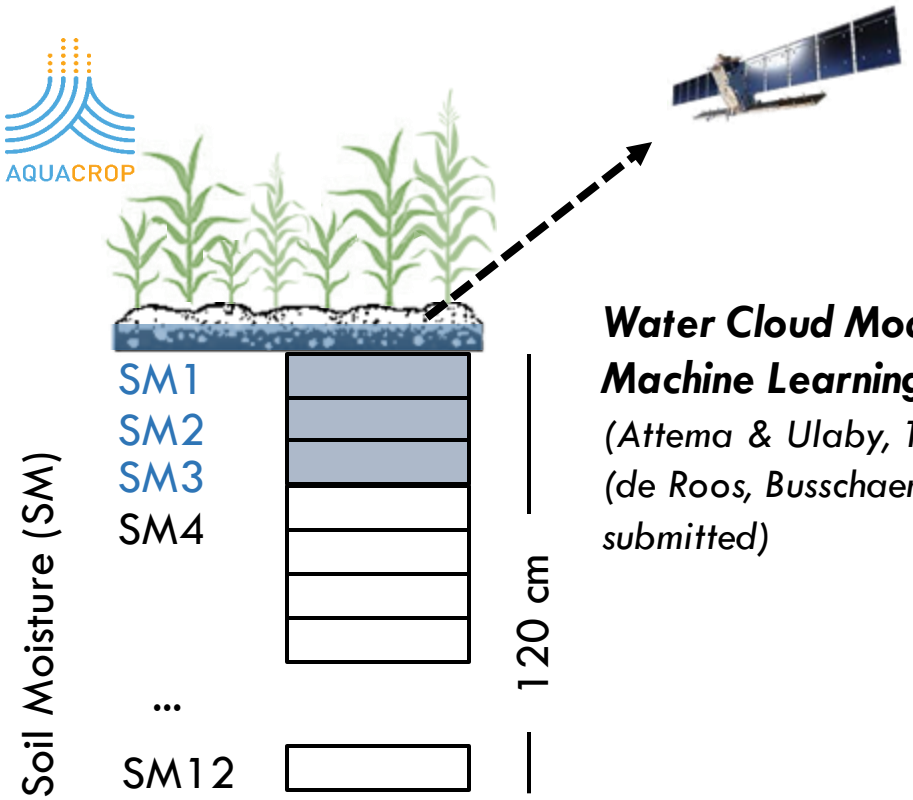


- Assimilation of SMAP Level-2 soil moisture **retrieval** at 0.25° resolution
  → Soil Moisture (SM) updating

- Assimilation of Sentinel-1 **backscatter** at 1 km resolution
  → SM updating
  → Simultaneous SM and vegetation updating (work in progress)

DA SETUP: LINK MODEL W/ SATELLITE

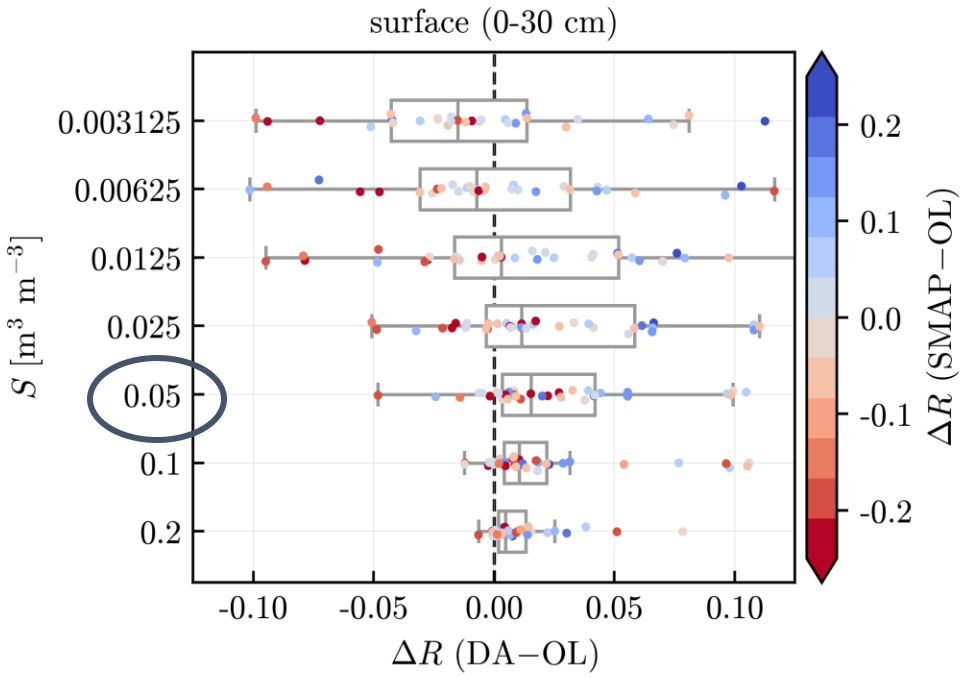


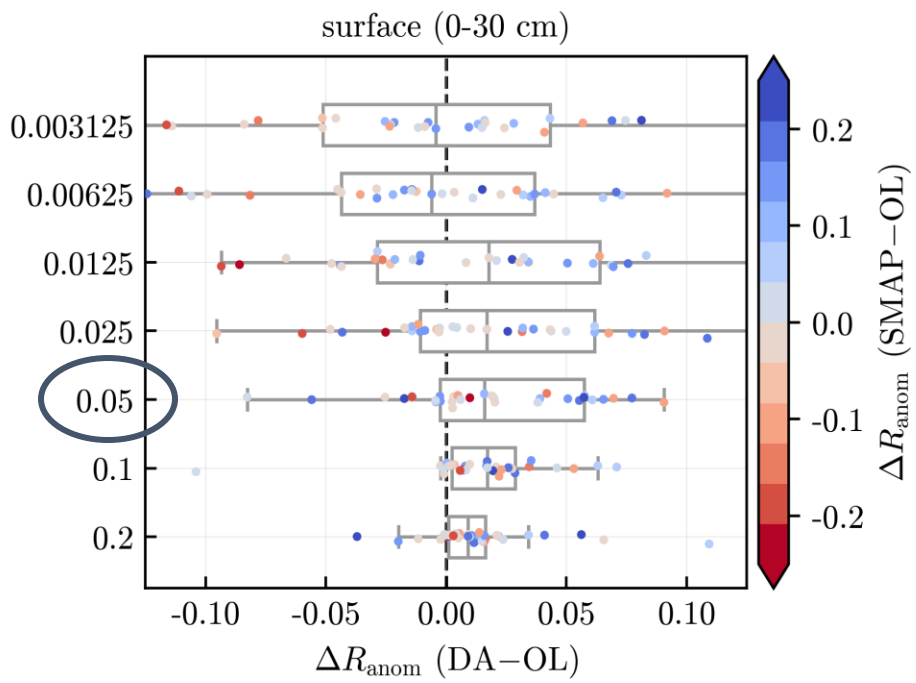


Water Cloud Model (WCM)
Machine Learning
(Attema & Ulaby, 1978)
(de Roos, Busschaert, et al., submitted)

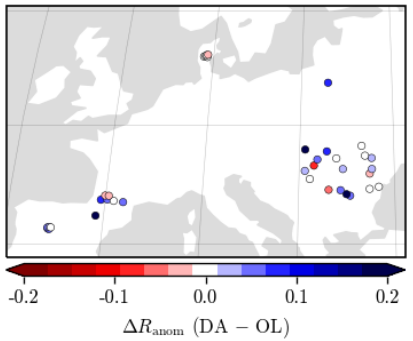
EVALUATION AGAINST IN-SITU DATA

- DA: positive impact on SM at 0-30 cm
- Optimal SMAP SM observation error ~0.05 m^3/m^3



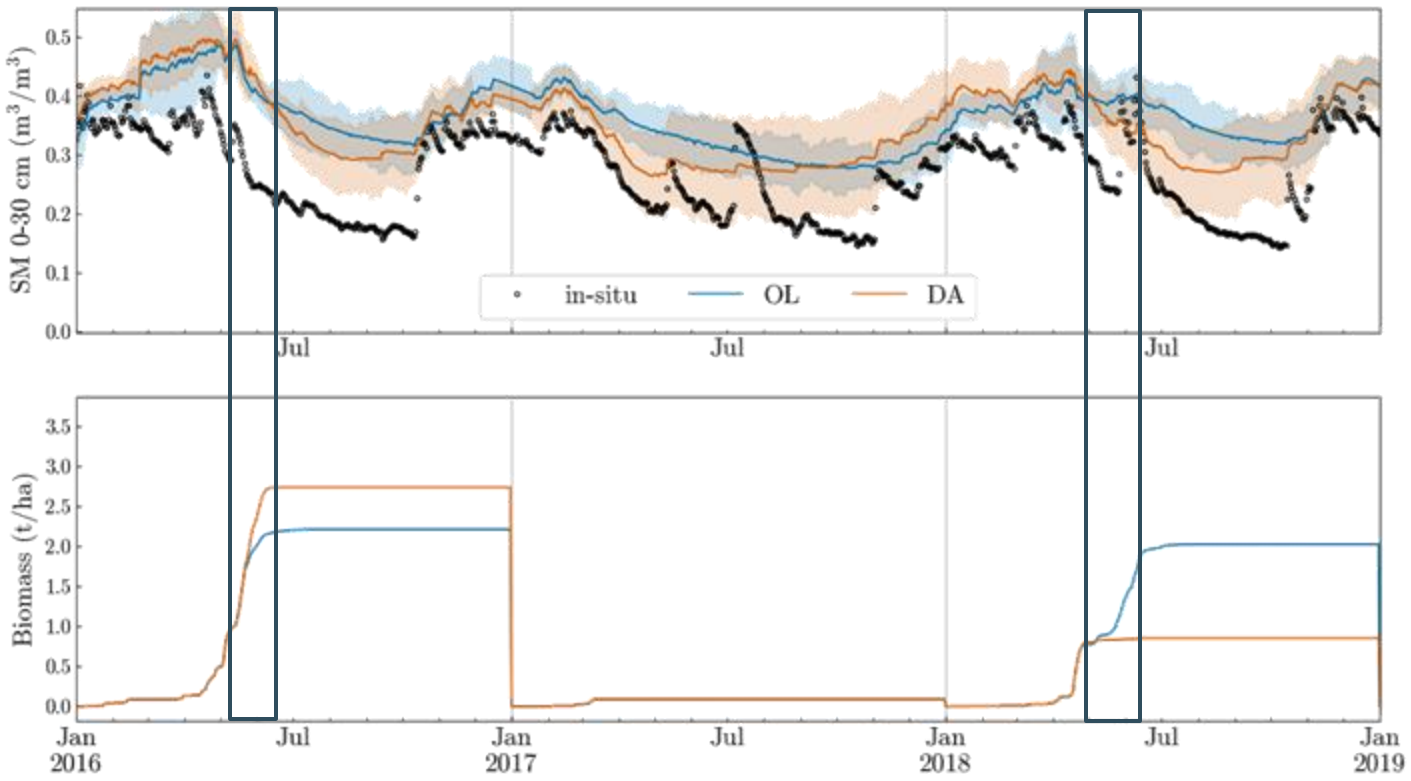


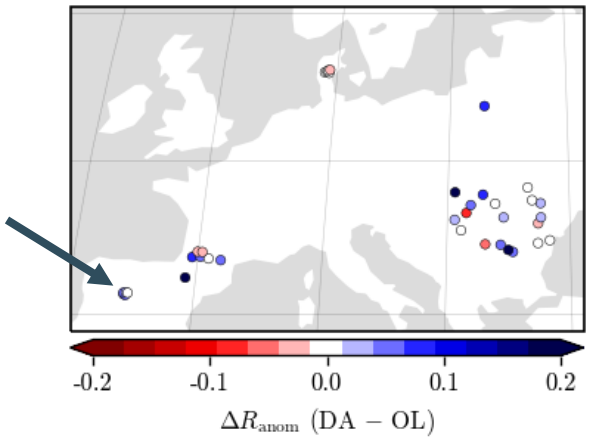
in situ data from 37 grid cells (0.25 deg res.) → metrics averaged over grid cell



IMPACT ON SM AND BIOMASS

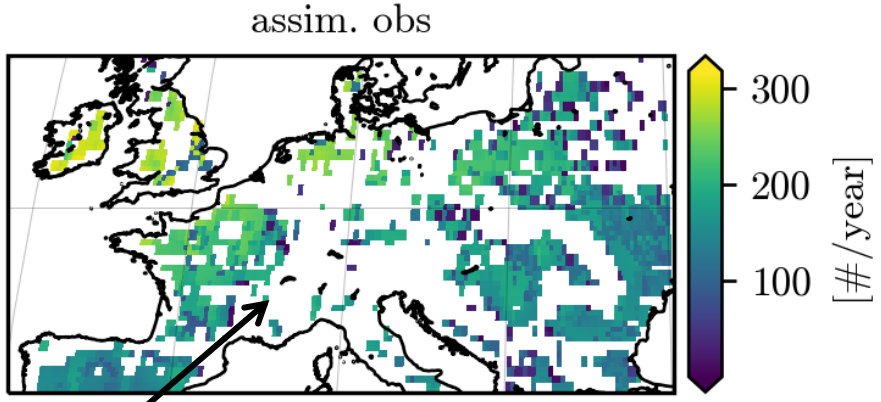
Example site: 41.12°, -5.38°



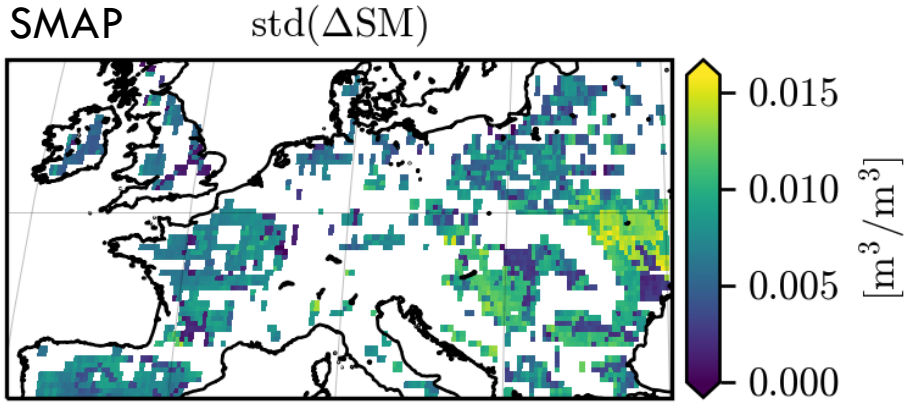


Small updates in **soil moisture** can propagate to strong changes in **biomass** development

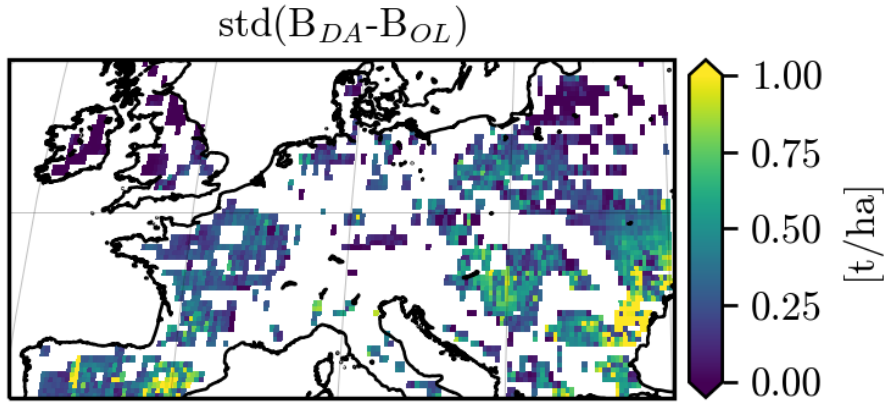
IMPACT ON SM AND BIOMASS



conservative quality flagging of SMAP data



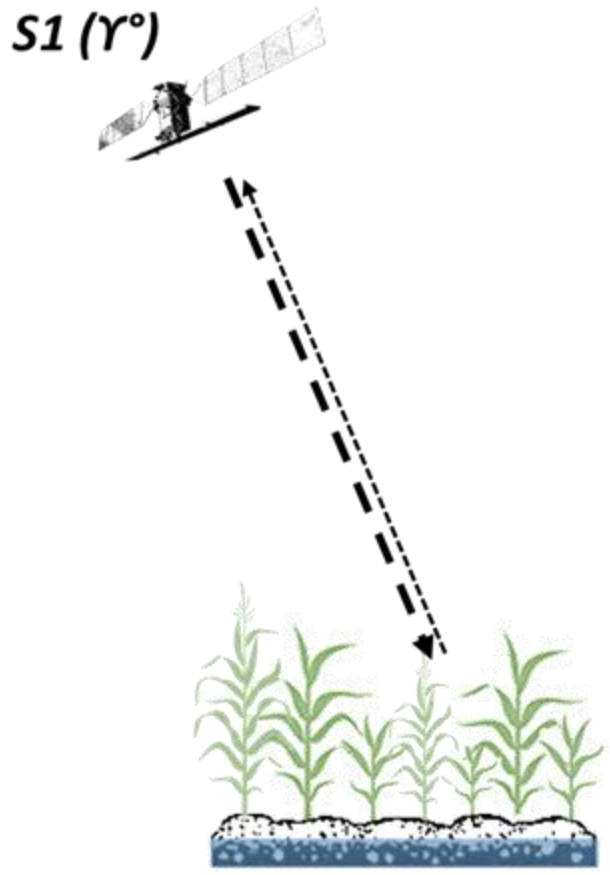
Areas with most **soil moisture** increments ≠ Areas with largest DA impact on **biomass**

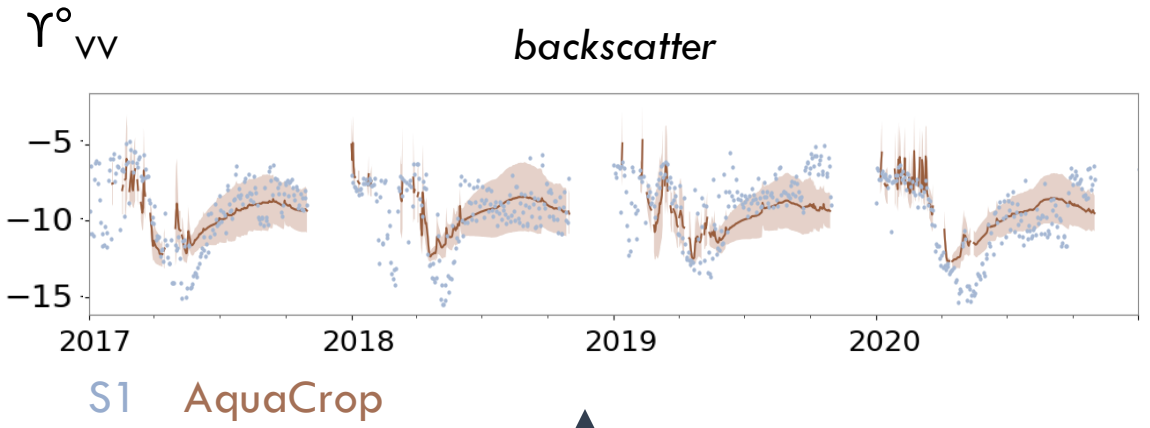


CONCLUSIONS

- AquaCrop v7.0 now in Fortran90 and **open source**
  → first crop model in the NASA LIS framework
- Improved surface soil moisture (0-30 cm) by combining **regional** crop modeling with **satellite** data: SMAP SM retrievals, or Sentinel-1 backscatter data
- Strong connection between soil moisture – crop production in water-limited regions
  → opportunities for soil moisture and vegetation DA, and irrigation estimation
- Next: skill evaluation of DA impact on biomass

BACKUP SENTINEL-1 DA





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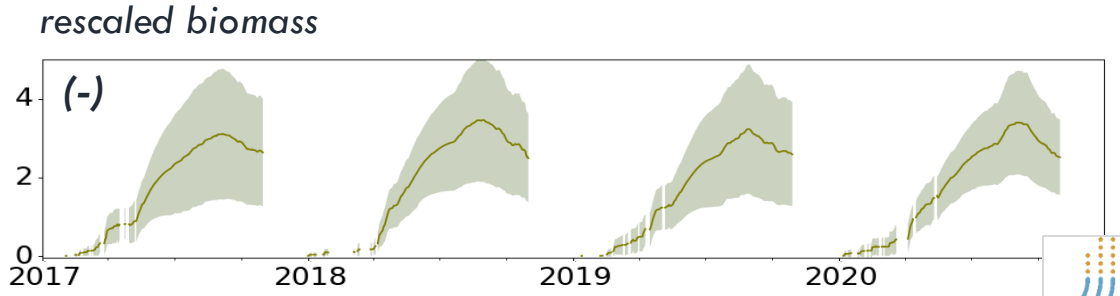

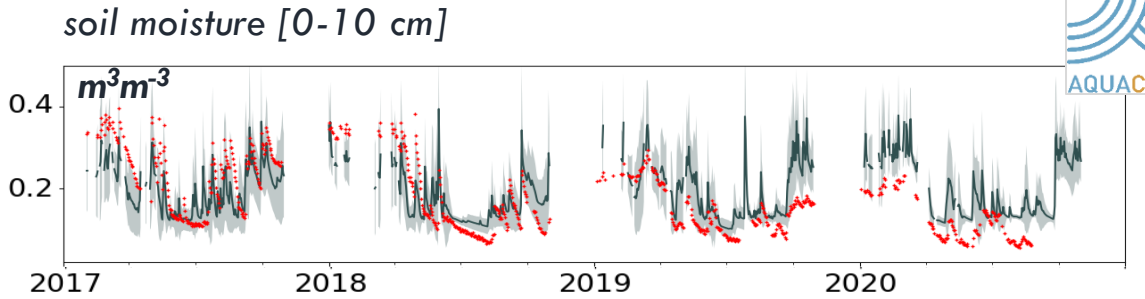

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