

The oceans are waving goodbye: discourse on ocean issues within the United Nations
Framework Convention on Climate Change
Jess Poteet

Humankind is changing our ocean.

Human activity is increasing the amount of greenhouse gases in the atmosphere causing the ocean, which covers the majority of the planet, to change in a myriad of ways. Rising water temperature, increasing levels of carbon dioxide, and inadequate oxygen levels are altering coastal and ocean ecosystems with consequent impacts on coastal communities, fisheries, and aquaculture. These changes are driven by increased greenhouse gases in the atmosphere creating a warmer Earth and a warmer ocean.

Ocean warming accounts for more than 90 percent of the energy accumulated in the climate system between 1971 and 2010 (IPCC 2014). The ocean has warmed most at the surface; between this time period (1971 to 2010), the upper 75 meters of the ocean warmed by 0.11 [0.09 to 0.13] °C per decade (IPCC 2014). Warmer water results in decreased oxygen concentrations in marine ecosystems because the solubility of oxygen decreases as temperature increases. Warm water is more stable and slows the thermohaline circulation system that brings surface oxygen down to the deeper layers of the ocean (Brewer and Peltzer 2009). The reduced overturn of water means a reduced overturn of nutrients and this negatively affects the phytoplankton that produce half the world's oxygen (Morello 2010). Furthermore, reduced dissolved oxygen concentrations make respiration very difficult for marine animals. Oceanic dead zones (areas with low oxygen content) will expand and the effects on organisms and ecosystems may be severe (Brewer and Peltzer 2009).

Global ocean warming will continue during this century, with the most warming projected for tropical and Northern Hemisphere subtropical regions. As the water warms, the sea level rises due to thermal expansion of the water and melting glacial ice. Sea level is currently rising around 3 mm per year, which is a significantly larger rate than the average sea-level rise over the last several thousand years. Furthermore, this rate seems to be increasing (NOAA 2014). It is very likely that the global mean sea-level will rise at a faster rate than observed from 1971 to 2010. Sea-level rise will not be uniform across all regions but it is very likely that more than 95 percent of the ocean area will rise by the end of the 21st century.

There are many uncertainties in predicting future sea level rise, especially with regards to how glaciers and ice caps will behave. With medium confidence, the threshold for the loss of the Greenland ice sheet over a millennium or more is less than 4°C of global warming. The associated sea level rise with the loss of this ice sheet is 7 meters. Separately, in a business as usual (BAU) scenario, the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) projected global sea level rise up to 0.82 m by the end of the 21st century. It is virtually certain that global mean sea level rise will continue beyond 2100 for many centuries due to thermal expansion (IPCC 2014). Even if the global mean temperature is stabilized, coastal systems and low-lying areas would still continue to experience adverse impacts such as coastal erosion, coastal flooding, and submergence from sea-level rise (Wong et al. 2014).

As the oceans are taking up around 30 to 40 percent of the carbon dioxide released by humans into the atmosphere, the pH of the water decreases (Feely et al. 2004). Some of the carbon dioxide reacts with the water to form carbonic acid, and these molecules, in turn, react with the water to produce carbonate and hydrogen ions. The ocean then becomes less alkaline with the addition of hydrogen ions (Jacobson 2005). The IPCC AR5 states with high confidence that the pH of the ocean has decreased by 0.1 since the beginning of the industrial era. Because pH is measured with a logarithmic scale, this represents a 26 percent increase in acidity (IPCC 2014).

Looking to the future, Earth System Models predict an increase in global ocean acidification by the end of the 21st century for all possible emission scenarios. Representative Concentration Pathways (RCPs) represent possible greenhouse gas concentration trajectories. RCP2.6, which assumes annual greenhouse gas emissions peak between 2010 and 2020, would see a slow recovery in ocean acidification mid-century. However, in RCP4.5, which projects an emissions peak around 2040, shows a 0.14 to 0.15 decrease in global pH (equivalent to 38 to 41 percent). In a BAU scenario (RCP8.5), surface ocean pH could decrease from 0.30 to 0.32, which is a 100 to 109 percent increase in acidity (IPCC 2014).

Even relatively small changes in acidity have wide-ranging consequences for a large number of species. It can interrupt reproduction, metabolism, growth, calcification, and behavior. It makes forming biogenic calcium carbonate more difficult and more energy consuming for calcifying organisms such as coral, mollusks, and some plankton. Increasing acidity can kill off algae and therefore decrease oxygen levels. The vast changes that occur with a more acidic ocean

mean that cascading and unknown effects will result as well. Crashes in vital populations and changes in habitat or prey cause wide ranging effects for both ecosystem and fisheries (Harrould-Kolieb and Herr 2012). Furthermore, it is crucial to remember that all of these threats to the ocean are occurring simultaneously; to survive, organisms will need to adapt to multiple changing conditions in the world's oceans (Noone et al. 2012).

The ocean's impact on humans.

The marine ecosystems and organisms affected by climate change have an intrinsic value that will degrade with the changing climate. Economically, the ocean has an enormous use value to humankind, who relies on its services. Economists at the Stockholm Environment Institute estimated that the cost of climate change on the oceans will be 1.98 trillion dollars annually by 2100 (in 2010 dollars). This assumes a 4°C increase in global temperatures by 2100. If emissions are drastically cut soon and the earth warms by 2.2°C, then the cost would be 612 billion dollars. Acting to mitigate climate change now could mean an economic savings of over a trillion dollars (Noone et al. 2012).

These values were reached by examining the losses in the fisheries and tourism sectors, the losses resulting from rising sea levels, the damage costs of increased storms, and the damages from the ocean's lesser absorptive capacity of carbon. The value given by the study does not take all the ocean's benefits into account. Processes that often go unnoticed, such as nutrient cycling and ecosystem functioning, were not valued in the study. Furthermore, the more intrinsic values of the ocean, as well as the dignity and identity that can be lost as coastal communities must relocate, are immeasurable losses not included in these numbers. (Noone et al. 2012).

There is a great threat to livelihoods, property, and health. People who directly depend on the ocean for food could face lower fish stocks as a result of ocean acidification. Those reliant on the tourism industry will face declines as coral reefs suffer and ecosystems decline. Coastal properties may become worthless as the sea inches forward. Atmospheric warming, resulting in an increase in storms, hurricanes, and cyclones means greater damage costs and even increased injury and death. In the US alone, higher sea levels, joined with increased storm surge, and potential changes in hurricane activity is likely to increase the average cost of coastal storms every year to \$7.3 billion along the Eastern Seaboard and the Gulf of Mexico (Houser et al. 2014).

Rising sea levels means that some low-lying island nations may disappear; by the end of this century, citizens of some islands may be climate change refugees. In 2009, residents of the Carteret Islands of Papua New Guinea began relocating. This was mainly due to rising sea levels causing saltwater intrusion, damaged farming, flooding, and shore erosion. The highest point on the island is only 1.7 meters above the sea. Sustaining themselves on the island was becoming impossible as the spring tides wiped out the islanders' gardens for several years. As *The Guardian* pointed out, very few other news sources even covered this event: the first organized relocation of a people due to climate change (Monbiot 2009). However, relocation has proven to be quite difficult as many families have decided to return home due to hostility and lack of living facilities on the neighboring islands meant to be their new homes. Carteret islanders have mixed feelings regarding where they should go and how to retain their identity (UNESCO 2012).

The era of climate change relocation has begun. The Maldives has had to relocate people from at least three islands because of erosion and violent storms since 2010 (Pyper 2013). The people of Taro Island of the Solomon Islands are planning to move and build an entirely new town on a higher island. As the sea level rises, their low-lying island is at ever-higher risks for storm surges, tsunamis, and floods. This relocation is much more thoroughly planned than the movement of the Carteret islanders. A \$3 million grant from the Solomon Islands will help with the transition, but the final cost will likely range in the hundreds of millions of dollars. A team of scientists, engineers, and planners are preparing to move the population of around 500 to 1,000 people in stages. Essential infrastructure is being built now, with government buildings, roads, and a hydropower system to be completed within several decades. In the meantime, adaptation measures like a tsunami response plan attempt to protect the community until they can relocate to their new home (Spross 2014).

A family from the small Pacific nation of Tuvalu was granted residency in New Zealand in 2014 on the basis of climate change threats in their home country. The country consists of just nine atolls that lie just one and a half to two meters above sea level and may disappear within 30 to 50 years. The family was granted residency because of the difficulty in growing crops due to coastal erosion and the vulnerability of the island to natural disasters. As Shuichi Endo, Environmental Goodwill Ambassador of Tuvalu, explains, the "sea [is] eating our lives" (2014). The citizens of Tuvalu are so dependent upon the environment that they have little resilience for adapting to a changing ocean. "Our people are mostly self-sufficient. So [they] get the fish from

the sea and they get the fruits from the island. Coconuts, banana... But we lose land now [and] that means no food in the future” (Endo 2014). In spite of the seemingly gloomy future, Endo says that the Tuvaluan government does not want a mass migration out of the country. The government would lose money and resources to help protect the island if the country’s 10,000 residents relocate.

Kiribati, a Pacific island nation with over 100,000 citizens at risk, has set up a “Migration with Dignity” program to train its citizens as highly skilled workers so that they will be needed in other countries when they are forced to move (which may be within 30 years). They have also bought almost 6,000 acres on the nearby country of Fiji. This land is currently used for agriculture but may be needed when Kiribati, which consists of 33 islands, must find land to inhabit (Noack 2014).

However, Fiji is also facing relocation of some of its small islands. According to Mahendra Kumar, director of the Climate Change Division in the Fijian government,

“really what [the government is] talking about is relocation with dignity. So we have a planned relocation for communities where there’s no hope now. You know, the seas are basically washing their houses, their agriculture, they’re actually intruding on the portable water, and so on. It’s making it almost impossible to survive where they have. Then perhaps the most decent thing for the government and the community to do is to see where they can relocate to another area, but of course with that comes also all sorts of other issues like land ownership, social consequences. You don’t really want to move from a place where you’re born and you’re comfortable and so on. So we are beginning to look at some of that work. We are looking at some guidelines for relocation, and we’ve already relocated one or two communities actually” (Kumar 2014).

Kumar also highlighted the social consequences of relocating a community. Forcing an established group to find a sense of place in another community is incredibly difficult and may never happen.

Climate change’s impact on sea-level rise is already observed globally. Coastal changes are no longer a distant possibility but a current reality. Adaptations to these changes are needed locally; as each country acts, individual case studies are presented, displaying a microcosm of possible global strategies. As sea level rises, some governments have chosen to build sea walls as a strategy to protect citizens. This strategy is not often the most cost effective (Frihy and El-

Sayed 2012). In Egypt, one of the countries that is most vulnerable to sea level rise, the neoliberal Mubarak government decided to adapt to climate change with sea walls. They expanded investments in infrastructure which helped to protect the more privileged citizens of Egypt instead of creating strategies as one unit, paying special attention to the most vulnerable areas. This, according to Malm, is likely to accentuate inequality and vulnerability in the society as a whole (2012).

For example, the government installed detached breakwaters to prevent coastal erosion for the tourist resorts of Ras El-Bar, but the nearby fishing communities have no protection. The breakwaters protect the resorts from storms from the rising sea but they actually accelerate erosion in the nearby poorer communities (Malm 2012). It is important to note the distinction between mitigating climate change and adapting to climate change. Mitigating is a global concept, with all on Earth receiving the benefits. Adaptation is regional; only those with capital can avoid the harshest effects from climate change. Only the most privileged can build sea walls or purchase less vulnerable property. This case study in Egypt can be applied to the global approach to coastal adaptation (Frihy and El-Sayed 2012).

Preparing for future ocean changes is an important step in better equipping vulnerable areas for climate change impacts. There are many changes that the oceans may experience. Many are predictable and gradual but others are abrupt events associated with tipping points that would create potentially catastrophic losses. Even worst-case scenarios should be examined and prepared for; the oceans need insurance too (Noone et al. 2012). The ocean will experience great shifts due to ocean acidification, sea surface temperature rising, and increasing sea levels. Those who directly depend on the ocean and live in coastal communities are at greatest risk. Some land will be lost due to sea level rise. Policy now must both help communities adapt to present ocean changes and mitigate carbon emissions to minimize future damage.

The largest arena for international climate change policy is the United Nations Framework Convention on Climate Change (UNFCCC). With almost-universal nation membership, the treaty was negotiated at the United Nations Conference on Environment and Development (known as Earth Summit) in Rio de Janeiro in June 1992. The objective of the UNFCCC is to “stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system” (UNFCCC 1992). The treaty is open, with no binding limits on greenhouse gas, but sets up a framework of negotiations.

The responsibility of participating nations is cited as “common but differentiated”, with the more developed countries categorized as Annex 1 and the less developed countries grouped as non-Annex 1 countries. Parties to the Convention meet annually to negotiate protocols. Notable agreements include the Kyoto Protocol, which established legally binding obligations for Annex 1 Parties, and the Cancun agreements, which set a 2°C global average warming limit. In December of 2014, the 20th Conference of the Parties (COP20) was held in Lima, Peru.

When considering these international negotiations through the lens of ocean communities and ecosystems, the largest stakeholders are small coastal nations that directly rely on the sea for their economy. The small island developing states (SIDS) were first recognized at the creation of the UNFCCC in 1992 as a distinct group with high vulnerability to climate change. These 52 small island developing states are broken down into three geographic regions: the Caribbean; the Pacific; and Africa, Indian Ocean, Mediterranean, and South China Sea (AIMS) (United Nations Department of Economic and Social Affairs 2014). Although it is important to note that not all members of SIDS are actually small (e.g. Papua New Guinea), islands (e.g. Guyana), developing (e.g. Bahrain) or even states (e.g. Netherlands Antilles), most share common characteristics of high population density, limited land resources, vulnerability to natural hazards, threatened biodiversity, high dependence on tourism, limited funds, and limited human resources (Wong 2011).

The UNFCCC, a framework to globally mitigate climate change and adapt to its effects, should be providing small island developing states with sufficient attention on ocean issues within negotiations and adequate support for implementing adaptation efforts. However, due to the power of large, less vulnerable, nations that do not want to be further penalized for climate change effects, the issues of small island developing states are not adequately addressed within the Conference of the Parties. Members of SIDS perceive a lack of discussion surrounding ocean issues such as ocean acidification and coastal adaptation within the Conference of the Parties and do not feel sufficiently supported by other members of the UNFCCC in terms of funds or capacity.

Methods for research.

In order to explore how the UNFCCC addresses ocean issues resulting from climate change, text based research was coupled with interviews at the 20th Conference of the Parties

(COP20). Text of protocols and documents from the UNFCCC were examined for their relevancy to ocean issues. The UNFCCC website search tool was used to analyze official UNFCCC documents that mention oceans. In the advanced search function, keywords such as AOSIS, Oceans, Coastal areas, Coastal zone management, SIDS, and Green Climate Fund were selected to sort through the many official documents. Furthermore, large databases such as EBSCO and web searches through Google Scholar were used to find previous research on any developments within the UNFCCC and ocean issues. Keywords such as ocean acidification, UNFCCC, small island developing states, and coastal adaptation were used to identify relevant documents.

After extensive review of UNFCCC documents, specific interview questions were devised to understand the ocean issues that SIDS face, countries' methods of adaptation, and, most importantly, how the UNFCCC was addressing these issues. The interview protocol and questions were approved as exempted from the Institutional Review Board. At the two week Conference of the Parties in Lima, Peru, participants were chosen based upon their involvement and knowledge of ocean issues resulting from increased greenhouse gas emissions. Delegates representing SIDS were crucial to the research process as well as observers focusing on ocean issues (government workers or university professors) and CEOs of ocean non-governmental organizations (NGOs) and private companies. Participants who worked within and outside of the UNFCCC negotiations provided a fuller understanding of the opinions and atmosphere surrounding COP20. However, participants who were delegates from SIDS were most sought after in the study in order to fully explore how vulnerable coastal nations perceive the UNFCCC as addressing ocean issues within the COPs.

Interviews were recorded at the 20th Conference of the Parties in Lima, Peru from December 1 to 10, 2014. For each interview, the participant was informed of the uses of the data collected and then signed a consent form detailing these uses. Each interview was videotaped for subsequent transcription and review. The interviews were semi-structured; guided by the main questions and ideas but flexible depending upon the interviewee. Interviews ranged from ten to forty minutes in length. A daily log was kept during the conference to record any extra information about the interviews and participants.

The interviews were then transcribed and coded for important information. The nine relevant interviews were sorted on a spreadsheet that detailed participants and answers to key

questions such as if they felt ocean issues were sufficiently discussed at the COP, if their nation had adequate funds for adaptation and their opinion of the strength of AOSIS. Other key quotations and themes of the interviews were identified and sorted.

This study was undertaken with a limited number of participants. More research, with more participants from a larger range of countries, would provide an even greater understanding of perceptions of ocean issues within the UNFCCC.

Demographics of participants.

Ten participants made up the nine relevant interviews extracted from COP20 in Lima, Peru. Participants from SIDS represented Palau, Fiji, the Philippines, the Solomon Islands, and Tuvalu. Other participants included a climate change engineer from Brazil, a Peruvian senior scientist at the Monterey Bay Aquarium Research Institute, and two American CEOs from the private sector who work on ocean issues and climate change. Participants had a range of experience with the UNFCCC. Some had been deeply involved with the UNFCCC process for many years while others had never before attended a COP. Common themes of the interviews included each specific nation's struggles with climate change ocean issues, the need for financing adaptation, and the need for loss and damage financing.

Ocean acidification as addressed within the UNFCCC.

Ocean acidification is an issue that remains largely on the periphery of the UNFCCC according to Harrould-Kolieb and Herr. It is true, the most effective strategy for addressing ocean acidification is reducing carbon dioxide emissions and the ultimate goal of the Convention is stabilization of global greenhouse gas concentrations. However, the mitigation goals that the Convention sets are seeking to avoid dangerous climate change, not prevent devastating ocean acidification. Carbon concentrations that are relatively "safe" for the atmosphere may be dangerous to the oceans (Harrould-Kolieb and Herr 2012).

Ocean acidification does not seem to be a focus of the conferences. It is mentioned only once in the Cancun Agreements as part of a footnote of a long list of slow onset events caused by climate change (UNFCCC, 2011, Decision 1/CP.16). This also suggests that the UNFCCC mistakenly perceives the rising acidity of the oceans as a symptom of climate change rather than as a concurrent problem (Harrould-Kolieb and Herr 2012). The IPCC has taken on a somewhat

greater role in discussing ocean acidification in their assessment reports. The Fifth report states with high confidence that the pH of the ocean surface water has decreased by 0.1, which translates into a 26 percent increase in acidity. It further states with high confidence that acidification and warming of coastal waters will continue with significant negative consequences for coastal ecosystems. These negative effects include bleaching, mortality and decreased coral reefs and decreases in the abundance and health of calcifying organisms (IPCC 2014).

Of the eight interviews in which participants were asked about the focus on ocean issues at COP20, five participants did not think that ocean issues were not addressed adequately. More specifically, four participants discussed the COP with regards to ocean acidification. Three felt that the COPs did not adequately address issues of ocean acidification while one saw representation of the issue but stated more is needed.

Mahendra Kumar, head of the Fijian government's Climate Change Division, perceives ocean acidification as "discussed at the science level, but that is a very important part of the discussion which should be had, because clearly, the coral reefs, fisheries, small islands are, as you know, our biggest resource the marine sector... I think a lot more needs to be done" (Kumar 2014). The human components of ocean acidification have not yet been brought to the table. Perhaps, the issue of sea-level rise has received more attention because it is creating drastic consequences for people right now. Issues of biodiversity and fisheries catch are subtler and more difficult to pick up from simply a cursory glance at the ecosystem.

Caleb Otto, ambassador and delegate for Palau, proposed that a focus on ocean acidification is unwanted by developed nations at the COP because it would highlight the need for funding developing countries. "I think the other part of that is that if they really wanted to look into acidification and warming then they would have to sort of look more focused on loss and damage and I think they don't want to do that" (Otto 2014). Further discussing the damages that least developed countries face as a result of (mostly) developed countries' growth would support the former's call for loss and damage finance. Loss and damage is a highly contested plan to provide funds to developing countries for damages sustained from climate change related incidents such as storm damage or coral loss from ocean acidification.

The CEO and Executive Director of the Sea Trust Institute, Lynn Wilson, states that ocean issues were not really a focus of COP20. Furthermore, she realized that some people attending the COP had no understanding of ocean acidification. In her interview, she says: "Has

anyone talked about ocean acidification? Only in passing, and in fact, I watched some students not know what it was who were being asked the question. Yes, which was a little scary. So the blank stares of ‘oh ocean acidification?’ Yes, because that wasn’t their [area of expertise] and that’s alright because everybody can’t know everything, but it’s a little unnerving to see how little knowledge there is about the oceans” (Wilson 2014). Lack of knowledge about ocean acidification in COP attendees highlights the lack of focus on the issue within the UNFCCC. If ocean acidification is not discussed enough to be recognized by all attendees of the COP immersed in climate change issues, then efforts to include the issue in documents produced at the conferences may be limited.

In contrast, Melchior Mataka, Permanent Secretary for Climate Change and Disaster Management and Ministry of Environment in the Solomon Islands, felt there was adequate representation on ocean acidification within the UNFCCC. However, he does not believe this translates into action. “I think there is a representation and in fact, ocean acidification has also been captured in the decisions as well as in the draft documents that are coming in term of the ADP [Ad Hoc Working Group for the Durban Platform on Enhanced Action], but I think more is needed. What we actually need here is not just talking about it but we really need concrete action on the ground to address the issues which we are facing. We cannot really be just talking about it and having very good documents that come out of conferences like this but then it doesn’t translate into action on the ground” (Mataka 2014). Even with perceived adequate representation, Mataka still feels that more action from member countries of the UNFCCC on ocean acidification is needed.

Harrould-Kolieb and Herr state that the UNFCCC does not currently have the capacity to successfully mitigate ocean acidification. They argue that non-carbon dioxide greenhouse gases may be better regulated outside the UNFCCC, freeing up more room within the convention for ocean issues. Recognizing the different mitigation strategies between the two interlinked issues of climate change and ocean acidification will allow for better governance of both (Harrould-Kolieb and Herr 2012). This, however, assumes that the fundamental problem that causes lack of regulation and ambition within the UNFCCC is capacity, not its inherent anarchy as an intergovernmental negotiation organization.

Ocean acidification is a difficult issue to tackle. Mitigation of ocean acidification means decreasing global levels of carbon dioxide in the atmosphere but global ocean pH levels will

continue to rise over the next century due to today's emissions (Harrould-Kolieb and Herr 2012). Adapting to ocean acidification is challenging as well. Strategies involve increasing ocean resilience to acidification by decreasing its other stresses. Overfishing continues to be a huge problem for most commercial fish stocks. In order to lessen the damages associated with climate change, the oceans must be healthier and more robust. The fourth addition of the *Global Biodiversity Outlook*, prepared after COP10, recommends greater use of innovative fisheries management like community co-management which will give local communities a greater stake in the long term health of their fish stocks. Countries should also reform destructive fishing subsidies that lead to overfishing and further develop and better enforce marine protected areas. These goals were integrated into the Strategic Plan for Biodiversity that is assisting communities across the world (Secretariat of the Convention on Biological Diversity 2014).

Coastal adaptation as addressed within the UNFCCC.

The Fifth Assessment Report from the IPCC states with high confidence that the social and economic costs of inaction are now much higher than the adaptation costs of protecting against increased coastal flooding and land loss due to submergence and erosion. However, the relative costs of adaptation vary greatly among regions and countries. The greatest affected are those in low-lying developing countries and small islands. Those dependent on coastal tourism will also be impacted by coral bleaching, ocean acidification, and loss in tourism (IPCC 2014). Caleb Otto discussed his nation's complete reliance on the ocean for a stable economy.

“Because Palau is a very small island and completely surrounded by ocean and so the ocean is really the means of our livelihood. And so, in terms of economic development, it is very important to us because our number one economic development activity is tourism.” (Otto 2014).

The economies of many of these small island nations are so closely tied to a dying resource, the ocean, and it is not clear how they should adapt to these changes. It is also important to note that some small island states will be made uninhabitable long before the rising sea level submerges them. Erosion, contaminated groundwater, limited natural resources and damage from violent storms displace inhabitants first (Pyper 2013).

Countries need to be able to adapt to these impending changes. However, the report states with high confidence that coastal adaptation has progressed significantly more in developed

countries. Community-based adaptation has generated larger benefits and is paired well with other development activities, but small island developing countries need more funding to be able to focus on adaptation (IPCC 2014).

Three interview participants were asked if the UNFCCC and COP20 was adequately addressing issues of coastal adaptation for sea level rise and increased storms. Mixed reactions to the UNFCCC's involvement were given.

Milton Nogueira is an engineer at Climate Change UNO in Brazil. When asked about the conversation surrounding sea level rise and coastal adaptation in the COP, he said: "I didn't see much. But...when you can see, there are hundreds of side events, maybe some of them I did not look for them because I live in the mountains, we are far away from this. Of course, that's no excuse, the thing affects everyone, poverty and so on. But I don't see it so much, despite the fact that nearly half the public of the world lives near the coast" (Nogueira 2014). This issue is clearly relevant to much to the world's population, but not a major issue at the COP or, as Nogueira admits, may not be a major issue to COP participants who are not directly involved with the issue.

On the other hand, another participant saw the UNFCCC's involvement in coastal adaptation as the role of mitigation. When asked about how the UNFCCC was handling issues related to sea level rise and increased storms, Francisco Chavez, senior scientist at the Monterey Bay Aquarium Research Institute, said that "I think that, you know, the root of it all is greenhouse gases, and so that's how COP20 is addressing all these other problems" (Chavez 2014). Chavez sees the role of the UNFCCC as focused on mitigation, not necessarily required to assist nations in adaptation to coastal sea level rise.

Shawn Burns is CEO of consultancy company Core Value Concepts which licenses coastal forests, "blue forests", as carbon credits for corporations and entities. He was positive about the UNFCCC's involvement in coastal zones. He said: "I think right now it's on the map. I think the UN is looking carefully at the coastal zone, they're looking at blue carbon and blue forests, so I think it's something – something that's on the map now. Finally, which is great. There's always more that can be done" (Burns 2014). Using the private sector to protect coastal forests is another facet in the protection of SIDS. He compares his program to the REDD+ program for forest offset credits. Placing an economic value on coastal ecosystems, he says, is

crucial in protecting them. Now communities can chose preservation over development for the economic value of their land.

This may be a very beneficial strategy because one innovative study found that protecting vulnerable people and property may not mean building large sea walls. Researchers found that if existing coastal habitats remained fully intact, the number of people, poor families, elderly, and total value of residential property that are most vulnerable and exposed to hazards can be reduced by half. This study was done regarding the United States and risk reduction was highest in Florida, New York, and California, where coastal habitats defend the greatest number of people and total property value. Instead of sea walls, conservation and restoration of reefs and vegetation may have the greatest potential to protect coastal communities (Arkema et al. 2013).

However, many coastal adaption programs within the UNFCCC still focus on sea walls and dikes. In Senegal, a 3,000 meter anti-salt dike was built to help reclaim 17 hectares of rice farm land and a drying area for fishery products. The program also involved education in the community about climate change through methods such as radio programs and training sessions. There is also the potential to scale up the project and implement it in other countries like Ethiopia, the Philippines, South Africa, and Thailand (UNFCCC.int 2013).

In other areas, ecosystem-based adaptation measures are also implemented in the UNFCCC. For example, a National Adaptation Program Action (NAPA) for Bangladesh is a coastal reforestation project with community participation to protect against storm hazards. The UNFCCC's NAPAs are used by least developed countries to highlight their most urgent adaptation needs. NAPAs attempt to improve capacity to adapt by building on existing local strategies. Other priority projects currently include protecting coral reefs and mangrove vegetation in Djibouti, upgrading and restoring the resilience of coastal defenses and causeways in Kiribati, protecting the diverse fish population and prevent overfishing in Mauritania, and adapting to near-shore coastal shellfish fishery resources in Tuvalu. These projects are meant to increase coastal resilience so that increased storms, marine organism declines due to ocean acidification, and sea level rise effects will compound less with existing ocean threats (UNFCCC (NAPA Priorities Database) 2014).

General ocean issues addressed within the UNFCCC.

Delegates from SIDS were observed attempting to inject ocean issues into the COP discussions. Delegates such as Caleb Otto, from Palau, were adamant about asking ocean related questions at COP side events to gather more information and recognition. Others, when interviewed, described their nation's catastrophes and fears in great detail. Heherson Alvarez, a delegate from the Philippines, was resolute about the world's unrecognized reliance upon the oceans. He talked about his country's struggle with Typhoon Haiyan which hit before the 2013 COP. During the time of the interview in December 2014, he was worried about the impending Typhoon Hagupit which was about to hit the Philippines. When asked about ocean issues being addressed at the COP, he said: "They're not talked about enough. Without the oceans, we'd be dead today. About 700 meters down the sea, the heat, which we have been creating with the carbon I told you about, is being absorbed. But supposing those oceans lose the capacity to absorb the heat, we're going to toast... No, they're not being talked enough." (Alvarez 2014). Indeed, the oceans have been absorbing most of Earth's heat but it does not have unlimited capacity for heat (IPCC 2104). With the oceans as Earth's thermal regulator, what affects them affects everyone.

Lynn Wilson, attendee of six COPs, was asked to discuss the focus on ocean issues within the UNFCCC. She said: "It's not much of an agenda item at this COP. In fact it's not much of an agenda item in the text. And because people see it as remote, they don't understand. I think part of the problem with the oceans [is that]... people can't see under the water, they're not going to care what's there" (Wilson 2014). Although the majority of people live by a coast, the ocean damages from climate change are often gradual and difficult to see. Ocean acidification, for example, must be measured chemically and it affects ecosystems in ways that may not be obvious at first.

Milton Noguiera states that oceans have been neglected in many areas of international negotiation. Considering how many ways the oceans connect nations, this is a critical omission. As Noguiera summarized: "you may realize that there is no international treaty for oceans. You have treaty for many other things: air travel, diseases, but not for oceans. It has general agreement, but voluntary agreement. What we need, because oceans are so important for life, is international treaty including one who addresses the problems of salinization, acidification, warming of the oceans" (Noguiera 2014). It seems that the regulation of oceans has been often

neglected within the UNFCCC and international negotiations. Unlike land, the oceans are mostly shared areas, with often vague relations and lax levels of enforcement.

The negotiating power of AOSIS.

The Alliance of Small Island States (AOSIS) is an intergovernmental organization for the Small Island Developing States (SIDS) to lobby and negotiate within the United Nations system. Almost all— but not every— small island developing state is a member of AOSIS. These 44 low-lying coastal countries are similar in their development and adaptation challenges with regards to climate change impacts and can negotiate together with common interests (aosis.org 2014).

SIDS are acutely aware of their relatively small political power within the global sphere. Yet, the future of their livelihoods, ecosystems, and, sometimes, their country, depends upon the decrease of greenhouse gases from more powerful countries. As Mahendra Kumar, a representative from Fiji stressed, “we are obviously very interested in the international response to climate change, because, you know, climate change is affecting nearly every aspect of development in the small islands” (2014). Many other nations had this glaring problem; they were relatively powerless regarding the amount of future climate change. Shuuichi Endou, Environmental Goodwill Ambassador of Tuvalu, discussed at COP20 the little power that his representative country has in the climate change arena. “Of course in the future, what happens in the future, we already understand. Now we try to fight the world society but we don’t have any weapons. No money, no energy, so what do we do?” (Endou 2014). In an attempt to combat this disparity in power, nations especially vulnerable to a changing ocean banded together.

The Maldives, a nation consisting of nearly 1,200 coral islands (200 of which are inhabited) is one of the world’s nations most vulnerable to climate change. The nation’s President, Maumoon Abdul Gayoom, appealed to the United Nations General Assembly to take action as early as 1987, with a speech citing the unusually high waves that had flooded farms and washed away land. The Maldives then held the first scientific conference on sea level rise two years later. Subsequent conferences, such as the 1994 conference on sustainable development in Barbados, allowed the concerned nations of SIDS to form the coordinating body of AOSIS (Wong 2011).

These small islands contribute a relatively minuscule amount (less than one percent) to the overall amount of carbon in the atmosphere, yet they are one of the first people affected by climate change (Wong 2011). The very existence of SIDS are directly threatened by climate change impacts, unlike any other nations in the world. However, the SIDS did almost nothing to cause this plight; issues of environmental injustice permeate through AOSIS negotiations. Anote Tong, the President of the small island nation of Kiribati stated that, “The impacts of climate change cover a wide spectrum, from those who will not even feel it for the next two hundred years and those who are feeling it yesterday” (Noack 2014). Unfortunately, the people feeling it “yesterday” are not the key negotiators in the UNFCCC.

However, these nations did become a force when they banded together as AOSIS. Despite their relatively small size and lack of political power among nations, AOSIS has become one of the key players in the dialogues within the UNFCCC. This kind of negotiating power within any international regime is a notable accomplishment for island microstates (Betzold et al. 2012). According to Keya Chatterjee, senior director of Renewable Energy and Footprint Outreach at the World Wildlife Fund and author of *The Zero Footprint Baby*, what AOSIS does have is a strong moral force within the Conference of the Parties. They are a persistent and constant force in the UNFCCC that has a strong legitimacy behind their rhetoric. Many small island states are leading the way in renewable technologies, despite their limited capacity. Furthermore, because of their actual experience with the early impacts of climate change, other nations feel an obligation to give AOSIS weight to its words (Chatterjee 2014).

This moral authority has been demonstrated throughout the Conference of the Parties negotiations. SIDS were given seats on various bodies established under the UNFCCC and the Kyoto Protocol (Betzold et al. 2012). At the thirteenth COP in Bali in 2007, Micronesia declared that “no island should be left behind”, reaffirming the AOSIS position. In the subsequent COP, in Poznan, AOSIS led lobbying groups to ensure that “climate risk insurance” would become part of any deal on adaptation. AOSIS proposed a global temperature rise of less than 1.5°C above preindustrial levels at the 15th COP in Copenhagen. This proposal was supported by more than half of the members of UNFCCC and the global goal to stay below 2°C warming above preindustrial levels is now under review (Wong 2011).

The 2013-2015 Review is assessing both whether the long term global goal of stabilizing temperatures below 2°C is adequate and if the current progress towards achieving this goal is

sufficient. The Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI), two groups established under the UNFCCC, are conducting the review with the COP and the support of the structured expert dialogue group. Through expert meetings and scientific workshops, the structured expert dialogue group considers the inputs of the review. On the basis of inclusivity, workshops are open to all stakeholders. The review should be finished by COP21 in Paris which will allow the Parties to discuss the outcome of the review and decide whether to strengthen the long term goal of average global warming to below 1.5 °C (UNFCCC.int 2014).

The AOSIS submission on the 2013-2015 Review calls limiting global average temperature increases to below 1.5 °C essential for minimizing damage to small island developing states. The submission cites sea-level rise, ocean acidification, extremes of heat, food security, precipitation extremes, water availability, severe weather, and the protection of coral reefs as important needs in SIDS that would face greater insecurities with a goal of 2 °C. When considering the UNFCCC's goal of preventing dangerous climate change, AOSIS asks the Review committee to understand the dangers that a 2 °C warmer world would pose for their nations.

Barriers to change.

Although the global warming limit of 2°C is currently under review, with AOSIS pushing for a limit of only 1.5°C average global warming in order to prevent catastrophic changes to their nations, global politics makes even the 2°C limit seem unattainable. A paper by Rogelj and colleagues looked at the commitments of all the nations in the UNFCCC and found that the current national targets give virtually no chance of constraining global warming to 2°C. Furthermore, studies have shown that atmospheric concentrations of carbon dioxide at 550ppm can halt the growth of and begin dissolving coral reefs. Atmospheric concentrations could reach 550ppm shortly after 2050 (Rogelj et al. 2009).

The power of AOSIS as a cohesive group may be declining due to changes in the UNFCCC process. A study by Betzold and colleagues tracked how AOSIS fared within the UNFCCC over three distinct time periods (1995-2000, 2001-2005, and 2006-2011). Because of an increasing number of issues addressed within the UNFCCC platform, members within AOSIS have formed conflicting opinions on certain issues. There are now more unions of nations in the

negotiations and AOSIS members may belong to many other groups such as a single-issue coalition or a leftist alliance. There is still overall agreement with regards to mitigation and adaption within the group. However, there is less consensus regarding forestry issues; the UN programs Land Use, Land-Use Change and Forestry (LULUCF) and Reducing Emissions from Deforestation and Forest Degradation (REDD) programs are debated among the members. Still, the researchers note that AOSIS continues to be a tightly coordinated and cohesive alliance that continues to be a key player in global climate policy (Betzold et al. 2012).

When describing AOSIS, a delegate of one of the member nations, Palau, said:

“I think AOSIS is a very strong and unified group. It is an interesting group in a sense that we come from... the only thing that really does unify us is the ocean... and that’s why it’s very important to all of us. We are, the Pacific Islands, very different in terms of culture, food, even the way we look, from the Caribbean, which is very different from the Indian Ocean, Atlantic Ocean, and the South China Sea. So really the only thing that combines us, that we have in common, is the fact that we are small...I think, we have been the moral for addressing climate change. And that, it’s not because we think that we have particular intellectual about this, in fact, we need more capacity to understand more and more of the science, but we speak from experience and from the traditional ethic of conservation” (Otto 2014).

The fact that AOSIS states have had personal experience with the impacts of climate change allows them to have a certain power within the UNFCCC.

However, will this international moral power be sufficient? The group’s power to change national legislation in other countries is more limited. AOSIS members have little ability to combat the causes of climate change within their own borders. Some AOSIS member delegates are doubtful. “I think that is the crux of the international negotiations because, as you know, at the end of the day, this is intergovernmental process and the national interest will come into play when it comes to a final agreement” (Kumar 2014). Their powerful moral influence is seen in the rhetoric of the Conference and its members, but the actions of UNFCCC members to reduce greenhouse gas emissions seem to better reflect each nation’s personal risk of climate change impacts rather than the risk that AOSIS members face.

“For me, the biggest obstacles I think still has to do with political will and I think there’s a lot of sort of talk and rhetoric about, ‘yeah, this is very important and we need to all,

you know, deal with it' but when it comes to actual commitment, it always turns out to be that the developing nations are asking the developed nations to do something, to give the resources. And it's the developed nations that are having some problems with their commitment" (Otto 2014).

In the end, national interest may win out over collective moral cooperation. However, AOSIS still has the power to create change. It simply may not be change that is drastic enough.

Funding within the framework of the Convention.

One theme that was expressed in most of the interviews was the need for funding and capacity building. The marine protected areas established in Palau to increase climate change resilience are not patrolled due to lack of capacity and funds, the storm warning signal in the Philippines is inadequate, leading to unnecessary deaths, and Tuvalu has a very small government staff that makes it difficult to attend international conferences (Otto 2014; Alvarez 2014; Endo 2014). As Shuichi Endo remarked about Tuvalu: "Our population is 10,000. That means that we don't have any specialists for such kind of conference or another option for the larger society. For example, for the office, only five staff in there- one minister and five staff but we have to go far outside, some meeting in England, another meeting in America. Then, nobody in the office so [chuckles] but we try our best" (2014). There are clearly issues of equity and justice when small developing countries must find the capacity and funding to handle issues that were created by powerful, more developed nations.

In an attempt to be more just, the UNFCCC established the Adaptation Fund with the Kyoto Protocol in 2001; it funded adaptation projects in developing countries that are particularly vulnerable to the negative impacts of climate change. It was funded with a tax on the certified emission reduction credits. (adaptation-fund.org). Projects within the Adaptation Fund included implementing a climate change adaptation program in the coastal zone of Mauritius, improving the adaptive capacity of communities to climate change related floods in Papua New Guinea, enhancing the resilience of agriculture and food security in the Solomon Islands, and implementing an integrated water resource management program in the Maldives (climatefundsupdate.org).

However, the Adaptation Fund was not sufficient to fulfill the needs of developing nations. At COP16 in Cancun, the Green Climate Fund (GCF) was established to support

projects, programs, policies, and other activities for developing country Parties. The fund was endorsed at COP18 and established a secretariat during COP19, but no funds were contributed until COP20. During COP20, Parties contributed USD 10.2 billion which makes the GCF the largest dedicated climate fund. COP20 requested that contributors confirm pledges, the Board accelerate the operationalization of the adaption and mitigation windows and procedures, and the Board implement its work program on readiness and preparatory support (UNFCCC, Green Climate Fund, 2015). As Martin Khor, Director of the South Centre, was quick to point out, the GCF requires that half of the funds be used for adaptation. He sees this as progress for developing countries such as the small island states.

“[T]he feeling is that developed countries are more interested in terms of self-interest... Whereas adaptation is something that you suffer on your own, so our heart bleeds for you and we will do whatever we can, but [mitigation] you need to do because my children’s lives depend on it. So it is more likely that developed countries would be tempted to put more of their money, or most their money in mitigation. And that’s why the developing countries say no in this fund half of it must be for adaptation because the reverse is true for us. We already having the floods, the droughts, the loss of livelihoods, the typhoons, and it’s an immediate issue, and we need to solve it” (Khor 2014).

Although Khor thinks that the GCF is a step in the right direction, efforts to raise the USD 100 billion planned by 2020 may fall flat. The GCF does not have a set plan to obtain these funds, but it is hoped that countries will heavily contribute as they can. This was a contentious issue at COP20; many developed countries were hesitant to contribute large amounts, to the dismay of developing countries. However, the USD 10 billion pledge goal for COP20 was met at the conference so nations may succeed in meeting the 2020 goal.

Loss and damage.

AOSIS suggested an international insurance pool for the finance of climate change damages within the UNFCCC in 1991. The text of the Convention did not incorporate the proposal, save for the word “insurance” in Article 8 which describes the needs of developing countries (UNFCCC 1992). The UNFCCC focused on mitigating greenhouse gases in order to prevent dangerous climate change but it later became clear that adaptation to climate change would also be necessary. The concept of loss and damage is finally directly addressed in the Bali

Action Plan, which calls for stronger action on adaptation including the consideration of “disaster risk reduction strategies and means to address loss and damage associated with climate change impacts in vulnerable countries” (UNFCCC 2008). AOSIS then proposed the Multi-Window Mechanism to Address Loss and Damage from Climate Change Impacts to the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA). This proposal included a rehabilitation or compensation aspect to address loss and damage from “the progressive negative impacts of climate change, such as sea level rise, increasing land and sea temperatures, and ocean acidification” (AOSIS 2008). In one way, the UNFCCC goal to mitigate greenhouse gas emissions can be seen as avoiding future loss and damage costs. Secondary to this is adaptation measures which could also prevent future loss and damage. However, the historic and current level of emissions are causing loss and damage costs so a system of insurance must be set up.

Michael Khor, Director of the South Centre, was very excited by the recent progress in the realm of loss and damage. He said:

“So at this COP the establishment of the mechanism it has been established, but the implementation of the mechanism will have to be brought one step further here. Because in Warsaw, the biggest achievement in Warsaw was the establishment of this Loss and Damage pillar. And they wanted it as an independent pillar, but we didn’t get it quite independent. It became still under the umbrella of adaptation, but it had a little bit of economy somewhere. And now they have to flesh out whether this mechanism is going to be funded as well and so on, because at the moment adaptation is when you build a sea wall, but when the sea wall crumbles and whole villages are swept away, then to rehabilitate those villages at the moment is not covered by climate financing. So loss and damage is stepping in to say these are the desperate measures that are really needed, you know” (Khor 2014).

As Khor mentions, COP19 in Warsaw created a loss and damage framework. Least Developed Countries (LDCs) and the Africa Group finally joined the campaigns for loss and damage from AOSIS in COP16 in Cancun and allowed the topic to be fully explored. The Executive Committee of the Warsaw International Mechanism on Loss and Damage was established to develop a loss and damage plan. They are scheduled to deliver their advice to the Parties at COP22 in 2016. Loss and damage will continue to be a contentious, pertinent issue for the future

of climate change negotiations and could bring more just assistance to SIDS in their struggle with costs resulting from climate change (Huq 2014).

Outcome of the Twentieth Conference of the Parties.

In the opening statement that Nauru presented on behalf of AOSIS at the Twentieth Conference of the Parties (COP20) in Lima, Peru, the group spoke about the current level of commitment and the degree of ambition that they need for the future. AOSIS first congratulated the Annex B Parties for meeting their first commitment targets in aggregate, stressing the legally binding commitments with flexible mechanisms which produced transparent results. However, AOSIS went on to stress that these commitment targets were “tragically modest” and fall short of keeping the temperature increase below 1.5°C (AOSIS, High Level Statement, 2014).

Most delegates interviewed described the Twentieth COP to be a preparatory meeting for COP21 in Paris. “Well as you know this is really a buildup or a watershed COP before the COP in Paris next year when a new international agreement will hopefully be finalized” (Kumar 2014). Nevertheless, it was crucial that progress be made in Lima in order to have a framework of set agendas for Paris.

Other delegates discussed the demands of AOSIS during COP20. Caleb Otto, delegate from Palau, stated:

“For all of the AOSIS... we want to make sure that we have some commitment that are going to be honored with regards to climate change... [We need to] get some resources to help us with mitigation efforts and this has to do with emissions reduction and for us also we are very interested in getting assistance for adaptation to help us deal with what’s going on and now there’s so much at the moment... And then, beyond what we cannot adapt for, we also want some provisions in the convention to address [loss and damage]” (Otto 2014).

Small island developing states seemed hopeful for sufficient commitments, adaptation provisions, and possibly a focus on loss and damage.

However, after two weeks of negotiating, the climate talks in Lima seemed to be on the verge of collapse. Over 80 developing countries, including those in the AOSIS group, refused to back proposals that were suggested by UN officials. This heated meeting took place a day after meetings were scheduled to end. However, the many delegates pulled a 32-hour marathon

session to produce a modest compromise. With the overtime session, 195 countries agreed to adopt a document that explains the types of national climate targets (Intended Nationally Determined Contributions) they will need to deliver in the next six months (COP20 Newsroom 2014).

The agreed upon document, the “Lima Call for Climate Action,” outlines the main aspects of the new climate proposal for Paris. The first part of the text comments on the conclusions reached in Lima and commits to concern regarding climate change. It confirms the goal of limiting average global warming to 2°C although it notes the significant gap between the aggregate effect of mitigation pledges and the aggregate emission pathways consistent with having a likely chance of holding global average temperatures below 1.5°C or 2°C (CP.20 2014). The new developments in the text are outlined as a preliminary deal text for Paris. Far from being an established text, however, some clauses have as many as eleven different options. Many critics have called the draft weak as it does not make any decisions on the most controversial issues, leaving them instead for Paris (Hope 2014). The text does not specify whether the new deal will be legally binding (CP.20 2014).

As previously mentioned, keeping a limit of 2°C of average global temperature warming does not seem probable with current policy. The upcoming conferences are key if there is to be any change in this path. The COP21 in Paris will be especially important. The 2013-2015 Review of the 2°C warming goal will be complete and the Parties will have new information with which to reevaluate their policies and pledges in terms of what goal they hope to achieve. If the nations decide that 1.5°C is a safer goal to set for the earth, then the members of AOSIS may have a victory. There are underlying issues. Individual nations must actually enact stringent legislation in order to achieve these lofty goals. Further, the amount of carbon dioxide in the atmosphere is such already that some small island states will still need to evacuate their islands. Incredible damage to marine ecosystems and coastal communities has already been experienced but policies now will dictate how much more damage SIDS will have to suffer in the future.

Conclusion.

Small island developing states rely on the ocean for their development, livelihood, and culture. The status of the oceans is in jeopardy; anthropogenic increases in greenhouse gases are causing ocean acidification, sea level rise, increased storms, and ocean warming. However, the

framework of the UNFCCC does not adequately focus the plights of SIDS and ocean issues resulting from climate change. The majority of participants interviewed did not feel that the UNFCCC focused enough on ocean acidification, coastal adaptation, or ocean issues as a whole. Furthermore, SIDS lack adequate funding for adaptation and loss and damage. AOSIS is a powerful negotiating body, but the rhetoric does not match global action. The world is not on track to stay below 2°C warming while many SIDS face disaster with only an increase of 1.5°C. The UNFCCC is simply a group of world nations. The most powerful nations in the UNFCCC rely on a carbon based economy. These nations, such as the United States, Australia, China, and India, would have to sacrifice greatly economically in order to avert catastrophe for SIDS. Negotiating within the framework of the Conference is unlikely to change the system completely. However, with increased funding and awareness, SIDS can decrease the damage on the oceans that is occurring and will continue into the future due to climate change.

References

- Adaptation-Fund.org (2014). About the Adaptation Fund. *Adaptation Fund*. Web. <https://www.adaptation-fund.org/about>.
- Alvarez, Heherson (2014). Interview at the Twentieth Conference of the Parties in Lima, Peru. 2 December 2014.
- AOSIS (2008). Proposal to the AWG-LCA: Multi-Window Mechanism to Address Loss and Damage from Climate Change Impacts. *United Nations Framework Convention on Climate Change*. http://unfccc.int/files/kyoto_protocol/application/pdf/aosisinsurance061208.pdf.
- AOSIS.org (2014). About AOSIS. Web. <http://aosis.org/about/>.
- AOSIS (2014). AOSIS High Level Statement Delivered at COP20 in Lima. *AOSIS.org*. <http://aosis.org/aosishigh-level-statement-delivered-at-cop-20-in-lima/>.
- Arkema, K. K., Guannel, G., Verutes, G., Wood, S. A., Guerry, A., Ruckelshaus, M., ... & Silver, J. M. (2013). Coastal habitats shield people and property from sea-level rise and storms. *Nature Climate Change*.
- Betzold, C., Castro, P., & Weiler, F. (2012). AOSIS in the UNFCCC negotiations: from unity to fragmentation? *Climate Policy*, 12(5), 591-613.
- Brewer, P. G., & Peltzer, E. T. (2009). Oceans: Limits to marine life. *Science*, 324(5925), 347-348.
- Burns, Shawn (2014). Interview at the Twentieth Conference of the Parties in Lima, Peru. 3 December 2014.
- Cameron, F. R. (2011). Saving the 'disappearing islands': Climate change governance, Pacific island states and cosmopolitan dispositions. *Continuum*, 25(6), 873-886.
- Chatterjee, Keya (October 18, 2014). Climate Change. *Student trip to Washington D.C.* Lecture conducted from Dickinson Climate Change Mosaic, Washington D. C.
- Chavez, Francisco (2014). Interview at the Twentieth Conference of the Parties in Lima, Peru. 2 December 2014.
- ClimateFundsUpdate.org (2014). Adaptation Fund: Graphs and Statistics. *Climate Funds Update*. <http://www.climatefundsupdate.org/listing/adaptation-fund>.
- ClimateNetwork.org (2014). Climate Action Network. <http://www.climatenetwork.org/>.

- COP20 Newsroom (2014). Late deal in Lima saves UN climate talks from collapse. *Lima COP20*. 18 December 2014. <http://www.cop20.pe/en/18014/english-late-deal-in-lima-saves-un-climate-talks-from-collapse/>.
- CP.20 (2014). Lima call for climate action. *United Nations Framework Convention on Climate Change*.
- Decision 1/CP.16 (2010). The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention. *United Nations Framework Convention on Climate Change*.
- Endou, Shuichi (2014). Interview at the Twentieth Conference of the Parties in Lima, Peru. 3 December 2014.
- European Commission (2014). Climate Action: 2030 framework for climate and energy policies. *European Commission*. http://ec.europa.eu/clima/policies/2030/index_en.htm.
- Feely, R. A., Sabine, C. L., Lee, K., Berelson, W., Kleypas, J., Fabry, V. J., & Millero, F. J. (2004). Impact of anthropogenic CO₂ on the CaCO₃ system in the oceans. *Science*, 305(5682), 362-366.
- Frihy, O. E., & El-Sayed, M. K. (2013). Vulnerability risk assessment and adaptation to climate change induced sea level rise along the Mediterranean coast of Egypt. *Mitigation and Adaptation Strategies for Global Change*, 18(8), 1215-1237.
- Harrould-Kolieb, E. R., & Herr, D. (2012). Ocean acidification and climate change: synergies and challenges of addressing both under the UNFCCC. *Climate Policy*, 12(3), 378-389.
- Houser, Trevor, R. Kopp, S. Hsiang, M. Delgado, A. Jina, K. Larsen, M. Mastrandrea, S. Mohan, R. Muir-Wood, DJ Rasmussen, J. Rising, and P. Wilson (2014). American Climate Prospectus: Economic Risks in the United States. *The Rhodium Group*. <http://rhg.com/reports/climate-prospectus>.
- Huq, Saleem (2014). Loss and damage: a guide for the confused. *Responding to Climate Change*. <http://www.rtcc.org/2014/10/20/loss-and-damage-a-guide-for-the-confused/>.
- IPCC (2014). Summary for Policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken,

- P.R. Mastrandrea, and L.L. White (eds.)]. *Cambridge University Press*, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.
- Jacobson, M. Z. (2005). Studying ocean acidification with conservative, stable numerical schemes for nonequilibrium air-ocean exchange and ocean equilibrium chemistry. *Journal of Geophysical Research: Atmospheres* (1984–2012), 110(D7).
- Kumar, Mahendra (2014). Interview at the Twentieth Conference of the Parties in Lima, Peru. 30 November 2014.
- Malm, A. (2013). Sea wall politics: uneven and combined protection of the Nile Delta coastline in the face of sea level rise. *Critical Sociology*, 39(6), 803-832.
- Mataki, Melchior (2014). Interview at the Twentieth Conference of the Parties in Lima, Peru. 8 December 2014.
- Monbiot, George (2009). Climate change displacement has begun- but hardly anyone has noticed. *The Guardian*.
<http://www.theguardian.com/environment/georgemonbiot/2009/may/07/monbiot-climate-change-evacuation>.
- Morello, L. (2011). Phytoplankton Population Drops 40 Percent Since 1950. *Scientific American*.
<http://www.scientificamerican.com/article/phytoplankton-population/>.
- Nicholls, R. J., & Cazenave, A. (2010). Sea-level rise and its impact on coastal zones. *Science*, 328(5985), 1517-1520.
- NOAA (2014). Is sea level rising? *NOAA National Ocean Service*.
<http://oceanservice.noaa.gov/facts/sealevel.html>.
- Noack, Rick (2014). Has the era of the ‘climate change refugee’ begun?’ *The Washington Post*.
<http://www.washingtonpost.com/blogs/worldviews/wp/2014/08/07/has-the-era-of-the-climate-change-refugee-begun/>.
- Noguiera, Milton (2014). Interview at the Twentieth Conference of the Parties in Lima, Peru. 7 December 2014.
- Noone, Kevin, Rashid Sumaila, & Robert J. Diaz (editors) (2012). Valuing the Ocean: Draft Executive Summary. *Stockholm Environment Institute*. <http://www.sei-international.org/mediamanager/documents/Publications/SEI-Preview-ValuingTheOcean-DraftExecutiveSummary.pdf>.

- Otto, Caleb and Charlene Meral (2014). Interview at the Twentieth Conference of the Parties in Lima, Peru. 4 December 2014.
- Pyper, Julia (2013). Drama unfolds on islands facing a watery end. *E & E Special Report: Islands*. <http://www.eenews.net/stories/1059977973>.
- Rogelj, J., Hare, B., Nabel, J., Macey, K., Schaeffer, M., Markmann, K., & Meinshausen, M. (2009). Halfway to Copenhagen, no way to 2°C. *Nature Reports Climate Change*, 81-83.
- Secretariat of the Convention on Biological Diversity (2014). *Global Biodiversity Outlook 4*. Montréal, 155.
- Spross, Jeff (2014). Meet the First Pacific Island Town to Relocate Thanks to Climate Change. *Climate Progress*. <http://thinkprogress.org/climate/2014/08/18/3472645/pacific-island-town-relocate-climate-change/>.
- Taylor, Lenore (2014). US and China strike deal on carbon cuts in push for a global climate change pact. *The Guardian*. 12 November 2014.
<http://www.theguardian.com/environment/2014/nov/12/china-and-us-make-carbon-pledge>.
- UNESCO (2012). I need a new home, my island has sunk. *United Nations Educational, Scientific, and Cultural Organization*. http://www.unesco.org/new/en/rio-20/single-view/news/i_need_a_new_home_my_island_has_sunk/#.VPs25hrF9ps.
- UNFCCC (2008). Report of the Conference of the Parties on its thirteenth session, held in Bali from 3 to 15 December 2007. FCCC/CP/2007/6/Add.1*. 14 March 2008. *United Nations Framework Convention on Climate Change*.
<http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf>.
- UNFCCC.int (2013). Adaptation to Coastal Erosion in Vulnerable Areas: Senegal. *United Nations Framework Convention on Climate Change*.
http://unfccc.int/secretariat/momentum_for_change/items/7093.php.
- UNFCCC.int (2014). NAPA Priorities Database: Lists of All NAPA Priority Projects by Country. *United Nations Framework Convention on Climate Change*.
http://unfccc.int/adaptation/workstreams/national_adaptation_programmes_of_action/items/4583.php.

- UNFCCC.int (2014). What is the 2013-2015 Review? Frequently Asked Questions. *United Nations Framework Convention on Climate Change*.
http://unfccc.int/science/workstreams/the_2013-2015_review/items/7532.php.
- UNFCCC.int (2015). Green Climate Fund. *United Nations Framework Convention on Climate Change*.
http://unfccc.int/cooperation_and_support/financial_mechanism/green_climate_fund/items/5869.php.
- United Nations Department of Economic and Social Affairs, Division for Sustainable Development (2014). SIDS Action Platform.
<http://www.sids2014.org/index.php?menu=1605>.
- Wilson, Lynn (2014). Interview at the Twentieth Conference of the Parties in Lima, Peru. 2 December 2014.
- Wong, P. P. (2011). Small island developing states. *Wiley Interdisciplinary Reviews: Climate Change*, 2(1), 1-6.
- Wong, P.P., I.J. Losada, J.-P. Gattuso, J. Hinkel, A. Khattabi, K.L. McInnes, Y. Saito, and A. Sallenger (2014). Coastal systems and low-lying areas. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 361-409.