

Close-range remote sensing for monitoring the weathering in wall surfaces of a historical building at Orval Abbey, Belgium

*Yuichi S. Hayakawa¹, Chiaki T. Oguchi², Celine Elise Thomachot-Schneider³, Patricia Vázquez³, Soizic Gibeaux³

1. Center for Spatial Information Science, The University of Tokyo, 2. Saitama University, 3. University of Reims Champagne-Ardenne

Monitoring and evaluation of weathering processes of materials in historical buildings are crucial for the maintenance and conservation of such cultural heritage. For this purpose, spatial distribution of the surface condition, including the area, depth, and volume of weathering, should be examined. Detection and quantitative evaluation of changes in the surface condition of rocks have become possible by the availability of terrestrial laser scanning (TLS), and structure-from-motion multi-view stereo (SfM-MVS) photogrammetry approaches. We applied these technologies to the detailed, multi-temporal morphological measurements of a wall surface at a test site in the Orval Abbey, a historical building in Belgium. Time series of the high-definition topographic data including point clouds and digital elevation models (DEMs) were registered to each other, and the millimeter- to centimeter-scale changes were detected for the time periods of the surveys in three years. The changes are most likely induced by salt weathering. The spatial distribution of the surficial changes indicates the spatial variability in the surrounding condition of wetness and temperature, which significantly affects the rate of weathering.

Keywords: TLS, weathering, point cloud, digital elevation model