



Distribution of preferential flow pathways and solute transfer along the Hailuogou Glacier Chronosequence on the Eastern Tibetan Plateau

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Preferential flow pathways (PFPs) are key contributors for the ecological status of the hydrosphere in high mountain environments, as the precipitation will transfer to PFPs with rapid solute transport from soil to groundwater. This particularly refers to nutrient allocation from soils to groundwater and surface waters.

To understand the effects of the pedogenesis and forest types on the soil PFPs, the soil preferential flow was studied by *in situ* dye tracing image analysis and elemental chemical analysis at the Hailuogou glacier chronosequence, Gongga Mountain on the eastern Tibetan Plateau. A soil chronosequence and a vegetation primary succession following the retreat of the Hailuogou glacier has been forming since ~1890. Three sites representing different exposure age (45, 85 and 125 years) in the Hailuogou glacier retreat area chronosequence and two sites typical forest lands (deciduous broadleaf forest and coniferous forest) were selected to carry out a brilliant blue dyeing experiment to visualize the distribution of water infiltration in soil.

The tracer-infiltration patterns were parameterized by dye coverage (DC), preferential flow fraction (PF), length index (L_i) and the variation coefficient of DC in the PFPs (C_v). Furthermore, the distribution of PFPs, transported solute of soil PFPs was analyzed including Hailuogou glacier chronosequence and vegetation succession.

According to the comparison of PFPs parameters, soil PFPs at the 125-year-old site extremely more developed than that at the younger site due to the fracture development between rock and soil on the process of soil development. The soil PFPs under broadleaf forest is more pronounced than that in coniferous forest soils, largely depending on the different root system.

In general, PFPs in Gongga Mountain were important contributors to the potential translocation of bioavailable inorganic P (PB_{Pi}) and organic P translocation to the hydrosphere. The elements transported with PFPs could be divided into three categories, reactive, conservative, and both reacted and conservative elements for the concentration of the elements remain in the PFPs. The

results indicated that Mg and Al are the reactive elements, while Na, K, Ca and Mn are the conservative elements in the PFPs. Iron is both reacted and conservative element in the PFPs. Zn, Na, K, Mg, PBPI, had a significant correlation with the variation coefficient of DC in the PFPs (C_v).

The results highlight the effects of the pedogenesis and forest types on the distribution of PFPs and solute transfer. Preferential flow contributes largely to elements flow at the Hailuogou glacier chronosequence and vegetation succession, Gongga Mountain.

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