Geophysical Research Abstracts
Vol. 19, EGU2017-18366, 2017
EGU General Assembly 2017

Water exchange in raised bogs: revised views especially in relation to biogeochemistry

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Raised bogs are one of the most common and exciting mire type within the boreal zone and appear in the other zones including mountain regions in the tropics. They receive water and nutrients from the atmosphere and pore water stored in their domes is spaced above the surrounding area (up to 10 m in height). Traditionally it is assumed that water flow occurs mainly in a peat layer near to the surface and water transport is negligible in deeper layers (lvanov, 1981; Ingram, 1982; etc.). The «acrotelm/catotelm» paradigm on active and inert horizons for the peat above and below the lowest water level is still widely spread in peatland hydrology. However, recent studies have shown that deep water movement is much more dynamic in raised bogs than was previously thought (Sirin et al., 1997, Reeve et al., 2000; etc.). Relying on isotope studies we conclude that all the mounded strata of the raised bogs have relatively active water exchange although water residence time changes with depth. The study included two raised bogs, representing different typical hydrological conditions (underlain by outwash sands and moraine clay) at the Zapadnaya Dvina Peatland Field Station of the Institute of Forest Science RAS located 400 km west of Moscow (56 N, 32 E). Peatlands, among which raised bogs dominate, constitute > 30% of the area, and maximum peat thickness exceeds 7 m. To evaluate water residence time in peat strata specially determined mathematical model which include the equations of water mass and tritium balance, imbedded in a conceptual framework of water dynamics within a raised bog peat body, have been developed and tested. The results from isotope studies (3H, 18O, 2H) were additionally supported by geochemical (pH, Eh, electrical conductivity) and temperature long term monitoring, as well as dissolved CO_2 and CH4 monitoring within vertical profiles of the studied raised bogs (Sirin et al., 1998). Later it was also supported by microbiology data of methane cycle in the profile of peat bogs (Kravchenko, Sirin, 2007). The obtained results confirm that the hydrological stratification of peat bogs is a more complicated picture than previously thought and need to be considered.