

GRADE Map Tool

Density maps for a quantitative ground risk assessment

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Agenda

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- 2** Introduction to the Map Tool
- 3** Data sources
- 4** Combination of data sources
- 5** The Map Tool
- 6** Application within SORA
- 7** Evaluation and defining parameters

GRADE project

Data-driven Ground Risk Assessment for Drone operations in Europe



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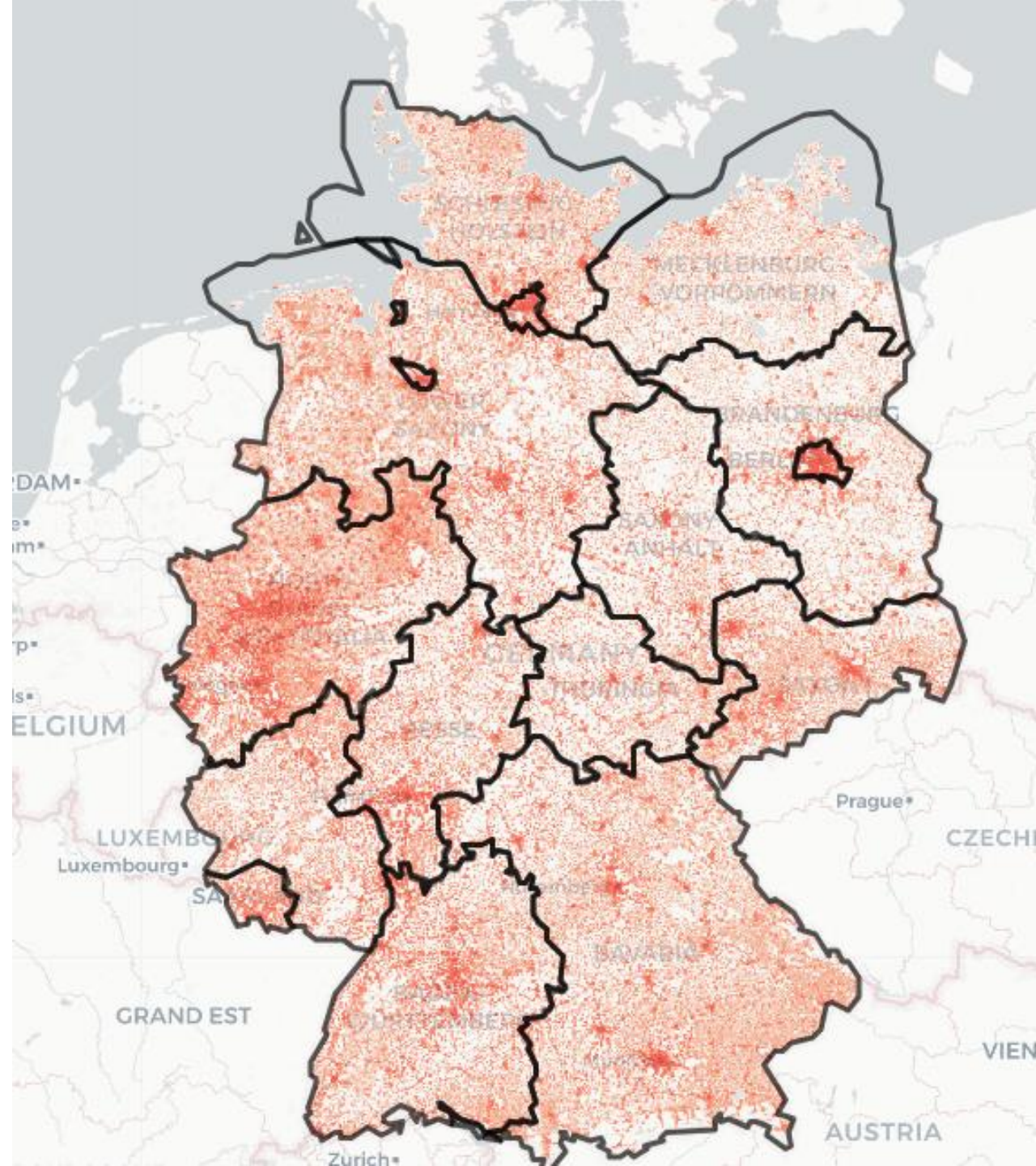


Introduction to the Map Tool

Quantitative Ground Risk Assessment

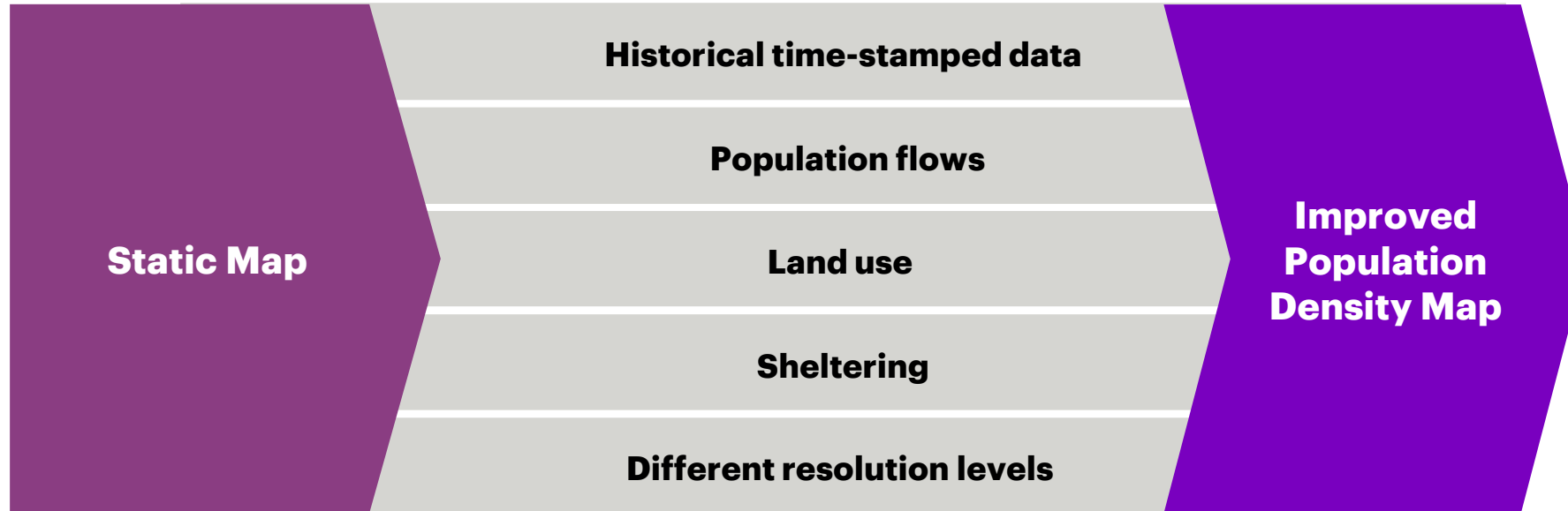
Improved population density maps

- Dynamic data
 - Movement patterns of people
 - Changes in population density over course of the day
- Sheltering
- Higher map resolution



GRADE Concept

Combination of data sources



- How are the data combined?
- How can the map be used by UAS operators?

GRADE Concept

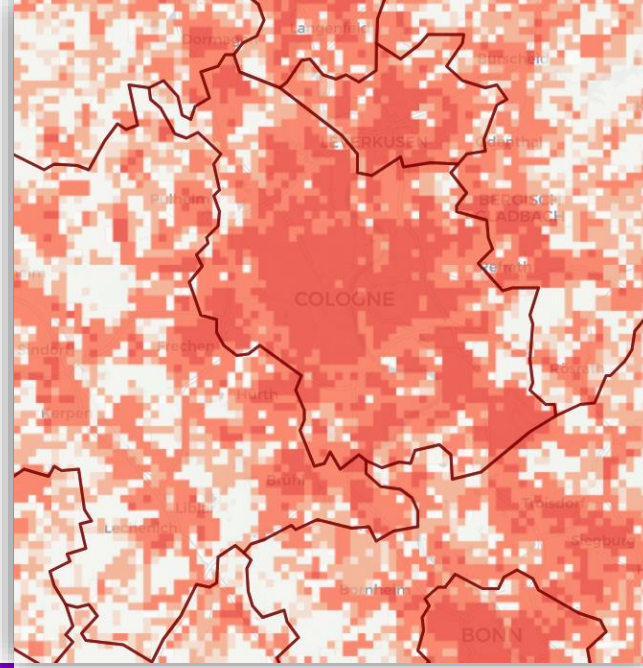
Combination of data sources



- **How are the data combined?**
- **How can the map be used by UAS operators?**

Data sources

Data sources



Sheltering information

OpenStreetMap

- Position of buildings
- Sheltering of people

Census data

Census information

- Base layer

Crowd Data

Mobile phone users

- Anonymized data
- Movement of people

Population flows

Commuter data

- Communities
- Mobility data

Land use

Copernicus, OpenStreetMap

- Influence of the type of area (residential vs. industrial)

Crowd data

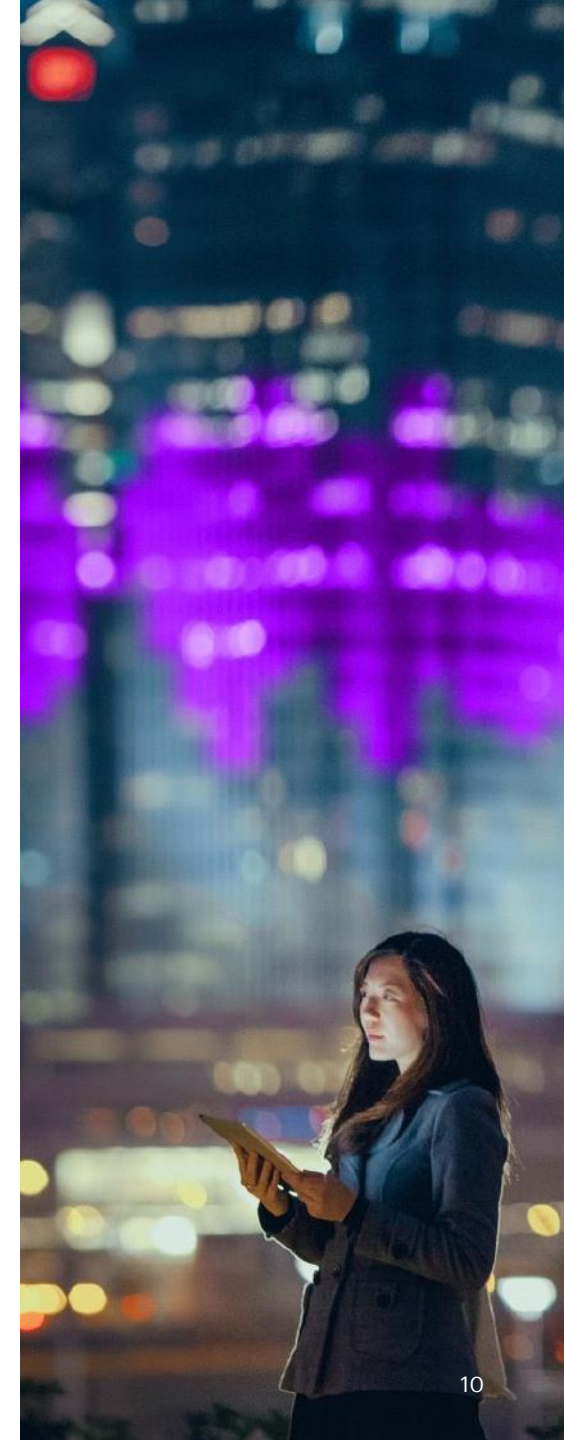
Movement of people

umlaut collects performance and usage data across mobile networks in a global panel of smartphone users:

- Based on an SDK that integrates a variety of Android apps and collects anonymized data in the background on customer devices
- Data collection occurs 24/7/365
- Over 250 million devices worldwide
- Time-stamped data

Application:

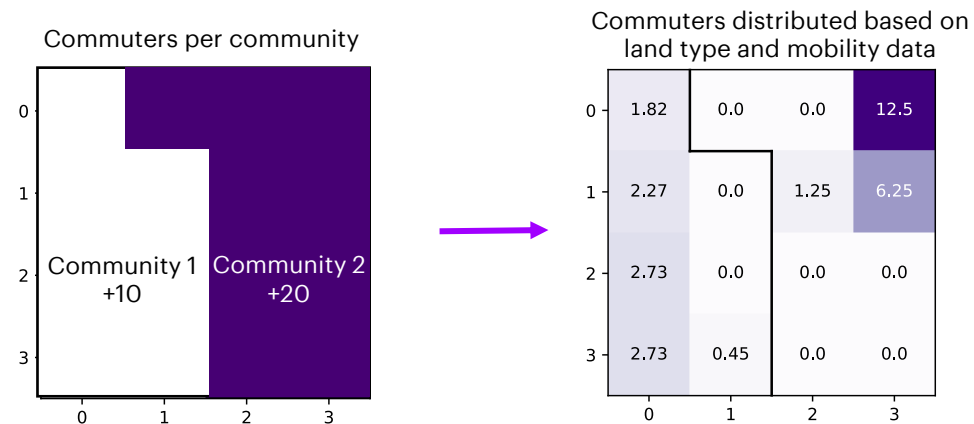
- The time-stamped data points are divided into 6 time intervals to see changes in population density over the course of the day
- The data points are aggregated in the corresponding grid format



Commuter data

Population flows

- **Commuter data is used to track population flows**
 - “Pendleratlas” provides this data for Germany at municipality level
 - Inbound commuters and out-commuters are taken into account for the calculation of the population density
 - A logic is developed for the addition and subtraction of population flows from the static data



Land use

Type of area



Copernicus

Satellite imagery

- For GRADE, relevant areas are extracted from land use data: residential, industrial or commercial areas
- The areas are weighted into the population distribution to varying degrees depending on the time of day



OpenStreetMap

Geographic database

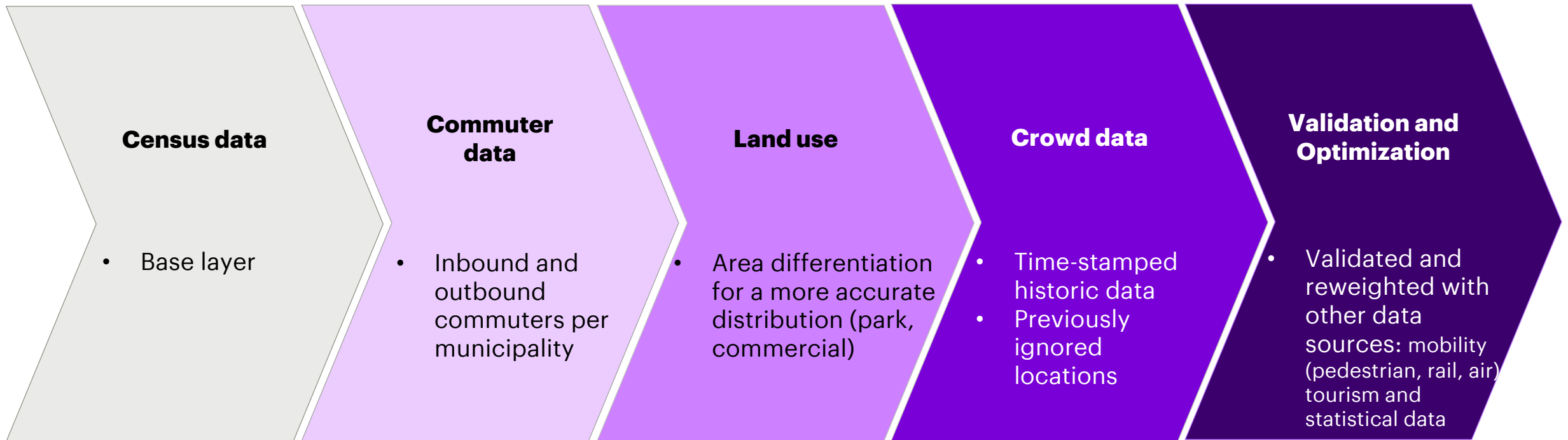
- In addition to Copernicus , land use data is also extracted from OpenStreetMap
- Higher granularity at building level
- Sheltering is extracted based on building information and time of day



Combination of data sources

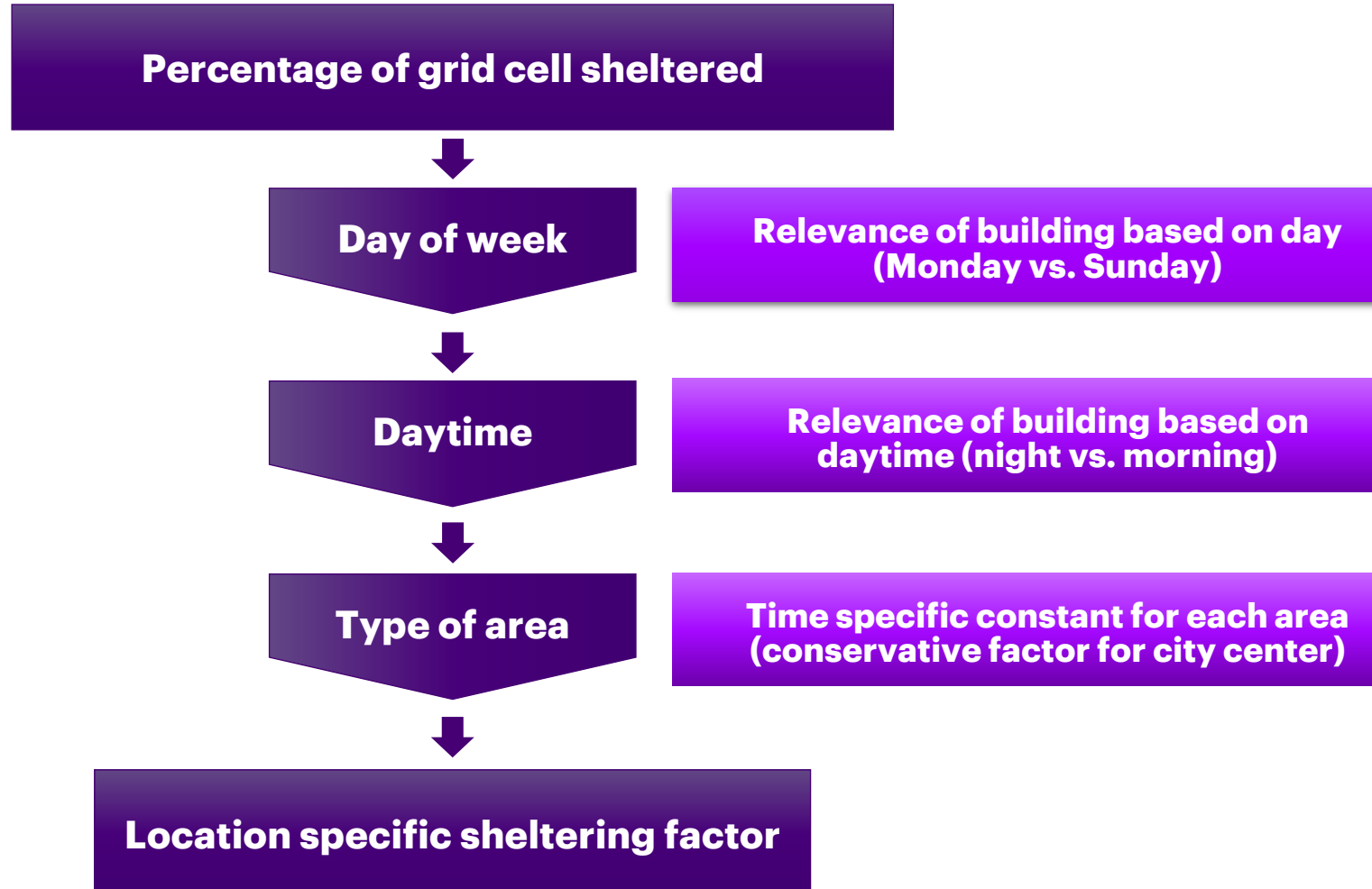
Population density

Extrapolated data

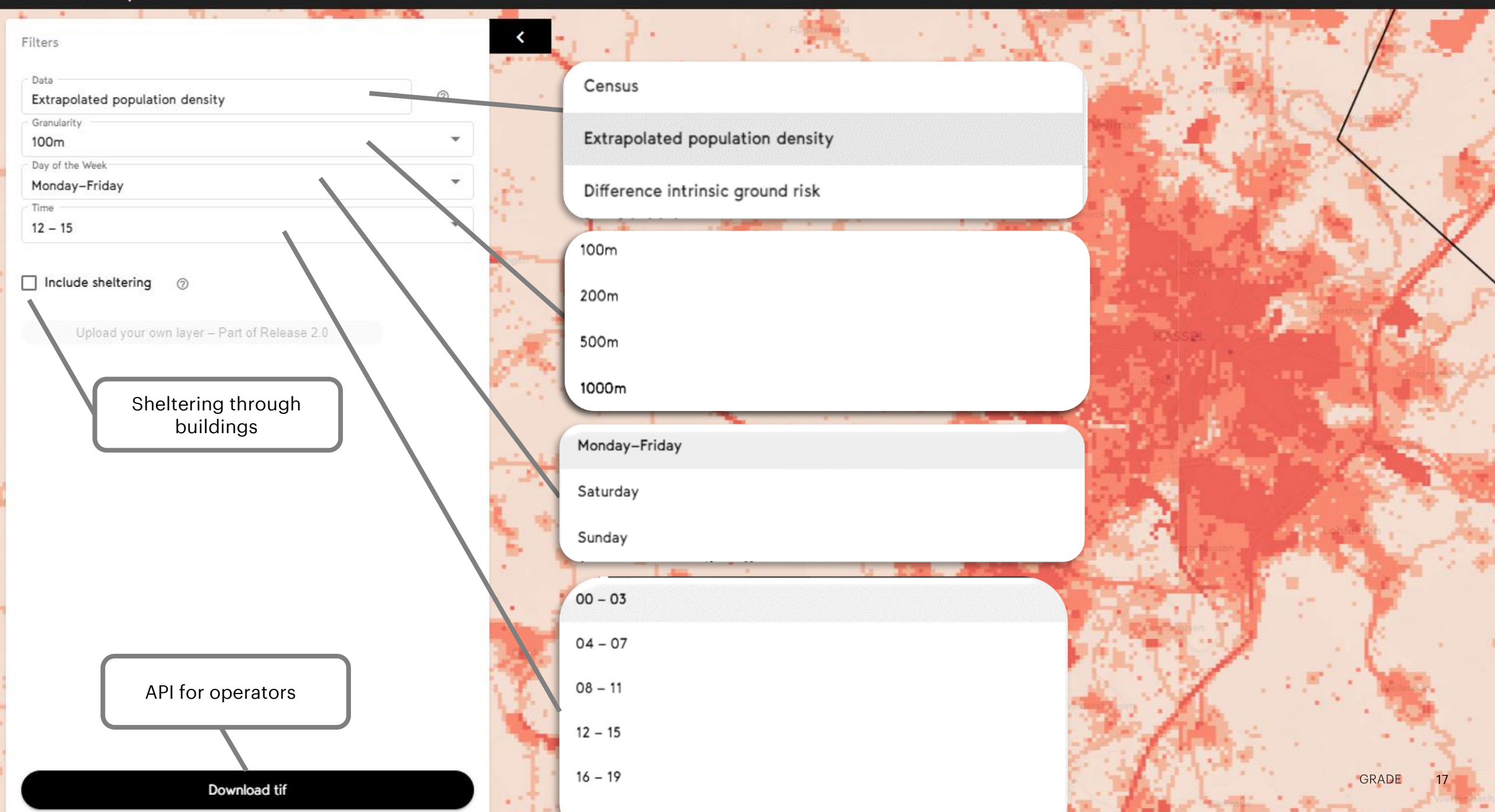


Sheltering through buildings

Factor derivation



The Map Tool



Filters

Data

Extrapolated population density

Granularity

100m

Day of the Week

Monday-Friday

Time

12 - 15

☐ Include sheltering



Upload your own layer - Part of Release 2.0

Sheltering through buildings

API for operators

Download tif

Census

Extrapolated population density

Difference intrinsic ground risk

100m

200m

500m

1000m

Monday-Friday

Saturday

Sunday

00 - 03

04 - 07

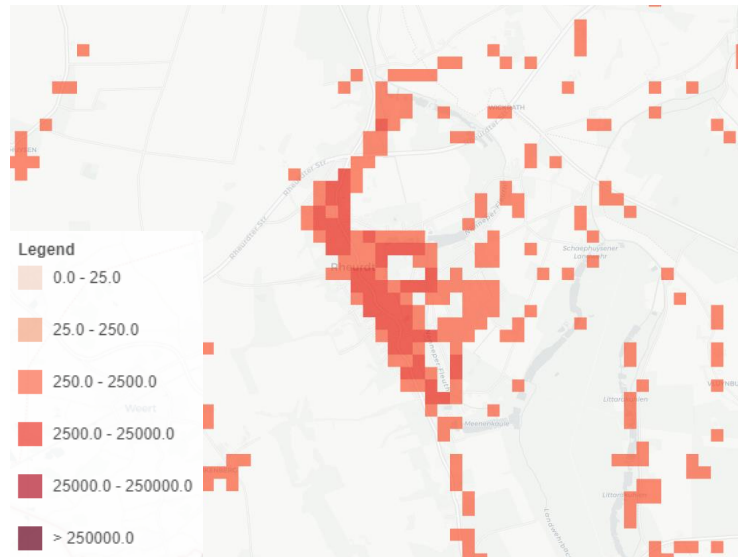
08 - 11

12 - 15

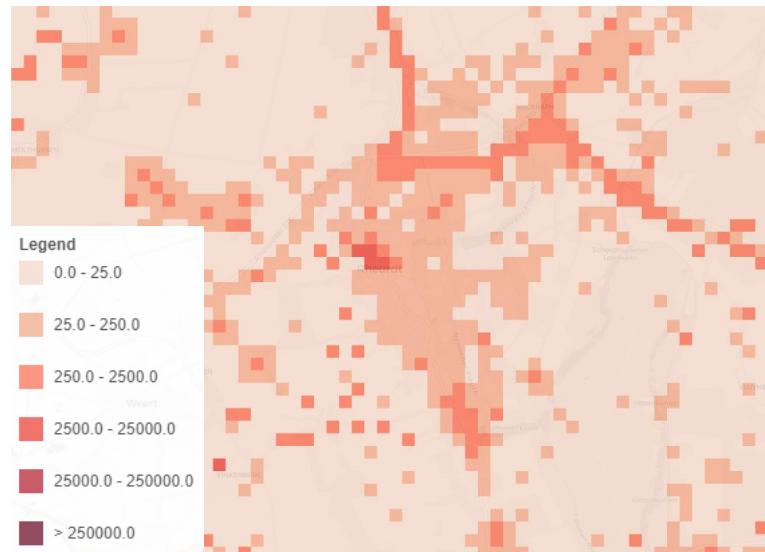
16 - 19

Ground Risk Assessment

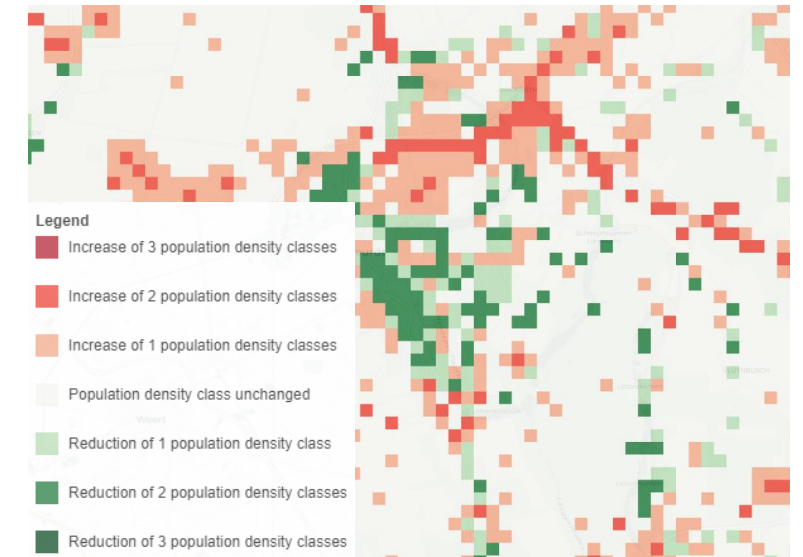
Dynamic data as basis for iGRC



Census Data



Extrapolated, sheltered, 12:00 to 15:59 h

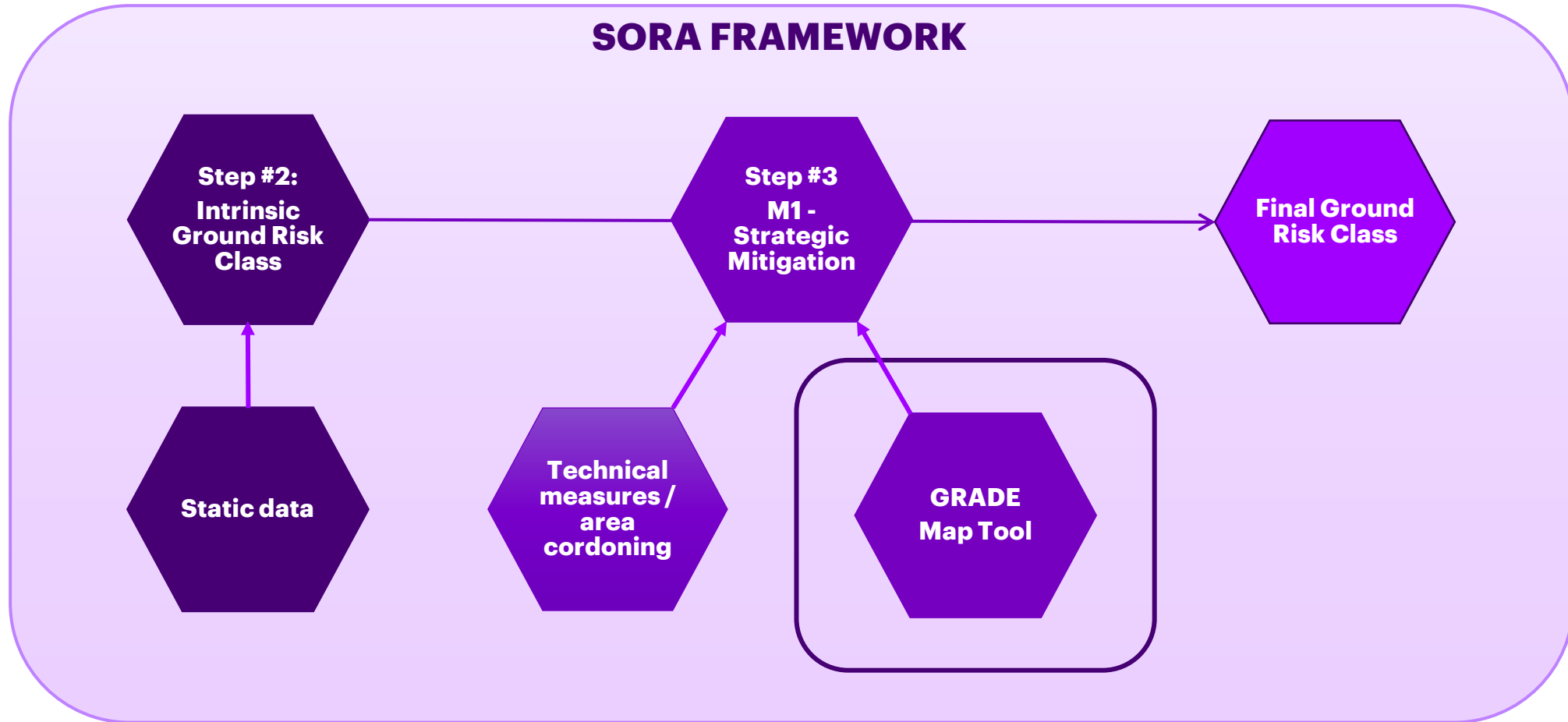


Difference, sheltered 12:00 to 15:59 h

Application within SORA

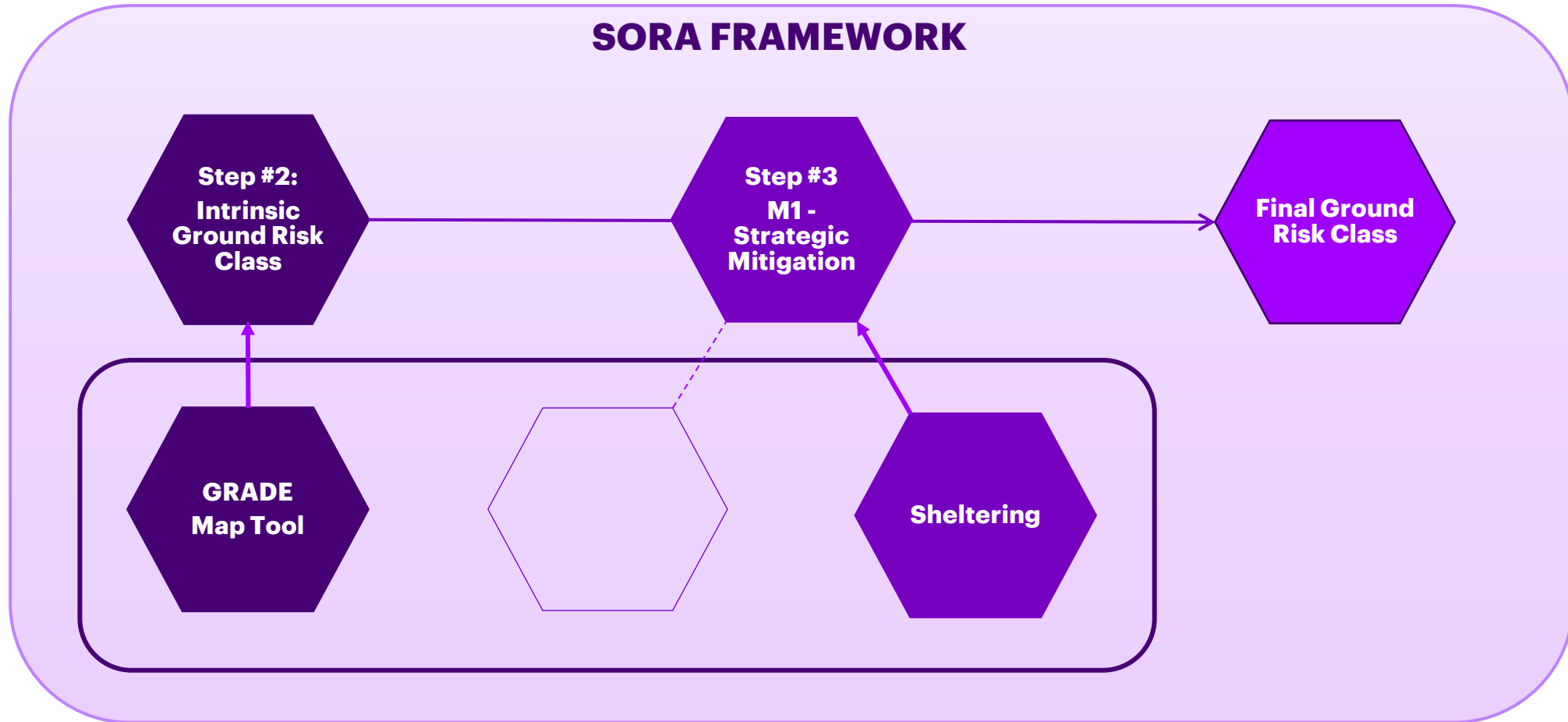
Application within SORA

Ground Risk Assessment



Application within SORA

Ground Risk Assessment



Evaluation and defining parameters

Evaluation and defining parameters

GRADE Map Tool

Map Resolution	Data Refresh rate	Shape of grid cell	Level of Confidence assessment	Privacy requirements
<ul style="list-style-type: none">• 100 x 100 m• 200 x 200 m• 500 x 500 m• 1000 x 1000 m	<ul style="list-style-type: none">• Historical dynamic data over 12 months	<ul style="list-style-type: none">• Square	<ul style="list-style-type: none">• Validate extrapolated data with 3rd party data• Localized sensibility checks	<ul style="list-style-type: none">• GDPR compliance in data sources• Min. grid size
Depending on size of operational volume and data quality	Important to cover seasonal changes	Standardized to avoid "Gerrymandering"	AMC needed to ensure commonality	Ensure privacy at source



Further performance criteria

1.

Evaluation of services by authorities

2.

Is dynamic population density always needed?

3.

Minimum dimension of a cell in populated vs. sparsely populated area?

4.

Privacy requirements

5.

Minimum threshold for reliability

6.

Historical dynamic data, how long accumulated?

7.

Methodology to assess the declared level of confidence

8.

Data sources