CLIMATE OF SLOVENIA AT GLANCE

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Overview

Climatic conditions in Slovenia vary. There is a Continental climate in the northeast, a severe Alpine climate in the high mountain regions, and a sub-Mediterranean climate in the coastal region. Yet there is a strong interaction between these three climatic systems across most of the country. This variety is also reflected in climatic variability over time and is an important factor determining the impact of global climate change in the country.

Photo 1. Martuljek or Špik mountain range

Of course, average conditions do not reflect the variety of conditions that occur in the presence of different weather types, which are the main cause of variability. It is quite common that strong southwest winds bring clouds and precipitation to the west of Slovenia, while sunny and relatively warm weather prevails in the eastern part. Alternatively, when during winter low cloudiness and cold grey weather persists inland in the Primorska region it is sunny with a mild temperature.

Photo 2. Ljubljana and Ljubljanica river

Temperature

The temperature of the air in Slovenia has a well distinctive daily and yearly course. The greatest differences between maximal and minimal rates occur in the northeast of Slovenia, where the influence of the continental climate is the strongest. The sea has also a certain influence on the temperature of the air: it acts like a large thermal storehouse and it participates to a tighter temperature span of the air in the coastal region. The effect of the sea on the temperature rates is perceivable also in the valley of the river Soča up to the valley of Trenta.

Photo 3. Piran

The maximum air temperature depends mainly on the elevation, but for the minimum air temperature the situation is more complex. Even over a very short distance the differences can be significant. The lowest temperature occurs on elevated plateaus in the presence of snow cover when a strong temperature inversion forms in shallow basins.

Photo 4: Spring snowflakes (Leucojum vernum L.) on Ljubljansko Barje (Photo: Marko Clemenz)

Temperature trends clearly show there have been some changes during the last two decades, a trend of higher air temperatures can be spotted all over the county but, of course, there are some regional variations and the coastal region seems to show less pronounced temperature trends, mainly due to the vicinity of the sea. In urbanised areas the trends show a major increase, however that is mainly due to the rapid urbanisation and growth of cities. A notable rise in temperature has been observed at our highest mountain station, Kredarica (2514 m a.s.l.), where the impact of urbanisation is negligible. Differences between seasons are also well pronounced. The most intense warming trends are observed during winter and spring. There are also noticeable trends in the decrease in the number of foggy days and a trend of extended duration of solar radiation. To date, natural variability is so much larger than the observed trends that it is sometimes difficult to distinguish between natural variability and climate change impacts. Thus, although the majority of trends are not statistically significant these results indicate changes in the overall atmospheric circulation, which in our area is reflected in milder and sunnier winters.

Temperature inversion

Photo 5. Temperature inversion in Ljubljana basin

Ground inversions in calm and clear nights represent a common phenomenon within the inland regions. A high relative humidity and often also fog appear to be typical characteristics for the air below and inside the inversion layer. But as the nights during winter time are longer, also the inversion temperatures from November to February are stronger, resisting sometimes all day long or even for several days. In all the other months of the year, inversions dissolve early in the morning or up to midday. Strong temperature inversions occur sometimes also in the coastal region of the country (Primorje), when the valley of the river Po and the northern part of the Adriatic are covered with cold and moist air mass.

Precipitation

Great differences can be recorded not only in temperatures, but also in precipitation. Actually, there are areas, where annual precipitation is about 3500 mm, what is four times more than in relatively weak moistened northeast part of the country.

Photo 6. Babič's mill on Mura river in Veržej

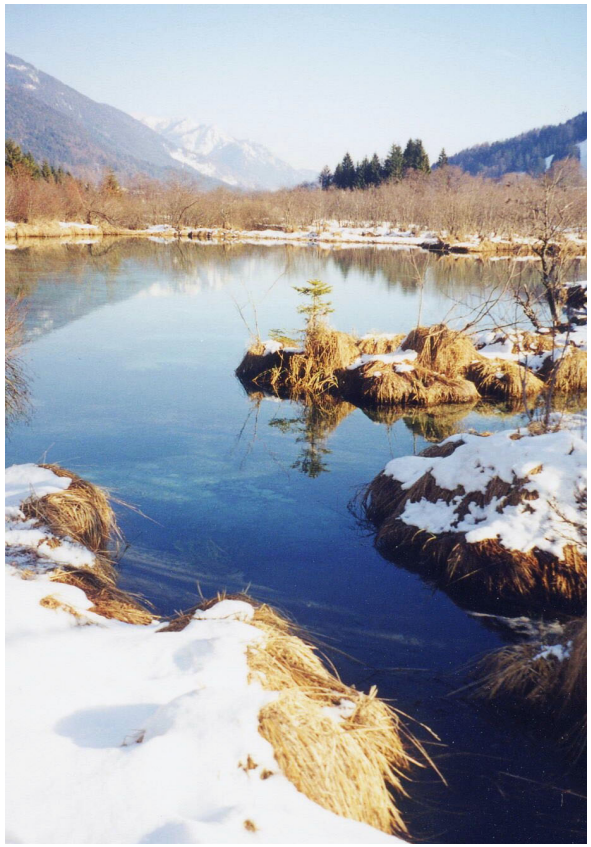

Photo 7. Zelenci, ground spring of Sava Dolinka river

The annual precipitation changes a lot with years, and the differences are even greater when the quantity per each separate month is in observation. The Julian Alps and the Dinaric-Alpine barrier receive the greatest amount of precipitation; the second maximum are the Alps above Kamnik and above Savinja river. The annual amount of precipitation declines with the remoteness from the sea towards the northeastern part of the country, and in Prekmurje it drops to 800 mm. Such a distribution is the consequence of the territory relief, but also of the fact that most of the precipitation are brought by the southwest winds. Regions under strong influence of the vicinity of the sea receive the highest rate of precipitation in autumn, while regions in the northeastern Slovenia, that are already affected by the continental climate, receive the maximum of precipitation in summer, but then again, the majority of these precipitation fall in heavy showers or storms.

Photo 8. Krka river

The number of days with at least 1 mm of precipitation moves between 90 and 130 days per year. Also the differences in distribution per season are not really high. But it is quite something else with the frequency of strong precipitation, of which the strongest are recorded in regions exposed to the greatest rate of perturbation. The highest daily quantities of precipitation, even those above 400 mm, have been recorded in the region of Posočje. During the warm part of the year, there is also a frequency of strong showers, and the estimation is that in one hour a precipitation of more than 100 mm is possible.

Sunshine duration

Photo 9. Close to the mountain Planjava two steinbocks enjoyed late summer sun rays (Photo: Matej Bulc)

There is enough solar radiation in a yearly average over the entire Slovenian territory. The highest rate of exposure to solar radiation goes to the region of Primorje, which is especially outstanding in winter, when the

interior of the country is often covered with low cloudiness and fog.

Photo 10. Sunflowers (Photo: Marko Clemenz)

Snow

The frequency of heavy snowfall in low-lying areas reveal considerable differences across Slovenia. Snow cover is quite frequent in winter in spite of the ever more frequent so-called green winters, but again variations from one year to another are well pronounced. In most instances a falling trend is more or less present; the cycles are notably stressed, especially the minimum at the end of the 1980s and beginning of the 1990s. Many areas also observed a minimum in the 1970s. The climax at the beginning of the 1980s is noticeable across the entire Slovenia. The deepest snow cover in Ljubljana came on 15 February 1952 when the snow cover was 146 cm thick. At Kredarica the maximum snow cover occurred in April 2001 and was 7 m thick.

Photo 11. Snow in Tamar

Winds

Strong winds are not very frequent in Slovenia. With the exception of strong wind gusts that usually accompany storms, the burja (bora) is the strongest and exceptional gusty wind in Slovenia. In gusts it reaches a velocity of up to 45 m/s. It is typical of the Vipava valley, the Karst and the coastal region. It blows mostly from the northeastern direction, but due to the construction of the relief, it deviates locally also to the east and to the north. In locations where burja is the strongest, sometimes traffic is disturbed or in case of extremely strong burja (bora) even interrupted for long and large vehicles.

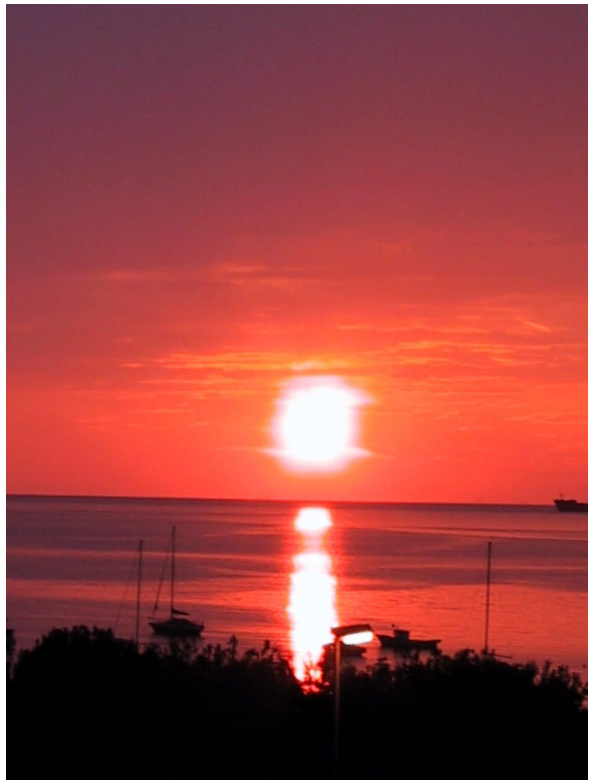

Photo 12. Sunset in Koper

The north fen is another occasionally very strong local wind, from time to time its consequences destroy parts of woods and buildings, yet strong southerly winds can also have similar impacts, although in different areas.

Photo 13. Lake Bled with the castle

Extreme events

Average conditions are not enough to properly describe the climate. Apart from averages, another important aspect of climate involves extreme events as they constitute an integral part of the natural climate. Although Slovenia is relatively small, the differences in the magnitude and frequency of extreme values of weather variables in respective parts of the country are noticeable and crucial. Due to the very well pronounced variability and, by definition, rare occurrence of weather and climate extremes it is difficult to assess trends and long-term variations. The time between two occurrences of one particular extreme event in a certain area may extend over a period of several years. All extreme events observed to date will continue to occur in the future, along with the expected climate change impact on extreme weather we will most likely experience an increase in both its intensity and frequency. We also need to take into account the possible synergistic effects of various components of the climate system and the environment.

Photo 14. Vineyards in Dolenjska region

Extreme weather and climate events have always represented a threat to society and the environment, in such a varied climate as ours extremes have various impacts and their consequences involve different aspects. Torrents and floods are a direct result of heavy precipitation which may, however, also cause a series of other harmful events such as soil erosion, landslides and material deposits onto fields and pastures. The intensity of events that cause significant damage is not uniform throughout the country. Thresholds for each region should be set separately. There are almost no differences among regions in short intense precipitation lasting from several minutes to several hours, but there are outstanding differences in daily and multi-day extreme precipitation among regions. The share of the most intense precipitation across Slovenia is either increasing or stagnating; linear trends are not statistically significant, there is the strong prevalence of cyclical changes. In the Julian Alps the daily maximum is comparable with one-half of the annual precipitation in the northeast of Slovenia.

Extreme events represent a major burden on the environment so climatic analyses of such events are necessary for assessing the damage and for all interventions in space (threat risk, planning etc.). The regular monitoring and analysis of extreme events is important for establishing climatic changes since with such monitoring we also monitor the frequency and intensity of these events. At the

same time, data on the intensity of extreme events provide the necessary basis for assessing the damage that such an event causes. Normally, extreme events that cause damage receive greater attention. It is not necessary in this that any meteorological variables achieve an extreme value. During droughts, for example, it is not necessary that the lack of rain is extremely high, just that it is unusually high for the time of the year in which it appears. How a specific extreme weather event affects the environment therefore depends on a range of factors: from the adaptability of the environment, the time in which the event occurs, the weather in the previous period etc. An increase in the intensity and frequency of extreme events is considered to be closely related to climatic change.

Photo 15. Swans on Drava river

Drought

Photo 16. The 2003 summer drought affected crop yields

One of the extreme phenomena that causes a great deal of damage, above all to arable farming, is drought. Although Slovenia gets enough annual precipitation, we have experienced a severe summer drought four times during the last 15 years. Especially the northeast of Slovenia is a drought-prone region. In addition, in the Karst and coast regions a summer drought is quite common, although it is geologically driven. Damage caused to agricultural production has been significant. The most serious drought was in summer 2003.

Floods

Photo 17. Hladnik stream turned into raging torrent

Further, floods as a consequence of abundant precipitation are not unknown in Slovenia. Flash floods are usually a consequence of intense precipitation during thunderstorms, even small streams can turn into raging torrents in the mountainous regions, while more extensive floods are caused by rainy

periods which can occur at any time during the year, albeit most of them are concentrated in autumn.

From time to time landslides are also triggered as an indirect consequence of abundant precipitation.

Photo 18. In the late afternoon cumulus clouds formed above Koper and later on developed into thunderstorm.

Thunderstorm

Every year local severe weather affects our country a few times, strong thunderstorms are coupled with strong wind gusts, intense precipitation and sometimes hail cause significant damage to local communities, while heavy precipitation sometimes results in flash floods.

Black ice

Sometimes rain coupled with warm advection aloft and the persistence of a temperature inversion in lower part of the atomsphere results in the formation of black ice, especially in the region of Brkini and Notranjska; significant damage to electro-infrastructure and forests has been observed several times in the last few decades.

Photo 19. Black ice (Photo: Matej Bulc)

Frost

Individual parts of Slovenia vary considerably in their level of frost risk. The frequency of frost is greater in open basin and flatland areas, but less on slopes and crests as well as in locations where relief conditions allow good wind circulation. The altered climate conditions will increase the risk of frost in Slovenia.

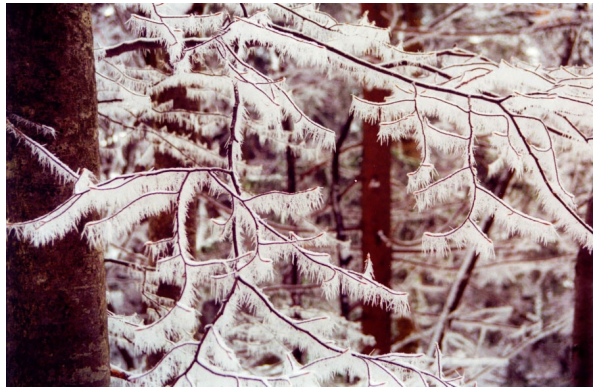

Photo 20. Rime (Photo: Matej Bulc)

Climate change and vulnerability

In wrapping up it might seem that we are particularly endangered by extreme weather events but fortunately they are quite rare and achieve a destructive force only in a very limited area. But this might change in the future.

Photo 21. Cornfield

Slovenia is a heterogeneous country not only in its climate and relief, but also in its vegetation. This diversity in vegetation is affected by different temperature conditions, which directly define the length of the yearly vegetation period.

Photo 22. Health resort Šmarješke Toplice, there are several health resorts in Slovenia

Photo 23. Vršič Pass (the highest in Slovenia)

During the last year more attention was paid to extreme events and potential conesquences of climate change and a project focussing on assessing the impacts of potential climate change in Slovenia was established. The first step is to determine the vulnerability of our environment and society to climate change. The main threat is represented by extreme weather and climatic events, therefore signals of a change in occurrence and intensity are being looked for, although past extreme events and their impacts and long-term consequences have also been studied carefully.

Glaciers

Glaciers are indirect indicators of climatic change, they respond quickly and noticeably to climatic change. There are only two small glaciers in Slovenia, the best known one is the Triglav glacier and the second one is situated on the slopes of Mount Skuta. Both of them lie at a relatively low altitude and are subjected to the detectable impact of climatic changes. The existence of the Triglav glacier can no longer be taken for granted; in the 19th century it covered 45 ha but recently it only encompassed 1.1 ha.

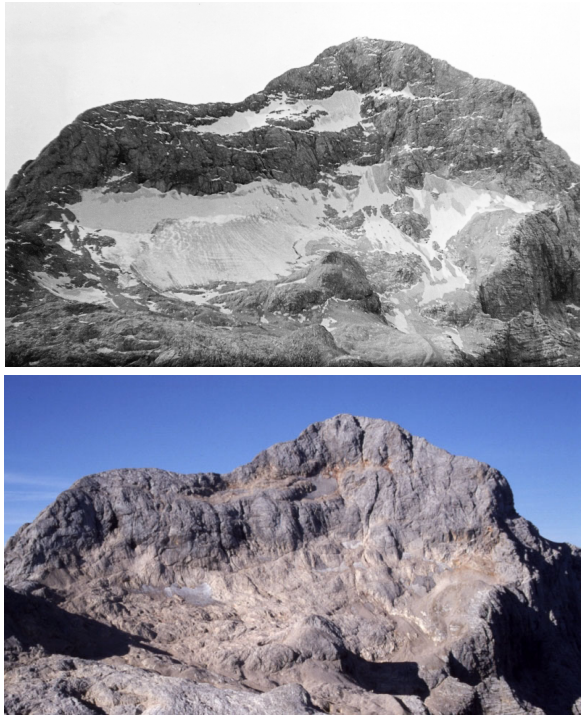

Photo 24. Triglav glacier in the year 1957 and 2003 (Photo: Archive GIAM ZRC SAZU and Matej Gabrovec)