

MAPPING AND VISUALISING LAVA FLOWS OF THE FAGRADALSFJALL VOLCANO IN ICELAND

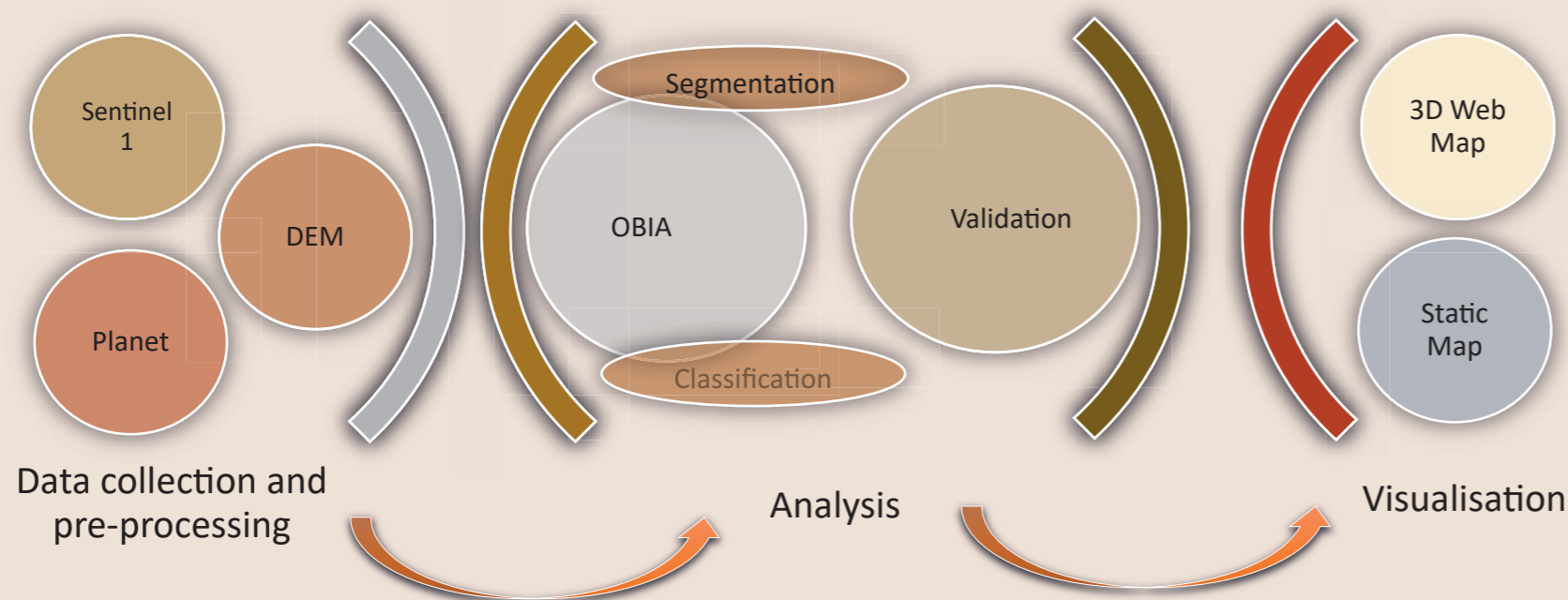
Diploma Thesis

The research goals were to 1) determine the evolution of the lava flow extent for the 2021 Fagradalsfjall eruption in Iceland using OBIA and SAR data



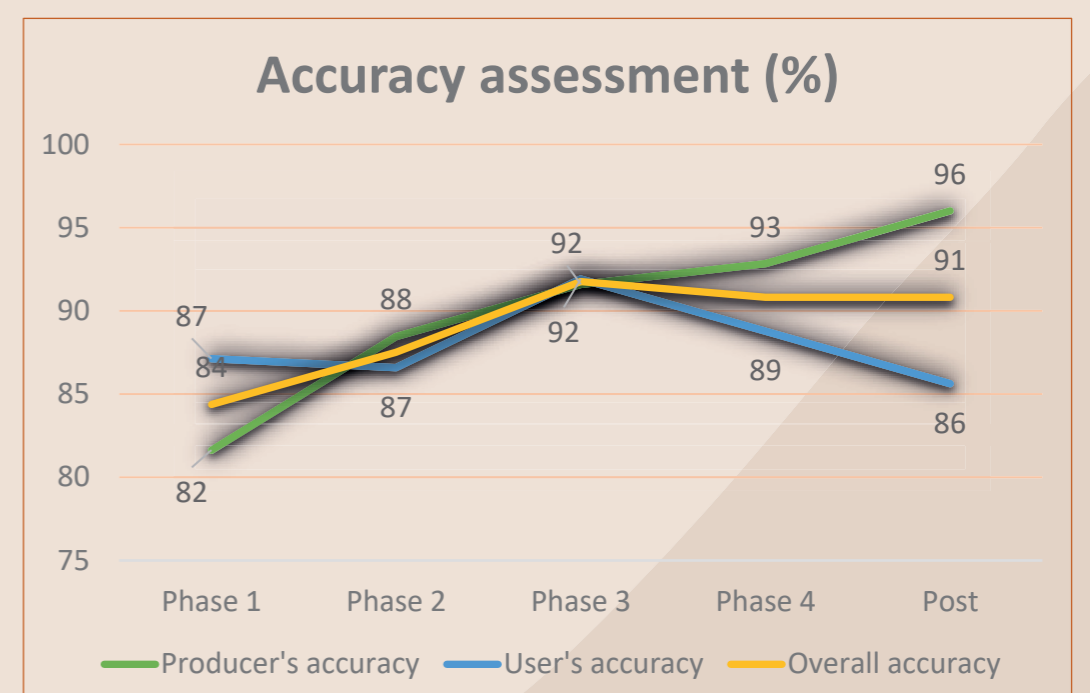
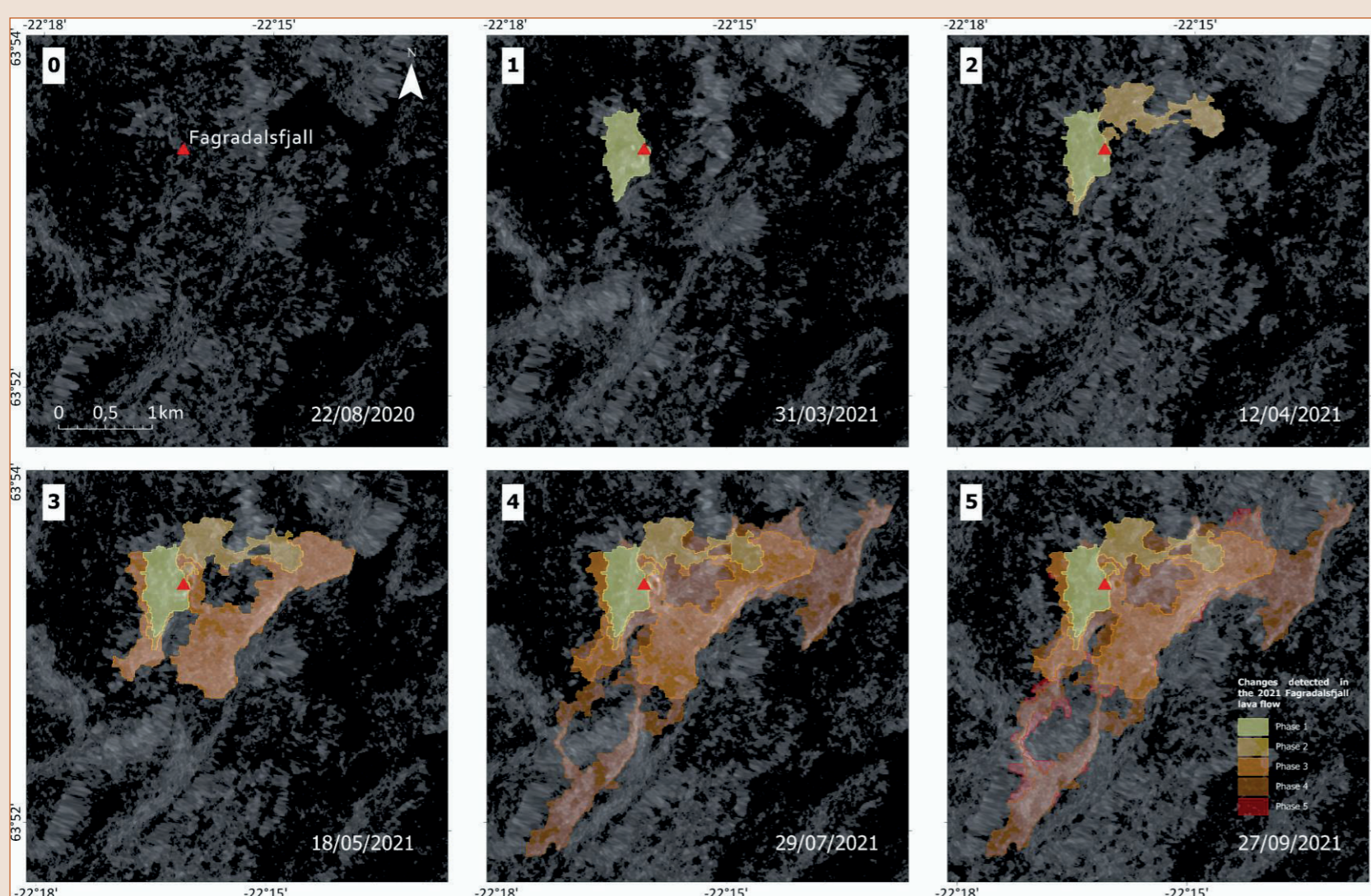
2) to evaluate the potential of freely available SAR data for semi-automated lava flow mapping, and 3) to visualise the lava flow paths interactively.

METHODOLOGY



Sentinel-1 Image Date	Event
22 August 2020	Pre-eruption
31 March 2021	Syn-event (Phase 1)
12 April 2021	Syn-event (Phase 2)
18 May 2021	Syn-event (Phase 3)
29 July 2021	Syn-event (Phase 4)
27 September 2021	Post-eruption

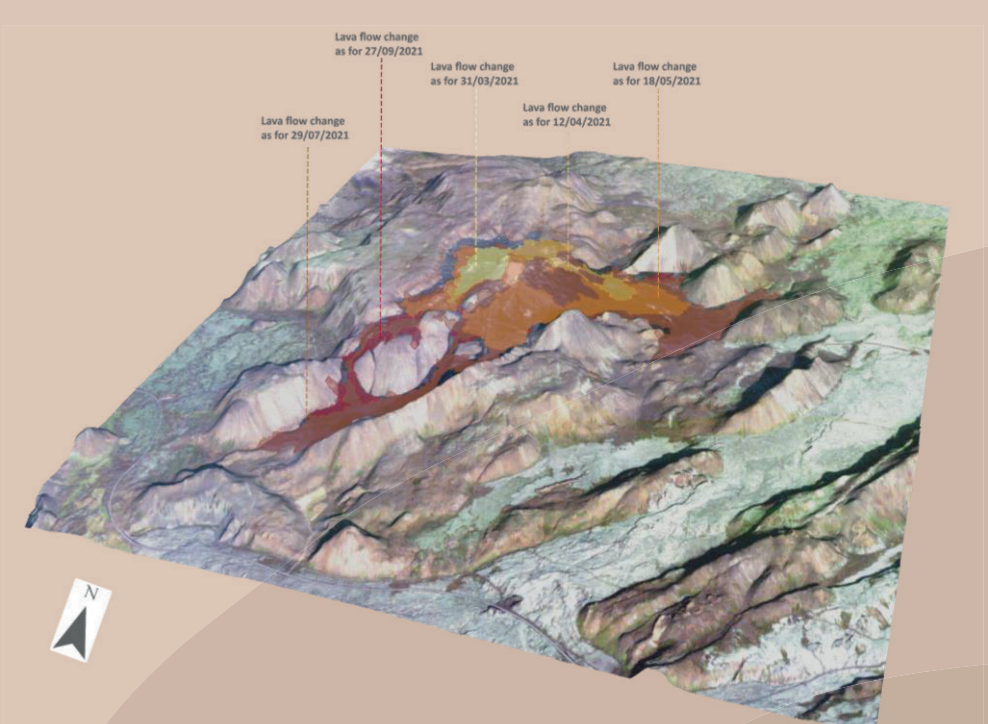
LAVA FLOW MAPPING RESULTS



Event	OBIA (km ²)	Reference (km ²)	Difference (%)	Overlap (km ²)	Producer's Accuracy (%)	User's Accuracy (%)
Phase 1	0,32	0,30	6,74	0,26	81,62	87,12
Phase 2	0,73	0,74	-2,12	0,64	88,45	86,58
Phase 3	2,07	2,06	0,35	1,89	91,59	91,91
Phase 4	4,10	4,28	-4,37	3,80	92,83	88,78
Post-eruption	4,32	4,85	-10,82	4,15	96,01	85,61

The results of the lava flow mapping is shown in the time-series maps. The pre-eruption image (0) was used as a base to compare how the area changed after the lava flow started to infill the neighbouring valleys within the Fagradalsfjall area. The images from 1 to 5 show the evolution of lava extent for the 2021 eruption. Overlap in km² shows the correctly classified lava extent. A 3D static map and a web application visualize the lava flow paths.

LAVA FLOW VISUALISATION RESULTS



CONCLUSION

In conclusion, this study revealed the high potential of using OBIA on Sentinel-1 backscatter data for mapping the lava flows of the 2021 Fagradalsfjall volcano and provided an interactive web application to communicate the results. Nevertheless, limitations associated with the SAR data and the sensitivity of the method to the chosen image objects parametrisation and classification scheme should be considered to obtain high-quality results. The outcomes of the research could be used as ground data for upcoming studies in the area. Additionally, the information contained in the lava flow maps can contribute to a better understating of the lava flow model and can support local authorities to thoroughly respond against volcanic hazards.

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References:
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 -Pedersen, et al., 2022b. Digital Elevation Models, orthoimages and lava outlines of the 2021 Fagradalsfjall eruption: Results from near real-time photogrammetric monitoring (v1.1) [Data set]. Zenodo.
 -Imagery © 2021 Planet Labs Inc.

