TEP Urban

The Urban TEP – Joint Analysis of Multi-Source Data for Innovative Monitoring

Felix Bachofer

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urban tep

DLR

Brockmann Consult

terradue 2.0

gisat

IT4I

Motivation

Urban challenges

- Water
- Energy
- Waste
- Food
- Risk adaptation and mitigation
- Growth management
- Living conditions
- Basic services
- Transportation
- …

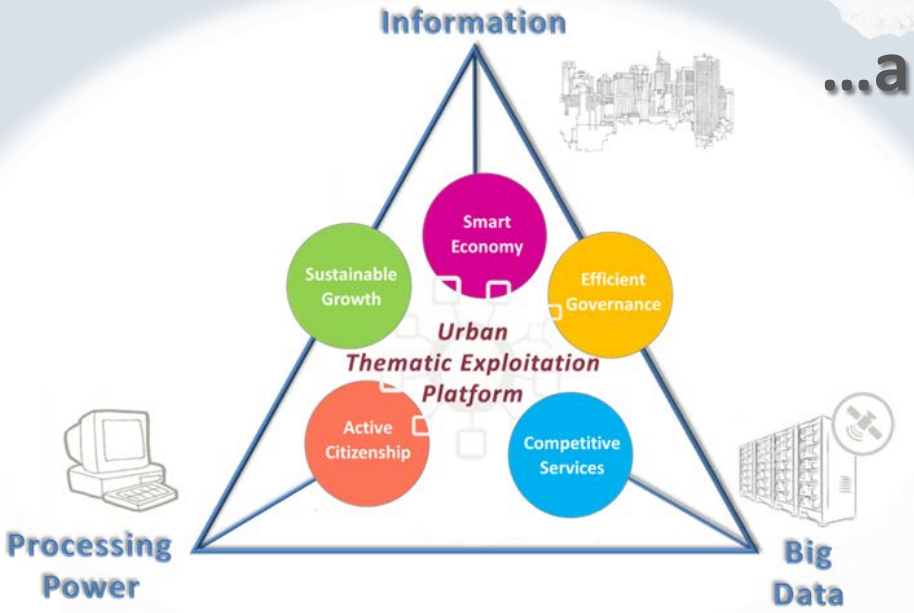
Portfolio

Data provision

Data processing

Analysis & Visualization

Knowledge exchange



...all *data* and *tools* needed...

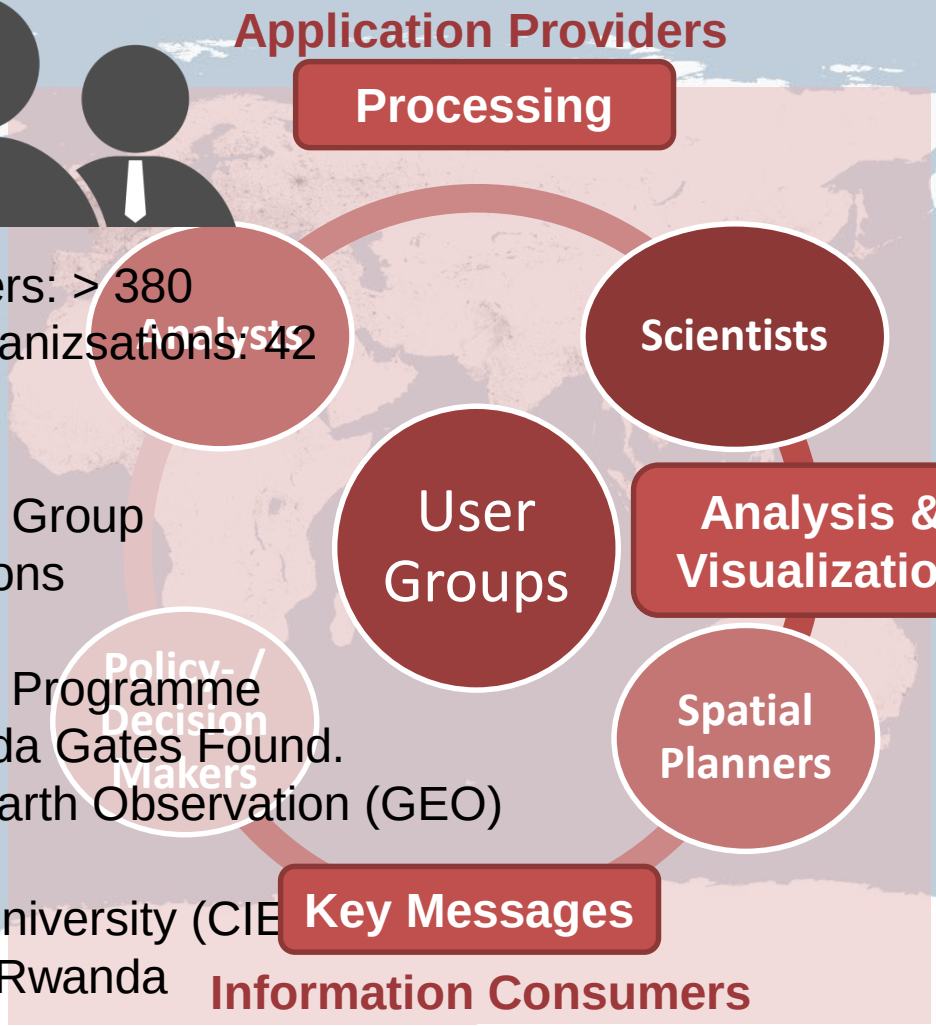
...available in ***one place!***

end-to-end solutions ready to use

User community

Number of users: > 380
Number of organizsations: 42

Key users:
- World Bank Group
- United Nations
- OECD
- World Food Programme
- Bill & Melinda Gates Found.
- Group on Earth Observation (GEO)
- WorldPop
- Columbia University (CIE
- MININFRA Rwanda
- ….



Outlook

- Kick-Off for the next funding phase took place two weeks ago
- Streamlining of operations, design and functions (until March 2019)
- Release of more functions and datasets to the urban community (e.g. processing services, WSF products)
- Striving for sustainability during next phase

Esch, T., Asamer, H., Bachofer, F., Balhar, J., Böttcher, M., …. et. all (Accepted 2018): **Digital World Meets Urban Planet - New Prospects For Evidence-based Urban Studies Arising From Joint Exploitation Of Big Data, Modern Information Technology And Open Knowledge**. Accepted: International Journal Of Digital Earth.

Platform

Urban Thematic Exploitation Platform (U-TEP)

Live Demo

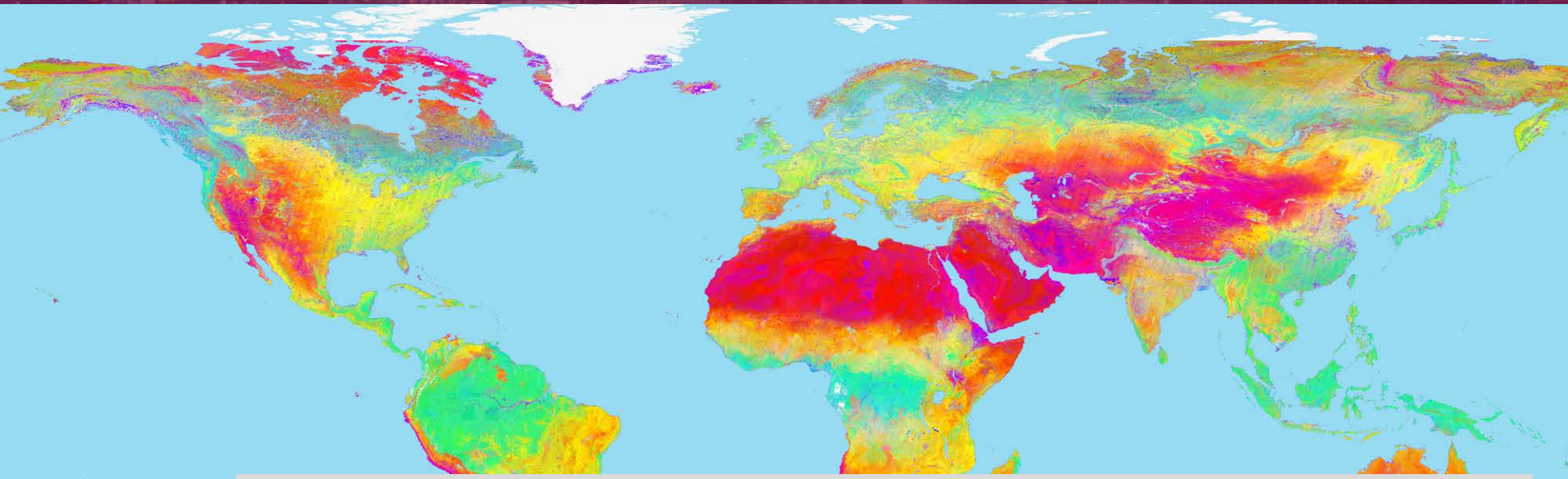
Portal
https://urban-tep.eo.esa.int/#!

Geobrowser
https://urban-tep.eo.esa.int/geobrowser/?id=portfolio#!&context=GUF%2FGUF2012-12m

TimeScan-Processing
https://urban-tep.eo.esa.int/geobrowser/?id=timescandev#!

Thematic Application
https://urban-tep.eo.esa.int/puma/tool/?id=78554&lang=en&needLogin=true

TimeScan Landsat 2015



Esch, T., S. Üreyen, J. Zeidler, A. Metz–Marconcini, A. Hirner, H. Asamer, M. Tum, M. Böttcher, S. Kuchar, V. Svaton and M. Marconcini (2018). "Exploiting big earth data from space – first experiences with the timescan processing chain." Big Earth Data: 1-20.

~460.000 Landsat-8 scenes collected in **2014-2015**	**6** spectral indices **5** temporal statistics	**30m** spatial resolution	**> 1.5 PB** intermediate products **25 TB** final product

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urban-tep.eo.esa.int

urban-tep.eu (From 01.12.2018)

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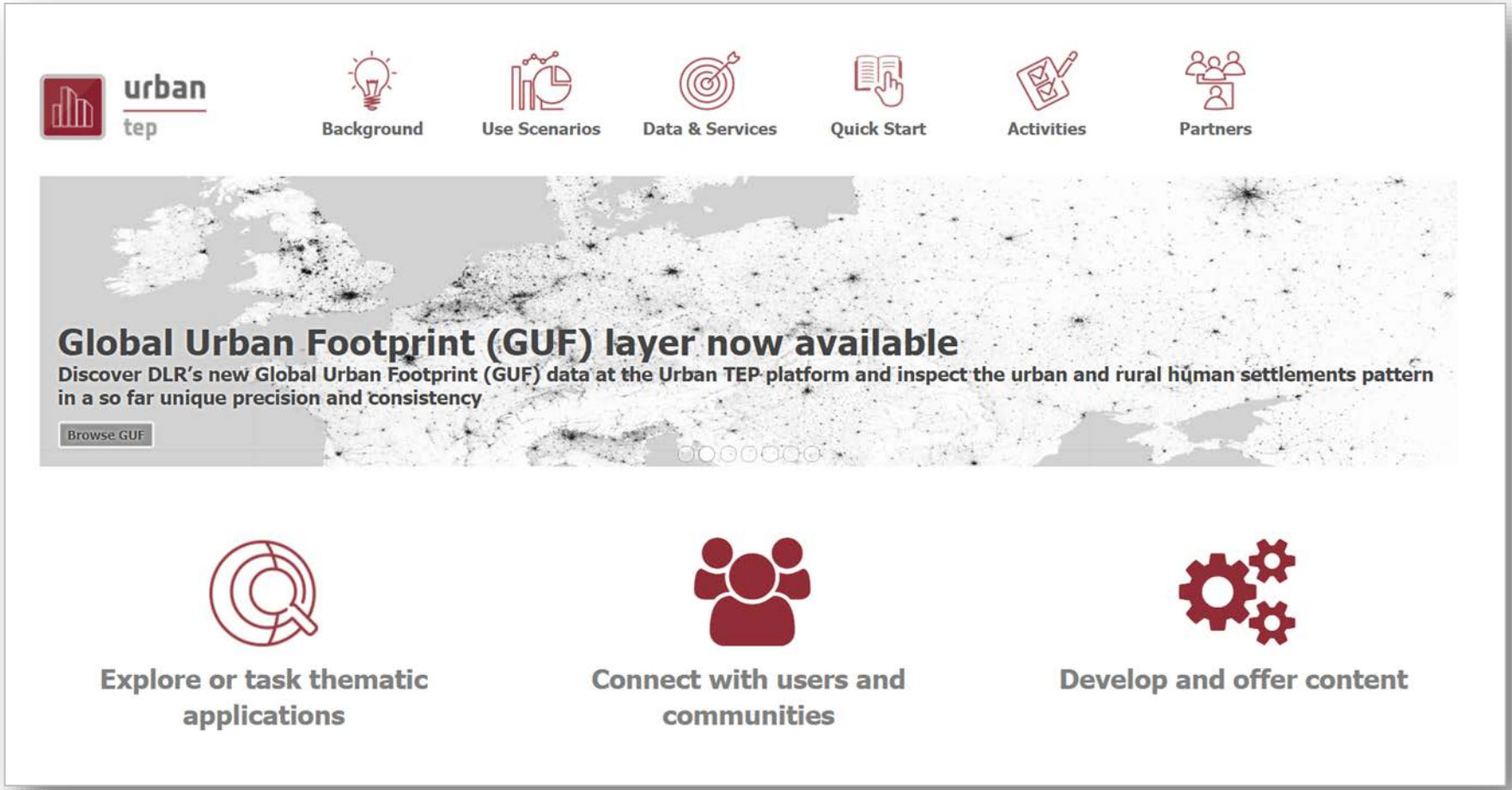
Live Demo

1) Portal
   - Develop offer content
   - Tutorials & Videos
   - Connect with user communities
2) Product Portfolio
   - GUF /WSF
   - Nightlights
   - Geotagged Tweets
3) Time Scan on Demand
   - Information Aggregation
4) VISAT (predefined Thematic Applications)
   - WSF Evolution
   - Zoom to Hanoi
   - Single date / multidate
   - Tilt view / DGM
   - Bar Chart (population / settlement)
   - Scatterplot (population / settlement)
   - Table SDG 11.3.1: Area change normalized with population change
   - Polar table (Area change / pop chnage/ Gross national income ($ / capita)
   - If time available: Land-use

Back-up Slides

Platform

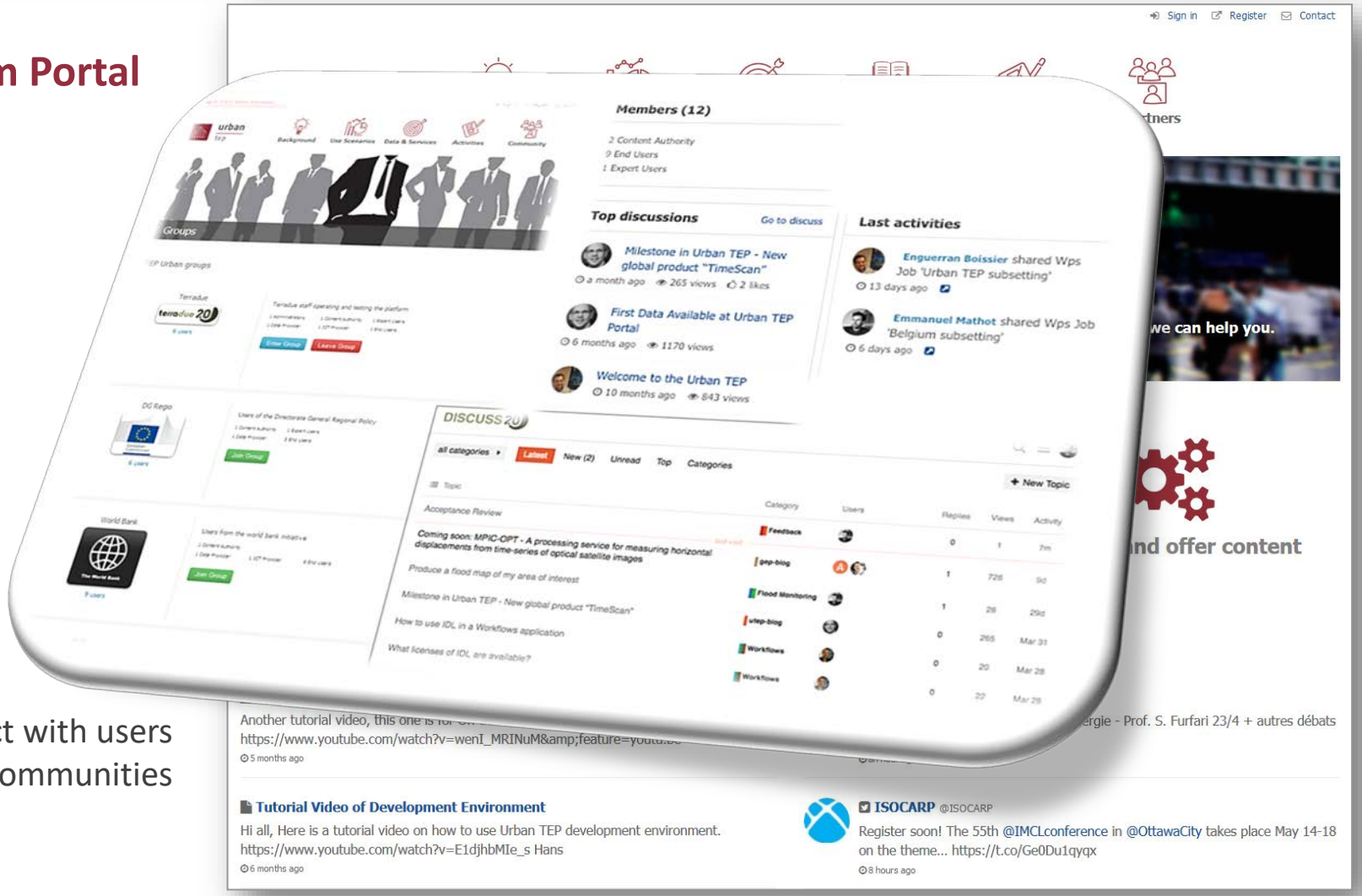
https://urban-tep.eo.esa.int



Urban Thematic Exploitation Platform (U-TEP)

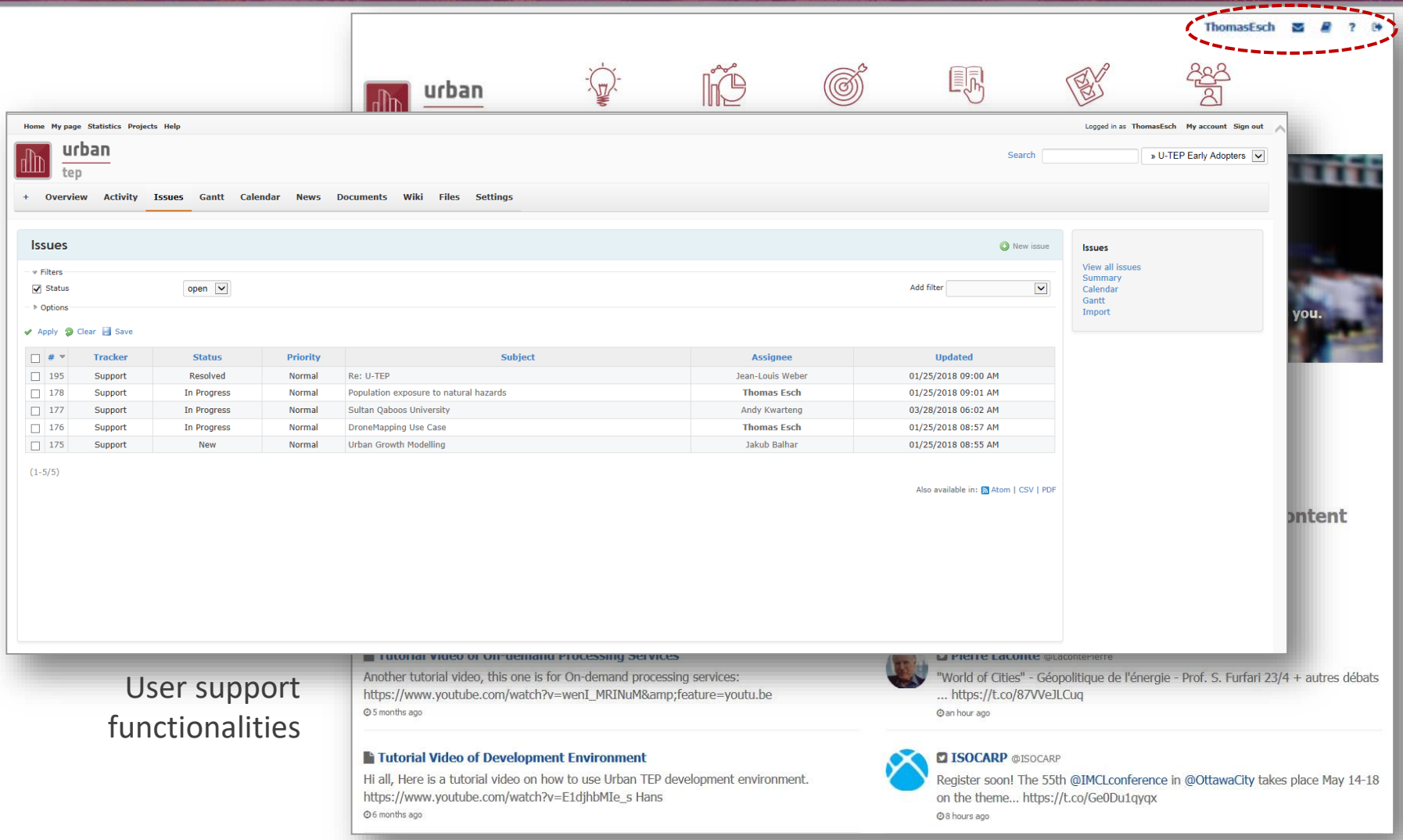
User Communities

- **Platform Portal**



Connect with users and communities

User Support – Ticketing System



User support functionalities

System Design

APIs of U-TEP's integrated software components are based on open standard specifications such as Open Cloud Computing Interface (OCCI) and Open Geospatial Consortium (OGC).

i) a web portal (geobrowser), interacting with an
ii) EO data catalogue (and associated data storage; based on Apache Lucene) and various internal and external Web Processing Services (WPS)
iii) a Visualisation and Analytics Toolbox (VISAT)

GitHub (https://github.com/urban-tep)

Deployment of Processors

Development and Deployment of Processors

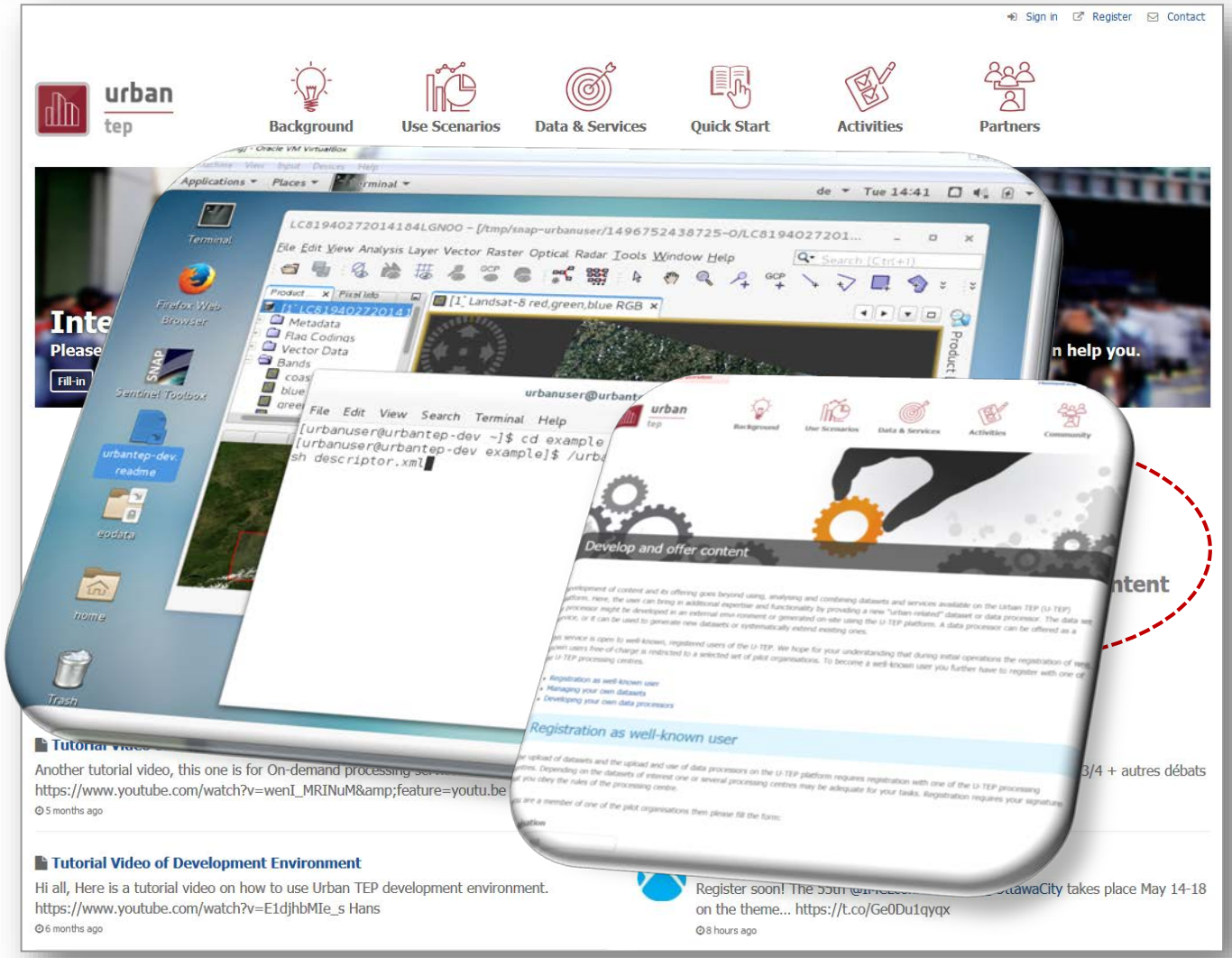
Processing Centers:

Salomon HPC cluster (Landsat data)

Calvalus cluster (Sentinel-2)

Geofarm (Sentinel-1)

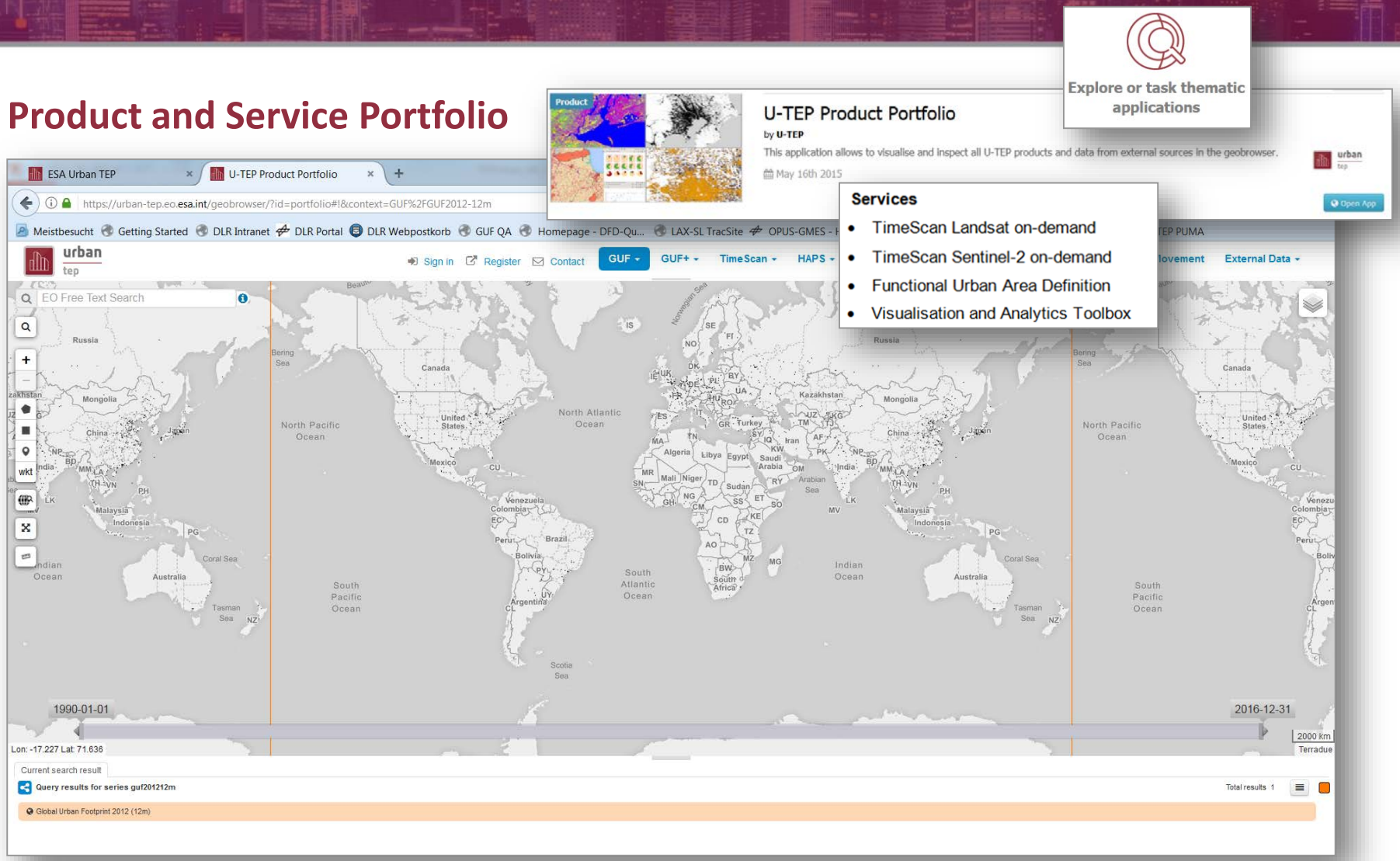
Copernicus Data and Information Access Service (DIAS)



Product Portfolio

Geobrowser Product Portfolio

- **Product and Service Portfolio**

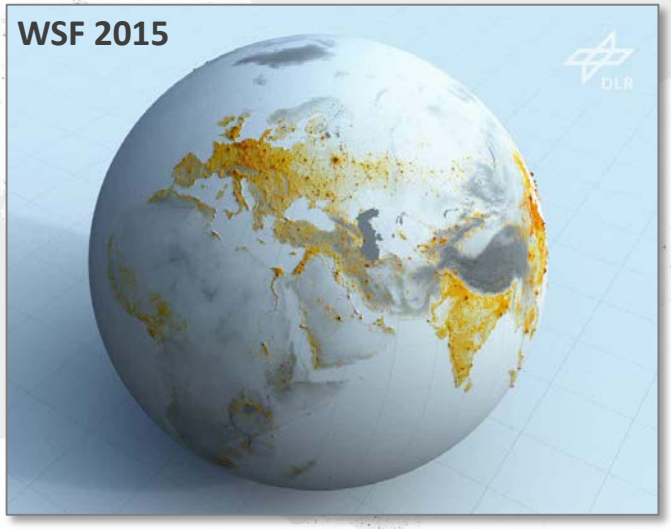


Tracing Global Urbanization: New Data from Space

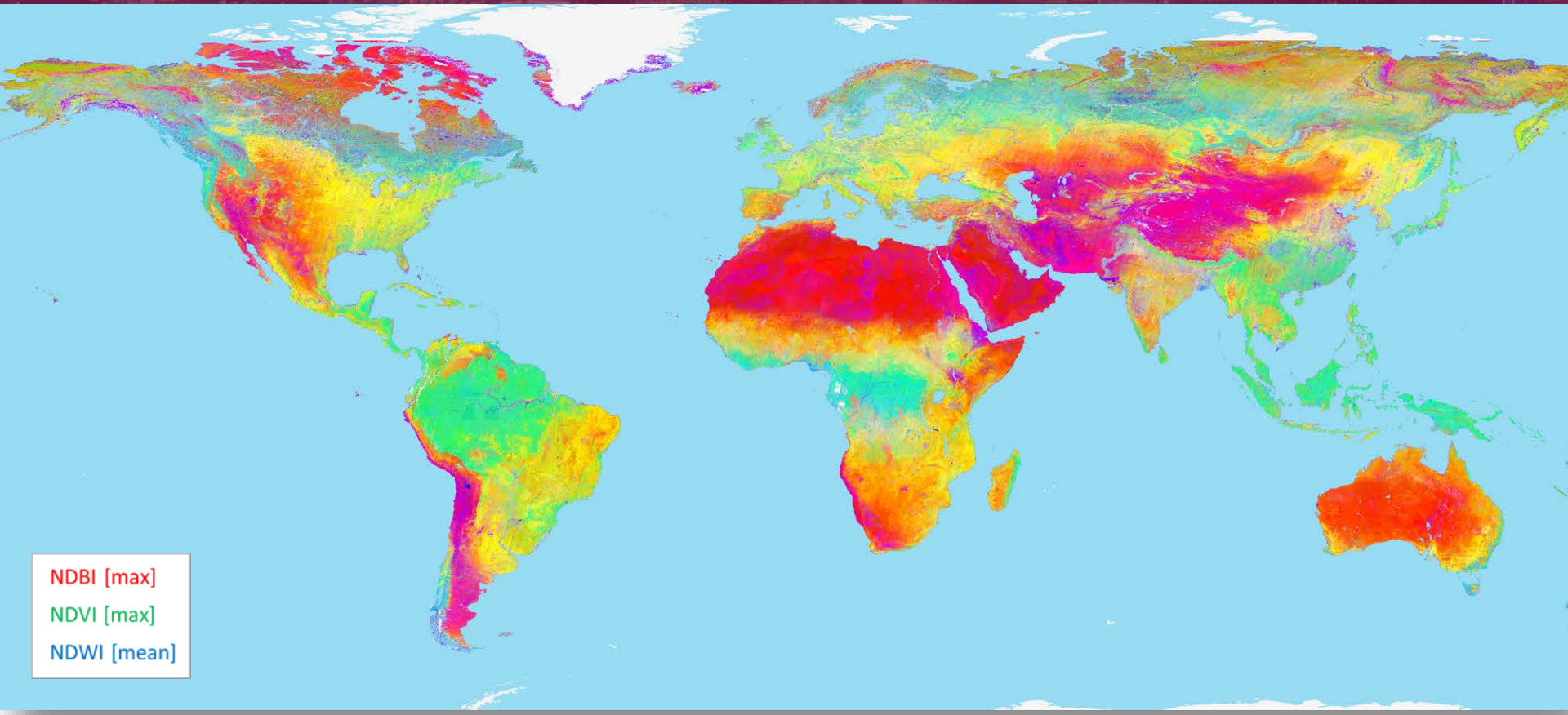
- ***Global Urban Footprint (GUF)***
  - Data base: 182,249 TerraSAR-X/TanDEM-X images (3m) collected in 2012 (308 TB)
  - Spatial resolution: 12 m (scientific use), 84m (non-profit use)
  - Release: November 2016
  - Users: >300 institutions from 43 countries
- ***World Settlement Footprint (WSF)***
  - Use of free and open data
  - Multi-sensor (Sentinel-1, Landsat/Sentinel-2)
  - Multi-date (use of all scenes available)
  - Multi-facility (DLR, U-TEP, GEE)

Product portfolio

- WSF 2015 (10m, binary mask)
- WSF 2015 Density (30m, imperviousness)
- WSF 2015 Network (settlement pattern)
- WSF Evolution (30m, 1984-2015)
- WSF/GUF 3D (average building volume)



World Settlement Footprint: TimeScan Landsat 2015



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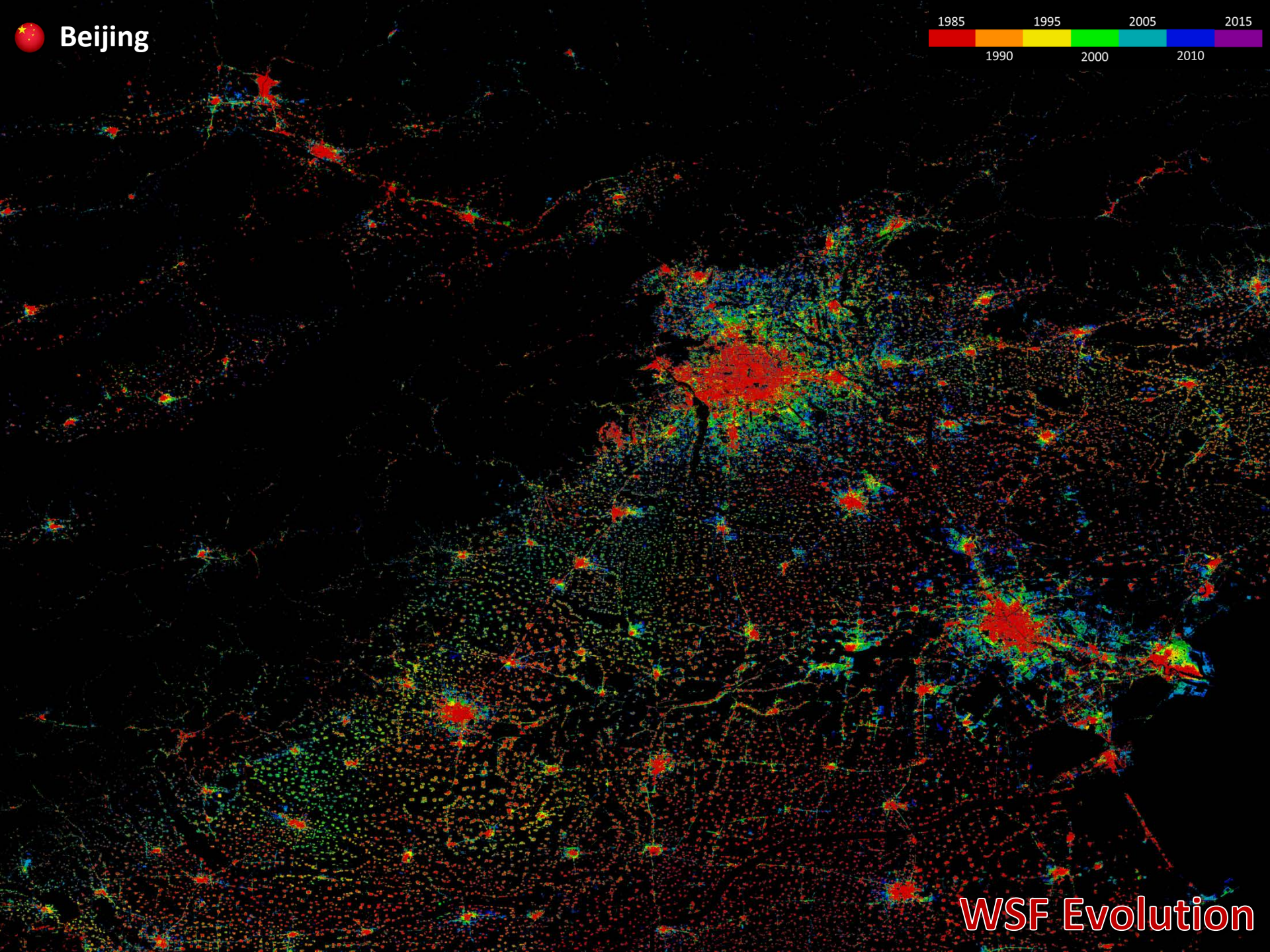
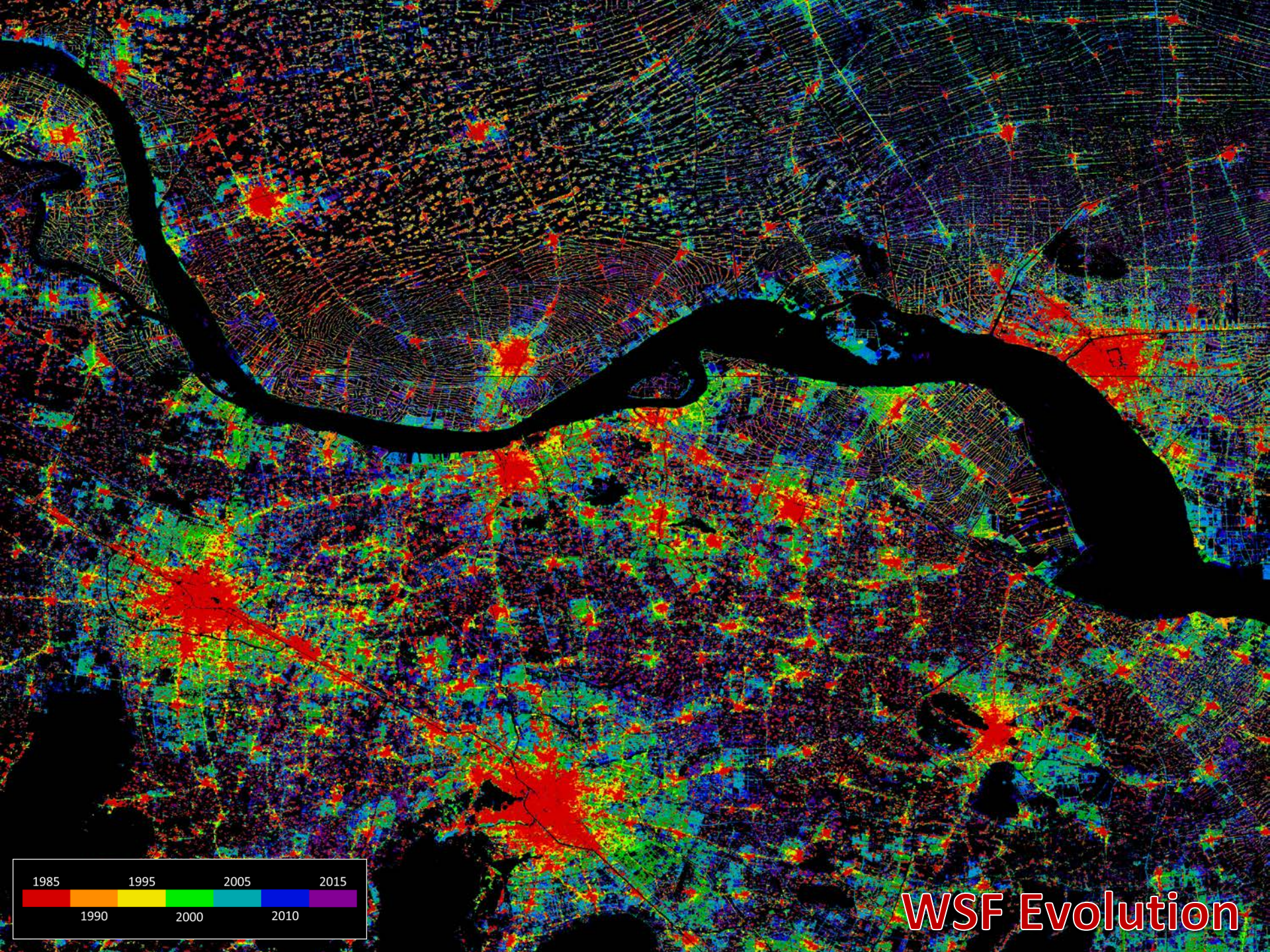
WSF


Beijing
1985
1990
1995
2000
2005
2010
2015
WSF Evolution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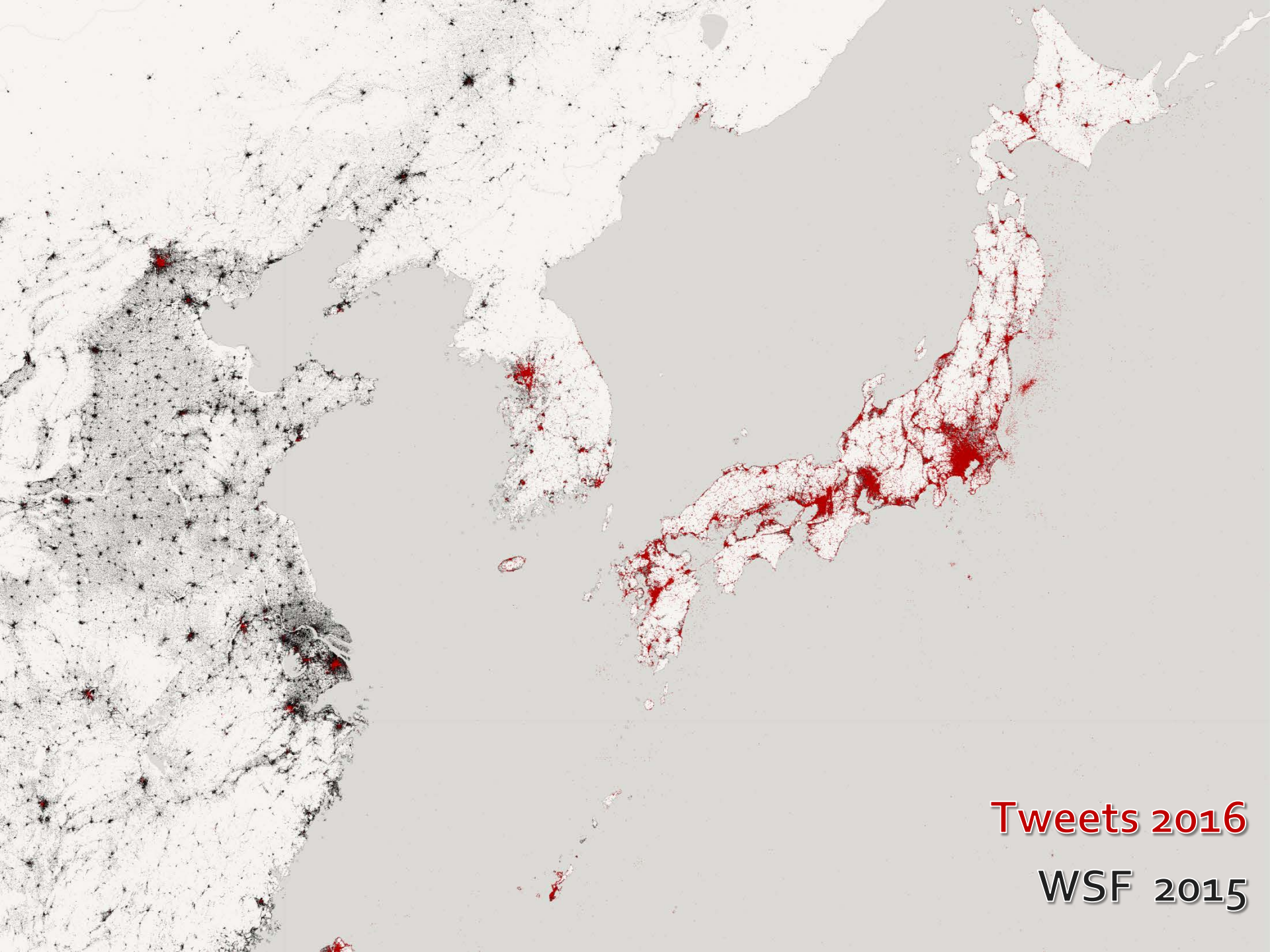

Tweets 2016
WSF 2015

High Resolution / Local Level

E.g. Pilot User: World Bank

Use case: ***UAV Mapping Service***

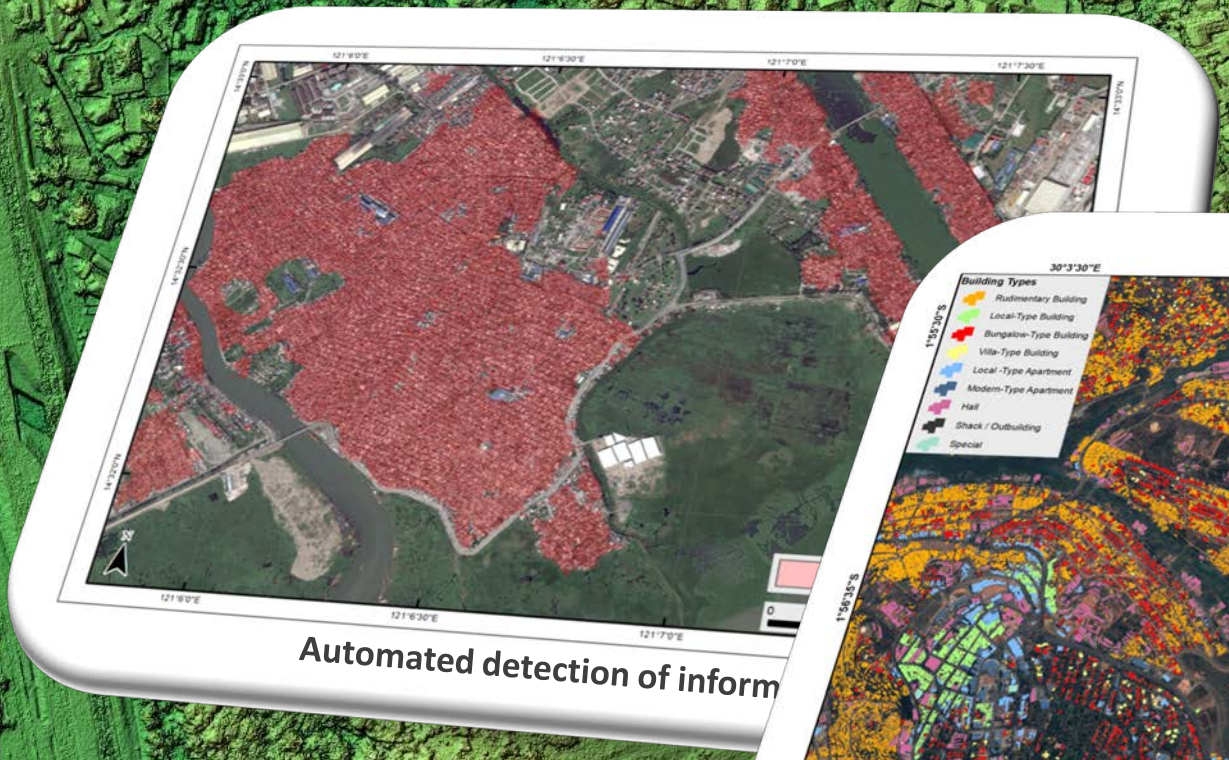
Motivation: Demonstration of an approach for UAV mass data processing to orthomosaic and DTM (test area: Dar es Salaam, Tanzania, ~100 sqkm, 11832 images).

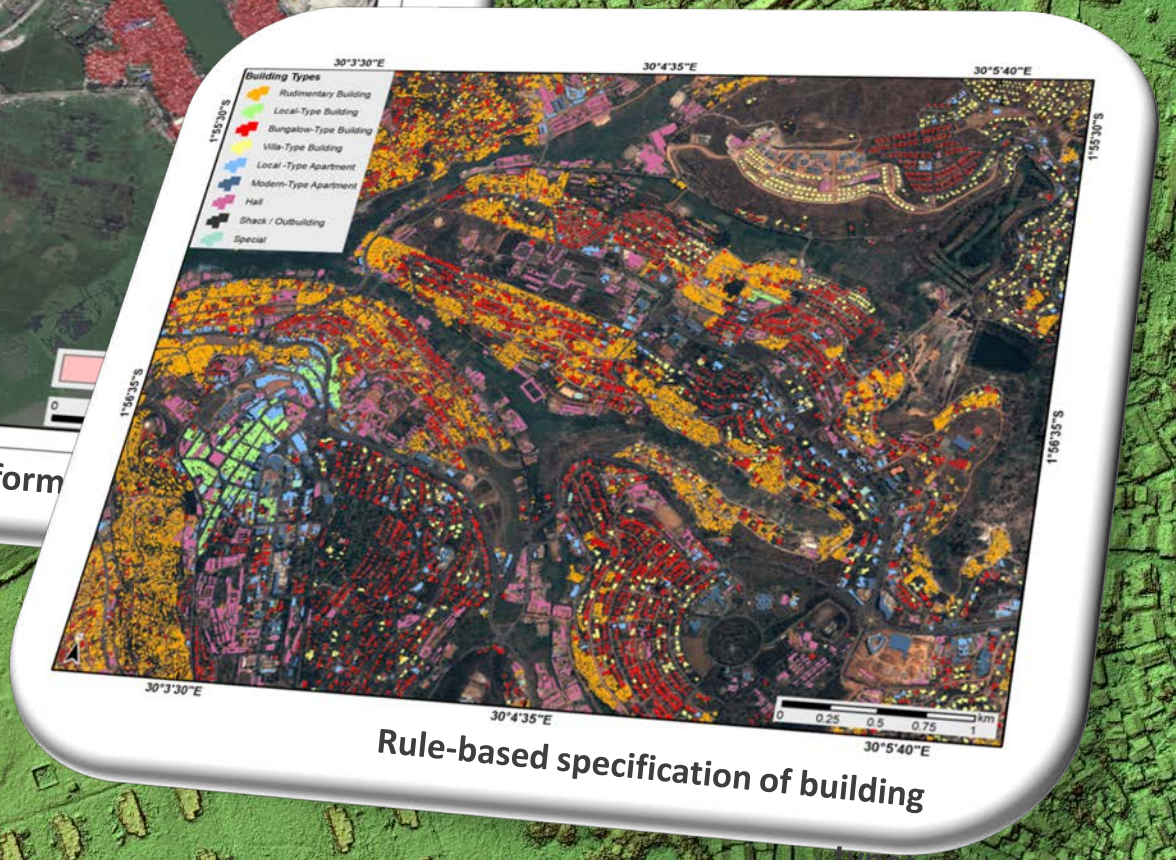
Methods: Orientation, matching , DTM processing, orthoprojection and mosaicing.

Results: 5cm resolution orthomosaic and 20cm DSM delivered to World Bank.

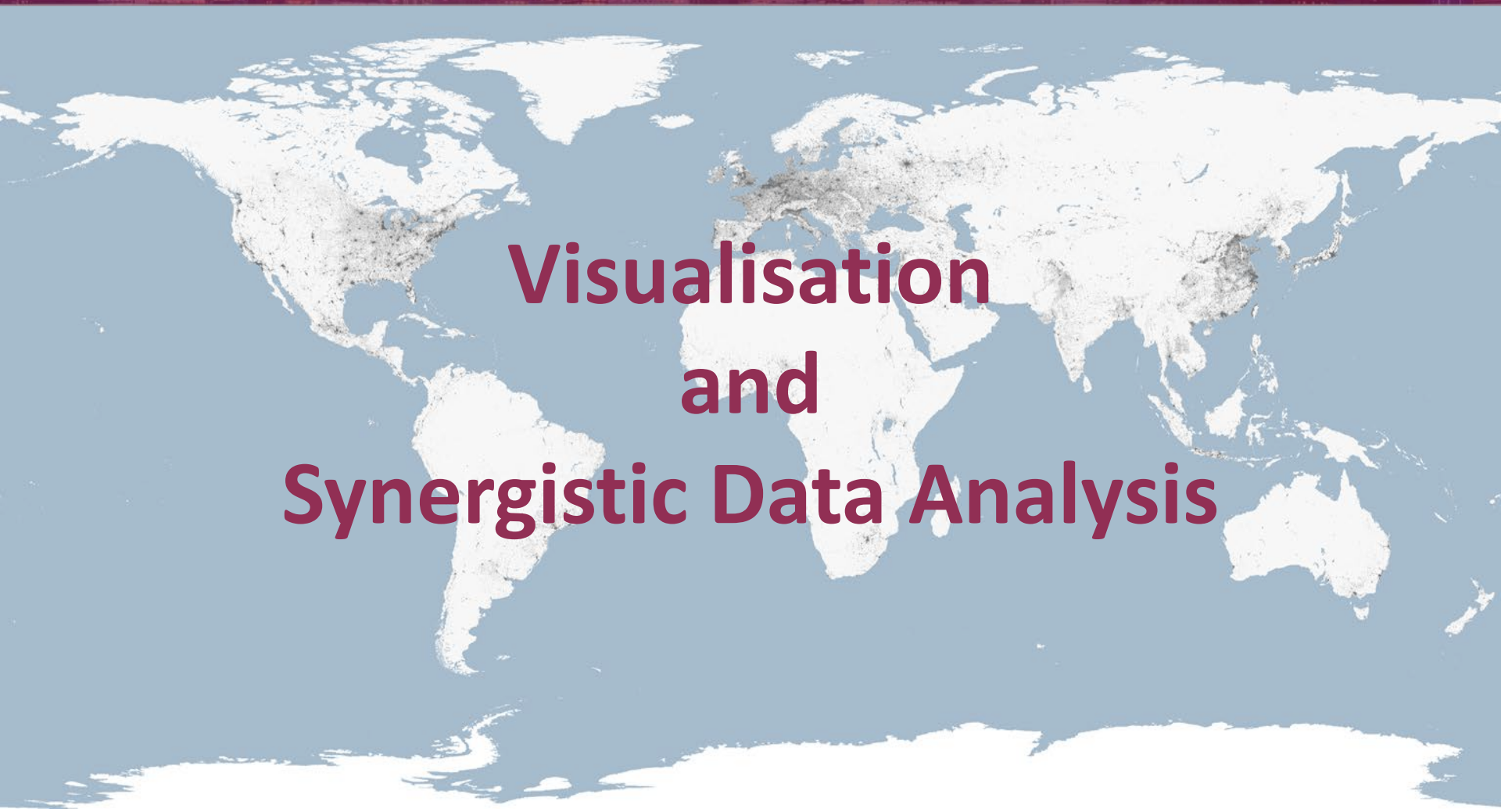
High Resolution / Local Level

Derived Digital Surface Model



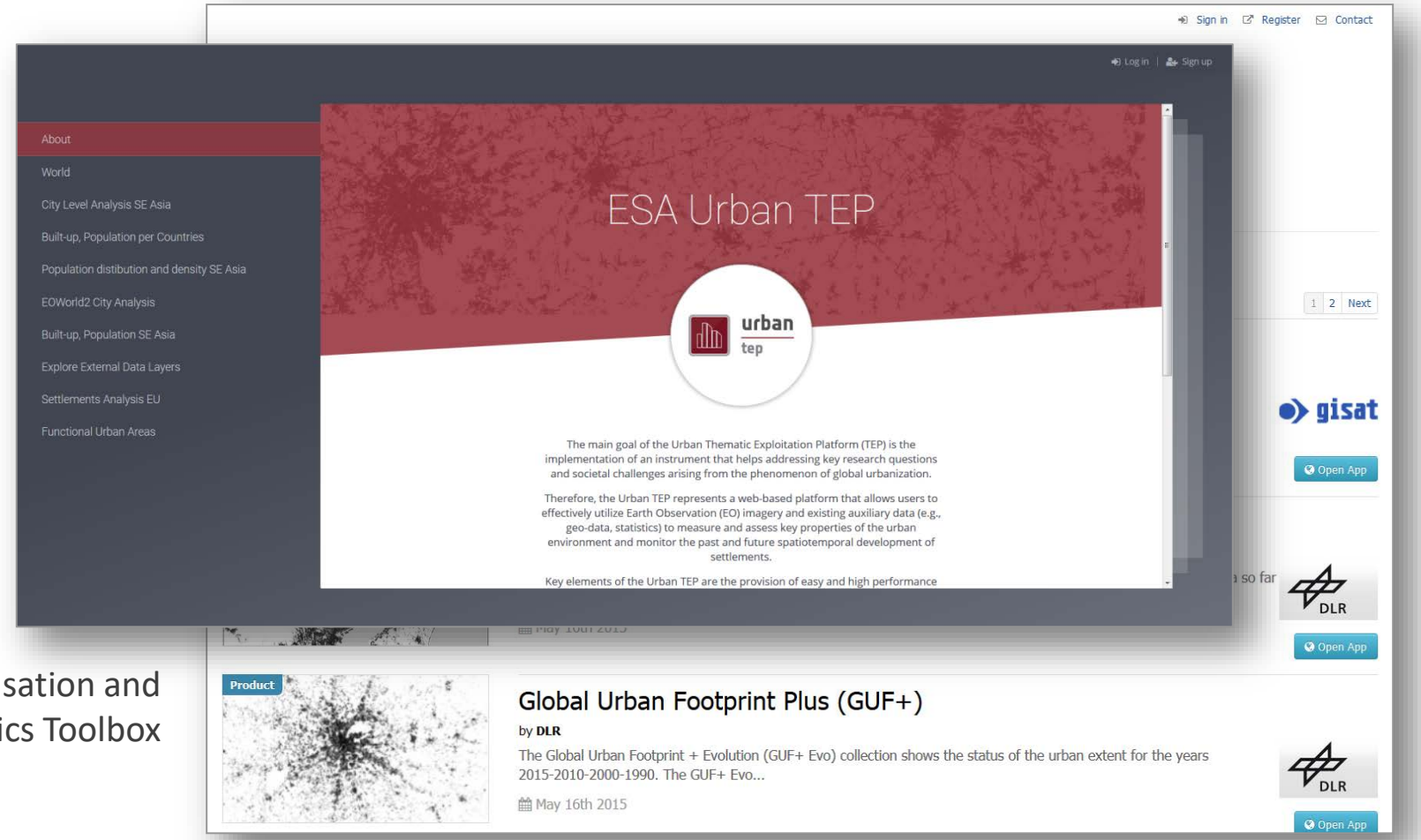


Thematic Applications

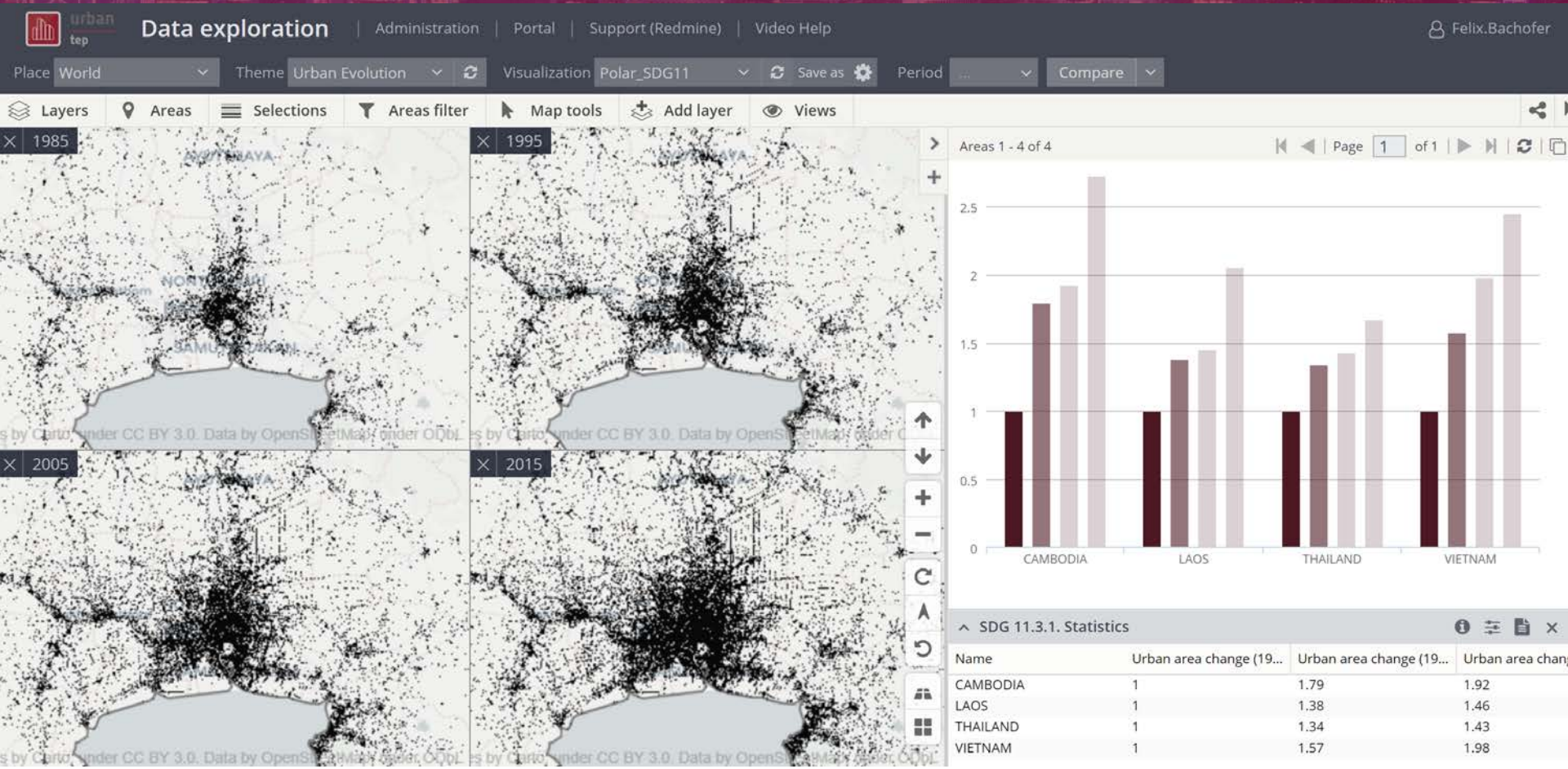


Visualisation and Synergistic Data Analysis

Thematic Applications

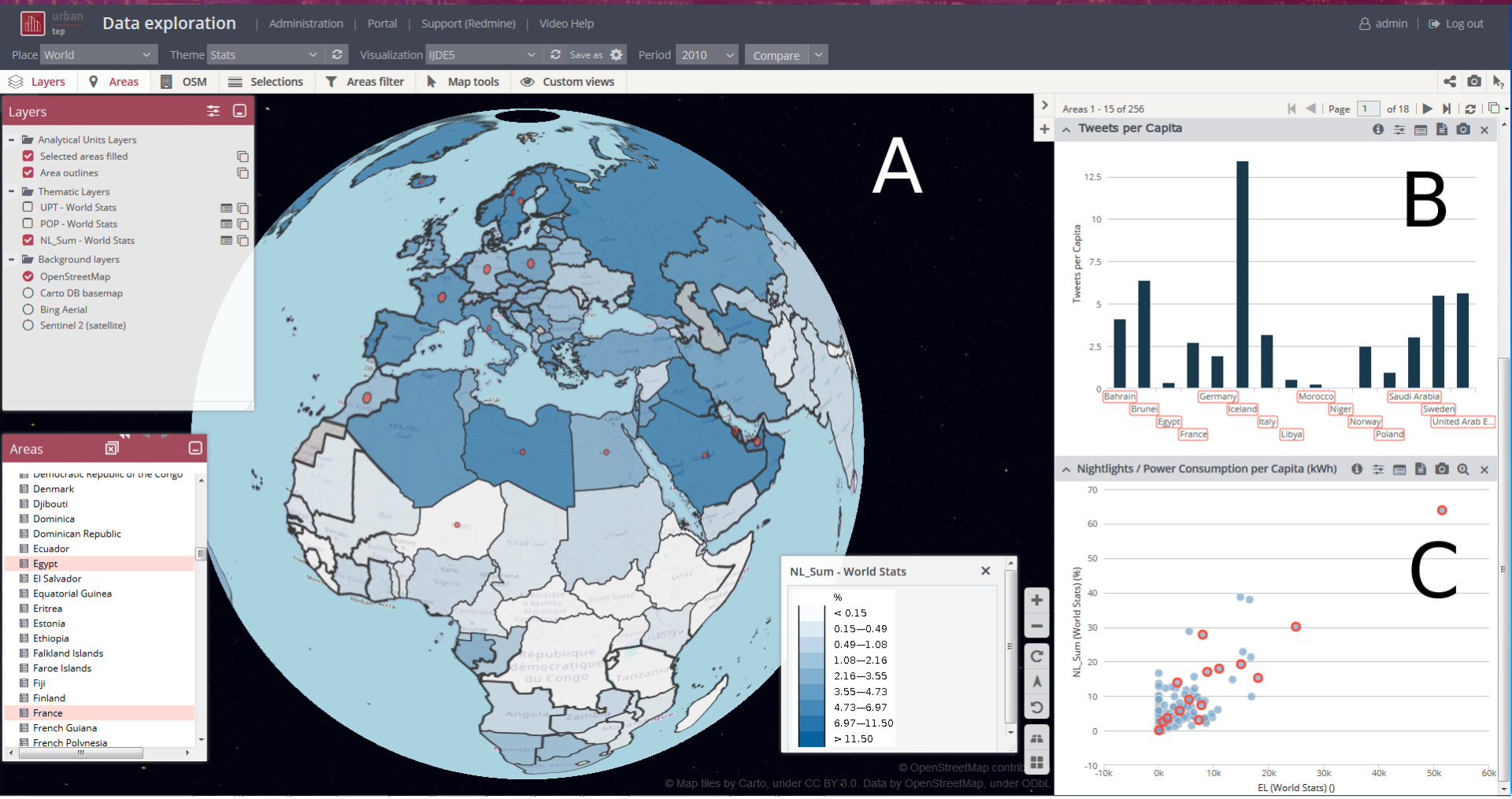


Visualisation and Analytics Toolbox



Map: WSF Bangkok 1985, 1995, 2005 and 2015. Bar Chart & Table: SDG 11.3.1 Indicator: Population Change normalized by Settlement Area Change. The higher the ratio the more unbalanced the development between population and settlement area.

Thematic Applications

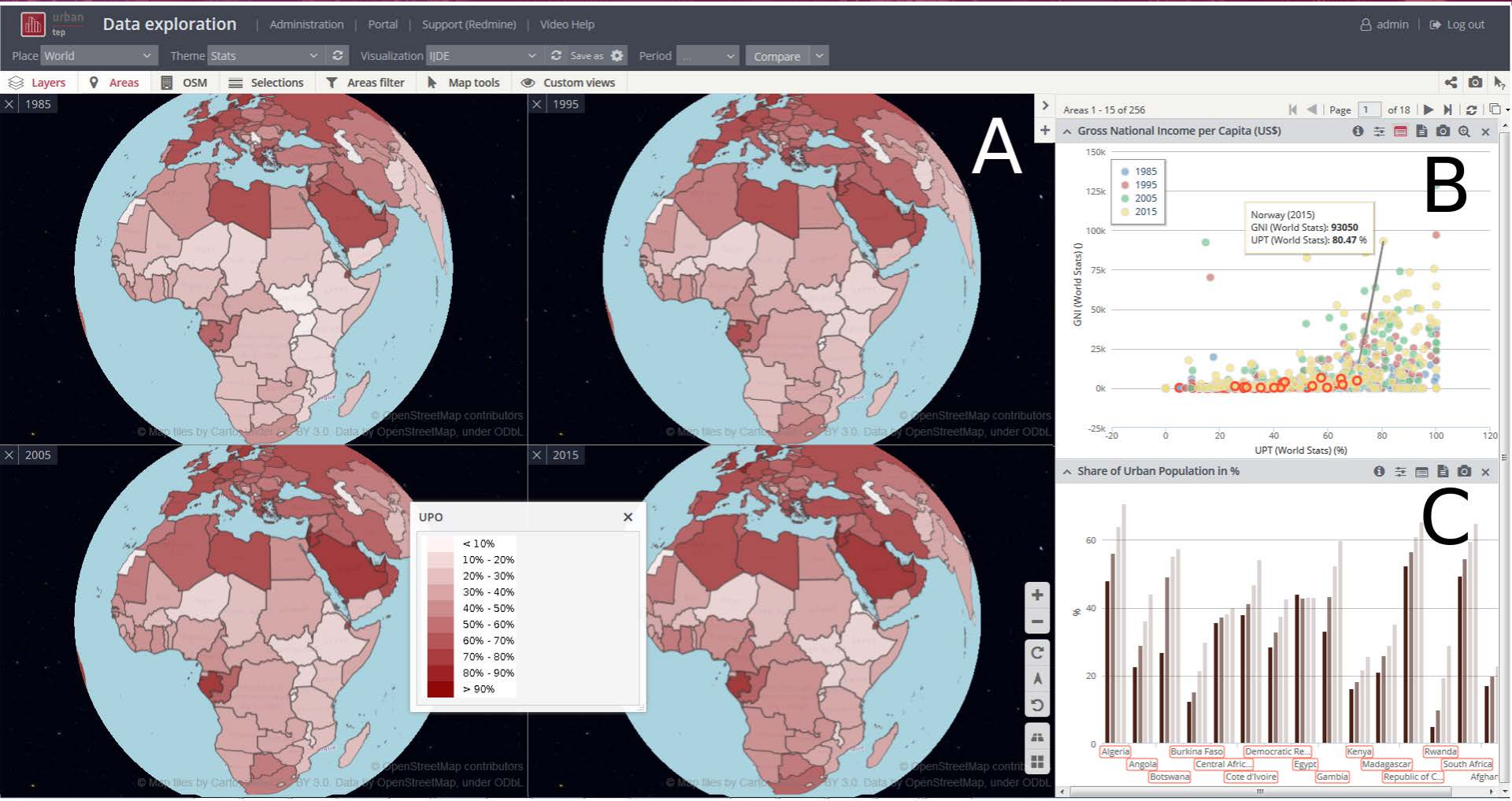


A: Accumulated nightlights intensity of 2015 in relation to the total population of a country in 2015

B: Number of geotagged tweets per capita 2016

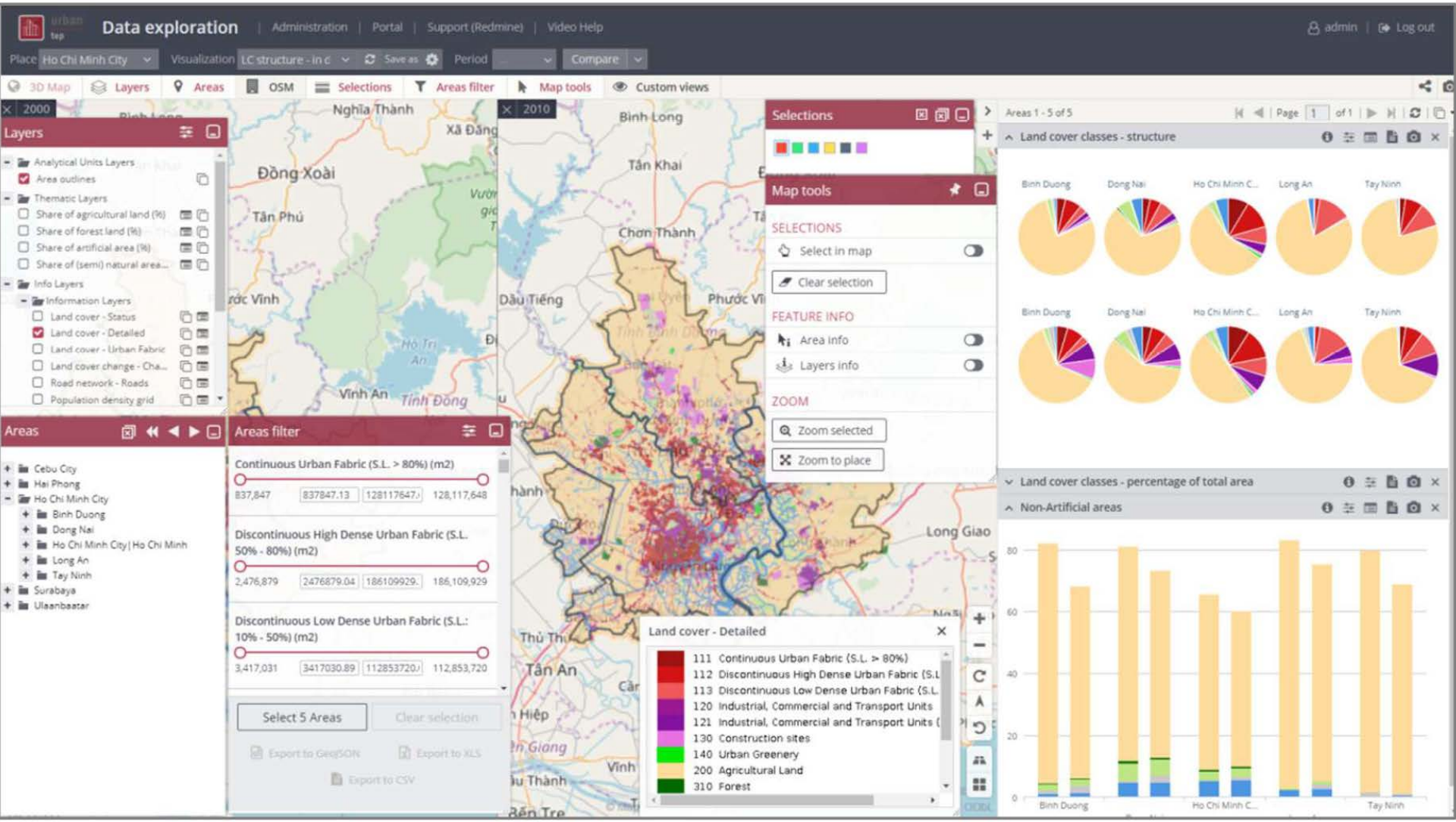
C: Accumulated nightlights intensity of 2015 in relation to the electric power consumption per capita [kWh]

Thematic Applications



A: Urban population in % of total population (1985 – 2015)

B: Gross national Income per capita (US$) (Development 1985 – 2015)

C: Urban population in % of total population (1985 – 2015)

Thematic Applications