MINI REVIEW

Climate change and its effects on island nations

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ABSTRACT

In recent years, there has been an increase in the frequency of extreme weather and climatic events, as well as the intensity of their effects on the natural environment and society. Extreme weather and climate events, in addition to natural climate variability and greenhouse-induced climate change, have the most influence. The climate of three island countries in the has been studied in this research. Annual average maximum and minimum temperatures have been warming since the 1950s, in keeping with the global warming trend. We look at three recent examples of extreme weather and climate events in the Western Pacific, including the 2011 drought in Tuvalu, the 2012 floods in Fiji, and the tropical storm Evan, which wreaked havoc on Samoa and Fiji in December 2012. Extreme weather and climate events are also linked to phases of the El Nio-Southern Oscillation (ENSO) phenomena. Natural disasters have devastating consequences for countries, and the costs of devastation are enormous. Climate disasters can sometimes cause countries to declare a state of emergency, as happened in Tuvalu in 2011 when a severe drought wreaked havoc on the country's water resources.

Key Words: *Adaptive climate; Western Pacific; Droughts; Tropical maritime; Mountains.*

INTRODUCTION

The most destructive severe weather and climate extreme events that strike countries in the Western Pacific include tropical cyclones, floods, and droughts. Floods are commonly linked to tropical disturbances in this region, while droughts are linked to the El Nio-Southern Oscillation (ENSO). The ENSO is a large-scale climate phenomenon that affects the tropical Pacific Ocean, with two distinct phases: warm (El Nio) and cold (La Nia). There is also a neutral phase, which is a form of transition from the ENSO warm to cold phase and vice versa. The ENSO and tropical cyclone activity in the Western Pacific, as well as rainfall variability in Australia, are well understood and discussed in the literature [1]. On the other hand, there were only a few studies that recorded climatic conditions in the Western Pacific islands and the ENSO implications on regional climate variability until recent study undertaken under the Pacific Climate Change Science Program. Weather and climate extremes have even less of an impact on the environment and society in this region [2]. As a result, we were inspired to write about the effects of catastrophic weather occurrences on island countries in the Western Pacific. This paper describes some of the damages caused by cyclones, floods, and droughts, as well as establishing links between occurrences of climate extremes and ENSO phases, using a few case studies.

Current Climate

The country consists of a 332 island archipelago, of which 111 are continually inhabited, with a total land area of approximately 18,333 km2. Viti Levu and Vanua Levu, the two largest islands, account for 95% of the population of 837,271. Samoa is a Polynesian island nation. The two large islands of Upolu and Savai'i, which account for 99 percent of the total land area, plus eight minor islets, make up the total land area of 2934 km2. Samoa has a population of 194,320 people, with almost three-quarters of them living on Upolu, the major island Tuvalu is a small Polynesian island republic with three reef islands and six atolls. It has a population of 11,200 people, making it the world's third-smallest sovereign state, after only Vatican City and Nauru [3]. Tuvalu is the world's fourth smallest country in terms of physical land area, with about 26 km2. There are two different seasons in the countries: a hot and humid season (November to April) and a colder yet rather dry season (May to October) (May to October). The climates of Fiji, Samoa, and Tuvalu are examined in depth in this section [4]. The research was based on long-term historical climatic records acquired from each NMS. The Pacific Climate Change Data Portal, has been used to analyse meteorological data. Temperature and rainfall variations have been studied seasonally and interannually, and long-term trends have been determined. Significant climate variability has been discovered in the countries, which has been linked to the ENSO.

In island

Fiji, Samoa, and Tuvalu are island nations in the Western South Pacific Ocean that have a tropical maritime environment with warm temperatures all year. Fiji is a Melanesia island nation.

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The annual average temperature of Fiji ranges from roughly 27°C in the coastal sections to around 20°C in the mountainous inland regions. Seasonal temperature changes are minor and strongly correlated with changes in the surrounding water temperature. The average nighttime temperature around the coast can be as low as 18° C, while the average maximum daytime temperature can be as high as 32°C. Average nighttime temperatures in the middle regions of the main islands can be as low as 15 °C. The amount of rain that falls on Fiji varies greatly. High mountain peaks of up to 1300 m impact rainfall on Fiji's two main islands, Viti Levu and Vanua Levu. The average annual rainfall on the south-eastern slopes of Viti Levu, near Suva, is around 3000 mm. The lowlands on the western side of Viti Levu, near Nadi, are shielded by the mountains and get roughly 1800 mm of annual rainfall with a well-defined dry season. Fiji's climate is also impacted by the Hadley Circulation, which brings trade winds from the east and south. The trade winds carry moisture ashore, resulting in severe rains in the interior and eastern regions of the bigger islands.

Climate of Samoa: Samoa has a very stable climate throughout the year, with an annual average temperature of roughly 26°C to 27°C. Temperatures are coolest in July, when the chilly, dry south-east trade winds are strongest, with only minor seasonal changes. March is the warmest month [6]. There are different rainy and dry seasons in the country. The wet season accounts for about 75% of Samoa's total annual rainfall. The mountains of Samoa have a major impact on rainfall distribution. Wetter places can be found in the south-east, whereas sheltered, drier parts can be found in the north-west. The ENSO phases are linked to the significant interannual fluctuation in rainfall experienced in Apia. El Nio events in Samoa are associated with drier-than-average circumstances (climatology), whereas La Nia events are associated with wetter-than-average conditions. In December 2012, both Samoa and Fiji were hit by severe tropical storm Evan. The worst tropical cyclone to hit Samoa since cyclones Ofa and Val destroyed the island in 1990 and 1991, respectively, was severe tropical cyclone Evan. Due to a combination of storm surge and high seas, Cyclone Ofa caused gales or strong winds, causing significant damage. Seven persons were killed in Samoa, with $130 million in damage. Crop and tree damage was also reported to be severe. A year later, catastrophic tropical cyclone Val wreaked havoc on the country once more. Damage to electrical, water, and telephone connections, as well as the destruction of different government buildings, schools, and homes, has been assessed at $200 million in Samoa as a result of cyclone Val. It took a long time for the country to recover from such damage, but two decades later, in December 2012, catastrophic cyclone Evan caused much more devastation. On the 9 December, the system was originally detected as a weak tropical depression around 700 km northeast of Suva, Fiji. The depression rapidly worsened over the next few days before being declared a tropical cyclone by the Regional Specialised Meteorological Centre (RSMC) Nadi, Evan on December 12.

The system travelled into Samoa throughout that day and steadily increased before slowing down and severely affecting the Upolu and Savaii Islands the next day. The storm then turned anticlockwise and continued on its way to Fiji. On the 17 December, cyclone Evan reached its peak intensity, with 10 min wind speeds of 185 km/h, as it continued to move around the coast of the Fijian island of Viti Levu wreaking havoc on the island before gradually fading as it passed over the island's west coast. RSMC Nadi stated on the 19 December that storm Evan had dropped below cyclone strength and had been declassified as a tropical cyclone. Significant improvement has been made in the operational forecasting of tropical cyclones. Although better forecasting has been accomplished in recent years, resulting in enhanced early warning systems, the mortality toll from cyclones remains high. As a result of the impact of hurricane Evan in Samoa, at least 14 deaths have been verified and ten sailors have gone missing. Authorities in Fiji evacuated about 400 people from remote resorts on small islands and low-lying areas to emergency shelters in advance of the cyclone's arrival. We presented a number of recent cases of storm, flood, and drought-related damage [7]. The impact on the natural environment and the economy could be massive, especially given that these countries are among the least developed. Economic losses from natural disasters can wipe out a considerable portion of a country's annual GDP in extreme instances. Authorities in island countries develop various action plans as well as adaptation strategies in order to create efficient early warning systems with the goal of decreasing the impacts of extreme events, climate variability, and climate change on the natural environment and society.

Authorities making informed decisions based on the latest achievements in climate science and efficiently using seasonal climate prediction products that forecast expected rainfall and temperature over the coming season is one of the most cost-effective and easy-to-implement ways to adapt to climate variability and change that we discuss here (next three months). Research has been carried out under the Pacific Adaptation Strategy Assistance Program and the Pacific Australia Climate Change Science and Adaptation Planning Program to assess the ability of the dynamical climate model POAMA (Predictive Ocean Atmosphere Model for Australia) to predict seasonal rainfall. POAMA outputs are now given through a variety of web-based information tools to assist NMSs in 15 Western Pacific island countries in developing operational monthly seasonal climate outlooks.

CONCLUSION

Severe weather and climate extremes have the greatest influence on countries, and we offered examples of such consequences produced by tropical cyclones, floods, and droughts in this research. Tropical cyclones represent a significant threat to the economies and well-being of Pacific Island nations. Tropical cyclones have devastating effects on countries, and the expenses of devastation are enormous. Projections show a decrease in the number of tropical cyclones by the end of the century, but a likely move toward more intense categories. Furthermore, warming of the atmospheric and marine environments may create geographical modifications in the distribution of tropical storm occurrences. Increases in the frequency of hydrological extremes such as floods and droughts are also rise.

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