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WINTER TOURISM DEVELOPMENT TRENDS IN GEORGIA

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Summary: *One of the new tools that can be effectively used to hedge weather risks are derivatives of the weather (forwards, futures, options and swaps on selected weather variables – temperature, rain, snow, wind, etc.) .In this article, we will introduce the possibility of using weather derivatives in winter tourism – snowfall ahead – to insure the tourism business. Our research is based on snowfall data from a ski resort in Georgia. We show that weather derivatives can be an effective tool for hedging weather risks and reducing income volatility in the winter ski tourism business.*

Key words: *winter tourism, snow cover*

Tourism, which is one of the driving forces of economic development [1-6], has a number of risks. In addition to foreign currency exchange and frequent fluctuations in prices for fuel and transport our research shows that the tourism industry has become increasingly vulnerable to climate conditions in recent years.

Mountain ecosystems are considered to be vulnerable to climate change, which can have a number of negative effects of reducing winter seasons, glacier retreats and also reducing water resources. The winter tourism sector is particularly vulnerable to climate change, while some resorts are expected to reduce the length of the ski season and recreation zone. It is particularly important to determine the regularity of changes in the climatic characteristics of winter resorts in order to determine the start and end dates of the season in order to plan the development of mountain-ski tourism.

In order to study how snow conditions change in the light of climate warming for the two winter observation periods in the winter tourist regions, we have identified two main climatic characteristics of snow cover duration and maximum snow cover changes over a long period of observation 1956-2015.

The spatial distribution of snow cover parameters is significantly influenced by the location and height of the tourist site. There is a significant decrease in the length of snow cover days during the study period. Statistically significant change was observed mainly in the southern part of the region. It is accepted that skiing is considered reliable with snowfall when the height of snow cover (artificial or natural) exceeds 30 cm for 100 days no more than 7-10 years. According to studies, the largest changes in snow cover duration are observed in December and March, while a significant change is observed only in April. The maximum height of the snow cover was virtually unchanged during the survey.

The period of snow cover is determined by some of Georgia's winter resorts, for the three observation periods I – 1956 ÷ 1985 II – 1986 ÷ 2015 and I I I-1956 ÷ 2015. According to Student's criterion. This parameter was set the regularities of change between the first and second periods I – 1956 ÷ 1985 II – 1986 ÷ 2015.

Particularly sensitive to climate change is mountain-ski tourism, the development of which is important to consider aspects of climate change.

In Mestia, during the study period, the average snow season began on November 30 and ended on March 19. The average duration of snow cover was 108 days. Snow coverage trend is negative. -Duration of snow cover in period II decreased by 17% compared to period I.

Table 1. Duration of snow cover characteristics at winter resorts.

Station	Years	Season's beginig	Season's ending	Season's Duration		Season's number
				days	change %	
Mestia	1956-2015	30 Nov	19 March	108		32
	1986-2015	26 Nov	2 March	95	-17	6
	1956-1985	1 Dec.	28 March	111		26
Gudauri	1956-2015	23 Nov	5 May	162		35
	1986-2015	29 Nov	3 May	154	-12	19
	1956-1985	15 Nov	7 May	172		16
Goderdzi	1956-2015	8 Nov	10May	182		46
	1986-2015	10 Nov	15 May	185	3	20
	1956-1985	6 Nov	6 May	180		26
Bakuriani	1956-2015	26 Nov	28 March	122		35
	1986-2015	19 Nov	17 March	118	-8	19
	1956-1985	15 Nov	22 March	127		16

During the observation period in Gudauri, the average snow season started on November 23 and ended on May 5. The duration of the snow cover was 162 days throughout the observation period. The trend of snow cover is negative. During the second period the duration of snow cover is reduced by 12% compared to the first one.

In Goderdzi, the average snow season for the observation period began on November 8 and ended on May 10. The duration of the snow cover was 182 days throughout the observation period. The trend of snow cover is positive – the duration of snow cover has increased by 3% compared to the first period.

In Bakuriani, for the observation period the snow season started on average on November 26 and ended on March 28. The duration of the snow cover was 122 days throughout the observation period. The trend of snow cover is negative. During the second period the duration of snow cover is reduced by 8% compared to the first one.

The results show that the duration of the winter season in addition to climatic factors depends on physical and geographical factors such as the location of the tourist site and the altitude. Evaluations are of a benchmark nature, further studies are required.

In the future, climate change may significantly affect the length of the ski season. According to the climate scenario, average temperatures are expected to increase every month compared to the baseline 30-year period (2041–2070) compared to the baseline 30-year period (1971–2007) (Table 2). Precipitation throughout the whole territory of Georgia, with the exception of a few low-lying stations, has reduced precipitation. In the future, as temperatures rise and precipitation falls, snow cover will likely decrease.

Table 3. gives the statistical characteristics of the maximum snow cover depth in Bakuriani and Gudauri from 1956 to 2015. As shown in this table, the average depth of snow cover in Bakuriani is highest in February (61.3 cm) and minimum in June and September (0.1 cm). During the whole observation period, the maximum depth of snow cover was 130 cm in Bakuriani in March 1956. The average depth of snow cover in Gudauri is highest in March (115.1 cm), minimum in October (0.7 cm). The maximum depth of snow cover at 330 cm in Gudauri was recorded in February 2008.

Table 2. Average temperature change (°C) in individual months compared to baseline during the first forecast period.

Station	Month						Season			Year
	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	Spring	Autumn	Winter	
Mestia	4.4	2.1	2.8	2.4	5.9	1.6	3.5	3.3	2.5	2.9
Gudauri	3.4	3.1	2.9	2.7	2.8	2.1	2.9	3.0	2.9	3.0
Goderdzi Med.	2.7	1.7	1.3	1.5	2.0	1.7	2.1	2.3	1.3	2.0
Bakuriani	2.8	2.6	1.8	2.1	2.3	1.7	2.2	2.7	1.9	2.1

Table 3. Statistical characteristics of maximum snow cover depth in Bakuriani and Gudauri 1956-2015.

Months	Mean		Min		Max	
Station	Bakuriani	Gudauri	Bakuriani	Gudauri	Bakuriani	Gudauri
Jan.	49.0	81.2	0	0	83	300
Feb.	61.3	99.8	0	0	112	330
Mar.	54.2	115.1	0	0	130	294
Apr.	23.9	91.9	0	0	109	260
May	2.3	37.6	0	0	23	312
June	0.1	0.0	0	0	3	0
July	0.0	0.0	0	0	0	0
Aug.t	0.0	0.0	0	0	0	0
Sep.	0.1	0.7	0	0	2	35
Oct.	4.9	6.8	0	0	28	50
Nov.	20.2	26.1	0	0	80	121
Dec.	35.2	55.8	0	0	70	244

Table 4 and Figure 1 provide the statistical characteristics of maximum snow cover depths in Bakuriani and Gudauri.

In Bakuriani, from 1956 to 1985, a noticeable change in the average mean depth of maximum snow cover was observed in January (decrease of 17%), in February (decrease of 19%) and in November (increase of 17%) in 1986-2015. The average maximum depth of snow cover in Gudauri increased in April (18%) and

Table 4. Change in mean depth of maximum snow cover between two periods

Months	Bakuriani			Gudauri		
	1956–1985	1986–2015	Change %	1956–1985	1986–2015	Change %
Jan.	54	45	-17	81	82	1
Feb.	70	57	-19	98	101	3
Mar.	55	56	2	110	116	5
Apr.	22	23	5	83	98	18
May	18	21	17	20	26	30
June	30	30	0	58	61	5

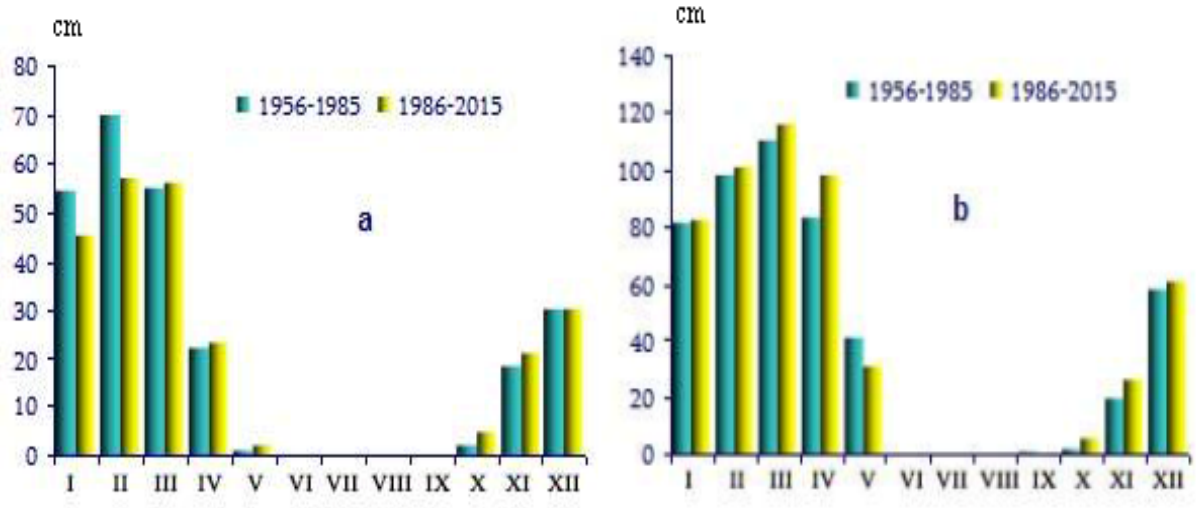

Fig. 1. Maximum snow cover depths in Bakuriani and Gudauri.

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