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## Gridded Harmonized Dataset for the Spatial Location of the Global Critical Infrastructure Network

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Critical infrastructure (CI) is fundamental for the functioning of a society and forms the backbone for socio-economic development. Natural hazards, however, pose a major threat to CI. The destruction of CI, and the disruption of essential services they provide may hamper societies and economies. Moreover, the overall risk for CI is expected to rise. This is due climate change (i.e. intensification and more frequent hazards), and socio-economic development (i.e. increase in the amount and value of CI).

Building sustainable and resilient infrastructure is a key to reducing the impacts of natural hazards and climate change on society. However, an in-depth knowledge of the global CI that is directly at risk for natural hazards is still lacking. The development of a harmonized dataset integrating the geospatial locations of the main CI systems at a global scale will aid to our knowledge on the CI that is exposed and at risk for natural hazards.

We present a first-of-its-kind globally consistent spatial dataset for the representation of CI. In this study, an index to express the spatial intensity of CI at the global scale is developed: the Critical Infrastructure System Index (CISI). The CISI is expressed in a dimensionless value ranging between 0 (being no CI intensity) and 1 (being highest CI intensity). The CISI aggregates high resolution spatial information of CI based on OpenStreetMap (OSM) data. For the development of this index, a total of 34 CI types (e.g. primary roads, waste-water plants and hospitals) are defined and categorized under seven overarching CI systems: transportation, energy, tele-communication, waste, water, health and education. Spatial data on these CI types are extracted by using a selection of 78 OSM tags. The detailed spatial data is rasterized into a harmonized and consistent dataset with a resolution of 0.1x0.1 degrees.

This novel global dataset will be a valuable starting point for policy makers, planners, and researchers in several fields. The dataset can be deployed as a tool to gain insights in the current landscape of the CI network, to identify hotspots of CI, and to gain exposure information for risk assessments. We use open data hosted by OSM, and provide code for further use and development. In this study, we demonstrate the database and CISI at a global scale, but the publicly accessible code can also be used to further develop the dataset with latest releases of data on CI provided by OSM as well as other (open) sources for any location and any resolution.

