

→ MAPPING URBAN AREAS  
FROM SPACE CONFERENCE

# Towards a Global Built-up Area Map using Multitemporal Sentinel 1A Data

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# Outline

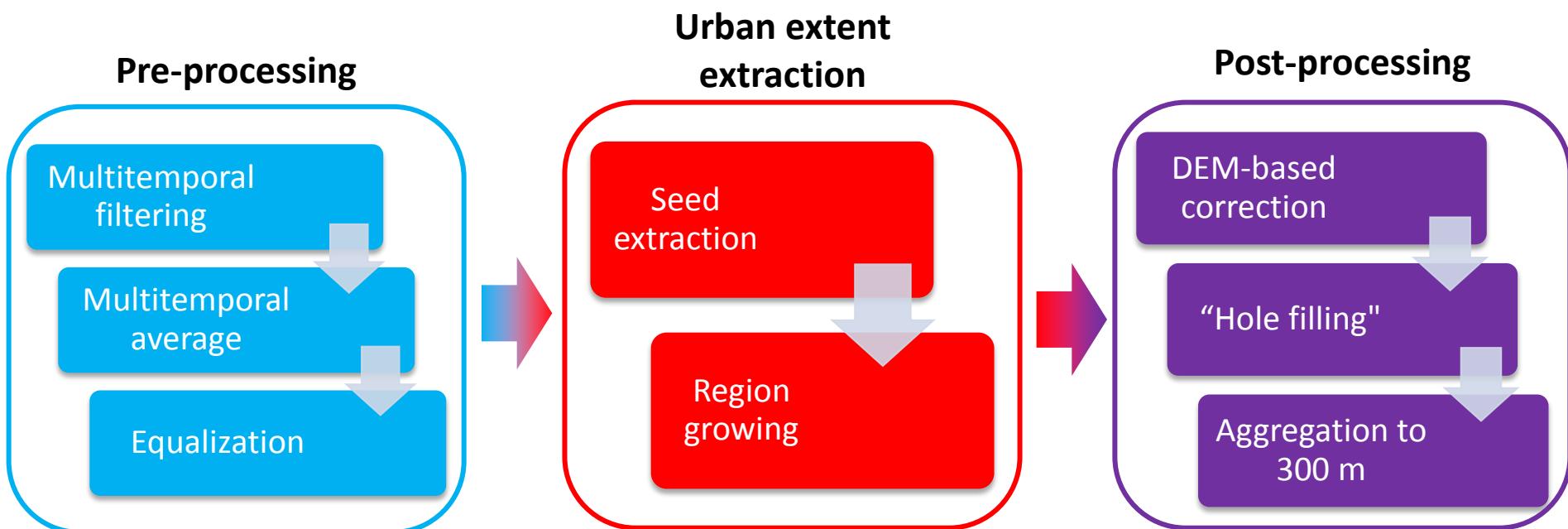


- Urban Extractor (UEXT) algorithm
- UEXT 2.0
- Results
- Accuracy assessment
- Conclusions & perspectives

# Urban EXTractor



- Tuned to 75m spatial resolution of ASAR WSM
- Exploits strong backscatter from artificial structures in multi-temporal data sets



# Is UEXT applicable also on Sentinel 1 data?



- Optimization of UEXT for Sentinel 1A data
- Adoptions necessary due to increased resolution

Changed thresholds:  
seed\_th, around\_seed\_th  
Blob\_fill\_th, max\_blob\_mountain

## Pre-processing

Multitemporal filtering

Multitemporal average

Equalization

## Urban extent extraction

Seed extraction

Region growing

## Post-processing

DEM-based correction

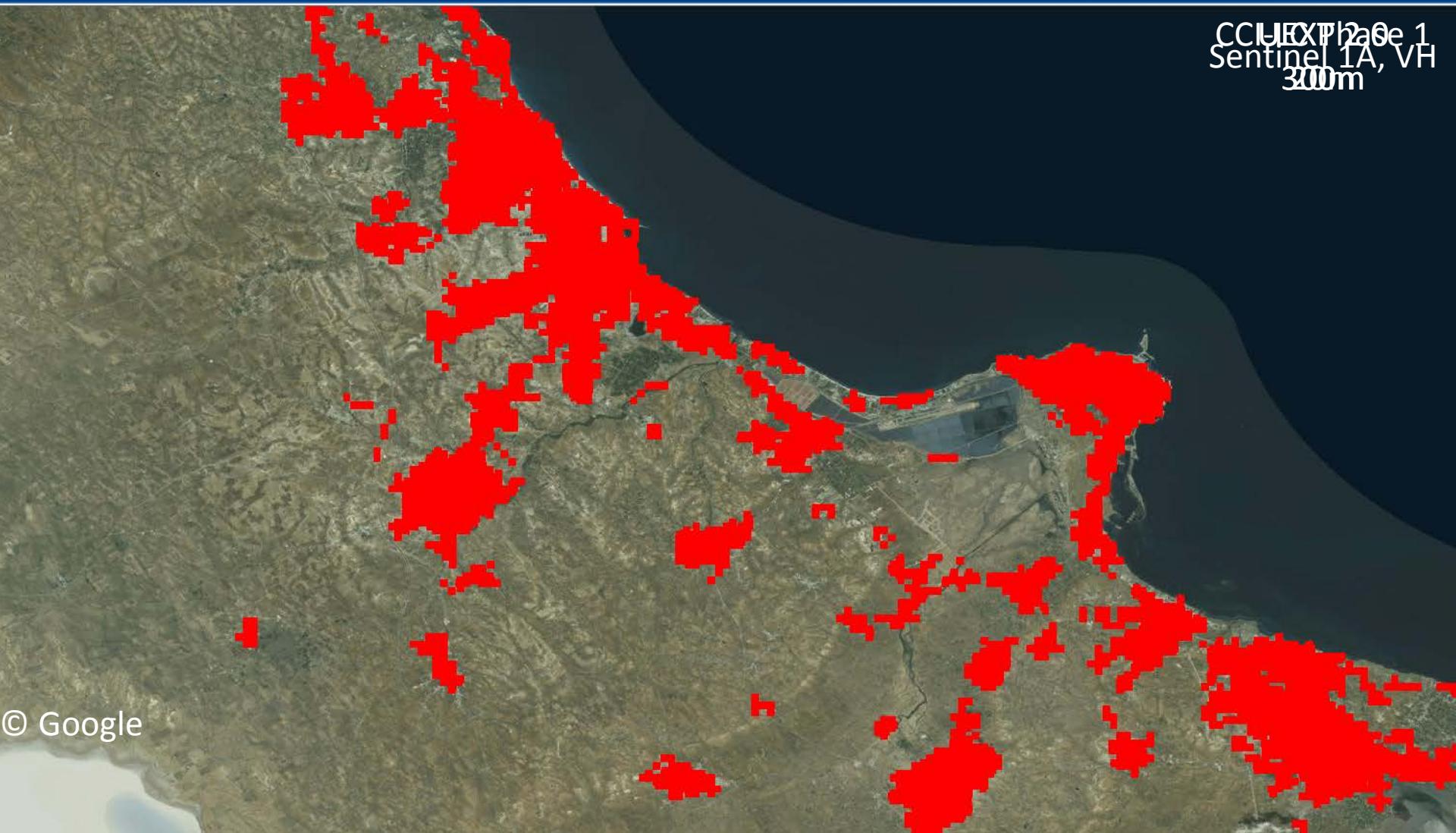
"Hole filling"

Object-based refinement

# Test sites



# Results



# Results



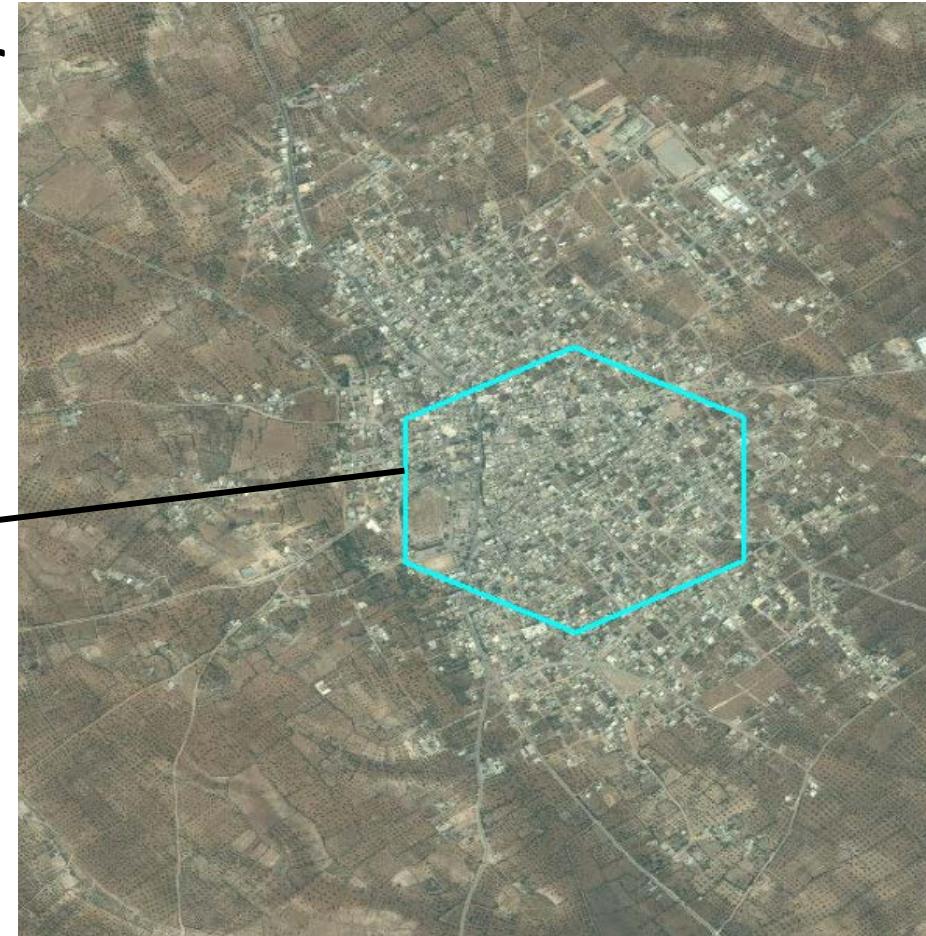
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# Reference data



- **Visual validation of random samples**

- CLASS 0: no urban cover
- CLASS 1: 1-25 %
- CLASS 2: 26-50 %
- CLASS 3: 51-75 %
- CLASS 4: 76-100 % ←



# Accuracy assessment

Testsite	CLASS 0	CLASS 1	CLASS 2	CLASS 3	CLASS 4	FINAL # samples urban/rural
TUNISIA	123	16	18	134	101	<b>235</b>
PORTUGAL	187	102	119	170	69	<b>239</b>
TURKEY	101	100	67	113	40	<b>153</b>
EGYPT	153	34	42	301	187	<b>488</b>
ISRAEL	141	38	53	208	66	<b>274</b>

# Accuracy assessment

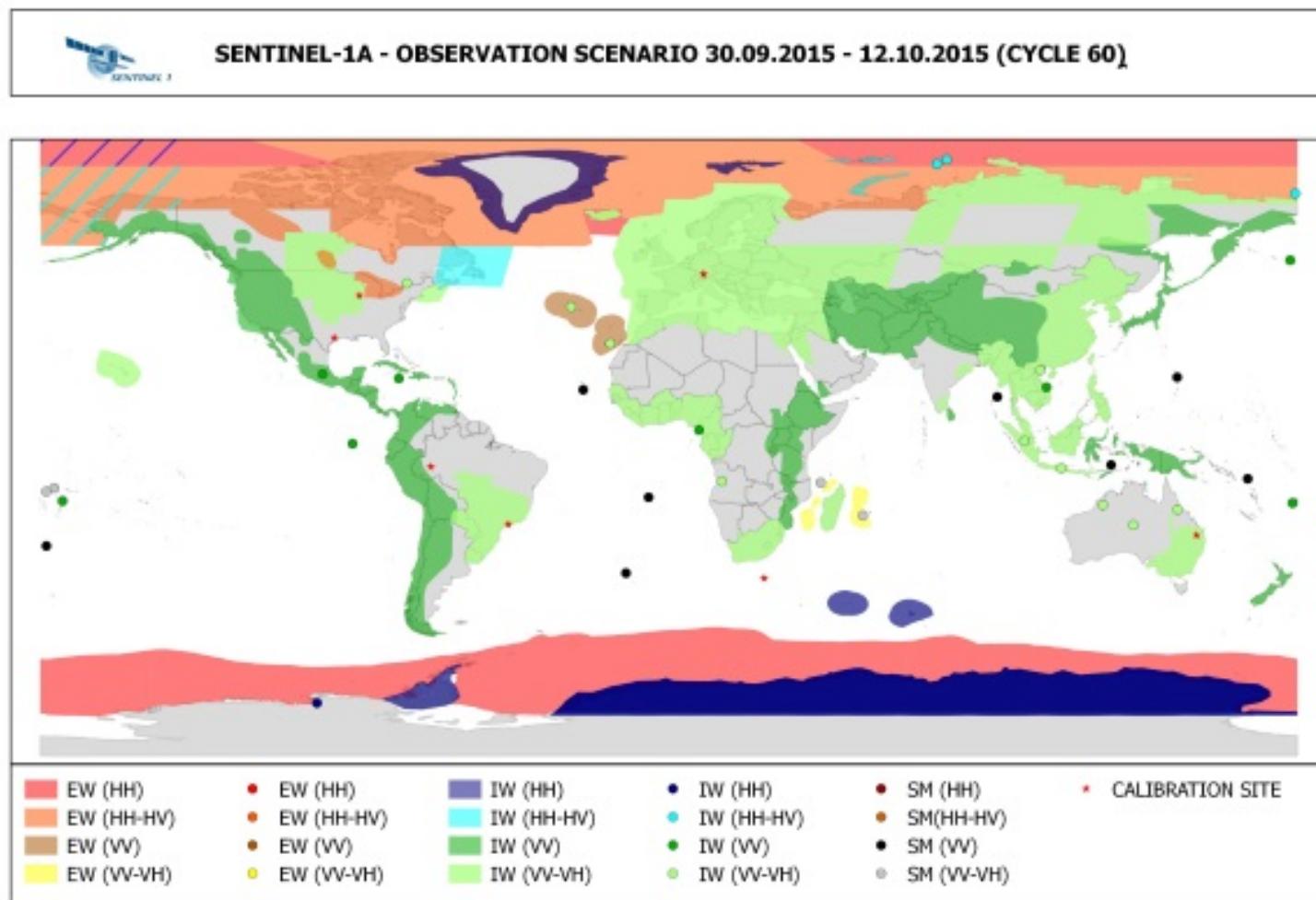
Testsite	data	resolution [m]	Polarization	Commission Error [%]	Omission Error [%]	Overall Accuracy [%]	KHAT	Change OA [%]
Turkey	CCI-LC-urban 2010	300	VV/HH	47.06	3.27	<b>74.84</b>	0.5	<b>xxx</b>
	S1-multitemp	20	VV/VH	4.58	9.15	<b>93.14</b>	0.86	<b>18.3</b>
	S1-multitemp	300	VV/VH	5.23	4.58	<b>95.1</b>	0.9	<b>20.26</b>
Tunisia	CCI-LC-urban 2010	300	VV/HH	31.06	13.62	<b>77.66</b>	0.55	<b>xxx</b>
	S1-multitemp	20	VV/VH	5.53	14.47	<b>90</b>	0.8	<b>12.34</b>
	S1-multitemp	300	VV/VH	6.38	11.06	<b>91.28</b>	0.83	<b>13.62</b>
Israel	CCI-LC-urban 2010	300	VV/HH	42.34	19.71	<b>68.98</b>	0.38	<b>xxx</b>
	S1-multitemp	20	VV/VH	17.15	17.15	<b>82.85</b>	0.66	<b>13.87</b>
	S1-multitemp	300	VV/VH	19.34	13.5	<b>83.58</b>	0.67	<b>14.6</b>
Portugal	CCI-LC-urban 2010	300	VV/HH	31.38	0.84	<b>83.89</b>	0.68	<b>xxx</b>
	S1-multitemp	20	VV/VH	11.72	14.64	<b>86.82</b>	0.74	<b>2.93</b>
	S1-multitemp	300	VV/VH	17.15	8.37	<b>87.24</b>	0.74	<b>3.35</b>
Egypt	CCI-LC-urban 2010	300	VV/HH	14.55	2.87	<b>91.29</b>	0.83	<b>xxx</b>
	S1-multitemp	20	VV/VH	26.02	13.93	<b>80.02</b>	0.6	<b>-11.27</b>
	S1-multitemp	300	VV/VH	27.87	9.22	<b>81.45</b>	0.63	<b>- 9.84</b>

# UEXT 2.0 Pros & Cons



- + High level of detail due to fine spatial resolution and VH polarization
- + Fast processing
- + robust, same thresholds for all testsites
  
- Multitemporal stack is necessary
- Results depend on number of images

# Data availability



# Conclusion & perspectives



- UEXT is applicable on Sentinel 1 data
  - Quality of urban maps is improved significantly
  - Transferable to the planetary scale
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- Participation in Round Robin (in collaboration with FSU Jena)
  - Combination of methods and update of current CCI-LC urban class