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– RESPAL 2006, Ljubljana (Slovenia) –

RESPAL (Remote Sensing for Past Landscape)
Erasmus – Socrates Program
Ljubljana (Slovenia) from January 23rd to February 7th 2006.

RESPAL program was organised in order to teach European students how to use remote sensing (aerial photographs and satellite imagery) in analysing past landscapes. 8 European universities are involved in this project. The first intensive courses were organised in Ljubljana (Slovenia) from January 23rd to February 7th 2006, coordinated by Pr. Dr. Pedrag Novakovic (univ. Ljubljana).

Around 30 students were concerned, Slovenian for a half, foreign for the other half: 3 students from the university of Pisa (Italy), 2 from the university of Halle (Germany), 2 from the university of Besançon (France), 2 from the university of Tours (France), 2 from the university of Leiden (Netherlands), 2 from the university of Vienna (Austria) and 2 from the university of Birmingham (England).

After a first lecture from P. Novakovic (univ. Ljubljana) and V. Gaffney (univ. Birmingham) about the history of remote sensing in archaeology and recent innovations, the first week dealt with processing and analysing aerial (oblique) photographs. It was made by D. Grosman (univ. Ljubljana), M. Doneus (univ. Vienna) and S. Wilkes (univ. Birmingham).

Archaeological remains in the soil are visible from the air by different kind of clues: soil marks, crop marks, shadow marks, etc… Students were taught how to recognize and interpret these clues.

By rectifying and analysing those images, it becomes possible to measure and interpret the archaeological remains. It has been underlined that field controls are absolutely necessary to confirm or not reality and chronological properties of all structures visible by plane.

Students were trained how to rectify oblique aerial photographs using the software *Airphoto*. In locating control points which are visible in the same time on the oblique photo and on a georeferenced map, it is possible to transform the original image, thanks to different algorithms.

Several applications of aerial archaeology were presented, in particular by M. Doneus (univ. Vienna) about a project along an Austrian valley of 600 km² which has been completely covered by aerial oblique photographs. In this case, aerial photographs permitted to multiply by 2 the number of known sites.

S. Wilkes (univ. Birmingham) made a demonstration of the application of LIDAR (Light Distance And Ranging) in landscape studies. A laser fired from an aircraft reflects on the ground and can be measured in the same aircraft. The laser can penetrate vegetation to the ground level. It could be useful for locating and mapping archaeological remains hidden by the forest. LIDAR collects X, Y, Z and I (Intensity) data at about 70 000 points per second. It creates an enormous point cloud which is to be filtered in order to create terrain model. The accuracy of these data is up to 10 cm in plan. Intensity data permits to measure soil moisture, presence of water, etc…

The second week was dedicated to processing and analysing satellite imagery. The course was made by K. Ostir (univ. Ljubljana), François-Pierre Tourneux (univ. Besançon) and Tomas Podobnikar (univ. Ljubljana).

First, they explained mechanisms of electro-magnetic radiation which are received and reflected by the Earth. Then they described the main different families of satellites: Landsat (low spatial resolution but high spectral resolution), SPOT (medium spatial resolution), Quickbird and Ikonos (high spatial resolution but low spectral resolution). Given that Landsat images archives are free on the internet, the training was made on these data.

Students were trained to the different steps of processing satellite images:

- pre-processing (geometric and radiometric corrections),
- filtering,
- image transformation, taking different spectral bands in account (arithmetic operations, building vegetation indexes, principal component analysis)
- image classification, based on spectral signatures which can be interpreted as different type of soil coverage.

Application of satellite imagery in archaeology has been discussed. It seems that only indirect clues can be detected with satellite images: moisture anomalies, vegetation anomalies, etc… It could be useful in order to detect paleochannels or ancient hydrographical features.

T. Podobnikar (univ. Ljubljana) presented several spatial analyses performed in GIS, using digital elevation models. In this course, students were trained how to use DEM from the SRTM (Shuttle Radar Topography Mission) which are free on the internet with an accuracy of 90 meters. Different interpolation methods were performed: IDW, Spline, Kriging, Natural Neighbours), using the software *ArcGis*.

During the two last days, many lectures were made about applications of remote sensing in archaeology and past landscapes, by several Slovenian researchers and some foreign (H. Kamermans from the University Of Leiden, Netherlands)

Every student involved in RESPAL program was credited of 15 ECTS corresponding to 120 hours. The evaluation was based on the presentation of individual projects at the end of each week. Every student had to prove his mastering in the different skills. Even more than methodological knowledge, a great result of this program is the meeting and exchange between students from different countries, all involved in the study of past landscapes.