In-depth review of satellite imagery / earth observation technology in official statistics
Prepared by Canada and Mexico

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Conference of European Statisticians
67th plenary session
Paris, France June 28, 2019
Earth observation (EO)

EO is the gathering of information about planet Earth’s physical, chemical and biological systems. It involves monitoring and assessing the status of, and changes in, the natural and man-made environment.

**EO examples**

- Measurements taken by a thermometer, wind gauge, ocean buoy, altimeter or seismograph
- Photographs and satellite imagery
- Radar and sonar images
- Analyses of water or soil samples
- Processed information such as maps or forecasts

Source: Group on Earth Observations (GEO)
Introduction

Satellite imagery uses have expanded over time.

Satellite imagery provide generalized data for large areas at relatively low cost:

Aligned with NSOs needs to produce more information at lower costs.

NSOs are starting to consider EO technology as a data collection instrument for purposes beyond agricultural statistics.
Scope and definition of the review

To survey how various types of satellite data and the techniques used to process or analyze them support the GSBPM

To improve coordination of statistical activities in the UNECE region, identify gaps or duplication of work, and address emerging issues
Overview of recent activities

• EO technology has developed progressively, encouraging the identification of new applications of this infrastructure data.

• Three groups are prominent fostering the use of EO data for official statistics:

  - **CEOS (The Committee on Earth Observation Satellites)**
    - Encourages international collaboration on space-borne EO missions.

  - **GEO Group on Earth Observations**
    - Seeks to make EO data more broadly available as a public good.

  - **UN Committee of Experts on Global Geospatial Information Management**
    - Highlights the importance of aligning the functions of official statistics with geo-spatial and EO expertise.
Overview of recent activities

• Three significant documents produced in recent years provide an overview of the state of the art EO and suggest some promising directions for its use by NSOs

1. **Handbook on earth observation for official statistics**
   Guide for NSOs with limited experience producing official statistics from EO data

2. **Earth observation in support of Sustainable Development Goals**
   Informs all sectors of society on the contribution of geospatial information, EO data and other data sources to the 2030 Agenda

3. **Handbook on remote sensing for agricultural statistics**
   Provides guidelines to assess the utility of remote sensing for agricultural statistics, and how EO can be integrated into GSBPM
Overview of recent activities in selected countries & agencies

- Each overview is structured to differentiate between statistical programs currently using EO inputs and research initiatives that seek to further uses:

<table>
<thead>
<tr>
<th>Country</th>
<th>Activities and Observations</th>
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<tbody>
<tr>
<td>Eurostat</td>
<td>EO has not yet found its way into major Eurostat’s statistical programs. The exception is the Land Use and Land Cover Survey (LUCAS) every three years, where EO input is essential. Research (sensor data): • Use of Automatic Identification Systems (AIS) • SDGs • Agriculture &amp; Aquaculture • Greenhouses &amp; Solar panels</td>
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<td>INEGI</td>
<td>INEGI has produced maps of Mexico for several decades; initially in paper format and now in geospatial datasets. The current process of extracting information from satellite imagery is operator-assisted and labor intensive. Research: • Big data &amp; machine learning as an enabler of EO use • Agricultural statistics • Geospatial Data Cube</td>
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<td>Statistics Canada</td>
<td>StatCan does not conduct the collection, pre-processing, and processing of EO data. It uses data that is already prepared by other federal partner. Research: • Crop and Greenhouse area estimation • Mapping built-up area • Wetland detection • Construction starts/completions</td>
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<td>Statistik Austria</td>
<td>Statistik Austria benefits from access to high quality administrative data sources of all sorts, so the use of EO data has not yet found its way into official statistics. Research: • Using airborne laser data to improve the building register • Valuation of real property • Machine learning using EO as input</td>
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Main findings, emerging issues & new opportunities for NSOs
Current uses of EO by National Statistical Offices

01 Agricultural statistics programs
Such as crop type, area, condition and forecasting

02 Environmental accounts modules
Related to stock of land by class, forest, water, land-use change

03 SDGs
Such as land-use, climate change, water stress, water quality

04 Macro-level statistics
Related to sustainable development indicators
Main findings, emerging issues & new opportunities for NSOs
National Statistical Offices-EO research

Real-estate property valuation and updating building register
Austria & Canada

Geospatial Data Cubes
Australia & Mexico
Break new ground on two fronts:
a) Ways to process vast amounts of EO data to bring new value
b) Business case that will reduce costs for its storage and use

SDG reporting
Countries and some international organizations are involved in refining EO methods for use in this area

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Main findings, emerging issues & new opportunities for NSOs

Issues

Issues include:

- NSOs lack expertise handling EO
- EO data are voluminous
- EO data alone cannot produce statistics
- Institutional Commitment to EO Integration
Main findings, emerging issues & new opportunities for NSOs

Opportunities

If approached shrewdly, there are opportunities in EO data

1. EO strength is macro-level reporting
2. SDGs reporting is a good application of EO technology
3. Collaborate on a generalized approach to EO data use
4. Work on a consolidated approach to EO data processing
5. Availability of Analysis Ready Dataset (ARD)

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Conclusions

- EO data has a long history for the production of official statistics, mainly for agricultural and rural data
- NSOs are increasingly using them according to agency-specific interests and capacity
- There are many significant issues and implications of trying to better exploit EO inputs
- Despite the cautions about EO use, there are real opportunities for the NSO community

Recommendations

1. NSOs should use SDG reporting as a context for our priority EO-based research
2. NSOs should collaborate on a generalized approach to EO-data use
3. NSOs should collaborate with EO organizations to consolidate input requirements