A3.01 Towards global rangeland monitoring using Sentinel-1/2/3

Deep Learning Methods for Grassland Activity Monitoring

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Overview

Grassland Monitoring for the Common Agricultural Policy (CAP)

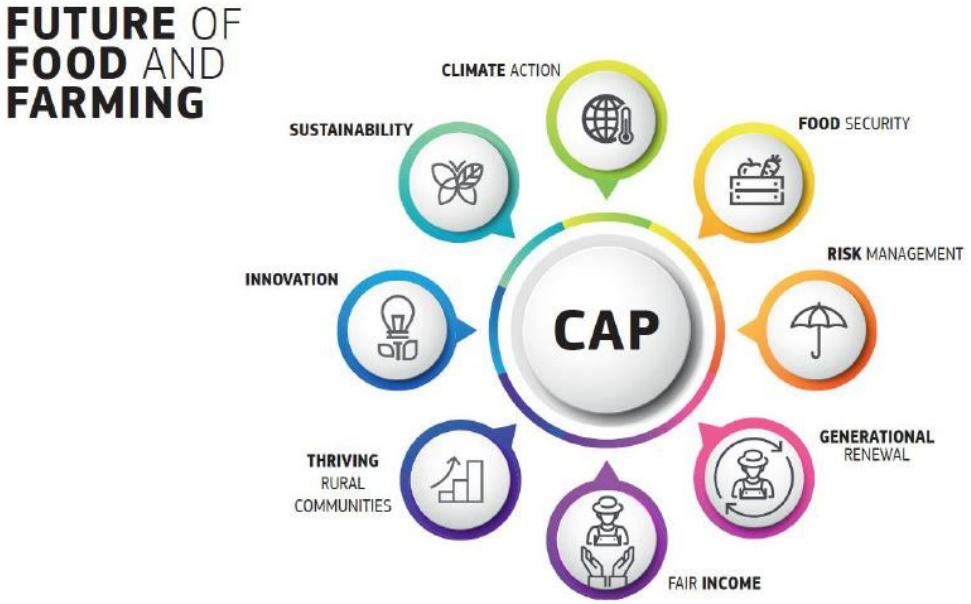
Extensive Cloud Coverage and S1-S2 Fusion

Deep Learning for Event Detection

Quantification of the Grassland Use Intensity and CAP monitoring

Remarks & Future work

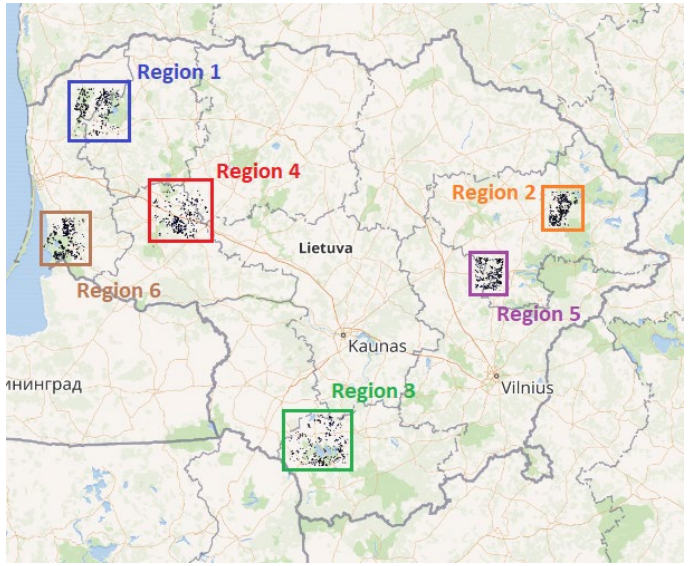
Grassland Monitoring for the Common Agriculture Policy (CAP)



- Grasslands provide a wide range of ecosystem services (e.g. fodder for live stocking animals, wildlife habitats, carbon storage, soil erosion protection etc.)
- The Common Agricultural Policy (CAP) requires the systematic and timely remote monitoring of Agricultural Lands and Grasslands
- *Pillar I of CAP* - The detection of grassland mowing events at the parcel-level has been identified as a key data product to assess the compliance with respect several CAP measures, including the crop diversification and permanent grassland areas maintenance
- Most countries also define national regulations such as a reference date or period for the mowing of permanent grasslands, as well as grazing events, boundaries elements, mowing date or mowing within an agronomic year (e.g. Spain, Italy)
- *Pillar II of CAP* - Conceptual Design of targeted agro-ecological and climate-focused measures (CAP post-2020)

Study Area and Extensive Cloud Coverage

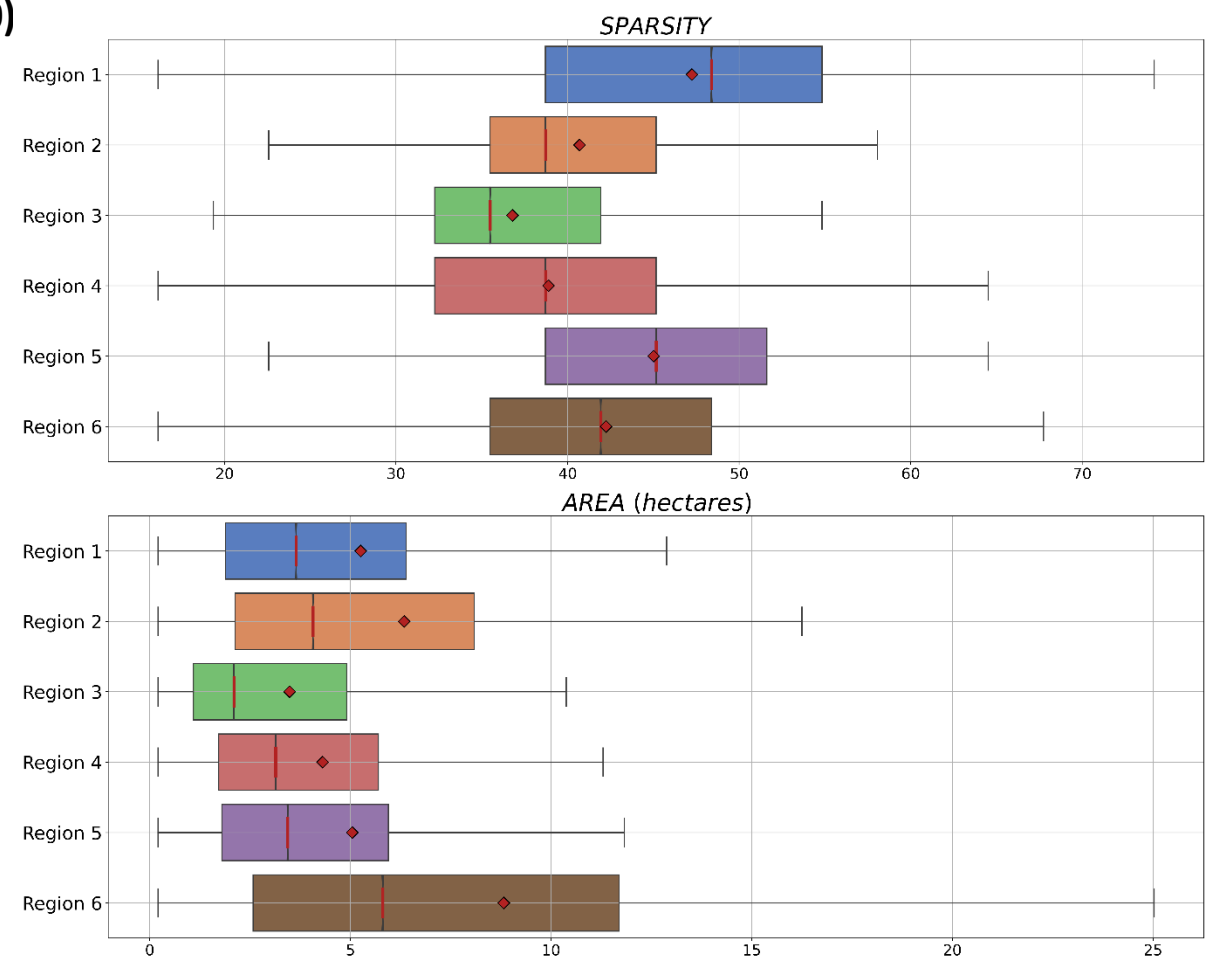
The study was conducted in the country of **Lithuania (April-October 2020)**



Climatic Regions*

- Region 1 → Samogitian
- Region 2 → SE Highlands
- Region 3 → Middle Lowlands
- Region 4 → Samogitian
- Region 5 → SE Highlands
- Region 6 → Coastal

** Based on Climatic Regioning of Lithuania 2013 (Lithuanian Hydrometeorological Service under the Ministry of Environment of Lithuania)*



300 sample parcels (area > 0.5 hectares) are taken from 6 different regions of Lithuania (**Regions 5 and 6 will be used only for testing**)

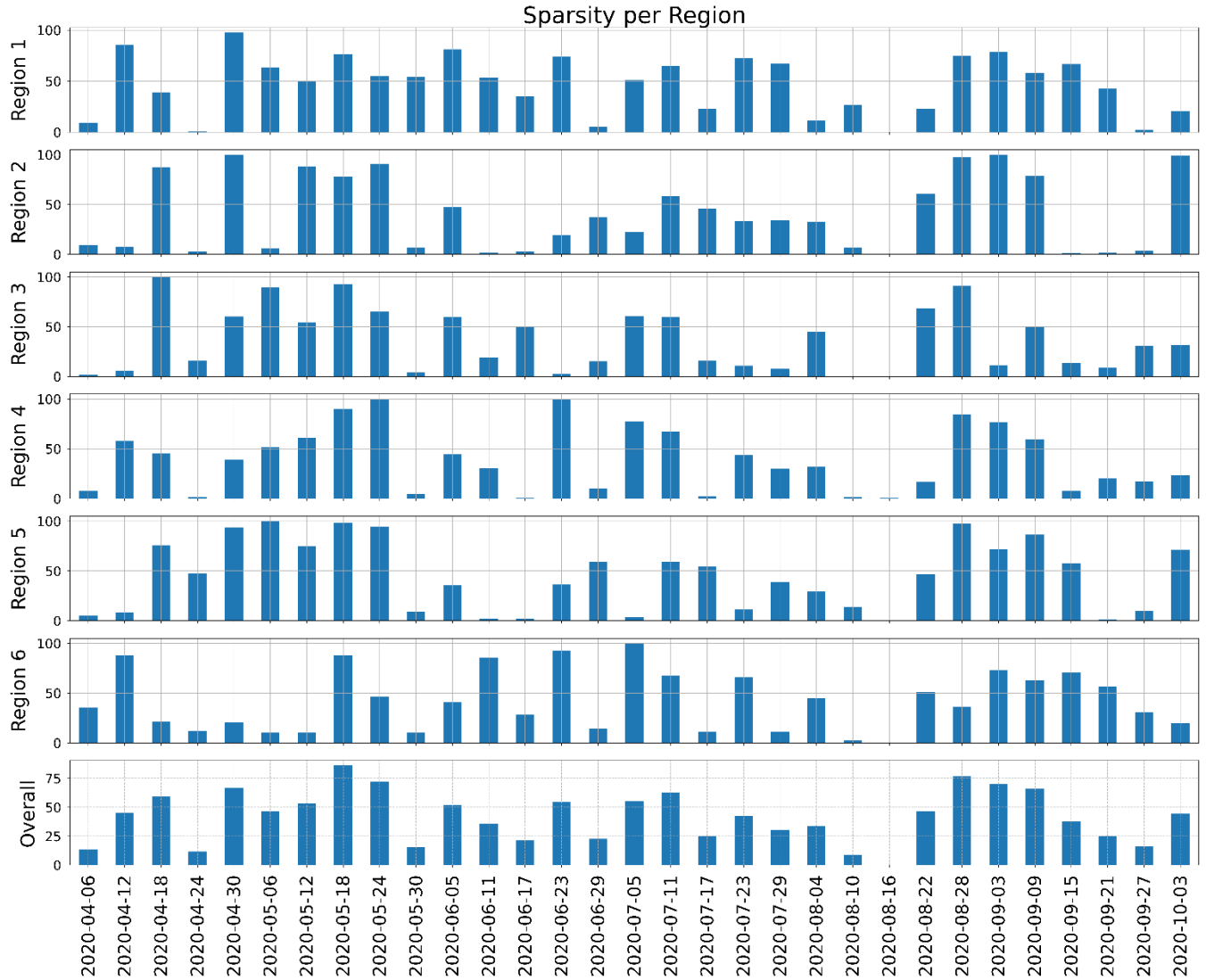
Sentinel-2 L2A

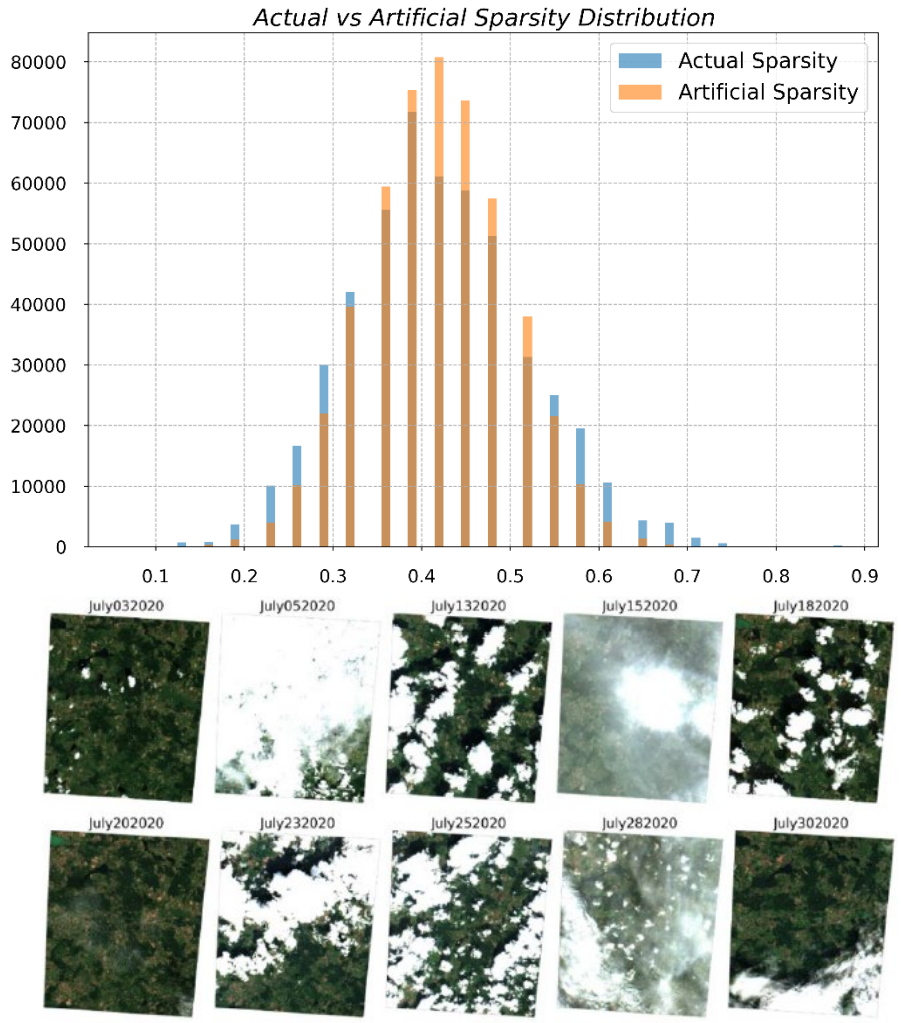
- Normalized Difference Vegetation Index (NDVI)
- Scene Classification (SCL) based on sen2cor L2A processor

Sentinel-1 GRD (rel. orbits: 58, 131) → Backscattering coefficients (VV-VH)

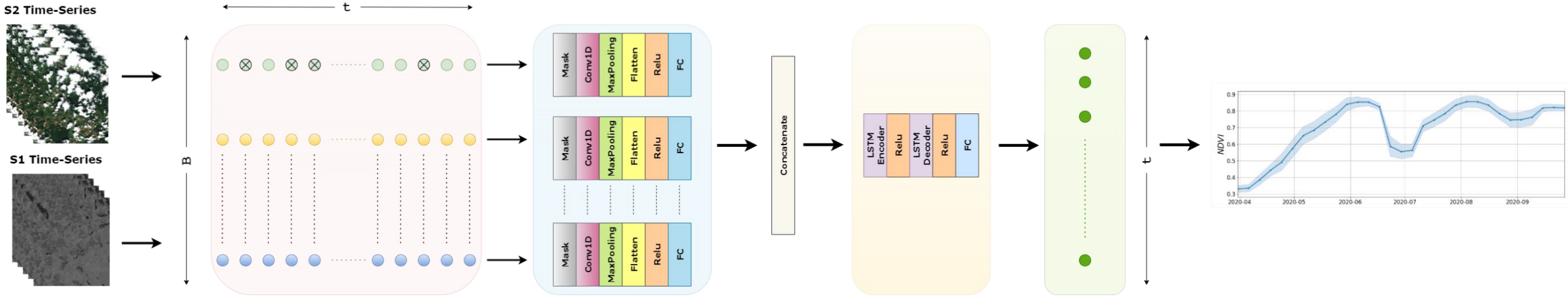
Sentinel-1 Coherence (rel. orbits: 58, 131) →Coherence coefficients (VV-VH)

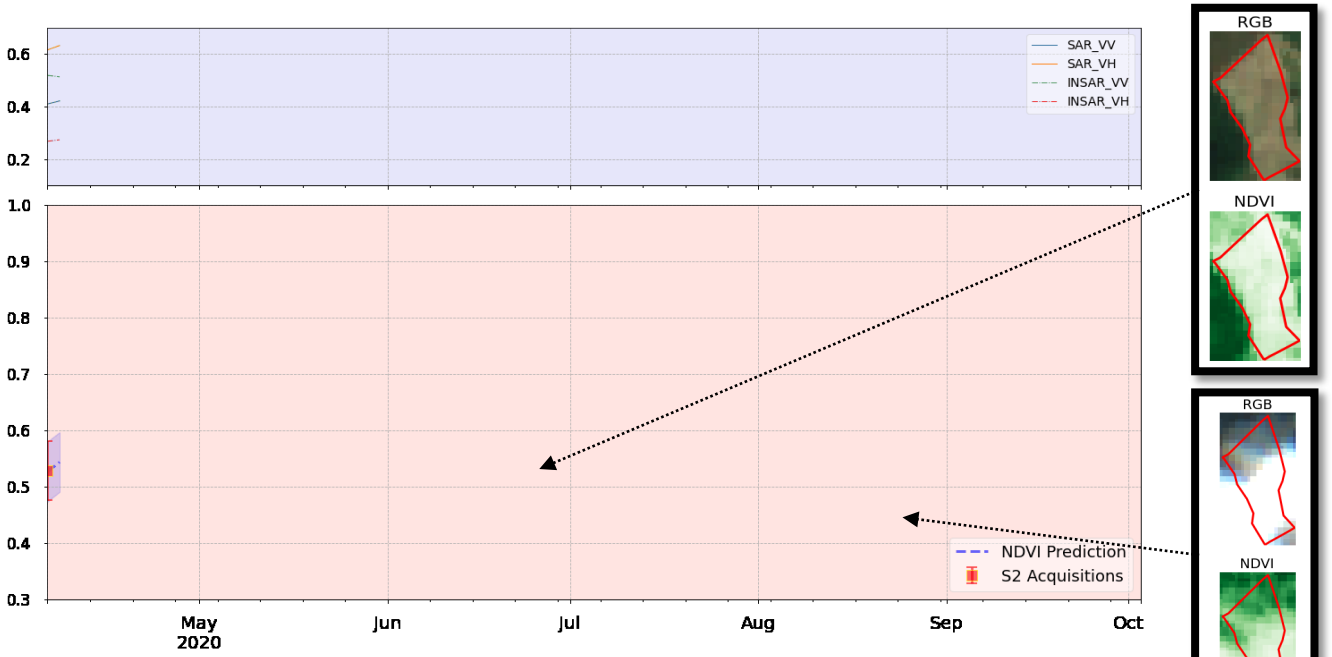
Sparsity due to Cloud Coverage and Artificial Masking

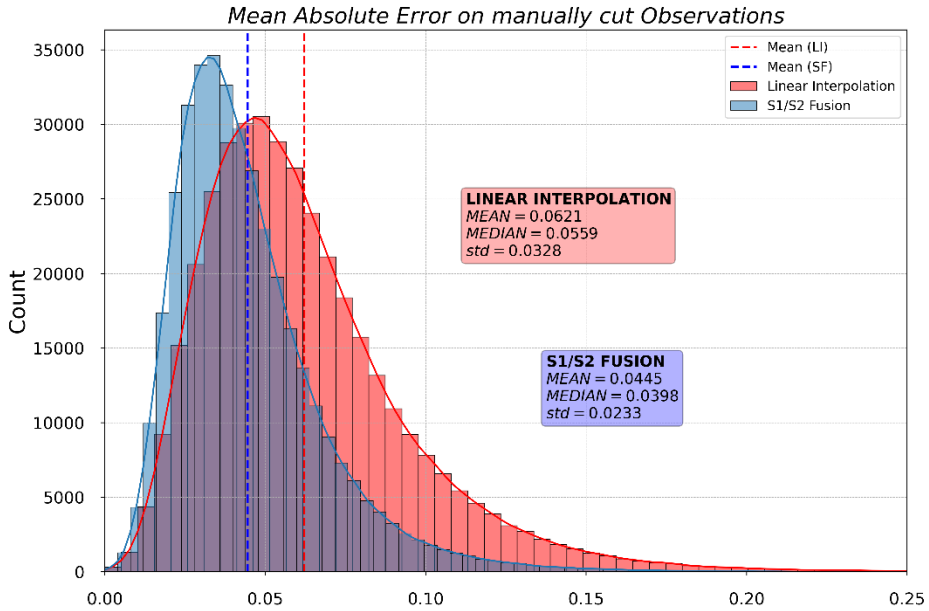




Sentinel-1/Sentinel-2 Fusion







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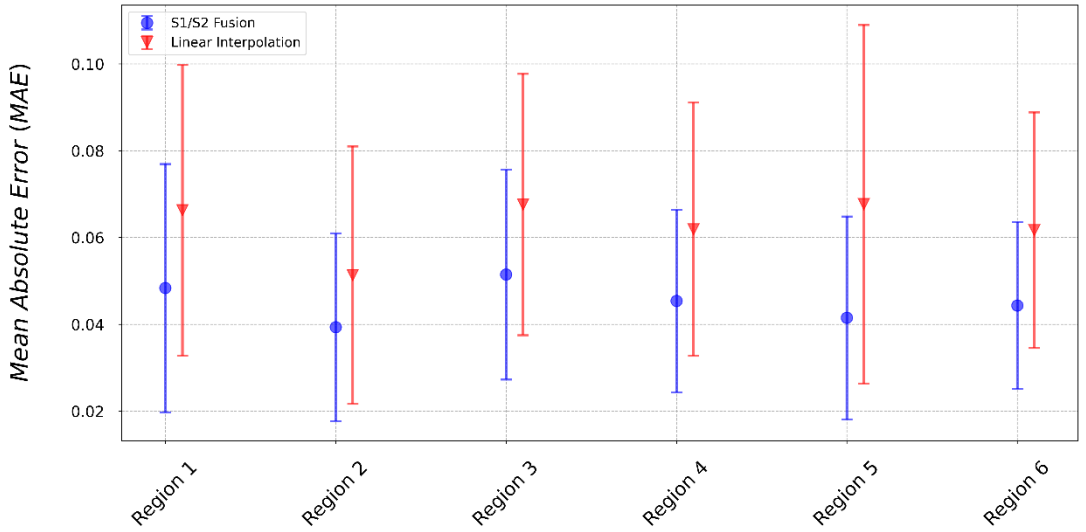
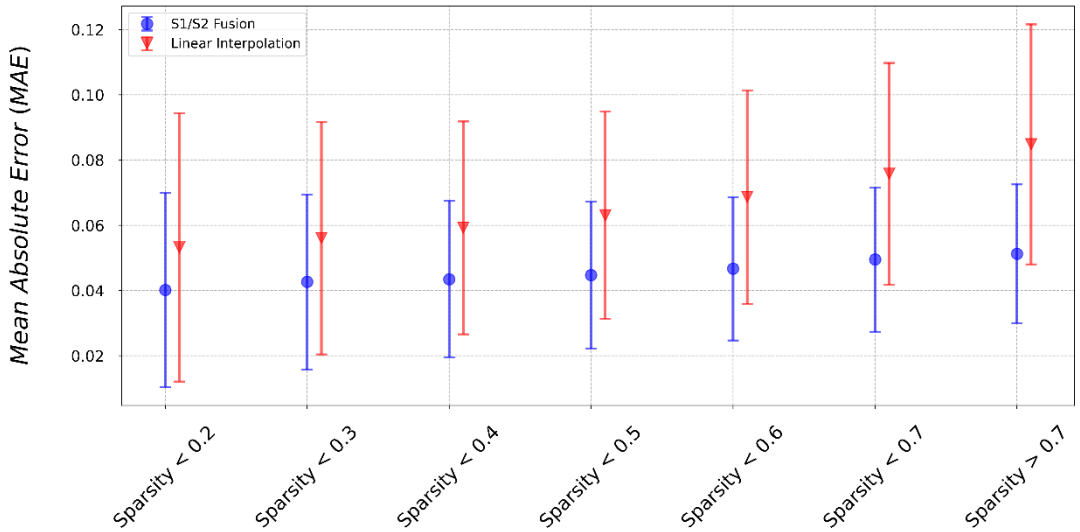
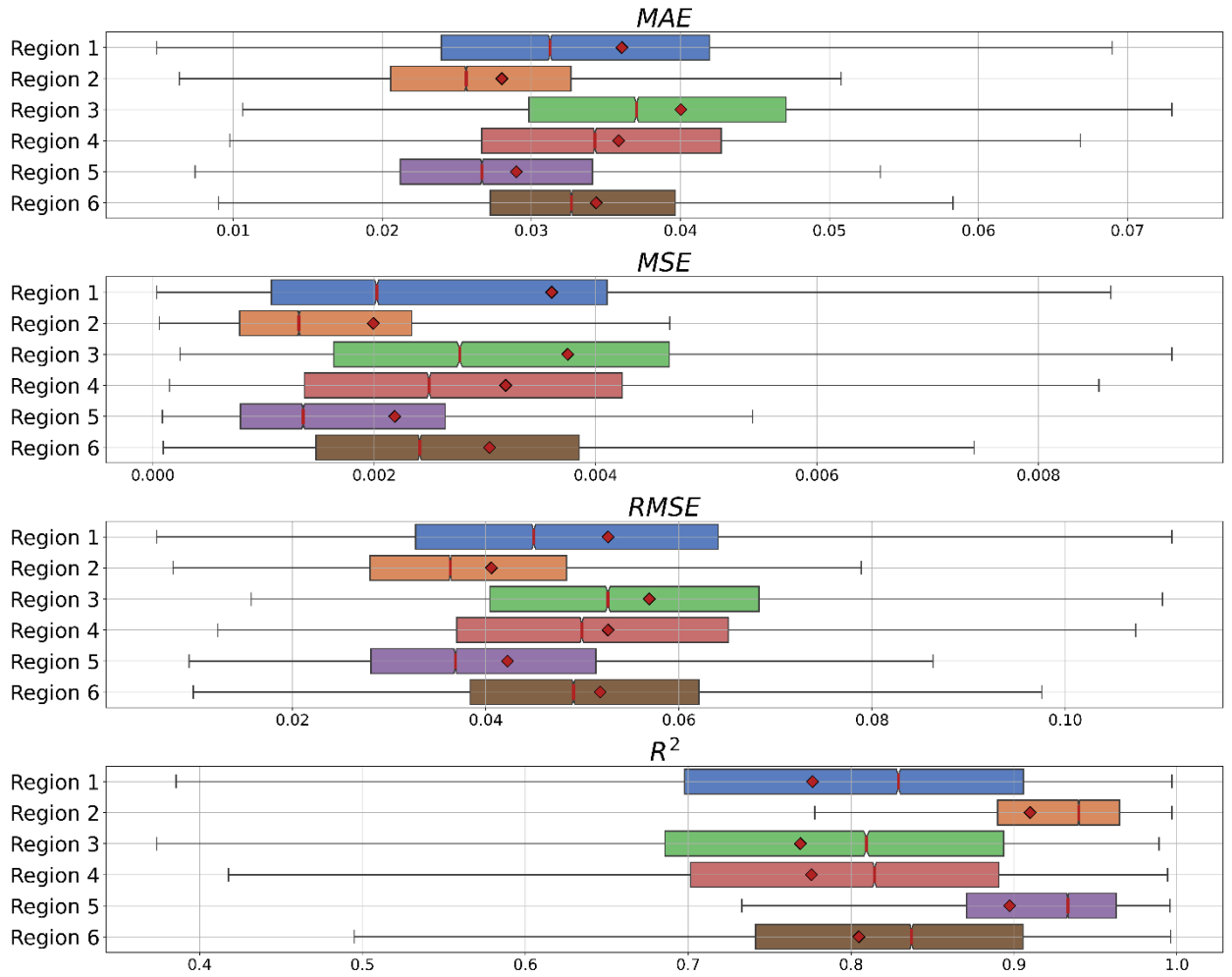
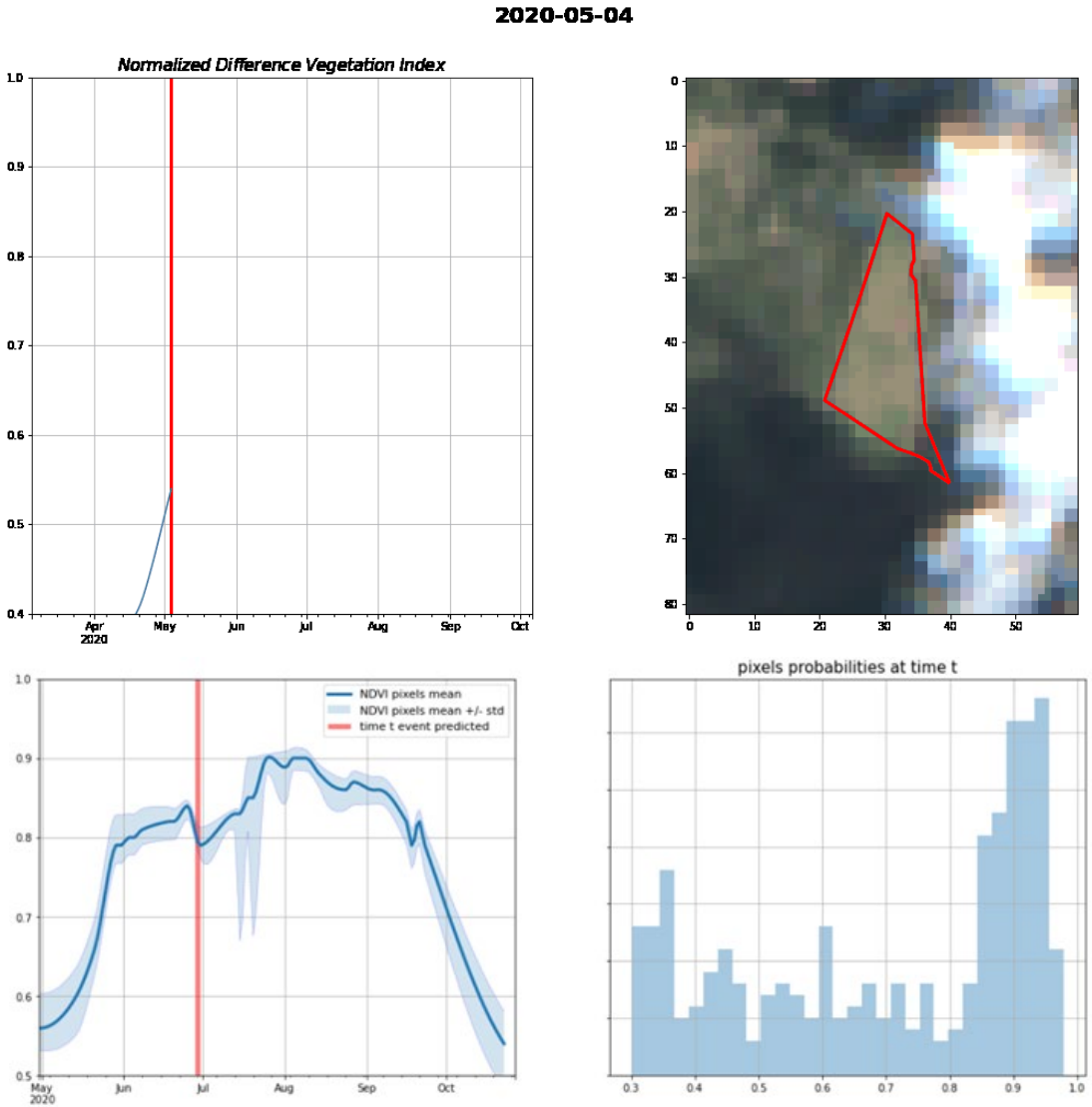
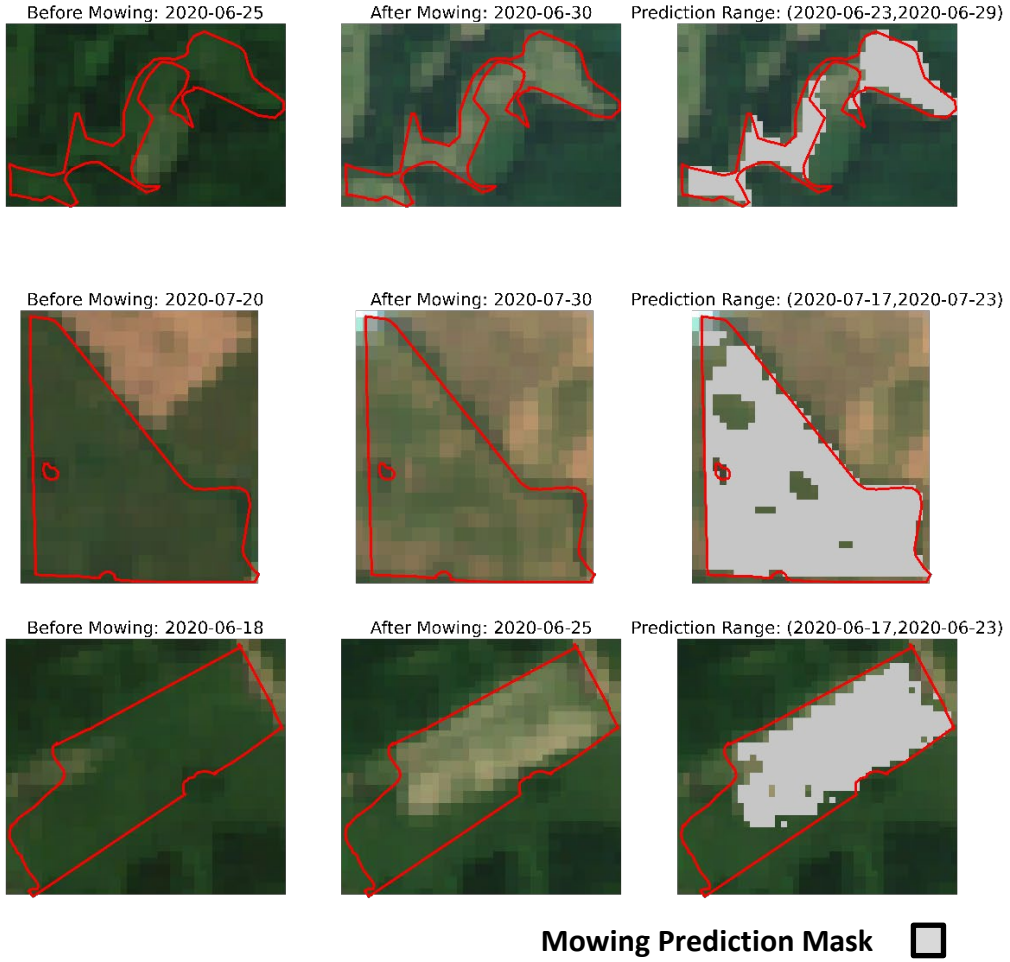






Deep Learning for Events Detection





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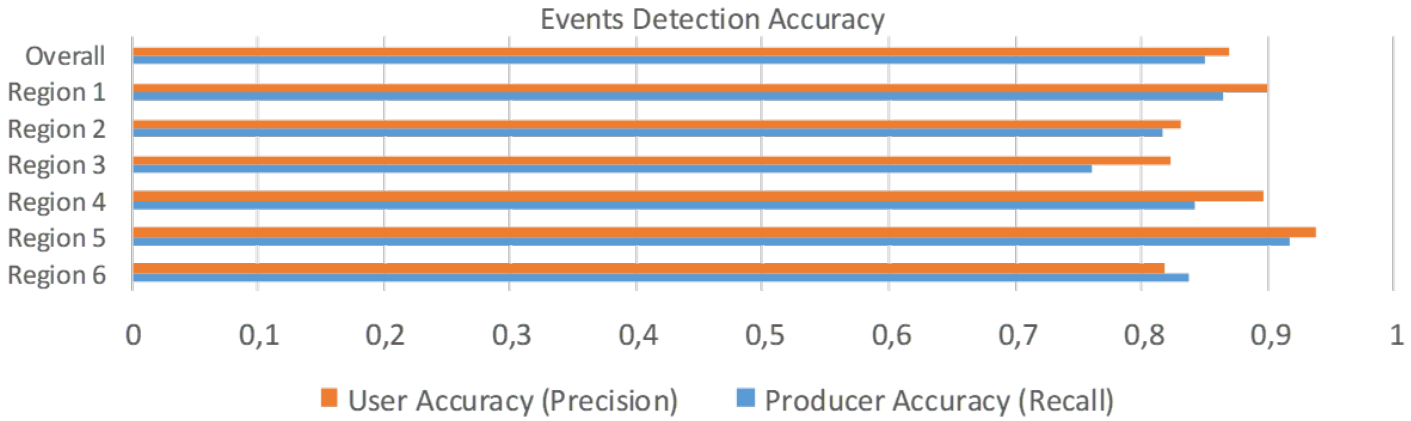
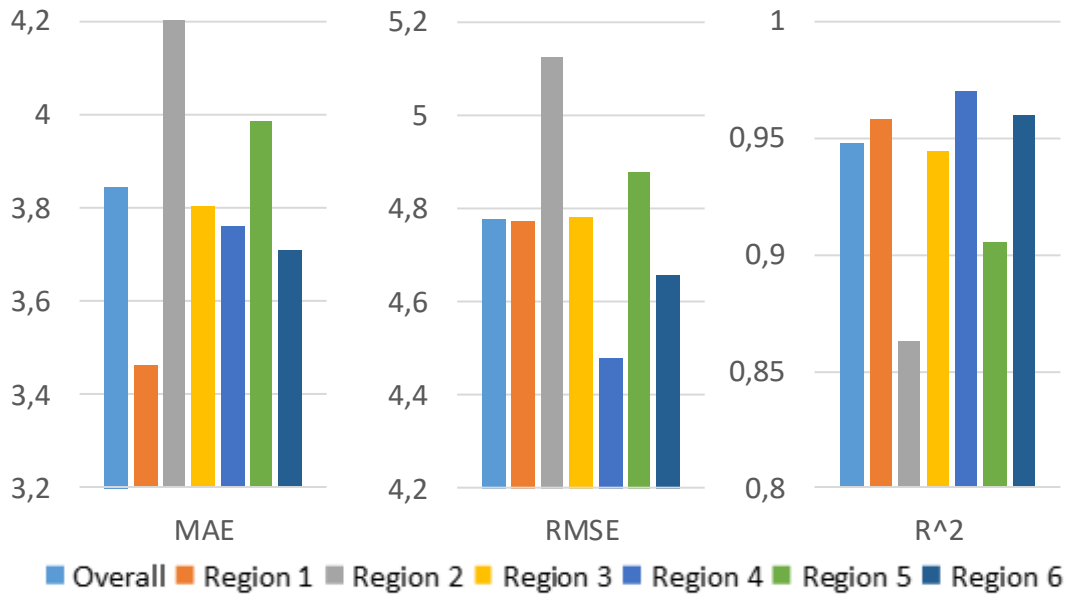
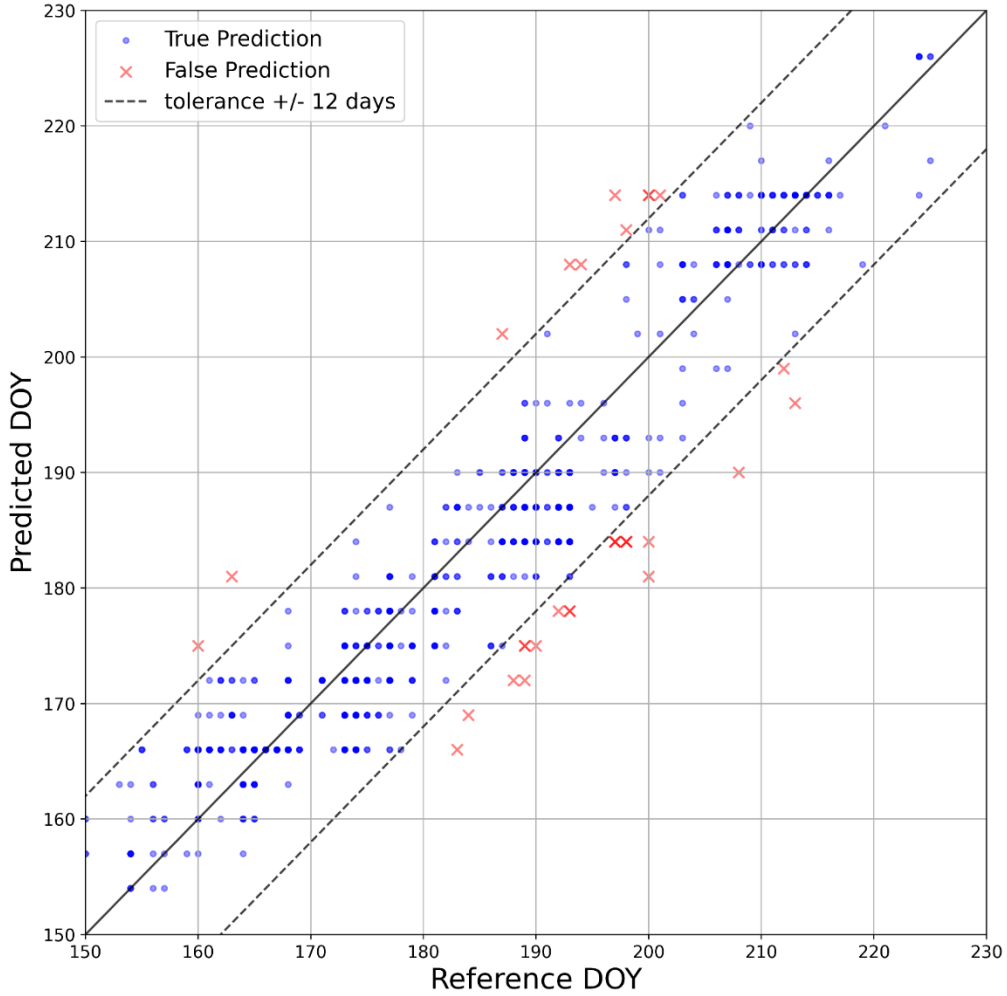
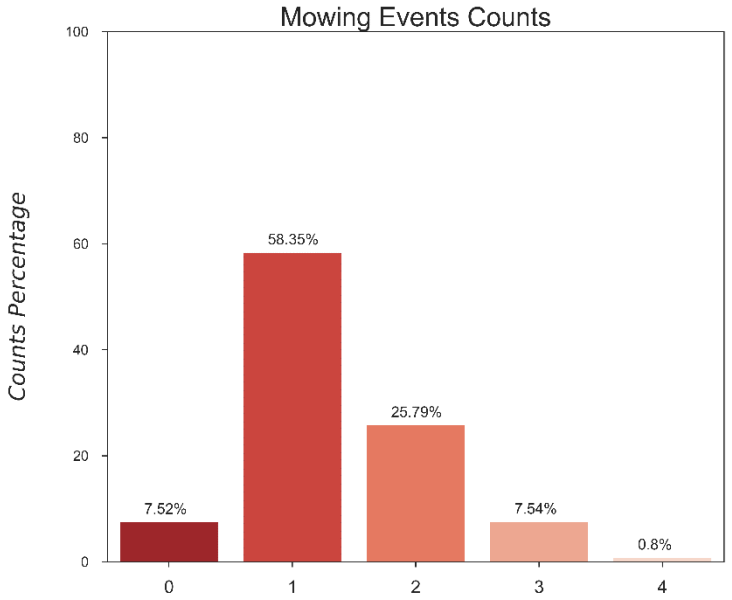


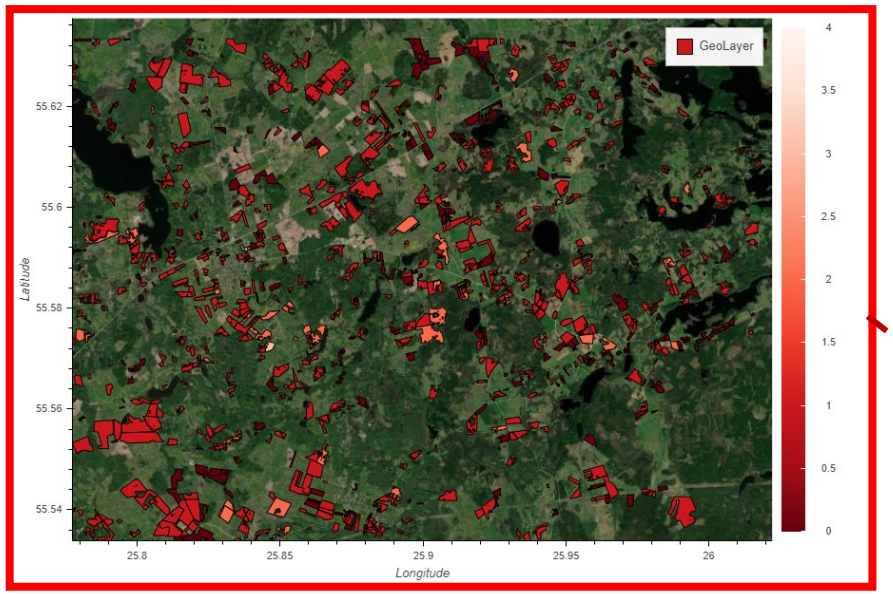


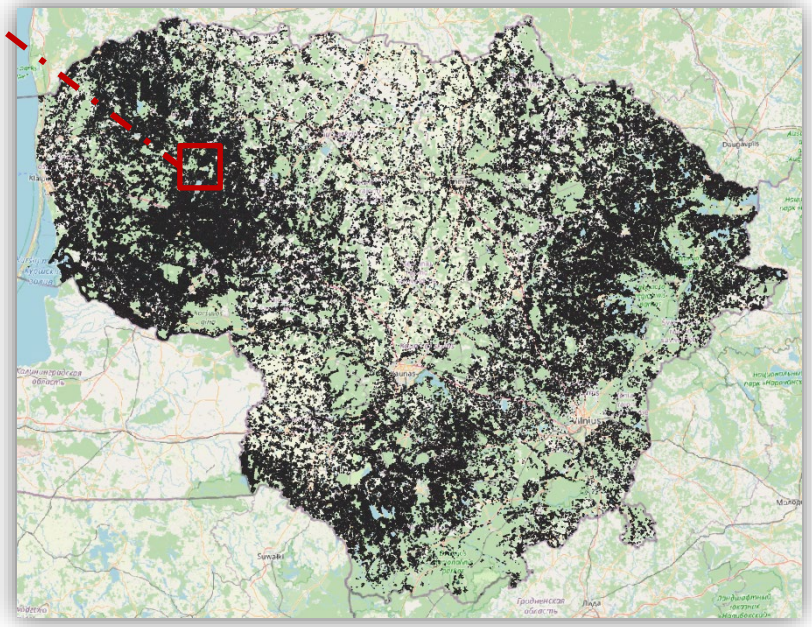
Reference day of the year (DOY) for the mowing events and the DOY predicted by the model

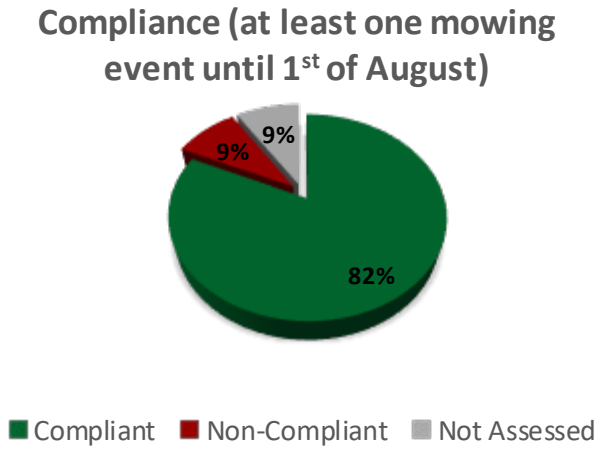


Towards exhaustive CAP monitoring & Quantification of Grassland Use Intensity



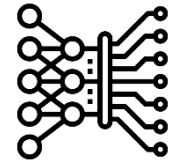






Remarks & Future work

- A pixel-wise (DL) routine that can create dense NDVI time-series integrating both Synthetic Aperture Radar (Sentinel 1) and the available cloud free Sentinel 2 acquisitions
- An original Deep Learning Mowing Detection Algorithm based on Recurrent Neural Networks
- Meteorological and other ancillary metadata (e.g. topographic, DOY, LPIS subclass etc.) integration
- Evaluate more sophisticated architecture layers (e.g. self-attention)
- Analyze grasslands management activity of Lithuania and provide an eco-scheme knowledge
- Generalization of pipeline to a variety of similar event detection tasks on SITS (e.g. Stubble Burning Detection)



Acknowledgments

- A **blind photo-interpretation process**, performed by 3 experts in order to generate annotated training and validation event instances
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Thank you!

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