A RADARSAT-2 POLARIMETRIC MULTI INCIDENCE ANGLE ANALYSIS OVER ARCHAEOLOGICAL SITE

THE UNESCO ANCIENT CITY OF SAMARRA (IRAQ)

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WHAT ARCHAEOLOGY IS AND WHAT IT COULD BE

WHO PEOPLE THINK WE ARE...

WHO WE ARE...

POLINSAR 2013
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WHY ARCHAEOLOGY IS INVASIVE?
AIM OF THE RESEARCH

We need SATELLITES

Non-invasive technique of investigation

Detection and monitoring of structures already detected

Detection of archaeological structures affecting the soil

Detection of structures still underground and unknown
- Capital of Iraq only for 58 years (836 – 892 A.D.)
- Suddenly and mysteriously abandoned
- Very well preservation of its topography
WHY SAMARRA?

- Appropriate meteorological conditions

- Structures big enough for SAR spatial resolution

- Semi desert area characterized by fluvial terraces, never flooded

- 2007 inscribed in the UNESCO Cultural Heritage List in Danger

List of World Heritage in Danger

The 38 properties which the World Heritage Committee has decided to include on the List of World Heritage in Danger in accordance with Article 11 (4) of the Convention.
STARTING POINT: The empiric case study

Books

Historical photographs

Archaeological maps

Professor

Alastair Northedge
Professor of Islamic Art and Archaeology
Sorbonne (Paris, France)
RADARSAT-2

TIME ACQUISITION | INC. ANGLE
---|---
16\04\2012 | 43.43°
07\05\2012 | 26.63°
22\10\2012 | 43.43°
25\10\2012 | 26.63°

Different Incidence Angle

26.62°
Better detection of **Single bounce**

43.43°
Better detection of **Double bounce**
METEO DATASET

RADARSAT-2

TIME ACQUISITION | INC. ANGLE

16\04\2012 | 43.43°
07\05\2012 | 26.63°
22\10\2012 | 43.43°
25\10\2012 | 26.63°

16\04\2012

07\05\2012

21\10\2012

25\10\2012
FIRST STEP: A QUALITATIVE ANALYSIS

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26° INCIDENCE ANGLE IMAGES

May 26.63°

Oct 26.63°

Time 14:57

22-10-2012

21-10-2012

(meteo station: Tuz Khormato)
PRODUCTS EVALUATION

May 26.63°

Entropy

Alpha Angle

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PRODUCTS EVALUATION

Multiple Scattering
Volume Scattering
Surface Scattering

Entropy
Alpha Angle

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PRODUCTS ANALYSIS: Shannon Entropy
YAMAGUCHI DECOMPOSITION
AND PHOTO “TRUTH”

*MODEL BASED - 4 COMPONENTS DECOMPOSITION
Y. Yamaguchi et al. (2005 - 2013)
YAMAGUCHI DECOMPOSITION AND PHOTO "TRUTH"

*Photographs courtesy of Prof. Alastair Northedge*

qanāt
I step
Qualitative analysis of the images

- Pauli RGB 26°

II step
Analysis of polarimetric products in order to find the most useful

- Yamaguchi decomposition
- Shannon Entropy
FOR THE FUTURE

Evaluate if we have terrain deformation or presence of vegetation

Analysis of two more RADARSAT-2 images acquired on 02-01-2013 and 05-01-2013

Analysis of the northern part of the archaeological area
THANK YOU FOR YOUR ATTENTION