Revision and update of the national strategy on adaptation to climate change in Slovakia

Marcel Garaj[1], Jaroslava Slavková[1], Ladislav Markovič[1]

[1] Slovak Hydrometeorological Institute, Jeséniova 17, 831 01 Bratislava, Slovakia

marcel.garaj@shmu.sk

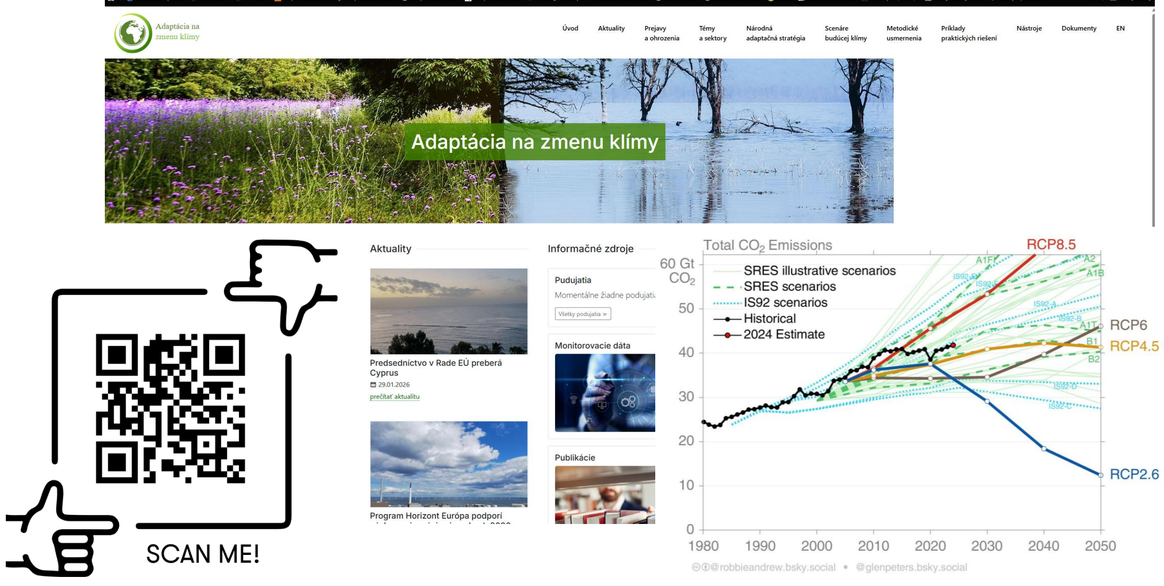
Funded by the European Union

The Climate Change Adaptation Platform is maintained by the Slovak Environment Agency in cooperation with the Ministry of Environment of the Slovak Republic and the Slovak Hydrometeorological Institue.

The aim of this Platform is to provide information on climate change adaptation to the public and experts with a focus on national, regional and local level, with the potential to expand its content in the future and become part of the planned information system for climate information provision.

The Platform focuses on describing and assessing the manifestations of climate change and related phenomena. It assesses the projected impacts of climate change on the natural environment and economic sectors, and describes adaptation measures with the potential to mitigate these negative impacts.

It summarizes the documents adopted in the field of adaptation to climate change at international, national, regional and local level. It presents examples of practical solutions implemented by various subjects such as local authorities, NGOs and businesses.



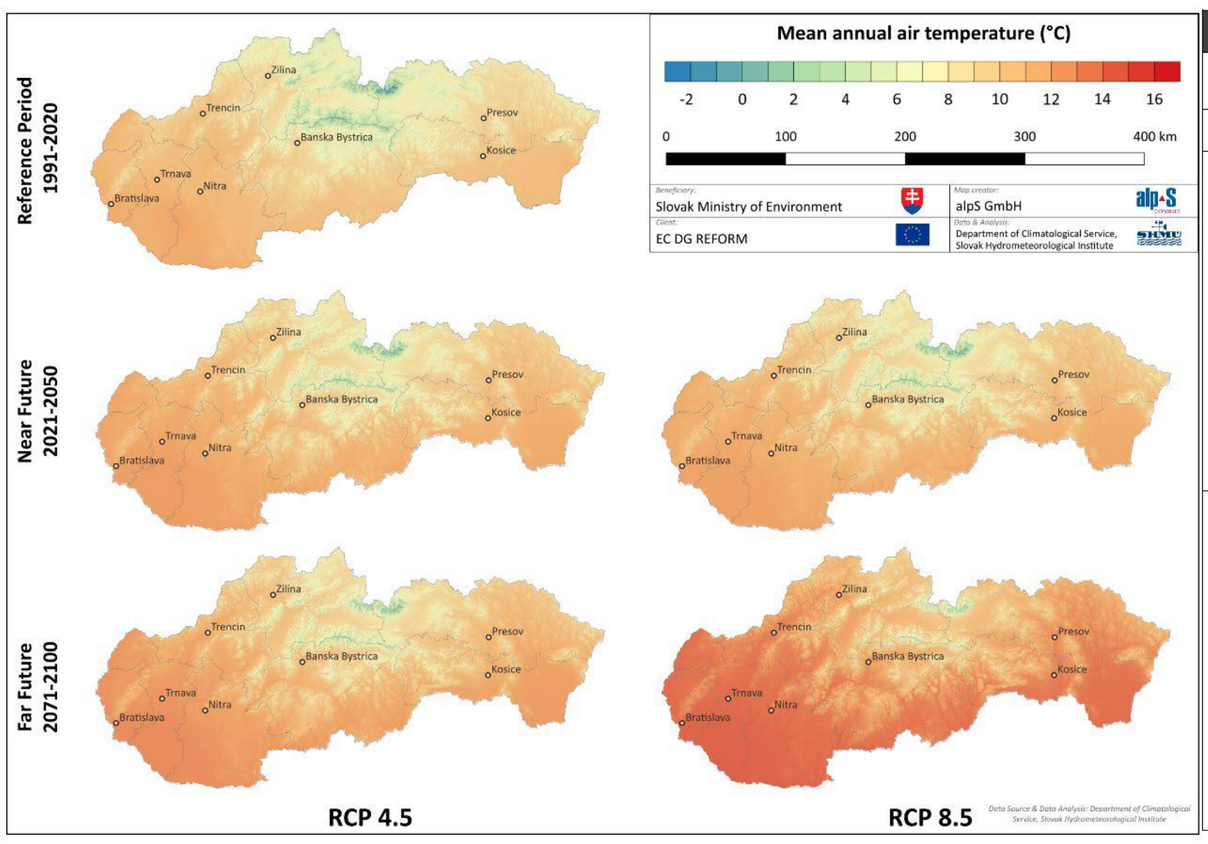


Figure 1: Mean annual air temperature in °C; scenarios for the near (2021-2050) and far (2071-2100) future under RCP4.5 and RCP8.5 are shown for Slovakia, including regional boundaries and regional capitals.

Indicator	City	Ref. Period 1991-2020	Absolut changes to reference period 1991-2020 Near Future 2021-2050 RCP4.5	Near Future 2021-2050 RCP8.5	Far Future 2071-2100 RCP4.5	Far Future 2071-2100 RCP8.5
Temperature [°C]	Bratislava	10,9	0,6	0,3	1,3	2,8
	Trnava	10,5	1,0	0,8	1,6	3,2
	Nitra	10,7	0,8	0,6	1,3	3,0
	Trencin	10,0	0,7	0,6	1,2	2,9
	Banska Bystrica	9,1	1,0	0,9	1,5	3,2
	Zilina	8,8	0,9	0,8	1,3	2,9
	Presov	9,0	1,2	1,2	1,7	3,4
	Kosice	9,8	0,9	0,9	1,5	3,2
Tropical days [Days]	Bratislava	25,8	6,1	5,8	11,1	30,5
	Trnava	23,3	5,3	5,2	10,4	30,3
	Nitra	27,8	6,3	6,8	12,5	31,7
	Trencin	21,3	4,8	5,2	10,0	28,6
	Banska Bystrica	14,0	3,9	4,2	9,7	27,1
	Zilina	15,1	4,6	4,4	8,3	24,2
	Presov	13,4	3,2	3,9	9,2	26,9
	Kosice	16,3	3,3	4,8	10,8	29,5

Indicator	Region	Ref. Period 1991-2020	Absolut changes to reference period 1991-2020 Near Future 2021-2050 RCP4.5	Near Future 2021-2050 RCP8.5	Far Future 2071-2100 RCP4.5	Far Future 2071-2100 RCP8.5
Temperature [°C]	Bratislavsky kraj	10,4	0,9	0,6	1,5	3,1
	Trnavsky kraj	10,5	0,9	0,7	1,5	3,1
	Nitriansky kraj	10,6	0,7	0,5	1,2	3,0
	Trenciansky kraj	9,0	0,7	0,6	1,2	2,9
	Banskobystricky kraj	8,3	1,0	1,0	1,6	3,3
	Zilinsky kraj	6,4	1,1	1,0	1,6	3,3
	Presovsky kraj	7,3	1,3	1,3	1,8	3,5
	Kosicky kraj	9,0	0,9	0,9	1,5	3,2
Tropical days [Days]	Bratislavsky kraj	18,1	4,9	4,5	8,8	27,2
	Trnavsky kraj	25,7	5,6	5,8	11,0	30,5
	Nitriansky kraj	28,0	6,0	6,5	12,4	32,1
	Trenciansky kraj	19,1	4,6	4,8	8,8	25,2
	Banskobystricky kraj	17,1	4,4	4,9	9,4	25,5
	Zilinsky kraj	7,5	3,2	3,1	5,5	17,5
	Presovsky kraj	10,8	2,8	3,7	7,4	20,9
	Kosicky kraj	17,9	3,7	5,1	10,1	26,6

Figure 2: Changes in mean annual air temperature in °C and tropical days (maximum temperatures reaching at least 30°C) in days for regions and regional capitals of Slovakia for the near (2021-2050) and far (2071-2100) future under RCP 4.5 and RCP8.5.

Climate projections by the Slovak Hydrometeorological Institute indicate that by 2071-2100 (*Figure 1 and 2*), the annual mean temperature for selected cities in Slovakia is expected to rise by approximately 1.2 to 3.4 °C compared to the reference period of 1991-2020, depending on the city and the climate change scenario (RCP4.5 or RCP8.5). This increase in temperature is anticipated to impact energy consump-tion patterns, leading to higher demands for cooling and lower requirements for heating. The warming is expected to be relatively consistent across the country, whereby scenario results show more pro-nounced levels of warming for southern and western parts of Slovakia. Additionally, heatwaves and the frequency of days with maximum temperatures exceeding 30 °C are projected to rise by the century's end.

Climate models forecast that by 2030, southern Slovakia could see an increase in the annual average air temperature of 0.7-0.9 °C (compared to 1991-2020 period). By 2050, this rise is expected to reach 2.0-3.0 °C, and by 2100, temperatures could increase by 3.5-6.0 °C, depending on the RCP scenario. Mini-mum temperatures are anticipated to rise more rapidly than maximum temperatures, potentially in-creasing by 6.0 to 10.0 °C for minimums and 2.0 to 5.0 °C for maximums by 2100. This pattern may lead to a reduced daily temperature range. While there are no major expected changes in the annual tem-perature pattern, autumn is projected to warm more slowly compared to other seasons. By 2100, sum-mer temperatures are expected to rise by 1.5 to 4.0 °C and winter temperatures by 2.5 to 5.0 °C.

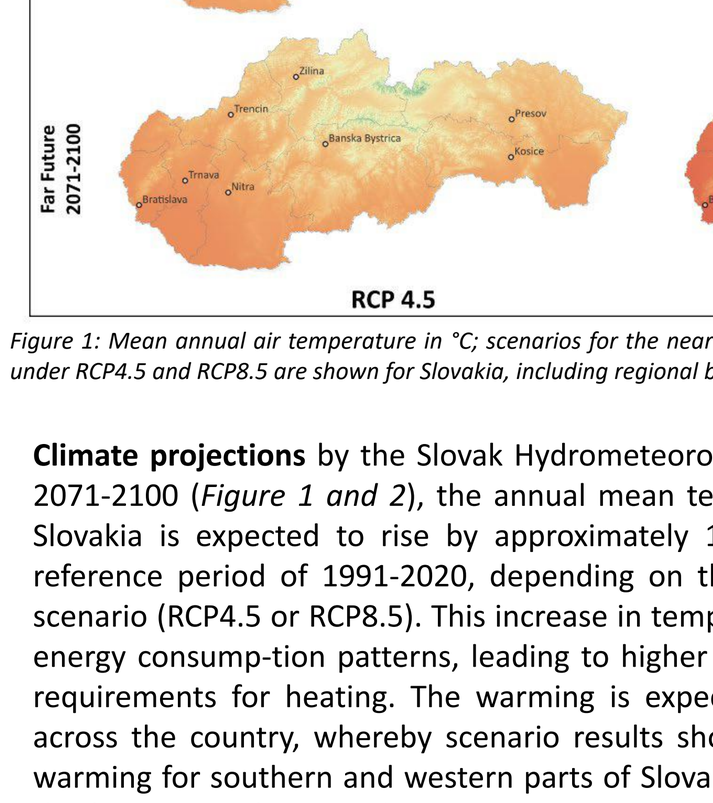


Figure 3: 25-field matrix template for sectoral climate impact assessments. Climate impacts above the red blurred line are climate impacts of high priority, which are considered for in-depth analysis..

Key Risks for Europe

The IPCC report for Europe (2022) has identified four key risks: heat, agriculture, water scarcity and flooding. While most risks are assessed as moderate until up to 1.5 °C warming, their severity increases substantially with every increment of warming.

Heat. The increasing frequency, intensity and duration of heat extremes and increasing mean temperatures influence human health, morbidity and mortality as well as productivity. Terrestrial and marine heat waves cause losses in biodiversity and species extinction, and reduces ecosystem service provision, especially in Southern Europe and the Mediterranean.

Agriculture. Heat also affects agricultural production and crop yields, especially compounding with dry conditions or extreme weather, leading to reduced crop quality and quantity as well as shifts in agricultural zones and desertification.

Water Scarcity. Risks related to water scarcity are already persistent in Southern Europe and are projected to increase in Western and Central Europe too. Water scarcity is closely connected to multiple other sectors, causing cascading impacts well beyond the scope of water availability and precipitation alone, as agriculture, ecology, energy supply and industries are negatively influenced. Droughts are projected to become more persistent, making water scarcity more widespread and severe, especially at 3 °C global warming level and beyond.

Flooding. Coastal, pluvial and fluvial flooding depend on regional spatial contexts and topography. As sea levels rise, so does human exposure in coastal areas, due to the amount of people and assets present. In parallel, inland pluvial flooding is considered a key risk in Europe due to the extent of exposed settlements and the limited adaptation options in urban areas.

Climate-related hazards, or climate impact drivers and non-climatic risk drivers are both broadly understood as risk drivers. Climate-related hazards are defined according to the categories of the EU Taxonomy (European Commission, 2021), i.e. temperature-related, wind-related, water-related and solid mass-related and aligned with the IPCC WGI Interactive Atlas. Non-climatic risk drivers are defined as ’processes and conditions that determine how certain climate-related hazards, individually or in combination, affect a human activities or ecological system. They range from environmental stressors to technical, socio-economic factors as well as policy aspects. Direct and/or indirect climate impacts were identified through literature research building the foundation of the later derived key risks. In contrary to the EUCRA report which uses the term ’major climate risk’, the term ’key risk’ is used, according the Climate Risk Sourcebook, in the present report to describe risks which have potentially severe adverse consequences for humans and social ecological systems resulting from the interaction of climate-related hazards with vulnerabilities of societies and systems exposed

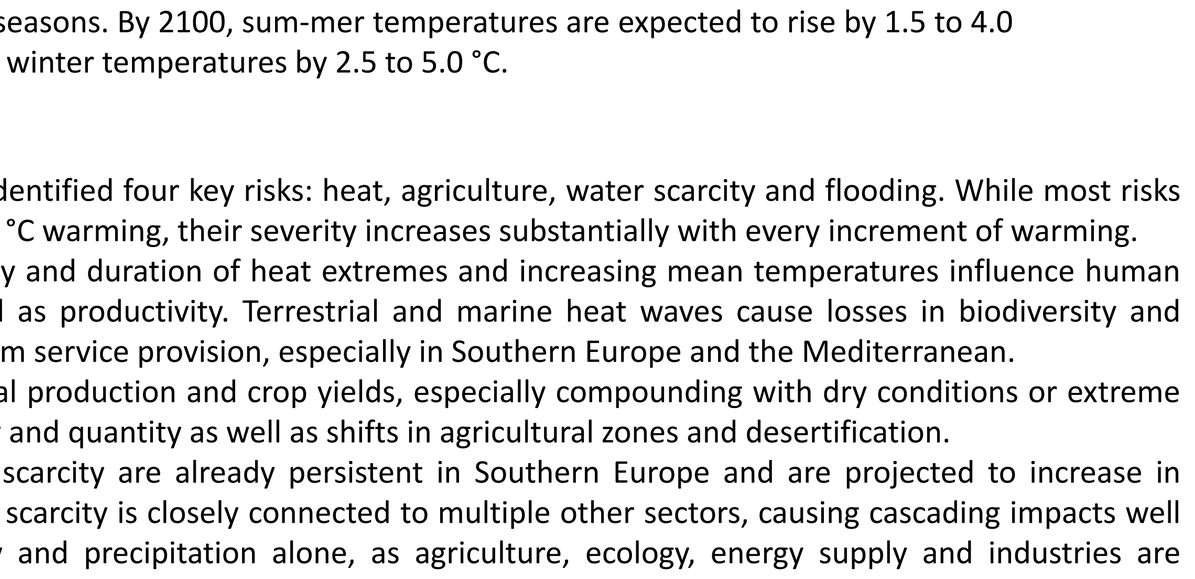


Figure 4: *Online web map service for emission scenarios and climatological indices* *https://geoportal.gov.sk/maps/default/datasets?view=-364444,-1247104,304.7887656217&adhoc-dataset-id=d8ceca69-3f13-40cc-b107-f81f13f5044f*

Acknowledgment

„Vypracovanie komplexných scenárov (2030/2050) zmeny klímy so zameraním na zraniteľnosť vybraných sektorov vo väzbe na adaptačné opatrenia“