

# A census-derived aggregated exposure model for Japan

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## ABSTRACT

We have developed an aggregated exposure model for Japan at the municipality level. This model is entirely derived from open building data (e.g., census) and result is in an open inventory of uniformly defined building parameters available for risk assessments. The Japanese ESTAT website (<https://www.e-stat.go.jp/en>) provided information about building type (apartments, detached houses, tenements) and their number, dwelling type (used exclusively for living, and those also used for commercial or other purposes), their number and size, tenure type (owned houses, issued houses, and rented houses), construction material type (wooden and non-wooden), year of construction, number of stories, persons per dwelling and size of dwelling (area in square meters). After interpreting this information, different combinations of building type, construction material, and number of stories were mapped to the GEM taxonomy-based building classes. Furthermore, building parameters required for loss assessments (e.g., average floor area of a dwelling, replacement cost per unit area of a dwelling, number of people per dwelling) were assigned to the identified building class at the municipality level and stored in a database open for public access. This model thus represents an open catalogue of rules for mapping Japanese building attributes to a GEM taxonomy-based building class and, in doing so, creates an opportunity for the scientific and non-scientific community to collaborate on the assessment, correction, and expansion of individual aspects of the aggregated exposure model and hopefully encourages the development of such open aggregated exposure models for other countries.

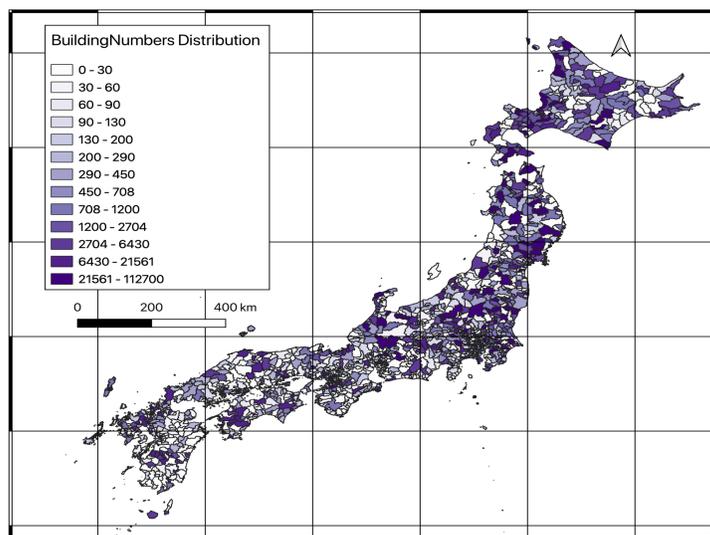


Fig. 1: Map showing the number of buildings distribution for Japan

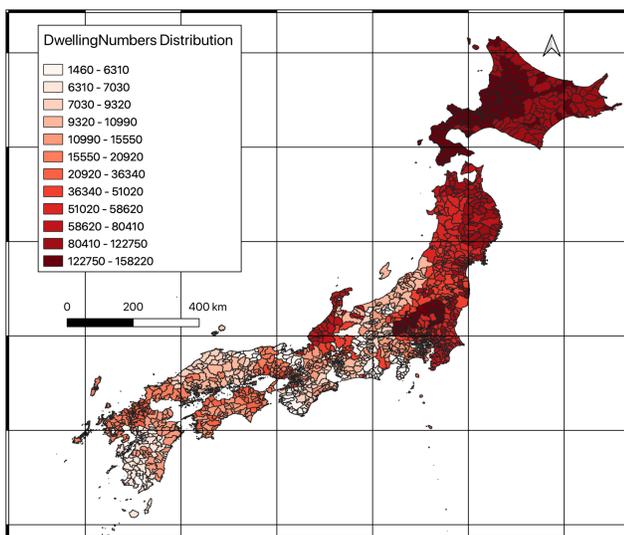


Fig. 2: Map showing the number of dwellings distribution for Japan

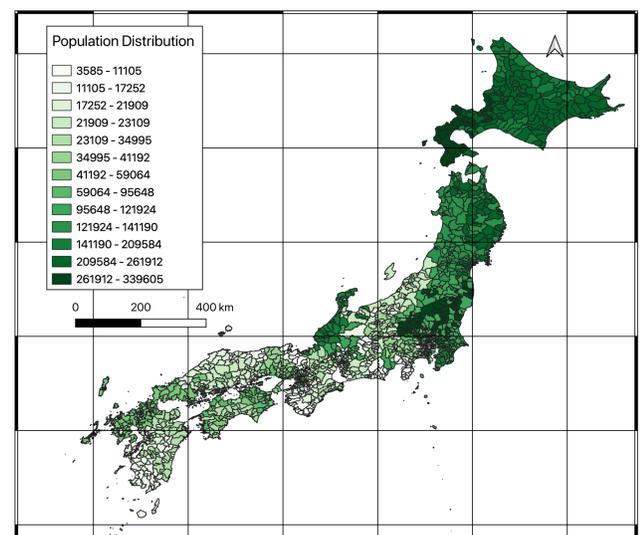


Fig. 3: Map showing the population distribution for Japan

## OPEN JAPAN BUILDING AND POPULATION DATA

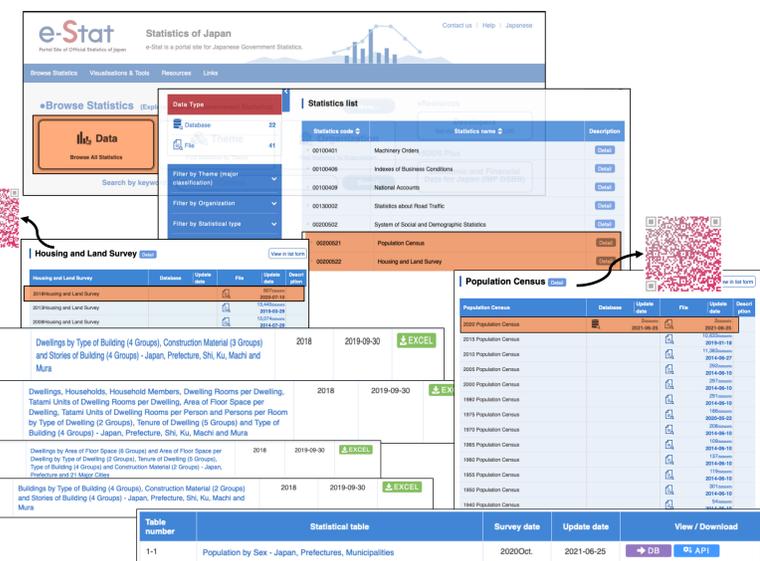


Fig. 4: Above images are showing the Japanese statistics database. Scan the QR code to see housing and population data.

## GEM TAXONOMY MAPPING

The building attributes extracted from the census data are mapped to a GEM taxonomic string (2). A sample showing below explains the method. From the literature it was identified that a wooden detached house in Japan was made of post and beam lateral load resisting system (1).

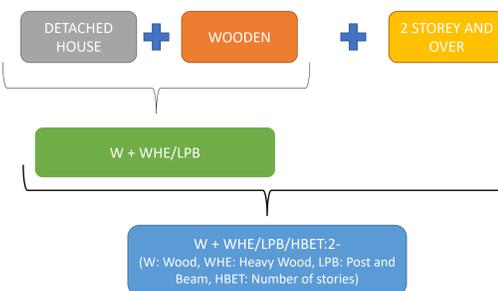


Fig. 5: Flow chart showing the mapping of building attributes (2 and over storeys wooden detached house) in the census data to GEM taxonomy string

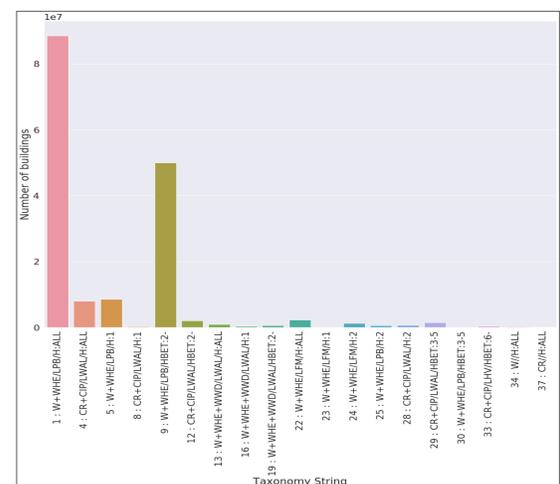


Fig. 6: Distribution of building for different GEM taxonomic strings for Japan

## AGGREGATED EXPOSURE MODEL DATABASE

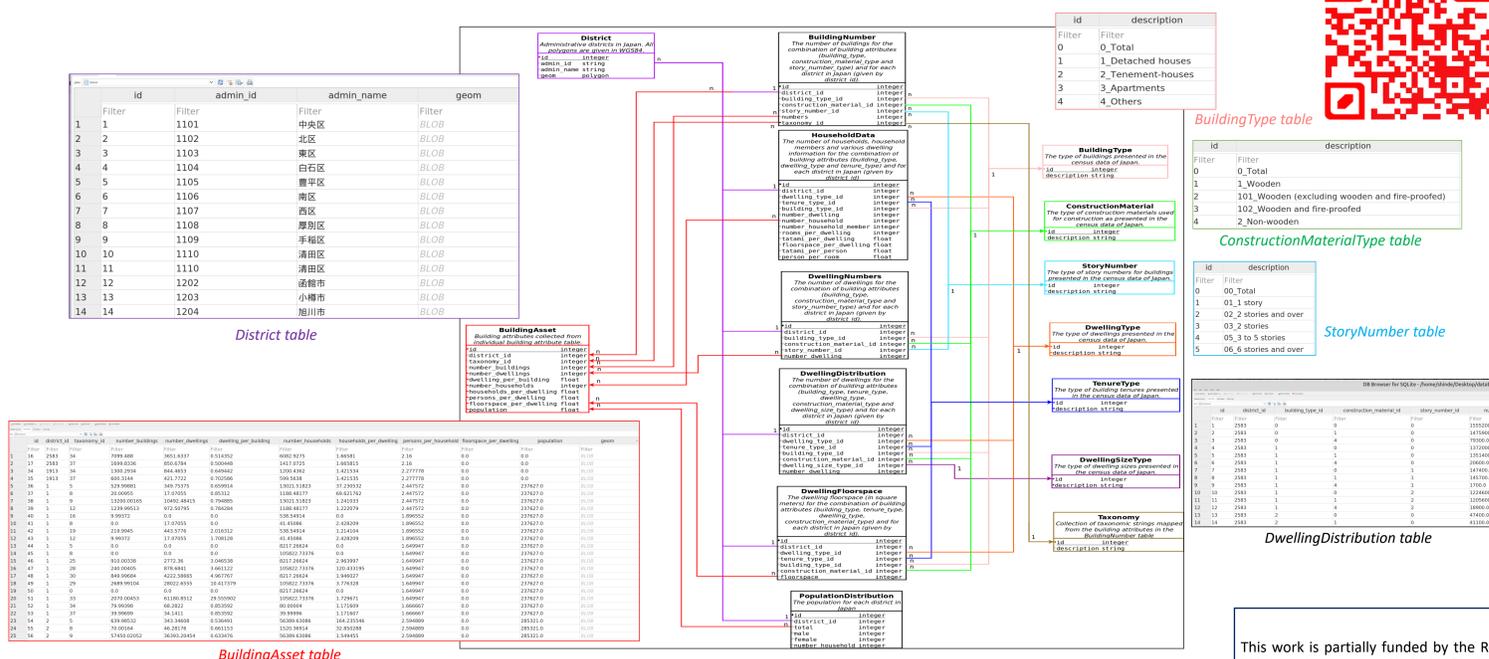


Fig. 7: Flow chart showing the database structure and images of the corresponding database tables. The colours of the arrow lines and the table borders, are to simplify visualisation of the connections between the various tables. (The database in a csv format can be accessed using the QR code)

## OBJECTIVES

- To create a **free and open** database of aggregated exposure model.
- Invite the **scientific and non-scientific** community to collaborate on the assessment, correction, and expansion of individual aspects of the aggregated exposure model.
- Encourage **collaboration** on mapping of building taxonomic terms.
- Worldwide collaboration** and access accessible via our Gitlab repository (<https://git.gfz-potsdam.de/dynamicexposure/globaldynamicexposure/exposure-japan>).
- Encourage the development of such open aggregated exposure models for other countries.

## REFERENCES

- Arnold C., Timber Construction, Building Systems Development, USA
- Brzes S., et al. (2013) GEM Building Taxonomy Version 2.0, GEM technical report 2013-02

## Acknowledgements

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