

Automated debris-covered glacier mapping – development for and application to Afghanistan

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Project Link: <https://wp.unil.ch/alpenv/home/our-projects/water-resource-impacts-of-afghan-glacier-recession/>

- **High altitude glaciers are difficult to map** via field data collection due to their inaccessibility (Veettil, 2012).
- **Manual digitizing:** it is time consuming and labor intensive for a large number of glaciers (Paul et al., 2004; Bhambri et al., 2011; Kaushik et al., 2019).
- **Artificial neural network (ANN):** rapid and good quality maps of clean and debris-covered ice but still errors occur due to existence of shadow, cloud cover, and seasonal snow in the imagery (Bolch and Kamp 2006; Frey et al., 2012; Kaushik et al., 2019).
- **Geomorphometric:** fails in mapping a debris covered glacier when the glacier tongue transition to the unglaciated region is gentle (Paul 2003; Bolch and Kamp 2006).
- **Decision tree & Texture analysis:** requires several post-processing steps (Bhambri et al., 2011). Patterns may not be characteristic for all the debris cover across the region (Racoviteanu & Williams 2012).
- **Unmanned Aerial Vehicle (UAV):** provides more accurate results but it is labor intense, costly, and not applicable for a large regions (Immerzeel et al., 2014).
- **Thermal (TIR) and optical:** The infrared radiometer will no longer record the thermal gap between pure debris and thicker debris. an increase or a decrease of 0.1 in the threshold value significantly influences the size of the identified zone of debris-covered ice (Bhambri et al., 2011).

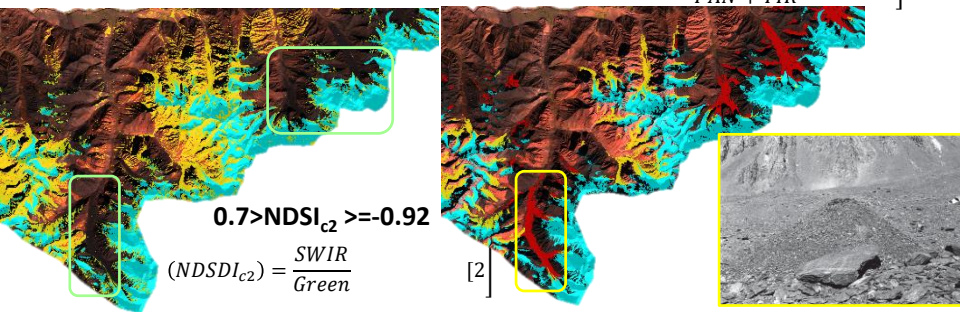
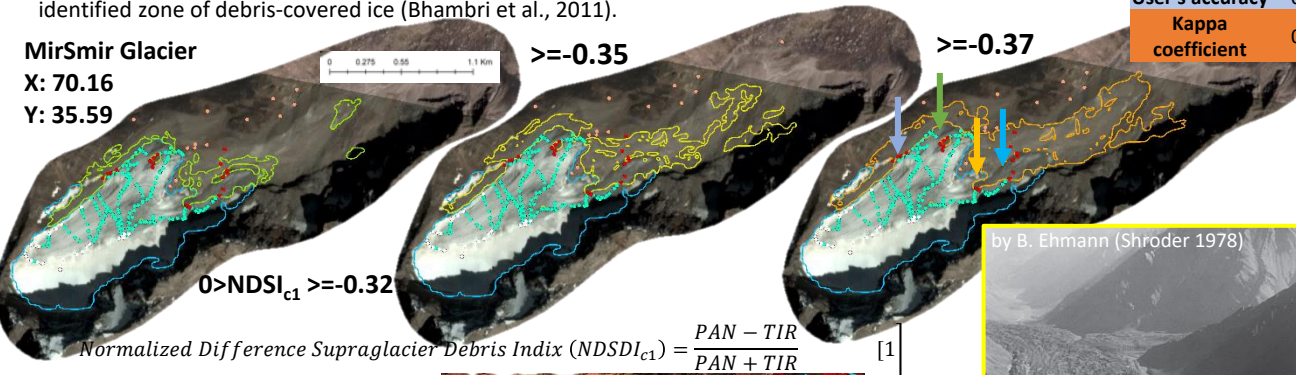
By J. Shokory 05.09.2019



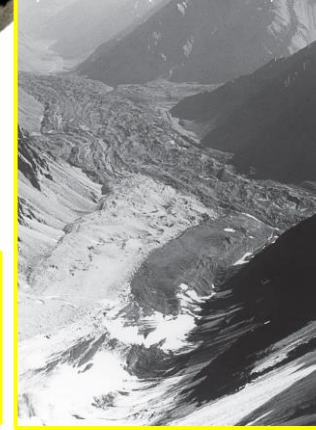
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	Clean ice	Debris covered ice	Debris
Overall Accuracy		0.96	
Producer's accuracy	0.97	0.90	1.00
User's accuracy	0.99	0.75	1.00
Kappa coefficient	0.88	0.96	0.96

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by B. Ehmann (Shroder 1978)



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