Answer to the interactive comment of J. Constantz:

We propose to extend the discussion on sw/gw interaction and to add references that more explicitly deal with heat exchange processes related to surface waters in the final version of the manuscript.

- ➔ Extension p. 7190 l.16-21: *Temperature-differences between surface and groundwater can be used to qualitatively identify in- or exfiltration zones and to quantify exchange rates through the streambed (Constantz, 1998); (Constantz and Stonestrom, 2003). In case infiltration of surface water into riverine groundwater is the dominating exchange process time series derived of measured vertical temperature profiles allow to detect cyclic urnal and event driven temperature changes within the streambed. However, in case exfiltration of groundwater into surface waters is the dominating exchange process changes in vertical temperature distributions within the streambed are reduced or not detectable.*

  For the investigated groundwater body, apart from flood events, exfiltration of groundwater into the river Rhine is the dominating exchange process. During average flow conditions the influence of river water temperature on groundwater temperatures (within the aquifer near to the river) is dominated by heat conduction.

  Therefore, the following procedure was chosen for the river model boundary: (1) selection of a transient Cauchy boundary condition considering daily intervals of head and river water temperature data (Fig. 1); (2) calibration of flow and heat transfer rates (see above) for regions beneath the river which correspond to river bed conductance; and (3) zonation of regions with different conductance corresponding to the location of the sheet pile wall at the river board as well as to the thickness of the gravel layer in the river bed, which is thickest in the south (Fig. 1).

- ➔ Situations where infiltration of river water into the groundwater body can be observed is qualitatively described by the propagation of warm (summer) and cold (winter) infiltration water during flood events which on p.7194 l.17-20.

  The Figure below illustrates a further situation where the infiltration of river water into the groundwater body could be observed. The Figure illustrates a situation during major groundwater drawdown which was necessary for the construction of a tunnel road 1994 to 2008 (Epting et al., 2008). A calibration of the heat transport model was performed for the time period 01.04.2006 to 31.03.2007 (Epting et al., 2011; Huggenberger and Epting, 2011). The drawdown resulted in a reversal of groundwater flow (cf. Fig. 1).

  Simulated groundwater temperatures during summer show relatively high temperatures of the river water. The infiltration of river water with elevated temperatures into the aquifer can be well observed. Furthermore, areas with enhanced river-groundwater interaction can be contrasted to areas with little interaction due to a sheet pile wall. Further to the West, regions with low temperatures derive from cold river water that has infiltrated during winter time. North of the sheet pile wall the influence of the drawdown is less distinct and regional groundwater flow from southwest to northeast controls the groundwater flow regime.

  Even though this situation was limited to the duration of tunnel road construction, it illustrates the spatiotemporal transient character of river-groundwater interaction within the investigated water body.

- ➔ For another project in the Basel region (Epting et al., 2009) we used the heat pulse method to describe the transient character of riverbed conductance. As for the investigated groundwater body exfiltration of groundwater into the river is the dominating process (see above) and as we do not have temperature measurements within the streambed for this investigations the exchange of surface and groundwater, including temperatures was calibrated with PEST (Doherty, 1994).

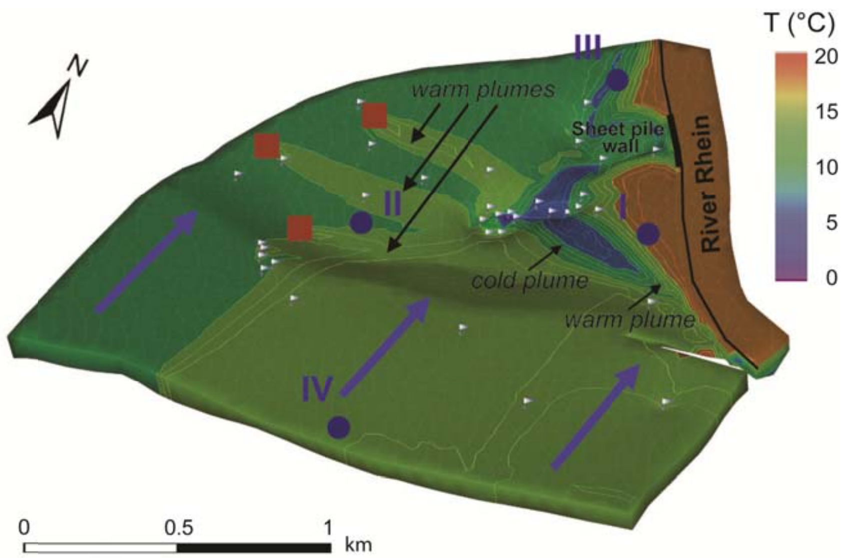

Fig. Simulated groundwater temperatures for northwestern Basel and locations of observation wells (dots) as well as reinjections (rectangles). Blue arrows show the regional groundwater flow direction. Locations of observation wells for depth-oriented groundwater temperature measurements I-IV

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