**Optical remote sensing mapping and monitoring of landslide-dammed lakes – a case study after the 2016 Kaikōura Earthquake in New Zealand**

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On November 14, 2016, a 7.8 magnitude earthquake struck the Kaikōura region in New Zealand. The event triggered numerous landslides, which consequently dammed the river courses in the area and led to the formation of hundreds of dammed-lakes [1]. Landslide-dammed lakes constitute a natural risk, given their propensity to breach, which would provoke subsequent downstream floods, affecting the settlements and infrastructure around the affected areas. Hence, detecting and monitoring dammed-lakes is a key step for risk management strategies. Aerial images and helicopter flights are usually used to assess an area after natural events have occurred. However, this assessment only takes place shortly after the event happened, and no posterior monitoring is performed at larger scales.

Satellite imagery can support this task by providing an overview of the affected area, in multiple time instances after the main earthquake event, without deploying major resources. In this study, we present an automated approach to detect landslide-dammed lakes using Sentinel-2 optical data, through the Google Earth Engine. It combines a water detection algorithm, as described in [2], with change detection methods to identify the newly formed lakes at different points in time. This allows for a continuous monitoring of the lake status through time, and for the detection of new lakes forming in the area.

A random sample of lakes delineated from Google Earth high-resolution imagery, right after the Kaikōura earthquake, was used as a validation set. The proposed approach detected 70% of the lakes. Ten key dams that presented a potential hazard, previously identified by local authorities, were further monitored in multiple timestamps, from December 2016 to March 2019. Taking advantage of the Google Earth Engine cloud computing capabilities, the proposed automated approach allows fast time series analysis of large extents, which can be easily applied to other earthquake-prone areas where landslide’s associated hazards are common and need to be closely monitored.

[1] Dellow, Sally, Chris I. Massey, Simon Cox, Garth Archibald, John Begg, Zane Bruce, Jon Carey, et al. 2017. “Landslides caused by the Mw7.8 Kaikōura earthquake and the immediate response.” *Bulletin of the New Zealand Society for Earthquake Engineering* 50 (2): 106–16. <https://escholarship.org/uc/item/8gg8q85b>.

[2] Donchyts, Gennadii, Jaap Schellekens, Hessel Winsemius, Elmar Eisemann, and Nick van de Giesen. 2016. “A 30 m resolution surfacewater mask including estimation of positional and thematic differences using landsat 8, SRTM and OpenStreetMap: A case study in the Murray-Darling basin, Australia.” *Remote Sensing* 8 (5). <https://doi.org/10.3390/rs8050386>.