Jennah Seaver – China Travel Report

During the period of July 10th- 15th, 2016, I was given the privilege to present my research from the Center for Remote Sensing of Ice Sheets (CReSIS) in a poster session at the International Geoscience and Remote Sensing Symposium (IGARSS) held at the National China Convention Center (CNCC) in Beijing, China. The theme of this conference was titled, "Advancing the Understanding of Our Living Planet." Primary sponsoring agencies of this event included the Institute of Electrical and Electronics Engineers (IEEE), the National Space and Science Center (NSSC), Fudan University, and the Institute of Remote Sensing and Digital Earth (RADI).

In addition to presenting my research, Dr. Linda Hayden was able to secure tickets to a variety of luncheons, dinners, plenary speakers, and outings with my group from Elizabeth City State University (ECSU). The first of such events was the "Welcome Reception" held on Sunday, July 10th, from 6:30 pm – 9:00 pm on the Corridor and Platform on the 4th floor of the CNCC. At this event, we were given the opportunity to mingle and network with other IGARSS attendees, taste authentic Chinese cuisine, and witness a unique and cultural tai-chi show. The performers' glowing fuchsia and cobalt uniforms popped against Beijing's undulating, monochromatic skyline as a shimmering peach sunset spilled over the horizon. In that moment, I truly felt warm and welcome to this international experience.

The following day, I was scheduled to present my research poster from CReSIS from 5:20 – 7:00 pm during session MOP.P25 on the third floor, south hall. My poster was under the theme: *Remote Sensing Data and Policy Decisions*. Session co-chairs included Stephanie Chalifoux, from the Canadian Space Agency, and ECSU's own Jerome Mitchell, currently attending Indiana University. My poster was titled, <u>The Addition of a Survival Unit, Featuring: Why Do Mittens Keep Our Hands Warm?</u> I found my presentation to be among the most interesting of my experiences at the conference because of the varying degrees of receptiveness I received from viewers. Initially, a noticeable amount of attendees reacted to my poster with a feeling of slight skepticism and a compulsion to probe its relevance to the field of remote sensing. While taken aback, I suppose I could sympathize with this viewpoint. After all, my poster did display, in blaring boldface: "**Why Do Mittens Keep Our Hands Warm?**" A strikingly simple question in a sea of posters analyzing glacier surface velocities, vegetation indexes, sea surface temperature anomalies, etc. Nonetheless, I was able to clarify misconceptions with relative ease, explaining my role as an educational outreach coordinator for

CReSIS and advocating the value of Science, Technology, Engineering, and Math (STEM) exposure to children at as early of an age as possible. As I articulated the engaging aspects of a "polar survival" theme and the effectiveness of hands-on, inquiry-based lessons, confusions were alleviated, frustrations reconciled, and viewers expressed their appreciation for my work as a K-12 educator.

The morning of the day of my poster session, I attended the IGARSS Opening and Plenary Sessions at the CNCC Plenary Hall A, 4th floor. There, I listened to a series of welcome speeches from XU Dazhe, Administrator of the *China National Space Administration* (CNSA), XIANGLI Bin, Vice President of the *Chinese Academy of Sciences* (CAS), Howard Michel, *IEEE* Former President, and Kamal Sarabandi, *IEEE GRSS* President. Following the major awards and recognitions was a plenary session held by a variety of accomplished remote sensing and geoscience advocates, featuring Tong Xudong, Director of Earth Observation System and Data Center, speech titled, *Plans to implement the National Space Infrastructure Construction of China*, Yves-Louis DESNOS, Head of the R & D Section in the Earth Observation Directorate of ESA at ESRIN, speech titled, *The ESA and MOST-NRSCC Dragon cooperation, 12 years of advances in understanding our Living Planet*, Michel H. Frelich, Director of NASA's Earth Science Division, speech titled, *From Science to Societal Benefits: NASA's Earth Observation and Research Programs*," and Zhang Wenjan, Director of the Observing and Information Systems Department and Director of WMO Space Programme of the World Meteorological Organization (WMO), speech titled, *The WMO view on global change in particular with space observation data*. These sessions helped renew my appreciation for geoscience and remote sensing and the efficiency and progress these fields bring to technological development and global connection.

Fast-forward to Tuesday, July 12th, 12:10 pm – 1:30 pm, and I am brought to the inspiring Women in Geosciences Luncheon in room 402, CNCC. Enjoying a buffet of Peking duck and other foods relevant to Chinese culture, I was given the opportunity to network and discuss opportunities for women in the remote sensing and geoscience fields. I sat next to opening speaker, Mariko Bürgin, who works in Radar Science at the NASA Jet Propulsion Laboratory in Pasadena, California. She encouraged all of us to consider attending the IEEE Women in Engineering (WIE) Leadership Conference held on May 22 – 23rd, 2017 in San Jose,

California, expressing the importance of a strong female network and how empowered she felt to be among such accomplished women in science. Representation is a powerful force, and I felt encouraged to pursue my dreams as a woman in such a supportive setting. Following Mariko's presentation was a talk by Qian (Jenny) Du, who is IEEE GRSS JSTARS Editor-in-Chief. Born in Shanghai, China, Du talked about how to become more involved with GRSS and how GRSS membership can benefit your career. She drew from her experiences as a journalist and how she worked her way up the career ladder, landing her prestigious spot as Editor-in-Chief, and encouraged women to volunteer to edit papers for next year's conference, emphasizing the importance of participation and perseverance. It was at this luncheon that I met IGARSS Outreach and Education Chair, Lori Mann Bruce, from Mississippi State University. I felt that it was valuable to meet her because she was in a field related to my own (albeit in a much higher position). I got in contact with her and we exchanged information. She needs a K-12 outreach perspective on her committee for next year's IGARSS, being held in Houston, Texas. I may get involved in that.

That evening, I attended an IGARSS social program, courtesy of Dr. Linda Hayden, titled, "*Evening in Beijing*" from 6:30 pm – 8:30 pm at the Lord Gui's Mansion. Lord Gui was the younger brother of Ci Xi, the Empress of the Qing Dynasty. We got to feast on the "royal dishes" of the Lord Gui's mansion, which included traditional Chinese food. These foods included fried rice, fish, duck, orange chicken, and an assortment of soups and salads. The experience was a delight. I met people from China, Germany, and South Africa at this event, and I got to learn about the interesting, indulgent history of the famous Lord Gui in his colorful, elaborate mansion.

The following morning, I attended Session WE1.L6 from 8:20 am – 10:00 am on Data Fusion to watch Mississippi State University's Lori Bruce and Daniel Reynolds' oral session titled, "GAME THEORY BASED DATA FUSION FOR PRECISION AGRICULTURE APPLICATIONS." This was the first session I attended at IGARSS. Since Remote Sensing and Geoscience are not my expertise, being an undergraduate elementary education major, I decided to skip the notes and do my best to absorb as much information as possible of this fascinating, but very advanced theory. I feel I got more out of the presentation by listening attentively instead of taking notes. However, I was able to find Bruce's published abstract about game theory from a previous conference, called *Whispers* in Tokyo, Japan in 2015, that describes game theory and

how it applies to her field in remote sensing. My descriptions of her application of game theory will derive from her abstract, the origins of which have been included in the references section of this paper. From Mississippi State University, Bruce expounds upon the basic concepts of game theory, described in her abstract as a mature field in the discipline of information analysis and decision making with well-supported mathematical models (Bruce, 2015). In pure concept, game theory involves the accumulation of player advantage through deliberate strategies in a "competitive or cooperative" activity (Bruce, 2015). "Game theory, and its mathematical models, can be applied to many areas of decision making in hyperspectral remote sensing… [including] campaign planning, routing/mapping sensors, data fusion, feature selection, and classification" (Bruce, 2015). Bruce explained how she applied game theory methods to maximize the accuracy of her data in agricultural and environmental fields.

On Thursday, July 14th, I further challenged myself to attend a series of oral sessions on topics that intrigued me. These topics included Neural Network Based Classification, Surface Hazards and Anomalies, and Remote Sensing Data and Policy Decisions. My deep explanation of all presentations are derived from the detailed notes I took from the corresponding PowerPoint presentations. The first session I attended was Session TH1.L2, from 8:20 am – 10:00 am, on Neural Network Based Classification, with session co-chairs Farid Melgani from *University of Trento* and Fabio Dell'Acqua from *Università di Pavia*. The session I attended was titled, "INTEGRATING SPECTRAL AND SPTIAL INFORMATION INTO DEEP CONVOLUTIONAL NEURAL NETWORKS FOR HYPERSPECTRAL CLASSIFICATION" by Shohui Mei, Jingyu Ji, and Qianqian Bi of *Northwestern Polytechnical University*; Junhui Hou, *Nanyang Technological University*; Qian Du, *Mississippi State University*; and Wei Li, *Beijing University of Chemical Technology*. In the presentation, they proposed a Convolutional Neural Network (CNN) – Based Framework. Their goal involved "integrating latest achievements in deep learning areas, e.g. batch normalization, Dropout, and Parametric Rectified Linear Unit (PReLU) activation function." They started their presentation with an introduction to deep learning, described as an "attempt to model high-level abstractions in data by using multiple processing layers, with complex structures or otherwise, composed of multiple non-linear transformations." They went on to explain how a "convolutional neural network" can construct deep structure when making sense of overwhelming amounts of data, its strength lying in its "full use of…two-dimensional construction of input data." I got the impression that 2-D

image data was a common source of information for scientists working with remote sensing and geoscience. To make full use of such data, the presenters explained how they converted an "input layer" into a "convolution layer" through weight sharing, which "increases learning efficiency by greatly reducing the number of free parameters being learnt." To solve generalization of vision problems, presenters further converted the "convolution layer" of a given image into a "pooling layer," which connects "weight" and "bias" and reduces the dimensions of the "output array" to produce a more efficient image. The presenters went on to introduce the concept of "hyperspectral data," the architecture of which is a data cube. The layer of the image "corresponds to a spectral band, and each pixel corresponds to a spectral curve of the position." Presenters went on to display their experimental results, complete with output maps, training time, classification error, and filter sizes of single and double layers, as well as comparative experiments between their proposed CNN method and a support vector machine (SVM). Presenters came to the conclusion that, "if given enough iterations and input data, high classification accuracies can be obtained for hyperspectral image classification." All in all, presenters were optimistic about the future of the CNN model, stating that it "has a higher research value and better development prospect," that it will "become mainstream in hyperspectral classifications," and that their main obstacle will be to overcome "the high computation complexity of the algorithm and the complicated data characteristics" associated with the CNN model in order to achieve "a more clear and accurate deep architecture for data descriptions."

From 10:30 – 12:10 pm, I attended another intriguing session on Surface Hazards and Anomalies, with session co-chairs Alex Hay-Man Ng from *University of New South Wales* and Amin Beiranvand Pour from *Universiti Teknologi Malaysia*. I watched the first presentation, titled, 'LANDSLIDE PREDICTION USING SOIL MOISTURE ESTIMATION DERIVED FROM POLARIMETRIC RADARSAT-2 DATA AND SRTM" by Shiyu Luo, from *University of Electronic Science and Technology of China*; Kamal Sarabandi, from *University of Michigan, Ann Arbor*; Ling Tong, from *University of Electronic Science and Engineering of China*; and Leland Pierce, from *University of Michigan, Ann Arbor*. The objective of their study was to "retrieve soil moisture from a steep area covered with vegetation." They listed two difficulties in achieving this: 1) "Vegetation reduces the sensitivity of the microwave instruments to measure soil moisture" and 2) "Geometric distortion caused by surface topography needs to be

considered." I can see how these factors could pose a challenge in obtaining accuracy in their experiment. Their methods to overcome such difficulties included SAR Data Correlation in the form of geometric distortion, which involved foreshortening, layover, shadowing, and polarization rotation. The measurable area was "back-slope area excluding shadows," mathematically expressed as follows: $\beta = \arccos(\hat{k} \cdot \hat{n})\ 0 \leq \beta < \pi/2$. Explained in a series of increasingly complex equations, the presenters were able to produce a landslide prediction method based on the soil moisture estimated using "fully polarimetric Synthetic Aperture Rader (SAR) data in conjunction with surface topography." Important steps to achieving this include: 1) Local angle of incident and polarization correction of SAR data for the mountainous terrain, 2) soil moisture estimation based on polarimetric scattering model, and 3) Landslide prediction using a soil stability model. While the math used to obtain this critical information was a bit over my head, I still found it fascinating that these scientists were able to account for surface topography when using SAR data with the use of mathematics, deriving such equations I can only imagine to be a highly complex feat, but inspiring to me, nonetheless.

The last oral session I attended was a breath of fresh air compared to the highly complex, but equally fascinating, talks I had attended previously because it was related to my work at CReSIS: educational outreach. This talk went from 3:40 pm to 5:20 pm and was in the same field as my poster presentation was listed, in Remote Sensing Data and Policy Decisions, with session co-chairs Reginald Blake, from *New York City College of Technology*, and Lanyu Li, from *Nanjing University*. The talk I watched was titled, "EQUIPPING UNDERGRADUATE STEM MAJORS WITH GEOSCIENCE AND REMOTE SENSING TOOLS: A PATHWAY TO REPLENISHING THE GEOSCIENCE WORKFORCE" by Reginald Blake, Janet Liou-Mark, and Hamidreza Norouzi from *New York City College of Technology*. Describing an outreach program extended to undergraduates pursuing geoscience, the presenter first outlined their geoscience workforce program goals: 1) Create pathways for non-geoscience STEM majors to pursue geoscience degrees and careers. 2) Provide hands-on geoscience training. 3) Engage students in fundamental remote sensing/geoscience research experiences. 4) Integrate authentic geoscience research experiences into the curriculum of an extant geoscience course. Participants in this outreach program went on to work for agencies such as New York City Environmental Protection, PARTNER Engineering and Science, Inc., and the United States Environmental Protection Agency. 37 undergraduates participated in the study. 38% (14) were African-

American, 22% (8) were Hispanic/Latino, 24% (9) were Asian American/Pacific Islander, 8% were Caucasian, 3% (1) were American Indian, and 5% were self-identified as "other." This particular outreach program incorporated an undergraduate research student self-assessment survey to measure four "student gains" from their experience: 1) Gains in Thinking and Working like a Geoscientist, 2) Personal Gains Related to Research Work, 3) Gains in Becoming a Scientist, and 4) Gains in Geoscience Skills. The presentations went on to calculate the means and standard deviations of the benefits gained in thinking and working like a geoscientist by ethnicity and used their findings to obtain a realistic, holistic understanding of the participants' attitudes towards geoscience. Their findings included that "African Americans and Asian Americans/Pacific Islanders had the highest gains in extending and solidifying their geoscience knowledge," "Asian Americans/Pacific Islanders also responded in higher gains in understanding how geoscience research and problem solving are carried out," and "Hispanic/Latinos responded with higher gains in understanding how geoscience research is done, how to analyze data for patterns, and how to interpret results from analyzed scientific data." This information was used to help improve their program and get through to a wider range of ethnicities in the geosciences, using their research to help promote racial diversity in STEM. I found this talk to be highly encouraging and gave me research insight into the field of outreach. This conference, and particularly this session, has opened my eyes to the value of education coordinators to help inspire the next generation of students to pursue careers in STEM fields.

In addition to watching conference presentations, I went to the Young Geoscience Professionals Lunch from12:10 pm -1:30 pm in room 402, CNCC. Along with a usual buffet of unique chinse cuisine, I had the opportunity to network with more IGARSS attendees, and even met the Vice President of the National Oceanic Atmospheric Administration (NOAA), Stephen Volz. He was very approachable and encouraged my educational outreach endeavors. Later that evening, I went to the Award Banquet at the National Museum of China. With dinner including Classical Foie Gras BBQ Salmon & Asparagus, assorted mushroom soup, Australia Fillet Steak, and Peking Duck, we got to listen to a choir sing "Flying Free" and "Let There Be Peace on Earth" followed by Chinese classical music, featuring songs such as "Jasmine" and "Auld Lang Syne." We got to watch a remarkable dance called the "Thousand-hand Kwanyen," and witness the "Handing Over" Ceremony, watching some deserving guests receive awards for their hard work.

It was with that last event that the IGARSS Conference had officially concluded. The experience was a whirlwind adventure filled with cultural events and international insight into the field of remote sensing and geoscience. To top off the trip, my travel group had the privilege to spend Friday, July 15th, touring the Great Wall of China and the Ming Tombs. The view of the Great Wall was breathtaking. I have never seen anything like it. Perched atop a green, misty mountain range, the heights of the Great Wall were only to be walked upon if one could conquer the mountain of stairs ascending into the high hills where the masterpiece snaked and winded. This was quite a hike, to say the least, and I am eternally grateful that I brought my running shoes and not my sandals, because slipping down those stairs could have been potentially fatal. Still, despite the risks and the elevation, I hiked up the Great Wall for as long as I could, taking in the most beautiful mountain range I have ever seen. I breathed in the history and exhaled deep appreciation for where I was at that monumental moment in time. After the trek, we visited the Ming Tombs, where I toured the exact tunnel that architects had been searching for and uncovered the mysterious tombs and artifacts that helped emperors transition comfortably into the other side. The Ming Tombs are a group of mausoleums of 13 Ming emperors. Our group only toured the underground burial chamber of Ming Emperor Wanli, which has been open to the public since 1956.

My experience in Beijing, China was unforgettable. When I had free time to explore the city, I learned how to hail a taxi in the chaos that is Beijing traffic, learning to go with flow and not get completely shell-shocked by the utter lack of order and complete disregard for boundaries on the highways and roads. I got the opportunity to tour the majestic Forbidden City, haggle with street vendors that attempted to sell me out of ¥12,000 RMB until I whittled down the payment all the way down to ¥400. That experience opened my eyes to how foreign countries have a distorted perception of American wealth and will try to get all their money's worth out of something as simple as a tea set. This was not so much disappointing as it was amusing, and it taught me to keep my wits about me when visiting foreign countries. One of the most valuable aspects of the experience was getting me to step out of my comfort zone and connect with people in spite of language barriers. I learned to communicate more effectively with people who don't understand English, whether I am trying to communicate with a taxi driver who cannot speak English, to communicating with a fellow IGARSS attendee who is perfectly fluent in Mandarin but cannot speak any English. We did not let our language barriers get in the way of connecting

with one another, and I found that inspiring. Participating in this conference helped me understand the magnitude of collaboration on a global scale. The IGARSS conference helped me understand how the science community, from a wide range of disciplines, interacts and works as a team to draw ideas off of and encourage one another to make the world a better place. It is one thing to read that sentence in theory, and then to truly experience and witness it at an international conference. I will be forever grateful for my experience at IGARSS.

References

Bruce, L. M. (2015). APPLYING GAME THEORY TO HYPERSPECTRAL IMAGE ANALYSIS WITH APPLICATIONS TO VEGETATIVE GROUND COVER MAPPING. *Whispers* (p. 37). Tokyo: The University of Tokyo.