Extended abstract - cover page

David Viner
Climatic Research Unit
University of East Anglia
Norwich NR4 7TJ
UK
d.viner@uea.ac.uk
Tel: +44 1603 592089
Fax: +44 1603 507784

Bas Amelung
International Centre for Integrative Studies
University of Maastricht,
P.O. Box 616
6200 MD Maastricht
Netherlands
b.amelung@icis.unimaas.nl

Title: The Implications of Greenhouse Gas Stabilisation for International Tourism Flows

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The Implications of Greenhouse Gas Stabilisation for International Tourism Flows

David Viner, Climatic Research Unit, University of East Anglia, Norwich, UK
d.viner@uea.ac.uk
Bas Amelung, International Centre for Integrative Studies, University of Maastricht
Maastricht, Netherlands

Abstract

This paper describes the possible impacts of greenhouse gas stabilisation policies on the major tourism flows. Tourism is one of the largest industries in the world and a vital component for the economy of many countries. Implementation of pro-active policies at the national and international level that will attempt to stabilise the atmospheric concentrations of greenhouse gases in the atmosphere will require substantial cuts in anthropogenic greenhouse gas emissions. But even then, the climate system will have changed, and so will the climatic conditions of tourist destinations. The Mieczkowski Tourism Climatic Index (MTCI), constructed from observed climate data is used as an analogy for a region's potential for tourism. The results from a range of General Circulation Model (GCM) integrations forced with greenhouse gas stabilisation scenarios are then used to construct the MCTI for the future. A comparative analysis is undertaken to assess how different levels of GHG stabilisation will impact upon the major international tourism flows and to identify the critical responses.

1. Introduction

One of the ultimate objectives of the United Nations Framework Convention on Climate Change (UNFCCC) is the stabilisation of greenhouse gas (GHG) concentrations at a level that will prevent dangerous anthropogenic climate change. The meaning of this objective has been open to wide interpretation, and what is meant by 'dangerous' has yet to be defined. Whilst there have been numerous studies into the impacts of climate change undertaken on many sectors and at a large number of scales [1], very few have addressed the impacts of GHG stabilisation on a given sector, the most noticeable exceptions being the Defra 'Fast Track' studies [2].

A further compounding issue is the very limited number of climate change stabilisation integrations that have been performed with General Circulation Models (GCMs). To date the results from only two integrations have been made available and used, which were both performed with the second generation of the Hadley Centre's GCM, termed HadCM2. These two integrations were performed to investigate the response of the climate system to the stabilisation of atmospheric carbon dioxide concentrations at 550 parts per million by volume (ppmv) and 750 ppmv.

Leisure and tourism are responsible for an estimated 5% of global CO_2 emissions [3], mainly through travel, and are thus intensifying climate change. At the same time, the global tourist industry is vulnerable to climate change. It is dominated by a number of major flows of international tourists, and these are primarily driven by 'sun, sea and sand'. The dominant flow is from Northern to Southern Europe, which accounts for around 15% of total international tourist arrivals.

Stabilisation of GHG concentrations at different levels implies different patterns of climatic advantage and disadvantage for tourist resorts and destinations. Patterns may change in a spatial sense, but also in a temporal sense, with climatic circumstances improving or deteriorating in certain seasons.

This paper examines the implications of different stabilisation scenarios for the patterns of climatic attractiveness for the world as a whole, and for a few selected tourist destinations in particular. To achieve this, the Tourism Climatic Index [4] is applied to the climatic data provided by the HadCM2-550 and -750 runs. The MTCI consists of a number of crucial climatic factors that determine tourists' thermal, physical and aesthetic well-being: temperature, humidity, precipitation, sunshine and wind.

2. Major International Tourism Flows

The concentration of tourism activity is heavily focussed on relatively few markets and destinations. Three regions - Europe, North and South East Asia, and North America - account for a large proportion of both demand and supply. Around 58% of all international arrivals take place in Europe, 16% in North and South East Asia and around 12% in North America. This represents almost nine out of ten of the world's international tourist arrivals. While travel to other regions of the world may be highly significant to the destinations concerned - such as to the Pacific islands - it is negligible in terms of the global flows. Tourism is also highly concentrated: the top four markets - the USA, Germany, the UK and Japan - account for over one-third of all international demand, and the top ten (the previous four plus France, Italy, China, the Netherlands, Canada and Belgium/Luxembourg) for well over half.

Most international travel takes place intra-regionally, and most of this is within sub-regions: approximately 87% of all international arrivals in Europe are from Europe itself (some 350 million arrivals), with a corresponding figure of 71% in the Americas (92 million arrivals) and 77% in the Asia Pacific region (88 million). In addition to this intra-regional activity, there are six major tourism flows that dominate international travel and account for around a quarter of total arrivals:

- Northern Europe to the Mediterranean:116 million
- North America to Europe: 23 million
- Europe to North America: 15 million
- North East Asia to South East Asia: 10 million
- North East Asia to North America: 8 million
- North America to the Caribbean: 8 million

2.1 Climatic influences on tourism flows

Among these major bilateral flows, the climate is a dominant factor in much of the travel that takes place from northern Europe to the Mediterranean and from North America to the Caribbean. This mass movement of people is not only primarily leisure-based, but the intrinsic reason for travel is to visit a sunny beach destination.

The climate is a far less significant influence on travel from North America to Europe. In part there is a far higher proportion of business travel within this flow. However, even for the leisure traveller, the weather is not a major determining factor since the primary reason for travel is more likely to be to visit the destinations' cultural attractions, rather than for the appeal of its weather.

The flow between North East Asia to South East Asia has a large sun, sand and sea component, although there is also a significant element of business and VFR travel. Equally, the composition of travel between North East Asia and North America and between Europe and North America encompasses a variety of types of traveller.

The World Tourism projects a further doubling of global tourist arrivals between now and 2020. In addition, while new, perhaps less climate dependent tourism niches are emerging, empirical data do not suggest any reduced competitiveness of classic sun and sand destinations [5]. Climate change is therefore very likely to alter major segments of international tourist flows [6].

2.2 Defining dangerous anthropogenic climate change for the tourism industry

The European summer of 2003 has been identified as a significant extreme event and one that has had profound impacts across many sectors in Europe [7], including tourism and health. This paper will attempt to define the summer of 2003 as a dangerous threshold for global tourism flows.

2.3 Tourism Climatic Index (TCI)

The tourism climatic index as a concept has evolved from more general knowledge about the influence of climatic conditions on the physical well being of humans. In the 1960s and 1970s systematic research in this field yielded many insights, ranging from preferred temperatures, and the role of relative humidity to the appreciation of wind.

Mieczkowski (1985) was among the first to apply the general findings about human comfort to the specific activities related to recreation and tourism. He devised a unique tourism climatic index, ranging from 0=poor to 100=excellent, and consisting of five sub-indices, describing daytime thermal comfort, daily thermal comfort, precipitation, hours of sunshine, and wind speed. The mapping of raw data to sub-index values depends on the kind and level of tourist activity. Beach holidays require other climatic conditions than ski holidays; in his article, light activities, such as touring, are used as a reference.

Figure 1 shows TCI values for the average conditions in the month of August in the period 1961-1990. While the TCI was originally developed to map existing climatic conditions, it has also been successfully applied in exploratory studies to estimate the effects of climate change on tourism [8].

3. Greenhouse Gas Stabilisation Scenarios

The Tourism Climatic Index will be constructed for a range of future time slices based upon a number of stabilisation scenarios, derived from climate model runs forced with the SRES scenarios that can be used for stabilisation profiles as defined by Swart et. al. [9] Results from the two stabilisation integrations performed with the Hadley Centre's global climate model (HadCM2) will also be used.

3. Results

As expected, differences are quite marked, with changes being smallest for the 550 scenario and largest for the B1A and B2A scenarios.

Changes in the annual distribution of TCI scores between 1991 and 2099 are presented for all four scenarios for the south of Spain and Norwich in Figure 2.

In more general terms, there are winners and losers from climate change, with the losers being more numerous. Figure 3 shows the results of an analysis for the HadCM2 550 scenario, giving an indication of how many regions pass the 80-points (good conditions) barrier either in an upward or downward direction, and how fast they do this. Clearly, there are more regions losing their good conditions than getting them, although the speed of change is much lower than in the B1A and B2A scenarios.

4. Discussion

This paper attempts to define dangerous levels of climate change for tourism. These estimates are then confronted with the implications of a range of climate change mitigation scenarios to examine whether mitigation policies are likely to have an impact on the timing of negative effects and on the possible avoidance of dangerous thresholds.

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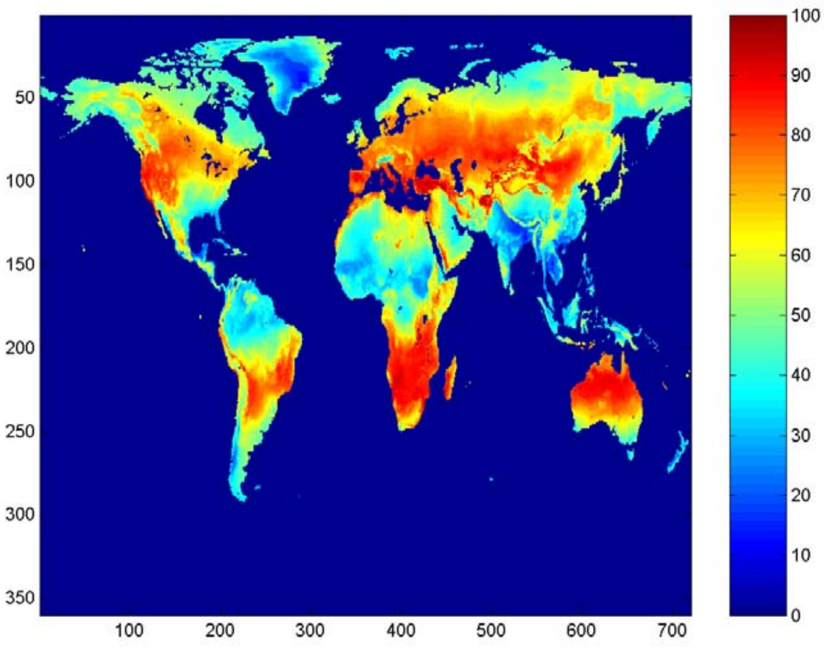

Figure 1: TCI values for mean conditions in August, 1961-1990

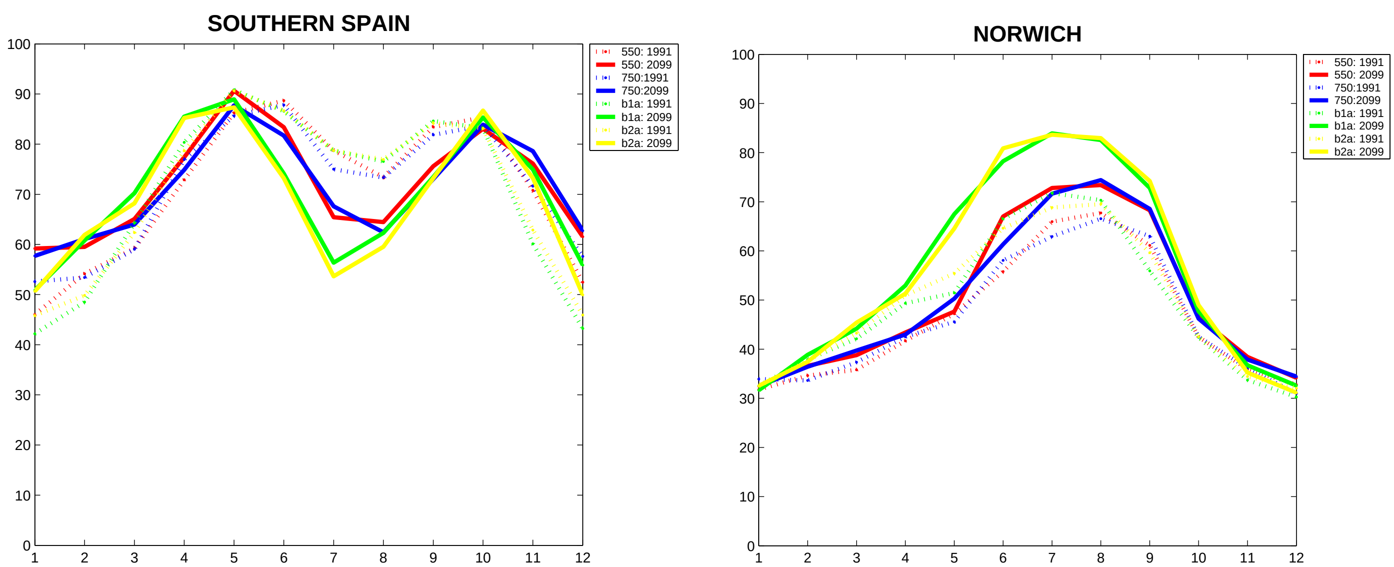

Figure 2: TCI distributions for Southern Spain and Norwich for the 550 (red), 750 (blue), B1A (green), and B2A (yellow) scenarios in 1991 (dotted) and 2099.

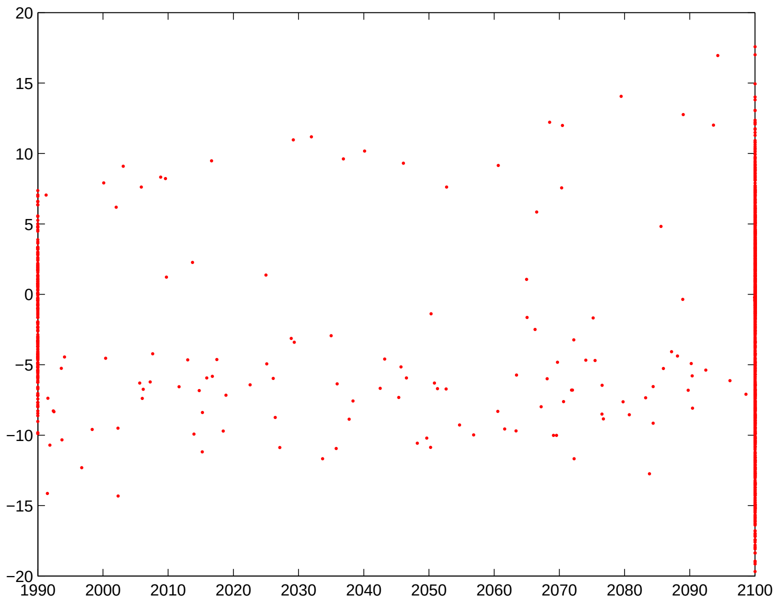

Figure 3: moment of passing the 80-point threshold (horizontal) and speed of change (vertical, in points per century), with a dot representing one cell in the HadCM2 550 73x96 cell model