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Time-SIFT : a frugal method for leveraging multi-temporal photogrammetric data without ancillary data

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Latest advances in lightweight aerial platforms, miniaturized RTK DGPS positioning and IMUs make now it possible to build multitemporal photogrammetric datasets with centrimetric accuracies. Together with the increase of very high-resolution topographic data availability, algorithms that came from the computer vision community also provoked a marked resurgence of interest on archival photogrammetric data. Recently, Feurer and Vinatier (2018) proposed a method that rely on the invariance properties of the feature detection algorithms such as SIFT to estimate orientations in a single multi-temporal block. This method allows for an inherent co-registration of processed multi-temporal photogrammetric datasets and hence detection and mapping of 3-D change from past imagery. This work demonstrated that – in the case of archival aerial imagery – the Time-SIFT method enables the processing of multi-temporal photogrammetric imagery without ancillary data.

However, the potential of the Time-SIFT method had to be checked for in various contexts and spatio-temporal scales. More, the Time-SIFT method may allow to cope with the lack of precise positioning, in the case of image acquisitions made with frugal acquisition systems for instance. Hence this study proposes to apply the Time-SIFT method on five contrasting test cases. Their time and space scales vary from a domain of several square-centimeters to domains of several tens of kilometers, with time spans varying from the minutes to the decades. The test cases rely within different disciplines of geosciences, from soil science to vulcanology. Our works showed that the Time-SIFT methods succeeds through this whole range of spatio-temporal scales, and show even some unexpected robustness in context of strong changes due to vegetation and/or presence of water in coastal areas. These results demonstrate that the Time-SIFT method has a potential to tackle a wide variety of multi-temporal photogrammetric datasets, in particular in contexts where additional and calibration data are scarce.