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Drought in the Lower Danube

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Bulgaria is situated on the Balkan Peninsula. Its northern frontier is the lower part of the Danube. The Balkan range, with its zonal situation, is part of a natural climatic frontier, dividing Bulgaria into two parts—north and south.

One of the main features of the climate in the Danube Plain (northern Bulgaria) is insufficient precipitation—a tendency toward dryness and frequent droughts. The annual amount of precipitation is 500–600 mm. The highest monthly values are measured in June (in some places in May), with 55–75 mm. February (in some places, March) is the driest month. Absence of precipitation can occur in any month, but the probability of this happening in May and June is very low. At the same time, monthly precipitation can exceed 100 mm in any month; in the summer it can even exceed 250–300 mm. The radiation balance is about 50 Kkal.sm⁻².

In this study, Budyko's dryness ratio (1985) is used to define land moistening. The ratio is:

$$K = R / L.r$$

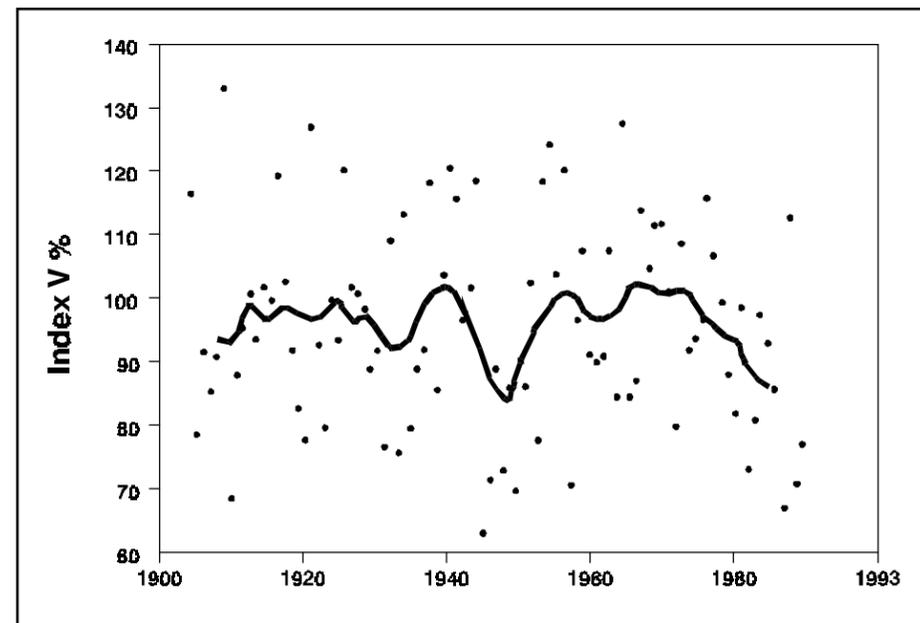


Figure 1. Variability index (%) for annual precipitation, 1901–93.

where R is the annual radiation balance, r is the annual precipitation total, and L is the latent heat of vaporization of water. This ratio defines what part of the radiation balance is used for precipitation vaporization. When K is less than 0.45, the climate is considered excessively moist; between 0.45 and 1.0, moist; between 1.0 and 3.0, insufficiently moist; and greater than 3.0, dry. The values of K for Bulgarian stations are between 1.5 and 2.0; the Danube Plain climate therefore is insufficiently moist (subhumid).

The variability of average precipitation from year to year in this region can be expressed as a simple index:

$$V_j = 1 / n \sum x_i / x_i \cdot 100\% \quad j = 1 \dots N \text{ years}$$

where x_i is precipitation at the i station, x_i is the average precipitation for the same station, and n is the number of stations. In this study, index V for annual precipitation and V1 for May–September precipitation is computed. Individual years in the 20th century based on precipitation index V and V1 are ranked from driest to wettest.

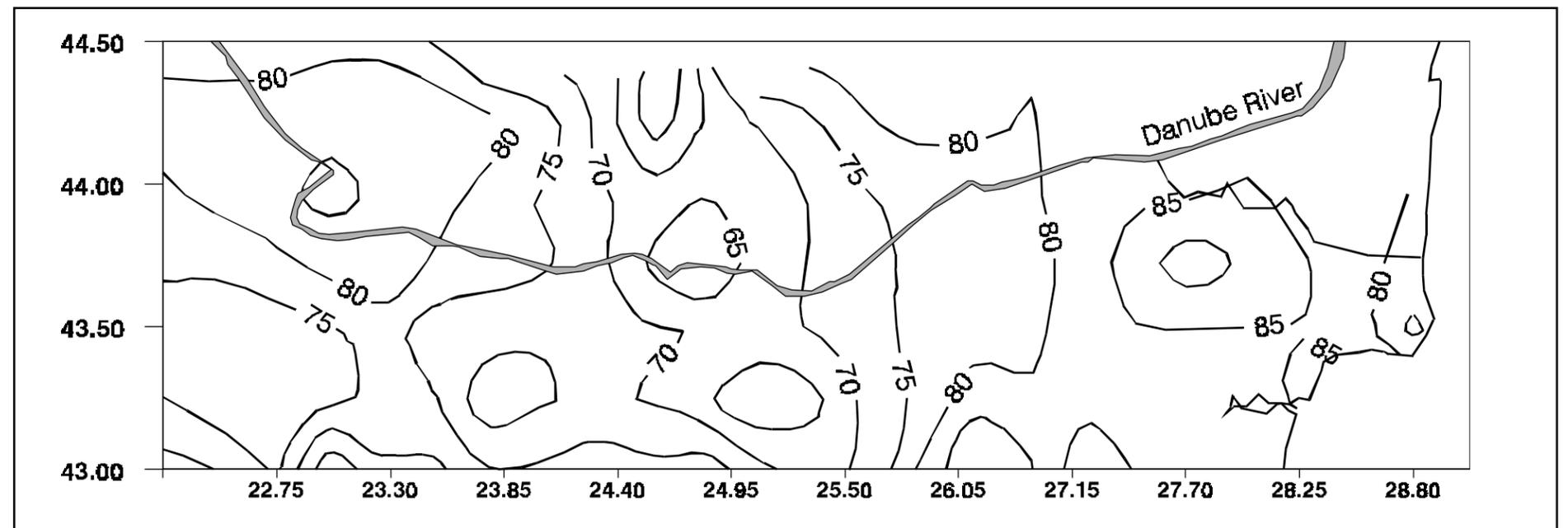


Figure 2. Departure (%) of precipitation (1985–90 average) from the 1961–90 average for May–September in the lower Danube Basin.

The driest year (up to the end of 1993) is 1945, which was abnormally dry in almost every part of the considered region. The second and third driest years are 1990 and 1907, respectively. Recent years that were below normal include 1992 and 1993 (sixth and sixteenth driest years, respectively, on record). In the western part of the Danube Plain, 1992 and 1993 were much below normal, ranking as the fifth and sixth driest years, respectively, in this part of the region. The 1980s were the driest decade of the century, with the 1940s ranking second. Six of the past thirteen years were in the driest twenty, and four were in the driest ten. In 1991, precipitation was predominantly above normal for the entire region.

The driest May–September period occurred in 1945, when precipitation was very much below normal. The second driest May–September period occurred in 1958; the third, in 1907. Other recent years with very dry May–September periods include 1993 and 1990 (tenth and eleventh driest, respectively). Nine of the last thirteen May–September periods (1981–93) had much below normal precipitation (more than 20% below normal).

In recent years, drier than normal conditions persisted throughout the entire region of the lower part of the Danube Basin. The persistence of drought at this level occurred only once in this century—1945–53 (Figure 1). Recent May–September periods have also been especially dry. Figure 2 shows the percentage departure of precipitation (1985–90 average) from the 1961–90 average for May–September in the lower Danube Basin. Data for 37 stations are used (including data for seven Romanian stations). A broad area of much below normal precipitation (65% below normal) covers the entire central part of the region.