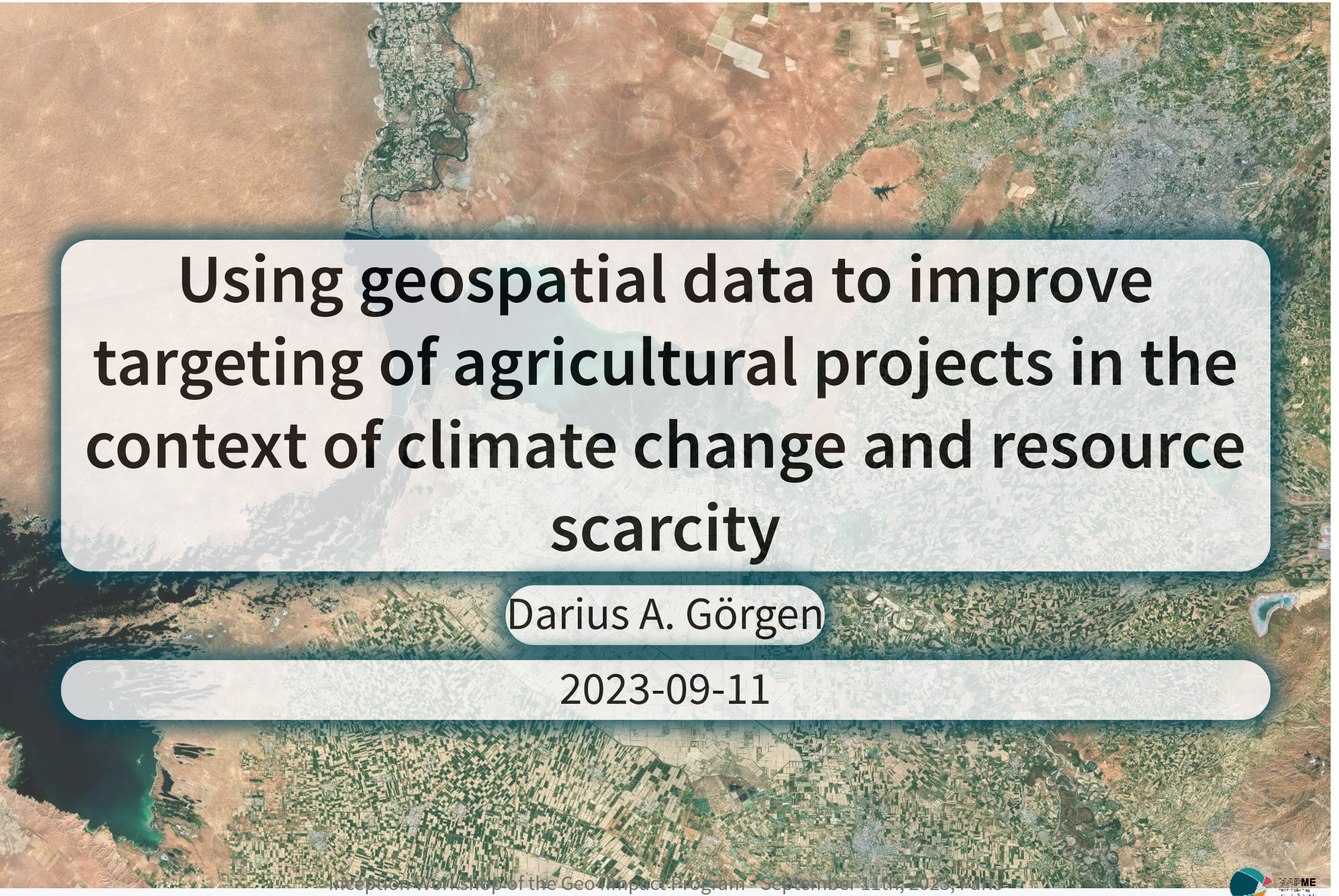

# Using geospatial data to improve targeting of agricultural projects in the context of climate change and resource scarcity

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2023-09-11

# Who am I?

- 🙋 Darius A. Görgen
- 🎓 M.Sc. Geography, B.Sc. Political Sciences
- 🌍 Focus on Climate Change and Agriculture
- Part of the MAPME Initiative since 2020
- 🔬 Advocating for OpenSource and OpenScience

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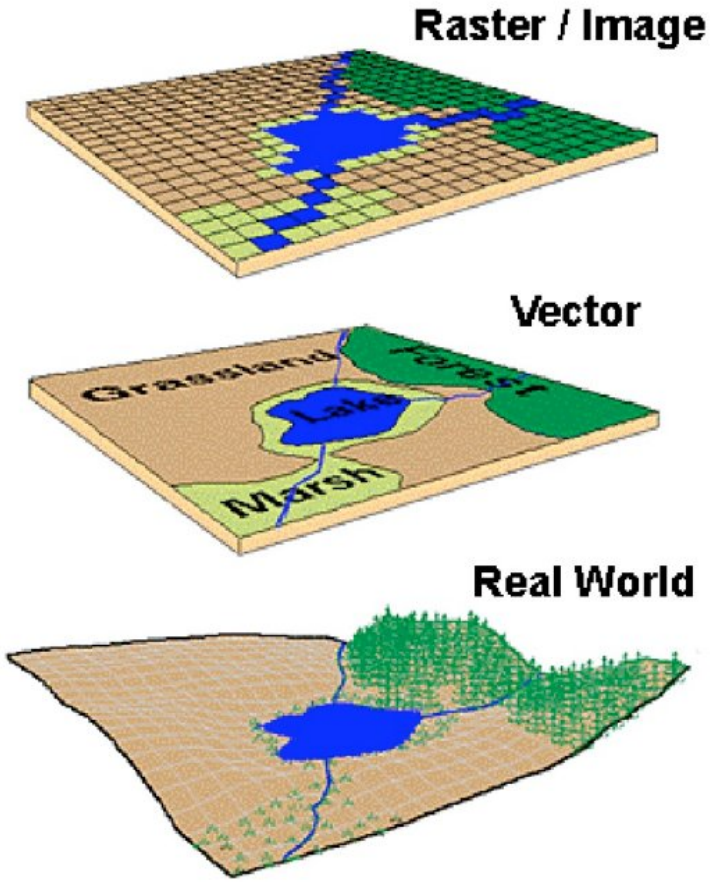
# Content

- What is geospatial data?
- From visual interpretation to automated analysis
  i. Counting trees by hand
  ii. Deep Learning for field boundary delineation
  iii. Satellite time series for crop type identification
  iv. Data fusion for crop biophysical monitoring
- Targeting in the context of agricultural projects
  i. Mapping flood areas
  ii. Analyzing climatological drought
  iii. Water accounting
- Wrap-Up

# Geospatial data

# Geospatial data




Conceptualization of space in the dominant digital formats.

Source: Saab (2003)

# From visual interpretation to automated analysis

# Visual interpretation

A tree plantation near the Jordan EcoPark.

Source: GoogleMaps, CNES 2023

# Field boundary delineation

- very often our area is too large for manual interpretation
- we need tools that automate the interpretation of satellite imagery
- Meta AI's Segment Anything Network is already used in the agricultural sector
- field boundaries can be used to inform about the area distribution of farms …
- … but also they might be required for later analysis stages

Screenshot of agricultural boundaries produces by SAM.

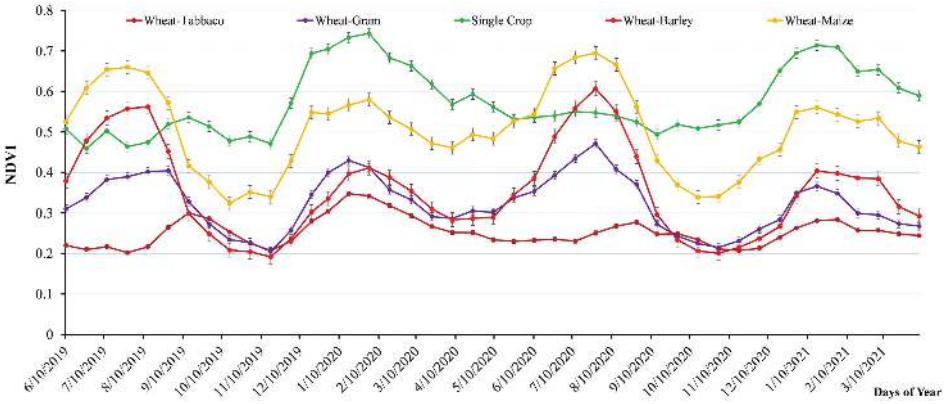
Source: lofty

# Crop type indentification

Satellite imagery timeseries …


Animation of a Sentinel-2 timeseries over an agricultural area.

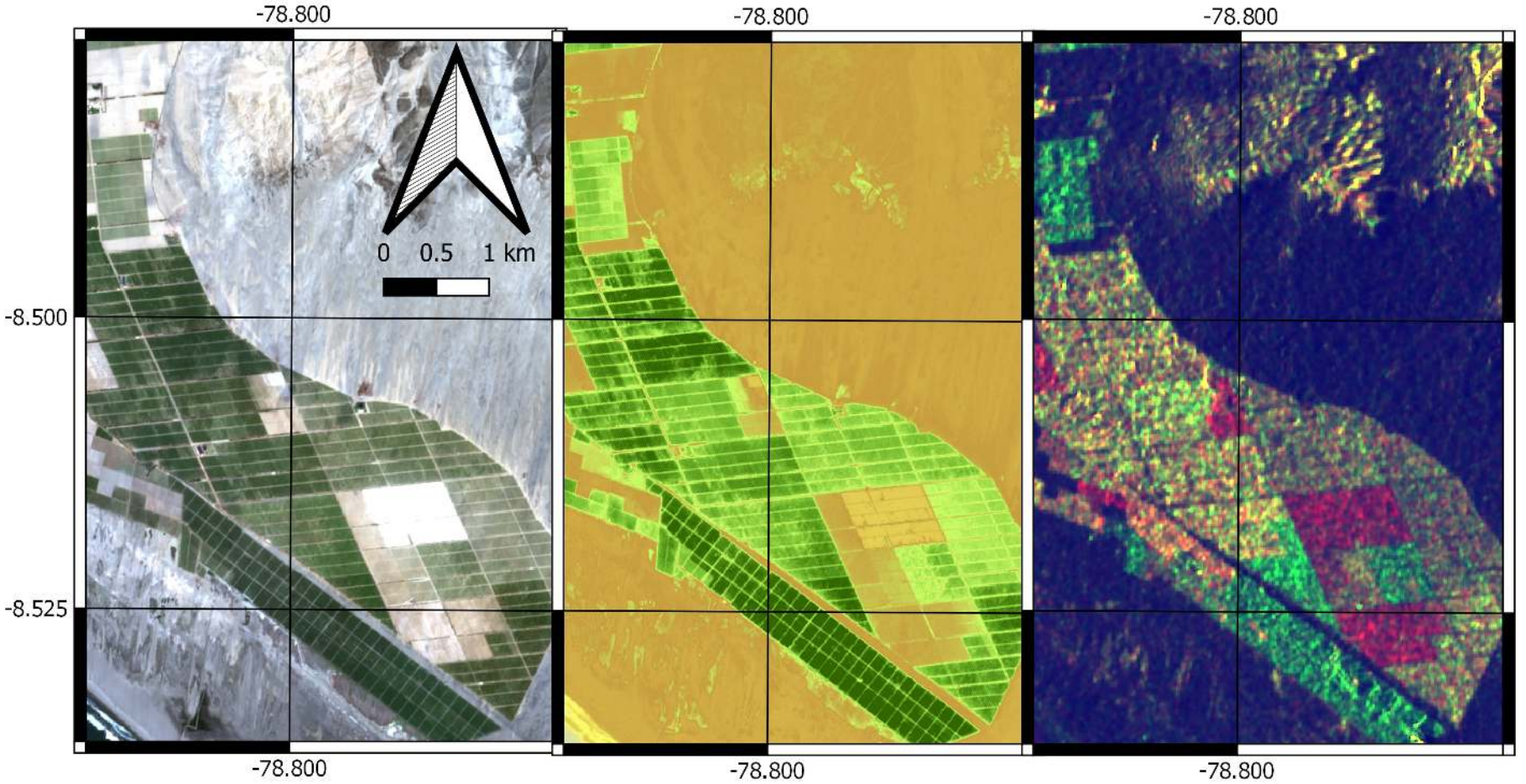
… reveal distinct signatures of crops over time.




Temporal NDVI profiles of different crop types.

Sources: GeoVille, ESA CC BY-SA 3.0 IGO, Tariq et al. (2022)

# Data fusion




Visualisation of an data fusion approach from Sentinel 1 and 2 for crop biophysical monitoring.

Source: Silva-Perez, Marino, and Cameron (2022)

# Targeting

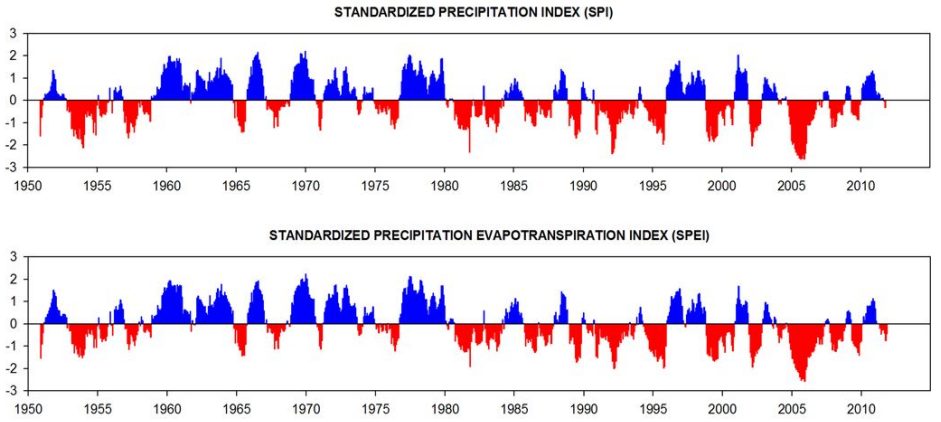
# Flood areas


Animation of 2022 monsoon floods in Bangladesh.

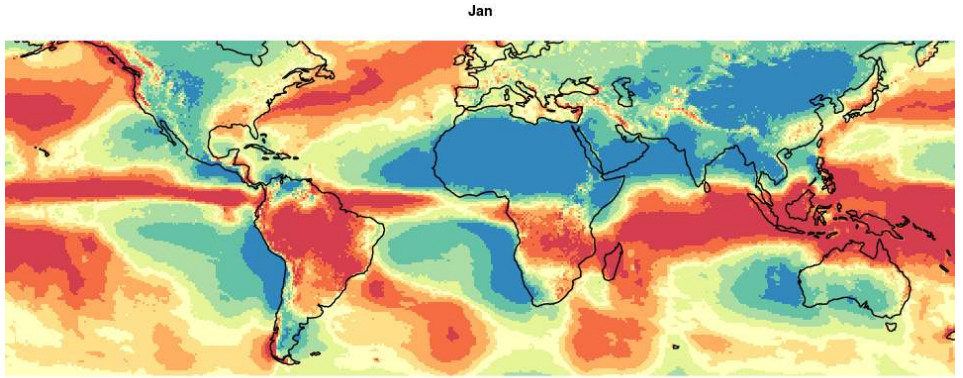
Source: ESA, CC BY-SA 3.0 IGO

# Climatological drought

- SPI/SPEI to quantify intensity and duration of meteorological droughts
- SPEI is preferable when temperature or $ET_0$ data is available
- gridded datasets allow drought analysis even in data scarce regions
- CHELSA has good performance for complex terrains and data-scarce regions
- includes climate projections for different CMIP6 scenarios




Comparison of SPI and SPEI to charachterize meterological drought.

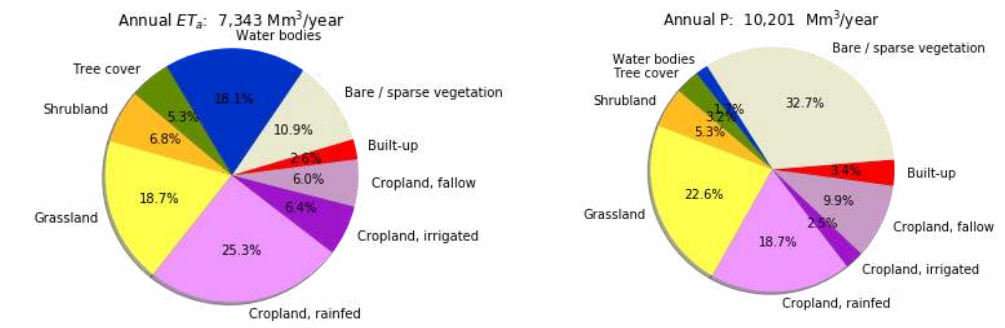



CHELSA animation of average precipitation between 1981-2010.

Sources: Karger et al. (2021), Vicente-Serrano, Beguería, and López-Moreno (2010)

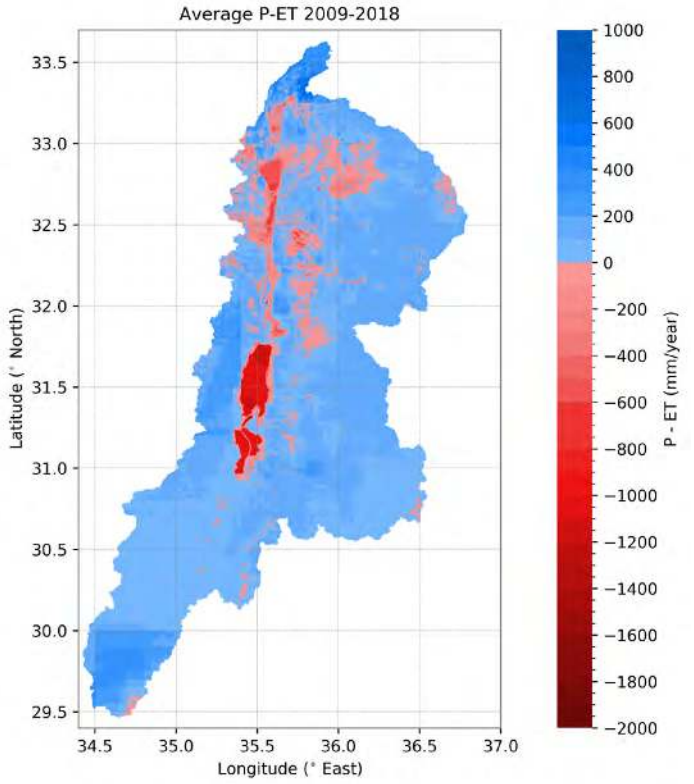
# Water accounting

- Water accounting study in the Jordan River Basin by FAO
- Uses remote-sensing based variables by FAO's WAPOR
- Differentiates between water generating ( $P > ET_a$) and consuming ($P < ET_a$) land cover classes




(a) $ET_a$ (b) $P$

Figure 1: Contribution of landcover classes to $ET_a$ (a) and precipitation (b) in the Jordan River Basin.




Difference between Precipitation ($P$) and Actual Evapotranspiration and Interception ($ET_a$).

Sources: FAO and Delft (2020)

# Wrap Up

- 🎯 geospatial data can help to better target areas to maximize benefit
- 🛰️ remote sensing can deliver valuable insights in data scarce regions
- 🗨️ *All models are wrong, but some are useful.* (George Box)
- 🍎 evaluate the low-hanging fruits first
- 💰 gold standards require large amounts of high-quality and thus expensive data
- 💡 SSL might be a game-changer, but the training of foundation models is expensive

# Thank you for your attention!

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