

WORLD *Climate* NEWS

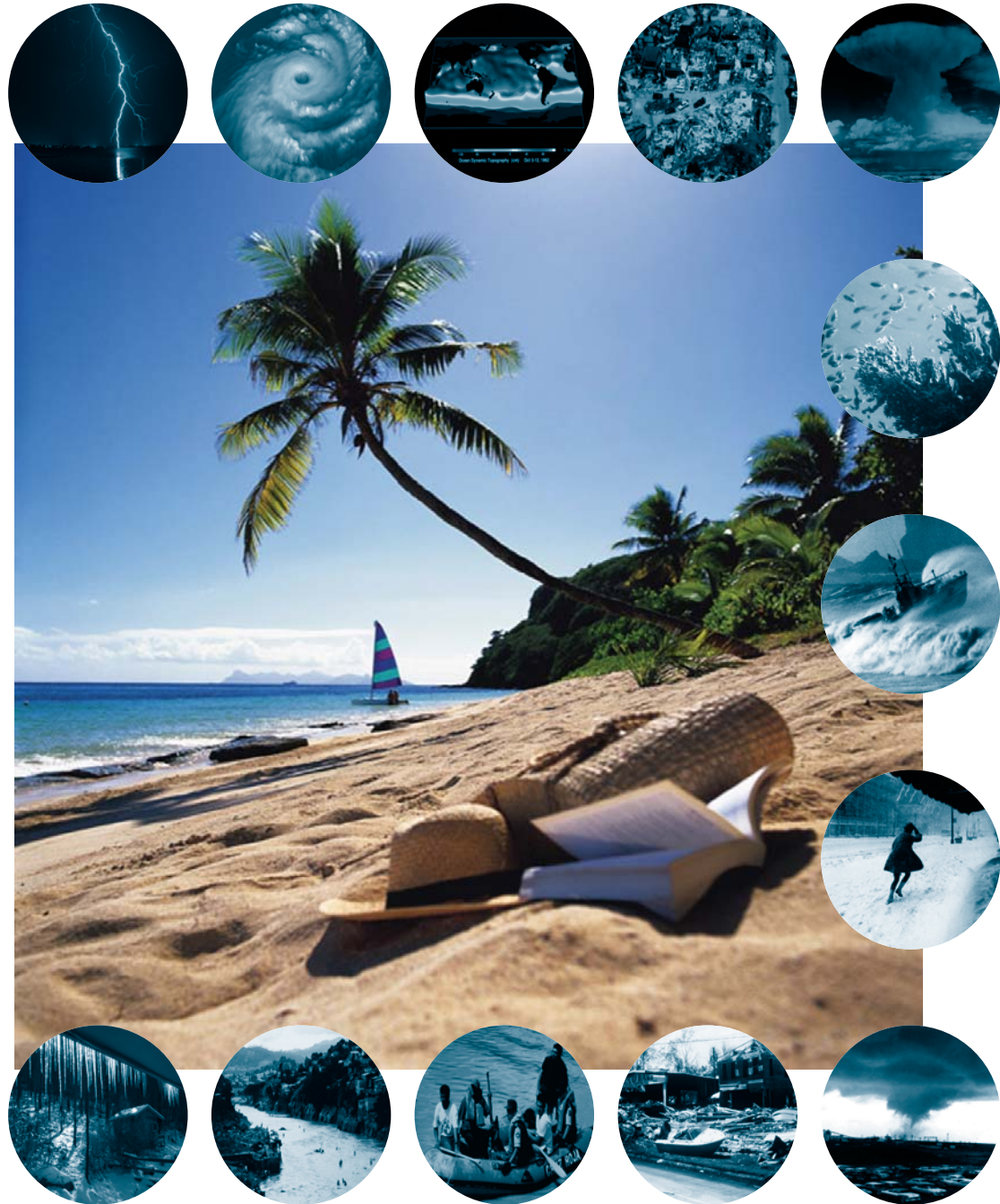
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Weather • Climate • Water

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Climate and tourism—the special theme of this issue (see page 3).

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CALENDAR

13-15 June

Wallingford, United Kingdom

Steering Committee for WCP-Water

14-16 June

Bologna, Italy

Workshop on Climatic Analysis and Mapping for Agriculture

20-24 June

Exeter, United Kingdom

The Aviation Seminar

20-24 June

Orange County, California, United States

Fifth International GEWEX Conference

21 June-1 July

Geneva, Switzerland

Executive Council – Fifty-seventh session

13-16 July

São Paulo, Brazil

Regional Technical Meeting on CLIPS and Agrometeorological Applications for the Mercosur Countries

8-19 August

Lima, Peru

CLIPS Focal Point Training Workshop for RA III

29 August-9 September

Fortaleza (Ceara), Brazil

Thirteenth Brazilian Meteorological Congress

5-9 September

Toulouse, France

WWRP Symposium on Nowcasting and Very Short Range Forecasting

5-7 October

St Petersburg, Russian Federation

Thirteenth session of the GCOS Steering Committee

Foreword

Climate and weather, together with people and their surrounding environment, constitute the natural resource base of any country or region for recreation and tourism. Tourism is currently one of the world's largest and fastest growing economic sectors. Many aspects are climate-sensitive and some may adversely affect the Earth's climate system itself. Timely and accurate climate information and prediction services, such as the early warnings and tailored products and services provided by the National Meteorological and Hydrological Services of WMO's 187 Members, are vital to the success of the various components of the sector.

This issue of World Climate News highlights a number of WMO's activities related to tourism, including provision of early warnings of natural hazards, the impacts of shrinking glaciers, receding snow lines and changing water resources, the GURME project and research findings from the IPCC Third Assessment Report. The lead article, contributed by the World Tourism Organization (WTO), shows how tourism activities support the production and export of goods and services, foreign exchange earnings and employment—all important factors in sustainable development and the eradication of poverty.

WTO recognizes the increasing importance of weather and climate information and prediction of extreme climate events provided by National Meteorological and Hydrological Services (NMHSs) and is committed to working with WMO and other international agencies to foster sustainable tourism around the world, maximize opportunities and reduce threats to the sector.

Some 90 per cent of the world's natural disasters are related to weather, climate and water extremes. WMO therefore has a significant role to play in helping WTO reduce the threats from natural hazards and changes in the climate system. WMO, through its World Climate Programme, its Commission for Climatology and the NMHSs, will continue to spearhead international efforts to monitor, collect and analyse climate data and, in collaboration with WTO, to formulate timely and reliable climate information, services and products for use by policy- and decision-makers in the tourism sector, and by the travellers themselves.



(M. Jarraud)
Secretary-General

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CLIMATE AND TOURISM

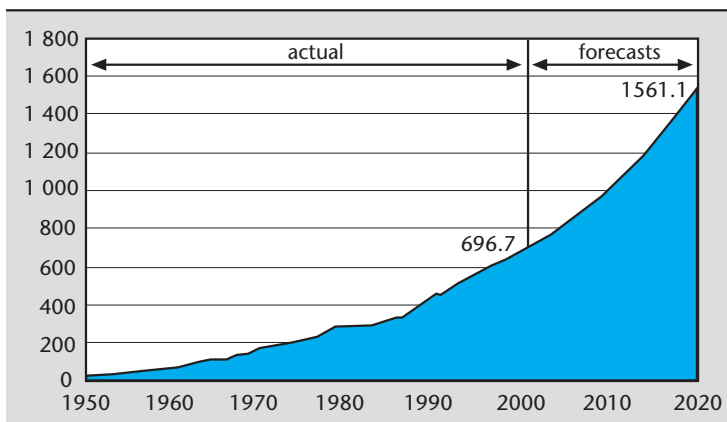
Tourism has been one of the major economic and social phenomena of the past century. From an activity enjoyed by a small group of relatively well-off people at the beginning of the century, it had become a mass phenomenon in the more developed countries by the 1970s and has now reached wider groups of people in most nations. Total international tourist arrivals grew from a mere 25 million in 1950 to 760 million in 2004, generating receipts of US\$ 523 000 million in 2003. Domestic tourist movements are much higher than international ones, though more difficult to quantify. According to a study by WTO, the growth of international tourist arrivals is likely to increase by about 4 per cent a year, to reach nearly 1 600 million by the year 2020.

Tourism is now a major economic sector in the world. In 2001, 7.5 per cent of the worldwide export value of goods and services came from tourism, surpassing such leading industries as automotive products and chemicals. Tourism is already the largest sector of international

development trends in tourism include: increased market segmentation; new forms of sustainable tourism, especially those related to nature, wildlife, rural areas and culture; and changes in consumer motivations and behaviour, increasingly characterized by a more selective choice of destination, greater attention to the tourism experience and its quality.

As a result of the rapid expansion of the tourism sector, traditional and emerging tourism destinations are facing increasing pressure on their natural, cultural and socio-economic environments. Uncontrolled growth in tourism aiming at short-term benefits often results in negative impacts, harming the environment and societies, and destroying the very basis on which tourism is built and thrives. Host societies have become progressively aware of the problems of unsustainable tourism, and sustainability concerns are increasingly being addressed in local, national and regional policies, strategies and plans.

WTO has been promoting sustainable tourism policies and practices, and raising



International tourist arrivals, 1950-2020 (million a year)

trade in services. For many nations, in particular most Small Island Developing States (SIDS), but also some bigger and more economically diversified countries, tourism has become the main sector of economic activity, or at least the main source of foreign exchange earnings, and an important source of employment.

In addition, the development of tourism is characterized by the continuing geographical spread and diversification of tourist destinations. Some key qualitative

tourism issues in the global sustainability agenda. Main activities include the publication of the Agenda 21 for the Travel and Tourism Sector in 1995, contributing to the 7th Session of the UN Commission on Sustainable Development in 1999, to the World Summit on Sustainable Development in 2002 (“Johannesburg Summit”), to the conference on SIDS (Mauritius, January 2005), developing activities in the framework of the International Year of Ecotourism 2002 and the current International Year of Microcredits. Since the Johannesburg Summit, poverty reduction through sustainable tourism has been a major focus of WTO work, in line with the Millennium Development Goals. International and national activities are supported by numerous technical publications and manuals on policies and tools for sustainable tourism, applied through capacity building and technical cooperation activities

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WMO/WTO cooperation on climate and tourism

Many aspects of the tourism sector are vulnerable to variability and change in weather and climate conditions, and National Meteorological and Hydrological Services (NMHSs) around the world provide a growing body of meteorological products and services to assist users throughout the sector, including travellers themselves. In recognition of this interdisciplinary partnership, and of the benefits of WMO services to such an important part of the global economy, WMO and the World Tourism Organization (WTO) in 1992 entered into a formal interagency working relationship. Activities include publications such as the 1998 joint contribution to the United Nations International Decade on Natural Disaster Reduction, the *Handbook on Natural Disaster Reduction in Tourist Areas*. WMO took part in the International Conference on Climate Change and Tourism (Djerba, Tunisia, April 2003) and in the 15th Session of the General Assembly of WTO (Beijing, China, October 2003). On 7 November 2003, WTO became a specialized agency of the United Nations, and WMO welcomed the opportunity to focus increased attention on the data, information and services needed to support tourism activities.

In November 2004, WTO held a United Nations

continued on page 4 ...



Excessive temperatures may encourage tourists to holiday elsewhere.

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Coordination meeting on Tourism Matters. Diverse organizations, including ILO, FAO, UNESCO, ICAO, WHO, WMO, UNCTAD and UNEP, discussed the possibilities of inter-agency collaboration to maximize tourism's contribution to the Johannesburg Plan of Action and the Millennium Development Goals. Of particular importance was support to WTO activities for socio-economic development and poverty reduction through sustainable tourism. This session recommended the creation of a flexible network mechanism within the UN to carry out these activities.

The WMO Commission for Climatology, at its 14th session (3-10 November 2005, Beijing, China), will discuss establishment of a new Expert Team on climate and tourism, to further enhance the development of knowledge and partnerships at international, regional and national levels.

(see www.world-tourism.org/sustainable). The transformation of WTO into a Specialized Agency of the United Nations in 2003 further emphasized the importance of the tourism sector and the need for its sustainability.

Climate and weather have both a direct and an indirect impact on tourism. Most directly, tourists are attracted by climatic conditions such as sunshine, warm temperatures and little precipitation to beach destinations, or cool temperatures and good snow conditions for winter sports. In the sun-and-sea tourism segment, climate is a key attraction for

tourists. Therefore, adverse conditions can impact on the tourists' experience and, in extreme situations, on their health and safety. Changes to climatic conditions could affect the flows of tourists, overall arrivals at destinations, or result in a seasonal shift of tourism activity. For example, in Europe, the conventional flow of northern tourists visiting the Mediterranean coasts could be altered by excessive summer temperatures, encouraging tourists to take vacations closer to their homes with more favourable weather conditions.

Tourism is also a highly seasonal activity and changes in demand patterns caused by altered climatic conditions can have major impacts on local tourism businesses, employment and supply, also affecting related services and sectors (such as agriculture, handicrafts and construction). More tangible direct impacts can be caused by extreme weather and climate events, such as cyclones and hurricanes, on tourism infrastructure and establishments, especially in vulnerable coastal areas.

Indirectly, climate change can have a significant impact on tourism activities by altering the natural environment, one of tourism's most important resources. For example, changes in precipitation patterns can cause flooding or drought that can lead to desertification or water shortages; increased seawater temperatures can damage coral ecosystems; storm surges can cause shoreline erosion and saline intrusions can affect coastal ecosystems; animal populations can be affected by environmental stress and changes in vegetation, habitat fragmentation and biological

invasions. Tourism is an active user of such environmental resources as water, energy, food and biodiversity-rich and pristine natural areas. Tourism in mountain regions can be affected by changing snow conditions, and destinations in flood- and drought-prone areas are increasingly vulnerable to environmental impacts. Climate change can also alter health conditions, which can have an impact on day-to-day tourism activities, and the safety of both tourists and local communities.

Recognizing the complex relationship between climatic factors, climate change and tourism, WTO convened the First International Conference on Climate Change and Tourism (April 2003, Djerba, Tunisia) (see <http://www.world-tourism.org/sustainable/climate/brochure.htm>). The Conference brought together the scientific community and tourism professionals from the public and private sectors, as well as international and UN organizations, including WMO. The main outcome was the Djerba Declaration on Climate Change and Tourism which provides a basic reference and framework for further action. The Declaration recognizes the two-way relationship between climate change and tourism: that tourism is both impacted by climate change and contributes to the causes of this phenomenon through greenhouse-gas emissions, resulting mainly from energy consumption in tourism transportation and establishments.

For tourism businesses, weather and climate information and predictions of extreme climatic events developed by National Meteorological and Hydrological Services are becoming increasingly important, given that the programming of many tourism activities is heavily climate-dependent, and that insurance practices in tourism are greatly affected by natural hazards. Climate change will constitute an increasing risk for tourism operations in many destinations. Governments and the private sector must therefore give priority to the application and management of climate information, and incorporate climate factors in tourism policies, development and management plans. For this, effective coordination between environmental and tourism organizations, particularly between WMO and WTO, is determinant for further research, awareness raising, capacity building, as well as the development and application of adaptation and mitigation measures in the tourism sector.

THE CLIMATE IN 2004

The year 2004 included some of the most destructive hurricanes and typhoons on record, claiming more than 6 000 lives. Disastrous floods and landslides due to heavy precipitation were also reported worldwide. Prolonged drought continued to affect parts of Africa, Australia, South Asia and the western USA. Conversely, natural climate variability produced benefits such as a significant boost to grain harvests in Europe and to Middle East winter grain crops.

The global mean surface temperature was 0.44°C above the 1961-1990 annual average (14°C). This places 2004 as the fourth warmest year since 1861. The five warmest years in decreasing order are: 1998, 2002, 2003, 2004 and 2001.

An exceptional heat wave affected eastern Australia during February, when temperatures soared to 45°C in many areas. Much of the northern hemisphere also experienced warm conditions.

Precipitation in 2004 was above average and 2004 was the wettest year since 2000. Wetter-than-average conditions prevailed in the southern and eastern USA, Russian Federation, parts of western Asia, Bangladesh, Japan, coastal Brazil, Argentina and north-west Australia.

Heavy rains from mid-January to March in areas of Angola produced flooding along the river system which flows into neighbouring Zambia, Botswana and Namibia. Extensive flooding along the Zambezi River, the worst flooding since 1958, threatened more than 20 000 people

in north-eastern Namibia and caused much damage to crops.

Extensive ozone depletion was observed over the Antarctic during the southern hemisphere winter/spring but the October ozone hole was the smallest for more than a decade.

During the Atlantic hurricane season, 15 named tropical storms developed (the average is around 10). Six were "major" hurricanes. Hurricane *Ivan* was the most powerful storm to affect the Caribbean in 10 years. Hurricane *Charley* was the strongest and most destructive hurricane to strike the USA since *Andrew* in 1992. Hurricane *Jeanne* caused more than 2 000 deaths in Haiti.

Conversely, in the eastern North Pacific, tropical cyclone activity was below average. Only 12 named storms developed during the year, of which six reached hurricane strength and three reached "major" status. None made landfall as a tropical storm or hurricane.

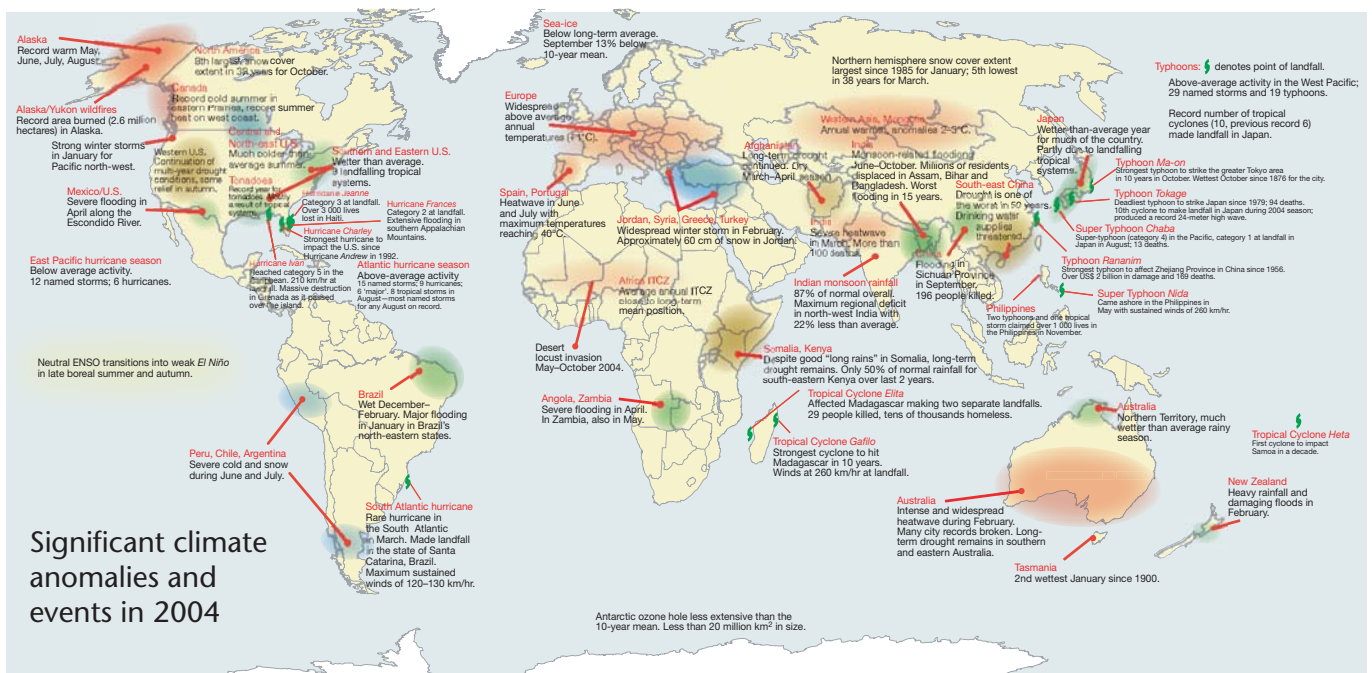
A hurricane reached the southern coast of Brazil on 28 March 2004, causing damage to property and some loss of life. In the north-west Pacific, 29 named storms developed, of which 19 reached typhoon intensity. Typhoon *Tokage* was the deadliest to affect Japan since 1979. Typhoon *Rananim*, the most severe typhoon affecting Zhejiang, China, since 1956, claimed 169 fatalities and caused much damage. The South-west Indian Ocean cyclone season was also active with an above-normal number of tropical storms.

Weather and climate information for tourists

About 7.5 per cent of economic activity concerns tourism, which inevitably involves outdoor recreational activities and is therefore influenced in some way by weather. Weather services for recreation are designed to add to the safety, economy and enjoyment of leisure activities. Weather services in this sector include climatological information giving a broad overview of the types of weather and range of conditions generally encountered—on the mountains, near the coast or at sea. Other services include daily variations in weather. Following the daily weather forecasts—many specially prepared for recreational activity—is an essential part of preparation for outdoor recreational activity.

Tourism in the mountains, on the snowfield and on and near the water requires

... continued on page 6



Significant climate anomalies and events in 2004

... continued from page 5

knowledge of local weather conditions to interpret and use the more general forecasts. Tourists are a group of consumers of climate and weather information who should be catered for by taking into consideration their particular requirements, just like other major user groups. While National Meteorological Services (NMSs) have large amounts of accurate data and information on climate and weather, they need to increase awareness of threats posed by high-impact weather, climate, hydrological hazards, storm surges, etc. and provide information that is easily accessible and understandable everywhere.

NMSs need to develop better communication links to users including the tourism industry, to assure that appropriate and effective responses to hazardous environmental events are triggered. But linkages alone are not sufficient. NMSs' public weather service programmes have a vital role in improving the use of information through building capacity among decision-makers and increased cooperation between forecasters and users of information. The long-term goal of public weather services is to work with national and international decision-makers, including governments, the private sector and the media, to prevent extreme and high-impact weather events turning into disasters. For the tourism industry, this means better use of reliable information to contribute to the safety of the tourists and sustainable tourism and development.

ADAPTING TO WATER SCARCITY IN THE TOURISM INDUSTRY

The highest growth rates of tourism are found in coastal areas with naturally low rainfall and maximum daily sunshine hours. This is true in most Mediterranean countries but also in other destinations with arid or semi-arid climates. This has led to direct competition between water demand for traditional purposes, such as agriculture and water demand for the tourism industry. In these areas, where water scarcity is likely to be amplified as a result of

climate variability and change, different water-resources management strategies have to be adopted if the growing tourism industry is to be maintained.

Water scarcity is aggravated by the fact that tourists and facilities linked to tourism have significantly higher water consumption than the average domestic water demand. It has been estimated that a Spanish city-dweller uses some 250 litres a day, while the average tourist uses 440 litres. With an allowance for watering gardens and golf courses and filling swimming pools, this can rise to some 880 litres per day for visitors in luxury accommodation.

The diagram above shows the effects of seasonality on the resource base of one Catalan Mediterranean resort, Lloret de Mar, a town in north-east Spain covering 47 km² whose permanent population of

20 000 inhabitants increases to a peak of 180 000 in the summer, as a result of the 4 million tourists who visit each year.

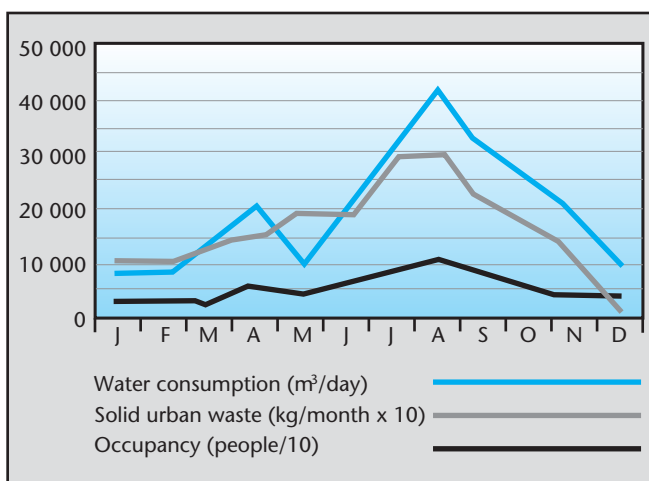
In addition, network losses in the water-distribution system amount to up to 30 per cent and evaporation losses in open

reservoirs are also substantial during the peak demand in the dry season from mid-June to the end of August.

The tourism industry is beginning to develop adaptation strategies, including the

use of water-saving technologies such as the installation of water-saving sanitary installations, reduced and improved efficiency of irrigated greenlands and public gardens as well as wastewater reuse and even the introduction of closed water cycles in hotels and entire communities. Seawater and brackish water desalination are progressively being used in areas with high tourism occupancy rates and continued growth where the high cost of using such technologies is justified by the expected income from the tourism industry. If climate change leads to a further aggravation of water scarcity, these technologies will have to be increasingly used.

Note: although the source consulted (Costa Brava-Girona Board of Tourism-INSETUR) indicates a maximum occupancy of approximately 100 000 persons, other sources have reported significantly higher occupancy rates for the month of August, with peaks surpassing 180 000.



Seasonal variation in water consumption, production of solid urban waste and occupancy in Lloret de Mar, Spain

SIDS UPDATE

The International Meeting to Review the Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States (SIDS) was held in Mauritius, 10–14 January 2005. WMO was involved in the prepara-

tory process and participated in the Meeting.

The Meeting approved the Mauritius Declaration and the Mauritius Strategy for the further implementation of the Programme of Action for the Sustainable

Development of Small Island Developing States ("Barbados POA"). The Declaration reaffirmed the Barbados POA as the blueprint for the implementation of the Mauritius Strategy and called for enhanced international cooperation and partnership, technology development and transfer and capacity building. It expressed appreciation to the UN and its specialized agencies for their contributions in support of SIDS.

The Mauritius Strategy addresses high priority issues of concern to SIDS that relate to climate change and sea-level rise, natural and environmental disasters, management of wastes, coastal and marine, freshwater, land, energy, tourism and biodiversity resources, transport and communication, science and technology, graduation from least developed country status, trade globalization and liberalization, sustainable capacity development and education for sustainable development, sustainable production and consumption, national and regional enabling environments, health, knowledge management

and information for decision-making, and culture.

In order to contribute to the implementation of the Strategy in areas falling under the responsibility of WMO and the NMHSs, an Action Plan will be developed. The Plan will take into account WMO's Programmes and activities and in particular the Programme on LDCs, the cross-cutting activities being undertaken in relation to disaster mitigation, climate, water, the Global Earth Observation System of Systems and other relevant regional and global initiatives such as the Millennium Development Goals, the Johannesburg Plan of Implementation of the World Summit on Sustainable Development and the Hyogo Framework for Action: 2005-2015 of the World Conference on Disaster Reduction (Japan, January 2005). The Plan will also include the development of relevant partnerships with UN organizations with regional and international organizations in areas of concern to NMHSs.

GCOS IMPLEMENTATION PLAN COMPLETED

Under the leadership of the Global Climate Observing System (GCOS) and with input from the climate and related scientific communities, the Implementation Plan for the Global Observing System for Climate in Support of the United Nations Framework Convention on Climate Change (UNFCCC) has been completed. The Plan addresses the requirements identified in the Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC and, in particular, the need for Essential Climate Variables and associated climate products defined in the report. It takes into consideration existing global, regional and national plans, programmes and initiatives, including those of the recently established Group on Earth Observations, and implementation priorities and resource requirements, as well as indicators for measuring progress. Details are available at: www.wmo.int/web/gcos.

The Plan calls for some 131 actions over the next five to 10 years to address the critical issues related to the global observing system for climate, namely:

- Improving key satellite and in situ networks for atmospheric, oceanic and terrestrial observations;
- Generating integrated global climate analysis products;
- Enhancing the participation of least-developed countries and small island developing States;
- Improving access to high-quality global data for Essential Climate Variables; and
- Strengthening national and international infrastructure.

The UNFCCC Conference of the Parties endorsed the Implementation Plan at its 10th session (Buenos Aires, Argentina, 6–17 December 2004) through a formal decision which encourages Parties to strengthen their efforts to address the priorities identified. The decision also welcomes the emphasis given to enhancing the participation of developing countries in the global observing system for climate and invites GCOS to provide information to future sessions on how the actions identified in the Plan are being implemented. Ensuring implementation of the actions in the Plan will be a major priority for GCOS in the coming years.

New report on ozone and global climate

The WMO/UNEP Intergovernmental Panel on Climate Change (IPCC) met in Addis Ababa, Ethiopia, 6–8 April 2005, to finalize the Special Report "Safeguarding the ozone layer and the global climate system: issues related to hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs)".

The report describes both scientific and technical information regarding alternatives to ozone-depleting substances (ODSs) that may affect the global climate system. It addresses scientific linkages between stratospheric ozone depletion and climate change, and how the phase-out of ODSs is affecting climate change. HFCs have no ozone-depleting potential but are greenhouse gases. They are used as replacements for ODSs in applications such as refrigeration and air-conditioning, foams, aerosol and solvents and fire protection. The report assesses options for reducing emissions of these greenhouse gases, explores their technical feasibility and cost and addresses environmental, safety and health considerations.

The report was requested by the Parties to the UN Framework Convention on Climate Change and to the Montreal Protocol on Substances that Deplete the Ozone Layer. It was prepared by IPCC Working Groups 1 and 3 in cooperation with the Montreal Protocol's Technology and Economic Assessment Panel (TEAP).

THORPEX

Fourteenth World Meteorological Congress in 2003 established THORPEX as part of the WMO World Weather Research Programme under the auspices of the WMO Commission for Atmospheric Science.

THORPEX aims to accelerate improvements in the accuracy of one-day to two-week high impact weather forecasts for the benefit of society, the economy and the environment. THORPEX will play a major role in helping the climate forecast community to bridge the gap between weather and climate forecasting, leading to better understanding, improved forecast techniques, and more skilful forecasts for the 10-60 day range between the weather and climate time scales.

The THORPEX International Science Plan (www.wmo.int/thorpex/mission.html) defines four main research topics: global-to-regional influences on the evolution and predictability of weather systems; global observing system design and demonstration; multi-model ensemble predictions, targeting and assimilation of

observations; and social and economic benefits of improved weather forecasts.

The THORPEX International Research Implementation Plan (Version 1, www.wmo.int/thorpex/implementation.html) for 2005-2014 defines a series of research tasks within four interconnected subprogrammes: predictability and dynamic processes; observing systems; data assimilation and observing strategies; and social and economic applications.



THORPEX will conduct demonstrations of the social and economic benefits of improved

forecasts through:

- Use of new user-specific probabilistic forecast products;
- Introduction of interactive procedures that make the forecast system more responsive to user needs; and
- Design of, and training in, the use of user-specific forecast products.

Research will assess the social and economic costs and benefits of THORPEX recommendations for implementing interactive forecast systems and improvements in the global observing system.

GURME: IMPROVING AIR QUALITY SERVICES HELPS LOCALS AND TOURISTS

Short-lived air pollutants can affect tourism by reducing visibility, corroding monuments and restricting outside activities for a significant fraction of the population such as the elderly and asthmatics. These pollutants originate largely from urban areas but their impacts can be felt far away. For example, deposition of acidic and toxic constituents far from source

areas can have negative impacts on recreational fishing, and regional haze impairs the views at national parks.

The GAW Urban Research Meteorology and Environment (GURME) project was established by Thirteenth World Meteorological Congress (1999). Its goal is to enhance the capabilities of National Meteorological Services in providing

Climate and Cryosphere (CliC) Project

The Conference "Cryosphere, the 'frozen' frontier of climate science: theory, observations, and practical applications" was held 11-15 April 2005 in Beijing, China, on the campus of the host organization—the China Meteorological Administration. Sixteen national and international sponsors provided support to the conference organization and participants' travel.

CliC, a World Climate Research Programme core project co-sponsored by the Scientific Committee on Antarctic Research, studies the cryosphere as an integral part of the climate system. Its principal goal is to assess and quantify the impacts that climate variability and change have on components of the cryosphere, and the consequences of these impacts for the climate system. An additional goal is to determine the stability of the global cryosphere. To support these goals, CliC seeks to enhance and coordinate efforts to monitor, model and understand the cryosphere and relevant processes, and to develop cryospheric indicators of global climate change.



Photograph from the top of the 325-m tower of the Institute of Atmospheric Physics north of Beijing on 16 February 2001. BECAPEX research on multi-scale urban air pollution is providing new understanding of the processes contributing to the "pollution dome" over Beijing.

A major aim of the conference was to examine and develop ideas for future collaborative studies in cryospheric and climate research, and to establish links between cryospheric research groups and institutions. Conference plenary sessions addressed the main CliC Project Areas:

- The terrestrial cryosphere and hydrometeorology of cold regions;
- Glaciers, ice caps and ice sheets and their relation to sea level;
- High-latitude oceans and the marine cryosphere; and
- Links between the cryosphere and global climate.

Specialized sessions were held on remote sensing, *in situ* observations, climate modelling, data assimilation and small-scale modelling, impacts and their mitigation, the carbon cycle and permafrost, partner projects and activities during the International Polar Year 2007-2008.

The Conference was attended by approximately 300 scientists and was a landmark event in the development of the global studies of cryosphere and climate.

air-quality services for a variety of purposes, including support of tourism. Pilot projects demonstrate how agencies and organizations can successfully expand their activities into pollution-related issues and provide illustrative examples of best practices and experiences. One example is the Beijing City Air Pollution Experiment (BECAPEX), which focuses on multi-scale urban air pollution, with the goal of increasing knowledge of the laws controlling the temporal and spatial distribution, diffusion and dilution of pollutants. The project takes a comprehensive approach, which combines field experiments and modelling activities. More than 50 researchers are participating in this project, which has already produced a series of achievements that have important impacts for Beijing air quality. These results are providing important guidance for meeting the green objectives of the 2008 Olympics.

GURME is also working to improve forecasts of “chemical weather” such as 1-3 day outlooks of levels of dust, smoke and smog. These forecasts are distributed widely via newspapers, Websites and even mobile telephone text messaging. The information is used by public health agencies, transportation authorities, tourism and event planning groups, and private citizens. GURME conducts expert meetings to gather up-to-date information on new methods for chemical weather forecasting and to help identify future research needs to improve the forecasts. GURME also provides guidelines and training in chemical weather forecasting. The next training workshop is planned in Latin America later this year.

Further details can be found on the GURME web site: <http://www.wmo.int/web/arep/gaw/urban.html>

OCEANS IN A CARBON-RICH WORLD



According to Dr Christopher Sabine, an oceanographer with the US National Oceanic and Atmospheric Administration, the ocean has taken up approximately 120 billion tonnes of carbon since 1800. Its introduction leads to production of carbonic acid in the ocean's upper layer. The warming increases stability of surface layers, and it is expected that the resultant decrease of the upper ocean water pH by the year 2100 may be as much as 0.4 units. Over the next few centuries, surface ocean pH could decrease by as much as 0.7 units, which would be the lowest levels in at least the past 300 million years. This acidification is likely to affect marine life and especially corals and hard-shelled organisms. The full range of consequences of this process is difficult to project. CO₂-induced ocean acidification and related changes in seawater carbonate chemistry can affect phytoplankton physiology, ecological interactions and biogeochemical cycling. They may lead to a

University of Bergen (Norway) Large Scale Mesocosm Facility (left) and view of an enclosure seen from above

Photos courtesy Ulf Riebesell

reduction in biogenic calcification of the plankton, which in turn reduces the vertical transport of calcium carbonate to the deep sea. The associated increase in the CO₂ storage capacity of the surface ocean comprises a negative feedback to anthropogenic CO₂ increase. At the same time, concerns regarding the bearing capacity of ocean and marine life with respect to increased carbon content cast a shadow on perspectives of ocean carbon sequestration.

In order to study the possible consequences of increased ocean carbon uptake, scientists associated with the Surface Ocean-Lower Atmosphere Study (SOLAS) are conducting a series of laboratory experiments in the University of Bergen Large Scale Mesocosm Facility (see

Photos right show the effect of changes in ocean chemistry on different types of plankton caused by a high carbon world.

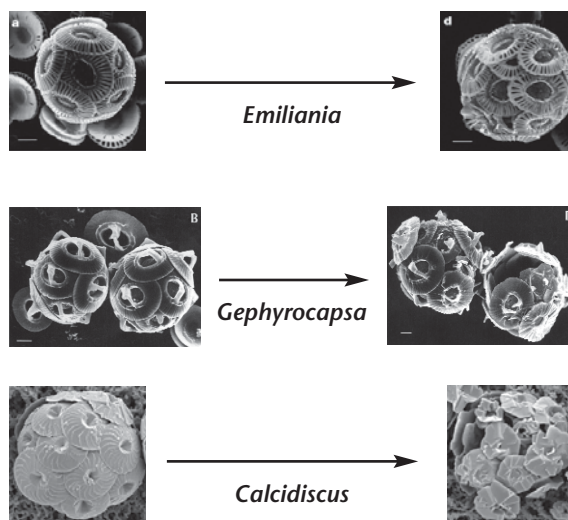
Photos courtesy Ulf Riebesell

photos on page 9). The goal is to reproduce in reality the dominant processes which will occur in the ocean in a carbon-rich world. The results reveal marked changes in several types of plankton (see photos right) and demonstrate a need for quantitative representation of biological feedbacks in climate models.

Source: http://pubs.acs.org/subscribe/journals/esthag-w/2004/nov/science/pt_warming.html

Today's world

High carbon world



World Meteorological Day

World Meteorological Day (WMD) was celebrated on 23 March 2005. The theme was "Weather, climate, water and sustainable development", focusing on the vital contribution of National Meteorological and Hydrological Services (NMHSs) to sustainable development, environmental protection and poverty alleviation.

For WMD 2005, WMO published an information kit, including a message from the Secretary-General, a booklet and a poster and a press release was issued. A film entitled "Weather, climate, water and sustainable development" (16 minutes) and a video news release (3 minutes) were produced by UNTV. All WMD 2005 products are available in English, French, Spanish and Russian. In addition, the message of the Secretary-General and the film are available in Arabic and Chinese.

In his address at the WMD celebration at WMO Headquarters, Mr Jarraud recalled the achievements of WMO and elaborated on the challenges ahead. He expressed the hope that WMD 2005 would mark increased recognition of the role of NMHSs and greater use of their products for sustainable development and greater collaboration with various partners to effectively address environmental and developmental challenges in the areas of weather, climate and water.

Mr Supachai Panitchpakdi, Director-General of the

GOS: RECOMMENDATIONS TO 2015

The WMO Commission for Basic Systems at its 13th session (23 February–3 March 2005) considered issues related to Integrated Observing Systems. The Commission noted the development of the Implementation Plan for Evolution of Space- and Surface-Based Sub-systems of the Global Observing System (GOS) which contained a number of specific actions and recommendations needed over the next 10 years to address the most essential issues related to GOS performance.

Twenty recommendations address the space-based subsystem of the GOS. They build upon known plans of the operational and research-and-development satellite operators and call for rigorous calibration of remotely sensed radiances, as well as improved spatial, spectral, temporal and radiometric accuracies. The wind-profiling and global precipitation-measurement missions were singled out for their importance to GOS. Implementation of most of these recommendations would be realized through the WMO Space Programme working with space agencies, via the Coordination Group for Meteorological Satellites.

Twenty-two recommendations address the surface-based subsystem of GOS. They include more complete and timely data distribution; improved data coding; enhanced aircraft meteorological data reporting, especially over data-sparse areas; optimized rawindesonde distribution

and launches; improved upper-tropospheric and lower-stratospheric moisture measurements; operational use of targeted observations; inclusion of ground-based global positioning systems, radars and wind profilers; increased oceanic coverage through an expanded Automated Shipboard Aerological Programme, drifting buoys and the Argo float programme and development of some new observing technologies.

Five recommendations address numerical weather prediction interactions with data from the evolving GOS, further study of observing system design and training issues.

The Commission agreed on the mechanism of implementation of these recommendations and requested the Secretary-General to publish it and arrange for its circulation, as guidance material to Members, appropriate working bodies of regional associations and technical commissions.

The full text of deliberations of CBS-XIII in all official languages is posted at <ftp://wmoftpreader:wmoftp@ftp.wmo.int/Documents/sessions/> or at

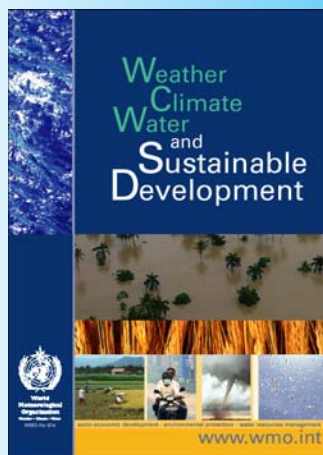
<ftp://ftp.wmo.int>
(UserName: wmoftpreader,
Password: wmoftp)

CLIMATE OUTLOOK FORUMS: AN UPDATE

World Trade Organization (WTO), was invited to address the celebration as the guest of honour.

Mr Supachai emphasized that human progress, sustainable social-economic development, environmental protection and poverty alleviation are commonly shared goals. He believed that the main contribution that WTO can make to sustainable development is the successful completion of the Doha Development Round negotiation.

World Water Day was celebrated on 22 March 2005. Mr Jarraud issued a statement entitled "Water for life".



Weather, climate, water and sustainable development (brochure for WMD2005) (WMO-No. 974). Issued in English, French, Russian and Spanish. Electronic versions (pdf) available at:
<http://www.wmo.int/wmd/>

To order this publication and those featured overleaf, see page 2.

The electronic version of *World Climate News* is available under the Catalogue of WMO Publications on the WMO homepage at www.wmo.int.

The World Climate Programme (WCP) has continued to participate in and support Regional Climate Outlook Forums (RCOFs).

In March 2005, WCP attended the 15th Climate Outlook Forum for the Greater Horn of Africa (GHA) subregion in Mombasa, Kenya. The Forum was organized by the Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Centre, Nairobi, in collaboration with 10 GHA countries; Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, United Republic of Tanzania and Uganda. International collaborating partners provided scientific advice. The Forum discussed the current El Niño event and its possible evolution, assessed global climate models' diagnostics and prepared rainfall outlooks for the region (March–May 2005). A noticeable factor was the increased participation of end-users in the Forum.

WCP participated in the first session of the Forum on Regional Climate Monitoring, Assessment and Prediction

for Asia (FOCRAII) in Beijing, China, 7–9 April 2005. The Forum reviewed the limitations and prospects of seasonal-to-interannual climate forecasting methodologies and systems and provided a platform to share experience and forecasting products from other global climate prediction centres. FOCRAII was organized and co-sponsored by the China Meteorological Administration in collaboration with other national institutions and organizations.

WCP supported the International Workshop on Climate Prediction and Agriculture—Advances and Challenges organized by START (System for Analysis, Research and Training), WMO and IRI, at WMO Headquarters in Geneva, 11–13 May 2005. The Workshop reviewed the advances made during the past five years in seasonal climate prediction and its application to decision-making in agriculture, and identified the challenges to be addressed in the next five to 10 years to enhance operational applications, especially in developing countries.

GROUP ON EARTH OBSERVATIONS

The Secretariat of the intergovernmental Group on Earth Observations (GEO) is being hosted by WMO at its Headquarters in Geneva. A transitional secretariat will serve until the permanent Secretariat is established later this year.

The purpose of GEO is to oversee the implementation of a 10-Year Implementation Plan for a Global Earth Observation System of Systems (GEOSS). The "system of systems" will integrate existing environmental observations made on land, in the atmosphere, in the oceans and from space in such a way that the data will be readily available and useful to decision-makers worldwide. The Plan will also identify gaps in various observing systems and finds ways to remove obstacles which inhibit integration of data from those systems.

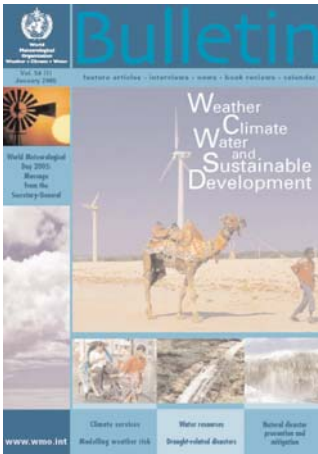
WMO hosted the first meeting of GEO (GEO-I) on 3 and 4 May 2005. Some 200 representatives of nearly 60 nations and the European Commission, as well as of over 40 international and intergovernmental organizations attended.

GEO-I delegates elected a new Executive Committee to oversee the administrative workings of GEO. It will consist of 12 Members representing developing and developed countries in various regions of the world: Brazil, China, the European Commission, Germany, Honduras, Italy, Japan, Morocco, Russian Federation, South Africa, Thailand and the USA, four of which are Co-chairs.

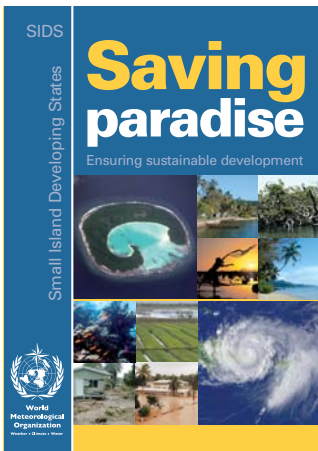
The benefits of GEOSS will range from disaster prevention, climate monitoring and environmental preservation to improved socio-economic development. GEOSS will help all nations involved to manage their information in a way that benefits the environment as well as humanity.

WMO will be fully involved in the planning and implementation of GEOSS and will encourage National Meteorological and Hydrological Services to participate so that they may derive maximum benefit.

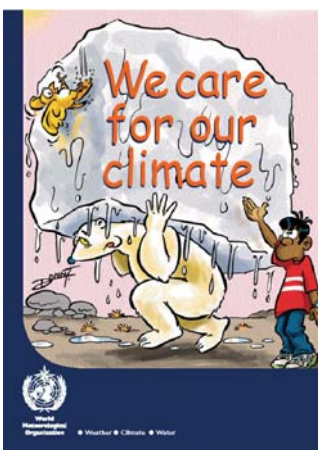
THE CRYOSPHERE AND WINTER ALPINE TOURISM



New-look, new-format, full-colour WMO Bulletin. Issued four times a year in English, French, Russian and Spanish versions.



Saving paradise, ensuring sustainable development (WMO-No. 973), English and French. Electronic version (pdf) available at: <http://www.wmo.int/sids/>



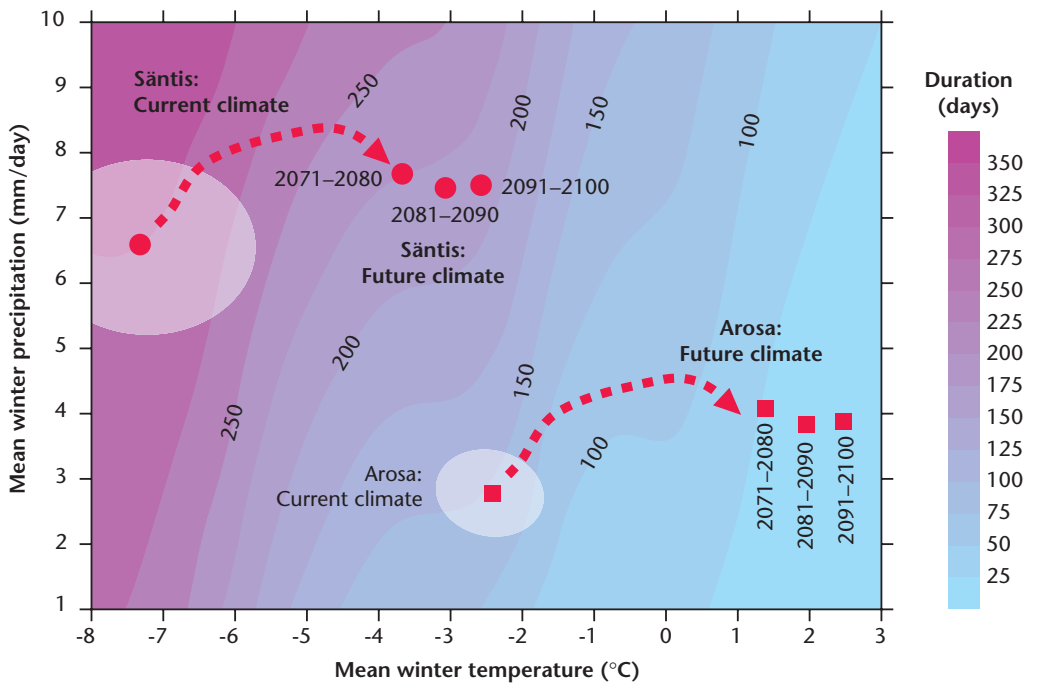
We care for our climate (cartoon-style booklet for children) (WMO-No. 975), English, French and Spanish

According to the expectations of the World Trade Organization and the World Tourism Organization based on the results of the IPCC Third Assessment Report (2001), winter mountain tourism is likely to diminish in the 21st century due to a number of interrelated factors.

A study conducted by Dr R. Bürki and co-authors from the University of Zurich shows that the most important link between climate change and mountain tourism is the reduction in snow amount. The study considers a ski resort to be

in Switzerland would drop from 85 to 63 per cent.

By 2030, 20-70 per cent of Swiss glaciers are expected to disappear, continuing a tendency which started at the end of the "Little Ice Age". The loss of glaciers is not only damaging to mountain aesthetics and water management but is also a problem for winter and summer skiing on glacier ski slopes. Increased melting of mountain permafrost would also make many mountain areas vulnerable to landslides and reduce the stability of cableways, lift masts



Studies for two Swiss ski resorts suggest how snow reliability may change over the century.

Source: M. Beniston, F. Keller, B. Koffi and S. Goyette, 2003: Estimates of snow accumulation and volume in the Swiss Alps under changing climatic conditions. *Theoretical and Applied Climatology*, 76, 125-140

snow-reliable if, in seven out of 10 winters, the snow cover is at least 30-50 cm thick for a period of at least 100 days between 1 December and 15 April. The number of snow-reliable resorts in this century is likely to diminish. The most significant impact would be on relatively low-lying resorts, particularly in Europe. For example, if the line of snow-reliability rises to 1 500 m, which is expected in 2030-2050, the number of snow-reliable ski resorts

and other buildings built on soil with permafrost.

Regional climate change studies for two locations in northern and eastern Switzerland (see figure) show that warmer temperatures are expected to co-exist with somewhat increased winter precipitation and a significant reduction in the winter snow cover duration.

Expected changes are being addressed by the alpine ski industry through developments in artificial snow-making, and a complex set of adaptive economical, environmental and educational measures.