Products of the Soil Composite Mapping Processor (SCMaP)
A novel approach for mapping soil development

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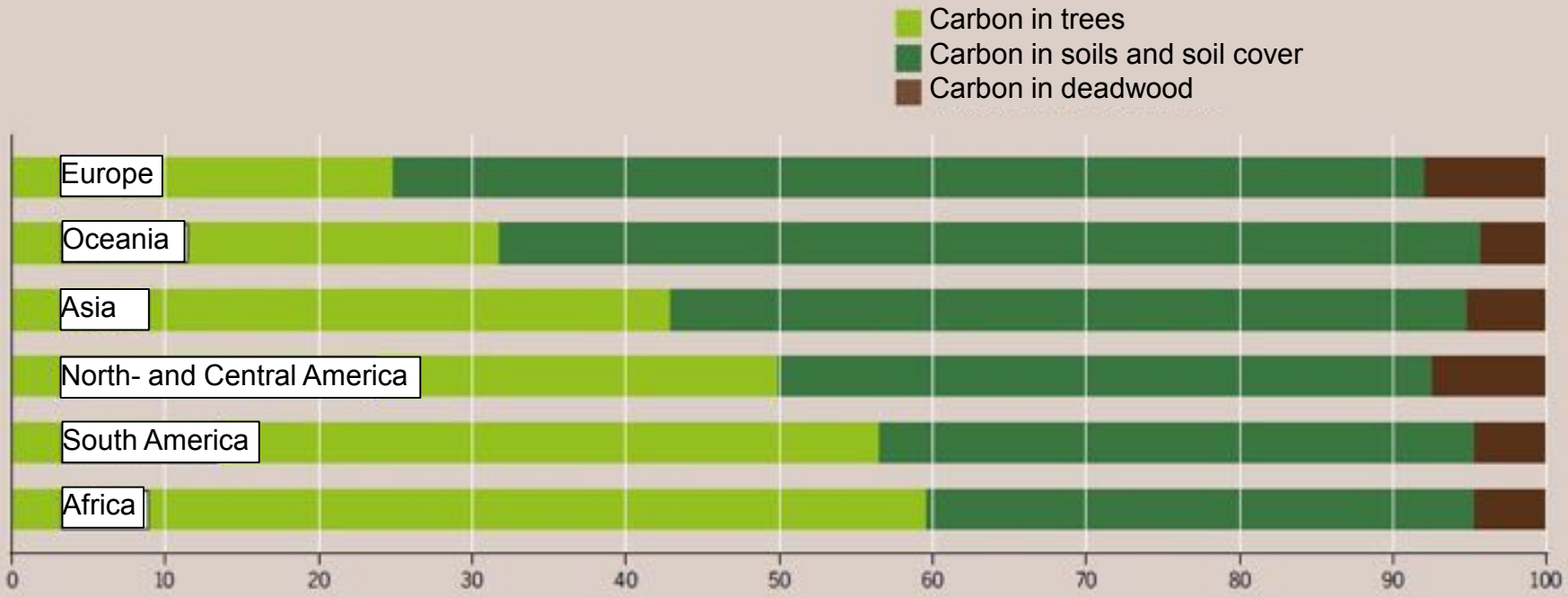
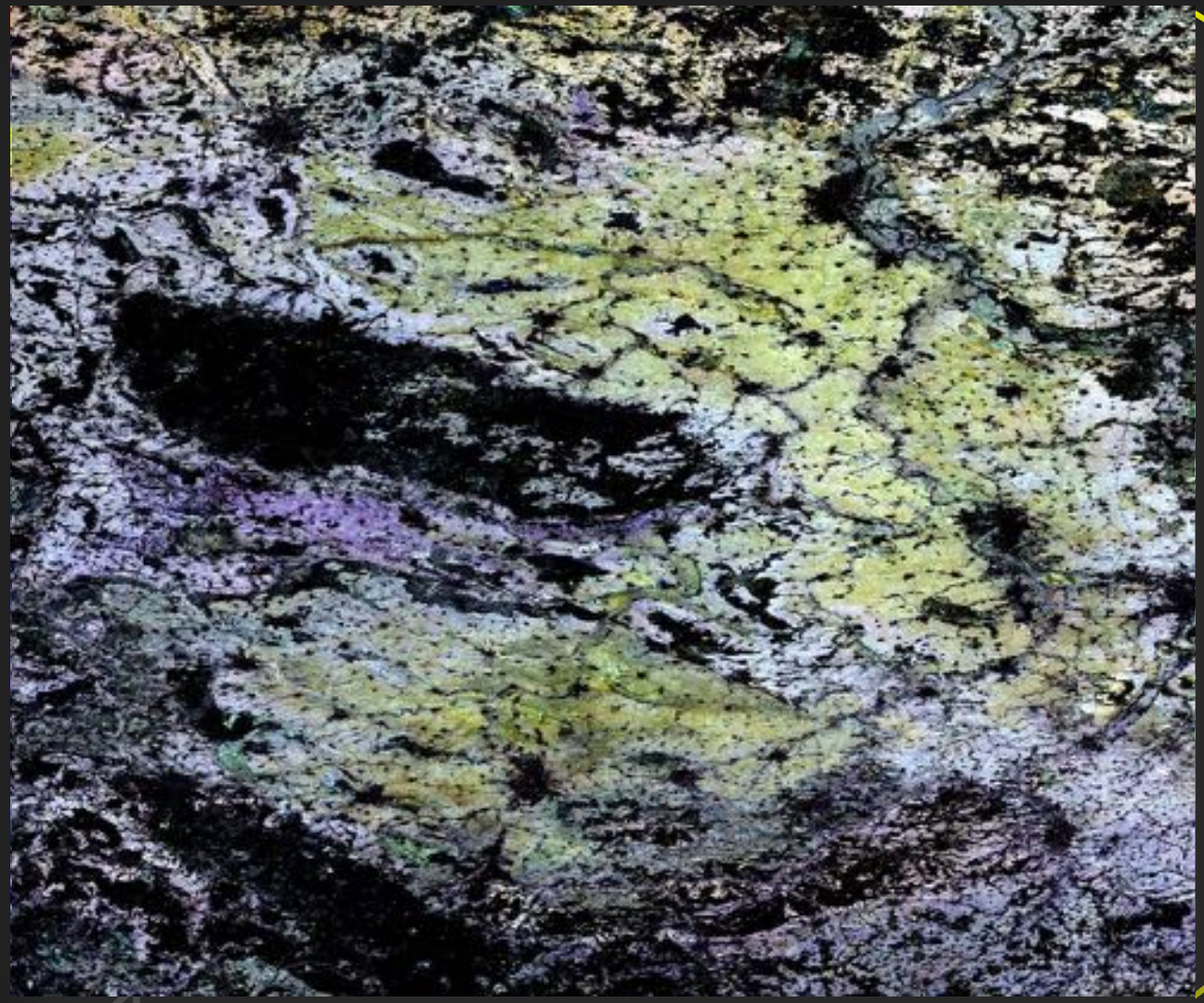
Overview

1. SCMaP Products
2. Methodology
3. Potential Application
4. Outlook

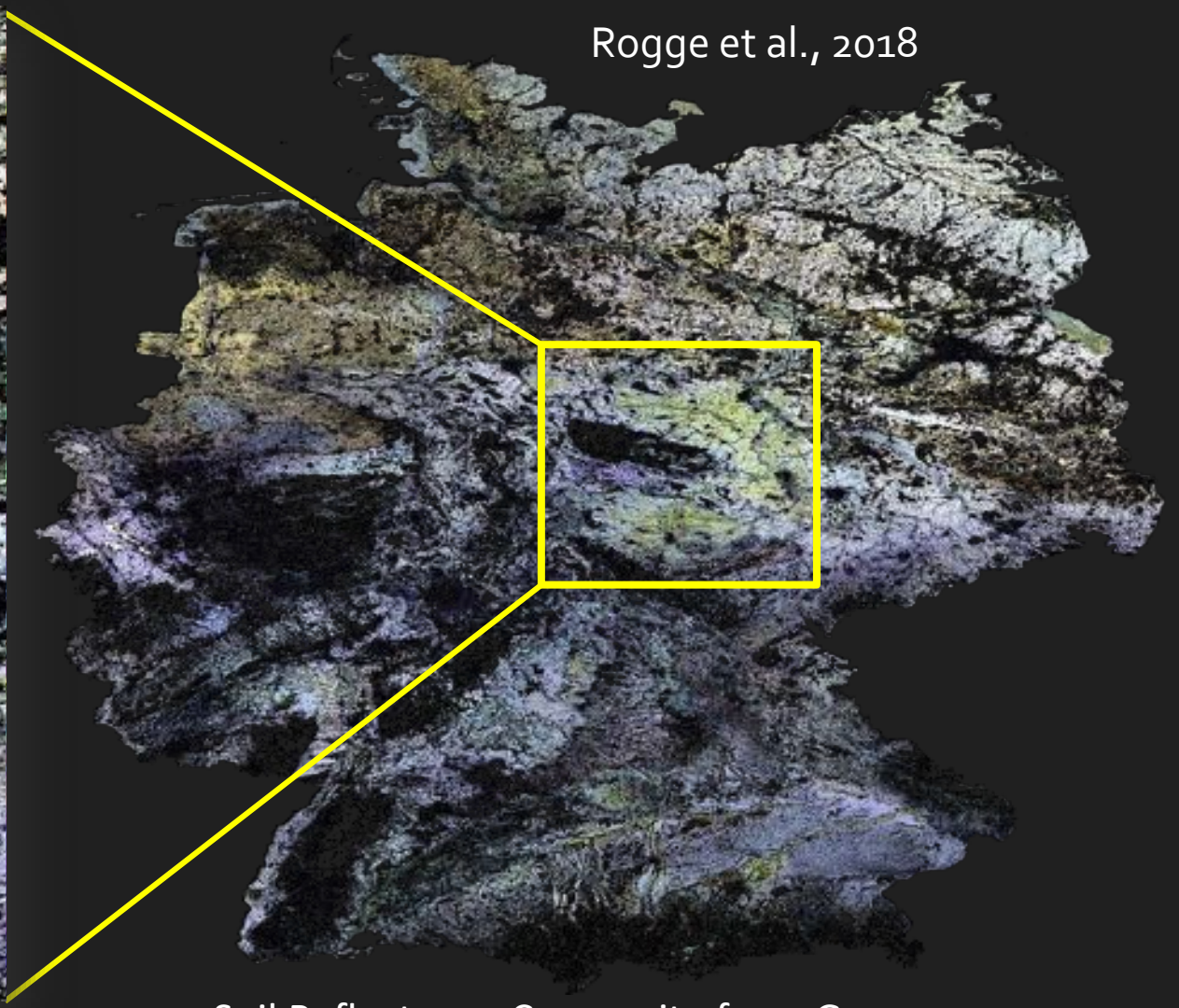


SCMaP Products – Soil Reflectance Composite



Harz Mountains, Germany

Rogge et al., 2018



Soil Reflectance Composite from Germany
(RGB: Landsat 7-5-3), Images taken from 1984 - 2014

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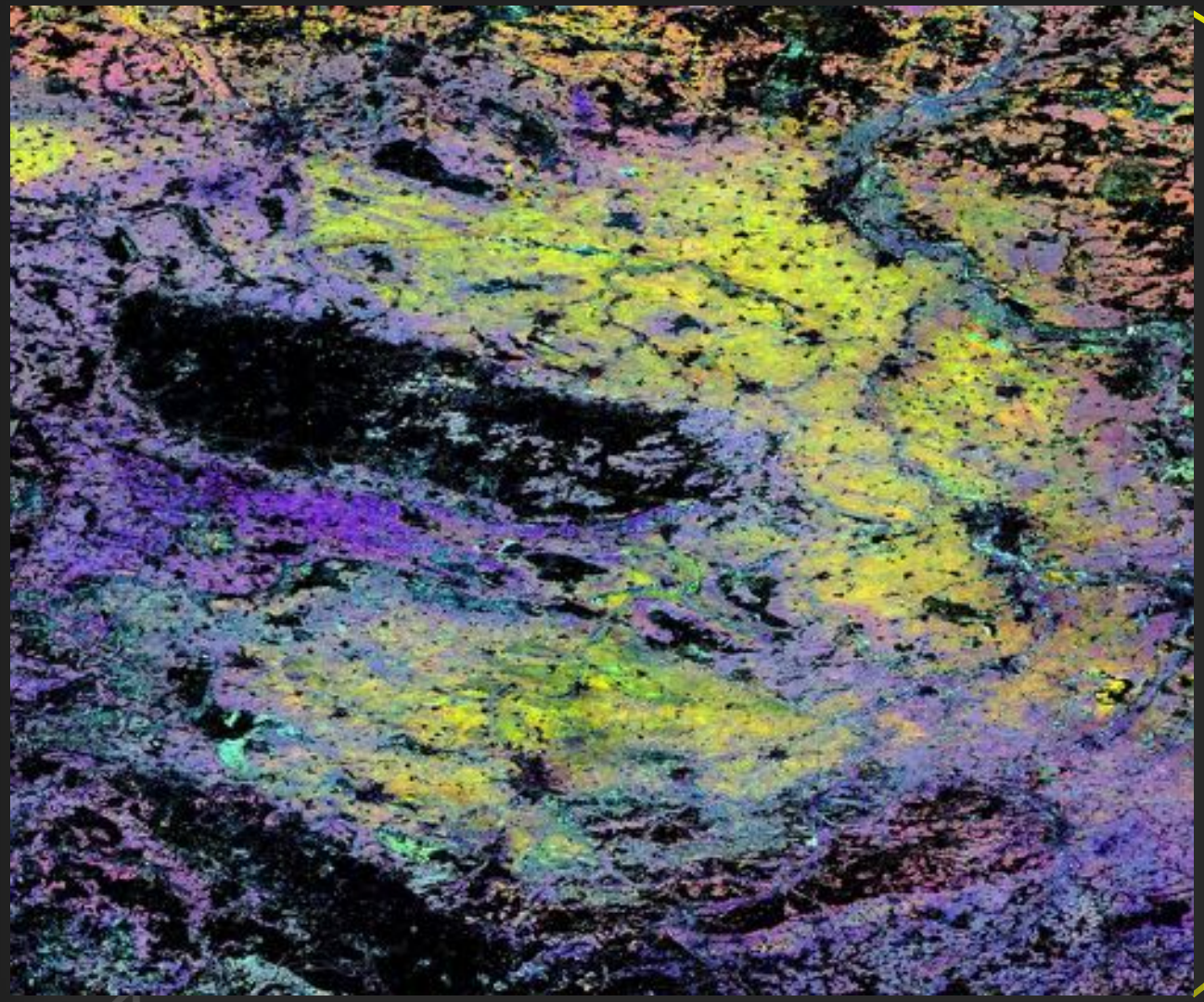
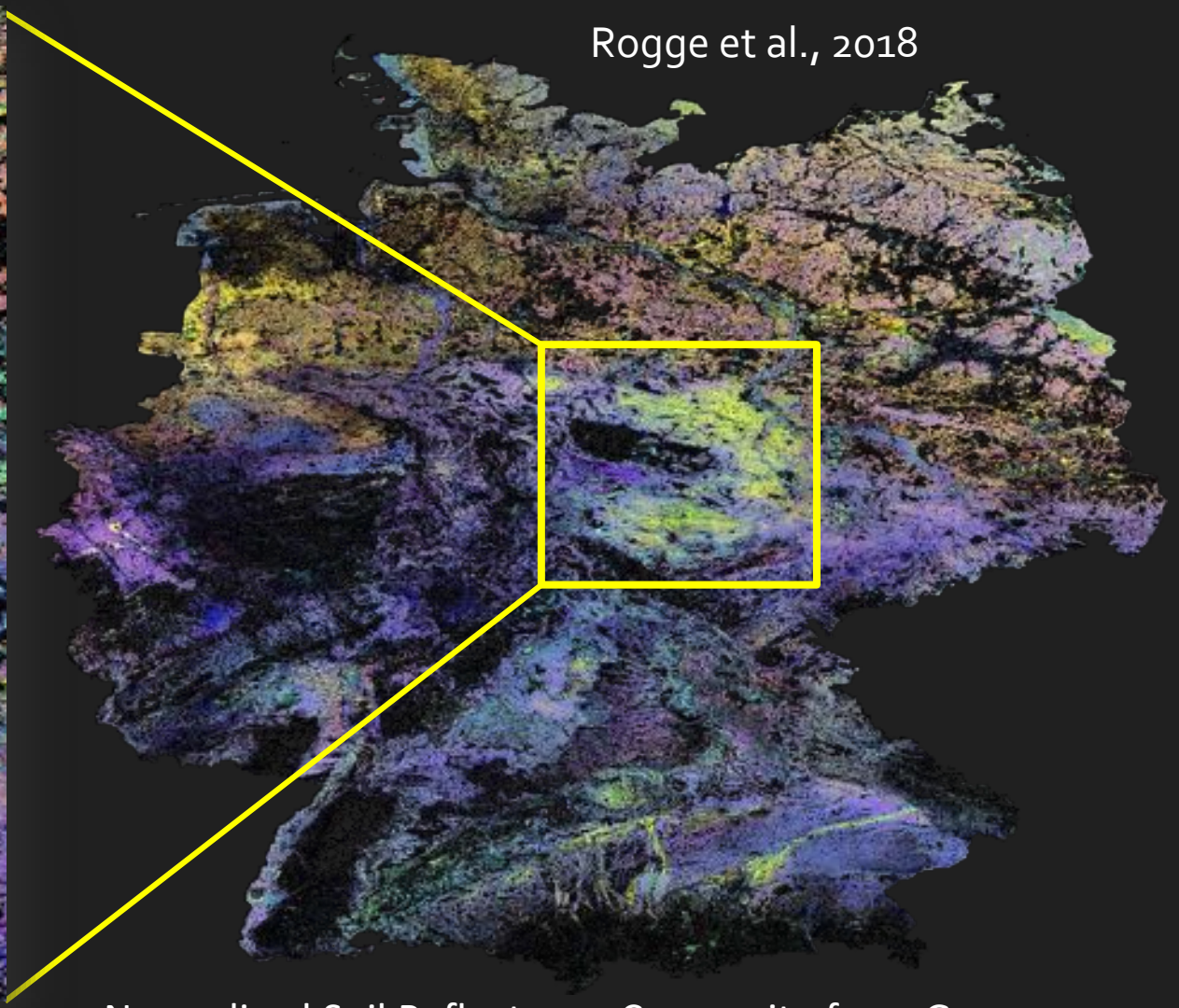
SCMaP Products – Soil Reflectance Composite / Normalized



Harz Mountains, Germany



Normalized Soil Reflectance Composite from Germany
(RGB: Landsat 7-5-3), Images taken from 1984 - 2014

DLR

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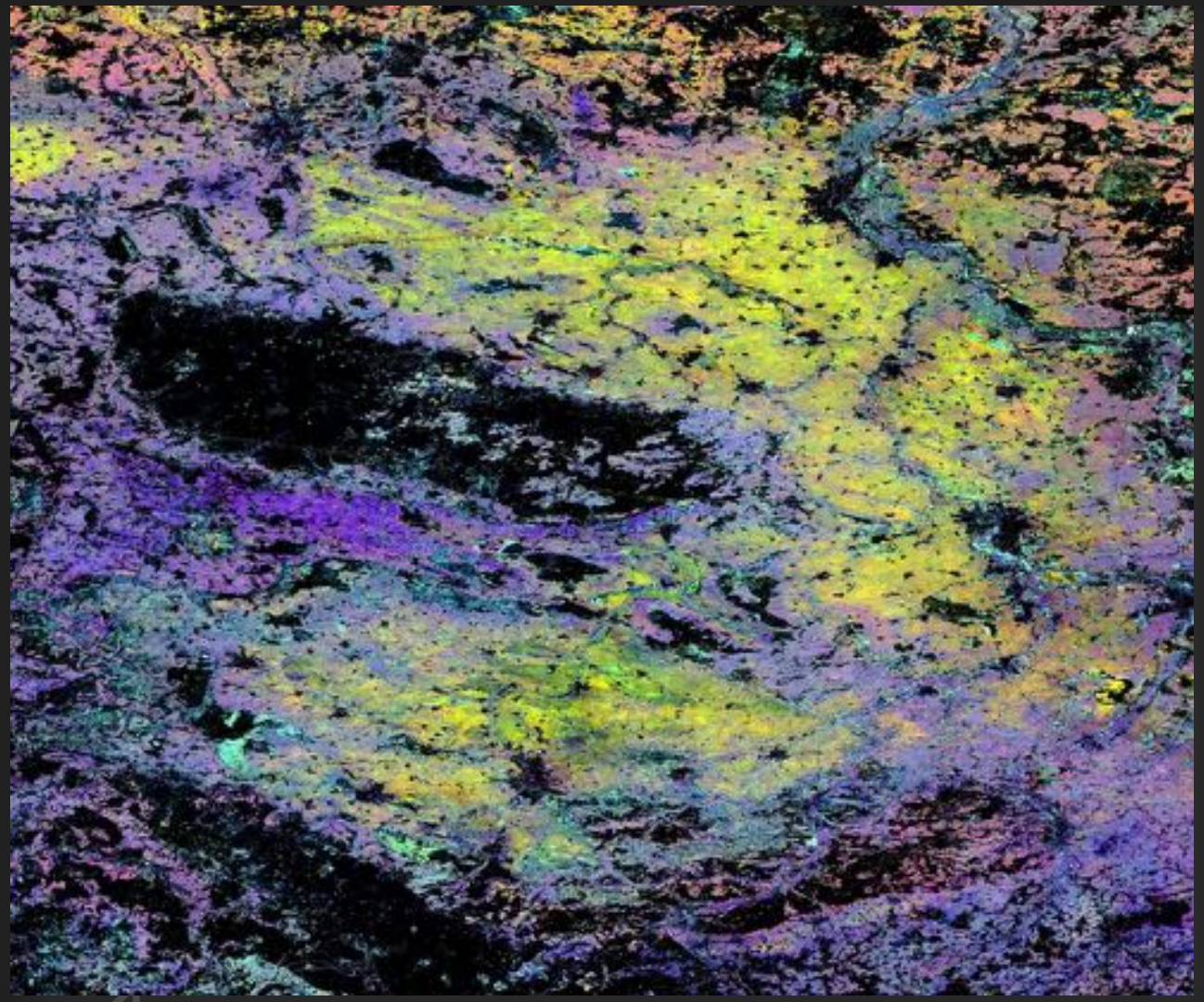
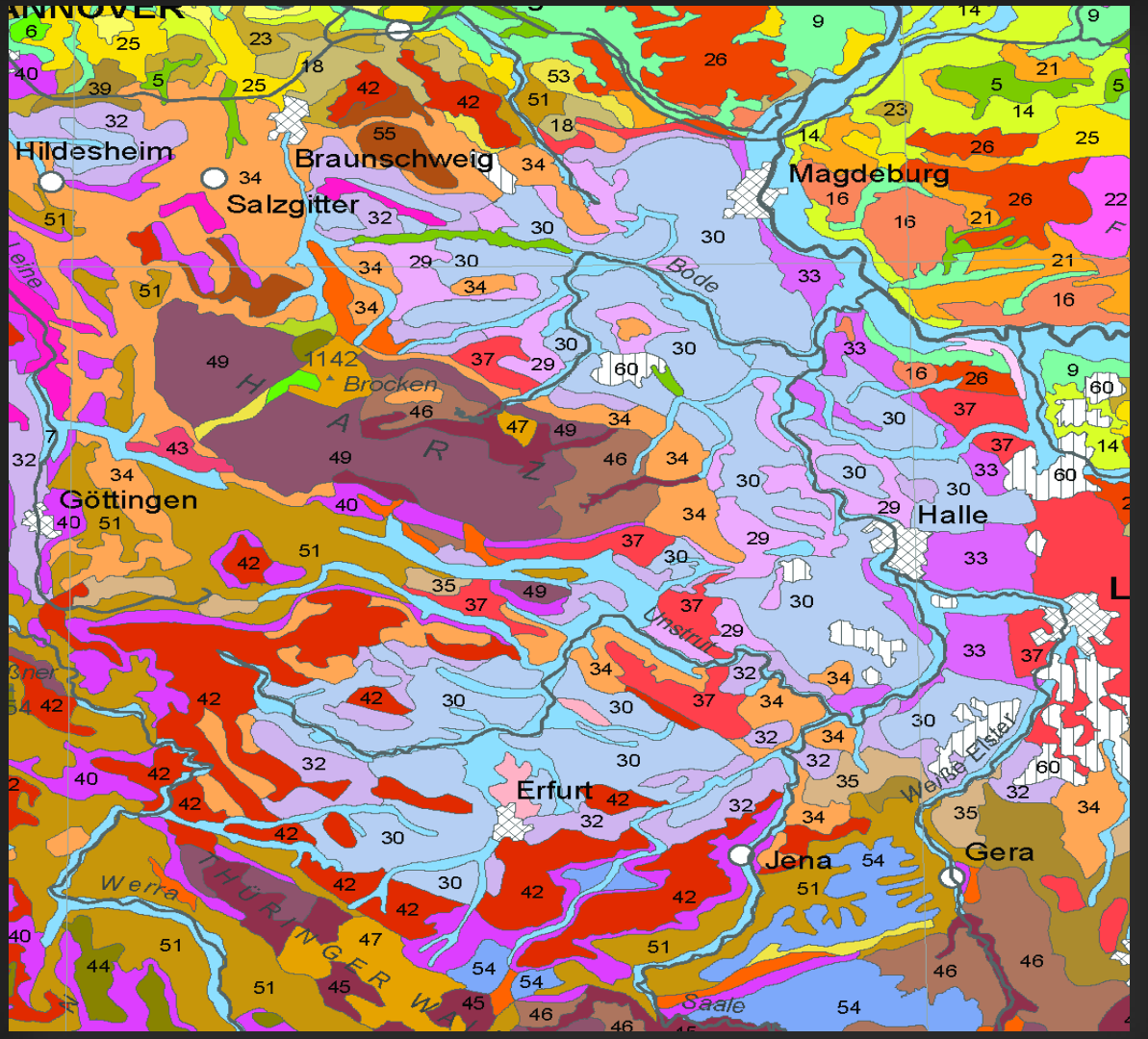


Around Harz Mountains, Germany



BÜK 1000 - Soil Map of Germany

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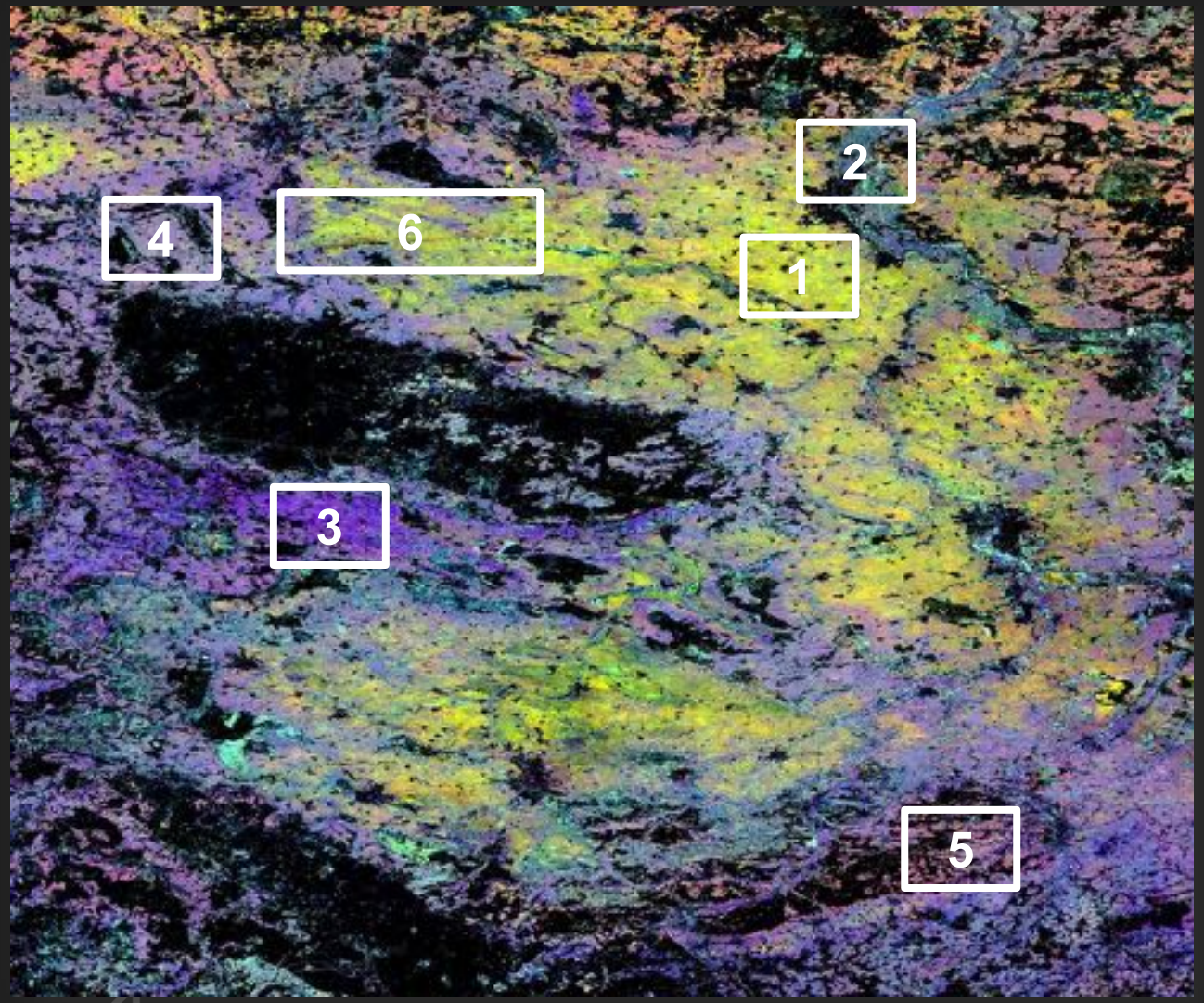
SCMaP Products – Normalized Soil Reflectance Composite



Harz Mountains, Germany

Soil units World Reference Base (WRB) for Soil Resources: Examples

1 Haplic Chernozem (Chha)

2 Calcaric Cambisol (CMca)

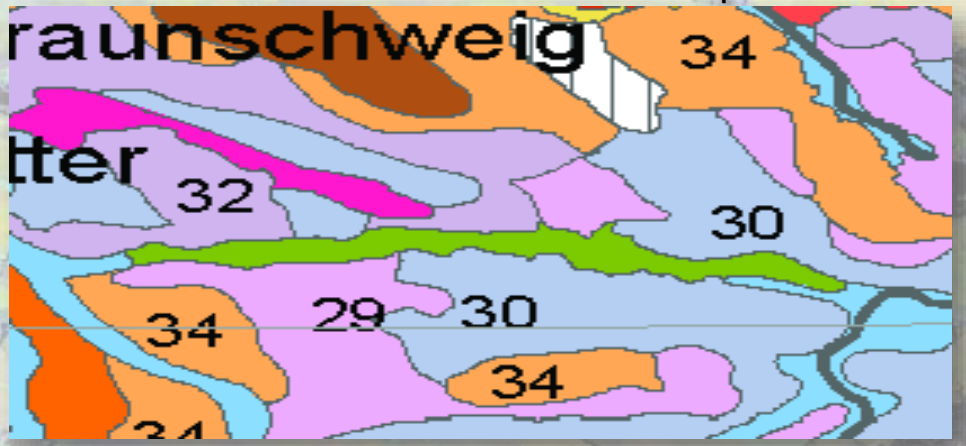
3 Dystric Cambisol (CMdy)

4 Haplic Luvisol (LVha)

5 Dystric Gleysol (GLdy)

6 Eutric Histosol (HSeu)

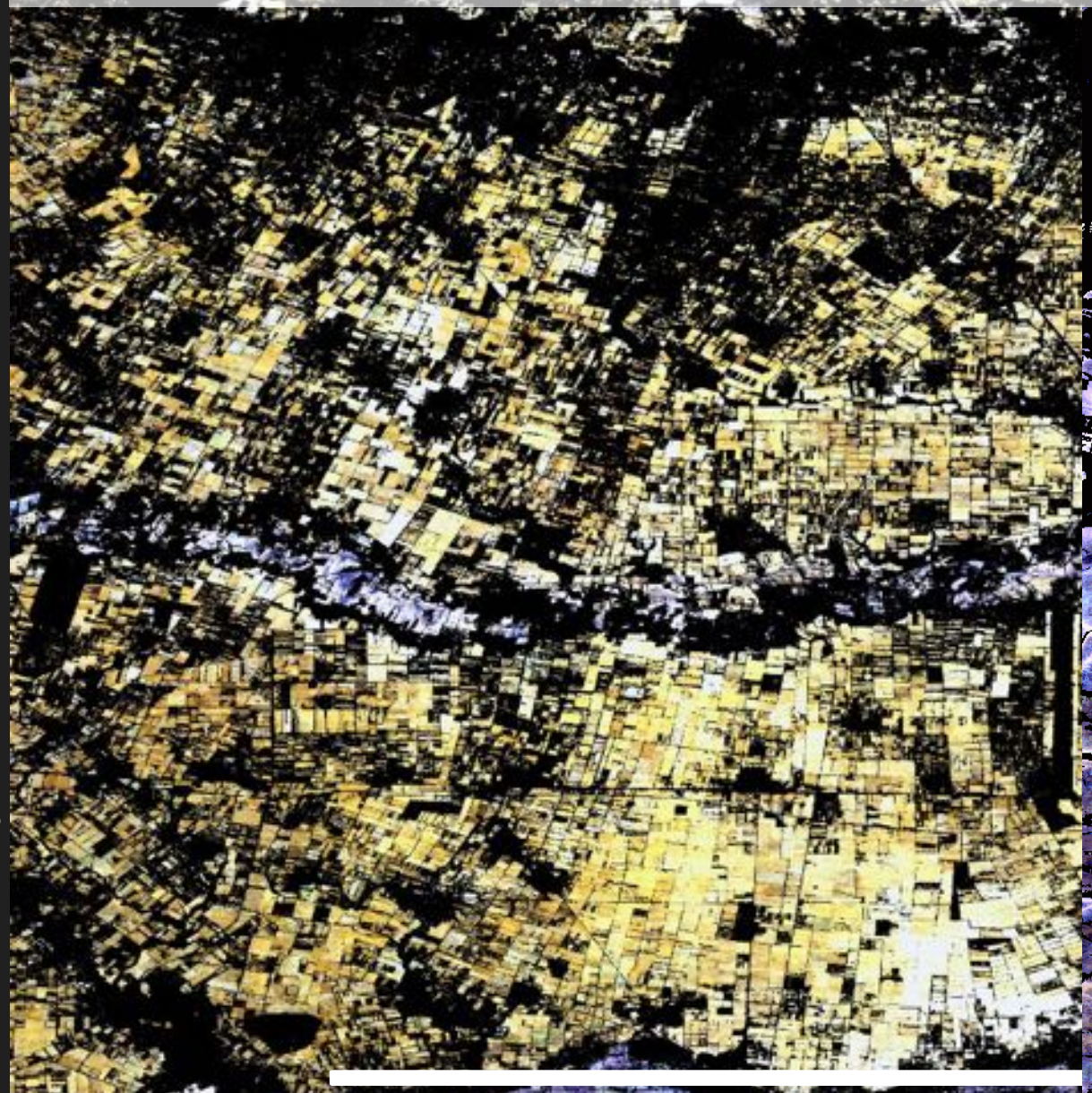
BÜK 2000 (German Soil Map)

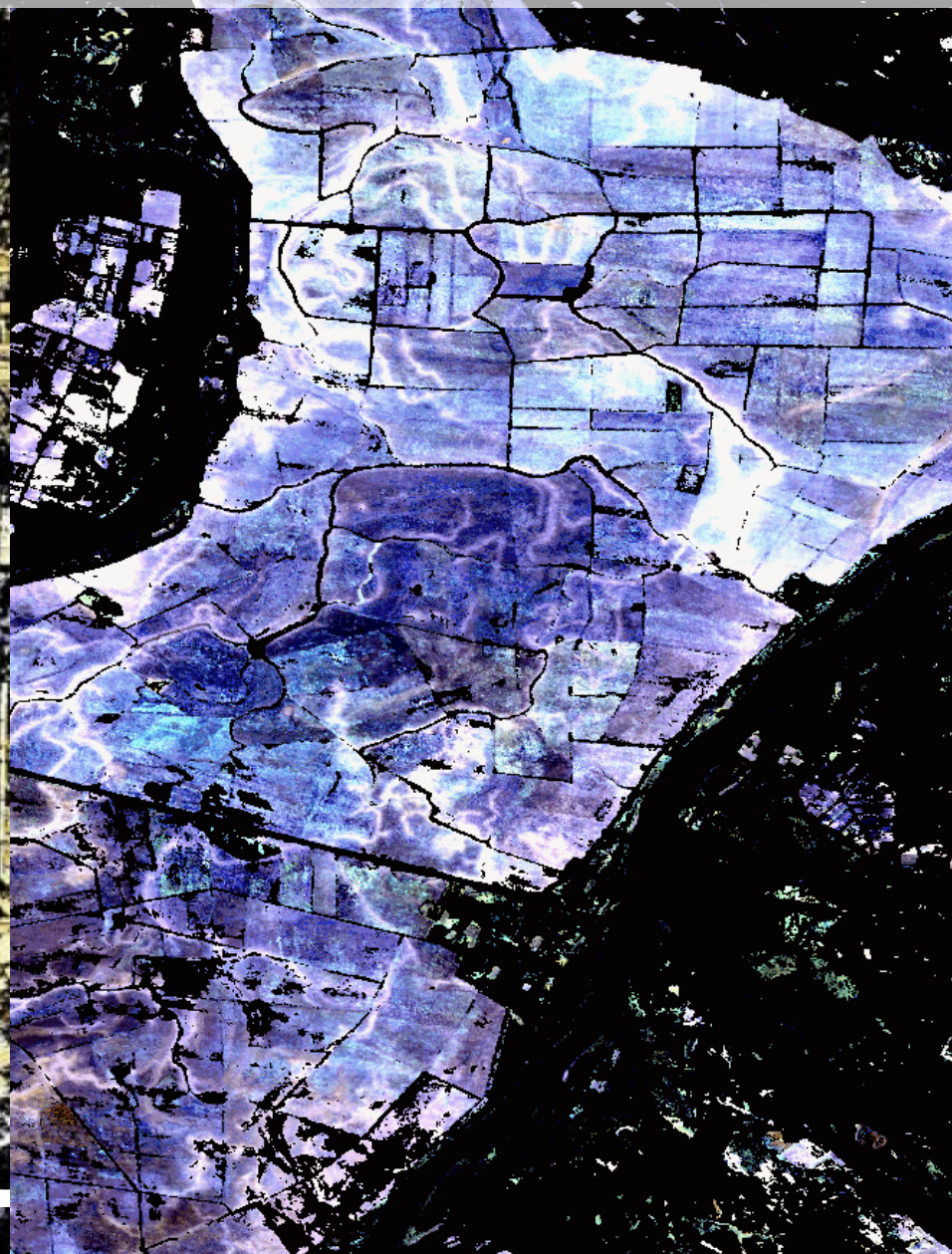


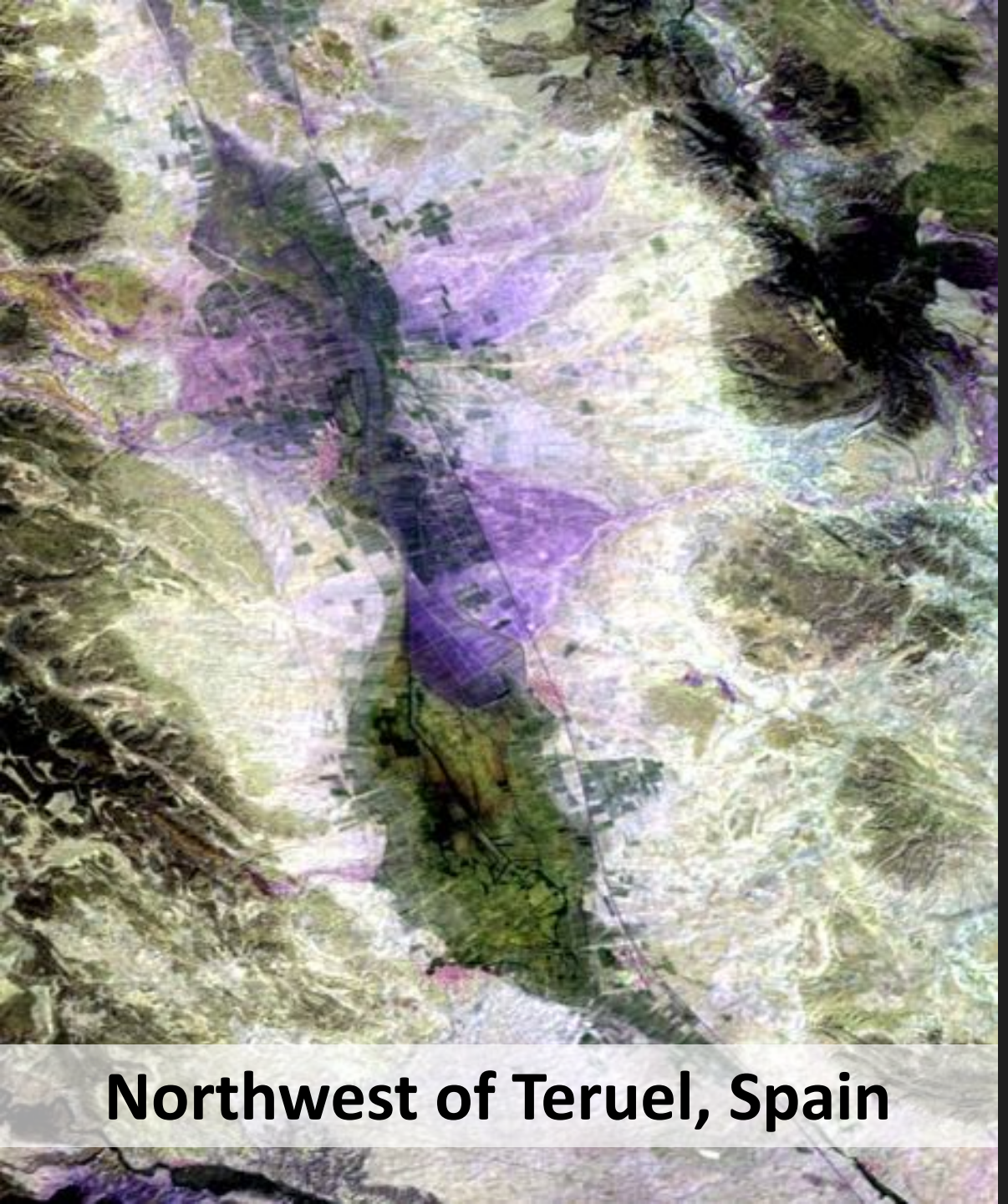
Romania between River Danube and Ialomita

SCMaP Products

- Normalized Soil Reflectance Composite
- Bulgaria, Romania, Spain
- Country selection to analyze processing requirements across Europe





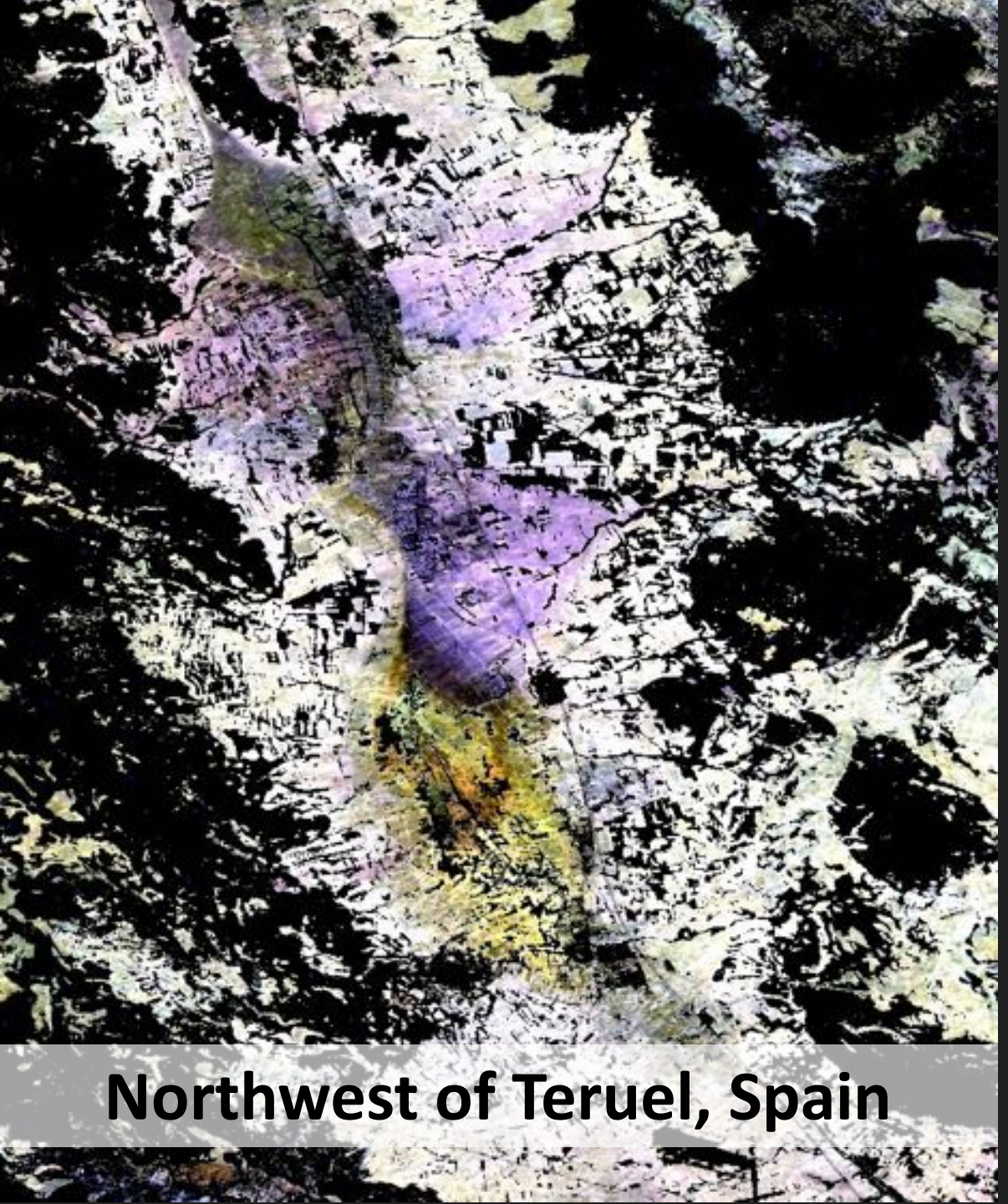


Northwest of Teruel, Spain

SCMaP Products – Soil Development

Mean reflectance composite (RGB Landsat 7-5-3)

Composite from available Landsat images between 1984-1989



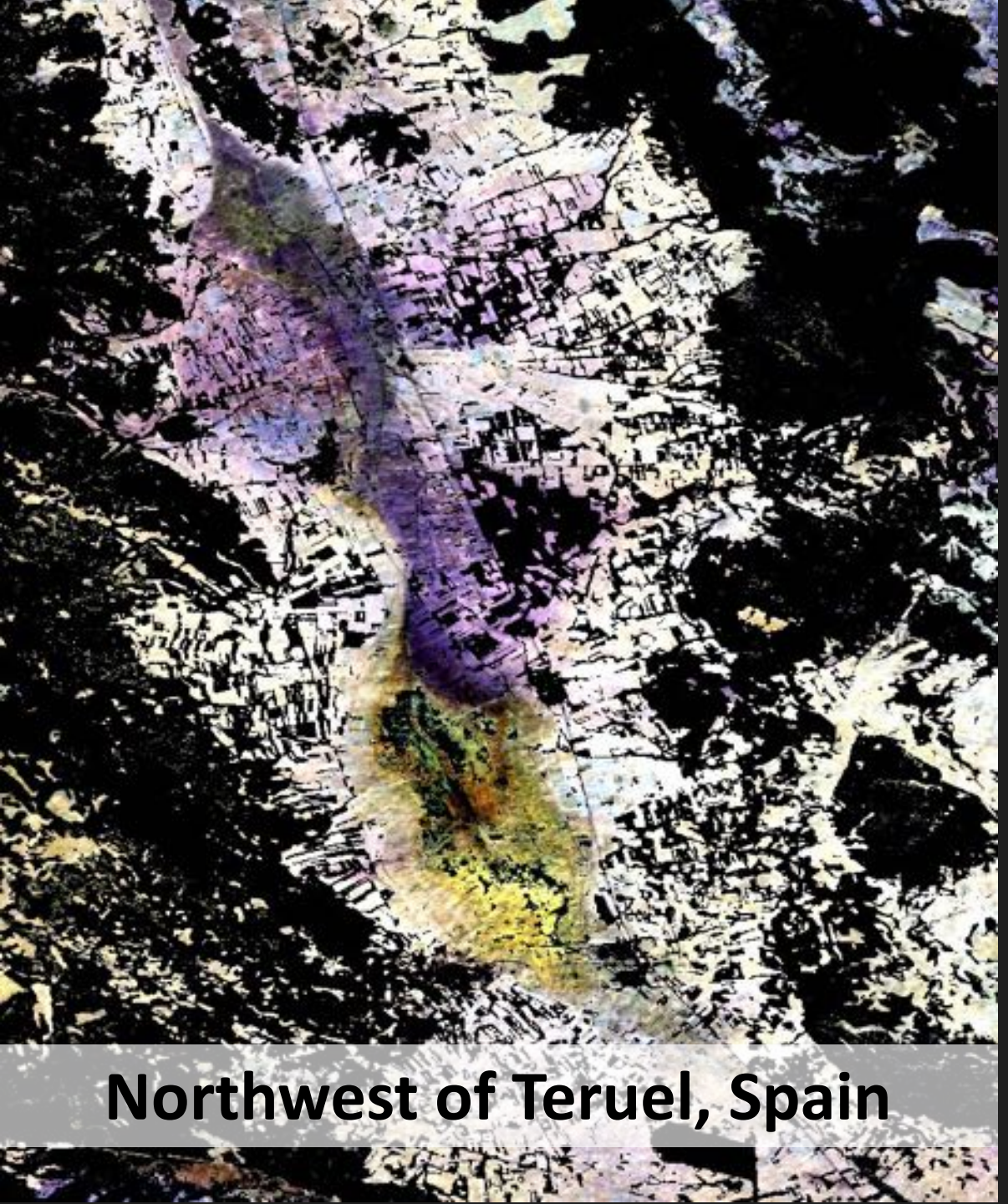
Northwest of Teruel, Spain

SCMaP Products – Soil Development

Exposed Soil Reflectance Composite (RGB Landsat 7-5-3)

- Shows agricultural active areas only
- 5-year time periods:

  1984 - 1989



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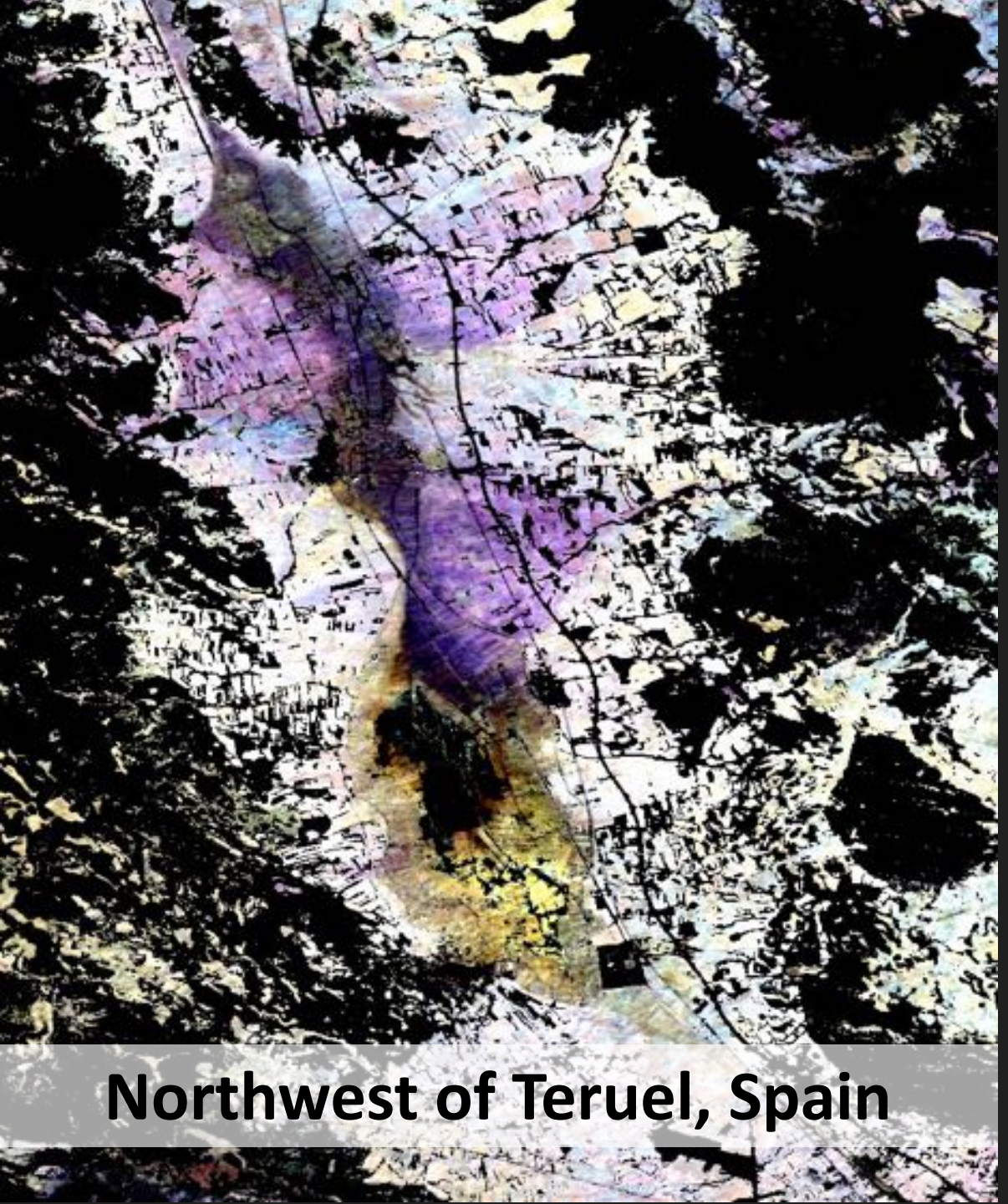

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Vineyard area, Germany

SCMaP Products – Soil Development

Soil Exposure frequency [%]

- Percentage of time a soil is exposed
- Areas prone to soil erosion
- Agricultural active areas only
- 5-year time periods:

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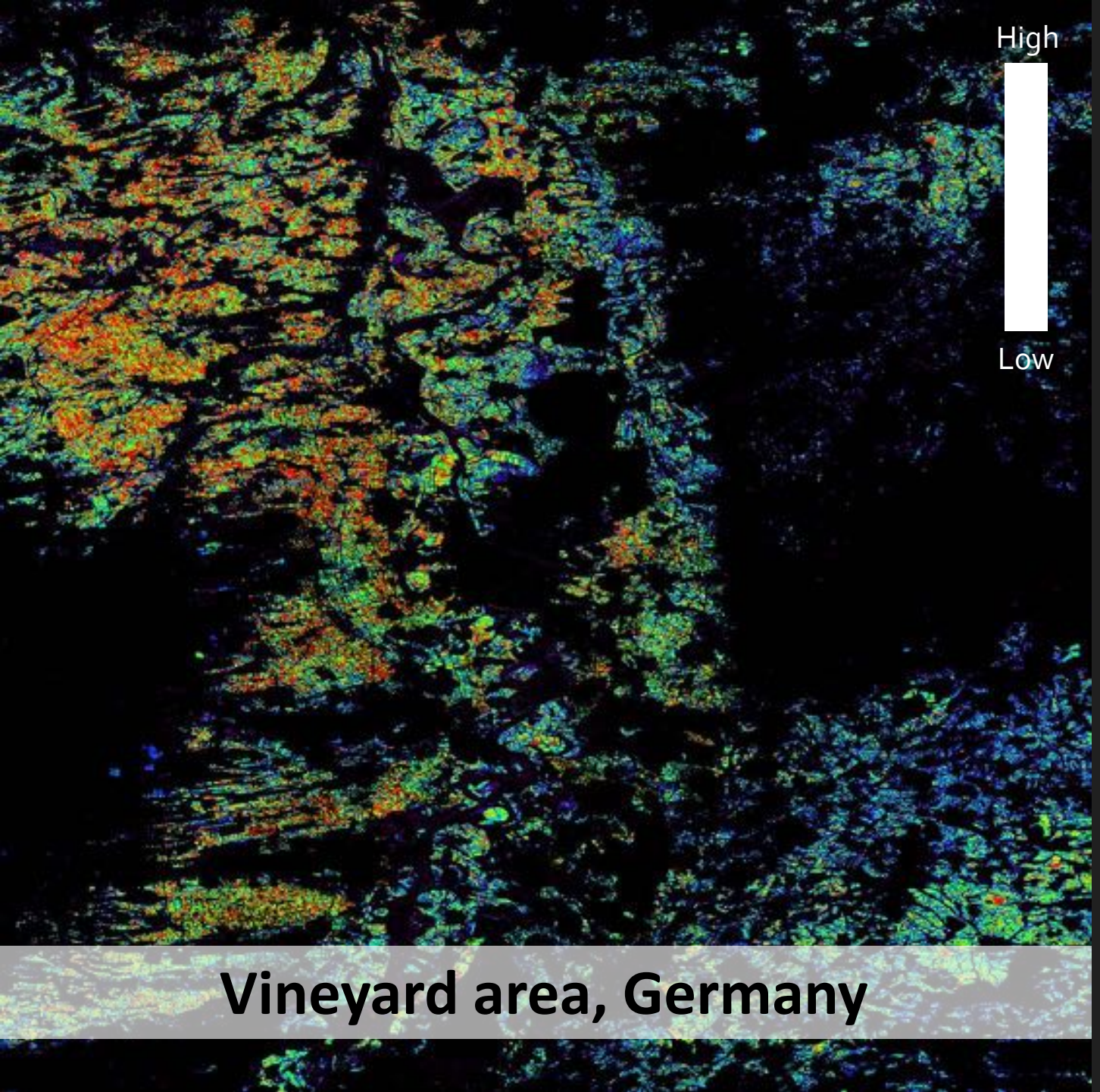

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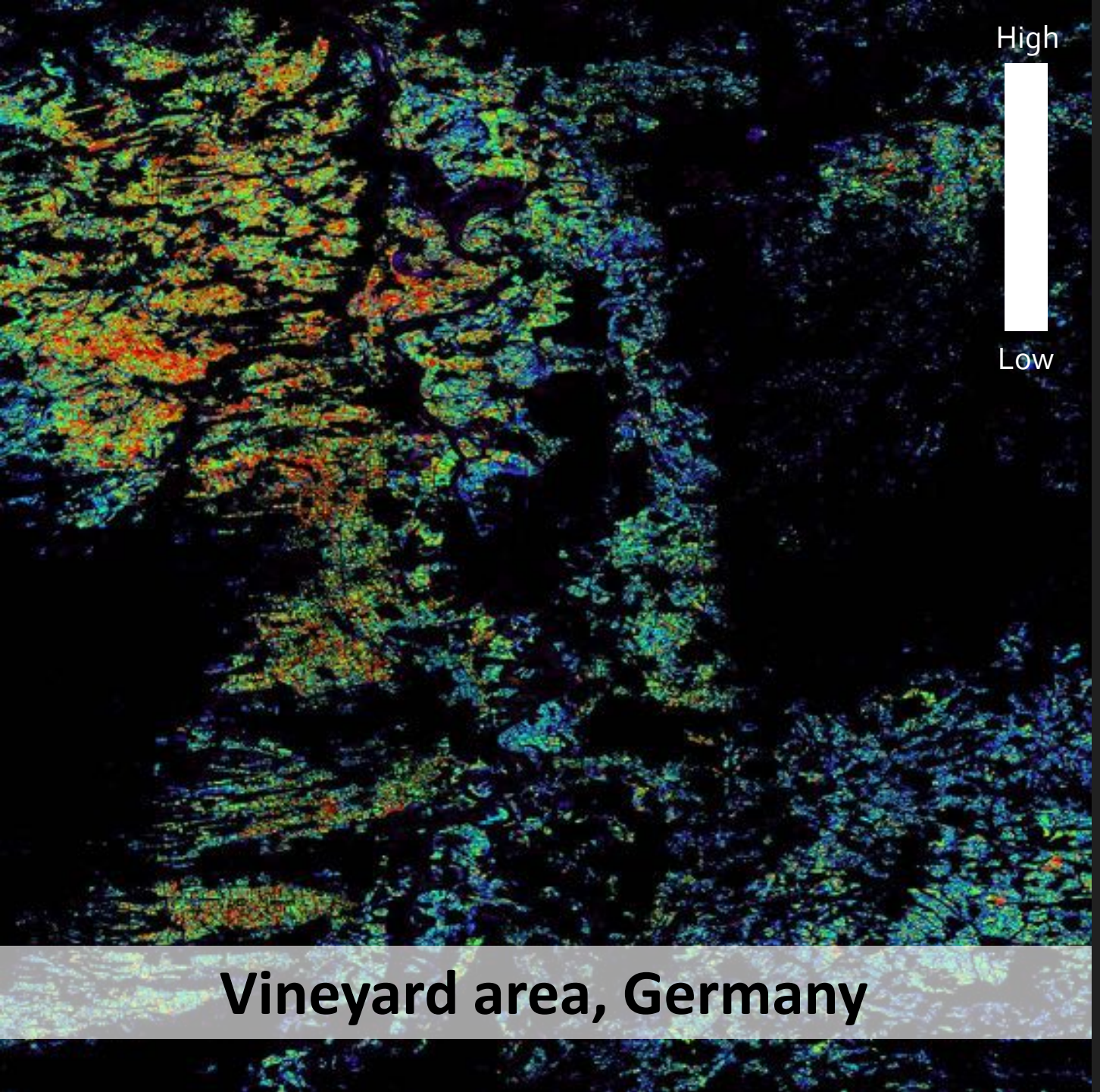

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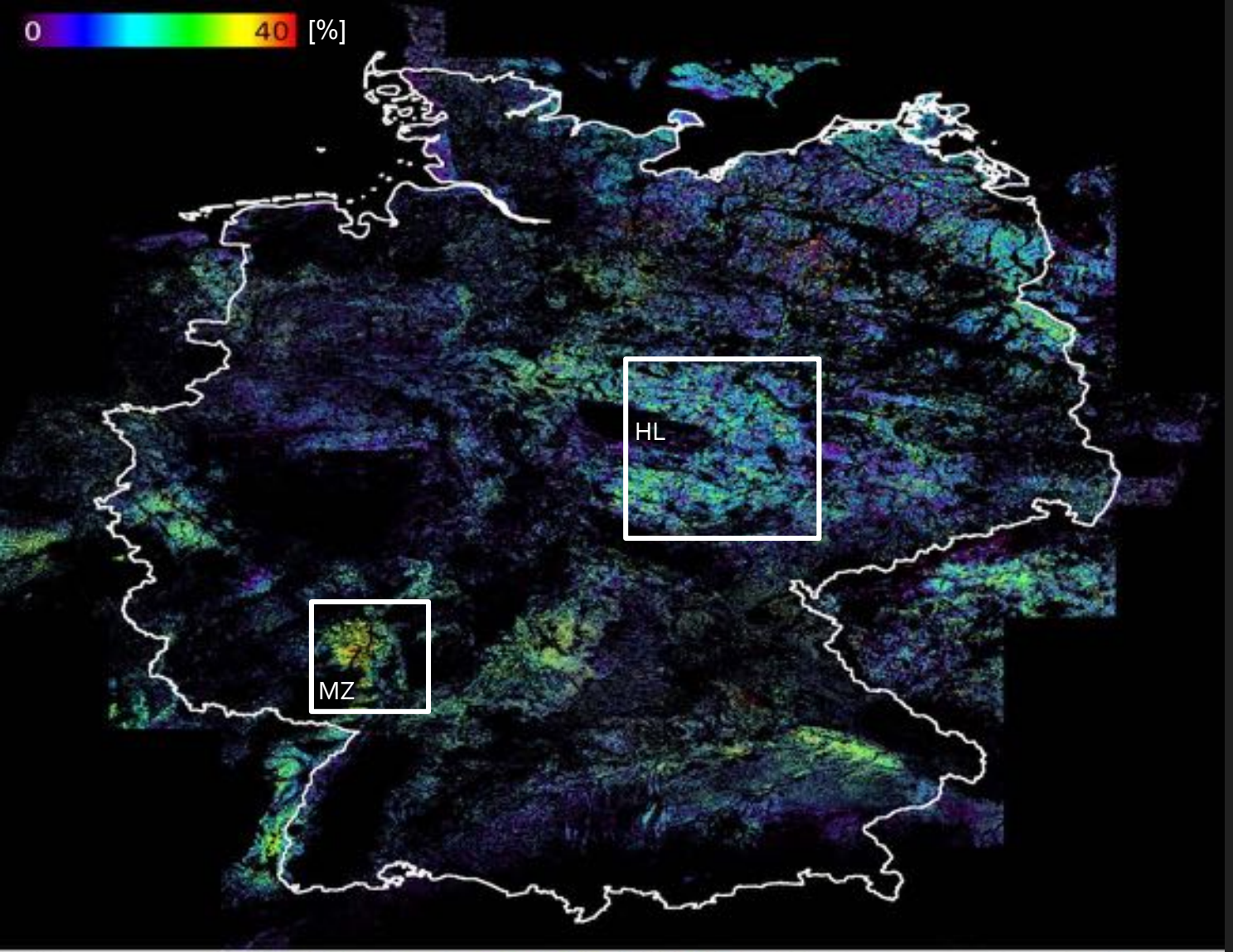

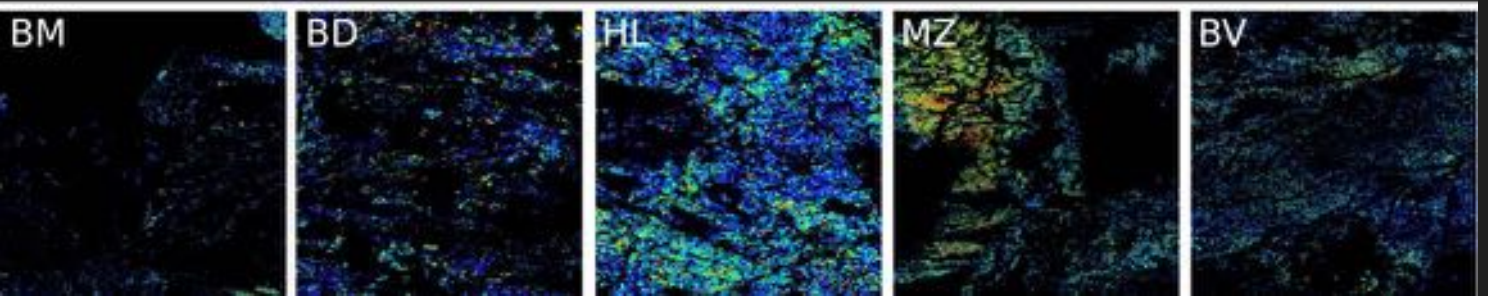

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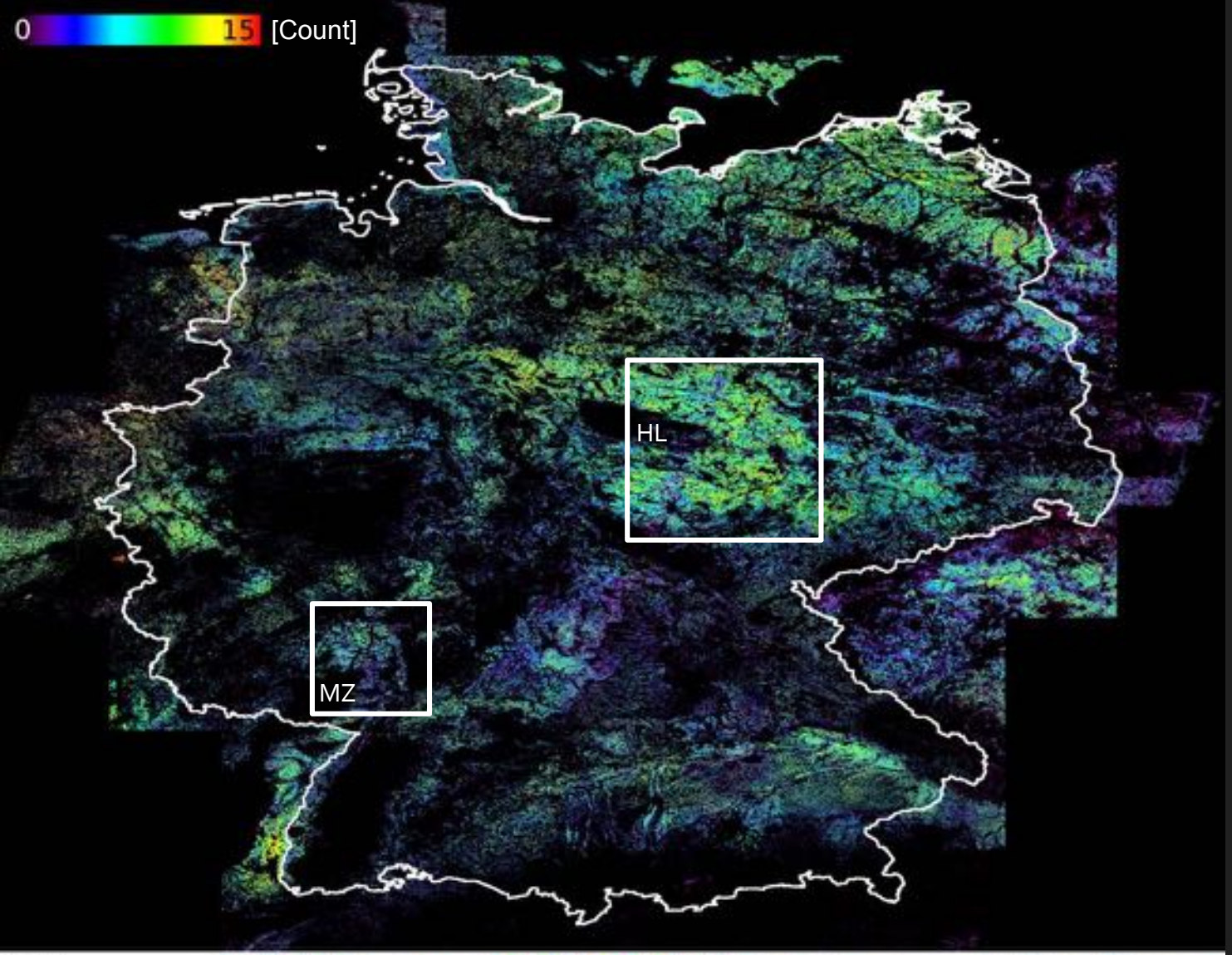
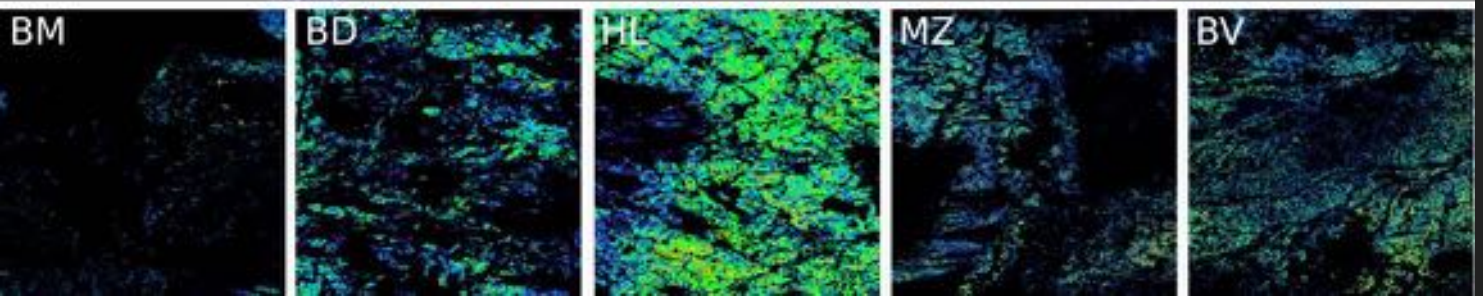




SCMaP Products – Soil Development

Soil Exposure frequency [%]

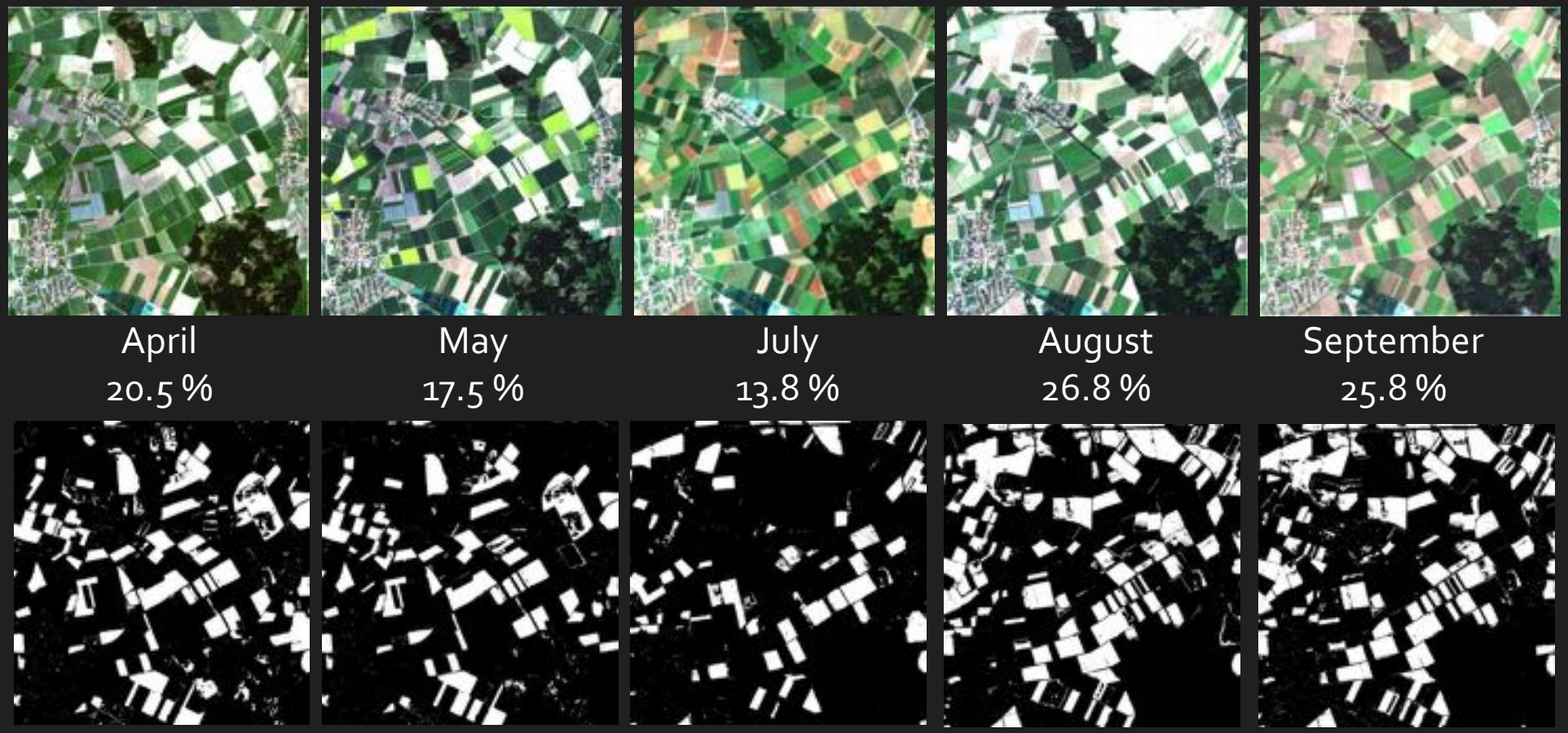
- Areas prone to soil erosion

Vegetation frequency [Count]

- Intensity of use

Methodology – Challenge to observe soils with optical EO data

Soil exposure vary over time (example RapidEye, 2012)



April	May	July	August	September
20.5 %	17.5 %	13.8 %	26.8 %	25.8 %

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Methodology – Challenge to observe soils with optical EO data

Soil exposure vary over time (example RapidEye, 2012)

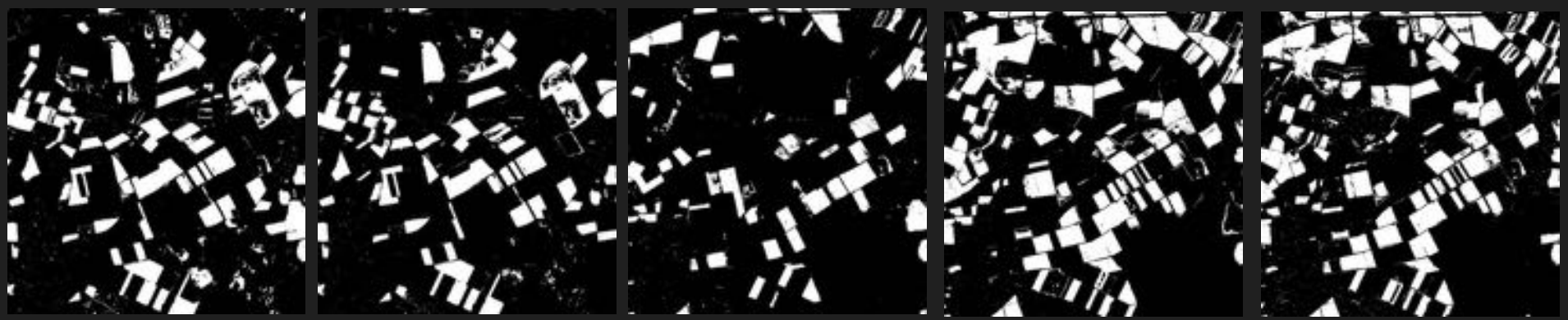
April
20.5 %

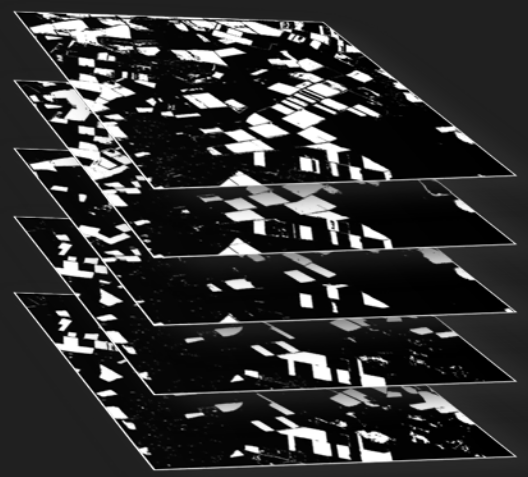
May
17.5 %

July
13.8 %

August
26.8 %

September
25.8 %





Expanding data base
Bare Soil Exposure = 47.9 %

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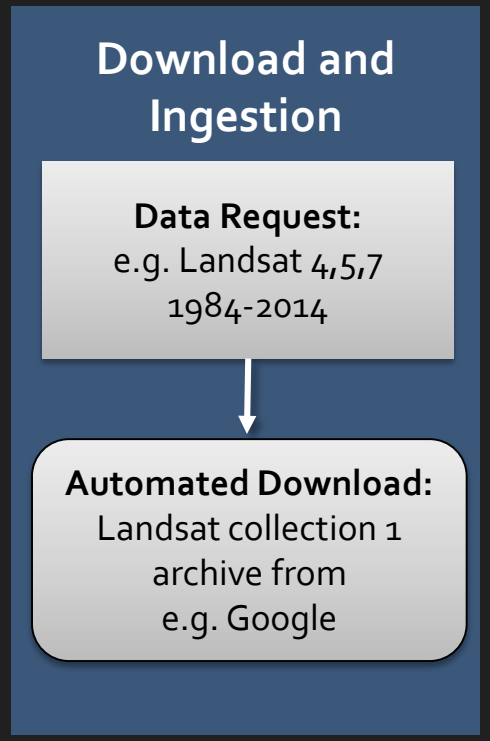
Methodology – Overview



Processing of Germany

Number of scenes	Process
18146 240 LT04 11263 LT05 2172 LE07	Downloaded and ingested files for pre-processing

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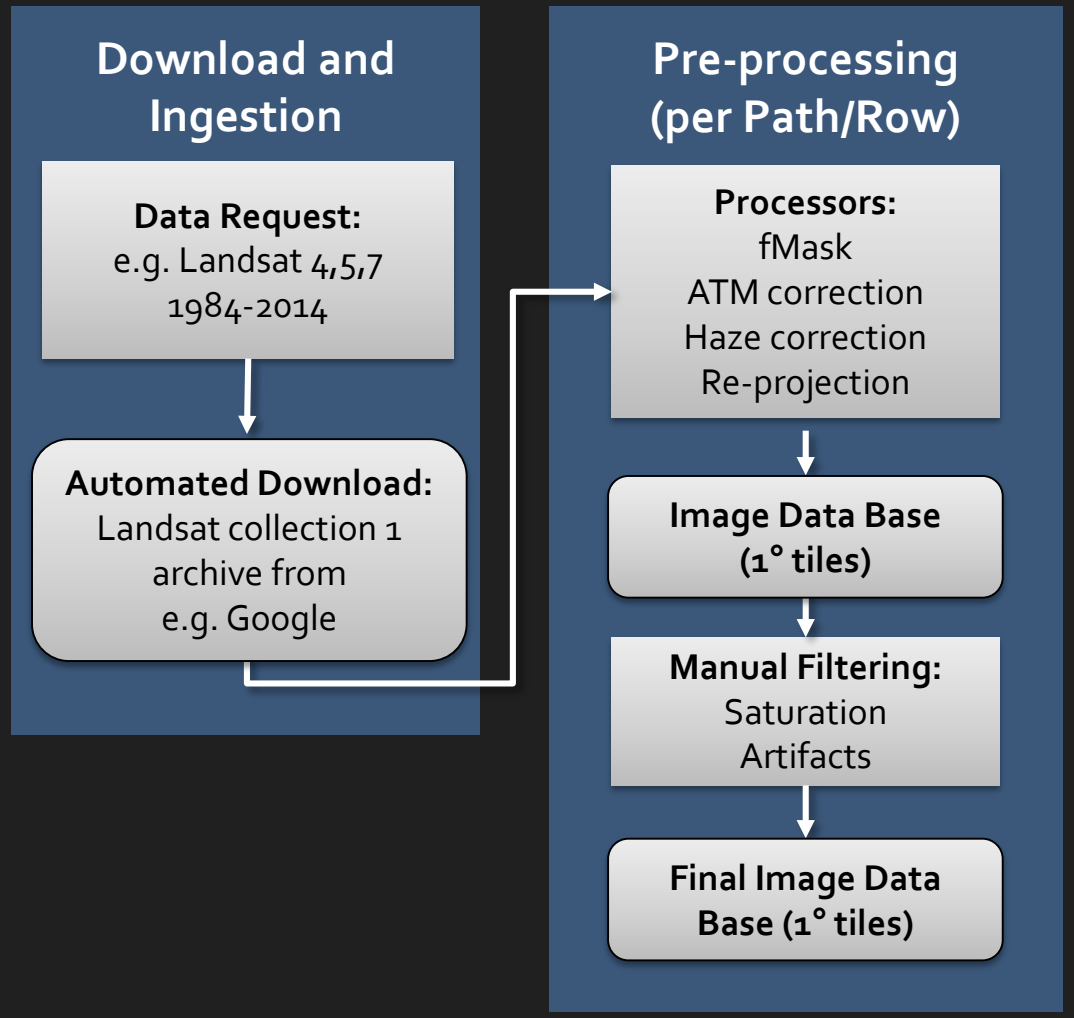
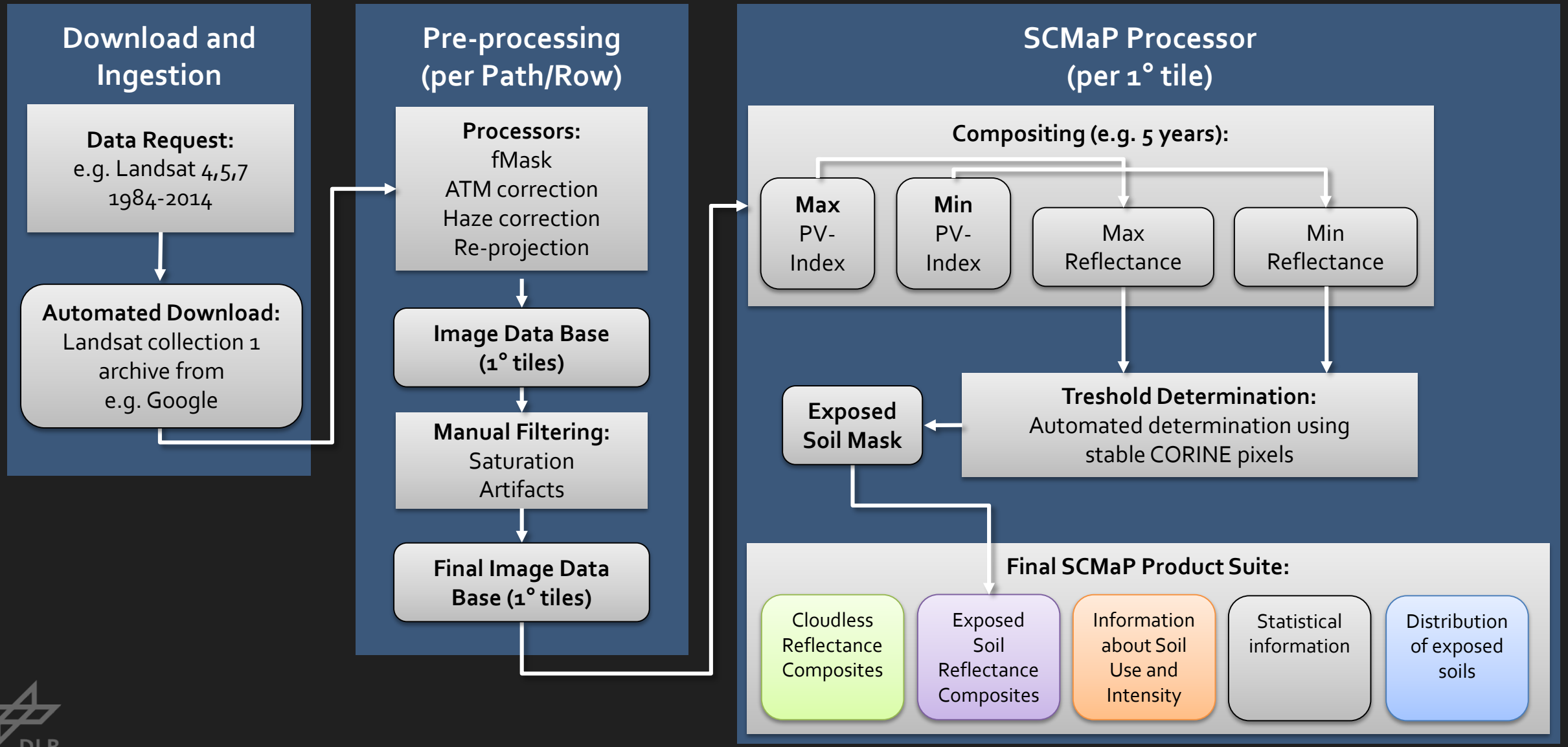
Methodology – Overview



Processing of Germany

Number of scenes	Process
18146 240 LT04 11263 LT05 2172 LE07	Downloaded and ingested files for pre-processing
9479 184 LT04 5880 LT05 3415 LE07	Fmask, atmospheric correction, haze removal, re-projection
9331	Manual Filtering

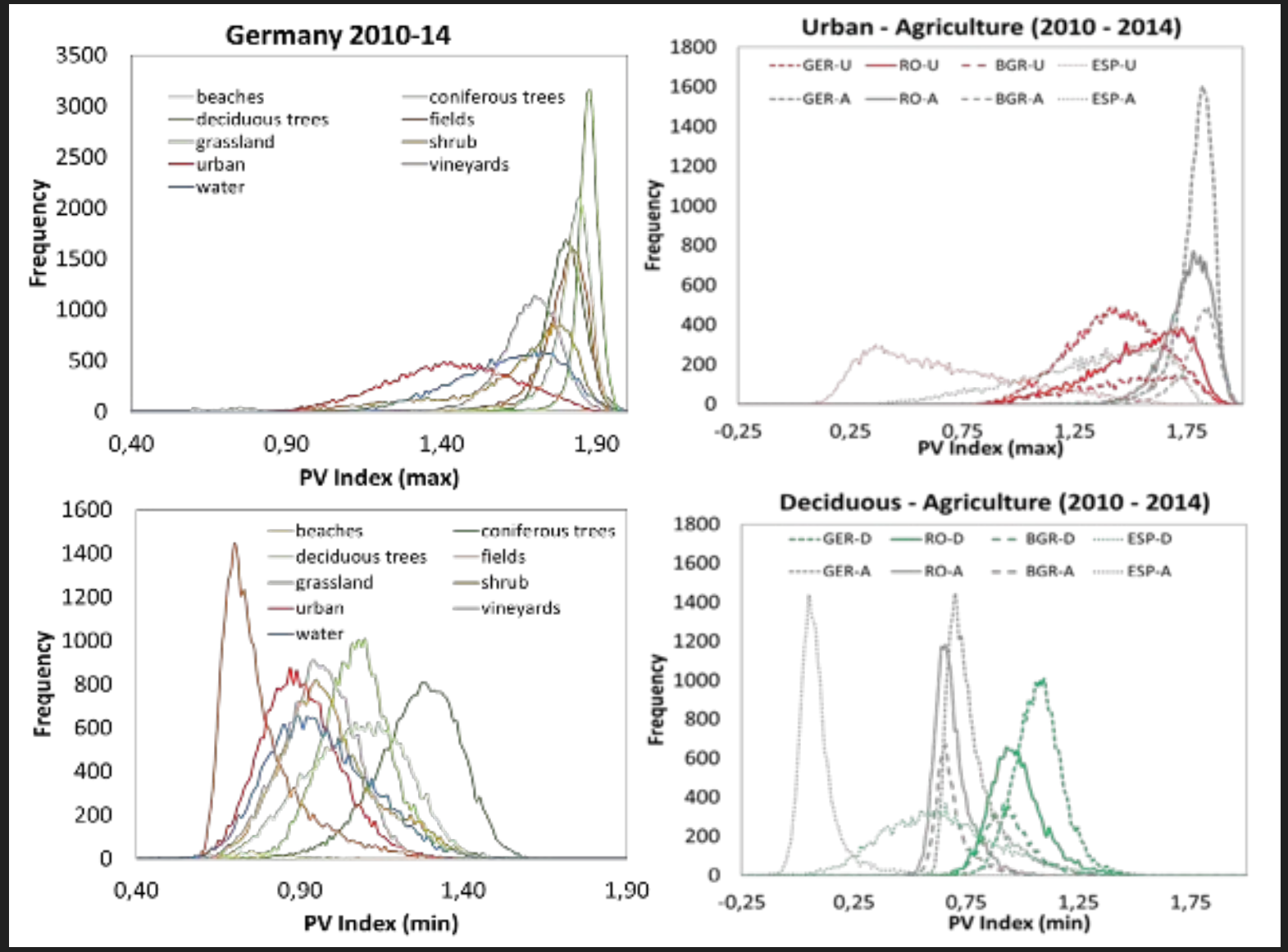
Methodology – Overview



Methodology – Treshold determination

$$\text{PV Index} = \frac{NIR-RED}{NIR+RED} + \frac{NIR-BLUE}{NIR+BLUE}$$

- Challenge is to separate exposed soil pixels from dry vegetation with Landsat/Sentinel-2
- Use of seasonal reflectance characteristics of land cover classes
- Threshold analysis is based on minimum and maximum PV index composite
- CORINE serves as data base for land cover classes that are constant during the entire investigated time period



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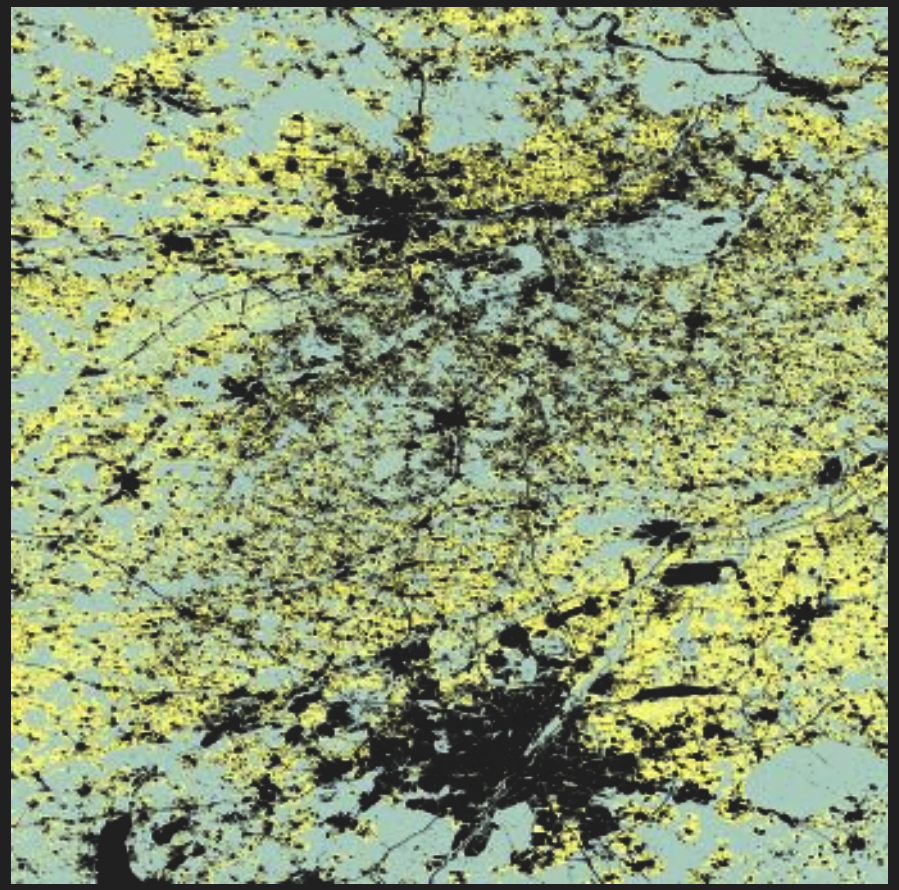
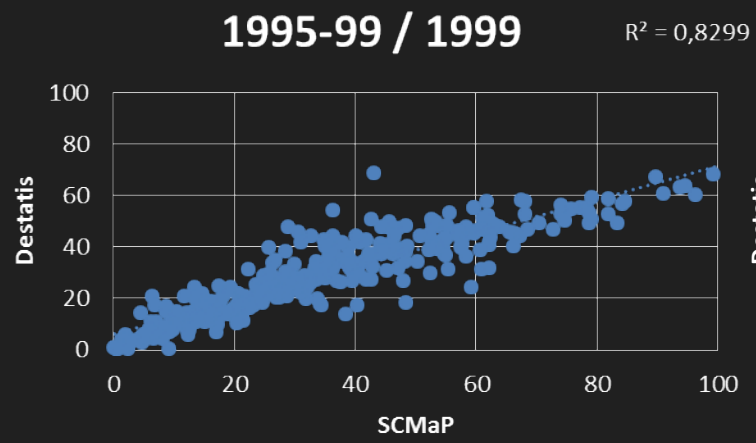
Potential Application – Development of intensively used agricultural areas

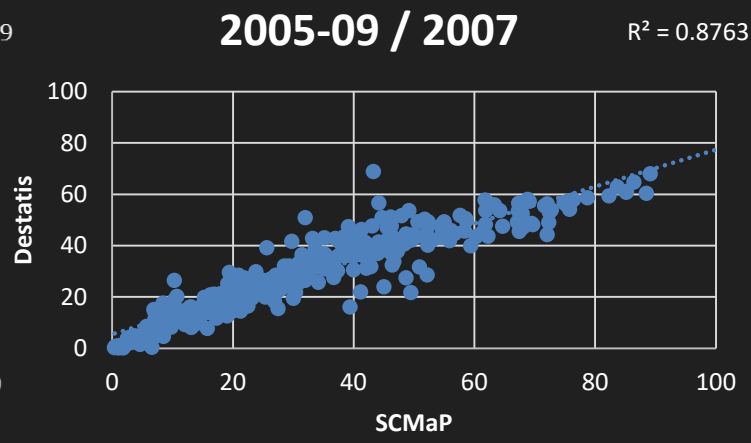


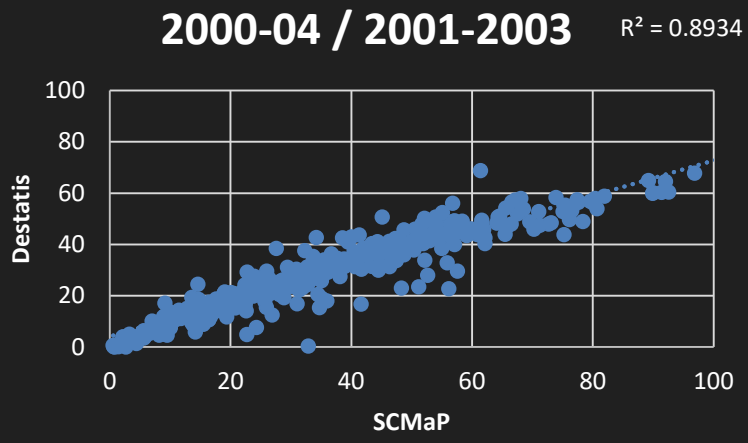
Soil Exposure

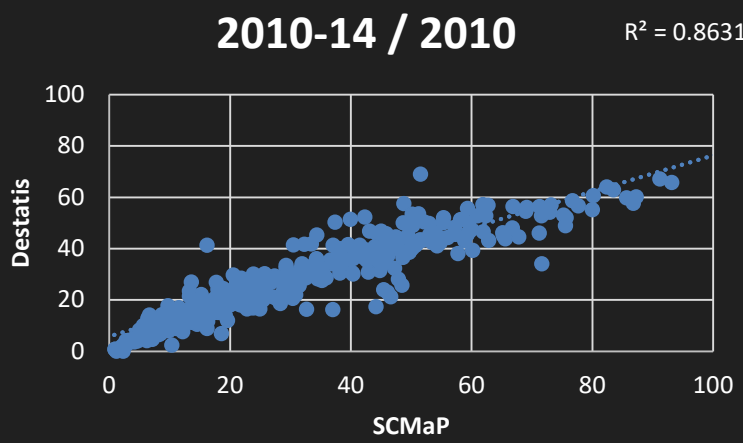
Permanent Non-vegetation

Permanent Vegetation









- Statistical Data from DESTATIS (German Federal Statistical Office)
- Exclusion of permanent grassland)
- 1999, 2001, 2003, 2007, 2010
- Comparison on county level

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Potential Application – Development of intensively used agricultural areas

- Change between two 5-year time periods
- Link to political events and EU regulations

Summary and Outlook

- New large scale data base for analyses about soil development
- Automated processor developed based on Landsat archive
- Critical: Threshold determination

<u>Next challenges</u>

- Derivation of soil information (SOC, minerals, soil units, …)
- Test of new indices for threshold determination
- Substitutes for tresholds – first analysis started
- Processor adaption to Sentinel-2

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Thanks for your attention!

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