SESSION #3A
CHAIR: Dr. Ryan Jones

Space Science Policy

Thursday, Oct. 24, 2019
4:00 – 5:30 pm

Papers:

1.) **Barriers to Entry (And Re-entry): A Comparative Analysis of Launching Practices Between the US, Canada, and Mexico**
By Matthew Contursi, Arizona State University and Timiebi Aganaba, Arizona State University

2.) **US Public Preferences in Geoengineering Research Funding and Governance**
By Leah R. Kaplan, Arizona State University and John P. Nelson, Arizona State University

3.) **Influence of Solar Magnetic Activities on Rainfall and Surface Air Temperature in West African Sub-region**
By Esther A. Hanson, University of Nigeria, Nsukka; Francisca N. Okeke, University of Nigeria, Nsukka; and Dean Pesnell, National Aeronautics and Space Administration (NASA)

4.) **Air Forces Southern Partnerships with South America**
By Zoja Bazarnic, US Department of State; Lt. Col. Eric Alonsobernal, U.S. Air Force; and Tyrone Barbery, U.S. Air Force

Paper # 1

Barriers to Entry (And Re-entry): A Comparative Analysis of Launching Practices Between the US, Canada, and Mexico

*By **Matthew Contursi**, Student, School for the Future of Innovation in Society, Arizona State University and **Timiebi Aganaba**, PhD, Assistant Professor, School for the Future of Innovation in Society, Arizona State University*

Keywords: spaceports; launch; dispute resolution; comparative analysis; stakeholder theory

Abstract: Commerce in space has become a robust activity, with investors seeding $3.25 billion USD into space company startups in 2018. Yet before any ship reaches the stars, they all start the same way: in a field on a launch pad. How a private actor can gain access to those launch pads varies. Within the US, the Federal Aviation Administration (FAA) regulates launches and re-entry. Since SPD-2, the FAA has issued a NPRM attempting to streamline these regulations as well as update them to include communication about the payload and encryption; this inclusion is in contention. However, in Brian Israel's theory of Space Law, this is a typical situation of **Space Law 2.0,** where negotiations of space treaties are between a state actor and its own private sector. **Space Law 3.0,** however, would be an environment entirely of private cooperation, raising its own challenges for dispute resolution and access. To help clarify what that path towards private cooperation may be, this article will take a comparative approach to the policies of the FAA's recent NPRM in full and explore how it may impact collaboration in space as well as seek to apply stakeholder theory to these spaceports and see who the stakeholders are and how policy should be structured accordingly. Policies within the US will be compared to Canada's and Mexico's as they are nations with nascent to medium space capabilities. This comparison is vital in elucidating how the status as a middle power space state affects the decision-making process and how states evolve to bigger space actors.

Paper # 2

US Public Preferences in Geoengineering Research Funding and Governance

*By **Leah R. Kaplan**, Program Specialist, Consortium for Science, Policy and Outcomes, School for the Future of Innovation in Society, Arizona State University and **John P. Nelson**, Graduate Research Associate, School for the Future of Innovation in Society, Arizona State University*
Keywords: Geoengineering, public deliberation, science policy

Abstract: Sustainable Development Goal 13 calls for urgent action to combat climate change and its impacts. In light of continued emissions mitigation failures, geoengineering, i.e., intentional large-scale manipulation of Earth's climate, has been increasingly forwarded in expert discourse as potential means to reduce climate change impacts. As more geoengineering research projects—including outdoor field trials--are proposed, we assert an increasing need for broad public engagement on this controversial and globally impactful issue.
Prior geoengineering public engagement work has been limited, primarily focusing on geoengineering methods and research design over funding or governance. Recognizing this gap, our team has hosted two deliberative public forums on geoengineering research conduct, funding, and governance, engaging diverse local populations in Boston, MA and Phoenix, AZ. These forums elicited feedback relevant to three critical audiences in the geoengineering landscape: researchers, funders, and governing bodies. Our forum outputs, which include rich data on public preferences regarding geoengineering research funding and governance, can support thoughtful and publicly oriented discourse and policy decision making regarding future climate change research and action to support SDG 13.

Paper # 3

Influence of Solar Magnetic Activities on Rainfall and Surface Air Temperature in West African Sub-region

*By **Esther A. Hanson**, Chief Scientific Officer, Advanced Space Technology Applications Laboratory, NASRDA, University of Nigeria, Nsukka; **Francisca N. Okeke**, Professor of Physics, University of Nigeria, Nsukka; **Dean Pesnell**, Project Scientist, Solar Dynamics Observatory, National Aeronautics and Space Administration (NASA)*

Keywords: Sunspot Number; Galactic Cosmic Rays; Neutron Monitors.

Abstract: Using the facilities at NASA Goddard Space Flight Center, Greenbelt, Maryland USA, we analyzed galactic cosmic ray (GCR) particles recorded by Neutron Monitors (NM) at Thule, Newark, Mc Murdo and South Pole, which are hosted at Bartol Research Institute, University of Delaware, USA. We adopted a time-series [1960 – 2012] analyses of smoothed GCR from the four NM stations, Sunspot Number (SSN) obtained from the Royal Observatory of Belgium, Brussels; Surface Air Temperature (SAT) and Rainfall data of selected West African Countries namely Nigeria, Niger Republic, Mali, Mauritania Cote D'Ivoire and Guinea obtained from the HadCRUT-4 project of Climate Research Unit of University of East Anglia, United Kingdom. During the period under investigation (1964-2016) sunspot number (SSN) fluctuation followed an eleven-year pattern encompassing the 5 solar cycles, with magnitudes oscillating between 10 and 250 at solar minima and maxima respectively. During solar minima, GCR intensities maximized with values ranging from above 8000 counts in solar cycle 21 and 7800 counts in cycle 24. At solar maxima in cycle 22, GCR recorded a low of about 5500 counts whereas SSN peaked at 250. SSN and GCR amplitudes are out-of-phase; with an anti-correlation coefficient of -0.3. The amplitudes of GCR in all the four NM stations were in phase with each other. The time-series trend of GCR normalized to the mean values show peak values at solar minima and vice versa for all the four NM Stations, namely South Pole Mc Murdo, Newark and Thule. In Northern Hemispheric polar regions in the Arctic NM station at Thule much higher GCR flux penetrate the earth's magnetic field in the magnitude of 4600 counts, which is in sharp contrast to GCR intensities recorded at a high latitude station in Newark (USA), where GCR flux peaks at mere 3600 counts. At the Antarctica region, GCR peaks at 13,000 and 10,000 in South Pole and Mc Murdo respectively. Surface Air Temperature variations were out-of-phase with the Rainfall variations, with a significant negative correlation coefficient of -0.5. Negative, but significant correlations existed between SSN and Rainfall in Nigeria, Guinea and Cote D' Ivoire with coefficients -0.64, -0.58 and -0.9 respectively. Positive, weak and insignificant correlations existed between SSN and SAT in the entire West African sub-region with coefficients ranging

from 0.041 to 0.003. The Regression Equations show negative slopes for GCR and SAT coupling in all the selected countries in the West African sub-region; affirming that the correlation between GCR and SAT is negative. This implies that as GCR increases at solar minima, SAT decreases accordingly during the same period. Similarly, as GCR decreases during solar maxima, SAT increases accordingly. Since geomagnetic field modulates GCR incidence on Earth and our results confirm that GCR is positively and strongly correlated with Rainfall or precipitation, we therefore, conclude that geomagnetic fields contribute to climate change.

Paper # 4

Influence of Solar Magnetic Activities on Rainfall and Surface Air Temperature in West African Sub-region

*By **Zoja Bazarnic**, Foreign Policy Advisor to the Commander, US Department of State; **Lt. Col. Eric Alonsobernal,** 12 Air Force/Air Forces Southern Plans and Requirements, Strategy, and Assessments; and **Tyrone Barbery**, 12 Air Force/Air Forces Southern Plans and Requirements Deputy Division Chief*

Keywords: Partner, Training

Abstract: The role of diplomacy and science are bound together in the mission of Twelfth Air Force (Air Forces Southern). Air Force Southern, the air component for the U.S. Southern Command throughout the Caribbean, Central America, and South America, partners with 31 states to bolster security throughout the Americas. Southern Command charges the Armed Forces to strengthen regional and inter-agency partnerships, counter threats, and building our institutions that carry out the mission to improve relations in the Western Hemisphere. The objectives are accomplished through joint exercises; exchanges of practices by technical experts; supporting the Department of State, to include the U.S. Agency for International Development in humanitarian assistance disaster relief (HA/DR) missions; and uniting with ally nations to counter transnational criminal organizations and illicit activities.