INTENSIVE TRAINING COURSE ON
Geological Application of GIS/Remote Sensing

The **International School for Geoscience Resources** of KIGAM presents an intensive training course on **Geological Application of GIS/Remote Sensing**. The course will take place at the Ara room of International School for Geoscience Resources (IS-Geo) of KIGAM in Daejeon (Korea) in **February 18 through March 15, 2013** and will include the following 4 modules:

Modules	Date	Instructors
Module 1. Introduction to GIS and Data Processing	Feb. 18 - 22	Dr. Saro Lee (KIGAM, Korea)
Module 2. Geological GIS Application	Feb. 25 - Mar. 1	Prof. Biswajeet (University Putra Malaysia)
Module 3. Introduction and Application of Geospatial Statistics and Remote Sensing in Geology	Mar. 4 - 8	Prof. Freek van der Meer (University of Twente, Netherlands)
Module 4. Hyperspectral and SAR Remote Sensing in Geology	Mar. 11 - 15	Prof. Eun Gyu Park (Kyungpook National University, Korea)

Agenda

The object of this course is learning application of suitability analysis using GIS/RS technique and social networking between practicians and researchers in geological field. For these purposes, it consists of four sessions 'Introduction of GIS and Data Processing', 'Geological GIS Application', 'Introduction and Application of Geospatial Statistics and Remote Sensing in Geology', and 'Hyperspectral and SAR Remote Sensing in Geology '. At the first session we will provide basic concept of GIS and GIS data processing using ArcGIS software for geological event mapping, and some part of geological GIS application and practical exercises according to groundwater productivity. At the second 'Geological GIS Application' session it is an advanced course in GIS-based modelling for geological event mapping. The purpose of this module is to provide the participants with application of GIS to analysis and evaluate geological phenomenon particularly landslide, land subsidence, flood, earthquake and mineral potential mapping with practical exercises. The third session is an introductory and advanced course in geospatial statistics and remote sensing in geology. It will cover the understanding of overview of geospatial statistics, remote sensing, basic digital image processing, and introductory of SAR applications and geological image interpretation. Lastly, the fourth session is an advanced course in remote sensing for geological phenomena. It will cover the introduction of SAR and hyperspectral remote sensing, and practical exercise of geological remote sensing in geology.

Course Covered

- Introduction of GIS and ArcGIS
- GIS Data Processing using ArcGIS
- GIS Data Preparation and Topographic Analysis for Geological Application and Practical Exercise of Geological GIS Application
- Introduction and Practical Exercise of Geospatial Statistics
- Introduction and Application of Remote Sensing and Digital Image Processing
- Introduction and Practical Exercise of Geological Image Interpretation Technique
- Introduction and Application of Geospatial Statistics
- Introduction and Application of SAR Remote Sensing in Geology
- Introduction and Application of Hyperspectral Remote Sensing in Geology

Course Requirements: Prerequisite

- Have some basic knowledge of geology obtained through B.S. programs in Geoscience
- Have sufficient command of both spoken and written English

Who should Attend?

- National or local government officials, preferably middle manager, researchers and engineers engaged in the field of GIS, remote sensing, geological hazard and mineral resources

Module 1. Introduction to GIS and Data Processing

- **Summary of module contents and learning objectives**

This module is an introductory course in GIS-based spatial analysis for geological event mapping and part of geological GIS application. Firstly the course will talk about the GIS and GIS data management. The course is designed to provide a basic understanding of fundamental concepts and principles that is essential for GIS, method for managing GIS data for analysis geological phenomenon, practical exercises of ArcGIS software, and geological GIS application according to groundwater productivity. The objective of this course is to provide basic concepts, methodologies and learn GIS software for analysis and predictive modelling of geo-objects. The analysis of spatial association between geo-objects and evidence factors will be discussed and demonstrated.

- **Day 1. Introduction to GIS and ArcGIS** - *Dr. Saro Lee*

This topic introduces Geographic Information Systems (GIS) and how to use GIS Software for GIS data processing. You can learn the basic concept, principles and applications. Then, GIS software is introduced, focused on the GIS data processing for geo-environmental analysis.

  - Concept of GIS
  - Principles of GIS
  - GIS and Data
  - Applications of GIS
  - Introduction to GIS software

- **Day 2. GIS Data Processing using ArcGIS (I)** - *Dr. Moung Jin Lee*

This topic involves basics of data processing, data analysis technique using ArcGIS, GIS data processing and some examples applied to supported data using ArcGIS. The course consist of five main topics: introduction to ArcGIS, data display using ArcGIS, database query, spatial database format and Working with tables. All lectures include example data and practice time.

  - Introduction to ArcGIS: Overview of ArcGIS components
  - Data Display using ArcGIS : Basis Manual of ArcGIS
  - Database Query: Relational Database and its Management
  - Spatial Database Format: Vector, Raster and DBMS
  - Working with Tables: Data Exploration with ArcGIS

- **Day 3. GIS Data Processing using ArcGIS (II)** - *Dr. Moung Jin Lee*

This topic involves basics of data processing, data analysis technique using ArcGIS, GIS data processing and some examples applied to supported data using ArcGIS. The course consists of three main topics: edit database, cartographic design and geo-coding system. All lectures include example data and practice time. During the course,

we will acquire the skills we need as a basic process ability using ArcGIS. With the skills, we will be able to create and edit the virtual world with applying the real world.

- Edit Database: An Overview of Editing and Data Compilation
- Cartographic Design: ArcGIS Tools for Professional Cartography
- Geo-coding: Geo-coding Overview and Preparation

- **Day 4. GIS Data Preparation and Topographic Analysis for Geological Application** - *Dr. Young Sung Kim*

This topic involves advanced data handling methods for topographic analysis using ArcGIS such as TIN, DEM, Hillshade maps, SPI, TWI, Slope, Aspect and Curvature.

- Triangular Irregular Networks
- Digital Elevation Models and Hillshade Maps
- Slope, Aspect and Curvature
- Stream Power Index and Topographic Wetness Index
- Practical Exercise of Topographic Analysis using ArcGIS

- **Day 5. GIS Application and Practical Exercise of Groundwater Potential Mapping** - *Dr. Young Sung Kim*

This topic involves overview of GWP mapping, groundwater system, GIS data processing and some examples applied to groundwater potential mapping, using likelihood ratio, weight of evidence and logistic regression models and, verifies the accuracy for well locations in GIS Environment. The model is based on the relationship between groundwater productivity data, including specific capacity (SPC) and its related hydrogeological factors. Related factors, including topography, lineament, geology, forest and soil data are collected and inputted into a spatial database.

- Overview of GWP Mapping
- Introduction to Groundwater System
- Basic Groundwater Survey
- Introduction to GWP Mapping using GIS
- Construction of Spatial Data for GWP Analysis
- GWP Mapping using Frequency Ratio and Weight of Evidence

Module 2. Geological GIS Application

- **Summary of module contents and learning objectives**

This module is an advanced course in GIS-based modelling for geological event mapping. The purpose of this module is to provide the participants with application of GIS to analysis and evaluate geological phenomenon particularly landslide and mineral potential mapping. The analysis of spatial association between geo-objects and evidence factors will be discussed and demonstrated. Moreover, evaluation of performance of mineral potential, flood, earthquake, landslide susceptibility and land subsidence hazard models also will be discussed.

- **Day 1. GIS Application and Practical Exercise of Landslide Susceptibility Mapping** - *Dr. Saro Lee*

This topic involves the overview of landslide susceptibility mapping, landslide analysis technique using GIS, GIS data processing and some examples applied to landslide susceptibility mapping, using likelihood ratio, weight of evidence and logistic regression models, and we verify the accuracy for well locations in GIS Environment. The model is based on the relationship between landslide location data and its related factors. Related factors, including, geological structure, bedding altitude, seismicity, slope steepness, morphology, stream evolution, groundwater conditions, climate, vegetation cover, land use, and human activity are collected and inputted into a spatial database.

- Overview of Landslide Susceptibility Analysis
- Landslide Analysis Technique using GIS
- Landslide Susceptibility Analysis using Probability Method
- Landslide Susceptibility Analysis using Statistic Method
- Landslide Susceptibility Analysis using Neural Network Method
- Construction of Spatial Data for Landslide Susceptibility Analysis
- Landslide Susceptibility Analysis using GIS

- **Day 2. GIS Application and Practical Exercise of Mineral Potential Mapping** *- Dr. Hyun Joo Oh*

This topic involves introduction to predictive modelling, some examples applied to mineral-potential mapping and practical exercises of mineral potential mapping. This is a basic course for the practical exercises of mineral potential mapping using GIS. Before exercises, you can learn how to design spatial database for mineral potential analysis and the analysis method of relationship between deposit and related factors involves database using GIS. The lecture aims to combine the mineral potential maps using likelihood ratio, weight of evidence and logistic regression models and to verify the accuracy for the epithermal gold (Au) - silver (Ag) deposits in a Geographic Information System (GIS) environment.

- Introduction to Predictive Modelling of Mineral Potential
- Construction of Spatial Data for Mineral Potential Analysis
- Analysis of Relationship between Deposits and Related Factors
- Practical Exercise: Gold Potential Mapping based on GIS
- Practical Exercise: Gold Potential Mapping based on GIS - Area under the Curve for Verification
- Practical Exercise: Gold Potential Mapping based on GIS - Summary

- **Day 3. GIS Application of Flood Hazard and Risk Mapping** - *Prof. Biswajeet Pradhan*

This topic is an advanced course in flood mapping using remote sensing data and GIS tools. This module will give an insight to the participants about the concept of flood susceptibility, hazard and risk mapping in GIS environment. The relationship between the various flood controlling parameters such as slope angle, slope aspect, slope curvature, morphology, stream evolution, land use, human activity, etc. will be discussed and demonstrated.

- Construction of Spatial Database for Flood Mapping (I)
- Flood Susceptibility Analysis using Logistic Regression Model
- Extraction of Flood Water from Remote Sensing Images
- Construction of Spatial Database for Flood Mapping (II)
- Flood Hazard and Risk Analysis
- Verification of Flood Prediction Models

- **Day 4. GIS Application of Geomorphological and Earthquake Hazard Mapping** - *Prof. Biswajeet Pradhan*

This topic devotes to geomorphologic and earthquake mapping using GIS and remote sensing data. The relationship between the various geomorphologic conditioning factors such as slope angle, slope aspect, slope curvature, morphology, stream evolution, land use, human activity, etc. will be discussed and demonstrated. We will discuss about the remote sensing data and its applications to earthquake mapping using NOAA and MODIS (both terra and aqua sensors) satellite images. Further we have some earthquake examples with validation and comparison from Asian subcontinent.

- Geomorphologic Hazards: Introduction
- Overview to Geomorphologic Susceptibility, Hazard and Risk
- Construction of Spatial Data
- Application of Digital Elevation and Numerical Modelling in Geomorphologic Mapping
- Earthquakes: Introduction to Important Terminologies
- Use of Remote Sensing and GIS in Earthquake Studies

- **Day 5. GIS Application of Forest Fire Hazard and Risk Mapping** - *Prof. Biswajeet Pradhan*

This topic introduces forest fires mapping using remote sensing, GIS and statistical models with validations.

- Earthquake Prediction: Case Studies
- Forest Fire: Introduction to Forest Fire Susceptibility, Hazard and Risk
- Construction of Spatial Data for Forest Fire Susceptibility
- Detection of Hotspots from MODIS/NOAA Images
- Forest Fire Susceptibility Analysis using Statistical Based Model
- Model Validation

Module 3. Introduction and Application of Geospatial Statistics and Remote Sensing in Geology

- **Summary of module contents and learning objectives**

This module is an introductory course in remote sensing and image processing. It will cover the introduction of Remote Sensing, and basic digital image processing. Also, based on a few examples, participants will learn how to apply remote sensing technique for the description of spatial patterns and identification of spatial properties.

- **Day 1. Introduction and Application of Remote Sensing** - *Dr. Jong-Kuk Choi*

This topic is an introduction to remote sensing of the earth as a system and explores the fundamental principles of remote sensing. And you can learn how to collect and display the remote sensing data. We will have lab time to hands-on work with field spectroadiometer for mineral detection. The topic introduces some applications using remote sensing data.

  - Overview of Remote Sensing
  - Collecting Remotely Sensed Data
  - Displaying Remotely Sensed Data
  - Remote Sensing Applications (I)
  - Remote Sensing Applications (II)
  - Field Spectrometry

- **Day 2. Practical Exercise of Remote Sensing S/W** - *Dr. Changwook Lee*

This topic covers include energy interactions, reflectance, scanning systems, satellite sensors, digital image process, and image classification. Integral to the course is an introduction to the handling of large image data sets using computers. Students will work with image processing software.

  - Overview of Digital Image Processing
  - Geometric Correction (I)
  - Geometric Correction (II)
  - Image Enhancement
  - Special Transformations: PCA and Vegetation Indexes
  - Image Classification

- **Day 3. Introduction of Geological Image Interpretation Technique** - *Dr. Sung Ja Choi*

This topic is an introductory course for understanding structural geometry of randomly chosen area in the context of their application to mining or social overhead capital (SOC) projects. It is designed to provide a basic understanding of the fundamental concepts and principles that influence investment and decisions of

government projects at the pre-feasibility stage. Its main objective is to impart to the participants the skills necessary to construct a realistic model of a certain area, and to evaluate it initially under assumed certainty, thus to establish a preliminary certainty. The session will be concluded with a review of current development of participants particularly in the area of their own country. The hands-on modelling nature of this training makes it essential that participants should express all kind of information of their countries.

- Structural Geology and Global Tectonic Background
- Fold and Fault Mechanism
- Image Interpretation on Fold
- Image Interpretation on Fault
- Image Interpretation on Geometry
- On-Job Training

- **Day 4. Introduction of Hyperspectral Remote Sensing in Geology** - *Prof. Freek van der Meer*

Remote sensing, or earth observation, refers in a general sense to the instrumentation, techniques and methods used to observe, or sense, the surface of the earth, usually by the formation of an image in a position, stationary or mobile, at a certain distance from that surface. In spectral remote sensing energy reflected from an object is being measured and translated into information about the object or into processes related to the object. Reflectance spectra have been used for many years to obtain compositional information of the earth surface. Spectral reflectance in visible and near-infrared offers a rapid and inexpensive technique for determining the mineralogy of samples and obtaining information on chemical composition. Recent developments in this field are fast and this topic series will introduce state-of-the-art techniques in multi- and hyperspectral processing and interpretation with a focus on airborne and satellite-based sensors. Hyperspectral sensors acquire imaging data at high spectral and moderate spatial resolution allowing reflectance, radiance and emittance spectra to be constructed that permit physical measurements of the earth surface. In this topic, participants will learn the basic physics of spectroscopy and learn how to measure and understand spectra in the laboratory and field and to integrate these with imaging data. These concepts will be extended to hyperspectral data for which the full processing chain from data acquisition up to thematic mapping will be covered throughout the topics. Thematic applications that will be covered include case studies from the fields of geology, mining, petroleum geosciences and environmental sciences. Examples from neighbouring areas such as soil science, soil engineering, vegetation science, agriculture and water quality will be briefly shown.

- Basics of Remote Sensing and Reflectance Spectroscopy
  - Reflection: specular reflectance, diffuse reflectance (Lambert's law), intermediate cases and reflectance types (i.e., directional, conical, hemipsherical), albedo
  - Absorption: molecular rotation, lattice vibration, electronic transitions, free carriers

- Reflectance spectroscopy: measurement of reflectance, intimate mixture models, spectral properties of minerals, rocks, soils, vegetation, water, atmosphere and man-made objects
- Reflectance spectrometry: field and lab spectroradiometers, natural vs. artificial illumination, absorption band characterization using Hull difference/quotient
- Multispectral scanning principles, ASTER, ratio-ing, color composites
- Video I: Field spectroscopy

o Preprocessing of Hyperspectral Data
- Instrument calibration: geometric spectral calibration, spectrometric calibration, radiometric calibration, in-flight versus lab calibration
- Atmospheric calibration: absolute calibration using radiative transfer models, relative calibration (flat-field, IARR, empirical line) using field spectra
- Video II: Calibration of hyperspectral data

o Selection of Endmembers and Training Data Sets for Hyperspectral Mapping Purposes
- Endmember selection: spectral libraries, regions of interest, orthogonal subspace projections and pixel purity index

o Hyperspectral Sensors and Systems
- Hyperspectral remote sensing: review of spectrometry with emphasis on spectral resolution and resampling, rationale of hyperspectral remote sensing, data acquisition, airborne and spaceborne instruments, spectral libraries

- **Day 5. Application of Hyperspectral Remote Sensing in Geology -** *Prof. Freek van der Meer*

o Spectral Mapping Methods
- Spectral mapping techniques: binary encoding, waveform characterization, spectral feature fitting, spectral angle mapping, spectral unmixing, constrained energy minimization, cross correlograms

o Geologic Applications of Hyperspectral Remote Sensing
- Theory and examples in various disciplines of hyperspectral remote sensing: geology: alteration mapping, surface mineralogy, calcite-dolomite mapping, oil & gas seeps, mining pollution, some examples from soil; clay mineralogy, soil properties, and vegetation; chlorophyll, APAR, pigment, stress indicators,

determining soil fertility from hyperspectral data for agricultural purposes.

- Geologic Remote Sensing in the Thermal Domain
  Emissivity of rocks and minerals, temperature-emissivity separation, thermal mapping

Module 4. Application of Geological Remote Sensing

- **Summary of module contents and learning objectives**

This module is an advanced course in remote sensing for geological phenomena and geospatial statistics in geology. It will cover the introduction of SAR/InSAR, remote sensing and geological remote sensing in coastal area analysis and earth surface analysis in SAR remote sensing part, geospatial statistics course, the early part of the classes will be assigned to introduction of geostatistics including the history, practical applications, current issues of geostatistics, and so on in geospatial statistics part. The purpose of this module is to provide the participants with application of remote sensing to analysis and to evaluate geological phenomenon. Also, based on a few examples, participants will learn how to apply remote sensing and geostatistics techniques for the description of spatial patterns and identification of spatial properties

- **Day 1. Introduction of SAR** - *Dr. Hoonyol Lee*

The purpose of this topic is to provide the participants with an introduction to the Satellite Synthetic Aperture Radar (SAR) and the activities and tools for in situ measurement of microwave backscattering. The course begins with a short introduction of SAR imaging mechanism and recent satellite SAR systems.

  - Introduction to Synthetic Aperture Radar
  - Imaging Principles of SAR
  - SAR Interferometry and Polarimetry
  - Ground-Based SAR

- **Day 2. Application of SAR Remote Sensing in Geology** - *Dr. Changwook Lee*

InSAR is a proven method for mapping surface deformation to monitor volcanoes activity using radar image. Analysis of InSAR image can detect dynamic volcanoes monitoring and can measure surface deformation before and after eruption. Ground deformation measurements from InSAR technique is complementary method to observe of much greater study areas on a monthly basis from earthquake events. Moreover, 3D surface deformation estimated from the combination of InSAR and MAI techniques will better resolve the parameters of deformation models for earthquakes. Active microwave remote sensing transmits a series of pulses from the radar antenna to the surface of the earth. Differential interferometric phases from L-band SAR data sets show spatial variation of path-length ranging from a few mm to several cm. Penetration depth varies depending on the incidence angle, frequency and soil dielectric corresponding to a wavelength range of each SAR satellite system. Although the amount of total effect caused by soil moisture is not measurable, it is clear that the soil moisture according to precipitation is another factor to be considered in DInSAR analysis.

  - Volcanic Activity Monitoring using InSAR
  - Soil Moisture Measurement of SAR Remote Sensing
  - Time-Series Surface Deformation for Natural Hazards (I)(II)

- **Day 3. Introduction and Theory of Geospatial Statistics** - *Prof. Eun gyu Park*

As the first day of geospatial statistics course, the early part of the classes will be assigned to introduction of geostatistics including the history, practical applications, current issues of geostatistics, and so on. Also in the later part of the classes, we will learn geostatistical concepts and a few tools to measure spatial regularity of field data through examples and computer tools. Followings are the topics to be discussed in the 1st day geospatial statistics classes.

- Introduction to Geostatistics
- A few Important Concepts in Geostatistics
- Introduction of Geostatistics Software: GSLIB
- Tools for Measuring Spatial Regularity of Field Data
- Exercise with Real Data

- **Day 4. Application of Geospatial Statistics for Remote Sensing and GIS** - *Prof. Eun gyu Park*

At the second day of geospatial statistics course, a powerful spatial interpolation tool of kriging will be discussed in detail. Kriging is often used in daily GIS data processing and analyses while the input parameters of kriging model are improperly handled in many actual practices. In the classes, the theory of kriging model is briefly introduced and a few kriging models will be applied to real data with GSLIB software in which the meaning of each input parameter will be discussed.

- Linear Interpolation
- Inverse Distance Weighting (IDW) Method
- Simple Kriging
- Ordinary Kriging
- Exercise with Real Data

- **Day 5. Practical Exercise of Geospatial Statistics using GSLIB** - *Prof. Eun gyu Park*

At the last day of geospatial statistics course, we will further discuss on indicator based kriging method. We will also learn very important analysis tools of sequential simulation method which have a lot of practical applications.

- Indicator Semi-Variogram and Kriging
- Sequential Simulations Models
- Exercise with Real Data

About the instructor – *Dr. Saro Lee*

Saro Lee got his B.Sc. degree in geology (Yonsei University, Seoul, Korea) in 1991, M.Sc. in GIS-based geological hazard mapping (Yonsei University, Seoul, Korea) in 1993, and Ph.D. in landslide susceptibility mapping with mathematical models (Yonsei University, Seoul, Korea) in 2000.

He is currently a director at the department of geosciences information, KIGAM where he involved in GIS/RS application on geological hazard studies. He started his professional career in 1995 as a researcher in the KIGAM. He spent many years as a part time lecturer in the department of earth system sciences, geology and military affairs at the Yonsei Univ., Kyungpook National Univ. and Daejeon Univ., respectively, Korea from 2004-2005. Since 2006 to the 2010, he is an adjunct professor in the department of geology & earth environmental sciences at the Chungnam National Univ. He is now the Chief Prof of the Department of Geoinformatic Engineering, University of Science & Technology.

He carried out several International Cooperative Research Projects in the field of geological hazard in Cambodia, China, Indonesia, Malaysia, Philippines, Thailand and Vietnam. Also He managed and had lectures KOICA International Training Program six times (Mineral Exploration and GIS/RS) for participants from more than 20 Countries (Afghanistan, Cambodia, Cameroon, Colombia, DR Congo, East-timor, Fiji, Indonesia, Kazakhstan, Kyrgyz Republic, LAO PDR, Madagascar, Malaysia, Mongolia, Myanmar, Nigeria, Nepal, Peru, Philippines, Turkmenistan, Uzbekistan, Vietnam, and so on).

His research interest includes geospatial predictive mapping with GIS and RS such as landslide susceptibility, ground subsidence hazard, groundwater pollution hazard, mineral potential, as well as habitat potential. He has published over 70 papers a citation h-index of 28 in Scopus.

About the instructor – *Dr. Moung Jin Lee*

Dr. Moung Jin Lee is currently working as Research Specialist at Korea Environment Institute. He received the B.Sc. degree in Environment in 2000, and the M.Sc. in Remote sensing and GIS from Yonsei University in 2004, and the Ph.D. in GIS and Geological hazard from Yonsei University, Seoul, Korea, in 2012.

He worked in the image processing of remote sensing and GIS application on natural disaster in Yonsei Natural Science Institute (YNSI) from 2001 to 2004. He spent one years as research in the department of groundwater development at the Korea Rural Community Corporation, Korea from 2004-2005. During the period, 2005-2006, he was worked Korea Telecomm Network(KTN) 2005 to 2006, and work in Urban Information System(UIS) and Ubiquitous city. He has more than 10 years of research and industrial experience and

has published over 20 research and reviewed articles in referred technical journals and books. He specializes in remote sensing and GIS application and soft computing techniques in natural hazard and environmental problems. He is also the associate of The Korea Society of Remote Sensing.

About the instructor – *Dr. Young Sung Kim*

Yongsung Kim got his B.Sc. degree in geology (Yonsei University, Seoul, Korea) in 1998, M.Sc. in discrimination between earthquake and artificial blast by using seismic and infrasound waves (Yonsei University, Seoul, Korea) in 2000, and Ph.D. in groundwater productivity potential mapping with probability models (Kyungpook University, Daegu, Korea) in 2010. He got P.E. in geology and geotechnics in 2006.

He is currently a vice-president of GeoGreen 21, groundwater and soil specialty company where he involved in groundwater survey and planning.

His works includes geospatial predictive mapping with GIS and RS such as groundwater equipotential distribution, groundwater productivity and groundwater vulnerability. He has done numerous projects such as national groundwater survey(13 areas), national groundwater inventory, national groundwater management plan, national groundwater information strategy planning, basic groundwater survey for RBF, and related deign project.

About the instructor – *Dr. Hyun-Joo Oh*

Dr. Hyun-Joo Oh is currently working the department of mineral resources research at KIGAM as a researcher. Her research interests include application of GIS and remote sensing in mineral resource mapping. She got her B.Sc. degree in geological engineering (Daejeon University, Daejeon, Korea) in 2001, M.Sc. in GIS-based mineral potential mapping (Yonsei University, Seoul, Korea) in 2006, and Ph.D. in geological event mapping (mineral, landslide and ground subsidence) with mathematical models (Yonsei University, Seoul, Korea) in 2010.

About the instructor – *Prof. Biswajeet Pradhan*

Prof. Dr. Biswajeet Pradhan is currently working as Associate Professor at Department of Civil Engineering, Faculty of Engineering, University Putra Malaysia. He was awarded with prestigious Alexander von Humboldt Research Fellowship at Dresden University of Technology, Germany since between July 2008 till October 2010. He received the B.Sc. degree in Geology honours in 1995, and the M.Sc. in Applied Geology from Indian Institute of Technology (IIT), Bombay in 1998, and the M.Tech. in Civil Engineering from Indian Institute of Technology (IIT), Kanpur in 2000, and the Ph.D. in GIS and Geomatic engineering from University Putra Malaysia, Selangor, Malaysia, in 2005.

He was German Deutscher Akademischer Austausch Dienst (DAAD) and Saxony Scholarship holder from 1999 to 2002, and worked in the fields of remote sensing and GIS application on earth surface studies. He then spent three years as senior lecturer in the department of civil engineering at the Asian Institute of Medicine, Science and Technology (AIMST) University, Malaysia from 2002-2004. Afterwards, he spent four years as Geomatics Division Manager at Cilix Corporation, Malaysia from 2005-2008. During the period, 2006-2008, he was simultaneously pursuing his post doctoral research at Institute for Advanced Technology with the University Putra Malaysia. He has more than 15 years of teaching, research and industrial experience and has published over 100 research and reviewed articles in referred technical journals and books. He specializes in remote sensing and GIS application and soft computing techniques in natural hazard and environmental problems. He is the Editorial Board Member of various international journals. He is also the Editor of various international journals: Arabian Journal of Geosciences (Springer), Disaster Advances, Central European Journal of Geosciences (Springer).

About the instructor – *Prof. Eun gyu Park*

Eungyu Park is currently at Department of Geology, Kyunpook National University, Daegu, Korea as an associate professor of hydrogeology and geostatistics. He received geologic bachelor (1997) and master (1999) degrees from Department of Geology, Yonsei University, Korea and a hydrogeologic doctorate (2002) from Department of Geology and Geophysics, Texas A&M University, Texas, US. The title of his phD dissertation was “Analytical Modeling of Contaminant Transport and Horizontal Well Hydraulics”.

After finishing his degree programs, he further studied the field of hydrogeology and geostatistics as a research associate at Department of Civil Engineering, Delft University of Technology, the Netherlands (subject: Markov chain based geostatistics), and

Environmental Science Division, Oak Ridge National Laboratory, Tennessee, US (subject: contaminant transport in heterogeneous subsurface media).

His current research interests are two folds. First, he studies on the field of hydrogeology which includes subsurface fluid flow, especially groundwater flow, and contaminant transport with a consideration of realistic heterogeneities in subsurface media properties. As an active researcher in the field, he has published several research papers on horizontal well hydraulics, TCE mass transfer modeling, water-table fluctuation modeling, analytical PRB modeling, etc., at highly ranked journals. Second, he has developed his own indicator based geostatistical simulation model of Generalized Coupled Markov Chain (GCMC). GCMC model can have wide variety of applications in mineral explorations, water resources, soil sciences, reservoir characterizations, decision makings, etc. He published several important articles on the GCMC model and is improving the model predictability and performances.

About the instructor – *Dr. Jong-Kuk Choi*

Dr. Jong-Kuk Choi got his Ph.D. in remote sensing and geographic information system from Yonsei University (Department of Earth System Sciences). He is currently a research scientist in the Korea Ocean Satellite Center of Korea Ocean Research & Development Institute (KORDI). Prior to joining KORDI, Dr. Choi worked in the companies related to remote sensing and GIS for twelve years, and carried out several projects in the field of environments and geology.

His research interest is the optical remote sensing in the coastal area, especially the surface sediments distribution, tidal channel networks, macro-/microphyto- benthos distribution in the tidal flat, suspended sediment concentration on the coastal water and the classification of coral reef. An estimation of geological hazard by using data mining methods such as artificial neural network, fuzzy logic, probabilistic model, etc. is also another field of interests.

About the instructor – *Prof. Hoonyol Lee*

Prof. Hoonyol Lee received the B.S. degree in geology in 1995 and the M.S. degree in geophysics in 1997, both from the Department of Geological Sciences in Seoul National University, Seoul, Korea, and the Ph.D. of radar remote sensing from the Department of Earth Sciences and Engineering, Imperial College London, University of London, U.K., in 2001.

From 2001 to 2003, he was a postdoctoral research associate with Imperial College London, U.K. From 2003 to 2004, he was a senior researcher with the Korea Institute of Geoscience and Mineral Resources (KIGAM), Daejeon, Korea. Since 2004, he has been with the Department of Geophysics, Kangwon National University,

Korea, where he is currently an Associate Professor. From August 2008 to July 2009, he was a Visiting Scholar with the Department of Geological Sciences, University of Oregon. His research interests include synthetic aperture radar, interferometry, and polarimetry. He developed an educational synthetic aperture radar (eSAR) processor, a SAR Ocean Processor (SOP), polarimetric scatterometer systems and ground-based SAR systems.

Prof. Lee was supported by the Korean Ministry of Education Scholarship, the Overseas Research Student Award from the Committee of Vice-Chancellor and Principals, UK, and the Chevening Scholarship from British Embassy in Korea, for his Ph.D. study. He was awarded the Interactive Session Prize Paper Award at the 1999 IEEE International Geoscience and Remote Sensing Symposium (IGARSS'99), Hamburg, Germany. In 2008, he received the Best Paper Award of Korean Journal of Remote Sensing. He is a senior member of IEEE Geoscience and Remote Sensing Society and a member of American Geophysical Union. From 2011, he serves as the editor of the Korean Journal of Remote Sensing.

About the instructor – *Dr. Changwook Lee*

Changwook Lee got his B.Sc. degree in geology (Kangwon National University, Chuncheon, Korea) in 1999, M.Sc. in Remote sensing using SAR interferometry (Yonsei University, Seoul, Korea) in 2002, Researcher & Visiting Scientist for U.S. Geological Survey (USGS) National Center for Earth Resources Observation and Science (EROS), USA in 2006, and Ph.D. in Time-series surface deformation by SBAS InSAR technique (Yonsei University, Seoul, Korea) in 2009. He had fill the Postdoctoral position in InSAR for the ARTS contract with the US Geological Survey EROS data center, and all work was to be performed as determined by the USGS project Manager working in coordination with SSSC Management. The work was performed at the USGS Cascades Volcano Observatory in Vancouver, Washington by National Aeronautics and Space Administration (NASA) project supports until August 2011. He was research professor at the Department of Geoinformatics, The University of Seoul where he involved in Remote Sensing applications using SAR and Optic images for geological natural hazard until August 2012.

He is currently a research scientist at National Institution of Meteorological Research (NIMR) where he involved in Global Environment System Research lab using SAR and Optic images for geological natural hazard. He supported an awarded NASA grant to develop and apply advanced satellite interferometric synthetic aperture radar (InSAR) image technique to study Aleutian volcanoes. Especially, Small BAse Subsets (SBAS) and Persistent Scatterer InSAR (PSInSAR) using multi-interferogram InSAR processing methods were applied to approximately a dozen active Aleutian volcanoes by identifying point-like, persistently-scattering and time-series surface deformation patterns on the volcanoes to analyze the temporal history of ground movement with an accuracy of a few millimeters.

He has knowledge of synthetic aperture radar (SAR) and interferometric SAR (InSAR) techniques, high precision SAR processing technique development, strong analytical skills, excellent presentation skills, and ability to work in a team environment. He also possesses extensive experience using SAR and InSAR with applications to natural hazards monitoring such as earthquake, volcanic activities, and land subsidence.

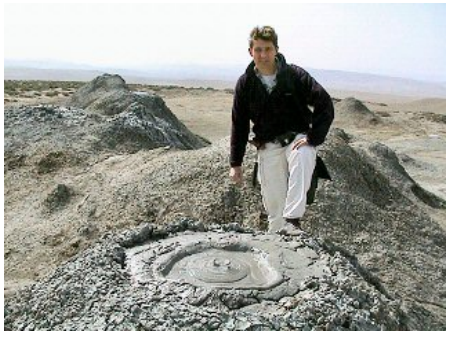
He managed Human Resources Development Program for monitoring of natural hazards using SAR interferometry technique by Korea Research Foundation from 2006 to 2007. For his outstanding research achievement, he received the award of Excellent Poster Award on Korea Society of Economic and Environmental Geology in 2006, Award of Excellent contestant-Student Prize Paper Competition Oral Session at International Symposium on Remote Sensing in 2007 and Excellent Paper Award on Graduate School of Yonsei University in 2008.

About the instructor – *Dr. Sung-Ja Choi*

Dr. Sung-Ja Choi is currently Head of Geological Mapping Department of Korea Institute of Geosciences and Mineral Resources (KIGAM). She got her B.Sc. degree in Earth Science (Ewha Womans University) in 1974, M.Sc. degree in Paleontology (Yonsei University, Korea) in 1978-80, and Ph.D. in Paleontology with thesis paper titled "Charophyta of the Catalan potassium basin (North-east of Spain) at the boundary of Eocene-Oligocene." (Montpellier II Universite, Montpellier, France) in 1982-1984. She started his professional career in 1986 as a geological mapper in the department of geological mapping. She is a recognized expert on geological mapping & satellite image interpretation with 28 years of experience.

Her research interest are 1) Digital fracture composition techniques based on geological mapping & satellite image (resolution: 5-1m) interpretation; 2) Hydrogeologic fracture mapping: subsurface reservoir & hot spring; 3) Structural interpretation: sedimentary basin; 4) GPS terrace mapping; 5) Tectono-geomorphologic interpretation; 6) Micropaleontologic classification.

About the insturctor – *Prof. Freek van der Meer*



Prof. Dr. F. (Freek) D. van der Meer (1966) has an MSc in structural geology and tectonics of the Free University of Amsterdam (1989) and a PhD in remote sensing from Wageningen Agricultural University (1995) both in the Netherlands. He started his career at Delft Geotechnics (now Geodelft) working on geophysical processing of ground penetrating radar data. In 1989 he was appointed lecturer in geology at the International Institute for Geo-Information Science and Earth Observation (ITC in Enschede, the Netherlands) where he worked to

date in various positions. Since January 2010, ITC is the Faculty of Geo-Information Science and Earth Observation of the University of Twente.

At present he is the chairman of the Department of Earth System Analysis (http://www.itc.nl/esa/). His research is directed toward the use of hyperspectral remote sensing for geological applications with the specific aim of use geostatistical approaches to integrate airborne and field data into geologic models.

On 1 November 1999, Prof. van der Meer was appointed part-time full professor of imaging spectrometry at the Delft University of Technology (DUT, Faculty of Civil Engineering and Geosciences). From 1999-2004, Dr. van der Meer worked at Delft University of Technology. In 2005 he was appointed professor of geological remote sensing at Faculty of Geosciences of the Utrecht University (http://www.geo.uu.nl/). Prof. van der Meer is a adjunct professor to the Asian Institute of Technology (AIT, Thailand; http://www.set.ait.ac.th/).

Prof. Van der Meer published over 100 papers in international journals and authored more than 150 conference papers and reports. Prof. Van der Meer is editor of the book Spatial Statistics for Remote Sensing published in 2000 by Kluwer, editor of the book Imaging Spectroscopy: Basic Principles and Prospective Applications published by Kluwer in 2001 and editor of the book Remote sensing image analysis: including the spatial domain published by Springer in 2004.

Prof. van der Meer is the past chairman of the Netherlands Society for Earth Observation and Geoinformatics, chairman of the special interest group geological remote sensing of the European Association of Remote Sensing laboratories (EARSeL), he is council member and national delegate of EARSeL, member of the Board of earth and life sciences of the Royal Netherlands Academy of Sciences (KNAW), member of the section earth observation of the Society Geoinformatics Netherlands, chairman of the WG VII/3 Information extraction from hyperspectral data of the International Society for Photogrammetry and remote sensing (ISPRS), associate editor of the International Journal of Applied earth observation and geoinformation, associate editor of Terra Nova and series editor of the remote sensing and digital image processing book series of Springer-Kluwer.

Activities in education - Prof. van der Meers´ education focuses on principles of remote sensing; physical principles of remote sensing, principles of sensors and systems, multi spectral scanning systems and Multi- and hyperspectral remote sensing for geologists (http://www.itc.nl/education/fields/earthsciences.aspx). He also guides MSc students in these fields.

Activities in research - Prof. van der Meers´ research focuses on the use of hyperspectral remote sensing in geology and on the development of image processing strategies to analyse high spectral resolution data sets in this context. For more information see http://www.itc.nl/research/policy/spearhead1/earthsystems.aspx

Activities in project services - Prof. van der Meer has been active in research and consultancy projects for major oil companies on the use of hyperspectral remote sensing in the oil and gas industry. At present he is the coordinator of the EU Asialink project (http://www.itc.nl/bridge/) BRIDGE: Building Human Resources In the Development of Academic Programmes in Sustainable Geosystem Exploration and Engineering with partners in Thailand (AIT), Laos (National University of Laos), Vietnam (Vietnam National University) and Sweden (Stockholm University).

GENERAL INFORMATION

• STARTING/END DATE AND LOCATION

✓ February 18 through March 15 (4 weeks) at KIGAM in Daejeon, Korea.

• LANGUAGE OF STUDY

✓ The language of instruction is English and all courseware is in English.

• ASSESSMENT AND CERTIFICATION

✓ A participant will receive the certificate upon completion of the course.

• REGISTRATION

✓ **Deadline** – Before 7 days Each Module starting date(But January 31 for a nomiee)

✓ **How to Register**

- Complete and return the attached registration form to Ms. Eunkyung Lee by email at lek0927@kigam.re.kr or fax at +82-42-868-3432
- Visit at http://isgeo.kigam.re.kr, IS-Geo URL. You can learn more about all training course of IS-Geo website.

• COURSE FEE

✓ The full fee for each module of all courses including access to electronic course notes, the certificate of attendance and the Pre-Course e-Learning is 500,000 KRW / Module (200,000 KRW /Module).

• CONTACT

✓ **Ms. Eunkyung Lee**, Assistant Coordinator by phone at +82-42-868-3816 or via email at lek0927@kigam.re.kr

✓ For more inquires about training courses of IS-Geo, please contact at any time **Ms. Ock-Sun Lee**, Coordinating Researcher by phone at +82-42-868-3712 or via email at sun@kigam.re.kr