→ MAPPING URBAN AREAS FROM SPACE CONFERENCE

SENTINEL-1A SAR DATA FOR GLOBAL URBAN MAPPING: PRELIMINARY RESULTS

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Outline

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Rational For the Research

- Urbanization: a global trend

- Environmental impacts

- Climate change

- Satellite Imagery globally accessible

- Especially with the Sentinel-1A & Sentinel-2A

- Need for efficient & effective analysis tools

Main Research Objectives

- 1. To evaluate Sentinel-1A SAR imagery for urban area extraction with the KTH-Pavia Urban Extractor

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innovators
eoforurban

Global Urban Services

Team — KTH Royal Institute of Technology (Sweden)
University of Pavia (Italy)
Users — Stockholm County Administration (Sweden)
National Geomatics Center (China)

Study Areas & Data

| Study area	Image Date	Image Type	Orbit Type	Polarization	Incidence Angle
Beijing	2015-05-02	IW	DSC	VV	~ 28° (IW 1)
	2015-05-12	IW	ASC	VV	~32° (IW 1-2)
	2015-05-24	IW	ASC	VV/VH	~32° (IW 1-2)
	2015-05-26	IW	DSC	VV	~28° (IW 1)
Jakarta	2015-05-12	IW	DSC	VV	~32° (IW 1-2)
Mexico	2015-05-15	IW	DSC	VV	~45° (IW 3)
Milan	2015-03-10	SM	DSC	HH/HV	~ 35° (S4)
	2015-03-11	SM	ASC	HH/HV	~ 43° (S6)
Stockholm	2015-06-09	IW	ASC	VV/VH	~35° (IW 2-3)
	2015-06-09	IW	DSC	VV/VH	~35° (IW 2-3)
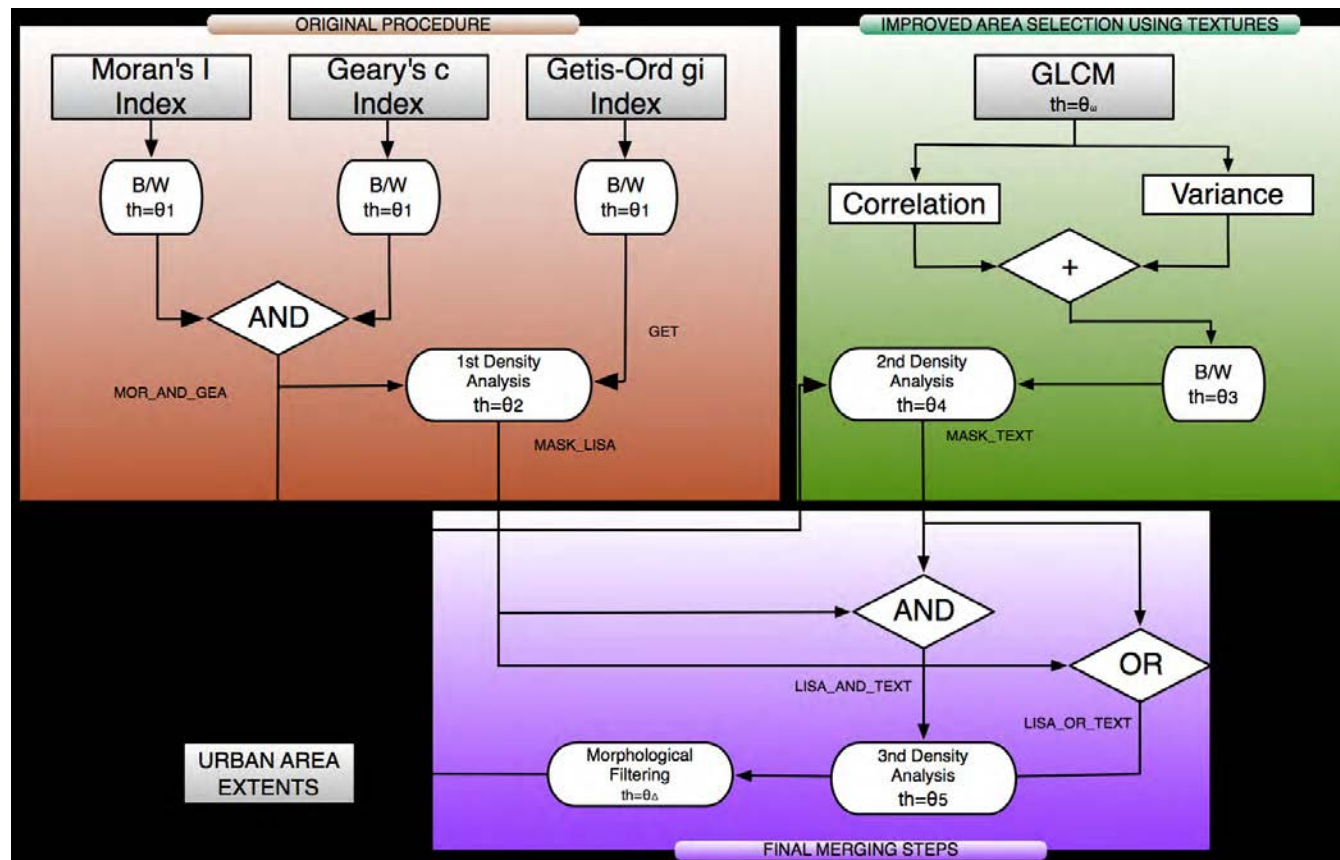
Gamba, P. , Aldrighi, M. and Stasolla, M., 2011, Robust Extraction of Urban Area Extents in HR and VHR SAR Images, IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, Vol. 4, No. 1, pp. 27 – 34
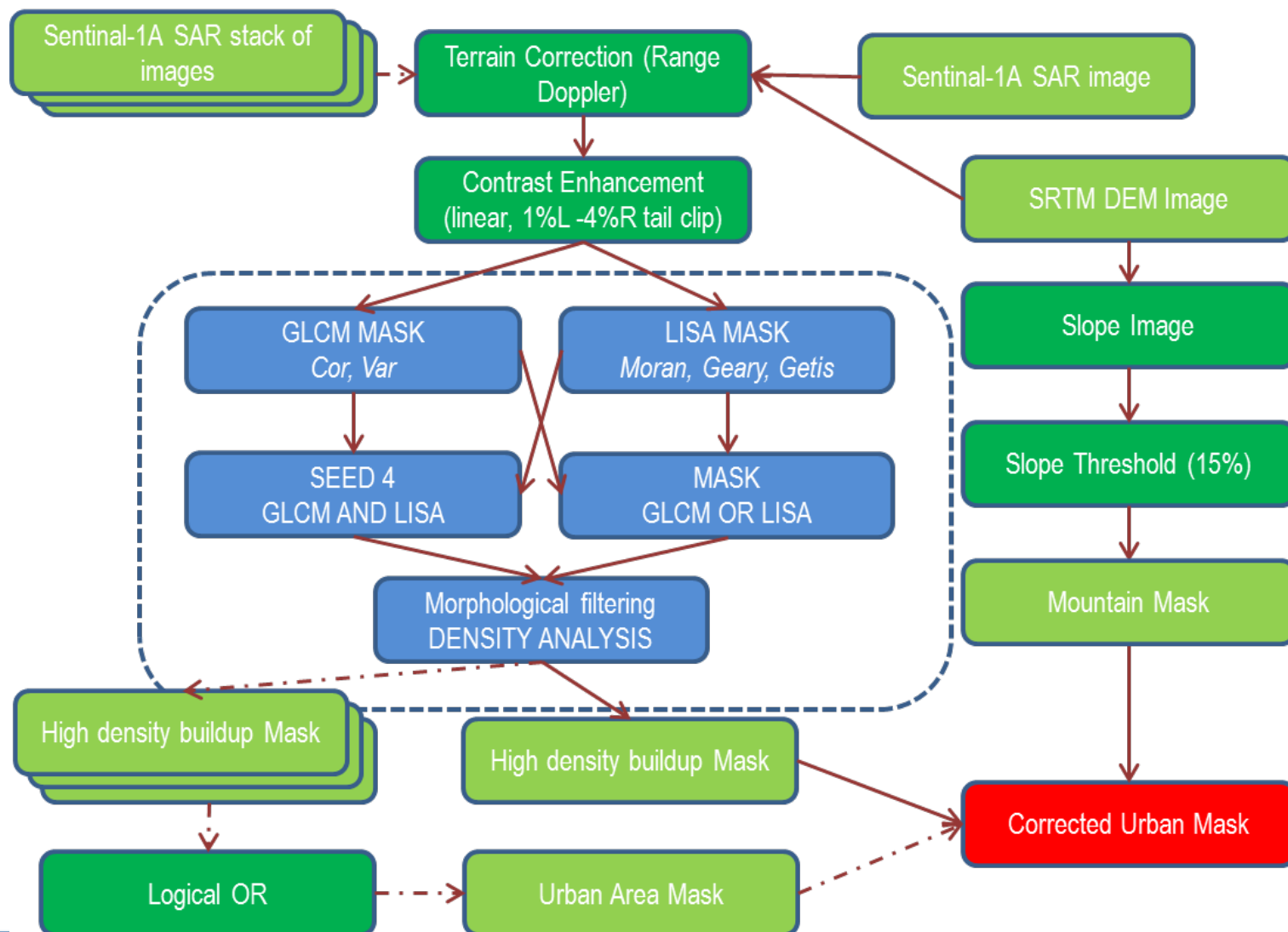
- Milan and Stockholm were evaluated using EEA Urban Atlas
  - The classes have been divived into urban and non-urban
  - Additional evaluation of Stockholm against building cadaster.

- Beijing & Stockholm were evaluated using random sampling
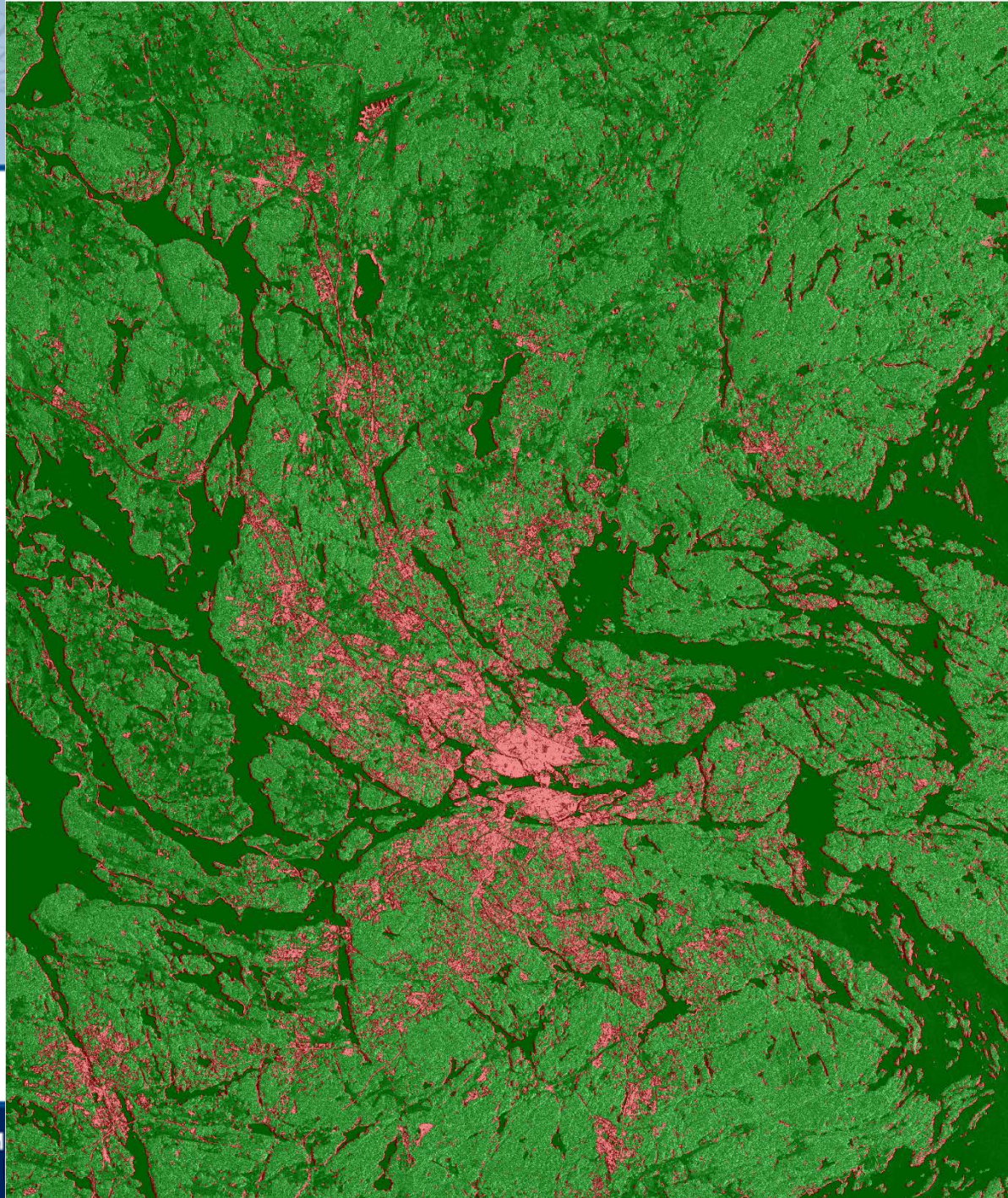 - Roughly 10000 urban and 10000 non urban pixels have been labeled for each study area.

Results

Milan

March 2015
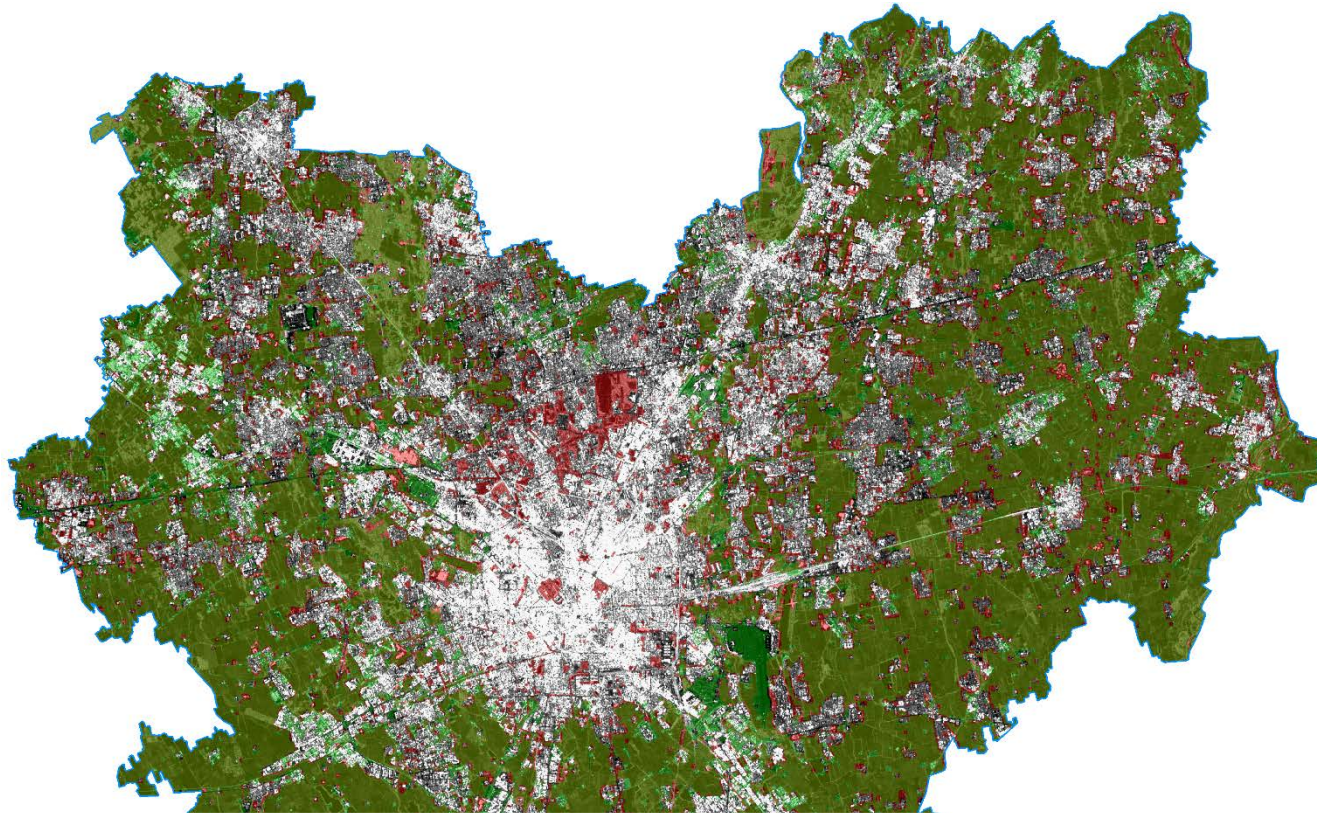
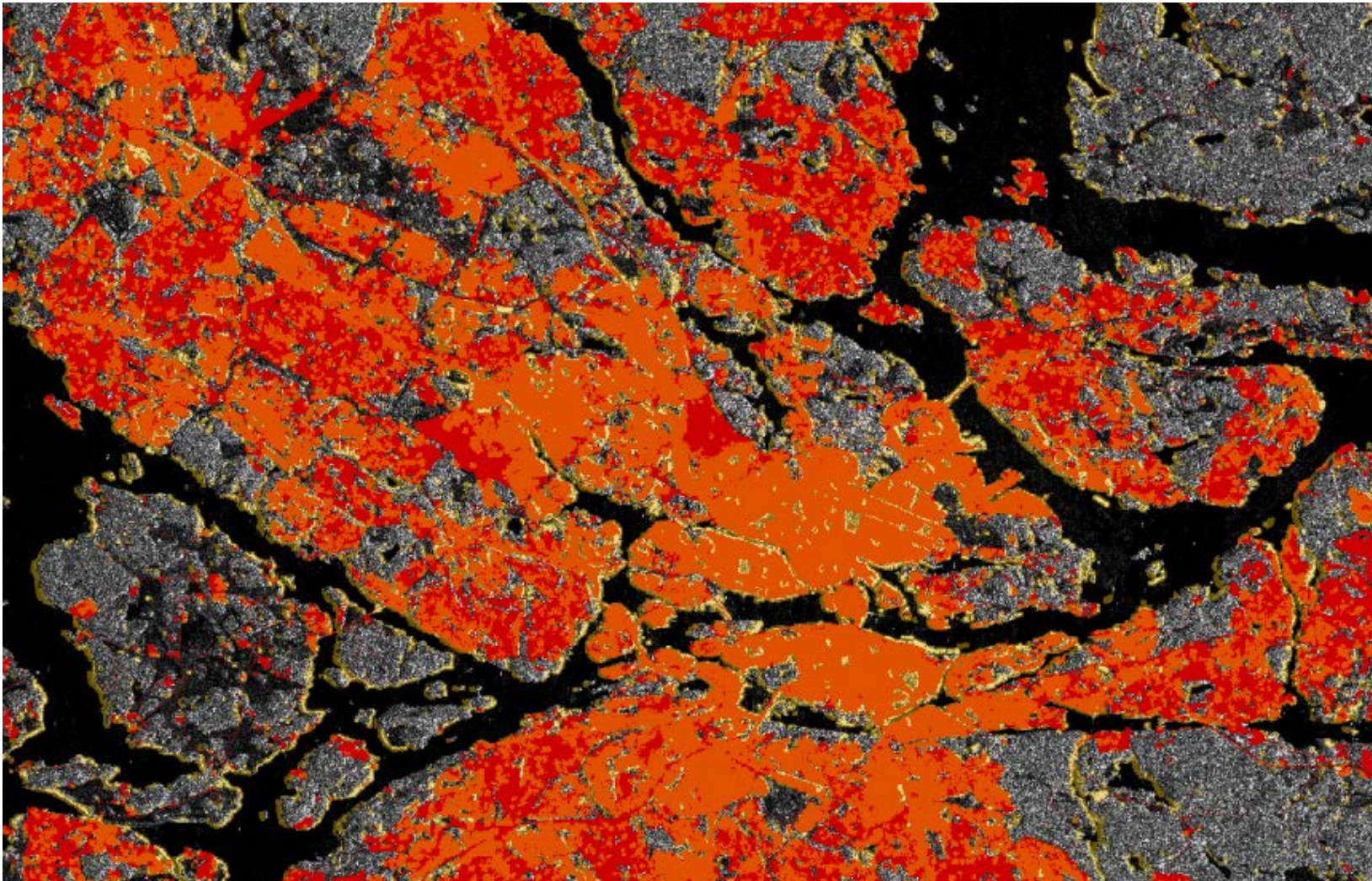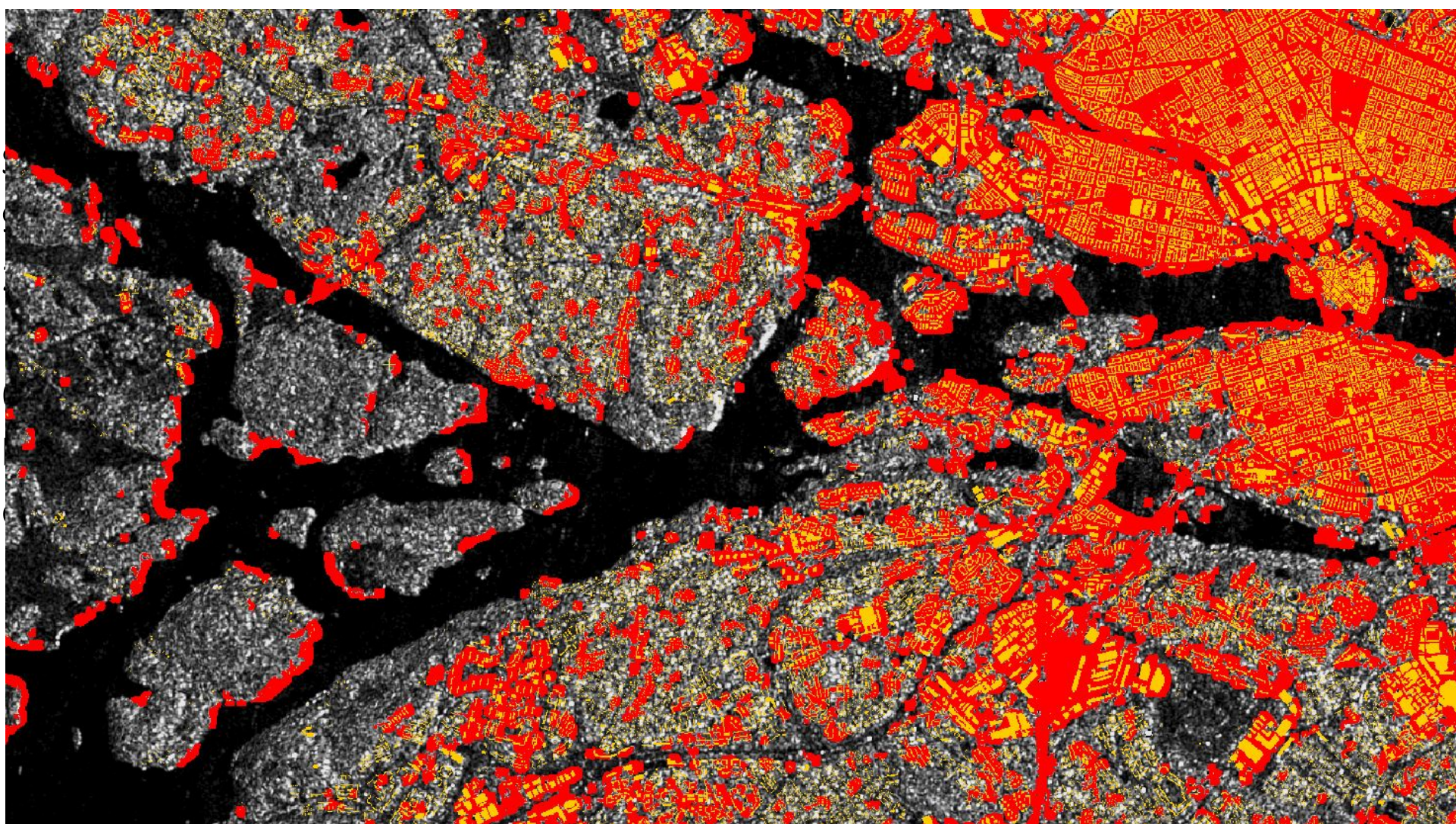| Input data	Sensor Mode	Overall Accuracy	Urban Precision
ASC HH	SM	81.81%	69.9%
ASC & DSC HH	SM	83.21%	79.5%

Stockholm

9th of June 2015

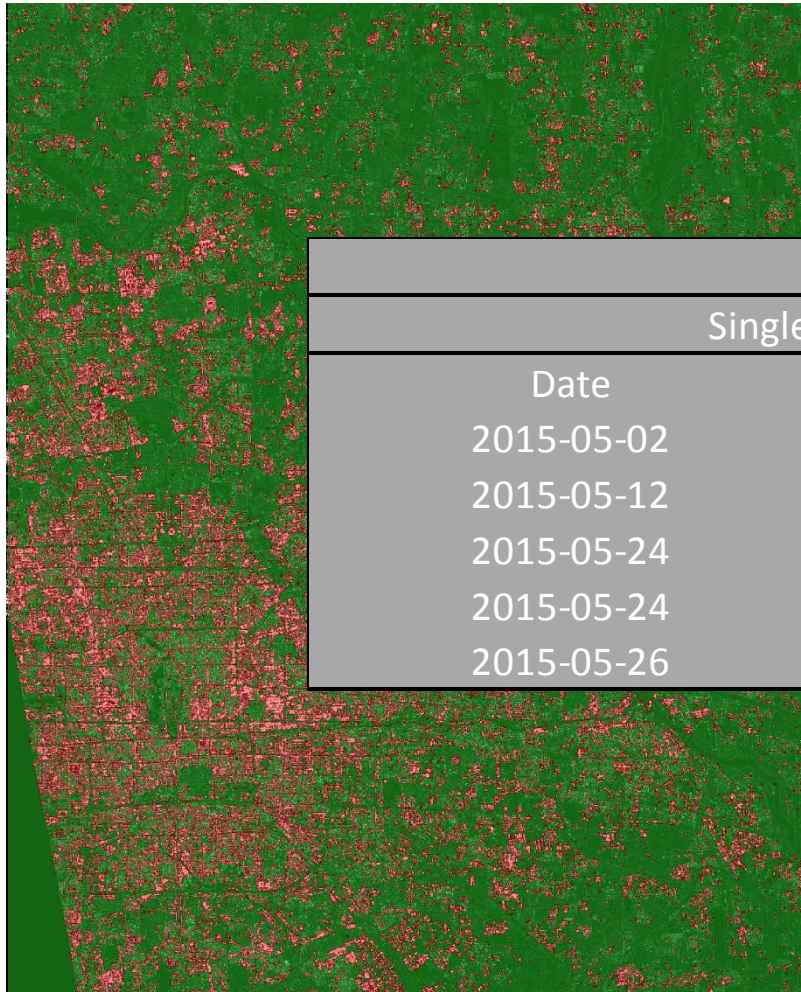72% Urban Acc.

9% Commision

28% Ommission

Stockholm
9th of June
2015

45% Urban
Agreement
with
Urban Atlas
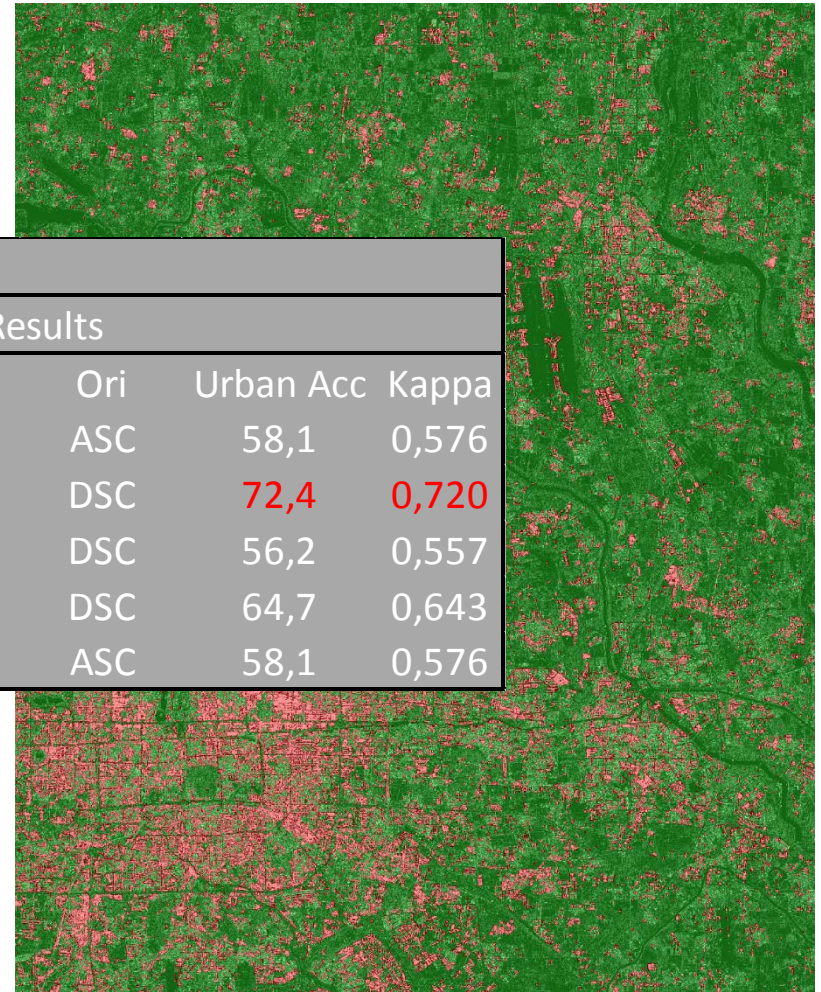
Results

Results

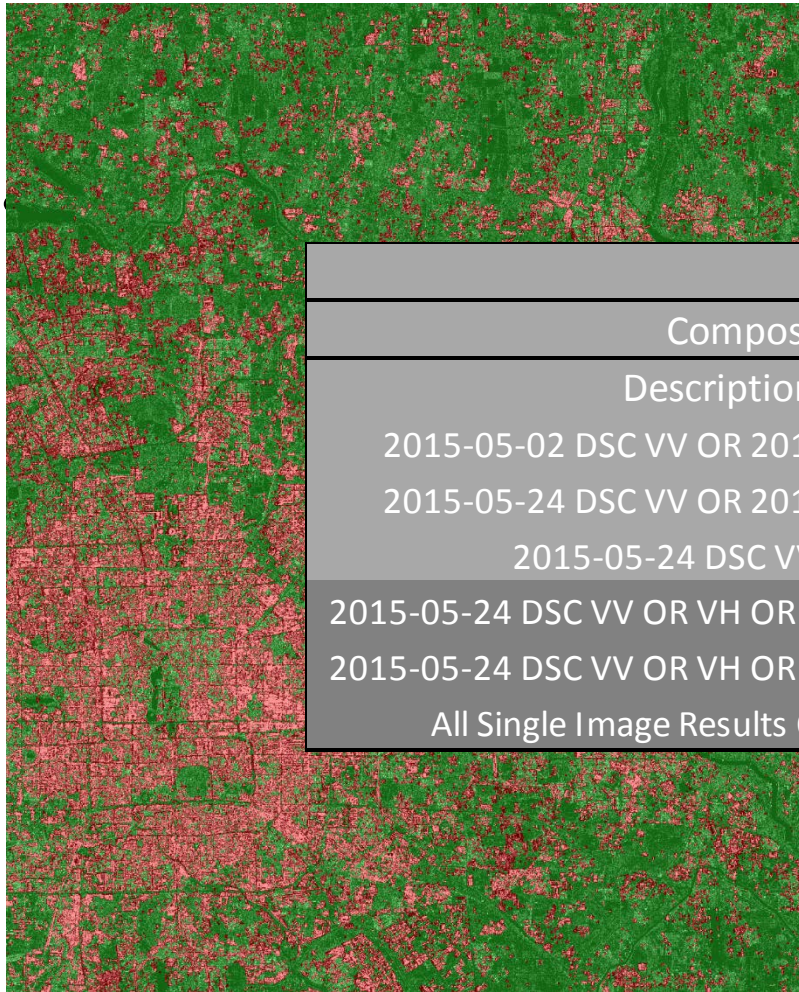| Beijing				
Single Image Results				
Date	Pol	Ori	Urban Acc	Kappa
2015-05-02	VV	ASC	58,1	0,576
2015-05-12	VV	DSC	72,4	0,720
2015-05-24	VH	DSC	56,2	0,557
2015-05-24	VV	DSC	64,7	0,643
2015-05-26	VV	ASC	58,1	0,576

Beijing May 2015-05-02 VV DSC

Beijing May 2015-05-24 VV ASC

Beijing May Pol Comp May 24

Beijing ASC DSC Comp 0502 0512

Results

Beijing		
Composite Image Results		
Description	Urban Acc	Kappa
2015-05-02 DSC VV OR 2015-05-12 ASC VV	78,3	0,780
2015-05-24 DSC VV OR 2015-05-26 ASC VV	68,4	0,679
2015-05-24 DSC VV OR VH	72,8	0,724
2015-05-24 DSC VV OR VH OR 2015-05-26 ASC VV	79,7	0,793
2015-05-24 DSC VV OR VH OR 2015-05-12 DSC VV	79,8	0,795
All Single Image Results OR Combined	84,9	0,846

Beijing Pol + ASC + DSC
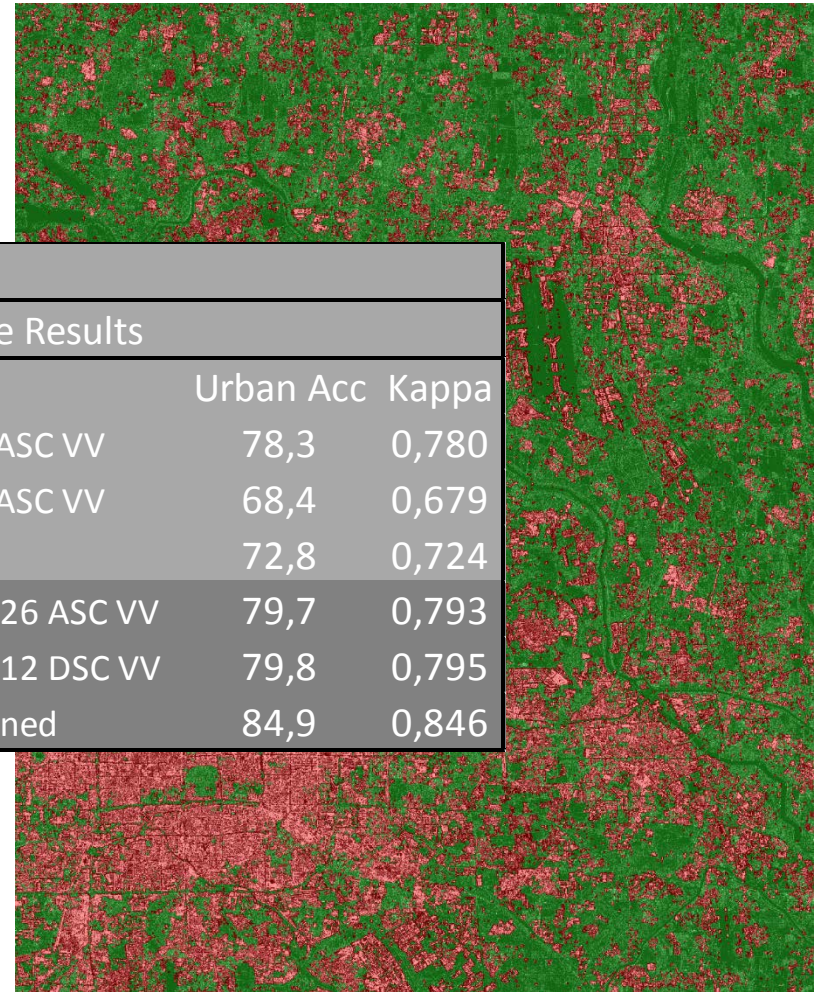
Beijing All Images Composite
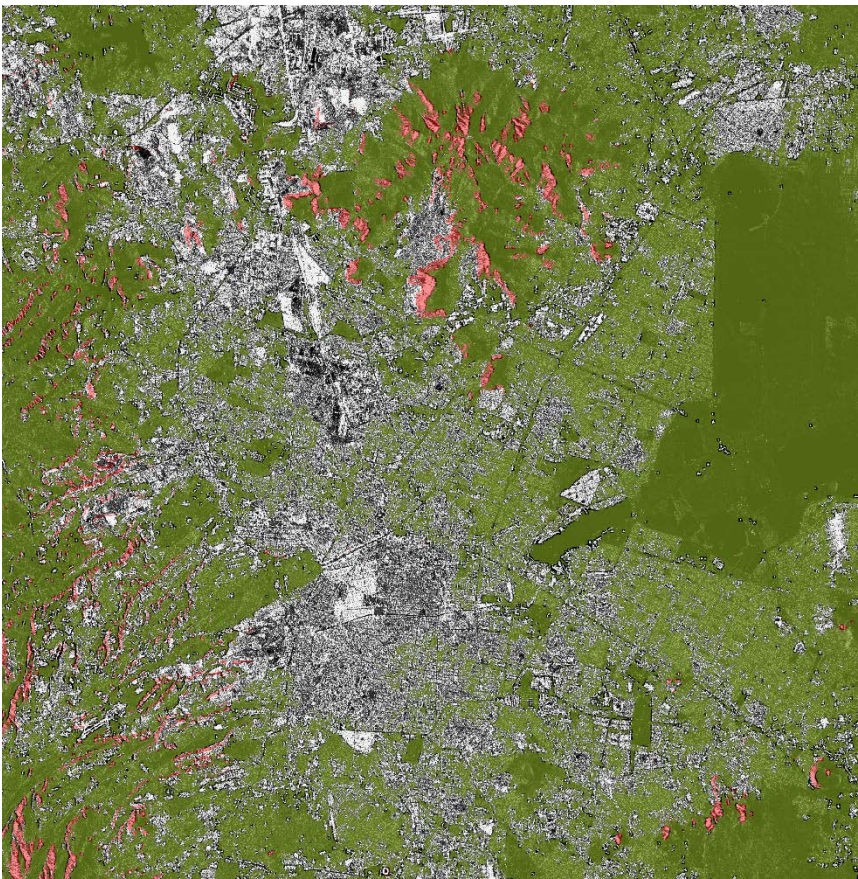
Results

Mexico City May 2015

Jakarta May 2015

Conclusion
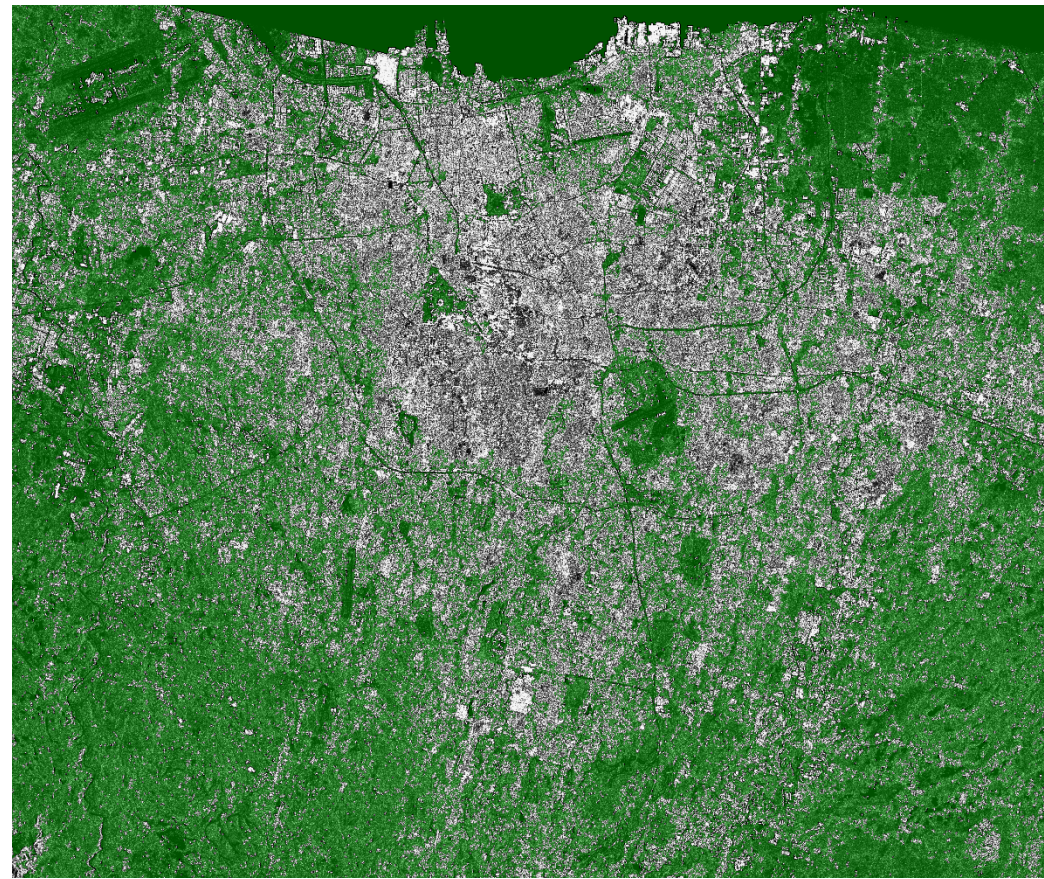
- Sentinel-1A data produced very promissing results for SM & IW modes

- When having images from ascending and descending orbits and even better when those are also available in two polarizations: > 80% urban detection.

- Some problems with low density builtup extraction (individual houses surrounded by gardens)

Future Research

- Direct comparison of SM & IW mode -> Milano Study area
- Analyze additional images from peak vegetation season
- Once available inclusion of sentinel 2A data -> for improvement in low density builtup areas.
- Possibly introduction of automatic adaptivity both in preprocessing for image contrast enhancement as well as in threshold selection.

Thank you for your attention!

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