

**DETERMINATION OF SUBMERGED MICROBIAL MAT AREA, HIDROGEOCHEMICAL AND WATER
QUALITY PARAMETERS BY USING HYPERSPECTRAL DATA: A CASE STUDY: LAKE ACIGOL,
(DENIZLI), TURKEY**

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Project Summary

Lake Acigol is a tectonic playa lake with high Na-Cl-SO₄ content. It has a high economic importance as it corresponds almost 85% of sodium sulfate production of Turkey. Alkaline saline water chemistry turns lake shore environment into habitable areas for the halophilic bacteria. In particular, Lake Acigol is located in a protected area for the wild birds feeding themselves with organisms surviving in salty lake sediments. This study will be realized in two different basal perspectives. First, geochemical-hydrogeochemical parameters of microbial mat occurrences in Lake Acigol shore environment and the effect of bacteria on mineral interaction, and hydrogeological investigation of Lake Acigol district. The second is that determination of actual hydrogeochemical and sedimentary components of Lake Acigol with spatial distribution of microbial mats occurrences and lake water quality parameter changes by remote sensing data. Valuable information will be collected about element speciation, ligand coordination and oxidation state, structural arrangement, and crystallinity on different scales, and physical mechanisms morphology and topography of surfaces by the help of the detailed study of molecular environmental geochemistry of these microbial mats occurrences. The detailed determination of the shallow environment microbial mat occurrences and effective environmental factors on these will be achieved. The evaluation of the water chemistry, quality parameters and actual sediment geochemistry which are determined by laboratory and area studies will be taken into consideration with the hyperspectral images obtained at the same time period by different satellites. The determination of distinguishability of lake shore sediments and determination of most-appropriate wavelengths will be evaluated in scope of this study.

Statement of Work

Lake Acigol is a tectonic playa lake with high Na-Cl-SO₄ content. It has a high economic importance as it corresponds almost 85% of sodium sulfate production of Turkey. Alkaline saline water chemistry turns lake shore environment into habitable areas for the halophilic bacteria. In particular, Lake Acigol is located in a protected area for the wild birds feeding themselves with organisms surviving in salty lake sediments. This study will be realized in two different basal perspectives. First, geochemical-hydrogeochemical parameters of microbial mat occurrences in Lake Acigol shore environment and the effect of bacteria on mineral interaction, and hydrogeological investigation of Lake Acigol district. The second is that determination of actual hydrogeochemical and sedimentary components of Lake Acigol with spatial distribution of microbial mats occurrences and lake water quality parameter changes by remote sensing data. Valuable information will be collected about element speciation, ligand coordination and oxidation state, structural arrangement, and crystallinity on different scales, and physical mechanisms morphology and topography of surfaces by the help of the detailed study of molecular environmental geochemistry of this microbial mats occurrences. Modern instrumental methods such as X-ray absorption and scattering techniques and scanning probe microscopes will provide direct biogeochemistry data that can elucidate molecular mechanism. Modern instrumental methods such as X-ray absorption and scattering techniques and scanning probe microscopes will provide direct biogeochemistry data that can elucidate molecular mechanism. Determination of Stable isotope (C, O, D, S) values and radioactive ³H as well as the circle of the mentioned isotope in Acigol contribute to the determination of hydrogeological characteristics of unknown underground water discharge herewith leading for the important knowledge of the occurrence mechanism about microbial mats. Thus, the detailed determination of the shallow environment microbial mat occurrences and effective environmental factors on these will be achieved. The evaluation by remote sensing data of the properties of hydrologic change, water chemistry and actual sediment geochemistry which are determined by laboratory and area studies will be taken into consideration with the hyperspectral images obtained at the same time period by different satellites will form another dimension of this study. In the studies concerning remote sensing, The determination of distinguishability of lake shore sediments by remote sensing methods and determination of most-appropriate wave lengths will be evaluated in the scope of this study. In the studies concerning remote sensing evaluation of hyperspectral images along with the satellite images of hydrogeochemical properties will be taken into consideration. Our approach is based on cooperation of area and laboratory studies in the scientific scope of introduced project. Site- studies will be realized in the light of a long observation of mentioned environmental conditions in the areas chosen at Acigol shores.

Biographical Sketch and Available Facilities

Investigators:

Muhittin KARAMAN

1995-1997 (Ankara University) Computer Programming

1998-2003 (Pamukkale University) PAU, Dept. of Geological Engineering

2003-2006 PAU Institute of Applied and Natural Sciences

2006-... PAU Institute of Applied and Natural Sciences, Ph.D.Student

Other Researchers:

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1994-1998 (Istanbul Technical University) Aeronautics and Astronautics Engineering

1998-2002 (Istanbul Technical University) Information Technologies

2002-2011 (Istanbul Technical University) Geomatics Engineering

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1985-1990 (Istanbul Technical University) ITU, Dept. of Geological Engineering

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1993-2000 ITU Institute of Applied and Natural Sciences

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1985-1989 (Akdeniz University), Dept. of Geological Engineering

1989-1992 Akdeniz Institute of Applied and Natural Sciences

1992-2000 ITU Institute of Applied and Natural Sciences

Investigators' papers on water studies:

Uça, Z. D., Sunar Erbek, F., Kuşak, L., Yaşa, F., and Özden, G.; 2006, The Use of Optic and Radar Satellite Data for Coastal Environments; *International Journal of Remote Sensing*, Vol. 27, No. 17, 3739-3747, 2006.

Sunar, F., Akkartal, A., Göral, B., **Uça Avcı, Z. D.**; 2007, The Threat of the Oil Pollution Incident Occurred in Lebanon to the Northern Cyprus Coasts and the Importance of Operational Satellite Monitoring System; *International Conference on Environment: Survival and Sustainability*, Near East University, 19 - 24 February, Nicosia-Northern Cyprus, 2007.

Uça Avcı, Z. D., Göral, B., Akkartal, A., Sunar, F.; 2006, Flood Monitoring Using Multi-Temporal Radarsat-1 Images; *RspSoc Annual Conference, Understanding A Changing World*, 5 - 8 September, Cambridge-England, 2006.

Akkartal, A., Göral, B., **Uça Avcı, Z. D.**, Sunar, F.; 2006, The Need of an Operational Flood Monitoring System in Turkey: A Case Study - The Maritsa River; *RspSoc Annual Conference, Understanding A Changing World*, 5 - 8 September, Cambridge-England, 2006.

Uça, Z. D., Kuşak, L., Yaşa, F., Özden, G., Sunar Erbek, F.; 2003, The Use of Optic and Radar Satellite Data for Coastal Environments, *Studying Land Use Effects in Coastal Zones with Remote Sensing and GIS*, 13 - 16 August, Kemer-Antalya, Turkey, 2003

Karaman, M., Uça Avcı, Z. D., Papila, İ., Özelkan, E.; 2010, The Analysis of Destruction in Flamingos Habitat of Acıgöl Wetland, *34th International Symposium on Remote Sensing of Environment*, 10-15 April, Sydney, 2011.

Karaman, M., Uça Avcı, Z. D., Budakoğlu, M., Taşdelen, S., Özelkan, E., Papila, İ.; 2011, Flamingoların Beslenme Alanlarındaki Tahribatın Uzaktan Algılama Yöntemleri ile Değerlendirilmesi: Acıgöl (Denizli) Örneği, *II. Türkiye Sulak Alanlar Kongresi*, 22-24 Haziran, Kırşehir, Türkiye, 2011. (Not Published Yet)

Karaman, M., Budakoğlu, M., Taşdelen, S., **Uça Avcı, Z. D.**, Duman, A.; 2010, Acıgöl'ün (Denizli) Uzaktan Algılama Yöntemleri ve CBS Kullanılarak Rezervinin Hesaplanması, *II. Türkiye Sulak Alanlar Kongresi*, 22-24 Haziran, Kırşehir, Türkiye, 2011. (Not Published Yet)

Karaman, M., Uça Avcı, Z. D., Özelkan, E., Budakoğlu, M.; 2010, Çözelti Madenciliği Faaliyet Alanımın Zamansal Değişiminin Uzaktan Algılama Yöntemleri ile Değerlendirilmesi: Acıgöl (Denizli) Örneği, *4. Madencilik ve Çevre Sempozyumu*, 2-3 Haziran, İzmir, Türkiye, 2011. (Not Published Yet)

Uça Avcı, Z. D., Karaman, M., Özelkan, E., Budakoğlu M.; 2010, Su Madenciliği Yapılan Göl Ortamının Nesne-Tabanlı Yöntemle Sınıflandırılması, Acıgöl (Denizli) Örneği, *II. Ulusal Jeolojik Uzaktan Algılama Sempozyumu*, MTA, 4 - 5 Kasım, Ankara, Türkiye, 2010.

Karaman, M., Uça Avcı, Z. D., Budakoğlu, M., Taşdelen, S.; 2010, Sodyum Sülfat Üretimi Yapılan Acıgöl (Denizli)'de Sülfat İyon Dağılımının Nesne-Tabanlı Sınıflandırma Yöntemi ile Belirlenmesi, *II. Ulusal Jeolojik Uzaktan Algılama Sempozyumu*, MTA, 4 - 5 Kasım, Ankara, Türkiye, 2010.

An on going similar project (titled Determination of Recent Lake Shore Biomineralization Areas and Hydrogeochemical Parameters via in-situ and Remote Sensing Methods: Lake Acıgöl, Denizli Western Anatolia, Turkey) was going to be performed with other satellite data such as WorldView and Chris Proba. This project will be active for 3 years. The products of the image analyzing and ground surveying studies (laboratory analysis, in situ measurements) will also be used in this study, which are supported by TUBITAK (The Scientific and Technological Research Council of Turkey)

Output and Deliverables

With this project proposal, a hydrochemical application of hyperspectral remote sensing will be applied firstly to the Acıgöl Tectonic Basin. Using Hico hyperspectral images, hydrochemical changing analysis and determination of microbial mat existence and type of bacteria will investigate. Also Hyperspectral sensors may give healthy results in terms of hydrochemical mapping.

Remote sensing methods combined with field investigations will localize at the Lake Acıgöl Basin .The global water cycle is perhaps the most important of all the biogeochemistry cycles and evaporation, which is a significant component of the water cycle, is also linked with the energy and carbon cycles. Long-term evaporation over large areas has generally been computed as the difference of precipitation and river runoff. Analysis of short-term evaporation rate and its spatial pattern, however, is extremely complex, and hyperspectral remotely sensed data could aid in such analysis.

Project Schedule

The suitable plan for our research will be as:

2011 (May 20-30)

2011 (September 10-20)

2012 (May 20-30)