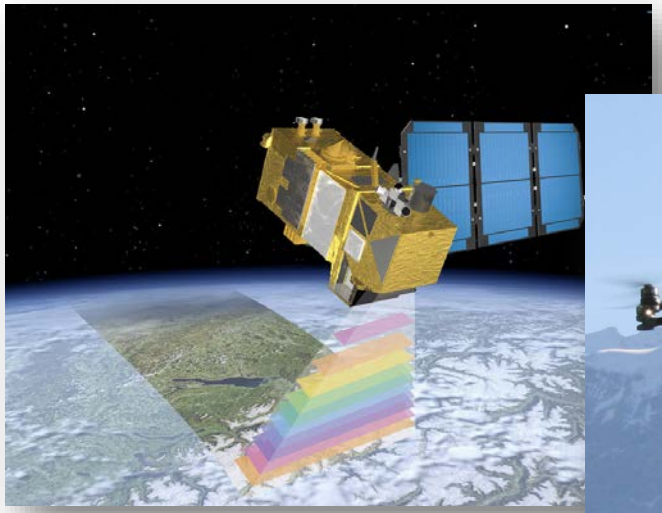
Environmental sensing with multiple techniques: Satellite, UAV, in-situ



Marc Zebisch, eurac research

Georg Niedrist, Enrico Tomelleri, Sarah Assam, Felix Greifeneder,
Mariapina Casetelli, Giacomo Bertoldi, Mejia Aguilar Abraham, Claudia Notarnicola

Monitoring key environmental parameters

Grassland

Orchards

Forest

Vegetation: Leaf Area Index, NDVI, Phenology, Tree height and structure

Water: Soil moisture, Evapotranspiration, Snow

Soil Properties

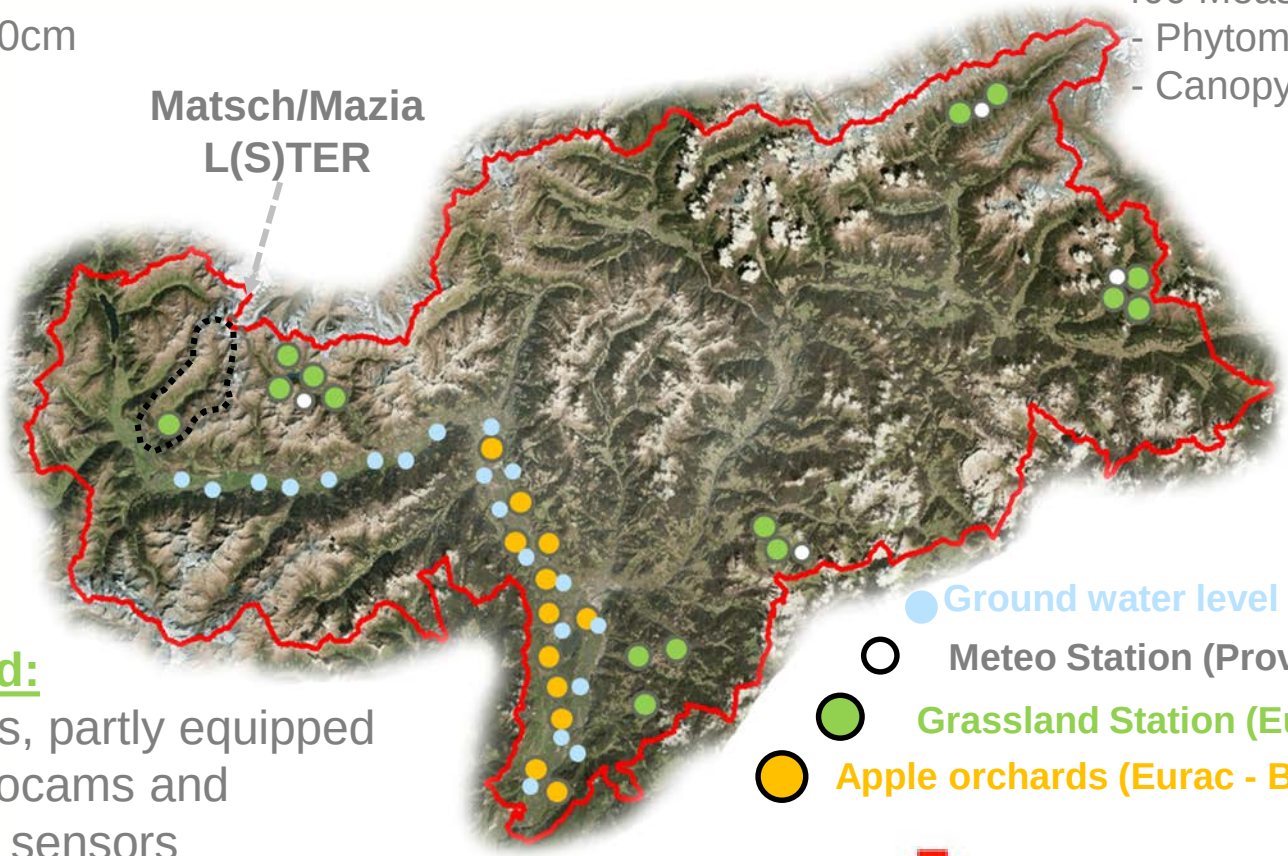
Test sites and ground sensor network

Common test sites and ground sensor network

Apple orchards:
12 stations with SWC and Soil temp. at 20+40cm

Grassland:
400 Measurements
- Phytomass
- Canopy Structure

Matsch/Mazia
L(S)TER



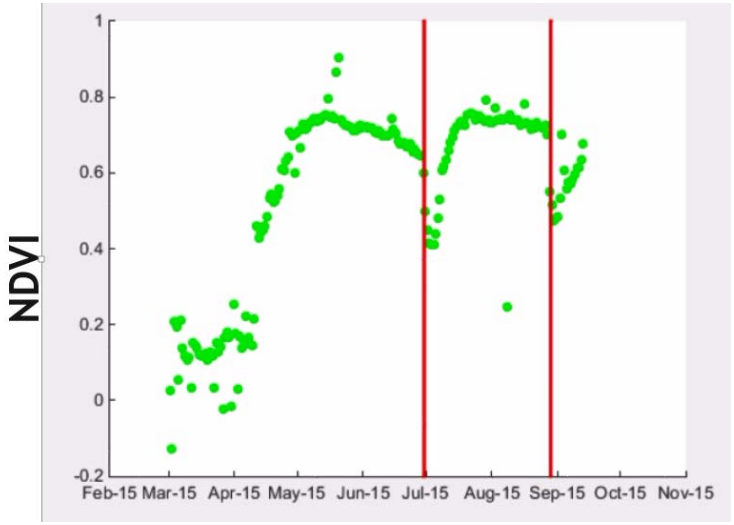
Grassland:
15 stations, partly equipped with phenocams and NDVI/PRI sensors

Ground water level (Province Bz)
Meteo Station (Province Bz)
Grassland Station (Eurac)
Apple orchards (Eurac - Beratungsring)

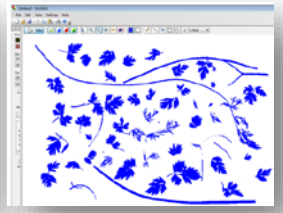
beratungsring.org

Parameters measured:

- Soil water content at 2,5,20cm
- Soil temperature at 2,5,20cm
- Photosynthetically active radiation (above and within canopy)
- NDVI/PRI
- Phaenocam (RGB, IR)
- Regular soil and vegetation sampling campaigns
  - Soil texture
  - Soil carbon content
  - Leaf area index
  - Leaf dry mass

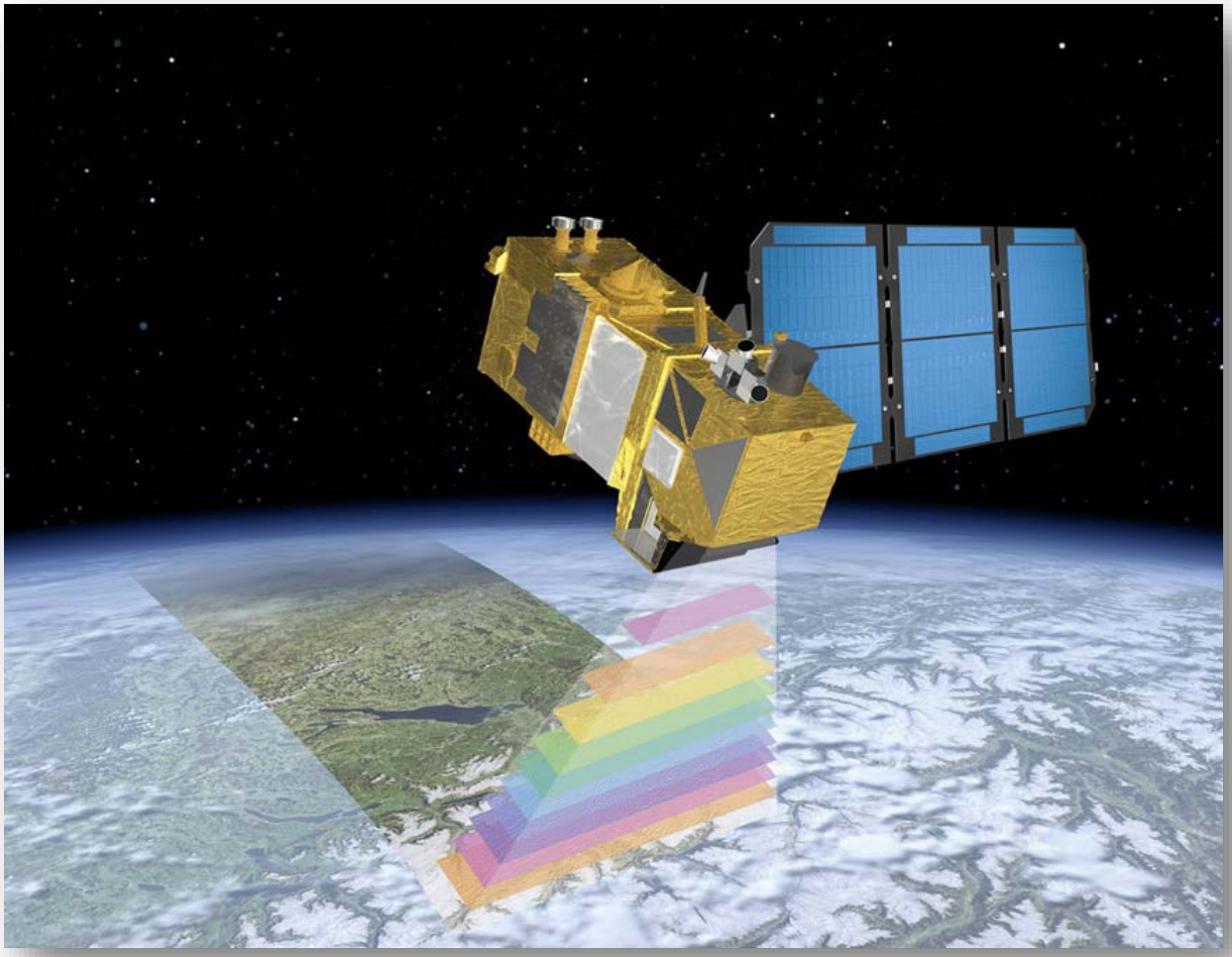


NEMEF 2000 Station, Gsies, Versell


Monalisa_nemef2000- NETCAM SC IR - Fri Sep 25 2015 15:31:22 MET-2METDST
Temperature 21.0 °C internal
Exposure: 31

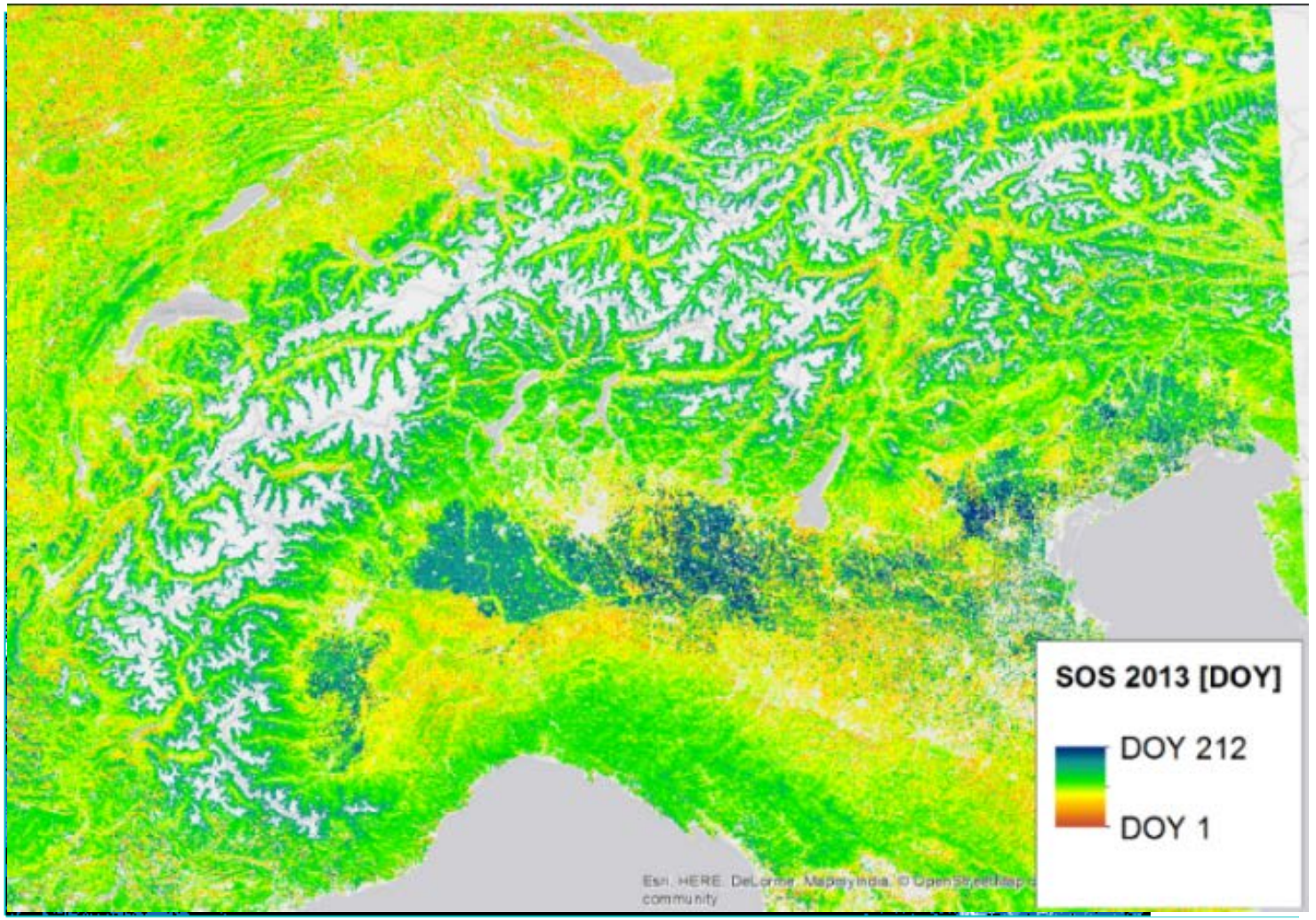
Satellite Remote Sensing



Satellite Remote Sensing

Snow Cover Days

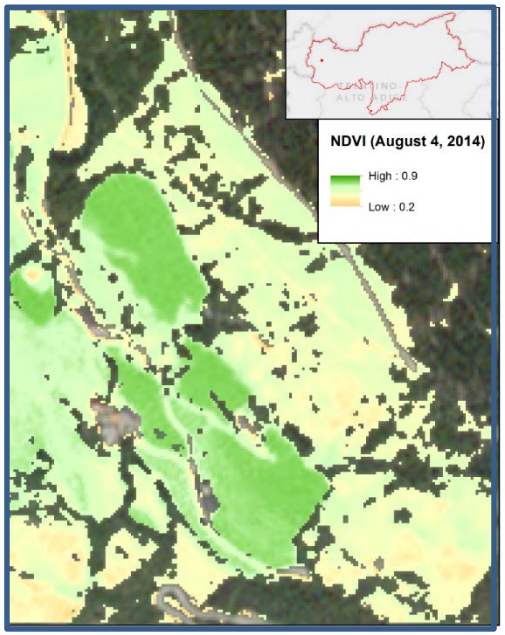
Start of Growing Season



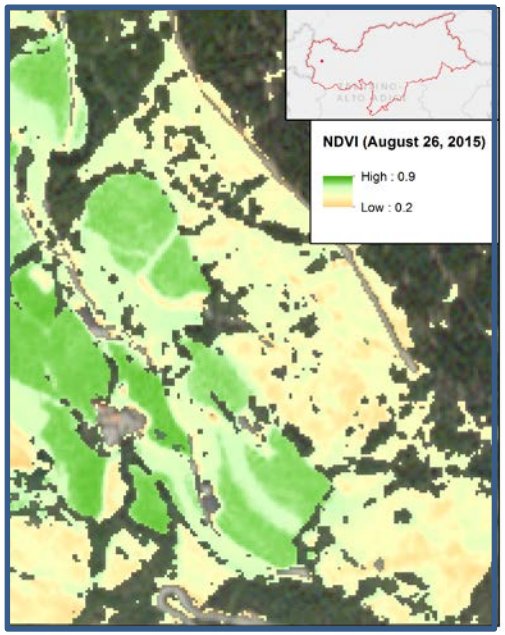
Satellite Remote Sensing: Vegetation

Impact of hot and dry summer 2015

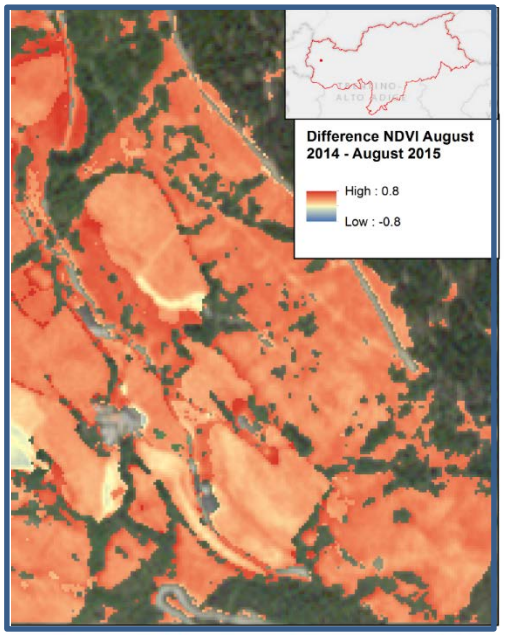
August 2014



August 2015

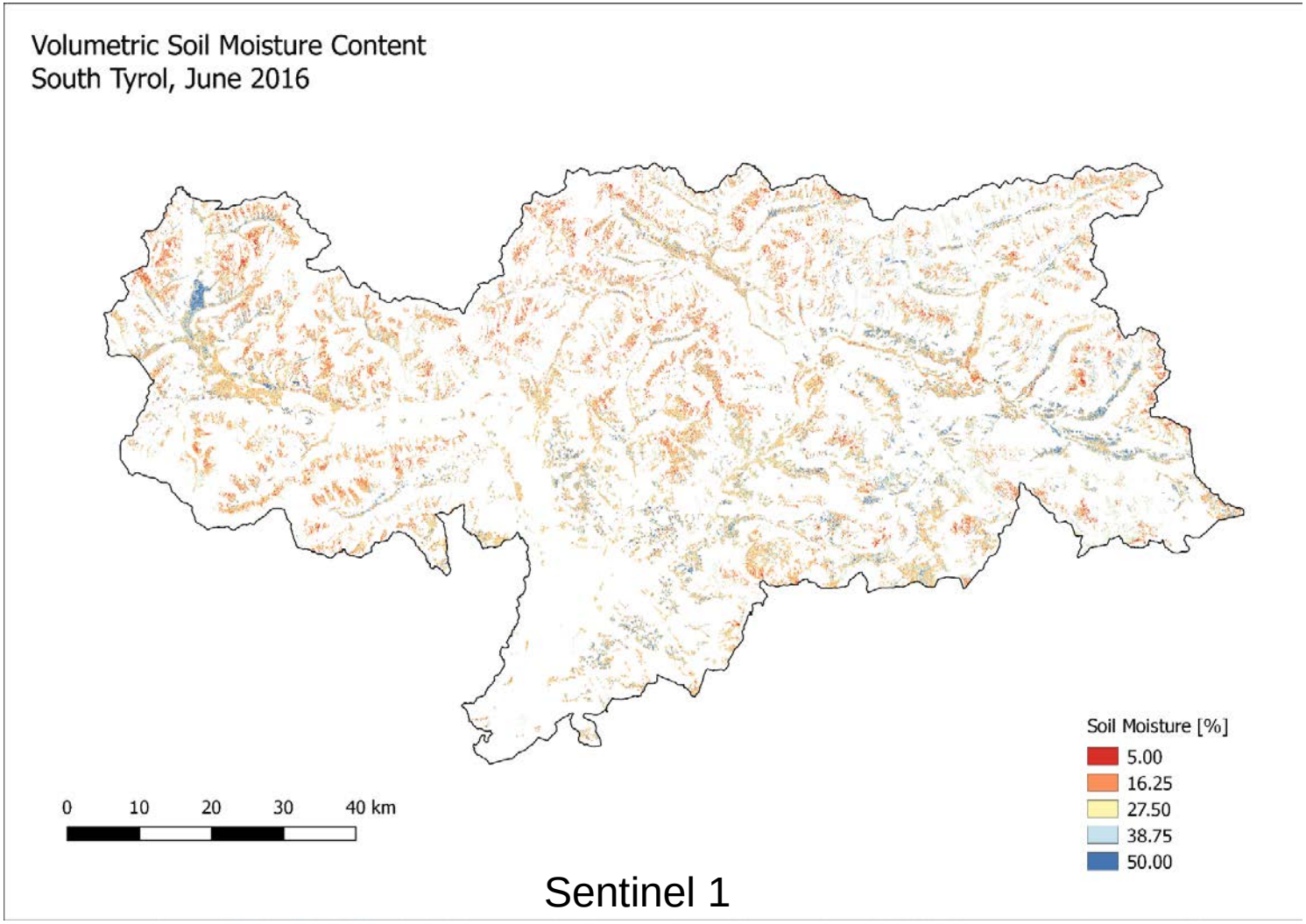


Difference 2014 - 2015



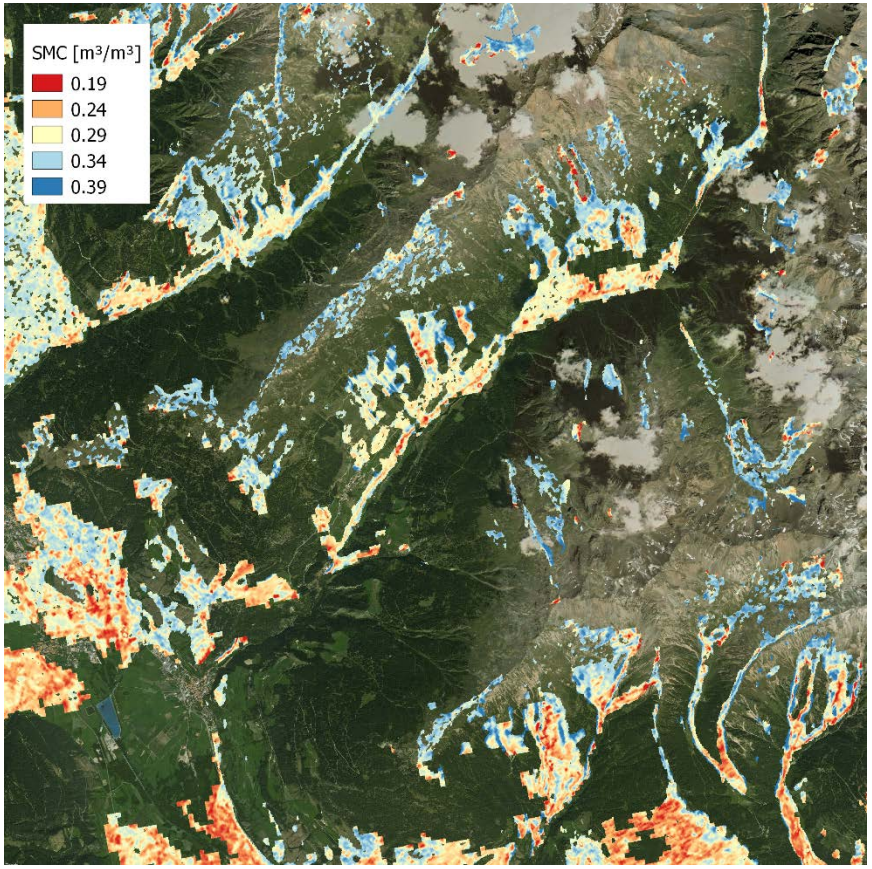
Rapid Eye

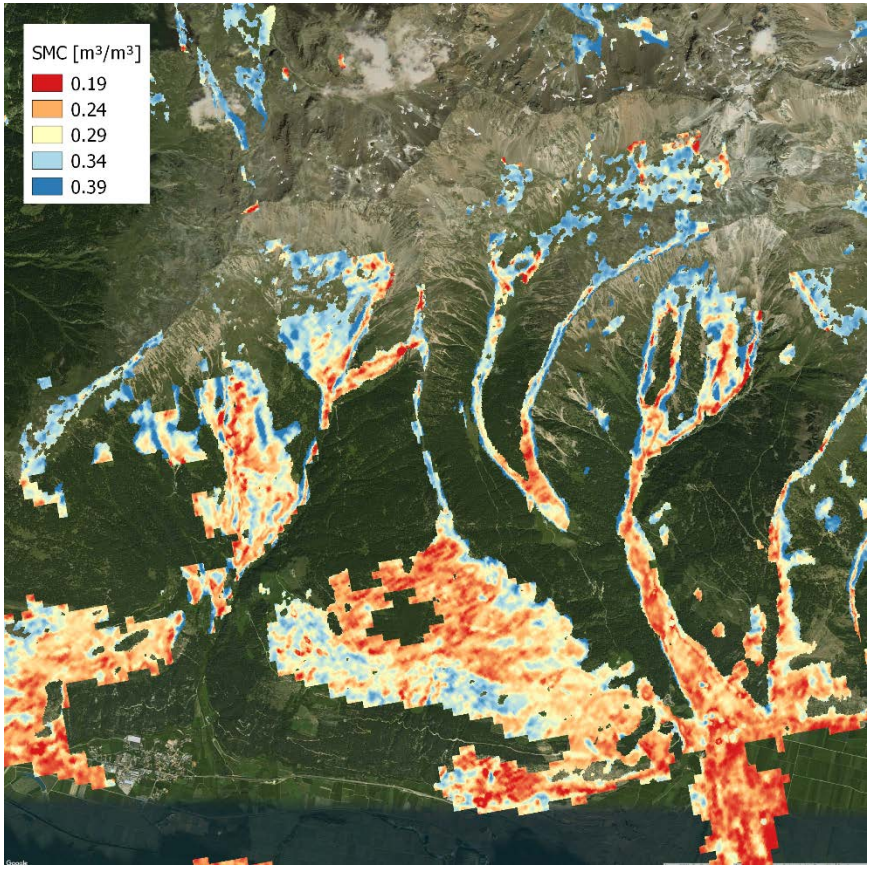
Satellite Remote Sensing: Soil Moisture



Sentinel 1

Satellite Remote Sensing: Soil Moisture

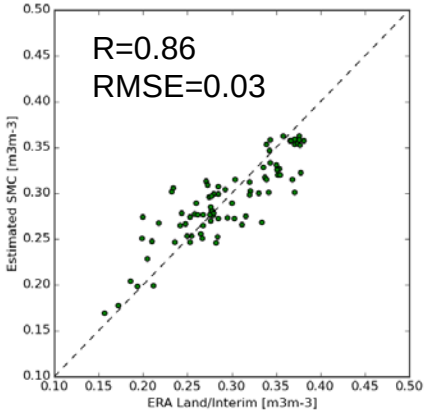




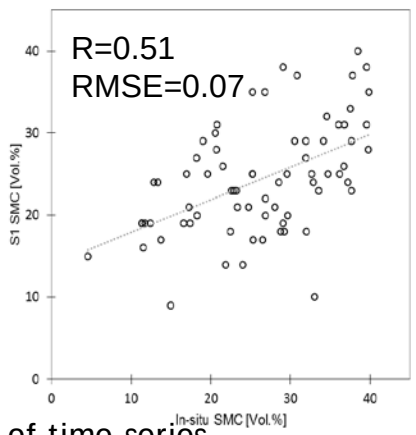
Sentinel 1

Satellite Remote Sensing: Soil Moisture

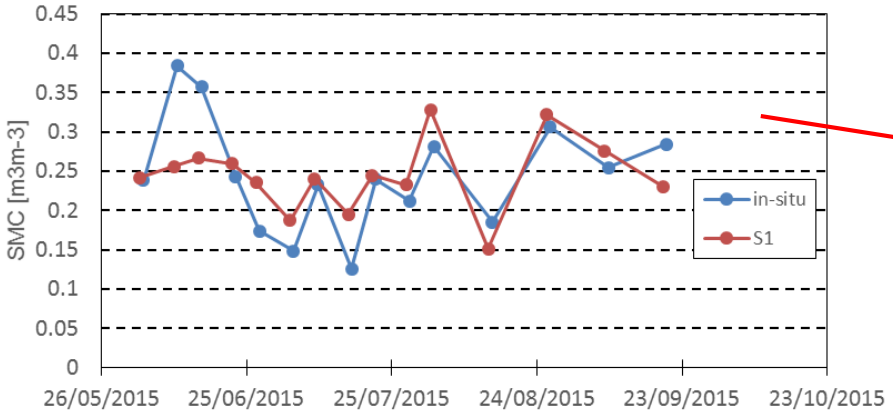
Target based Validation

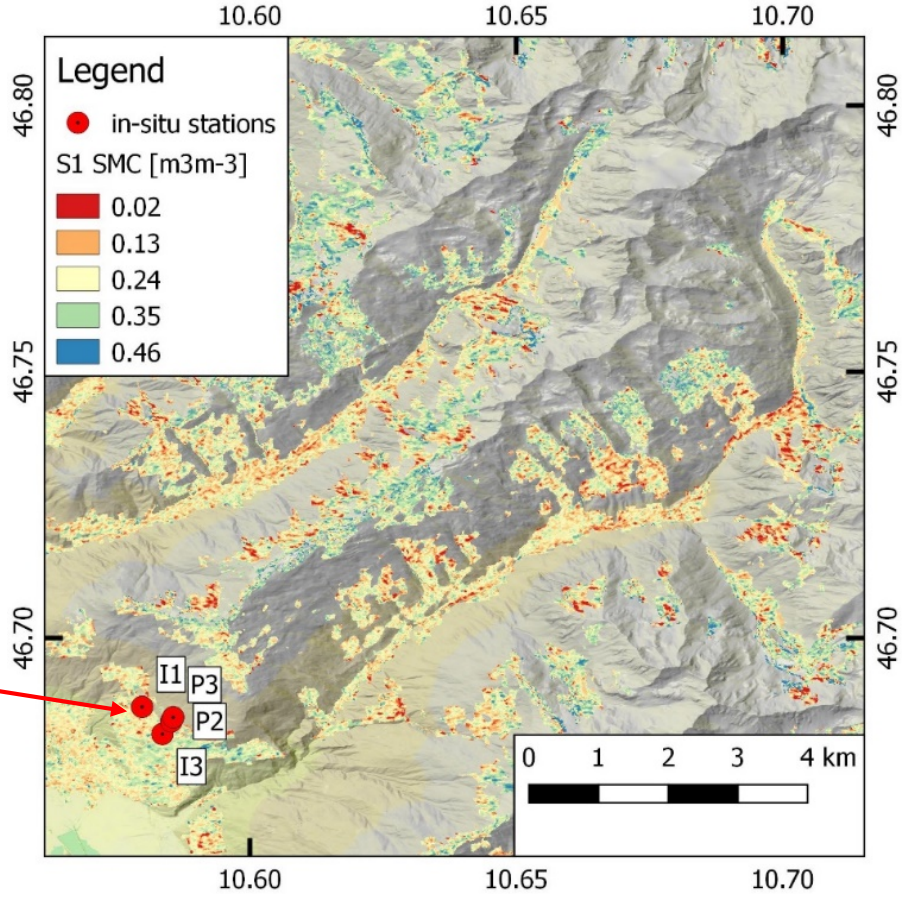


Validation with spatially distributed in-situ measurements

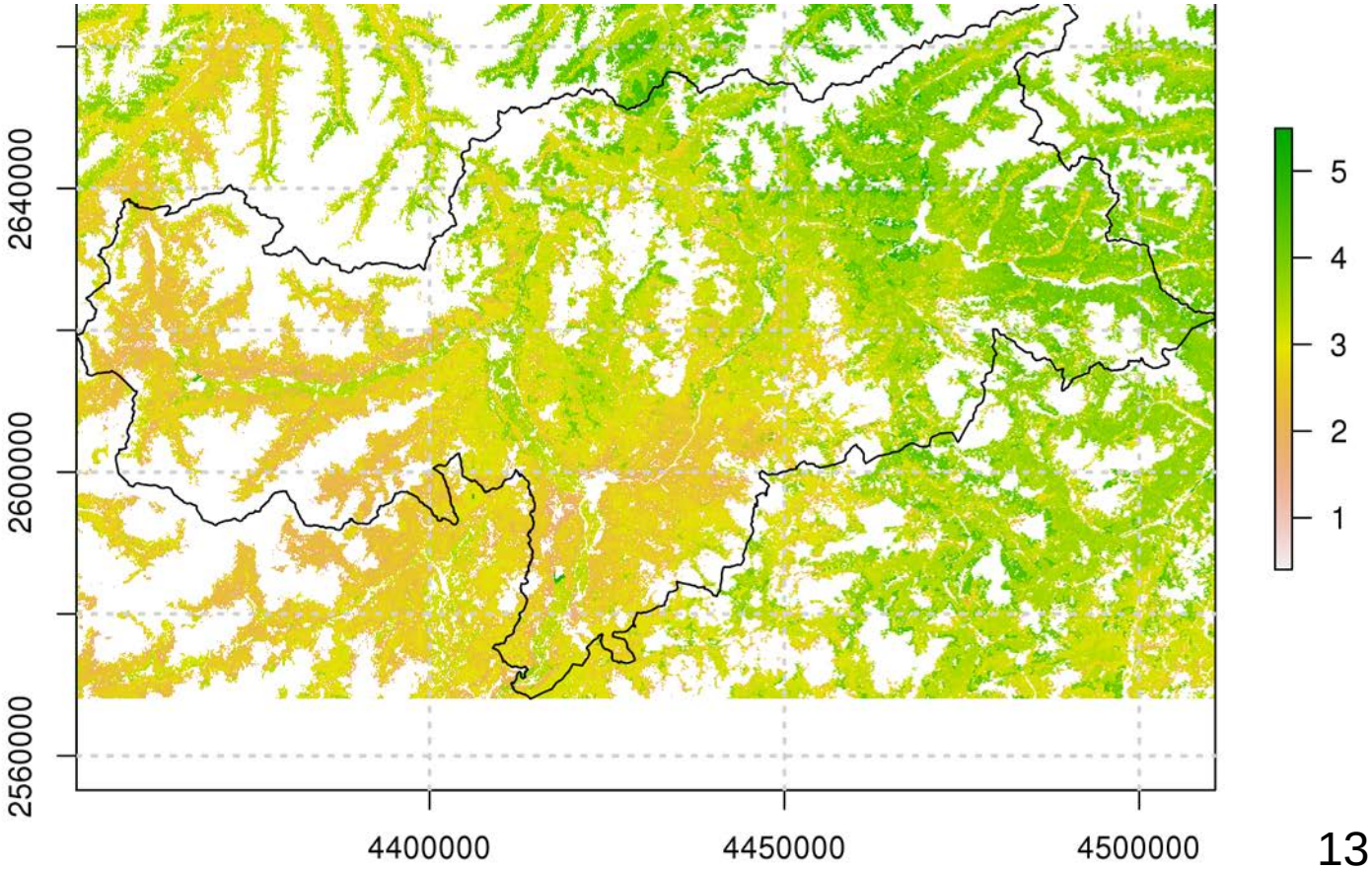


Validation of time-series





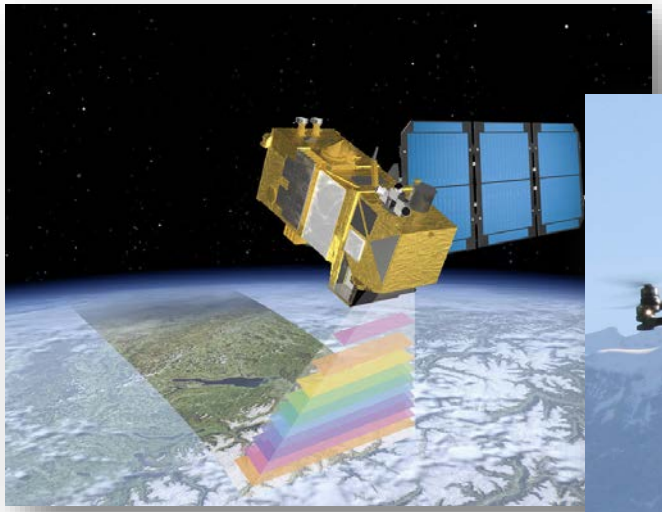
Satellite Remote Sensing: Evapotranspiration



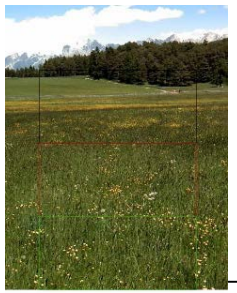
13.08.2015

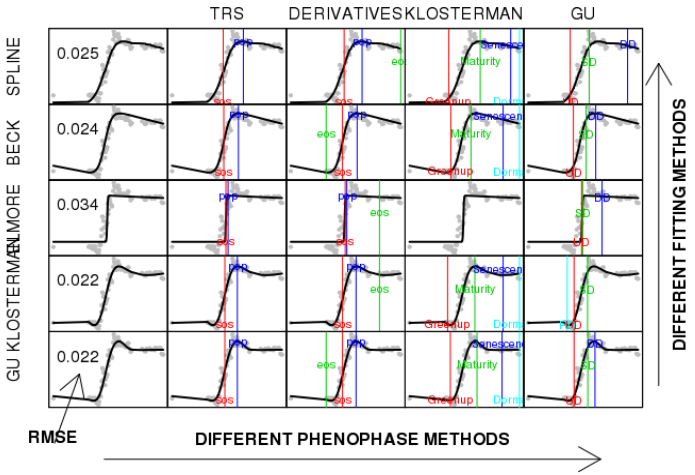
Sentinel 2

Integration: Satellite, UAV, in-situ

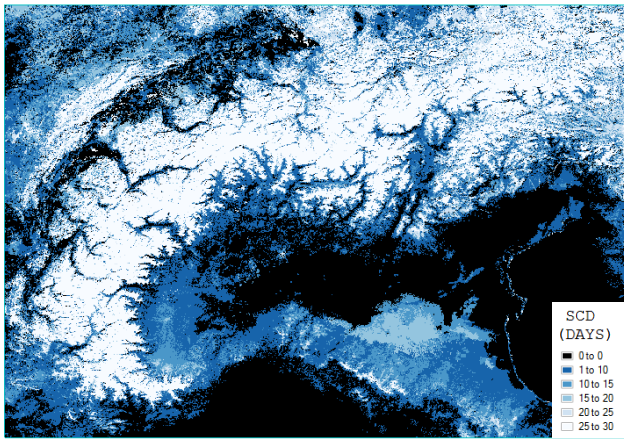


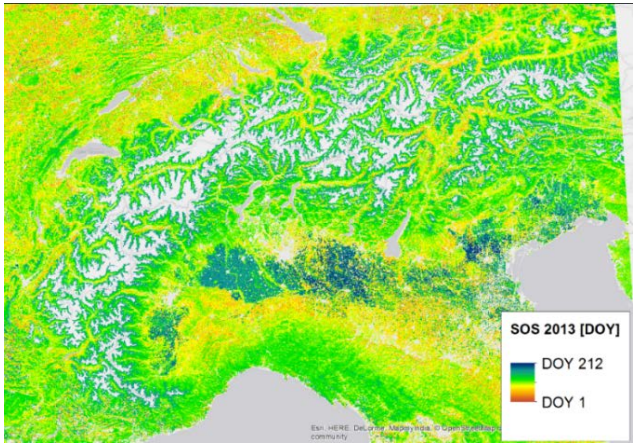
Alpine-wide analysis of vegetation-climate interactions

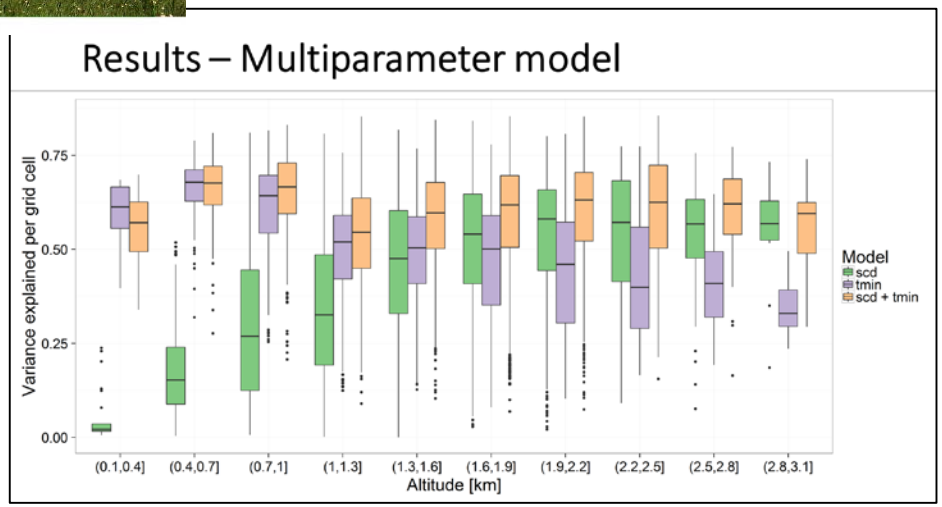




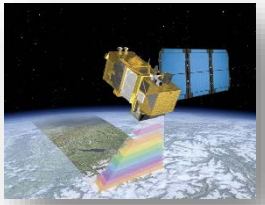
Extraction of phenophases (PhenoCams)





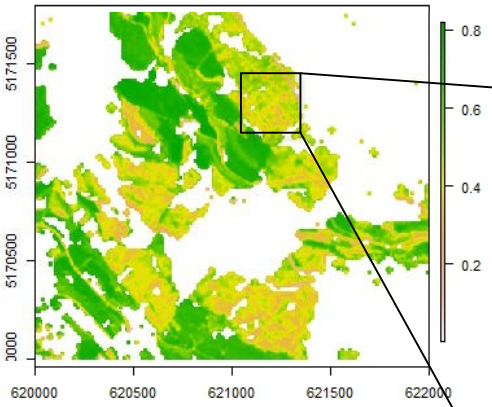


(S. Asam, E. Tomelleri, M. Matiu, L. De Gregorio)

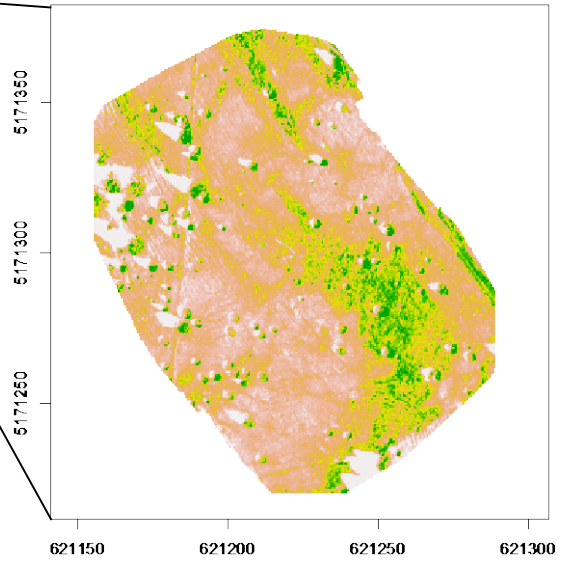


High resolution grassland properties

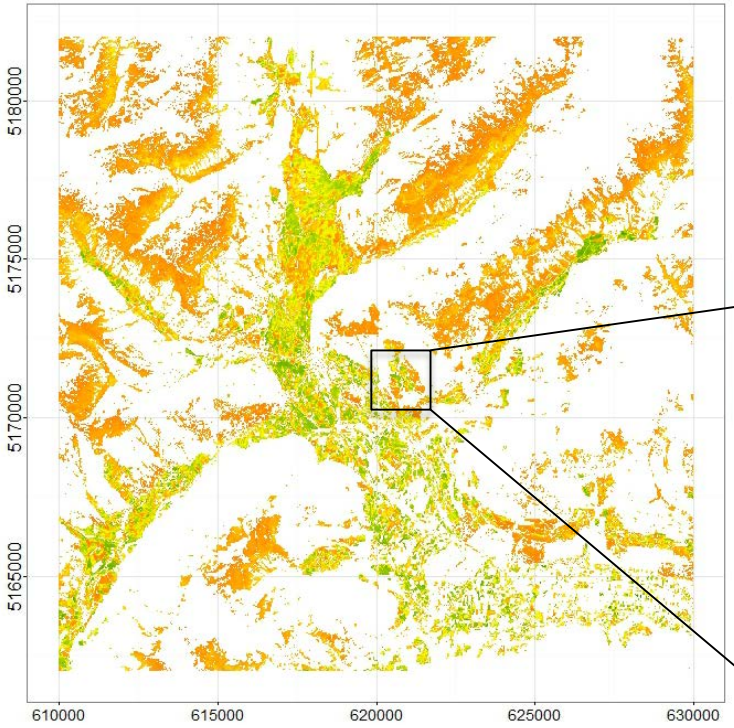
RapidEye NDVI [5m]
August 26, 2015, Mazia

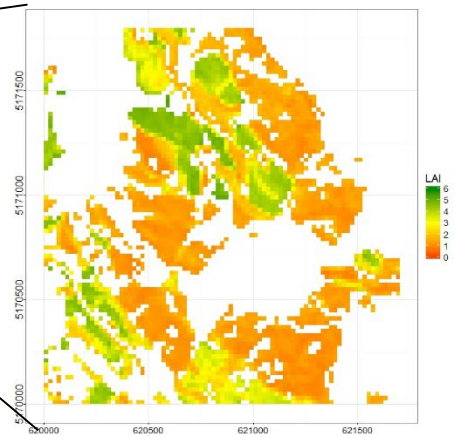


Rikola [50 cm]
August 21, 2015, Mazia



Sentinel-2 LAI [20 m],
August 26, 2015, Val Venosta/SouthTyrol





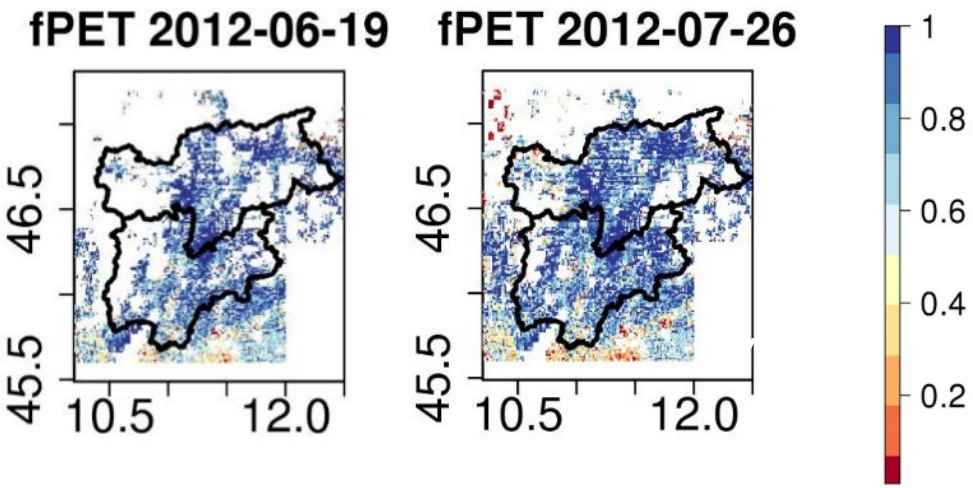
Sentinel-2 LAI [20 m],
August 26, 2015, Mazia

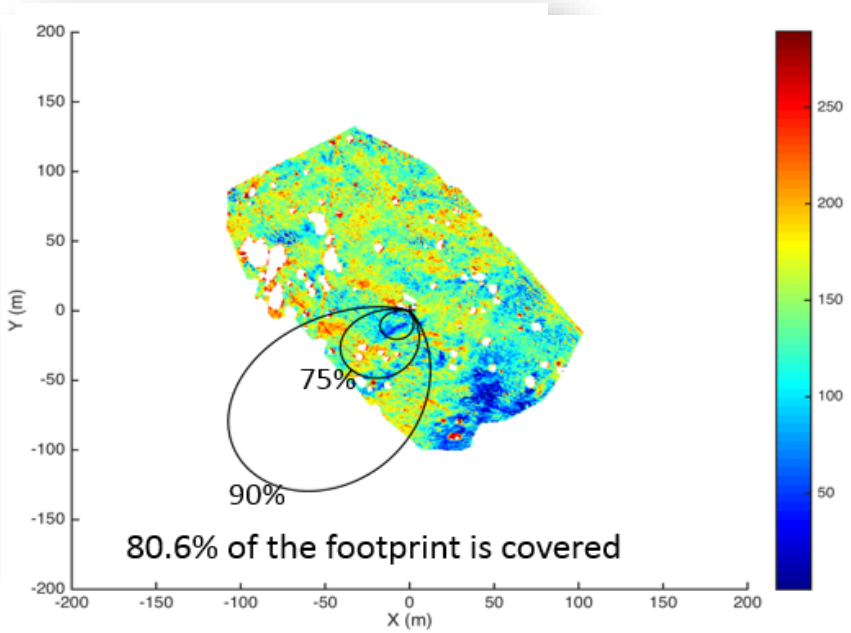
(S. Asam, E. Tomelleri)

Evapotranspiration

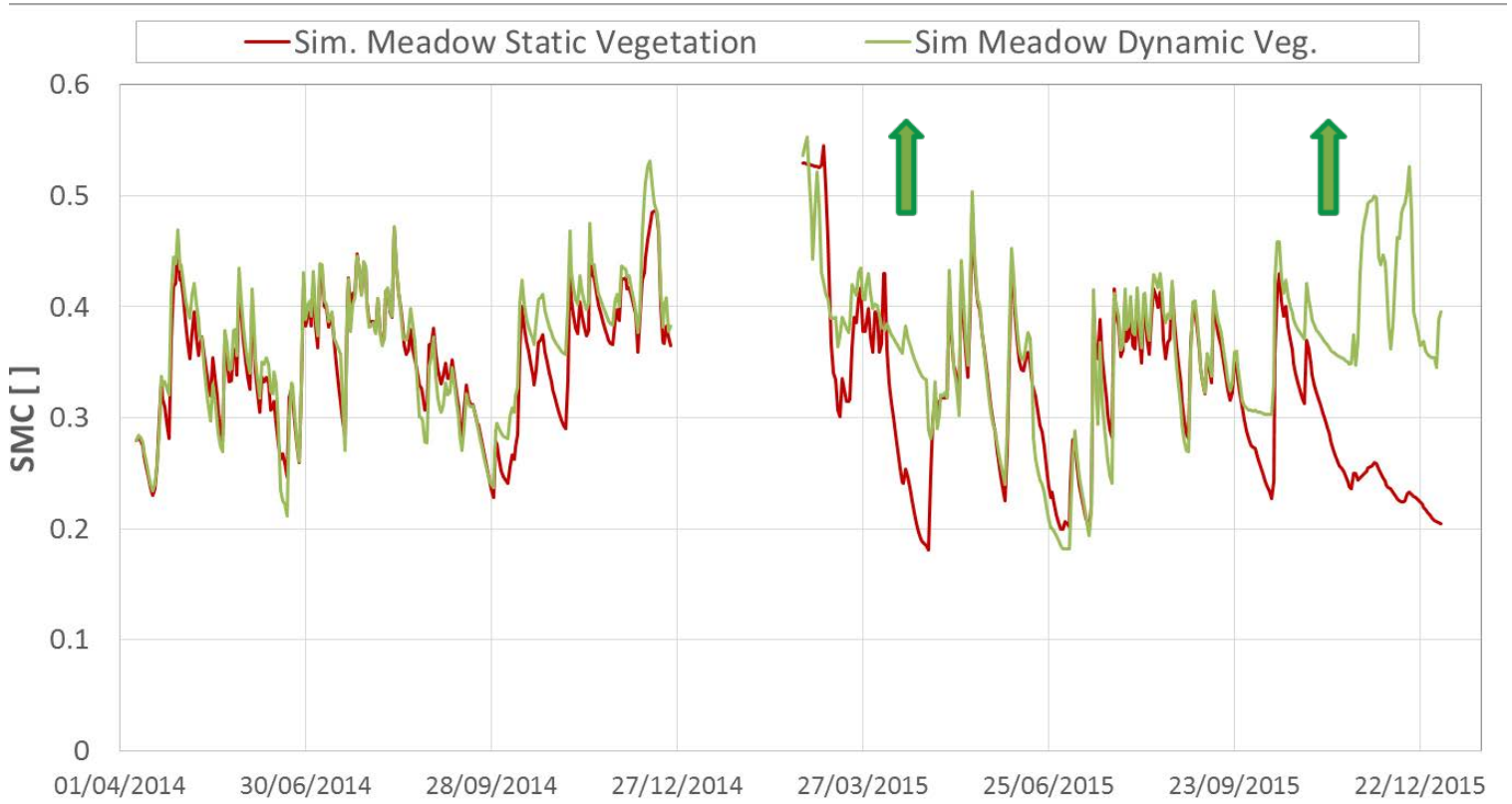
Evaporative stress from **MODIS LST** and climate model data

ET at sub-field scale from local meteo data and thermal camera measurements from UAV





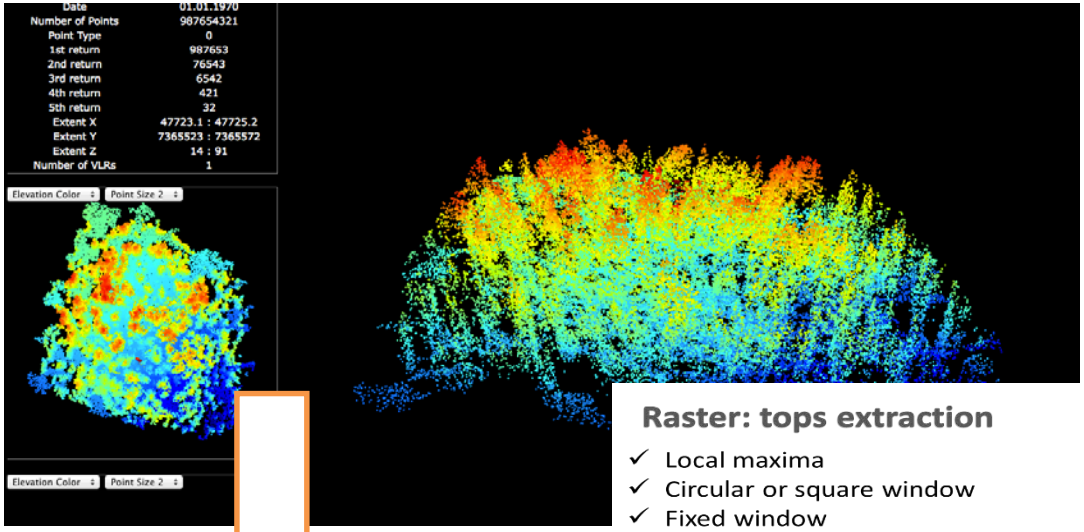
Modelling Soil Moisture

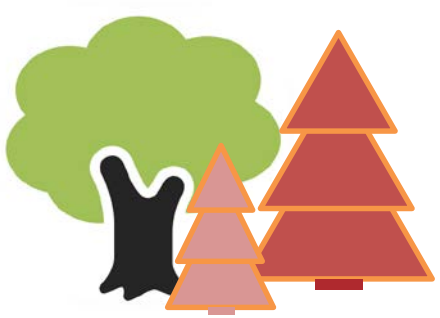


Vegetation dynamic has an impact on SMC, especially in spring and autumn

Tree height and structure

Integration of airborne Lidar and UAV photogrammetry for vegetation structure parameters



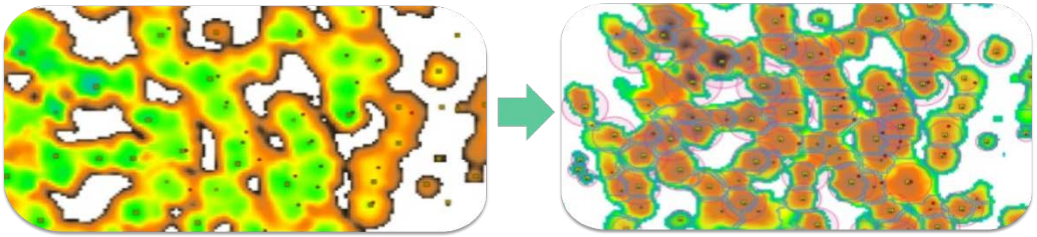


Raster: tops extraction

- ✓ Local maxima
- ✓ Circular or square window
- ✓ Fixed window

Raster: crown extraction

- ✓ Popescu variable circles (height-based)
- ✓ Watershed (Soile)
- ✓ Region growing



The MONALISA Database

Conclusion: Where we are

- Consolidated scientific approaches for monitoring key environmental parameter across scales
- Well established infrastructure for monitoring
- Database with rich time series of multi-scale, multi-parameter datasets
- Links to users (e.g. Beratungsring)

→ High potential for follow up activities in research and application