

Report
*Americas Conference on Solar Radiation Modification:
Science, Governance and Implications for the Region*
University of the West Indies, Kingston, Jamaica
24-25 August 2022



THE UNIVERSITY OF THE WEST INDIES
ORIENS EX OCCIDENTE LUX



Ministry of Science,
Energy and Technology

Contents

Presentations	3
Day One	3
Day Two	3
Acronyms	4
SRM - Solar Radiation Modification	4
Introduction	5
Proceedings Day One	6
Opening Session	6
Session One: Introduction to SRM: Concepts and Definitions	6
Climate Change, solar radiation modification and governance: A scientific challenge for the Americas, Dr Paulo Artaxo and Dr Thelma Krug	6
Session Two: Overview of Current State of SRM Research	9
Reflecting Sunlight, Dr Douglas MacMartin	9
Current State of SRM Research, Dr Kate Ricke	10
Discussion in plenary - Dr Steven Kendall	11
Session Three: Global Views	12
Building the capacity of developing countries to evaluate SRM, Dr Andy Parker	12
SRM views from Pakistan, Bilal Anwar	12
An overview of African SRM research, Dr Chris Lennard	13
Session Four: Views from the Americas	14
Americas Conference on Solar Radiation Modification: Science, Governance and Implications for the Region, Dr Marcos Regis da Silva	14
South American climate response to solar radiation modification, Dr Inés Camilloni	15
Day One Closing Discussion	15
Proceedings Day Two	16
Opening Session	16
Session Five: How Climate Change is affecting the livelihoods of Jamaicans, Ms Ashley Codner and Mrs Farrah Murray	16
Session Six: Risks of overshoot vs risks of SRM, Dr Ines Camilloni	17
Discussion in plenary, Ms Alia Hassan	18
Session Seven: Outdoor experiments and SCoPEX Overview	19
Outdoor experiments and SCoPEX Overview, Dr Frank Keutsch	19

SCoPEX Governance, Dr Shuchi Talati	19
Plenary Discussion, Dr Frank Keutsch & Dr Shuchi Talati as Moderators	20
Session Eight: How SRM can help: an optimal climate strategy (if the world were rationally governed), Dr Ted Parson	20
Discussion in plenary, Ms Alia Hassan	21
Session Nine: SRM policy - US developments, Dr Shuchi Talati	21
Session 10: Building regional collaboration on SRM	22
Conference Concluding Discussion: Where do we wish to be in 10 years and how do we get there?	22
Plenary Discussion	23
Closing Session	23

Presentations

Day One

- [Climate Change, solar radiation modification and governance: A scientific challenge for the Americas - Dr Thelma Krug and Dr Paulo Artaxo](#)
- [Reflecting Sunlight - Dr Douglas MacMartin](#)
- [Current state of SRM research - Dr Kate Ricke](#)
- [Overview of Current State of SRM Research - Dr Steven Kendall](#)
- [Building the capacity of developing countries to evaluate SRM - Andy Parker](#)
- [An overview of African SRM research - Dr Chris Lennard](#)
- [Americas Conference on Solar Radiation Modification: Science, Governance and Implications for the Region - Dr Marcos Regis da Silva](#)
- [South American climate response to solar radiation modification - Inés Camilloni](#)

Day Two

- [How Climate Change is affecting the livelihoods of Jamaicans - Ms Ashley Codner and Mrs Farrah Murray](#)
- [Using a risk-risk framework to guide research and support decision making on the use or non-use of solar radiation modification - Dr Ines Camilloni](#)
- [Outdoor experiments and SCoPEX Overview - Dr Frank Keutsch](#)
- [SRM Governance lecture - Dr Ted Parson](#)
- [SCoPEX Governance & U.S. Policy Developments - Dr Shuchi Talati](#)

Acronyms

C2G- Carnegie Climate Governance Initiative

CDR- Carbon Dioxide Removal

CO₂- Carbon Dioxide

DOE- United States Department of Energy

DMF- Degrees Modelling Fund

GDP- Gross Domestic Product

GHG- Greenhouse Gas

IAI- Inter-American Institute for Global Change Research

IPCC- Intergovernmental Panel on Climate Change

MCB- Marine Cloud Brightening

NGO- Non-government organisation

NOAA- National Oceanic and Atmospheric Administration, United States Department of Commerce

NSF- National Science Foundation (United States)

OSTP- Office of Science and Technology Policy

SAI- Stratospheric Aerosol Injection

SCoPEx- Stratospheric Controlled Perturbation Experiment

SRM- Solar Radiation Modification

STeP- Science Technology Policy Fellow

TWAS- The Academy of Sciences

UWI- University of the West Indies

Introduction

This document has been prepared by the Degrees Initiative, the Carnegie Climate Governance Initiative (C2G) and the IAI Directorate in collaboration with the co-organizers of the meeting.

The Americas Conference on Solar Radiation Modification: Science, Governance and Implications for the Region, was held from 24 to 25 August 2022 at the University of the West Indies, in Kingston, Jamaica.

The meeting was hosted by the Government of Jamaica and organised jointly by the Carnegie Climate Governance Initiative of the Carnegie Council for Ethics in International Affairs (C2G), the Degrees Initiative (formerly the SRM Governance Initiative), the Inter-American Institute for Global Change Research (IAI) and the and the University of the West Indies (UWI), with the support of the U.S. National Academies of Sciences, Engineering, and Medicine (NASEM).

The objectives of the meeting were to introduce the concept of Solar Radiation Modification (SRM), present current and possible science, including research in the Americas, offer views from other regions and describe efforts at establishing governance at the international level. Organisers to the meeting stressed that they held neutral views on whether SRM should ever be used and how it should be governed and shared the belief that a broader and inclusive conversation in the region is needed.

Accordingly, the meeting would not be submitting policy recommendations to the Parties.

The meeting was chaired by Dr. David Smith, Coordinator of the Institute for Sustainable Development of the University of the West Indies and member of the IAI Science-Policy Advisory Committee.

Participants

The following Parties to the IAI attended the meeting: Brazil, Canada (via videoconferencing), Chile, Colombia, Dominican Republic, Guatemala, Jamaica, Panama, Peru and Uruguay.

The list of participants attending the meeting can be [found here](#).

The Conference provided Spanish and English simultaneous interpretation services. Additionally, the programme is available in both languages; Annex 1 (English); and Annex 2 (Spanish). All presentation slides are available via the [IAI website](#).

Proceedings Day One

Opening Session

The opening session was addressed by Dr David Smith, Director for the Centre of Environmental Management, who introduced the Honourable Daryl Vaz, Minister of Science, Energy and Technology, H. E. Lasford Douglas, Ambassador of Panama to Jamaica and Prof Aldrie Henry-Lee, Pro- Vice-Chancellor, Graduate Studies and Research at the University of the West Indies.

The Honourable Daryl Vaz, Minister of Science, Energy and Technology opened the meeting and, in his address, thanked participants for their participation. He emphasised the need for multilateral cooperation to meet challenges related to climate change and its impact on small island developing states. He continued by noting that preconceived notions should be put aside in discussions related to solar radiation modification (SRM). He closed by wishing participants a successful meeting.

H. E. Lasford Douglas, Ambassador of Panama to Jamaica thanked the organisers for the invitation to address the meeting. He spoke on the need for greater regional collaboration, particularly given the challenges posed by climate change. He stressed the need for greater discussion at the regional level on the possible benefits and dangers of SRM. He closed by thanking the University of the West Indies for its warm welcome.

Prof Aldrie Henry-Lee, Pro- Vice-Chancellor, Graduate Studies and Research at the University of the West Indies, in thanking the organisers and participants, noted the importance of the meeting. He spoke on the urgency of research related to climate change and on the need to understand the issues underpinning SRM.

On conclusion of the addresses, the Chair introduced panel members and key organisers of the event: IAI Executive Director, Dr Marcos Regis da Silva, Dr Andy Parker, CEO of the Degrees Initiative and Ms. Alia Hassan, Outreach Officer for the Carnegie Climate Governance Initiative (C2G). Participants to the conference were then invited to introduce themselves by name, organisation and country.

Session One: Introduction to SRM: Concepts and Definitions

Climate Change, solar radiation modification and governance: A scientific challenge for the Americas, Dr Paulo Artaxo and Dr Thelma Krug

During the first session of the meeting, Dr Paulo Artaxo, Professor of Applied Physics, University of São Paulo, presented on the current context of the global climate situation. He opened by highlighting how modern studies in the field of SRM are minimal. He stated that science should be looking towards the most crucial questions regarding possible and

unintended side-effects. Dr Artaxo then provided a brief history on past inclusion of SRM in the climate change conversation, emphasising the role of the [Intergovernmental Panel on Climate Change \(IPCC\) AR6 report](#) in bringing higher global awareness on the topic.

He continued by discussing future projections and the human influence of rising global emissions, highlighting how greenhouse gas warming is partly masked due to aerosol cooling. He outlined the likelihood of a future scenario of a three-degree temperature rise. This would be varied regionally, but would have large impacts on ecosystems and change in precipitation, which would have large impacts on agriculture. Simulations have now been done on flooding at the three-degree scenario, which show 39 times higher frequency of extreme weather events.

Dr Artaxo stated that physical interactions between four of the key climate tipping elements are already under stress today due to anthropogenic global warming: Greenland and West Antarctic Ice Sheets, Atlantic Meridional Overturning Circulation, and the Amazon rainforest. He concluded his half the presentation by reflecting on the importance of carbon emission and methane reduction. Increased urgency and action need to occur, and the IPCC needs to be aware of available options in all sectors (energy, land use, industry, urban, building and transport) that can contribute to halving emissions by 2030.

Dr Thelma Krug, Vice Chair of the IPCC, gave the second half of the presentation and focused on SRM in current climate discussions and the findings of the IPCC report. She stated that researchers are investigating deliberate large scale climate intervention options that are studied as potential supplements to deep mitigation. SRM is not a climate mitigation option as it does not address the problem. That is, SRM options aim to offset some of the warming effects of greenhouse gas (GHG) emissions by modification of the Earth's shortwave radiation budget. SRM contrasts with climate change mitigation activities, such as emission reductions and carbon dioxide removal (CDR), as it introduces a 'mask' to the climate change problem by altering the Earth's radiation budget, rather than attempting to address the root cause of the problem, which is the increase in GHGs in the atmosphere. By masking only the climate effects of GHG emissions, SRM does not address other issues related to increase in atmospheric CO₂ concentration, such as ocean acidification. Dr Krug then addressed key questions outlined in session one of the agenda (Annex 1).

She stated that there is growing interest in SRM due to its potential to offset some effects of increasing GHGs on global and regional climate. However, side effects are not yet fully understood, the implication of application has not yet been fully researched. SRM is viewed as controversial due to low confidence in our understanding of the climate response to its application, specifically at the regional scale; risks of a sudden and sustained termination of SRM in a high-emissions scenario such as SSP5-8.5 would cause a rapid climate change. She addressed the risk of moral hazard, as well as the risk of political pressure for a quick decision on SRM when the potential implications are still unclear.¹

¹ Moral hazard is when one party has the opportunity to assume additional risks that may negatively affect other parties. The decision is based not on what is considered 'right' but what provides the highest level of benefit.

Dr Krug outlined how the use of SRM would create its own risks and would only make sense in a world experiencing or expecting severe and immediate climate change impacts. As such, consideration of SRM takes place in a risk–risk context (whereby the risks of deploying SRM are assessed against the risks associated with rising temperatures). Considering the impacts of SRM in isolation can be misleading, as it should be considered alongside other climate response options. She then emphasised that the assessment of SRM needs to enhance our understanding of potential effects across a multitude of socially relevant parameters, rather than a single one.

Dr Krug then reflected on the work of the IPCC and SRM. Overall, it is very likely that abrupt water cycle changes will occur if SRM is abruptly initiated or halted, especially in tropical regions.² There is low confidence in projected benefits or risks to crop yields, economies, human health or ecosystems. Large negative impacts are projected from rapid warming for sudden and sustained termination of SRM in a high-CO₂ scenario. SRM would not stop CO₂ from increasing in the atmosphere or reduce the resulting ocean acidification under continued anthropogenic emissions.

She continued by noting that SRM is at best a supplement to achieve climate goals and cannot be the main policy response to climate change. Its effects will only last as long as it is maintained. The plausibility of SRM is highly contested, and not all scenarios are equally plausible because of socio-economic issues. Depending on the focus of a limited climate model simulation, SRM could look grossly risky or highly beneficial.³ Solar radiation modification could drive abrupt changes in the water cycle. The impact of SRM is spatially heterogeneous, will not fully mitigate the greenhouse gas-forced water cycle changes, and can affect different regions in potentially disruptive ways.

Dr Krug then stated how if SRM was used to cool the planet, it could reduce plant and soil respiration; Slow the reduction of ocean carbon uptake due to warming; Enhance global land and ocean CO₂ sinks; And slightly reduce atmospheric CO₂ concentration relative to unmitigated climate change. SRM would not stop CO₂ concentration from increasing in the atmosphere or affect the resulting ocean acidification under continued anthropogenic emissions. Dr Krug concluded the joint presentation by highlighting the IPCC's Sixth assessment report WG2, Chapter 6, pages 16-84, stating that the more intensive the deployment, the more potential environmental risks there are with each scenario presenting different levels and distributions of SRM benefits, side effects, and risks.⁴ If emissions

² IPCC (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY. WG1 Chapter 8, section 8.6.3, page 1151. Available from: <https://www.ipcc.ch/report/ar6/wg1>

³IPCC (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge University Press., pf 16-84. Available from: www.ipcc.ch/report/ar6/wg2/

⁴ The scenarios are: (1) Early substantial mitigation with no SRM (2) More limited or delayed mitigation with moderate SRM (3) Unchecked emissions with total reliance on SRM (4) Regionally heterogeneous SRM.

reductions and CDR are deemed insufficient, SRM may be seen by some as the only option left to ensure the achievement of the Paris Agreement's temperature goal by 2100.

Session Two: Overview of Current State of SRM Research

Session two was split into three presentations that connect to the theme of the current state of SRM research. The first presentation was delivered by Dr Douglas MacMartin, Senior Research Fellow, Sibley School of Mechanical and Aerospace Engineering, Cornell University on 'Reflecting Sunlight'. Presentation two was made by Dr Kate Ricke, Assistant Professor, Climate Sciences, Scripps Institution of Oceanography and School of Global Policy and Strategy, University of California on 'Current State of SRM Research'. The third presentation was by Dr Steven Kendall, Program Officer, U.S. National Academy of Sciences, Engineering, and Medicine who continued presenting an overview of the current SRM research.

Reflecting Sunlight, Dr Douglas MacMartin

Dr Douglas MacMartin focused on the earth modelling of SRM. He defined SRM methodology as a way of cooling the planet by reflecting the sun. The default strategy on climate change to date has been focused only on cutting carbon emissions. While this is essential, reduction of emissions under the Paris agreement are insufficient and may lead to three degrees of warming. No current economic models provide solutions to stabilize at two degrees without massive amounts of carbon removal. Due to the lack of current strategies on reducing significantly carbon emissions, four options are available in some combination: a) accept higher temperatures, b) cut emissions more aggressively, c) massive CO₂ removal, and d) solar geoengineering. He then highlighted how if 1% of sunlight was deflected from the earth's surface, it would offset rises in temperature to date.

The two main strategies of SRM under discussion are stratospheric aerosol injection (SAI) and marine cloud brightening (MCB). When comparing the two, SAI is better understood as it has a clear observational analog which provides a basis for climate modelling, whereas MCB needs small experiments to understand underlying physics. SAI is more inherently global where MCB could be applied at a regional scale. Additionally, there are different potential side-effects and public acceptance levels.

Dr MacMartin stated that there are currently no standardised models, but that climate models show better temperature control and precipitation levels with SRM. However, when it comes to understanding the effects on ecosystems and agriculture, it gets harder to measure and less certain. Dr MacMartin also highlighted that results depend on the latitude of deployment which will result in different risks and emphasised that the set of models that can evaluate regional impacts is currently minimal.

Currently there are no aircraft with the required technology for SRM deployment as they would have to reach an altitude of 70,000 feet, with a cost in the tens of billions per year. According to Dr MacMartin, the risk of rogue actors or governments deploying SRM is minimal because it would take an estimated five years of planning to develop such an aircraft. He reminded participants that SRM could have environmental impacts such as ozone loss and acid rain

deposition, as well as risks from a societal dimension. Currently there is relatively limited research, most of which is mainly published from developed countries, and is researched through academic interest rather than mission-driven objectives.

To conclude, Dr MacMartin outlined the direction which would be most beneficial when going forward with SRM research. He stated that more research needs to be done that will assess the risk, develop scenarios, improve projections in order to understand what deployment might look like. These all need to be integrated with the human dimension and the research needs to be from global perspectives.

Current State of SRM Research, Dr Kate Ricke

Dr Kate Ricke then took the floor, stating that SRM research is a new field in comparison to wider climate research, with the vast majority of papers on SRM being published in the last ten years. Most of this research is in the physical sciences. She then introduced her 'sandwich' framework on earth systems science, comprising earth system science at the centre, in between scenarios and assumptions at the top and impact assessment and interpretations at the bottom.

Dr Ricke continued by stating that it is the 'climate context' that will affect SRM outcomes. Decisions about SRM deployment would be made by a wide variety of actors with differing motivations and under differing climate, geopolitical, and societal conditions. At least three types of scenarios have been commonly discussed in this regard:

1. 'Peak shaving' in which mitigation efforts are having a positive effect but are not sufficient enough to prevent an "overshoot" of temperature goals to limit global mean temperature increase.
2. Emission reductions and large-scale adaptation are underway, but there is no reliance on carbon dioxide removal (CDR). In this context SRM deployment is considered to slow the rate of temperature rise, with the goal of securing more time for adaptation (Irvine et al., 2019; Keith and MacMartin, 2015; MacMartin et al., 2014a). Current projections of peak temperatures, expected impacts, and the timescale for adaptation would influence considerations of how or if SRM might be utilised.
3. Efforts for meaningful mitigation, CDR, and adaptation have been insufficient, and SRM is considered as an emergency response to reduce risks caused by rapidly accelerating temperature rise. This scenario is characterised by the need for indefinite and ever-increasing levels of SRM, with significant unmitigated direct harms from rising CO₂ concentrations (e.g., ocean acidification), and growing risk of unintended side effects from intensifying SRM deployment.

Differing political contexts and scenarios will also affect decision making. An example could be the involvement of deliberative action through a globally representative body or agreement that would address social and governance concerns and provide the most resilient foundation for research activities or sustained deployments. But there may also be scenarios in which regional coalitions or groups of state actors act autonomously, or even scenarios involving a lone actor, perhaps not even representing a sovereign nation, attempting unilateral deployment.

Dr Ricke then highlighted a number of ethically salient questions that are raised by SRM research: Is intentional manipulation of the climate morally permissible? How to determine the goals of geoengineering? Is just, fair, and equitable SRM possible? How should geoengineering be governed? How will mitigation, adaptation, and geoengineering interact from an ethical perspective? She then referred to the terms 'moral hazard' and 'slippery slope'; Moral hazard as the idea that SRM might undermine mitigation efforts and slippery slope being an assumption that research leads to the acceleration of eventual deployment.

Formal SRM impact assessments looking at how climate impacts can be reduced while global temperatures are also reduced are currently limited. SRM looks at how impacts are reduced while global temperatures are also reduced, however modern science is yet to get accurate results as impact models are limited. There have been less than ten formal studies on the impact of SRM on agriculture and human health, and all have had varying results. Risk-risk assessments would identify the risks posed by climate change without SRM versus the risks of climate change with SRM deployment.

Dr Kate Rick ended her presentation by discussing the conclusions outlined in the Reflecting Sunlight Report.⁵ She stated that current scientific understanding of SRM is limited and has an insufficient research basis for informing decision making. There are no coordinated or governance systems in place. The goal of academia/SRM research is to characterise and reduce uncertainties and must be both transdisciplinary (across physical, social, humanities research) and international.

Discussion in plenary - Dr Steven Kendall

This session was an opportunity for participants to ask further questions to both Dr Ricke and Dr MacMartin. From these discussions both presenters highlighted the risks and uncertainties of SRM. Dr MacMartin focused on how deployment decisions would be dependent on what happens on climate change, while Dr Ricke stated the need to expand earth system science for better decision making and more impact assessment which gives greater legitimacy.

Both presenters also spoke about the need for SAI to be a global approach and further research on governance aspects of SRM needs to be conducted from different perspectives, currently the majority of SRM research is from the US. They compared SAI to MCB, stating that MCB is much less complicated as it has the potential to be implemented by individual countries. However even with global approaches there is the capacity for unequal outcomes. Dr Ricke said there are many factors to consider, but everyone needs a seat at the negotiation table and those most affected should have a stronger voice in the conversation.

⁵<https://nap.nationalacademies.org/catalog/25762/reflecting-sunlight-recommendations-for-solar-geoengineering-research-and-research-governance>

Session Three: Global Views

This session outlined SRM research from the global south. Specifically, The Degrees Initiative, an organisation that funds scientists from developing regions, as well as Dr Chris Lennard, University of Cape Town, and Bilal Anwar, Director of the National Disaster Risk Management Fund, Pakistan.

Building the capacity of developing countries to evaluate SRM, Dr Andy Parker

Dr Parker, Degrees Initiative, began by discussing SRM as a global issue and how climate vulnerable countries, particularly in the Global South, are at most risk. He then presented information on his organisation the Degrees Initiative that has been working for over a decade to build the capacity of developing countries to evaluate SRM. In particular, he outlined how they build expertise and create a well-informed global community of experts to debate this controversial idea. He emphasised his neutral approach to SRM, stating his organisation believes more research is necessary for informed decisions and wider global conversation is needed if people are to make equitable decisions.

The Degrees Initiative was launched in 2010 as the SRM Governance Initiative (SRMGI), a response to the Royal Society's seminal *Geoengineering the Climate* report and partnership between Environmental Defense Fund (EDF), the Royal Society, and The World Academy of Sciences (TWAS). In 2018 Dr Parker launched the Degrees Modelling Fund (DMF- formally known as DECIMALS) and it is the world's first international SRM research fund and the first aimed exclusively at developing countries. The grant has received more than 75 applications and independent peer review recommended 11 projects. He has now funded SRM research in Argentina, Jamaica, Benin, Ivory Coast, South Africa, Kenya, Iran, Bangladesh, Indonesia, and the Philippines. The teams have independence to design their own research questions and methodologies. They work collaboratively with each other, and with a group of research collaborators from the Global North who volunteer their time to work with the teams.

Dr Parker stated that The Degrees Initiative is currently expanding through a second call for physical science proposals and the future launch of a social science SRM research programme.

SRM views from Pakistan, Bilal Anwar

Mr Bilal Anwar, CEO of the National Disaster Risk Management Fund in Pakistan, presented on the current context of climate change and SRM understanding in Pakistan. He started by outlining the establishment of the National Disaster Risk Management Fund by the Pakistan government in order to invest in interventions for a more resilient Pakistan against the increase in natural disasters as a consequence of climate change.

Mr Anwar then stated that Pakistan has seen dramatic increases in extreme weather and is highly vulnerable to monsoons and flash flooding. With the increase in climate disasters in the last seven months, over half of Pakistan now is flooded. He stated that adaptation is the

primary focus, followed by mitigation efforts. SRM is not well understood and is at the early research stages within academia. The current research reflects the international as opposed to the domestic context.

Mr Anwar stated that the possibility of an overshoot scenario reflects the need for the research to be facilitated in both Pakistan and the wider South Asia region, as the region would face similar impacts from SRM. Mr Anwar concluded by stating that discussions need to begin on these new technologies as part of adaptation strategies by looking at best practices from around the world and customising them regionally. There are large research gaps, the level of understanding in the countries is still at the early stages and they need to be addressed going forward.

An overview of African SRM research, Dr Chris Lennard

Dr Chris Lennard of the Climate System Analysis Group and Professor from the University of Cape Town presented an overview of African SRM research via the video conferencing platform, Zoom. Dr Lennard began his presentation by stating that impact is a function of risk. He reflected on the IPCC Sixth Assessment WGII Report, Chapter 9 (Africa) where a response layer has been added to risk. What has been observed in the African region is 1.1 degrees of average temperature rise.

Due to the increase of temperature, the increase of impacts follows. Africa is facing widespread losses and damages including reduction in food production, decreasing economic outputs, losses in biodiversity and rising morbidity/mortality rates. Additionally there are the projected impacts: above 1.5°C is high risk which would see large regional agricultural losses, increase in poverty and inequality, higher exposure to diseases, rises in drought and heat related deaths. If temperatures rise above 1.5°C it would be very high risk. This would create widespread crop yield loss, widespread heat-related mortality, 7-18% African species at risk of extinction, over 30% decline in fisheries catch potential and severe risks of malnutrition.

These risks suggest that Africa needs to focus on adaption, but this has many barriers especially in regard to finance and research. Globally only 3.8% of climate change research has been spent on Africa since 1990, with majority funding going to either the European Union or the United States. Dr Lennard stated that due to The Degrees Initiative more research can be developed on SRM implications in the African region. Thanks to their Degrees Modelling Fund (DMF) six papers specifically on African contexts have been released and another seven will be released in the next year and a half. He said that it is crucial more funding initiatives like this occur as funding is currently the biggest barrier. Internally countries have greater immediate issues to address (e.g., rising unemployment rates). However, with further research there will be greater awareness on such issues in the region.

Dr Lennard finished his presentation with an open floor for questions. Among the questions asked were whether there was any push-back from policy makers on his SRM focus. He answered saying that there has not been any push back from the government, but as climate change becomes more prominent, he is well prepared to contribute more. This led to a question on local funding, and whether South Africa will contribute more in the future or will

it continue to rely on NGOs like The Degrees Initiative or funding mechanisms. Dr Lennard replied stating that the current focus is on adaption research rather than climate intervention, but hopes this will change in the future.

Session Four: Views from the Americas

Americas Conference on Solar Radiation Modification: Science, Governance and Implications for the Region, Dr [Marcos Regis da Silva](#)

Dr Marcos Regis da Silva, Executive Director of IAI opened this session. He outlined the history of IAI as a treaty organisation between 19 governments in the Americas. The purpose of the IAI is to promote regional cooperation for transdisciplinary research on aspects of global change related to the sciences of the earth, ocean, atmosphere, and the environment and to social sciences, with particular attention to impacts on ecosystems and biodiversity, socio-economic impacts, and technologies and economic aspects associated with the mitigation of and adaptation to global change. The *Agreement establishing the Inter-American Institute for Global Change Research* directs the IAI to function as a regional intergovernmental organization that promotes interdisciplinary scientific research and capacity building to provide the best possible scientific information to policy makers for the development of more effective public policies. The primary objective of the institution is to pursue the principles of scientific excellence, international cooperation, and the full and open exchange of scientific information, relevant to global change.

Dr Regis da Silva then highlighted the problems of traditional models of science to policy. At a regional level it follows a well-defined path, countries identify a problem where solutions must come from regional/international solutions. However, this traditional model of science to policy is under strain. He stated that governance is fragmented resulting in treaty congestion; there are currently more than 900 multilateral and over 1500 bilateral treaties and other international agreements dealing with environmental issues. Dr Regis da Silva suggested most governance treaties have not been fully successful in reaching their objectives He then questioned which international instrument would then be the most appropriate as the umbrella agreement for sovereign nations to discuss challenges posed by Solar Radiation Modification.

Dr Regis da Silva continued by describing the IAI working as a collaborative mechanism to provide its policy makers from the region with the best available scientific information for more informed decision making. This reflects the cooperative and successful regional framework found in Latin America and the Caribbean. The IAI works with ecosystems to identify priorities and provides the context for science and activities. For IAI to be able to deliver its mission, three conditions need to be met: funding of scientific projects, a collaborative multinational approach to identifying and researching an issue, member country involvement through its scientific communities and interdisciplinary and transdisciplinary research.

Dr Regis da Silva concluded by reaffirming Latin America and the Caribbean as offering a unique opportunity for supporting collaborative, multinational effective scientific projects. It

has a well-established network of peers and as a region, it is uniquely effective in the articulation of its needs and in the involvement of its scientists and policy makers in international fora.

South American climate response to solar radiation modification, Dr Inés Camilloni

Dr Inés Camilloni, Associate Professor of the Department of Atmospheric and Ocean Sciences, University of Buenos Aires was the next to present. Her presentation summarised findings from her recent DECIMALS funded paper on the South American hydroclimate response to Solar Radiation Modification using Stratospheric Aerosol Injection (SAI) in comparison to a high emission scenario. Her work analyses terms of changes in mean and extreme temperature and rainfall, and water availability and hydrological extremes in La Plata Basin (LPB), Argentina.

To develop this paper, her research team used GLENS: Community Earth System Model CESM1. The simulations consist of simultaneous SAI using sulphur dioxide at four levels; Historical (1980-2010); Control RCP8.5 (high emission scenarios); Feedback (SAI) and Future. The data showed how temperature is maintained by using SRM over the next 30 years. With high emissions of carbon dioxide outlining a symmetric pattern of rain, the data highlights where rain will increase and decrease. In this scenario of high emissions, we can compare the different zones with different scenarios. For the study's hydrological simulations, Dr Camilloni and her team used VIC: Variable Infiltration Capacity Model, which came from the US and looks at weather data. They used information on soil and vegetation types, using 4 degrees latitude and 4 degrees longitude. Through this they then assessed the streamflow of the Uruguay, Paraná, Iguazú and Paraguay rivers, observing any changes that were projected.

Overall, Dr Camilloni found that relative to the historical conditions (1980–2010), SAI can offset the projected increase in the magnitude of mean and extreme temperatures. The cooling effect of SAI is not spatially homogeneous. The response of SAI on precipitation is not uniform with (for example) an increase in the northern sector of the LPB and a reduction to the south. Precipitation extremes are projected to decrease under the SAI scenario with different magnitudes depending on the location. She also stated that SAI mostly increases mean and extreme flows of the main rivers of LPB. A reduction in the flow variability of the river and less severe drought conditions over the basin are also associated with the SAI scenario. However, this latter advantage could come at the expense of a slightly higher risk of flooding under extremely high flow conditions.

Day One Closing Discussion

Day one of the conference was closed by Dr [Paulo Artaxo](#) and Dr David Smith presenting their perspectives on SRM from both the Americas and the Caribbean. Dr Artaxo stated that research approval in South America needs to transform itself to allow for an increase of funding, especially towards providing more postdoctoral opportunities. He highlighted four

important areas of future research collaboration on SRM: The Amazon region; climate change; democracy; and new sustainable economic systems.

Dr Smith then spoke about the need for detailed research on SRM in the Caribbean, as it is both a climate and economic issue. The Caribbean is dependent on tourism, and if the increase of extreme weather events continues it would have large impacts on GDP. He said that going forward the region needs to have more collaborative discussions and greater knowledge sharing at all levels. Dr Leonardo Clarke from the University of West Indies and DMF funded researcher also added to this discussion. He stated that when conducting SRM research in the Caribbean there are challenges towards resource access as well as a lack of funding.

Dr Regis da Silva then opened the floor for questions. The questioning focused on what is needed for an increase of funding on SRM to occur within the Americas and Caribbean. Dr Artaxo answered by stating that greater calls for proposals from funding agencies within Latin America as well as enhanced collaborations between regions is vital for the future of this research.

Proceedings Day Two

Opening Session

Day two of the conference was opened again by Dr David Smith, who briefly welcomed everyone and gave an outline of the day's proceedings. He then introduced Ms Ashley Codner and Mrs Farah Murray who presented the first session on how Climate Change is affecting the livelihoods of Jamaicans.

Session Five: How Climate Change is affecting the livelihoods of Jamaicans, Ms Ashley Codner and Mrs Farrah Murray

The first half of the session was presented by Ms Ashley Codner, Sustainable Development Specialist at the Planning Institute of Jamaica who focused on climate change and its effects on tourism in Jamaica. She began her presentation by introducing the [Vision 2030](#) document, which contextualises the region's climate vulnerability due to its geographic location. There has been a dramatic increase in extreme weather events and climate projections predict that by the end of the century, Jamaica will see more temperature rises and stronger and more frequent storms. This has already resulted in large costs across the country. Ms Codner stated that Jamaica relies on five key sectors for development: agriculture, health, water and tourism, coastal resources and human settlement. All these sectors will be affected due to the increasing impacts of climate change.

Ms Codner explained that Jamaica's climate response has focused on adaption. This has positive implications as there is now more diversification, new economies and new jobs. She commented on how tourism contributes to 4.2% of Jamaica's GDP. However, this is a largely informal economy so this data may not be accurate, restating that the economic impacts on

tourism could then be much larger. Climate change indices the quality of natural resources and holiday climate index. Contributing factors include the decline of coral reefs, beach erosion, sargassum blooms, poor water quality, hydrometeorological events and increases in temperature. Ms Codner ended her presentation by comparing these effects to Hurricane Ivan as a recent example of a climate event impacting the regional tourism sector. On top of the impacts on natural resources, there was also a significant loss of livelihoods.

Mrs Farrah Hansel Murray, Science and Technology Development Planner at the Planning Institute of Jamaica then took the floor for the second half of the presentation. Mrs Hansel Murray continued from an agricultural perspective. 46% of the population live rurally and agriculture contributes to 8% of the GDP - meaning that climate context plays a central role towards Jamaican livelihoods. The two main climate events are droughts and hurricanes, which collectively have caused massive economic losses. In 2014 approximately 1,600 hectares valued at \$900 million was lost or damaged due to drought and bushfires. In 2007 Hurricane Dean caused 23.8 billion Jamaican dollars worth of damage to the agricultural sector.

Mrs Hansel Murray then presented on Jamaica's agricultural adaption and mitigation strategies. The region is adapting through three key actions; First is by building adaptive capacity. This includes 1800 MICRO check dams, aquaponics, climate smart greenhouses and the procurement and distribution of timber and fruit trees to restore denuded slopes. Second is restoration of degraded watersheds through Integrated Land and Sustainable Landscape Management. And third is the improvement of data through installation of soil moisture probes, automatic weather stations, installation of weather radar tower and Dropller Weather Radar and the State of the Jamaica Climate Volumes I, II, III.

The presentation was concluded by reemphasising the symbiotic relationship between the economy and the environment. Agriculture and Tourism sectors are highly vulnerable to climate change and Mrs Hansel Farah reiterated that Jamaican livelihoods within these sectors have been negatively impacted by recurring hydrometeorological events.

At the end of this presentation both Dr Marcos Regis da Silva and Dr David Smith highlighted the vulnerability of small island states and the importance of their voices within the climate change conversation. The floor was then open to questions, the discussions were centred on the rising numbers of women in the Jamaican workforce and the importance of their involvement in future discussions as well as the current Jamaican perspectives on SRM. Dr Regis da Silva and Andy Parker answered by acknowledging that there needs to be an increase in stakeholder awareness on these issues. Through this more money can be allocated to such research so there is a greater knowledge base when it comes to decision making on SRM.

Session Six: Risks of overshoot vs risks of SRM, Dr Ines Camilloni

This session on the risks of overshoot versus the risks of SRM was the second presentation by Dr Ines Camilloni. She started by stating that climate change poses multiple, interacting

risks to human society and the environment which are expected to worsen with additional warming. Managing these risks requires a portfolio of policy responses - each of these strategies will have different aims e.g., decreasing global temperatures, emission reduction and reducing the rise in sea levels. Dr Camilloni emphasised that not only do we have to address mitigation but adaptation as well, as some impacts could be permanent.

She then introduced the peak shaving diagram that outlined different SRM options in relation to mitigation, adaptation and carbon dioxide removal. These are dependent on emission levels at time of potential deployment. Potential new risks of this technology need to be evaluated if it has potential to be incorporated into climate change strategy. She then stated that evaluation is on the risks of using SRM in a warming world over the risks of not using it. There is a target risk, countervailing risk and non-target risk. The risk measures are magnitude, likelihood, timing, and distribution of consequences. This risk-risk framework would allow us to think beyond the benefits and costs and bring the side-effects further into consideration. It is through this framework that decisions could be made.

Dr Camilloni then presented on side-effects that are being observed within SRM research. Positive benefits include the reduction in frequency and intensity of temperature and precipitation, arctic sea ice and ice sheets melting, sea-level rise, tropospheric ozone and increase in water availability. Potential negative impacts include unintended warming or cooling in some areas, regional precipitation changes, increase in acid deposition, effects on stratospheric ozone, light diffusion and dimming and an increase in salt deposition over land. Additionally, there are wider impacts to be considered including termination shock and interactions with major volcanic eruptions.⁶

Dr Camilloni outlined three illustrative scenarios with regards to policy; peak shaving, high mitigation with some SRM; half warming, with moderate mitigation and some SRM; and half warming, with high mitigation and high SRM. All scenarios assume that SRM is deployed in 2040 when Earth is facing roughly 1.5 degrees of temperature increase. By using the risk-risk analysis, she stated we can attempt to position the risks on a risk matrix to prioritise further investigation. This would enable a more comprehensive analysis on risks to inform any future policy towards SRM.

Discussion in plenary, Ms Alia Hassan

Following Dr Camilloni's presentation the floor was then opened for questions which were coordinated by Ms Alia Hassan, Outreach Officer of the Carnegie Climate Governance Initiative. Most questions were centred on sulphur particles and whether there are any other identified substances that can reduce SRM risks. Dr Camilloni answered that sulphur is currently the only particle we can analyse. She stated that through observations of atmospheric changes when an eruption happens, we see that the sulphur particles stay accumulated. This is due to their genetic makeup - which allows sulphur to remain in the

⁶ Termination shock is the potential risk of SRM being stopped suddenly. There could be a rapid and damaging rise in temperatures.

atmosphere for a long time. Further study is needed however, and current models are hard to finance.

Session Seven: Outdoor experiments and SCoPEX Overview

Session seven was introduced by Dr Andy Parker. He outlined that the format of the following two presentations intends to be an interactive format in which a question will be posed, and participants will have small collaborative discussions before returning the question to the main floor.

Question one: "You have 10 million USD to allocate to climate activities in your country. What amounts do you allocate to mitigation, adaption and SRM? And why?"

Answers varied between representatives from the Global North and Global South. Global South participants placed higher focus on funding towards adaptation, where Global North participants centred on mitigation efforts. Some representatives from the US highlighted that it could go to SRM research since the US has recently allocated a large budget towards mitigation - by comparison 10 million would be a small budget to do exploratory research on SRM.

Outdoor experiments and SCoPEX Overview, Dr Frank Keutsch

Dr Frank Keutsch, Stonington Professor of Engineering and Atmospheric Science and Professor of Chemistry and Chemical Biology at Harvard University was then introduced to present on ethics surrounding outdoor experiments and gave an overview of [SCoPEX](#). He stated that models are used to make predictions on impacts, and currently climate modelling shows significant risk reduction from stratospheric aerosol injection (SAI). However, for accurate results, observations are needed from the field to inform the models. Currently the only sources for information are natural permutations such as volcanic eruptions, thunderstorms, wildfires, as well as some human events like rocket launches. From these we understand that sulphate aerosol changes stratospheric temperature, however it is important to analyse if there are other materials that could reduce risks. Dr Keutsch then outlined SCoPEX as a small-scale example of such an experiment that would be a starting contribution to learning more about the risks and benefits of SAI.

SCoPEX Governance, Dr Shuchi Talati

Dr Shuchi, Scholar in Residence, American University was then introduced by Dr Andy Parker to discuss the governance surrounding an experiment such as SCoPEX. She started by outlining the [independent advisory committee](#) that was formed to create the terms of reference and independently assess risks of the project.

The advisory committee framework was built on five components: engineering integrity and safety; scientific merit review; financial transparency; legal review; and societal review. The advisory committee terms of reference advised Harvard University and the SCoPEX research team on:

- a. The scientific quality and importance of the proposed experiments, including scientific review and processes and standards for transparency;
- b. Risks associated with the proposed research program, including environmental and social risks;
- c. Effectiveness of risk management including regulatory compliance management of environmental health and safety;
- d. The need, objectives and possible formats for stakeholder engagement; and
- e. Other issues as deemed necessary by the Advisory Committee.

Dr Shuchi outlined how the advisory committee was tasked to provide a periodic public written evaluation of the experiment plan in the arenas described above. It also ensures that mechanisms are established to share both research outcomes and governance lessons learned from SCoPEX with researchers and diverse stakeholders.

Plenary Discussion, Dr Frank Keutsch & Dr Shuchi Talati as Moderators

Based on the initially outlined session format, Dr Keutsch and Dr Talati posed two questions to participants for collaborative discussion. Question One asked what more information would be needed for perberbative experiments to go forward? Question two asked if the governance framework on the SCoPEX project was adequate, or whether there are other things to consider?

Participants were invited to break into smaller groups and discuss these questions. After twenty minutes, the discussion was brought back to the moderators who asked for reflections on main discussion points. Answers were centred on controversies that might face the experimentation location. Participants stated that context and the political implications need to be considered. It was also asked whether this could be a global collaboration, rather than a localised one.

Session Eight: How SRM can help: an optimal climate strategy (if the world were rationally governed), Dr Ted Parson

Dr Ted Parson, Dan and Rae Emmett Professor of Environmental Law and Faculty Co-director, Emmett Institute on Climate Change and the Environment, UCLA presented to the conference virtually from California. He began by outlining the potential of SRM as a way of reducing climate risks due to its fast action. However, there are unknown risks with this response such as imperfect climate correction, potential environmental impacts, the undermining of other climate responses, termination shock and governance.

He stated that there are three claims on SRM governance from research and deployment scopes. The first claim is that SRM has high leverage and has global effects, therefore global governance is essential. From a research context on this claim, SRM has potential to cause harm and accordingly global governance becomes essential. Additionally, the deployment angle is ideally yes, due to its high leverage. The second claim is that SRM governance does not presently exist. When applying this to governance research this claim asks whether

governance capacity exists. Deployment on this claim understands that there is no international body at present to make decisions on governing SRM deployment. The third claim is that governance needs are novel and severe and needs a large new capacity. From a research perspective this asks whether governance needs strengthening. Deployment perspectives on this claim is that somebody or a governance body needs to make decisions on this and be aware of all the vast concerns involved. Governance would have to monitor what is being done and respond to unauthorised deployment.

Dr Parson concluded by saying that currently nothing is in place to address these claims. There have been slow responses from governments. He highlighted the creation of the Climate Overshoot Commission (COC) as the only existing body that is taking SRM into consideration.

Discussion in plenary, Ms Alia Hassan

Following Dr Parsons presentation, Alia Hassan, C2G, opened the floor to questions. These focused on the current state of government awareness and why responses have been slow. Dr Parson stated that the primary focus has been on cutting carbon emissions and governments are worried about the potential backlash of this response being seen as a distraction. He said that for awareness to grow, more conferences such as this need to take place. Bodies such as COC where they are exploring options but not making decisions, is essential. Any formal action would be premature, but dissemination of information at all levels is vital in order for growth of understanding the implications of SRM.

Session Nine: SRM policy - US developments, Dr Shuchi Talati

Dr Shuchi Talati, Scholar in Residence, American University, presented for a second time on the current state of policy towards SRM. She began by outlining her newly established NGO called the Alliance for Just Deliberation in Solar Engineering. She then introduced the topic 'SCoPEX Governance & U.S. Policy Developments'. As she outlined in her first presentation in session seven, Dr Talati was part of the advisory committee that was created in order to establish whether SCoPEX should proceed. It was tasked to independently assess risks and benefits through establishing norms for oversight, transparency and public consultation.

She reiterated that the advisory framework was based on principles of engineering integrity and safety, scientific merit, transparency, legal and societal review. After revisiting the committee, Dr Talati discussed current US policy developments and funding from 2020-2022. In 2020, the US Government allocated US\$4 million to the [National Oceanic and Atmospheric Administration](#) (NOAA)'s Office of Atmospheric Research; in 2021 US\$9 million funding was given to NOAA, and in 2022 another US\$9 million was provided. So far this has only funded research. She then provided the paragraph in legislation on this funding allocation. She emphasised the choreographed language that allows it to have several interpretations.

From this funding NOAA is directed to support the Office of Science and Technology Policy (OSTP), in coordination with Department of Energy (DOE) and the National Science Foundation (NSF) and provide a five-year plan with a scientific assessment of solar and other rapid climate interventions in the context of near-term climate risks and hazards. From this,

OSTP has been directed to develop an interagency working group, in coordination with NOAA, NASA, DOE, and other relevant agencies, to manage near-term climate hazard risk and coordinate research in climate intervention. In parallel, the interagency working group has been asked to establish a research governance framework to provide guidance on transparency, engagement, and risk management for publicly funded work in solar geoengineering research.

Meeting Participants were also informed that NOAA has begun baseline studies on the modelling, assessments, observations, and monitoring of stratospheric conditions and the Earth's radiation budget. Studies include observations to understand baseline aerosol conditions in the stratosphere and modelling to simulate and understand the impacts of natural and human-caused aerosol injections, including volcanoes, air and space traffic, and solar climate intervention methods, on Earth's radiation balance, weather and climate patterns, and other Earth systems.

Dr Talati concluded by rhetorically asking the participants what next if the report recommends that the US greatly expand its SRM research program over the next 5 years and what the wider implications could be.

During the ensuing discussion, IAI Parties requested the IAI Directorate to communicate with NOAA to seek more information on possible baseline studies and to ask collaboration under such studies with IAI Parties would be possible.

Session 10: Building regional collaboration on SRM

This session followed on from Dr Talati and was moderated by Dr Marcos Regis da Silva and Dr Paulo Artaxo, it was an open format for participation, feedback and discussion. Dr Regis da Silva opened by asking how improvements can be made for intergovernmental collaboration and how we can strengthen scientific collaboration.

Comments from participants highlighted the importance of inclusive SRM research going forward. This should not only address physical science but governance research as well. Collectively the comments were thanking presenters for the introduction to SRM and bringing greater awareness to such an issue. Dr Regis da Silva stated that the IAI directorate will present a report from the conference to 31st meeting of the IAI Conference of the Parties, to be held in June 2023, in Panama.

Conference Concluding Discussion: Where do we wish to be in 10 years and how do we get there?

In this session Dr Regis da Silva introduced Prof María Inés Carabajal, Professor in Anthropology at the University of Buenos Aires and Dr Anne-Teresa Birthwright, a National Consultant, working with the Tropical Agricultural Research and Higher Education Center (CATIE). Both are Inter-American Institute for Global Change Research (IAI) Science Technology Policy Fellows (STeP) who recently completed their doctorates. This was an

opportunity for early career researchers to provide input on their perspectives. They both individually spoke, and the floor was then open for directive questions.

Prof María Inés Carabajal

Prof Carabajal introduced herself and highlighted her current project on governance and solar radiation modification and decompacting the various layers. She outlined how there is significant lot of focus on climate change but a lack of research on its social and cultural implications. SRM has many ethical dimensions to consider. This includes funding sources, protection of vulnerable communities, and whether it would have global benefits. Prof Carabajal acknowledged her appreciation for the different perspectives from governments and scientists at the conference, stating that this is the first step towards further discussions.

Dr Anne-Teresa Birthwright

Dr Birthwright outlined her research on rural livelihoods in Jamaica, focusing on vulnerability of local farmers to climate change and possible options for adaptation. She stated that the contribution of farmers, although critical, is overlooked in the decision-making process. Her research aims to push the narrative so that producers have equitable access to resources. Dr Birthwright then stated how she is new to the topic of SRM but is concerned about its ethics and the consequences it may have on small island nations. She stated that investment in research is vital going forward, as well as the involvement of diverse stakeholders. Approaches towards SRM research need to be transdisciplinary and consider its risk on other sectors such as health. She acknowledged that the conference is a good first step to starting such dialogues and to further ensure that collaboration takes place where all stakeholders benefit.

Plenary Discussion

The questions from the floor directed to both Prof María Inés Carabajal and Dr Anne-Teresa Birthwright centred on approaches to public opinion and participatory approaches to involve diverse stakeholders. Dr Birthwright stated how she worked on the [Jamaica climate solution document](#), and SRM was not mentioned. She stated that further public awareness on SRM is critical. She said how it is the government's responsibility to bring awareness to SRM, as full transparency on SRM is important to the public. We need to translate the knowledge in a more digestible manner as a potential supplementary approach. Dr Carabajal added that current barriers are research funding in developing nations and further expansion of research beyond physical science is vital.

Closing Session

Dr David Smith presented the closing session. He asked participants if there were any further comments. Mrs [Anna Baldwin](#) from the Degrees Initiative stated how there were a lot of remarks on the importance of social science research in the SRM field, reiterating Dr Andy Parker's comments on the Degrees Initiative plans for specific social science grants. Dr Steven Kendall thanked all who were involved in organising the conference and everyone who participated. Ms [Alia Hassan](#) acknowledged the variety of topics and thanked all who attended. Dr [Marcos Regis da Silva](#) acknowledged David Smith, the University of the West Indies, and

both speakers and participants. He concluded by thanking C2G and the Degrees initiative whose generous financial support made the organisation of the meeting possible.

Dr David Smith concluded the acknowledgements by providing thanks to Naden Sherlock, the Office Manager of the Institute for Sustainable Development of the University of West Indies who assisted with a lot of the organisation of this Conference. He also thanked the researchers from the University of West Indies, the chancellor, pro-vice chancellor, translators and all the participants.

The meeting was closed on 25 August 2022 at 17:30.