

The role of freeze-thaw/cool-heat cycling in rock surface topography evolution and rock cliff

retreat

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Introduction

In order to make clear the role of freeze-thaw/cool-heat cycling in the rock wall retreat, an on-site 24h monitoring measurement program that consists of crack meter, solar radiation meter, rock surface thermal sensor, and thermal camera monitoring is installed in February and March 2021. Those datasets will help to understand how the crack grows with the changing temperature of rock mass.



3D SfM Model of December 2020



Location and geological map



Campaign1: 2021.02.24-2021.02.25 Campaign2: 2021.03.22-2021.03.24



and hinds



Temperature measurement/recording:



Time-lapse thermal imaging for the cliff surface: campaign 1



Campaign 1 (2021.02.24-2021.02.25)

Surface temperatures are taken from time lapse thermal photos and calibrated according to thermocouples, reflector, and thermal radiation data.





Daily maximum difference of temperature on rock surface is around 40 °C

<mark>Campaign 2</mark> (2021.03.22-2021.03.24)



Daily maximum difference of temperature on rock surface is around 25 °C



time

Crack monitoring with crack meter (5mm resolution:0.01mm)



Result of Macro-crack evolution-Campaign 1



Result of Macro-crack evolution-Campaign 2



Discussion

- 1. According to the observation of the two field monitoring campaigns, it is known that the crack of the cliff experienced the daily open-close cycles with a daily variation of the rock surface temperature.
- 2. Those daily open-close cycles combined with other factors such as rainfall will contribute to the degradation of weak marl layers and the sandstone/limestone (generate new cracks, elongate and widen existed cracks), which will lead to rockfalls and retreat as a result.

Prospect

- 1. Tests on the rock samples will be done to quantitatively study the surface morphology evolution of rock blocks under the freeze-thaw/cool-heat cycles.
- 2. Establish a numerical model of heating transfer in rock mass to explore the role of thermal stress caused by variation of temperature in crack generation and evolution.