IMAGERY INFORMATION ON DRAINAGE FEATURES

M. Lazaridou, E. Patmios

Aristotle University of Thessaloniki, Civil Engineering Faculty, Lab. of Photogrammetry – Remote Sensing,
P.O. Box 465, 541 24 Thessaloniki, Greece -
lazamari@civil.auth.gr

Commission VIII, WG VIII/7

KEY WORDS: Image Interpretation, Interpretation, Aerial Photograph, Feature Detection, Hydrology

ABSTRACT:

This paper concerns Sarantaporos River in Northern Greece and particularly to the part that its course is near and parallel to the national road that connects Eastern with Western Greece. We used aerial photographs and satellite imagery of high resolution. The study of these images (image interpretation) gave useful information for the river and its wide surroundings in general and particularly for the civil engineer.

1. INTRODUCTION

Drainage network (torrents, rivers) – system of different order of streams is an important geomorphologic feature – landform (Verstappen 1985, Zuidam et al 1979) in its whole extension – drainage basin, from first order streams to its outfall-estuary to a major receiver: lake, sea, ocean.

Its importance is depended on several factors – aspects:
- Formation and development of the different parts of drainage network: sources, valley, estuaries
- Potential of irrigation and water supply for drinking
- Relation to natural processes (erosion, landslide)
- Production of sediments or/and sedimentation until the final receiver
- Relation to pollution sources
- Relation to technical works (roads, bridges) and built-up areas (cities, villages)
- Drainage patterns and longitudinal and cross sections of different streams
- Relation to the land uses/land cover of drainage basin area

The study of the above subjects is seconded by the study of aerial photographs and satellite data with methods of Photogrammetry, Photointerpretation and Remote Sensing.

Qualitative and quantitative study of the surrounding area and processes are done in photogrammetry, photointerpetation and remote sensing by "mapping" with suitable "receivers"-detectors on suitable corresponding "images".

In the case of aerial photographs the study may concern visual image interpretation or/and metric processing with different methods (analytical, digital, orthophotography, DTM, etc.).

In the case of satellite data, image interpretation is done by visual study – photointerpretation , digital analysis or/and by some kind of combination of the two.

Particularly for satellite imagery, digital analysis may include stages-subjects that concern the nature of digital images, the factors that must be considered for the extraction of thematic information, the recognition of features and image interpretation and image processing for extraction of thematic information (geometric correction, enhancement, image arithmetic, classification-accuracy assessment) (Lillesand et al 1987).

Visual interpretation of satellite imagery may use principles and methods from photointerpretation as well from digital analysis.

2. DRAINAGE NETWORK – STUDY OF AERIAL PHOTOGRAPHS AND SATELLITE DATA

This paper refers to the visual study – image interpretation of aerial photographs and satellite data of a part of the hydrologic basin of Sarantaporos River in northern Greece.

Sarantaporos is developed among the mountain mass of Grammos, Voio and Smolikas (Pindos mountain chain).

The study area presents particular interesting for subjects of civil engineering, because at a great part of the river course there is a national road with almost parallel course to the river and because of processes (erosion, landslides) in the wide area.

Some topographic information of Sarantaporos River basin is presented in figure 1.

In the case of aerial photographs, it was possible to observe stereoscopically, while it was not possible for the used satellite imagery. Ten aerial photographs (five stereoscopic pairs) were studied from the area in scale 1: 30,000 covering the course of the river at the part that is indicated in figure 1.
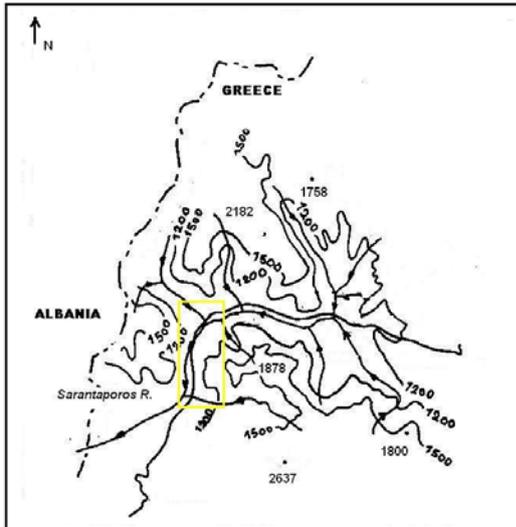
Figure 1. Sarantaporos River basin from topographic map 1: 500,000 (reduction), with indicative contours, altitudes, the river (→) and the study area.

The information from the study of aerial photographs concerns water devides, drainage network, areas of erosion and landslides, vegetation areas, road network, built-up areas and technical works.

An indicative example of photointerpetation is presented in figure 2.
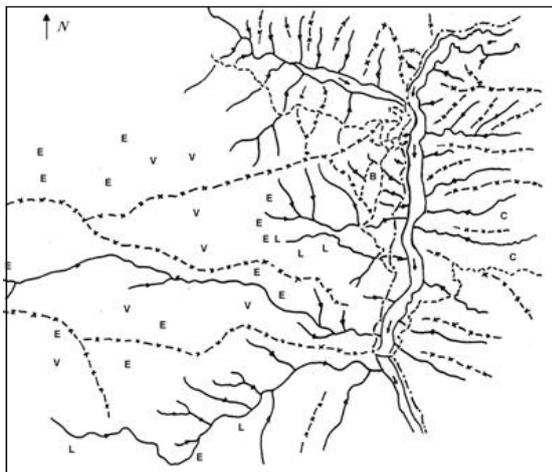
Figure 2. Photointerpretation that indicatively presents drainage network (→), water devide (- x – x -), main road (− · − · −), vegetation areas (V), erosion areas (E), landslide areas (L) from aerial photographs in scale 1: 30,000 (reduction).

In the case of satellite data (Lazaridou et al 2007), we used SPOT 5 (SPOT Image, CNES) imagery, dated 2007-07-21, level processing 2A, multispectral mode: green (0.50-0.59μm), red (0.61-0.68μm), near infrared (0.78-0.89 μm) and SWIR (1.58-1.75 μm) with 10m spatial resolution.

The study-visual interpretation of satellite imagery was done with Erdas Imagine 9.0 (ERDAS 2005). The wide area of the

river (course – basin) is presented in figure 3 as well the part that was studied with aerial photographs.
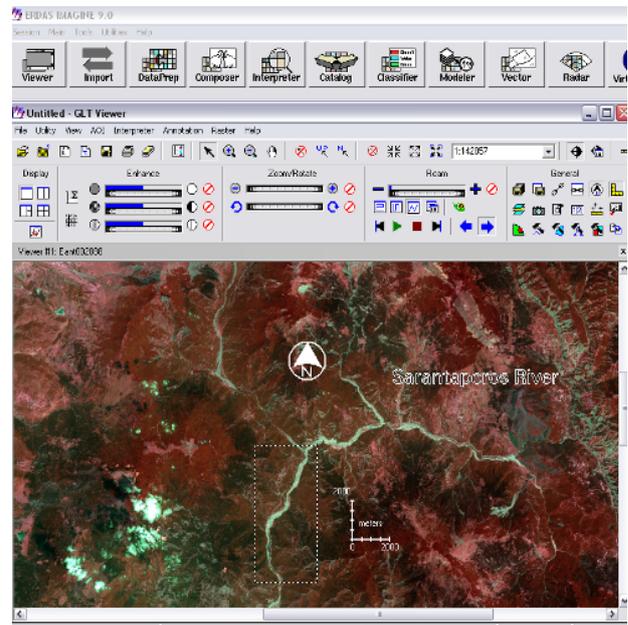

Figure 3. The wide area of Sarantaporos River (the part that was studied with aerial photographs is indicated).

In the display of this image the contrast is maximized with Erdas Imagine 9.0 GLT viewer.

The resulting information from the study – visual interpretation in the case of satellite imagery, concerns the detection of linear features (drainage and road network), built-up areas, vegetation cover, possible location of processes (erosion, landslides, alluvial deposits) and technical works.

The next two figures (4,5) present part of the study area in magnification with marking some of the detected features, drainage network and road network – built up area respectively.
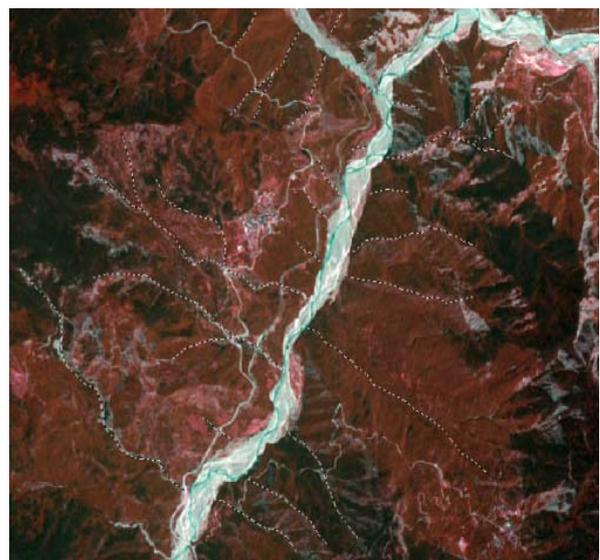
Figure 4. Part of the study area showing the detected drainage.

Figure 5. Part of the study area showing the detected main road and built-up area.

Edge enhancement (3x3, 5x5) was used according to the case for the detection of linear features.

3. DISCUSSION

Rapid progress in sciences and technology and the capability to be informed about them, cover at great extent the "user" from the aspect of knowledge.

However, for a university laboratory that aims to education, research and applications, mainly on subjects of national interest, personal experiences are necessary besides the above mentioned informational knowledge.

Water, in particular relatively to drainage network (rivers, torrents, streams), presents great interest globally and especially in Greece.

Relatively to the potential of satellite imagery, it seems that their study has valuable contribution in parallel with aerial photographs.

In both the cases (aerial photographs, satellite imagery) the resulting information is interesting for the study of the river in general and particularly for the scientific and professional subjects of civil engineering.

Moreover visual interpretation can be the basis for further metric (quantitative) study depending on user demands.

REFERENCES

ERDAS Field Guide™, 2005. Geospatial Imaging, LLC Norcross, Georgia, Leica Geosystems.

Lazaridou M., Patmios E., 2007. *Remote Sensing Satellites.* Post-Graduate Program "Protection of Environment and Sustainable Development", Aristotle Univ. of Thessaloniki, Dept. of Civil Engineering.

Lillesand T.M., Kiefer R.W., 1987. *Remote Sensing and image interpretation.* 2nd Edition, John Wiley and Sons, Inc.

SPOT 5 satellite http: spot5.cnes.fr/gb/satellite/instruments.htm

Verstappen H. Th. 1985. *Applied Geomorphology.* ITC, The Netherlands.

Zuidam R.A., Zuidam-Cancelado F.I., 1979. *Terrain analysis and classification using aerial photographs.* ITC, The Netherlands.