

PRACE GEOGRAFICZNE, zeszyt 107

Instytut Geografii UJ
Kraków 2000

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BEGINNINGS OF INSTRUMENTAL METEOROLOGICAL OBSERVATIONS IN SLOVENIA

Abstract: An overview of the history of systematic instrumental measurements of meteorological parameters in Slovenia is presented. Instrumental period of meteorological observations in Slovenia can be divided in three sub-periods. The first official meteorological observing station on the ethnically Slovenian territory was established in Trst (Trieste) in 1779 (Pučnik 1980). The second important period of instrumental measurements of meteorological parameters started after the First World War, during this period in Ljubljana *Zavod za meteorologijo in geodinamiko* (Institute for Meteorology and Geodynamics) was established in the frame of University (Trontelj 2000). After the Second World War the Hydrometeorological Institute was established, which is operating till nowadays; this is the third period. Most of the data are taken from the archive of Hydrometeorological Institute of Slovenia, but also some other sources were taken into account.

Key words: meteorological observations, Slovenia, Kredarica, Ljubljana.

1. Introduction

The first official meteorological observing station on the ethnically Slovenian territory was established in Trst in 1779. The second station was set up in Gorizia, it started collecting data in 1781, but as far as we know, data since 1788 are preserved (Pučnik 1980). Similarly to Trst also Gorizia nowadays belongs to Italy and is outside Slovenian borders. In the following we will concentrate on the establishment of network within the borders of the present Republic Slovenia.

There are records that the third meteorological station in Slovenian territory was in Tolmin, functioning from 1784 to 1810 (Pučnik 1980). No data from that period are available. Written evidence exists (Lippich 1843) that meteorological observations in Ljubljana started in 1820, F. Francka is reported as observer. Probably those

observations stopped in 1834, there are some fragments of those data available today, but they are not substantial enough to reconstruct the data set from those period.

It was the *Societas Meteorologica Palatina* that promoted meteorological observations in Europe and also in Austro-Hungarian empire (at that time Slovenia was a part of the empire). At the beginning *Kaiserliche Akademie der Wissenschaften* played a leading role in establishment of observation network, and in 1848 they established *Zentralanstalt für Meteorologie und Erdmagnetismus* in Vienna, which took over the organisation and professional leadership of meteorological stations in the empire. The first director was Carl Kreil. But not all the stations belonged to the *Zentralanstalt*, precipitation stations mostly belonged to the *Hydrographisches Zentralbüro* established in 1893 in Vienna. Among the most prominent promoters of meteorology in the empire was certainly the director of ZAMG Julius Hann. He gave a due importance to the representatively chosen measuring sites, the accuracy of instruments and precise observing protocol (Pučnik 1980).

2. First Meteorological Stations in Slovenia

Zentralanstalt für Meteorologie und Erdmagnetismus started to establish the first systematic network on the present territory of Republic Slovenia. A station in Ljubljana was re-established in 1850 (March, 23rd) and with small changes in the location it is still operating. The first location was nearby a telegraph office, and the first observer was Wagner; Zeilinger took over him until February 1857. It was a meteorological observation site of second order, air pressure measurement was introduced in January 1852. In 1853 the station was moved in Prečna ulica (Prečna street), where operated until 1896, when it was moved in Vegova ulica (Vegova street).

But that was not the only observation site in Ljubljana, Hydrographic section operated a precipitation station (a station of third order) from 1895 to 1919, at that time the snow depth was measured only at that site.

After Ljubljana many other stations were established in Slovenia, for example in Celje in 1852, Novo mesto in 1858, Maribor in 1863, Ptuj and Kranj in 1864, Kamnik in 1871, followed by many others. Even at that time it was difficult to find observers ready to scrupulously perform their duties. Many of the stations collected data only for a short period, sometimes only few months. Illnesses, death, but also frequent removals of observing sites had impact on data quality from that period. Of course, metadata from that period are scarce, often completely missing. Among the most known observers from that time is F. Seidl, an observer in Novo mesto from 1885 to 1887. He published some relevant descriptions of climate in Slovenia (Seidl 1886; Seidl 1887; Seidl 1902; Seidl 1935; Seidl (year of publication not known)).

Until the beginning of the 20th century the number of stations significantly increased. Most of the data from that period are still preserved, not as originals, but mostly as monthly data published in the annual reports of the *Zentralanstalt für Meteorologie und Erdmagnetismus* in Vienna (later renamed to *Zentralanstalt für Meteorologie und Geodynamik*).

3. Between the First and the Second World War

After the First World War Slovenia became part of the SHS kingdom, later known as Yugoslavia. In 1918 General Inspectorate of water operated 86 meteorological stations of third and fourth order in Slovenia. Mainly due to the engagement of F. Seidl Meteorological station in Ljubljana was expanded into Institute for Meteorology and Geodynamic. When in 1920 A. Gavazzi became a director, only meteorological stations in Ljubljana, Celje, Novo mesto and Maribor belonged to the Institute. Lack of financial means was the main problem at that time. Aware of the problems, but also trying to provide representative meteorological data, Gavazzi moved the measuring site from centre of the city to Šiška (the north suburb of Ljubljana). He introduced thermograph and hygrograph at Ljubljana station. Already in 1922 the measuring site moved again in the centre of the city; the courtyard of a maternity hospital was chosen as the best observing site.

In 1921 the parallel meteorological station in Ljubljana was established, but the site was peculiar, it was situated on the second floor of Geographic Institute. For some shorter periods also other measuring sites were operating in Ljubljana. Gavazzi tried to increase the number of meteorological stations in Slovenia; in spite of lack of funds, he succeeded to engage several teachers, priests, monks and members of hospitals' staff in order to assure the reliability of the data. In 1924 about 120 measuring stations were active, but only four of them were equipped with recording instruments. As in 1927 Gavazzi moved to Zagreb, O. Reya took the position over him. He continued to establish new observing sites and to improve data quality. During his heading of the Institute the meteorological network consisted of 276 measuring stations (Pučnik 1980).

4. Mountain Observatory on Kredarica

Before the era of radiosounding, which enable us to measure the vertical profiles of temperature, wind and humidity from a ground level up to the height of about 20 km, observatories on high mountains were extremely important. They were the only available way to find out what was going on in a free troposphere. So, about one hundred years ago many mountain stations were established in the Alps, some of them on the top of very high mountains (for example Sonnblick, Zugspitze, Jungfrauoch). Already in 1897 the first meteorological observing site was established on Kredarica, the first observer was Anton Pekovec. Because of the severe climate, observations were performed only during summer. Original data were destroyed during the Second World War, but monthly data were published in *Zentralanstalt's Annals* and in *Planinski vestnik* (Planinski vestnik 1897-1905, 1908, 1912, 1948). We can trace data from Kredarica until 1912. In August 1954 observation station on Kredarica (2514 m a.s.l.) was re-established, and since then the data set is complete. Kredarica is not situated at the very top of the highest mountain in Slovenia (which is Triglav), that is why the wind rose from Kredarica is not representative for the free atmosphere. The

mountain Triglav is sheltering Kredarica from north-east winds, and south-west winds are rare. In 1991 night observations were introduced, and in 1994 an automatic meteorological station was added to the classical instruments. Beside Kredarica a mountain meteorological and ecological measuring site on Krvavec is operating at the altitude of 1740 m a.s.l. This station is also located on the slope, not on the top of the mountain.

5. The Last 50 years

During the Second World War most of the stations ceased to work, the rare exceptions were Ljubljana, Maribor, Novo mesto and Celje. The first military meteorological station in Slovenia was established in Draga pri Gorjancih in June 1944, the second one in autumn 1944 in Črnomelj. In May 1945 four meteorological stations were active in Slovenia, from those four two were synoptic ones (Maribor and Celje) and two were located at the airports in Črnomelj and Ljubljana.

In January 1947 a civil Hydrometeorological Service in former Yugoslavia was established. In Ljubljana on May, 24th 1947 Hydrometeorological Institute of Slovenia was founded (Vlada LRS 1947). At that time there were only few meteorological stations in Slovenia, financial and personal resources were extremely limited. In 1947 the present location of meteorological observatory in Ljubljana was chosen and in 1948 the first measurements started at the observatory Ljubljana Bežigrad.

Reconstruction of the former measuring sites, destroyed during the war was proceeding slowly. Precipitation stations were given the priority. Much more resources were needed to reconstruct the so called climatological stations, we had to import all the instruments and to educate observers. Not an easy task at all! Use of instruments from many different manufacturers created additional problems, it was difficult to provide suitable substitute parts for broken instruments. Not less difficult was to find qualified observers and volunteers willing to respect a rigorous protocol of meteorological measurements and observations. In the 70's in Slovenia there were 383 meteorological stations (including synoptic, climatological and precipitation stations).

6. Conclusions

It is evident that Slovenia took part in the early development of meteorological network. Many times only the enthusiasm of some enlightened individuals helped to overcome the difficulties and to find ways to improve the meteorological observations and measurements. In our archives there are more than hundred years long data sets, allowing us to detect the most relevant characteristics and variations of climate over the last century, for some places even for a longer period. We recognise that our colleagues have done a great job and it is up to us to continue their work. Unfortunately in the last two decades the number of meteorological stations decreased drastically, mainly because it is more and more difficult to find enthusiasts (the so called volunteers are terribly under paid) willing to observe weather regularly, funds are reducing

constantly. Due to recent social and political changes, the decision makers show less interest and understanding for meteorological monitoring and applications. After the former Yugoslavia disintegrated, and Slovenia became independent in 1991, Hydrometeorological Institute of Republic Slovenia started to operate also as national meteorological and hydrological service. Since 1992 Slovenia is a member of World Meteorological Organization, that gave us more opportunities for international co-operation, but also many more duties and tasks to perform.

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