

THE FIFTH NATIONAL COMMUNICATION OF THE SLOVAK REPUBLIC ON CLIMATE CHANGE

under the United Nations Framework Convention
on Climate Change and Kyoto Protocol

Bratislava 2009



Ministry of the Environment of the Slovak Republic
Slovak Hydrometeorological Institute

6.7 SECTOR TRANSPORT

Basic kinds of transport are influenced negatively by climate extremes and dangerous meteorological phenomena. In case of railways and roads, they are influenced primarily by the extremes of air temperatures, abundant and long-lasting precipitations, high snow cover and dangerous events, like glaze, fog and windstorm. Inland water transport is influenced negatively by very low air temperature in winter, drought and high speed of wind. Air transport is influenced primarily by low temperature together with precipitation, fogs and high wind speed, what makes the operation of airports more difficult. Special transport (cable cars, ski lifts) is influenced primarily by icing, glaze and strong wind.

6.7.1 Expected impacts of climate change on sector transport

The assessment of the impacts of climate and its variability on particular types of transport at expected climate change in future is based on the Fourth National Communication of the Slovak Republic on Climate Change from 2005 according to GCMs model CCCM 2000. Expected climate change will affect basic types of transport as follows:

- General increase in air temperature will affect positively the transport types that are the most sensitive and vulnerable to frost and snow, i.e. road transport, inland water transport and partially air transport.
- The decrease in atmospheric precipitation totals during summer months will affect inland water transportation, which is concentrated in hot lowlands and where the biggest decrease in atmospheric precipitation is expected during summer. The increase in air humidity in colder seasons may have negative impacts due to more frequent creation of fog, icing and black ice. In particular, road transport will be affected negatively by these effects, but partially also air transport, especially in moderately warm and cold climate regions.
- Warming causes the increase in number and intensity of extreme meteorological phenomena that relate to the increased accumulation of heat in the atmosphere (thunderstorms, heavy rains, windstorms and tornados) and can affect directly all kinds of transport.
- It is expected that in the Slovak Republic, road transport and inland water transport will be affected the most and railways and pipelines seem to be affected the least by climate change.

6.7.2 Vulnerability assessment in sector transport

Main corridors of road transport will be affected negatively also in future, particularly in winter (snow cover, fog, icing, black ice and wind). The increase in snow precipitation totals can be expected during winter in mountain areas and passes in the central and south of Slovakia, for example in Donovaly, Čertovica, Besník, Šturec, Cesta Slobody (Road of Liberty) in the area of the Tatra Mountains, in particular in its part western from Smokovec to Podbánske. The decrease in snow precipitation totals, number of frost days, or days with glaze, can be expected in lowlands. Overall variability of climate impacts on road transport will increase.

More positive impacts of climate change, as regards air temperature in highlands, are expected in railway transport; more negative impacts can occur as episodes with extremely high air temperature in lowlands during summer. The increase in atmospheric precipitation totals can negatively affect also the railway transport in highlands during colder seasons.

Inland water transport on the Danube, the Morava and lower part of the Váh rivers will be affected negatively by the decrease in flows during summer, but also by heavy rains in summer along with steep increase in water level up to flooding activity level. Water transportation on the Danube depends on expected climate change in localities of its upper flow and the right tributaries in the Alp.

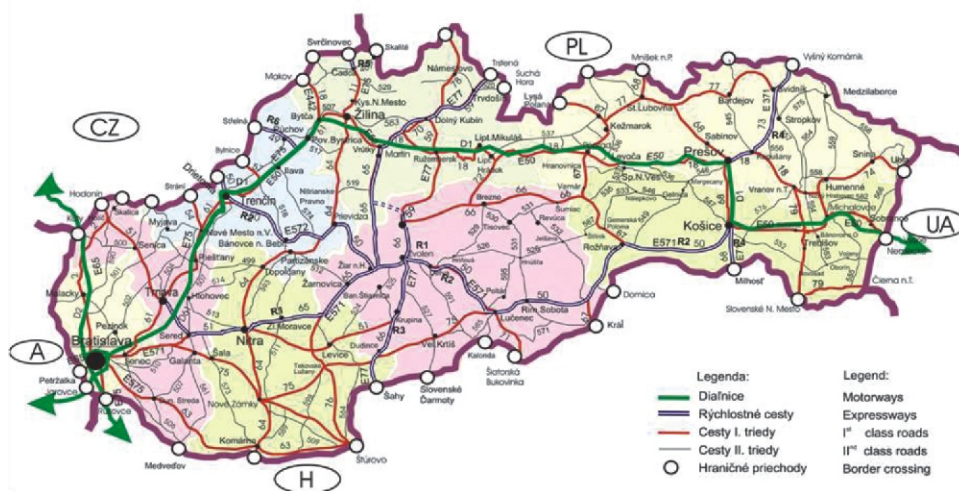
Air transport will be more sensitive to extreme meteorological phenomena. Airports in Bratislava and Košice will be affected especially in winter (glaze, snow), but also by dangerous meteorological phenomena, like strong thunderstorms and wind all the year round.

6.7.3 Adaptation measures in sector transport

Due to major climate impact on road transport, it would be better to support the development and modernisation of railway transport, i.e. electrification, double tracks, high speed lines, etc.

In road transport, it will be more important to improve and modernise the infrastructure in dangerous sections (road broadening, improving maintenance and road signs, and tunnel construction), diverting goods transportation, etc. In this regard, Donovaly, Vernár, Čertovica and Šturec are the most important sections. It is necessary to continue in the construction of motorways, to support the construction of new corridors and to modernise present corridors, that must be oriented into borders of highlands, as these are less affected by water flows (fogs, icing, black ice) and temperature inversions.

Figure 6.8: Planned construction of motorways and roads in the Slovak Republic till 2015.



Furthermore, it is important to continue in supporting internal air transport in relation to passenger transport in the most frequent sections, e.g. Košice – Bratislava, Poprad – Bratislava, to develop and broaden storage areas of airports in order to develop cargo transportation as the alternative to truck transport.

Completing the Váh transport route and making navigable the Bodrog, the Laborec and the Latorica is the priority in water transportation due to the cross connection of the Baltic Sea and the Balkan as the alternative to truck transport. This solution will allow permanent using existing water route of the Danube, the Váh and the Bodrog. Stream-beds of the rivers must be adapted in order to provide suitable navigation conditions during the whole year. It is also necessary to harmonise and adapt the construction of new corridors not only to the needs of Slovak economy, but also to actual commercial and transport trends in Europe and the orientation to the construction of multi-modals corridors.

6.8 SECTOR TOURISM

According to the *Regionalisation of Tourism in the Slovak Republic (2005)*, tourist activities or holiday/leisure activities are divided into the activities related to natural or anthropogenic environment.

6.8.1 Expected impacts of climate change on sector tourism

According to the climate impact, tourism activities can be divided as follows:

- Activities markedly affected by climate, i.e. staying and relaxation at the water, water sports, cycling, paragliding, skiing, snowboarding, ski tourism, cross-country skiing and water tourism.
- Activities less affected by climate, i.e. walking, visiting historical sites and events (culture, sport, churches), country tourism, staying and relaxation in forests or mountains, in spa (thermal water), hunting, recognition of local traditions, shopping, participation in and visits of exhibitions and fairs, conference attendance, visits of museums and art galleries, caves, speleology, mountain climbing and fishing.

Table 6.5: Activities the most affected by climate change and their potential development in the regions of the Slovak Republic.

	Bratislavský	Podunajský	Záhorský	Dolnopovažský	Strednopovažský	Nitriansky	Hornonitriansky	Severopovažský	Turčiansky	Oravský	Liptovský	Ipeľský	Gemerský	Horehronský	Pohronský	Tatranský	Spišský	Košický	Šarišský	Hornozemplínsky	Dolnozemplínsky
Ski tourism and cross-country skiing											X			X		X					
Staying and relaxation at water	X	X																			X
Cycling tourism	X	X	X								X					X					
Staying and relaxation at thermal water			X	X	X						X					X					
Water sports	X	X		X						X	X										X
Downhill skiing								X	X	X	X			X		X					
Water tourism	X	X	X			X		X			X			X	X	X					

6.8.2 Vulnerability assessment in sector tourism

According to the *Regionalisation of Tourism in the Slovak Republic (2005)*, the most vulnerable activities are the following:

- Ski tourism and cross-country skiing

Lower located centres (up to the altitude of 1,000 m) will be more vulnerable – less snow, irregularity in the occurrence of snow cover, shorter skiing season. On the other hand, positive impact is expected at higher localities (above 1,200 m) – more snow, longer skiing season, strong frost reduction.

- Staying and relaxation at water

Higher air temperature and less precipitation in summer positively affect this activity as the summer season will be longer; negative impact can be expected due to higher intensity of dangerous meteorological phenomena as a result of higher energy in the atmosphere (strong thunderstorms, heavy rainfalls, tornadoes).

- Cycling tourism

In the Danube basin region and Záhorie region, cycling tourism season is expected to be longer (positive impact). On the other hand, extreme heat waves and dangerous meteorological phenomena can negatively affect this activity during the warmest months. In Liptov and Tatras regions, expected climate change may have positive impact on this activity through better temperature conditions in spring, summer and autumn.

- Staying and relaxation at thermal water

Positive impact is expected due to warming, in particular in spring months (March, April, May), as well as the prolongation of the season of summer thermal swimming pools. The increase in the intensity of dangerous meteorological phenomena and followed-up damages may have negative impacts.

- Water sports

Positive impacts and season prolongation are expected in all regions. The increase in the intensity of dangerous meteorological phenomena may have negative impacts.

- Downhill skiing

In the Slovak Republic there is 76% of ski centres located up to 1,000 m. More significant warming during winter months will affect these centres as skiing conditions will become worse – unstable occurrence and height of snow cover, shortening of skiing season. On the other hand, a positive impact can be expected in higher altitudes (over 1,200 m), where the increase in precipitation totals at minus temperature will result in more snow and season prolongation despite the warming. But only some centres are affected by this effect (Chopok, Čertovica, Štrbské pleso, Skalnaté pleso – Lomnické sedlo, Zverovka – Spálená, Martinské hole, Vrátna - Chleb).

- Water tourism

Negative impacts are expected due to the decrease in atmospheric precipitation totals and their non-uniform distribution in Bratislava region, Danube region, Záhorie and Nitra regions in summer. Positive impact of the increase in atmospheric precipitation totals on this activity is expected in the highlands of Central and North Slovakia, particularly in Liptov region, the Tatra Mountains and the north parts of the river Váh basin and the Hron Basin.

6.8.3 Adaptation measures in sector tourism

- Supporting the development of tourism in lowlands of Slovakia that have a high potential for the development of several activities, like staying and relaxation at water, water sports, cycling tourism, water tourism, staying and relaxation at thermal water, staying and relaxation in spa, as these activities are less vulnerable to expected climate change.
- Supporting the development of tourism in mountains that have a high potential for the development of staying and relaxation in forest, mountains and in the country, walking, cycling, mountain climbing, visits of caves, where no significant impact of climate change is expected.
- Making efforts to prolong winter season and compensate the lack of natural snow by technical snow in ski centres up to 1,000 m.
- Reorienting ski centres in lower mountains (e.g. the Malé Karpaty mountains) to the activities that are less vulnerable to expected climate change, e.g. cycling and walking. Neither the construction of new ski centres, nor the investments in existing ski centres are recommended.

Activities connected mainly with the anthropogenic environment, where the direct impact of expected climate change is not significant, should be developed in all regions. These are staying and relaxation in spa, staying and relaxation at thermal water, staying and relaxation in the countryside, visits of fairs, exhibitions, congresses, conferences, seminars and caves. Development or improving quality of existing infrastructure (roads, hotels and restaurants), improving marketing and advertising are the proposed measures to enhance the potential of these activities.