



Session 1: From Hazards to Risk

Hazard and Risk for Pacific Atoll Futures

Andrew Jones

Director, Geoscience, Energy and Maritime, Pacific Community

Key Messages:

1. The Pacific needs to build a narrative at a global scale around the 'existential crisis' of climate change that goes beyond the traditional metrics of lives lost and economic damage from disasters. The focus must be on the preservation of cultures.
2. There is a small window for action on climate change in the Pacific. As SLR starts to impact Singapore, London, Tokyo and New York, donor countries will not have the same resources to put into development funds. Developed nations will start to turn their attention to the impacts of climate change in their own countries and economies, and there will no longer be climate financing available for SIDS in the Pacific.
3. It's important to understand the uncertainty in climate change science, and specifically in SLR curves. However, this uncertainty should not prevent people and governments from making decisions in this context but should help them make informed decisions.
4. The impact of SLR on atolls will not be slow and consistent inundation. The current periodic flooding atoll nations already experience through natural cycles of relative sea level, tides and extreme waves, will increase in scale and frequency under higher sea levels.
5. Climate change will result in more than SLR, and the impacts on humans will be compounded. Increased frequency of intense cyclones, ocean warming and acidification, and prolonged drought will affect coastal systems, water supply, food security and human health.
6. Quantitative future scenario modelling can be used to understand the compounded impacts of climate change hazards and risk, which will allow governments and communities to make evidence-based adaptation decisions.
7. There are existing Pacific data, portals and decision-making tools for assessing hazard and risk, which could be built upon to provide tailored solutions for atoll nations in adapting to climate change impacts.
8. There needs to be a paradigm shift in infrastructure investment and decision-making regarding climate change. Previously, decisions were made within individual sectors and then pathways found to climate-proof investments. A more holistic integrated adaptation plan at an island or national level is needed to support infrastructure making. Given that space is the primary limiting factor on atoll development, all planning needs to be based on spatial planning.

Hazard to Risk: Analysis with Purpose

Julien Oliver

Hydro-met Risk Specialist, DHI

Key Messages:

1. Risk quantification requires characterization of hazard intensities and frequencies, human and economic exposure and their vulnerability under varying hazard pressures.
2. Quantified risks support objective decision-making, including the ability to identify segments of the society most at risk and the development of cost-efficient mitigation and response strategies.
3. Regional or national scale risk studies, as done under the Pacific Catastrophe Risk Assessment and Financing Initiative (PACRAFI), can help identify priority intervention needs and define strategic planning, and support financial risk transfer instruments such as insurance.
4. Large-scale risk studies also help generate regionally coherent and consistent primary data to underpin local and detailed risk studies and design interventions.
5. Valuation is key to objectively structure climate change investments plans at the national scale and for the decades to come but should also be considered in concentration with other social and political factors and the uncertainties remaining in current and future prediction.

Hazard to Risk: Multi-hazard Analyses

Ahmed Rasheed,

Director Meteorology, Maldives Meteorological Service

Key Messages:

1. The Maldives experiences meteorological hazards such as heavy rain, flooding, strong winds, squalls, waterspouts, rough seas, swell surges, tsunamis and tropical cyclones. Seismological hazards include earthquakes and tsunamis.
2. From 1987-2015, the Maldives experienced significant natural hazards such as swell surges, flooding, tsunamis, and tropical cyclones which caused significant infrastructure damage and disease outbreaks.
3. There are potential tsunami-genic zones that may continue to affect Maldives.
4. The Maldives has a weather, earthquake and early warning system in place to minimize the impact on human life and property. This consists of manned observatories, automatic weather stations, an upper air observation, weather radar seismometers, tide gauges, satellite picture receiving system and numerical weather prediction models such as the Weather Research and Forecasting model (WRF).

5. Early warning alert messages are then disseminated across various media channels for mass public communication. Recently this has included social media platforms and mobile phone applications.

About the Speakers:



Andrew Jones is currently a Divisional Director within SPC, the principal scientific and technical organization in the Pacific region. Mr. Jones shapes the strategic direction of SPC's Geoscience, Energy and Maritime Division by overseeing and ensuring provision of high quality scientific, technical and policy support for activities across a range of sectors including Resources, Energy, Oceans, Maritime, Water and Sanitation, Disaster Reduction and Climate Change.



Julien Oliver currently leads the development and implementation of consultancies and digital solutions supporting hydro-meteorological disaster risk analysis and management at DHI. He has more than 16 years of experience in hydrological and hydraulic modelling, IT system development, extreme value analysis, hydro-meteorological risk analysis and management, climate change impact assessment, and stochastic modelling. He has supported the development of several risk transfer schemes in the Caribbean, the Pacific, South-East Asia and Latin America.



Ahmed Rasheed is Director Meteorology, Maldives Meteorological Service. His main interest is in the field of Numerical Weather Prediction modeling, Synoptic and Aviation meteorology. Mr. Rasheed has worked with Weather Research and Forecasting (WRF) model and has worked as a Meteorological Observer and Operational weather forecaster. Currently he is overseeing the operational activities of the weather forecasting unit of Maldives Meteorological Service.

Session 2: From Risk to Resilience

The Sea Level Rise Crisis: An Emergency for Atoll Nations

Charles Fletcher

Associate Dean for Academic Affairs and Professor, Department of Earth Sciences, University of Hawai'i and Vice-Chair of the Honolulu Climate Change Commission

Key Messages:

1. Global progress in reducing greenhouse gas (GHG) emissions is falling short of the Paris Agreement. Less than 1% of the global population is in full compliance. Paris targets also constitute less than 1/3 of the reductions needed to stop warming at 2C.
2. For a two thirds (66%) chance to limit warming to 1.5°C from 2018 onward, emissions must stay below 420 Gigatons (Gt) of carbon dioxide (minus an additional 100 GtCO₂ for environmental emissions triggered by warming). In 2018, carbon dioxide emissions rose 2.7% above 2017 to equal 42 GtCO₂/yr. Thus, at current emission levels, to have a 66% chance of limiting warming to 1.5°C, only 8 years of emissions remain.
3. Global energy demand is set to grow more than 25% by 2040. Renewables make up only two-thirds of new capacity. Oil consumption grows due to rising demand for petrochemicals, trucking, aviation, and energy. Carbon dioxide emissions are projected to continue to increase to mid-century. Renewable energy grows rapidly, though it primarily adds to, rather than displaces, fossil fuels. This is roughly equivalent to a mid- to low-level resilient country pathway (RCP) 8.5 pathway, potentially leading to a median emergence time for 4C warming in the decade of the 2080's.
4. Experts conclude there is a 10% probability of global mean sea level rise reaching 2m by the end of the century. On our current emissions path, sea level will exceed 7.5 m by 2200 and 9.7 m by 2300.
5. To plan for resilient atoll communities, we must assume global mean sea level will rise a minimum of 2.5 m above mean higher high water (MHHW) by the end of this century and potentially three or four times that much in the following century. Communities must plan for high temperatures, scarce water resources, stronger storms, higher wave overtopping, and sea level-related flooding such as groundwater inundation, and storm drain back flow, coastal erosion, and combinations of these.

Risk to Resilience: Maldives

Mareer Mohamed Husny

Assistant Director

Climate Change Department, Ministry of Environment, Maldives

Key Messages:

1. **Water security:** Before, Maldives used to depend on groundwater and rainwater due to a lack of proper water networks. Over-extraction led to salination, and limited water storage capacity. Now, an integrated water resource management is being implemented by utilizing all water available — rainwater, groundwater, and desalinated water — to ensure water security. As a result, the amount of water required during the dry season has been reduced, as well as the dependency on water from the capital. The long-term goal is to achieve clean water and sanitation (SDG6); increase storage capacity and catchment management; establish a water distribution network with treatment facilities and wastewater recycling technologies for enhancement of groundwater aquifers.
2. **Coastal resilience:** Erosion in the islands was recorded as early as the 1970s and now all the islands in Maldives report moderate to severe erosion and beach loss. According to IPCC reports, this will cause a significant amount of land loss and affect critical infrastructure such as hospitals and utilities which are currently located in low-lying areas. Tetra pods, a gift from the Japanese government in response to the 1980s floods, are now in place and an artificial beach, has been created in Male' using hard and soft engineering.
3. **Sustainable tourism:** Beaches need to be recreated around the country to boost coastal resilience and decrease erosion for tourism. A one island-one resort measure has been implemented, where hotel management is only allowed to use 30% of island resources – leaving the rest untouched. Maldives currently has 135 resort islands and more to come. Stronger governance and sustainable use of island ecosystems is required to increase energy efficiency (including renewables) for the tourism sector.
4. **Coral rehabilitation:** The Maldives has one of the largest reef systems in the world. However, in 1998 and 2005 massive coral bleaching occurred due to El Niño. To evaluate the rehabilitation and recovery process a coral reef monitoring program has been implemented in various outer islands.
5. **Human health:** All islands have primary healthcare and there are three tertiary hospitals in Male'. To address the increase in dengue outbreaks and vector-borne diseases, a disease surveillance system was established where authorities are alerted to send adequate response where required. The Maldives has also established a green smart climate health system, where technology is low-carbon and greener.
6. **Partnerships:** Maldives is leading a coalition of countries towards a holistic approach to climate change to utilize existing natural resources; promote and innovate new technology that is SIDS-specific; and enhance finance. It currently has 10 partner organizations in 28 SIDS countries.

About the Speakers:



Charles Fletcher is the Associate Dean for Academic Affairs and Professor, Department of Earth Sciences, at the School of Ocean and Earth Science and Technology, University of Hawai'i at Mānoa. He is also the Vice-Chair of the Honolulu Climate Change Commission. His research focuses on Pacific paleo-sea level history, beach processes, and modeling the impacts of past, present and future sea level rise on island environments and communities. The results of his work are used by government agencies for policies and projects



Mareer Mohamed Husny is an Assistant Director in the Climate Change Department of Ministry of Environment, Maldives with a speciality in island coastal dynamics. Mr. Husny is a lead author for Maldives Second National Communication to United Nations Framework Convention on Climate Change and contributing author for the Maldives Climate Change Policy Framework. He is actively engaged and has contributed to developing the Maldives Climate Change Policy Framework, which will form the base of Climate Change agenda in the Maldives.

Session 3: The Role of Coastal Protection in Addressing Climate Change

Coastal Engineering Methods for Resilient Atoll Nations in Productive Oceans

Michael Foley,
Coastal Engineer and Project Manager, Oceanit

Key Messages

1. By increasing water depths, SLR will decrease the effectiveness of natural reefs at protecting atoll islands. In the future, larger waves will break along the shore, washing further inland and accelerating erosion. Unless mitigated, waves may sweep islands away long before ocean levels exceed land elevations.
2. Nature-based approaches that are sensitive to the environment should be explored. Wide sandy beaches are an effective natural buffer against episodes of shoreline recession. Beaches may be nourished and restored to provide atoll islands with resiliency against SLR. In addition to erosion protection, beaches may enhance wildlife habitat, water quality, recreation and esthetics.
3. Reefs help sustain beaches against prevailing weather patterns by dissipating and rotating wave forces. In nature, reefs are multidimensional structures with complex morphologies evolved specifically to their local wave climates. They are not easily moved by extreme weather events. In addition to shoreline stabilization, reefs offer the benefits of ecosystem habitat, fisheries and recreation.
4. Advancements in technologies for environmental monitoring, computer vision and artificial intelligence have allowed engineers to rapidly gather and evaluate detailed site-specific information at relatively low costs. The resulting empirical models can be used in conjunction with numerical simulations to develop and validate the design of reefs, beaches and other coastal defenses. Innovative construction methods and materials may allow remote islands to build structures using abundant and recycled local materials rather than expensive imports.
5. In some areas, the installation, restoration and protection of natural systems may be a better strategy than constructing traditional seawalls. Community ownership in the alternative evaluation process is critical for the success of any approach. Site investigations and data collection could be started immediately to allow time to develop and appraise holistic, resilient and sustainable solutions to the challenge of SLR within the atoll nations.

The Coastal Protection Benefits and Cost Effectiveness of Coral Reefs

Michael Beck, Research Professor
Institute of Marine Sciences, University of California

Key Messages:

1. Reefs provide significant coastal protection benefits by acting as low crested submerged breakwaters and serving as natural defenses.
2. Reef and mangrove benefits can be rigorously valued globally, locally and nationally using tools from engineering and insurance. These values can be used to inform policy, practice and financing from national accounts to blue bonds to insurance.
3. Reef restoration and conservation are among the most cost-effective investments in coastal protection. Information on reef benefits and costs can be collated to prioritize investments in conservation and restoration.
4. Reef degradation is driving significant amounts of new erosion and flooding, which impacts people, property, roads, ports, resorts and beaches. These impacts are under appreciated.
5. Reef degradation is driving significant new investments in artificial infrastructure to replace these lost benefits from reefs. Cost effective investments are needed to restore these natural benefits rather than just investing billions in artificial defenses.

About the Speakers:



Michael Foley is a coastal engineer and principle investigator and project manager for the Resilient and Sustainable Engineering (RiSE) team at Oceanit, a private company dedicated to solving problems in fields ranging from artificial intelligence to nanotechnology. Mike has worked on a diverse range of projects including beach restoration, shoreline erosion protection, and repair of historic coastal structures. His practice aims to develop holistic systems-based solutions to responsibly manage the hazards of climate change on island communities.



Michael W. Beck is a Professor in the Institute of Marine Sciences at the University of California Santa Cruz. Mike focuses on building coastal resilience to reduce risks to people, property and nature. He works broadly on issues in climate adaptation, marine conservation, and disaster risk reduction to bring tools and results to decision-makers in policy and practice. Mike served for twenty years as Lead Marine Scientist at The Nature Conservancy. He has been a Fulbright and Pew Marine Conservation Fellow.

Session 4: Financing Resilience and Adaptation

Financing Adaptation and Climate Resilience

Bruce Dunn,
Director Safeguards Division,
Chief, Environment Thematic Group, ADB

Key Messages:

1. There is a need for urgent and scaled-up climate finance for atoll nations. Adaptation will be very costly in relation to the national gross domestic product (GDP). For example, coastal protection for Kiribati and the Marshall Islands will be five times their GDP.
2. Traditional financing options in recent years have been from governments; bilateral institutions; multi-lateral institutions like ADB; and multi-lateral climate funds such as the Green Climate Fund. However, due to the scale of climate-related issues, other potential financing opportunities must be explored, specifically in the fisheries and tourism industries of large ocean states, like the atoll nations.
3. To explore these funding opportunities, important questions need to be answered:
 - What is the value of the blue economy?
 - What are the enabling conditions? What policy, regulations and increased government capacity to participate in multi-lateral negotiations must be in place?
 - What are investors looking for? What are some of the constraints that investors might have? What do we need to do to stimulate that interest?
 - What instruments can be used? Some investors may be interested but face risks such as credit risks, and access to land/land tenure.
4. There is a broad range of challenges, risk and opportunities that need to be addressed if we are to access finance more comprehensively
5. ADB is looking into answering questions such as, “how do we stimulate more bankable projects and the use of these innovative financing instruments?” and “how do we provide better access to atoll nations?”

Securing the Sustainable Blue Economy for Atoll Nations

John Tanzer, Practice Leader, Oceans
WWF International

Key Messages:

1. Whilst the existing economic situation for most of the atoll nations is challenging, their large EEZs, substantial fisheries (especially tuna and tuna like species) and tourism potential means these countries are the custodians of ocean-based resources with considerable economic value and potential.
2. Realising that potential will take time and require external investment to help secure better economic 'ownership' and development, adapt physical infrastructure against SLR, storms and coral bleaching as well as capacity building.

3. The overall goal should be for atoll countries to be in a situation of being 'price makers' rather than 'price takers' for access to their resources.
4. Practical steps to help secure ocean and coastal resources should be taken, signalling to investors across the spectrum that atolls are committed to achieving long-term sustainability and resilience for their economies. These steps could include:
 - **Securing ocean governance** - developing legislative and policy frameworks that recognise the importance of their ocean and coastal assets and clearly state commitment to sustainable development based on SDG principles.
 - **Marine Spatial Planning** - developing enforceable marine spatial plans for the EEZs and territorial seas. Such statutory plans should identify and protect the most critical blue infrastructure as well as providing guidance on allocation of areas for development e.g. those places most important for securing the recruitment of fisheries.
 - **Capture and track the value of ocean assets and flows** in national economic accounts. 'Blue accounting frameworks' are important to properly value ocean assets and activity and should be reflected in the spatial zoning mentioned above.

Financing Resilient Atolls: Strategies and Tools for Success

Michael Adams,
President, Oceans Assets Institute

Key Messages

1. Atoll nations need to collaborate to identify and build a portfolio of model projects that collectively reach a minimum of \$50million, with and MDB as issuer or risk-mitigator, for green bond issue by late 2020.
2. Atolls should diversify their approach by combining sector and national priorities with good governance, management and science to demonstrate how they will generate direct revenues.
3. Atolls should remain confident even if they need to change agents (resort managers, fishing companies and power companies for example) if they are not aligned with their sustainability interests, because impact investors will be on their side.
3. Atolls countries have a window of opportunity to offer unique investment opportunities such as physical resilience and eco-social sustainability, that need to be structured correctly for alignment between best long-term interests and those of impact investors - not corporate ones - who are ready to invest at very large scale at low rates for the long-term.

About the Speakers:



Bruce Dunn is an environmental scientist with 20 years' experience in environment and natural resource management. At ADB, Bruce serves as the Director of Safeguards, coordinating on environmental and social safeguard compliance issues, as well as technical support on ADB's proactive agenda on environment, as well as Chief of the Environment Thematic Group. Prior to this, he served as Principal Environment Specialist, coordinating ADB's engagement with the Global Environment Facility and leading efforts to increase investments in natural capital.



Michael Adams established the non-profit Ocean Assets Institute (OAI) to finance solutions for sustainable maritime industries and conservation. He is active on several investment initiatives for sustainable oceans, including the EC Blue Economy Investment Platform and the Pacific Ocean Finance Program. Michael began his career by founding *The Journal of Investing* in 1987 and Pedigree Investments Ltd in 1992. In 2010, he became active in sustainable finance as an Advisor to GH Partners (New York) and several European firms.



John Tanzer joined WWF International in 2012 as the Director of the Global Marine Program. He was then appointed as the Leader of the WWF Oceans Practice in 2016. His responsibilities include development and implementation of a new global oceans strategy. Throughout his career, he has worked in various areas of natural resource management and policy. Between 2000-2012, he worked with WWF and The Nature Conservancy to assist with the development of the Coral Triangle Initiative.

Session 5: The Social, Political and Economic Sides of Adaptation

Tuvalu Adaptation Projects

Palipa Lauti,
Deputy Secretary
Ministry of Finance and Economic Development, Tuvalu

Key Takeaways:

1. An offshore wave forecasting model has been created for Tuvalu to help understand its current dynamics. Based on those assessments, coastal protection initiatives have been undertaken, e.g., Fongafale gravel beach nourishment to improve protection, beach use, and use of sustainable materials locally sourced and the reclamation of Queen Elizabeth Park.
2. The Tuvalu Coastal Adaptation Project (TCAP) will integrate lessons learned from the Queen Elizabeth Project and carry a foreshore reclamation at another site in Funafuti, as part of its coastal protection measures. Other methods for coastal protection in other islands include construction of Berm Top Barrier, the use of sandbags, seabee walls, and sheet piling. Adaptation measures have been a combination of hard and soft measures. However, there needs to be an integrated approach.
3. The elements of the key financing arrangements through the Pacific Islands Climate Change Insurance Facility (PICCIF) are index/parametric based risk transfer/insurance scheme; indemnity insurance; clearinghouse for product options; insurance industry fossil fuel disclosure facility. It is expected to launch at the next Pacific Islands Forum (PIF) Leaders Meeting in Vanuatu in 2020.
4. The method has been a bottom-up approach where countries identify needs and look for partners to capitalize investment.
5. Tuvalu Survival Fund established in 2015, has been governed by its board. They are investing immediate support for disaster resilience and climate change impacts.

Reflections on the Social, Political and Economic Sides of Adaptation

Ben Graham, Principal Evaluation Specialist,
Independent Evaluation Department, ADB

Key Takeaways

1. The current horizon is incremental adaptation which includes coastal flood protection, climate-proofing infrastructure and strengthening water security. As the climate crisis worsens, its effects will become deeper and more complex, reaching a tipping point that requires a shift to a more radical, transformational approach such as population relocation and/or consolidation; large-scale reclamation; elevation or creation of new islands/settlements.

2. Most of what is being done is focused on tangible (physical) measures that are infrastructure and project based. The non-physical dimensions (e.g. social, cultural, legal, economic, sovereign aspects and implications) are harder to address and need to be discussed now. These will require more planning and systems focused.
3. Key questions to consider around adaptation are around internal population relocation and consolidation; impacts of sea-level rise on sovereign boundaries and resources; external population relocation; and complexities of land reclamation and elevation.

About the Speakers



Ben Graham is a Principal Evaluation Specialist in ADB's Independent Evaluation Department (IED). He is the lead advisor for IED, coordinates its engagement with the ADB Board and Management, and supports evaluation and capacity development work. From 2017 to 2019 he served as Chief Secretary of the Marshall Islands, a constitutional post where he served the dual roles of chief advisor to the President and head of the 3,000-member public service. He led major projects and reforms and chaired the national climate and disaster management committees. From 2012 to 2017 he worked as a Senior Evaluation Specialist in IED and prior to that was as a private consultant in the Pacific region and Washington, DC.

Palipa Lauti is Deputy Secretary in the Ministry of Finance, Tuvalu. Previously, she was Advisor to the Executive Director for Australia at the Asian Development Bank, Philippines. Ms Lauti has spent the majority of her career in the public service in the Ministry of Finance & Economic Development, now the Ministry of Finance.