



INTERNATIONAL CONFERENCE ON CLIMATE CHANGE IMPACTS ON TOURISM

7th - 8th September 2007, Lisbon, Portugal

Convened and Organized by the Climate Change Impacts, Adaptation and Mitigation
Research Group (C-CIAM) of the Instituto D. Luíz at the
Faculty of Sciences of the University of Lisbon



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INTRODUCTION

Evidence from the latest report of the Intergovernmental Panel on Climate Change clearly indicates that global climate change is a reality. While there has been significant progress in the study of climate change impacts in various sectors and at various geographical regions, few have addressed climate and/or climate change impacts on tourism.

The interactions between climate change and tourism are complex. On the one hand tourism activities associated with high energy demands contribute to climate change, while on the other the sector is affected by climate and associated environmental changes. It is thus important that climate change impacts on tourism needs be better assessed so that we recognize what is likely to happen and to formulate appropriate plans to minimize potential negative effects and on the other hand maximize on positive effects.

With this in mind, the CLITOP Project is proud to organize this International Conference on Climate Change Impacts on Tourism. The conference covers the emerging research area of climate change and tourism, with a special emphasis on climate change impacts and adaptation measures on tourism under the following themes:

- Climate and Tourism: Trends and Future Scenarios
- Tourism Related Energy Demand Changes under Climate Change
- Implications of Thermal Comfort and Extreme Events in Tourism
- Climate Change Impacts on Tourism Resources
- Adaptation Measures and Socio-economic Implications for Climate Changes on Tourism

CLITOP (Climate Change and Tourism in Portugal: Potential Impacts and Adaptation Measures) is a two-year research project co-ordinated by researchers of the Faculty of Science of the University of Lisbon (FCUL). The project is funded by the Portuguese Science and Technology Foundation (FCT) and counts with the support of researchers from the National Institute on Engineering, Technology, and Innovation, the Portuguese Institute of Meteorology, the National Health Institute, and the University of Beira Interior.

In this conference book we present the abstracts of the communications delivered in the event. Additional information is available online at <http://www.siam.fc.ul.pt/clitop/index.htm>.

Conference Organizing Committee

Elsa Casimiro	University of Lisbon
Filipe Duarte Santos	University of Lisbon
Ricardo Aguiar	Nat. Inst. Eng., Tech & Innovation
Tiago Lourenço	University of Lisbon
Bas Amelung	University of Maastricht
Paulo Nogueira	National Health Observatory
Angela Antunes	University of Lisbon
Carlos Fazendeiro	INFOTOX
João Ferreira	Institute of Meteorology
José Calheiros	University of Beira Interior

PROGRAMME

Friday, 7th September 2007

9:00	Registration
9:30	Welcome address
Session 1	<p>Welcome address & Introduction <i>Elsa Casimiro (IDL, University of Lisbon)</i> <i>Filipe Duarte Santos (IDL, University of Lisbon)</i> <i>Adérito Vicente Serrão (Portuguese Meteorological Institute)</i></p> <p>Climate Change Research Agenda <i>Georgios Amanatidis (DG Research, EU Commission)</i></p>
11:00-11:30	Coffee break
Session 2	<p>Climate and Tourism</p> <p>Climate and Tourism: The Interactions <i>David Viner (English Nature, UK)</i></p> <p>Global Tourism Trends: Past, Present and Future <i>Eugenio Yunis (World Tourism Organization)</i></p> <p>Climate Trends and Future Scenarios <i>Ricardo Aguiar (Nat. Inst. Eng., Tech & Innovation, Portugal)</i></p> <p>Discussion</p>
13:00-14:30	Lunch
Session 3	<p>Energy and Tourism: Impacts</p> <p>Energy Demand Changes under Climate Change: Buildings <i>Geoffrey Levermore (University of Manchester, UK)</i></p> <p>Energy Demand Changes under Climate Change: Transport <i>Ricardo Aguiar (Nat. Inst. Eng., Tech & Innovation, Portugal)</i></p> <p>How can the Portuguese Tourism Sector Contribute to Reduce Energy Consumption and Pressure on CO₂ Emissions? <i>Angela Lobo (Ministry of Environment Spatial Planning & Regional Development, Portugal)</i></p> <p>Discussion</p>
15:45-16:00	Coffee break
Session 4	<p>Thermal Environment and Extreme Events: Implications for Tourism</p> <p>Implications of Thermal Comfort for Tourism <i>Maria João Alcoforado (University of Lisbon, Portugal)</i></p> <p>Climate Change Impact on Thermal Comfort in Portugal: Tourism Implications <i>Tiago Lourenço (University of Lisbon, Portugal)</i></p> <p>Extreme Events and Health <i>Franziska Matthies (World Health Organization)</i></p> <p>Discussion</p>
17:45	End of day 1

Saturday, 8th September 2007

9:30	Start of day 2
Session 5	<p>Tourism Resources: Changes and Impacts</p> <p>Climate Change and Coastal Tourism <i>Bas Amelung (University of Maastricht, The Netherlands)</i></p> <p>Climate Change Implications for Recreational Fishing <i>Carlos Sousa Reis (University of Lisbon, Portugal)</i></p> <p>Climatic Resources for Tourism in Europe: An Application of the Tourism Climate Index on a Daily Basis <i>Sabine Perch-Nielsen (ETH Zurich, Switzerland)</i></p> <p>Climate Change, Tourism and Landscape Impacts: A Regional Analysis <i>Gina Cavan (University of Manchester)</i></p> <p>Discussion</p>
11:00-11:15	Coffee break
Session 6	<p>Adaptation Measures & Socio-economic Implications</p> <p>Climate Change in Small Island States (SIS): Vulnerability, Resilience and the Implications. <i>Murray Simpson (University of Oxford, UK)</i></p> <p>Climate Change Impacts on Human Health: Implications for Tourism <i>Elsa Casimiro (University of Lisbon, Portugal)</i></p> <p>Tourism Strategies for Adaptation and Sustainable Development in Mountain and Coastal Destinations in Germany <i>Claudia Bartels (University of Lueneburg, Germany)</i></p> <p>Do Snowmaking Investments Improve the Operating Margin of the Cableway Companies in the Perspective of Climate Change? <i>Camille Gonseth (University of Geneva, Switzerland)</i></p> <p>Discussion</p>
12:50-13:30	<p>Final Comments & Conference Closure</p> <p>Climate Impact Research Co-ordination for a Larger Europe: Funding Opportunities for Climate Impact Research <i>Martin König (CIRCLE ERA-Net Coordinator, Umweltbundesamt GmbH, Austria)</i></p> <p>Conference Closure <i>Elsa Casimiro (IDL, University of Lisbon, Portugal)</i> <i>Filipe Duarte Santos (IDL, University of Lisbon)</i></p>

ABSTRACTS

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Climate Change Research Supported by the EU Framework Programmes

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One of the main aims of the European Union environmental research policy is to promote scientific excellence to advance knowledge and understanding on climate change, and support the implementation of related European policies and international commitments (i.e. the Kyoto Protocol). Since the early 1990s, the Research Directorate General of the European Commission has been supporting research on climate change and its impacts through the EC successive Framework Programmes (FPs) for research and technological development. This interdisciplinary research on climate change has addressed, among others, climate change prediction and impacts, global carbon and nitrogen balance, stratospheric ozone and climate interactions, adaptation and mitigation strategies, etc. European research teams have played a major role in the IPCC process by providing scientific input and have thereby had a significant bearing on international policy making in climate change.

Among the many and diverse impacts of climate change, European research is focussing on sea level rise, energy consumption and production, agriculture, forestry, water resources and, lately, tourism. Several EU funded projects of the FPs have been instrumental in this context. For example, the FP5 MICE (Modelling the Impacts of Climate Extremes) project carried out a number of studies on climate change impacts on tourism (e.g. winter sports in the Alps, Mediterranean summer tourism). Moreover, the FP6 ENSEMBLES (Ensemble based predictions of climate change and their impacts) integrated project includes studies of the impacts of climate change on tourism, expressing the impacts as a function of vulnerability and exposure.

The launch this year of the 7th Framework Programme (FP7) comes at an important time for climate change research. Under the FP7 (2007-2013), climate change is a key priority. Integrated research addressing the functioning of the climate and earth system is needed in order to better understand its causes and future evolution, determine current and future impacts (including impacts on tourism), and develop effective adaptation and mitigation measures.

Climate and Tourism: Trends and Scenarios

Global Tourism Trends: Past, Present and Future

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International tourism confirms every year its ineluctable and sustained growth, as well as its geographical expansion. Tourism demand is highly resilient, since traveling has become an integral part of consumption patterns in our modern societies, and there are now very few places on earth that cannot be reached from any point of origin within a relatively short period of time and usually at a relatively accessible cost.

One of the significant changes in tourists' behaviour refers to cutting their vacations in shorter trips, stimulated by the continuing expansion of transport services by low-cost carriers, plus the widespread ownership of private cars. This implies, among many other impacts, increased potential of tourism as an economic development sector at the local level; a densification in all forms of tourist transport, but principally in air traffic with all the potential negative environmental impacts; and, more generally, that all tourism destinations are now facing increased pressure on their natural and socio-cultural environments.

It is now, therefore, an imperative widely recognized that tourism activities should be planned, developed and managed in a more sustainable way. Efforts must be made in this direction by all stakeholders; many UNWTO activities are precisely geared to help tourism stakeholders, and principally policy makers, in improving the sustainability of the sector. These activities include specific issues like sustainable tourism policy guidelines and the corresponding instruments to apply such policies, indicators of sustainability at destinations, corporate social responsibility, technical cooperation projects, etc. UNWTO and the tourism sector in general should also address global challenges, like climate change and the UN Millennium Development Goals, principally poverty alleviation.

The presentation will describe general, quantitative and qualitative tourism trends in order to highlight the need for a more sustainable approach to tourism development and management, and the corresponding actions currently underway at UNWTO in connection with climate change.

Scenarios of the Future and Climate Trends

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The future is sure to bring change not only to planetary climate but also to the planetary human society. It would be naive to study how Climate and Tourism relationships evolve without allowing for long term these socio-economic and technological changes as well as for the global warming effects. While for a scale of 5 to 10 years ahead existing trends may be projected to supply this evolving background, the global warming framework poses an especially difficult problem, as the time horizon stretches to 30, 50, 70 years or more. At this long range, projections are not adequate tools, their assumptions becoming invalid after a few years; prospective work is done instead with scenarios.

It is not an easy task to draw coherent and consistent scenarios for a sector like Tourism, and the more difficult the smaller the spatial scale. With the current state-of-the-art, coherent socio-economic and technological scenarios can be posed for the Globe, and then climate models can be run using the respective global greenhouse gas emissions. Large scale Tourism analysis, e.g. impact studies, can be done using this data. Such results provide very valuable insights and are relevant, for instance, for international debates or raising public awareness through mass media. However, they are not enough for regional, country or even municipality level decision makers and operators: downscaling is necessary to smaller areas – and this is where many practical problems appear.

The current work reviews these downscaling issues with the help of examples from recent work by Project CLITOP – Climate and Tourism in Portugal. In particular, the problems approached are: downscaling of climate data; obtaining daily or even hourly meteorological time series, which are the adequate input to numerical models of micro scale aspects, such as human comfort or energy demand; downscaling socio-economic scenarios in a consistent manner; and merging results of the micro scale impact studies with the socio-economic future data, thus obtaining regional or country level predictions, as well as measures of the uncertainty associated with the whole procedure.

Keywords: Global Warming, Long-Term Scenarios, Downscaling, Portugal

A Global Trip Destination Model for Estimating the Effect of Climate Change on International Tourist Arrivals

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A recent study on the effects of climate change on the tourism industry indicates that research in which geographical information systems (GIS) are used, could provide insight in the determinants of tourist flows in the world. The literature on this topic mentions numerous factors affecting international tourist arrivals and departures are mentioned. We have been evaluated these and other possible factors with regard to arrivals for leisure, recreation and holidays in all countries of the world for which data are available. This has resulted in a highly significant regression model with reasonable overall predictability, applicable to countries with one million or more international tourist arrivals, with climate attraction, number of UNESCO world heritage sites and density of road infrastructure as independent variables. This trip destination model can be seen as a first step in the prediction of the effect of climate change on tourist flows in the world.

The first independent variable, climate attraction, was derived from TCI (tourism climatic index) patterns presented by Amelung. The TCI scores for each month of the year, were transformed to annual climate attraction scores per country on the basis of weights determined by UNWTO figures on the distribution of tourist arrivals over the months of the year and a raster GIS procedure consisting of reclassification, linear stretching and pixels-to-polygon conversion. This resulted in a world map of climate attraction based on observed climate data, which was consequently joined with a 2004 world database of potential variables regarding tourist arrivals and departures based on data from various sources.

Using the same procedure, climate attraction per country derived from TCI scores related to a climate scenario for 2080 was added to the database. A run with the regression model with this attraction replacing the observed attraction allowed the calculation of the difference between tourist arrivals as observed in 2004 and predicted tourist arrivals for 2080 caused by a change in climate attraction, and assuming the other independent variables unchanged. Because of incomplete data and anomalies found in some data, predictions could only be applied to a limited set of major tourist destinations. Notwithstanding this limitation, valuable results have been found, showing a pattern of world regions where countries benefit from changed climate conditions and those countries with an unfavourable development.

We finally discuss the limitations of the model, i.e the problem that domestic travel is ignored in the model as well as the unavailability and unreliability of certain data.

Keywords: climate attraction scores, trip destination model, geographical information systems, multivariate data analysis

Poster presentation

TOPIC: Climate and Tourism

Changes in Frequency of Extreme Events over Portugal Based on Two Different Climate Change Scenarios

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Portugal economy is highly dependent on Tourism with a seasonal peak during summer and less activity in winter. Major changes on the frequency of summer hot (winter cold) days may alter considerably the seasonal distribution of tourists. We present an analysis of climate change over Portugal simulated by a regional climate model of Hadley Centre (HadRM3). Maximum and minimum temperatures for both IPCC emission scenarios (A2 and B2) are discussed for the 2071-2100 period and compared with the control simulation (1961-1990). In these 2 scenarios, Portugal undergoes a substantial warming with highest values of maximum temperatures increase in summer reaching 7°C (A2) and 6°C (B2). In winter, maximum temperature increases range between 2.5°C and 5.5°C (A2) and 2°C and 4.5°C (B2). For minimum temperature, in winter there is an increase of approximately 3°C (A2) and 1.5°C (B2).

Seasonal percentiles of extreme episodes (10th and 90th) for both maximum and minimum temperatures were computed for present and future periods in order to evaluate changes of extreme events for the two distinct future climate scenarios. Additionally we have also computed the number of days per season (in 2071-2100) with temperatures higher than the 90th percentile (hot events) and lower than 10th percentile (cold events) based on the 1961-1990 reference period. The ratio between the number of days with maximum temperatures in the summer higher than the 90th (61-90) in the future and the present climate show an increase of hot events for both scenarios. As expected, this increase is milder for the B2 scenario (ranging between 1.5 and 4 times more), being more intense for the A2 scenarios (ranging between 2 and 5 times more). The steepest increases were always obtained in the interior regions of Portugal. In winter, the number of days with minimum temperatures below 10th percentile (61-90) decreases substantially for B2 and becomes virtually zero in the A2 scenario. In order to evaluate the spatial variability of our results we have divided Portugal into 4 homogeneous regions. For each sector we have computed the frequency distribution and the probability of exceedence of maximum and minimum temperatures on a seasonal basis for both scenarios.

Keywords: Tourism, Climate change scenarios, extreme temperatures, frequency, probability

Poster presentation

Energy and Tourism

Energy Demand Changes Under Climate Change: Buildings

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The basis of climate change predictions is based on the Intergovernmental Panel on Climate Change, (IPCC), reports. This presentation briefly outlines the history of the IPCC, its purpose and outputs, including the AR4 and its relation to the Kyoto Protocol, and the IPCC authoring process. The presentation then briefly examines the Fourth Assessment Report, AR4, Climate Change 2007 which has now been approved and will be published shortly and the trends in carbon emissions, especially from the built environment (which are a major source of greenhouse gas, GHG, emissions in the world), and the potential mitigation reductions in carbon emissions that are considered possible and the scenarios on which they are based.

The Report consists of three volumes based on the work of three IPCC Working Groups (WGs). WG1 considered the scientific basis of climate change and what the climate models are showing and WG3 considered how the climate change could be mitigated. Within this WG3 volume is chapter 6 on the mitigation options for residential and commercial buildings.

This presentation reviews this chapter which discusses how the very significant potential savings of greenhouse gases from the buildings can be achieved through the technical fix and policies. The technical fix is largely based on existing technology although it is recognised that existing building refurbishment is a major issue to be addressed and that there are a number of policies that can help achieve these reductions although some are in their infancy. Some of the future technical fixes are also reviewed.

Impact of Global Warming on Air Conditioning Demand in Tourism Related Car Travel – Case Study for Portugal

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The effects of global warming on the energy demand for space heating have been extensively studied for several regions and building types. However, not much is known about the case of vehicles. For cars and buses, plenty of engine irradiated heat is available, so heating energy demand is not affected by climate change. But for cooling, extra power is required from the engine, to drive the air conditioning system (A/C) –7% is typical –, so the cooling energy demand for cooling is sensitive to climate change

As a first approach for Portugal, the CLITOP Project examined the case of tourism related car travel. The decision of a car driver to turn the A/C on is likely to be dependent on many factors. Some are clearly meteorological – ambient temperature, cabin temperature, relative humidity, solar radiation, cloudiness. Other factors should come into play such as exposure to heat previously to travel, clothes, presence of children or old age passengers, trip duration, even culture and concerns about extra cost. A driver behaviour model should include all these factors, but monitoring and survey data for calibration and validation is very rare. Therefore this first CLITOP model simply uses an ambient temperature threshold of 24 °C.

The model analyses the main tourism regions, accounts for seasonality, typical energy consumption and extra power required by A/C. The Algarve region has shown the highest impact, the Lisbon area ranked next. Unfortunately, various model parameters are speculative, due to lack of monitoring data - viz. distribution of travels during the day, car sharing, and the threshold temperature itself – so the interpretation of the results was difficult.

The impact model was further combined with four technological and socio-economic scenarios adapted from the IPCC SRES exercise - and this finally provided various valuable insights. A/C energy demand is estimated to represent today about 0.1% (Madeira) to 0.7%(Algarve) of the overall energy consumption. In the future it should step up to about 0.9% (Madeira, scenario B1, 2100) to 3.4% (Algarve, scenario A1, 2100); but in any event the responsibility of climate change in this should amount to about half (A1) to 2/3 (B1) of the total rise by 2100.

Keywords: Global Warming, Energy Demand, Air Conditioning, Car Travel, Portugal

How can Portuguese Tourism Sector Contribute to Reduce Energy Consumption and Pressure on CO₂ Emissions?

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Tourism and Climate Change are linked in a double way. The activity can be affected by climate change but has also impacts on it. This paper will deal with the second aspect, referring a set of measures to mitigate the effects of Portuguese Tourism on CO₂ emissions.

The Tourism sector is of up most importance for Portugal. In 2005 the activity contributed, with 5,5% to GDP, 7,1% to employment and 14,9% to national exports of goods and services.

It is a key objective for the sector to increase and diversify the activity, facing the challenge of decoupling it from energy consumption. That implies strong energy policy orientations. Recent European and National energy and climate change policies have set ambitious targets for 2010 and 2020. Tourism and the use of transports associated with it (including aviation) can play an important role in the CO₂ mitigation through a set of energy measures: energy efficiency, renewable energies, decentralized energy, clean transports.

Legislation in force on energy performance of buildings can accelerate changes in energy patterns, since new lodging capacity will be built more efficiently, using thermal efficient materials and passive solar architecture. Tourist lodging will require less energy consumption during its lifetime that associated with efficient appliances, can contribute to energy savings in all uses.

This sector have good conditions to apply for new technologies of decentralized energy production. Electricity, heating and cooling, can be produced adopting micro-generation, co-generation or tri-generation systems, including fuel cells, renewables (for example photovoltaic solar panels) and smart grids. In the limit tourist resorts could be energy self-sufficient.

Organization and logistics are also crucial as the diversification of touristic products, other than sun and beach, are associated to an increase of mobility. It is important to develop flexible travel modes, adapted to different group dimensions, in order to benefit clean and collective transports.

All those measures will require investments but can also be opportunities for a sustainable development of national tourism and can contribute to national commitments with the Kyoto Protocol and beyond.

Keywords: Tourism, CO₂ Emissions, Energy efficiency, Renewable energies, Clean Transports

How Climate-Efficient Is Tourism? The Case of Switzerland

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The tourism sector is not only affected by climate change but also has an impact on the Earth's climate by emitting greenhouse gases (GHG). Consequently, the sector is under increasing pressure to make its contribution to the mitigation of GHG. In this context, there is a growing interest in identifying those measures that are the economically most efficient. In order to assist the determination of such measures, we calculate the climate efficiency of the tourism sector for the case of Switzerland. We define climate efficiency as the amount of GHG emissions per added value generated by all tourism subsectors. This concept allows to identify which subsectors generate high emissions and relatively low added value (i.e. low climate efficiency) and should thus be focussed on for mitigation purposes.

The tourism sector's GHG emissions were assessed by two different approaches: CO₂ emissions of the operation processes (measured in kg CO₂) and GHG emissions of the whole lifecycle (measured in kg CO₂-equ). The calculations are based on the Swiss Tourism Satellite Account 2003 and life cycle inventory data on energy and material supply, as well as transport services. Additional data for transport, accommodation and activity options was obtained from literature published between 1995 and 2007.

The sectors with the best climate efficiency are tourist agencies/tour operators, restaurants and cultural offerings. The medium range is occupied by the accommodation sector and the sport & entertainment sector. The least efficient sector is passenger transportation, which is headed by air traffic. These results indicate that measures should be focussed on the transport and accommodation subsectors. By September, we expect to present the numbers in detail as well as additional analyses, such as an assessment on how strongly a life cycle perspective changes the different climate efficiencies as well as a comparison of the tourism sector's climate efficiency with that of other economic sectors.

Keywords: climate efficiency, tourism, GHG emissions, added value, Switzerland.

*Thermal Environment and Extreme Events: Implications for
Tourism*

Importance of Thermal Comfort and Bioclimate for Tourism

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Common thermal indices, used for tourism and climate studies are based only on simple climatic parameters and combinations of them. In humanbiometeorology the affect of single parameters and factors are combined in effective complex in order to describe more detailed and holistic manner of the diverse atmospheric phenomena and variables on humans.

In this analysis, only the thermal complex of humans is considered. It includes the meteorological factors air temperature, air humidity, and wind velocity, as well as short and long wave radiation, which affect humans thermo-physiologically in indoor and outdoor climates. This thermal complex is relevant to human health because of a close relationship between the thermoregulatory mechanisms and the circulatory system. Effects of the thermal environment of humans are best determined with the aid of thermal indices based on the energy balance of the human body.

Using the measure of Physiologically Equivalent Temperature (PET) it is analysed how changes in the thermal environment can affect human well-being. The presented examples show how thermal comfort and in generally bioclimate affect not in a temporal way but also in several micro, meso and macro climates. The results and examples are focused on their application for tourism purposes.

Outdoor Thermal Comfort in Portugal: Future Scenarios and Implications for the Tourism Industry

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Global environmental change and particularly climate change impacts on thermal comfort levels are regarded as a major potential disruptive effect for worldwide tourism destinations. Tourists use climate and thermal environment information along with other tourism facets to construct a mental image of their desired destinations. Changes in the environmental and climatic attributes of a given location are bound to generate medium to long term modifications on such location's attractiveness as a tourism destination.

Both surveys and travel statistics have already established climate and weather as a significant *pull* factor for tourism in Portugal. The main destinations in Portugal: Algarve; Great Lisbon area; Madeira Island; and Great Porto area, show a tendency for seasonal attractiveness with most nights slept by both national and international visitors being registered between June and September. Algarve, for example, shows winter occupancy rates not reaching a third of the values registered in August.

Outdoor thermal comfort levels are therefore a main driver for tourists and can definitely affect one's travelling experience. Although climate and weather variables are physically measurable their effect on tourist's perceptions of a given region is not straightforward. Using climatic indexes has proved to be a useful tool when researching tourist's preferences and perceptions. An example is the Physiologically Equivalent Temperature (PET) index used in the present work to evaluate how future climate-driven changes may impact the tourism attractiveness of Portuguese destinations.

Future short-, mid- and long-term scenarios for thermal comfort levels in the main Portuguese tourism regions were developed. Downscaled climate data from the Hadley's Centre HadCM3 General Circulation Model (GCM) forced by the SRES scenarios (A1, A2, B1, and B2) was used to calculate future PET values for each region. These regional scenarios of future thermal comfort levels allowed the development of a regional analysis on the potential impacts for the tourism attractiveness of each location. These results can now form a coherent set of potential futures against which the Portuguese tourism sector needs to position itself.

Keywords: thermal comfort, climate change, Portugal, tourism.

Extreme Weather Events and Health

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Global climate change projections predict an increase in frequency and intensity of extreme weather events. Recent events like floods and heat-waves in Europe showed that also high-income countries are not well prepared. In Italy for example, changes in the climate system have been observed. Effects on physical and biological systems that are relevant for tourism include for example severe water stress, increased risk of algae and cyanobacteria growth in lakes as well as toxic algae in the sea, increased risk of fires and sea level rise leading to increased flood risk for coastal regions. Climate change can affect human health directly through changes in temperatures, precipitation and the frequency of extreme events as well as indirectly through alterations in water, food and air quality, changes in ecosystems and effects for example on agriculture or the economy. Extreme weather events such as floods, storms, heat-waves and droughts can have severe direct and also indirect impacts on human health such as heat related morbidity and mortality, death, injuries and morbidity from floods and fires and increased burden of food and water borne diseases. Population groups particularly at risk and sensitive to health impacts from weather extremes include children, the elderly and people with pre-existing health problems or individuals with limited access to social support or health care. (e.g. the urban poor). Also tourists are particularly vulnerable to these health impacts as they are unfamiliar with the local environment, climate, health risks and health care system. They may not be acclimatized to the local weather conditions, lack local cultural and traditional knowledge, don't speak the local language so that access to information and health care may be more difficult.

Responses to prevent health impacts of extreme weather events include early warning systems composed of a meteorological component for accurate forecasts and timely alerts to extreme events and a public health component (preparedness and response plans, including risk communication and public education). Effective disease surveillance systems allow early detection of health impacts. Examples for advanced early warning systems are the heat health action plans that have been developed in a range of European countries, most of them in response to the extreme heat-wave in 2003.

Climate projections and related possible impacts on environment and human health should be considered in the planning of tourist infrastructure and offers. These considerations include the protection of the local environment, ecosystems and population (e.g. water resources) as well as the safety and well being of the tourists (e.g. building codes and location of holiday infrastructure in areas at risk). Tourists should also be included as a specific target group for information and advice materials published in the frame of heat health action plans or flood prevention and preparedness plans. This could include translation of information materials into foreign languages and inclusion of tourist information offices, hotels and tour agencies into the dissemination of health information in relation to extreme weather events.

Apart from emergency and short-term measures in the health sector also long term measures to improve adaptation to climate change and predicted increase in extreme events in the areas of urban planning, housing improvements, tourism industry, the energy water and transport sector need to be developed and implemented.

Keywords: extreme weather events, health impacts, tourists, public health responses, early warning and preparedness

Heat Waves in Portugal: Impacts and National Surveillance

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Heat waves are extreme weather events that are somewhat frequent in Portugal. World wide, the impact of heat waves on human health is acknowledged though the complete impacts are far from fully known and measured.

For heat waves in Portugal impact on mortality have been quite thoroughly evaluated and models have been established with success to the relation between heat wave occurrence and associated mortality.

Evidence of heat waves impact on morbidity has been harder to get. We present evidence of heat wave impact on elder individuals' hospital admissions in Portugal during the 2003 August heat wave.

From the heat wave - Mortality models a heat health warning system was created in Portugal in 1998 that operates yearly since 1999. In fact this was the only operating system in Europe in 2003.

This Portuguese heat health warning system was initially a city-centred system based on a statistical model for the mortality of Lisbon district, which had a very good correspondence to the national (mainland) level of observed mortality. So the city centred system was regarded has a good indicator of heat waves impact in Portugal mainland. But counter examples appeared with weather conditions in Lisbon being completely different from the rest of Portugal mainland or the 2004 regional heat wave in Algarve, having impacts on mortality that were not flagged by the existing system.

Having this as a concern, four regional systems were created using climate data from their corresponding districts capitals.

Emerging regional models resulted slightly more complicated than the original model for the Lisbon district and individual models' predictions somewhat less accurate. But when combining the four models predictions together they provide a more correct prediction for the country's mainland observed mortality.

Currently a national index is used to measure the country population heat risk, which consists of the weighted mean of the four regional models where weights are based on the resident population on these regions.

So the Portuguese heat health warning system is now most probably the first national system world wide. For a country where tourism plays an important role this national system promotes also visitors improved security.

Poster presentation

How Does Climate Effectively Affect Tourism? The Advantage of a Weather Type Methodology

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As tourism is an important source of income for several countries, the consequences of climate change on tourism are a very important issue, particularly for tourists seeking outdoor leisure activities.

However, one must bear in mind that the individuals are sensitive to particular combinations of meteorological parameters rather than to single ones. Therefore, it is important to assess the relationship between climate and tourism by considering the frequency of weather types and their change in time and space. This presentation has two aims.

i) to present examples of a methodology, where climate influence on human beings is assessed through the use of tourism-oriented weather types in 2 sea-side resorts: Funchal (Madeira Island) and Praia Grande (western coast of Portugal). For this purpose, the weather types are defined as a combination of different meteorological parameters (Funchal) or of Physiological Equivalent index (that measures the thermal effect) and cloud cover (to monitor the aesthetic aspects). The thresholds were defined in function of weather type fitness for sea-side leisure activities. In the first example, the weather type frequency for summer and winter was computed. In the second example, the results were verified by means of indirect indicators (cars parked near the beach and business of restaurants with different locations).

ii) to show that great care must be taken referring to the meteorological stations used to construct the models, and/or validate the results, because there is frequently a large spatial variability between nearby resorts and between resorts and the nearest meteorological station.

In order to be able to establish relationships between climate change and tourism (outdoor leisure activities), the forecast of the future frequency of tourism-oriented weather types and its spatial variation should be considered.

Keywords: weather type, local climate, PET, sea-side tourism, climate change.

Perception of Bioclimatic Comfort by Persons of Different Geographic Origins in a Leisure Riverside Area in Lisbon

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The climate, comprising its thermal, physical and aesthetical aspects (de Freitas, 2003), is an important part of how the image of a tourist destination is formed. The perception of atmospheric conditions and the sensation involved in thermal and mechanical comfort (Oliveira and Andrade, 2007) are, therefore, important to the construction of that image and are influenced not only by the climate itself, but also by subjective factors, including motivation, individual preferences and cultural aspects. The geographic origin of individuals influences the way they feel and evaluate all of these features.

In order to know how users of a leisure riverside area of Lisbon (Parque das Nações) perceive the atmospheric conditions and sense them as more or less comfortable, measurements of weather parameters (air temperature, relative humidity, wind speed and solar and infrared radiation) as well as surveys were carried out simultaneously. The Physiological Equivalent Temperature was calculated, in order to evaluate the combined influence of the atmospheric parameters. Nearly 400 inquiries were made to users of the area during every seasons of 2006 and 2007. In analysing of results, the complex relations between measured values, personal characteristics (including gender, age, clothing, geographic origin, among others) and the level of comfort declared by the interviewees were taken into account (Oliveira and Andrade, 2007).

The results showed that, in spite of a large level of acceptability of outdoor atmospheric conditions by persons involved in leisure activities, it is possible to define boundaries beyond which this acceptability greatly decreases. It was also possible to demonstrate the obvious significance of personal (including geographical origin) and subjective parameters in the perception and evaluation/assessment of atmospheric conditions.

Key-Words: Bioclimatic Comfort; Thermal Perception, Leisure Area, Survey, Lisbon.

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Tourism Resources: Changes and Impacts

Climate Change and Coastal Tourism

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Climate change will have profound impacts on both tourism and coastal regions, and consequently also on coastal tourism, a sector of massive economic importance. A large share of Europe's and the world's tourism activity is concentrated in coastal zones. A majority of the roughly 100 million northern European tourists visiting the Mediterranean basin every year spends some or most of their time at or near the coast. Any shift in climatic conditions that would cause a redirection of tourist flows to other coastal areas would have major economic, social and ecological consequences.

In my presentation, the impacts of climate change on coastal tourism are addressed from a number of angles. Building on published work using the Tourism Climatic Index (TCI), I will discuss the broad changes in climatic suitability for tourism around the world and in different seasons. A general poleward shift of good conditions is shown, and indications are given of changes in seasonality patterns and types. Complementing the TCI analyses, some preliminary results are presented of a study using a weather type approach. In contrast to the TCI approach, in which one optimum is defined, the weather type approach distinguishes nine different weather 'niches' that are suitable for different types of tourism activities. Using this approach, climate change induced shifts in the frequency of weather types are explored, with a focus on the weather type that is most appropriate for beach tourism.

In addition to the impact side, the presentation will also touch upon the vulnerability side of climate change and coastal tourism. Building on work for the European PESETA project, a rudimentary vulnerability assessment is made for the tourism industry in Europe's coastal zones. The presentation will conclude by exploring the place of coastal tourism in the IPCC's 4th impact assessment AR4, and by indicating a priority issues for future research.

Climatic Resources for Tourism in Europe: An Application of the Tourism Climate Index on a Daily Basis

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In the past few years, climate change's impact on tourism resources has been analysed by means of the Tourism Climate Index (TCI) developed by Miezkowski (1985). This index was developed to assess – in one single number - the climatic factors that influence the tourism experience. It has in recent years been applied to estimate the impact of future climate change on the tourism potential by using data from projected climate change (e.g. for North America by Scott et al. (2004) or globally by Amelung et al. (2007).

We apply the TCI to Europe and refine the method regarding (i) spatial as well as (ii) temporal resolution, enabling more detailed results as well as new insights:

- (i) The global circulation models used previously reproduce the global climate well, but have a very coarse geographical resolution. Portugal, for instance, would be represented by one to three grid points. In the presented research, the spatial resolution is increased by using data from so-called regional models that are nested in global circulation models. Different combinations of global and regional models are analysed (data from the PRUDENCE regional modelling project are used), enabling an assessment of how robust the projected changes are.
- (ii) Previously, the TCI has been calculated on the basis of monthly data. We calculate the TCI on a daily basis, yielding answers to following questions: What are the projected changes in the mean TCI? Are there large differences between results calculated with daily data and those calculated with monthly data, i.e. is it worth the effort to use daily data? As tourist satisfaction depends on the tourist's expectations, not only the average climate but also its variability is of interest. Will the variability of the climate increase or decrease? In addition, the daily data enables a number of new calculations or analyses. For instance: What are the changes in the probability of a destination experiencing high TCI ratings ("good weather") for 5 days in a row?

Keywords: Tourism Climate Index, climate change, tourism resource

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Climate Change, Tourism and Landscape Impacts: A Regional Analysis

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Increasingly pronounced impacts of tourism have been experienced on a global scale due to the rapid growth of tourism. Focus has tended to be on economic impacts, with less consideration of environmental and social effects, which often include negative impacts of tourism. Countryside tourism and recreation has increased considerably in scale and diversity over the last three decades, and as a result, environmental impacts are being experienced, especially in popular locations. Impacts include air pollution, disturbance of wildlife, visitor crowding, and erosion of footpaths. Areas freely open to public access are particularly susceptible to pressure. These include national parks and open countryside where entrance charges are neither practicable nor acceptable.

Climate change exerts a strong influence on landscape condition, and this may increase the vulnerability of recreational landscapes to visitor pressure. Since most outdoor tourism relies on the attraction of visitors to climate-dependant renewable biophysical resources, such as beaches or forests, these resources are likely to be vulnerable to changes in climate. The Climate Change and the Visitor Economy (CCVE) project, found that drier and hotter summers will present an increased wildfire risk to moorland areas, and rising sea levels will cause adverse effects on coastal sand dune ecosystems, such as increased flooding and erosion, affecting the tourist carrying capacity of these landscapes.

Following on from CCVE, this paper discusses the results of a methodology involving visitor capacity and landscape character assessment to identify probable impacts of climate change and socio-economic change on the landscape resource. This is a suitable scale for tourism impact analysis since advances in computer modelling have enabled climate change impacts to be assessed at the landscape scale. A sub-regional level of analysis is important since implementation strategies developed to respond to impacts are usually best tackled at the landscape or site scale. This research uses indices to represent landscape sensitivity and landscape value, to assess visitor impacts on landscapes in Northwest England, which are considered a nationally important tourism resource.

Keywords: climate change, tourism, capacity, landscape

Climate Change Implication for Recreational Fishing

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Recreational fishing is one of the most important alternative opportunities, and complementary process, for developing some fishing communities in the Portuguese coastal zones, in the context of a sustainable and rational exploration of marine resources.

A large spectrum of activities could support the cluster of recreational fishing, and create new jobs, including in the commercial and high technology sectors, in alternative or complement the maritime tourism and commercial fishing, is already a reality.

It began to be more and more consistent the references of captures of the most appreciated species in the recreational fishing as different bill fishes, dolphin fish, various species of sharks and tunas, some of them close of international records.

The increase of captures of some subtropical species it seems to be a reality and promote the occurrence of new clubs, events as competitions/tournaments, appropriated fleet (private and for renting), equipment of last generation, safety structures and procedures in the sea and in land for to support the specifications of this activities.

It's important to note that most of the competitions promoted today are increasing the fish and release, including tagging procedures for specific programs.

The global climate change, namely related with the temperature of sea surface, it's seems the justifications of the displacement and abundance of some and "new" subtropical fish species, and in that conditions it's necessary optimize and profit that new opportunities.

This scenario, with the influence of climate factors that could emerge the sea recreation fishing activities, is presented the support of some examples of the current situation in Portugal.

Spatial Distribution of Leishmania Sandfly Vectors in Portugal: Risk Areas, Climate Changes and Impacts on Tourism

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Portugal is an endemic region of Human and Canine Leishmaniosis, being the dog the main reservoir of *Leishmania infantum*, the protozoa transmitted by two confirmed vectors: *Phlebotomus perniciosus* and *Ph. ariasi*. Distribution of these two sandfly species is conditioned by climate and environmental conditions. *Ph. perniciosus* presents a larger climatic plasticity, being present from wet areas to more arid regions.

Growing awareness of global climate change has stimulated several assessments of its likely effects on vector-borne diseases (VBD). Countries with a temperate climate, such as Portugal, are at risk of future climate conditions that may be more favorable to VBD transmission. SIAM II Project concluded that predicted future climate changes would enhance the number of days favorable to transmission of *Leishmania* strains, due to higher density and activity of *Ph. perniciosus* during a larger period (from April to November).

Based on collections performed from 1978 to 2004, at 104 localities, spatial distribution of both species in mainland Portugal was determined and, by geostatistical techniques (kriging), the most important risk areas were defined. For *Ph. perniciosus*, risk areas were mainly at Northwest (NW) regions of Portugal and the Algarve region and for *Ph. ariasi*, risk areas were restricted to Northwest regions.

These new recent data, along with the previous information on impact of climate changes on developmental cycle of sandfly vectors, contributes for the application of several adaptation measures, as surveillance programs, to decrease the vulnerability to this disease.

This vulnerability is present, not only for local populations of these risk areas, but also for foreign tourists coming from non-endemic regions and from endemic regions, the latter potentially responsible for carrying other strains. With no less importance, the national tourists and their pets may also "transport" national strains between the different risk areas, contributing for the change of the known actual pattern.

Multidisciplinary measures, applied in a sustained way in Human and Canine Leishmaniosis and their vectors, should benefit these local populations, but also the tourists that visit Portugal every year.

Keywords: *Leishmania* sandfly vectors, Climate changes, Risk areas, Tourism

Poster presentation

Could Climate Change have a Positive Impact in Portugal's West Tourism Region Coast?

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The Portuguese west tourism region is defined as a priority in the national strategic plan for tourism. Coastal tourism is dominant in this region showing signs of great development.

Climate plays an important role in tourism activities at several levels: it can act as a localization factor for attracting areas, it can influence the activity periods; it can influence the infrastructures and its well functioning; and it influences strongly the tourist comfort and wellbeing. Nevertheless climate change impacts on tourism have only recently begun to be analysed.

In this paper we focus on the predictable climate change impacts on the tourism activities of Portugal's coastal west tourism region, taking as an example the climate conditions around Peniche. In order to identify the observed environmental changes in recent years, monthly sea surface temperatures from the last decade and average daily temperature were analysed and a tourism climate index was calculated since 1943. This data showed a slight increase of the sea surface temperature by the west coast of Portugal and a considerable increase of the average minimum air temperature of 0,2 °C per decade, since 1940 to 2000. The average annual temperature has increased since mid seventy's reaching 15,6 °C in the last decade, approaching the considered optimum holiday average annual temperature of 16,2 °C defined by Bigano, et al in 2006.

The trends observed were compared with the predictable climate change impacts in Portugal and conclusions for the future of the tourism in the central west coast were drawn.

Although the climate change can have several negative impacts, it is expected that the sea proximity can moderate the expected summer discomfort increase to some extent. This "moderating" effect probably benefits indirectly the west tourism region coast of Portugal as the region's climate may become more appealing in comparison to the central mainland of the Iberian Peninsula, where the temperature increase is expected to be higher (Hein, 2007).

Keywords – Climate change, Portugal, Tourism, Air Temperature, Sea surface temperature.

Poster presentation

Weather Types for Tourism in a Changing Climate

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Tourism is highly dependent on climatological and weather conditions. As a result, climate change may have a large impact on tourism patterns. The implications vary between different tourism types and activities, according to the type of weather they require. This study explores how climate change may alter the frequency of a range of weather types across Europe, and discusses the possible implications for 'summer-time' tourism activities.

Besancenot (1989) developed a system of nine weather types. The weather types are intended to resemble the intuitive weather categories that tourists use. The approach was originally developed to analyse local frequency distributions of these weather types, based on daily weather data from local weather stations.

Here, the (change in) incidence of the nine weather types is assessed by counting the number of days belonging to each of them according to five different climate models. Frequencies are calculated for two time slices per climate model: the simulated baseline period of 1961-1990 ('1970s'), and the future period of 2071-2100 ('2080s'). The required daily data – results from the integrations of a suite of climate models forced with the SRES A2 scenario – are available from the PRUDENCE project.

In Summer, large losses of favourable days (Type 1-7) are expected for the Mediterranean (Med), with some gains towards the North. In this latter area, major increases are projected for the year as a whole, whereas the Med may suffer slight decreases. The Med is well-known for its Type 1 (sunbathing) weather, but is projected to lose much of its competitive edge. For most weather types, the five models generally coincide in the direction of change, but the magnitude of change varies.

The projected northward shift of favourable conditions coincides with previous studies based in the Tourism Climate Index (e.g. Amelung and Viner, 2006). The weather type approach is richer, however, as it provides useful information for a range of tourism activities. It shows, for example, that northern Europe is unlikely to become very popular for beach tourism (type 1) in the next decades. Key issues for future research are a thorough comparison between model results in order to test robustness; further exploration of the implications for different types of tourism activities; and the use of additional scenarios.

Keywords: weather types, climate change, tourism activities

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Poster presentation

Effects of Air Pollution on Daily Mortality in Lisbon: Implications for Tourism

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Ambient air quality is a key indicator used for the Quality Performance Evaluation (QUALITEST) of tourist destinations. Bad air quality can lead to respiratory and cardiovascular illness and can have an influence on the tourists' perception of the destination. Since bad air quality affects the health of both tourists and residents it is important to monitor the destination's air quality as well as associated health impacts. This study evaluates the association between exposure to air pollutants and daily mortality in Lisbon, Portugal, from 2000 to 2004. Pollutants investigated were sulphur dioxide (SO₂), nitrogen dioxide (NO₂), ozone (O₃) and particulate matter (PM₁₀).

The associations between daily mortality and air pollutants were estimated using generalized additive Poisson regression modelling (GAM). The models were adjusted for temporal trends, seasonality and temperature. Analyses were done for all year and for summer season only (1 of May to 30 of September) using daily mortality due to cardiovascular and respiratory diseases.

Significant associations were observed between daily mortality and concentrations of NO₂ and O₃. The observed associations were dose dependent and quite evident after a short period of exposure (2 days). An increase of 10µg/m³ in NO₂ mean concentration was associated with 0,89% increase in cardiovascular mortality and a 1,23% increase in respiratory mortality. Summertime ozone was significantly associated with cardiovascular and respiratory mortality in Lisbon. The results of this study are consistent with other studies showing an association of short-term effects of air pollution and increase mortality in large urban areas.

It is anticipated that climate change will reduce air quality, especially in the summer. As Lisbon is one of the most popular tourist destinations in Portugal, it is important to take mitigation actions now to ensure that air quality does not worsen because a lack of attention to quality issues now could have serious consequences later in terms of loss of health (safety), image, falling income and the initiation of potentially expensive damage limitation exercises.

Key words: air pollution, mortality, respiratory diseases, cardiovascular diseases, tourism implications

Poster presentation

Adaptation Measures and Socio-economic Implications

Climate change in Small Island States (SIS); Vulnerability, Resilience and the Implications

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A crucial interdependence exists between tourism, climate, the environment and communities. The tourism industry, in its position as one of the world's largest economic sectors and one of the most climate and environment-dependent, is inextricably linked to economic development, sustainable livelihoods and environmental protection. This is particularly true for Small Island States (SIS) where climate and the environment are the key resources for tourism.

Beach tourism (the dominating segment) is highly dependent on these resources and SIS are some of the most vulnerable destinations to global environmental change due to the wide range of impacts on these resources; changes in climate, both extreme and gradual, will play a significant role in the continued sustainable development of small island states especially those with a large economic reliance on tourism and related industries.

This presentation examines the implications for SIS of global environmental change and the resilience of these destinations in the face of the impacts.

Key Words: Tourism; Climate Change; Small Island States; Impacts; Vulnerability; Adaptation; Resilience.

Climate Change Impacts on Human Health: Implications for Tourism

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Climate change is now a reality. The issue of how climate change may affect human health and tourism are, individually, growing research areas. The implications of climate change health impacts on tourism are complex and an integrated research area with few studies currently. The objective of this paper is to review the literature on the implications of climate change for travellers' health in southern Europe.

It is well known that southern Europe and the Mediterranean region are generally more vulnerable to climate change than central and northern Europe, with extreme weather events likely to occur more frequently together with accelerated warming and sea level rise. It is also well known that tourism has become one of the fastest growing economic sectors in the world and a key driver for socio-economic progress in many countries. Tourism flows to southern Europe are second to none. The fact that southern European countries are generally considered as warm and sunny destinations that offer a low health risk to the tourist enhances the region's attractiveness as a tourist destination.

Climate change is anticipated to affect human health through a variety of pathways. Some are direct pathways such as extreme thermal exposure and floods. Others involve intermediate and multiple pathways such as those affecting the transmission dynamics of vector-borne and water-borne diseases. These impacts are obviously not limited to the local population; all individuals (locals and visitors) in a region are vulnerable to the potential climate change impacts of that region. For numerous reasons (i.e. unfamiliar culture and environmental conditions and also hazards linked to specific recreational activities) visitors are often more vulnerable to these health effects.

Any adverse impact on tourist health makes their and their family members' holiday experience less pleasant and subsequently reduces the location's attractiveness as a future tourist destination. Alterations in the potential tourist health risk to previously "low health risk" destinations will also have economical implications not only for disease treatment and prevention (i.e. vaccinations), but also on national/local policy (i.e. implementation of routine disinsection of aircrafts and of early warning programs for extreme weather outcomes).

Evidence as to tourist vulnerability to these climate-sensitive health effects will be discussed as well as suitable adaptation measures to reduce tourist vulnerability.

Keywords: Southern Europe, climate change, tourist health, tourism implications, adaptation measures.

Tourism Strategies for Adaptation and Sustainable Development in Mountain and Coastal Destinations in Germany

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The anticipatory adaptation to extreme weather events and expected climate change is an important aspect of sustainable development in the tourism sector because it can change the patterns of traveler flows and create a new demand of products of the either frequently visiting or new coming tourists. A strategically oriented tourism policy and business is therefore challenged to integrate climate change into their decision-making processes, in order to minimize socio-economic risks and take advantage of new opportunities.

However, studies on tourism and climate change show that tourism business is focused on short term decision-making and that climate change is not integrated adequately into management procedures. There is a need for climate models examining various destinations' scenarios, a lack of studies about tourist's traveling behavior in the case of climatic changes and prognoses missing that deal with the outcomes of climate change for regions dependent of tourism industry.

The interdisciplinary project "Climate Change and Sustainable Development of Tourism in Coastal Zones and Mountain Regions" works with these challenges and combines natural and social science disciplines work (in the fields of cooperation processes, tourism analysis and strategy, weather and climate change analysis, information and communication and knowledge transfer) in a approach with actors from tourism policy and business in the focus regions North Sea Coast and Black Forest. The project is divided into four phases – diagnosis, assessment, strategy/design of solutions, evaluation – where the scientific subprojects and the praxis partners are constantly meeting for the purpose of discussing the research activities, identifying the needs of the actors and to develop jointly adaptation strategies like installing weather-independent alternatives products and infrastructure, implementing technical improvements or offering activities for an all-year-tourism. These instruments should be implemented including mitigation strategies to stabilize the anthropological greenhouse effect. The anticipatory adaptation requires communication activities on the level of the individual tourism actors among themselves and with visitors as well as processes of cooperative learning and joint decision-making in tourism regions.

Key words: Climate change, tourism, adaptation, cooperation, capacity building

Do Snowmaking Investments Improve the Operating Margin of the Cableway Companies in the Perspective of Climate Change?

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Tourism generates significant revenues in Switzerland though its importance varies strongly from one region to the other. In many mountain cantons and regions, tourism is a central economic activity that can represent up to 40% of the GDP. In these tourism economies that highly rely on the winter season, the ski lift branch is often thought to be the spine of the tourism sector. However, as a result of climate change, this major branch is now threatened by deteriorating snow conditions. Investments in snowmaking facilities are then presented as the adaptation measure *par excellence*. These investments are yet limited in Switzerland but are expected to grow quickly. The economic advisability of these forthcoming investments is subject to caution. In the climate change adaptation context, one could ask whether the increased recourse to snowmaking is a strategy that will improve the operating margin of the companies or, on the contrary, that will reduce it. This question is also relevant for determining whether the snowmaking investments planned by the companies should be financially supported by the public authorities. The present paper would like to shed some light on these issues looking at the current effect of the snowmaking facilities on the operating margin of the companies. For this purpose, several statistical models of the cableway companies' operating margin will be estimated.

The estimated models will then allow us to assess the impacts of further reduction in the natural snow cover on the cableway sector. Future climatic conditions will be simulated by atmospheric values derived from the HIRHAM Danish Regional Climate Model. These values will then be used as inputs in the GRENBLS model (ground energy balance model) in order to work out the future values of the snow depth in several ski areas throughout Switzerland. Based on these predictions and models, we will also be able to discuss and reassess the snow reliability notion and predictions which has been widely used for assessing the potential impacts of climate change on the ski industry.

Keywords: Alpine tourism, ski industry, snowmaking, adaptation, climate change impacts.

Challenges for Swedish Tourism and Recreation Activities Considering Climate Change

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Regional and global climate scenarios indicate a possible tremendous change by the end of the century in Sweden with substantial implications for tourism and recreation activities. In the Northern part of Sweden snow cover may disappear altogether in the lowlands and in the Southern part some low lying coastal areas will be prone to erosion and inundation. Heat waves during summertime are a challenge as infrastructure; buildings and public transport are not adapted to such conditions. At the same time, climate change will prolong the season for summer tourism and as Sweden has a long coastline, numerous lakes as well as large tracts of forested land, opportunities for summer tourism may increase.

Tourism in Sweden is today largely focused to the three major city regions, Stockholm, Gothenburg and Malmö, but there are also many popular tourism areas in the Swedish mountains and along the Swedish coast. The mountains are visited both wintertime, for skiing, and summertime, mainly for hiking, while the coastal areas primarily attract people at summer. Sweden also has large areas with natural and scenic lands used for recreation activities, including boat tourism and ice skating.

The share of GDP from tourism is lower than in Sweden than in many other European countries, around 2,8 % although increasing. A large percentage of tourists in Sweden come from Norway and Denmark while visitors from outside of Scandinavia mainly arrive from Germany, the Netherlands and Great Britain. Swedes travel extensively as tourists, but mainly within Scandinavia and the southern part of Europe. Given climate change scenarios, some of these destinations will be adversely affected during summer time, with heat and drought, while the Alpine region chosen for skiing opportunities will have a decreasing snow cover. This, in combination with possible future policy measures directed at the transportation sector may alter travel patterns.

In this study, we give a first overview of the challenges ahead when it comes to Swedish tourism and recreation and sketch some future trends. Three climate change scenarios are considered. The study is part of the research programme Climatools where tools for climate change adaptation are developed for Swedish stakeholders within the tourist and recreation sector.

Keywords: Swedish tourism, Mountain, Coast, Travel pattern, Challenges

Poster presentation

Integrating Climate Change in the Environmental Performance of Resorts

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Tourism is a priority for Portugal's development and a strategic sector, explaining the country's predicted expansion in tourism-related construction. In particular, tourism resorts will observe an increase due to a market specialization. At the same time, climate change (CC) impacts are becoming more persistent, and the tourism sector, especially accommodation, should take them into consideration at the risk of jeopardizing its own success.

The life cycle of a resort – from policy, programmes and plans (PPP) design, to deactivation – can have its environmental performance improved through the application of three tools, integrating differently the issue of CC. First, CC has to be considered in PPP by applying Strategic Environmental Assessment (SEA), which implies adopting measures at the planning stage directed at avoiding certain CC impacts on the tourism sector, and at the reduction of greenhouse gases (GHG) emissions. Second, Environmental Impact Assessment (EIA) can ensure compliance of the project design with PPP and, at the project level, address CC by: i) accounting for cumulative impacts of CC and project on the same environmental receptors; ii) considering CC consequences in the definition of alternatives; iii) pondering potential impacts on CC of proposed mitigation measures; iv) and proposing GHG emissions reduction measures, that is, reducing the contribution of the project to CC. In particular, the definition of alternatives should consider different climate scenarios and risk assessments. Third, Environmental Certification (EC) allows the environment to be taken into account at the exploration stage through a continuous process of evaluation and environmental improvement. Nowadays, the improvement of environmental performance is a key factor of tourism sector success. EC can enable the reduction of GHG emissions and natural resources consumption and the enhancement of the image and competitive position of resorts in the market.

Being the market and environmental success of a resort also determined by how well CC issues are addressed in its life cycle, tools like SEA, EIA and EC should be the focus of this integration as they act together on different levels of analysis.

Keywords: Climate Change; Environmental Evaluation; Tourism.

Poster presentation

Climate Change Impacts on Vector-borne Diseases in Madeira

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Climate variables such as rainfall, temperature and humidity are known to affect the survival of vectors and their hosts as well as the infectious agents (pathogens) they can transmit. Hence even small climate changes can have significant influences in vector-borne disease (VBD) transmission dynamics. Growing awareness of global climate change has stimulated several assessments of its likely effects on these diseases as well as other health outcomes. The impact that a warmer climate may have on VBD transmission risks in Madeira is assessed in this study based on temperature thresholds favorable for mosquito-borne diseases (dengue, yellow fever, malaria, West Nile virus fever) tick-borne diseases (Lyme disease, anaplasmosis, Mediterranean spotted fever), and flea-borne diseases (murine typhus).

The Madeira Islands are part of the Macaronesia archipelagos situated in the North Atlantic. It's subtropical climate, rich natural biodiversity together with a well developed social infrastructures have made this a favorite tourism destination for European visitors. It is viewed as an "exotic" location close to Europe but without the adverse health effects associated with exotic locations. Tourism is one of the most important economic sectors in the islands.

During the period of 1976-2000 the observed maximum and minimum temperature records in Madeira (Funchal, island capital) show significant warming with a rate of +0,51°C and +0,75°C per decade respectively. This is well above the global warming rate. Annual changes in participation, humidity and cloud cover have not been as significant. Results from future climate change scenarios for Madeira indicate that this warming is very likely to continue for the next century and that significant reduction in precipitation is likely. These results indicate that climatic changes may become more favorable for vector survival/activity and parasite development and thus potentially more favorable for transmission, especially in spring and autumn months.

In this paper we also highlight typical tourist activities most at risk of being exposed to each of the VBD assessed as well as adaptation measures to reduce tourist vulnerability to these impacts.

Keywords: Vector-borne diseases, climate change, Madeira, tourist health, adaptation measures

Climate Change Changes Tourism – In Many Regions

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Too hot

In many regions of the Mediterranean, summer tourism might shrink due to very high temperatures in summer. This might affect Portugal's coastline at last (due to the Atlantic AC i.e. the cooling effect of the NAO), but is certainly relevant for Greece, Turkey, Italy, Spain and southern France.

Too wet

Some parts of Europe (e.g. the UK and Scandinavia) might suffer under very rainy conditions in summer, so that less tourists can be attracted for those regions in summer.

Too extreme

As we have recently been reminded in Greece (forest fires) or in the Caribbean/South-East U.S. (hurricane Dean), tourism is dependant from extreme weather events and climate trends towards more of these extremes. The crucial thing is that such events do not only damage the touristic infrastructure to a certain degree, but they do also deteriorate the image of affected regions. Tourists normally want safe conditions in their resorts. Other extreme events (like avalanches) might increase – also in winter destinations.

Too little snow

In many Austrian ski resorts, winter tourism is under pressure. Especially at elevations below 1500 metres (with some exceptions), any kind of investment in winter tourism becomes very risky. All climate models for Austria show significant temperature (between 3-5°C for this century) increase and to some extent (liquid!) precipitation increase in winter. Thus, glaciers will furtheron retreat (with only very few exceptions). An almost glacier-free Austria is expected between 2050 and 2070. That means that even the glacial ski resorts will become under pressure. One could raise the question, which future winter tourism as such will have in the Eastern Alps.

Some more details on tourism attitudes in the Austrian Alps in winter (following the results from STRATEGE project):

- ▶ People dislike artificial snow (if resorts use it, they definitely shouldn't advertise it)
- ▶ People dislike alternative offers in winter season (e.g. spas, wellness or Nordic walking in the rain)
- ▶ People are more flexible than expected when it comes to exchange their winter holidays by another summer or autumn holidays. Prerequisite: Additional summer products have to be offered and advertised. These could be hiking, rafting, cycling, swimming, green skiing, canoeing, canyoning, paragliding,

Towards a redirection of tourism streams (?)

Austrian resorts will certainly have to attract more tourists during for the summer season to compensate for the more and more uncertain winter business. This can take place by

- ▶ Conversion from winter to summer products in some resorts
- ▶ Attracting especially southern European tourists (Austria as “summer refreshment”)

So, one recommendation might be to work on new strategies to redirect summer tourism in more Nordic and Mountainous regions and instead focus on the Mediterranean region for spring, autumn and winter? This would also lead to less stress on the water cycle in the critical summer season.

Research funding for climate change impacts on tourism

The most important funding resources will remain:

- ▶ European Framework Programme (FP7)
- ▶ National research programmes
- ▶ INTERREG scheme (a/b/c)

A new funding infrastructure for CCI/AV-related research is just created within the ERA-Net CIRCLE. Within the forthcoming months, CIRCLE will decide, if climate change impacts on and adaptation measures for tourism are in the focus.

One of the opportunities within CIRCLE might be that it allows for transnational cooperation for countries with similar sets of climate impacts – also on tourism (cp. above). CIRCLE contains different GROUPs of countries, which can raise joint calls individually. These GROUPs are:

- ▶ The Mediterranean countries (involved: France, Italy, Portugal, Israel and Galicia/Spain)
- ▶ The Nordic countries (involved: Sweden, Norway, Finland, Denmark, Iceland, (Russia))
- ▶ Atlantic coastal countries
- ▶ Central and Eastern European Countries
- ▶ Mountainous/Alpine countries
- ▶ (Developing countries)

SPEAKER BIOGRAPHIES

Ricardo Aguiar

Ricardo Aguiar has a degree and a Ph.D. on Geophysics. His main areas of interest include climatology applied to renewable energies and energy efficiency in buildings; engineering of solar thermal and photovoltaic systems; global warming impacts and adaptations, especially, but not only, on the energy sector; and socio-economic and technological prospective.

He often collaborates with Universities as a professor on renewable energies and climate change issues. Also he is often called by government bodies as an expert on energy/environment interface areas, this including a time serving at the cabinet of the Secretary of State for Environment, helping to mount the European Emissions Trade scheme and other climate change related initiatives in Portugal. However, his main work for the past two decades has been developed at the Portuguese public research laboratory on the area of energy, on its renewable energies department.

His expertise on stochastic weather time series generators and assembling of future scenarios has proved very useful when applied to the various aspects of climate change. He participated as team leader in the climate change impact and adaptation multi-sector integrated studies SIAM I and SIAM II for continental Portugal, and also as co-coordinator in the similar study for the Madeira Is. His current work on climate change themes includes impact studies at regional and municipality level, also development of detailed long term emission scenarios, applied to post-Kyoto negotiations of Portugal (Project MISP), to Human Health issues (Project 2FUN) and to Tourism (Project CLITOP).

Maria João Alcoforado

Maria João Alcoforado is full Professor at the University of Lisbon (Department of Geography). She is a member of the Commission on Climate, Tourism and Recreation of the International Society of Biometeorology, of the Expert Team 9 (urban Climate) of the World Meteorological Organization, of the International Association on Urban Climate and was board Member of the Commission on Climatology of the International Geographical Union and of the Association Internationale de Climatologie during two mandates each. She is the Coordinator of the Geo-Ecological Research Area of the Centre for Geographical Studies of the University of Lisbon and Director of its journal Finisterra-Revista Portuguesa de Geografia.

Her main research areas are urban climate, particularly the Urban Heat Island effect (including its application to urban planning, and its relation to global warming), human comfort and its perception and historical climatology (since her participation in the European Project ADVICE, climate reconstruction from 1675 onwards in order to understand natural climate variability in Portugal). She has also worked in other applied fields of Climatology, such as climate and health and tourism climatology (weather type methodology applied to Madeira Island and the Lisbon's western coast). At the moment she coordinates the URBKLIM Project on climate and urban sustainability: comfort perception and climatic risks (<http://www.ceg.ul.pt/urbklim/index.html>).

Georgios Amanatidis

Georgios Amanatidis holds a PhD on atmospheric physics from the Aristotle University of Thessaloniki, Greece and a DEA on atmospheric chemistry from the University of Paris XII, France. He has worked during 1989 to 1994 as a research scientist on urban meteorology and air pollution at the National Scientific Research Center "Demokritos" in Athens, Greece.

Since 1994, he has been working as a scientific officer in the Environment Directorate of the Research Directorate General of the European Commission in Brussels, Belgium. He has managed various environmental research areas, such as stratospheric ozone, earth observation, aviation impacts and, lately, climate change prediction and impacts.

Bas Amelung

Dr. Bas Amelung (1971) is deputy director of and a research fellow at the International Centre for Integrated assessment and Sustainable development (ICIS) at Maastricht University in the Netherlands.

His main research interest is climate change and tourism, a field in which he wrote his PhD thesis and various international and national publications. Bas acted as a contributing author to the Millennium Ecosystem Assessment, and currently contributes to the EU-commissioned PESETA project on costing climate change.

He is also working on a post-doc project on sustainable tourism in Antarctica, and is supervising two PhD projects on tourism-related issues at ICIS.

Claudia Bartels

Claudia Bartels is Scientific Assistant at the Institute of Strategic Management and Tourism Management (University of Lueneburg, Germany), working since March 2007 on a three-year project called "Climate Change and Sustainable Development of Tourism in Coastal Zones and Mountain Regions", sponsored by the Federal Ministry of Education and Research (BMBF). Besides, she works as a Ph.D. Student on her thesis about potential conflicts between tourism and stakeholders caused by adaptation strategies for climate change.

During her studying period as an environmental scientist at the University of Lueneburg she was working for a local tourism organisation and the tour operator Protours in Chile. One semester at the Swiss Federal Institute of Technology Zurich (ETH) in Switzerland added to her knowledge gained in Lueneburg.

The diploma in Environmental Science focused on tourism management / environmental management and environmental planning. It was completed in the department of environmental management at TUI AG (Hanover, Germany) with the final thesis about a life cycle assessment on tourism services.

Elsa Casimiro

Elsa Casimiro has a Ph.D. in Applied Chemistry with post-graduate studies in Toxicology and Risk Assessment. She is a researcher at the Institute Don Luíz (IDL), of the Faculty of Science of the University of Lisbon (FCUL).

Her research interests are on the health and socio-economic impacts of global environmental change, having conducted the first national assessments of the potential climate change impacts on health and on tourism in Portugal. She is also a member of the national expert group on environmental health issues at the (Portuguese) National Council for the Environment and Sustainable Development (CNADS).

Elsa has worked as a consultant on many national and international projects in Europe and Southern Africa, one of which she was a co-recipient of the (South African) Council for Scientific and Industrial Research (CSIR) Environmentek Director's Team Award.

Presently, is she is involved in various climate change impact assessment projects including: Climate Change & Tourism in Portugal: Potential Impacts & Adaptation Measures (CLITOP) funded by the (Portuguese) Foundation for Science and Technology (principal investigator), Climate Change and Impact Research: The Mediterranean Environment (CIRCE) funded by the EU 6th FP (principal national investigator), and Full-chain and uncertainty approaches for assessing health risks in future environmental scenarios (2FUN) funded by the EU 6th FP (principal national investigator).

She has published various scientific papers and book chapters on environment and health issues and is an expert reviewer for key technical communications including the 4th IPCC Assessment Report and various WHO publications.

Gina Cavan

Gina's main research interests lie in exploring human-environment interactions, and particularly in climate change impacts and adaptation.

Gina gained a BSc (Hons) in Geography and a distinction in an MSc in Applied Meteorology and Climatology at the University of Birmingham. She undertook research in meteorology in the School of Geography, Earth and Environmental Sciences, at the University of Birmingham, before working for Worcestershire County Council investigating climate change impacts, as part of the development of a Climate Change Strategy for the County. This included assessing the impacts of climate change on a new school, by providing an initial outline adaptation strategy for the design and construction phases, and throughout the design life of the building.

Gina then worked as a Research Assistant in the Centre for Urban and Regional Ecology, University of Manchester, on the Climate Change and the Visitor Economy (CCVE) project, which ran from 2004-2006. CCVE investigated the interaction between climate change, the visitor economy and the environment in order to understand future opportunities and threats for the North West region of England. This was funded by Defra and the Environment Agency. This

project studied some of the iconic landscapes of the North West region, including the Sefton dunes, Peak District and Lake District National Parks, and investigated topics such as moorland wildfires and footpath erosion. Gina was recently involved in a follow up study to investigate costing adaptation responses to fighting moorland wildfires in the Peak District National Park.

At present, she is studying a PhD full-time, continuing the CCVE research and focusing on how climate change interacts with tourism and the capacity of the landscape. In particular, she is concerned with developing a methodology through which the impacts of climate change on landscape character areas can be assessed at the regional and landscape scales.

Filipe Duarte Santos

Filipe Duarte Santos is a researcher in Geophysical Sciences and Global Change in the Department of Physics of the Faculty of Sciences of the University of Lisbon. He is, since 1979, full professor of Physics, Geophysics and Environment at the University of Lisbon and Director of the Research Center SIM - Systems, Instrumentation and Modelling in Environmental and Space Sciences and Technology.

Prof. Santos holds a M.Sc. in Geophysics by the University of Lisbon and a Ph.D. in Theoretical Physics by the University of London. Author of more than a hundred articles in areas of Nuclear Physics, Nuclear Astrophysics and Global Change, He has recently published a considerable number of reports and articles covering climate change and its impacts. In addition, besides being principal researcher of various specific research projects on the environment, he was the coordinator of the SIAM Project, "Climate Change in Portugal. Scenarios, Impacts and Adaptation Measures".

His academic career includes being visiting professor at University of Wisconsin, University of North Carolina and University of Indiana in the USA, Munich University in Germany, University of Surrey in the UK and Vrije University in the Netherlands. Within the University of Lisbon, he has been Dean of the Faculty of Sciences, and chaired the Department of Physics.

He is delegate to the UN Commission on the Peaceful Uses of Outer Space, to the Conference of Parties of the United Nations Framework Convention on Climate Change and has been Research Fellow at the Atomic Energy Authority in Lisbon. He is also member of the Portuguese National Council for the Environment and Sustainable Development and of the National Academy of Sciences.

Camille Gonseth

Born 1978 in Geneva, Camille Gonseth is a Swiss citizen. He graduated in 2002 from the Ecole Polytechnique fédérale de Lausanne (EPFL) in environmental engineering. Since his graduation, he works as post graduate student doing a PhD at the REME, an EPFL laboratory which specialises in environmental and housing economics. After having completed his first work on the analysis of the Swiss climate policy, he has successfully attended the one year doctoral school in economics (microeconomics and econometrics) of the Swiss national bank.

His research interests and works are focused on the green tax reforms and the impacts of climate change on the Swiss winter tourism sector. For the latter part of his work, he is affiliated to the

National Centre of Competence in Research (NCCR) Climate, a gathering of researchers in physics of the atmosphere, history, biology and economy.

Martin Konig

Martin studied Geography, Geology, Soil Sciences and Political Sciences at the universities of Marburg, Gießen and Edmonton/Canada. During his studies he worked for projects in Argentina (Mendoza) and South-Eastern Siberia, where he wrote his thesis about Chances for sustainable development of two big national parks (Tunkinsky and Transbaikalsky) based on comprehensive field and laboratory research.

After some research semesters in geoinformatics/radar remote sensing (EU-funded projects SIBERIA and SIBERIA II) at the University of Jena, he changed in 2001 from pure science to research consultancy becoming Austrian national contact point for the Environmental and Climate Change Research Parts of the European Framework Programme of Research and Development at BIT/FFG in Vienna.

In 2003 he changed to Umweltbundesamt (Austrian Federal Environment Agency), where he installed the topic of climate change impacts and adaptation. While setting up and coordinating different CCIIV-related research programmes in Austria, he wanted to expand his activities back to the European level. He did so by creating and coordinating the ERA-Net research network CIRCLE (Climate Impact Research Coordination for a Larger Europe), which has the major aim to network and coordinate national CCIIV research programmes in 20 member countries. The project is supported with some 3 million EUR by 6th European Framework Programme of Research and Development. During these months, CIRCLE launches the first joint calls of the partner programmes and thus becomes a new research funding infrastructure for CCIIV research in the EU.

Besides the coordination of CIRCLE and his involvement in other ERA-Net projects, Martin is analysing climate scenarios for Austria, is co-responsible for the climate chapters of the Austrian State-of-the-Environment report, is consulting the Austrian ministries in climate impacts and adaptation measures and sets up new CCIIV-projects.

Geoffrey Levermore

Geoff Levermore is Head of the Built Environment Research Group in the School of Mechanical, Aerospace and Civil Engineering, the University of Manchester and is Professor of the Built Environment.

Professor Levermore has made contributions to the production of weather data for the design of buildings and for his research on energy use and comfort in buildings:

- UK-nominated Lead Author for Working Group 3: Mitigation of Climate Change of the Intergovernmental Panel on Climate Change (IPCC). He contributed to Chapter 6 Residential and commercial buildings in the Fourth Assessment Report (AR4) which will be published in late 2007. Chapter 6 establishes that over a third of the world's greenhouse gas (GHG) emissions come from buildings and that buildings provide the greatest potential for mitigation of emissions.
- UK-nominated Expert Reviewer on IPCC WG2: Impacts, adaptation and vulnerability. (Expert Reviewers comment on the accuracy and completeness of the scientific/technical/socio-economic content and the overall scientific/technical/socio-economic balance of the drafts.)

- Co-ordinator of Working Commission W108: 'Impact of climate change on the built environment' for the International council for Research and Innovation in Building and Construction (CIB).
- Principle Investigator for the EPSRC grant "Scorchio " through which the impact of climate change on the urban heat island (UHI) effect is being investigated with particular reference to Manchester and Sheffield. This work will be drawn upon in this project so that the probabilistic weather data for urban areas take into account UHI effects, rather than being based only on near-rural data obtained from airports.

Angela Lobo

Ângela Lobo was born in Lisbon, in 1961 and graduated in Chemical Engineering, in the Technical University of Lisbon, IST - School of Engineering, in 1984. She also upgraded her knowledge in the energy field, having a master attendance in Policy, Planning and Economics of Energy (IST/ ISEG, Lisbon, 1987) and a specialization course in Energy Modelling (USA, Argonne, Chicago University, 1989).

Her professional activity has been diversified along 20 years, but always in horizontal areas connected with energy, economy and environment.

Since March 2006 she is working as a senior technical adviser in DPP - Department of Prospective and Planning and International Relations, a reference Government organization in the area of Macro-economy, Modelling, Prospective and Planning, now under the Ministry for Environment, Spatial Planning and Regional Development. DPP is expanding its expertise in the energy and environment fields, having a Department of Sustainable Development and Competitiveness, where Ângela belongs.

Since the beginning of her career in 1985, in the Directorate General for the Energy (DGE), she worked in energy and environment related areas, particularly the rational use of energy and energy planning, until 1999. From 1999 to 2003 she was in the Cabinet of Studies and Economic Prospective (GEPE) of the Ministry of Economy, as Head of Department of Studies and Prospective. She stayed in the new Cabinet of Strategy and Studies (GEE) that follows, until the beginning of 2006.

She participated in the drawing up of several national and international reports: National Energy Plans (1986, 1989 and 1995), National Plans for Climate Change (1995 and 1999), Scenarios for the Portuguese Industry 2000-2020 (2000), Scenarios for the Portuguese Economy 2000-2025 (2002), National Strategy for Sustainable Development (several versions, since 2000 to 2006), Cardiff Reports (2003 and 2004), Lisbon Strategy Report 2005-2008 (2005). She is also co-author of several studies of characterization and prospective of Portuguese sectors.

Tiago Lourenco

Tiago Capela Lourenço holds a degree in Environmental Engineering by University of Algarve and is currently undergoing work towards an MSc degree. He has worked as a grant-hold researcher at both University of Algarve and University of Lisbon. He is currently a researcher at the Institute Dom Luiz (IDL) of the Faculty of Science of the University of Lisbon (FCUL).

His main research interests are related to climate change impacts, vulnerability and adaptation strategies. He's main focus has been on climate change impacts and vulnerability of the tourism sector in Portugal. He has participated in several assessment projects on climate change impacts and adaptation including: Climate Change & Tourism in Portugal: Potential Impacts & Adaptation Measures (CLITOP); and Climate and Meteorology of the Atlantic Archipelagos (CLIMAAT II). He was also involved in the scientific review of the book Climate Change in Portugal: Scenarios, Impacts and Adaptation Measures (SIAM II Project).

Currently he is working for CIRCLE (Climate Change Research Coordination for a Larger Europe), a European Research Area Network where Portugal is represented by FCUL. He's work is related to the alignment of the national research agendas on climate change for several European countries.

Franziska Matthies

Franziska Matthies holds a MSc in Biology from Ludwig-Maximilian University in Munich, Germany, and a PhD in Epidemiology from the University of Basel, Switzerland. Between 1998 and 2005 she worked at several European University Institutions such as the Swiss Tropical Institute, Basel, the Institute for Social and Preventive Medicine, University of Lausanne, the Department for Hygiene and Tropical Medicine, University of Heidelberg, and the Department for International Health at the University of Copenhagen, where she was collaborating in designing, coordinating and running various short courses and training modules in international health as well as a one year Masters Programme in Health Economics (offered in Hanoi, Vietnam).

She started working on global climate change and human health when she joined the German Advisory Council on Global Change (WBGU) as research analyst in 2001 at the Department for Hygiene and Tropical Medicine in Heidelberg. Her main interest lies in the development of adaptation and response strategies in health policies and health systems to prevent and reduce impacts of climate change on human health. The work for the German Advisory Council also continued when she moved to the Tyndall Centre for Climate Change Research in 2003, where she also joined a research team on flooding and human health. She was a co-editor of the book "Flood Hazards and Health". Dr Matthies was seconded to the Parliamentary office of Science and Technology to compile a briefing note on health impacts of climate change in the UK for the British Parliament. In 2005 she joined the WHO Regional Office for Europe, Centre for Environment and Health in Rome. She coordinated the DG Sanco co-funded project EuroHEAT to improve public health responses to extreme weather events and heat-waves in particular. The project was successfully concluded in April 2007 and the overall project results are currently being compiled in a monograph to be published towards the end of the year. Future projects will focus on the interface between global change, security and human health.

Sabine Perch-Nielsen

Sabine Perch-Nielsen is a PhD student at the Environmental Physics group at the ETH Zurich, Switzerland. She received her Diploma (M.Sc.) in Environmental Sciences and with it an award for the best degree from the ETH Zurich in 2004. Climate issues became the main research interest early on in her studies, amongst others she investigated emerging Swiss climate policies. Since then her interest has geared towards climate change impacts on social and economic systems. For her Master's thesis on „Understanding the Effect of Climate Change on Human

Migration" she received the ETH medal for the best Master's thesis. In her PhD she now looks at the interactions between Climate Change and Tourism with special consideration of vulnerability.

Her general background is international, she has visited schools in Austria, the UK, Costa Rica and Denmark. Her professional interest in climate issues is also a personal one: In 2002, she cofounded the non-profit-organisation "myclimate". She is vice president of this foundation that is active in environmental education as well as carbon offsetting.

Murray Simpson

Senior Research Associate, at Oxford University Centre for the Environment, an associate Professor at the Estonian University of Life Sciences, and visiting Professor at the University of Geneva. He is also a consultant for the United Nations World Tourism Organization (UNWTO), Sustainable Tourism and Tourism and Climate Change and Sustainable Solutions Worldwide.

Murray has extensive experience in tourism, sustainable development and the environment as a Senior Research Associate at Oxford University Centre for the Environment, at Senior Executive management and board level in industry, and as a professional Consultant. He has worked with the public and the private sector in a range of tourism initiatives including: sustainable tourism development; tourism strategy; corporate social responsibility; and tourism impact analysis projects in both developed and developing countries, bridging the gap between research, policy and implementation.

International organizations he has worked with include the UNWTO, the EU, the Association of Caribbean States (ACS), the British Academy, UNEP and the European Travel Commission (ETC). He has facilitated and chaired working groups in projects, international workshops and conferences and held positions on international tourism industry association boards. He has worked in the UK, Europe, Australasia, South Africa, the USA, Asia, South America and the Caribbean.

Murray is a Fellow of the Royal Geographical Society and a founding member of the Experts in Climate Change and Tourism (eCLAT) the international research and development community studying the interactions of climate change and tourism. On this topic he has worked in conjunction with the European Science Foundation (ESF), NATO, the EU, the European Forum for Environmental Assessment (EFIEA), UNDP, the British Academy, UNWTO and UNEP. Murray is a member of the UK Committee of the International Human Dimensions Programme on Global Environmental Change (IHDP-GEC) and a member of the UNWTO Panel of Tourism Experts. He is co-author of the forthcoming UNWTO/UNEP/WMO publication examining the global challenges of climate change and tourism: impacts, adaptation and mitigation.

Adérito Vicente Serrão

Adérito Vicente Serrão was born in Coruche (Portugal), in 1952. He is married and has two children and a granddaughter. He has economical and managerial background, having been graduated in Economy since 1976, by Universidade Técnica de Lisboa. His professional activity has been conducted in several fields, mainly dealing with Planning issues, Public and Private Investments, Tourism, Environment and Natural Resources and also with Management activities.

At present he is the President of Portuguese Meteorological Institute (IM) and he was appointed to this position in 2003.

Representing IM he is the Permanent Representative of Portugal with World Meteorological Organization (WMO) and he is member of several bodies and institutions, both national and international. In 2006 he was elected for President of the Council of the European Centre for Medium-Range Weather Forecasts (ECMWF), a leading institution worldwide in its activity.

For 9 years he was chairman and CEO of a state owned company responsible to build up and run a Multipurpose Project located in the southern region of Portugal and based in water resources, agricultural, energy and tourism objectives.

Previously, he was in charge of a national system of state incentives to industry. He also worked in the Central Planning Department, occupying several directive positions. He was member of the board of directors of a Portuguese company operating in the transport sector. He have been working as private consultant to many Portuguese companies, mainly giving advice in investment projects issues. He was invited Professor in a private University for a 6 years period.

He published several papers in technical editions, magazines and national newspapers.

Eugenio Yunis

Mr. Eugenio Yunis is a Civil Engineer (University of Chile), with post-graduate studies in Development Economics (University of Grenoble, France), who has been involved with international tourism development and management issues for the last 25 years, always from a public perspective.

From 1990 to 1994 he was Director General of the National Tourism Department in Chile, his home country, period during which an impressive growth of the Chilean tourism industry took place, doubling the number of international tourist arrivals. During his term in office, he stimulated joint public-private sector initiatives in tourism development and marketing.

Since 1997 and until June 2007, he was Head of the Sustainable Development of Tourism Department at the UN World Tourism Organization. In this capacity, he was responsible for developing the areas of Tourism Sustainability, Ecotourism, Conservation of Natural and Cultural Assets through Tourism, and Poverty Alleviation through Sustainable Tourism. He has been recently appointed as Director General for Programme and Coordination of UNWTO.

He has written books and articles on the relationships between tourism and environment, tourism and culture, and tourism and poverty alleviation, published in journals throughout the world.

PARTICIPANT LIST

Surname	First Name	Organization	Country
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