New Agendas in Remote Sensing and Landscape Archaeology in the Near East

Studies in Honour of Tony J. Wilkinson

edited by

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Archaeopress Archaeology

Archaeopress Publishing Ltd
Summertown Pavilion
18-24 Middle Way
Summertown
Oxford OX2 7LG

www.archaeopress.com

ISBN 978-1-78969-573-1
ISBN 978-1-78969-574-8 (e-Pdf)

Cover illustration: Palaeochannels and archaeological sites north of Nasiriya, Iraq. A. SRTM image B. Landsat Image C. Features visible on SRTM D. Features visible on Landsat. For full explanation see Chapter 18

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Recognition of Ancient Channels and Archaeological Sites in the Mesopotamian Floodplain Using Satellite Imagery and Digital Topography

Jaafar Jotheri and Mark B. Allen

Introduction

Examination of satellite imagery and digital topography has become an increasingly important tool for geologists, geomorphologists, and archaeologists, because this method integrates information drawn from multiple sources and provides accurately calibrated physical locations (Hritz 2010; Walstra *et al.* 2013). The use of such techniques to identify palaeochannels and ancient settlements has increased in recent times, particularly in the Middle East region (e.g., Hritz 2010; Pournelle 2003; Scardozzi 2011; Ur 2013; Walstra *et al.* 2011).

Methodology

The landscape of the Mesopotamian floodplain (Figure 18.1) is mainly structured by channel processes, including the formation of levees, meanders, scrollbars, oxbow lakes, crevasse splays, distributary channels, inter-distributary bays, and marshes. Moreover, several human-made features also organise and shape this landscape, such as canals and both modern and ancient settlements on scales from villages to cities (Verhoeven 1998; Wilkinson 2003; Yacoub 2011). For this study, a variety of imagery, including CORONA and QuickBird images, and SRTM (Shuttle Radar Topographic Mission) and ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) digital elevation data was investigated. We do not attempt to review all available topographic and satellite image platforms and datasets, but instead focus on some of the generic features of sites and landforms in the Mesopotamian plain and describe how they can be identified and interpreted using such imagery. We stress the physical appearance of features of interest rather than processing multispectral data for image enhancement. In part this is because such techniques are not applicable to the high-resolution panchromatic data we have used. Additionally, we find that such techniques are not always needed for the identification and interpretation of key features. The high spatial resolution of both panchromatic datasets and digital topography is the critical parameter.

Digital topography (srtm and aster)

SRTM data were acquired via a radar system on board the Space Shuttle *Endeavor* in 2000, with the objective of producing elevation data for most parts of the globe. Imagery is available for Iraq with the standard 90 m pixel size, and it can be freely downloaded online from the Consortium for Global Agricultural Research (CGIAR) website. The CGIAR website contains 5 x 5 degree tiles made from the original 1 x 1 degree data, which is available from the United States Geological Service (USGS).

ASTER data has a pixel size of 15 m, and include data in 14 spectral bands, from the visible to the thermal infrared wavelengths. A stereo viewing capability has made it possible to create digital elevation models, which are now also available (referred to as ASTER GDEM).

Most geomorphologic features of the palaeochannels and archaeological sites in the Mesopotamian floodplain have a relatively high topographic elevation with respect to the surrounding area; this phenomenon can make these features easy to identify in both SRTM and ASTER data (Altaweel 2005; Hritz and Wilkinson 2006). Digital elevation data may be more useful than either panchromatic or multispectral satellite imagery, even if the spatial resolution is lower, because the crucial element in identifying these features is the relative height. Conversely, some palaeochannels and archaeological mounds with low elevation and small dimensions cannot be identified by SRTM or ASTER because their resolution and accuracy are not sufficient to recognise certain features (Rexer and Hritz 2014). In this paper, we will therefore demonstrate how to use the visual expression of objects that are visible in QuickBird and CORONA satellite images to recognise palaeochannels and archaeological sites, as well as how to recognise these features by examining SRTM and ASTER topography.

SRTM and ASTER data can be used to examine and quantify topographic values of the surface features in several ways, such as by taking cross-profiles of river levees (Hritz and Wilkinson 2006). Simple topographic maps can be sufficient to show raised levee systems where such features are not clear on multispectral or panchromatic satellite imagery. In practice, not all ancient rivers are detectable in the topography data, for example, in the case of levees that have been destroyed by cultivation or quarrying, or where it has

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