developmentSEED

Building open source interfaces for Earth observation

Gjore Milevski

Development Seed

IMPACT
Interagency Implementation and Advanced Concepts Team

developmentSEED

NASA’s Earth Mission

When we think of NASA, we often think of space exploration...

But a huge part of NASA's mission is looking inward at our own planet

- Precipitation monitoring
- Temperature tracking
- Wildfire detection
- Ocean analysis
- Glacier monitoring
- And more…

developmentSEED

The Challenge

Given the massive amount of data available, how do we make it usable?

Not just for scientists, but for:

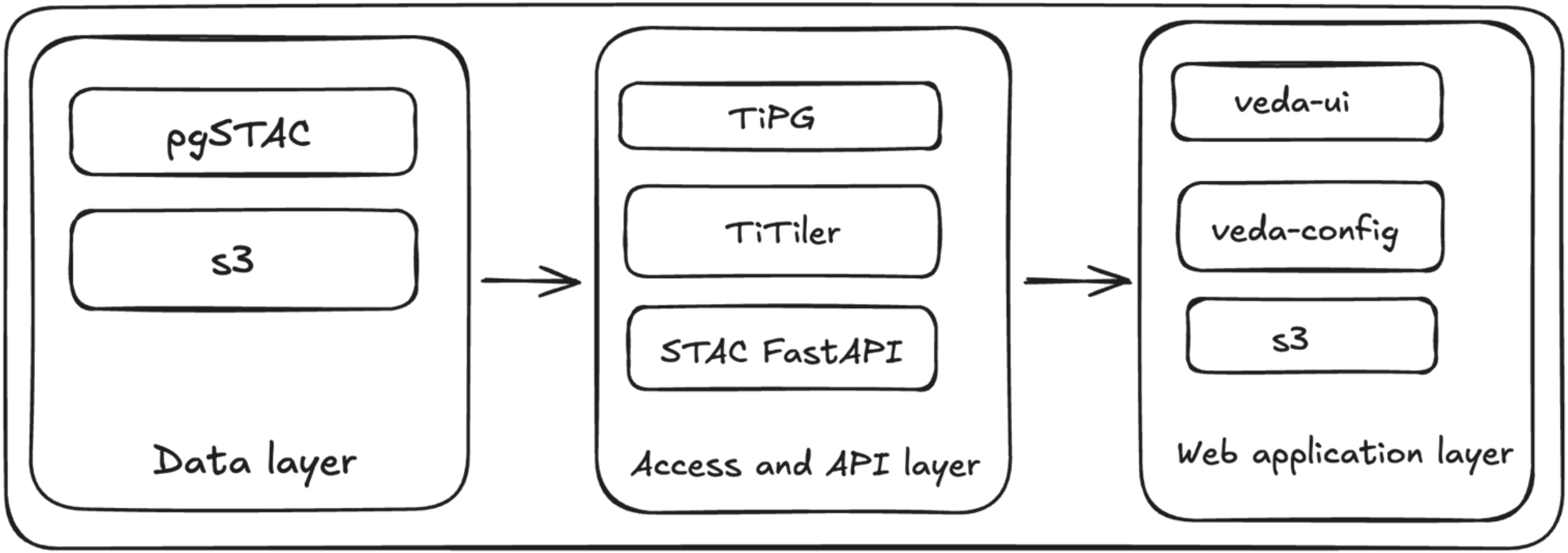
- General public
- Policymakers
- Decision makers
- Analysts

developmentSEED

VEDA (Visualization, Exploration and Data Analysis)

A set of open-source components and services for easily working with earth observation data, envisioned by NASA IMPACT.

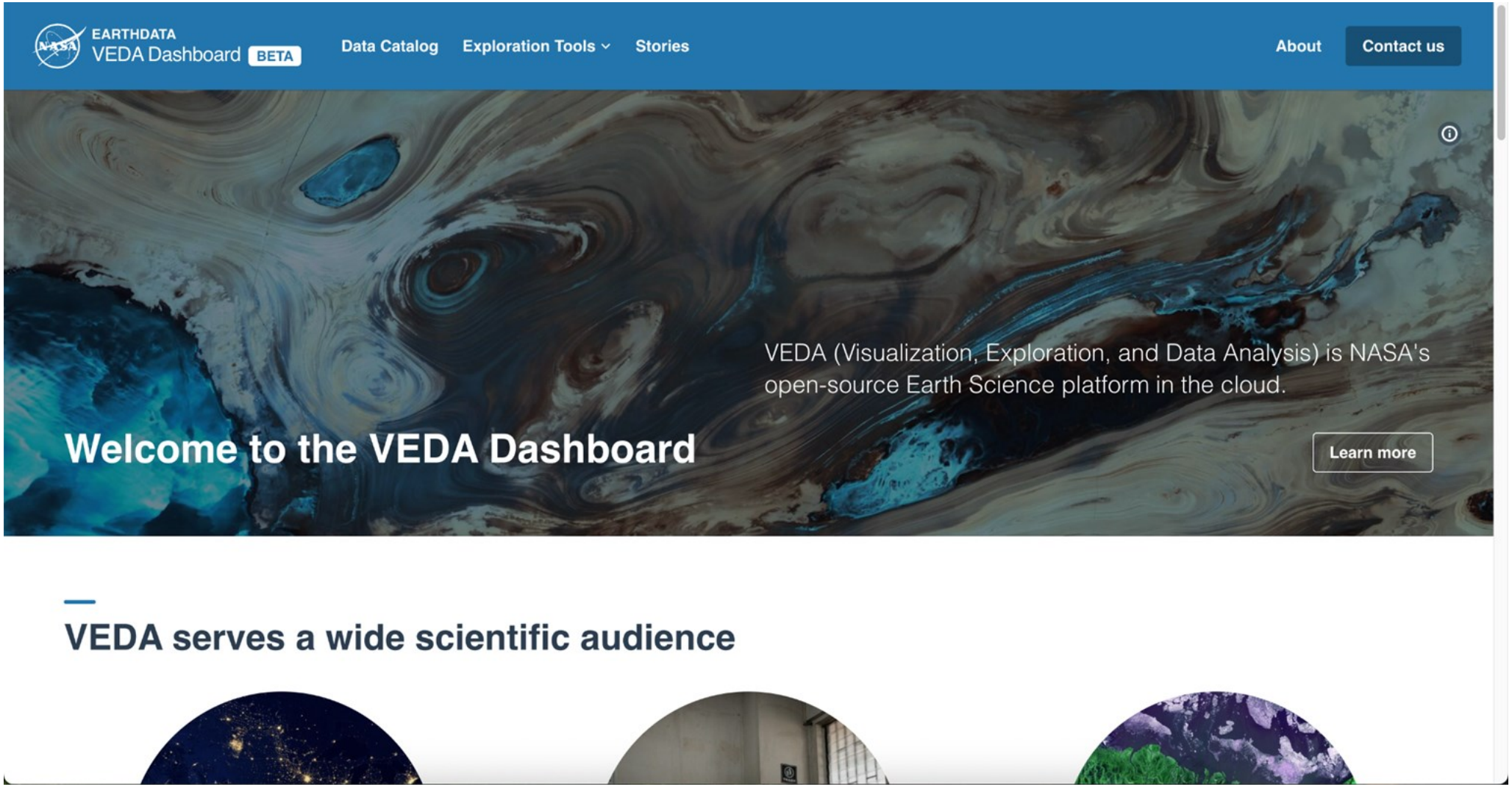
VEDA architecture overview



VEDA Dashboard:

https://www.earthdata.nasa.gov/dashboard/

https://www.earthdata.nasa.gov/dashboard/

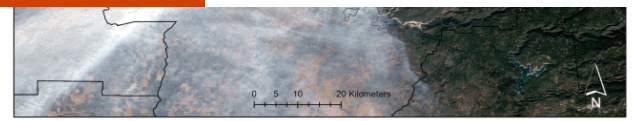


Datasets

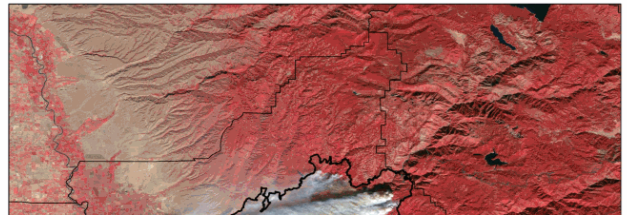
- Collection of STAC datasets
- Searchable and filterable
- Ready for analysis and visualization
- Foundation for stories and tools

burning over 153,000 acres and causing $16.65 billion (2018 USD) in damages. The fire was initiated by a faulty transmission line maintained by Pacific Gas and Electric (PG&E), and resulted in 85 fatalities and 17 injuries. The Camp Fire was the most expensive natural disaster in the world in 2018 and remains the seventh deadliest wildfire in U.S. history as of October 2023. Among several communities impacted by the fire, the city of Paradise was the most severely impacted, with 95% of the city burned and 18,804 of the city's buildings destroyed.

A dominant pathway through which wildfires affect local weather, climate, and hydrology is via alteration of land-atmosphere interactions. Removal of vegetation by wildfires causes surface albedo (proportion of sunlight reaching the surface to that which is reflected) to increase, which reduces the amount of energy deposited by sunlight at the surface. The emissivity of the surface (efficiency for emitting/absorbing infrared radiation) can decrease following a wildfire, leading to a reduction in loss of energy from the surface in the form of infrared radiation. The net radiative energy deposited at the surface is transported as heat and moisture (through evaporation and transpiration) into the atmosphere and the rest as heat flow into deeper layers of the surface. The presence of vegetation at the surface influences how the radiative energy deposited at the surface is partitioned into

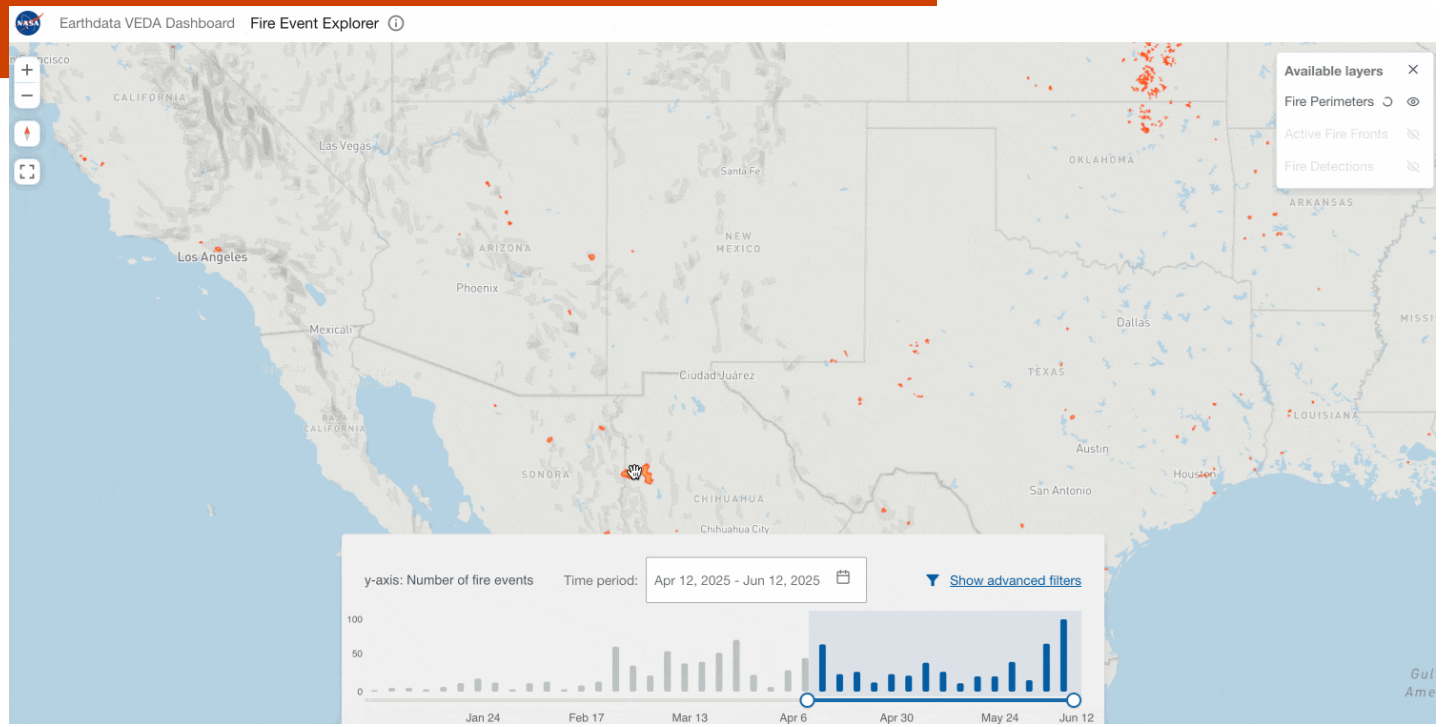


Harmonized Landsat and Sentinel-2 (HLS) true-color imagery from November 11, 2018, of the Camp Fire impacting the Paradise, CA, area. The thick black outline is the extent of the burn scar on November 25, 2018, once the fire was 100% contained.



Stories

- Predefined narratives built from datasets
- Combine multiple data sources
- Tell compelling stories using various widgets



Tools

When static stories aren't enough…

Specialized tools for specific use cases:

- Interactive data exploration
- Tailored for specific user groups
- Deep data interaction beyond static visualizations

https://www.earthdata.nasa.gov/dashboard/tools/fire-event-explorer

developmentSEED

Resources:

- VEDA Docs: https://docs.openveda.cloud/
- VEDA Dashboard: https://www.earthdata.nasa.gov/dashboard/
- GHG Dashboard: https://earth.gov/ghgcenter

Conclusion?

Having more Earth observation data is great, but we need to build good tools and interfaces that help users think with the data, not just look at static pages

Merci vielmal

GITHUB
dzole0311

LINKEDIN
gjore-milevski

Username

OST
Ostschweizer
Fachhochschule

Raumplanung unter Strom

Was Smartmeter-Daten über die Raumstruktur verraten

Dirk Engelke and André Biskup
Geobeer, 12.06.2025

IRAP Institute for Spatial Development
Department of Architecture, Civil Engeneering, Landscape Design, Spatial Planning

Foto: St. Gallisch-Appenzellische Kraftwerke (SAK)

Mixed use and activities in the urban environment

- New concepts of monitoring land use are necessary – and on the long run even steering
- Smart meter data provide detailed insights into electricity consumption at household level, indicating human activity
- Switzerland aims for 80% coverage of smart meters by 2027

ENR 2019: Paris Mixed-Use Development

Do smart meter indicate space utilization and spatial structures?

Smart Data representing People‘s Behavior

- Open data from local energy supplier: CKW Centralschweizerische Kraftwerke
- Smart meta data aggregated by postal code for specific time range of Lucerne Region
- 65MB comma separated csv file. So, analysis reduced to two days in calendar week 45 in 2024

Anonymized Meter ID
Unique identifier for each smart meter (text format)

Area Code
Postal code of the service area (categorical data)

Timestamp
UTC-based timestamp marking the beginning of a 15-minute measurement interval (ISO-8601 format)

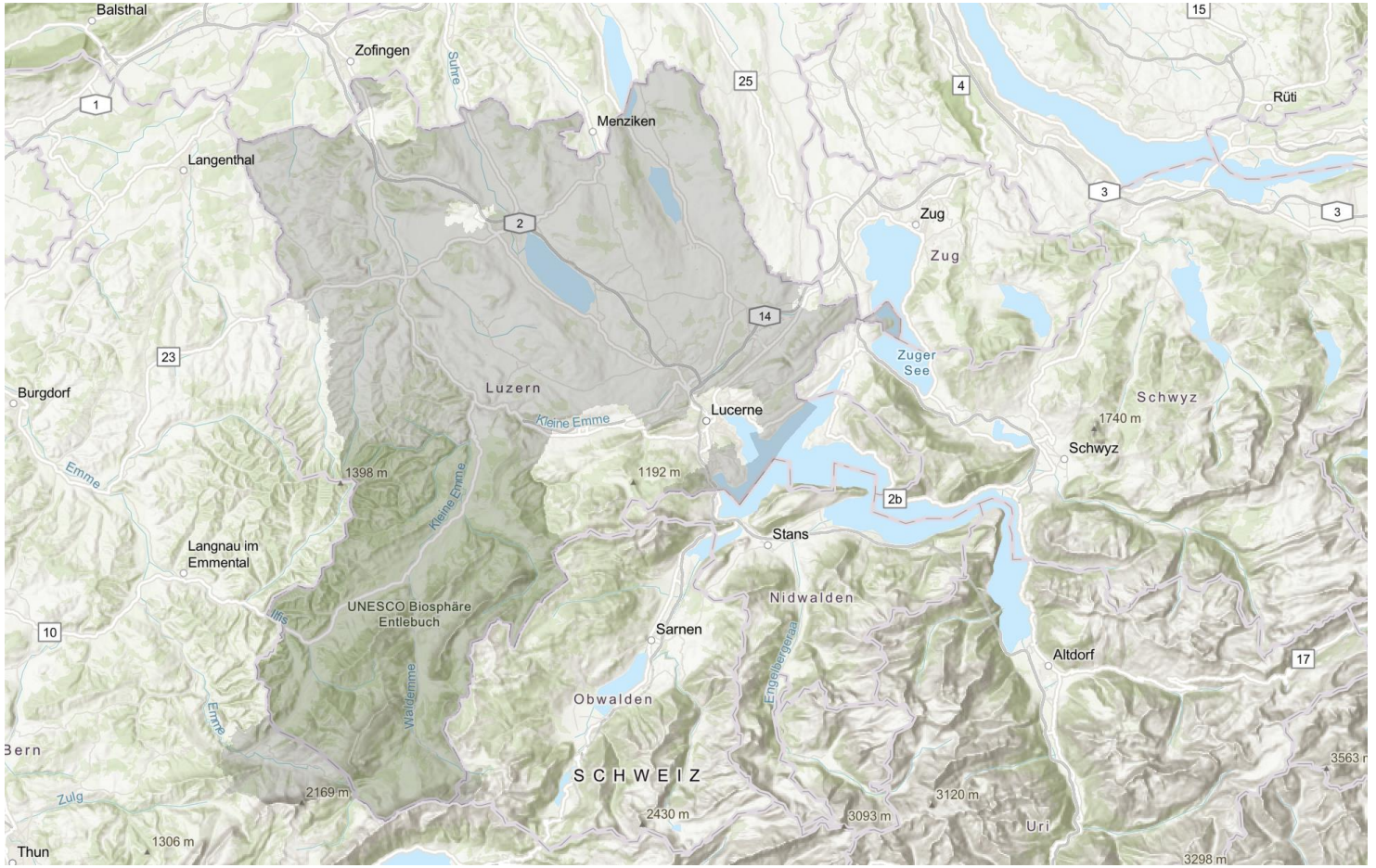
Number of Meters
Count of smart meters aggregated per area (integer format)

Energy Consumption (kWh)
Total measured electricity consumption in kilowatt-hours (continuous variable)

OST

Case study region

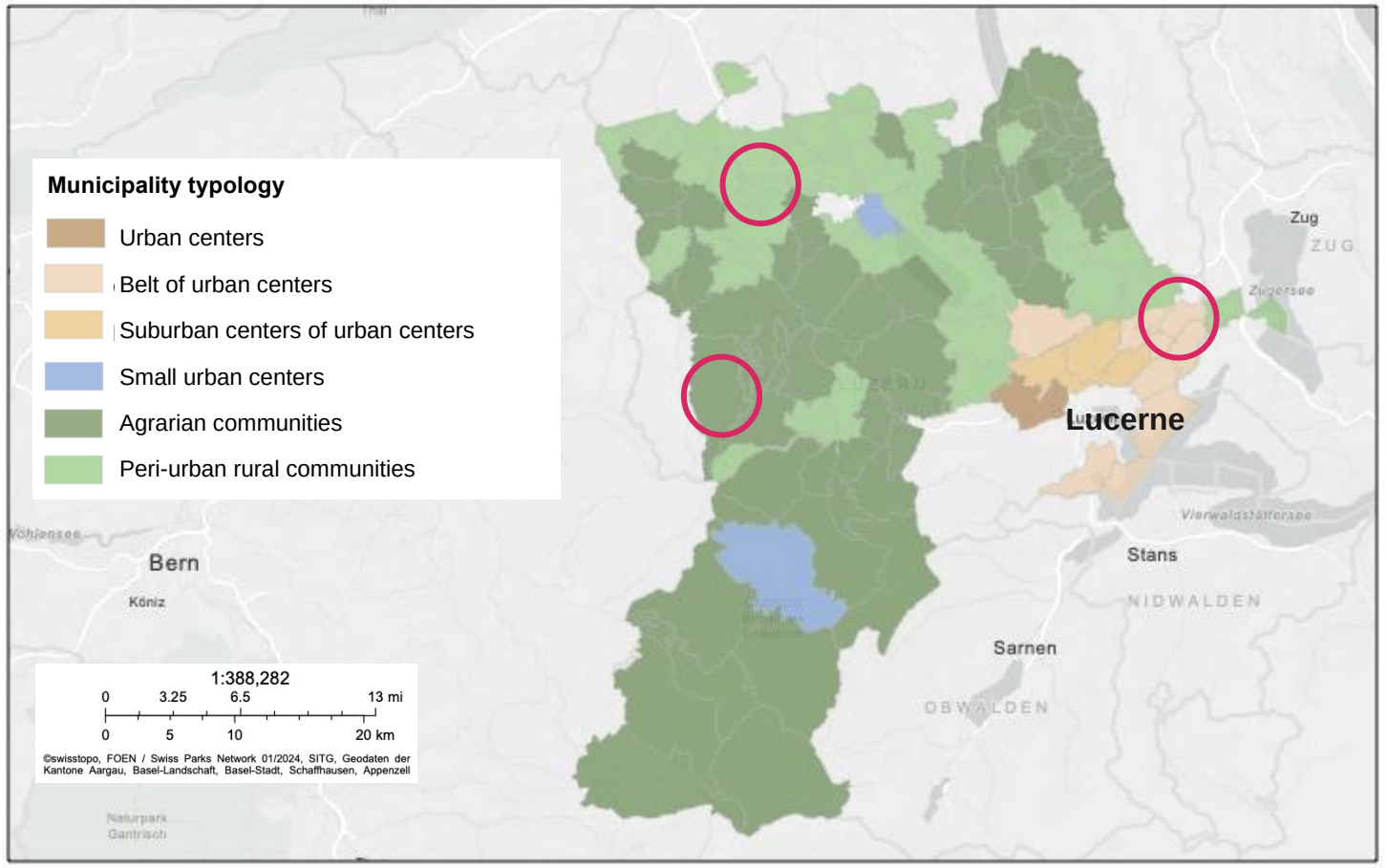
- Lucern located at Lake Lucerne (Vierwaldstättersee)
- Region Lucerne has 250‘000 inhabitants
- Case study region covers part of agglomeration program and parts UNESCO biosphere Entlebuch



Case study region‘s typology

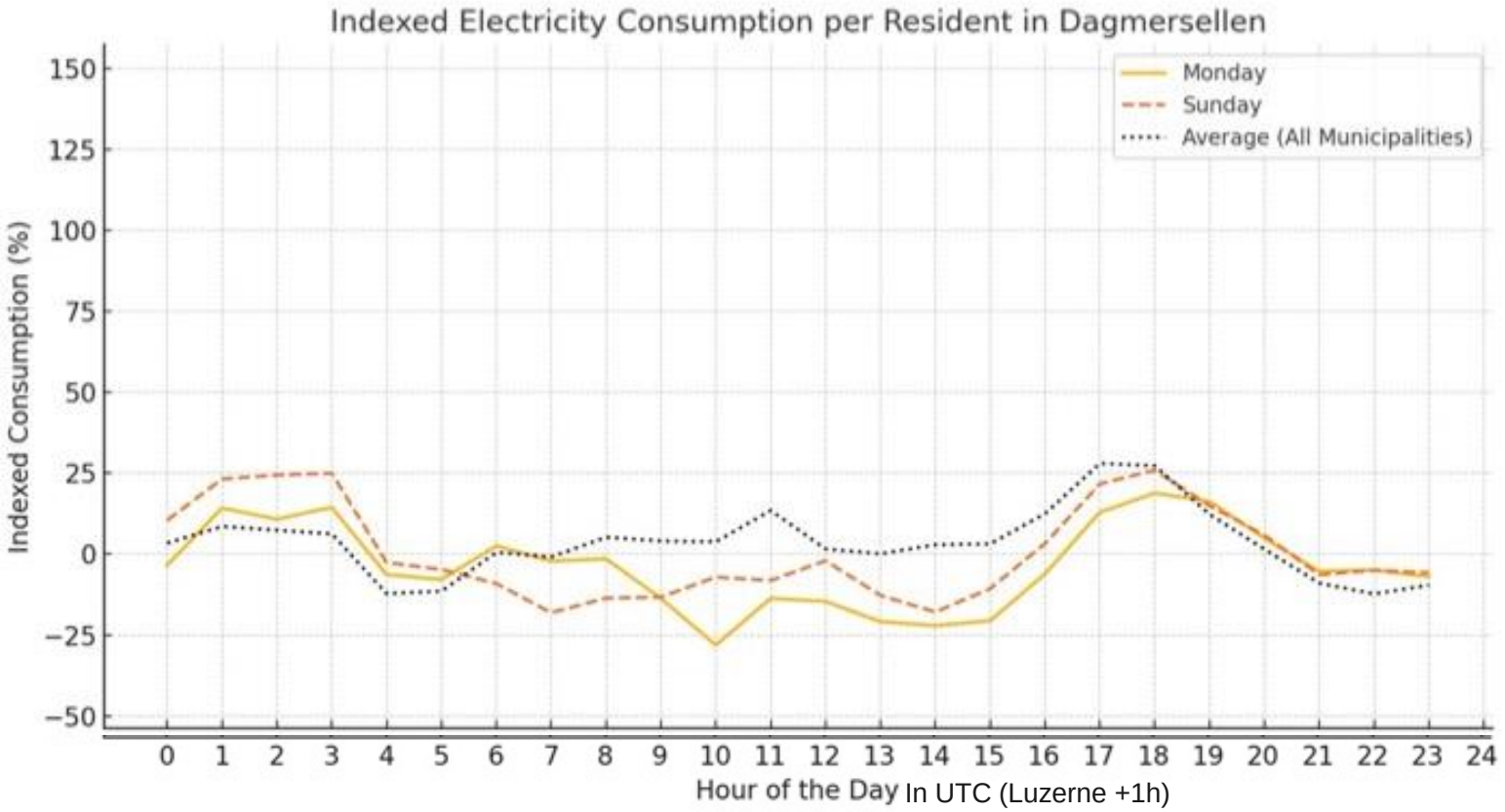
Three exemplary communities

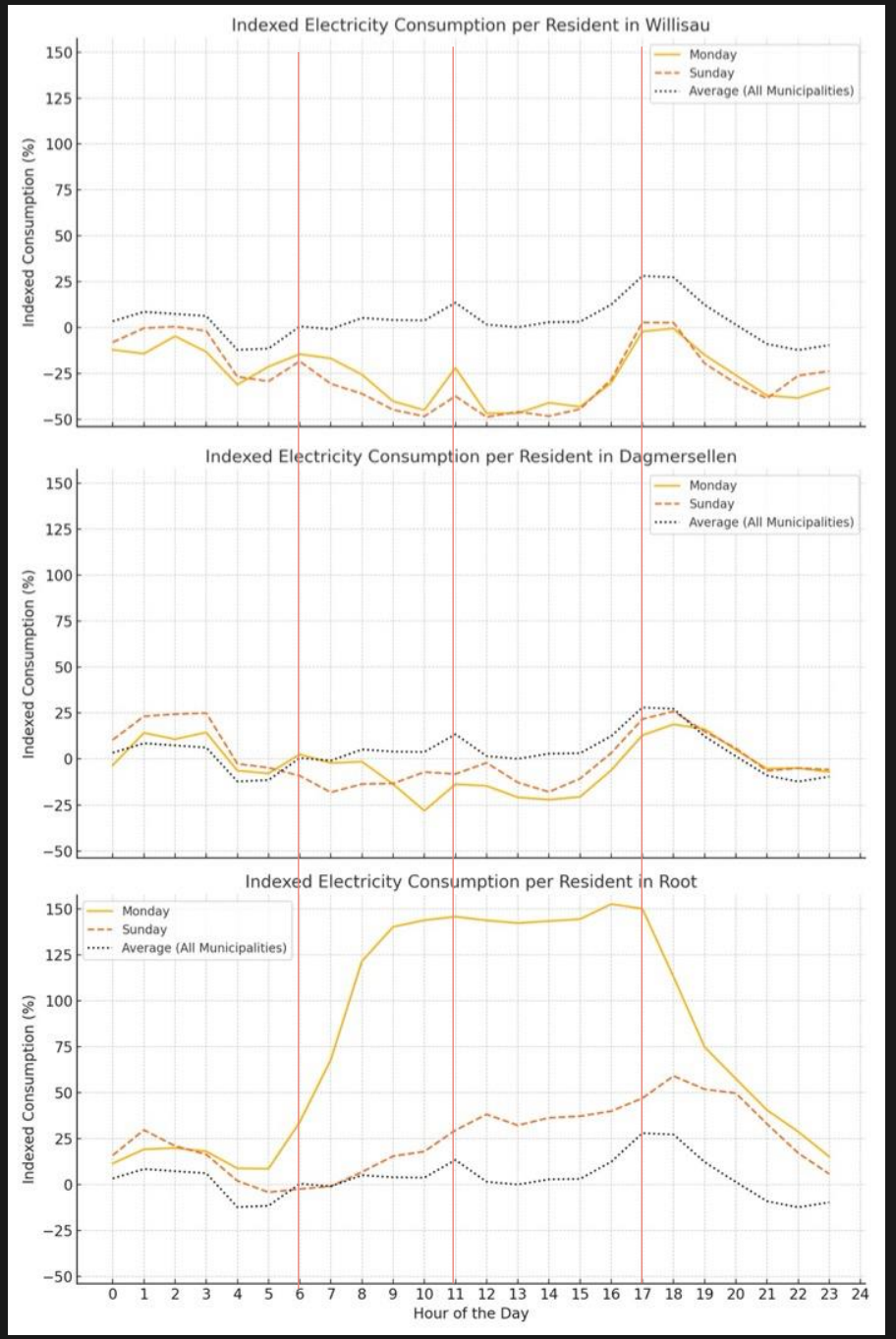
- **Dagmersellen**
  Peri-urban rural community
- **Root**
  belt of urban centers
- **Willisau**
  Agrarian community



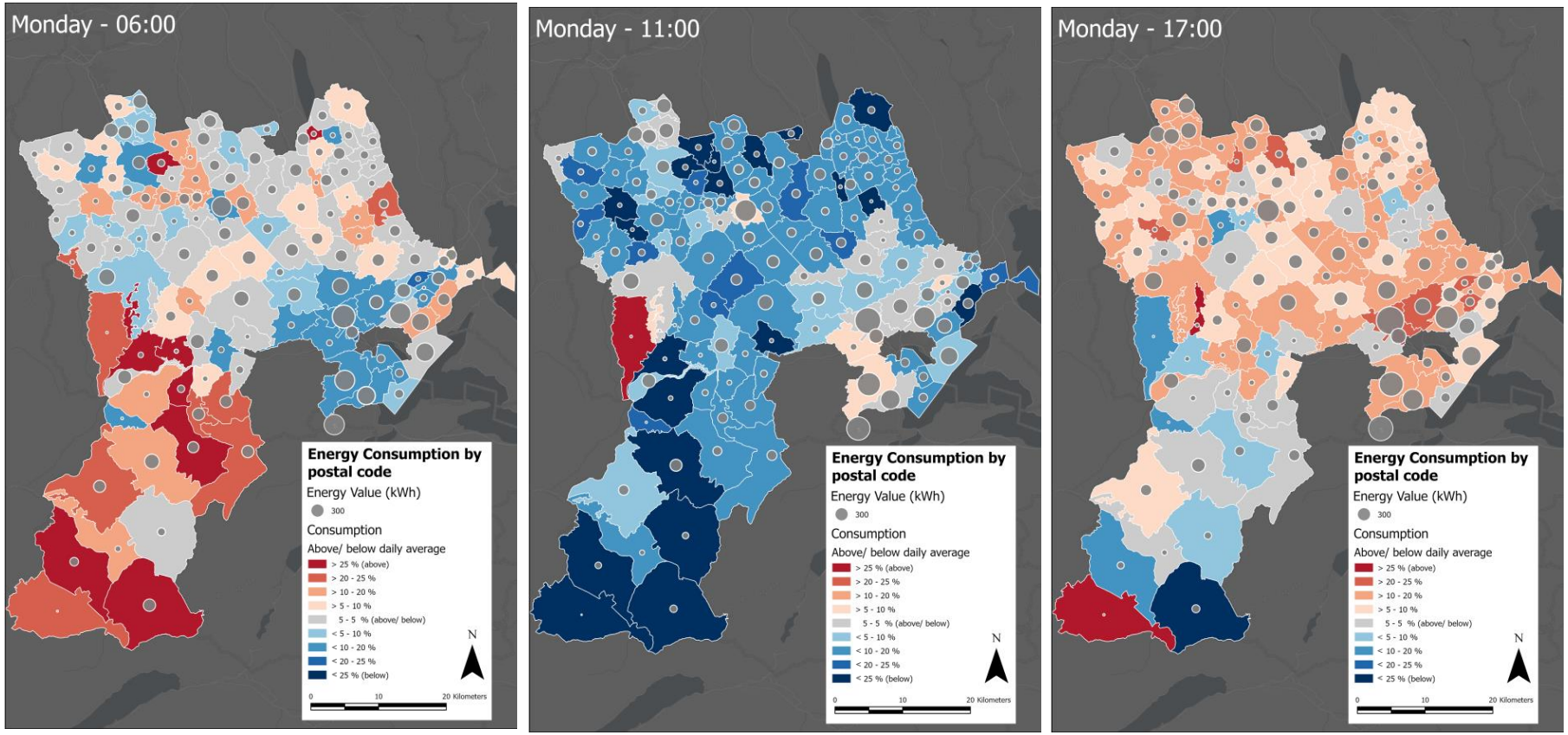
Indexed electricity consumption per resident

- Municipality of Dagmersellen, peri-urban rural community with 5‘800 inhabitants
- Electricity consumption compared to the average activities on Monday/workday
  - morning: average
  - noon: no noon peak
  - afternoon: catching up
- High electricity consumption in the night caused by charging activities




Indexed Electricity Consumption per Resident in Willisau
Indexed Electricity Consumption per Resident in Dagmersellen
Indexed Electricity Consumption per Resident in Root
Monday
Sunday
Average (All Municipalities)
Indexed Consumption (%)
150
125
100
75
50
25
0
−25
−50
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour of the Day

Spatio-temporal distribution on weekdays (Monday)



What to talk about over a beer

Do smart meter indicate space utilization and spatial structures?

- YES! Smart meter data indicate space utilization, differentiated in spatial units and behavior in time
- YES! Smart meter data map spatial structures like commuting, center, agriculture, aso.
- Smart data such as smart meter data reveals real-world spatial and temporal use, addressing limitations of traditional zoning. In particular mixed use.
- Combine smart meter data with other Smart City sources (mobility, socio-economic, environmental sensors) for robust planning insights

Spatial planning must evolve dynamic data-driven principles – grounded in real-world behavior, adopt continuous empirical feedback and adjust instruments