

EGU2020-18918

<https://doi.org/10.5194/egusphere-egu2020-18918>

EGU General Assembly 2020

© Author(s) 2020. This work is distributed under the Creative Commons Attribution 4.0 License.



Modeling Surficial Water runoff and estimation of its damaging factor on Rock Curved Cultural Heritage Monuments of Georgia – Application of Close Range Aerial Photogrammetry

Akaki Nadaria, **Giorgi Kirkitadze**, Mikheil Lobjanidze, Nikoloz Vacheishvili, and Mikheil Elashvili
Cultural Heritage and Environment Research Center, Ilia State University, Tbilisi, Georgia (info@iliauni.edu.ge)

Rock curved monuments of Georgia, represent a unique cultural heritage – an ancient cities, churches and kelly carved in rock, painted and decorated by hermit monks, which unites architectural monument and Natural-Geological complex. Such monuments are particularly vulnerable and their restoration and conservation requires a complex approach. These monuments, as many other similar monuments worldwide, is subjected to slow but permanent process of destruction, expressed in several main factors, one of which is rock weathering caused by surface rainwater runoff and water infiltration, coupled with temperature variations.

Close Range Aerial Photogrammetry, with its actively developing applications has been used to address this problem. Several Rock Curved Monuments of Georgia: Vardzia (12th Century), Vanis Qvabebi (8th Century) and Uplistsikhe (Late bronze period) were studied. First two of which represent large Monastery complexes curved in Volcanic tuff and tuff-breccia, while the Uplistsikhe represents ancient Rock Curved town, constructed in a coarse-grained week sandstone, with roots deep in the history of Georgian state.

To achieve sustainable preservation of cultural heritage rock-curved monuments, this particular type of danger should be addressed: Preservation of structural integrity of monument and avoiding ground or surficial water infiltration is substantial to preserve unique mural paintings and wall inscriptions, still preserved in these Rock Curved Monuments.

High-resolution Digital Elevation Models and Orthographic Aerial Photo images (in vertical and horizontal perspectives) were constructed through several aerial missions. Spatial data was accurately Georeferenced using the DGPS RTK system and Total Station (for vertical cliffs). The obtained data serves as an input for the Hydromodeling of Surficial water runoff, calculated using the ArcMap Hydro tool extension. Moreover, high-resolution photo textures allowed to estimate the damaging effect of formed water channels and crack systems of water infiltration. Conceptual solutions of water drainage systems allowing surficial water diversion and mitigation of its effect on rock strata were elaborated and even constructed in the case of Vardzia. Aerial Photogrammetry as a tool for routine periodic inspection has been adopted for the given monuments, where the damaged areas are hardly accessible by foot and even highly dangerous for the access of rock climbers.

