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Stable isotopic compositions of carbon in vegetation and soil organic matter along the bioclimatic transect, North Caucasus

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Stable isotopic composition of carbon in plant species and soil organic matter was investigated along the bioclimatic transect in the North Caucasus. The aim of this research was to find the possible shift of stable isotopic composition of carbon reflecting the gradual successive changes of landscapes connected with the changes of climatic conditions (temperature, precipitation, air humidity) at a various absolute heights above sea level i.e. along the vertical zonation.
The study site was located in the North Caucasus near Arkhiz, Big Zelentchuk valley (43o33-40'N; 41o16-27'E). Soil and vegetation samples were collected along Precaucasus and Caucasus slopes at an absolute heights interval of 1280 – 2065 m. Soils are formed at eluvo-deluvium of noncarbonated silicate massive rocks under warm temperate climate with MAT 4-5oC and MAP $\sim$ 860 mm and more. Samples of vegetation (whole grasses and tree leaves) represented several altitudinal vegetation belts including forest and subalpine belts with coniferous (pine, spruce, fir), mixed coniferous-deciduous (fir + beech), broad-leaved (beech, maple), small-leaved (birch, aspen) forests, elfin birch wood and subalpine meadows. Stable isotope composition of carbon was determined using IRMS Finnigan Delta V+.
Stable isotopic composition of vegetal species ranges from -33.04 to -27.29 o/oo with the general trend of lighter 13 with the decreasing of absolute heights. The most heavier 13 = $\sim$ -27o/oo were found in subalpine meadow plants, while at a smaller altitudes in the forest belt 13 shifts to $\sim$ 30-31, and up to $\sim$ - 32-33o/oo.
More clear regularities were found for vegetation specimens grouped into three categories such as "trees", "grasses" and "litter". 13 of each category clearly shifts to the lighter values with the decrease of absolute heights i.e from subalpine meadows to spruce-broad-leaved forests. 13 shift is about 2,49o/oo for trees, 1,75-4,92 o/oo for grasses and $\sim$ 1,8 o/oo for the litter. The complimentary determination of 15N have shown large variability from -3,59 to + 18,24o/oo which corresponds with the expected large variation of 15N of plant debris and general trend of lighter 15N during the decomposition.
13 of soil organic matter varies from -28.92 to –24.99 o/oo. The similar trend for lighter stable isotopic composition of carbon at a lower absolute heights i.e. in forest belt was found for soil organic matter. The whole picture of 13 values in soil samples is quite complicated and needs further investigation.
As a result, the isotopic characteristic of carbon and nitrogen in vegetal specimens, and carbon in soil organic matter were obtained along a bioclimatic topocatena. The general trend of lighter C isotopic composition was found. It is known that lighter isotopic composition correlates with cooler and/or wetter climate. While the temperature gradually decreases upward, the changes of precipitation are not linear. Further research is needed to better explain the variation of stable isotopic compositions in dependence of those climatic factors.

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