

# CYPRUS ENVIRONMENT SYMPOSIUM



## Data-driven Approach for Urban Sustainability and Climate Adaptation

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11.12.2024

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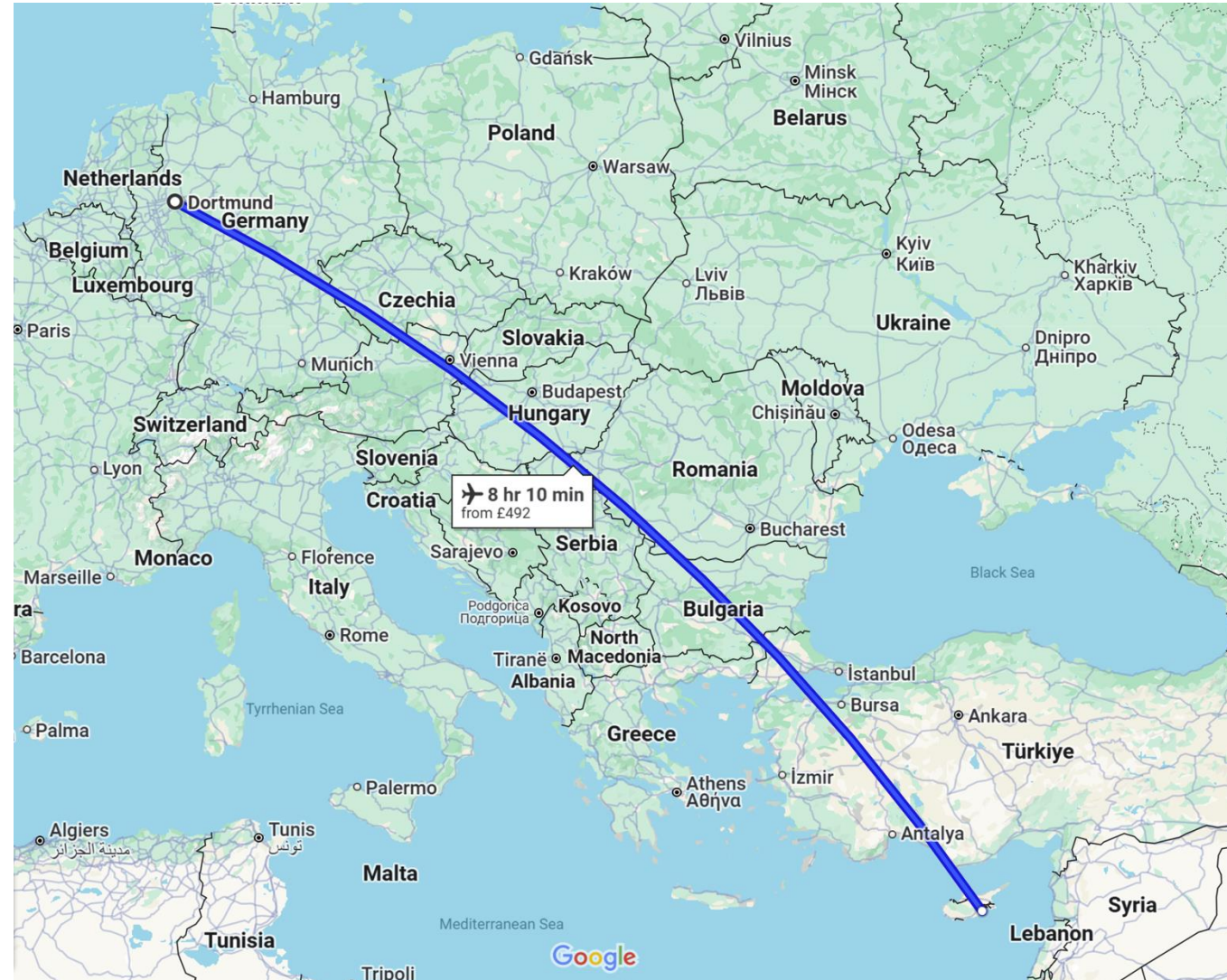
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## Content

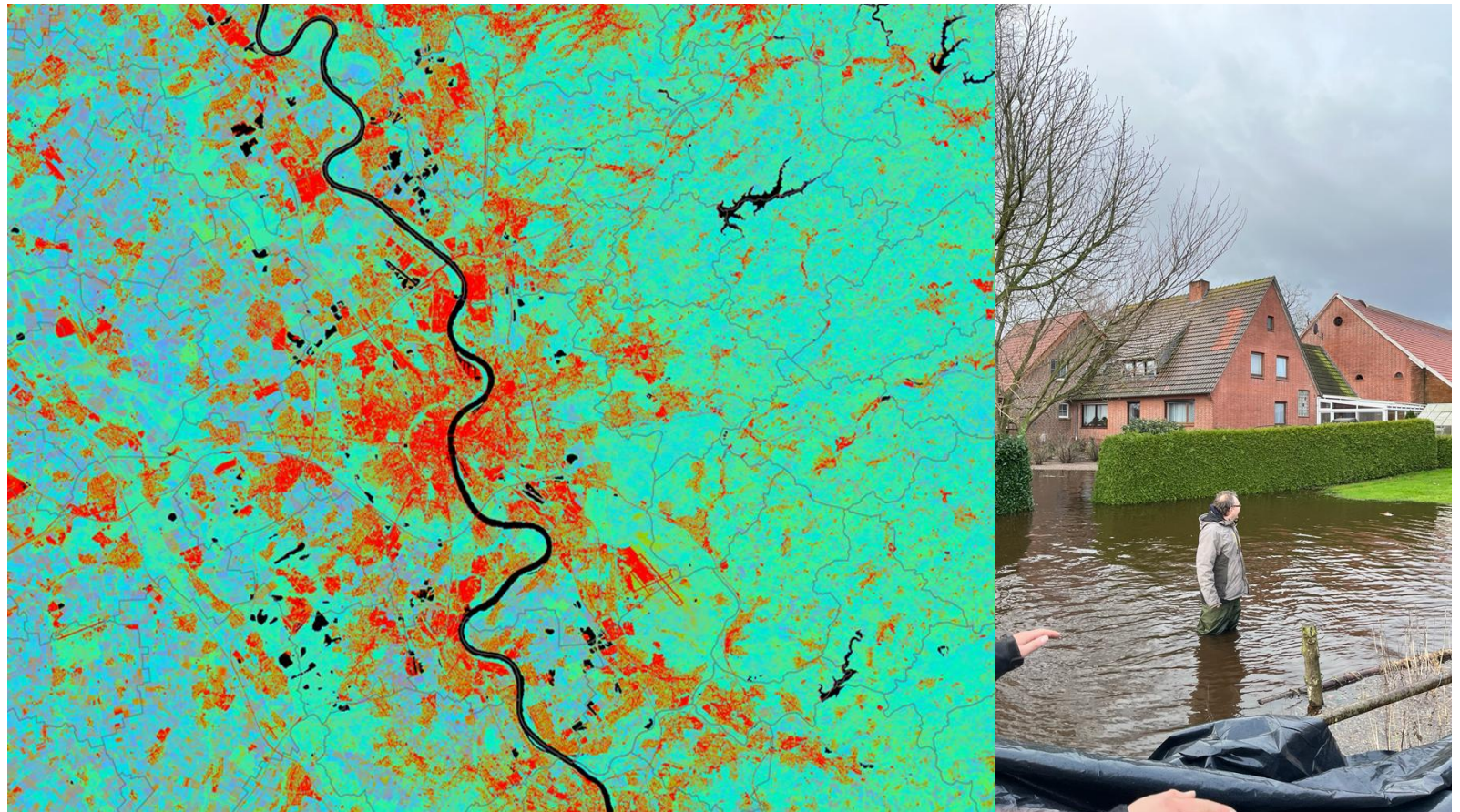
- Background
- Data-driven approach
- Three study cases
  - Urban sprawl
  - Urban heat
  - Building energy efficiency
- Summary





## Urban Sustainability and Climate Adaptation

- Living space, home
- Urban sprawl
- Flood
- Urban heat island





## Policies



 EUROPEAN COMMISSION

Brussels, 24.2.2021  
COM(2021) 82 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change

{SEC(2021) 89 final} - {SWD(2021) 25 final} - {SWD(2021) 26 final}

German Sustainable Development Strategy

Update 2021



The Federal Government





Handlungsprogramm  
Klima-Luft 2030  
Maßnahmensteckbriefe  
Juli 2021

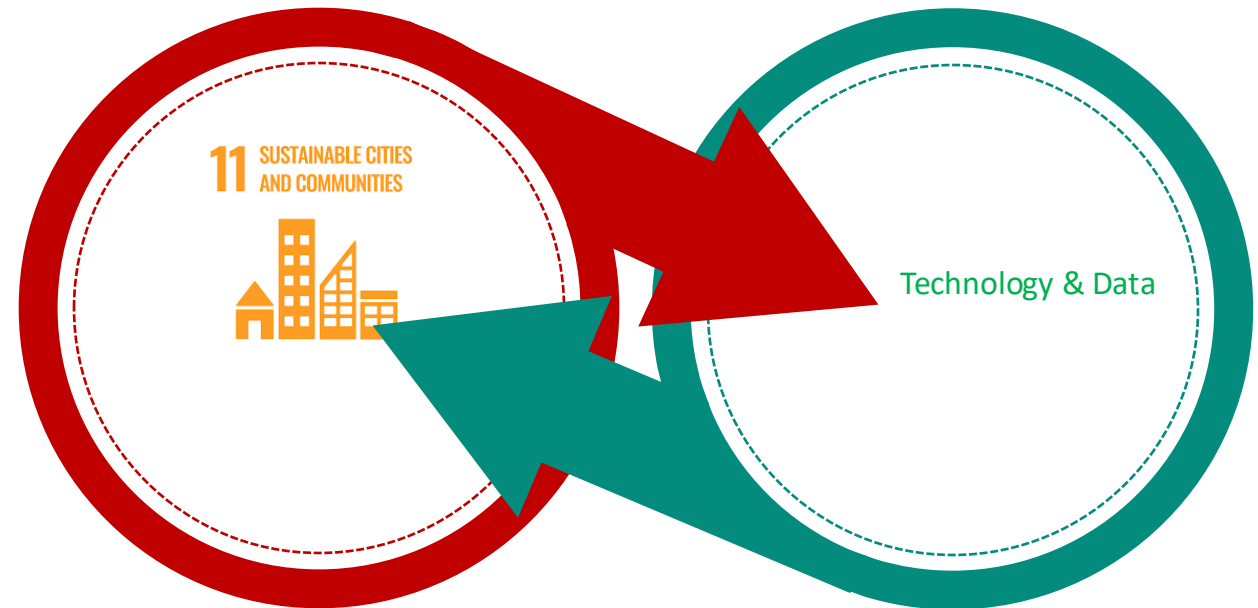






## Data-driven approach

- Rea-time and long-term monitoring
- Track progress toward goal achievement
- Communication tool for multi-stakeholder collaboration
- Ensure informed, efficient and evidence-based decision making





# Using Earth Observation data to support sustainable land use



## Sustainable Land Use Policy

- At EU level
  - Roadmap to a Resource Efficient Europe (2011)
  - EU soil strategy for 2023 (2021)

No net land take by 2050 !

- At country level
  - German sustainability strategy (2016)
  - German climate action programme 2030 (2019)

The development of additional land for settlement and transport purposes is to be limited to below 30 hectares per day by 2030

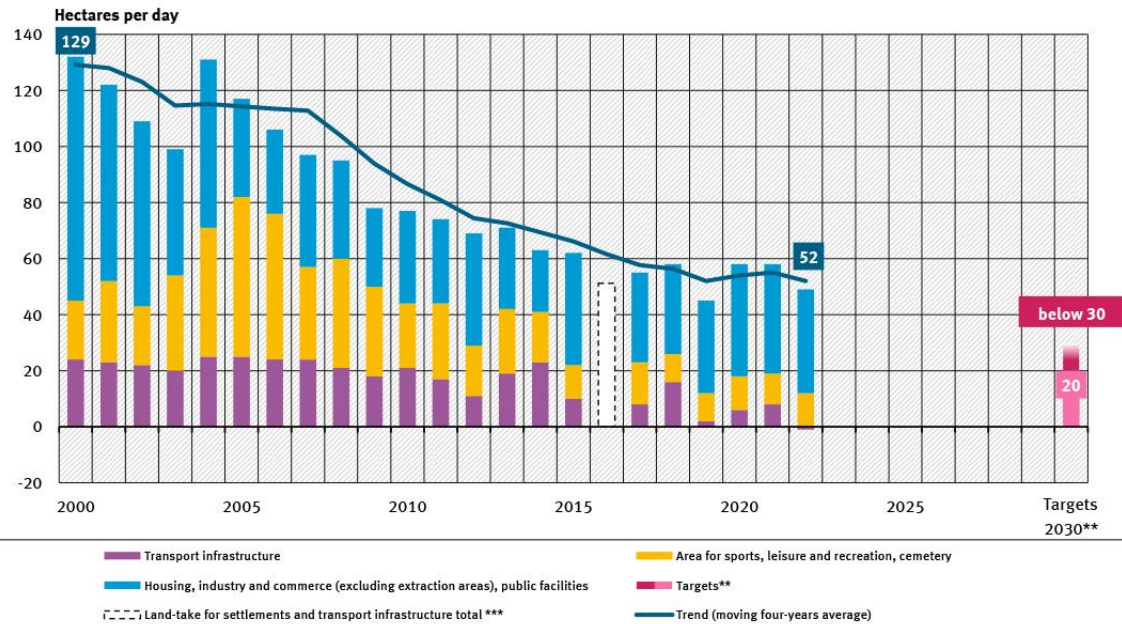




## German 30-hectare goal

## Earth observation data

Land-take for settlements and transport infrastructure\*



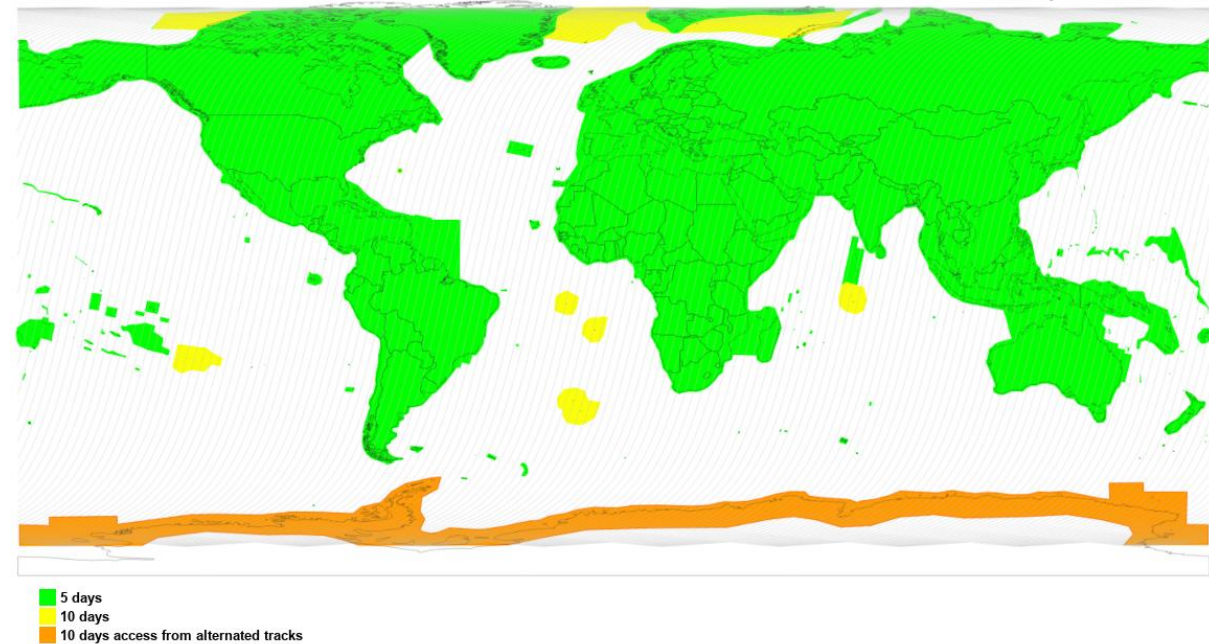
\* Land use survey is based on the evaluation of the states' (Länder) land registry. Data on increase in land-take for settlement and transport infrastructure have been distorted from 2004 due to a change-over in land registries (recoding land use types in course of digitalisation).  
 \*\* Targets 2030: '30 minus X' hectares per day: German Sustainable Development Strategy, revised 2016; 20 hectares per day: Integrated Environmental Programme 2030  
 \*\*\* Since 2016, the distinction between "buildings and adjacent open areas" and "operating area excluding extraction areas" has become obsolete due to the switch from the automated property book (ALB) to the automated real estate cadastre information system (ALKIS). This means that time comparison is currently impaired and the calculation of changes is made more difficult. The settlement and traffic area determined after the changes contain largely the same types of use as before. Further information is available at [www.bmu.de/WS2220#c10929](http://www.bmu.de/WS2220#c10929).

Source: Values from Federal Statistical Office 2024, Increase in settlement and transport area (moving 4-year average) and increase of sub-types in settlement and transport area (yearly basis) (in German only)

Sentinel-2 Constellation Observation Scenario: Revisit Frequency



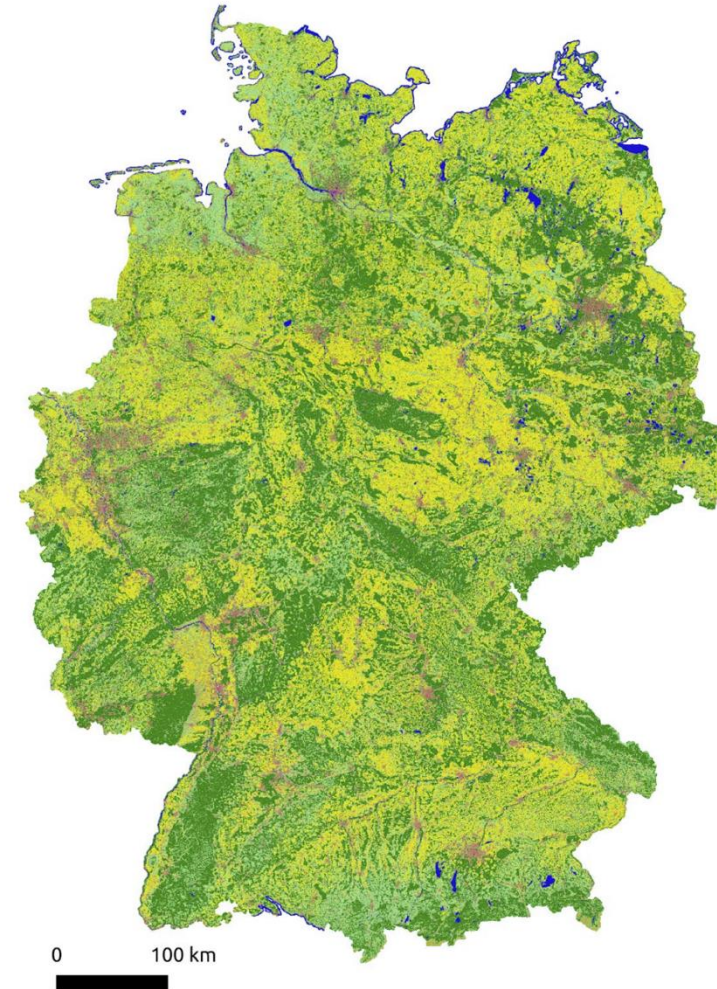
Validity start: June 2022





## Urban land mapping

- Machine learning
- Land cover classification
- Post-classification comparison
- Annual change detection

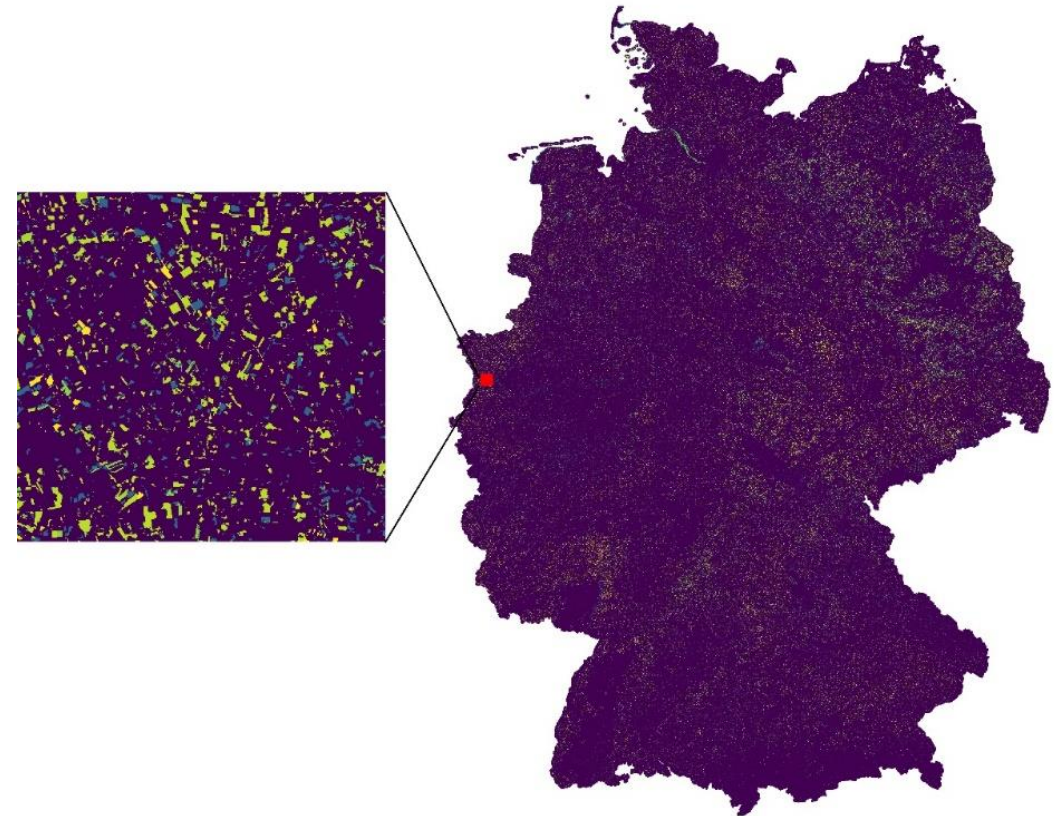




## Mixed pixel problem



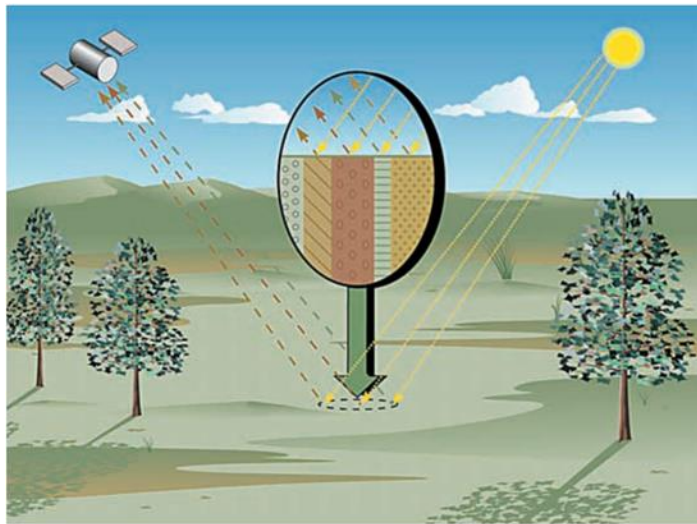
## Random noises in post-classification comparison



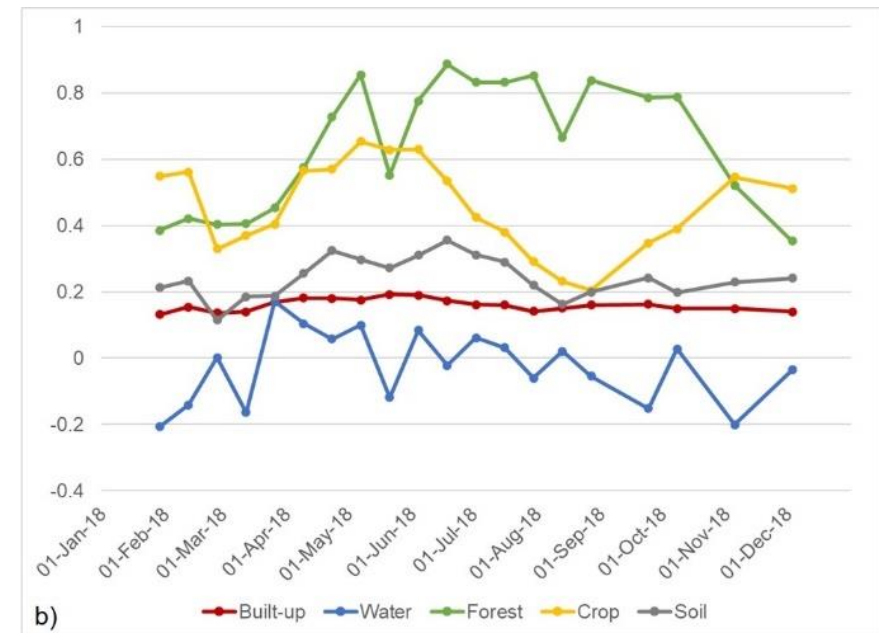


## Spectral unmixing

## Temporal variation

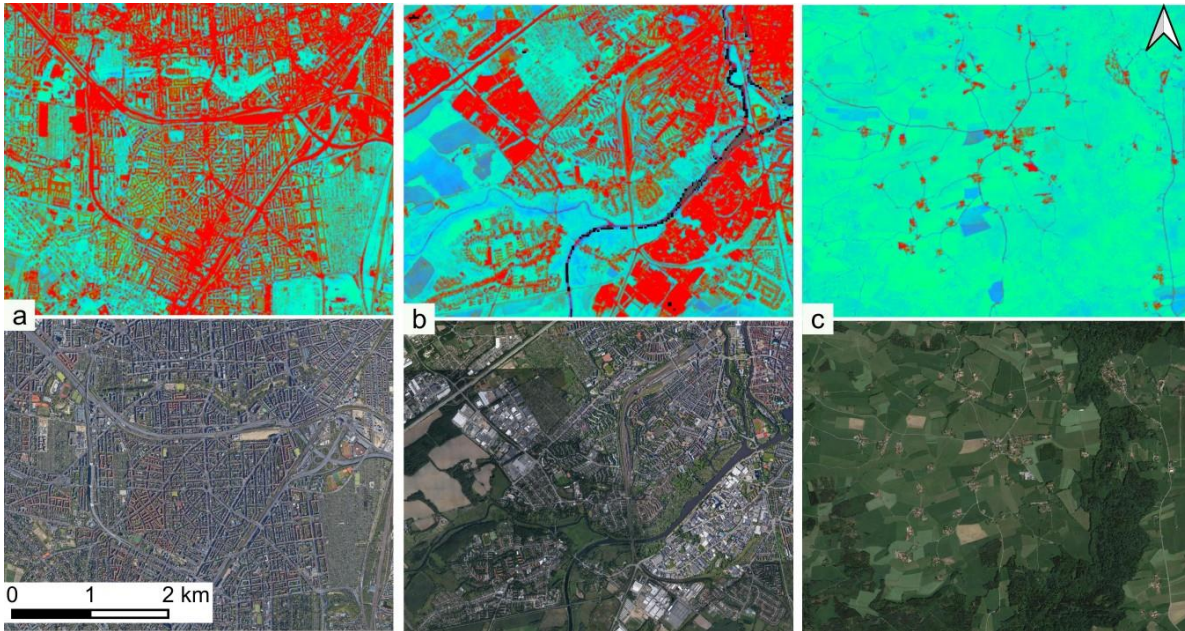


Source: Keshava & Mustard, 2002

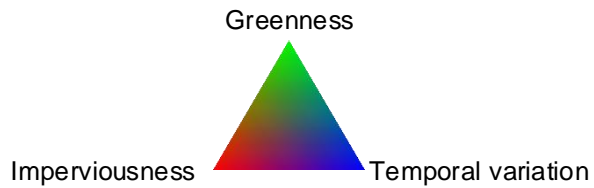
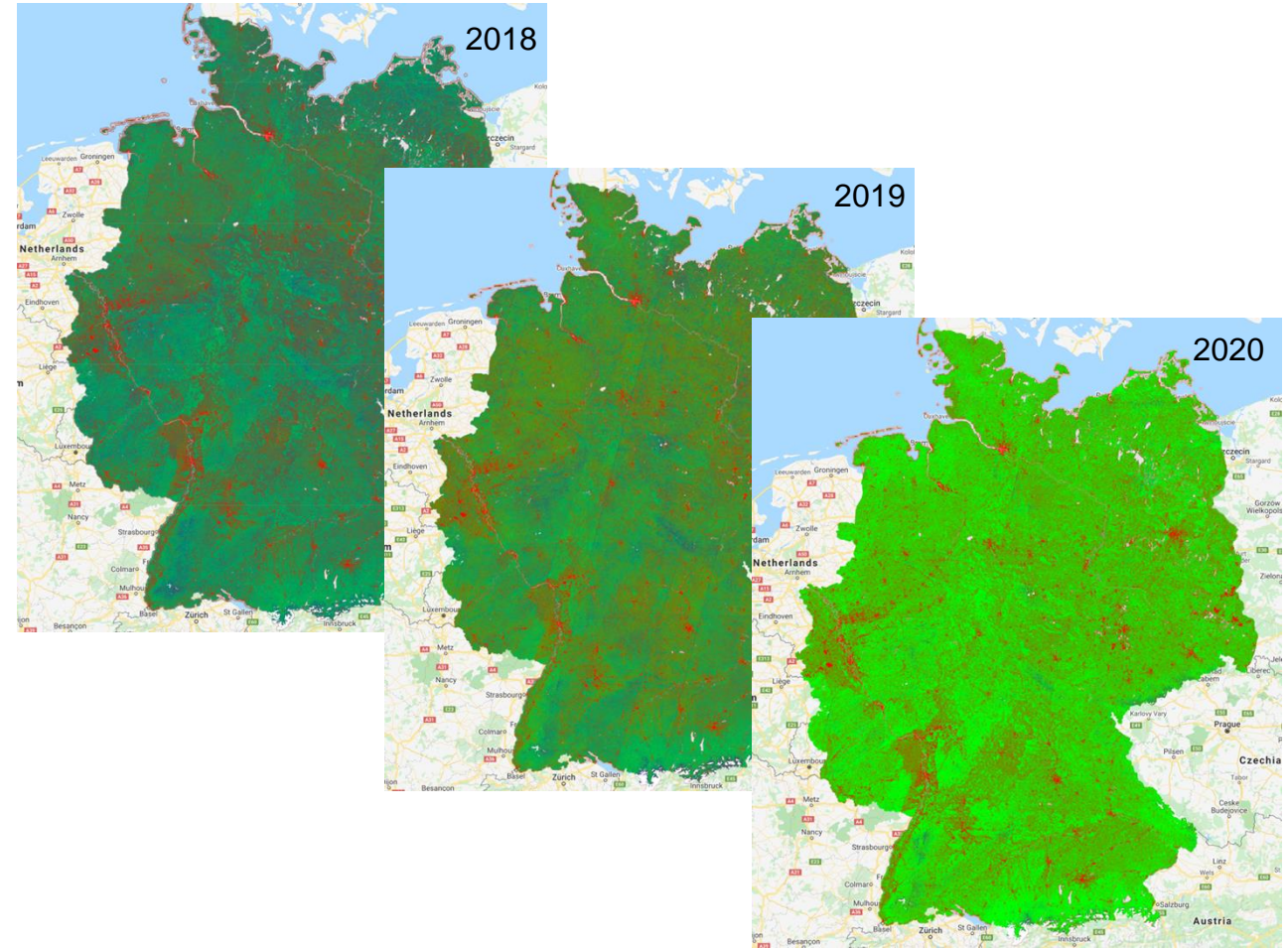




## Imperviousness



## Annual mapping





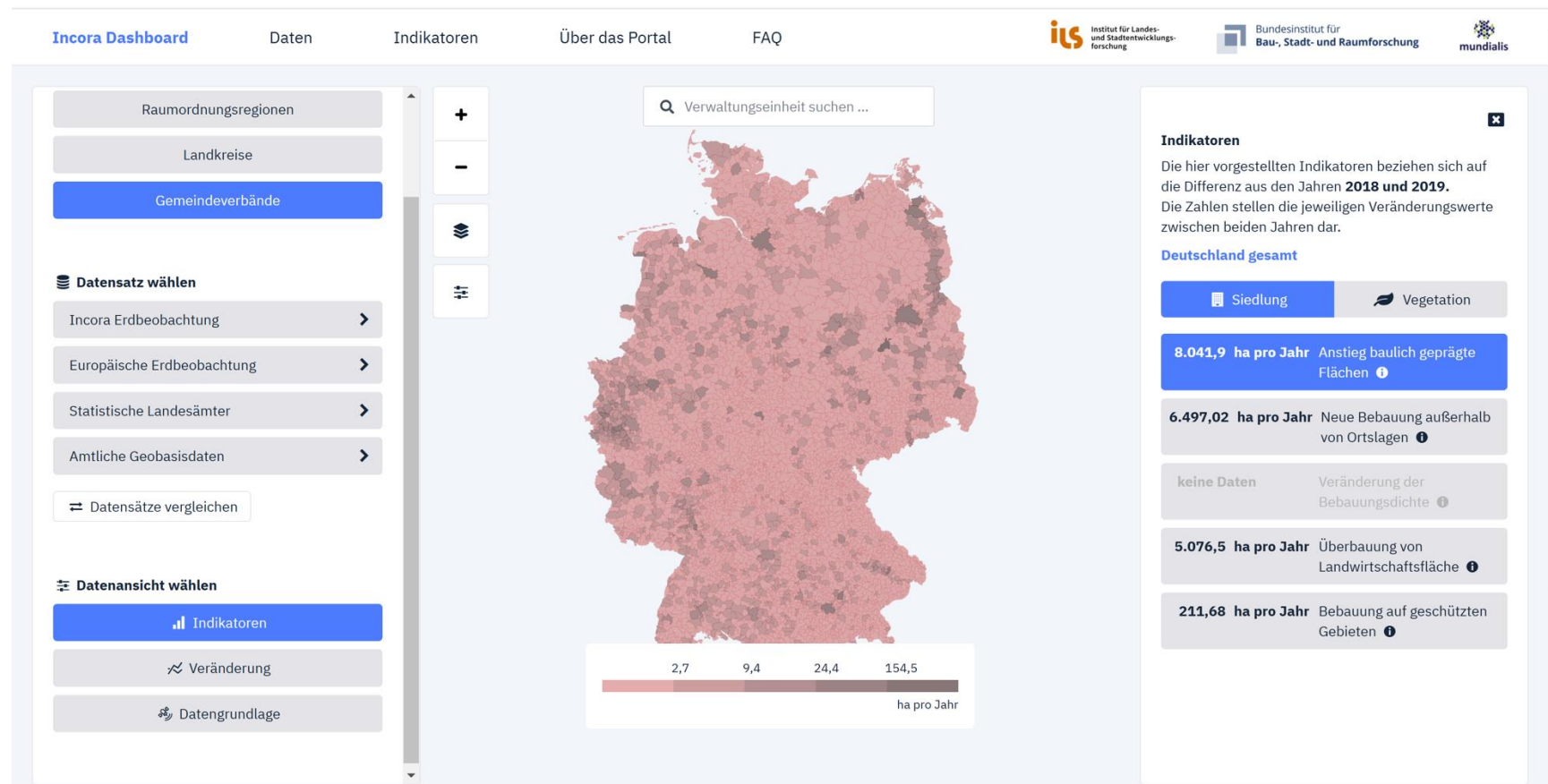
## Change detection



S. Xu and S. Fina (2023), "National-scale imperviousness mapping and change detection using spectral unmixing", *ISPRS Journal of Photogrammetry and Remote Sensing*, Vol. 202, pp. 369-384. DOI: 10.1016/j.isprs.2023.06.010

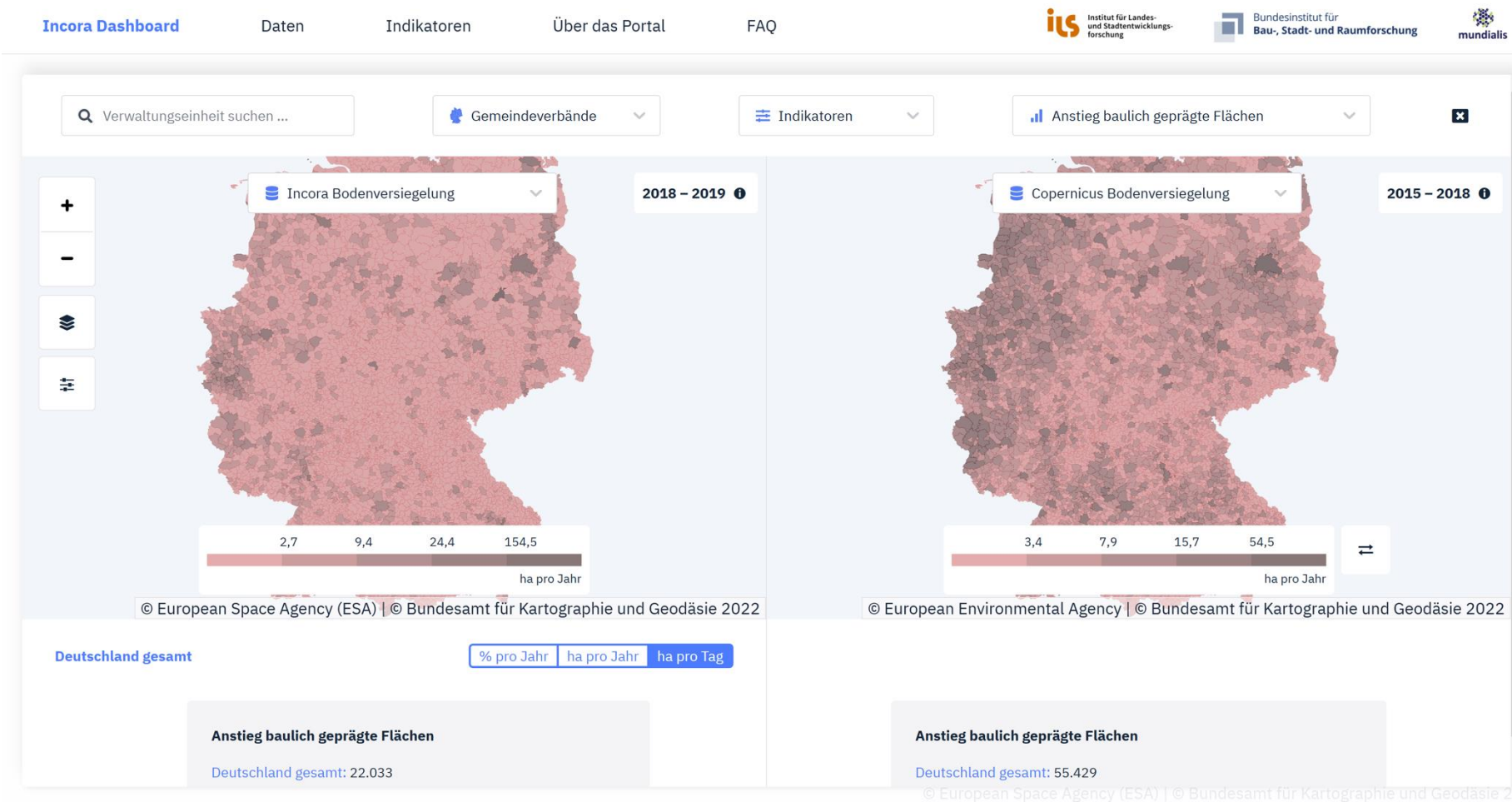


## Interactive Dashboard for stakeholders (<https://incora-flaeche.de>)





## Comparison of different datasets



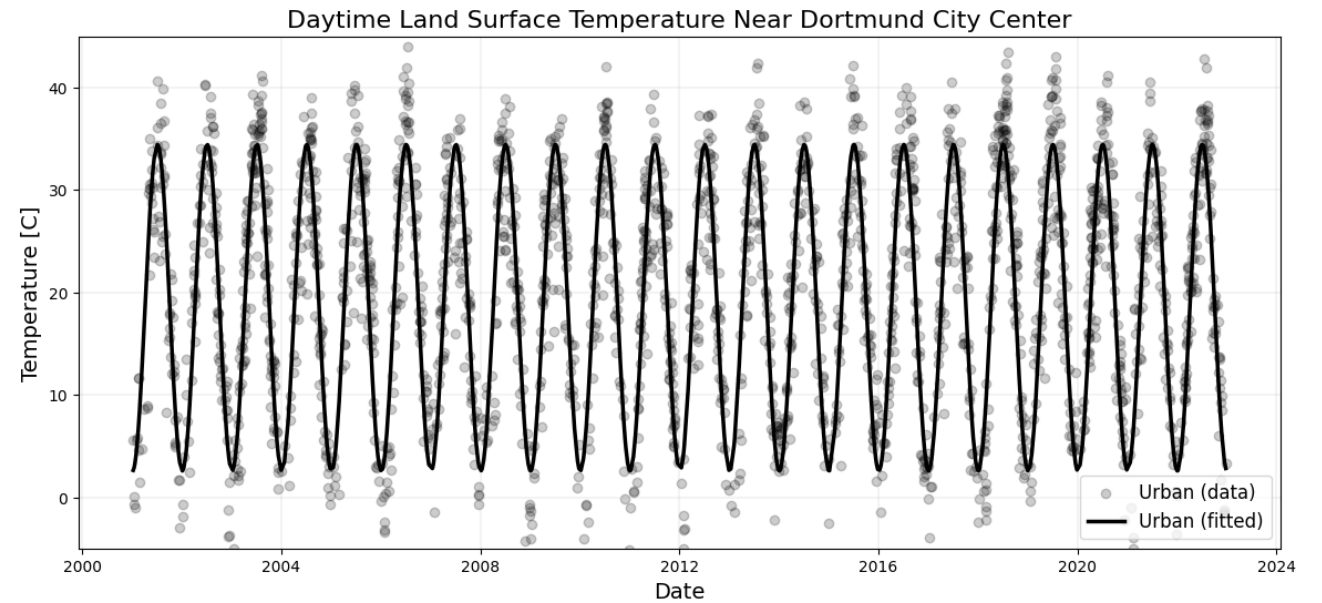
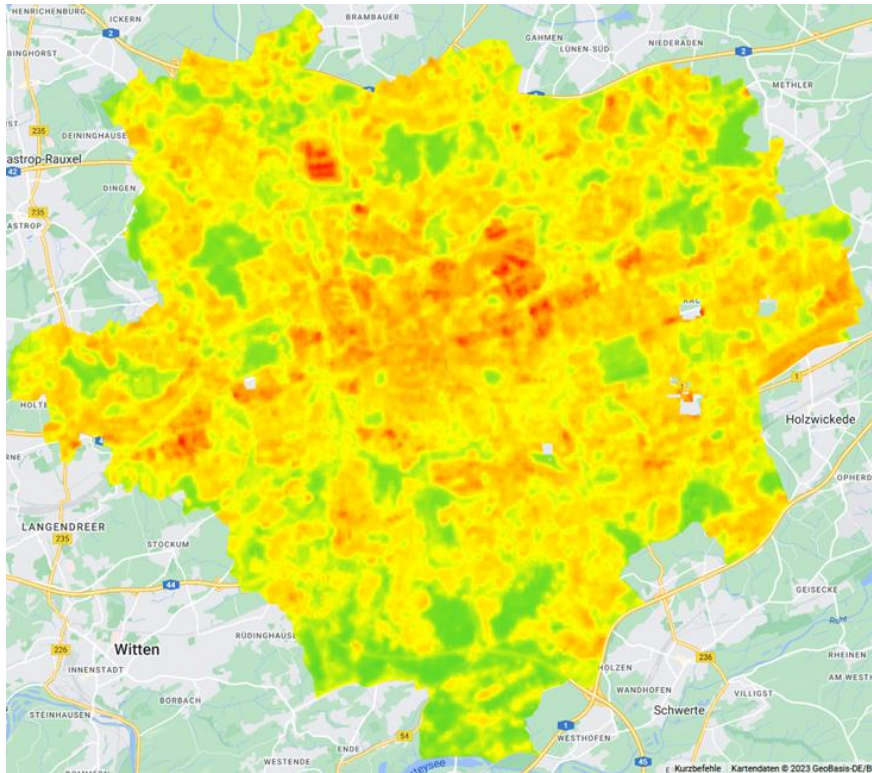




# Using Earth observation data and 3D modelling to support urban heat mitigation



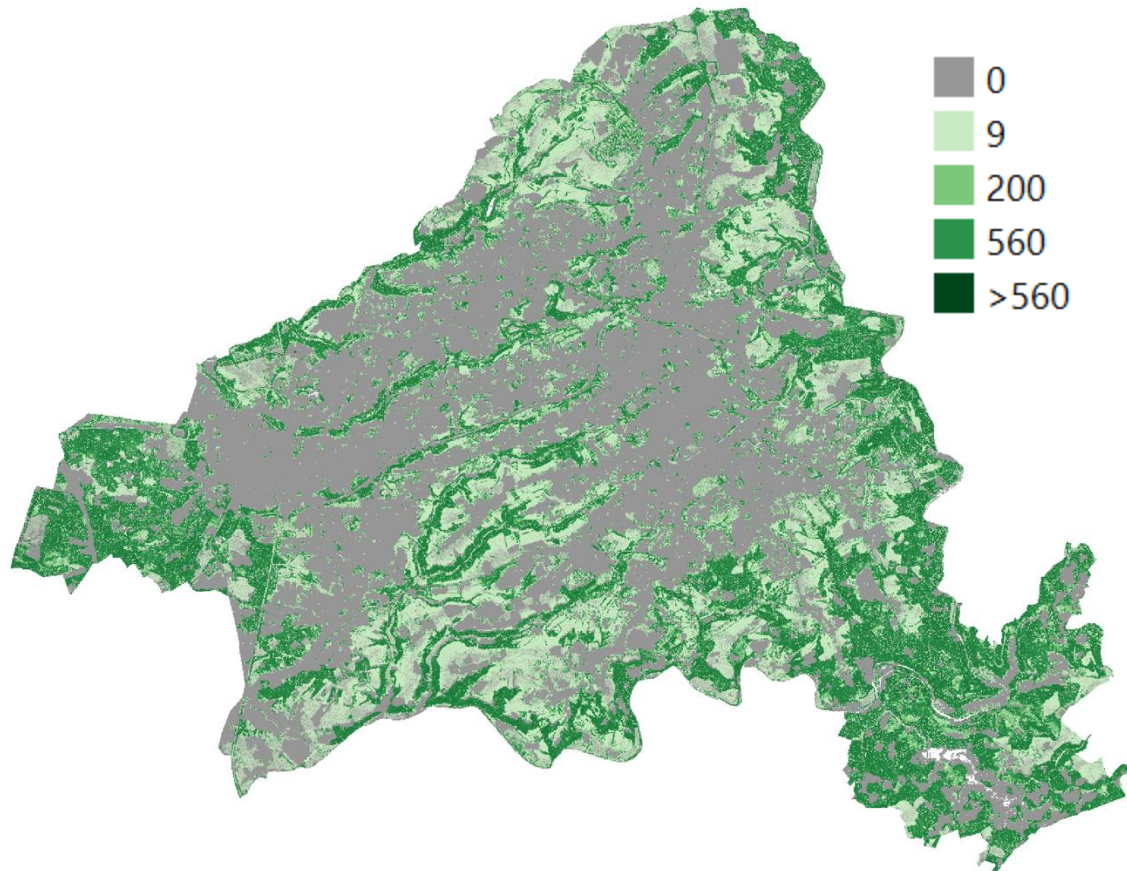
# Land surface temperature



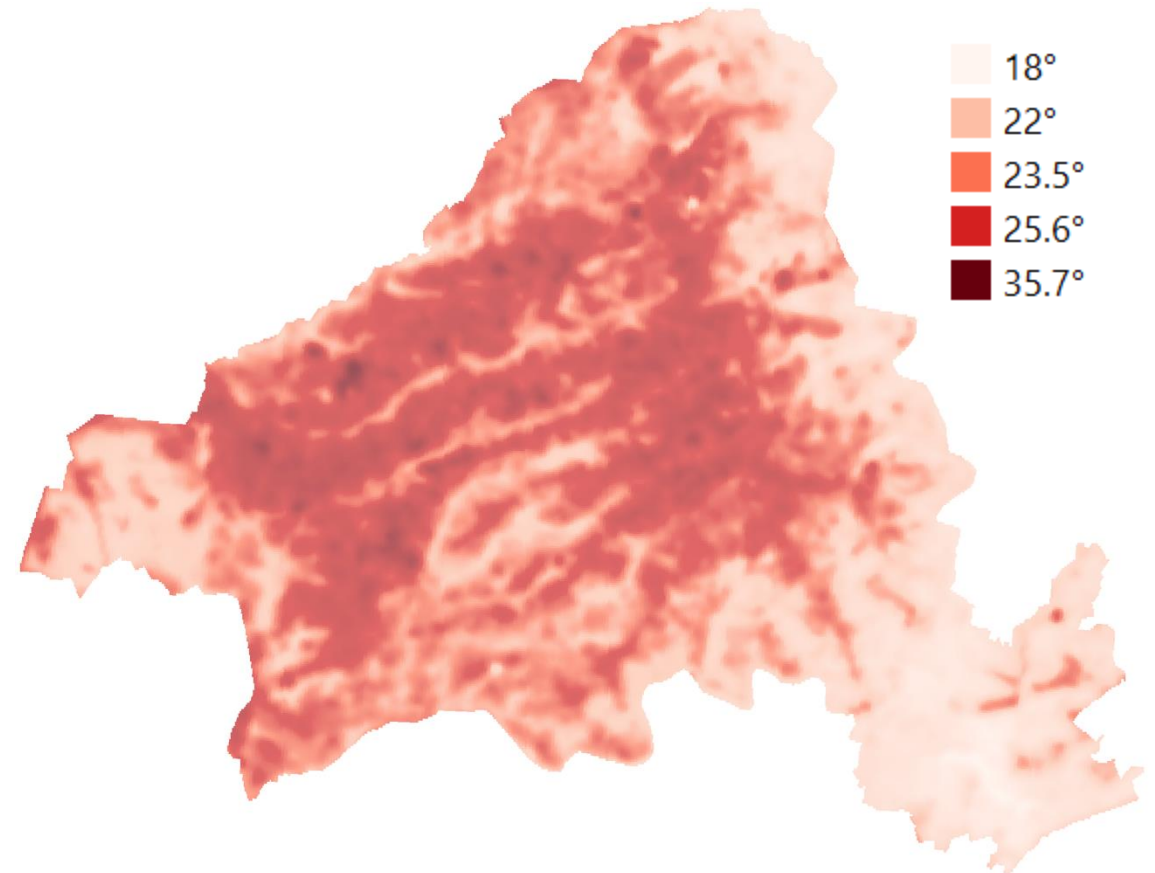


## Green infrastructure for heat mitigation

Green volume (m<sup>3</sup>)



Land surface temperature





## Needs from local governments and district managers

- Using shaded places as cooling space
- Heat vulnerable groups
- Potential places for tree planting





## 3D shadow simulation tool (<https://catch4d.de/schattenkarte>)



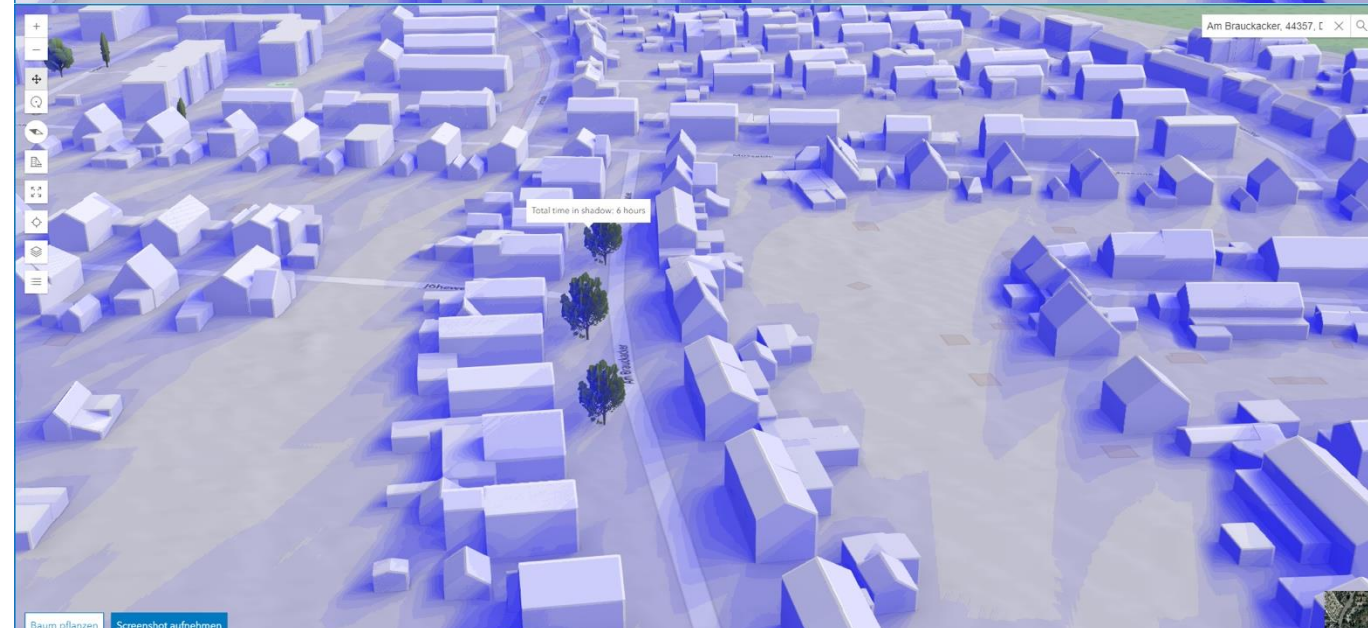
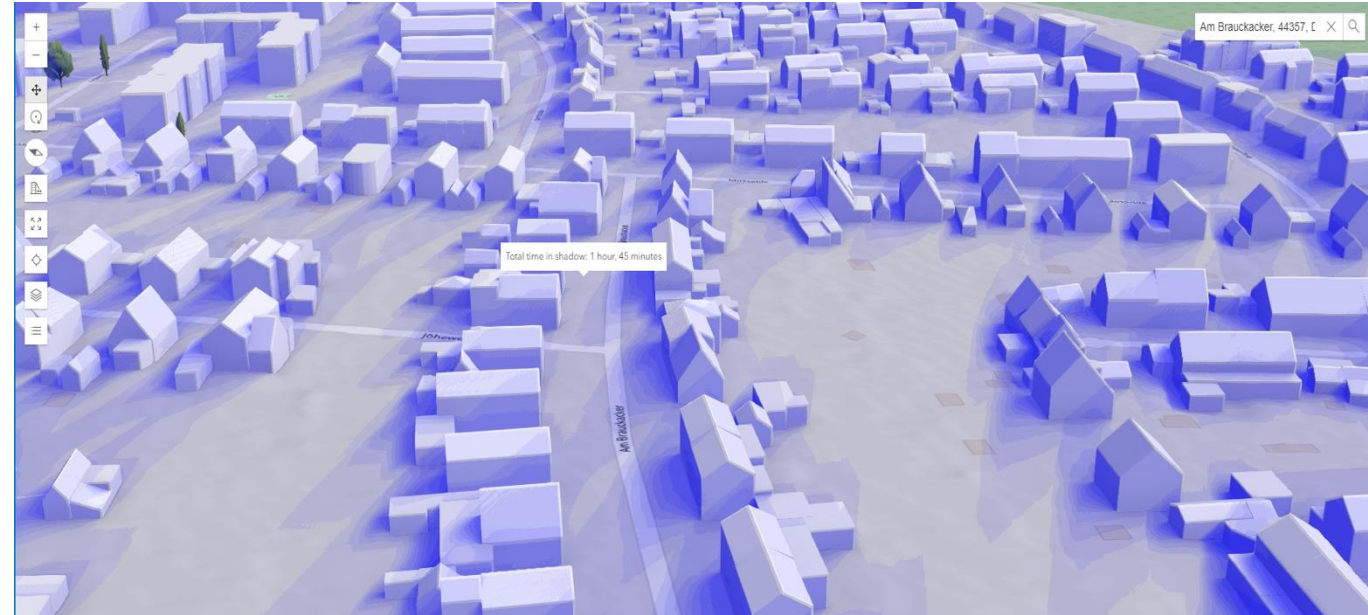


## Vulnerable groups





## Tree planting tool





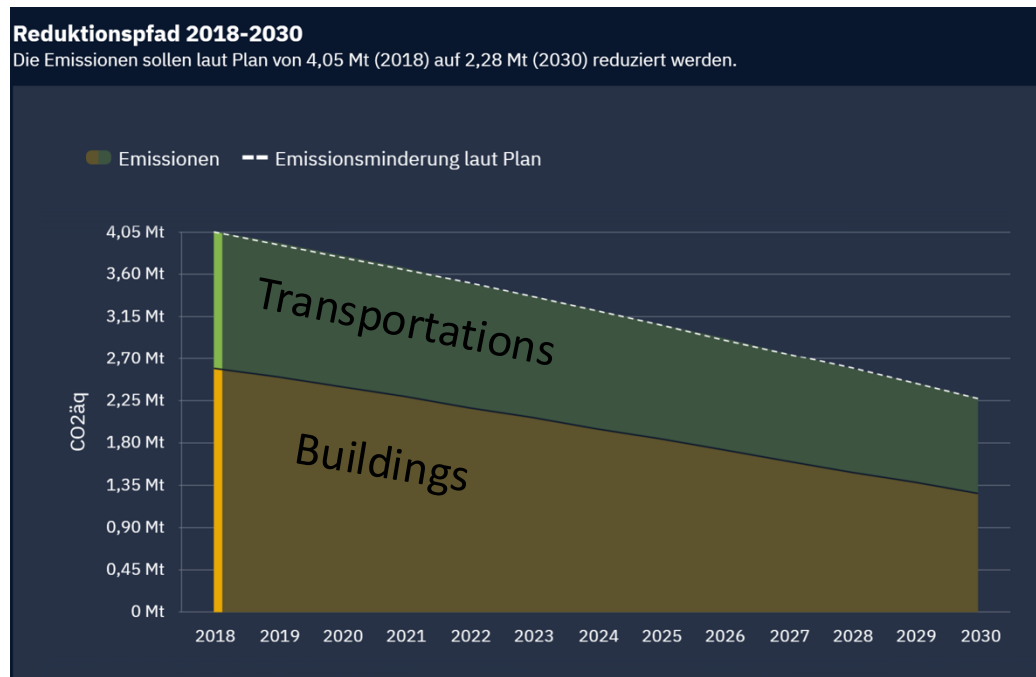
# Using airborne remote sensing to support reducing CO<sub>2</sub> emissions





## Climate-neutral goal

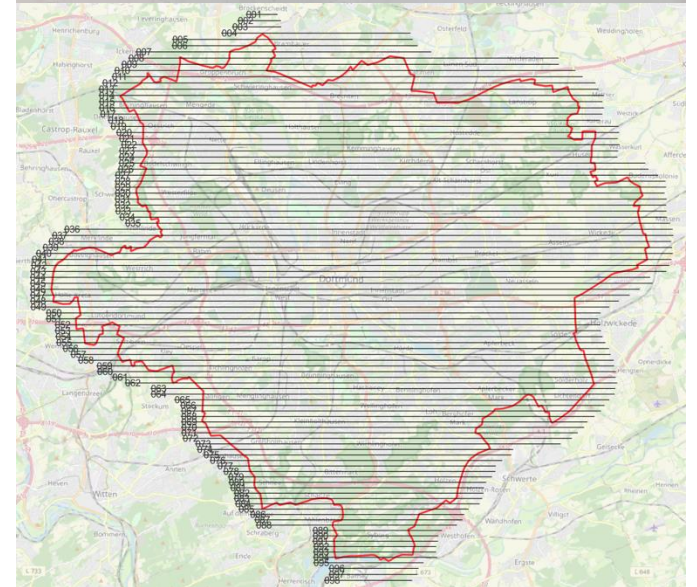
## Building energy leaks





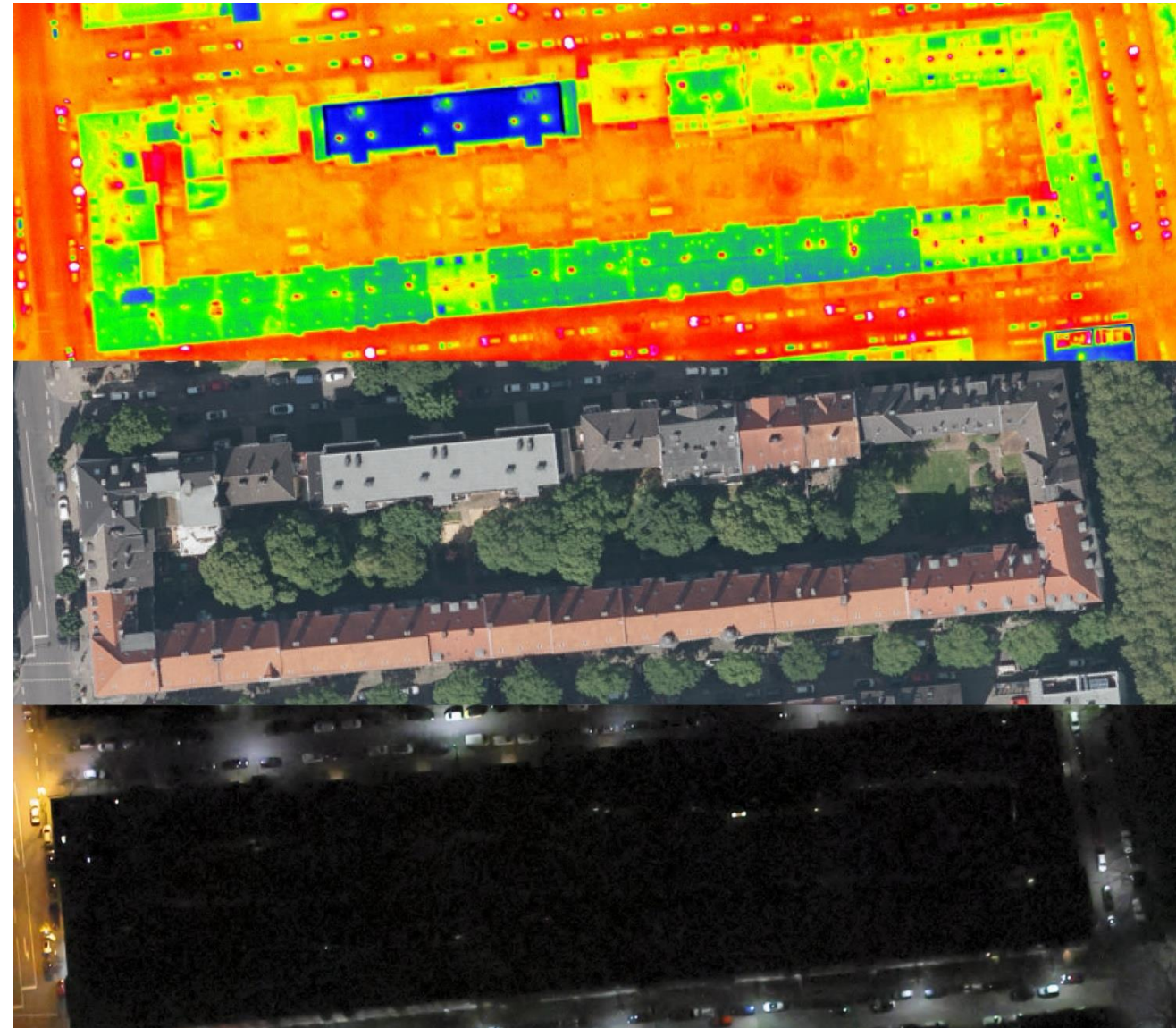
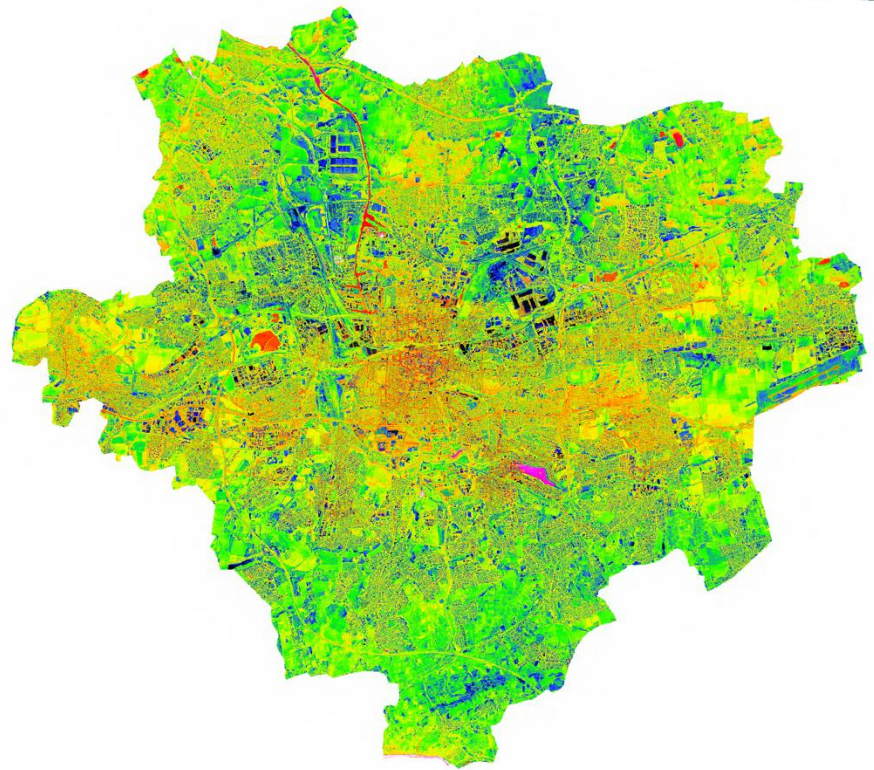
## Aerial survey

- Flight height 4000 feet
- 5-Cameras settings
- Flight paths: 98 lines
- Survey time
  - First survey 28.02.2024
  - Second survey 07.03.2024



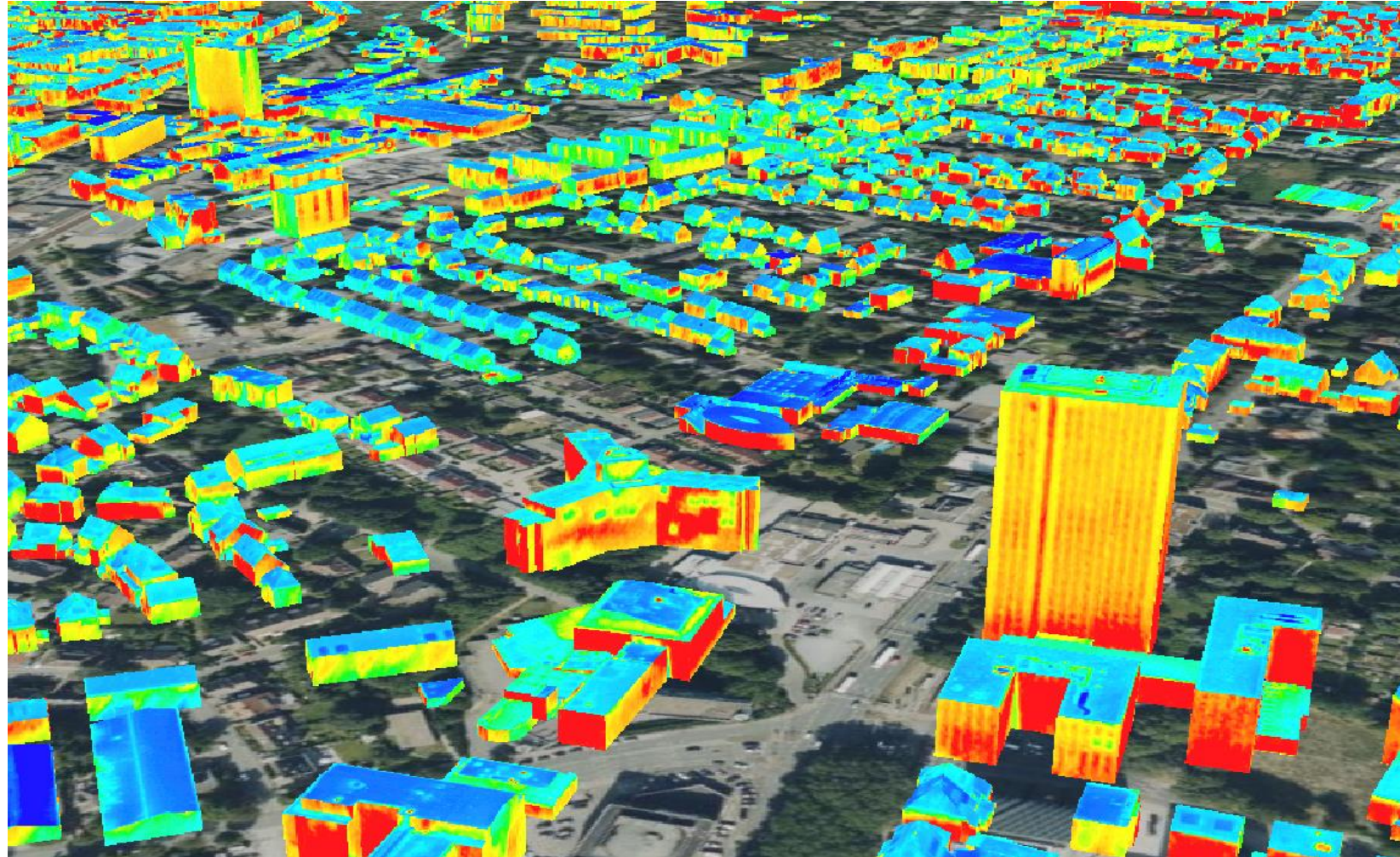


## Nadir thermal images



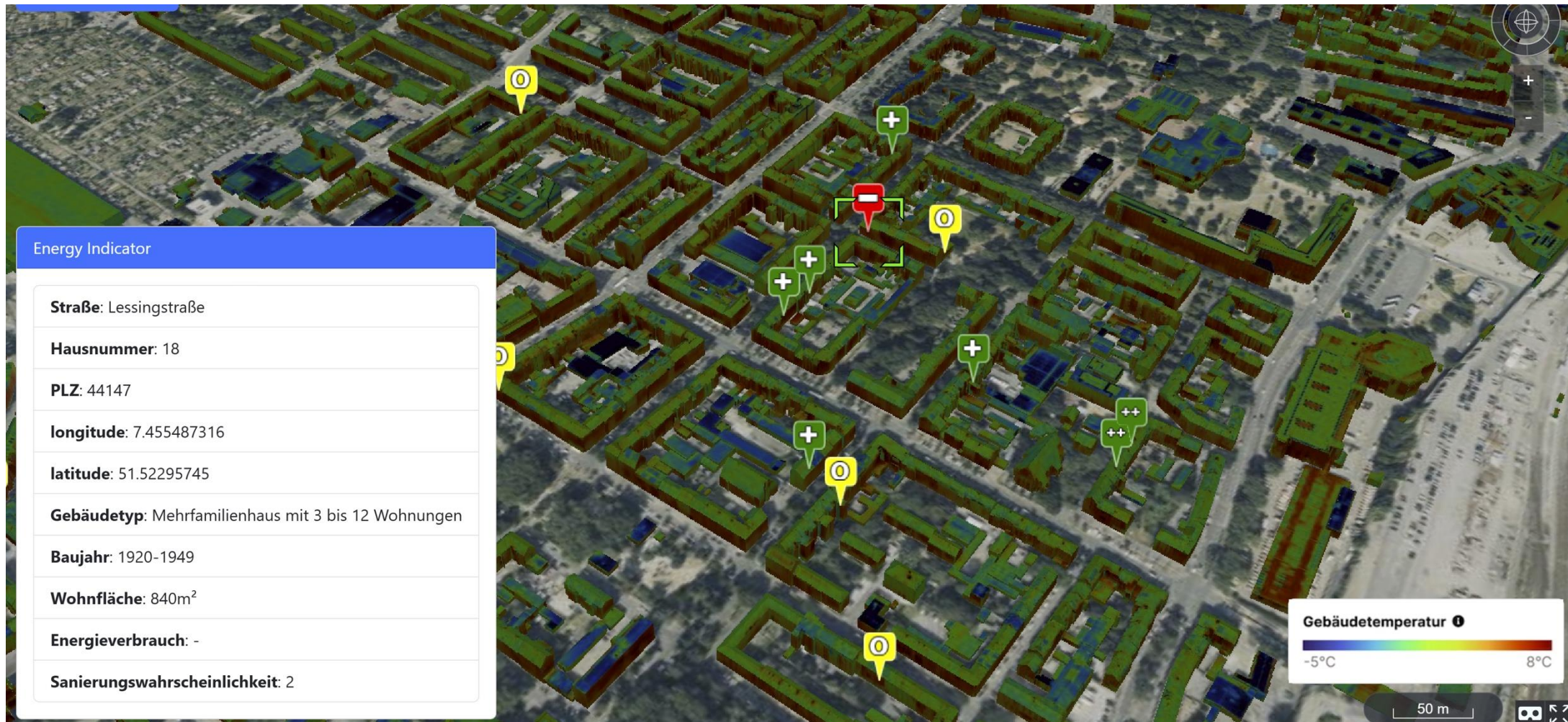


## 3D thermographic model (<https://catch4d.de>)



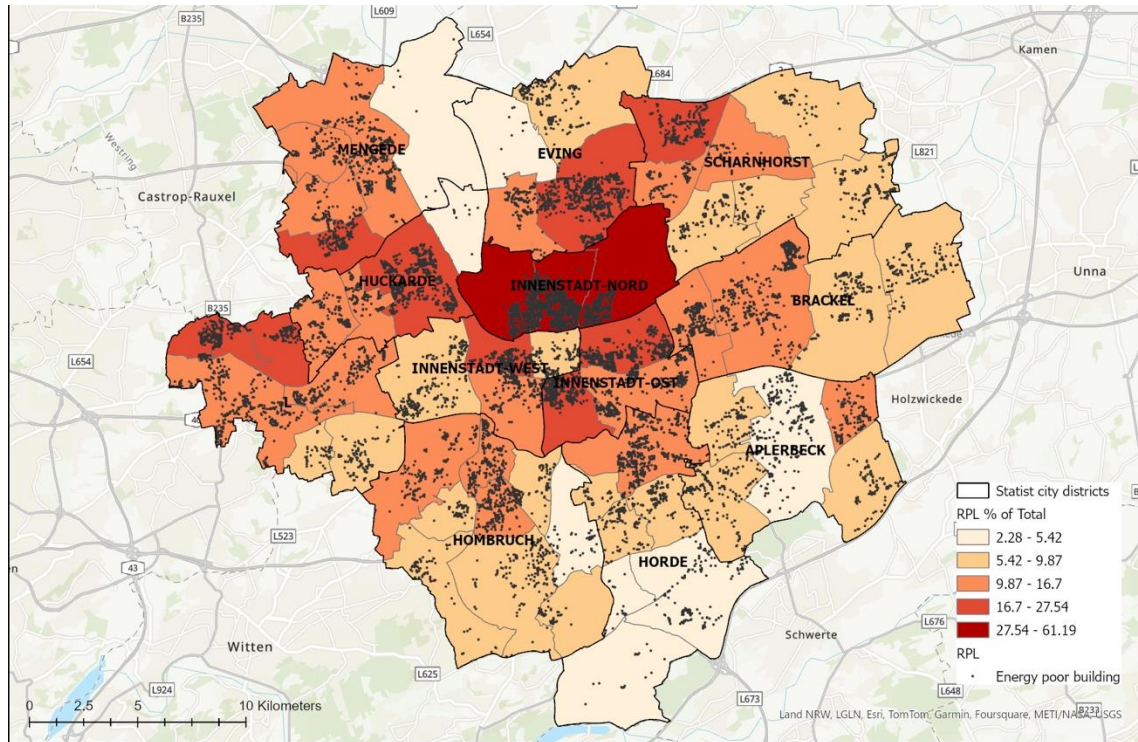


## Support building energy renovation consultancy

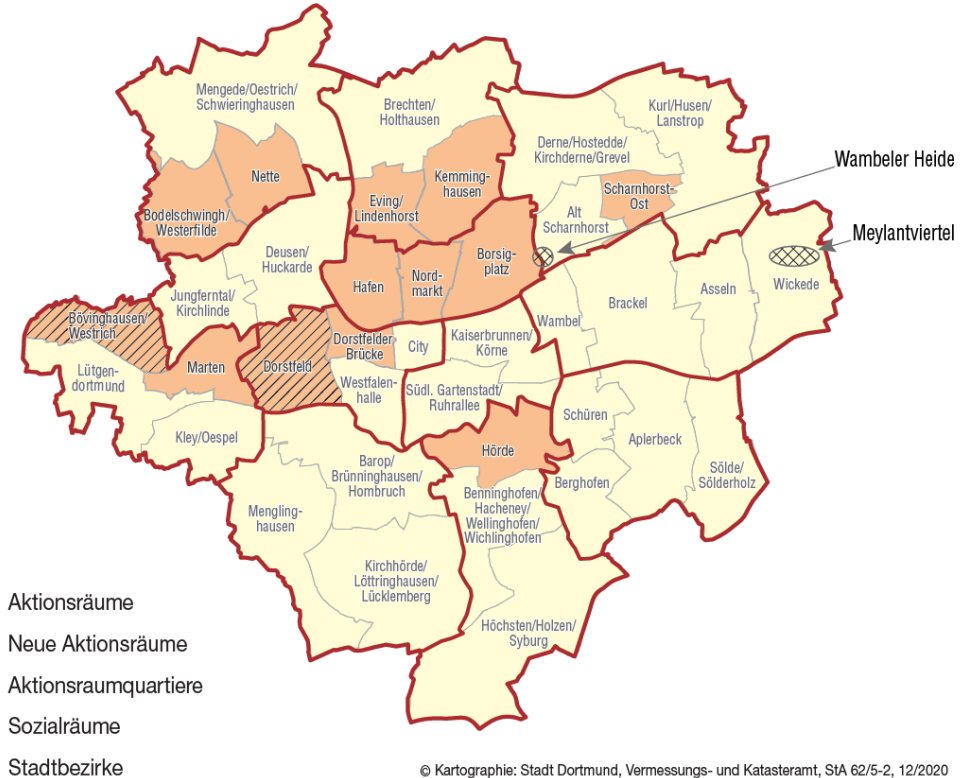




## Energy poverty



Mapping Energy Poverty in Households with RPL Measure



© Kartographie: Stadt Dortmund, Vermessungs- und Katasteramt, StA 62/5-2, 12/2020



## Summary

- Data-driven approach to support
  - Sustainable land use
  - Urban heat mitigation
  - Reduce CO2 emissions from buildings
- Data provides us
  - Quantitative measurements
  - Intuitive communication tool for stakeholder engagement
  - Evidence for the process toward the sustainable goal
- More available data leads to more applications



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