Final Program of the 3rd MORE Science Colloquium

Dear students and mentors:

Thank you very much for taking time from your busy schedule to contribute to the success of the MORE Science Program. The third MORE Science Colloquium contains eight oral presentations, showcasing undergraduate (5) and graduate (3) researches being conducted within our departments. The content covers a diverse spectrum of interdisciplinary topics from Rainfall Measurements, to Science and Technology for Antarctic Sea Ice, Landscape Analysis from DEM, Stratigraphy, Flash Flood Modeling, and to Geospatial Intelligence Tech. Each speaker has 15 minutes for his/her oral presentation and 5 minutes for questions and answers. Ph.D. students within the ESE Ph.D. program are going to serve as judges. Winners based on the judges' evaluations on each speaker's paper and oral presentation. Graduate and undergraduate students will be assessed separately. Colloquium will be held on Friday, Jan 30th 2009. The specific schedule is listed in Table 1. All abstracts are following the Table 1.

All other students and faculties are welcome to attend the colloquium.

Room: SB 2.01.02, UTSA
Time: 1:30-4:30, Friday, Jan 30th 2009
Lunch provided by COS Dean's Office will be from 1:00-1:30 pm

Judge Committees

Burcu Cicek – Laboratory of Remote Sensing and Geoinformatic (LRSG)
Karen Engates – HydroGIS
Keith Muhlestein – HydroGIS
Somenath Ganguly - ?
Mike Lewis – Laboratory of Remote Sensing and Geoinformatic (LRSG)
Newfel Mazari - Laboratory of Remote Sensing and Geoinformatic (LRSG)

For more information about Colloquium, please call Newfel Mazari at 210-458-7815 or e-mail to him at **Newfel@yahoo.com**.

We are looking forward to meeting you at the Colloquium!

Sincerely yours,

Newfel Mazari
Coordinator, the 3rd MORE Science Colloquium
The Laboratory of Remote Sensing and Geoinformatics
Department of Geological Science
The University of Texas at San Antonio

Table 1. The final program of 3rd MORE Science Students Colloquium				
Date	**January 30, 2009, Friday**			
Room	**SB 2.0102, UTSA**			
1:00-1:30	**Check in and Lunch**			
	Students	**Mentors**	**Categories**	**Title**
1:30-1:50pm	Anne Ji	Hongjie Xie	Undergraduate	A preliminary study of rainfall measurements based on four double-gauge platforms at the Government Canyon State Park, Texas
1:51-2:10pm	Beverly Saunders	Steven Ackley	Undergraduate	Nutrient Dynamics in Antarctic Sea Ice
2:11-2:30pm	Jeffrey Allen	Donald Hooper & Marius Necsoiu	Undergraduate	Morphometric Analysis and Landscape Evolution from Gridded Digital Elevation Models
2:31-2:50pm	Mark Childre	Lance Lambert	Undergraduate	Proposed Stratigraphic Nomenclature for the Kainer Formation, San Antonio Area, Texas.
2:51-3:10	Michael Daniel	Brent Nowak & Steve Ackley	Undergraduate	AUV design for sea ice research
3:11-3:20	**Break**			
3:21-3:40pm	Almoutaz Elhassan	Hatim Sharif	Graduate	Analysis of San Antonio River Floods Caused by Tropical Storm Erin
3:41-4:00pm	Shuangxi Xie	Keying Ye	Graduate	Satellite Image-Based Geospatial-Intelligence Technique: Development and Implementation of a New System for Categorization Using Statistical Tools
4:01-4:20pm	Thomas Whitney	Brent Nowak & Steve Ackley	Graduate	Machine Vision Analysis for Krill Population Estimation
4:21-4:40pm	**Judge meeting and discussion**			
4:41-4:50pm	**Announce awards and certifications**			

Abstracts:

Undergraduate Students

1- Anne Ji: A preliminary study of rainfall measurements based on four double-gauge platforms at the Government Canyon State Park, Texas. ***(Advisor Dr. Hongjie Xie)***

The purpose of this study is to understand rainfall patterns of the Government Canyon area and to evaluate the accuracy and precision of the tipping buckets used to measure rainfall. It is important to know how rainfall is distributed throughout an area of a radar cell and how well rainfall measurement equipment and technologies work under both uniform and non-uniform conditions. With accurate rainfall information, we can validate rainfall measurement products like the WSR- 88D NEXRAD radar. In this study, a total of 8 rain gauge of tipping buckets are set up at four locations within a 1 km by 1 km grid to test for rainfall patterns like uniform and non-uniform rainfall. Each location has two rain gauges mounted side by side, to ensure that the rainfall data collected is accurate. The data examined are based on the 6-minute interval collections of rainfall. The mean, standard deviation, and the coefficient of variation are used to determine uniform or non-uniform rainfall patterns. The Coefficient of Variation (CV) measures the relative scattering in data with respect to their mean and CV=0.5 is used as a threshold to determine uniform or non-uniform rainfall. Initial findings indicate that the percentage of uniform rainfall decreases from April to July and also decreases with heavier rainfall.

2- Beverly Saunders: Nutrient dynamics in Antarctic sea ice ***(Advisor Dr. Steve Ackley)***

The ecological systems within Antarctica are highly dependent on biological activity within the sea ice. This activity is in turn largely dependent on the physical processes and dynamic sea ice interactions which are unique to Antarctica. In addition the porosity of ice which allows for nutrient transport also plays a very large role in microbial community development. Nutrient values are dependent on the amount of biological activity present within the ice as well as the ice formation processes while isotope values depend solely on the latter. Studies looking at the nutrients, chlorophyll a and isotope values are needed in order to confirm models describing sea ice interactions and also in order accumulate data so that trends may be established over time. This report presents SIMBA cruise 2007 nutrient and isotope profiles of ice cores taken from the Bellingshausen Sea Ice. The profiles show counterintuitive trends and require further evaluation.

3- Jeffrey Allen: Morphometric Analysis and Landscape Evolution from Gridded Digital Elevation Models. ***(Advisors Drs Donald Hooper and Marius Necsoiu)***

This study focuses on the ability to obtain data collected from Digital Elevation Models (DEM) to interpret landscape characteristics and evolution. Slope, elevation, and aspect data were extracted from the ten meter DEM then summarized and compared to their respected geologic formation. The project evaluates specific data (slope, aspect, and elevation) from gridded 10 meter DEM's in order to analyze different geologic features in the U.S. The areas of interest contain different sets of data comprised of 250 meter^2, 10,000 meter^2, 22,500 meter^2,

250,000 meter^2, and 10^6 meter^2 regions. The quality of data is a 10 meter DEM, the highest in Digital Elevation Models. Each landscape chosen represents an area of change by various means of geologic activity throughout the United States landscape: drainage and flooding, drumlins, volcanic activity, dunes, impact crater, ridge and valleys, and mesas and buttes. These selected areas provide well-defined topographic features which make this study and the data more unambiguous. In order to explore the DEM's and obtain the data we used the software package ENVI, version 4.5. KaleidaGraph, version 4.0, was used to organize and analyze the data. The data collected from the DEM's did help visualize even the most minuscule topographic feature. This study endorses the use of 10 meter DEM's to define, analyze, and read topographic sections whether large or small scale.

4- Mark Childre: Proposed Stratigraphic Nomenclature for the Kainer Formation, San Antonio Area, Texas. ***(Advisor Dr. Lance Lambert)***

Lower Cretaceous strata of north Texas have been formally subdivided following the North American Stratigraphic Code (NASC) requirements for some time. However, in south Texas more informal descriptive units have historically been used with success because the paleoenvironment was a stable, shallow, lagoonal region protected behind the Stuart City Reef Trend. As more detailed studies are conducted, the stratigraphy, hydrogeology, karst, and structure of the Edwards Group and its equivalents are often confused by the misleading informal nomenclature, which often used descriptive lithologic terms for member names. Formal stratigraphic nomenclature is needed to more precisely correlate increasingly finer subdivisions of the Edwards Aquifer with equivalent shelf-edge deposits of the Devil's River Trend and the epicontinental Maverick Basin. Better correlations beyond the immediate region, such as with Lower Cretaceous strata in trans-Pecos and north Texas, should be another positive result because of concurrent sequence stratigraphic analysis. The objective of my research is to measure potential type sections, describe the lithology, and interpret the sequence stratigraphy for each of the members for the Kainer Formation according to the NASC. The data collected will ultimately result in a formal stratigraphic nomenclature based on properly measured and described reference sections with geographically derived names.

5- Michael Daniel: AUV design for sea ice research. ***(Advisors Drs. Brent Nowak and Steve Ackley)***

Research under the Polar sea-ice is a remote, hazardous, and a unique environment. The Polar Regions are by definition remote, which limits access due to seasonal ice breaking expeditions in the Antarctic. Under ice investigations are hazardous to humans. Therefore, to conduct ongoing research under the sea-ice in Polar Regions requires an influx of technology. Remotely operated underwater vehicles (ROV) or autonomous vehicles (AUV) have been shown to be strong candidates to collect scientific data. However, current AUV and ROV technologies are not specifically designed for sea-ice research. The most prolific AUV technologies are designed around the "torpedo" geometry. Many of the applications for this design are for benthic research. Two major commercial manufacturers are Bluefin Technologies and Hydroid, LLC. The cost of these AUVs is over $400,000. These costs are prohibitive for many researchers. ROV technologies have been typically designed around hull inspection, oil platform

and oil pipeline service. Again, the costs and utility of these ROVs is limiting for sea-ice research. Therefore, we conducted research, analysis, and prototyped candidate AUV designs for shallow depth applications. The requirements for the application were provided by Prof Steve Ackley (sea-ice geophysicts), in conjunction with Matthew Joordens (visiting researcher). The intent of the vessel is to explore the underside of arctic ice, creating a topographic map of the bottom of the ice. This would be used to monitor the melting rate of such ice caps. Our focus was the design of the hull for the AUV. The main constraints are as follows: The AUV had to be able to obtain a depth of 100 meters, it must be easily serviceable, and it must be cost effective to produce in numbers. During the course of the design we explored many different options for the design of the hull. Several shapes were investigated, as well as several materials. Once the design was narrowed down, we began running finite element analysis to ensure that the vessel could withstand the pressure at the depth. Next, several "hatch" designs were explored until a suitable option was found. Our work is on-going, yet we will provide some preliminary results, discuss the analysis, and provide an outline of future work.

Graduate Students

6- Almoutaz Elhassan: Analysis of San Antonio River Floods Caused by Tropical Storm Erin. ***(Advisor Dr. Hatim Sharif)***

Tropical Storm Erin started as a depression on August 14 2007. It deepened rapidly to evolve into a tropical storm the morning of the 15th. It moved into Texas on the 16th with maximum sustained winds of 56 km/hr. The storm produced 2-10 inches over south central Texas on August 16-17, 2008. The heaviest rainfall fell within a 6-hour period with totals in excess of 7.5 inches, as observed by the WSR-88D radar in New Braunfels, near San Antonio, TX. Average precipitation over the summer provided sufficient moisture to cause Erin's precipitation to produce significant rapid runoff over portions of the San Antonio River. Radar rainfall data and a two-dimensional, physically-based, distributed-parameter hydrologic model were used to perform hydrometeorological analysis of this event. Hydrologic simulations on several sub-basins will be discussed.

7- Shuangxi Xie: Satellite Image-Based Geospatial-Intelligence Technique: Development and Implementation of a New System for Categorization Using Statistical Tools. ***(Advisor Dr. Keying Ye)***

The aim of this project is to develop and implement a new system in classifying the subjects of geospatial multi-spectral satellite data sets, by using Bayesian statistical method. In order to improve our satellite remote sensing data for geospatial-intelligence analysis, we develop a data analysis system based on the Bayesian algorithm in processing multi-dimensional data sets. Through our study of satellite images we are able to construct training data sets containing different wave bands for a set of terrain types. These training data sets in our

algorithm are carefully chosen to establish frequency models. By incorporating the Bayes' rule we are able to compute the posterior probability of each category given individual pixel data. Consequently, the category with largest probability will be classified as the one for the specified pixel point. Preliminary data analysis shows that the results are promising and this algorithm will be tested on more remote sensing data types. Furthermore, in order to achieve better accuracy in classification we will be incorporating the correlations between wave bands and structural classes in our future research. Finally, with these improvements, we will be able to integrate our algorithm with the Arcmap program to calculate the percentage of given terrain types in a specific area of satellite images.

8- Thomas Whitney: Machine Vision Analysis for Krill Population Estimation. ***(Advisors Drs. Brent Nowak and Steve Ackley)***

An off-the-shelf SeaBotix ROV (Remotely Operated Vehicle) was deployed under Antarctic sea ice near Palmer Station Antarctica during the Sept-Oct 2007 Sea Ice Mass Balance in the Antarctic (SIMBA) project from the research vessel *NB Palmer*. Video imagery taken showed significant numbers of Antarctic krill (sp. *Euphasia Superba* and/or *Euphasia Crystallorophis*) under the sea ice at the two stations deployed. The goal of this research is to conduct image analysis on the recorded ROV video footage. From this we hope to count and estimate the visible krill population, as well as, make steps towards identifying other life forms. The difficulties of the image analysis include, but are not limited to, the relative motion between the krill and vehicle, the avoidant behavior of the krill, and the changing lighting conditions under the sea ice. In this paper, we will discuss these and other challenges and describe the algorithms that are under development. The ROV video was converted into a string of JPEG images, which were used to simulate an approximate running speed of 3 frames/second (fps). Three 5 second clip (15 frames each) were selected as an initial test for the vision software. National Instruments: Vision Builder for Automated Inspection® has been selected as an image processing platform, which allows us to rapidly prototype algorithms. We found that inconsistent underwater illumination and poor image quality allowed only the most prominent individuals in proximity of the camera to be counted. In order to increase the visible depth of the recorded footage, certain image processing techniques were conducted. Grayscale noise reduction techniques were applied to reduce some of the image noise. Edge detection filters (such as, but not limited to the Sobel and Roberts Filter) have been applied to further reduce the image's noise level and increase the contrast between the krill and the background environment. Next, intensity mapping was used to detect and count the contrasted objects. Finally, the data were logged. Once all of the parameters were set, the 15 images were cycled through the configured inspection in chronological order to simulate an actual inspection of the ROV video. Once completed, the result of the automated krill estimation was compared to a visual (naked eye) inspection of the same krill images. The results of the automated inspection, although considerably faster than the visual inspection, did not properly log the number of visible krill in the images. This was most likely due to illumination glare, low image resolution, and blurring. The technique, through research and testing, appears to have practical application.