Classification of artificial light sources in the Yamal Peninsula, Western Siberia
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1. Licence

2. Citation

When using the data please cite:

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The data are supplementary to:

Beamish, A., Kyba, C. C. M., Coesfeld, J., Chabrillat, S., Salzano, R., & Salvatori, R. (2020). Deliverable 3.2.1: A technical report on the assessment of the capabilities and limitations of advanced optical satellite missions for snow, vegetation, and gas flaring mapping applications in Arctic areas. German Research Centre for Geosciences GFZ. https://doi.org/10.2312/GFZ.1.4.2020.001

3. Data Description

The Radiance Light Trends app was used to identify artificial light sources on the Yamal Peninsula in Russia. In order to determine whether a location was lit, a threshold of 5 nW/cm² sr (displayed in yellow in the Radiance Light Trends app) was defined. Visible band daytime imagery from Google Maps and Bing Maps was then used to identify what type of human activity was responsible for the light. The positions of the 78 lit areas and their light source classification are provided in a csv table and kmz file. The classes are defined as: industry, industry / flare, community, ship/ airport, road, water and unknown.

This data publication includes the artificial light sources on the Yamal Penninsula (Western Siberia) in .csv and .kmz formats and a python code that identifies areas with bright light emissions in the arctic.

4. Code Description

4.1. Data source and thresholds

Monthly datasets of radiance from the Visible Infrared Imaging Radiometer Suite Day/Night Band (DNB) were downloaded from the Earth Observation Group (EOG) and analyzed individually for the months November to February during the period for which data was available (2012-2019). A boundary of the Arctic was defined as 60°N; data are only available up to 75°N. We used data without the “stray light correction” applied, and recommend that other users also use this dataset. Pixels were considered lit if they had a radiance above a specified value in nW/cm²sr, and areas with adjacent lit pixels were agglomerated into individual “lit sites”. The thresholds are by default set to 5, 10 and 20 nW/cm²sr.

4.2. Analysis of lit pixels:

In order to determine the total number of lit sites per month for a specified threshold, a clustering function loops over each pixel to check whether a neighboring pixel is also defined as lit. The input of this function is a binary array consisting of zeros for dark pixels and ones for sites with radiance above the defined threshold. Each cluster gets assigned a unique component label which can then be used to identify the total number of objects per month in the end. The total lit area per inspected month is calculated by looping though each lit pixel and summing up the individual area based on its latitudinal position.

For each threshold definition, the resulting data is plotted over time as scatter plot. Additionally, a linear regression model is computed using the seaborn regplot function displaying the corresponding function and confidence intervals.

5. File description

- Artifical_Light_Yamal_Peninsula.csv
- Artifical_Light_Yamal_Peninsula.kmz
- python_clustering_artifical_light_Arctic.py

5.1. Description of Artificial_Light_Yamal_Penninsula.csv

Column header	unit	Description
FID	-	Sample Identifier
Latitude	DD.dddd	Latitude in WGS84 in decimal degrees
Longitude	DD.dddd	Longitude in WGS84 in decimal degrees
Source_class	Industry, Industry /Flare, Community, Ship/ airport, Road, Water, Unknown	Classification which type of source is responsible for corresponding lit site

References:

Beamish, A., Kyba, C. C. M., Coesfeld, J., Chabrillat, S., Salzano, R., & Salvatori, R. (2020). Deliverable 3.2.1: A technical report on the assessment of the capabilities and limitations of advanced optical satellite missions for snow, vegetation, and gas flaring mapping applications in Arctic areas. German Research Centre for Geosciences GFZ. https://doi.org/10.2312/GFZ.1.4.2020.001