Geophysics

Time 8:40 - 8:55 AM

Abstract Title DOWNHOLE DAS ARRAY FOR MICROSEISMIC EVENT RELOCATION AT FORGE USING MACHINE LEARNING CONVERTED PHASE PICKS

Presenter Richard Asirifi

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Abstract Text

Microseismic monitoring is a vital reservoir management tool, offering insights into subsurface fluid-driven processes such as Carbon Sequestration, wastewater injections, and hydraulic fracturing in Enhanced Geothermal Systems (EGS), where precise event localization during reservoir stimulation is imperative for interpreting fracture activation and heat flow pathways. The FORGE site in Milford, Utah, dedicated to the study of advancing EGS, features an extensive geophysical monitoring network including Distributed Acoustic Sensor (DAS) fibers.

The downhole DAS array recorded complete full wavefield of microseismicity which occurred, during the 2019 and 2022 stimulation, where clear P, S and S-P converted phases can be identified. Notably, the S-P converted phase occurred at the granite contact, where the seismic velocity significantly changes.

We developed an interactive tool to manually pick and interpolate phase arrivals on April 2022 stimulated events DAS wavefields. The phase picks with high signal-to-noise ratios are used to train a PhaseNet machine learning model (EQnet) using Pytorch to check the accuracy of predicted phase arrivals. We evaluate phase prediction results from our model and find good agreement with manual picks especially for P-phases with the highest Precision, Recall and F1 accuracy. The S-P and S phases show a relatively large residual from the manual picks perhaps due to the trade-off at the contact interface.

The importance of accurately predicting Converted Phase SP is its sensitivity to event depth, which can be used to better constrain event depths and relocate repeating events. We investigate the application of using DAS-converted phases to locate repeating events. Using the delay time between the S-P and P wave measured from DAS array, we interpret multiplets occurring at different depth ranges, which differs from the raw depth from the original catalog

Time 8:55 - 9:10 AM

Abstract Title PETROLEUM SYSTEM MODELLING OF THE PASSIVE MARGIN DEPOSITS OF THE NORTHERN ORANGE BASIN, SOUTH AFRICA.

Presenter Chris Samakinde

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Department of Earth Sciences, University of the Western Cape, Capetown & the School of Geosciences, University of Witswatersrand, Johannesburg, South Africa.

Abstract Text The present study analyses the faults and petroleum systems models of the northern part of the Orange Basin, South Africa. A 3D numerical modelling of hydrocarbon-generation and migration from the Barremian/Aptian source rock intervals in the northern Orange Basin was performed using boundary conditions (HF, SWIT, PWD) to juxtapose the timing of hydrocarbon-generation, expulsion and tectonic faults formation. The Model reveals transformation of organic matter began from the graben-filled central part around 108Ma and increases towards the fringes and reached the peak during the late Cretaceous. As at present day (0.0Ma), 100% transformation of organic matter had generated hydrocarbon at the central part while the extreme northeastern section is yet to be transformed into hydrocarbon. Source rock bulk generation and expulsion statistics as at present day show that 430701.94Mtons of gas and 38399.53Mtons of oil had been generated by primary and secondary cracking processes, representing 91.81% and 8.19% of organic matter transformed into gas and oil respectively. The source rock has an expulsion efficiency of 0.77 indicating good efficiency. 1D Calibration of this model using wells AO-1, AE-1 and AF-1 drilled in the study area shows modeled temperature agrees with the calibrated temperature data in all the three wells. However, there are slight variations in modeled and calibrated Vitrinite data in the three wells, especially during the Cenomanian-Turonian period. These variations suggest the influence of additional localized heat flow during the Cenomanian-Turonian for the three wells. The hydrocarbon migration model suggests that vertical migration of gas began contemporaneously with generation from the central part as early as 108Ma. As at present day, Albian-aged reservoir remains only and gas –prone while Cenomanian reservoir unit is gas prone. A fault model constructed to test possible fault controls on migration pathways shows a syn-rift listric fault to be 100% gas saturated as at 93 Ma and lost its saturation by 65Ma, suggesting a breakthrough path through the listric fault which caused it to lose its saturation. Evidence from conventional seismic interpretations and instantaneous frequency attributes analysis indicate bright spot anomaly and frequency attenuation respectively on either side of the fault. The breakthrough path is linked to fault reactivation which enables further migration of gas, which is classical of a passive margin basin.

Time 9:10 - 9:25 AM

Abstract Title COORDINATION NUMBERS AND GRAIN TEXTURE FROM MICRO-XRAY TOMOGRAPHY OF ANGULAR UNCONSOLIDATED SEDIMENTS: VELOCITY PREDICTION USING HERTZ-MINDLIN MODEL

Presenter Kwabena Poku-Agyemang

Organization Louisiana State University, Department of Geology and Geophysics, Baton Rouge, LA

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Abstract Text Elastic properties of unconsolidated sediments depend on parameters such as porosity, grain texture (i.e., grain shape and sizes), sorting and coordination number. Coordination is the average number of grains each grain has with touching grains, is a critical parameter in rock physics models for estimating elastic moduli of materials. While previous works have focused on the influence of porosity and sorting on coordination numbers within well-rounded grains, natural sediments have a wide range of grain shapes and sizes, and it remains unclear how these parameters influence coordination numbers within angular unconsolidated sediments.

We investigate the impact of porosity, sorting and grain size on coordination numbers within angular unconsolidated sediments. Using micro-computed X-ray imaging tomography, we quantify the grain size, sorting, porosity and coordination numbers within three samples of angular unconsolidated sediments ranging from very coarse sand to medium sand. To understand the influence of these parameters on seismic properties within unconsolidated sediments, we predict seismic velocities using the Hertz-Mindlin rock physics model.

Our results show that coordination numbers are higher in well-sorted samples than in poorly sorted samples. However, porosity has little statistical influence on coordination number estimates. Predicted seismic velocities within well-sorted samples are higher than seismic velocities within poorly sorted samples. We propose a relationship between coordination numbers and sorting that can enhance the prediction of seismic velocities within angular unconsolidated sediments with varying degrees of sorting.

Time 9:25 - 9:40 AM

Abstract Title THE UPSIDE-DOWN: USING STATE-OF-THE ART OIL AND GAS EXPLORATION TOOLS TO SOLVE CARBON CAPTURE CHALLENGES

Presenter John Templeton

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Abstract Text Carbon capture and storage (CCS) as a science has been advancing quickly over the last two decades and has already been commercially deployed in North Dakota, Texas, Alberta, and other states. The U.S. Environmental Protection Agency and/or state-promulgated regulations for Class VI injection wells prescribe a set of data collection and modeling workflows, using technologies from the oil and gas industry, reapplied to CCS applications for geologic characterization and reservoir simulation. This presentation will use one case study to illustrate how

these workflows and tools translate directly to CCS, where the goal is to characterize saline reservoirs for CO2 injection, which is effectively the "upside-down" approach from characterizing hydrocarbon reservoirs for fluid extraction. Examples include well log analysis; seismic stratigraphy and structural analysis (using 2D and 3D datasets); routine core analysis; geomechanical, fluid, and rock geochemistry; and geo-modeling and simulation for single and multiple well injection scenarios.

Geology

Time

9:50 - 10:05 AM

Abstract Title

ORIGINS OF AEOLIAN SEDIMENT IN A BASALTIC GLACIO-FLUVIO-AEOLIAN ENVIRONMENT: ÞORISJÖKULL GLACIER, ICELAND.

Presenter

Kashauna Mason

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Abstract Text

Deciphering the sedimentary rock record necessitates a thorough grasp of the physical and chemical processes that have influenced sedimentary formations. Although substantial research has focused on felsic sedimentary systems, there is a notable lack of studies on basaltic sedimentary systems. This gap hinders our ability to interpret sedimentary processes and environmental and climatic conditions in regions dominated by basaltic source rocks, such as on Mars. On Earth, Iceland stands out as a promising Mars analog for studying such processes due to its primary starting composition and similar alteration abundances. Iceland hosts one of the largest expanses of basaltic aeolian sand on the planet, generated through volcanic, fluvial, and glacial activities. This study, part of the SAND-E (Semi-Autonomous Navigation for Detrital Environments) project, uses robotic procedures to investigate physical and chemical changes in sediments within Iceland's basaltic glacio-fluvial-aeolian environment. The focus is on the origins of aeolian sand, analyzing its physical attributes such as size, shape, density, sorting, and source characteristics. Source rocks with low density such as hyalotuff have minimal influence on the density of the bulk sand. Analyses of grain shapes and sizes highlight the importance of viscous dampening of finer grains and infrequent transport of the coarsest grains in reducing rounding through abrasion. Wind speeds at or slightly below the threshold are consistent with similar particle size and sorting between fluvial and aeolian sands at each location. The SANDE 2019 field site is surrounded by high-elevation features that can generate katabatic winds affecting ripple patterns and orientation. The trends in aspect ratio versus grain size are consistent with the tendency for smaller and larger grain sizes to be less rounded. The lack of significant variation in the size and shape of samples may be due to the relatively short length of the transect, and fluvial and wind transport capacity. Ripple orientation suggests the influence of local and regional winds.

Time	10:05 - 10:20 AM
Abstract Title	BIOSIGNATURE POTENTIAL IN MARS SULFATE MINERALS
Presenter	Karena Gill
Organization	Arizona State University, School of Earth and Space Exploration, Tempe, AZ
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Co-Authors	Kathleen Benison West Virginia University
Abstract Text	Sulfate minerals, prevalent on Mars, represent a significant but underexplored reservoir of potential biosignatures. Understanding these minerals is vital for astrobiology, as they can capture evidence of past life and environments. While extremophiles have been identified in gypsum, halite, and ancient halite, other sulfate minerals have not been comprehensively examined for their biosignature potential. The Mars2020 mission, with its sophisticated rover, has collected samples from sulfate-rich regions on Mars, offering a unique opportunity to study these sulfate minerals. Specific samples, such as those from Jezero Crater, are of particular interest for their potential to contain preserved biosignatures. This study utilizes observations and analyses of microorganisms and organic compounds in primary fluid inclusions within mirabilite (Na2SO4·10H2O), a Mars-analog sulfate mineral from the Great Salt Lake, Utah, USA. Through the application of transmitted light and ultraviolet-visible (UV-vis) light microscopy, complemented by Raman spectroscopy a diverse array of microorganisms including bacteria, Archaea, algae, fungi, diatoms, and protozoa, along with organic compounds such as beta-carotene are identified. This research highlights the critical role of sulfate minerals in astrobiological investigations and supports the Mars2020 mission's objective of detecting signs of past life on Mars. Additionally, it demonstrates how non-destructive techniques can be applied to understand biological and geological conditions of different minerals. These findings significantly enhance our understanding of the types of biological materials that can be preserved in sulfate minerals and inform the search for biosignatures on Mars.

Time	10:20 - 10:35 AM
Abstract Title	FIELD, LABORATORY, AND REMOTE SENSING SPECTRAL ANALYSIS OF MINERAL DEPOSITS RELATED TO DEEP WEATHERING IN THE GREATER ANTILLES AND VIRGIN ISLANDS
Presenter	Bernard Hubbard
Organization	U. S. Geological Survey
Contact	bhubbard@usgs.gov
Co-Authors	Graham Lederer, Floyd Gray, Frederic Wilson, Greta Orris, Mark Cocker U.S. Geological Survey
Abstract Text	Minerals and mineral products have been important to commerce in the Caribbean Basin since pre-Columbian times. The Greater Antilles produce >10% of the world's nickel (Cuba) and bauxite (Jamaica) and contain at least seven porphyry copper-gold deposits. Recently, this region has been affected by major hurricanes such as Irma, Maria, and Fiona. In Puerto Rico as a result, emphasis has also been

placed on assessing the quality, quantity and distribution of the island's industrial mineral resources needed for infrastructure reconstruction.

Laboratory spectral studies were conducted on a suite of samples collected from Puerto Rico and the U.S. Virgin Islands during fieldwork in 2018. These samples were analyzed using laboratory spectral reflectance methods covering the < 1-micron wavelengths in the visible and near infrared (VNIR), > 2-micron wavelengths in the shortwave infrared (SWIR), and the 8- through 14-micron wavelength range also known as the thermal infrared (TIR). The TIR data were converted to emissivity to facilitate comparison with data collected by remote sensing instruments such ASTER on the Terra satellite and ECOSTRESS on the International Space Station. In addition, cloud-free ASTER imagery covering parts of Cuba and Jamaica was calibrated to both VNIR-SWIR reflectance and TIR emissivity. The imagery for the chosen areas shows well-exposed landscape features due to active or recent mining of Ni-Co laterite and Al-bearing bauxite deposits, respectively.

The distribution and abundance of gibbsite, kaolinite and serpentine minerals in exposed lateritic deposits and mine waste in Jamaica and Cuba are shown as ASTER mineral maps. Laboratory spectral analysis of samples from porphyry, skarn and epithermal vein occurrences from Puerto Rico indicate a variety of minerals related to weathering and/or hydrothermal alteration. Limestone displays a variety of carbonate mineral features that include impurities such as quartz, clay, and mica. Finally, samples from the Water Island Formation in the Virgin Islands display spectral features indicative of rare earth elements (REEs) in deeply weathered volcanic rocks mapped as Cretaceous "Quartz keratophyre" dikes and plugs. This work demonstrates the utility of spectral studies at various scales for on-going and future mineral exploration and assessment work.

Water, Chemistry, Climate & Environment

Time 8:50 - 9:05 AM

Abstract Title EMPLOYING REMOTE SENSING TECHNIQUES TO UNDERSTAND SEASONAL CHANGES IN WATER QUALITY IN THE MUSKINGUM WATERSHED CONSERVANCY DISTRICT

Presenter Spencer Williams

Organization Kent State University

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Co-Authors

Abstract Text The Muskingum Watershed Conservancy District (MWCD) encompasses several reservoirs in Northeast Ohio. In addition to its flood reduction benefits, it provides many recreational activities that contribute to the local economy. Lately, the MWCD has experienced a rise in harmful algae bloom (HAB) occurrences. Poorly regulated agricultural practices have caused nutrient oversaturation and heightened phosphorous load in local reservoirs, leading to an influx of seasonal algae growth. Concurrently, the MWCD has been subjected to varying degrees of coal mine drainage (CMD) due to extensive coal mining. If left untreated, these anthropogenic catalysts can severely affect aquatic ecosystems and local economies. As a result, early warning procedures and advanced water quality monitoring systems are critical in today's evolving climate. To address this, we have applied a varimax-rotated principal component analysis (VPCA) to satellite imagery from Sentinel-2 A/B MSI using a Google Earth Engine (GEE) Python API combined with ground truthing and drone-based multispectral surveying to validate the satellite analysis. The VPCA uses unsupervised classification methods to extract six components from spectral images to be identified by a spectral library. Spectral reflectance is unmixed from water pixels to identify components such as various algae, suspended sediment, iron oxide/sulfide minerals, and semi-submerged surface vegetation. Employing Google Earth Engine (GEE) components generated by the KSU-VPCA, validated by ground-truthing field measurements, will allow for the identification of suspended sediment, HABs and other water column constituents. This research effort will demonstrate an advanced water quality tracking procedure for monitoring the spread of HABs and coal mine drainage over time.

Time 9:05 - 9:20 AM

Abstract Title THE MICROBIAL DIVERSITY OF CORALS AFFECTED BY TREATED WASTEWATER IN THE KAHEKILI BEACH AREA

Presenter Makeda Mills

Organization Texas A&M University, Department of Oceanography, College Station, TX

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Co-Authors Grace Mathis
Texas A&M University, University of Mary Hardin-Baylor
Jason Sylvan
Texas A&M University

Abstract Text

The Kahekili Herbivore Fisheries Management Area (KHFMA), Maui, Hawaii, is an important shallow-water coral reef ecosystem, providing essential habitat and protection for reef fish and echinoderms from predators. However, the nearby Lahaina Wastewater Reclamation Facility discharges nutrient-rich effluent onto the reef via submarine groundwater discharge, which represents a potential threat to the ecosystem. This nutrient pollution, along with increasing water acidity near the vent site, may heighten the risk of coral bleaching, disease, and mortality. We aimed to characterize the coral microbiome within KHFMA and compare microbial populations across a gradient from the vent site. Samples, including coral fragments, mucus, and water, were collected from six sites within KHFMA at sunrise, noon, and sunset in July of 2023. DNA was extracted and amplified using polymerase chain reaction targeting 16S rRNA and Symbiodinaceae ITS2 to analyze prokaryotic communities and zooxanthellae diversity, respectively. The study contributes to the knowledge of diversity and structure of coral-associated microbial communities under varying polluted conditions and will inform conservation strategies and regulations to mitigate the impact of pollution on these essential marine ecosystems.

Time 9:20 - 9:35 AM

Abstract Title INVESTIGATING STABLE POTASSIUM (41K/39K) ISOTOPE FRACTIONATION ASSOCIATED WITH MICROBIAL ILLITIZATION

Presenter David M. Davis

Organization Rutgers University, Department of Marine and Coastal Sciences

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Co-Authors Tae-hee Koo, Jin Wook Kim
Yonsei University, Department of Earth System Sciences
Danielle Santiago Ramos
Rutgers University, Department of Marine and Coastal Sciences

Abstract Text

Clay minerals, also known as phyllosilicates or sheet silicates, are ubiquitous on Earth and Mars. Until recent decades, the conversion of smectite to illite (illitization) has been thought to be a purely abiotic process. More recent studies have shown that illitization can occur through the microbial dissimilatory reduction of Fe (III) found in the smectite octahedra. Iron reduction and liberation result in a charge imbalance that is satisfied by the uptake of K+, thus producing illite, and this process has been shown to fractionate Fe isotopes. We also know that in seafloor sediments, K isotopes can fractionate due to adsorption onto clay minerals and ion exchange during authigenic clay formation. Biology can also fractionate K isotopes by their incorporation into tissues and cells through absorption and diffusion across concentration gradients. This leads to a question: During microbial illitization, will we see a measurable K isotope fractionation? In this study, we are investigating the fractionation of K-stable isotopes associated with microbial illitization by comparing the starting material (Fe nontronite) with the newly formed illite as well as thermogenic illite. We hypothesize that the illitization of nontronite clay by Fe-reducing bacteria causes a measurable and unique fractionation of K isotopes, where biogenic illite has a lighter isotopic composition than both Fe nontronite and thermogenic illite. We will also use cores from the Nankai Trough to attempt to make these same observations and interpretations but in natural samples. Our question is: If we observe a distinct K

isotopic signature for the newly formed illite from lab-based experiments, can we use drill cores to make these same observations in nature?

Time	9:35 - 9:50 AM
Abstract Title	EXPRESSION OF OAE 2 IN THE BENUE TROUGH
Presenter	Sadiq Rijiya
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Co-Authors	Sadiq Rijiya, Lucien Nana Yobo Department of Geology and Geophysics, Texas A&M University, Texas

Abstract Text

Epicontinental seas represent the locations of some of the most carbonaceous rock deposition during periods of global climate perturbation such as the Cenomanian – Turonian Oceanic Anoxic Event (OAE 2). The mechanism of deposition vis-a-vis the temporal and spatial distribution of these anoxic facies have been well constrained in Cretaceous epicontinental seas such as the Western Interior Seaway of North America and the La Luna Sea of South America. However, their African counterpart, the Trans Saharan Seaway that existed during the same period has remained largely under explored. To this end, we seek to understand the role of the Trans Saharan seaway as a sink for organic carbon and its implications on biogeochemistry of the proto equatorial Atlantic. The seaway served as gateway connecting the Paleo Tethys to the Atlantic Ocean as Africa and South America were rifting, hence the sediments deposited will provide valuable information about ocean circulation during this time interval. Samples for this project are obtained from a 23 m Cenomanian – Turonian section of the Pindinga Formation in the West African Upper Benue Trough in Nigeria. Our investigation has indicated the occurrence of 3‰ positive carbon isotope excursion, a globally characteristic signature of OAE 2, thus confirming for the first time the expression of OAE 2 in the Upper Benue Trough. Trace element analyses have shown the occurrence of three cycles of weakly sulfidic bottom water conditions between the onset and recovery phases within an overall oxic to dysoxic condition.

Geoscience Education, Communication and Data Science

Time 10:00 - 10:15 AM

Abstract Title COMMUNITY GIS AND GEOGRAPHY FIELDWORK EXPERIENCES ABROAD THROUGH NSF REU & RET SITES

Presenter Timothy L. Hawthorne

Organization Auburn University, Department of Geosciences, Auburn, AL

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Abstract Text Community geographers often focus on including local voices in the research and education process. Studies of coastal debris are often focused exclusively on conventional geospatial technology methodologies, and do not typically include community mapping and local knowledge. Our work from an NSF-funded undergraduate and K-12 teacher research and education program in Hopkins Village, Belize provides a community geography approach to include local knowledge to better understand coastal debris in relation to sense of place. This connection rests on the assumption that as people have a higher sense of place, they may be more likely to identify debris challenges and work to create solutions to protect these threatened landscapes due to their values and emotional attachment to these places. Our work is driven by two key questions: a) what are significant types of debris, and how do they vary with time and across different locations? and b) are these debris types in areas where people have high or low sense of place? Our approach and results show the importance of local knowledge and mapping through community geography for understanding the complexities of coastal debris challenges in an international research site. The research underscores the need for collaborative efforts between community members and local authorities in formulating targeted and sustainable debris management strategies that consider local knowledge and sense of place.

Time 10:15 - 10:30 AM

Abstract Title ESTIMATING URBAN TREE ATTRIBUTES USING TERRESTRIAL LIDAR REMOTE SENSING

Presenter Zantia King

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Abstract Text	Above-ground biomass (AGB) is vital for evaluating the carbon storage capabilities of terrestrial ecosystems, with urban trees playing a significant role in AGB storage. The diversity of tree forms, species, and land cover in urban environments, however, complicates AGB assessment. Remote sensing technology, particularly light detection and ranging (LiDAR), presents a promising method for accurately measuring tree structures and assessing AGB at both individual tree and plot levels. This project employs terrestrial LiDAR measurements to create new allometric models for various tree species on the Midwestern State University (MSU Texas) campus, specifically addressing tree structures typical of North Texas urban areas. Cedar Elm and Red Oak, commonly found in North Texas, are the focus of this study. We will analyze tree point cloud data obtained via LiDAR technology by using advanced tree segmentation and modeling algorithms, validating the estimated above-ground attributes against actual field measurements. By examining 3D reconstruction models derived from the point cloud data, we aim to evaluate the accuracy of these algorithms for North Texas tree species. Furthermore, the detailed data from LiDAR measurements will be used to develop valuable tools for assessing forest structure and growth. This approach seeks to enhance AGB estimation algorithms, particularly for urban ecosystems, contributing to improved urban forestry management and carbon storage assessment. The insights gained will apply to broader scales, including local and regional forests, using satellite-derived data.

Time	10:30 - 10:45 AM
Abstract Title	POTENTIAL SWITCHGRASS IMPLEMENTATION LOCATIONS ON SASKATCHEWAN AGRICULTURAL FARMS FOR BIOFUEL PRODUCTION
Presenter	Daphne Varmah
Organization	Texas Christian University, College of Science and Engineering, Fort Worth, TX
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Co-Authors	Esayas Gebremichael Texas Christian University, College of Science and Engineering
Abstract Text	Switchgrass generates cellulosic ethanol, classified as an alternative fuel by federal definition. For switchgrass and other vegetation to become biofuel we have to look specifically at the cellulose microfibril and extract the glucose. This extraction leads to the fuel being produced. Switchgrass can deposit organic matter deep within the soil profile as the roots expand into the subsoil for nutrients and water. Not only is switchgrass a good biofuel product, but the carbon sequestration that comes along with planting this grass is highly beneficial. Due to the roots reaching deep into the soil, switchgrass is low maintenance while adding nutrients. In this project, we will be researching possible farms in Saskatchewan, Canada preferably in close proximity to ethanol biorefinery plants for maximum switchgrass plantation, in order to seek possible expansion of biofuel production in Saskatchewan. We will be looking at farms, proximity of farms to biorefineries, and soil make up.

Time	10:45 - 11:00 AM
Abstract Title	STUDENT ENGAGEMENT: MAPPING CUMULATIVE IMPACTS, CLIMATE VULNERABILITIES, AND JUSTICE40 INVESTMENTS USING INNOVATIVE ONLINE MAPPING TOOLS AND COMMUNITY OUTREACH
Presenter	Reginald Archer
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Abstract Text

The HBCU EJ Technical Collaborative is developing innovative geospatial tools to help address environmental justice and the Justice40 initiative. These tools integrate environmental data to better serve overburdened communities. In addition to mapping Justice40 funds and screening for cumulative environmental impacts, the tools analyze spatial datasets on hazards such as flooding, wildfires, and sea level rise. This allows mapping communities facing both pollution burdens and increasing climate vulnerability. When combined with socioeconomic vulnerabilities, the enhanced screening tool prioritizes those facing the greatest compounded risks. Students can gain experience assisting with data acquisition and management of frequently updated hazards layers. The collaborative looks to build web mapping applications featuring comprehensive natural and technological hazard exposures. This online geospatial hub and the tracking tool provide spatial insights to help target Justice40 benefits and prepare underserved areas. The presentation provides an opportunity for students to interact with practitioners, learn advanced geospatial techniques, and explore becoming involved in refining these decision support resources. Involvement offers skills training that can inform more resilient and equitable community development.

LIGHTINING 1

Time 10:35 - 11:10 AM

Abstract Title THE COMBINED USE OF TOWED TEM AND ELECTRICAL RESISTIVITY TOMOGRAPHY FOR CHARACTERIZATION OF LEVEE FOUNDATION

Presenter Kolawole Arowoogun

Organization Missouri University of Science and Technology, Dept. of Geological Engineering

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Abstract Text Towed transient electromagnetic method (tTEM) and electrical resistivity tomography (ERT) data were acquired at the landside toe of a section of the Kaskaskia Island Levee, which has experienced underseepage and internal erosion leading to numerous sand boil occurrences during past floods. This study demonstrates the strengths of tTEM and ERT in imaging the underlying levee foundation and resolving heterogeneities of the substratum materials. The tTEM and ERT results complement each other, with tTEM reliably mapping the clay blanket and shaly bedrock units, while ERT shows detailed layering of the sand substratum and clay blanket. Both methods reveal that the clay blanket has variable thickness along the levee, with thinner or missing clay blanket in locations with multiple sand boil occurrences. The use of tTEM and ERT also reveals the presence of sandy in-fill materials used to cover scour holes from past levee overtopping along the levee stretch. Both tTEM and ERT successfully imaged the levee foundation units; however, ERT was more effective in delineating layer heterogeneity in the sand substratum, while tTEM proved effective in imaging the conductive clay blanket and shale bedrock. A comparison of the geology from both tTEM and ERT show reasonable correlation with the CPT lithology and driller's log. The geology from tTEM and ERT mapped the clay layer blanket thickness and sand substratum heterogeneity, which explains the presence of sand boils in the area. This study highlights the utility of tTEM and ERT in providing vital information to better understand internal erosion and sand boil mechanisms along river levees.

Time 10:35 - 11:10 AM

Abstract Title INVESTIGATING THE PRESENCE OF DEEP MELT IN THE NORTHERN WESTERN BRANCH OF THE EAST AFRICAN RIFT SYSTEM

Presenter Asenath Kwagalakwe

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Abstract Text

Despite decades of studying continental rifts, the competing roles of preexisting structures and magmatism in rift formation remain debated. The dominant mechanism for strain accommodation in the northern Western Branch of the East African Rift System, which contains magma-rich (Lakes George-Edward graben) and magma-poor (Albertine and Rhino grabens) continental rift segments, is not fully understood. This study uses the Advanced Solver for Planetary Evolution, Convection, and Tectonics (ASPECT) code to investigate the presence of deep melt (i.e., melt between the lithosphere-asthenosphere boundary and 660 km depth) beneath the northern Western Branch using two types of small-scale convections. The first type, Lithospheric Modulated Convection (LMC), investigates melt generation associated with mantle convection influenced by variations in the lithospheric thickness beneath the northern Western Branch. The second type, Tomography-Based Convection (TBC), investigates melt generation associated with mantle convection constrained by seismic-derived thermal anomalies that may be related to plume material. We use an established melt parameterization scheme to calculate the melt fraction below the lithosphere for both LMC and TBC. Our model output indicates that the LMC produces low amounts of melt beneath the northern Western branch at depths of 93–103 km, while the TBC produces higher volumes of melt at deeper depths, i.e., 93–186 km. Melt fractions range from 0.023 to 0.409 beneath the magma-rich Lakes George-Edward graben at depths of 93–186 km. Under the magma-poor Albertine graben, melt is observed between 160 and 186 km, with melt fractions ranging from 0.023 to 0.153. Under the magma-poor Rhino graben, melt fractions range from 0.023 to 0.228. These results suggest that deep melt is a plausible weakening mechanism for the magma-rich Lakes George-Edward graben of the northern Western Branch. We find that deep melt is unlikely to facilitate rifting in the magma-poor Albertine and Rhino grabens due to the small volumes (or absence) of deep melt produced, implying that another weakening mechanism, such as pre-existing structures, is required in the magma-poor region.

Time 10:35 - 11:10 AM

Abstract Title SINKING RUNWAYS: UNVEILING HIDDEN THREATS TO MAJOR US AIRPORTS

Presenter Oluwaseyi Dasho

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Co-Authors Manoochehr Shirzaei
Department of Geosciences, Virginia Tech

Abstract Text In the context of global climate change and local phenomena such as differential land subsidence, the quality of U.S. transportation infrastructure, particularly airports, lags behind other developed nations. Our study introduces a cutting-edge technique using satellite radar interferometry to detect subtle runway subsidence and assess associated damage risks at 15 major U.S. airports. San Francisco International Airport exhibits the fastest subsidence rate at -9.6 ± 0.2 mm/yr, while Los Angeles International Airport shows the slowest at -1.7 ± 0.2 mm/yr. Damage risk analysis reveals that approximately 96.3% of runway areas are at low risk, 3.5% at medium risk, 0.2% at high risk, and 0.1% at very high risk. This translates to 2.7 million m² being exposed to subsidence, with 13,825 m² at high to very high damage risk. These findings underscore the urgent need for investment in airport infrastructure to mitigate these risks and ensure operational safety and efficiency.

Time 10:35 - 11:10 AM

Abstract Title OPTIMIZING INJECTION STRATEGY FOR MITIGATING FLUID PRESSURE PROPAGATION INTO THE BASEMENT: INTEGRATING DEM AND WELL LOG

Presenter John Ogunleye

Organization Virginia Tech

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Co-Authors Ethan Conley, Ryan Pollyea
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Abstract Text Widespread groundwater abstraction in aquifer systems, such as the Potomac aquifer of the Virginia Coastal Plain, has led to significant groundwater depletion and land subsidence. Consequently, there is an increased interest in Managed Aquifer Recharge (MAR) as one of the mitigation strategies. However, the Potomac Aquifer is juxtaposed unconformably above crystalline basement rock, so MAR could trigger microseismicity due to changes in subsurface fluid pressure. Numerical modeling studies for the region commonly assume homogeneous aquifer properties within the Potomac aquifer, overlooking fine heterogeneities. However, recent deep drilling efforts associated with the SWIFT aquifer recharge project reveal clay interbeds on-site with a thickness of about 20m. The absence of a 3D numerical model incorporating site-scale clay interbeds hampers understanding their impact on fluid pressure dynamics. This study uses a 3D numerical model to understand fluid pressure dynamics and how injection strategies can be optimized by incorporating the effects of aquifer heterogeneity, particularly discontinuous clay layers (DCLs), to buffer fluid pressure propagation. Results from this study indicate that focusing injection in the upper and middle Potomac aquifer reduces fluid pressure reaching the basement directly below the injection well by 10 kPa for DCLs equal to or greater than about 400 by 800 m. DCLs of about 200 by 400 m or less subtly influence fluid pressure propagation, mainly affecting the extent of pressure propagating into the basement. Also,

injecting in the upper and middle Potomac aquifer increases fluid pressure coverage in the Potomac confining unit, potentially mitigating land subsidence and reducing pressure propagation towards the basement, thereby lowering the risk of inducing microseismicity.

Time	10:35 - 11:10 AM
Abstract Title	CLIMATE-DRIVEN RISKS TO SUBSURFACE INFRASTRUCTURES IN LOW-LYING SOUTH CAROLINA
Presenter	Riliwan Abioye
Organization	University of South Carolina, School of the Earth, Ocean and Environment (SEOE), Columbia, South Carolina
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Co-Authors	Alicia Wilson University of South Carolina, Columbia, SC, USA Norman Levine College of Charleston, South Carolina Amanda Guthrie, Landon Knapp South Carolina Sea Grant Consortium

Abstract Text

The low-lying nature of the coastal areas makes them vulnerable to the impact of climate change, which is causing the water tables to rise. This rise is aiding the interactions of groundwater with septic systems. Monitoring the fluctuations in the water table is crucial for assessing the flooding risk to septic systems. Long-term risk of impairment of septic systems was established using a machine learning (ML) algorithm, which was calibrated to a 13-month record of observed data. Observed water levels fluctuated by about 1 m in all our monitoring wells between August and September 2022, which was influenced by the significant rainfall event of about 3 inches/day and regional sea level rise of 7 cm. This rise was significant enough to cause impairment of septic systems in 83% of our wells, after which the water levels returned to baseline. We defined the baseline water levels for this study as the average water levels over the period of observation.

ML models confirmed an annual variability of 1 m in water levels using 34 years (1990–2023) of historical rainfall and tidal data. To establish the current risk at our study site, tidal data was adjusted to the 2023 stage, which increased the risk significantly. When different scenarios of rainfall were tested, the water level increased at a scale of millimeters to centimeters, which only impacted 17% of our wells. Generally, water levels were high enough to cause impairment of septic systems at least once a year in 83% of our wells, and the risk declined with increasing depth to the baseline water level. This relationship between the risk and the depth to baseline water level offers a spatial means of describing the risk instead of using traditional groundwater models. We employed a 1D analytical solution to resolve the baseline water levels spatially. The analytical solutions were consistent with the baseline water levels except at 17% of our wells located at the highest elevations in our study site, which was assumed to be an old marine terrace, keeping the water levels higher. However, when this solution was transferred onto a GIS platform, water levels interacted with the land surface, which limited its use. This challenge can be fixed on the GIS platform, but we will be using a steady-state MODFLOW approach to establish a new baseline water level.

Time	10:35 - 11:10 AM
Abstract Title	SIMULATED MODEL RESULTS ACROSS THE PERMIAN-TRIASSIC TRANSITION CLIMATE CONDITIONS
Presenter	Joseph Mayala Nsingi
Organization	Department of Earth and Environmental Studies, Montclair State University, Montclair, NJ 07043
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Co-Authors	Jiang Zhu and Feng Zhu, Climate and Global Dynamics Laboratory, NSF National Center for Atmospheric Research, Boulder, CO Justin L. Penn Department of Geosciences, Princeton University, Princeton Ying Cui Department of Earth and Environmental Studies, Montclair State University, Montclair
Abstract Text	During the end-Permian mass extinction event (EPME) that occurred about 252 million years ago, and the Earth experienced the loss of 80-90% of marine species and 70% of land species. The Siberian Traps (ST) volcanism is postulated to have triggered this event through the release of large amount of carbon dioxide (CO2) into the atmosphere from the huge volumes of magma outpoured. Despite decades of research on the EPME, the impact of the ST volcanic event on the EPME and the subsequent recovery of life is still poorly understood. Silicate weathering is typically responsible for sequestering CO2 from the atmosphere. We hypothesize that during the Early Triassic warm period, silicate weathering was not occurring at a rate sufficient to lower the atmospheric CO2 while degassing from the Earth's interior remained high. We focused on the Penn et al. (2018) global warming simulation across the Permian-Triassic transition to test the associated impact of the increased CO2 on the level of sea salinity, precipitation (both on land and over the sea), evaporation, surface temperature, sea temperature, wind direction, surface pressure and river runoff. We observed that all the above-mentioned variables increased during the transition period. Meanwhile the evident Permian snow trace in the mid-latitudes disappeared in the early Triassic, the CaCO3 production and formation and pH decreased. The meridional overturning circulation shows deep upwelling at the tropics and deep-water formation in the northern hemisphere during the Permian, and the Triassic was characterized by shallow upwelling in the tropics with no deep-water formation potentially due to warming temperatures that affected water density and increased precipitation at tropics impacted water salinity and decoupled deep-water formation at the northern hemisphere. The continued CO2 outgassing into the latest Permian may have exceeded the rate of carbon sequestration facilitated by silicate weathering, leading to long-term warming in the Early Triassic.

Time	10:35 - 11:10 AM
Abstract Title	IMPACT OF TEMPERATURE EXTREMES ON DROUGHT SEVERITY IN THREE SELECTED GEORGIA'S CLIMATE DIVISIONS
Presenter	Olalekan Alamoh
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Co-Authors

Flavia D. S Moraes
Georgia State University, Department of Geosciences, Atlanta, GA

Abstract Text

This study examines the influence of temperature extremes on drought severity and vegetation health across three climate divisions in Georgia, leveraging extensive data from 2004 to 2023. Utilizing the Palmer Drought Severity Index (PDSI) and the Normalized Difference Vegetation Index (NDVI), we explore the complex interactions between temperature anomalies and ecological responses. Regression analyses reveal a statistically significant relationship between temperature anomalies and PDSI, with a coefficient value of -0.4165 indicating that for each unit increase in the PDSI, there is an average decrease of 0.4165 units in the temperature anomaly. This suggests a negative relationship between PDSI and temperature anomaly. Also, with an R squared value of 10.7%, indicating that temperature extremes explain a portion of the variability in severe drought conditions. Specifically, periods of high-temperature anomalies consistently align with the lowest PDSI values, particularly severe in 2007-2008 and 2016-2017, signifying enhanced drought severity during these times. Further, NDVI analysis from 2012 to 2020 across the Southwest, Central, and Northeast climate divisions in Georgia highlights significant shifts in vegetation health, with notable degradation during peak drought periods as corroborated by temperature extremes. For instance, in the Northeast division, the NDVI decreased by an average of 0.24 points during the most severe drought conditions, emphasizing the sensitivity of vegetation to temperature-induced stress. The comprehensive data analysis underscores the critical impact of temperature extremes on drought dynamics and vegetation health, providing a quantitative basis for resource management strategies in agricultural and environmental planning. This study contributes valuable insights into the ongoing challenges posed by global warming, highlighting the necessity for integrated approaches to managing and mitigating the effects of climate variability.

Keywords: Drought, Temperature Extremes, Vegetation Health, NDVI, PDSI, Georgia

LIGHTNING 2

Time 2:00-3:00 PM [1]

Abstract Title ASSESSING WATER QUALITY AT AN ABANDONED MINE LAND IN TUSCALOOSA COUNTY, ALABAMA.

Presenter Godwin Sunday

Organization The University of Alabama, Department of Geological Sciences

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Co-Authors Rona Donahoe
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Rebecca Bearden
Geological Survey of Alabama

Abstract Text

This study examines the water quality at an abandoned coal mine site located in the northern portion of the Hurricane Creek watershed in Tuscaloosa County, Alabama. The site is slated for reclamation by the US Department of the Interior/Department of Labor Abandoned Mine Land Economic Revitalization (AMLER) program, which aims to improve water quality in the area. Since May 2021, monthly surface water samples and field parameters (conductivity, pH, DO, and temperature) have been collected at 10 locations: 6 stream sites (SW1–SW7), two retention pond sites (SW9 & SW10), and the retention pond outlet (SW8). Water samples were analyzed for cations by inductively coupled plasma–optical emission spectroscopy (ICP-OES), anions by ion chromatography (IC), alkalinity and acidity by potentiometric titration, and total dissolved solids (TDS) by gravimetry.

Surface water ICP-OES results indicated elevated concentrations of Fe, Al, Ni, and Mn that consistently exceeded USEPA primary or secondary drinking water standards of 0.05-0.2 mg/L for Al, 0.3 mg/L for Fe, 0.1 mg/L for Ni, and 0.05 mg/L for Mn, particularly at sites SW8–SW10, with peak concentrations observed during the drier months. Throughout the study period, IC results showed sulfate levels above the USEPA SMCL (250 mg/L) at all sites except SW7 with values ranging from 300 to 1200 mg/L.

Throughout the sampling period, stream water samples (SW1 – SW6) maintained circum-neutral pH (7-8), but elevated conductivity (600-1800 µS/cm), alkalinity (150-250 mg/L), and TDS (1500-2300 mg/L) values, except during the late winter and spring months. In contrast, the retention pond (SW9 – SW10) and pond outlet (SW8) samples exhibited very low pH (3-3.5), conductivity, alkalinity, and TDS values, while site SW7 consistently had higher pH (7-8) and lower conductivity, TDS, and alkalinity values.

Principal component analysis (PCA) revealed that two components account for 95.8% of the total variance in the surface water dataset. PC1 (61.6%) shows that surface water pH and alkalinity are negatively correlated with Al, Ni, Mn, Fe, and Co concentrations, indicating the significant influence of acid mine drainage on water quality. PC2 (34.2%) reflects a positive correlation between sulfate, Mg, Cl, K, Ca, and Sr concentrations, conductivity, and TDS, and is interpreted to represent climatic and seasonal variations.

Time	2:00-3:00 PM [2]
Abstract Title	UPSCALING CAVE DRIP DATA USING REMOTE SENSING LIDAR TO QUANTIFY GROUNDWATER RECHARGE.
Presenter	Rowann Remie
Organization	Kimbell School of Geosciences, Midwestern State University, Wichita Falls, TX, 76308
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Co-Authors	Kashif Mahmud, Andrew Katumwehe, Jonathan D. Price Kimbell School of Geosciences, Midwestern State University Marcus Gary Edwards Aquifer Authority
Abstract Text	In south-central Texas, the karst groundwater of the Edwards and Trinity aquifers are an important water source. Our research site, the Natural Bridge Caverns in Comal County is in the recharge area of the Trinity Aquifer and the contributing zone of the Edwards Aquifer. The caverns, nestled within Early Cretaceous limestone, marl, and shale units of the upper Glen Rose Limestone and the lower Kainer Formation, provide an ideal environment to study subsurface water infiltration within karst. This study employs a novel approach to evaluate water infiltration through the limestone formations at the caverns over one hydrological year. We combine the use of automatic drip loggers and remote sensing LiDAR. Twenty drip loggers were strategically placed throughout the largest two chambers and connecting passageways of the caverns at actively dripping sites to cover a range of elevation gradients. The drip time series are then meticulously evaluated with respect to various factors, including rainfall and observed flow patterns, cave ceiling morphology, host lithology, and overburden thickness. Terrestrial LiDAR 3D scans of the study area were used to pinpoint the individual stalactites feeding each drip logger. LiDAR data was additionally used to analyze stalactite morphology and spatial distribution to identify infiltration flow patterns and categorize varying flow types. Finally, we applied local weather data to the drip-logger data over the entire study area to predict the total infiltration. Preliminary analysis reveals significant findings related to surface-subsurface interactions. Many loggers respond to rainfall events, either instantaneously or delayed, suggesting the presence of ample fractures. Others indicate that cave drip is not directly connected to rainfall but rather driven by overflow of stored water in the overlying limestone or lateral groundwater flow in the vadose zone. This study evaluates karst controls on subsurface water movement and provides insight into the complex response of cave drips to local rainfall events.

Time	2:00-3:00 PM [3]
Abstract Title	SPECTRAL HYDRATION FEATURES IN NOMINALLY ANHYDROUS MINERALS AND IMPLICATIONS FOR REMOTE SENSING
Presenter	Kierra Wilk
Organization	Brown University, Department of Earth, Environmental, and Planetary Sciences, Providence, RI
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Co-Authors

Janice Bishop
SETI Institute
Carle Pieters, John Mustard
Brown University

Abstract Text

Near-infrared reflectance spectroscopy has observed the ubiquitous presence of a 3 μm absorption feature on the lunar surface, indicative of hydration (OH and/or H_2O). The lunar 3 μm "hydration" feature decreases in strength systematically with latitude and local time of day indicating that a portion of the hydration is surficial, with the remaining hydration likely encapsulated within the lunar regolith. Resolving the speciation of the hydration (H_2O vs OH) with existing 3 μm datasets, however, has proven to be difficult due to the overlapping nature of OH and H_2O related absorption features. Recent telescopic observations by SOFIA have detected H2O on the lunar surface through the identification of H_2O's fundamental bending mode at 6 μm, where there is no overlapping OH features. Combined 3 and 6 μm observations has the potential to resolve the speciation of hydration on the lunar surface. As such, we preformed laboratory experiments to evaluate the contributions of both external and internal hydration on the strength and shape of hydration related features at 3 and 6 μm under vacuum conditions. We observe systematic changes in the band shape and strength of the 3 μm hydration feature for two lunar relevant nominally anhydrous minerals, olivine and anorthite, associated with the removal of OH/H_2O. While several silicate related absorption features are identified near 6 μm, we do not observe a distinguishable feature nor changes in reflectance that can be attributed to the presence or removal of H_2O. Here we will discuss these laboratory variations in hydration content to better understand current (i.e., M3, HRI-IR, VIMS) and future (i.e., Lunar Trailblazer) 3 μm observations, contextualize the SOFIA 6 μm detection, and provide implications for the remote detection of water on planetary surfaces.

Time

2:00-3:00 PM [4]

Abstract Title

ECOLOGICAL RESPONSES OF BENTHIC FORAMINIFERA TO CHANGES IN SEA ICE EXTENT AND ORGANIC CARBON FLUXES IN THE BERING SEA (SITE U1339)

Presenter

Gael Nkwain

Organization

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Abstract Text

Benthic foraminiferal assemblages are well preserved in marine sediments and can indicate changes in benthic environments and ecological responses through glacial-interglacial cycles. Benthic communities are closely tied to the flux of organic matter to the seafloor, and changes in sea ice extent can profoundly affect benthic ecosystems at high latitudes. Sea ice extent significantly impacts marine productivity, with higher productivity during warmer periods when sea ice is declining. This study examines the stable carbon isotope composition (δ13C) of multiple species of benthic foraminifera at site U1339 in the Bering Sea over the past 19,800 years. δ13C variations between epifaunal and infaunal foraminifera are analyzed to understand factors influencing their isotopic values and faunal composition. Epifaunal species exhibit higher δ13C values due to access to phytoplankton-derived organic matter, while infaunal taxa display lower δ13C

values from exposure to degraded organic matter. δ13C records reveal a significant drop in nonionella sp. during the Bølling-Allerød hypoxic event, indicating changes in organic matter remineralization. Enhanced organic carbon export drives hypoxia, supported by a positive correlation between Δδ13C and low-oxygen-indicating taxa. High-resolution marine sediment records from Integrated Ocean Drilling Program Expedition 323 provide opportunities to decode environmental and ecological changes. This research focuses on sedimentary records from 300-500 kyr, spanning an interglacial interval (MIS 11) analogous to modern climate, to reconstruct biotic responses to changes in carbon export with climatic changes in Bering Sea.

Time 2:00-3:00 PM [5]

Abstract Title EFFECT OF PARTICLE COMPOSITION AND SHAPE ON TURBIDITY CURRENT DYNAMICS AND DEPOSITS: FLUME EXPERIMENT USING CARBONATE, QUARTZ, AND MIXED SANDS

Presenter David Nworie

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Co-Authors Dr. Zane Jobe, Dr. Arnoud Slootman
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Abstract Text Carbonate-rich sediment gravity-flow (SGF) deposits in the submarine environment remain an underexplored frontier in sedimentary geology, despite being important for paleoenvironmental reconstructions and earth-resource development. These deposits generate similar large-scale morphologies (e.g channels, lobes) as their siliciclastic counterparts, but carbonate particles are more complex in size, shape and density, which affects sediment transport dynamics, the resultant depositional textures and stacking patterns. To address this knowledge gap, we present insights gained from novel flume experiments focused on the transport dynamics in pure calciclastic flows, siliciclastic flows, and mixed calciclastic-siliciclastic (quartz) flows. These experiments provide a unique opportunity to observe and analyze flow patterns, vertical and lateral concentration and composition profiles, particle-shape distributions, and the resultant depositional textures. We conducted experiments with varying sediment compositions and concentrations, isolating the effects of shape and composition in calciclastic and siliciclastic systems, and their mixtures within a narrow settling velocity distribution. Preliminary results show that carbonates can generate high velocity flows with long run out distances in the presence and absence of mud. These flow velocities have a proportional relationship with sediment concentrations. We also observe distally increasing organic content in the mud-rich deposits. These findings not only contribute to deciphering the 3D stratigraphic architecture of carbonate SGF deposits but have implications for predicting carbon burial and pore-network connectivity, which are important for constraining ancient and future climate change as well as hydrocarbon resource prediction.

Time 2:00-3:00 PM [6]

Abstract Title LAMINA PROPERTIES AND MICROSTRATIGRAPHY OF SHELF DEPOSITS OF THE UPPER CRETACEOUS TUSCALOOSA MARINE SHALE

Presenter Chukwuma Mgbenu

Organization Missouri University of Science and Technology

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Co-Authors Wan Yang
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Abstract Text Shale makes up over two-thirds of all sedimentary rocks. Their fine-grained nature and multi-order heterogeneity have hindered characterization of lamina properties. Shale lamination represents highly sensitive shifts in sediment deposition conditions. Therefore, precise measurement of their thickness and composition could shed light on processes and controls of shale formation. Traditional methods of manually counting millimeter and sub-millimeter laminations in thin section, hand-specimen, core, or outcrop are limited in scope and inefficient, as they only examine a small portion of the overall stratigraphic interval. This study used grayscale data of shale cores to document lamina boundary, thickness, and color. This fast and precise method applies nested "IF" conditional statements in Python algorithm to detect significant multi-scale trends. It was applied to a 51-m-thick core of Upper Cretaceous Tuscaloosa Marine Shale (TMS) from the northern Gulf of Mexico (GOM). Results were cross-checked by direct observations of cores and thin sections. Shale lithofacies are subcategorized into pelagic, mixed and tractional. Of ~12,000 laminae, thickness ranged from 0.13 to 171.45 mm with a mean of 3.86 mm. Light gray laminae commonly have abundant quartz, feldspar, and pyrite and are x-laminated and lenticular. In contrast, dark gray to blackish gray laminae is dominated by clay and muscovite, and parallel or rippled. Ultra-thin laminae (<0.3 mm) account for 25%, very thin laminae (0.3–1 mm) 27%, thin lamina (1-3 mm) 21%, medium lamina (3-10 mm) 16%, very thin beds (10–30 mm) 8%, thin beds (30–100 mm) 2%, and medium beds (100–300 mm) 1%. 80% of grains in the bed category are equal to or finer than medium silt, while laminae show no correlation between thickness and grain size. Variations in lamina thickness are linked to dynamic sediment transport on the shelf. Dominance of thick laminae and thin beds of pelagic deposits in contrast to thin–medium laminae of tractional deposits suggests that sustained deposition of pelagic suspension load is the dominant mode of sediment transport and deposition on the shelf. Average lamina color shows overall upward darkening trend, which correlates to upward trend of decreasing energy and deepening of the TMS. Future work will use lamina properties to quantitatively understand the hierarchy of the TMS and their depositional mechanisms at variable scales, to accurately reconstruct the Late Cretaceous paleogeography of the GOM.

Time 2:00 – 3:00 PM [7]

Abstract Title USING 87SR/86SR TO IDENTIFY ROCK UNITS THAT SUPPORT GROUNDWATER FLOWPATHS AND FLOWPATH CONNECTIVITY IN DEGLACIATING ALPINE WATERSHEDS.

Presenter Ayobami Oladapo

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Abstract Text Alpine glacier meltwater is an important source of recharge supporting groundwater flow processes in the high mountains. In the face of rapid ice loss, knowledge of residence times and response times of mountain aquifers to loss of glacial ice are critical in evaluating the sustainability of alpine water resources for human communities and ecosystems. An important step toward addressing this knowledge gap is to identify the rock units that host flowpaths and how these flowpaths are connected across spatial scales. Here, I use strontium isotopes (87Sr/86Sr) and geochemical tracers to identify the rock units that host groundwater flowpaths and examine how the flowpaths are connected across spatial scales in Glacier National Park (GNP) and Mount Hood National Forest (MH). MH is comprised of mostly young, reworked volcanic rocks originating from three eruptions in the past 2 Ma. In comparison, GNP has complex geology where older (Precambrian) rock units are thrust over younger (Cretaceous) rocks. The springs in MH show very low variability in 87Sr/86Sr across spatial scales and aspects (compass direction of slopes) of the mountain. This is not surprising given the low variability in 87Sr/86Sr in the young volcanic rock. The springs in GNP show greater variability in 87Sr/86Sr. High-elevation springs are supported by groundwater flow through older sedimentary bedrock units. Springs with relatively low 87Sr/86Sr represent waters that flow along or through a young volcanic sill that crosscuts the strata. Finally, springs flowing from the alluvium have 87Sr/86Sr ratios that are intermediate between the two other groups showing a complicated flowpath history. Nearly all the springs that were sampled in GNP emerge on south-facing slopes. This is not an indication of ice preservation, instead it's controlled by hydrostratigraphy. It's unlikely that high-elevation groundwater is strongly connected to low-elevation sites due to hydrostratigraphy. There are more springs on south-facing slopes at MH as well; however, they do not preserve an isotopic signature of recharge from glacial meltwater. Springs on north-facing slopes do preserve the signature. Groundwater flowpaths are connected across scales at MH; low-elevation warm springs show an isotopic signature of glacial meltwater. GNP and MH have different hydrogeological characteristics and show different responses to ice loss.

Time 2:00-3:00 PM [8]

Abstract Title DIVERSITY IN THE MARINE WORKFORCE: REFLECTIONS FROM TWO STEMSEAS UNDERGRADUATE STUDENTS

Presenter Swazi Gurnell

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Abstract Text

The STEM Student Experiences Aboard Ships (STEMSEAS) Project recently partnered with the Ocean Exploration Trust (OET) to provide undergraduate students with opportunities aboard the E/V Nautilus. From May 24 to June 4, we sailed on expedition NA-160 from Honolulu to Sydney, B.C. giving us perspectives on life at sea. The maritime workforce exhibits a significant underrepresentation of minorities, particularly in senior positions. Currently, less than 1% of the global maritime workforce consists of individuals of Hispanic/Latin descent, Black, Asian, and other minority ethnic groups (BAME). Although a projected demand increase of 5 to 6% for maritime workers in 2024 opens opportunities for minority crew members, these individuals often face challenges when stationed aboard vessels for extended periods, leading to isolation from their lives and loved ones, affecting their overall well-being. In response to these challenges, the OET aims to make life aboard the Nautilus as comfortable and inclusive as possible, creating a home away from home for the crew. Measures taken ensure that even when away for months at a time, the crew can experience a sense of home and comfort. On our expedition, most of the crew were immigrants from various countries. This diverse group of seamen, deckhands, and navigators demonstrated remarkable dedication and sacrifice, highlighting the crucial role of immigrant contributions to the STEM field. As minorities in our own communities, we were deeply touched by the vast opportunities in the maritime industry for people of color (POCs) and even more inspired by the presence of a supportive and inclusive environment aboard the Nautilus, and in the STEM field. We will share how our perspectives evolved over 10 days at sea. We suggest that the maritime research community is positioned to promote broader participation. The Nautilus, serves as a beacon of hope and opportunity for underrepresented groups, providing a platform for POCs to excel and make meaningful contributions to the scientific community. We hope to engage in dialogue that promotes the inclusion of others in their fields and values the important perspectives of POCs. We will share our insights in hopes of inciting inclusion and understanding of the role of diversity in driving innovation and progress in the STEM fields.

Time 2:00-3:00 PM [9]

Abstract Title DATA ANALYSIS AND MACHINE LEARNING PREDICTION OF GAS HYDRATE OCCURRENCE AND SATURATION IN MARINE SEDIMENTS

Presenter Emanuel A. Murphy

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Abstract Text

I was provided this internship through the GEOPAths program. The research I conducted this summer was over the prediction of gas hydrate presence and amount and comparison of predictive modeling techniques. Gas hydrates, crystalline structures composed primarily of methane, are significant due to their impact on climate change. Gas hydrates behave just like ice, but the primary difference is that they release methane into the atmosphere when melted. The central questions addressed are how ML can improve prediction accuracy and the comparative performance of different ML models. Traditional methods, which

rely on geological and geophysical data, are time-consuming and uncertain due to complex geological formations and indirect inference. These methods being electrical, acoustic, and a mixture of electrical-acoustic. By applying new methods, such as linear regression (LR) and multilayer perceptrons (MLP), this research seeks to provide a more accurate and efficient approach to prediction. The study uses well log data from marine sediment samples, involving data curation, visualization, feature(variables) selection, and scaling for standardization. The findings show that MLP, a neural network type, captures complex relationships within the data better than LR, despite being computationally intensive, thus offering higher prediction accuracy. These results have significant implications for resource management and environmental protection, enhancing exploration efforts and aiding in assessing methane release's potential environmental impacts.

Time	2:00-3:00 PM [11]
Abstract Title	APPLYING EQUITABLE RESEARCH PRINCIPLES WITH COMMUNITY-SOIL-AIR-WATER (CSAW)
Presenter	CSAW Working Group
Organization	Georgia State University, Department of Geosciences, Atlanta, GA
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Abstract Text	As societal concerns related to climate and environmental justice gradually become more complex - spanning social, political, and economic contexts - there are increasing calls in geosciences for a more socially engaged workforce trained in conducting societally-relevant research to influence policy and management. This objective can be most readily achieved by redefining geoscience training and education from a form based in disciplinary rigidity to one that is transdisciplinary, opening the door for meaningful public inclusion into the research process. The Community-Soil-Air-Water (CSAW) learning ecosystem at Georgia State

University encompasses a cross-collaborative partnership among academic institutions, grassroot environmental organizations, and community leaders, and seeks to address issues of climate and environmental justice by integrating DEIA principles into geoscience graduate education. Based in Atlanta, Georgia, a battleground for environmental justice issues driven by historical racially driven policies and decision-making, the CSAW learning ecosystem seeks to answer, "How can Geosciences learn from, contribute to, and find solutions with communities facing fundamental problems related to Earth systems?" Now in its second year of implementation, this presentation highlights the early successes of CSAW, emphasizing the role of inclusion through its integration of community partners to help co-develop research projects and ensure their alignment with community considerations. Additionally, we will address the ways in which inclusion principles, such as knowledge co-production and place-based research are operationalized through the CSAW learning ecosystem, and the successes of CSAW graduate fellows in working with community leaders to produce actionable and informed science relevant to community environmental concerns in Atlanta, GA. Ultimately, the CSAW partnership aims to contribute to the development of a geoscientist workforce uniquely equipped to address contemporary issues of climate and environmental justice and to transform geoscience training by prioritizing inclusive and societally-relevant research.

Time 2:00-3:00 PM [12]

Abstract Title APPLIED GEOSCIENCE IN SUPPORT OF ENVIRONMENTAL JUSTICE AND GRASSROOTS ORGANIZATIONS IN BLACK COMMUNITIES

Presenter David Padgett

Organization HBCU Environmental Justice Technival Collaborative (HEJTC)

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Abstract Text Historically and currently, the majority of African American environmental justice leaders represent disciplines outside of the geosciences. However, nearly all environmental justice cases involve atmosphere, hydrosphere, and lithosphere related hazards that negatively impact Black communities. The Historically Black College and University (HBCU) Environmental Justice Technical Collaborative (HEJTC) was convened in 2001 by Dr. Robert Bullard, who is known as "The Father of Environmental Justice." The HEJTC is comprised of HBCU-affiliated

earth scientists and geospatial technology specialists who work on the ground with community stakeholders seeking to solve and mitigate environmental hazards. The demographic constitution of HEJTC intentionally matches the demographics of the Black communities they serve. Members of the HEJCT are leading the third iteration of the Water Justice Training Institute (WJTI) hosted by the Deep South Center for Environmental Justice (DSCEJ) based in New Orleans. The WJTI workshop audience consists primarily of Black environmental justice organization leaders who wish to become more familiar with the dynamics of flooding and other climate change related hazards. Workshop attendees are then charged with sharing what they learn with their organization's members in support flood preparation, mitigation and recovery strategies. Stakeholders who have completed the WJTI have in some cases been empowered to leverage funding via public and private sources. In 2022, the HEJTC developed the HBCU Climate and Environmental Justice Screening Tool (HCEJST) in response to the Council on Environmental Quality (CEQ) Climate and Economic Justice Screening Tool (CEJST)not including race as a variable to delineate "disadvantaged communities" (DACs) in the United States. Environmental justice stakeholders are using the HCEJST to identify and delineate specific threats to their public health. End users are able to customize the HCEJST to display specific hazard concerns imbedded in the CEJST database.

POSTER 1

Time 4:00 – 6:00 PM [1]

Abstract Title SWOT WATER SURFACE ELEVATION ACCURACY IN HERBACEOUS & SHRUB-DOMINATED WETLANDS OF FLORIDA'S EVERGLADES

Presenter Solomon Kica

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Abstract Text Wetlands globally contribute significantly to the conservation of biodiversity, and filter nutrients, heavy metals, sediments and pollutants from fresh water used by humans. They also provide important sink and source functions for climate-relevant trace gasses. As wetlands are water dependent, water level monitoring is critical for their management and restoration. Due to current limitations with existing ground- and other space-based water level measurement methods, hydrological monitoring remains a challenge in most wetlands globally. The Surface Water and Ocean Topography (SWOT) satellite mission was launched in December 2022 to survey the Earth's surface waters in unprecedented detail, with a primary focus on rivers, lakes, and oceans, but the satellite's performance in vegetated wetlands remains unknown. In this study, we compare SWOT water surface elevation (WSE) measurements with in-situ observations in herbaceous and shrub wetland areas in Florida's Everglades. We acquire SWOT Version C pixel cloud data collected from 5th August 2023 to 30th March 2024 from two overpasses: 091 and 438. The individual tile granules accessed are from three full swaths (i.e., 091_199, 091_200, and 438_109) and two half swaths (i.e. 091_201R and 438_110L). We compare SWOT WSE values using water level data from 110 gauges that satisfy criteria: 1) exist in grass-like or shrubby vegetation (2) provided real-time data, and (3) water level measured at the gauge is above ground surface. We examine SWOT backscatter and land-water classification and determine overall SWOT WSE errors, at gauge locations and across the observation swath. Comparison of SWOT WSEs against in-situ water levels shows strong correlations of r=0.994 and r=0.974 in herbaceous and shrub-dominated wetlands respectively. Mean absolute errors are 6.5 cm and 9.8 cm respectively for WSEs averaged over 1 km2 regions. Additionally, WSE errors are independent of cross-track position in the SWOT observation swath. SWOT's performance in these wetlands is consistent with pre-launch expectations for large lakes and rivers. SWOT's unexpectedly high accuracy will now improve hydrological and biogeochemical understanding of wetlands globally by providing critical WSE information needed to understand their ecology, biogeochemistry, and conservation status.

Time 4:00 – 6:00 PM [2]

Abstract Title MEASURING AGRICULTURAL ADAPTATION USING REMOTE SENSING: A STUDY OF PIGEON PEA IN MALAWI

Presenter Maria Gorret Nabuwembo

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Abstract Text Drought, heatwaves, and flooding cause tremendous damage to agricultural production in Malawi, and the continuous production of maize has led to widespread soil degradation. Additionally, climate change is transforming the environment at a scale beyond historical records, posing significant challenges to social, political, and economic systems. To combat these issues, agricultural innovations, such as the installation of irrigation systems or other types of water management and cultivating heat/drought resilient crop varieties, have been implemented. Pigeon pea is one of the prominent droughts tolerant and temperature resilient crops grown. It is a perennial legume with a wide variety of ecological, nutritional, and agronomic advantages (e.g., nitrogen fixation and soil-root biomass). Smallholder farm systems in Malawi use pigeon pea as a diversification strategy since it allows farmers to adapt to changing climatic conditions while maintaining subsistence needs. Adaptation can be monitored using remote sensing data to understand changes in the environment and human use of the land. This research investigates agricultural productivity as an adaptation indicator and pairs it with the adoption of pigeon pea across Malawi. NASA, MODIS, NDVI and NPP are used to measure agricultural productivity across time and will be related to pigeon pea production survey data from 2005 to 2023. This approach determines increased pigeon pea production, evaluates regions where crop production has shown notable growth, and finally shows the overlap between overall crop production increases in conjunction with pigeon pea integration.

Time 4:00 – 6:00 PM [3]

Abstract Title WIDESPREAD BACTERIAL USE OF LANTHANIDES FOR METHYLOTROPHY ACROSS ECOSYSTEMS

Presenter Leilani Warters

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Abstract Text Methylotrophs are aerobic bacteria that consume methane and C-1 compounds carbon and energy sources. Methylotrophs use the enzyme methanol dehydrogenase (MDH) to oxidize methanol to formaldehyde. MDH requires either calcium or lanthanides (also known as light rare earth elements) as a cofactor. While lanthanides are relatively common in the Earth's crust, they are poorly soluble in most environments. Yet accumulating evidence suggests that lanthanide dependent MDHs encoded by the gene xoxF, are more widespread

than calcium-dependent MDHs encoded by the gene mxaF. First, we studied the prevalence of lanthanide utilization in laboratory experiments using a model methylotroph alphaproteobacterium, Methylorubrum extorquens AM1. At concentrations of 1-10 μM, lanthanides (La, Ce, or Nd) supported fastest growth and highest cell density of M. extorquens. At 0.1 or 100μM, M. extorquens grew best with Ca while Ce, Nd, and Eu suppressed growth. Second, we performed bioinformatic analyses of environmental metatranscriptomes using the Joint Genome Institute's (JGI) Integrated Microbial Genome (IMG) database. XoxF amino acid sequences can be distinguished from MxaF sequences by an extra aspartate in XoxF sequences. We found xoxF genes were transcribed in all ecosystems (soils, freshwaters, sediments, salt marshes, seawater, and hot springs), whereas mxaF genes were only transcribed in marine sediments. The majority of transcribed xoxF genes in marine environments belonged to the classes Alphaproteobacteria or Gammaproteobacteria (including Burkholderiales). Transcribed xoxF genes in terrestrial environments showed more taxonomic diversity, with many belonging to the phyla Nitrososphaerota, Actinomycetota, Chloroflexota, Myxococcota, and Gemmatimonadota. This study enforces the importance of lanthanide-dependent methylotrophy in global biogeochemical cycles and suggests that previously unknown methylotrophs are active in the environment.

Time 4:00 – 6:00 PM [4]

Abstract Title EVALUATING THE EFFECTIVENESS OF LANDFILL COVER SOIL AMENDMENTS IN MITIGATING METHANE RELEASES: A LABORATORY COLUMN EXPERIMENT

Presenter Andrews Dwomoh

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Abstract Text

The recent global rise in methane (CH_4) emissions from landfills has made the mitigation of landfill gases increasingly crucial to fighting global warming. Previous research has suggested that landfill cover soil is an economical solution to reducing CH_4 emissions from landfills with or without gas-recovery systems, with the former a near-complete CH_4 removal (Reddy et al., 2014). However, limited studies have quantified methane removal efficiencies (MRE) of landfill-cover soils under different CH_4 loading rates using column experiments. In this study, a laboratory column experiment will be conducted using a glass column (7-inch height, 2.6-inch diameter) packed with different landfill cover soils (compost, biochar, wood chips, and soil obtained from the surface of Three Rivers Solid Waste Authority Landfill) to calculate the MRE of each cover soil and determine its effectiveness in mitigating CH_4 emissions under different CH_4 flux conditions. This goal will be achieved by flushing various concentrations of CH_4 air balance

from the bottom of the column at a flow rate between 13-15 ml/min to simulate typical landfill gas flux through landfill cover systems. Outlet flow rates will be measured using a flowmeter and the concentration of the CH_4 gas exiting the column will be measured on top of the column with an Arduino Uno-based gas sensor. The MRE will be calculated for each cover type based on a CH4 mass balance approach using the following equation: MRE = [$(J_{in} - J_{out})/J_{in}$] x 100% where J_{in} is the inlet CH_4 flux ($g/m^2/day$) and J_{out} is the outlet CH_4 flux ($g/m^2/day$). The findings from this study aim to determine the optimal soil cover amendment for effective CH_4 mitigation.

Time	4:00 – 6:00 PM [5]
Abstract Title	A SPATIAL INTERPOLATION AND COLOCATED ANALYSIS OF STORMWATER FAILURE AND 303(D) IMPAIRED STREAMS IN THE METROPOLITAN NORTH GEORGIA WATER PLANNING DISTRICT
Presenter	Imani Vincent
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Abstract Text

This research details a comprehensive spatial analysis integrating stormwater failure sinkholes Georgia water Planning District counties. This is important because stormwater runoff carries pollutants from urban landscapes into streams which cause them to become impaired and compromises water quality. A rise in urbanization in the District has accelerated stormwater runoff and infrastructure. More than 1 do not meet state water quality standards runoff knowledge and understanding of stormwater mitigation management and environmental protection initiatives in the District.

Time	4:00 – 6:00 PM [6]
Abstract Title	PREDICTING GROUNDWATER LEVELS IN THE PIEDMONT PROVINCE USING STATISTICAL MODEL
Presenter	Mubarak Bakare
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Abstract Text

Mapping groundwater levels is crucial for sustainable water resource management, environmental protection, and structural damage prevention. Contaminants from degraded sewer pipes and high groundwater levels pose significant health risks and structural challenges. Additionally, groundwater levels influence the feasibility of stormwater infrastructure and the efficiency of wastewater treatment plants (WWTPs). Therefore, it is essential to map groundwater levels and identify points where they are vulnerable to contamination or infiltration into sewer systems.

The overarching objective of this research is to develop a repeatable statistical interpolation technique to infer depth to groundwater in urban and suburban areas

across the Piedmont physiographic province. Methodologically, we employ multiple linear regression models incorporating variables such as relative elevation, distance to the nearest waterbody, and the maximum distance to either a stream channel or waterbody. Our initial results show that relative elevation correlates with groundwater depth at 0.7369. The distance to the nearest waterbody shows a positive correlation of 0.4998, while the maximum distance to either a stream channel or waterbody yields a correlation of 0.4473. These correlations indicate that these variables are significant predictors of groundwater depth. Future work will focus on developing a comprehensive multiple linear regression model using these parameters to predict groundwater levels across the Piedmont. This model aims to provide a robust tool for water resource management and environmental protection.

Time 4:00 – 6:00 PM [7]

Abstract Title SOURCES OF ARSENIC IN GROUNDWATER, POREWATER AND SURFACE WATERS IN MATAGORDA-GALVESTON COUNTIES IN TEXAS

Presenter Prince Akonde

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Abstract Text Arsenic is a toxic element that can cause various health issues including cancers. It is often introduced into humans through drinking water. High arsenic concentrations (>10μg/L) have been documented in groundwaters in Texas. Elevated fecal indicator bacteria (FIB) concentrations in Matagorda-Galveston bays may contribute to the increased presence of free arsenic (As) ions in water. Septic tanks may be the source of the elevated FIB. This study aims to explore the connection between FIB, measured ancillary parameters, and As in groundwater, porewater and surface water, with the anticipation that FIB-driven pollution might exacerbate As contamination through the promotion of reducing environments that trigger As release. I hypothesize that there exists a significant relationship between fecal indicator bacteria (FIB) concentrations and arsenic levels in the water. I further hypothesize that the presence of reducing environments, indicated by high ammonium concentrations, may lead to the release of free arsenic ions into the water. The investigation will involve analyzing water samples from different sources by using flow injection-hydride generation-atomic absorption spectrometry to quantify As concentrations and speciation. Additionally, the study will leverage nitrogen nutrient and isotopic composition as well as other ancillary data measurements to discern the contributions of anthropogenic and natural sources to nutrient distribution in the water. Preliminary findings suggest that groundwater and porewaters exhibit the highest As concentrations, emphasizing the need for further investigation.

Time 4:00 – 6:00 PM [8]

Abstract Title	COMPREHENSIVE ANALYSIS OF RADON EMANATION ACROSS VARIOUS SOIL HORIZONS
Presenter	Charlotte Annan
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Abstract Text

Radon (222Rn) is a hazardous radioactive gas that originates from the decay of uranium present in soils, rocks, and groundwater. Despite extensive research, most studies have focused on 222Rn emanation from surface soil layers. However, soils are stratified, with each horizon exhibiting unique physical and chemical properties. This study aims to measure and analyze 222Rn levels and emanation coefficients across different soil horizons, which is crucial for accurately assessing their contributions to both atmospheric and indoor 222Rn levels. Soil samples from the Appling series were collected from the O/A (0-5 cm), E (5-20 cm), B (20-38 cm), and C (38-100 cm) horizons at Stone Mountain, Georgia. After drying, the samples were analyzed using a Durridge RAD7 monitor in a closed-loop setup to measure 222Rn concentrations until secular equilibrium between 222Rn and 226Ra was achieved. 222Rn emanation coefficients were calculated using empirical relationships from Ishmori et al. (2013) and Arabi et al. (2015, 2016), and their variations with different soil water saturation levels were examined. 222Rn concentrations in dry conditions for the O/A, E, B, and C horizons were found to be 45.12 Bq/m³, 28.59 Bq/m³, 92.56 Bq/m³, and 128.1 Bq/m³, with emanation coefficients of 0.025, 0.016, 0.052, and 0.031, respectively. The potential for 222Rn emanation increased significantly with soil water content up to 10-20% saturation. At 10% saturation, the new emanation coefficients were 0.063, 0.04, 0.13, and 0.08, corresponding to 222Rn levels of 113.70 Bq/m³, 71.48 Bq/m³, 231.40 Bq/m³, and 330.50 Bq/m³, respectively. These findings highlight the importance of considering 222Rn contributions from various soil horizons when predicting radon fluxes and developing risk maps. Effective mitigation strategies are essential, especially as soils from the B and C horizons, commonly used in construction, exceed the EPA-recommended radon level of 148 Bq/m³. While radon levels in the O/A and E horizons are below this threshold, they may still pose risks to soil flora and fauna.

Time	4:00 – 6:00 PM [9]
Abstract Title	SURFACE CHARGE AND ION SORPTION ENERGETICS IN RICE HUSK BIOCHAR AND BIOCHAR COMPOST: IMPLICATIONS FOR SOIL REMEDIATION
Presenter	Isaac Gemedi
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Abstract Text Rice husk biochar (BC) and biochar compost (BCO) mixtures have been found to reduce the mobility of potentially toxic elements in soil. BC and BCO are increasingly seen as valuable amendments for remediating contaminated soils, particularly in Ghana, where affordable sources of poultry manure compost and rice husk biochar are readily available. The goal of this work is to characterize the physicochemical properties of BC and BCO and elucidate the impact of mixing rice husk biochar and compost on the overall adsorption performance. To that end, we utilized flow microcalorimetry (FMC) to probe the surface charge of BC and BCO and measure the energetics of metal sorption. Attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR) is used to investigate their molecular composition. Ion exchange cycles were used to quantify and probe both the surface positive and negative charge. It was found that the enthalpic sign was consistent across BC and BCO. The magnitudes of the heat of ion exchange (Qexch) were higher in BCO than in BC for both the positive ($NO3^-/Cl^-$) and negative (K^+/Na^+) surface charge. The Qexch increased from 0.386 ± 0.03 mJ mg-1 for BC to 0.515 ± 0.05 mJ mg-1 for BCO. Similarly, the Qexch for K^+/Na^+ was 0.857 ± 0.08 mJ mg-1 for BC and 2.046 ± 0.46 mJ mg-1 for BCO. The calorimetric results seem to indicate that the pH of the zero point of charge (pHZPC) of the BCO is lower than that of the BC; this explains the higher surface negative charge measured at the experimental pH of 5.8. Preliminary ATR-FTIR results show a higher absorbance of hydrogen - bonded (OH), carboxylate anions (COO-), and aliphatic group (CH) in BCO than in BC. As a result, the higher energetics observed on BCO may be explained by differences in the surface functional groups and hence an energetically different ion exchange reaction. Further studies are required to validate the contribution of functional groups to the higher Qexch by further probing the surface chemistry of the BCO and BC at different chemical conditions. Knowledge of their surface reactivity will inform future remediation plans.

Time 4:00 – 6:00 PM [10]

Abstract Title EVALUATION OF TEMPORAL VARIATIONS IN SEDIMENT FLUX OF A TROPICAL ESTUARY

Presenter Olumide Ajulo

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Abstract Text Sediment flux in estuaries can be influenced by natural and anthropogenic inputs, as such understanding its variation is vital for effective environmental management. The tropical Wouri Estuary in Cameroon receives water from three

main rivers draining urban, industrial, and agricultural areas. The complex inputs into the estuary can significantly affect sediment flux that will consequently impact the estuary ecosystem. In other to understand the variation in sediment flux in this estuary, a sediment core from a tidal flat in the estuary can be used as a proxy for time to reveal past conditions, pollutant levels, and ecological changes. We obtained a 78 cm sediment core from a tidal flat in the estuary and analyzed it at 5 cm intervals for organic content using Loss on Ignition (LOI) and for elemental concentration using X-ray Fluorescence (XRF).

The LOI results indicate organic content ranged from 1.0 to 3.0 wt.% between 0 and 35cm depth and increased from 3.0 to 13.5 wt.% from 35 to 75 cm depth. This variation in organic content correlates with lithological observations, where sediments transition from silty coarse material at the top to dark muddy sediments at the base. To understand elemental variation, we ratioed the concentrations of major and trace elements in the sediments to background values from the Upper-Continental Crust to determine the elemental enrichment factor (EF). The calculated EF values were used to assess variation in the concentration of elements within the sediment flux.

Sulfur generally decreases towards the surface, similar to organic matter, except at a depth of 50 cm where it shows an extremely high EF of 46. At 50 cm depth, where sulfur EF peaks and begins to decline, The EFs of Sb, Mo, Co, and As begin to increase in the sediment flux towards the surface. The EFs of Sb, Co, Mo, and As range from 4 to 27, 2 to 7, 3 to 7, and 6 to 7, respectively, denoting their significant enrichment from 50 cm depth to the surface in the sediment flux. The 50 cm depth from which the significant enrichment of these elements was observed is interpreted to be the time from which anthropogenic contributions in sediment flux became significant in the estuary. To determine the specific timeframe for the anthropogenic contributions, the sediment core sample will be subjected to geochronological dating in further studies.

Time	4:00 – 6:00 PM [11]
Abstract Title	SPATIAL ANALYSIS OF HEAVY METAL TRANSPORT IN A TEMPERATE URBAN STREAM
Presenter	Marcus Morris
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Co-Authors	Nadine Kabengi, Richard Milligan, Luke Pangle, Wisdom Akanmisikum, Finn Gillette Georgia State University

Abstract Text

Elevated concentrations of heavy metals (HMs) in urban streams are anthropogenically sourced from industrial activity and domestic waste. HM transport away from point sources can be enhanced or reduced by the contribution of colloidal particles in the subsurface and surface waters. In this study, the spatial distribution of select HMs in the South River is assessed in a 5.5-mile stretch at five sites. Sites were selected based on accessibility, with considerations for additional HM input by tributaries. The stream first daylights 0.42 miles downstream of a hazardous waste site, whose groundwater and soil are

contaminated with copper, lead, nickel, and zinc, among several other industrial-sourced pollutants. Surface water samples were collected using a suspended sediment sampler at two points equidistant from the stream banks at each site. Evaluation of the contribution of the colloidal fraction for transportation was done by size fractionating samples into < 415 nm, < 260 nm, < 35 nm, and < 3 kDa designations using differential centrifugation and ultrafiltration. Concentrations were subsequently measured using an inductively coupled plasma-mass spectrometer. Initial findings show HM concentrations exponentially decay as a function of distance away from the hazardous site. Knowledge of the spatial extent of point source pollution transported in non-perennial streams will better inform policy and remediation strategies and set a direction for future work.

Time 4:00 – 6:00 PM [12]

Abstract Title THE SPATIAL DISTRIBUTION OF HEAVY METAL CONTAMINATION IN SEDIMENTS OF SOUTH RIVER EASTPOINT, GEORGIA

Presenter Wisdom Akanmisikum

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Co-Authors Marcus Morris, Finn Gillette, Dr. Luke Pangle,
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Abstract Text

This study examines the spatial distribution of heavy metal contamination along the South River sediments in East Point, Georgia, focusing on the impact of the nearby Tift Site, a Class 1 Hazardous Waste Site. Despite previous remediation efforts, the site continues to affect the river and surrounding areas with persistent contamination from previous industrial activities. The research aims to assess the extent of heavy metal contamination in river sediments and establish its spatial distribution downstream from the Tift site. Sampling locations were selected based on their accessibility and proximity downstream of the Tift site to capture the spatial distribution of contamination in the South River. Sampling followed USEPA (2024) sediment sampling protocols (Method 5035). At each location, samples from the top 2 cm of the fine bed and bank sediments were collected and immediately stored in a cooler at 4°C until transported to the laboratory, where they were transferred to a freezer for storage until analysis. In the laboratory, the samples were oven-dried and digested using microwave-assisted digestion to prepare them for measuring Nickel (Ni), Copper (Cu), Zinc (Zn), Cadmium (Cd), Arsenic (As), and Lead (Pb) concentrations using an Inductively Coupled Plasma Mass Spectrometer (ICP-MS). A parallel study examining heavy metal transport in the colloidal fraction of the water is ongoing and will complement the sediment analysis. This approach will provide insights into contamination levels, spatial distribution, and transport mechanisms, contributing to the development of effective remediation strategies for the affected area.

Time 4:00 – 6:00 PM [13]

Abstract Title A REVIEW OF PETROLEUM SYSTEM IN KANSAS

Presenter Oluwaseun Omoyemi

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Abstract Text

Hydrocarbon has been produced in Kansas since the 1860s and the State ranks as the eleventh highest producer in the US. However, the petroleum processes and elements of the petroleum system that generated the hydrocarbons are not properly understood or studied. This study seeks to provide a compilation of information on petroleum systems from literature to highlight gaps in geological information. The sedimentary basin within Kansas is subdivided into five subbasins: Forest City Basin, Central Kansas Uplift, Hugoton Embayment, Cherokee Basin, Sedgwick Basin, and Salina Basin. These sub-basins are separated from each other by structural highs such as the Nemaha Uplifts, Bourbon Arch, and Pratt Anticline.

The general stratigraphy of the State is made up of different geologic layers that represent potential reservoirs, seals, and sources rocks that are critical in a petroleum system. In Kansas, reservoir rocks from which production has been made include Cambrian-Ordovician Arbuckle Dolomite, Ordovician Viola Limestone, Ordovician Simpson Sand, and Pennsylvanian Lancing-Kansas City Shale-Limestone intercalation. The seal rock includes Ordovician Maquoketa shale and Devonian-Mississippian Chattanooga Shale. Possible source rocks include Chattanooga Shale. However, they have been considered thermally immature to generate the amount of hydrocarbon. Hypothesis for the source of these oils includes the Anadarko basin to the southwest and local intervals such as Chattanooga shale.

Structural evolution which includes faulting and folding events as well as erosional events marked by the basal Pennsylvanian unconformity are indications of trap formations and migration pathways that are also essential to the petroleum system in Kansas. While the elements and processes of petroleum systems exist within the geographical boundaries of Kansas, the migration mechanisms as well as the characteristics of the oil being produced have been poorly reported or not investigated. Further studies such as oil-oil correlations and oil-source correlations need to be done to adequately define the petroleum system in Kansas. This will improve the exploration and production of hydrocarbons, as well as improve the body of knowledge in terms of hydrocarbon migration complexities.

Time 4:00 – 6:00 PM [14]

Abstract Title ANALYZING SUDDEN INFANT DEATH SYNDROME (SIDS) CORRELATION WITH SPATIAL ACCESSIBILITY IN GEORGIA.

Presenter Leslie Lomotey

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Abstract Text

Sudden Infant Death Syndrome (SIDS) continues to be a significant public health issue, marked by the inexplicable demise of an apparently healthy baby, usually occurring during sleep. Between 2019-2020, SIDS rate increased by 15% in the United States. SIDS is the leading cause of death in the United States in infants one to twelve months old. Some risk factors are suspected to be responsible for the surge in incidence cases. One of the most well-known risk factors for SIDS is the infant's resting position and maternal smoking during pregnancy. This study examines the correlation between rates of sudden infant death syndrome (SIDS) and the accessibility of OB-GYN health facilities in the state of Georgia. Data from state health departments and population data were used to estimate the different travel times to given OB-GYN facilities. This research will build on previous accessibility studies by using Geographic Information Science techniques to determine areas of high and low accessibility in the state of Georgia. This research, using quantitative analysis, will determine the accessibility of OB-GYN clinics and how that correlates with high or low SIDS incidences. It hypothesizes that lower accessibility will be correlated with a higher incidence of SIDS. This will be very beneficial in providing some understanding of SIDS. It also underscores the necessity for targeted strategies to mitigate SIDS risks. Finally, it will assist in altering the narrative regarding SIDS as the primary cause of mortality among infants aged one to twelve months in the United States, and advance infant health equity throughout Georgia.

Time 4:00 – 6:00 PM [15]

Abstract Title ASSESSMENT OF EDUCATIONAL INSTITUTIONS' FOOD WASTE IN GEORGIA, UNITED STATES USING GEOGRAPHIC INFORMATION SYSTEM TECHNIQUES

Presenter Queen Simbiat Onifade

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Co-Authors

Abstract Text

Global population growth has significantly escalated solid waste production, posing a major challenge to developing a sustainable food system and combating climate change. If food loss and waste were viewed as a country, it would rank as the third-largest emitter of greenhouse gases, after China and the United States. Educational institutions contribute notably to this issue, generating substantial food waste annually. Consequently, due to the large population, universities can be considered microcosms of cities, where activities in the dining halls result in potentially significant financial and environmental impacts. This proposed research aims to evaluate the magnitude, causes, and potential mitigation strategies for food waste in Georgia, United States. Understanding the contribution of food waste from university dining halls is essential, given that young adults are among the most wasteful demographic groups. Thus, addressing food waste in educational institutions is crucial for broader reduction efforts. The objective is to evaluate the magnitude and dynamics of food waste in educational facilities, identify key factors contributing to waste, and develop possible mitigation strategies. To this effect, this study will analyze spatial patterns, identify hotspot regions in Georgia, and offer recommendations to improve food waste management practices. Secondary data and Geographic Information system

techniques will be employed for data collection and analysis. The findings from this study will guide policymakers, educators, and facility managers in developing and implementing strategies towards reducing overall food waste, mitigating its environmental impact, and promoting sustainability.

Time 4:00 – 6:00 PM [16]

Abstract Title CRYSTAL MUSH EMPLACEMENT AND RAPID COOLING IN THE TUNNEL DIKE OF THE CHIEF JOSEPH DIKE SWARM

Presenter Jessica Ruhukya

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Co-Authors Ryan Currier, Lucian Bitner
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Paulo Hidalgo, Jada Nimblett
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Michael Ackerson
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Abstract Text This research reinterprets the formation of the Tunnel Dike within the Chief Joseph Dike Swarm, part of the Columbia River flood basalts, by analyzing core drill samples. Textural analysis of plagioclase crystals within these samples suggests the bulk of crystals were not formed in situ but were transported from deeper regions. These crystals align within bands, separated by regions with fewer plagioclase crystals, indicating shearing in a dilatant mush. The occurrence of numerous bent and broken crystals reinforces this interpretation. Notable features such as interstitial dacitic glass, acicular apatite crystals with epitaxial pyroxene, and film-like crystallization of feldspar, all suggest significant undercooling, perhaps due to rapid exsolution of H2O in the shallow crust. Taken in sum, these petrographic observations are consistent with an interpretation that the dike was emplaced as a mobile crystal mush, possessing a high effective viscosity and likely residing near the jammed state. These magmatic features would result in hindered and staccato-like propagation, ultimately leading to rheological arrest and rapid cooling. Conversely, these observations do not support the commonly held assumption that dikes are emplaced as near-liquidus magma. This study offers new perspectives on dynamics of magma transport, especially pertaining to thermal modeling in dike systems and magmatic flux rates. The recognition of a mobile crystal mushes in dikes contributes to a deeper understanding of the complex processes underlying the emplacement of thick dikes in continental flood basalt settings.

Time 4:00 – 6:00 PM [17]

Abstract Title EXPLORING GEOPHYSICAL TECHNIQUES: 2024 GEOPATH SUMMER INTERNSHIP AT FORT VALLEY STATE UNIVERSITY

Presenter Ciara Young

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Fort Valley State University, Georgia

Abstract Text The Summer 2024 Geoscience Program at Fort Valley State University provides a thorough and comprehensive overview of careers in geosciences, as well as the various methods used to investigate the physical properties in the Earth's subsurface. Faculty, visiting professors, and graduate students provided undergraduate STEM students an opportunity to immerse themselves in geophysics, geophysical data analysis and visualization. To practice these newfound skills, students attended workshops, such as the EarthScope 2024 Seismology Skill Building Workshop (SSBW) and Summer 2024 Numerical Modeling and Data Visualization Short Course. In these workshops, students became familiar with the concept of data manipulation, using Linux, Python, SAC etc. Through these collaborative exercises, students were able to gain a distinct perspective of geosciences and their many applications. In the summer program, there were two field days, where interns at Fort Valley State University were exposed to geophysical surveying methods, such as Ground Penetrating Radar (GPR) and Electrical Resistivity. Using Resistivity, they conducted a geophysical survey in front of the Academic Classroom and Laboratory building (ACL) on the Fort Valley State University campus. 112 meters (about 367.45 ft) was measured out and electrodes were placed every 2 meters. In total 56 electrodes were deployed, the first placed at 0 m and the last being placed at 110 m. Using the SuperSting R8 Resistivity Meter, two configurations, Dipole-Dipole and Wenner were used to collect data. ResIPy software was used to analysis the data, which formed clear images of the conductivity, where the field training commenced.

Time 4:00 – 6:00 PM [18]

Abstract Title FLUID INCLUSION ANALYSIS OF AURIFEROUS TYPE 2 AND TYPE 3 VEINS ACROSS THE ESTELLE PLUTON COMPLEX

Presenter Elizabeth Freeman

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Co-Authors Dr. Claudia Cannatelli
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Abstract Text The prolific Estelle Gold Project is located approximately 150 km (93 miles) northwest of Anchorage in the Alaska Range. The current project is classified as a reduced intrusive related gold system (RIRGS), and it hosts auriferous sheeted quartz veining. Mineralization is primarily low grade and follows a north/south trend across the property. The reported results suggest that two main vein types contain the bulk of Au mineralization, and three fluid inclusions assemblages (FIAs) were identified (Flagg ,2014). The objective of this current study is to gather additional information by collecting samples from new high-grade prospects on the Estelle property and determine if a correlation exists between fluid inclusion assemblages and gold grade using petrography, microthermometry, and Laser Ablation ICPMS (LAICPMS) methods. Fluid inclusions (FIs) are small droplets of fluid trapped in minerals during their growth or along fractures that develop and heal after the crystal has formed. (Randive et al.,2014). FIs represent an invaluable tool in mineral exploration due to their ability to provide constraints on

temperature/pressure conditions and ore fluid genesis. The 2022 Estelle drill program focused on increasing and proving the resource located on the Korbel portion of the property and the further exploration of RPM South, Cathedral, and Isabella prospects. These new drill cores offer a unique opportunity to continue vein analysis and conduct geochemical analysis on associated fluid inclusion assemblages.

Time 4:00 – 6:00 PM [19]

Abstract Title PETROPHYSICAL RESERVOIR CHARACTERIZATION OF THE VALANGINIAN SEQUENCE GAMTOOS BASIN, OFFSHORE SOUTH AFRICA.

Presenter Oluwatoyin L. Ayodele

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Co-Authors

Abstract Text

Gamtoos Basin is an echelon sub-basin in the Outeniqua offshore Basin of South Africa. It is a complex rift-type basin with both onshore and offshore components and consists of relatively simple half-grabens bounded by a major fault to the northeast. This study is mainly focused on the formation evaluation of the reservoir heterogeneity of the Valanginian sequence. The objective of this study is to quantify the heterogeneity of the hydrocarbon-bearing Valanginian sandstone reservoir within the sequence from the five drilled wells (Ha-B2, Ha-G1, Ha-K1, Ha-A1, and Ha-I1) located from the north to the south of the study area. The formation evaluation from well logs based on the petrophysical approach was applied by extensive, and Interactive Petrophysics (IP) ® software was used for the evaluation model. The data set contained wireline logs (Las format), core data, and geological well completion reports, which were used to model and characterize the reservoir parameters such as lithofacies, clay volume, porosity, permeability, and water saturation through petrophysical analysis. The results indicated that the reservoir characterization adequately captured the reservoir geometry of the sandstone dominated by the sequence in the study area. The cut-off parameters were applied to the eleven sandstone reservoir intervals studied from the wells to differentiate between the pay and non-pay interval sands, seven of the sand intervals were proven to be hydrocarbon bearing. The estimated average effective porosity for the pay sand intervals of the wells ranged from 12.5% to 16.2%, the average water saturation from 35.9% to 55.2%, and the average volume of clay from 10.0% to 20.6% for the study wells respectively. The predicted permeability obtained for the intervals lower than 1mD indicates an interval with poor permeability that cannot transmit fluids. The data from the four wells, except (Ha-G1), indicates a hydrocarbon-bearing reservoir (gas) with fair-to-good effective porosity and poor permeability with lower water saturation. The Interactive Petrophysics (IP) ©software gives a good account of the petrophysical evaluation of this formation. Keywords: Hydrocarbon, Reservoir, Effective Porosity, Permeability, Water saturation, Volume of Clay, Formation Evaluation, Petrophysical properties.

Time 4:00 – 6:00 PM [20]

Abstract Title	REDEFINING VOLCANIC CONDUIT DYNAMICS: INELASTIC DEFORMATION OF GRANULAR MEDIA DURING DIKE EMPLACEMENT IN THE CHIEF JOSEPH DIKE SWARM
Presenter	Keya Hopwood, Skyy Corral, Aydin Roberts Georgia State University Taiylor Williams University of West Georgia
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Abstract Text

Encompassing over 210,000 km² of land in the Pacific NW, the Columbia River Basalt Group (CRBG) is the youngest Large Igneous Province (LIP) and has an intricate and exhumed plumbing system known as the Chief Joseph Dike Swarm (CJDS). This study focuses on two dikes, hereafter PR1 and PR2, which have great exposures in the Grande Ronde River Canyon near Anatone, WA. PR1 (~2m width) and PR2 (~18m width) were emplaced into main-phase CRBG flows. Oriented core samples were collected at regular spacing across the dikes. Current views of magma dynamics assume near liquidus temperatures and high flux rates through fissures. The data collected was used to evaluate the magmatic conditions present during emplacement and challenged the previous assumption by revealing a large crystal proportion and near solidus behavior in the magmatic system. In these dikes, a high-strain environment during magma migration resulted in an anastomosing shear zone that controlled the spatial distribution of crystal deformation. Samples show evidence of force chains involving discrete bands of deformed crystals (e.g., mechanical twinning, subgrain formation, bending, and kinking) separating packets of smaller, undeformed crystals. The studied dikes display a large proportion of deformed crystal grains, but there are some differences. PR2, the widest dike, shows a higher proportion of deformed crystals than PR1, perhaps due to greater heat content. Interestingly, despite being narrower, PR1 is coarser than PR2, suggesting the presence of crystal cargo during emplacement. We interpret the large proportion and spatial correlation of deformed crystals due to in situ deformation during emplacement. Moreover, undeformed crystals were smaller than deformed crystals, suggesting that smaller crystals either grew in low-strain environments or did not participate in force chains. These findings question the commonly assumed near liquidus conditions in volcanic conduits. During the emplacement of magmas in the CJDS, crystalline mushes mobilized and deformed plastically. This is a paradigm-shifting emplacement mechanism for LIPs and challenges the assumption that magmatic systems are primarily fed by crystal-free magmas.

Time	4:00 – 6:00 PM [21]
Abstract Title	SOIL MICROBIAL RESPONSES TO ARTIFICIAL LIGHT AT NIGHT (ALAN)
Presenter	Randall Walker

Organization University of Texas at El Paso

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Co-Authors Dr. Kelly Ramirez
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Abstract Text Artificial light at night (ALAN) illuminates the night sky allowing humans to extend the day length for work, socializing, and other cultural activities. While ALAN is beneficial to society, it takes a significant toll on biological organisms that use the moon and stars for cues and thus, negatively affects the circadian rhythm of biological organisms. Many organisms – insects, birds, mammals, and even plants are significantly influenced by ALAN – yet there is a significant knowledge gap regarding microorganisms. Previous work has indicated that certain soil taxa are sensitive to artificial light, but it remains unclear at what scale ALAN impacts soil organisms or if there are feedbacks to ecosystem processes. Soil biodiversity, including bacteria, archaea, fungi, and other eukaryotes largely colonize the top 5-10cm of soils and are a significant contributor to ecosystem processes including nutrient cycling, supporting primary productivity, and water filtration. Here we present results from a comprehensive study assessing if tall grass prairie soils or global patterns of soil microbial communities can be related to ALAN. To test the impacts of ALAN on microbial diversity within tall grass prairie states and global scales we used two previously published microbial datasets and compared diversity patterns to ALAN levels, totaling 219 samples. ALAN was estimated by extracting raster values at point locations, corresponding to the microbial datasets, from VIIRS Nighttime Imagery Annual VNL V2 average dataset (year 2021). Skyglow, which is light reflected up into the atmosphere, was the primary version of light being analyzed. VIIRS Nighttime Imagery provides accurate visible and near-infrared light emissions at night which can highlight urbanization, human activity, and empty pockets of light. We then tested for correlations between microbial diversity measurements, microbial taxa, and microbial biomass. We hypothesized that sites with lower plant coverage (more bare soil) would be more strongly correlated to ALAN, than sites with high plant coverage. Overall, our results indicate that weak correlations can be detected at the tall grass prairie and global scale, but variation was too high to make strong conclusions.

Time 4:00 – 6:00 PM [22]

Abstract Title TEXTURAL ANALYSES-INFORMED THERMAL MODELING OF WALL ROCK: TUNNEL DIKE, CHIEF JOSEPH DIKE SWARM

Presenter Jada Nimblett

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Abstract Text

The Chief Joseph Dike Swarm (CJDS) in Northwestern United States was the primary feeder to the Columbia River Flood Basalts (CRFB), Earth's youngest flood basalt province. This dike system's textural diversity gives insight into the magma migration mechanisms that could have contributed to climate change during the emplacement of the CRFB. The Tunnel Dike, situated in the Grande Ronde River canyon in Anatone, Washington, is a part of the CJDS and provides fundamental micro-textural constraints on the magma transport system, including the magmatic flux rates. Previous studies have used the wall-rock adjacent to this dike to determine the duration of magmatic flux, with the foundational assumption that magma remained at the liquidus temperature during the lava flow feeding stage. However, our findings are consistent with at least two magmatic pulses indicated by two distinct crystal size distributions in dike orthogonal transects. Specifically, an outer fine-grained texture and an interior, relatively uniform porphyritic texture, both documented using Electron Backscatter Diffraction (EBSD) and traditional texture analysis methods. This complex textural relationship cannot be explained via a simple cooling model, and instead supports the notion that textures would have had to form over a range of temperatures to account for the two groups. We use here, a transient one-dimensional thermal model to explore a variety of scenarios, including those proposed by other researchers, but casting a wider net, including a multi-pulse scenario as informed by our textural analyses. We have produced time and temperature space diagrams for a range of contact temperatures, rather than keeping the liquidus temperature constant. Our results highlight the fundamentality of conducting textural analysis in magma transport, and thermal modeling studies. Taking into consideration the textural analysis of the Tunnel Dike, the temperature of the wall-rock at the contact must have been lower than previously assumed, which necessarily lengthens the estimated duration of magmatic flow through the dike. Contact temperature is critical to inferring magmatic flux durations and rates across dike systems, and not accounting for textural diversity will result in inaccurate and unrealistic outcomes.

Time

4:00 – 6:00 PM [23]

Abstract Title

EXPLORING NITRATE REDUCTION IN A SATURATED RIPARIAN BUFFER THROUGH A THREE-DIMENSIONAL REACTIVE CONTAMINANT TRANSPORT MODEL: IMPLICATIONS FOR AN OPTIMIZED REMEDIAL DESIGN TO IMPROVE WATER QUALITY IN A HYPORHEIC ZONE

Presenter

Franklin Ijigade

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Co-Authors

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Abstract Text

Sub-surface tile drainage is predominantly used in Midwest agricultural farmlands to improve soil aeration and crop yields. However, it also leads to nutrient export from fields, contaminating streams that drain into the Mississippi River and contributing to a hypoxic zone in the Gulf of Mexico, posing a major

environmental concern. Saturated Riparian Buffers (SRB) are promising management practices to mitigate this issue. Studies show their effectiveness in reducing nitrate within glacial till formations, but knowledge gaps remain. Specifically, the influence of sub-surface heterogeneities on tile drainage discharge to the stream is not well understood. These variations significantly impact nitrate transport and reduction within the SRB. The aim of this study is to develop a coupled flow-reactive transport model to assess the impact of nitrate loads from sub-surface tile drainage and precipitation on stream health. A 3-D static geological model was developed, incorporating data from 17 wells installed at the study site and three cone penetration test logs from the Illinois State Geological Survey. The static model consists of organic-rich soils and clays with increasing gradation of sand to gravel, Field estimates of hydraulic conductivities for organic-rich soil and clay with sand and gravel units were obtained from infiltrometer and slug tests. Result of the hydraulic conductivity were 0.68 m/day and 3.92 m/day respectively, which are consistent with typical glacial till formation. The water table information obtained during the spring within the study area shows that groundwater flows from north to west of the study site, and discharges into the stream. Stream gauging experiment indicated a gaining stream system, with downstream discharge exceeding upstream discharge (16,851 m^3/day vs. 9297 m3/day). The static model was converted into a dynamic steady State groundwater flow model using the MODFLOW-USG code. simulation produced hydraulic head values close to field conditions and the river leakage at the surface water-groundwater interface was 25.73 m^3/day during dry conditions. Hence, a starting ground for calibrating the flow model with observations wells from May 2024. The results of the calibrated hydraulic conductivities will drive the reactive transport model, analyzing nitrate transformation and reduction which will bridge the knowledge gap in understanding the efficiencies and future design of SRB to control nutrient flux and improve water quality

Time 4:00 – 6:00 PM [24]

Abstract Title GROUNDWATER LEVEL PREDICTION USING MACHINE LEARNING AND GEOSPATIAL INTERPOLATION MODELS

Presenter Fabian Zowam

Organization University of Georgia

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Co-Authors Adam Milewski
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Abstract Text

Given the vulnerability of surface water to the direct impacts of climate change, the accurate prediction of groundwater levels has become increasingly important, particularly for dry regions, offering significant resource management benefits. This study presents the first statewide groundwater level anomaly (GWLA) prediction for Arizona across its two distinct aquifer types – the unconsolidated sand and gravel aquifer and rock aquifer. Machine learning (ML) models were combined with empirical Bayesian kriging (EBK) geostatistical interpolation models to predict monthly GWLA between January 2010 and December 2019. ML models utilized remotely sensed meteorological and hydrological input variables including precipitation, soil moisture, land surface temperature, evapotranspiration, vegetation index, and groundwater storage percentile, and

monthly groundwater level (GWL) measurements from 59 monitoring wells constituted the target variable. Model evaluations were based on the Nash–Sutcliffe efficiency (NSE) and coefficient of determination (R2) metrics.

Considering average NSE/R2 values of 0.62/0.63 and 0.72/0.76 during the validation and test phases, respectively, our multi-model approach demonstrated satisfactory performance. EBK models improved ML model predictions, and the importance of the density and quality of kriging data was evident. In addition, with average NSE and R2 of 0.88 and 0.92 for the unconsolidated material aquifer, and 0.32 and 0.37 for the rock aquifer, respectively, predictive accuracy was much higher for the former. This discrepancy may be due to several factors, including intricate heterogeneities and geologic structures in rock aquifers, and the fewer number rock wells (21) compared to those drilled into unconsolidated materials (38) possibly limited the adequate representation of the geologic complexities of the aquifer. Overall, the trend of GWLA for the study area following model deployment reflects the challenges of a dry/arid climate with high water demand and withdrawal rates possibly exceeding natural recharge.

Model design utilized remotely sensed datasets from satellites with global coverages, enabling replicability for similar climates across the globe. In particular, our remote sensing approach ensures that data-sparse regions of the world, where field-based hydrological variables are limited or largely inaccessible, are not left out.

Time 25.00

Abstract Title INVESTIGATING HETEROGENEITY OF HYDRAULIC CONDUCTIVITY AND ITS INFLUENCE ON GROUNDWATER DYNAMICS WITHIN A SATURATED RIPARIAN BUFFER IN CENTRAL ILLINOIS

Presenter Joseph Awuku

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Abstract Text

The use of Saturated Riparian Buffers (SRBs) in agricultural settings as a means of reducing contamination of surface and groundwater resources has gained popularity due to their trapping ability and solute removal (nutrient recycling) capacity. In light of SRB's nutrient-trapping and removal ability, numerous studies have been conducted to characterize the effectiveness of SRBs. However, most studies on SRBs have paid minimal attention to how heterogeneity of hydraulic conductivity (K) contributes to the effectiveness of SRBs. Heterogeneity of K has been proven to be, if not the most significant, one of the contributing factors to the effectiveness of SRBs since heterogeneity in K controls water fluxes and solute trapping efficiency. This study investigates the heterogeneity in horizontal K and estimates the vertical groundwater specific discharge (qv) between the upper weathered and its underlying unweathered glacial units of an SRB, adjacent to a tile-drained agricultural farm field in central Illinois. The glacial deposits at the study area are of the Tiskilwa Formation and are distinguished into an upper

weathered clay, which becomes coarser and poorly sorted with depth, and an underlying unweathered diamicton. The diamicton comprises a clay dominated matrix with coarser sediment resulting in poorly sorted sediments. For 23 wells, geometric mean K values were calculated after reducing multiple slug test results using the Hvorslev (1951) method. From the preliminary analysis, mean K values from individual wells ranged from 1.92E-4 m/s to 7.63E-6 m/s within the weathered diamicton; whereas, the unweathered diamicton had K values as low as 4.79E-9 m/s. qv was computed as the product of the average vertical hydraulic conductivity (Kv) and vertical hydraulic gradients (iz) between depths of 1.5 and 4.6m as these depths represent locations in the weathered and unweathered diamicton, respectively. Kv values used were inferred from the horizontal K reduced from the slug test but as an order of magnitude lower. Typical iz values ranged from 0.03 to 0.1 from one-time measurements. Groundwater flow direction was downwards except in a few areas where groundwater flowed up. The qv ranged from 1.25E-5 m/s to 4.30E-7 m/s where areas with high K had higher qv. In conclusion, the study area exhibits heterogeneity, depicted by the variation of K over orders of magnitude.

Time	26.00
Abstract Title	SULFATE SOURCES IN GROUNDWATER FROM AN AGRICULTURAL AREA CENTRAL ILLINOIS
Presenter	Christabel Obi
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Co-Authors	Dr. Eric W. Peterson Illinois State University, Department of Geography, Geology and the Environment

Abstract Text

Increasing sulfate (SO_4^{2-}) concentrations in the water environment, corresponding with increases in urbanization and industrialization, are a rising global concern. In excess of 250 mg/L, sulfate threatens human health and ecosystems. Elevated concentrations influence carbonate rock weathering, which contributes to the evolution of the global carbon cycle. Knowledge of sulfate sources, whether natural or anthropogenic, is essential for understanding sulfate transport and fate in groundwater. This study investigates SO_4^{2-} origin and transport in groundwater in an area dominated by agricultural land use in Mclean County, Illinois. Specifically, we explored these questions: 1) Do sulfate concentrations change with groundwater depth? and 2) Are there seasonal differences in sulfate concentrations in groundwater? Water samples collected over 9 years (2015-2024) from 37 observation wells were analyzed for major anions, including SO_4^{2-}. Based on depths, wells screened at 4.6m (A) and 3.1m (B) were categorized as deep groundwater, while wells screened at 2.3m (C) and 1.5m (D) were categorized as shallow groundwater. Seasons were subdivided into spring/planting (April - June), summer/growing (July - September), fall/harvest (October - December), and winter/fallow (January - March), corresponding with agricultural practices. A cumulative probability plot and a one-way ANOVA revealed two SO_4^{2-} populations, with deep groundwater being statistically different from shallow groundwater, indicating depth-related changes in sulfate. A

two-way ANOVA showed no seasonal differences in sulfate concentrations. Depth differences in SO_4^{2-} are due to geogenic rock-water interactions releasing more sulfate in deeper groundwater wells. In contrast, shallow groundwater wells have lower sulfate levels, influenced by infiltration and recharge. Groundwater flow dynamics also contribute, with deeper groundwater having longer residence time, allowing more rock-water interactions compared to shallow groundwater. The lack of seasonal variation in SO_4^{2-} concentrations suggest sulfate levels are unaffected by seasonal changes like precipitation, agricultural runoff, or temperature fluctuations. The lack of seasonal variation suggests a stable groundwater system, potentially minimizing the immediate impact of seasonal surficial activities on sulfate levels.

Keywords: ANOVA, Sulfate, SRB, Cumulative probability plot, Groundwater

Time 28.00

Abstract Title ECOLOGICAL RESPONSES OF BENTHIC FORAMINIFERA TO CHANGES IN SEA ICE EXTENT AND ORGANIC CARBON FLUXES IN THE BERING SEA (SITE U1339)

Presenter Gael Nkwain

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Abstract Text

Benthic foraminiferal assemblages are well preserved in marine sediments and can indicate changes in benthic environments and ecological responses through glacial-interglacial cycles. Benthic communities are closely tied to the flux of organic matter to the seafloor, and changes in sea ice extent can profoundly affect benthic ecosystems at high latitudes. Sea ice extent significantly impacts marine productivity, with higher productivity during warmer periods when sea ice is declining. This study examines the stable carbon isotope composition (δ13C) of multiple species of benthic foraminifera at site U1339 in the Bering Sea over the past 19,800 years. δ13C variations between epifaunal and infaunal foraminifera are analyzed to understand factors influencing their isotopic values and faunal composition. Epifaunal species exhibit higher δ13C values due to access to phytoplankton-derived organic matter, while infaunal taxa display lower δ13C values from exposure to degraded organic matter. δ13C records reveal a significant drop in nonionella sp. during the Bølling-Allerød hypoxic event, indicating changes in organic matter remineralization. Enhanced organic carbon export drives hypoxia, supported by a positive correlation between Δδ13C and low-oxygen-indicating taxa. High-resolution marine sediment records from Integrated Ocean Drilling Program Expedition 323 provide opportunities to decode environmental and ecological changes. This research focuses on sedimentary records from 300-500 kyr, spanning an interglacial interval (MIS 11) analogous to modern climate, to reconstruct biotic responses to changes in carbon export with climatic changes in Bering Sea.

Time 29.00

Abstract Title

AN INTEGRATED GEOLOGIC AND GEOCHEMICAL APPROACH TO INVESTIGATING THE ORIGIN AND DEPOSITIONAL ENVIRONMENTS OF CARBONATES IN THE PARADOX BASIN

Presenter

Charles Ojodale Igomu

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Abstract Text

The well-exposed diapir-proximate dolomites of the Moab Valley provide an outstanding opportunity to gain insights into carbonate emplacement mechanisms within salt systems, fluid flow within diapir margins, and the extent of the heterogeneity of the Layered Evaporite Sequence of the Paradox Basin. These insights have significant implications for energy resource exploration and energy transition endeavors, such as CO_2 sequestration, hydrogen storage, and nuclear waste storage.

Notably, these dolomites exhibit distinct character from one side of the valley to the other. The dolomites are distinct in regard to their stratigraphic position relative to other lithologies, their content of detrital material and dead oil, and their fabrics. Given that carbonates typically reflect their environment and conditions of formation, this sharp contrast in lithological expression across the valley raises questions about earlier works suggesting a common origin. Consequently, this study hypothesizes that the dolostones have different origins, potentially ranging from Pennsylvanian carbonate megaflap and Pennsylvanian inclusion of non-evaporite lithology to Triassic Lake deposits, Triassic replacement carbonate caprock, modern karst and spring tufa.

To investigate this hypothesis, the study integrates geologic fieldwork, petrography, stable O & C isotope geochemistry, drone imagery, stratigraphy, and new geologic mapping. Following extensive fieldwork, 121 samples were analyzed for petrography and 50 for isotope fingerprinting. The data reveal that at least three categories of dolostones are present across the valley. The first category, interlayered with gypsum and corresponding to the Paradox Formation, is common to both sides of the valley. The second category, found only on the southwest side, is finely laminated with algal mat features and has an interfingering relationship with the Chinle Formation, showing no clear interbedding with the gypsum caprock. The third category, unique to the northeast side, lacks a clear regional stratigraphic correlation across the Basin, indicating a complex depositional history. These findings provide critical insights into the varied origins of the Moab Valley dolostones. Understanding the variability in these dolostone formations and their distribution within the Paradox Basin's salt system can influence the selection of suitable sites for CO2 sequestration and hydrogen storage.

Time

30.00

Abstract Title

DEPOSITIONAL PALEOENVIRONMENT AND ELEMENTAL ANALYSIS OF THE UPPER MANCOS FORMATION IN THE SAN JUAN BASIN, NEW MEXICO, USA

Presenter

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Abstract Text

The San Juan Basin has been a major producer of petroleum for over a century. Most of its production is gas and natural gas liquids from Upper Cretaceous blanket sandstones and coal beds. These sandstone reservoirs are primarily sourced from the organic-rich and thermally mature Mancos Formation. Twenty-seven core samples from the Upper Mancos Formation representing the interval between 315.5–188.7 m at the Melrich-Shaft-Site drilled in Smith Lake Field, McKinley County, New Mexico have been previously studied to evaluate their hydrocarbon source potential. Kerogen types II mixed II/III, and III were reported at various intervals. Although this gives some insight into the depositional paleoenvironment of the Mancos Formation in this field. More data is still needed to fully understand the intricate nature of factors controlling the deposition of the Mancos shales at this location. The present study introduces new elemental analysis data that paint an interesting picture of the interplay between marine water chemistry and terriginous input during the deposition of the Mancos Formation.

POSTER 2

Time 3:00 – 4:50 PM [1]

Abstract Title INVESTIGATING THE CO2 MINERALIZATION POTENTIAL OF THE UNITED STATES' BASALT PROVINCES: SOUTH GEORGIA RIFT

Presenter Charles Ojodale Igomu

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Abstract Text

In the face of escalating global climate change concerns, geologic sequestration of anthropogenic CO2 to combat climate change is one of the most promising strategies for achieving a net-zero economy. Several sequestration options are available for implementing this strategy, including storage in sedimentary formations such as saline aquifers and depleted oil reservoirs, utilization of coal beds, and organic-rich shale as well as volcanic basins containing favorable mafic and ultramafic formations such as porous and permeable basalts which could be crucial for regions with limited conventional sequestration resources in the form of viable sedimentary formations.

However, the success of any of these sequestration strategies hinges critically on its ability to permanently isolate the CO2 from the biosphere. To achieve this permanence of storage, the geochemical conversion of CO2 into stable carbonate minerals within mafic and ultramafic formations provides the greatest security against long-term leakage. Basalt exhibits instability when exposed to CO2-saturated brine, releasing carbonate-forming cations and facilitating the mineralization of CO2 into carbonates such as calcite, siderite, magnesite or dolomite.

Fortunately, the United States possesses several basalt provinces that could potentially be leveraged for this purpose. Therefore, this review work aims to assess these basalt provinces in the United States and their suitability for CO2 sequestration. The review shows that the porosity of the South Georgia Rift Basalt averages 14% with fracture/fault enhanced permeability of 200mD, a burial depth of about 740 meters and a thickness of approximately 256m. Mineralogically, the SGR basalt contains about 30.7 % interstitial glass, 43.3% plagioclase, 26% pyroxene, and less than 1% magnetite. Given its mineralogical and petrophysical properties, the basalt within the SGR shows promising sequestration potential. However, reactive transport modeling will be required to further evaluate its sequestration suitability.

Time 3:00 – 4:50 PM [2]

Abstract Title EXPLORING MONTHLY VARIATIONS IN URBAN EFFECTS ON PRECIPITATION IN THE ATLANTA, GA, USA REGION

Presenter Olamiposi Fagunloye

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Co-Authors Professor Jeremy Diem
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Abstract Text Urbanization significantly influences precipitation patterns, with effects varying seasonally. This study investigates the intra-annual variations in urban effects on precipitation in the Atlanta, GA, USA region. Using a comprehensive dataset spanning from 2014 to 2023, this research analyzes daily precipitation data from 70 meteorological stations within 110 km of downtown Atlanta. The study focuses on understanding the spatial and seasonal variability of urban-induced precipitation modifications by examining lower-troposphere winds, urban land cover, and precipitation metrics such as total precipitation, precipitation days, and heavy precipitation days. Results indicate that urbanization impacts are most pronounced in the summer months, enhancing precipitation downwind of urban areas. This enhancement is attributed to the urban heat island (UHI) effect, increased surface roughness, and elevated concentrations of aerosols from industrial activities. These factors collectively intensify atmospheric instability and convective precipitation processes. Notably, the study reveals significant spatial variability in urban effects, with the highest precipitation totals associated with westerly and southwesterly wind directions, particularly during the winter and early spring months. The methodology includes the generation of month-specific wind direction histograms, box-and-whisker plots of precipitation metrics for various wind directions, and spatial analysis using kriging techniques in ArcGIS Pro. The analysis of upwind urban land, assessed through mean developed imperviousness and medium- to high-intensity developed land, highlights the correlation between urbanization and precipitation. Pearson product–moment correlation tests confirm the statistical significance of these correlations. This research fills critical gaps in the literature by extending the temporal scope beyond five years and including all seasons, providing a more comprehensive understanding of urbanization's impact on precipitation. The findings underscore the need for urban planning strategies that mitigate adverse effects on water resources and manage the risks associated with increased surface runoff and flooding. These insights are particularly relevant for rapidly urbanizing regions globally, offering a framework for future studies and urban development policies aimed at sustainable growth and environmental resilience.

Time 3:00 – 4:50 PM [3]

Abstract Title AMBIENT NOISE TOMOGRAPHY OF THE KODIAK FOREARC: A DETAILED STUDY OF THE SOUTHERN M9.2 1964 GREAT ALASKA EARTHQUAKE RUPTURE AREA

Presenter Joshua Osasona

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Co-Authors Lindsay Lowe Worthington, Brandon Schmandt
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Abstract Text We present latest findings beneath the Kodiak forearc using seismic ambient noise tomography. We used data from a densely spaced array deployed along a ~50 km section of the road system on Kodiak Island as part of the Alaska Amphibious

Community Seismic Experiment (AACSE). The full array of ~ 400 stations were operational for 25 days between May-June 2019. Rayleigh wave dispersion measurements were extracted from ambient noise cross-correlations between station pairs in the node array, providing phase velocities for periods between 2 to 8 seconds. To overcome the limitations of aperture for deeper imaging, we employed the beamforming technique to extract phase velocities for longer periods (up to 17 seconds) using stations outside the Kodiak array as virtual sources. We validated the tomography results by comparing the beamforming outputs with those from the typical least squares solution. Preliminary results reveal a slow velocity wedge (<2.6 km/s) that thins towards the northwest, likely representing accretionary sediments. At 6-second periods, we identified a sharp discontinuity, potentially indicating a rigid backstop or terrane boundary. Conversely, at 14-second periods, we observed a reverse trend, with faster velocities (>3.9 km/s) near the subduction margin in the southeast. This trend may signify the presence of the subducting Pacific plate. These findings offer new insights into the crustal deformation and tectonic processes occurring beneath the Kodiak forearc.

Time 3:00 – 4:50 PM [4]

Abstract Title AUTOMATIC DETECTION OF CREEP USING WRAPPED INTERFEROGRAMS AND ITS APPLICATION TO THE ENRIQUILLO PLANTAIN GARDEN FAULT

Presenter Keiana Mazzio

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Abstract Text

Post-seismic deformation following the 2010 M7.0 and 2021 M7.2 earthquakes in Haiti indicates that some of the strain accumulation along the Enriquillo-Plantain Garden Fault Zone (EPGFZ) was released aseismically as triggered slip. Triggered slip events were detected as discontinuities in both Sentinel-1 (c band) and ALOS-2 (L band) wrapped interferograms but not unwrapped interferograms, which proved challenging due to atmospheric delay error. To evaluate if the EPGFZ releases strain aseismically during the interseismic stage of the earthquake deformation cycle, there is a need to detect discontinuities in a large number of unwrapped interferograms (>1000). In this project, we develop a detection method for finding discontinuities using 20-30 km-long across-fault phase transects for the EPGFZ following the 2021 earthquake. Phase change discontinuities were identified using visual inspection. Initial results reveal the location, timing, and magnitude of creep varies for interferograms ranging from August 03 to September 04 (5 acquisitions). Two creeping segments were observed moving from the rupture area, eastwards towards the Miragoâne pull-apart. The longest creeping segment is ~14 km long starting from the coseismic rupture area with a displacement of 112 cm and the shorter creeping segment is 3.5 km long with a displacement of 12 cm and is about 9 km east of the west creeping segment. We intend to improve upon this visual detection method with a statistical-based

method, which will enable us to search for phase discontinuities of a larger number of inter-seismic interferograms.

Time 3:00 – 4:50 PM [5]

Abstract Title COMPARATIVE ANALYSIS OF HEAT FLUX IN VENUSIAN AND TERRESTRIAL MANTLE PLUMES THROUGH CONVECTION MODELING

Presenter Raven McRae

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Co-Authors

Abstract Text This research aims to investigate the heat flux of various regions on Earth and Venus characterized by high mantle plumes, using convection models derived from available datasets. By employing Python, I have developed graphs and 2D models to visualize and analyze convection in specific areas. A key focus has been on understanding how variations in the Rayleigh number (Ra) influence the vigor and outcomes of these models, particularly through changes in the viscosity parameter. The project involves a comparative study between Earth and Venus, utilizing terrestrial data to establish a reference framework. By comparing convection models from both planets, the research aims to elucidate the differences in heat flux and demonstrate the ratio of thermal activity between Venus and Earth. This comparative approach will provide insights into the underlying geodynamic processes governing planetary heat distribution and mantle dynamics.

Time 3:00 – 4:50 PM [6]

Abstract Title CONSTRAINING THE RADIAL STRUCTURE OF SEISMIC ATTENUATION USING MULTIPLE S-WAVE DATASETS

Presenter Emmanuel Paul Irumhe

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Abstract Text The seismic quality factor (Q) of the mantle is important for determining the physical and chemical properties of the solid Earth. In this study, we use direct S waves and their multiples (SS, SSS and SSSS) as well as core-reflected ScS waves and core-diffrected Sdiff waves to constrain the radial structure of seismic attenuation in the Earth's mantle. The direct S waves and their multiples (S, SS, SSS, and SSSS) were used in a previous study (Zhu et al., 2022), which concluded that seismic Q values at depths between approximately 600 and 900 km are higher than those in current global Q models. This newly discovered high-Q region is in general agreement with recent mantle viscosity structure derived from inversions of geodetic measurements and has important implications for mantle dynamics, as

a strong layer at this depth will resist the penetration of subducted slabs into the lower mantle. To improve the depth resolution of the radial Q structure in the lower mantle, we expand the dataset of Zhu et al (2022) to include core-reflected ScS waves and core-mantle diffracted Sdiff waves. Unlike the multiple reflected SS, SSS and SSSS waves that turn in the shallow lower mantle, the average amplitude of the ScS waves does not show strong dependence on the epicentral distance. The ScS waves travel through the entire mantle and therefore they sample the average Q structure of the entire mantle. Their amplitude measurement characteristics are similar to the measurements of direct S waves at large epicentral distances. The Sdiff measurements, on the other hand, show a clear dependence on epicentral distance. At longer distances, the increased path lengths of the Sdiff waves are primarily along the core-mantle boundary. The joint inversion of the multiple S-wave datasets confirms the existence of the high-Q region at the top of the lower mantle. In addition, it suggests higher Q values in the lowermost mantle. We will discuss the radial structure and depth resolution of the Q models obtained from this new amplitude datasets based on linear inversion and forward modeling.

Time 3:00 – 4:50 PM [7]

Abstract Title CONSTRAINTS OF UPPER MANTLE THERMODYNAMIC STATE PARAMETERS WITH THE VERY BROADBAND RHEOLOGY CALCULATOR (VBRC) GIVEN IN SITU SEISMIC AND MAGNETOTELLURIC OBSERVATIONS

Presenter Samuel Ofori

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Abstract Text The electrical resistivity of Earth's subsurface varies by over five orders of magnitude depending on chemical and physical properties. Parameters that impact this response include mineral composition, temperature, pressure, melt fraction, and volatile content. Furthermore, the geometry of the mantle space will greatly influence the bulk resistivity depending on the interconnectivity of the conductive phases. These parameters of thermodynamic state that influence the electrical response also impact the seismic response. In 2020, the "Very Broadband Rheology calculator" (VBRc) open-source tool was released for calculating rheological properties of an olivine mantle given an array of thermodynamic state variables using laboratory-derived constitutive models (Havlin et al., 2020). To further the scope of the VBRc, we implement methods for calculating electrical resistivity for various thermodynamic states. This includes the melting and volatile partitioning for a range of geophysical mixing models. The objective is to yield a constraint on the possible ranges of each state variable (temperature, grain size, volatile content, grain size, and melt fraction) from geophysical observations (shear velocity, attenuation factor, electrical resistivity). We demonstrate the utility

of joint seismic-electric analysis by applying VBRc to existing datasets and synthetic examples, including the SERPENT magnetotelluric experiment. This research proves pertinent to seismic and electromagnetic observations related to geophysical anomalies (high conductivity and low velocity layers) observed in the upper mantle.

Time	3:00 – 4:50 PM [8]
Abstract Title	ELECTRICAL RESISTIVITY AND PYTHON CODING AT FORT VALLEY STATE UNIVERSITY
Presenter	Ariyanna Reedy
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Co-Authors	Adityamoy Kar Fort Valley State University

Abstract Text

During Summer 2024, six Fort Valley State University STEM interns secured the opportunity to explore a National Science Foundation sponsored summer internship program for undergraduates. On 2 field days, students completed high-tech, hands-on training with geophysical equipment, such as Electrical Resistivity and Ground Penetrating Radar (GPR). Furthermore, students attended workshops in seismology skill building and numerical modeling, with an emphasis on coding, such as Linux and Python. Through tutorials and independent-study, interns learned to manipulate and analyze geoscientific data. These coding skills enhanced the interns' ability to interpret data collected from geophysical surveys. This exposure not only deepened their understanding of geoscience applications but also fortified them with valuable computational tools, crucial to all fields.

Here, we report the results of our Electrical Resistivity method. The Electrical Resistivity study tasked participants with identifying a suitable area located on Fort Valley State University campus. The area identified was the quad, located between the Academic Classroom Building and FVSU dormitories (Wildcat Commons 5 and 6). Students measured a length of 112 meters in the quad. Along the 112-meter line, students inserted 56 electrodes, into the ground, which were placed 2-meters apart. Two configurations were employed to collect resistivity data: Dipole-Dipole and Wenner. In theory, the Dipole-Dipole configuration produces a deeper image of the subsurface but lacks details. Whereas the Wenner method produces a shallower image of the subsurface but is more detailed. The data collected was analyzed using geophysical software (ResIPy) for geoelectrical modeling and inversion. Using the Wenner configuration, results suggest that there are 4 distinct regions of high resistivity, with respect to the overall region of resistivity, which occurs in a horizontal position between 0 and 112 meters. These objects are positioned at a depth of 10 meters from the surface. Using the Dipole-Dipole configuration, a deeper image to a depth of 25 meters is produced. As predicted in theory, which is described earlier, a lesser detailed figure was produced, with three objects, extending to a depth of 15 meters from the surface. Combining the two geophysical techniques gives a powerful image of the anomalies in subsurface resistivity.

Time	3:00 – 4:50 PM [9]
Abstract Title	EVALUATING CRUSTAL SHEAR WAVE VELOCITIES IN TERMS OF TEMPERATURE, COMPOSITION, AND MELT IN THE CASCADES AND ACROSS THE UNITED STATES
Presenter	Kayode Agboola
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Abstract Text	Seismic velocities can be used to evaluate how temperature and melt/fluid fraction can be affected by composition. These parameters are important for interpreting volcanic unrest and are applicable in evaluating subsurface resources like geothermal energy. To evaluate the effect of temperature and fluids we need to evaluate the range of velocities affected by the bulk composition. For this, we used an integrative approach of heat flow measurements in combination with rock chemistry coupled with ambient noise data to quantitatively and qualitatively interpret seismic velocity in the subsurface across the continental United States. For a large suite of igneous basement complex rocks from the Cascades, we used Perple_X, a free-energy minimization algorithm, to estimate the modal mineralogy from major element oxide compositions while considering different wt% water (0-2.0 wt% H2O). Out of the initial 4162 rock samples from the database, a total of 3383 igneous rock samples across the spectrum of silica contents (49-78% SiO2) were subjected to this analysis. P- and S-wave velocities were computed for these different mineral aggregates at various mid- to lower-crustal pressure and temperature conditions. Using well-established models, we estimate the subsurface temperature across the United States from published heat flow measurements. Comparing ambient noise imaging with our results shows that most Vs models of the mid- to lower-crust can only be explained if only there is at least some water bound in the minerals of the rock. Also, our analysis shows that the S-wave velocity, unlike the P-wave, has little sensitivity to composition but gives good sensitivity to temperature and porosity. In the Cascades of the Pacific Northwest, the low velocities observed in this volcanically active region could not be explained by a compositional anomaly. The velocity anomalies here must be due to the presence of some degree of partial melt or fluids. Our method provides a unique approach to effectively identify where melts and other fluids might be present in the subsurface.

Time	3:00 – 4:50 PM [10]
Abstract Title	USING 87SR/86SR TO IDENTIFY ROCK UNITS THAT SUPPORT GROUNDWATER FLOWPATHS AND FLOWPATH CONNECTIVITY IN DEGLACIATING ALPINE WATERSHEDS.
Presenter	Ayobami Oladapo
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Abstract Text

Alpine glacier meltwater is an important source of recharge supporting groundwater flow processes in the high mountains. In the face of rapid ice loss, knowledge of residence times and response times of mountain aquifers to loss of glacial ice are critical in evaluating the sustainability of alpine water resources for human communities and ecosystems. An important step toward addressing this knowledge gap is to identify the rock units that host flowpaths and how these flowpaths are connected across spatial scales. Here, I use strontium isotopes (87Sr/86Sr) and geochemical tracers to identify the rock units that host groundwater flowpaths and examine how the flowpaths are connected across spatial scales in Glacier National Park (GNP) and Mount Hood National Forest (MH). MH is comprised of mostly young, reworked volcanic rocks originating from three eruptions in the past 2 Ma. In comparison, GNP has complex geology where older (Precambrian) rock units are thrust over younger (Cretaceous) rocks. The springs in MH show very low variability in 87Sr/86Sr across spatial scales and aspects (compass direction of slopes) of the mountain. This is not surprising given the low variability in 87Sr/86Sr in the young volcanic rock. The springs in GNP show greater variability in 87Sr/86Sr. High-elevation springs are supported by groundwater flow through older sedimentary bedrock units. Springs with relatively low 87Sr/86Sr represent waters that flow along or through a young volcanic sill that crosscuts the strata. Finally, springs flowing from the alluvium have 87Sr/86Sr ratios that are intermediate between the two other groups showing a complicated flowpath history. Nearly all the springs that were sampled in GNP emerge on south-facing slopes. This is not an indication of ice preservation, instead it's controlled by hydrostratigraphy. It's unlikely that high-elevation groundwater is strongly connected to low-elevation sites due to hydrostratigraphy. There are more springs on south-facing slopes at MH as well; however, they do not preserve an isotopic signature of recharge from glacial meltwater. Springs on north-facing slopes do preserve the signature. Groundwater flowpaths are connected across scales at MH; low-elevation warm springs show an isotopic signature of glacial meltwater. GNP and MH have different hydrogeological characteristics and show different responses to ice loss.

Time

3:00 – 4:50 PM [12]

Abstract Title

GEOPHYSICAL INVESTIGATION OF THE FRAMEWORK OF THE MAHOMET AQUIFER IN EAST-CENTRAL ILLINOIS

Presenter

Daniel Chukwudi

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Abstract Text

The Mahomet aquifer which lies over the buried Mahomet Bedrock Valley (MBV) system is the only source of drinking water to over one million residents in east-central Illinois. This unconsolidated glacial aquifer is characterized by complex

geology primarily influenced by glacial activities. In most areas, the sand and gravel of the Mahomet aquifer is overlain by clay rich till providing a cap over the aquifer, while shale or limestone defines the bedrock underlying the aquifer. The inherent complexity of the buried MBV system is mostly challenging in characterizing the framework of the Mahomet aquifer. Over the past decades, Prairie Research Institute (PRI) scientists have invested vast resources to improve understanding of the MBV system. Despite many scientific studies, to a great extent, the large parts of the Mahomet aquifer, particularly its boundaries and its detailed characteristics are still unknown. To address long-term, multiscale water quantity, quality and management issues, PRI scientists use advanced geophysical mapping technologies to create improved geological models of Mahomet aquifer distribution, geometry and character. This work aims to investigate the geometry and geological characteristics of the Mahomet aquifer at Chatsworth, IL (outside the aquifer boundaries) and Paxton, IL (inside the aquifer boundaries), Illinois. Using integrated geophysical methods can provide high-resolution subsurface information for both shallow and deep subsurface. We are going to present results from both airborne (HTEM) and ground based (WalkTEM) transient electromagnetic method (TEM), and electrical resistivity tomography (ERT). The ERT method provides detailed characteristics of the aquifer up to a depth of 100 m. Lateral changes in facies and discontinuous zones of high resistivity sand and gravel were identified within the investigated depth. HTEM and WalkTEM mapped the low-resistivity signature of the clay-rich materials from the high resistivity sand and gravel aquifer material at even greater depths (~250 m). The result shows thick package of high resistivity (≥100Ωm) sand and gravel at depths greater than 100 m within Chatsworth, which is consistent with information for sand and gravel within the Mahomet aquifer, supported by well log data. These results have implications on the current aquifer boundary, indicating that in some areas, the aquifer may extend further than previously thought.

Time 13.00

Abstract Title HYDROMECHANICAL IMPACTS OF ROCK LAYER HETEROGENEITY ON POROELASTIC DEFORMATION AND FLUID FLOW IN GEOTHERMAL FIELDS: A 3D FINITE-ELEMENT MODELING APPROACH

Presenter Ganiyat Shodunke

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Abstract Text

Pore pressure changes due to the geomechanical interaction of reservoir rocks with circulating fluids can induce ground deformation with rates of mm to cm per year, especially during geothermal operations. Geophysical observations of deformation in major geothermal fields, e.g., North Brawley and Salton Sea, California, often rely on simplistic homogenous structural models to interpret subsurface pressure sources and fluid flow. However, rock layer heterogeneity (i.e., different rock physical properties for reservoir rocks and confining rock units) can control fluid movement and fluid-rock interactions, affecting subsidence and uplift in these areas. Here, we investigate the impacts of layered structural variations in

geothermal fields in terms of porosity, permeability, confining rock thickness, and compaction on the total magnitude and temporal evolution of poroelastic deformation and pore pressure. We use a finite-element modeling approach and design 3D layered numerical models exploring these geologic scenarios under a constant production rate. To model deformation under compaction, we use Athy's law with a compaction coefficient of 0.31 km^{-1}. For the effect of confining rock thickness on surface deformation, we investigate scenarios including shallow vs deep confining rock unit configurations. The porosity and hydraulic conductivity of simulated geothermal systems range from 2% to 40% and 10-6 m/s to 10-10 m/s, respectively. Our results suggest the influence of layered heterogeneity on poroelastic deformation and pore pressure modeling is significant, with steady-state rates of deformation and pressure change differing by up to 40% compared to a homogeneous model scenario. We show that permeability has a greater influence than compaction-influenced porosity on the magnitude and time evolution of subsidence and pore pressure in a geothermal setting. Our results have broad implications in guiding our efforts to better combine high-resolution surface and subsurface observations and understand and predict the hydromechanical behavior of complex reservoir structures within geothermal fields.

Time 3:00 – 4:50 PM [14]

Abstract Title IMPORTANCE OF USING FINITE FAULT GEOMETRY IN EARTHQUAKE SOURCE MODELS

Presenter Elizabeth Sunday

Organization Iowa State University, Department of the Earth, Atmosphere, and Climate

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Abstract Text The uncertainties arising from earthquake-source-model studies, such as the choice of a model to simulate slip distributions, have not been well constrained. Determining the effect of various heterogeneous slip distributions on ground motions is necessary for the accurate prediction of earthquake hazards. Here, we quantify such uncertainties based on how earthquakes behave in nature. Some models assume that the k-square slip distribution will produce the omega-square spectral shape of radiation. These assumptions are based on a point-source geometry and an instantaneous fault motion. To test them, we use the representation integral of elasticity, which allows us to isolate the important physical parameters of faulting and their effects on the entire relevant frequency range. By applying a kinematic approach, we can prescribe a finite-fault geometry considering a non-instantaneous fault motion. This approach reveals variations in the slopes of the spectra generated by the k-square slip distributions varying between -6 and -3.5. This contrasts with the expected slope of -2 resulting from the omega-square spectral shape. Our findings further reveal that the finite geometry of the fault plays the role of the kappa filters that are needed to generate the high-frequency decay of the seismic spectra observed in nature. We use density plots to visualize the slip distributions across the fault plane, revealing heterogeneity. Our results help to constrain the choice of fault properties to produce realistic seismic spectra in earthquake-source studies.

Time	3:00 – 4:50 PM [15]
Abstract Title	INTEGRATING A VELOCITY-MODEL ASSISTED DEEP LEARNING CALIBRATION AND SEISMIC TOMOGRAPHY TO THE MIDDLETON PLACE/SUMMERVILLE SEISMIC ZONE, SOUTH CAROLINA
Presenter	Oluwaseyifunmi Adeboboye
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Abstract Text	The exact location and orientation of the fault source contributing to the ongoing microseismicity near the Middleton Place/Summerville Seismic Zone (MPSSZ) and its connection to the August 31, 1886, Mw ~7 Summerville earthquake in South Carolina remain unclear. In this study, we investigate the local crustal structures and stress distribution beneath the MPSSZ using stress inversion and seismic tomography from continuous waveforms recorded by an eight-station temporary network in 2011-2012, four permanent regional stations, and a combined network of nineteen L22 temporary short-period and nodal stations from 2021-2024. We begin by preciously detecting seismic phase arrivals using deep learning (DL) and template matching on unanalyzed seismic waveforms from 2022 – 2024, integrating them with previous analyses from 2011-2012 and 2021 – 2022. Preliminary evaluation metrics of conventional and our fine-tuned DL seismic phase pickers on 238 events (>2000 true picks) reveal significant misclassification of the pronounced S-P conversion from ~3km Atlantic Coastal Plain as either S or P phases. This highlights a challenge in applying DL models in a new study region with limited data and labels. To address this, we employ a combined workflow of phase association and 1D velocity model-assisted deep learning approach to optimize and validate our arrival time results. This approach aims to minimize errors in both our location estimates and Vp/Vs velocity inversions. Following this, we plan to relocate all microseismicity based on differential arrival times and invert for the crustal velocity structure using methods such as double-difference tomography. We expect these efforts to reveal velocity anomalies that closely correlate with seismicity and focal mechanisms solutions, thereby providing a reliable a priori model for future joint tomography studies with ambient noise cross-correlations and other geophysical measurements in the region.

Time	3:00 – 4:50 PM [16]
Abstract Title	INVESTIGATING SHALLOW SUBSURFACE WITH RESISTIVITY
Presenter	Keiralyn Thomas
Organization	Fort Valley State University

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Co-Authors Aditya Kar
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Abstract Text Geophysical techniques are powerful tools used in various fields such as geology, archaeology, environmental studies, and civil engineering to investigate subsurface properties without the need for excavation. This research was conducted as part of a summer internship program at a HBCU, Fort Valley State University in middle Georgia to train six undergraduate STEM majors in geophysics. These abstract aims to provide an overview of one of the geophysical methods, resistivity that the students were introduced to using both theoretical and hands-on data gathering with equipment followed by using a software to analyze the collected data followed by interpretation of the analyzed data. Electrical methods measure the ability of the earth's subsurface materials to conduct electrical currents. The electrical conductivity of rocks and minerals varies depending on their composition, moisture content, and temperature. Using the basic principle of Ohm's law V = I R, where V=Voltage, I=Electrical Current, and R=Resistance; resistivity surveys measure the electrical conductivity or its inverse resistivity of subsurface materials. By injecting electrical currents into the ground and measuring voltage differentials, resistivity surveys provide valuable information about subsurface lithology and fluid distribution. Materials with high resistivity impede the flow of electric current, whereas materials with low resistivity allow current to flow more easily. To conduct a resistivity survey in the field, electrodes are inserted into the ground and an electric current is passed between them. The potential difference is measured between other pairs of electrodes. The apparent resistivity is calculated and variations in resistivity can provide information about the subsurface. Resistivity plays a crucial role in subsurface investigations by providing valuable information about geological structures, material properties, and potential hazards. Integrating these techniques can offer comprehensive understanding of the subsurface environment and enhance decision-making in various applications. We identified an area on the campus of Fort Valley State University to carry out the research. We began by measuring out a straight-line length of 112 meters. 56 electrodes were inserted along this straight line, carefully inserting 1 electrode every 2 meters to cover the measured 112 meters line. We connected the resistivity cables to each electrode which were then connected to the SuperString and a battery. Using the SuperSting R8 Resistivity Meter, two configurations, Dipole-Dipole and Wenner were used to collect data. ResIPy software was used to analysis the data, which formed clear images of the conductivity, where the field training commenced. The resistivity data indicated that there was a high level of resistivity being shown in three main areas.

Time 3:00 – 4:50 PM [17]

Abstract Title MODELING HYDROGEN RELATIVE PERMEABILITY IN TIGHT GAS SANDSTONES

Presenter Deborah Agbamu

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Abstract Text

Storing hydrogen in the subsurface such as in aquifers and depleted oil and gas reservoirs emerges as a viable long-term solution for renewable energy. Therefore, accurate modeling of hydrogen relative permeability, k_{rh}, is essential for reliable simulation and performance predictions of underground hydrogen storage at reservoir scales. To model k_{rh} in low-permeability formations (18 tight gas sandstones from Texas), we assumed hydraulic and molecular flow as the two primary mechanisms influencing the movement of hydrogen gas. We combined concepts of effective-medium approximation and percolation theory from statistical physics with a crossover between the two at some gas saturation, S_{hx}. More specifically, we applied the universal power-law scaling from percolation theory at lower hydrogen saturations near and above the critical hydrogen saturation, S_{hc}, and scaling law from the effective-medium approximation far above the S_{hc} near $S_h = 1$. We found that the S_{hc} and S_{hx} ranged from 0.17 to 0.47 and 0.79 to 1.00, respectively. We also estimated the k_{rh} via the Parker et al. (modified van Genuchten-Mualem) model. Our results showed that the k_{rh} estimated by our proposed model was lower than that estimated using the Parker et al. (1987) model. Large values of S_{hc} determined from the mercury intrusion capillary pressure (MICP) measurements in this study are most probably because of low-porosity and low-permeability of the tight gas sandstones ($4.3\% < \phi < 8.9\%$ and $0.001\text{mD} < k < 0.04\text{mD}$).

Time

3:00 – 4:50 PM [18]

Abstract Title

POST-STACK SEISMIC INVERSION, SEISMIC ATTRIBUTE ANALYSIS, AND MACHINE LEARNING FOR GEOLOGICAL CARBON STORAGE IN THE GULF OF MEXICO

Presenter

Silas Adeoluwa Samuel

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Abstract Text

Global temperatures are rising, indicating climate change driven by industrial greenhouse gas emissions. These emissions, particularly carbon dioxide, contribute to polar ice melting, flooding, and ocean acidification. Despite these deleterious impacts, global energy demand continues to grow with population increase. To mitigate these effects, geologic carbon storage has been proposed. This method involves storing carbon in depleted oil and gas reservoirs. These sites may also be suitable for hydrogen storage, potentially leading to cleaner energy solutions. This study focuses on Block 118 of Mississippi Canyon in the Gulf of Mexico as a potential storage site. Salt tectonics have significantly altered this area over time, presenting challenges for carbon storage exploration. The region's numerous geologic faults add complexity, potentially serving as either structural traps or leakage points for stored carbon. This study employs post-stack seismic inversion to map spatial variations in key reservoir properties, including porosity. The workflow integrates seismic attributes and machine learning techniques to identify seismic facies and outline geological features like faults, which may compartmentalize reservoirs in the study area. This approach can be applied to other complex fields globally, especially those with limited well log data. The

findings may also prove valuable for exploring alternative energy sources, particularly hydrogen storage in geological reservoirs. This dual application enhances the project's relevance, addressing both current hydrocarbon exploration needs and future clean energy storage possibilities.

Time 3:00 – 4:50 PM [19]

Abstract Title RAIN RATE ANALYSIS AND RAIN ATTENUATION PREDICTION FOR 5G COMMUNICATION LINKS IN HOUSTON, SOUTHEAST TEXAS.

Presenter Emmanuel Ibekwe

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Abstract Text

Millimeter wave (mm-Wave) technology represents a significant advancement in wireless communication, promising to revolutionize mobile data transfer speeds. As the demand for 5G networks grows, understanding the impact of environmental factors such as rain attenuation on signal quality is crucial, especially in regions prone to heavy rainfall and hurricanes like Southeast Texas. Recent events, such as Hurricane Beryl, highlight the importance of this study. Currently, 5G systems are being widely deployed to support applications such as autonomous vehicles, smart cities, telemedicine, and high-speed internet services. This study investigates rain attenuation at 28 GHz and 36 GHz frequencies, essential for 5G communication links in Southeast Texas, using both measured data and predictive models. Analysis of rainfall rates during hurricanes and rainstorms were conducted to understand the variability and intensity of precipitation. Rainfall data were sourced from the National Weather Service (NWS). A terrestrial microwave link with a path length of 0.2 km was established in Houston. Both transmitter and receiver operated at 28 GHz and 36 GHz frequencies. Five rain attenuation prediction models (ITU-R, revised Moupfouma, revised Silva Mello, Abdul Rahman, and Lin models) were analyzed. Analysis revealed that all five models predicted rain attenuation values of less than 1 dB and 11 dB for 28 GHz and 36 GHz frequencies, respectively. These findings provide valuable insights for 5G network designers, emphasizing the need to account for rain impairments in Southeast Texas. Understanding rain attenuation effects is essential for the efficient design and deployment of 5G networks in regions susceptible to heavy rainfall and hurricanes. This study will aid network designers in mitigating rain-induced signal loss to ensure reliable communication in this region.

Time 3:00 – 4:50 PM [20]

Abstract Title RAPID AUTOMATED DISCERNMENT OF EARTHQUAKE SEQUENCES IN THE MEXICO SUBDUCTION ZONE: QUICKLY DISTINGUISHING SWARMS FORM MAINSHOCK-AFTERSHOCK SEQUENCES FOR TAILORED FORECASTING

Presenter Sharif Coker

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Co-Authors	Mike Brudzinski, Wilnely Ventura-Valentin Miami University, Oxford, OH
Abstract Text	A key feature of earthquakes is their tendency to cluster in space and time. The most well-known example of seismic clustering is a mainshock-aftershock sequence (MSAS), but earthquake swarms are another primary type of clustering. Short-term operational earthquake forecasting based on changes in earthquake activity has become more commonplace over the past decade, but different strategies are needed for forecasting MSAS vs. swarms. A new methodology for the automated identification and characterization of swarms and MSAS was recently developed and applied to seismicity in the Mexican subduction zone. This methodology integrated five quantitative characteristics based on the different laws to discern between swarms and MSAS. In this study, we investigated how well this automated discernment can determine the type of sequence within only five events to see how well the technique could be used to discern which type of forecasting strategy should be used. Using this characterization on the first five events, we found that swarms were identified with 95% accuracy, and MSAS were recognized with 78% accuracy. When evaluating the 5 characterization components individually, most had an 80% accuracy or better, but we found that the seismicity decay rate component did a remarkably poor job, discerning less than 10% of MSAS accurately. This reduction in accuracy is predominantly influenced by the incompleteness of aftershocks in the immediate aftermath of the mainshock that inhibits an accurate detection of the seismicity rate due to lost smaller magnitude events. Additionally, the component focused on the timing of the maximum magnitude saw a 22% decrease in accuracy for MSAS when restricted to the first five events, due to the impact of only a few foreshocks on the order of when the mainshock occurred in a short sequence. To examine the applicability of our technique, we evaluated how long it would take to get to five events in a sequence based on our catalog, considering that the USGS typically switches from aftershock forecasting to swarm forecasting within 24 hours. Out of the 677 sequences, 54% exhibited at least five events within a 24-hour timeframe. The median time to reach this threshold was 26 hours for swarms and 20 hours for MSAS. These results indicate that our approach would provide useful, timely guidance for decision-making regarding forecasting.

Time	3:00 – 4:50 PM [21]
Abstract Title	RESONANT RESPONSES TO PLANETARY NORMAL-MODES REVEALS SOME SECRETS OF SATURN'S C-RING
Presenter	Victor Afigbo
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Co-Authors	Matthew Hedman University of Idaho, Moscow, ID Philip Nicholson, Maryame El Moutamid Cornell University, Ithaca, NY
Abstract Text	Spiral density waves are features in Saturn's rings generated by mean-motion resonances whose detailed morphology depend on local ring properties. These resonances can be with either orbiting satellites or the planet's own internal vibrations, and waves generated by both types of resonances can be found

throughout the C ring (the innermost part of Saturn's main rings). Using data from Cassini's VIMS instrument and a linear density wave model, we performed a comprehensive analysis of the spiral waves found throughout the C ring. This work documented how the surface mass density, mass extinction coefficient and viscosity and particle size vary across the ring, revealing a number of interesting trends that probably reflect variations in particle properties and dynamics across this ring.

Time	3:00 – 4:50 PM [22]
Abstract Title	SPATIAL VARIATIONS IN SURFACE HEAT FLUX DURING STAGNANT-LID CONVECTION: APPLICATIONS TO VENUS AND OTHER ROCKY PLANETS
Presenter	Raven McRae
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Co-Authors	

Abstract Text

The global tectonic regime operating on Venus today is not well constrained. While Venus clearly lacks a global network of plate boundaries like on Earth, it also may not be in a purely stagnant-lid regime, either. Flexural profiles in some regions match subduction zones on Earth, indicating the possibility of limited, local scale subduction on Venus. Furthermore, estimates of lithospheric thickness and heat flux show heat fluxes in some regions that are higher than would be expected from stagnant-lid convection. However, even during stagnant-lid convection there are significant spatial variations in surface heat flux owing to regions impacted by upwelling plumes and those above downwellings departing the base of the stagnant lid. To rule out a stagnant-lid regime on the basis of heat flow estimates therefore requires a thorough analysis of the spatial variations in heat flux resulting from convection in this regime. We use two-dimensional models of mantle convection in a stagnant-lid regime to systematically explore surface heat flux variations. We vary the Rayleigh number (Ra), which influences the vigor of convection, and the Frank-Kamenteskii parameter controlling the strength of temperature-dependent viscosity. We also test the effect of heating mode by varying the internal heating rate. Surface heat flux variations are then analyzed after models reach statistical steady state, tracking the spatial average as well as minimum and maximum surface heat fluxes. We explore how heat flux variations scale with the key model parameters and assess whether the amplitude of heat flux variations seen on Venus can be explained by stagnant-lid convection. Our results provide insights into the underlying geodynamic processes governing planetary heat distribution and mantle dynamics on Venus and other rocky planets.

Time	3:00 – 4:50 PM [23]
Abstract Title	SUBSURFACE INFRASTRUCTURE DETECTION
Presenter	Claudia Shepphard
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Co-Authors Aditya Kar
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Abstract Text The Fort Valley State University's GeoPATHs Summer Internship provided six STEM undergraduate students with practical, hands-on field training and research in conducting geophysical data acquisition and analysis at Fort Valley State University, Georgia. This training utilized technologies such as Resistivity and Ground Penetrating Radar surveys. The program also included lectures from Penn State University, University of Wyoming, and Georgia Tech. Coding classes were provided by EarthScope and Miami University of Ohio, focusing on Python, Seismic Analysis Code (SAC), IRIS DMC, and Linux. Additionally, the internship facilitated exploration of graduate schools and their qualifications. The program also incorporated AGI and EarthScope Geoscience career modules and service-learning components, where we taught STEM summer program students (ages 6-13) about rock and mineral classifications. Through this experience, students gained a comprehensive understanding of various geophysical methods, coding, and career pathways in geoscience. This abstract focuses on the resistivity methods of geophysical surveys, which include a non-invasive way of visualizing the earth's shallow subsurface. Participants selected an area on the campus of Fort Valley State University's Quad area between the Academic Learning Building and Wildcat Commons 5 and 6 (dorms). We chose a straight line spanning 112 meters. Utilizing the SuperSting™ with Swift™ automatic and IP system, 56 electrodes were planted in a straight line over 112 meters, with a current transmitted through each electrode for 45 minutes. They also participated in workshops on seismology and data visualization, enhancing their ability to use cutting-edge scientific instruments and state-of-the-art software (ResIPY) for data interpretation. The collected data were analyzed using ResIPY software, providing detailed representations of subsurface conductivity. This resistivity method enabled the effective identification and characterization of subsurface features, offering insights into the physical and chemical properties of the Earth's surface. The findings from this internship highlight the importance of hands-on training in resistivity methods for STEM education. By equipping students with practical skills and research experience, the GeoPATHs program contributes to the development of future geoscientists and enhances their readiness for advanced studies and careers in geoscience.

Time 3:00 – 4:50 PM [24]

Abstract Title ULTRASONIC P- AND S-WAVE VELOCITY MEASUREMENTS IN THE SUBSURFACE CHARACTERIZATION OF THE MISSISSIPPIAN CARBONATE RESERVOIR ROCKS

Presenter Matilda King

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Abstract Text Good quality reservoir characterization is crucial for the development, monitoring, and management of reservoirs and optimizing production. Previous studies have shown that 50% of oil in carbonate reservoirs remains unrecovered due to waterflooding inefficiencies, largely because of complex geological and

petrophysical heterogeneity. Basic reservoir models and flow-simulation programs have proven inadequate in predicting performance. Understanding the elastic properties, especially acoustic and elastic impedances, is essential for interpreting the seismic reflection data in relation to petrophysical and stratigraphic aspects of a hydrocarbon reservoir.
This study aims to determine the elastic properties of rocks by using ultrasonic measurements obtained in the laboratory to estimate P- and S- wave velocities and calculate elastic moduli such as acoustic and elastic impedances, Young's modulus, bulk modulus, and Poisson's ratio. Core plugs obtained from the Kansas Geological Survey, for Wellington Field of Kansas, were subjected to overburden pressure using the Canver hydraulic press during ultrasonic measurements of propagating waveforms for P- and S-waves. The GCTS CATS Ultrasonic system was utilized to emit P and S waves, and first arrival times were recorded to calculate wave velocities and elastic parameters.

To assess the impact of different fluids on rock velocities, a fluid replacement experiment has been conducted using oil and brine at varying proportions—fluids commonly found in the Mississippian of the Wellington field. Fluids will be injected into core samples using a vacuum pump, and P and S wave velocities will be remeasured. This study sheds light on the potential of utilizing seismic attenuation as a fluid-diagnostic seismic attributes, particularly in the case of CO2-based enhanced oil recovery (EOR) or CO2 sequestration applications through enabling a fluid replacement modeling workflow

Time	3:00 – 4:50 PM [25]
Abstract Title	URBAN TRAFFIC MONITORING USING DISTRIBUTED ACOUSTIC SENSING (DAS)
Presenter	Lawrence Arthur
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Abstract Text

An essential part of individual life is transportation. Traffic data has become an important manifestation of societal activities, and to some extent, social patterns. In particular, changes in traffic due to external factors occur at broad time scales, from minutes or hours to days and years (holidays and road constructions). The spatial pattern is multi-scale, ranging from state-wide highway networks to local streets, business centers then to residential areas. Multi-scale continuous traffic monitoring at high spatial and temporal resolution is critical for detailed understanding of social patterns. To better monitor and manage traffic, a variety of technologies have been applied in the last decades, from stationary sensors and onboard GPS systems. However, there are limitations on these processes used to better understand traffic volume, such as coarse temporal or spatial resolutions, data bias and missing data.

Distributed acoustic sensing (DAS) is an emerging technology that may be employed to overcome the above limitations to improve traffic monitoring. DAS converts a standard single-mode optical fiber into an array of distributed sensors that can detect tiny vibrations from earthquake shaking vehicles moving to constructions. In this study, we connected a Silixa interrogator to campus fiber around Texas A&M main campus from August 2023 to January 2024. The fiber route goes through the central part of campus to the student housing area. By employing seismic data processing techniques, we geolocate DAS channels and identified fiber segments associated with different business and residential areas. Preliminary analysis of moving vehicle detection shows daily and weekly patterns. In addition to moving vehicles, we also identify segments associated with pedestrian crossings and a local airport. We will analyze the multi-type of traffic patterns, and assess factors that drive the patterns, such as game day, construction, university holiday, or weather events. Moreover, we will link the passive sensing results (from the DAS array) with mobility data from cell phones to further understand what factors drive social activity patterns. This is a timely and critical study to innovatively leverage DAS technology for real-time transportation activity monitoring.

Time 3:00 – 4:50 PM [26]

Abstract Title ADVANCED NOISE REDUCTION AND UPSCALING OF FIELD HYPERSPECTRAL SIGNALS TO SATELLITE SCALE

Presenter Mohammed Braimah

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Abstract Text Using satellite technologies for change detection and soil properties minimizes cost- and labor-intensive traditional methods while improving high efficiency. Ground truthing enables verification and dependency of satellite observations and ensures continuous enhancement of satellite products. Problems such as spectral similarity, mixed pixels, and multicollinearity have been identified in notable remote sensing approaches such as representative wavelength or band ratios that affect the accuracy of satellite-based estimations. The present work presents the results of transformations that minimize noise in hyperspectral signals and match them with multispectral satellite observations. The study applied the remote sensing spectral decomposition approach including interpolations of reflectance from 1 nm to 10 nm, first derivatives, and principal components to reduce the signal-to-noise ratio. The cutting-off bands between 1351-1420 nm, 1800-1940 nm, and 1481-500 nm from the raw hyperspectral signals enabled a direct comparison and matching with Sentinel 2 using the standardized scaling factors. The upscaled 1-1500 nm field-collected hyperspectral signals generated 12-band Sentinel 2 multispectral signals that can be used for precise ground truth verification. The first derivative of hyperspectral signals isolated unique signals and samples, making it easier to identify abnormalities. The component loadings of the varimax rotated principal component analysis generated a sum of clean signals that can improve change detection estimations. The results of the upscaled satellite observations facilitate direct comparison of satellite data with field data. The

results are significant for strong ground truth verification of satellite signals and precise satellite estimation of soil, its properties, plants, and change detection.

Time 3:00 – 4:50 PM [27]

Abstract Title GNOMES: A SHORT-TERM CRITICAL ZONE GEOPHYSICS PROGRAM TO RECRUIT, RETAIN, AND FOSTER COMMUNITY FOR MINORITIZED EARLY UNDERGRADUATES IN GEOSCIENCES

Presenter Yannie Donaldson

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Abstract Text The Geophysics of the Near Surface an Outdoor Motivational Experience for Students or GNOMES program was designed to recruit, engage, and retain racially and ethnically minoritized students early in their undergraduate experience into geoscience. This goal is enacted by introducing a diverse group of students, early in their postsecondary education, to the geosciences through an inclusive experiential learning field experience that builds community amongst the participants. The program focuses on critical zone geophysics field work to engage students in geoscience concepts. Throughout the two-week summer program, students work in teams to address research problems in critical zone science and build geoscience and professional skills. This paper presents the results from the first three years of the GNOMES program (2018, 2019, and 2022), during which time 47 participants and 8 mentors were engaged in the program 80% of whom were from racial and ethnic backgrounds minoritized in geoscience. Here we present the program design, the impact of the program on student participants, and discuss the successes and pitfalls in the program. Finally, we provide advice and suggestions for ensuring the successful implementation of similar programs. We conclude that GNOMES surpassed its goals and highlights how such programs can broaden participation in Geosciences.

Time 3:00 – 4:50 PM [28]

Abstract Title INSPIRING THE FUTURE QUEENS OF PALEONTOLOGY

Presenter Candice Nikki Simon

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Abstract Text Dinosaur National Monument (DINO) hosted two separate day camp opportunities for Girl Scouts around the US in the summer 2022 and 2023, for

ages ranging from 5-16 years old. The Girl Scouts had the opportunity to explore the natural wonders of DINO up close and personally, using scientific tools and techniques. These camps involved both in-class opportunities and field trips around the monument. The young women who participated in these camps were able to work alongside paleontologists and science communicators to learn more about the geologic history of the park, how fossils are excavated, how large dinosaurs were and how fast they were moving by analyzing tracks, made their own fossil replicas, and more! These lessons included the study of anatomy, geology, stratigraphy mapping, and fossil exploration, with visits to important paleontological sites such as the Carnegie Dinosaur Quarry Hall. These multi day camps provide a safe environment where these young women can ask questions and develop hands-on skills. Investing in the futures of these young women places them on a journey to become community leaders and to better understand the scientific process.

Time 3:00 – 4:50 PM [29]

Abstract Title MAPPING THE IMPACT OF GENTRIFICATION ON HEAT VULNERABILITY IN THE CITY OF BALTIMORE, MARYLAND

Presenter Victoria Clegg

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Abstract Text

Climate change has led to a significant increase in the frequency and severity of extreme heat events, posing a substantial threat to urban populations. According to the EPA, the frequency of heat waves in major U.S., with the average heat wave exceeding local thresholds by 2.3°F in the 2020s. Cities such as Baltimore are particularly vulnerable to heat stress due to the urban heat island effect, resulting in higher temperatures in urban areas than in their non-urban surroundings. Vulnerability to the heat hazard is not evenly distributed, with marginalized populations, including low-income individuals and people of color, often bearing a disproportionate burden. Furthermore, cities worldwide are investing and implementing climate resistance to mitigate and adapt to current and future severe heat events. However, there is a significant concern that the most vulnerable population may be excluded from these environmental amenities through the recent phenomenon known as green gentrification. In this study, we analyze and map the impact of the spatial patterns of heat vulnerability in Baltimore, one of the top 20 cities in the US with the highest urban heat land intensity and one of the seven U.S. cities accounting for nearly half of all gentrification in the U.S. between 2000 to 2013. Leveraging satellite data products and sociodemographic databases we conduct an in-depth analysis of observed changes and trends in high-risk heat vulnerability spaces within Baltimore from 2000 to 2020. Our preliminary results indicate a correlation between rising property values, lower land surface temperature (LST), and an increasing White demographic. Conversely, the African American demographic shows an opposite trend. Additionally, between 2000 and 2020, as the minimum, maximum, and mean LST increased, the White demographic has become more concentrated in fewer areas of Baltimore. Meanwhile, the African American demographic has been steadily moving away

from the city's central, more urbanized areas. Our study aims to contribute to a better understanding of how gentrification impacts heat inequity, with implications for public health and policy initiatives to mitigate heat-related vulnerabilities in marginalized populations.

Time 3:00 – 4:50 PM [30]

Abstract Title TRAINING OF UNDER-REPRESENTED MINORITY STEM MAJORS AT A HISTORICALLY BLACK COLLEGE / UNIVERSITY (HBCU) WITH GROUND PENETRATING RADAR (GPR)

Presenter Saniyah Brown

Organization Fort Valley State University

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Abstract Text

Fort Valley State University (FVSU) is a rural HBCU in middle Georgia, where regional challenges caused by poverty and inequity contribute to minimal production of STEM graduates from the local communities who are ready to meet the workforce challenges and needs of the 21st century. It has been reported in the literature that increasing the number and types of opportunities that provide individual undergraduate students with authentic, career-relevant experiences lead to growth in both student engagement and retention in the STEM pipeline. Fort Valley State University (FVSU) secured funding from the National Science Foundation and developed the GEOPAths Summer Internship Program to provide students with hands-on job-related experiences. One such experiences the students receive is with geophysical techniques such as Ground Penetrating Radar (GPR). Ground Penetrating Radar (GPR) uses energy waves in the microwave band, ranging in frequency from 1 to 1000 MHz and works by a transmitter emitting a pulse into the ground and a receiving antenna recording the returning echoes that result from interaction of the pulse with subsurface objects. The GPR system has software that translates the varying signals into images of the objects in the subsurface. This process is used to map man-made objects such as structures and utilities buried in the ground. Six FVSU STEM majors were selected to participate in the summer internship program. The interns using a GPR spend a day in the field collecting data. First a suitable location was identified on the campus of FVSU; this is the quad area between the ACL building to the north and dormitory building (WC 5 and 6) to the south. A team used a 500 MHz antenna and delineated 10 meters by 10 meters with spacing between each line being 5 meters. Thus, to cover the entire 100 square meters area, 9 north-south and 9 east-west transects were identified. The antenna was mounted on a pushcart and moved along each of these 18 transects. As the pushcart moved along a transect it transmitted radar pulses. The system then measured the amplitude of the returning signal over time, and the signal traces were displayed on a digital recorder and stored for analysis. EKKO software was used to analyze the collected data to visualize the subsurface. This project helped the interns gain valuable job related and computing skills for employment upon graduation.

Time 3:00 – 4:50 PM [31]

Abstract Title

RAINSTORMS AND REFUGEES. CLIMATE CHANGE-RELATED FLOODING OUTCOMES FOR VULNERABLE COMMUNITIES OF NORTH CAROLINA.

Presenter

Zed Bates

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Abstract Text

When we acknowledge environmental and racial violence in history and understand how communities of racial minorities have been disadvantaged, and when we fully understand the threat of the catastrophic effects of climate change to be entangled with the fate of the vulnerable, our resources compel us, as a society and as scholars, to mitigate the profound suffering and potential displacement caused by fossil fuels. We explore the consensus among predictive regional climate models and interpret the ways in which flood-causing severe storms would change before the next century; past (1981-2021) observations from FEMA already show great increases in flooding disasters in some socially vulnerable counties of NC. We place these storms within the context of historical environmental injustices and show how increased flooding risk could exacerbate the vulnerability of NC communities. Specifically, we concentrate on 9 NC counties that meet the criteria for the CDC Social Vulnerability Index and their susceptibility to heightened flooding due to heavy rainstorms, aiming to inspire targeted actions and policies that prioritize and protect the well-being of these folks.