Beach Litter Monitoring in the Arctic using drone and satellite imagery

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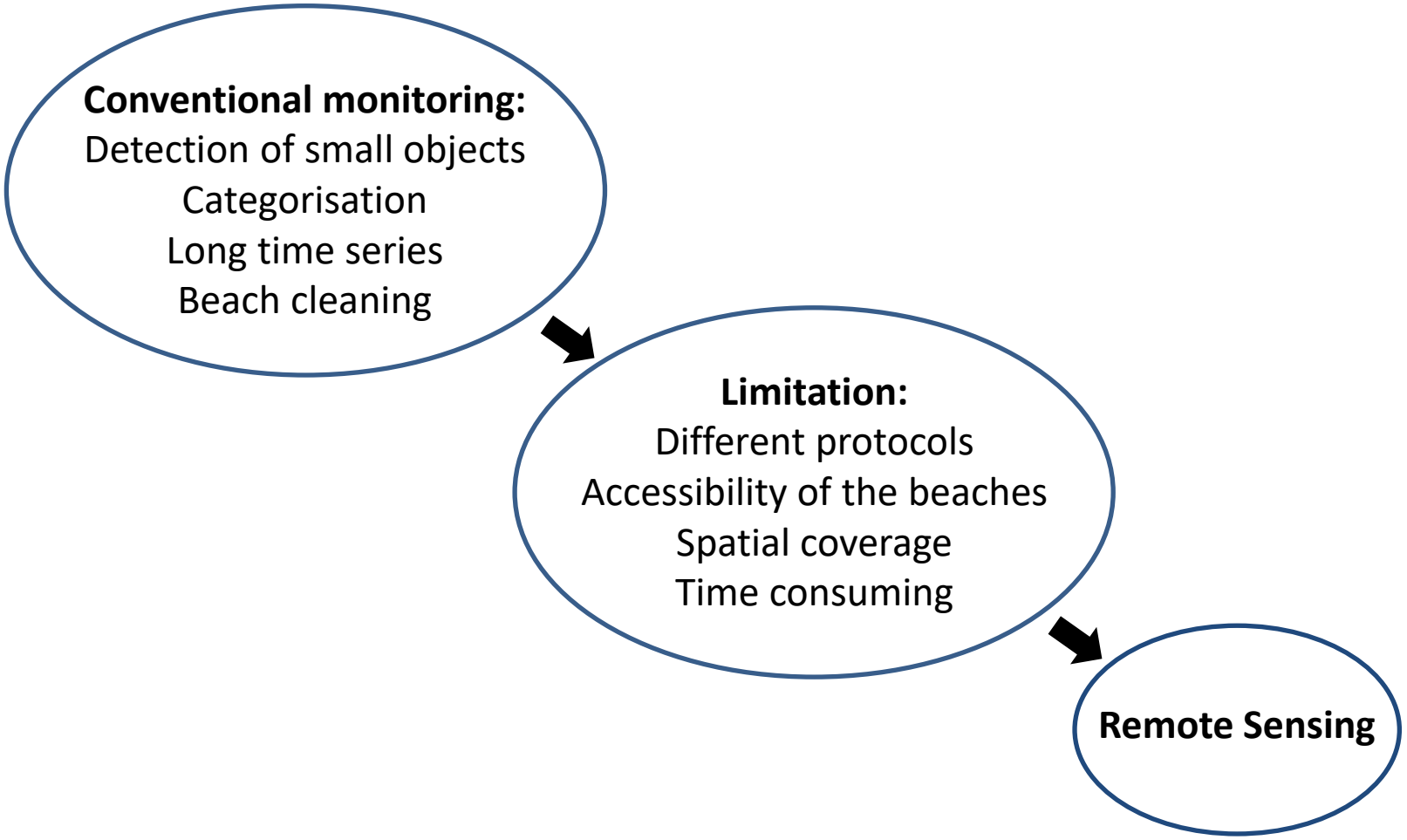
FKZ 3719 18 201 0 - Environmental Protection in the Arctic – support of German activities in the Arctic Council in terms of a pilot study on monitoring plastic litter on arctic coastlines applying remote sensing techniques

Monitoring of plastic litter



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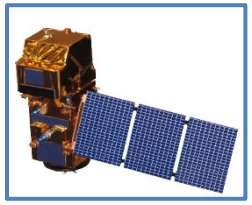
Remote sensing for beach litter in the Arctic

Conventional monitoring + remote sensing

Satellite



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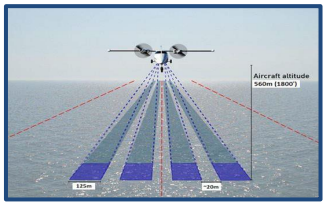
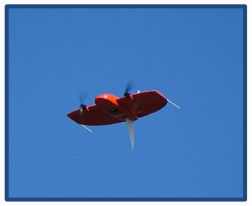
Aircraft



HiDef BioConsult SH

Drones



WingtraOne: VTOL Monitoring Drone

Requirements:

Area coverage | Time saving | Comparability

Combination of multiple methods:

High spatial resolution of the UAV sensor
Area coverage by satellite images (WV3)
Comparability through automatization

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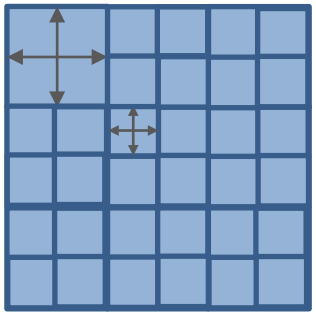
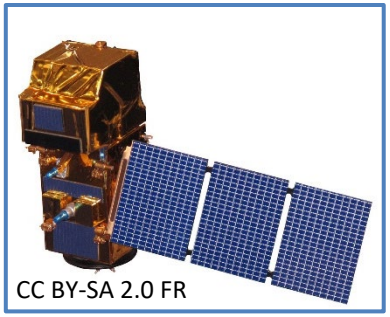
Remote sensing for beach litter

Drones



Manuell Screening
Detection/ Classification
Automatic detection

Satellite



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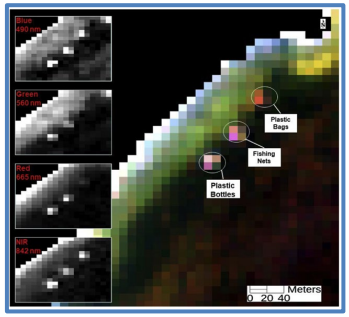
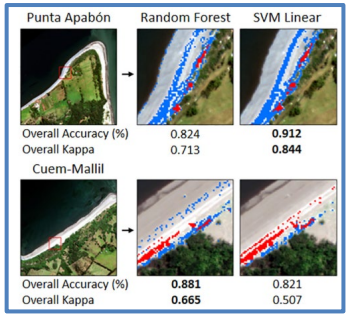
Credits: Digital Globe



Topouzelis et al. (2019)



Acuña-Ruz et al. (2018)

Detection
Sub-Pixel Recognition

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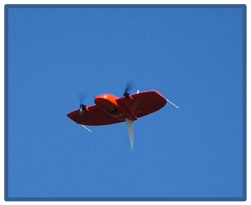
Remote sensing for beach litter - drones

Time saving / area coverage

Fixed-Wing drone



High area coverage : 50 ha/ h

Flight altitude: 70 m ⟷ GSD: 1.4 cm

Time saving: Up to 10x
Fieldwork << Office

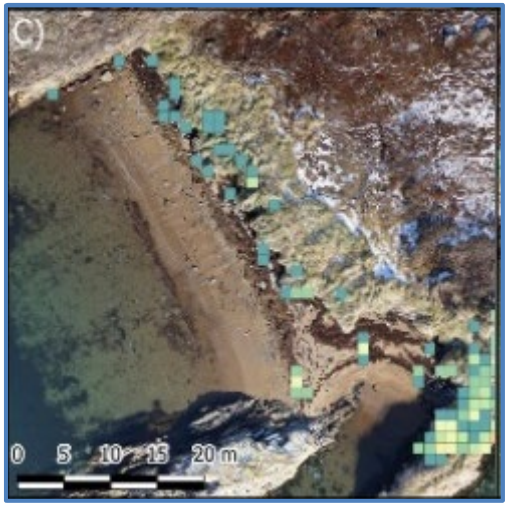
Detection/ Classification

Manual screening

Size/shape/colour + background
Objects >10 cm: mainly
Objects <10 cm: partly

Transferability

Automatic detection



False Positives
Beach parameters

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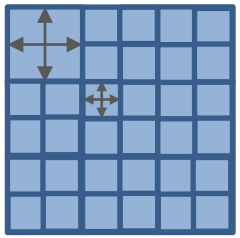
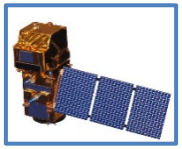
Remote sensing for beach litter - satellites

Area coverage/ costs



GSD: 1.2 m/ 3.7 m



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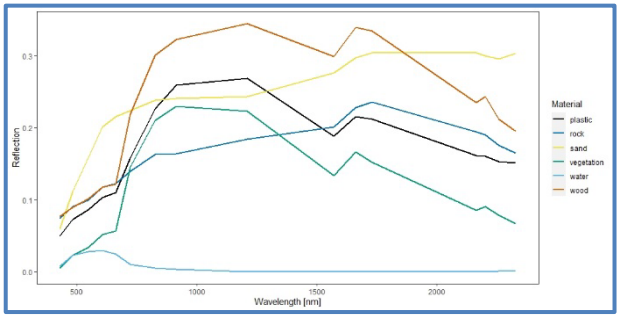
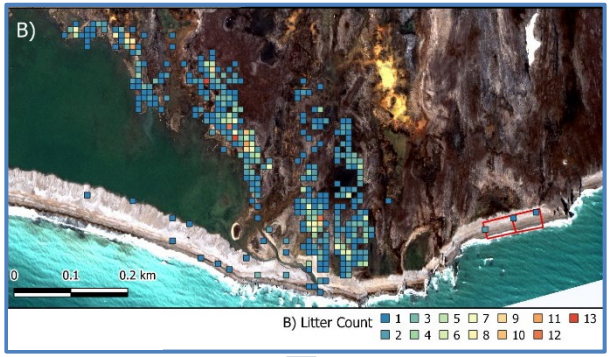
Credits: Digital Globe

GSD ⟷ Costs

Area ⟷ Costs

Detection





Sub-Pixel Recognition:
< 10% Plastics per pixel

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Outlook - Remote sensing for beach litter

Drones

- Detection < 10 cm
- Automatization
- Categorisation
- Integration in existing procedures

Satellite

- Identification Hotspots
- Spatial Resolution
- Reduction costs
- Integration in existing procedures

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Thank you!

Literature

Acuña-Ruz, Tomás, et al. "Anthropogenic marine debris over beaches: Spectral characterization for remote sensing applications." *Remote Sensing of Environment* 217 (2018): 309-322.

Topouzelis, K., Papakonstantinou, A., & Garaba, S. P. (2019). Detection of floating plastics from satellite and unmanned aerial systems (Plastic Litter Project 2018). *International Journal of Applied Earth Observation and Geoinformation*, *79*, 175-183.