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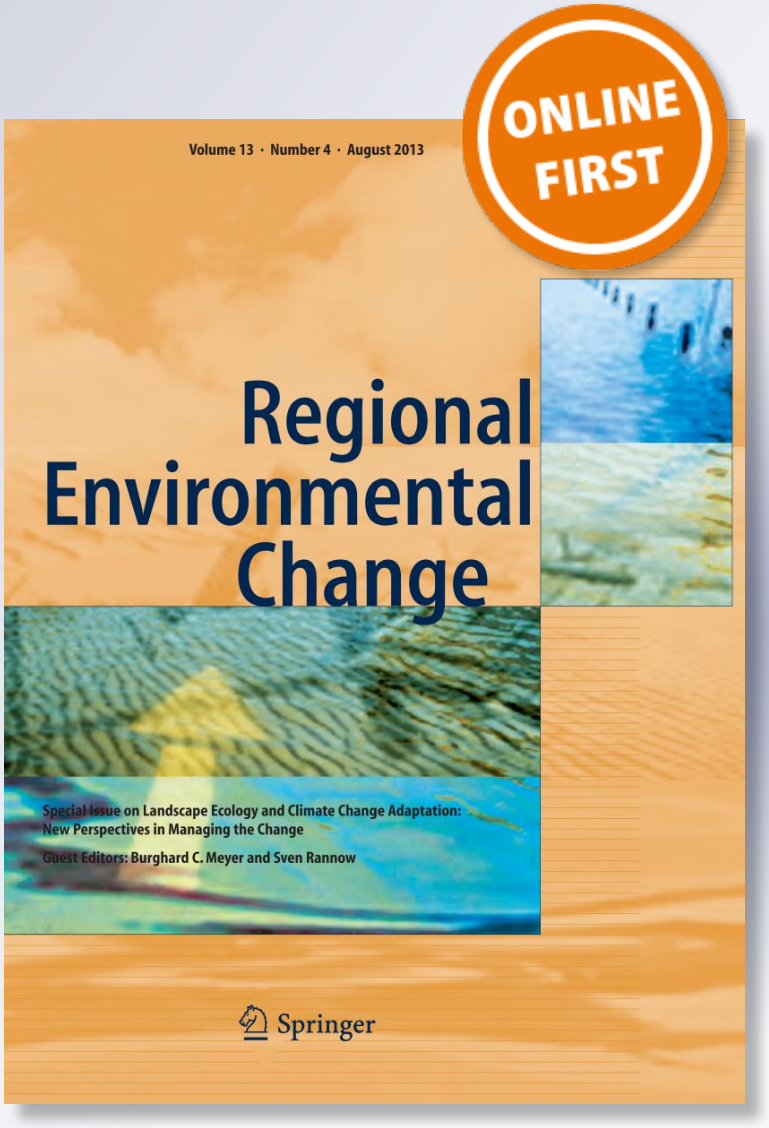
Regional Environmental Change

ISSN 1436-3798

Reg Environ Change
DOI 10.1007/s10113-017-1184-7



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ORIGINAL ARTICLE

Management of loss and damage in small island developing states: implications for a 1.5 °C or warmer world

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Received: 27 April 2017 / Accepted: 28 May 2017
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Abstract Small island developing states (SIDS) have been identified as some of the most vulnerable countries to the impacts of climate change due to inherent environmental, economic, and demographic characteristics. As SIDS experience impacts of climate change and reach their limits to adaptation, the identification and management of loss and damage is essential. Monitoring and evaluating loss and damage, and implementing effective responses to address these impacts, becomes even more important in a 1.5 °C or warmer world, as impacts from climate change increase. As global agreements on climate change are implemented and mechanisms to manage impacts continue to be negotiated and established, the existing ability of SIDS to monitor and respond to loss and damage must be evaluated to determine gaps that must be addressed in a 1.5 °C or warmer world. This research utilizes interviews with UNFCCC climate change negotiators for SIDS and analysis of Intended Nationally Determined Contributions, to assess the state of loss and damage management in SIDS. The research provides an assessment of loss and damage already being experienced in SIDS, the status of existing mechanisms to actively monitor and evaluate loss and damage, and the existence of policies and mechanisms in SIDS to address loss and damage. Three areas of concern appear to be common for SIDS: lack of data relating to loss and damage, gaps in financial assessments of loss and damage, and a lack of policies or mechanisms targeted at loss and damage. These issues appear to be most acute in relation to slow onset impacts. Cumulatively, these challenges may present difficulties in detection and attribution and in obtaining a holistic understanding of the extent and costs of loss and damage for SIDS.

Keywords Small island developing states · Loss and damage · 1.5 °C · Alliance of Small Island States · Paris Agreement

Introduction

The failure of mitigation efforts to prevent increases in greenhouse gas emissions along with recognition that there are limits to adaptation have led to the need to consider loss and damage due to climate change (Burkett 2016). Loss and damage, loosely defined as impacts of climate change that cannot be avoided, is a particularly concerning issue for small island developing states (SIDS). While SIDS are vulnerable to the full array of climate change impacts, sea level rise in concert with coastal erosion may result in the submersion of terrestrial territory for many low-elevation islands (Nurse et al. 2014). The existential threat that climate change poses to SIDS is perhaps the ultimate expression of loss due to environmental change.

The issue of loss and damage has proven to be contentious in the global climate change negotiations arena. While highly vulnerable countries have argued for years that loss and damage should be considered in the United Nations Framework Convention on Climate Change (UNFCCC), it was only in 2010 that organized

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Published online: 04 July 2017

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consideration of ways to approach loss and damage were initiated (UNFCCC 2011; Durand and Huq 2015). Since then, there have been strides made within the UNFCCC to address the issue, including the establishment of the Warsaw International Mechanism (WIM). The 2015 Paris Agreement established loss and damage as a separate article from adaptation, a win for SIDS and least developed countries (LDCs) that had been advocating for this treatment. The Paris Agreement also established the global average temperature goal of limiting warming to "well below" 2 °C above preindustrial levels, with an aspirational goal of limiting warming to 1.5 °C (UNFCCC 2015). These goals acknowledge that further levels of warming will take place and signal that countries must anticipate and prepare for increased impacts of climate change, including loss and damage. As the global average temperature increases, SIDS can expect more severe impacts, making adaptation more difficult and likely resulting in increased incidents of loss and damage (Benjamin and Thomas 2016).

While some progress is being made at the global level, addressing loss and damage must also take place at other scales: from the national level of determining policies and strategies, to the local scale where communities and households must confront changing conditions (Surminski and Lopez 2015). Given the consensus that impacts from climate change are already taking place (IPCC 2014), loss and damage is not an issue that will be experienced at some future date, but rather countries may be experiencing loss and damage now. Efforts to track, monitor, and assess existing and past incidents of loss and damage are necessary in order to determine the scale of these impacts and to properly manage the consequences. SIDS cannot only focus on mitigation and adaptation, but must also have systems and plans in place to address loss and damage. This becomes even more important as temperatures, and impacts, increase.

While the global temperature goals from the Paris Agreement have spurred further study on the impacts of climate change at different temperatures, this article takes a different approach. We explore the existing methods that SIDS use to address loss and damage and assess their applicability in a 1.5 °C or warmer world. It is important to assess the readiness of SIDS to manage loss and damage as temperatures, and impacts, increase. Utilizing interviews with negotiators from the Alliance of Small Island States (AOSIS) and analysis of documents submitted to the UNFCCC from AOSIS countries, this study aims to explore how SIDS are currently assessing loss and damage and policies and mechanisms that are already in place to address loss and damage on a national scale. The study aims to gain an understanding of the current level of oversight and management of economic loss and damage in SIDS, and to identify challenges that will need to be addressed in a 1.5 °C or warmer world.

Loss and damage and SIDS:

Defining loss and damage

One of the major challenges associated with loss and damage is the lack of a universal definition. The main reference to loss and damage in the UNFCCC was developed in 2014 and states that "loss and damage associated with the adverse effects of climate change includes, and in some cases involves more than, that which can be reduced by adaptation" (UNFCCC 2014, p.6). Loss and damage has also been referred to as residual costs which are not avoided through mitigation and adaptation (UNFCCC 2014). They have been further split into economic losses, which reflect losses of resources, goods and services that are commonly traded in markets, and non-economic losses, referred to as "remainder items" which are not commonly traded in markets and therefore are harder to value (UNFCCC 2013). Fry (2016) has noted that the lack of a universal and full definition adopted within the negotiations may be purposeful by some parties in order to avoid the contentious issue of liability and compensation. Indeed, keeping the definition of loss and damage purposefully vague has allowed negotiators with different perspectives on the issue to agree to include loss and damage within the UNFCCC framework (Durand and Huq 2015). While deliberations within the UNFCCC continue, a working definition can include loss and damage as relating to the residual impacts of climate change that were not prevented by either adaptation or mitigation, including impacts from both slow onset and extreme events (Durand and Huq 2015; Walliman-Helmer 2015; Parker et al. 2015). This working definition exposes the relationship between mitigation, adaptation, and loss and damage and also highlights the need to consider loss and damage as a separate, albeit connected, issue.

Detection and attribution of loss and damage

Loss and damage is further complicated by difficulties related to detection and attribution, which aim to assess the causal relationship between climate change and impacts on natural and human systems. Impacts from both extreme and slow onset events are influenced by a number of factors, including social, economic, demographic, and environmental changes (Leichenko and O'Brien 2008). Thus, determining what loss and damage can be detected and attributed specifically to climate change is a complex endeavor. While climate science has been able to increasingly detect and attribute impacts to climate change with higher levels of confidence, there is still a disparity for different types of impacts and for different regions (Cramer et al. 2014). Parker et al. (2015) note that it is difficult to attribute a particular event to climate change, which contributes to making slow onset events more easily

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attributable to climate change than determining whether particular extreme events can be linked to climate change. Lack of reliable and long-term data, a paucity of studies on impacts to human systems and difficulties in parsing out the role of climate change from socio-economic drivers has made detection and attribution of impacts on human systems particularly difficult to assess (Cramer et al. 2014). These variations in confidence in detecting and attributing impacts for different natural and human systems have been identified as a challenge in determining what can be identified as loss and damage from climate change (James et al. 2014). The issue of detection and attribution becomes particularly contentious when loss and damage is linked to political and legal determinations of cause and liability of impacts and the potential for monetary compensation (Surminski and Lopez 2015; Verheyen 2015).

Despite issues of detection and attribution, there are a number of studies that document existing loss and damage experienced by SIDS. Many studies do not address how these impacts can be directly attributed to climate change, but rather infer that given the high vulnerability of SIDS, climate change can be identified as a significant factor in existing loss and damage, while also acknowledging the potential contributions of other socio-economic and environmental drivers (e.g., Monnereau and Abraham 2013; Lashley and Warner 2015). There are also a number of studies that focus on existing impacts of climate change on SIDS that do not explicitly identify these impacts as loss and damage (e.g., McField 2017; Wilson 2017). Despite the terminology used and varying levels of confidence in direct attribution to climate change, it is clear that small islands have experienced impacts to a wide variety of coastal, terrestrial, and human systems, despite mitigation and adaptation efforts (Nurse et al. 2014). In a 1.5 °C or warmer world, SIDS are projected to face increased levels of loss and damage, with the 1.5 °C temperature goal representing a limit that AOSIS members do not wish to see surpassed (Benjamin and Thomas 2016). While there are limited studies on impacts for SIDS at 1.5 °C in particular, a warmer global temperature average than present will lead to greater levels of sea level rise, increased impacts on coral reefs, higher likelihoods of heat extremes, and changes to water availability and crop yields (UNFCCC 2015b; Schleussner et al. 2016), all factors of loss and damage experienced by SIDS.

Evolution of loss and damage in the UNFCCC

The inclusion of loss and damage within the UNFCCC climate regime has been highly contentious due to its relationship with the issues of historic responsibility, liability, and compensation (Roberts and Pelling 2016). Despite these difficulties, the existential threat that climate change poses to SIDS has never been far from the surface of the negotiations (Rajamani 2015). Despite AOSIS first raising the issue of loss and damage in a submission in 1991, calling for an insurance pool as part of the UNFCCC framework agreement to compensate SIDS for loss and damage from sea level rise, this proposal was not included in the 1992 Convention (Serdeczny et al. 2016). In order to move the debate away from the thorny issue of compensation, AOSIS submitted a revised proposal in 2008 for a multi-window mechanism to address loss and damage that would consist of three interdependent and complementary components: insurance, rehabilitation/compensatory, and risk management (AOSIS 2008; AOSIS 2013). The issue of loss and damage finally made its way into a Conference of Parties (COP) decision in 2010 when COP 16 established a work program to consider approaches to address loss and damage as part of the Cancun Adaptation Framework (UNFCCC 2011).

Several years later, the WIM was established through a COP decision and was designed to provide technical and financial support to poorer countries which are disproportionately affected by the negative impacts of climate change (UNFCCC 2013; Wentz and Burger 2015). The decision established three thematic areas of loss and damage, with related, supplemental action areas. The thematic areas the WIM would deal with were (i) enhancing knowledge and understanding of comprehensive risk management, (ii) strengthening dialog, coordination, coherence, and synergies, and (iii) enhancing action and support, including finance, technical, and capacity building to address loss and damage (UNFCCC 2013). As Mace and Verheyen (2016) note, the WIM decision did not open up new or additional financing for loss and damage, and so it was unclear how its activities would be funded over the long term. In addition, the WIM was not established as a separate legal entity, and so was established as a mechanism with powers "in progress," subject to the decisions and vagaries of the COP (Mace and Verheyen 2016; Burkett 2016). Given the shortcomings of the WIM, the agreement of Article 8 in the Paris Agreement was successful in establishing loss and damage as a permanent, third pillar of the global climate regime, separate, and apart from adaptation (Roberts and Pelling 2016). Its inclusion in the Paris Agreement, as a separate article from adaptation, was a "red line" for AOSIS and LDCs (Burkett 2016). However, liability and compensation for loss and damage was excluded through the related COP decision, reflecting a corollary "red line" for developed countries (Burkett 2016). The provision on loss and damage in the Paris Agreement does still have its shortcomings. Among other issues, it does not include specific language on funding, and a reference to loss and damage is not included in Article 9 which only refers to mitigation and adaptation funding (Burkett 2016). A reference to loss and damage is also not included in Article 14 regarding global stocktakes. However, Article 8.3 does refer to action and support, arguably linking loss and damage to the financial mechanism under the Paris Agreement (Mace and Verheyen 2016).

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Given the complexity of loss and damage at the international level, it is instructive to analyze how SIDS are dealing with the issue within existing policies and mechanisms. There is generally a paucity of studies of loss and damage within SIDS (Fisher 2012; Talakai 2015). For many countries and individual sectors, the concept of loss and damage is new, and therefore is not clearly reflected in current national policies (Talakai 2015). This is partly due to the lack of data collected over the long term within these states, as well as a lack of human, technical, and financial capacity. Decision makers require information about the limits of adaptation in order to develop appropriate policies on loss and damage (Roberts and Pelling 2016). As a result, a lack of data on the limits of adaptation efforts would hamper the development of specific policies on loss and damage. While investing in general developmental programs and policies can help to increase resilience to loss and damage, the impacts of climate change are putting pressure on already over-stretched national budgets, and re-allocation of financing to deal with impacts of climate change from longer-term developmental programs threatens to roll back existing development gains in these countries (Nansen Initiative 2015).

Methodology

Interviews with UNFCCC negotiators from AOSIS countries were conducted between November 2015 and June 2016. Countries from the African, Caribbean, Indian Ocean, Mediterranean, Pacific, and South China Seas regions are all included in the AOSIS membership. For ease of reference, these states have been divided into Caribbean states (including states located in the Atlantic Ocean and Caribbean Sea) and Pacific states (including states from African, Indian Ocean, Pacific, and South China Seas regions). Negotiators were contacted using a snowball approach and were asked to take part in a study assessing impacts, policies, and mechanisms related to loss and damage in SIDS. Interviews consisted of 24 questions and were focused on identification of both existing and expected loss and damage impacts and associated financial costs. Questions about the types of data that are used and needed to assess loss and damage impacts were also posed to participants. Interviewees were asked about how incidents of loss and damage have been addressed by governments and by affected communities and the existence of loss and damage issues in current policies. While interviewees provided information at the country scale, in order to maintain confidentiality, responses were aggregated by region. Interviews were conducted with seven negotiators in total, four from the Caribbean region and three from the Pacific region. Interviews lasted approximately 1 h and notes were reviewed using qualitative content analysis.

The Intended Nationally Determined Contributions (INDC) of AOSIS member states were analyzed to determine the inclusion of loss and damage issues. The UNFCCC called for parties to submit their plans for domestic climate change mitigation actions to be taken post-2020 in the form of an INDC (UNFCCC 2014). These INDCs were to be submitted prior to the 21st COP that took place in December 2015. Although the INDCs were aimed at detailing mitigation actions, parties were encouraged to also include issues related to adaptation. SIDS and LDCs in particular were advised to include adaptation needs and plans and to highlight support that would be needed in order to meet adaptation goals post-2020 (Holdaway et al. 2015). INDCs were highly anticipated and analyzed by the UNFCCC, affording countries the opportunity to publicly showcase issues of concern related to both mitigation and adaptation. If loss and damage was identified as being of particular concern by SIDS, including discussion of this issue in some way in the INDCs would publically call attention to these concerns.

Using qualitative content analysis, INDCs of AOSIS countries were reviewed to determine inclusion of (i) past incidents of loss or damage, (ii) policies or mechanisms in place or planned that were related to loss and damage, (iii) incurred or projected costs of loss and damage, and (iv) how loss and damage were related to extreme events or slow onset events. While there are 39 member states of AOSIS, only 35 of the INDCs were reviewed. One of the member states did not submit an INDC, and three INDCs were not translated into English which prevented their review. In total, 14 INDCs from the Caribbean and 22 INDCs from the Pacific were reviewed.

Results

Current and future loss and damage in SIDS

All of the interviewees indicated that there were already incidents of loss and damage experienced in their countries. Six of the respondents identified tropical storms as causing loss and damage to coastal areas. Most respondents named specific cyclones or hurricanes that resulted in significant levels of loss and damage, with the majority of these identified storms taking place in the last 15 years. However, one respondent indicated that losses were incurred after tropical storms that took place as far back as 1980. All respondents identified slow onset events as already causing loss and damage. Drought was identified as having seriously affected agricultural industries, and loss of coral reefs due to ocean acidification and temperature increases were mentioned by most participants. Coastal erosion due to sea level rise was also a loss that was identified by the majority of respondents.

When asked about loss and damage to critical infrastructure such as transportation networks and hospitals, tropical storms

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were identified as having the most impacts. Damages to roads and buildings as a result of tropical storms were acknowledged by most of the respondents. Due to the availability of disaster relief funds, these impacts were identified as damages rather than losses since infrastructure was able to be repaired. Only one respondent indicated that a slow onset event has resulted in damages. This interviewee identified sea level rise as contributing to ongoing damages to roads, stating that roads that are in close to proximity to the coast are increasingly affected by minor storms or high tides due to increased sea levels.

Interviewees were asked to provide details about residents of their countries that have already been impacted by loss and damage. For tropical storms, most respondents indicated that while small percentages of the population were directly affected, the need to divert resources towards disaster relief had impacts at the national scale. Interviewees indicated that there was a paucity of studies that looked at the specific demographic and socio-economic details of populations that have already been affected by loss and damage.

When asked about the financial costs of loss and damage that have already taken place, respondents were able to provide specific figures for impacts associated with extreme events, such as tropical storms. Interviewees were able to provide estimates of financial costs incurred or to identify documents and reports that had further details on costs. However, for loss and damage associated with slow onset events, respondents were unable to provide financial information. Respondents indicated that the financial costs associated with loss and damage from drought, sea level rise, and ocean acidification were difficult to quantify. In some instances, such as the repair of roads due to increased impacts from sea level rise, costs are ongoing and are not being specifically tracked and identified as loss and damage.

About half of the respondents indicated that projections were being conducted to identify future loss and damage for different time frames leading up to 2100. These projections rely heavily on regional organizations such as the Caribbean Community Climate Change Centre and the Pacific Climate Change Science Program. Respondents also identified information provided by the Intergovernmental Panel on Climate Change (IPCC) as playing a large role in their projections of future loss and damage. Future loss and damage stemming from sea level rise and for priority sectors such as agriculture, fisheries, and tourism were identified as important areas for projections. In terms of financial costs associated with projections of loss and damage, about half of the respondents chose not to provide a response. Those that did respond stated that projections of costs were difficult to measure due to the fragmented nature of loss and damage and the difficulty of separating adaptation costs from loss and damage costs.

In the review of INDCs, 13 Pacific AOSIS countries included discussion of past incidents of loss and damage. Most of these were focused on damages to coastal infrastructure or agricultural processes from extreme events and flooding that were credited to climate change. Only two of the Pacific INDCs discuss permanent loss of land associated with climate change impacts. The INDC for Kiribati states that two small islets "disappeared underwater in 1999" and that some of their low elevation islands are experiencing coastal erosion "leading to a loss of land, public and private buildings, and infrastructure" (Government of the Republic of Kiribati 2015). Similarly, the INDC for the Maldives credits beach erosion with "significant loss of land and coastal infrastructure" (Government of Maldives 2015).

Ten Caribbean AOSIS countries included discussions of past incidents of loss and damage. Most of these referred to damages such as infrastructure and agricultural processes from extreme events such as hurricanes. Only five Caribbean INDCs discussed permanent loss associated with the impacts of climate change. These included saltwater intrusion into ground water, coral bleaching from slow onset events, and loss of life due to extreme events such as hurricanes and flooding. The INDC for Dominica described the loss and damage after Hurricane Erika as, "We have, in essence, to rebuild the country." (Government of the Commonwealth of Dominica 2015). A number of these INDCs list specific costs of past incidents of loss and damage, particularly from hurricanes, but also from loss of crops and excessive flooding events. These range from US$60 million from Hurricane Joaquin in The Bahamas (Government of The Bahamas 2015), to US$393 million from Hurricane Erika in Dominica (Government of the Commonwealth of Dominica 2015). Some of these were cumulative costs such as US$600 million from extreme events from 2010 to 2014 in St. Vincent and the Grenadines (Government of St. Vincent and the Grenadines 2015) to US$335 million due to six hurricanes between 1995 and 2010 in Antigua and Barbuda (Government of Antigua and Barbuda 2015). A number of these estimates were also expressed as percentages of GDP.

In terms of future loss and damage, the majority of Pacific INDCs discuss loss and damage in some form, either overtly or indirectly, although there were little projections of impacts provided. For instance, although the INDC for the Federated States of Micronesia does not mention loss or damage specifically, they "stress that the very survival of many SIDS is at stake without ambitious global emissions reductions" (Government of the Federated States of Micronesia 2015). Other Pacific SIDS took a more direct approach and included discussion of the need for loss and damage to be assessed on a national scale (Government of Cook Islands 2015; Government of Fiji 2015). The INDC for the Republic of Nauru explicitly related different levels of future loss and damage impacts with varying global temperature averages, thereby linking loss and damage with mitigation (Government of the Republic of Nauru 2015). The majority

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of Caribbean SIDS included very little discussion of anticipated loss and damage, but did mention future policy directions. Many of these INDCs do, however, mention their extreme vulnerability to the impacts of climate change, and Suriname's INDC anticipates that by 2028 "huge and irreversible" losses will necessitate a "climate departure," perhaps referring to climate-induced migration (Government of the Republic of Suriname 2015).

Data collection and usage

Interviewees indicated that data currently available and utilized to determine existing loss and damage differs dependent upon the type of event. For extreme events, mostly tropical storms, respondents indicated that meteorological data is often captured, which provides evidence about the intensity of the event. Existing disaster response teams, with varying levels of efficacy, are already accustomed to assessing post-storm damages and developing estimates of financial costs. However, most respondents indicated that there is currently no ongoing data collection on sea level rise or on ocean temperatures and acidity. While in some instances there are specific studies that provide a snapshot in time, there is little funding or capacity to monitor slow onset changes on a national scale. Some countries did identify regional sources of data but articulated that regionally scaled data does not cover all islands with the same level of robustness.

When asked about the existence of historical or baseline data in order to determine the extent of loss and damage, most respondents articulated that this was an area of weakness. About half of the interviewees indicated that there are partial datasets available that record atmospheric temperature and rainfall, but that there were some gaps in the data due to lack of continuously working equipment or damage to hardcopy files. Respondents also indicated that data is often distributed among different agencies and that it is not collated and analyzed in a holistic manner. Another problem identified was that there is often uneven data collection, with most data available for urban areas and less data available in more rural areas. For archipelagic countries, this may result in some islands having very little historical or baseline data available.

In the review of INDCs, the need for data collection and analysis is recognized by many Pacific SIDS, although most of them state that existing efforts are insufficient. Most notable is Nauru with a full section highlighting the significance of loss and damage for SIDS and stating that "immediate and adequate financial, technical, and capacity building support for loss and damage is needed" (Government of the Republic of Nauru 2015). Niue similarly states that "it is beyond Niue's national measures to address loss and damage alone from climate change" (Government of Niue 2015). Some countries appear to be in the planning stages of assessing loss and damage such as Fiji that alludes to the "adoption of the damage and loss assessment methodology by 2015" (Government of Fiji 2015).

Within the Caribbean, Belize acknowledged the need to conduct a vulnerability assessment of transport infrastructure, particularly within urban areas (Government of Belize 2015). Dominica noted their inadequate planning tools as instances of maladaptation and recognized the urgent need for micro-finance and micro-insurance, hazard and vulnerability mapping, community-based early warning systems, community risk management frameworks, and community multi-use emergency shelters (Government of the Commonwealth of Dominica 2015). However, Dominica also notes that the country is facing "serious challenges" to implementing poverty-reduction programs and so cannot afford to continue to finance loss and damage resulting from global climate change (Government of the Commonwealth of Dominica 2015).

Strategies, policies, and mechanisms

Interviewees identified a number of strategies that are currently being used by governments to respond to loss and damage. Risk insurance for climate events has been used to defray the expenses of recovering after extreme events. Countries also mentioned their reliance on international donor funding to recover from damages after extreme events. Protection of coastal infrastructure using adaptation strategies such as coastal retreat, rehabilitation of natural coastal ecosystems, and sea walls were also identified as a response to preventing loss and damage. The relocation of communities to less vulnerable locations was also identified as a strategy to reduce future loss and damage.

In terms of specific policies or mechanisms that address loss and damage in a holistic manner, the majority of interviewees, five out of seven, stated that these issues were not covered in existing policies. Most respondents indicated that loss and damage was an emerging issue and that policy development would need to take into account outcomes from the Paris Agreement. Two of the respondents stated that some components of loss and damage, mostly focusing on damages from extreme events, are covered under existing integrated climate change adaptation and disaster risk reduction policies.

From the INDCs, most SIDS did not include discussion of any national policies or mechanisms focused on loss and damage. The few that do state that loss and damage will need to be factored into policy and planning in the future (Government of Cook Islands 2015; Government of the Republic of Vanuatu 2015; Government of the Commonwealth of Dominica 2015). Belize mentioned a more comprehensive approach with the development of a National Climate Resilient Investment Plan to improve both social and economic resilience (Government of Belize 2015). In terms of international policies and mechanisms, some SIDS include comments on the need to include

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issues related to loss and damage in the Paris Agreement. A number of these SIDS call for loss and damage to be included as a distinct element in the Paris Agreement, separate from adaptation (Government of Niue 2015; Government of the Republic of Nauru 2015).

Discussion/conclusion

From the interviews with AOSIS negotiators and analysis of INDCs, three areas of concern appear to be common for SIDS: lack of data relating to loss and damage, gaps in financial assessments of loss and damage, and a lack of policies or mechanisms targeted directly at loss and damage. Firstly, the majority of SIDS indicated a deficit of historical and baseline data and data coverage of less populated islands and regions that would assist in detecting loss and damage. SIDS also indicated that collection of data on loss and damage is not currently part of systematic climatic or environmental observations. Current collection of data that may be relevant to loss and damage is often housed in different agencies, meaning that there is no holistic assessment at the national level of loss and damage. This is particularly the case for loss and damage associated with slow onset events. While most SIDS have some form of assessment of loss and damage for extreme events, there is currently limited assessment of loss and damage associated with slow onset events. However, it should be noted that the unusual and changing nature of extreme events means that current data collection methodologies may be outdated, and new methodologies may have to be developed. For example, in St. Lucia, the extreme nature of the rainfall from Hurricane Tomas could not have been accounted for in traditional hazard mapping techniques which are based on historically derived data and related empirical correlations (ECLAC et al. 2011). This lack of data and lack of systemic assessment means that loss and damage may go unrecorded, particularly in less populated islands and regions, and for impacts associated with slow onset events.

Lack of data also has implications for attribution. Nurse et al. (2014) acknowledge the difficulty in detection and attribution of impacts in small islands due to extensive socio-economic and environmental changes associated with development, along with a lack of reliable empirical monitoring. Many existing methodologies used for attribution require high-quality data over long time periods that also take into consideration socio-economic and demographic changes that may also have affected natural and human systems (Cramer et al. 2014). For example, one way to assess the influence of climate change on loss and damage is by conducting reviews of economic losses from weather hazards over long time frames, usually 30 years or longer. After accounting for normalization of losses over time, long-term trends are revealed and are used to determine if climate change has had an impact (e.g., Pielke et al. 2008; Schmidt et al. 2009). However, the majority of these types of studies have focused on developed countries (Bouwer 2011). While this type of methodology has been attempted to be utilized for some SIDS, the lack of availability of historical economic data on hurricane damage has prevented in depth analysis (Pielke et al. 2003). Other methodologies used to determine attribution of impacts to climate change also rely on long-term data and have largely been used in developed countries where data is available and accessible (Hulme 2014; Parker et al. 2015).

However, there are some methodologies of attribution with less extensive data requirements. One such category of attribution methodology is simple physical reasoning, which relates specific observed impacts to the general known effects of climate change on broad climate and weather systems (Hulme 2014). This type of attribution does not require consideration of the multiple socio-economic, demographic, and environmental factors that may affect loss and damage in a particular location, but rather simply relates loss and damage associated with an event to the known impacts that climate change has on a much broader scale (Huggel et al. 2015). However, this type of attribution only allows for general conclusions to be drawn about the influence of climate change on specific impacts and will likely be insufficient in the political and legal arena (Hulme 2014; Verheyen 2015). From the interviews and review of INDCs, it appears that most SIDS are currently using this type of simple physical reasoning to identify loss and damage. In general, loss and damage associated with extreme events is all attributed to climate change, without usage of statistical or modeling methodologies or a nuanced determination of other factors that may have affected these impacts. While this type of attribution may be what SIDS can currently provide due to data limitations, it remains to be seen if this will be sufficient under the UNFCCC's loss and damage agenda.

Secondly, there are significant gaps in tracking the financial costs of loss and damage. While SIDS do have existing methodologies for capturing the economic impacts of extreme events, most SIDS are not collecting the financial costs of loss and damage associated with slow onset events. Respondents indicated that there is no current methodology in place to provide costs of loss and damage associated with slow onset events and so these costs are not being captured. This is associated with the lack of data and mechanisms to assess loss and damage from slow onset events, leading to an inaccurate perception of the extent of these impacts. While interviewees were comfortable in referring to specific post-disaster reports that clearly spell out loss and damage, slow onset events do not have this same level of data collection or assessment process and so it is more difficult to clearly determine loss and damage. The occurrence of non-economic losses is also not being recorded or valued on a regular basis. Difficulties in attributing a monetary value to loss of culture and traditions, as well as loss due to dislocation is a challenging task (Warner

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and van der Geest 2013). However, the more these types of losses are recorded by SIDS, the more prominent they will become on the international agenda.

The financial costs of loss and damage will likely have effects on financial stability at the national scale. The costs associated with responding to extreme events such as tropical storms can take up a significant percentage of national GDPs (ECLAC et al. 2011). Dealing with the negative impacts from climate change is already diverting resources away from long term developmental objectives such as education, health, and poverty reduction (Nansen Initiative 2015). Costs of addressing loss and damage will lead to the exacerbation of existing vulnerabilities within SIDS, further reducing their resilience to climate change impacts (Lashley and Warner 2015).

Lastly, there is a marked lack of policies and mechanisms in SIDS that are focused on loss and damage. While loss and damage has been identified as already taking place in the interviews and INDCs, SIDS have few systems in place to monitor and identify loss and damage, particularly for slow onset events. Loss and damage associated with extreme events are included in some existing policies that integrate disaster risk reduction with climate change adaptation. However, the majority of interviewees and INDCs indicated that policies and mechanisms for loss and damage have not yet been developed at the national scale. Some interviewees stated that national action on loss and damage would be contingent upon the UNFCCC process. However, while the WIM deliberates its modalities for addressing loss and damage, SIDS appear to mostly manage the issue on an ad hoc basis, without the benefit of formalized policies and mechanisms that would allow for a more holistic assessment and management of loss and damage.

UNEP (2016) anticipates that the current nationally determined contributions under the Paris Agreement have put the world on a pathway to temperature increases of between 2.9 °C–3.4 °C. This means that SIDS will have to cope with at least a 1.5 °C, and likely warmer, world. As a result, incidents of loss and damage are likely to only increase in these states, and therefore developing policies and mechanisms to deal with these impacts should become a developmental priority for these states. It is clear that significant gaps in data collection, management, and dispersion persist in SIDS. The WIM has included within its mandate action areas which focus on the collection, sharing, management and use of relevant data and information, as well as action to address gaps in understanding and expertise in approaches to loss and damage (UNFCCC 2014). SIDS should invest significant negotiating capital in ensuring that this mandate is fulfilled and directed towards filling the significant data and management gaps which exist in their countries. While significant capacity constraints within these states will likely continue, regional and sub-regional organizations should continue to play a role in complementing national efforts (Kalin 2015). The trend towards combining climate change adaptation and disaster risk management policies is also a potential way forward to streamline resilience and avoid duplication of efforts across various departments and ministries. Ultimately, however, SIDS will not be able to continue to finance the impacts of loss and damage in their states, and efforts at the international level to secure financing for vulnerable states such as these must continue.

In conclusion, it appears that loss and damage is an issue that SIDS are not adequately prepared to address currently, a situation which will be exacerbated in a 1.5 °C or warmer world where impacts of climate change, and loss and damage, will be intensified. Current methodologies used to monitor and evaluate loss and damage are mostly limited to assessing damages from extreme events, stemming from existing methodologies. While the collection of records of loss and damage from extreme events is ongoing, lack of baseline data will mean that recording and assessing the cumulative impacts of loss and damage, particularly for slow onset events, will be difficult and will also be problematic to attribute to climate change. The lack of robust policies and mechanisms focused on loss and damage has also resulted in limited financial assessment of the costs of loss and damage and a sectoral and fragmented understanding of the holistic impacts of loss and damage for SIDS. There is a need for significant capacity building for SIDS in the areas of data collection, policies, and mechanisms to aid in assessment, monitoring, and responses to loss and damage, areas which map almost directly on to the WIM's thematic areas. However, sufficient funding must be provided to the WIM, and to highly vulnerable countries such as SIDS, to achieve a robust response to loss and damage. As summed up by Nauru, "It is beyond our current national means to address loss and damage from climate change and financial flows from developed countries for addressing loss and damage in Nauru and other vulnerable developing countries should be new and additional to financing for those for mitigation and adaptation" (Government of the Republic of Nauru 2015).

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