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Ground water exfiltration in a river oxbow

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This paper deals with the quantification of the exchange between ground water and surface water in a river oxbow. Implementation and evaluation of the study site are based upon a conceptual model, in which exfiltration into the oxbow and mainly into the adjacent river Spree are supposed as major transport processes. A clogging mud layer in the oxbow with its low hydraulic conductivity controls exfiltration and is the highest hydraulic resistance in the considered aquatic system. The measurement of temperature depth profiles within that layer was one of the methods applied to measure groundwater exfiltration. Because of the different groundwater and surface water temperatures there are temperature differences between the upper and lower boundary of the mud layer. Depending on the extent of ground water exfiltration that depth profile is more or less curved. By adaptation of an analytical solution to the plotted temperature depth profiles the flux rates were calculated. A supplementary method to measure exfiltration, the seepage meter, is used for direct measurements of the flux rates. With that method the ground water flux which passes a defined cross section of the sediment-water boundary is collected. The evaluation of the results yields higher exfiltration rates for the temperature depth profiles than for the seepage meters. For the seepage meters the results show only a part of the actual flux rates because of several error sources. Despite those errors the comparison of the results from both methods shows a similar flux pattern with strong small-scale heterogeneities. At scales of few meters the measured flux rates fluctuate more than an order of magnitude. The flux rates near the bank are frequently higher than in the middle of the oxbow. However, the flux rates are controlled by the thickness of the clogging mud layer, its hydraulic conductivity, its heterogeneity and the water table differences between surface water and adjacent aquifer.