Shifts in surface, speed or shadows: What do we measure with different time-of-day overpasses of Sentinel-2

Bas Altena[1], Andreas Kääb

1) bas.altena@geo.uio.no, University of Oslo

Abstract

(Very) high optical satellites, like Sentinel-2, are commonly used for natural surface displacement estimation, like earthquake surface ruptures or glacier ice movement [1]. Due to off-nadir pointing or orbital decay, acquisitions have different sun illuminations, especially in azimuthal direction. Such shadowing can influence or corrupt the desirable geophysical measurements with biases related to terrain roughness [2]. Furthermore, orthorectification errors have a similar spatially varying nature, especially in mountainous terrain [3].

In this study we investigate the sensitivity of such biases (cross-orbit, illumination, ortho-projection) for typical image matching techniques. For this assessment we leverage on the continuous acquisitioning strategy of Sentinel-2A&B which are acquiring imagery in the polar region at different time-of-day. This is complemented with synthetic imagery from a high resolution elevation model, in order to disentangle the different illumination and elevation components.

This methodology gives a thorough assessment of the underlying geometric properties of such satellites, and the influence of elevation data quality of satellite imagery, which is essential for multi-temporal assessments over regions with significant topography. References

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