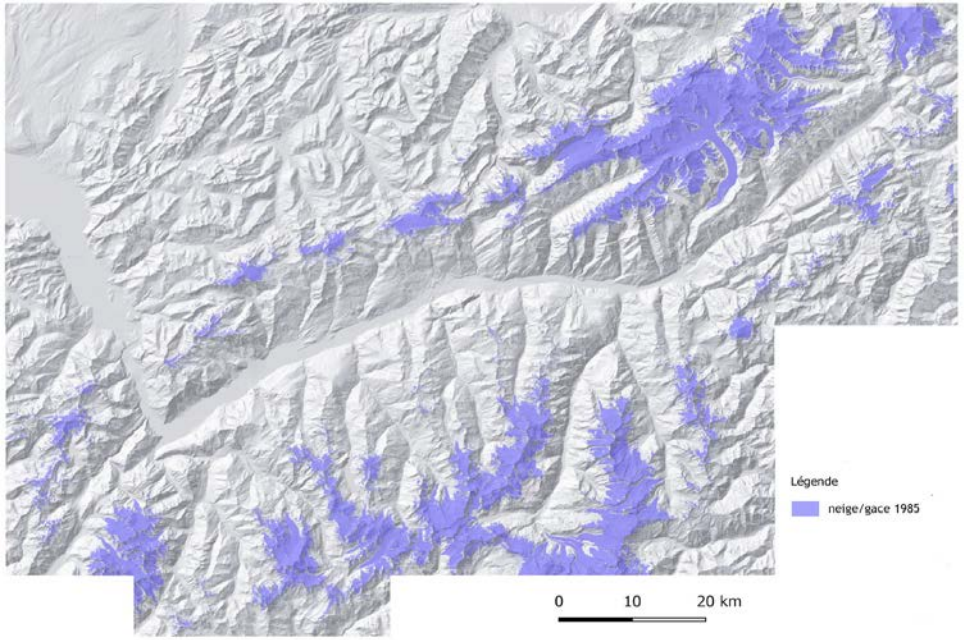
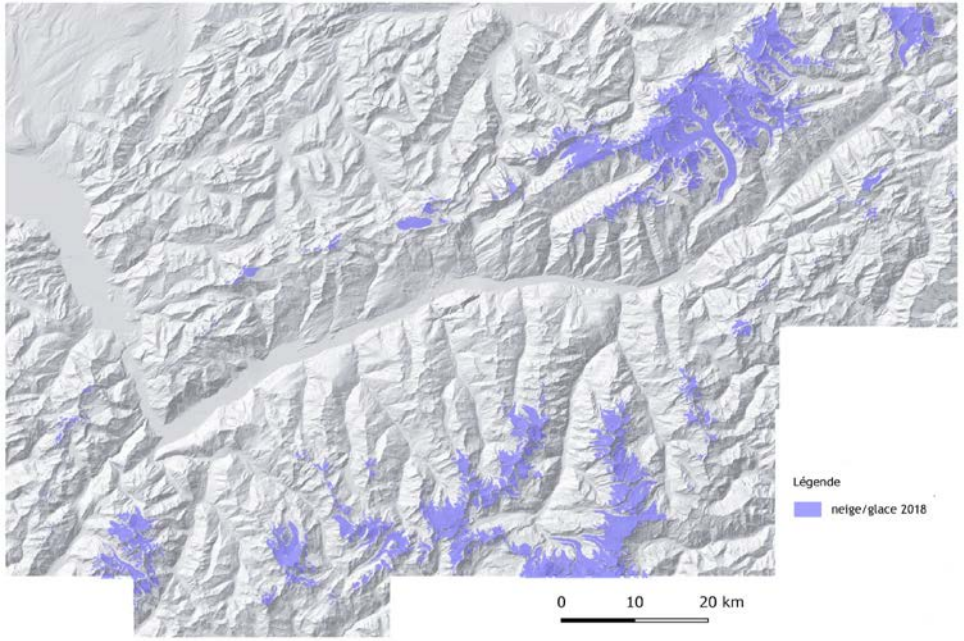
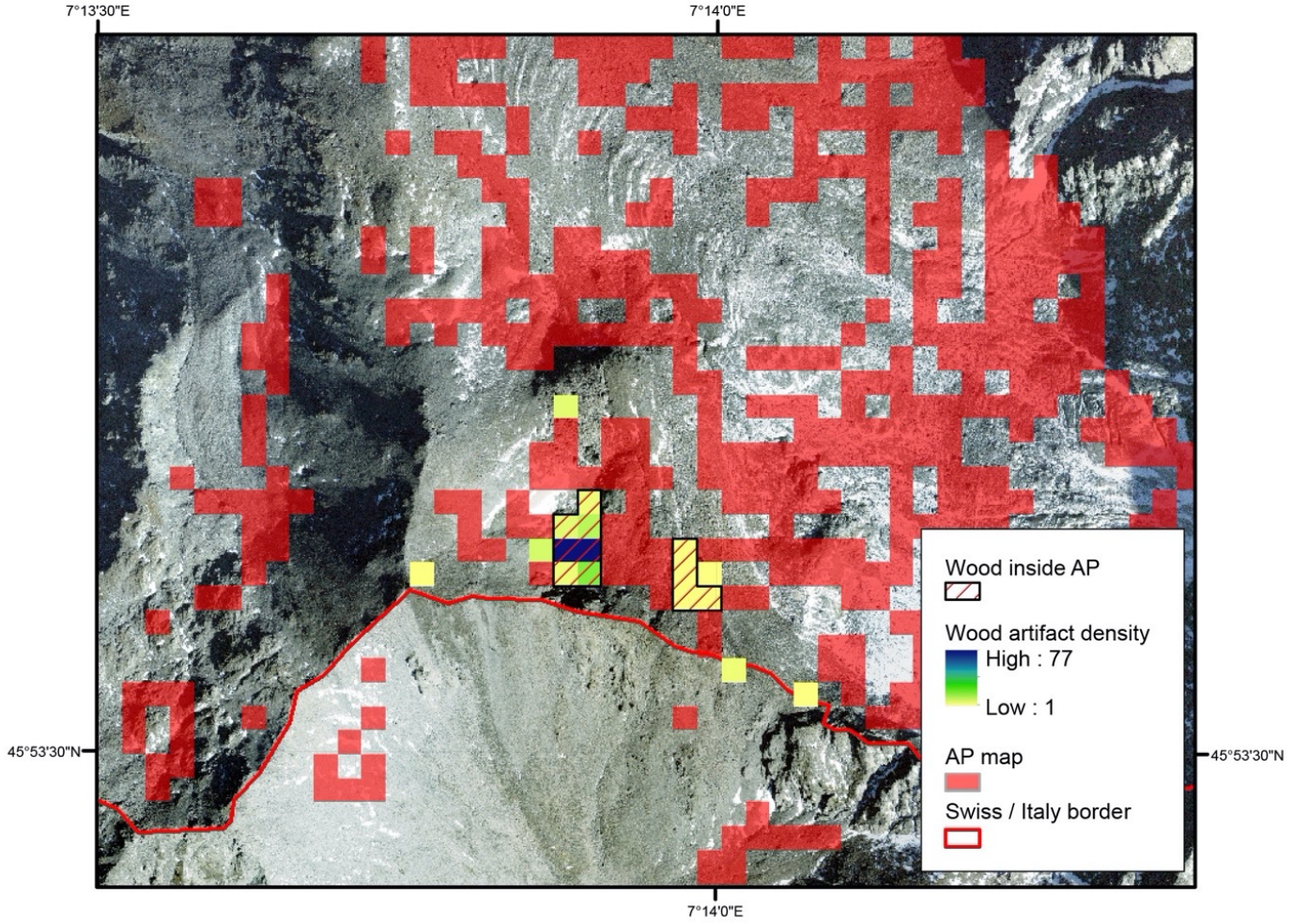
Identifying areas of archaeological potential in the Alps



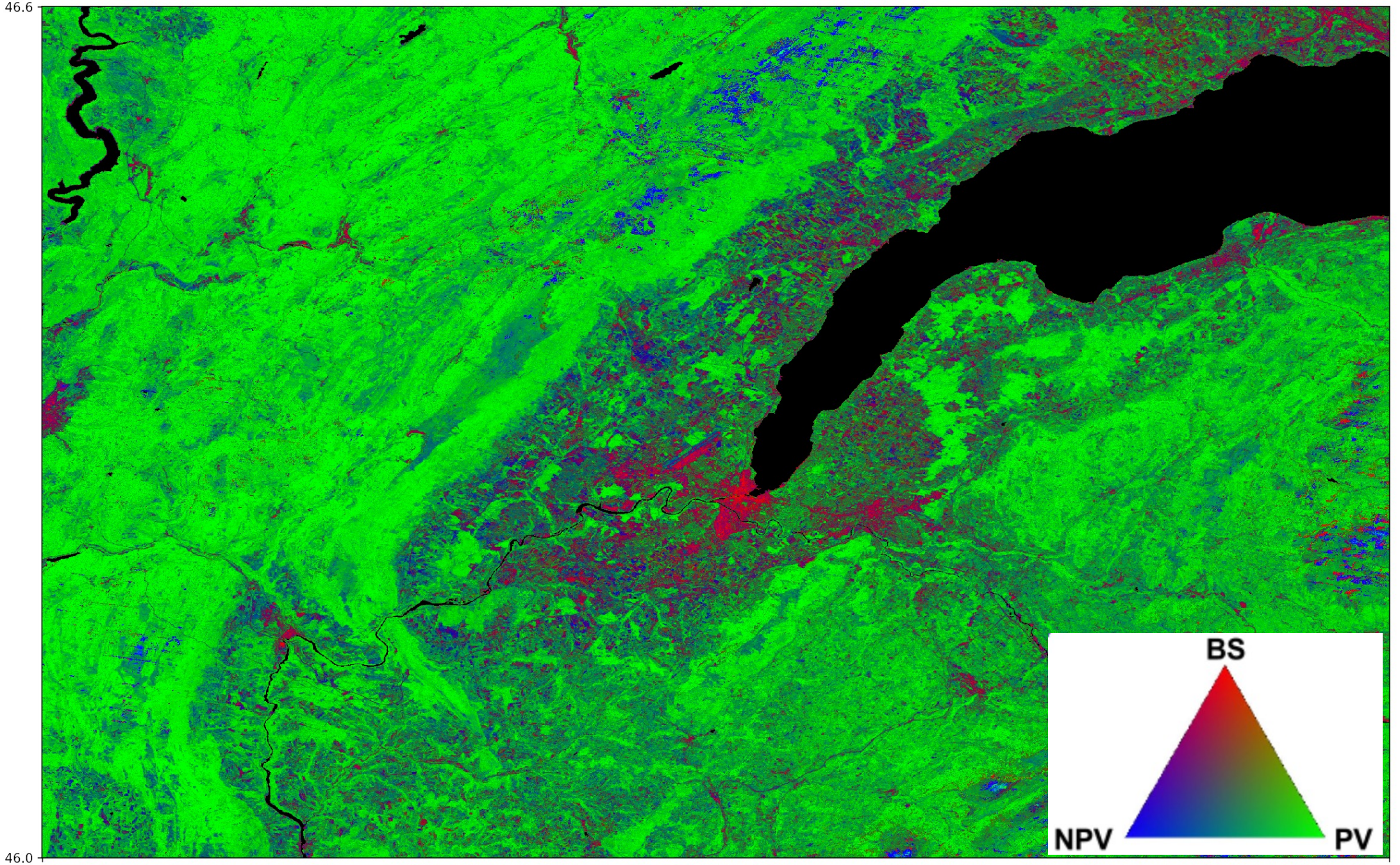




Cornut C., Ozainne S., Poussin C., Andenmatten R., Giuliani G., Identifying areas of archaeological potential in the Swiss Alps using satellite-derived time-series of snow cover estimates, Submitted to Remote Sensing Applications: Society and Environment

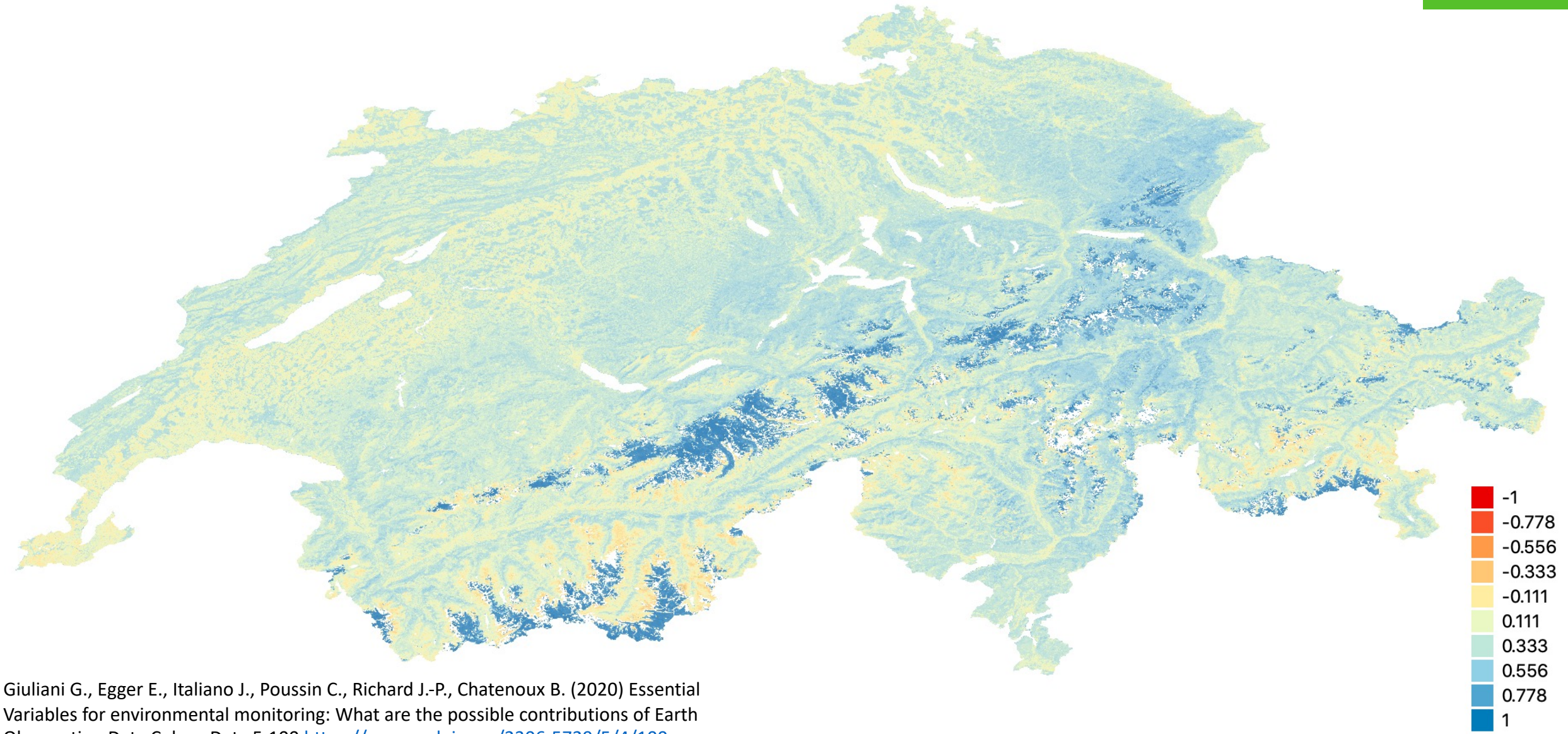

Composite RGB - Landsat 2003
46.6
46.0
5.7
6.6

Fractional cover - Landsat 2003



Normalized Difference Water Index (NDWI)…

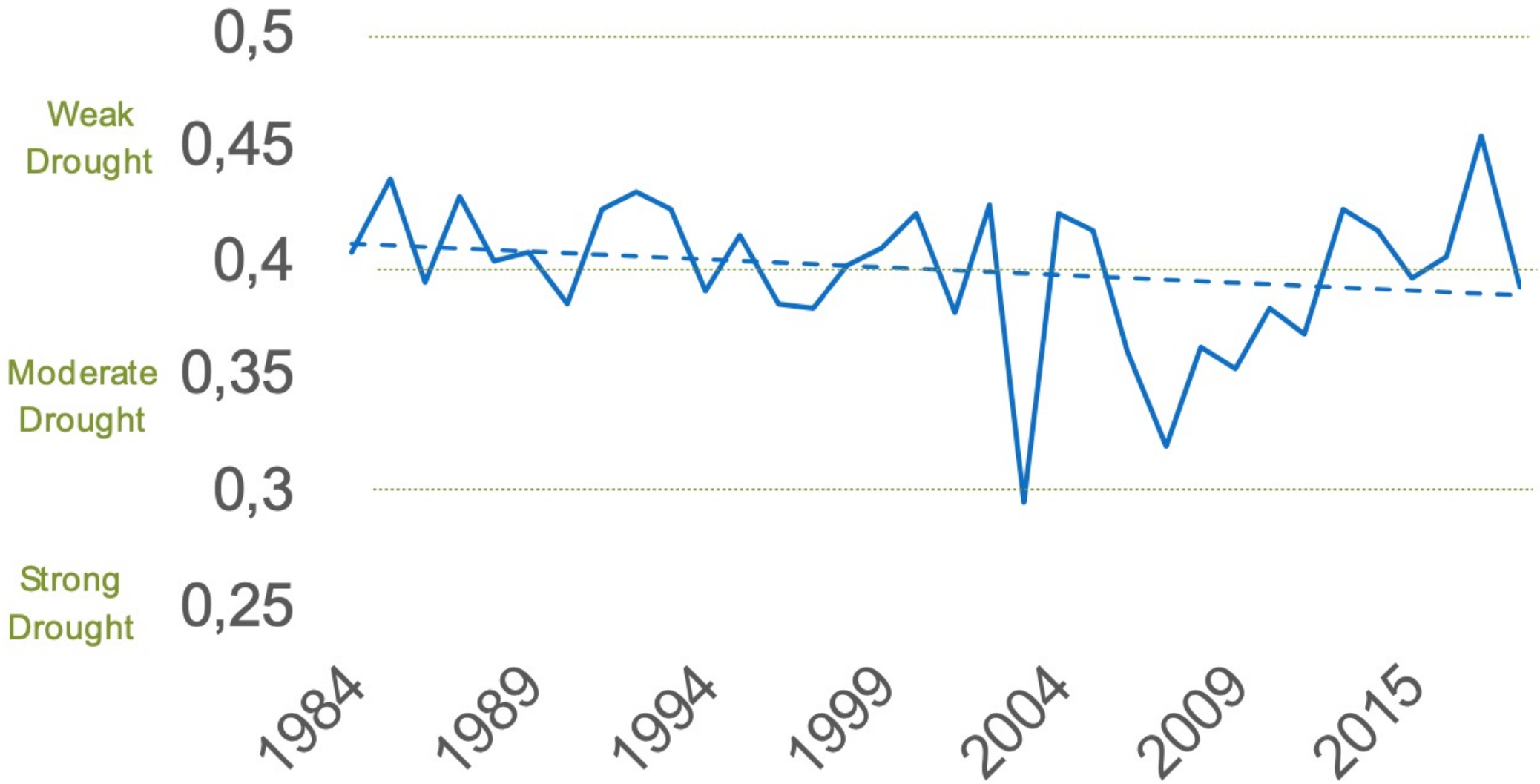
Water content of vegetation (2014 vs. 2003)



Giuliani G., Egger E., Italiano J., Poussin C., Richard J.-P., Chatenoux B. (2020) Essential Variables for environmental monitoring: What are the possible contributions of Earth Observation Data Cubes, Data 5:100 https://www.mdpi.com/2306-5729/5/4/100

Trends in vegetation water content

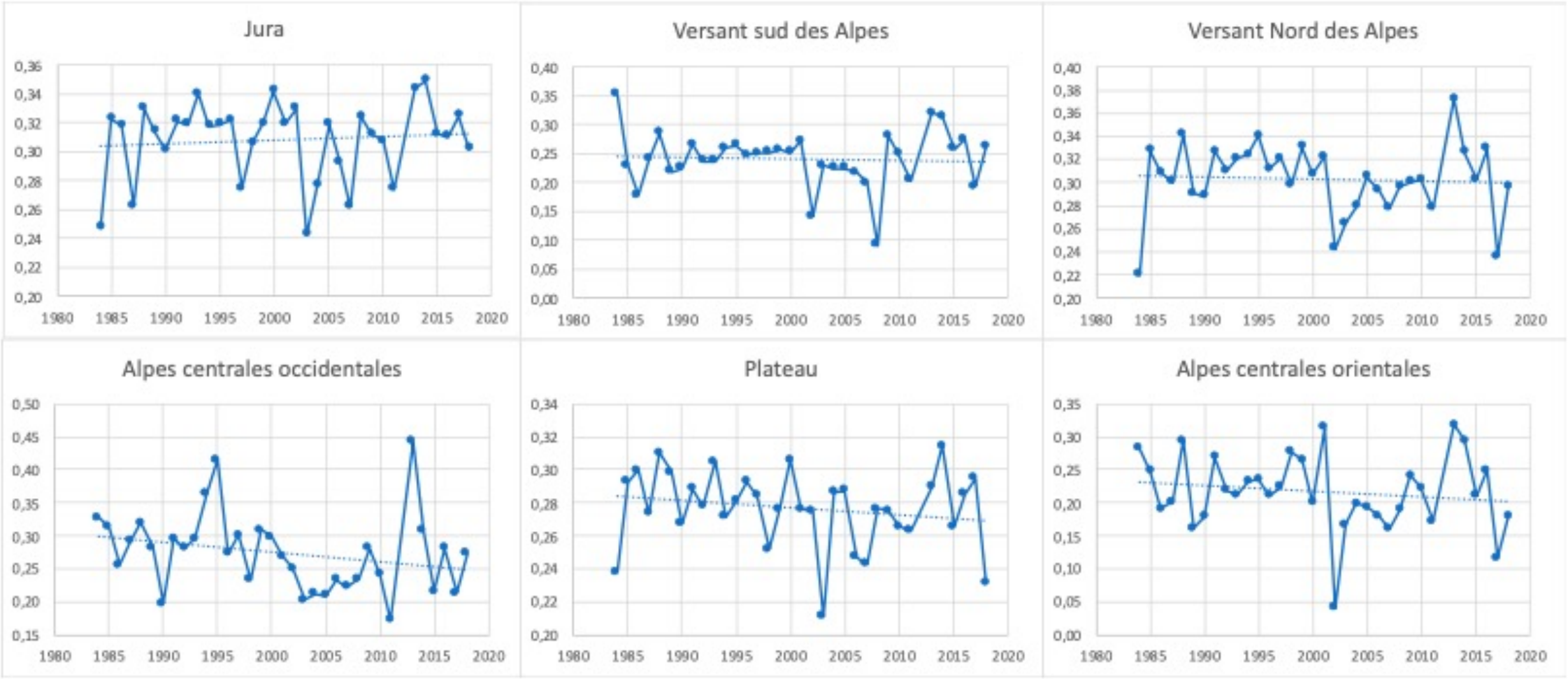
NDWI time-series from 35 years of Landsat observations – Annual mean



Poussin C., Massot A., Ginzler C., Weber D., Chatenoux B., Lacroix P., Piller T., Nguyen L., Giuliani G., Drying conditions in Switzerland - Indication from a 35-year Landsat trend analysis of vegetation water content estimates to support SDG15, *Submitted to* ***Big Earth Data***

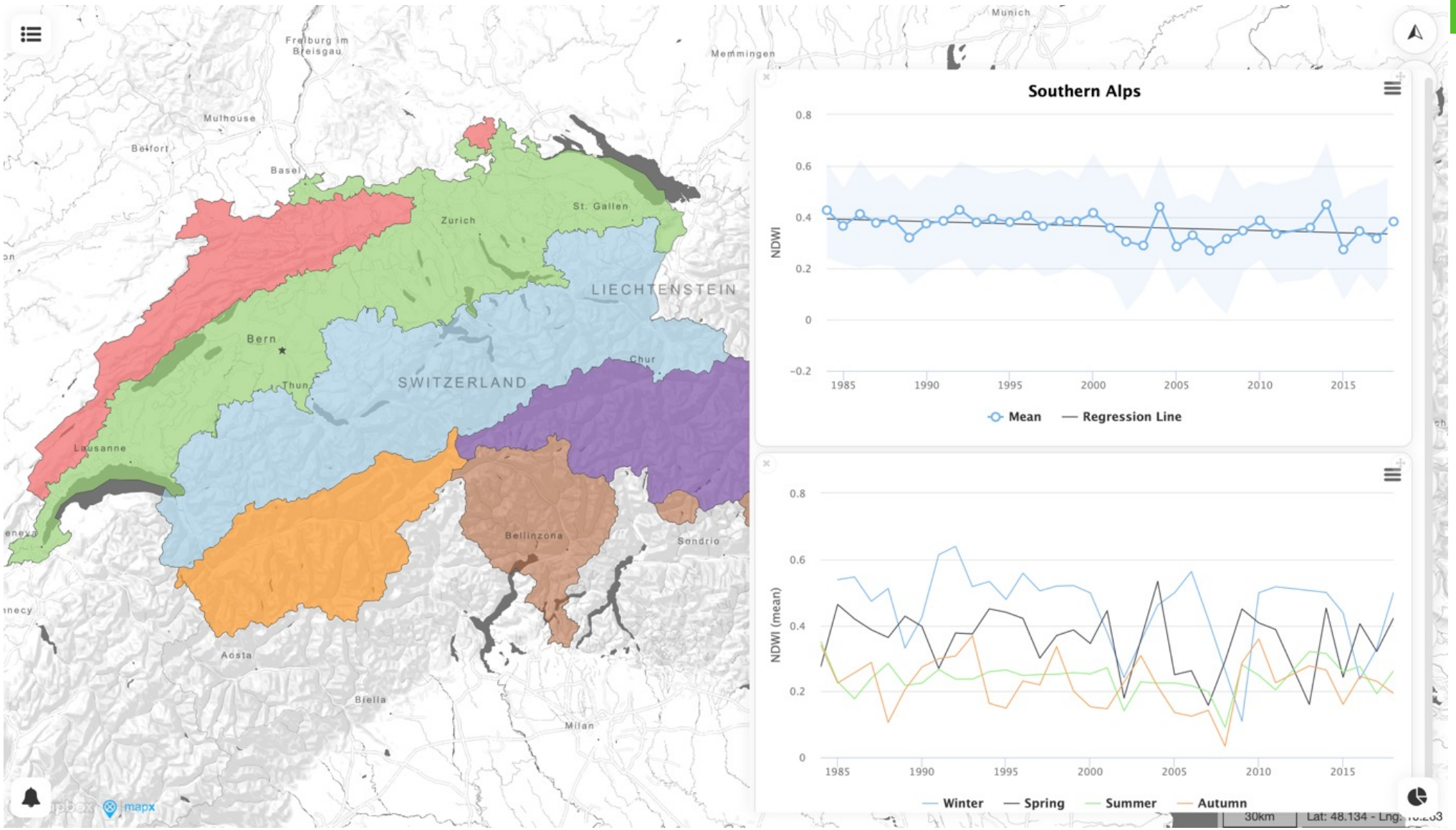
Trends in vegetation water content

Statistics by biogeographical zones – mean summer season



Soon…

A dedicated service/dashboard to follow trends by regions & cantons

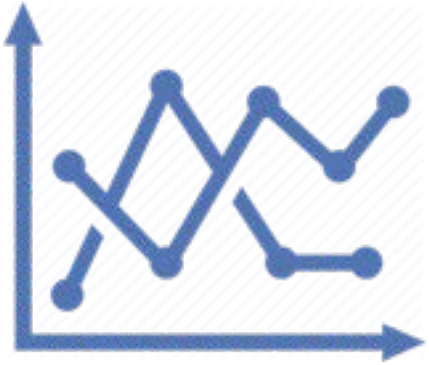


SDG 15.3.1 Land Degradation…

…is undermining the well-being of 3.2 billion people (IPBES)

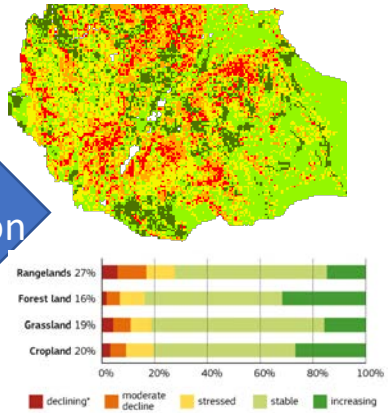
DATA → **INFORMATION** → **KNOWLEDGE**

Model



Model

Interpretation & representation



EO Data

- MODIS/AVRRR
- ESA CCI Land Cover
- SoilGrids

Sub-indicators

- Land Productivity Dynamics
- Land Cover Change
- Soil Organic Carbon Stocks

SDG15.3.1

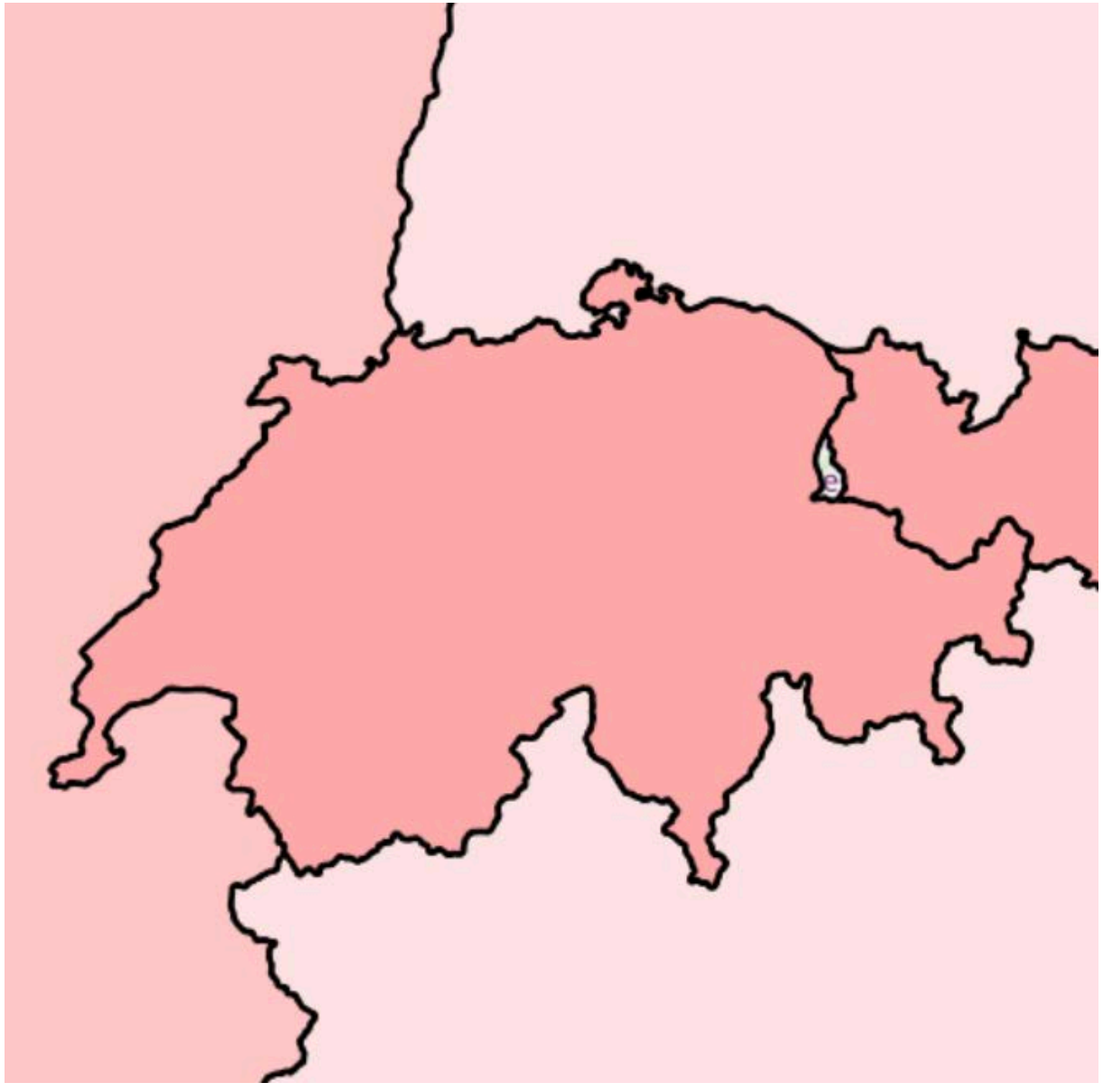
Proportion of land that is degraded over total land area

Collaboration: UNIGE, GEO, ESA, CNR, JRC, UNEP

Giuliani G., Mazzetti P., Santoro M., Nativi S., Van Bemmelen J., Colangeli G., Lehmann A. (2020) Knowledge generation using satellite Earth Observations to support Sustainable Development Goals (SDG): a use case on Land Degradation, International Journal of Applied Earth Observation and Geoinformation 88:102068 https://doi.org/10.1016/j.jag.2020.102068

Aggregated indicators…

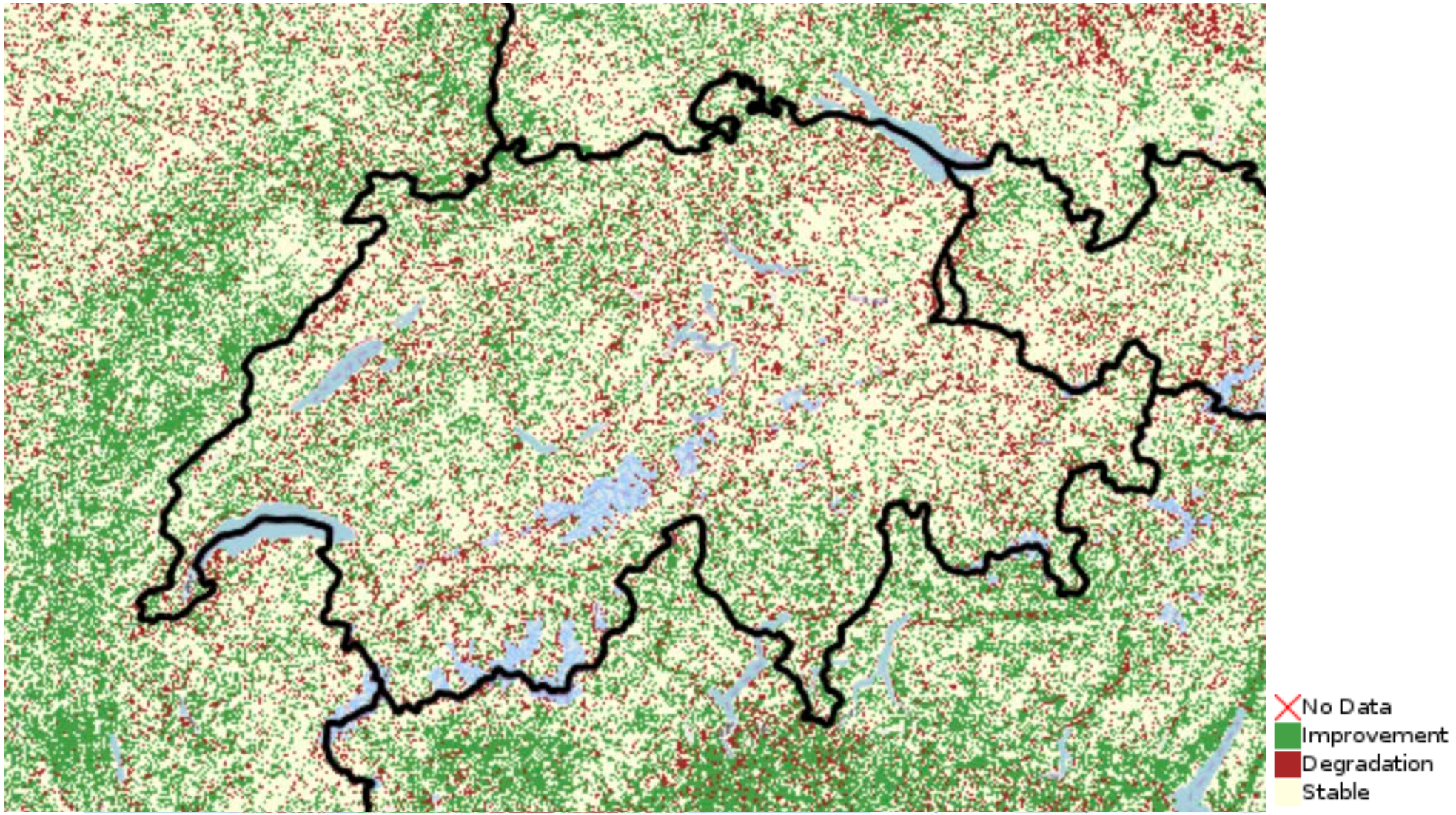
… are not enough for public policy!



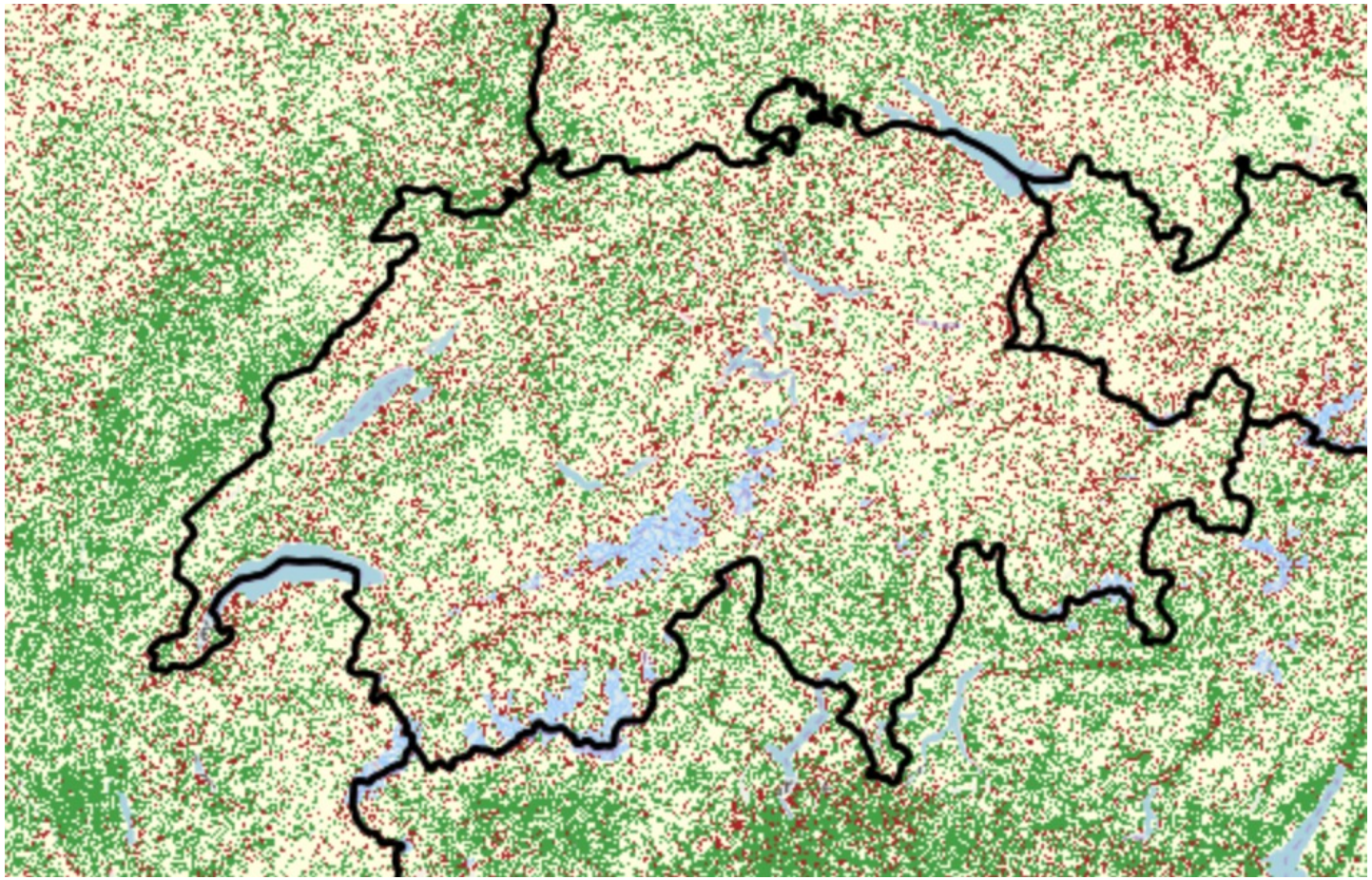
Disaggregation of indicators…

… to capture spatial (maps) and temporal dynamics (graphs)

How much? Where? When? Who?



SDG15.3.1 – Results from Switzerland



No data
Degradation
Stable
Improvement

Official value: 4.7%

SDC value: 9.7%

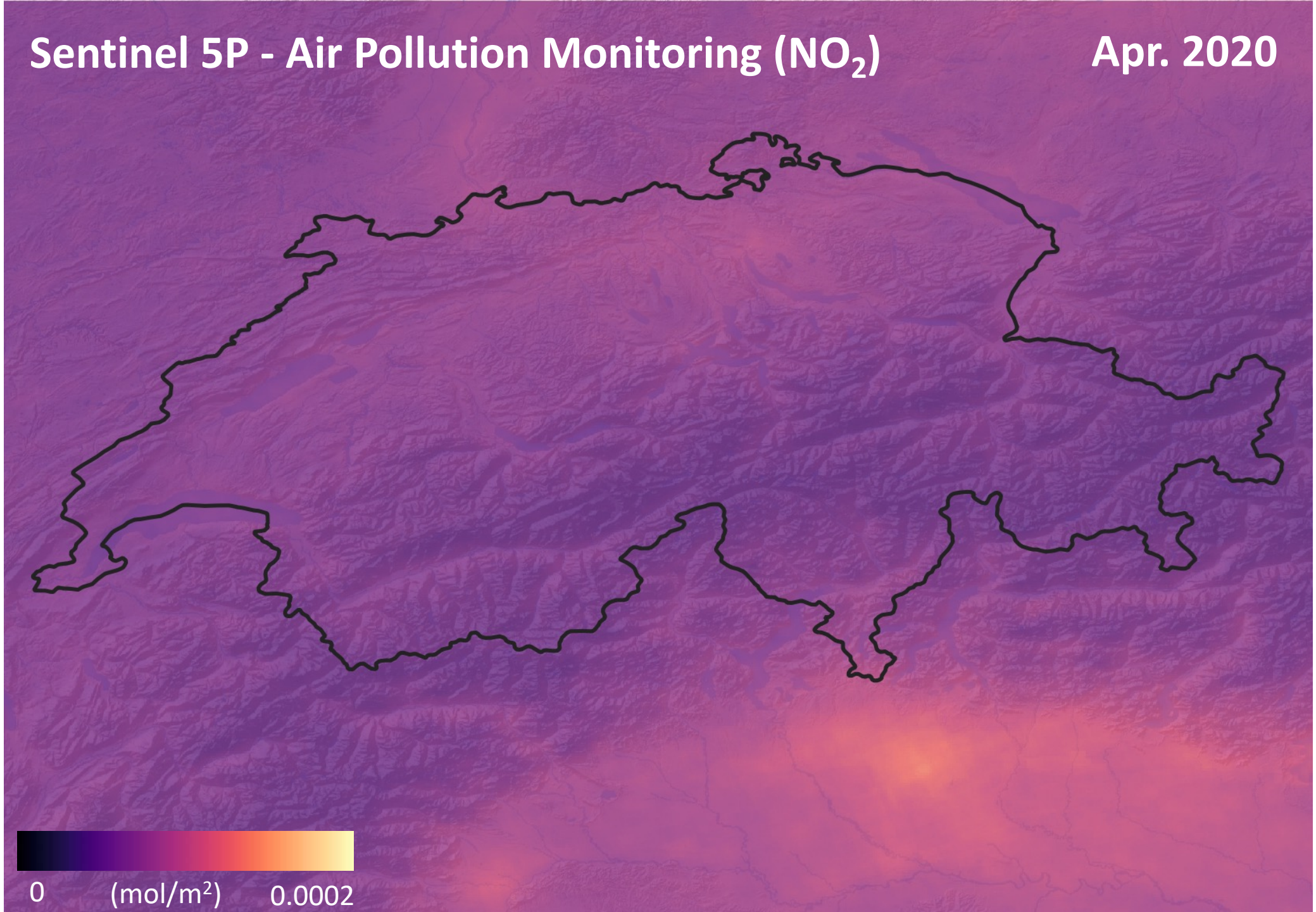
Official definition in Switzerland is based only on soil sealing and do not consider land productivity!

Do not comply with the official UN definition!

Giuliani G., Chatenoux B., Benvenuti A., Lacroix P., Santoro M., Mazzetti P., Monitoring Land Degradation at national level using satellite EO time-series data to support SDG15 – Exploring the potentiation of Data Cube, Big Earth Data, https://doi.org/10.1080/20964471.2020.1711633

Potential (other) applications

- Monitoring land cover change
- Glacier monitoring, ice extent mapping, snow cover monitoring
- Agricultural applications: crop monitoring, food security
- Vegetation and forest monitoring, parameter generation (chlorophyll concentration, carbon mass estimations)
- Water quality monitoring
- Flood mapping and management
- Urban mapping & monitoring


Sentinel 5P - Air Pollution Monitoring (NO_2)
Apr. 2020
0
(mol/m²)
0.0002

Interoperability challenges

Open Access | Feature Paper | Article

Paving the Way to Increased Interoperability of Earth Observations Data Cubes

data

by Gregory Giuliani [1,2,*], Joan Masó [3], Paolo Mazzetti [4], Stefano Nativi [5] and Alaitz Zabala [6]

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[2] Institute for Environmental Sciences, University of Geneva, GRID-Geneva, Bd Carl-Vogt 66, CH-1211 Geneva, Switzerland

[3] Center for Ecological Research and Forestry Applications (CREAF), Universitat Autònoma de Barcelona (UAB), 08193 Bellaterra, Barcelona, Spain

[4] National Research Council of Italy (CNR)—Institute of Atmospheric Pollution Research, Via Madonna del Piano 10, 50019 Sesto Fiorentino, Italy

[5] European Commission Joint Research Center (JRC), Via E. Fermi, 2749, 21027 Ispra, Italy

[6] Geography Department, Universitat Autònoma de Barcelona (UAB), 08193 Bellaterra, Barcelona, Spain

[*] Author to whom correspondence should be addressed.

Data **2019**, *4*(3), 113; https://doi.org/10.3390/data4030113

Received: 14 June 2019 / Revised: 26 July 2019 / Accepted: 27 July 2019 / Published: 30 July 2019

(This article belongs to the Special Issue Earth Observation Data Cubes)

View Full-Text | Download PDF | Browse Figures

Abstract

Earth observations data cubes (EODCs) are a paradigm transforming the way users interact with large spatio-temporal Earth observation (EO) data. It enhances connections between data, applications and users facilitating management, access and use of analysis ready data (ARD). The ambition is allowing users to harness big EO data at a minimum cost and effort. This significant interest is illustrated by various implementations that exist. The novelty of the approach results in different innovative solutions and the lack of commonly agreed definition of EODC. Consequently, their interoperability has been recognized as a major challenge for the global change and Earth system science domains. The objective of this paper is preventing EODC from becoming silos of information; to present how interoperability can be enabled using widely-adopted geospatial standards; and to contribute to the debate of enhanced interoperability of EODC. We demonstrate how standards can be used, profiled and enriched to pave the way to increased interoperability of EODC and can help delivering and leveraging the power of EO data building, efficient discovery, access and processing services. View Full-Text

Keywords: Open Data Cube; remote sensing; geospatial standards; landsat; sentinel; analysis ready data

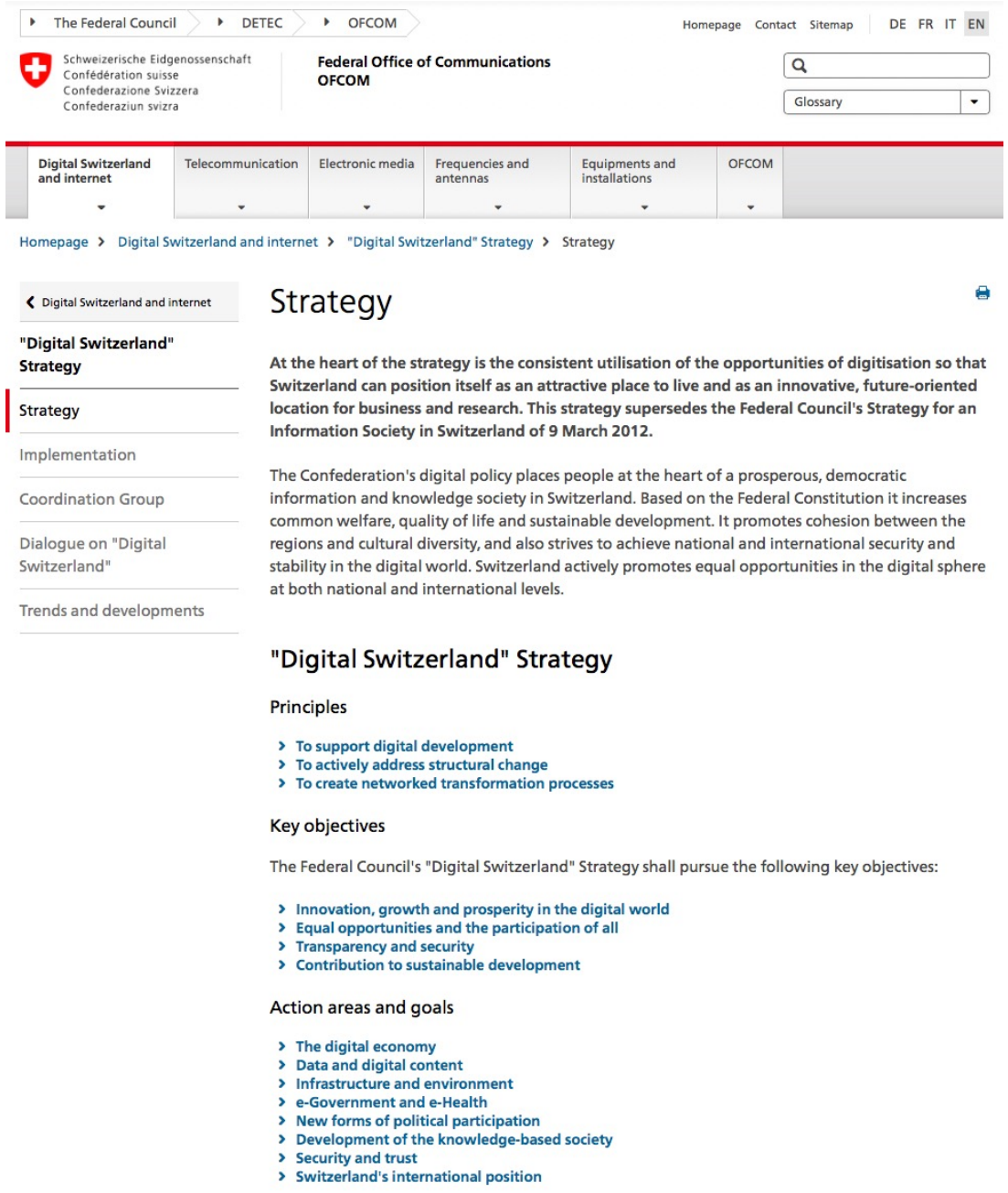
Giuliani G., Maso J., Mazzetti P., Nativi S., Zabala A. (2019) Paving the way to increased interoperability of Earth Observations Data Cube. Data 4(3):113

Part of the Special Issue “Earth Observation Data Cubes”: https://www.mdpi.com/journal/data/special_issues/EODC

Implemented standards in the Swiss Data Cube

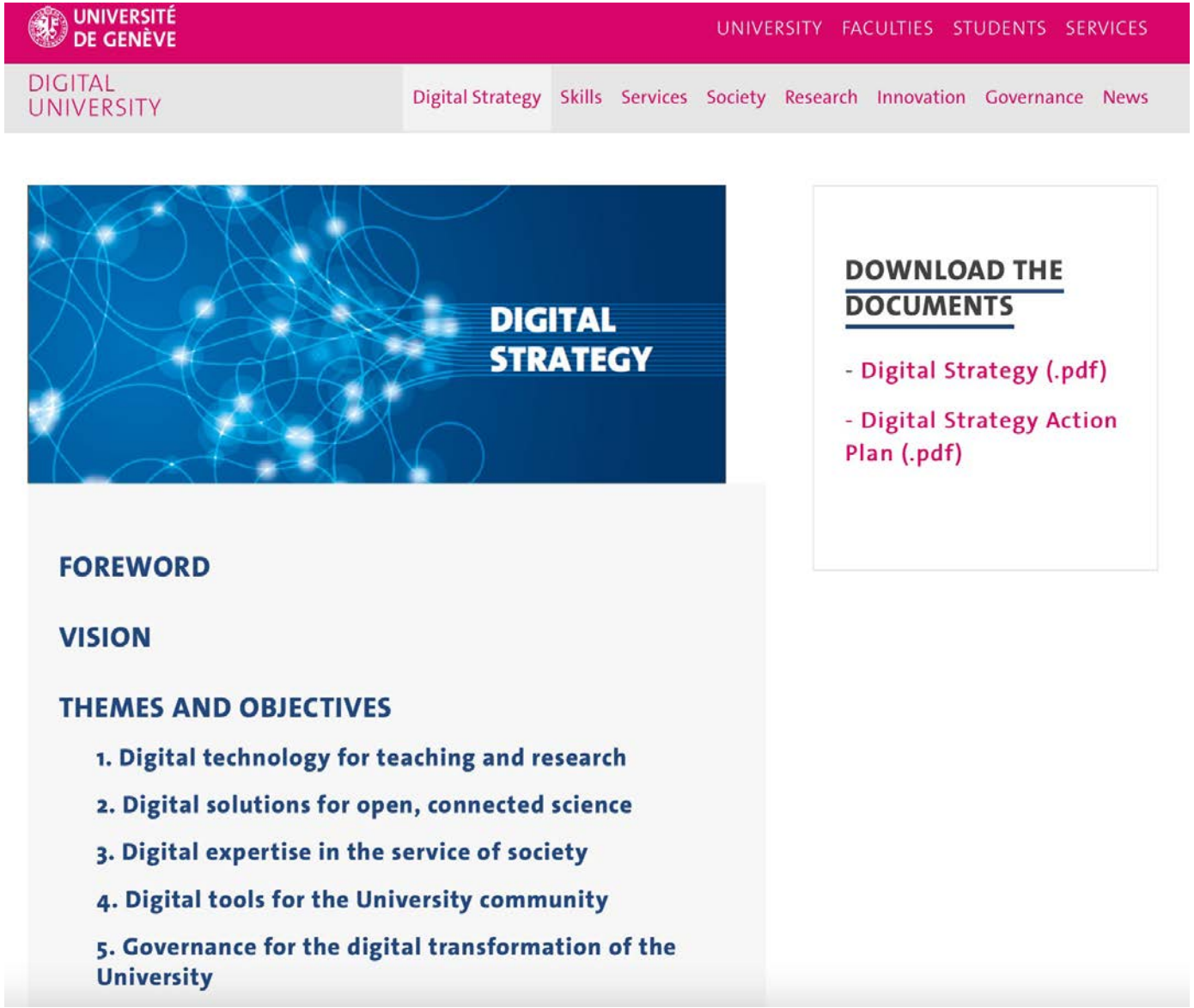
- **Upstream services**
  - *Discovery:* ISO19115-2 and ISO19139-2; OGC CSW, STAC (under evaluation)
  - *View & Download:* OGC WMS & WCS
  - *Processing:* Python API; OGC WPS (under test)
- **Downstream services**
  - *Discovery:* CSW; OpenSearch; OAI
  - *View:* WMS with EO extension, WMTS, TMS, WMS-C, ncWMS
  - *Download:* WCS with EO extension

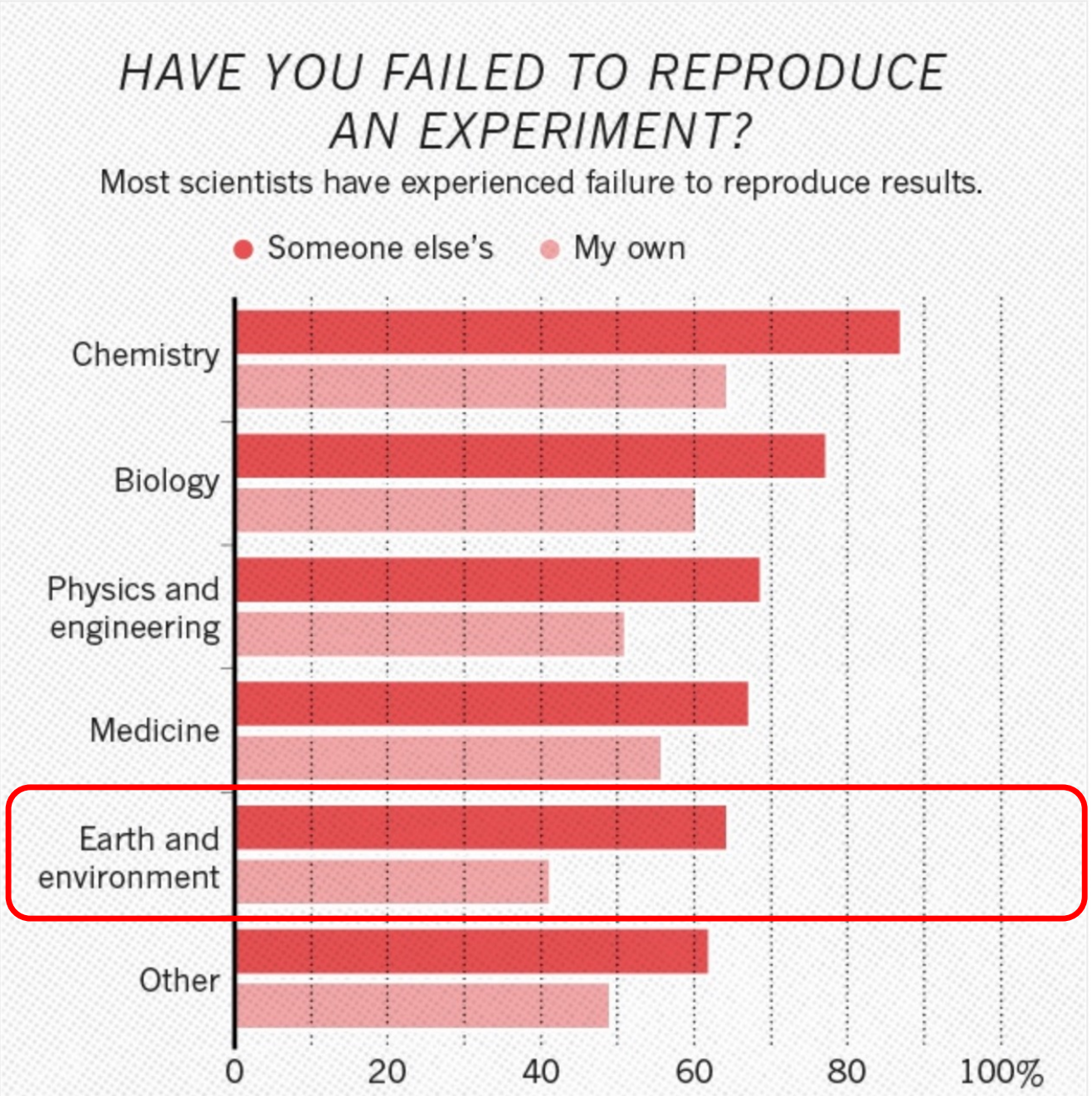
The SDC supports the « Digital Switzerland » strategy



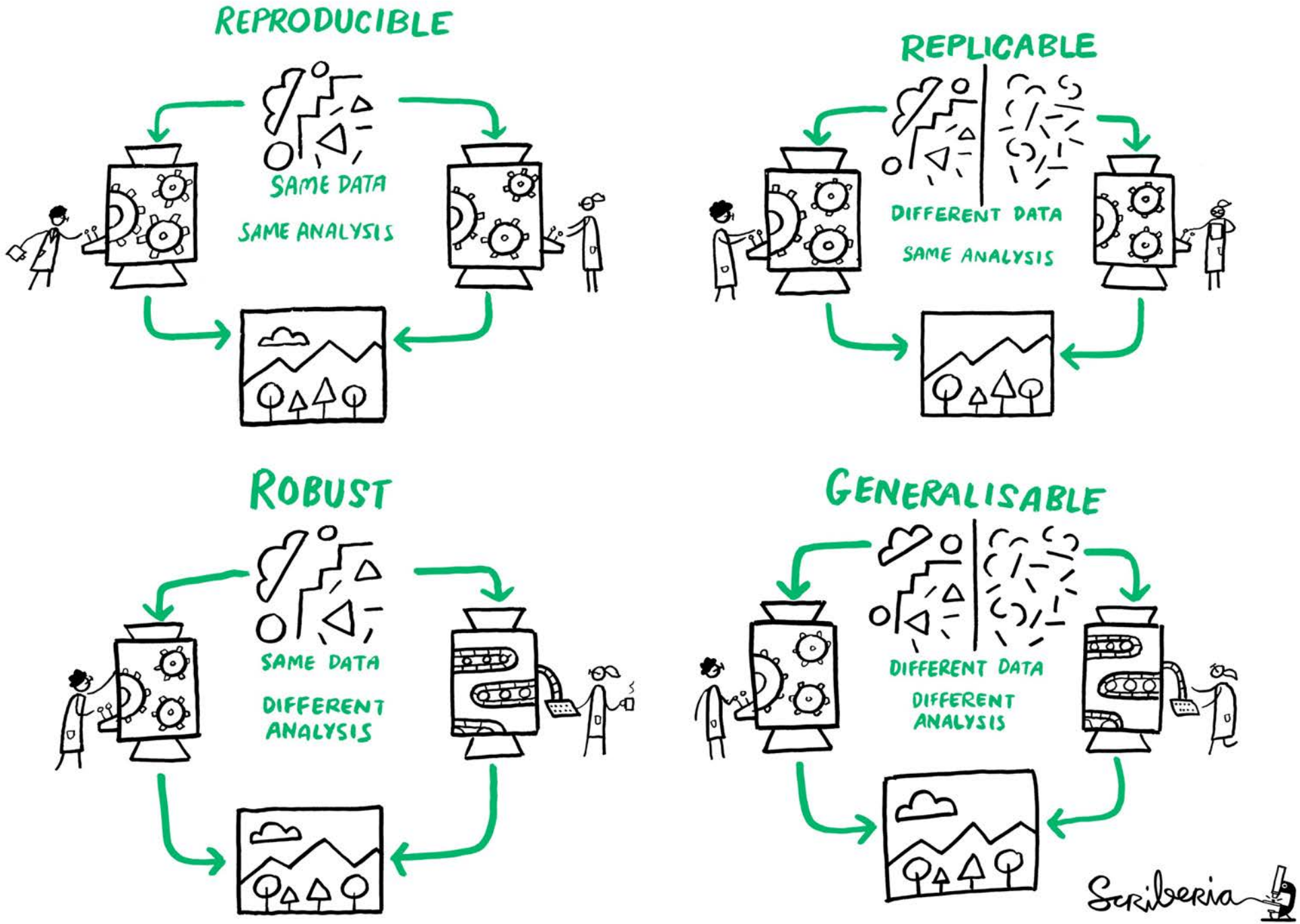
- Support innovation and growth in the digital economy
- Improve efficiency and effectiveness of government investments
- Improve management of natural resources
- Stimulate research
- Effective monitoring mechanism
- Generate information products
- Improve data access and use & enable new products/services that can transform everyday life

The SDC supports the UNIGE Digital strategy




HAVE YOU FAILED TO REPRODUCE AN EXPERIMENT?
Most scientists have experienced failure to reproduce results.
Someone else's
My own
Chemistry
Biology
Physics and engineering
Medicine
Earth and environment
Other
0
20
40
60
80
100%

Nature, 2016

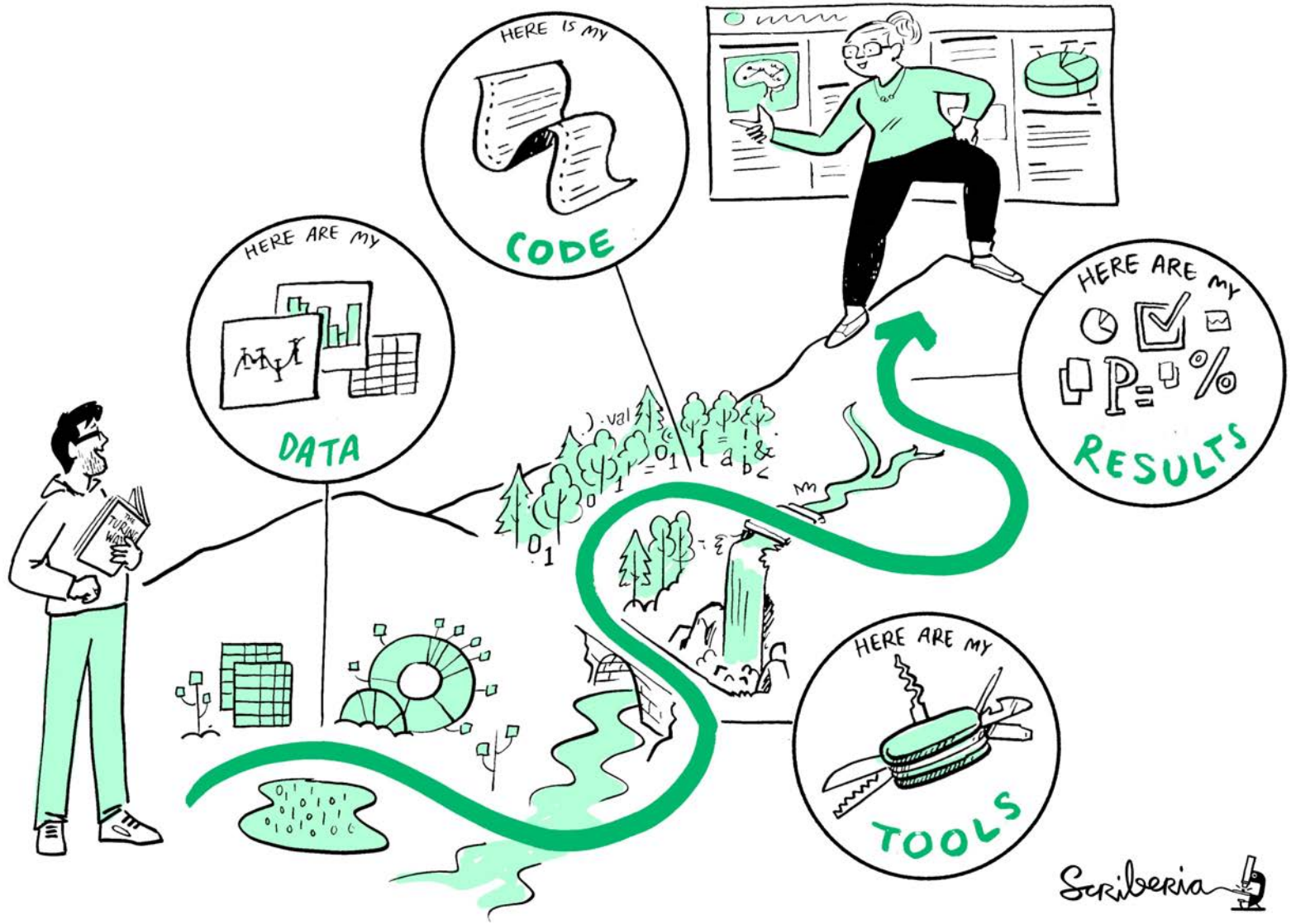

REPRODUCIBLE
SAME DATA
SAME ANALYSIS
REPLICABLE
DIFFERENT DATA
SAME ANALYSIS
ROBUST
SAME DATA
DIFFERENT ANALYSIS
GENERALISABLE
DIFFERENT DATA
DIFFERENT ANALYSIS
Scriberia

- GIVE PEOPLE THE TOOLS TO MAKE CLEAN DATA
- CLEAN DATA IS MORE REUSABLE AND INTEGRATABLE
- DATA FROM VARIOUS PIPELINES TO BE USED ACROSS DIFFERENT SYSTEMS

Scriberia

Achieving reproducible knowledge…

…exposing all parts of an application

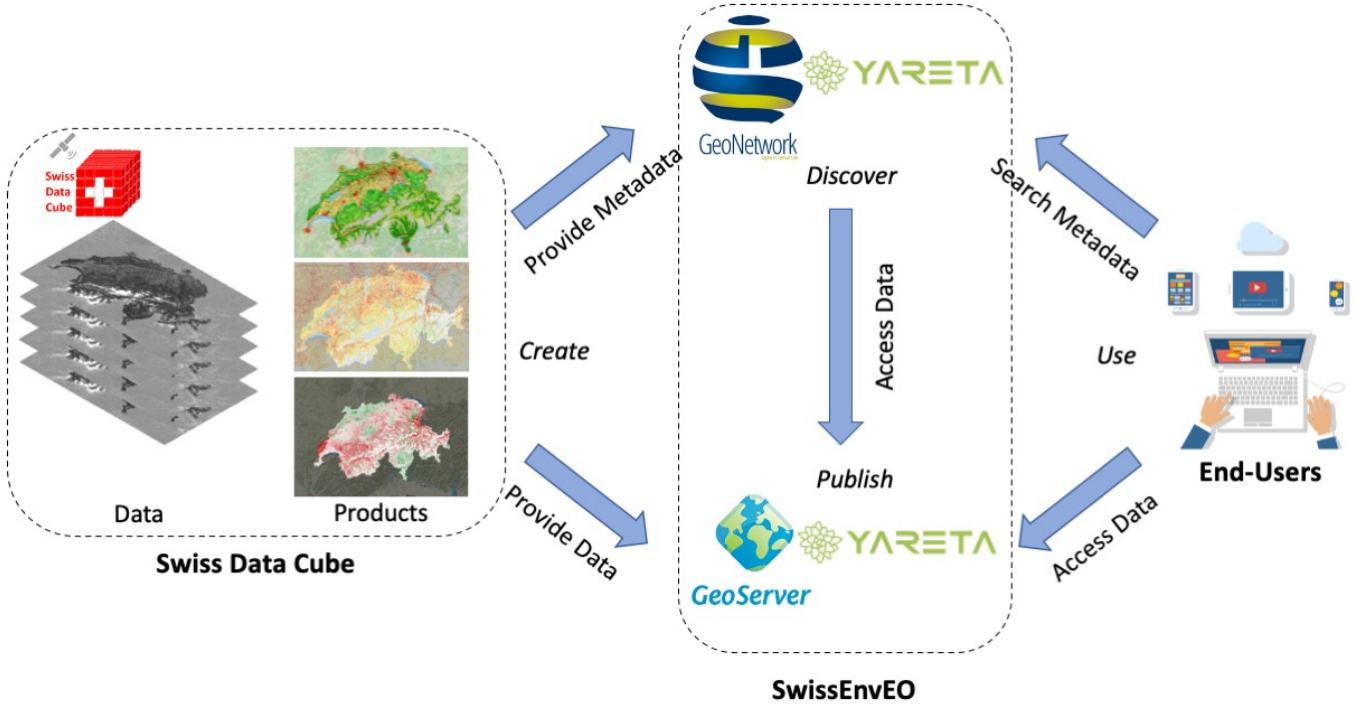


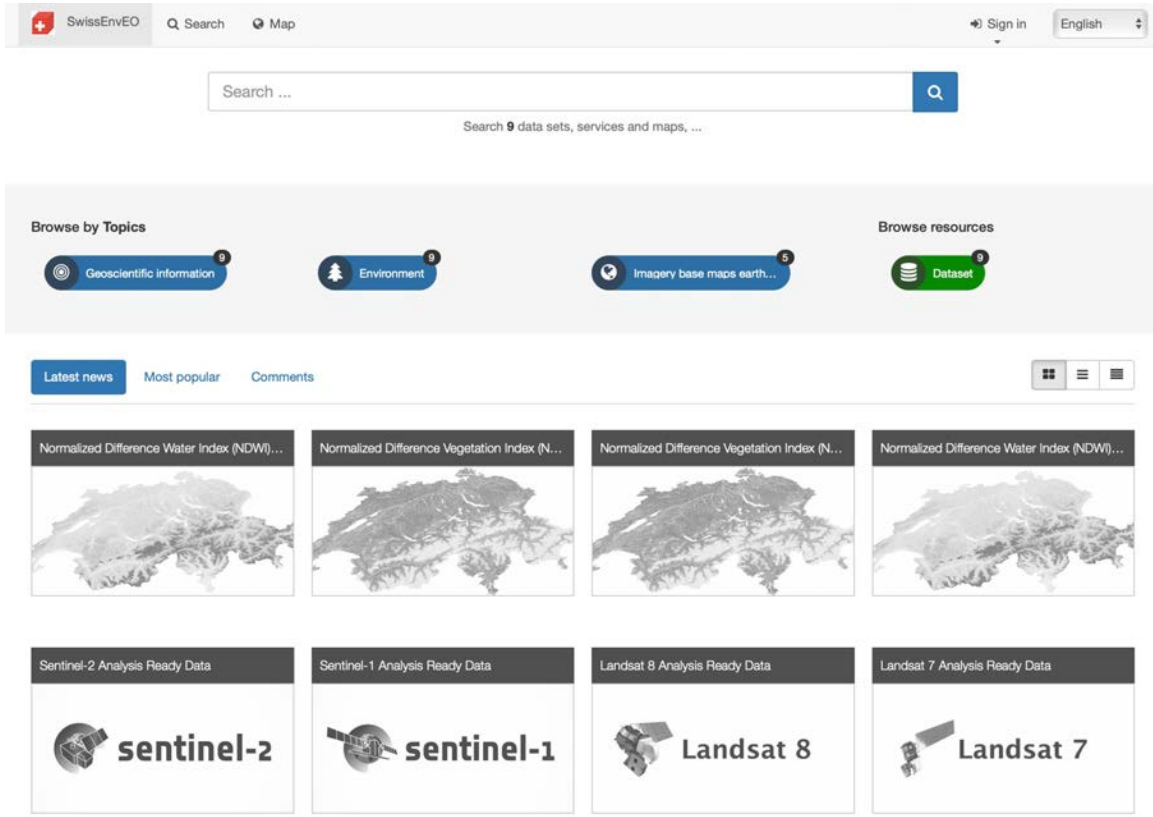
Good application:
Good in-situ, satellite data & models > produce new knowledge

Trust is the key (data):
For decision makers

SwissEnvEO: a FAIR national EO environmental database

http://geonetwork.swissdatacube.org

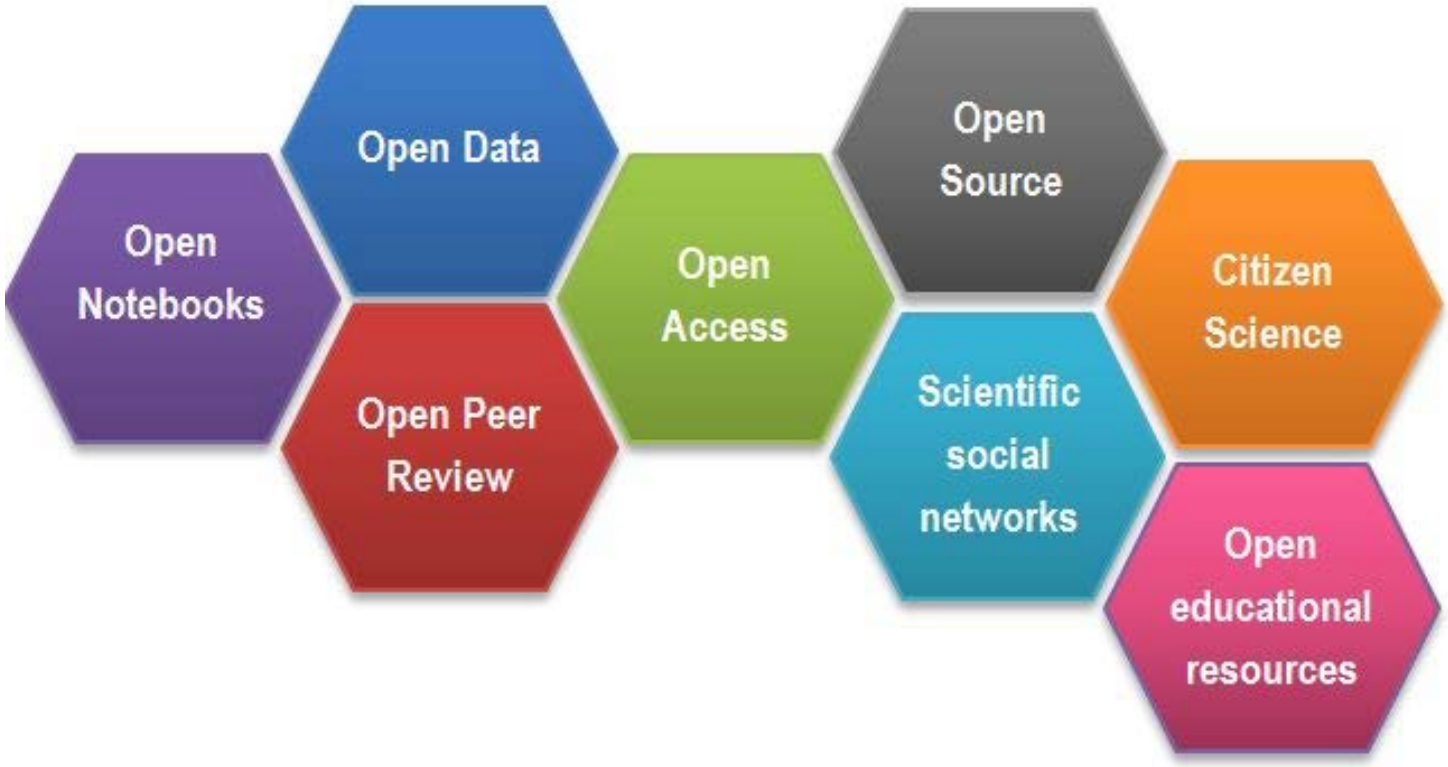


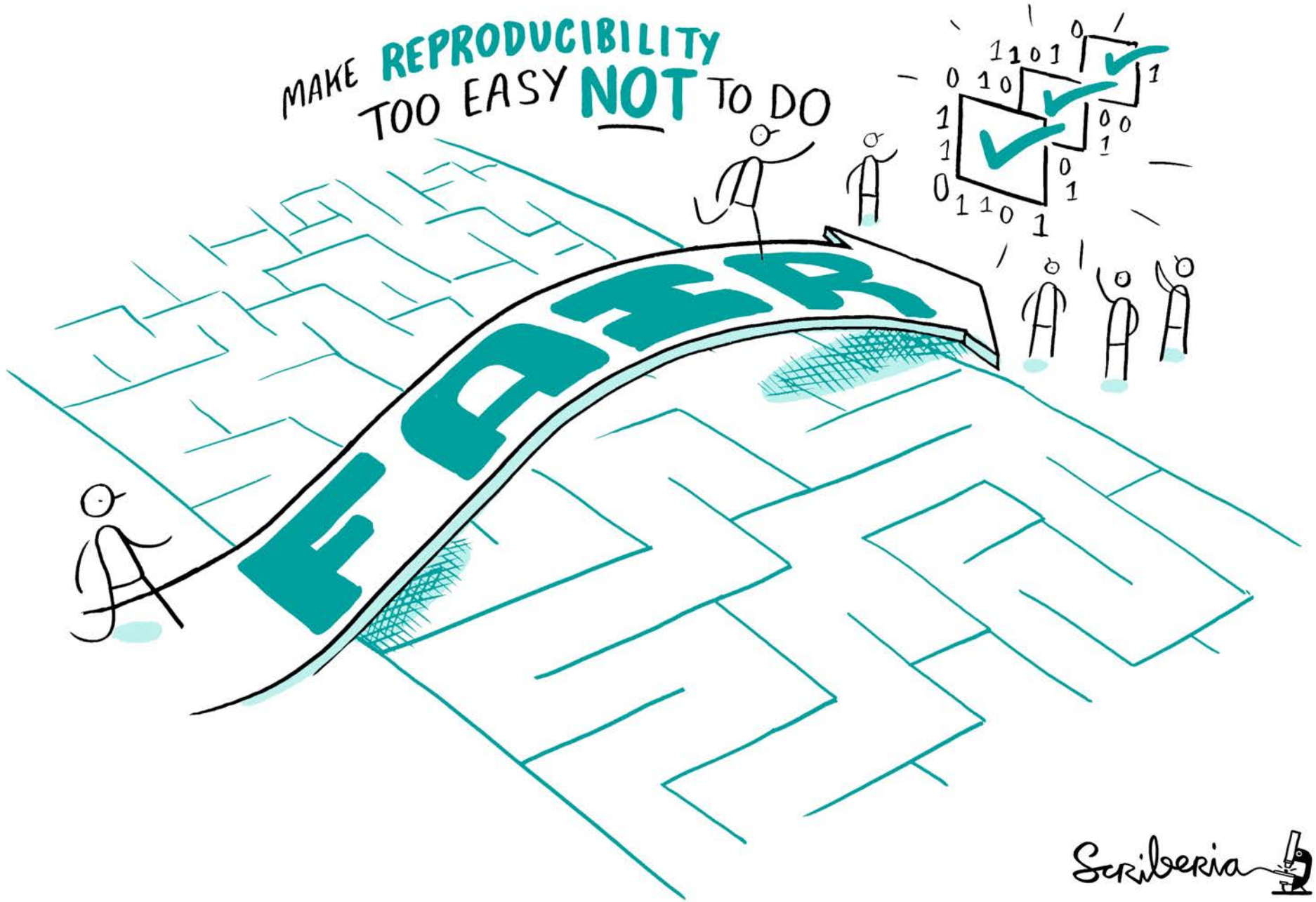


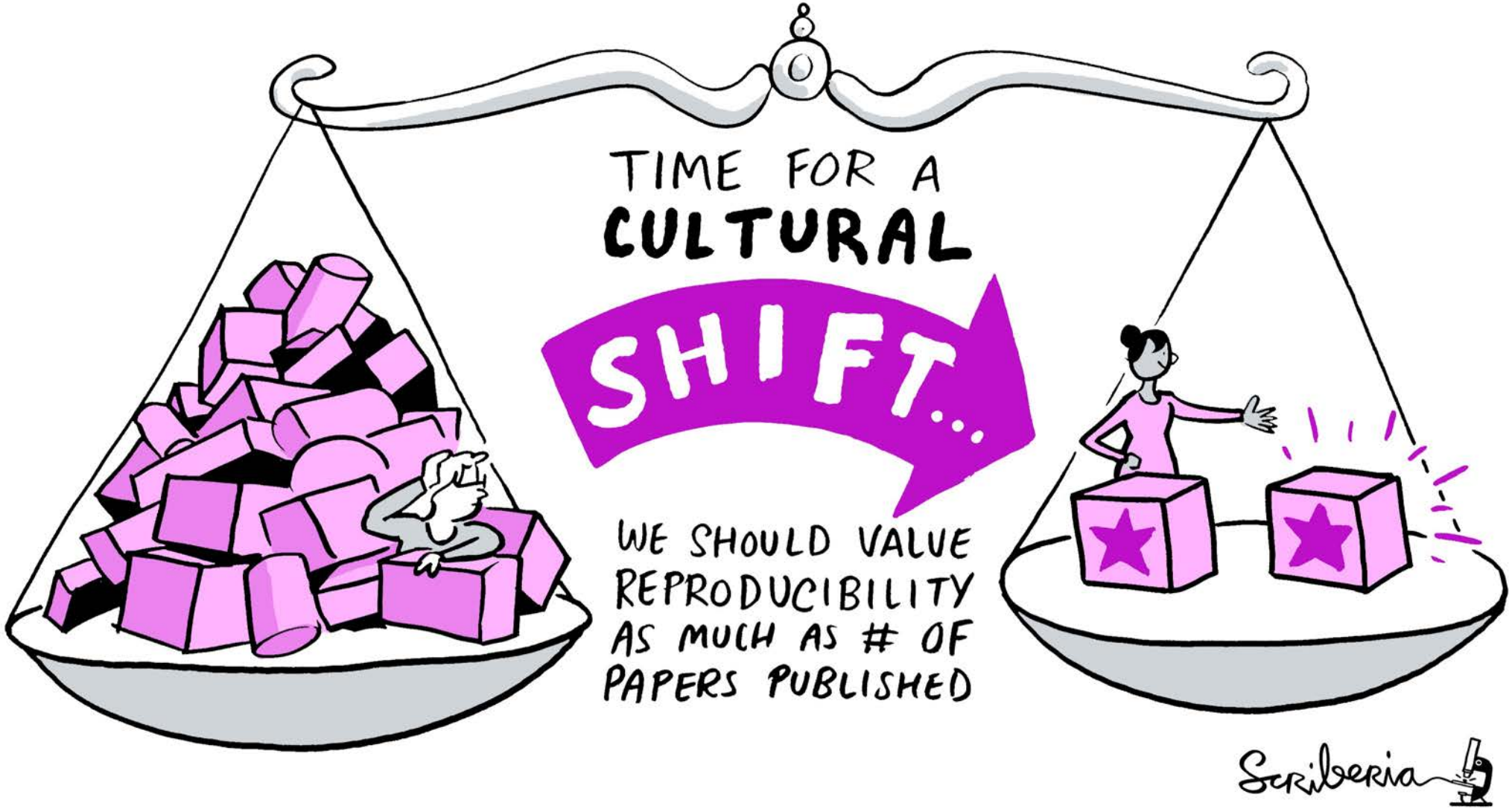
Giuliani G., Cazeaux H. Burgi P.-Y., Poussin C., Richard J.-P., Chatenoux B. (2021) SwissEnvEO: a FAIR national environmental data repository for Earth Observation Open Science, CODATA Data Science Journal 20(1):2 http://doi.org/10.5334/dsj-2021-022

SDC Open & Reproducible EO Science

- **Open Data:** Landsat 5,7, 8 ARD; Sentinel 1-2 ARD + All scientific/decision-ready products are freely, openly available & FAIR compliant
- **Open Notebooks:** All algorithms are documented and openly available
- **Open Access:** All publications
- **Open Source:** All applications
- **Open Educational Resources:** Bringing ODC into practice




MAKE REPRODUCIBILITY
TOO EASY NOT TO DO
FAIR
Scriberia


TIME FOR A
CULTURAL
SHIFT...
WE SHOULD VALUE REPRODUCIBILITY AS MUCH AS # OF PAPERS PUBLISHED
Scriberia

The Vision…
… being a National Infrastructure in the next 3-5 years

The Swiss Data Cube (SDC) will **deliver a unique capability to track changes across Switzerland** to process, interrogate, and present Earth observation satellite data in response to environmental issues of Switzerland.

This near real-time information can be **readily used as an evidence** base for the design, implementation, and evaluation of national policies.

Towards Digital Earth Switzerland…

…a comprehensive digital replicate/twin for analysis of nature's system and enabling reliable monitoring and prediction of the changing environment

2021 | Report

Geosciences Roadmap

for Research Infrastructures 2025–2028 by the Swiss Geosciences Community

This community roadmap presents an integrative approach including the most urgent infrastructure requests for the future development of geosciences in Switzerland. It recommends to strengthen the multidisciplinary nature of the geosciences by putting all activities under the roof of the Integrated Swiss Geosciences supported by four specific research infrastructure pillars.

Image: SCNAT

The roadmap represents the view of the Swiss scientific community in the field of geosciences and is a formal element of the process to elaborate the Swiss Roadmap for Research Infrastructures 2023. This bottom-up contribution to the identification and selection of important national and international research infrastructures has been coordinated by the Swiss Academy of Sciences (SCNAT) on a mandate by the State Secretariat for Education, Research and Innovation (SERI).

Edition / Volume: Swiss Academies Reports 16 (4)

Pages: 60

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Publisher
Platform Geosciences

scnat
swiss academy of sciences

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Confederaziun svizra

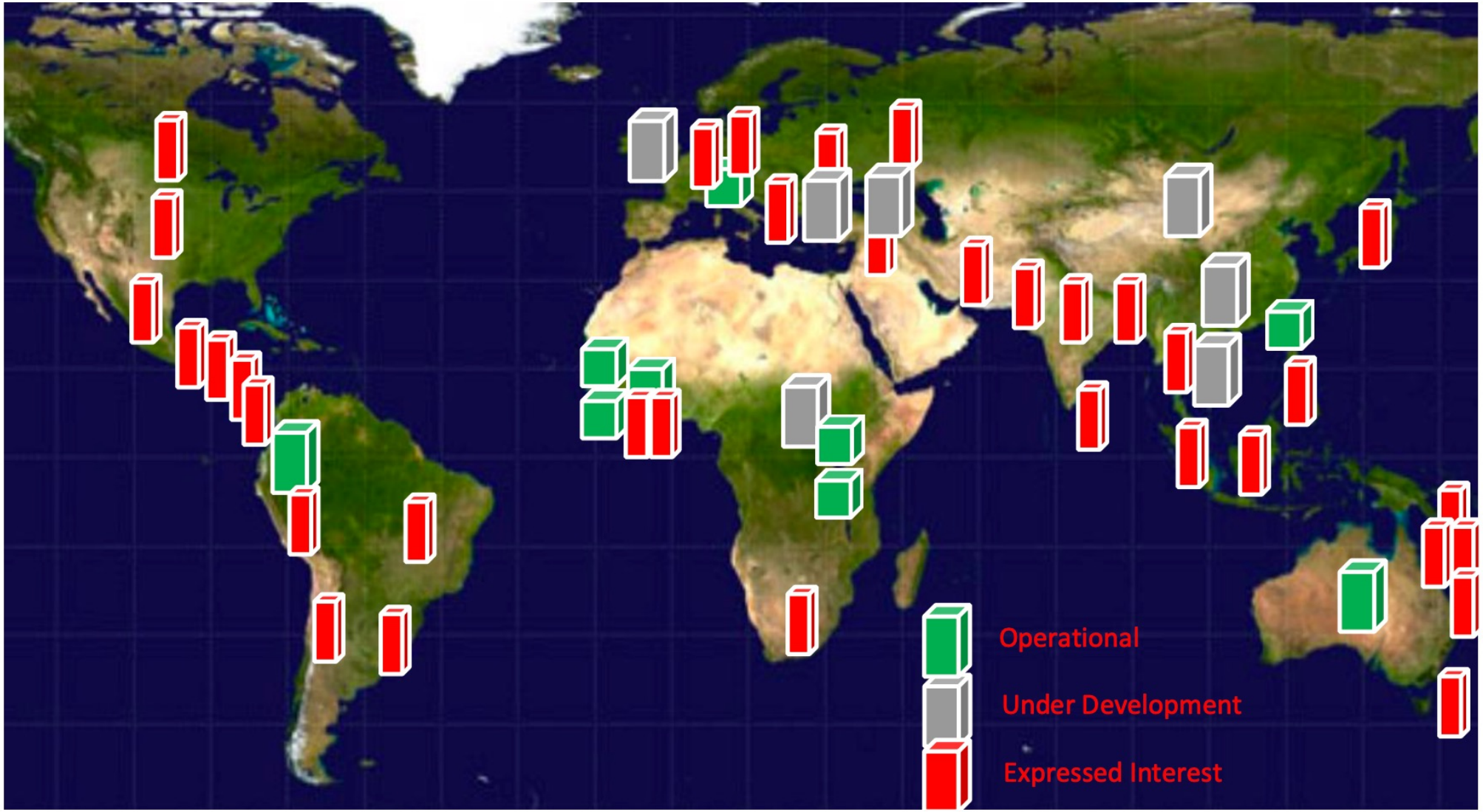
State Secretariat for Education, Research and Innovation SERI

swissuniversities

FNSNF
Swiss National Science Foundation

Global Impact

More than 50 countries are interested with 9 in operation and 7 coming soon!



EO Data Cubes have the potential…

… to enhance scientific accountability and credibility

Without trust and shared knowledge:

- Doing science can be difficult
- Taking sound decisions can be problematic
- And envisioning a sustainable development can be complicated

Amazon deforestation: Brazil's Bolsonaro dismisses data as 'lies'

20 July 2019 Share

azon has suffered losses at an accelerated rate since Mr Bolsonaro took office

olsonaro has accused his own country's national
t the scale of deforestation in the Amazon.

zil's reputation abroad by publishing data
on there.

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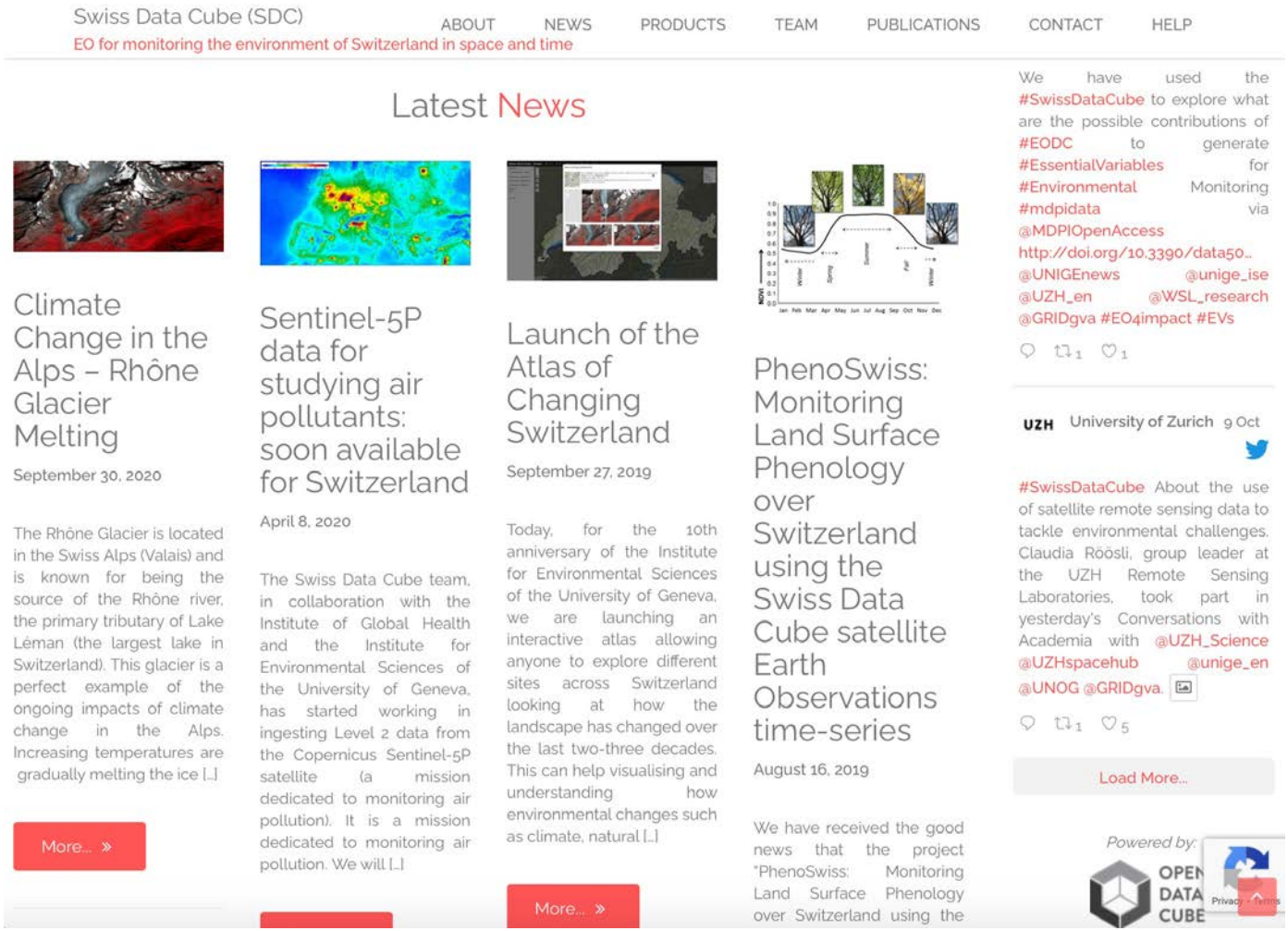

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