Climate Change's Effect on Sea-Level Rise on Tourism from an Economic and Environmental Perspective

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Abstract. Under the globally rising temperature circumstance, the dramatic change in the weather caused a different level of rising in the world's sea level. This study examines the different impacts of climate change on the domestic country's weather, geomorphic features, population, economic behavior, and damage to human facilities. Upon the various factors that contribute to the changing climate, the report will also evaluate the changes that will affect tourism, like sea-level rise, shortage of underground water, geological subsidence and coastal erosion are the consequences caused by this globally rising temperature. Based on the analysis of the causes of climate change and sea-level rise, the report will finally summarise how the impacts of sea-level rise will affect tourism and how it detriments the government's balance of payments. This paper proposes that based on the current data and research conducted by other scientists, the sea level rise will affect tourism the most from both environmental and economic perspectives.

Keywords: Climate change · Sea-level rise · Tourism

1 Introduction

The climate change issue is a newly rising hot debating global issue these years. With a rising temperature, the problem of drastic weather changes, shortage of water, ecosystem's changing composition and submerged land have emerged, troubling people with their devastating effects on both the environmental and human activities. This is because the submerged land will cause the houses built beside the coastal area to be flooded, and the country's land area to be reduced due to the submerged national territorial area. The dramatically rising cost of building control dams to prevent the sea from further drowning the cities also add to the government's fiscal deficit, while the catastrophe of a collapse in the sea dams will cause an irreversible outcome of estimation to thousands and millions of deaths in the city if there is no preparation for such disaster. An increased discount rate for building houses beside the coastline will also result in a further shrink in the local mortgage business. The decrease in the coastal asset value will also reduce the investor's confidence in investing in the area, which will lead to an economic recession or decrease the young population in search of better places for future living. Tourism, an

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industry that requires an outstanding natural scenery resource, a charming culture sedimented by time, and stability in the future sustainable growth in businesses related to the tourism industry will be strongly disturbed by the instability in the safety of residing in such area with the risk of being submerged by the sea. Thus, this report will mainly discuss how climate change will affect tourism in various factors.

Climate change has been associated with a rising issue of its impact on tourism worldwide lately. A soaring number of researches and investigations are conducted these years, seeking to discover the relationship between rising sea levels and the influence on the amount of tourism in certain areas. The debate was engaged [1], and different researchers issued their individual opinions based on the data collected on this topic. The first emerged debate on the topic of international tourist flows on the validity of macroeconomic analysis is conducted by Gössling [2] and Biagano et al. [3]. The debate established the complexity of the intricate model when explaining the disciplinary differences and level of realism. After years of clashing and fusing ideas, the debate marched into the second level of a research investigation in Tourism Recreation Research taken out by Hall [4]. The probe was aimed at the response to media coverage on the topic of tourism combined with climate change, with a typical focus on air travel. Becken [5] specifically pointed out that 'the challenge of climate change is also an opportunity for tourism to become more systematic, smart, strategic and sustainable. In the consecutive years, a researcher named Weaver [6] initiated another debate by striking the idea of 'the disproportional focus on climate change in the sustainable tourism literature is counterproductive to achieving tourism sustainability. One of his seven theses stated that 'failure of the international community to arrive at a consensus for concerted action [on climate change] is therefore unsurprising' and hindered by the 'rudimentary state of knowledge about the relationships between tourism and climate change, and apathetic and fickle traveling public and a reciprocally uncommitted tourism industry'. Afterward, Scott [7] replied to Weaver's [6] opinion by providing the counterarguments based on the sustainable tourism research's affordability in retrenching from climate change research. The later research conducted by Intergovernmental Panel [8] on climate change issues reinforced Scott's opinion on the tourism and climate change issue. A further academic exchange has taken place between Weaver and Peeters. Weaver [9] articulates that the 'recent contextual factors, including the global financial crisis, provide a fertile environment in which the growth paths of tourist destinations will converge towards a state of sustainable mass tourism. While Peeters [10] criticized Weaver's opinion based on the interpretation of the ignorance of a transit route in the tourist system.

This study will focus on the three main aspects: the causes of climate change, climate change's effects on tourism, and the policies to settle the side effects on tourism. Finally, this paper puts forward some feasible suggestions based on these studies.

2 The Side Effects of Climate Change

Disregarding the other factors causing a lapse in the local tourism industry, the sea level rise and the changes in the size and shape of the ocean basins caused by climate change all contribute to the deterioration by the tourism industry.

2.1 Sea Level Rise

The most well-known effect of climate change can be contributing to the sea level rise, as this is an obvious phenomenon in a worldwide range. To illustrate the causes of the sea level rise, the thermal expansion of the seawater is a major factor. As the heat capacity of water is about 1000 times of the air, it is estimated that the heat stored by the ocean is about 90% of the capacity that the earth can absorb in 40 years, which is estimated to be 20 times larger than those of air can stored. In addition, from the physics aspect of the water's convection and diffusion of heat and thermal energy, the ocean is currently situated in a dynamic status, and it will take the ocean millions of years to reach its thermal equilibrium, forming a strong contrast with the air, which can reach thermal equilibrium in a short time. Thus, from the current studies based on the thermal energy of the sea, it can be predicted that shortly, the sea level rise caused by the expansion of seawater will not cease.

The ocean's water storage is not only limited to liquid seawater, the land-based glaciers and ice caps also contain approximately 90 percent of the total freshwater resource. With the rising temperature worldwide, the longer and hotter summer combined with a shorter and warmer winter coerced the mountain glaciers formed on the high mountains and those ice caps ice sheets condensed in Greenland and the Antarctic and arctic poles to melt at an accelerating speed. Take West Antarctica Ice Sheet as an example, the new research found that the increase in precipitation brought by the increasing temperature will not reduce the sea level with a higher rate of snowfall that accumulates more ice on the sheet [11]. Instead, the ice sheet will be warmed by the underneath warmer seawater, resulting in an increasing melting speed of the ice sheet. Thus, by looking at the long-term changes in the dynamics of the ice sheets and the rising temperature, the drastic climate change will impact the glaciers with a rising sea level.

According to the following Fig. 1 which illustrates the cumulative ice mass loss in Greenland from 1990 to 2014, it can be inferred that there is a consistent increase in the

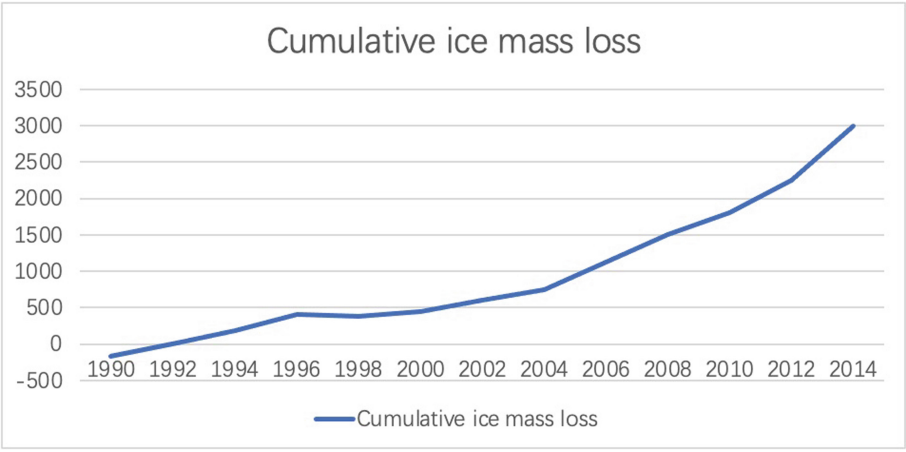

Fig. 1. Cumulative ice mass loss from Greenland ice sheet 1990–2014 (photo credit: original)

mass of the loss of ice, which backs up the theory of an increasing amount melting ice caps that will ultimately become sea water and increase the sea level height.

3 Climate Change's Effects on Tourism

3.1 The Effect of Climate Change on the Climatic and Environmental Resources of Tourism

The winter activities' patterns of vacation pursued by tourists are mostly weather dependent, so a change in the climate will affect the amount of tourists' daily consumption in the tourist areas. For example, the temperature will directly affect the snow cover rate, which in turn affects the winter sports use snow as a fundamental and essential resource [12]. 'K Smith' once claimed that 'low-level ski resorts are especially sensitive to winter temperature and snowfall.' When there is a serious anticyclone taking place in areas with a high proportion of snow coverage, the melting of snow will force the activities once resides on snow, such as skiing, snow skating, Bobsleigh and Tobogganing to turn into activities that exclude snow [13]. During the 1980s, a persistent increase in temperature forced the people in western Europe to change their snow activities into hill walking or indoor facilities because the snow all melted. Those tourists who come from a far away aiming to enjoy the winter activities were largely deterred by the lack of snow, causing disastrous devastation to the ski resorts or winter activities' amusement parks.

The global warming issue will also threaten many ecosystems on which outdoor recreations may depend [12]. Some tourist attractions are those animals instead of manually made entertainments. A change in the weather will severely affect that ecosystem, which in turn affects the whole tourism industry in that area. For example, the drought caused by the increasing temperature in North America in the 1980s limited the duck populations in the local area to a small number, and the living scope for those wildlife animals also decrease within that year. Sport fishers on intermittent rivers and impoundments were also badly depleted with the decreasing fish populations residing in their ecosystems. In addition, the forest fires that have taken place in America also destroyed countless camping grounds rehabilitation. The forest fire not only increased the government's balance deficit but also deterred potential tourists who planned to go there for fun, as the risk of future forest fires will increase the discount rate for going to a risky place of meeting a fire. Thus, those tourist attractions famous of the natural resource of animals may be devastatingly harmed by the changing climate.

The coastline environment can also be affected tremendously. The growing temperature and more devastating weather will lead to an increase in the number of hurricanes and tropical storms, which ultimately result in a more passive tourist [12]. As mentioned by K. Smith, 'long haul tropical holidays are becoming very fashionable just now but several popular destinations are vulnerable to tropical storms and hurricanes similar to Hugo, which devastated the Caribbean in September. 1989' [14]. Hurricanes are created by the presence of a high sea surface temperature. Thus, when global warming expands, the marine temperature will rise and the areas that are capable of initiating a hurricane are also likely to expand, thereby affecting more coastal areas that rely on the environmental resources of sun, beaches, and waves. In addition, due to the lack of capital intensity and technological flexibility, those developing countries cannot adapt as efficiently as

those developed countries to the facilities' protection or reallocation of resources to a less risky place, leaving them more vulnerable. Therefore, the vulnerability is not only shown in the environmental sector, but also in the economic sector which lacks social and government support for the reallocation.

3.2 Tourist's Satisfaction with Pollution Analysis

While climate change and pollution are closely linked, the emission of carbon dioxide and monoxide not only contributes to global warming but also serves to concentrate and migrate pollution sinks [15]. For those countries with severe air pollution, a result of the poor legislation on emissions and insufficient implementation of migratory measures such as filters, the decreased air quality is a considerable deterrent to tourism [16]. Coral bleaching, a damaging result of air pollution, will also decrease the tourist satisfaction with the certain location for scuba diving or snorkeling [17]. The increase in pollution on the river or sea's nutrition complex will also trigger a red tide, significantly decreasing the tourist's satisfaction with the attraction's quality.

4 Conclusion

In conclusion, the paper mainly discussed the impact of climate change effect of a rising sea level on tourism from both an environmental and economic perspective. The passage discussed the causes of the sea level rise, and the effect on the tourism industry in chronological order. The main causes of the sea level rise can be summarized as below: thermal expansion of seawater caused by the increase in temperature and the melting of the land-based ice caps and glaciers. The two causes result in a drastic increase in the height of the sea, which caused the problems of submerged lands, a shrink in the local mortgage business, and devastation to the ecosystem. The causations all lead to the effects on local tourism, while it significantly impacts the government's balance of payments due to the decrease in government revenue gathered from the tourism industry. Winter activities that require the ice will be affected due to the shorter winter season and melted snow. The ecosystem's destruction which tourism depends on is also detrimental due to the decrease in the number of scarce or special animals. The coastal environment's change can also lead to problems of decreasing number of tourists due to the breaking entertainment facilities and the need to relocate the tourist attractions. Therefore, to ease the detrimental effects caused by climate change, people should prioritize the policy of reducing the emission of carbon dioxide and monoxide, which serves as the main component of the rise in global temperature. Only a rise in the global awareness of reducing pollution towards the environment and a reduction in the gas emission can ease the devastation of rising sea level and temperature on tourism.

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