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Wet–dry seasonal and vertical geochemical variations in soil water and their driving forces under different land covers in southwest China karst

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Karst aquifers supply drinking water for 25% of the world's population, and they are, however, vulnerable to climate change. Bimonthly hydrochemical data in karst soil water samples from July 2010 to July 2011 were obtained to reveal the seasonal and vertical geochemical variations in soil water under five vegetation types in Qingmuguan, a small karst catchment in southwest China. Soil water chemistry was dominated by Ca2+, HCO_3-, and SO42− because of the dissolution of limestone, dolomite, and gypsum minerals in the strata. The predominant hydrochemical types in soil water were Ca2+–HCO_3-, Ca2+–SO42−, and mixed Ca2+–HCO_3-–SO42−. Ca2+ and HCO_3- concentrations ranked in the following order: shrub land > dry land > afforestation farmland > bamboo land > grassland. In warm and wet seasons, the main ion concentrations in soil water from grasslands were low. Na+, K+, Ca2+, Mg2+, HCO_3-, SO42−, and Cl− concentrations in soil water from other lands were high. An opposite trend was observed in cold and dry seasons. Marked seasonal variations were observed in Ca2+, HCO_3-, and NO_3- in soil water from dry land. The main ion concentrations in soil water from bamboo lands decreased as soil depth increased. By contrast, the chemistry of soil water from other lands increased as soil depth increased. Their ions were accumulated in depth. A consistent high and low variation between the main ions in soil water and the contents of carbonate and CO_2 was found in the soil. Hydrochemical changes in soil water were regulated by the effects of dilution and soil CO_2.