



Airborne and spaceborne remote sensing for archaeological and cultural heritage applications: A review of the century (1907–2017)



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ABSTRACT

Archaeological and cultural heritage (ACH), one of the core carriers of cultural diversity on our planet, has a direct bearing on the sustainable development of mankind. Documenting and protecting ACH is the common responsibility and duty of all humanity. It is governed by UNESCO along with the scientific communities that foster and encourage the use of advanced non-invasive techniques and methods for promoting scientific research into ACH and conservation of ACH sites. The use of remote sensing, a non-destructive tool, is increasingly popular by specialists around the world as it allows fast prospecting and mapping at multiple scales, rapid analysis of multisource datasets, and dynamic monitoring of ACH sites and their surrounding environments. The cost of using remote sensing is lower or even zero in practical applications. In this review, in order to discuss the advantages of airborne and spaceborne remote sensing (ASRS), the principles that make passive (photography, multispectral and hyperspectral) and active (synthetic aperture radar (SAR) and light detection and ranging radar (LiDAR)) imaging techniques suitable for ACH applications are first summarized and pointed out; a review of ASRS and the methodologies used over the past century is then presented together with relevant highlights from well-known research projects. Selected case studies from Mediterranean regions to East Asia illustrate how ASRS can be used effectively to investigate and understand archaeological features at multiple -scales and to monitor and assess the conservation status of cultural heritage sites in the context of sustainable development. An in-depth discussion on the limitations of ASRS and associated remaining challenges is presented along with conclusions and a look at future trends.

1. Introduction

The conservation of archaeological and cultural heritage (ACH) is a strategic priority, not only so that cultural property and evidence from the past can be safeguarded and passed on to future generations (Lasaponara et al., 2018) but also because these are valuable assets whose exploitation supports the UN's 2030 Sustainable Development Goals (SDGs) (UN, 2015; Cuca and Hadjimitsis, 2017; Stott et al., 2018;

Xiao et al., 2018). ACH is one of the fields in which remote sensing from elevated points was first used - the use of kites was followed by hot-air balloons, aircrafts and helicopters, shuttles, rockets, space stations and finally satellites (Fig. 1). Using each of these platforms, archaeologists and specialists have recognized the great value of multi-platform remote sensing in gaining a view from above in order to better identify and understand ACH sites and their wider environments (Aminzadeh and Samani, 2006; Luo et al., 2017b; Tapete, 2018).

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