

Four end-members mixing model of river runoff with using hydrochemical tracers in the task of hydrograph separation

Tatiana Gubareva (1), Boris Gartsman (1), and Nikolay Solopov (2)

(1) Water Problem Institute RAS, Moscow, Russian Federation (tgubareva@bk.ru), (2) PJSC Rostelecom, Vladivostok, Russian Federation

Four component (end-members) geochemical mixing model was adapted to evaluate a water sources of small rivers. The mixing model is a system of mass balance equations for water and tracers. This adaptation includes the search of analytical solution of model equations, the application of end-member mixing analysis using Principal Component Analysis, and the visualization of a mixing diagram in U-space. Modeling procedures were realized in the special original computer program Tetra_Editor. As potential water sources were taking account overland flow (direct flow to the river), soil waters from different horizons and parts of river watershed, and ground water forming the baseflow. The Principal Component Analysis allows selecting three first principal components which are orthogonal projections of all potential tracers. These three projections are considered as three complex tracers. Four end-members were identified by analysis of mixing diagram in U-space.

This variant of model was tested on two small river catchments in Sikhote-Alin Mountains in Primorye, Russian Far East on original data of hydrochemical and hydrological measurements for river water and water of potential water sources for some years 2013 and 2014.

The result of analysis and calculations showed that four end-members contribute the river runoff in these years; there are surface flow, two end-members of hillslope flow presented by samples of soil waters and the base flow. Results of a mixing model validation with four end-members and its verification are showed a high quality of the modeling.