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Spatial and Seasonal Variability of Extreme Soil Temperature in Croatia

Petra Sviličić (1) and Višnja Vučetić (2)

(1) Meteorological and Hydrological Service, Croatia (petra.svilicic@cirus.dhz.hr), (2) Meteorological and Hydrological Service, Croatia (visnja.vucetic@cirus.dhz.hr

In terms of taking the temperature of the Earth in Croatia, first measurements began in 1898 in Križevci, but systematic measurements of soil temperature started in 1951. Today, the measurements are performed at 55 meteorological stations. The process of setting up, calibration, measurement, input, control and data processing is done entirely within the Meteorological and Hydrological Service. Due to the lack of funds, but also as a consequence of the Homeland War, network density in some areas is very rare, leading to aggravating circumstances during analysis. Also, certain temperature series are incomplete or are interrupted and therefore the number of long-term temperature series is very small. This particularly presents problems in coastal area, which is geographically diversified and is very difficult to do a thorough analysis of the area. Using mercury angle geothermometer daily at 7, 14 and 21 h CET, thermal state of soil is measured at 2, 5, 10, 20, 30, 50 and 100 cm depth. Thermometers are placed on the bare ground within the meteorological circle and facing north to reduce the direct impact of solar radiation. Lack of term measurements is noticed in the analysis of extreme soil temperatures, which are not real extreme values, but derived from three observational times. On the basis of fifty year series (1961-2010) at 23 stations, the analysis of trends of the surface maximal and minimal soil temperature, as well as the appearance of freezing is presented. Trends were determined by Sen's slope estimator, and statistical significance on 5% level was determined using the Mann-Kendall test. It was observed that the variability of the surface maximal soil temperature on an annual and seasonal level is much higher than those for surface minimal soil temperature. Trends in the recent period show a statistically significant increase in the maximal soil temperature in the eastern and the coastal regions, especially in the spring and summer season. Also, the average duration of the period in which soil freezing occurs did not change between the recent period (1981-2010) and the standard climatological period (1961-1990). However, first freezing occurs later in the recent period, and the last day of freezing has not changed. Data requirements for the soil temperature come from different users. In agriculture it is very important to know the starting date of sowing, which is largely determined from the thermal state of the soil surface. Also, soil temperature plays a key role in heat stress for plants that cannot tolerate prolonged high or low temperatures. Freezing of the ground is very important in agriculture and construction. The soil can squeeze out more damaged plants which can thus be exposed to drying. In the construction industry, swelling and uplift of the soil can occur during water collecting and creation of ice lenses during the winter period. Also, the freezing of the soil is essential when setting up the gas pipeline, water pipes and underground cables.