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Assessing the effects of gravel augmentation on thermal processes in gravel-bed rivers

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Gravel augmentation has become common practice to mitigate the effects of decline in upstream sediment supply in gravel-bed rivers. However, functional aspects of river systems such as thermal functions are often left out of rehabilitation monitoring programmes. Despite temperature being a fundamental parameter determining the general health of rivers, a limited number of studies have tested whether gravel augmentation can aid restoring thermal functions. Using airborne thermal infrared (TIR) imagery, this paper explores potential feedbacks through the monitoring of gravel augmentation on 3 rivers in France. To overcome the lack of pre-rehabilitation data, we used hydromorphological indicators within a trajectory-based Before-After-Control-Impact (BACI) framework to assess the success of rehabilitation on thermal functions. This design, combining long-term geomorphic evolution with TIR-based CI strategy, indicated that restoring forms was not sufficient to restore thermal functions. Nonetheless, hydromorphological indices measures on historical aerial photographs can be used to estimate long-term evolution of groundwater-surface water interactions. We emphasise the benefits of trajectory-based BACI assessment to identify current conditions, understand the past evolution (trajectory) of the system to define the framework within which rehabilitation can objectively be assessed.