SEMANTIC DATA CUBES

FOR EO INDICATOR EXTRACTION FROM BIG EO DATA

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Department of Geoinformatics - Z_GIS

DGfG Arbeitskreis Fernerkundung | 05.10.2018

BIG EO DATA

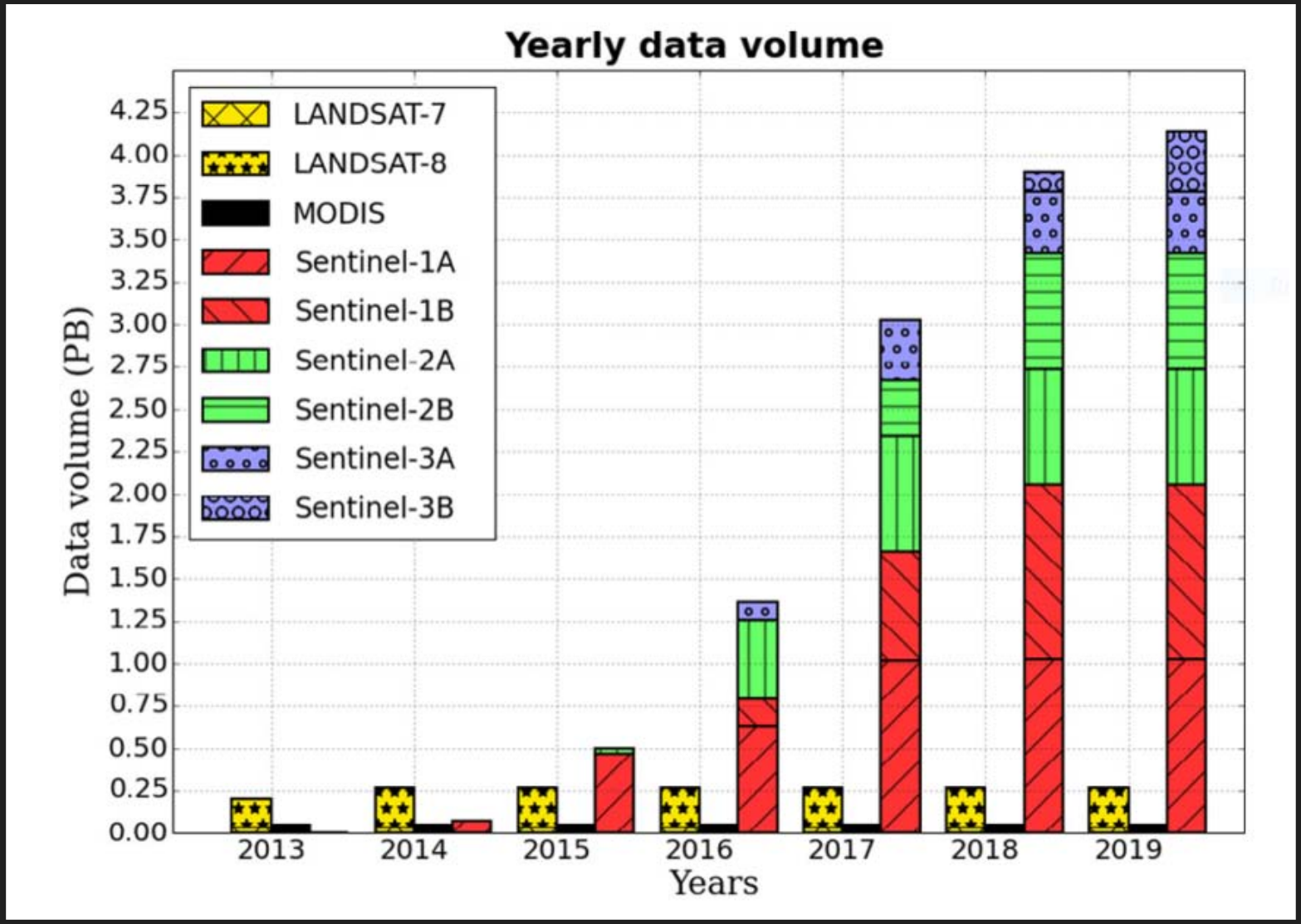


Figure 1: *from Soille, P., et al. 2018. A versatile data-intensive computing platform for information retrieval from big geospatial data. Futur. Gener. Comput. Syst. 81, 30–40. doi:10.1016/j.future.2017.11.007*

CHALLENGES

- efficient and intelligent analysis, storage and distribution
- low percentage ever downloaded (i.e. dark data)
- data is not (necessarily) information
- developing automated workflows

Bring the user to the data,
rather than data to the user.

WHAT IS A DATA CUBE?

> *A datacube is a massive multi-dimensional array, also called "raster data" or "gridded data"; "massive" entails that we talk about sizes significantly beyond the main memory resources of the server hardware. Data values, all of the same data type, sit at grid points as defined by the d-axes of the d-dimensional datacube. Coordinates along these axes allow addressing data values unambiguously.*

- The Datacube Manifesto, © 2017 Peter Baumann

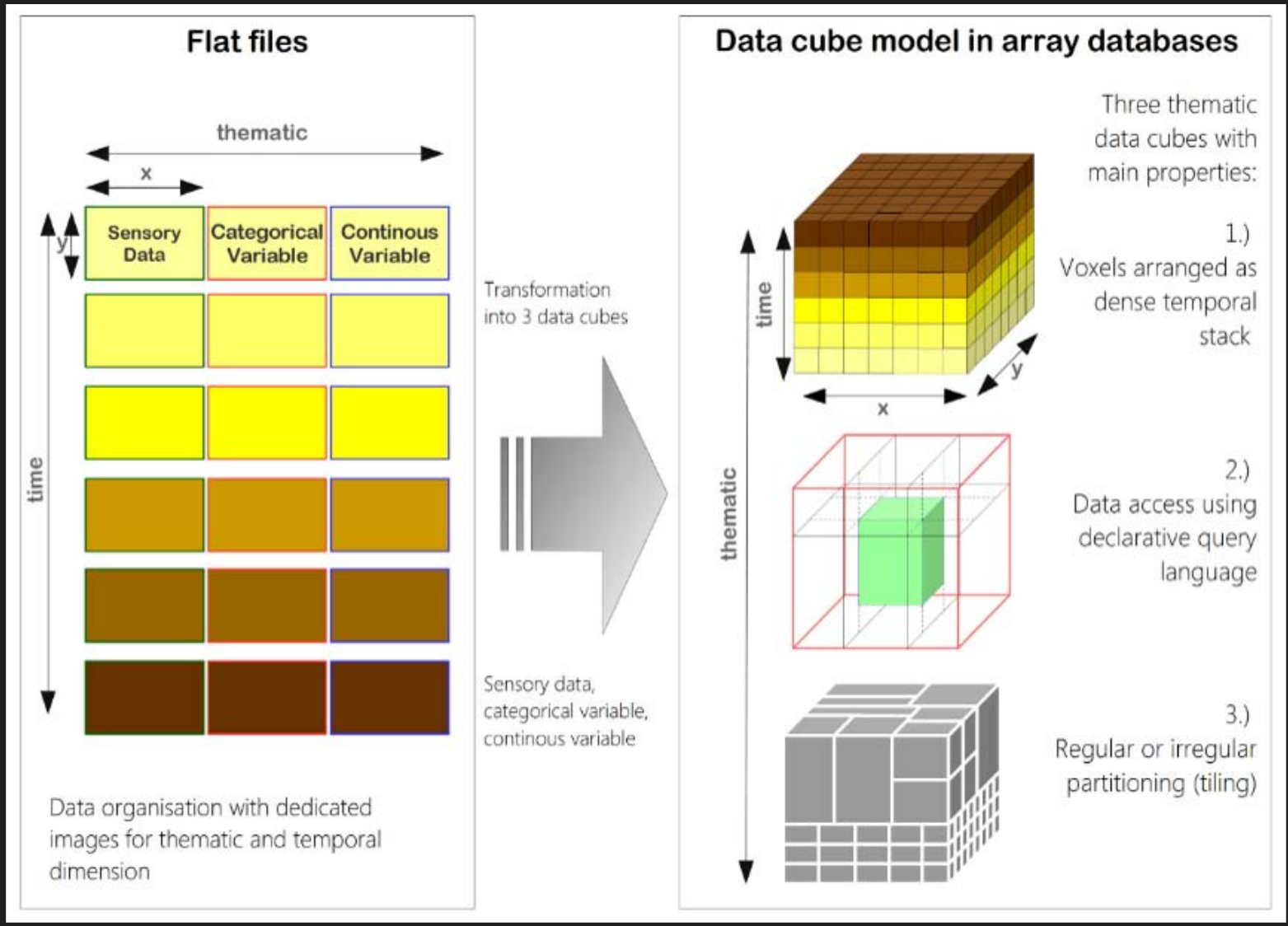


Figure 2: *from Sudmanns, M., Tiede, D., Lang, S., Baraldi, A., 2018. Semantic and syntactic interoperability in online processing of big Earth observation data. International Journal of Digital Earth 11, 95–112. doi:10.1080/17538947.2017.1332112.*

WHAT IS A SEMANTIC DATA CUBE?

DATA & INFORMATION

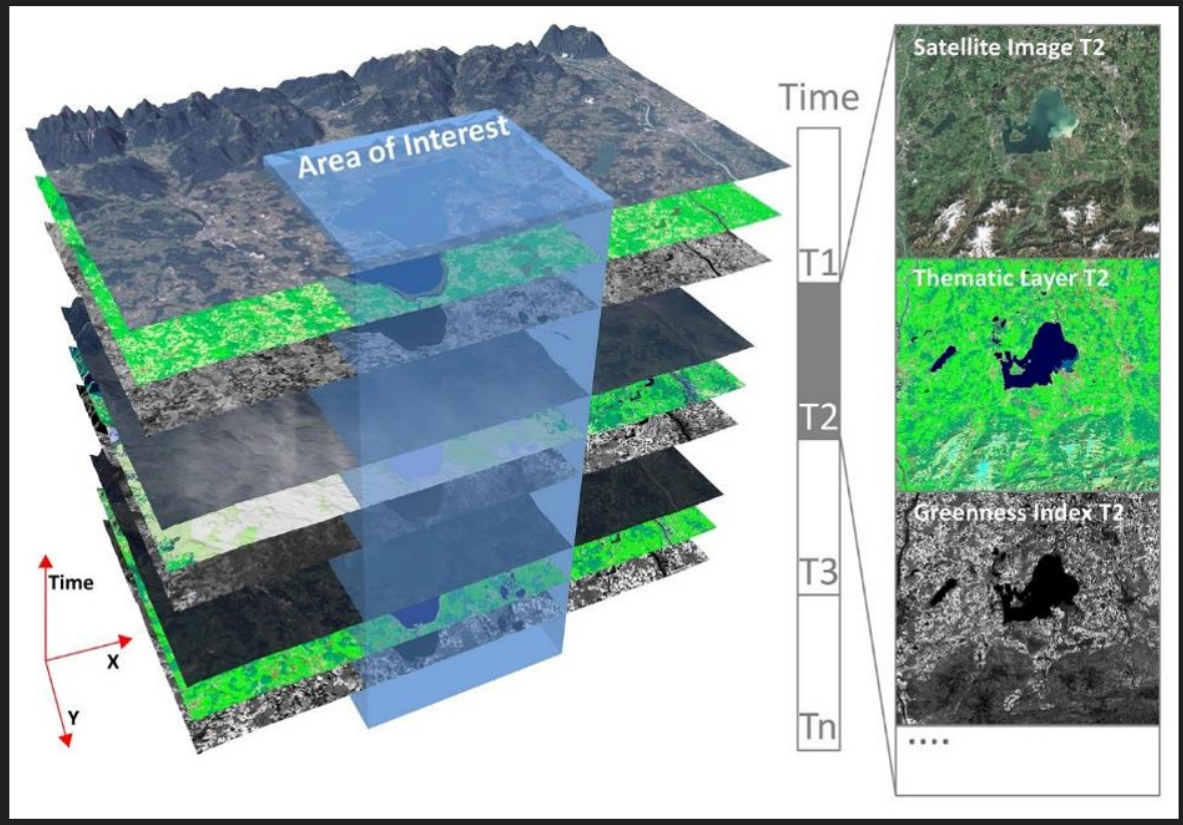


Figure 3: *from Tiede, D., Baraldi, A., Sudmanns, M., Belgiu, M., Lang, S., 2017. Architecture and Prototypical Implementation of a Semantic Querying System for Big Earth Observation Image Bases. Eur. J. Remote Sens. 50, 452–463. doi:10.1080/22797254.2017.1357432*

SEMANTIC ENRICHMENT

assigning meaning to (calibrated) pixel values

PRELIMINARY CLASSIFICATION WITH SIAM™

a priori knowledge-based

physical model-based

decision-tree

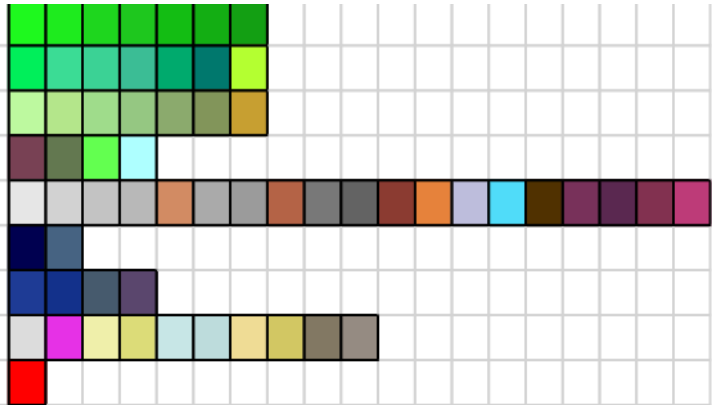
fully automatic

per-pixel spectral categorisation

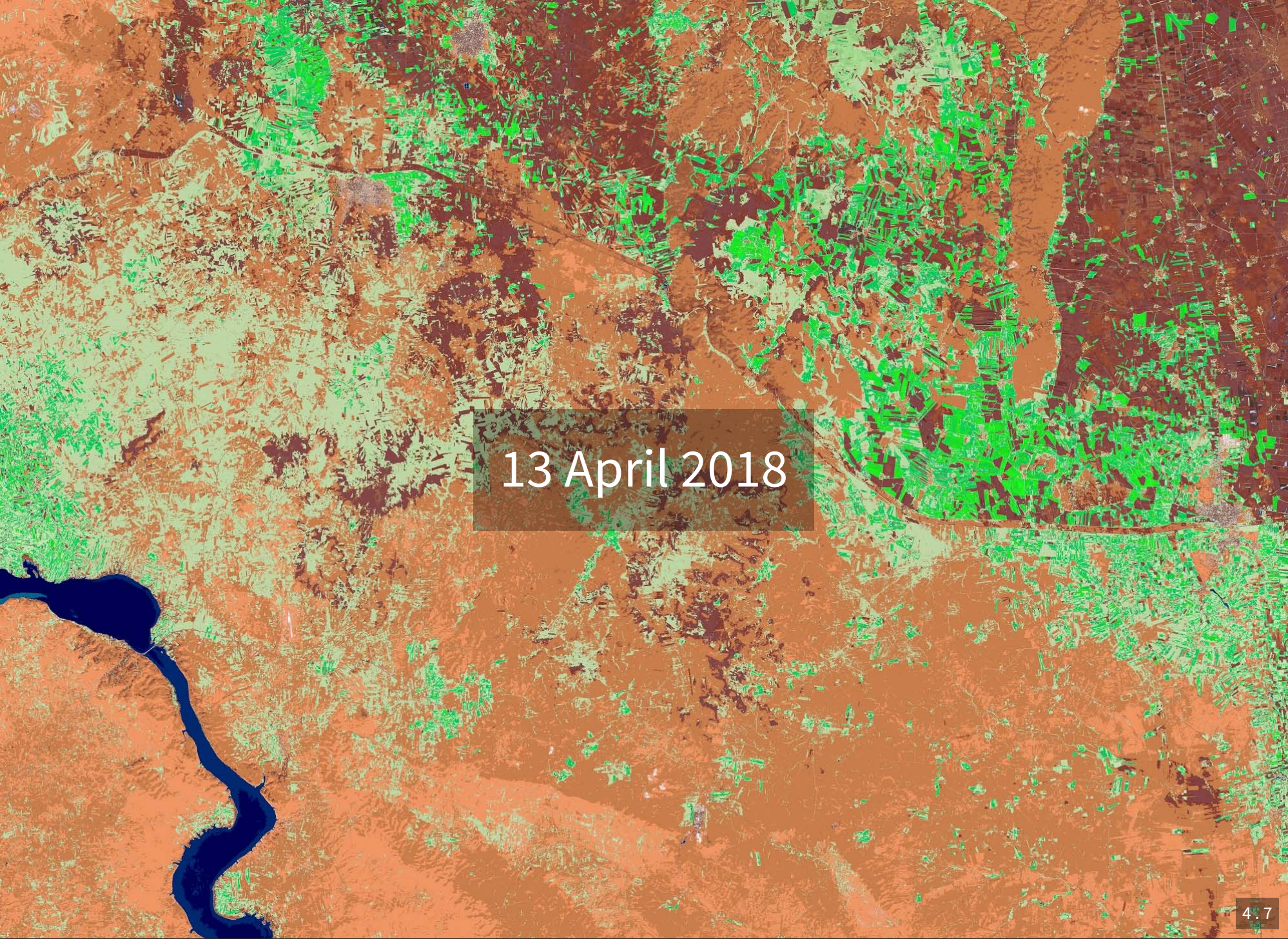
semi-concepts

EXAMPLE: 61 SEMI-CONCEPTS

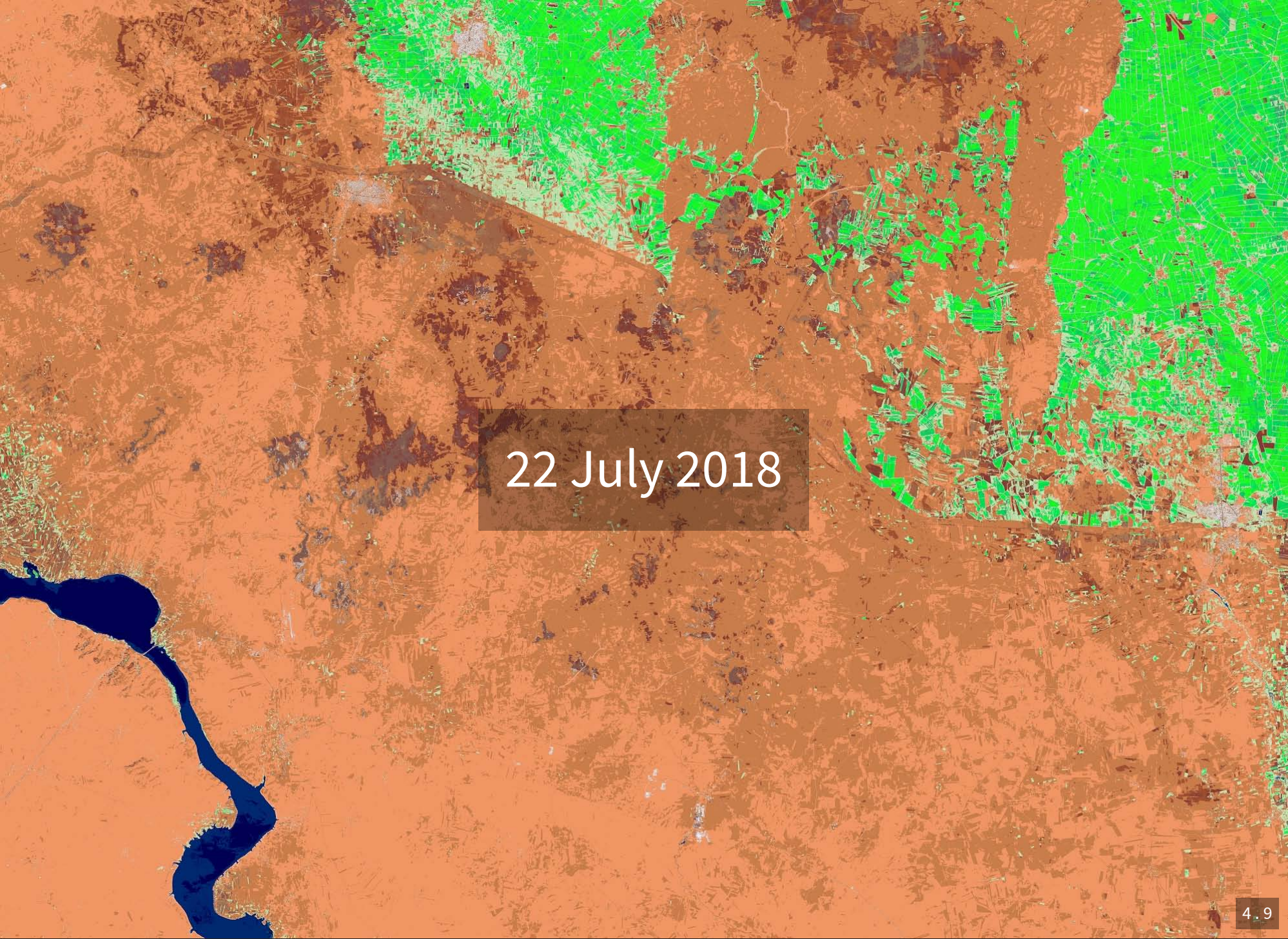
"High" leaf area index (LAI) vegetation types (LAI values decreasing left to right)
"Medium" LAI vegetation types (LAI values decreasing left to right)
Shrub or herbaceous rangeland
Other types of vegetation (e.g., vegetation in shadow, dark vegetation, wetland)
Bare soil or built-up
Deep water or turbid water or shadow
Smoke plume over water, over vegetation or over bare soil
Snow or cloud or bright bare soil or bright built-up
Unknowns



13 April 2018


13 April 2018

22 July 2018

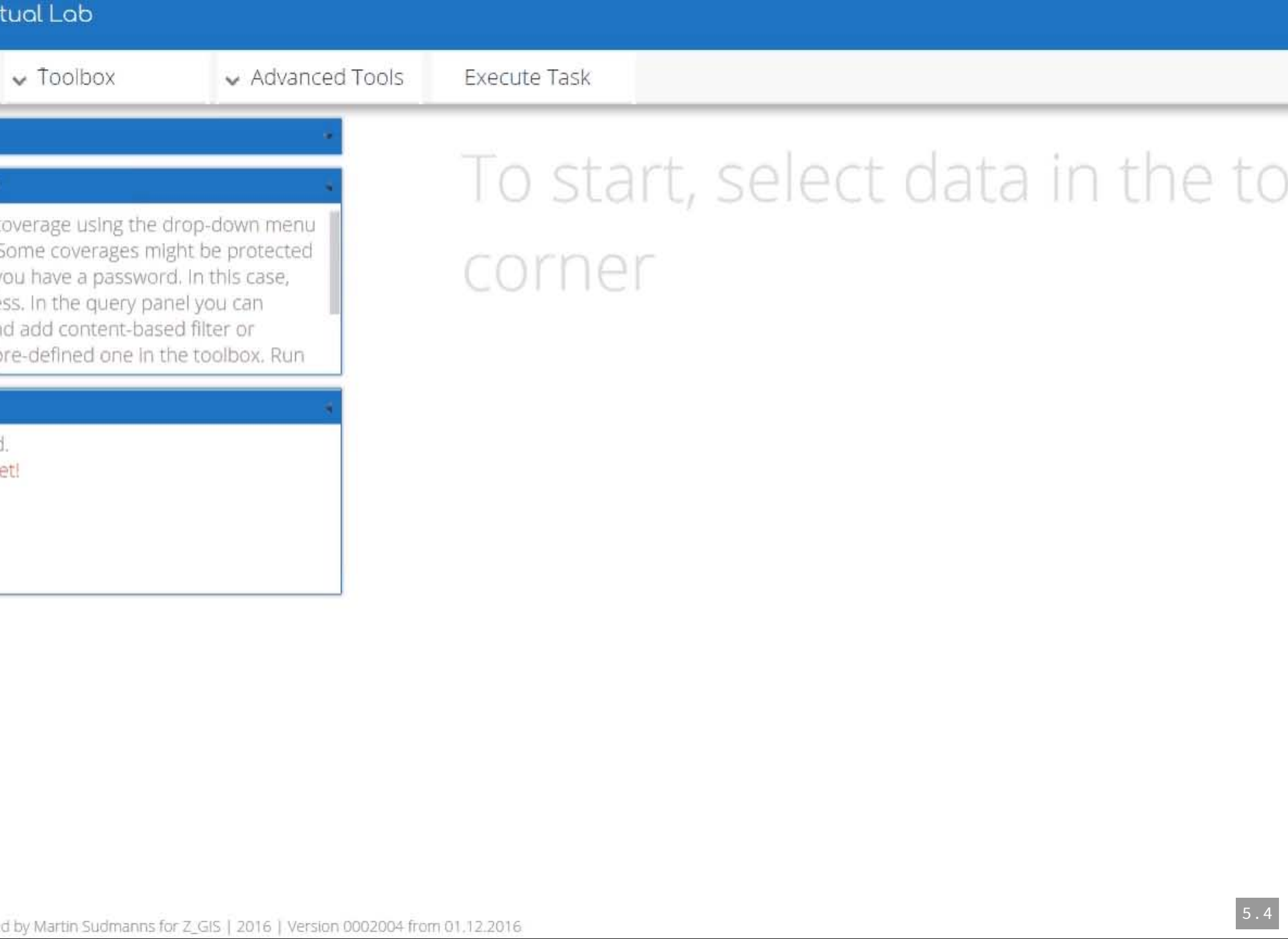

22 July 2018

PROOF-OF-CONCEPT IMPLEMENTATIONS

SOMALIA

- 78 Landsat 8 temporal images
- 2013 until September 2016
- in-house developed Web-based GUI

Example: indicate flood-prone areas over time


tual Lab
Toolbox
Advanced Tools
Execute Task
coverage using the drop-down menu
Some coverages might be protected
you have a password. In this case,
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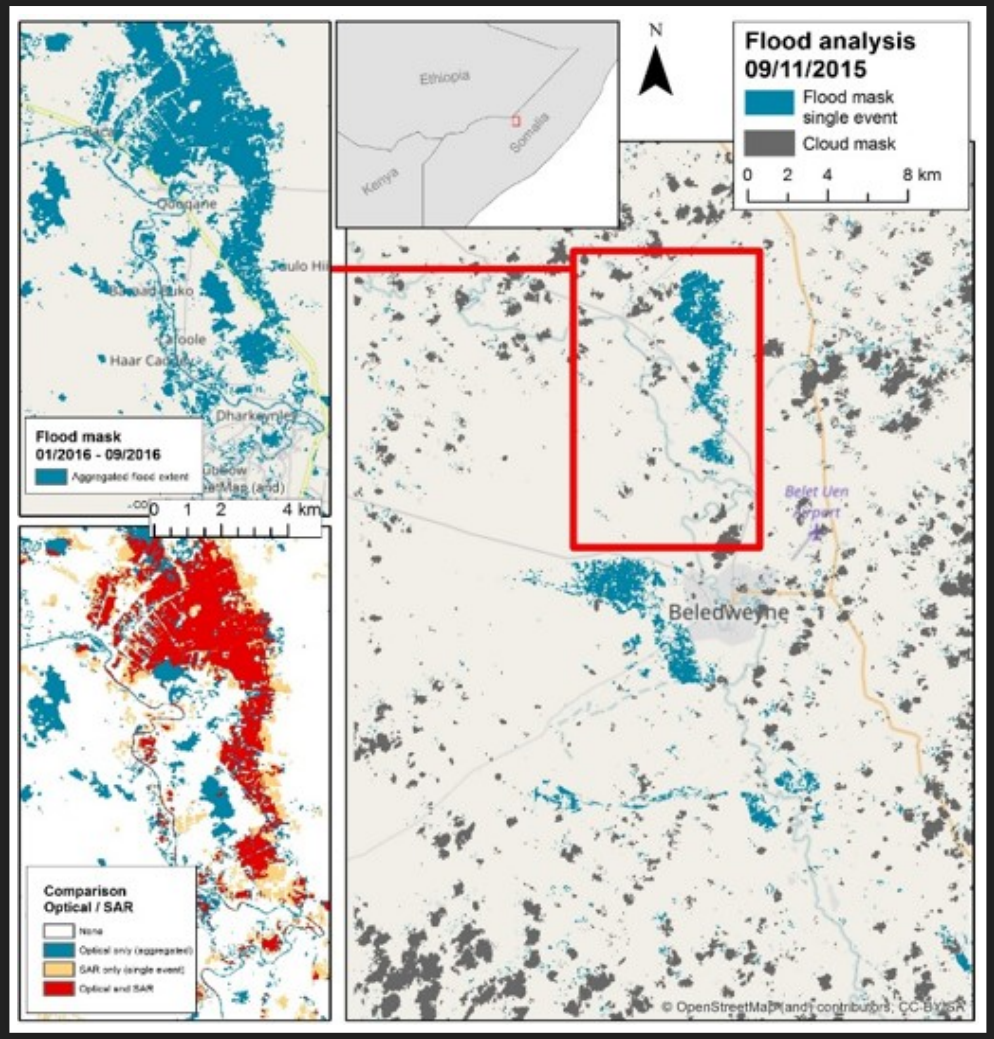


Figure 4: *from Sudmanns, M., Tiede, D., Wendt, L., & Baraldi, A. 2017. Automatic ex-post flood assessment using long time series of optical Earth observation images. In GI-Forum, Journal for Geographic Information Science (Vol. 1, pp. 217-227). doi:10.1553/giscience2017_01_s217*

SYRIA

- 3 Sentinel-2 granules
- June 28, 2015 - October 4, 2018
- ~680 scenes (~430GB)
- automated integration of newly acquired scenes
- Jupyter notebook interface access

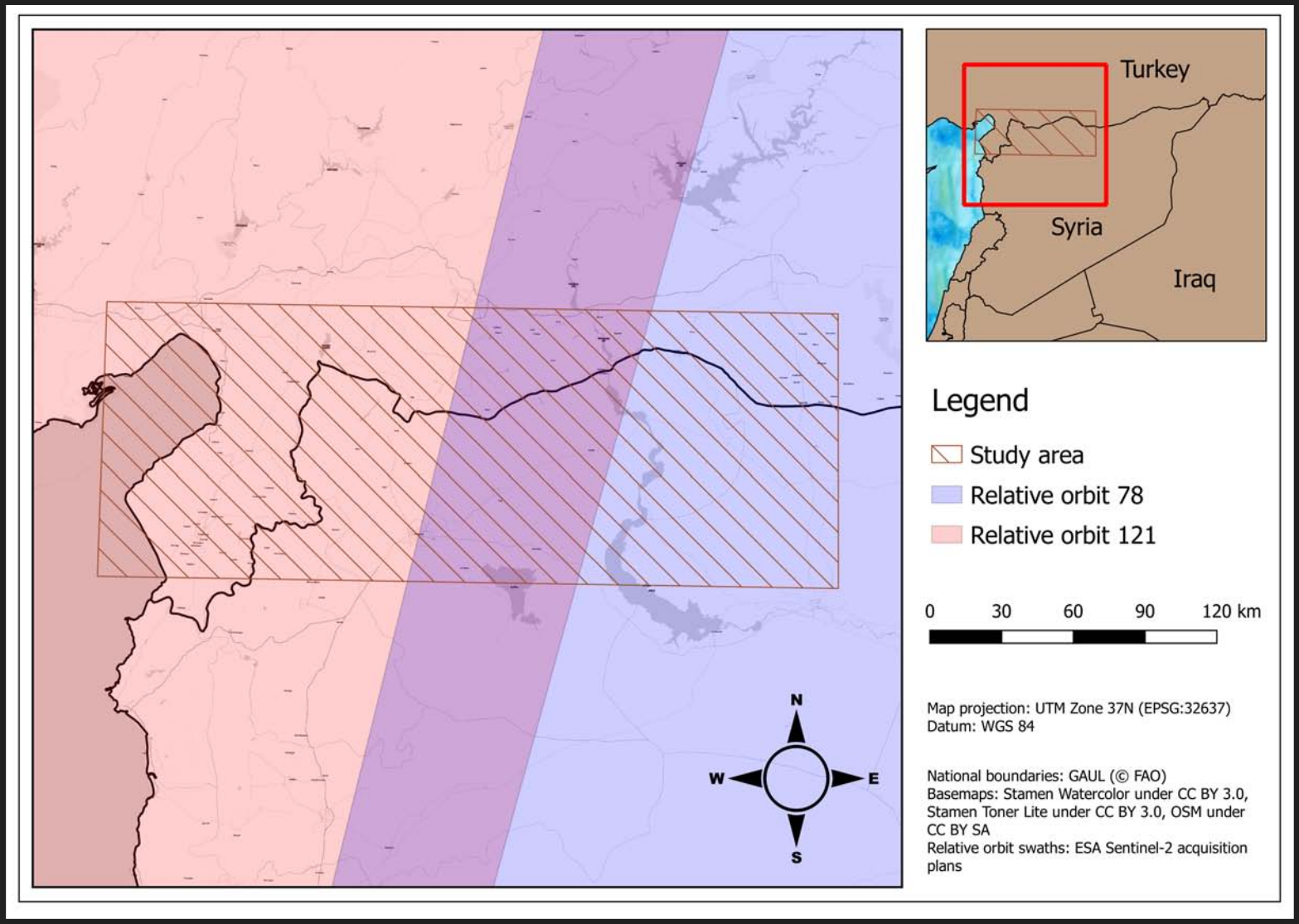


Figure 5: study area with overlapping relative orbits (Source: H. Augustin).

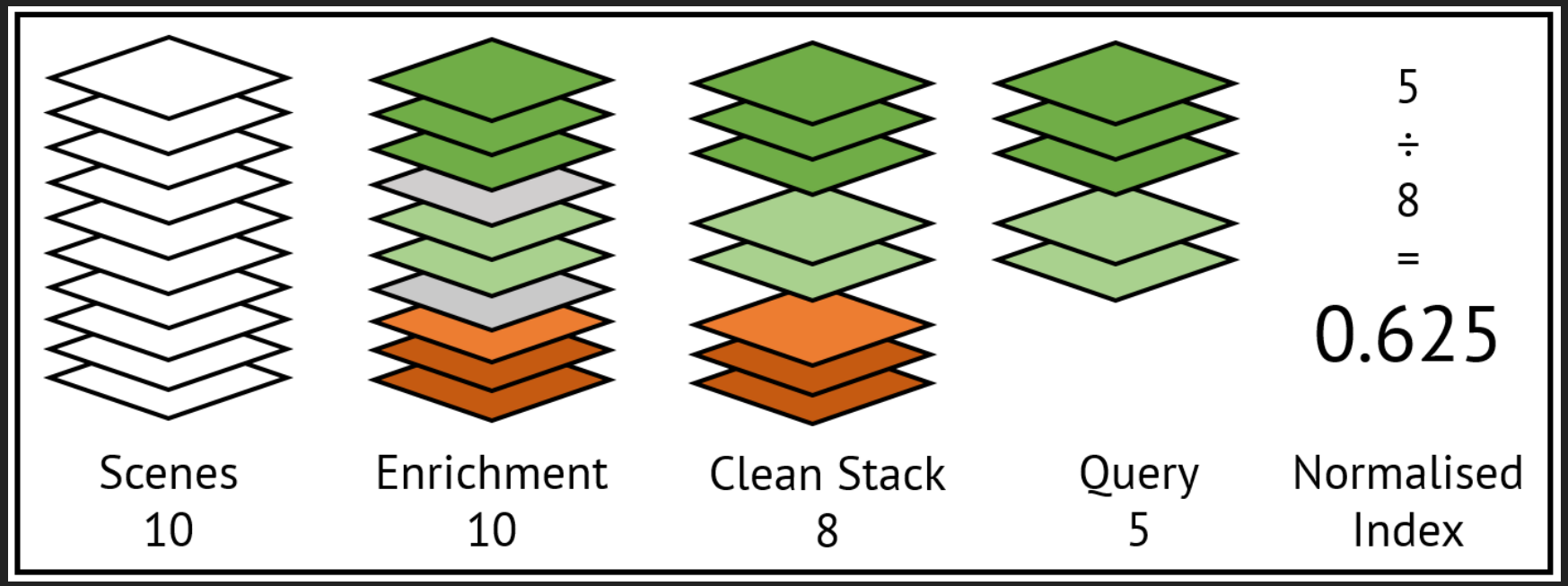
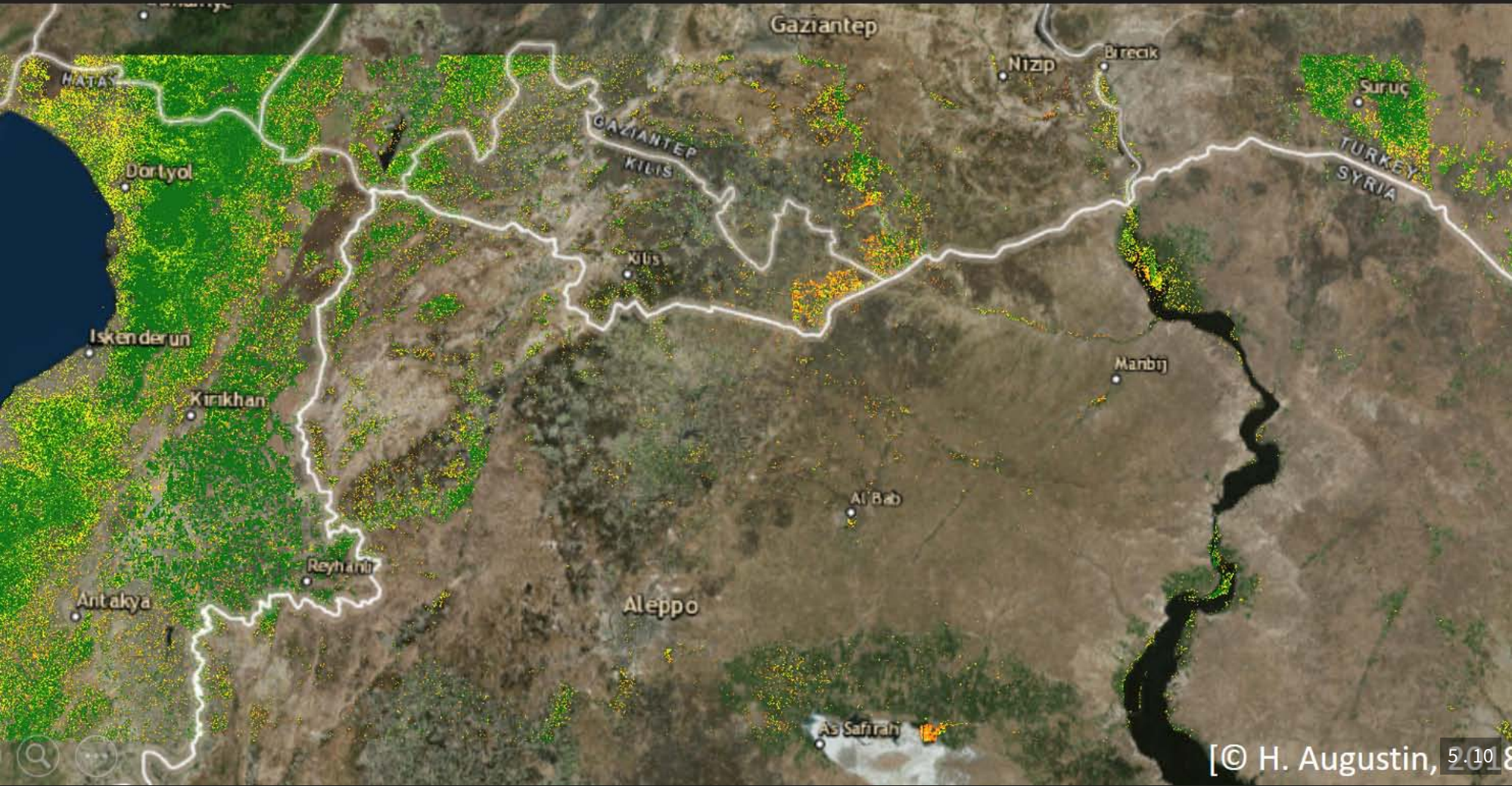


Figure 6: vegetation occurrence calculation (aggregated over time) (Source: H. Augustin).

Over 30,000 km^2
5-11 temporal images

- August 15 - September 15 2017
- <20 minutes, vegetation occurre



HATAY
Dortyol
Iskenderun
Kirikhan
Reyhanlı
Antakya
Aleppo
Al Bab
Manbij
As Safirah
Suruç
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5.11

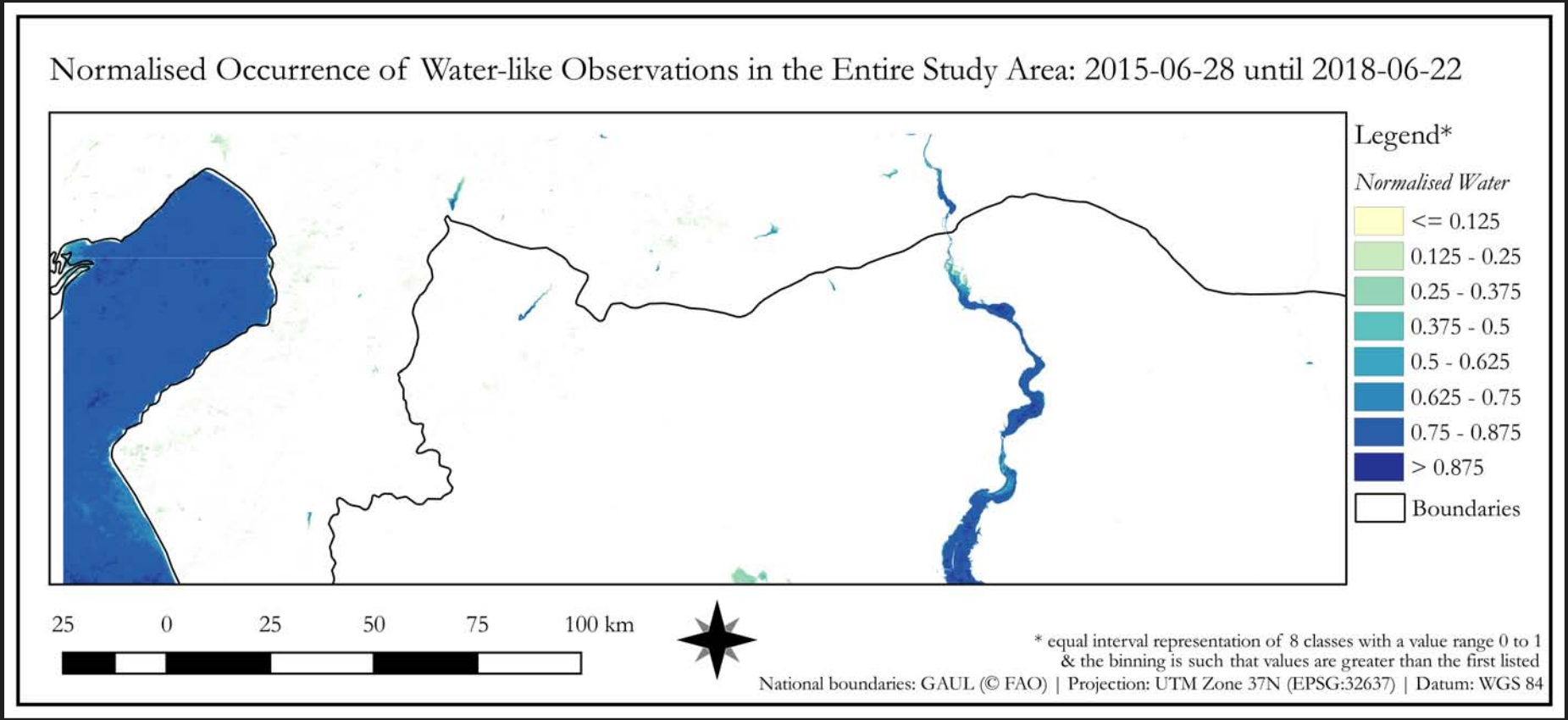


Figure 7: water-like query of clean pixels (Source: H. Augustin).

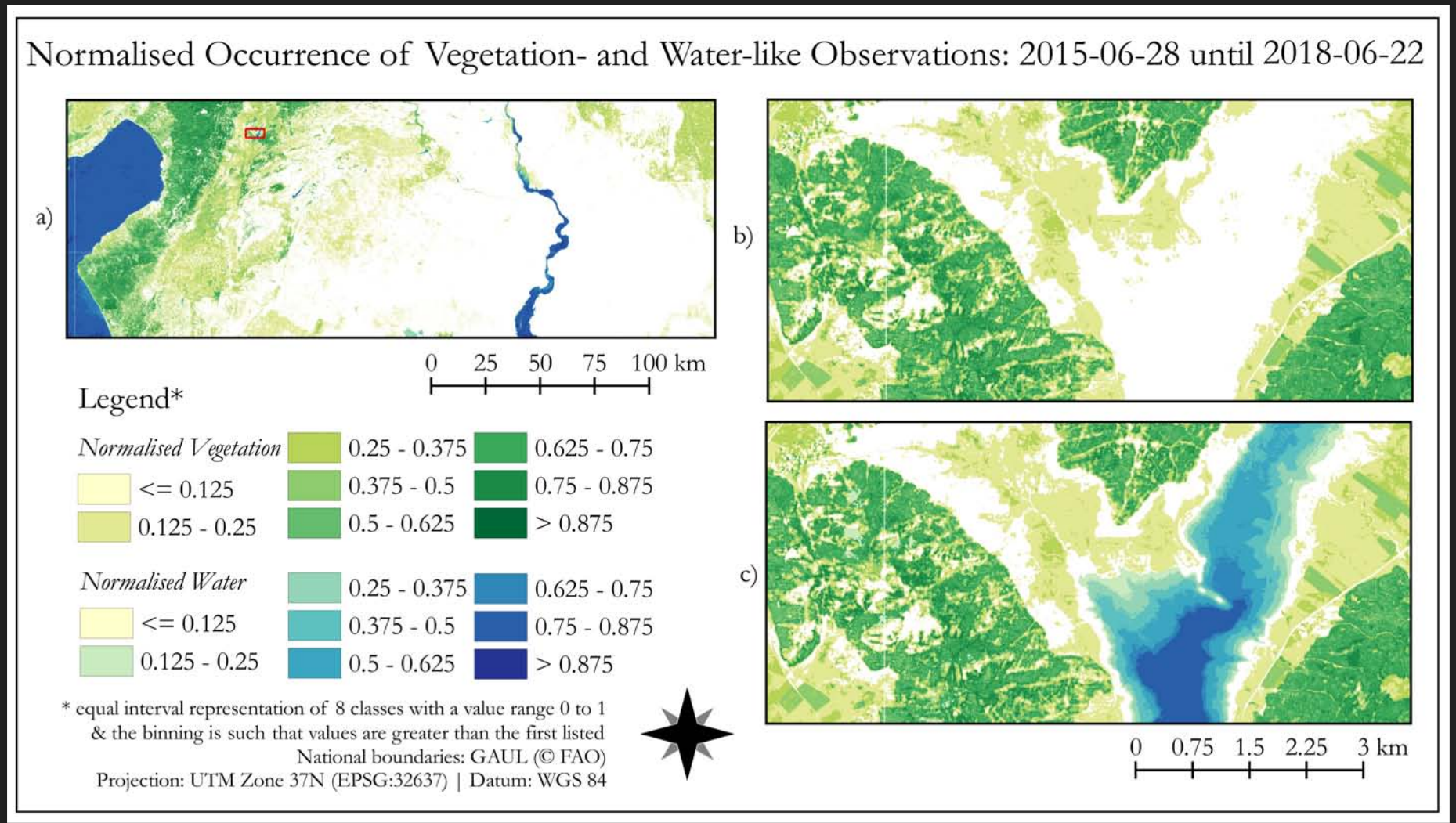
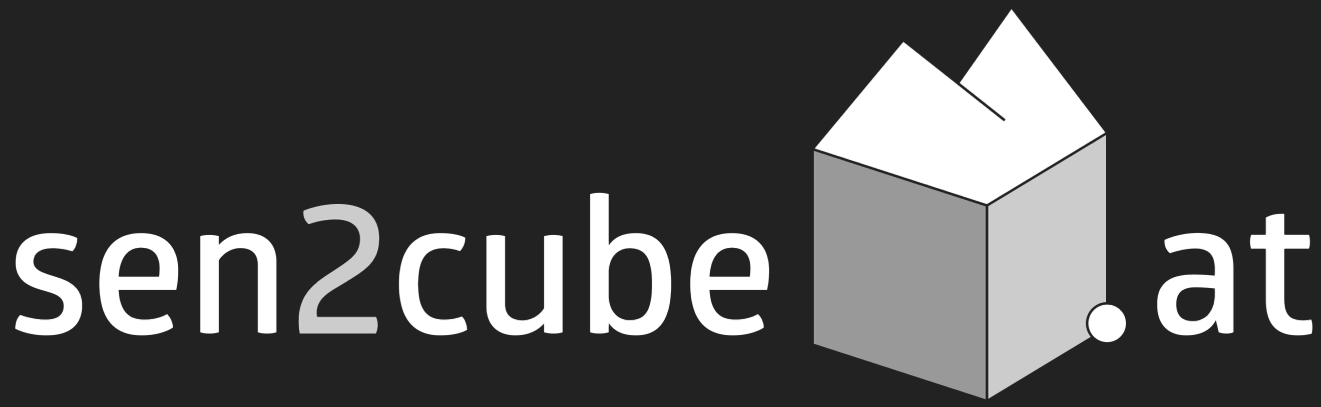


Figure 8: water-like and vegetation-like query of clean pixels (Source: H. Augustin).

CURRENT RESEARCH



Duration: 2018-2020

http://sen2cube.at

AUSTRIAN DATA AND INFORMATION CUBE

Sen2Cube.at is a project funded under the Austrian Space Applications Programme (ASAP) of the Austrian Research Promotion Agency (FFG; project no.: 866016).

FFG
Promoting Innovation.

PROJECT PARTNERS

AgrarMarkt Austria

spatial services

ZAMG

OUTLOOK

- integrate >4000 Sentinel-2 scenes
- semantic content-based image retrieval
- generation of cloud-free mosaics/composites
- location-based queries through time
- polygon-based/object-based land cover change analysis through time

THANK YOU FOR YOUR ATTENTION!

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Slides: http://slides.hannahaugustin.at/DGfG/2018/

39th European Association of Remote Sensing Laboratories Symposium & 43rd General Assembly

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