Geophysical Research Abstracts
Vol. 16, EGU2014-9769, 2014
EGU General Assembly 2014

Applications of passive sampling methods to reveal source apportionment in a lake catchment, the environmental behavior in rivers and the vertical profile in deep lakes

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We have established monitoring method for radioactive caesium in surface water is passive sampling by using Chemcatcher® and caesium rad disk (Empore disk). This method does not need mass volume of water samples, concentration by heat and Germanium semiconductor detectors. We can evaluate Time-Weighted Average (TWA) concentration of dissolved radioactive caesium in several weeks at any monitoring sites such as surface layer and bottom layer in rivers, lakes and estuaries. Therefore, we applied this method to two important monitoring projects which conventional grab sampling can not accomplish.
One project is evaluating mass flow of radioactive caesium from contaminated basin into a lake where contaminated aquatic organisms live (environmental behaviour). It is also important that which parts of the basin contribute to radioactive caesium mass flow in surface water (source apportionment). Lake Teganuma, which has two large input rivers, is one of the contaminated lakes by radioactive caesium in Japan. We tried to reveal the environmental behavior and source apportionment of radioactive caesium in Lake Teganuma catchment by our passive sampling method. Passive samplers and portable water level indicators were deployed at nine sites in Lake Teganuma catchment during two weeks. We also estimated relationships between water level and water mass flow rate at each site. This monitoring gave us TWA concentration and mass flow of dissolved radioactive caesium at each site. These results indicated that high TWA concentration of radioactive caesium was calculated in surface water from one of the small basin. GIS analysis of basins and the land use distribution also estimated one possible source (Hot spot area?).
The other project is revealing vertical trend of radioactivity in deep lakes contaminated by radioactive caesium in Fukushima. It is important to understand it during four seasons in order to use water resources safely. We deployed passive samplers and portable water temperature gauges at surface, middle and bottom layers in a Fukushima lake during one month. These results showed vertical radioactivity trends in the lake. It also revealed that relationships between radioactivity profile and water temperature profie.Our passive sampling monitoring can give us new important information to reveal both horizontal and vertical behavior of even trace level of radioactive caesium.