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Between Land and Sea: An analysis of the landscape changes in the Chekka region (Lebanon) based on airborne LiDAR data and historical aerial images from 1962

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The project “Between Land and Sea” was initiated by OREA (Institute for Oriental and European Archaeology) and is an interdisciplinary approach to combine the geology, geomorphology, and paleo-environment of the Chekka region (Lebanon) to investigate the ancient history and its archaeological remains. In the course of the project, the first ever scientific LiDAR (Light Detection and Ranging) data acquisition in Lebanon was conducted in autumn 2018 and a high-resolution DEM (Digital Elevation Model) was calculated. However, this model represents the recent topographical situation, which has changed drastically not only in the archaeologically relevant period up to 5000 years before today but also during the last decades.

To be able to qualitatively and quantitatively record geomorphological processes in the study area and thus understand long-term natural and anthropogenic landscape changes, the recent elevation model is compared with a historical model. The historical elevation model was derived on the base of aerial images of a French overflight from 1962. With the help of SfM (Structure from Motion/Agisoft Metashape) in combination with referencing methods (e.g. ICP), this historical model can be adapted to the LiDAR model. Quantitative analyses of selected areas provide information about surface changes over the last 56 years. But these results give also ideas about landscape evolution over longer time periods. Besides the natural changes, the historical model also reveals major anthropogenic changes since 1962 and shows that possible archaeologically relevant sites have been lost as a result of extensive overprinting due to the construction of buildings, infrastructure, industrial mining or agricultural use.

Our promising results show, that the implementation of historical terrain models based on aerial photographs can lead to a better understanding of the natural landscape development as well as anthropogenic induced changes and thus can also provide important additional information for archeological surveys.