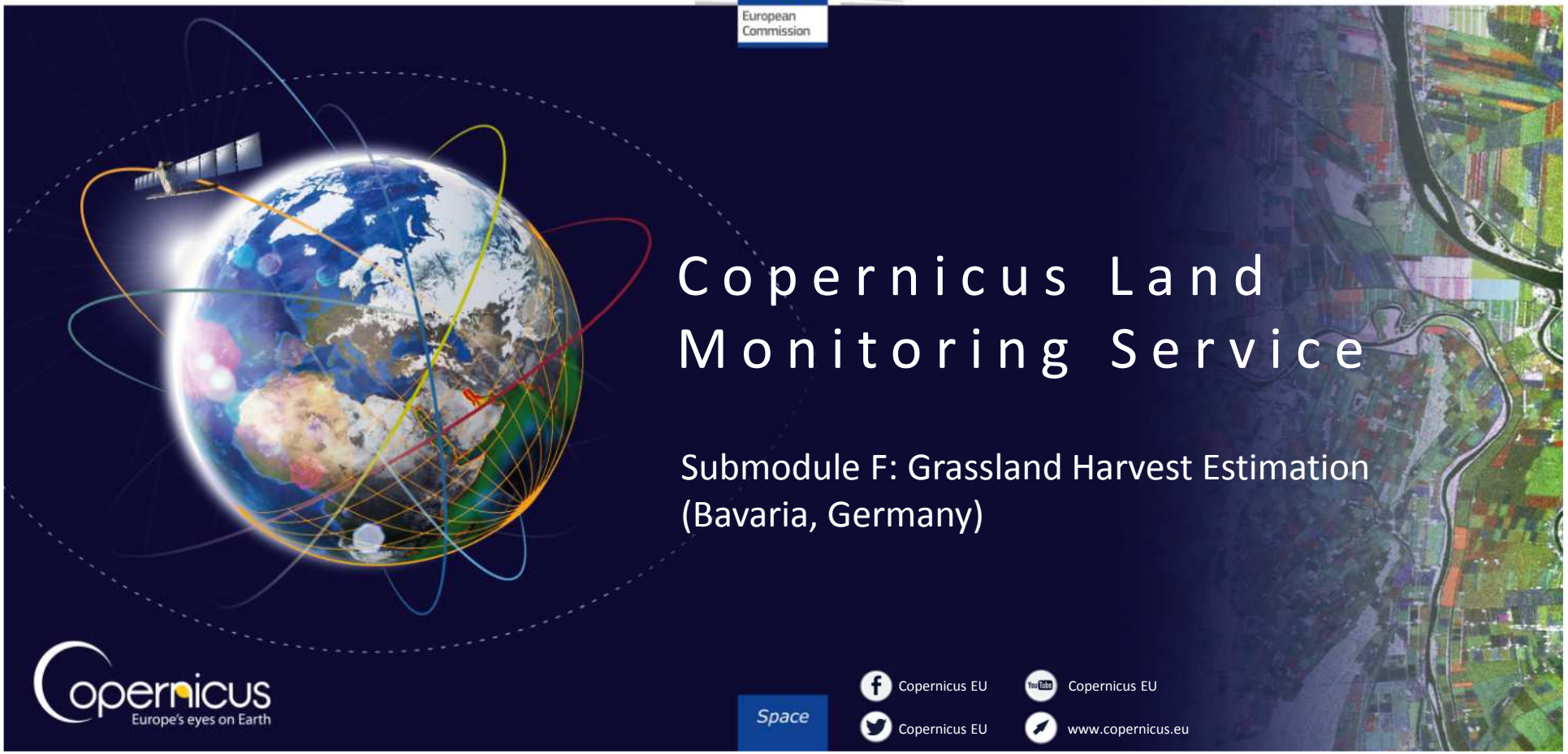
European Commission
Copernicus Land Monitoring Service
Submodule F: Grassland Harvest Estimation (Bavaria, Germany)
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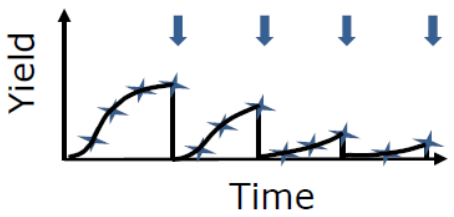
Introduction

- Grassland is one of the main (indirect) protein sources in Bavaria (Southern Germany) for producing milk and meat.
- Grassland is also an energy source for bio-gas production.
- Even slight changes in harvest have strong impacts on the protein and energy market and related prices.
- Existing information gap:
  - Grassland harvests per season and productivity is not well known
  - Only very rough estimates are available, as no weighing system or reporting obligation exist.

Introduction of use case

- The Bavarian agricultural administration wants to:
  a) know the number of grassland harvests per season
  b) use / improve a model for grassland productivity



- The case study has been implemented by:
  a) LFL (state entity for agricultural research) providing test areas for verification / validation
  b) CAU (University of Kiel) for modelling grassland productivity
  c) Service providers (GAF AG / e-GEOS) for radar remote sensing data processing

Input Data

- COPERNICUS can provide information on the:
  - grassland areas through the High Resolution Layer “Grassland” (http://land.copernicus.eu/pan-european/high-resolution-layers/grassland/view): currently HRL 2012 or other sources; large improvements expected from HRL 2015
  - Satellite Radar Data from Sentinel-1 and Copernicus Contributing Missions (here: COSMO-SkyMed) – to analayse date and number of harvests
- IACS – ‘Integrated Administrative and Control System’: administrative information system on farm and field level from the agricultural administrations for EU subsidies and environmental measures

Introduction of demonstration

- Presentation of grassland harvest date assessment
- Presentation of grassland productivity modelling
- Results

Two approaches for change detection using SAR data:

1) **Change detection** by comparing pairs of images in a time series

- Fixed geometries of the sensors allow four data acquisiton within 16 days (example: if using COSMO-SkyMed / should be possible with S-1 constellation in near future)

  → **image-to-image** comparison at 1, 3, 4, 8, 9, 12 days difference

  (...\final\Presentations\Videos\CLMS_Submodule_F_Cosmo4.avi)

2) **Improvement/adjusting of timelines** by comparing the detected changes of different times series

- variable geometries of the sensors allow for up to four data acquisitions per day

  → **improving** the data acquisition cycles up to one day

  (CLMS_Submodule_F_1403_025_AR_EN.mp4)

Data acquisition planning for SAR-sensors:

continuous and dense time series are possible using fixed acquisition geometries from

Sentinel-1A & Sentinel-1B, COSMO-SkyMed etc.

A. Annual reporting:

- **Timeframe:**
  - Using the complete time series for analysing the **vegetation period** e.g. April to October for southern Germany
  - Available at the end of the (agricultural) season
- **Spatial dimension / coverage:** from NUTS level 3 to 1 (counties/Landkreise to regions/Länder)
- **Possible products to be available:** GIS layer, **s**tatistics, frequency of mowing/harvest, summary report

B. Monthly reporting:

- **Timeframe:**
  - Analysis of the time series up to the recent month (statistics) or per harvest sequence (variable)
  - Available at the end of each month or harvest sequence
- **Spatial dimension / coverage:** from NUTS level 3 to 2 (1)
- **Possible products to be available:** GIS layer, **s**tatistics, frequency of mowing/harvest per parcel or field (depends on basic info.)

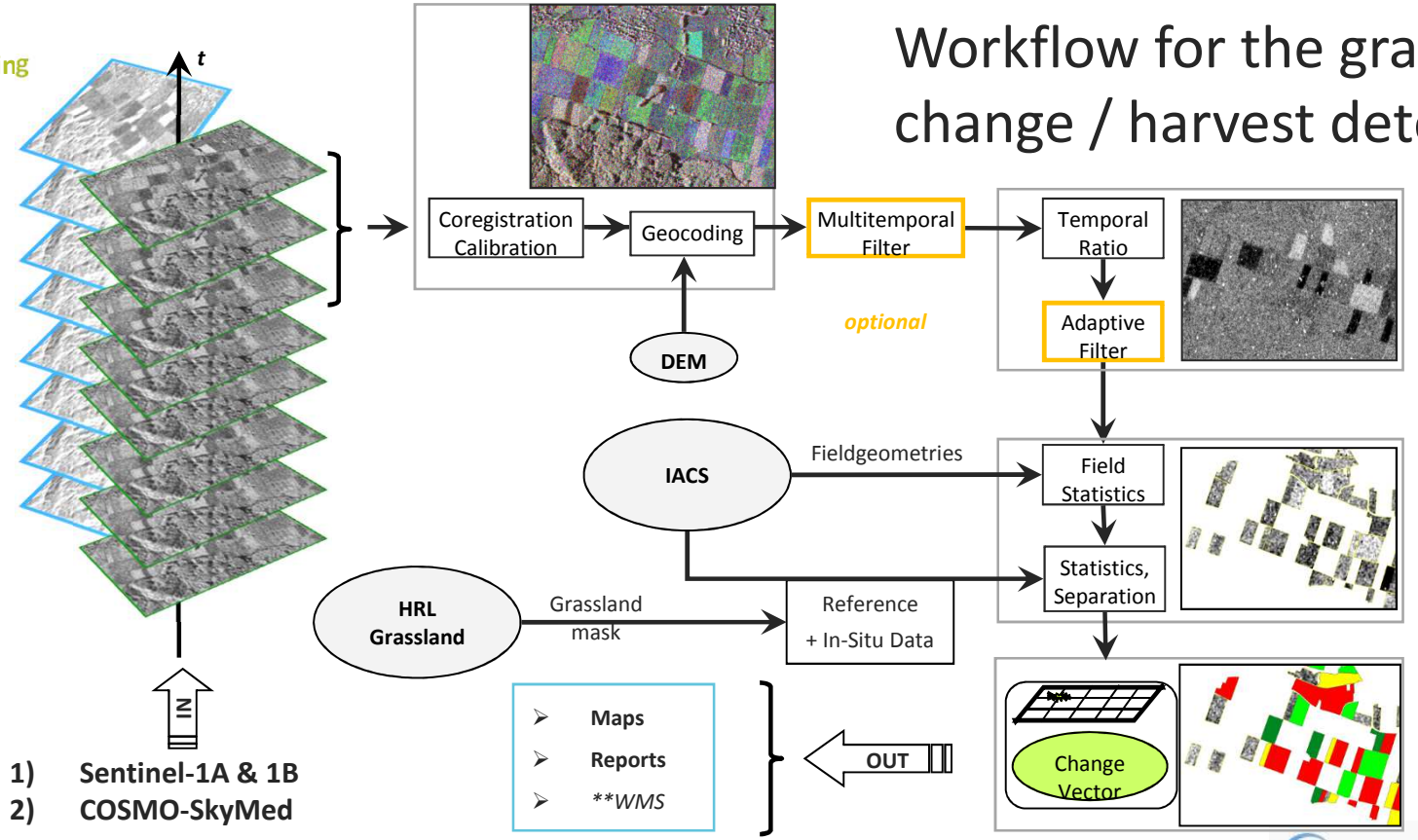
Demonstration

Parcel based change detection workflow and results

Demonstration of improved harvest detection

Land Monitoring

Workflow for the grassland change / harvest detection

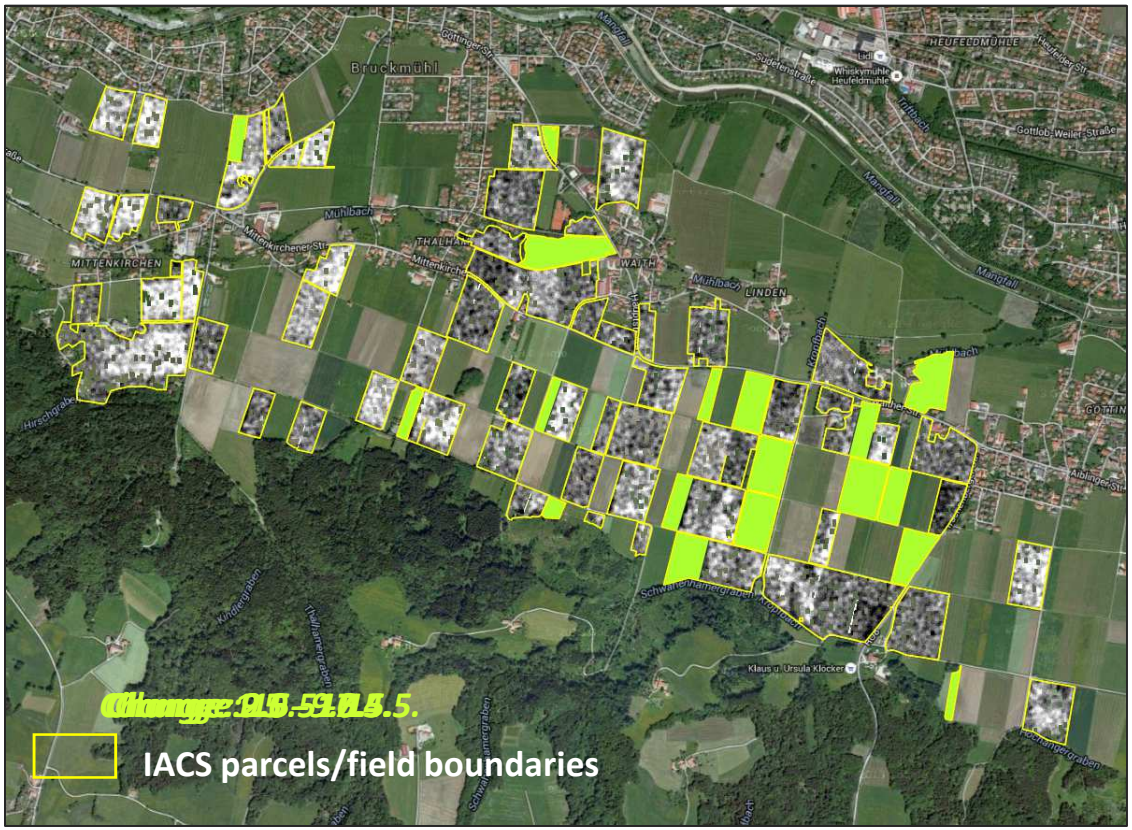


1) Sentinel-1A & 1B
2) COSMO-SkyMed

Land Monitoring

CLMS SUBMODULE F

- Demonstration ‚Bruckmühl' in southern Bavaria - parcel based changes in May:



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Ratio: change of signal from image at date one to image date two

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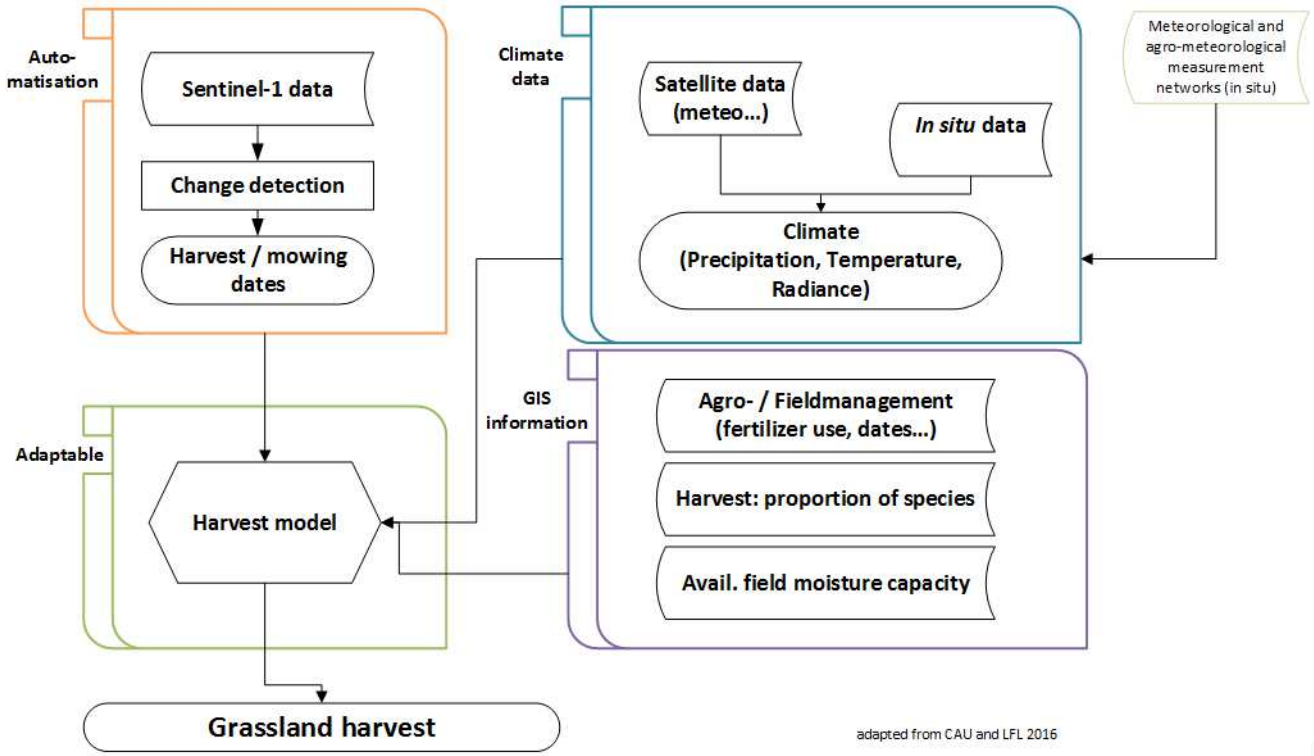
Harvest modelling / assessment: Components for a full coverage modelling



adapted from CAU and LFL 2016

- **Demo ‚Bruckmühl‘**
  - Highlighting the improved detection of harvested parcels: 1st - 17th May 2015
  - Data: COSMO-SkyMed, 3 pairs of data, 2 observation geometries

Time of harvest May 2015:	
	1. – 2.5.
	2. – 9.5.
	9. – 10.5.
	10. – 14.5.
	14. – 17.5.
	unknown