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Responses of hydrochemical inorganic ions in the rainfall-runoff processes of experimental catchments and its significance for tracing

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Aimed at the rainfall-runoff tracing using inorganic ions, experimental study is conducted in the Chuzhou Hydrology Laboratory with special designed experimental catchments, lysimeters, etc. The various runoff components including the surface runoff, interflow from the unsaturated zone and the groundwater flow from saturated zone are monitored hydrometrically. Hydrochemical inorganic ions including Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, SO_4^{2-}, HCO_3^-+CO_3^{2-}, NO_3^-, F^-, NH_4^-, PO_4^{2-}, SiO_2 and, pH, EC, ^{18}O are measured within a one month period for all processes of rainfall, various runoff components and groundwater from 17 boreholes distributed in the Hydrohill catchment, few soil water samples are also included.

The results show that: (a) all the runoff components are distinctly identifiable from both the relationships of Ca^{2+} versus Cl^-/SO_4^{2-}, EC versus $Na^+/(Na^+$+$Ca^{2+})$ and, from the inorganic ions individually except those of NO_3^-, NH_4^-, PO_4^{2-} which is not existed in runoff components; (b) the process of inorganic ions in surface runoff has biggest variations which marches the rainfall while that in interflow and in groundwater flow has there variations flattened; (c) however, with only few exceptions, the concentration of same ions has the lowermost in rainfall process but it is increased as the depth of runoff components increased; (d) quantitatively, the process of all ions measured in runoff components tends to have two end members i.e., the rainfall process and the process of groundwater in the catchment and (e) the ^{18}O processes of

rainfall and all the runoff components show some correlation with that of inorganic ions.

The results also show that the rainfall input is not the main source of the inorganic ions of the runoff outputs even it acts as an unique role of the formation of the output due to the process of infiltration and dissolution with the ions resulted from the pre-event process of ecology and water-rock (soil) interactions including those happened during geologic/historic time. A simplified model is then suggested for the ionic responses from the catchment rainfall-runoff processes.

From the results related to the amount distribution and sources of Cl^- and, the existence of various runoff components with different generation mechanisms, the current method for groundwater recharge estimation using Cl^- is challenged.