Landsat-based Global Urban Area Map

1. IDENTIFICATION INFORMATION

Name	Landsat-based Global Urban Area Map
Abbreviation	LaGURAM
Metadata Identifier	LaGURAM20210525120001-DIAS20210525095249-en

2. CONTACT

2.1 CONTACT on DATASET

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5. DATE OF THIS DOCUMENT

2021-05-25

6. DATE OF DATASET

creation : 2014-12-01

7. DATASET OVERVIEW

7.1 Abstract

The Landsat-based Global Urban Area Map (LaGURAM) is a dataset of urban/non-urban classification map developed from time-series Landsat data provided by US Geological Survey. In the dataset, "urban" is defined with existence of built-up areas and pavement, a physical aspect of urban areas. The data is developed primarily for 1990, 2000, 2005, and 2010 although the target year can be flexible to users' request. The data has been initially developed for major cities of the world. The data will be improved in accuracy especially for regions of interest requested by end users. Please contact with the author if you have any interest in the LaGURAM dataset.

7.2 Topic Category(ISO19139)

economy

planningCadastre

structure

7.3 Temporal Extent

Begin Date	1990-01-01
End Date	2010-12-31

7.4 Geographic Bounding Box

North bound latitude	90
West bound longitude	-180
Eastbound longitude	180
South bound latitude	-90

7.5 Grid

Dimension Name	Dimension Size (slice number of the dimension)	Resolution Unit
row	1	30 (m)
column	1	30 (m)

7.6 Geographic Description

7.7 Keywords

7.7.1 Keywords on Dataset

Keyword Type	Keyword	Keyword thesaurus Name
theme	Disasters, Energy	GEOSS

7.7.2 Keywords on Project

7.7.2.1 Data Integration and Analysis System

Keyword Type	Keyword	Keyword thesaurus Name
theme	DIAS > Data Integration and Analysis System	No_Dictionary

7.8 Online Resource

7.9 Data Environmental Information

7.10 Distribution Information

name	version	specification

8. DATA PROCESSING

8.1 Data Processing (1)

8.1.1 General Explanation of the data producer's knowledge about the lineage of a dataset

1. Method

The algorithm of the urban extent mapping was developed for Landsat TM and ETM+ data based on a machine-learning-based algorithm named Learning with Local and Global Consistency (LLGC) with improvements for remote sensing data . Basic concept of the algorithm is as the following: (i) initiate urban extent data with course scale urban extent map; (ii) overlay Landsat data on the initial urban extent data; (iii) classify Landsat pixels based on initial urban extent data and proximity between pixel values of TM or ETM+ bands; (iv) iterate the classification from (i) to (iii). The algorithm yields confidence of existence of urban development at each pixel with a range between 0 and 1. The urban extent map was generated by thresholding the confidence at 0.5. For some cities with more interest, confidence value was calculated from median values of four scenes of Landsat data for better robustness.

2. Input Data

Landsat TM and ETM+: The data was acquired primarily from public archive of cloud-free Landsat data operated by Global Land Cover Facility, University of Maryland , and supplementarily from Landsat data archive operated by US Geological Survey (USGS). The method was applied to Landsat data selected for the cities with more than one million population for 1990, 2000, 2005, and 2010. The coverage of Landsat data was 5200 scenes of WRS tiles.

Initial urban extent data: MCD12Q1 , a global land cover dataset with 500-m resolution developed from MODIS satellite data was used in the algorithm as the initial urban extent data.

Hydrology data: As the coarse resolution land cover maps is not likely to recognize major rivers in urbanized areas, such pixels needed to be excluded from initial urban extent data. USGS' s HydroSHEDS was used to identify major rivers in urbanized areas for better result of the classification.

Point coordinates of target cities: Global Rural-Urban Mapping Project (GRUMP) Settlement Points developed by Center for International Earth Science Information Network (CIESIN) was used to identify location of target cities with more than one million population. List of cities with more than one million population and those latitude/longitude coordinates was extracted from the dataset by thresholding estimated population for 2000.

3. Result

The algorithm was applied to the input data and generated urban extent data for 1990, 2000, 2005, and 2010. For better usefulness of the output data, the data was organized into Google Map' s Tile Mapping System with zoom level of 10. Size of each tile is approximately 40 km x 40 km. Number of tiles is 22,217 for the target coverage.

Quality of the data was assessed by kappa coefficient with initial urban extent data and also visually assessed for major cities of the world, including the data used for the exhibition "Evolution of Risk" at the Third UN World Conference on Disaster Risk Reduction.

8.1.2 Data Source

Data Source Citation Name	Description of derived parameters and processing techniques used

9. DATA REMARKS

10. DATA POLICY

10.1 Data Policy by the Data Provider

10.2 Data Policy by the Project

10.2.1 Data Integration and Analysis System

If data provider does not have data policy, DIAS Terms of Service (https://diasjp.net/en/policy/) and DIAS Privacy Policy (https://diasjp.net/en/privacypolicy/) apply.

If there is a conflict between DIAS Terms of Service and data provider's policy, the data provider's policy shall prevail.

11. LICENSE

12. DATA SOURCE ACKNOWLEDGEMENT

12.1 Acknowledge the Data Provider

This data was developed with supports by Global Facility for Disaster Reduction and Recovery, the World Bank, and Data Integration and Analysis System (DIAS), the University of Tokyo.

12.2 Acknowledge the Project

12.2.1 Data Integration and Analysis System

If you plan to use this dataset for a conference presentation, paper, journal article, or report etc., please include acknowledgments referred to following examples. If the data provider describes examples of acknowledgments, include them as well.

" In this study, [Name of Dataset] provided by [Name of Data Provider] was utilized. This dataset was also collected and provided under the Data Integration and Analysis System (DIAS), which was developed and operated by a project supported by the Ministry of Education, Culture, Sports, Science and Technology. "

13. REFERENCES

Miyazaki, H., X. Shao, K. Iwao and R. Shibasaki (2013). "An automated method for global urban area mapping by integrating ASTER satellite images and GIS data." IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing 6(2): 1-27.