Night-time light remote sensing for global sustainability

Overview

The United Nations 2030 Agenda for Sustainable Development provides the world a bright path for a more sustainable future. The 2030 Agenda aims to solve a number of key issues, such as extreme poverty, income inequality, and disaster risk reduction etc. Evaluating the implementation progress of the 2030 Agenda is critically important since the international community can focus on the unsolved issues far behind the 2030 Agenda. Remote sensing has played an important and indispensable role in monitoring natural resources, environment pollution as well as social development. Night-time light remote sensing, observing visible lights at night, provides a unique perspective on the human activities and socioeconomic dynamics. It has shown powerful capabilities in analyzing a number of issues in sustainable development, such as urban growth measurement, economic growth evaluation, humanitarian crisis evaluation, natural disaster damage assessment, as well as light pollution analysis.

A number of night-time light remote sensing satellites are now available. Since the 1970s, night-time light images acquired by the U.S. Defense Meteorological Satellite Program's Operational Linescan System (DMSP/OLS) have been applied to monitoring oil field combustion, estimating socioeconomic parameters and light pollution. In 2011 the Suomi National Polar-orbiting Partnership satellite's Visible Infrared Imaging Radiometer Suite (Suomi NPP/VIIRS) emerged with significantly improved performances compared with DMSP/OLS, ushering in a new era to the night-time light remote sensing community. China's Wuhan University launched Luojia-1 satellite in June 2018, providing global night-time light images at 130 m resolution. High quality night-time light remote sensing data is critical to retrieve detailed information on the geographical distribution of human population and their properties for disaster risk reduction and sustainable development.

Purpose

Although night-time light remote sensing has been applied to different issues of sustainable development, there is a significant gap between the scientists in night-time light remote sensing and users who are seeking high quality night-time light remote sensing data for sustainable development. Therefore, a systematic project of night-time light remote sensing for global collaboration and applications is urgently needed.

Activities for the period

- **Develop high resolution night-time light products for sustainable development**. The existing coarse resolution night-time light remote sensing imagery can help monitor human settlements at large scales but cannot provide sufficient spatial details at the street level. Finer resolution images are very useful in mapping human settlements details but their application to large scales is often limited. The purpose of this community activity is to highlight human settlements by integrating 30 m resolution Landsat and the coarse resolution night-time light remote sensing data. Considering that both Landsat and night-time light remote sensing have long historical archives, we expect our investigation on combining them together will also enable tracking human settlements expansion over time.
- **Develop night-time light products for sustainable development**. Develop standard night-time

light products, including poverty maps, regional inequality maps and urban growth trajectory, for general applications of sustainable development based on the high resolution night-time light products. Develop special night-time light products, such as humanitarian disaster maps, for hotspot areas such as extremely poor countries and conflict regions.

- **Build a data sharing network**. Exchange research ideas between different data providers and product developers. Advocate building a data sharing platform (e.g. website interface and contact information lists) from different night-time light data provider and product developers.

- **Develop a user network**. Contact current and potential users, from the social science community, the natural science community, the banking system, governmental departments as well as Non-Government Organizations (NGO), of night-time light products. Summarize the users' requirement on the night-time light products.

- **Collaborate with regional and global organizations.** Provide the night-time light products to the United Nations, NGO groups and investment agencies. Train these organizations to analyze the issues of sustainable development such as poverty, humanitarian disasters and impact of aid projects by use of night-time light products.

- **Disseminate research results.** Participation in international conferences, workshops and sessions. Publication of scientific articles.

User Engagement

- Users/stakeholders include the Asian Development Bank, United Nations Institute for Training and Research and etc.
- Users are engaged through scientific articles and direct communication.
- Collaborate to derive new research results and identify new use cases for nighttime light satellite imagery.

Future Plans

- Identify and collaborate with suitable GEO Flagships and GEO Initiatives such as 'Earth Observations in Service of the 2030 Agenda for Sustainable Development'.
- Establish linkages to other Work Programs

Resources

- National Natural Science Foundation of China (totally 1, 000, 000 CNY), Special Research Grant from Wuhan University (500, 000 CNY per year), Key Research and Development projects of the Ministry of Science and Technology, China (totally 9, 010, 000 CNY)
- In kind contributions (State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University; School of Aeronautics and Astronautics, Sun Yat-Sen University)
- Support from grant or contract for joint meetings and working group
- Night-time light images acquired from Luojia-1 satellite, owned by Wuhan University, China

Background and Previous Achievements

Prof. Deren Li leads a research group which uses night-time light remote sensing techniques to evaluate humanitarian crises in conflict areas and evaluate the economic progress in developing countries. Their research results have been widely cited by the United Nations, global media and

aid groups to support peace actions in the conflict zones. In June 2018, the research group launched Luojia-1 satellite, which is the first space-borne satellite acquiring night-time light images at near 100 m resolution. The research group has provided free data service of Luojia-1 images for global users and has supported the U.N. work for Syrian refugees. The research group has made a global network for research and application of the night-time light remote sensing. The research group at Sun Yat-Sen University lead by professor Qingling Zhang is collaborating with the Google Earth Engine team at the Alphabet Incoporation (parent company of Google) to successfully generate cloud-free NDVI mosaics from Landsat and then combined with DMSP/OLS imagery to produce 30 m resolution night-time light products worldwide.

Contributors

Participating Organizations:

- Wuhan University, China
- Sun Yat-sen University, China

Data Policy

- All data products will be delivered to GEO, participant organizations as well as the user network. The data products will be downloaded in permanent links or cloud storage.

Leadership

- Project leader: Prof. Deren Li (Wuhan University), drli@whu.edu.cn
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