Understanding the contribution of traditional roofs and building behaviour in a changing climate: a case study from the Mediterranean

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Abstract: The behaviour of traditional roofs affects issues relating to sustainability, zero-carbon targets, and Urban Heat Island (UHI) effect. This paper discusses an innovative approach towards understanding the behaviour of porous, and other types, of roofs in Malta in relation to temperature and moisture characteristics, and to project this behaviour onto a changing climate, predicted to be hotter and drier. The new methodology is being trialled on four roof types, on historic buildings, the innovation being the use of data from co-temporal Earth Observations (EO) and Unmanned Aerial Vehicles (UAVs), in conjunction with in-situ data. This research is helping to develop a new application for Remote Sensing in Cultural Heritage; results should enable recommendations for sustainable use of traditional roof-building techniques. The initial results show that the traditional roof has different (reflective and emissive) properties from the hybrid roof, that are being detected from space, complemented with UAV, hand-held thermal camera and in-situ measurements. These results are preliminary; satellite images for spring/early summer and mid-summer and the corresponding UAV images are expected to provide more conclusive information. These promising results should enable the proof-of-concept to progress onto a larger number and greater variety of roof types, even in other Mediterranean countries.

The other important objective of this study is to analyse the influence of potential ambient exposure of our target roofs to Malta's future climate. A predicted warmer and drier climate will affect all roof types when considering hotter ambient temperatures; in addition, the expected increased aridity comes into play in a significant way when considering the traditional porous roofs, where moisture movement will be affected (whether positively or negatively is still to be seen). This will be driven by decreased relative humidity and less precipitation, but also by a change in night dew occurrences which will alter the cooling effect which a porous roof has as the night dew evaporates under the morning sun. In this case, and others too, the platform of data collection is broadened, and to support data mining, deep learning will be used to enable modelling and data visualisation to give a true picture of the current and future behaviour of such roofs in a changing climate.

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