

GUF+ Suite and Urban Thematic Exploitation Platform

Developing a better Picture of the Built Environment

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^c Google (Earth Engine)



Knowledge for Tomorrow

Global Urban Footprint 2012



BILL & MELINDA
GATES foundation



World Food
Programme



WORLD BANK GROUP

wfp.org

- **Release:** November 2016
- **Data base:** 182,249 radar images from TerraSAR-X/TanDEM-X (3m, 2011-2013, 308 TB)
- **Spatial resolution:** 12 m (scientific use), 84m (non-profit use)
- **User community**
 - >260 institutions from 43 countries
 - Science, public sector, NGOs
 - 99% of all GUF requests were granted a license

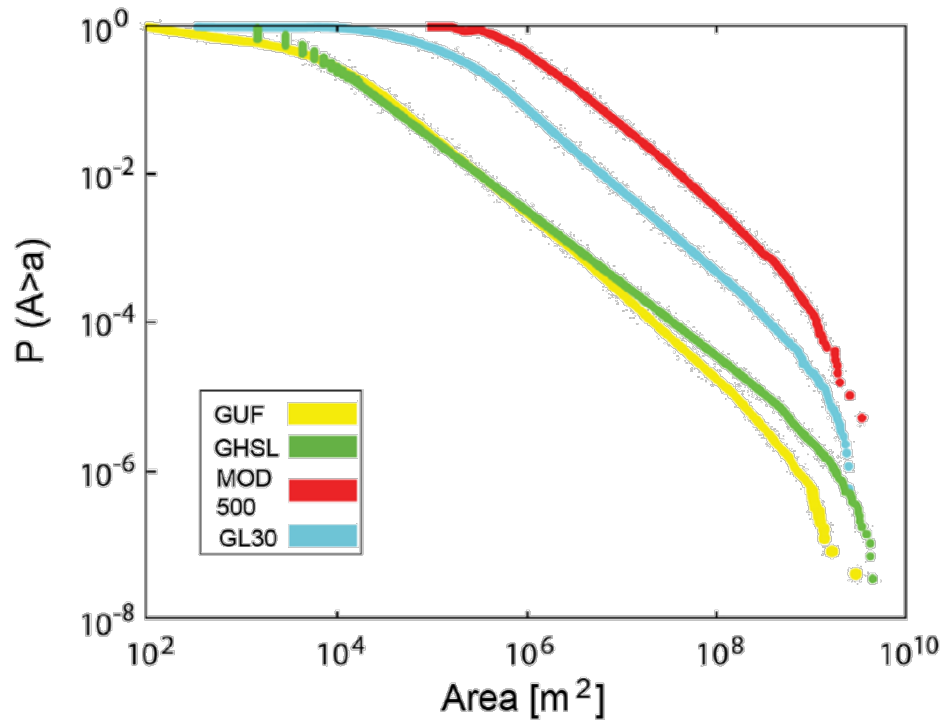
Global Urban Footprint: Accuracy Assessment (first results)

Study Area	GUF		GHSL		GL30		MOD500	
	OA	Kappa	OA	Kappa	OA	Kappa	OA	Kappa
Addis Ababa	84.87	0.695	78.41	0.524	81.66	0.630	69.29	0.369
Athens	85.42	0.672	86.67	0.703	82.98	0.624	78.27	0.475
Beijing	87.35	0.682	84.02	0.613	83.32	0.569	73.39	0.275
Dar Er Salaam	85.01	0.689	77.66	0.550	80.99	0.598	66.10	0.207
Kampala	84.95	0.690	76.13	0.521	79.99	0.559	71.56	0.321
Kigali	82.60	0.623	75.60	0.459	78.94	0.463	72.45	0.212
Lagos	84.49	0.688	92.15	0.843	79.14	0.580	63.28	0.257
Mexico City	89.40	0.786	82.30	0.641	84.30	0.683	68.60	0.347
Milan	89.33	0.784	88.28	0.763	84.23	0.680	69.35	0.365
Nairobi	85.01	0.688	69.22	0.326	81.44	0.616	67.86	0.262
New York	74.28	0.480	84.43	0.710	79.04	0.585	72.20	0.446
Perth	87.75	0.753	91.45	0.829	88.20	0.761	77.30	0.538
Mean	85.04	0.686	82.28	0.623	82.02	0.612	70.80	0.340
Standard Deviation	3.96	0.080	7.00	0.155	2.75	0.075	4.33	0.105

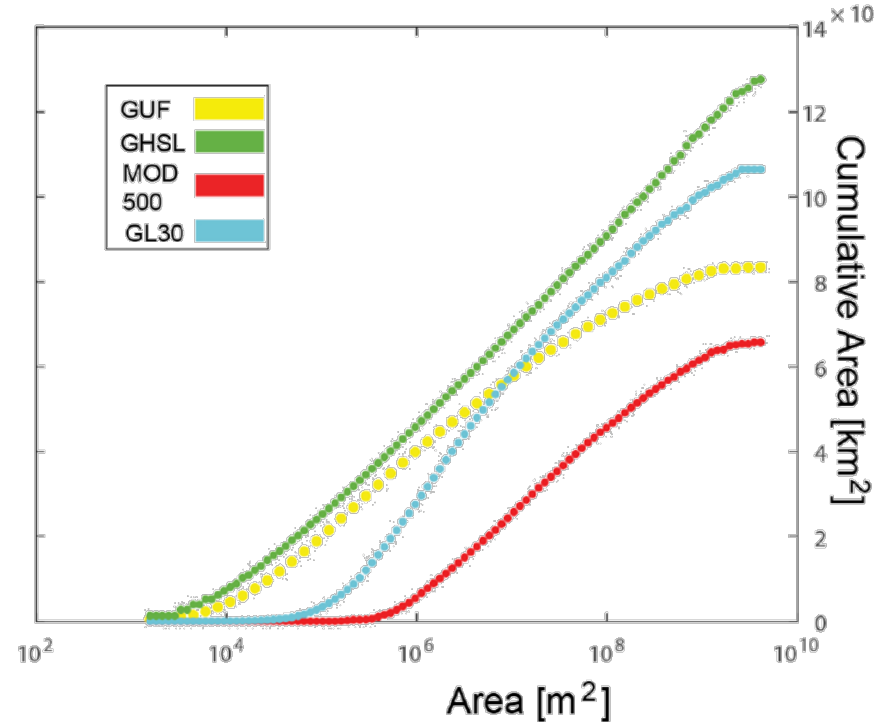


Global Urban Footprint: Accuracy Assessment (first results)

Cumulative distribution function of settlement objects



Cumulative area of all settlements



GUF : 834,260 km²

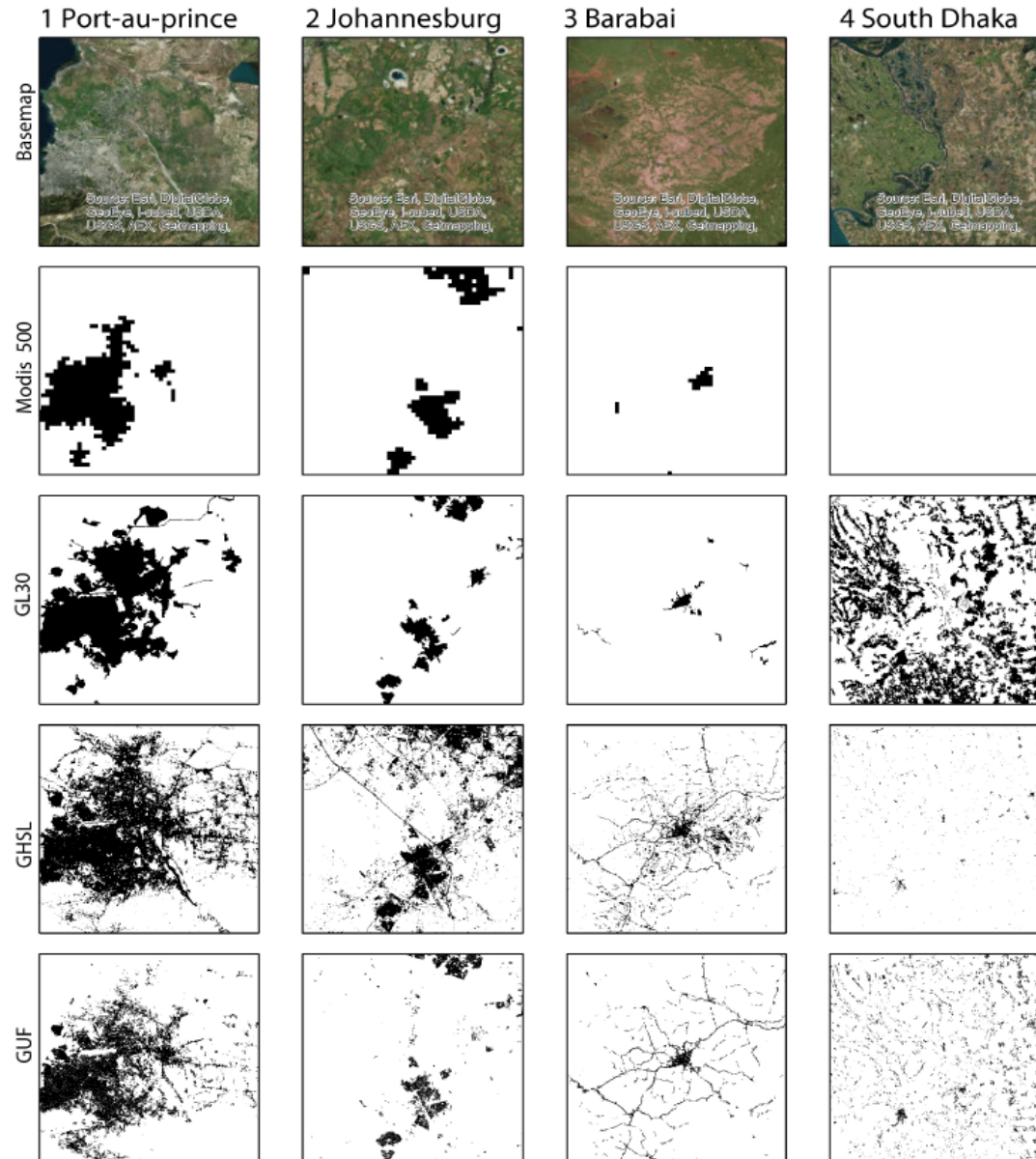
GHSL: 1,289,506 km²

GL30: 1,064,940 km²

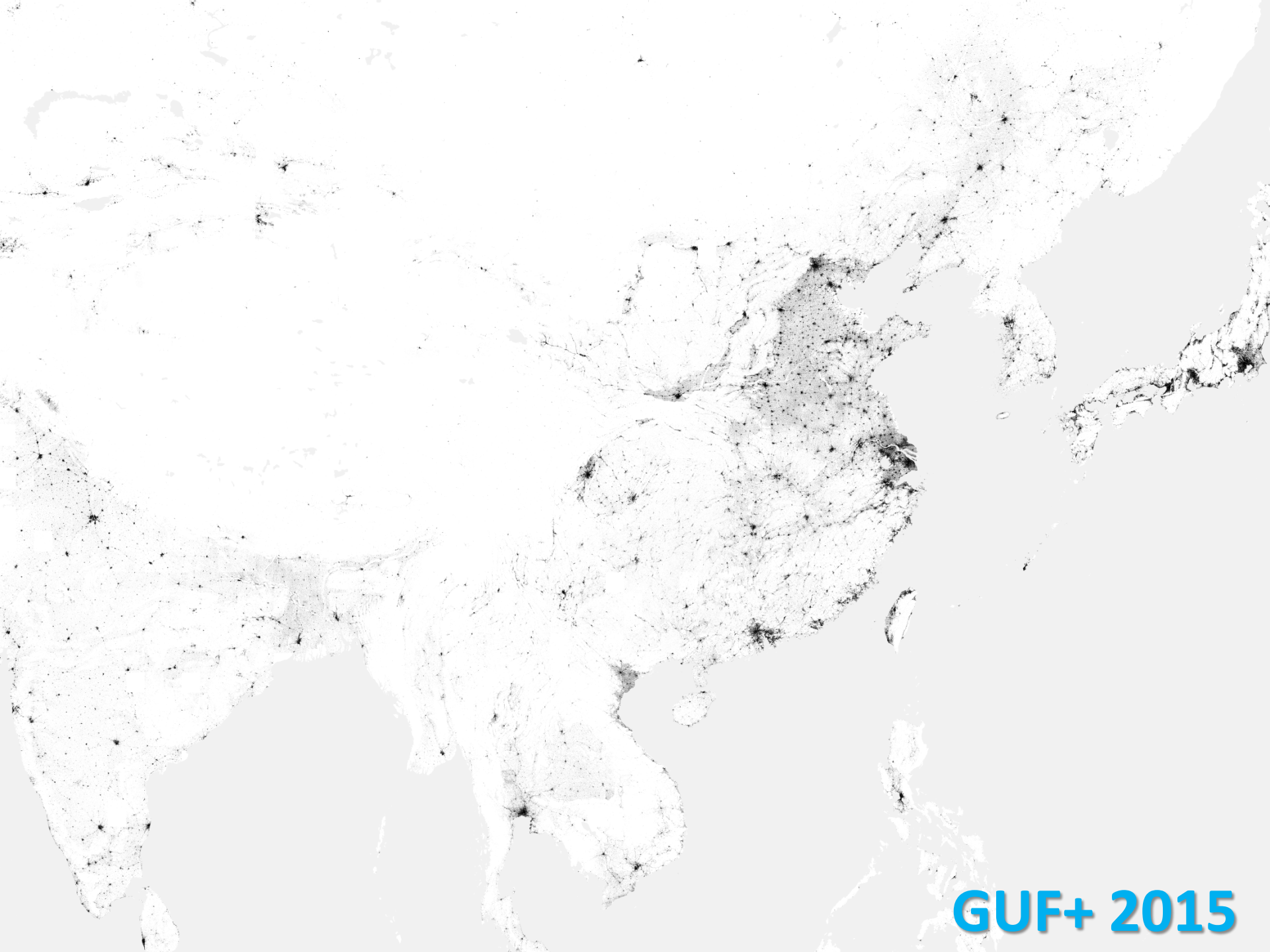
M500: 657,384 km²



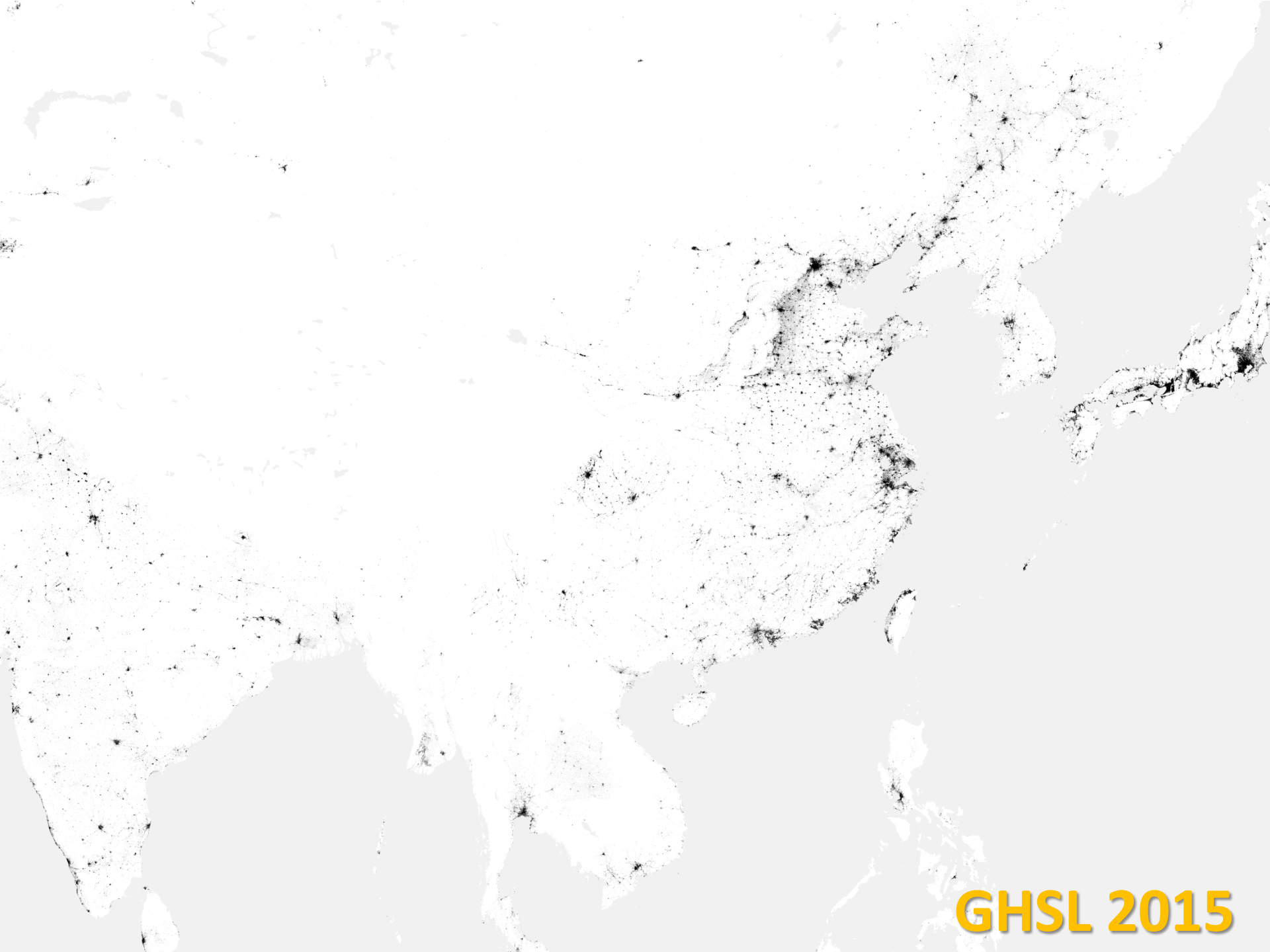
Global Urban Footprint: Accuracy Assessment (first results)



**Spatial accordance of
layers frequently
< 60%**



GUF+ 2015



GHSL 2015

Global Urban Footprint +



▪ *Key objectives*

- **Continuity**, sustainability
- Full **open and free** access to products
- Robustness: **repeatability**, **consistency**
- **Applicability**: product suite, data analytics tools

▪ *Methodology*

- Use of **free** and **open data** and **software**
- **Multi-sensor** (Sentinel-1, Landsat/Sentinel-2)
- **Multi-date** (use of all scenes acquired)
- **Multi-facility** (i.a. U-TEP, GEE)

▪ *Product portfolio*

- **GUF+ 2015** (binary settlement mask)
- **GUF+ 2015 Density** (% imperviousness)
- **GUF+ Evolution** (1984-2015)
- **GUF+ Network** (settlement properties/pattern)
- **GUF+ 3D** (average building volume)

GUF 2012



GUF+ 2015

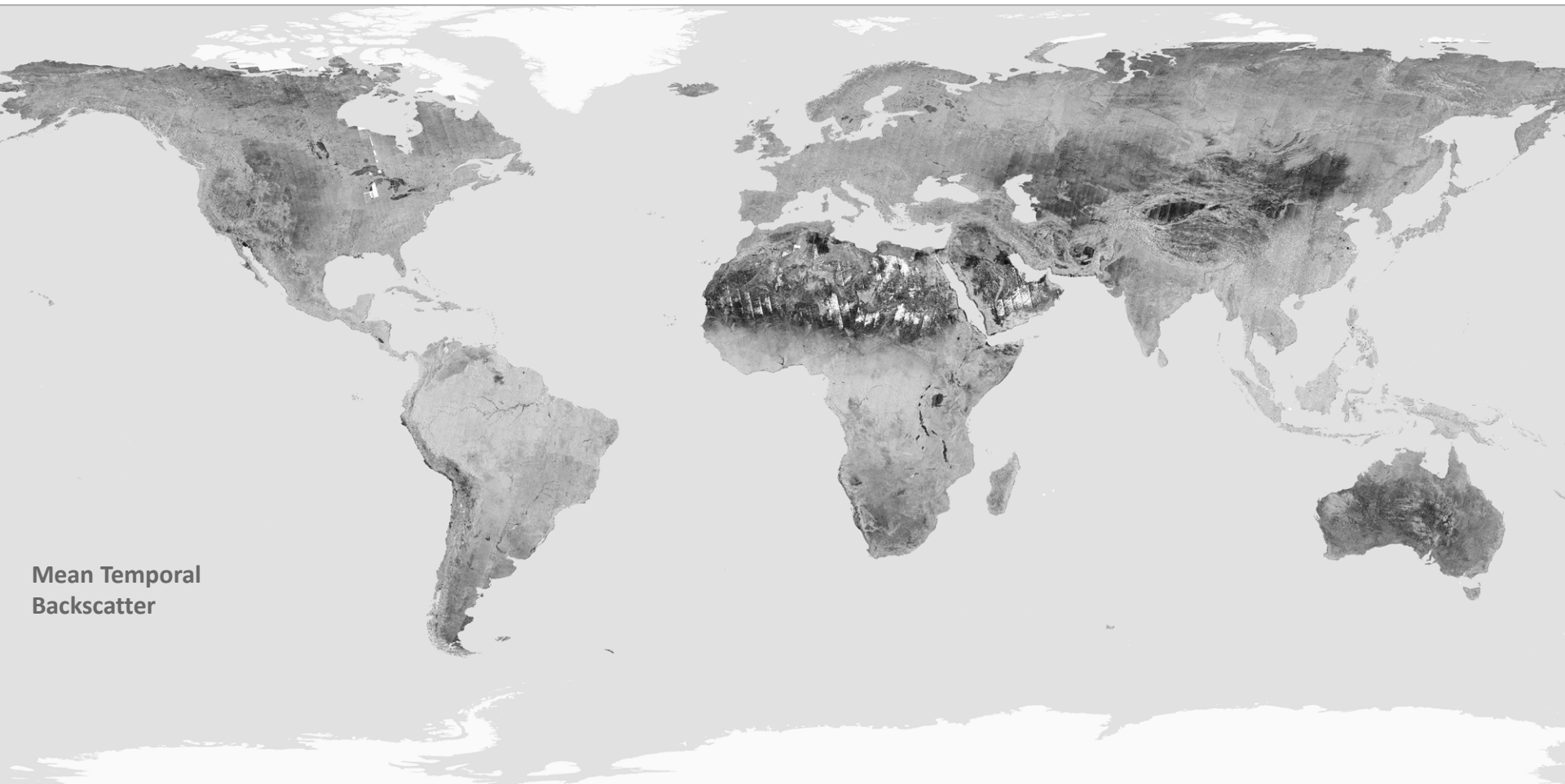


Global Urban Footprint + GUF+ 2015

(Binary settlement mask – 10m)



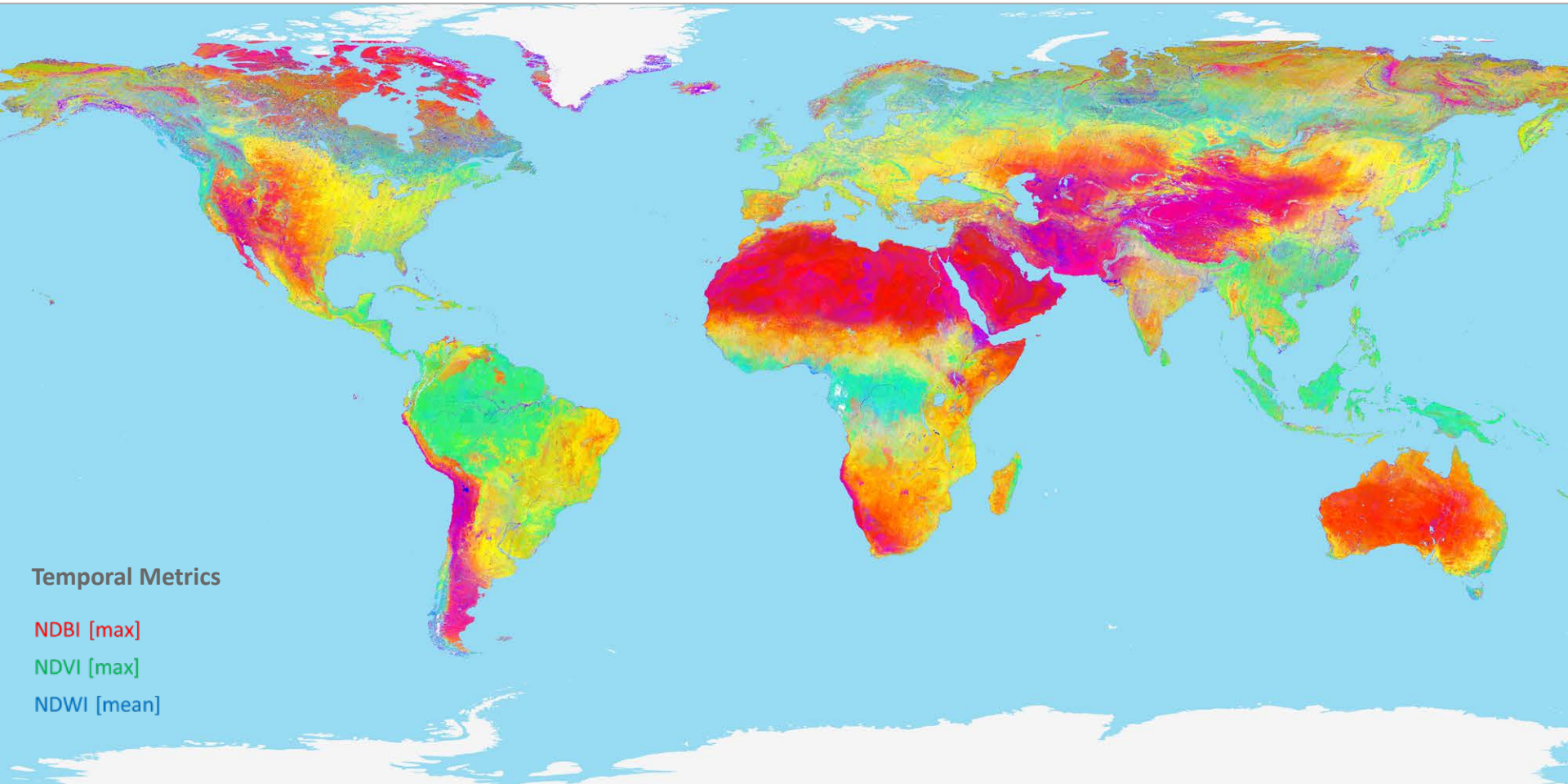
Global Urban Footprint + TimeScan Sentinel-1 2015



TimeScan layer derived from **245.535 Sentinel-1 images** collected in 2014-2015 (>**1.1 PB**; final product: 60TB)

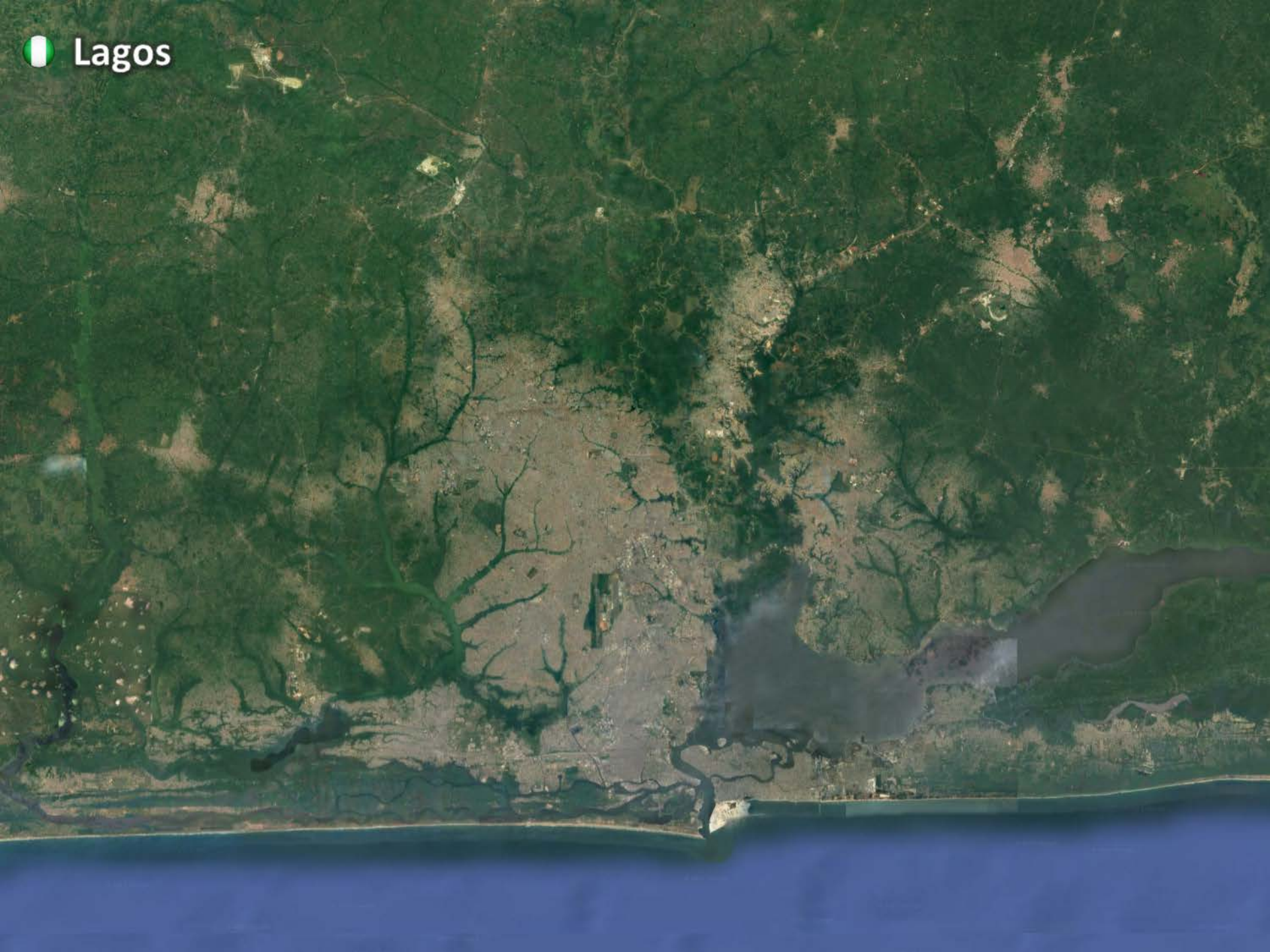


GUF+ 2015: TimeScan Landsat 2015

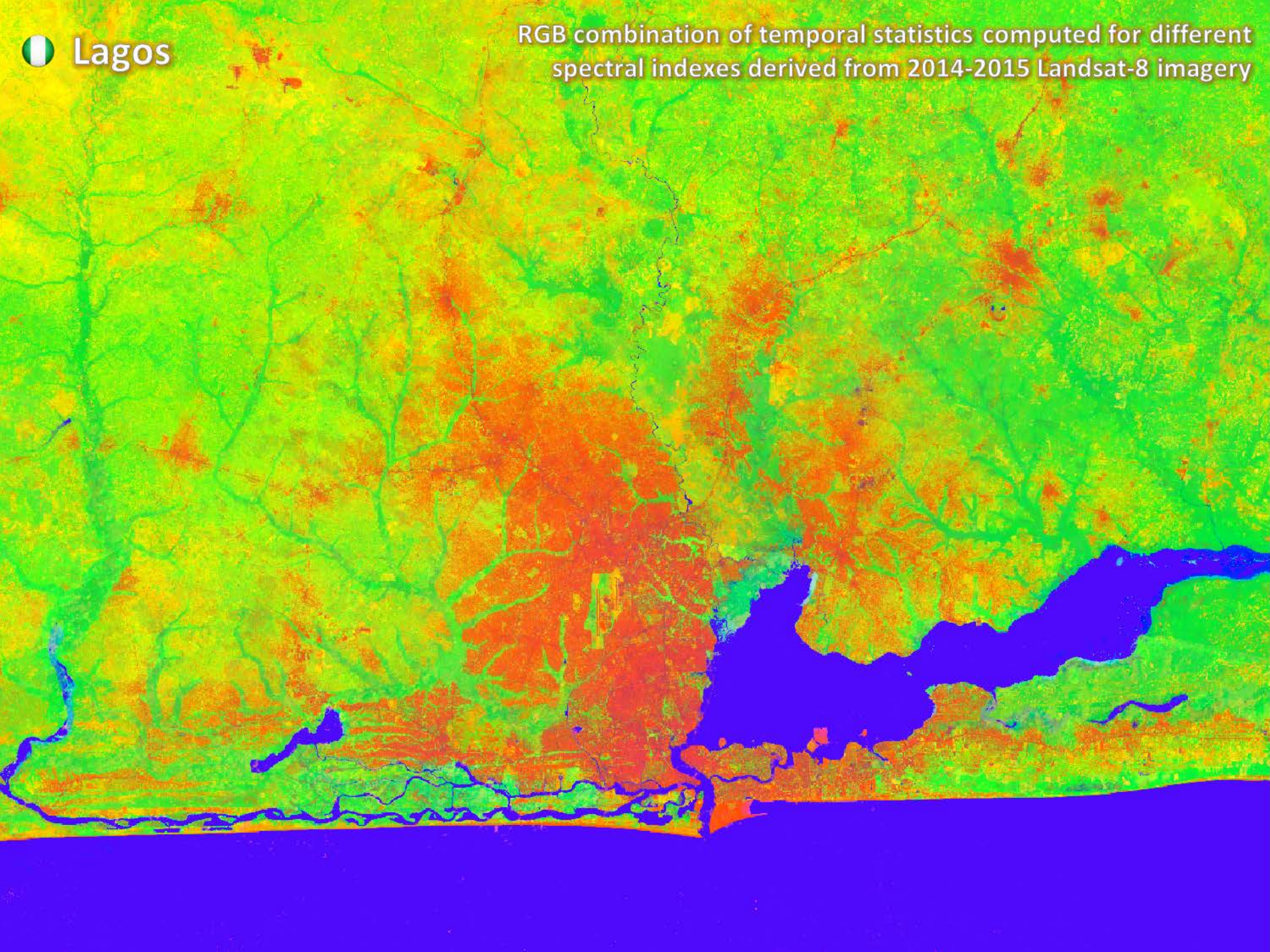


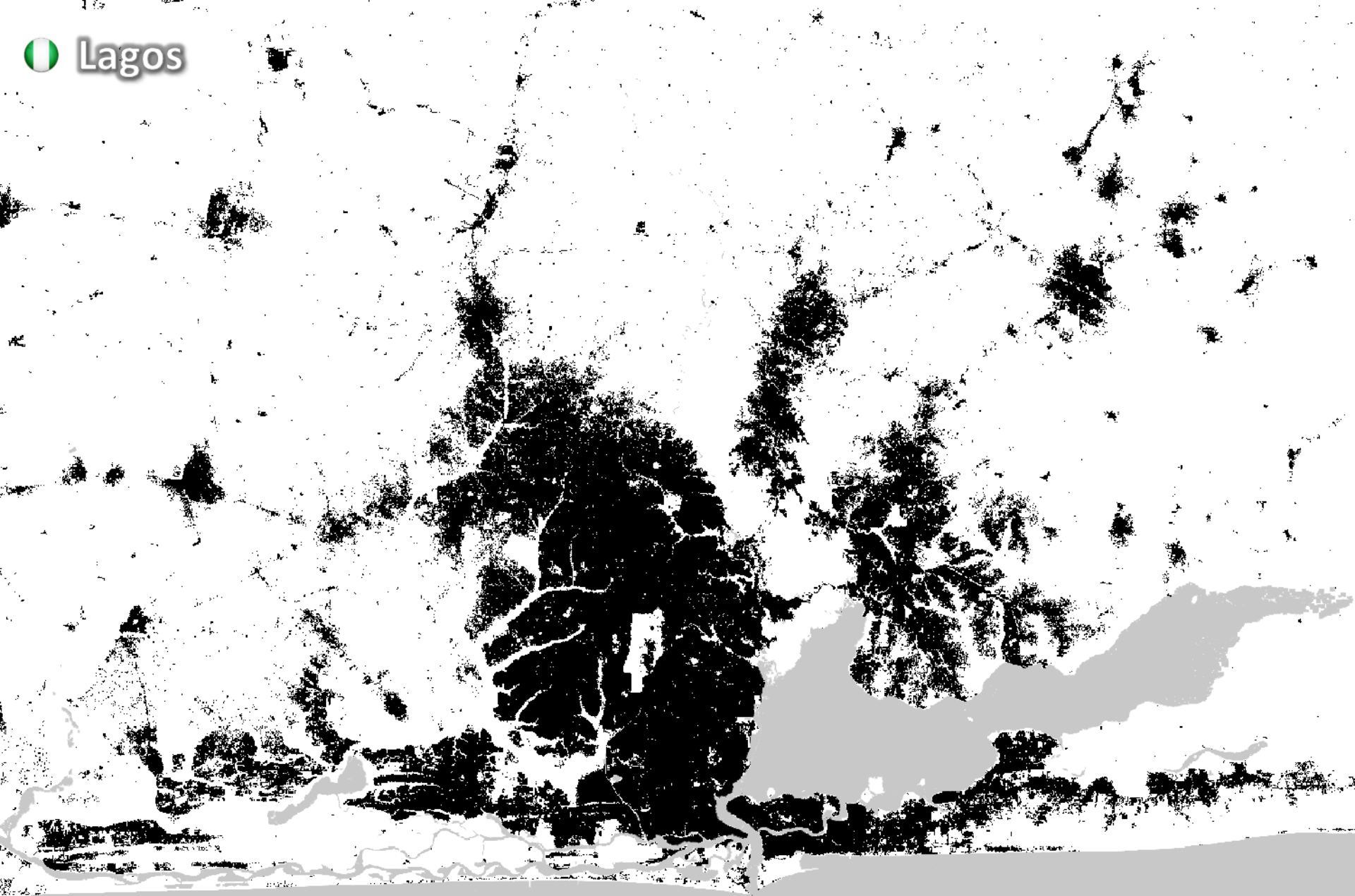
TimeScan layer derived from **452,799 Landsat images** collected in 2013-2015 (**>1.5 PB**; final product: 25TB)











Study Area	% Overall Accuracy	Kappa Coefficient
	GU+2015	GU+2015
Dar Es Salaam	93.49	0.869
Kampala	91.42	0.829
Kigali	86.25	0.725
Istanbul	83.54	0.671
Mexico City	92.80	0.857
Milan	91.14	0.825
Perth	93.10	0.862

Ongoing

Global Urban Footprint + DenS 2015

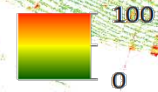
(Percent imperviousness, 30m)



Shanghai (China)

0 5 10 km

Imperviousness [%]



GU+ Density
2015

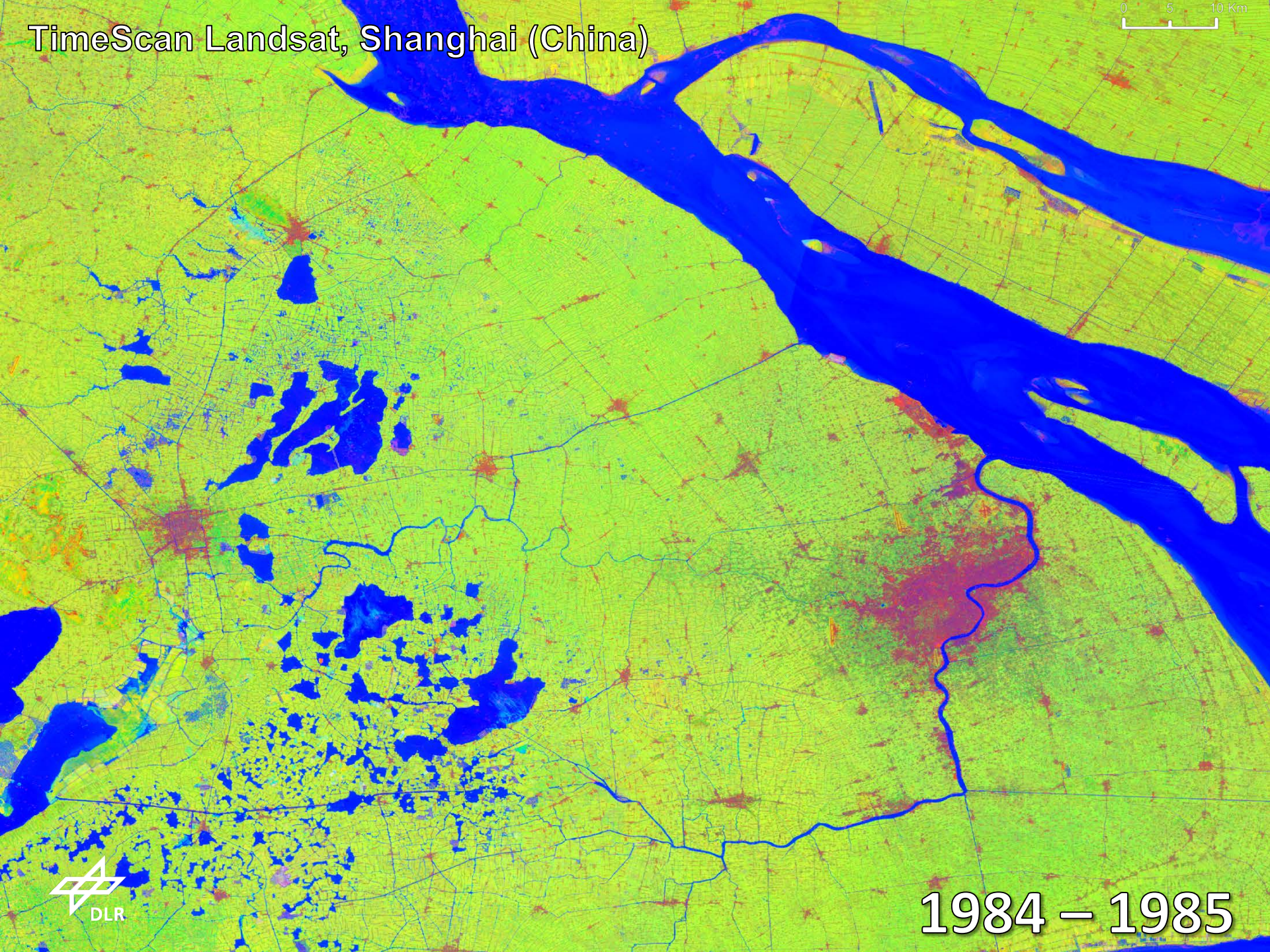


Global Urban Footprint + Evolution (1984 – 2015, 30m)



TimeScan Landsat, Shanghai (China)

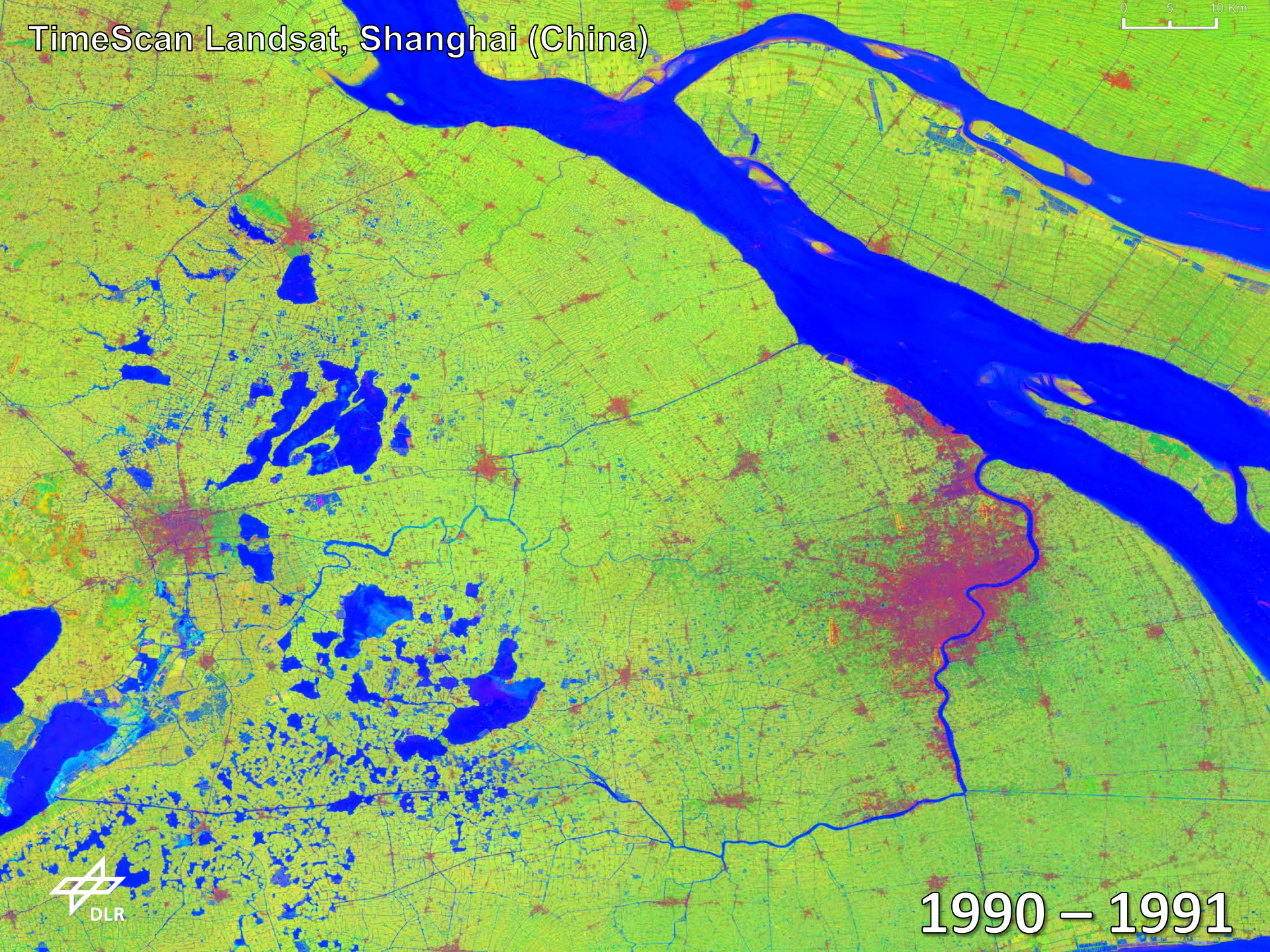
0 5 10 Km



1984 – 1985

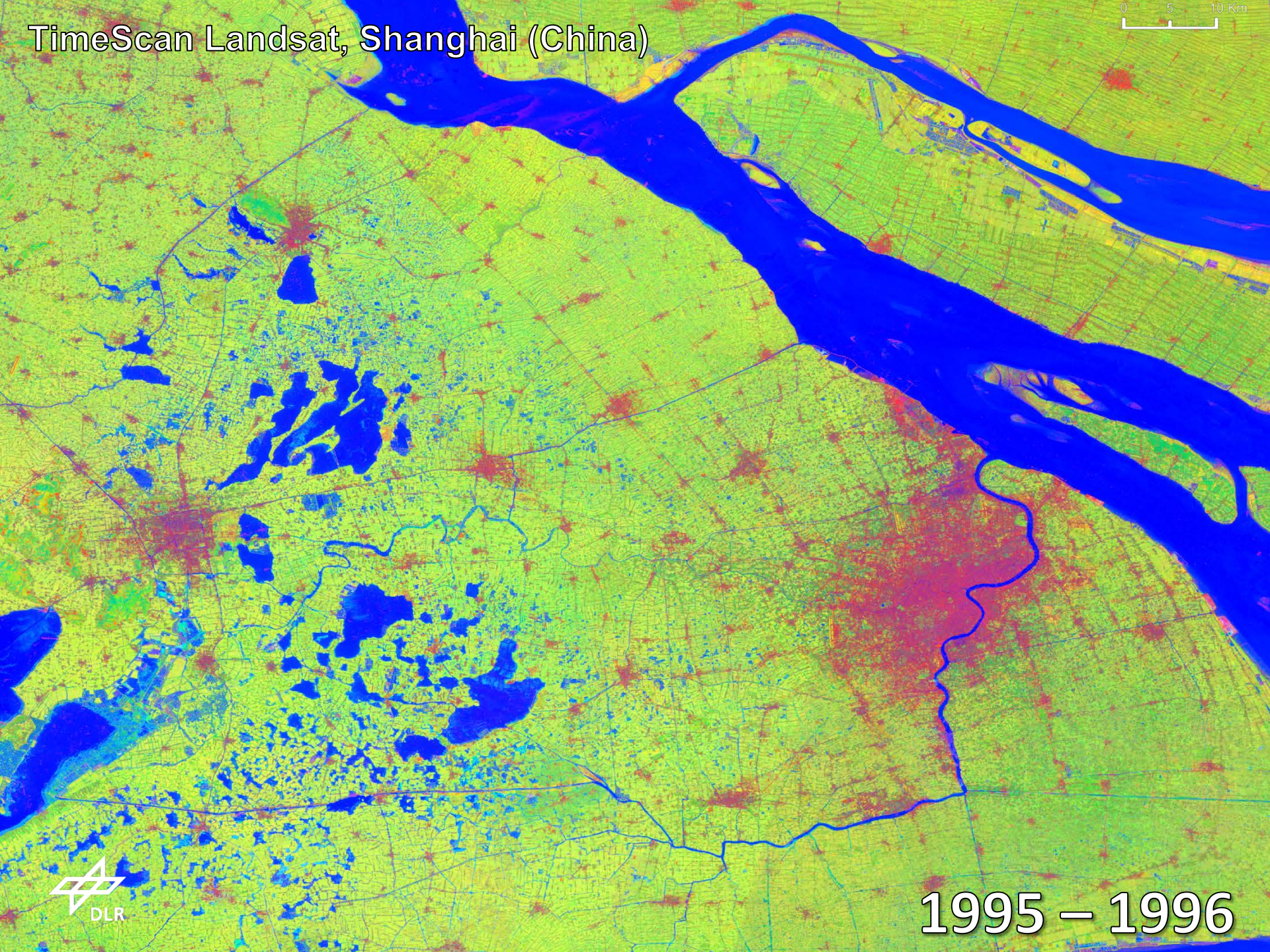
TimeScan Landsat, Shanghai (China)

0 5 10 Km



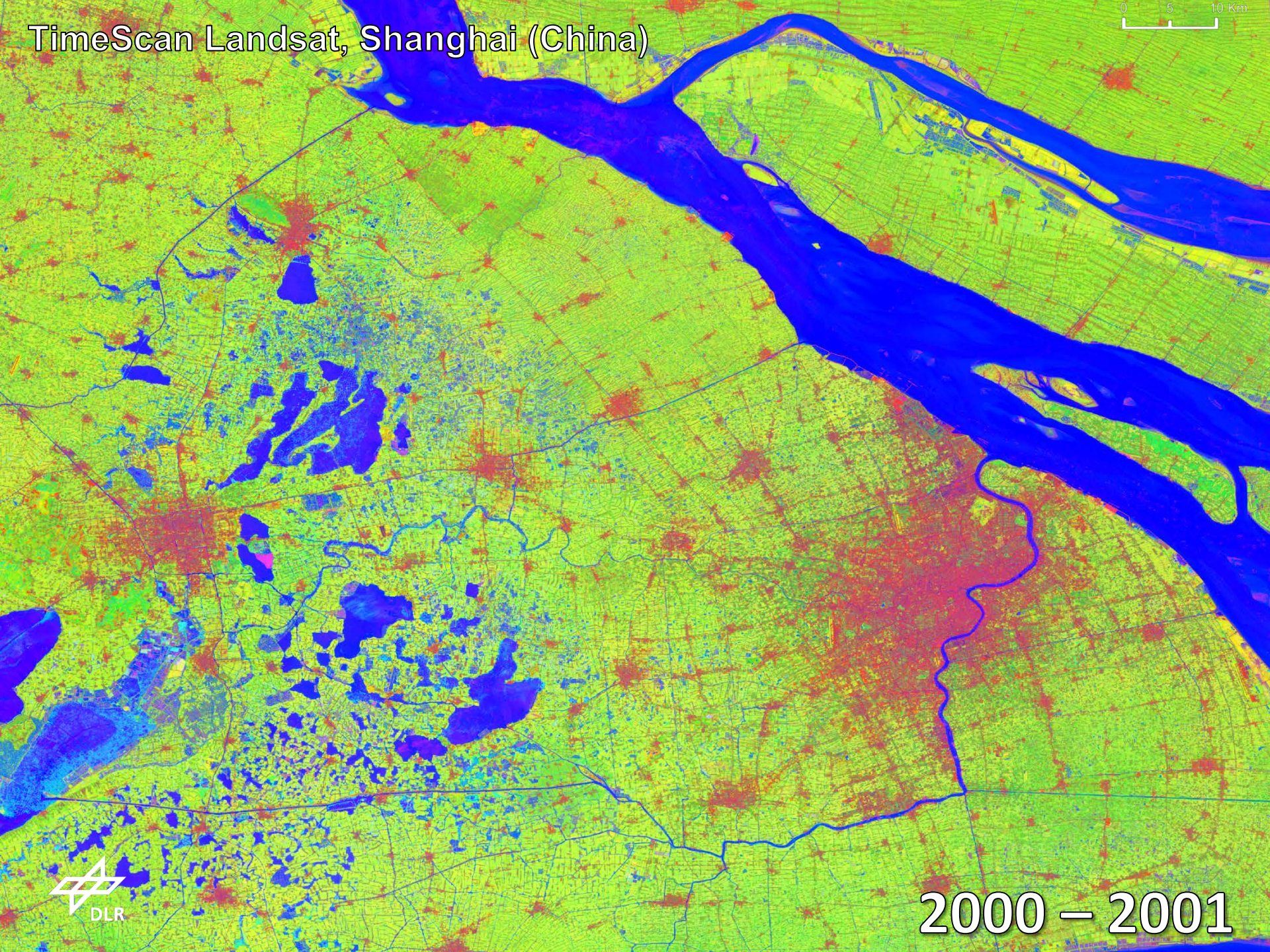
TimeScan Landsat, Shanghai (China)

0 5 10 Km



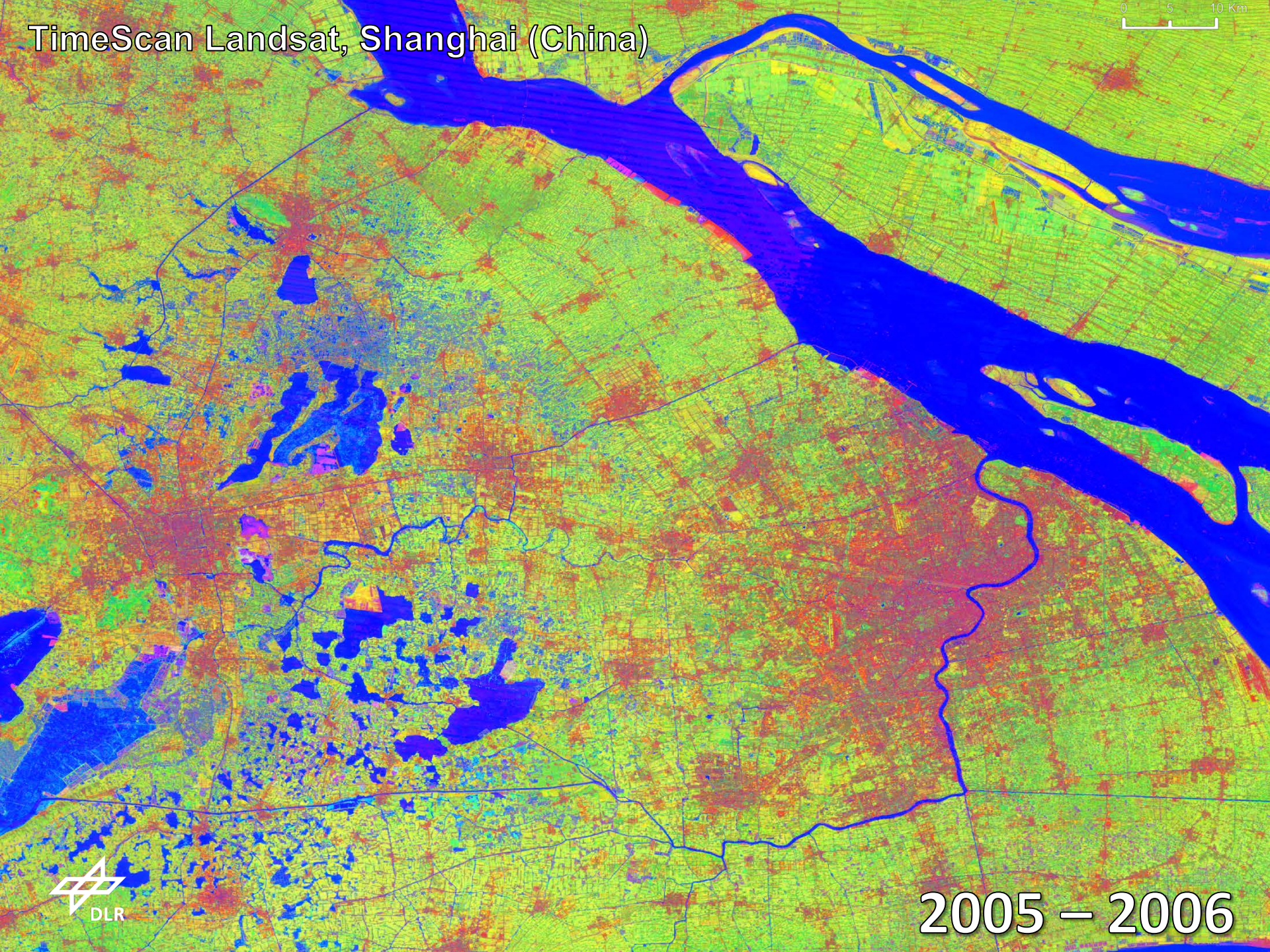
TimeScan Landsat, Shanghai (China)

0 5 10 Km



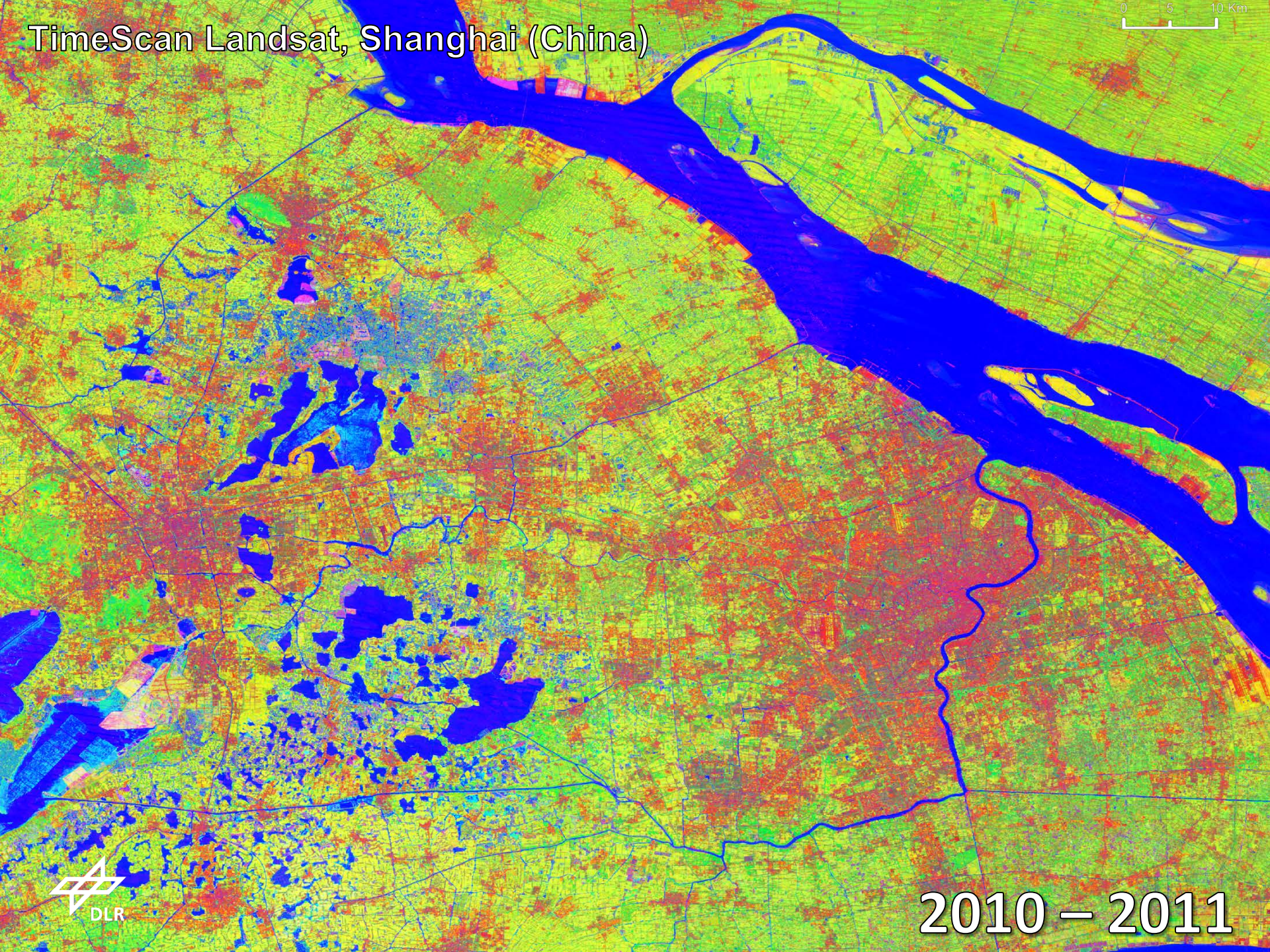
TimeScan Landsat, Shanghai (China)

0 5 10 Km



TimeScan Landsat, Shanghai (China)

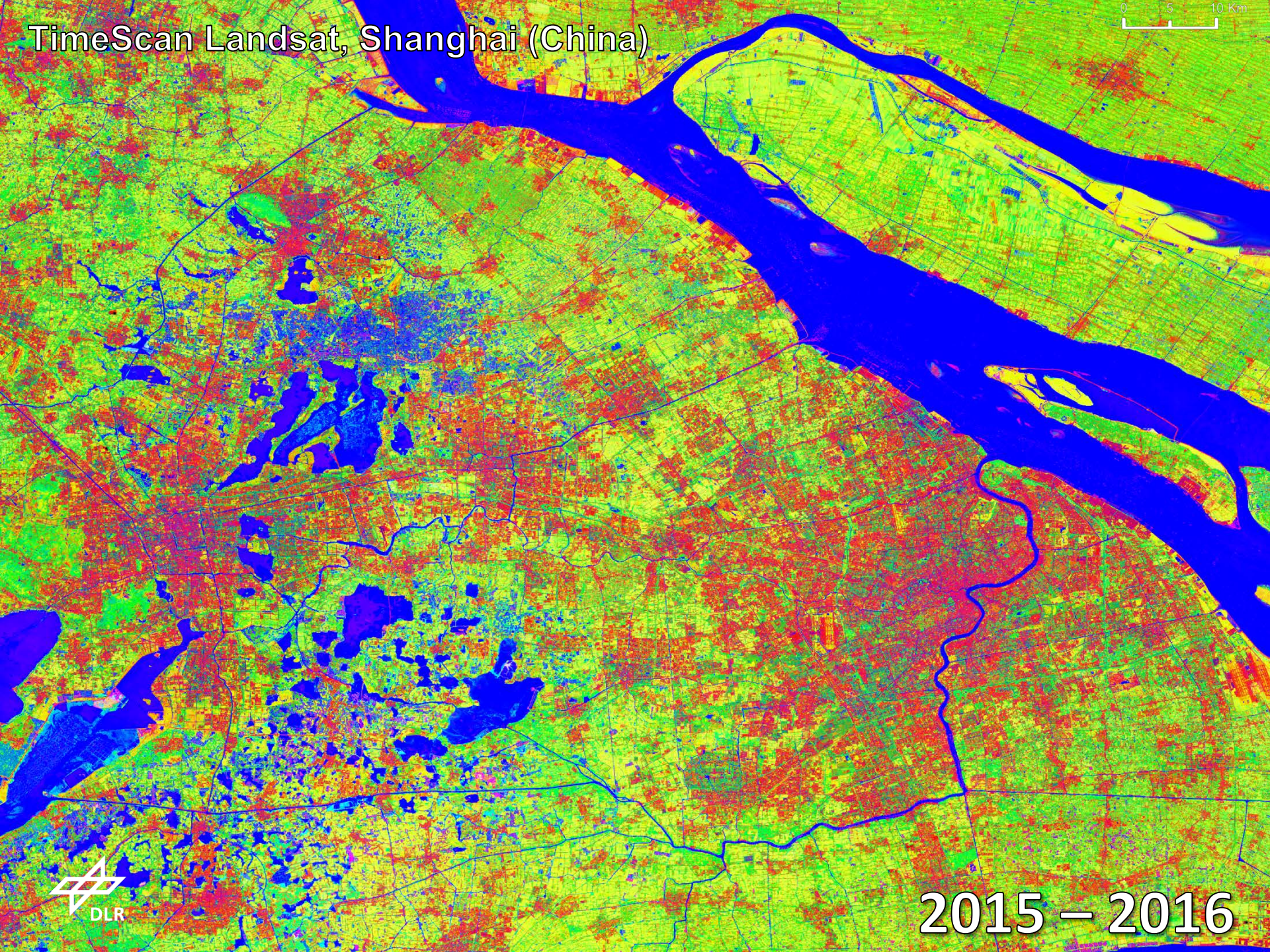
0 5 10 Km



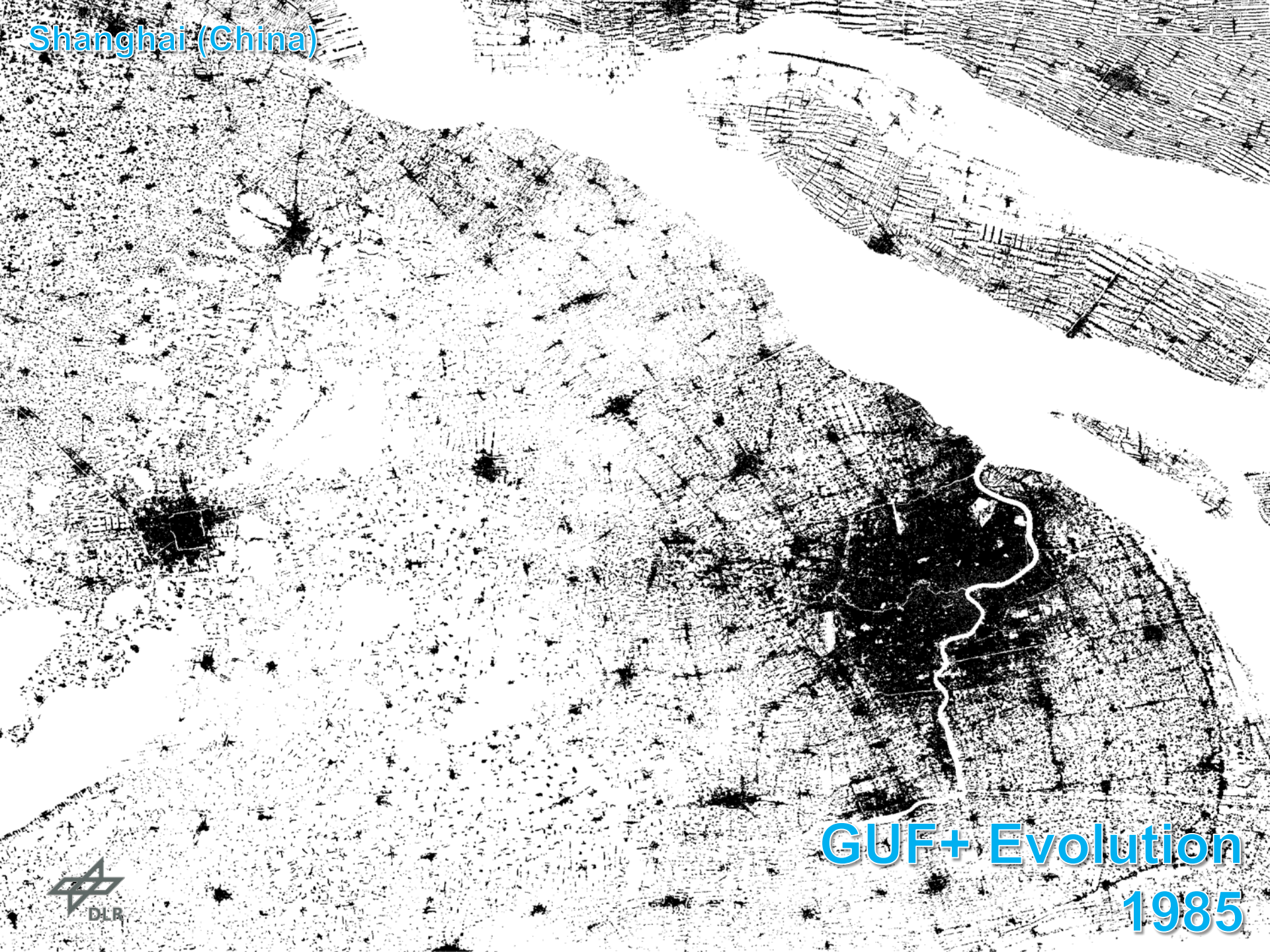
2010 – 2011

TimeScan Landsat, Shanghai (China)

0 5 10 Km



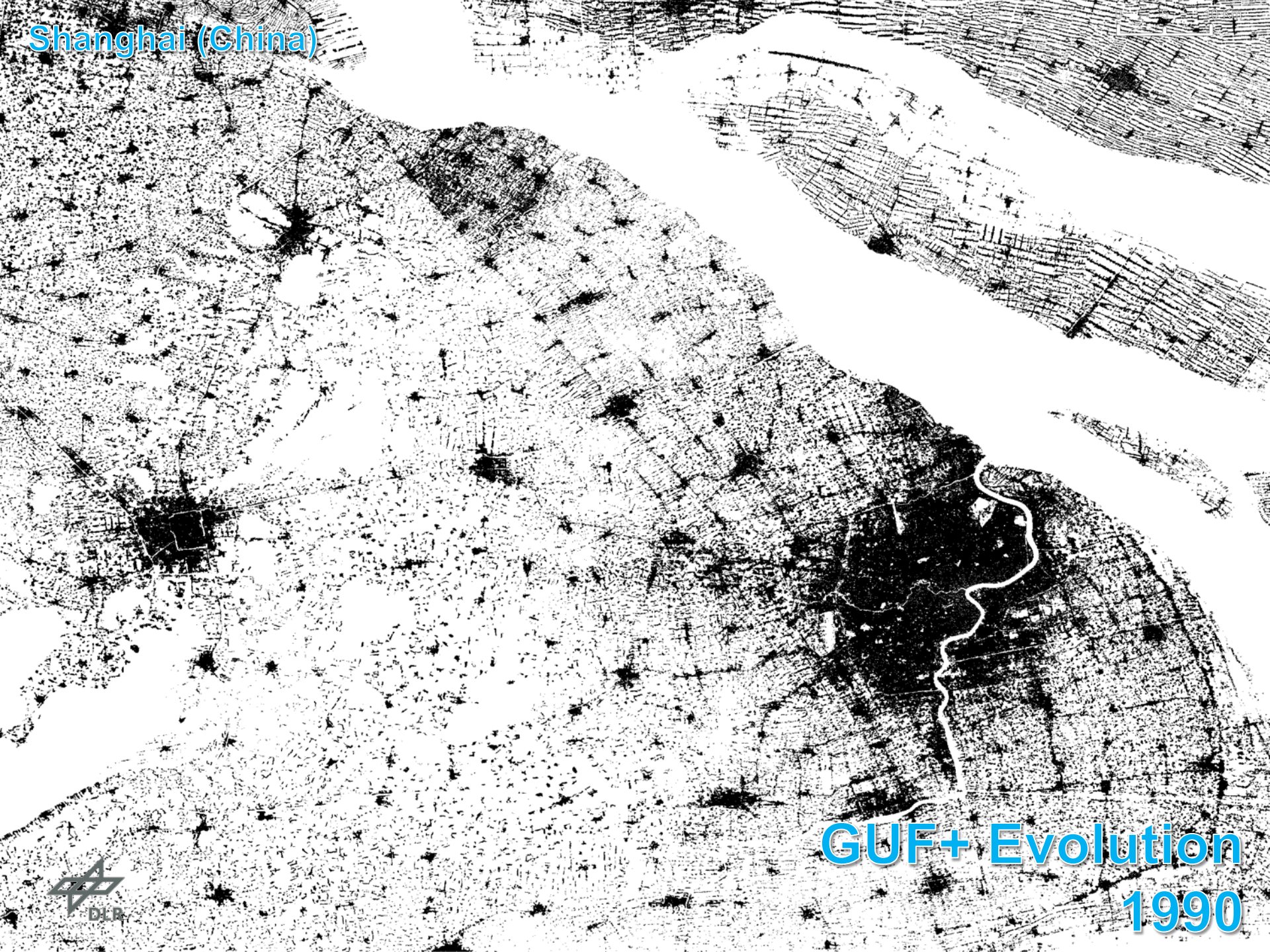
Shanghai (China)



GU+ Evolution
1985



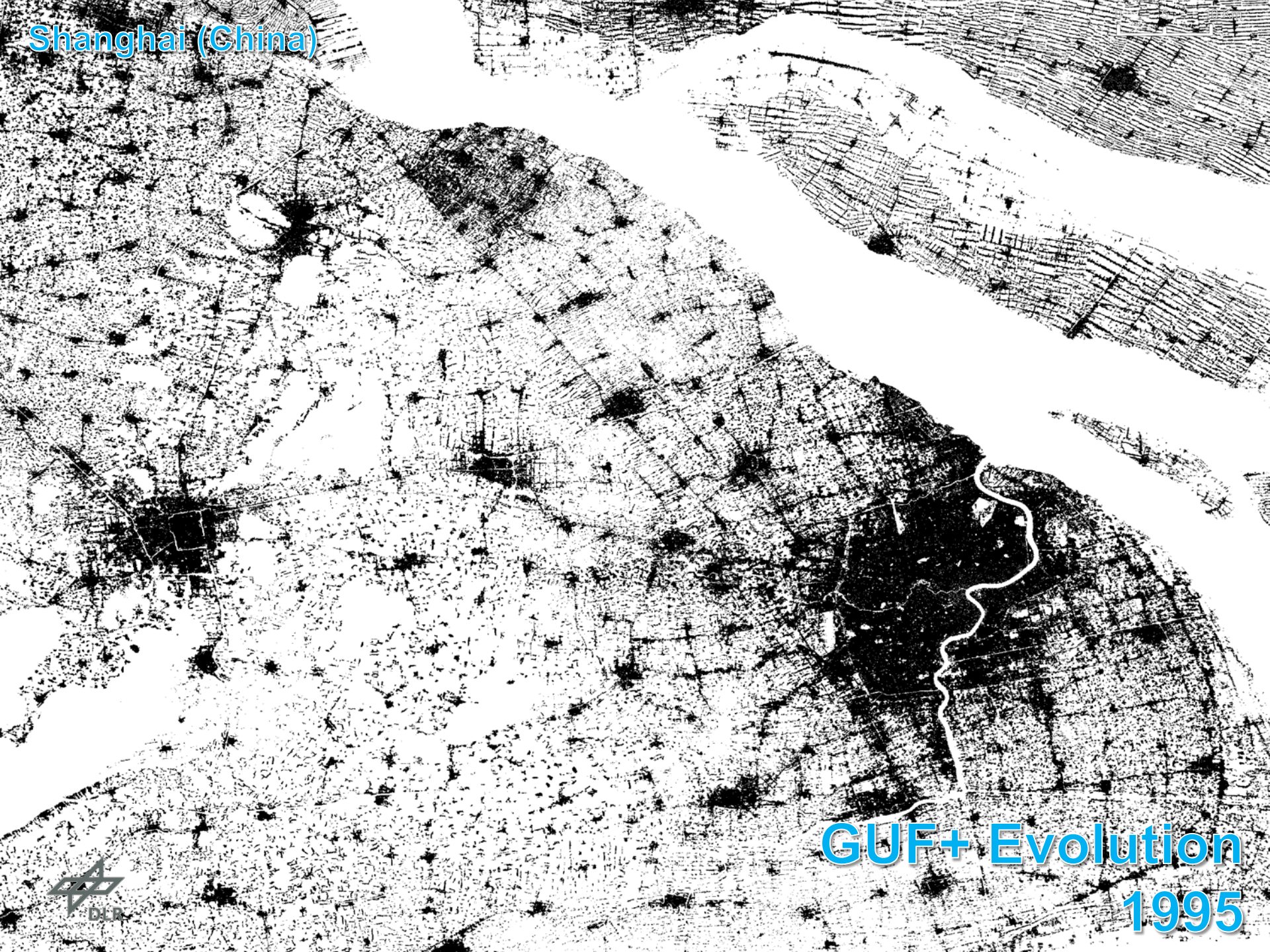
Shanghai (China)



GU+ Evolution
1990



Shanghai (China)



GUF+ Evolution
1995



Shanghai (China)



GUF+ Evolution
2000



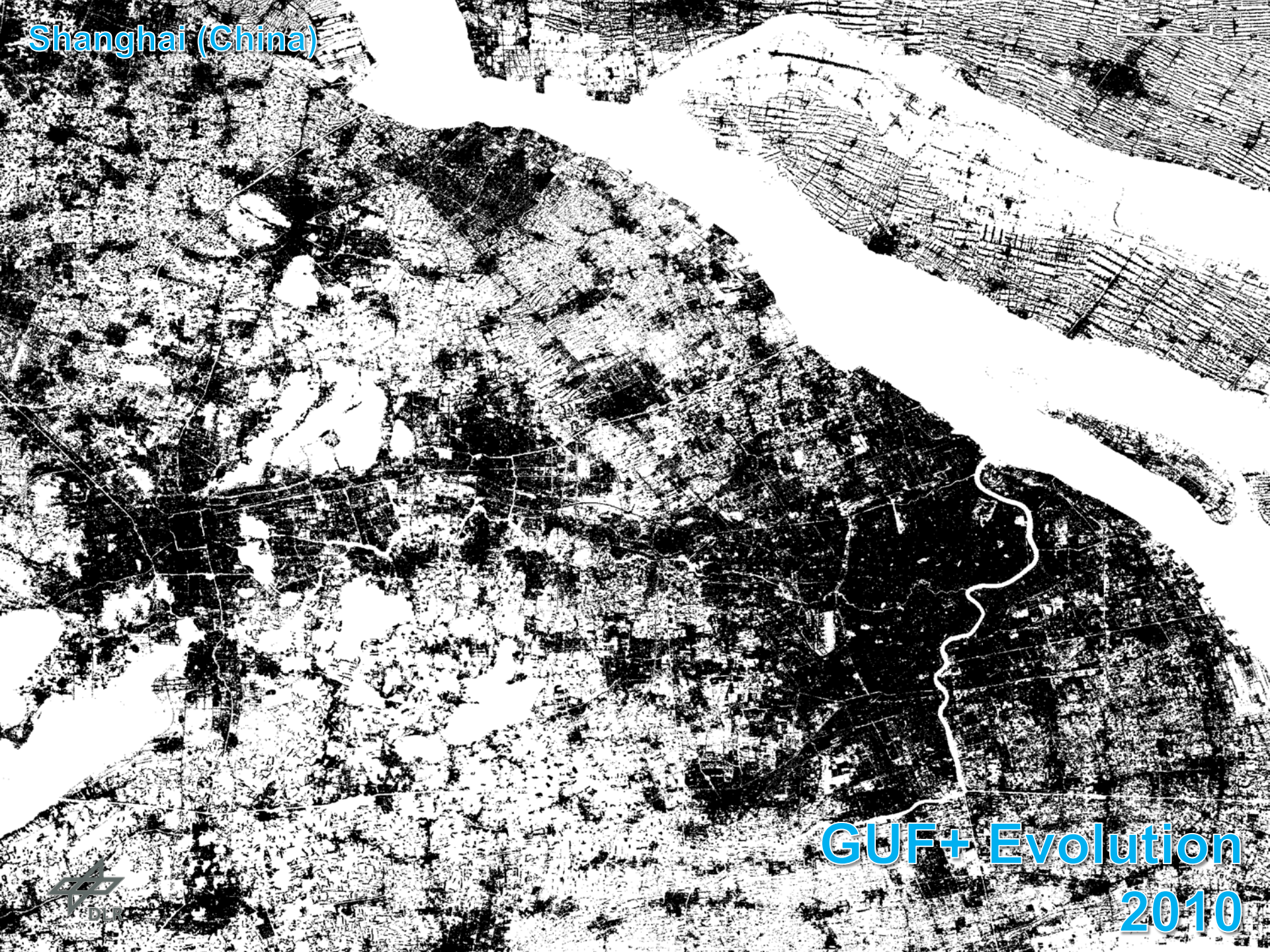
Shanghai (China)



GU+ Evolution
2005



Shanghai (China)



GU+ Evolution
2010



Shanghai (China)

GU+ Evolution
2015

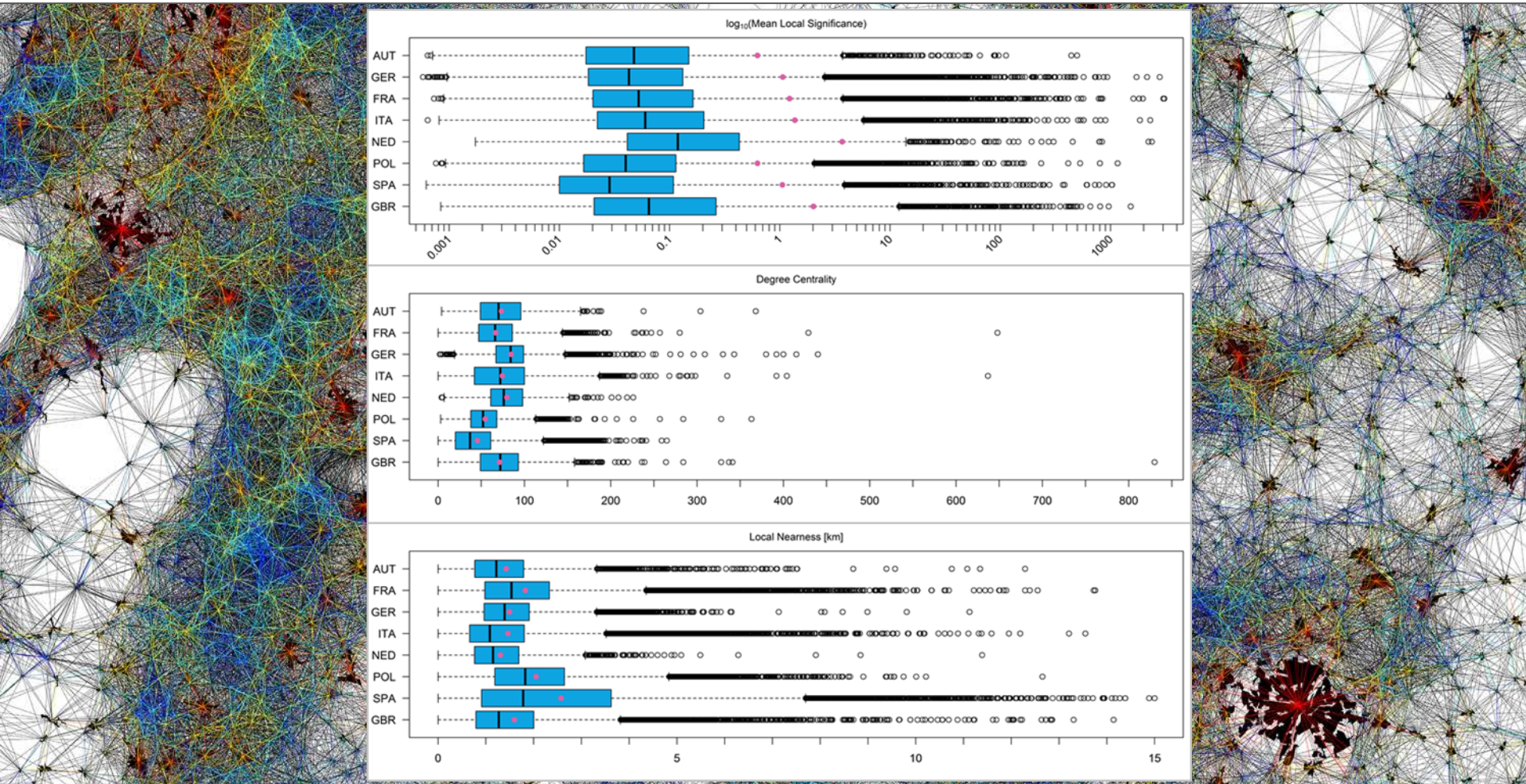


Global Urban Footprint + NetS

(Settlement properties and pattern, vector data)

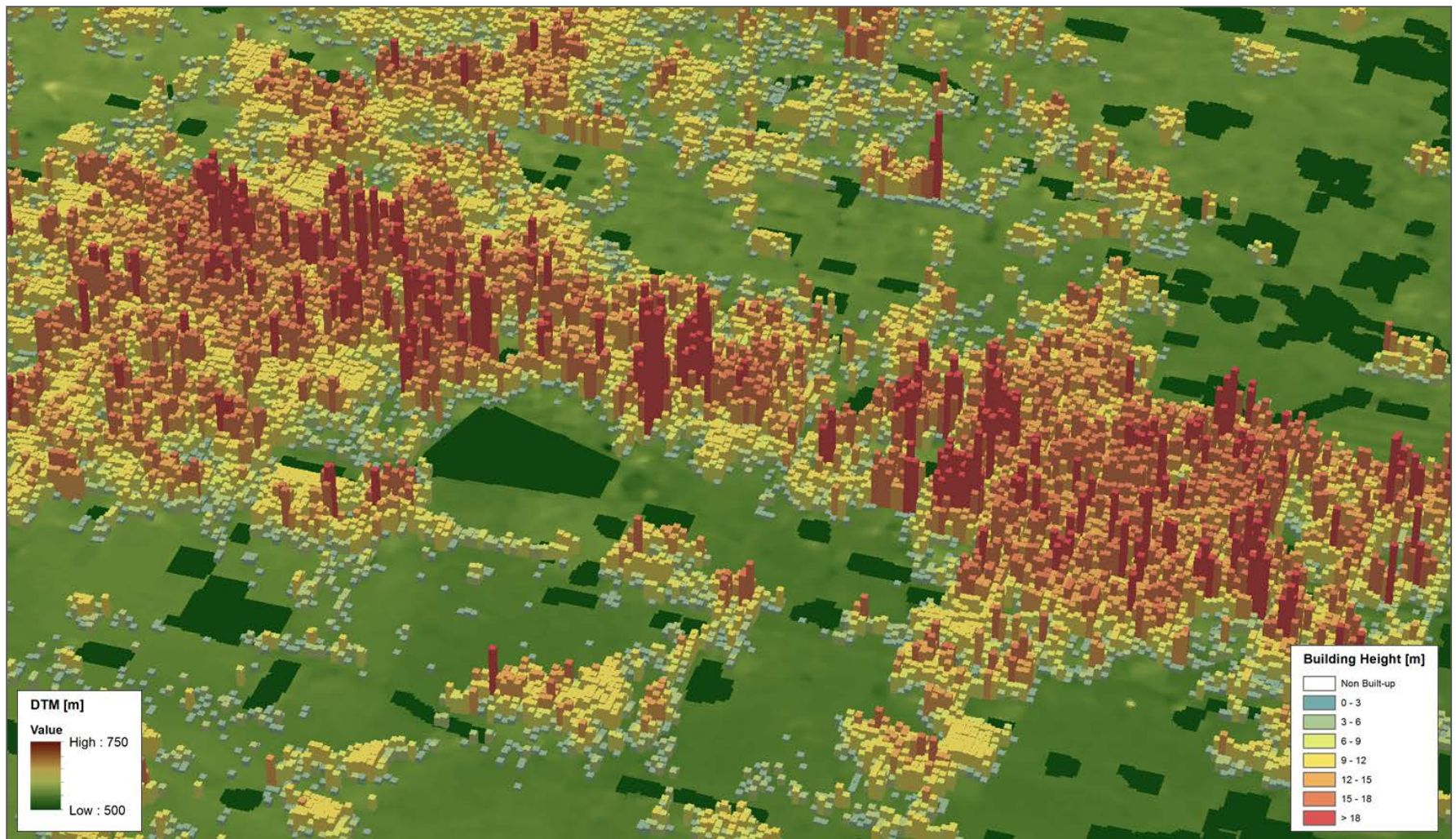


Global Urban Footprint + GUF-NetS



Characterizing the local relevance of settlements using spatial network analysis

Global Urban Footprint + GUF-3D



Average building height (120x120m) derived from TanDEM-X IDEM for Dongying, China

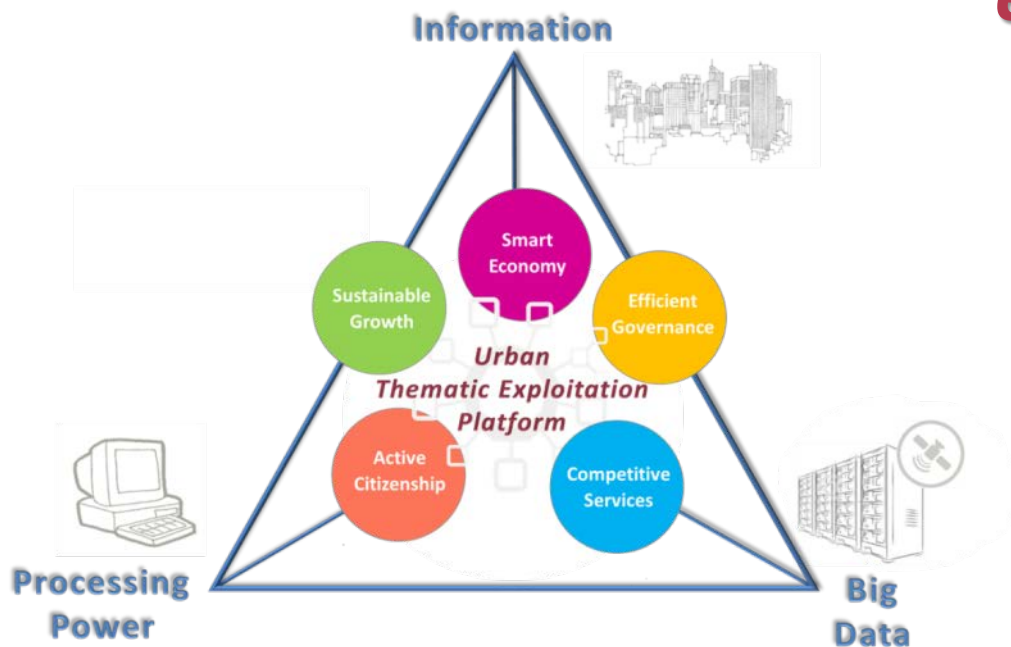


Urban Exploitation Platform (U-TEP)



U-TEP at a Glance: Scope and Objective

Development of a **platform** providing **end-to-end solutions...**



...for a broad **spectrum of users**
(experts and non-experts)...

...to extract **unique information/indicators** required for **urban management** and **sustainability**.

U-TEP Version 1.0: All-in-One Solution

Web-portal
(entry point)

urban tep

Background Use Scenarios Data & Services Activities Community

Global Urban Footprint (GUF) layer now available
Discover DLR's new Global Urban Footprint (GUF) data at the Urban TEP platform and inspect the urban and rural human settlements pattern in a so far unique precision and consistency

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

Browse GUF

Explore or task thematic applications

Connect with users and communities

Develop and offer content

U-TEP Version 1.0: All-in-One Solution



Explore or task thematic applications

Portal



Geobrowser

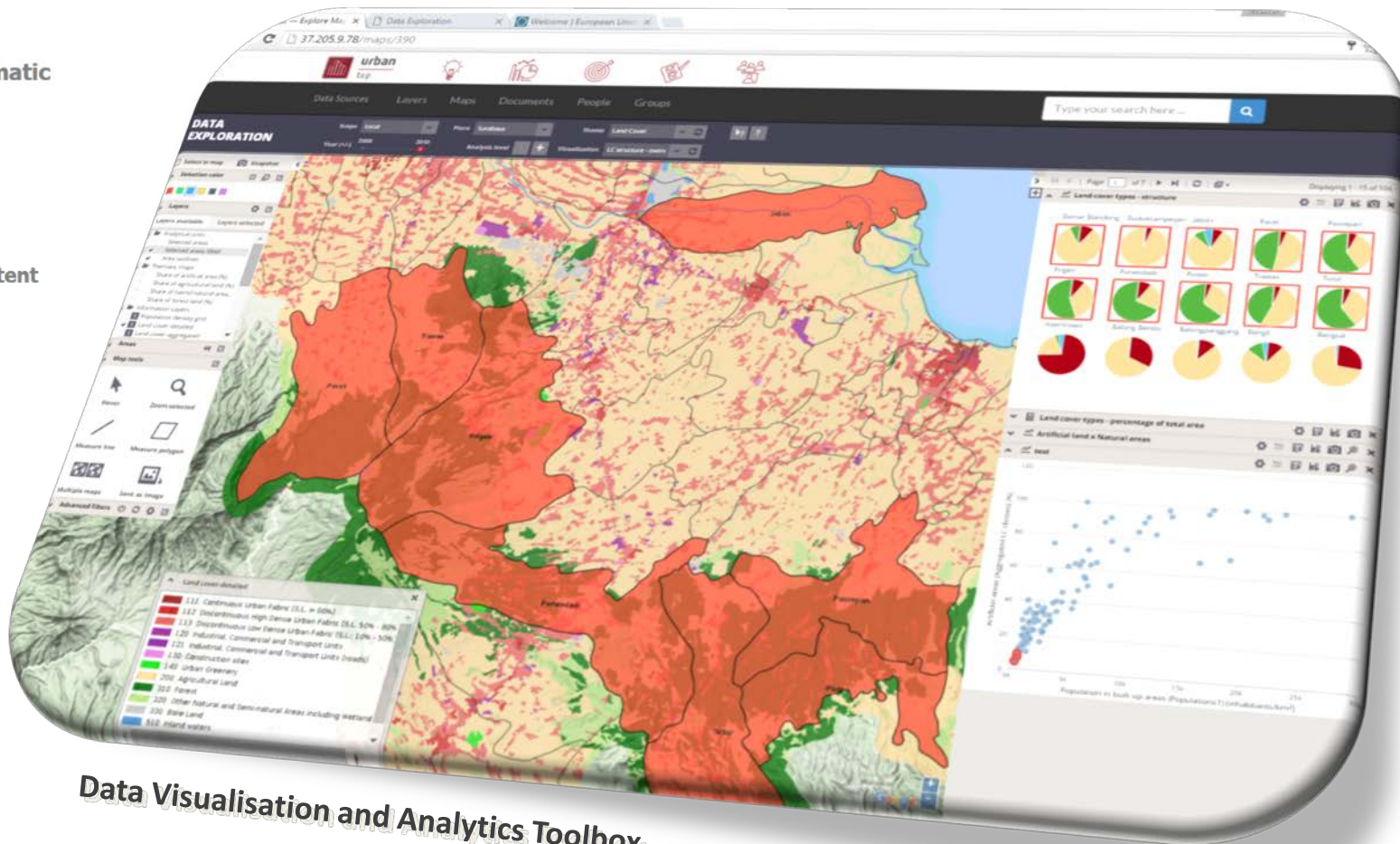
U-TEP Version 1.0: All-in-One Solution



Explore or task thematic applications



Develop and offer content

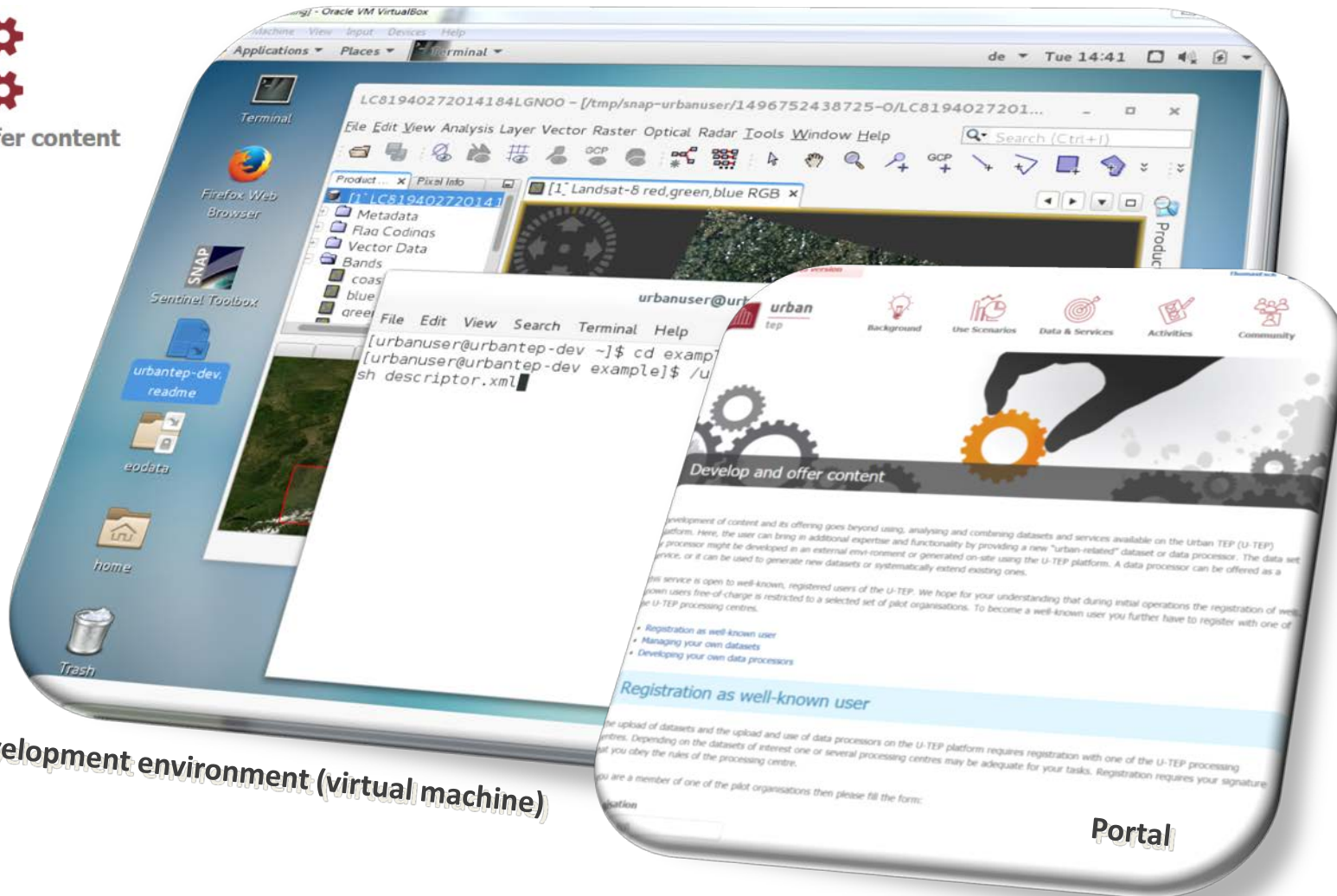


Data Visualisation and Analytics Toolbox

U-TEP Version 1.0: All-in-One Solution



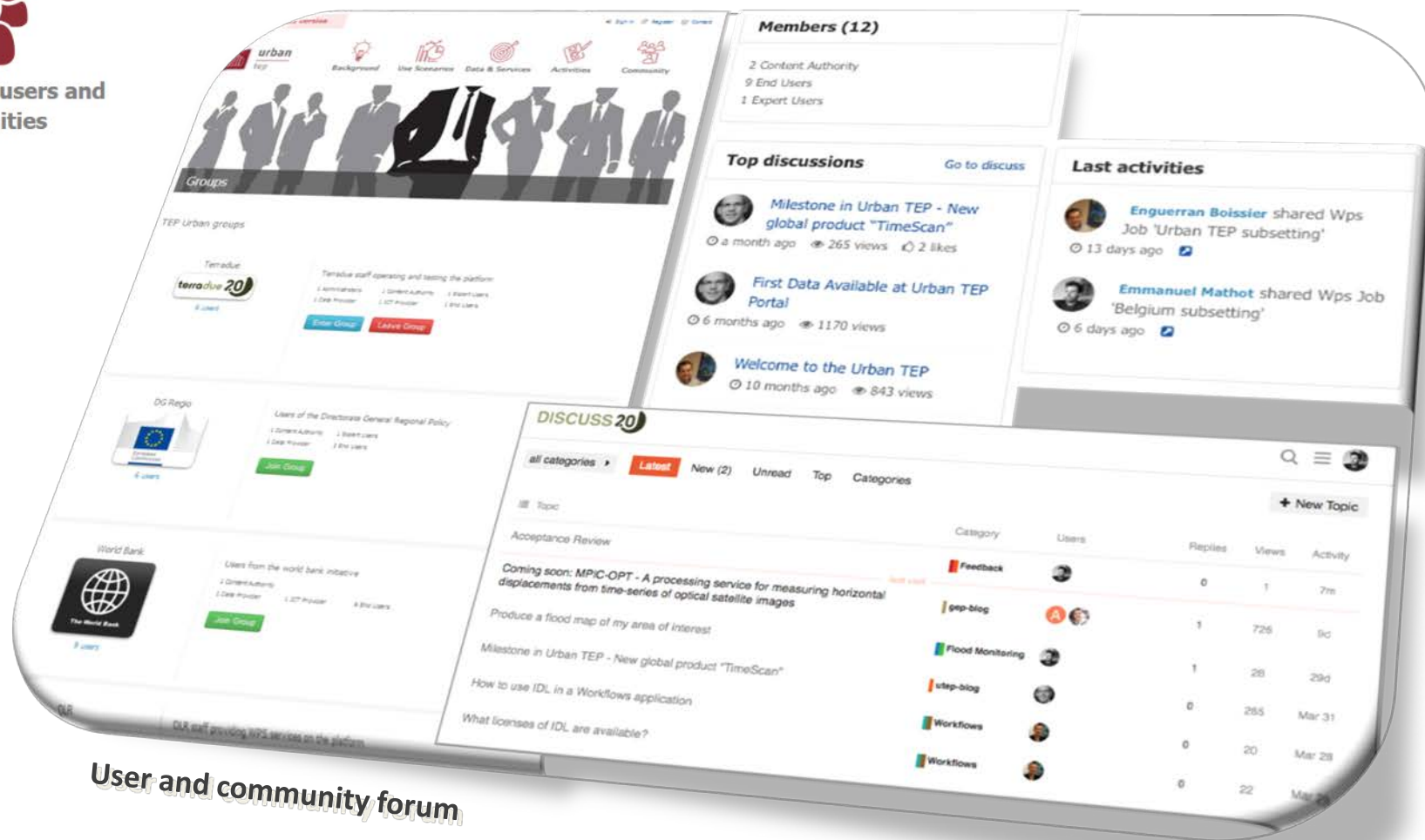
Develop and offer content



U-TEP Version 1.0: All-in-One Solution



Connect with users and communities



A stylized world map with a blue background and white landmasses, centered behind the title text.

Wrap-up

Contributions to Human Planet Initiative



Next Steps

▪ *Provision of GUF/GUF+ data*

- For GUF 2012: send order/license form to guf@dlr.de (download: www.dlr.de/guf)
- [GUF+ 2015](#), [GUF+ 2015 Density](#) and [GUF+ Evolution](#) ready by Oct-Nov 2017
- [Beta-version\(s\)](#) will be provided already [on request](#) (email to guf@dlr.de)
- [Open and free release](#) (i.a. via U-TEP portal) as soon as full validation/quality assurance are completed (early 2018)

▪ *Global validation and cross-comparison*

- Development of sound [understanding of product characteristics](#)
- Baseline for [HPI's future strategy](#) regarding [production/monitoring/analysis](#)
- [Managing expectations](#) of user communities

▪ *U-TEP*

- Innovative [all-in-one](#) and [end-to-end](#) solution
- [Matchlessness portfolio](#) of products, service and enabling technologies
 - Multi-mission, multi-source [data access](#) (efficiency, handiness).
 - Remote [high-performance processing](#) (timeliness, efficiency).
 - Data [visualization and analytics toolbox](#) (value-adding).
 - Data and technology [sharing](#) (innovation, societal benefit).
 - Participatory, collaborative [user forum](#) (benchmarking, outreach)



Thank you for your attention!



www.dlr.de/guf

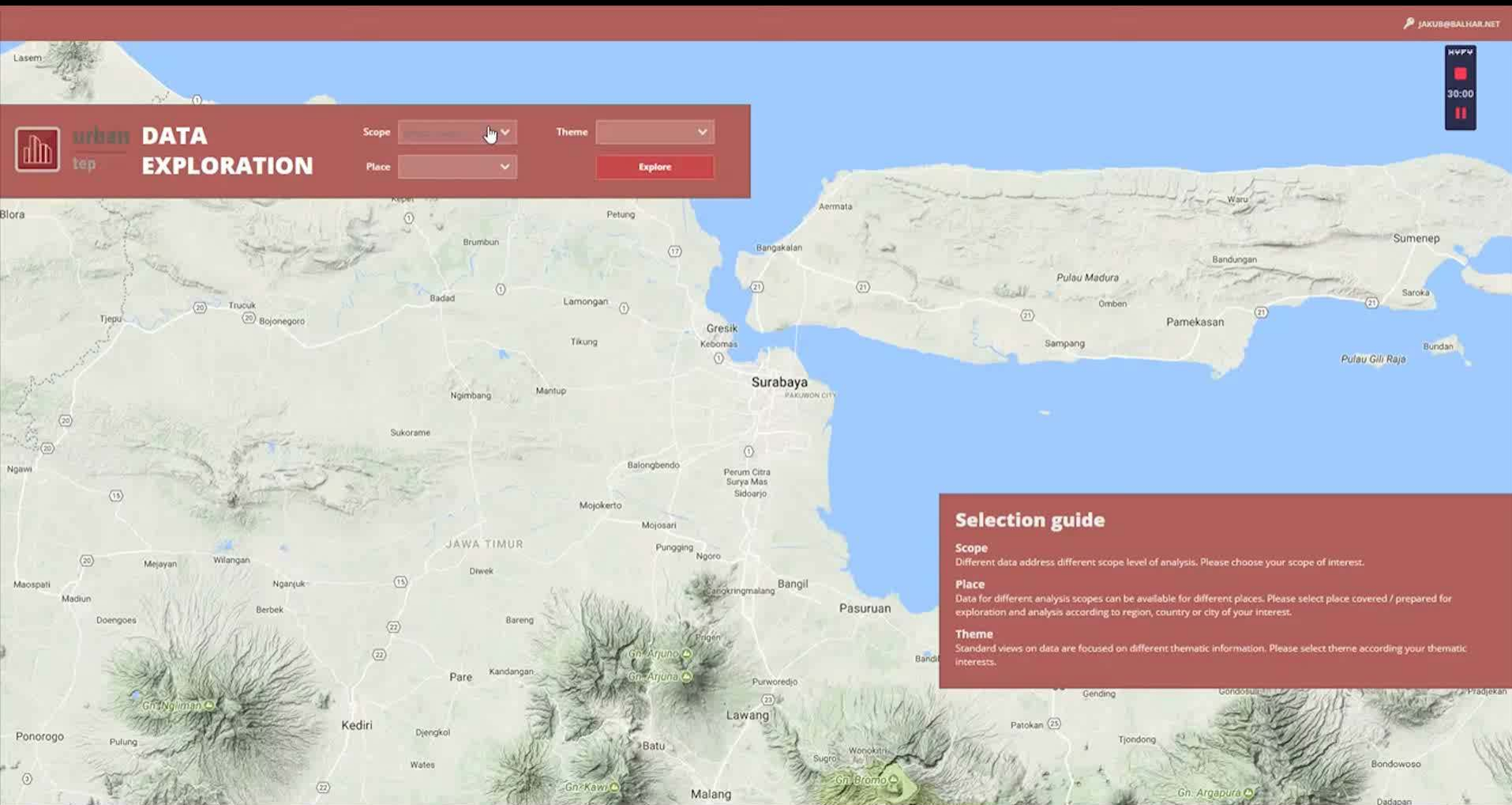
<https://urban-tep.eo.esa.int>

Dr. Thomas Esch

Telephone: +49 8153 28-3721 | Email: thomas.esch@dlr.de



U-TEP Version 1.0: All-in-One Solution



U-TEP Version 1.0: All-in-One Solution

WORLD BANK GROUP | Working for a World Free of Poverty

INTRODUCTION | DOWNLOADS | HELP

LOG IN | HVFV SIGN UP

30:00

DATA EXPLORATION

Scope:

Place:

User Agreement

By clicking "I agree", I certify that I have read, understood, and agree to be bound by the terms of this User Agreement and all of the Terms and Conditions of the Platform for Urban Management and Analysis website (the "PUMA Platform," or the "Platform"), which can be found through links on the Platform. I understand that accepting this User Agreement and the Terms and Conditions is a condition precedent to being able to access the Platform's data, and I will not be allowed to proceed unless I have agreed.

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Selection guide

Scope
Different data address different scope level of analysis. Please choose your scope of interest.

Place
Data for different analysis scopes can be available for different places. Please select place covered / prepared for exploration and analysis according to region, country or city of your interest.

Theme
Standard views on data are focused on different thematic information. Please select theme according your thematic interests.

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