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REVIEW

Progress in Research on the Impacts of Global Climate Change on Winter Ski Tourism

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Abstract

The impacts of global climate change on ski tourism, which depends heavily on climate conditions, have increasingly gained concern overseas**.** This paper systematically summarized the relevant research ideas, the technical methods used, and the obtained achievements through an extensive synthesis of the previous studies. Moreover, the major shortcomings and the limitations in the recent studies are pointed in order to present a useful reference for our Chinese investigators. It indicates that the future climate warming would cause the loss of skiable areas, the shortening of skiing seasons and the sharp drop of ski visitors in many low altitude and low latitude ski resorts. The paper finally stressed that future research should pay particular attention to strengthening interdisciplinary cooperation and consider more factors about the impacts of climate-induced environmental changes on tourist flows. In the future ski resort planning and management, the possible impacts of global climate change should be taken into account.

Keywords: climate change; ski tourism; impacts

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1 Introduction

The challenge coming from climate change for tourism is nowadays an important issue for the tourism researchers. Winter ski tourism, which has been called "the canary in the coalmine" [*Bicknell and McManus,* 2006], is highly sensitive to climate change. On 27 September, 2008, the theme of the World Tourism Day was named as "tourism responding to the challenge of climate change" by the World Tourism Organization, indicating that governments have paid more attention to the impacts of climate change on tourism.

In the future, global climate warming is a deadly threat to the ski areas in low latitude or low altitude. In recent years, the research regarding the impacts of climate change on ski tourism has increasingly gained concern overseas, while the relevant studies acquired little concern in China. *Scott and McBoyle* [2007] pointed out: "No climate change assessments of the ski industry in Spain, eastern Europe, South America, or China have been conducted, even though these regions have the greatest growth prospects in the next 20 years". In order

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to present a useful reference for our Chinese investigators, this paper based on an extensive synthesis of the previous studies, systematically summarized the relevant research ideas, the technical methods used, the achievements obtained, the major shortcomings concerning the current studies, as well as some special remarks that should be paid attention to for further studies.

2 Research background

Even though the significance of climate as an environmental consideration in the choice of a destination was noted as early as in 1936 [*Gössling and Hall*, 2006b], it was not until the late 1980s that researchers began to study the relationship between global climate change and tourism [*Wall et al.*, 1986; *McBoyle and Wall*, 1987]. The pioneering studies regarding climate change impacts on downhill skiing appeared in Canada, North America, such as the research undertaken in Quebec region by *McBoyle and Wall* [1987]. In the European Alps, some consecutive warm winters occurred in the end of the 1980s, and the number of tourists decreased sharply in many ski resorts due to insufficient snow, which made many owners panic. They wondered if under a global climate warming their ski resorts would face a threat of closure. Moreover, this had also attracted great attention of many scholars [*Abegg and Elsasser*, 1996; *König and Abegg*, 1997]. Thanks to the wide applications of computer technology, the quantitative study on tourism demand in the context of climate change began at the end of the 20th century. Since then a lot of statistics-based models have emerged [*Breiling and Charamza*, 1999; *Fukushima et al.*, 2002; *Scott et al.*, 2001; 2008; *Uhlmann et al.*, 2009], enabling the research content to be more detailed and the spatial coverage more extensive.

According to the statistics made by *Scott et al.* [2005], of all the journals publications including the analysis of the impacts of climate change on tourism, 40% have appeared in climate-meteorological journals, 42% in a range of geography-environmental management planning focused journals, and only 18% in tourism-recreation journals. This reflects that the impact of climate change on tourism is a multidisciplinary and integrated subject, which requires multi-sectoral collaborative research. Meanwhile, this also suggests that climate change impacts on tourism have not yet received much attention in the field of tourism research.

3 Main research contents, methods and conclusions

According to the Fourth Assessment Report of IPCC, global average surface temperature had risen 0.74±0.18 °C during the period from 1906 to 2005. Global climate change prediction based on six emission scenarios indicates that global average surface temperature will rise 1.1–6.4 °C over the 21st century. The study shows that future climate warming is expected to be greater in the high latitude of Northern Hemisphere. It is very likely that hot extremes, heat waves and heavy precipitation events will continue to become more frequent. Increases in the amount of precipitation are very likely in high latitudes, while decreases are likely in most subtropical land regions [*IPCC*, 2007].

So far, the research in relation to the impacts of climate change on ski tourism includes a very wide range of contents from which this paper presents only the most important aspects.

3.1 *Impacts of climate change on snow-reliability*

Skiing is the most important tourism activity in alpine winter. The current annual global skier visits were estimated at about 330 million, and direct revenues from global ski industry at nearly 9 billion U.S. dollars annually [*Scott and McBoyle*, 2007]. Ski tourism depends on sufficient snow conditions and it is generally believed that secure skiing needs at least 30 cm of snow cover. Many researchers therefore take 30 cm of snow cover as the threshold for snow-reliability in ski resorts. From the perspective of economic viability for ski industry,