Federal Agency for Cartography and Geodesy

BKG
Wir geben Orientierung.

# Digitaler Zwilling Deutschland – A digital twin for Germany

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There are many digital twins existing

**Cities & municipalities**

München.
**Digital. Twin.**

CONNECTED URBAN TWINS

**Germany**

**EU**
Destination Earth

# Why do we need a digital twin for Germany?

## Answering major societal questions with a strong geospatial-relationship

- Pandemics
- Climate Change
- Electromobility
- Equitable, improved living conditions
- …

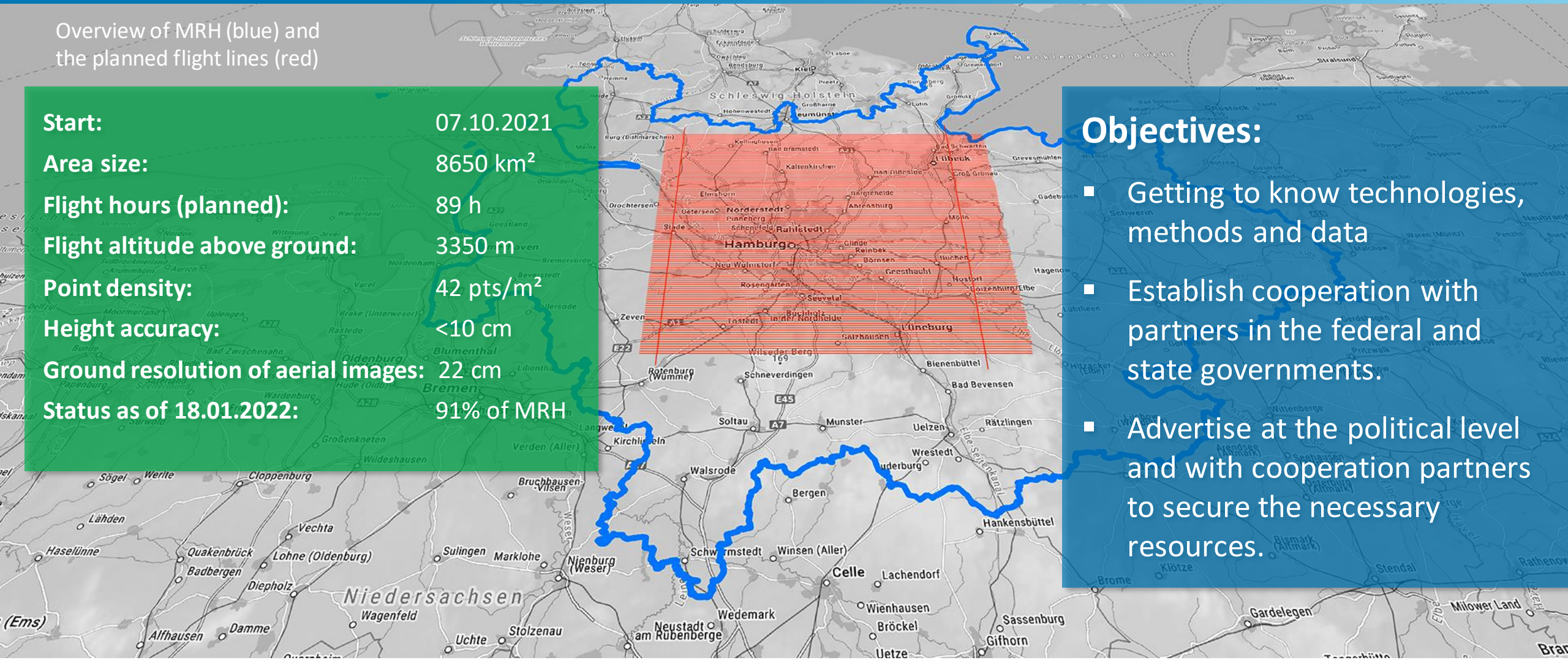
Alexander Spatari via Getty Images

# Digitaler Zwilling Deutschland

- Synergy with the EU Global Twin
- support our national tasks
- Basieline data set: high-precision 3D-model:
  - > 40 Pts/m² over the entire federal territory
  - Regularly in a three-year cycle (2023 and 2026)
  - Sensor technology: single photon or Geiger-mode LiDAR
- Enrichment with further information layers
  - Climate
  - Infrastructure
  - Agriculture
  - Traffic flows incl. measurement sensors in real time

# Pilot Project Hamburg Metropolitan Region (MRH) – Testing the Feasibility of a Digital Twin for Germany

Overview of MRH (blue) and the planned flight lines (red)




| | |
|---|---|
| **Start:** | 07.10.2021 |
| **Area size:** | 8650 km² |
| **Flight hours (planned):** | 89 h |
| **Flight altitude above ground:** | 3350 m |
| **Point density:** | 42 pts/m² |
| **Height accuracy:** | <10 cm |
| **Ground resolution of aerial images:** | 22 cm |
| **Status as of 18.01.2022:** | 91% of MRH |

## Objectives:

- Getting to know technologies, methods and data
- Establish cooperation with partners in the federal and state governments.
- Advertise at the political level and with cooperation partners to secure the necessary resources.

# What do we want to achieve with the demonstration project?

What are the main objectives of the demonstration project:

- Build up know-how
- Get to know technologies, methods and data
- Testing different procedures for data collection, integration, management and evaluation (e.g. Data Cube)
- Establish cooperation with federal and state partners
- Advertisement at political level and with cooperation partners to secure the necessary resources.

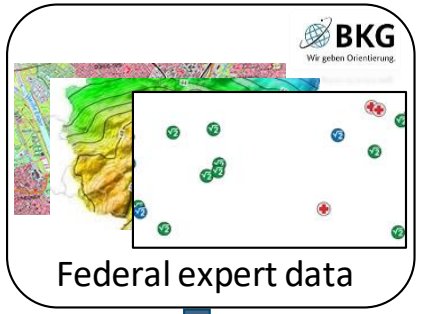
**Explore the feasibility of a digital twin for Germany.**

# Concept of the digital twin Germany

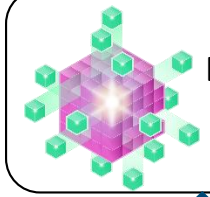
## Measure the real world (Basic data set)

3D-Model for Germany from LiDAR measurements

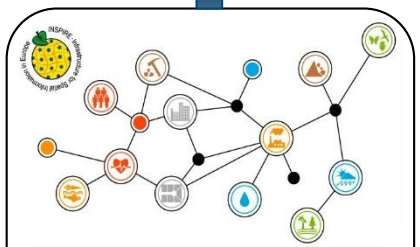
## Digital replica




Federal expert data



Data storage (Data Cube)



Further expert data

References

Data

Rules

## Variants of the digital replica

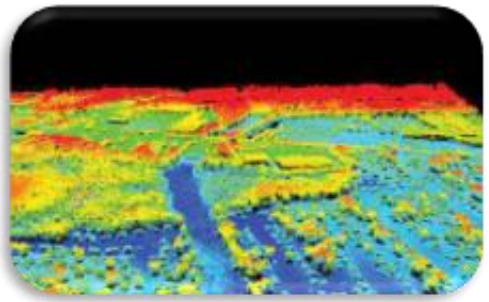
Provide results for further analysis

# Project schedule

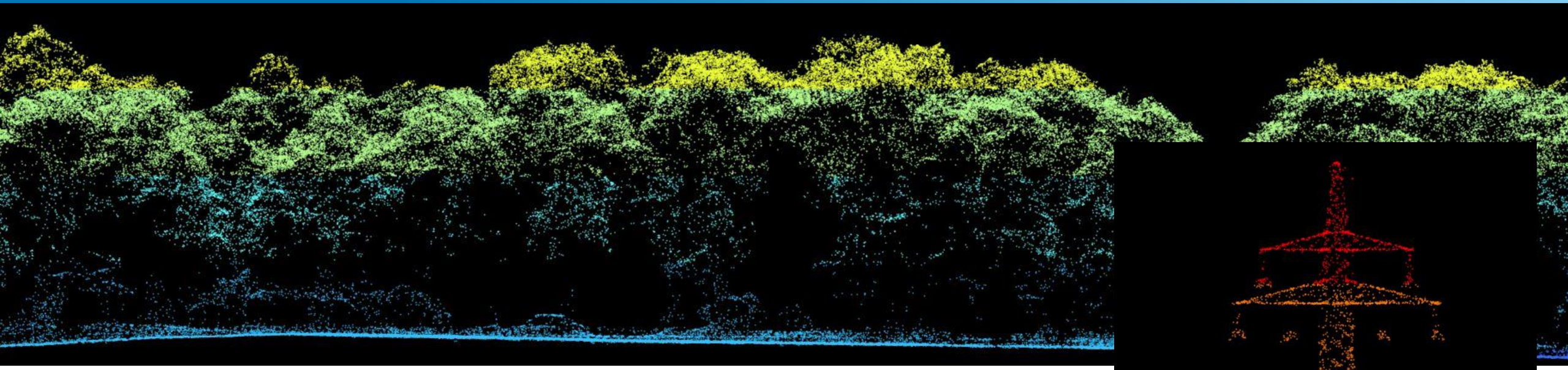
Demonstration project Hamburg metropolitan region in 2021

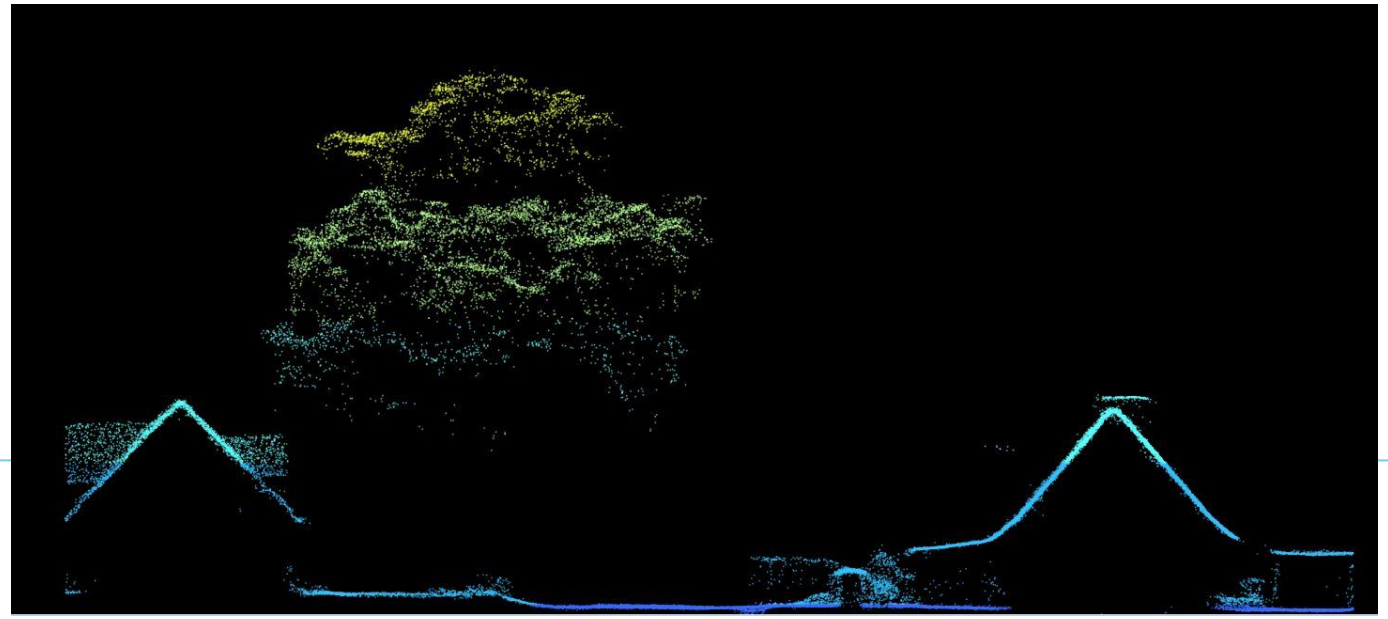
Conception / Lessons learned

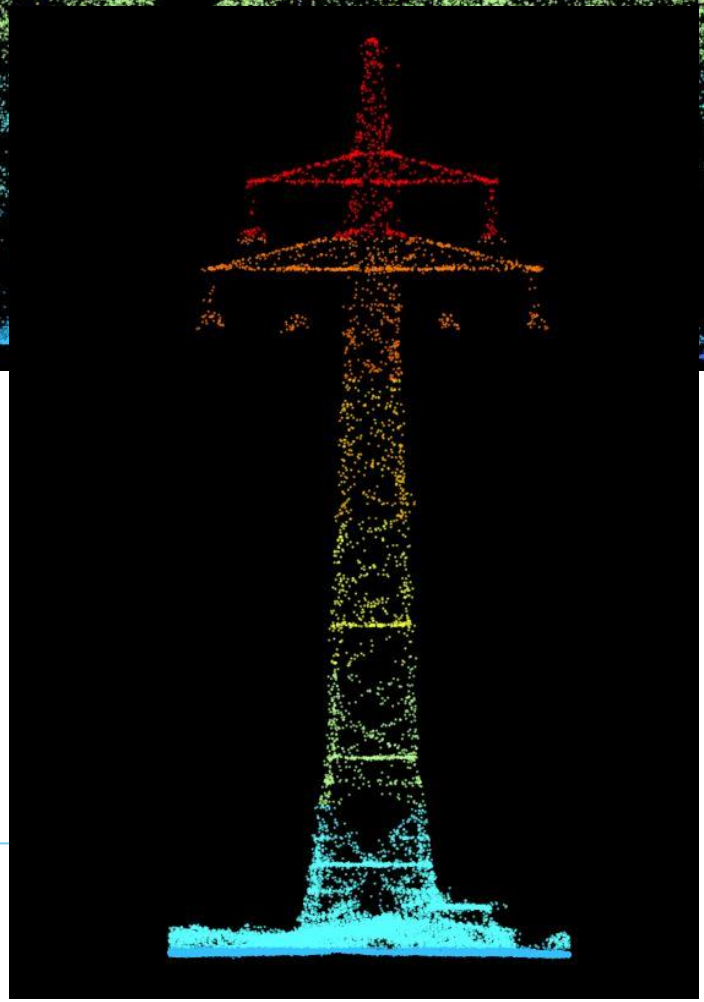
Digital Twin Germany from 2023



# Preliminary results

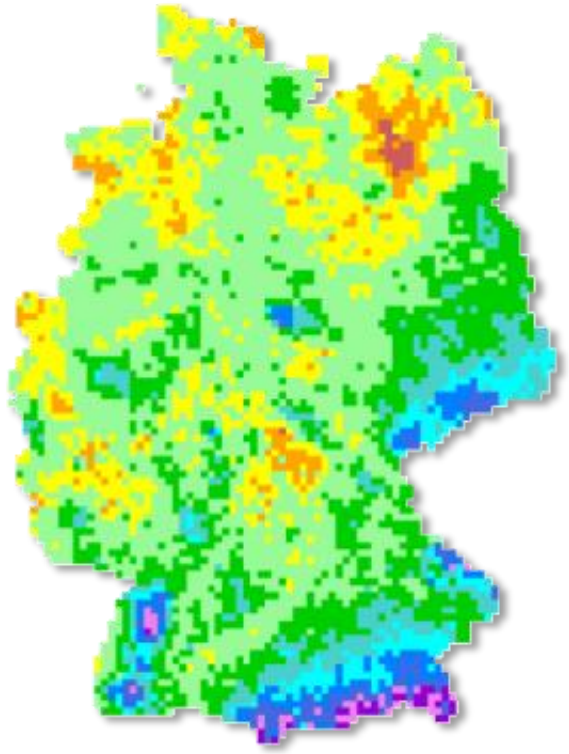






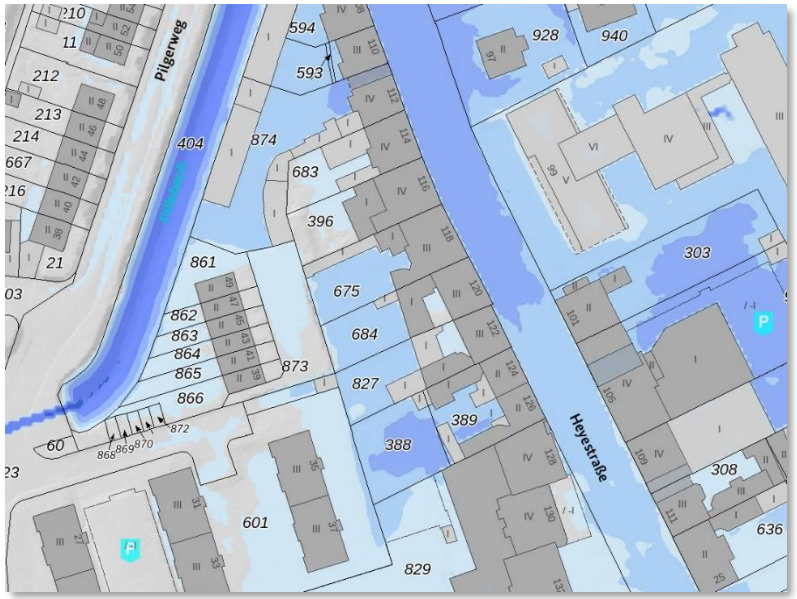
Expert data makes the difference

# Storm rainfall information map

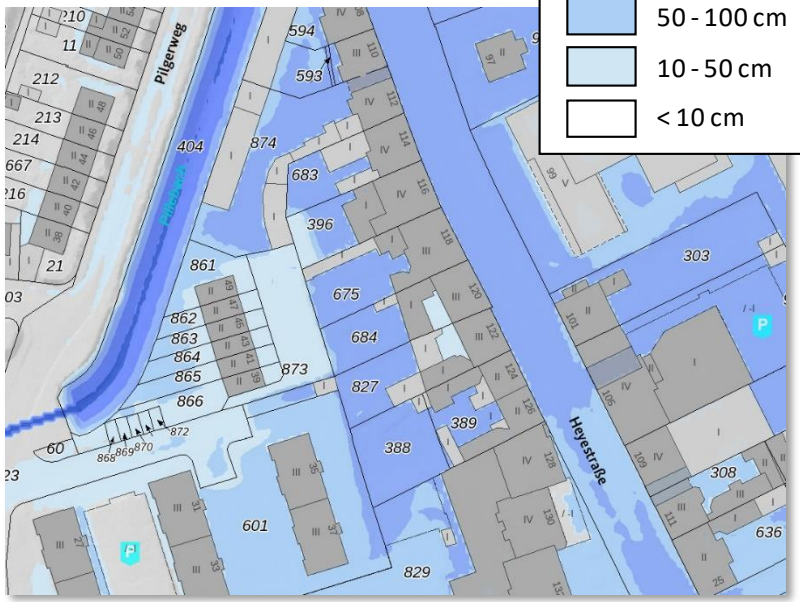


Probabilities of occurrence of storm rainfall, as a function of duration stages (5 min - 72 h) and annualities (1 a to 100 a)

**Scenario 1:**
Rare event
$T_N$ = 100 a



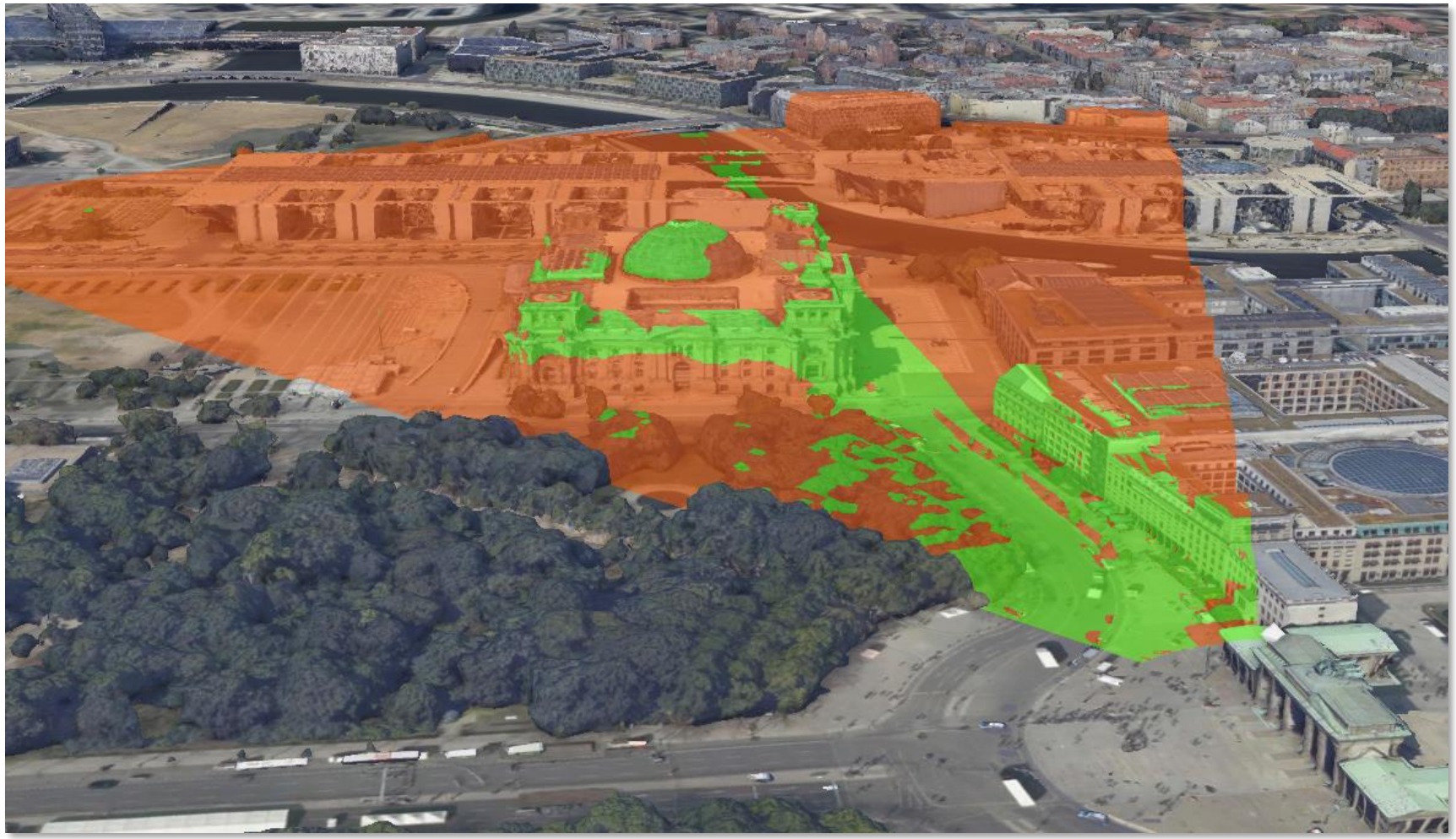

**Scenario 2:**
Extrem event
90 mm/h




**max. water level**

- > 400 cm
- 200 - 400 cm
- 100 - 200 cm
- 50 - 100 cm
- 10 - 50 cm
- < 10 cm

# Visibility analysis



# Summary

- There are many different Digital Twins existing
- Digital twins are much more than just a digital surface model / terrain model.
- Meaningful use can only be achieved through close cooperation between the holders of specialised and geographic base data.
- The BKG is creating a prototype with 30 cm resolution for the Hamburg metropolitan region.
- The digital twin is to be extended to the whole of Germany as a national infrastructure task.

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# Thank you for your kind attention!

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