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Intra-annual sediment dynamic assessment in the Wei River Basin, China, using the AIC functional-structural connectivity index

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Hydrological and sediment dynamics have changed a lot on the Chinese Loess Plateau during the last six decades due to large scale land use changes and numerous water regulation actions. Understanding the mechanism of sediment transport change and its effects is of great importance to food and environmental security. Computer-implemented numerical approaches are useful to map and assess spatio-temporal patterns in sediment dynamics. This study evaluates monthly and annual sediment connectivity in the Wei River Basin (134,800 km²) at the basin and sub-basin scales using the aggregated index of sediment connectivity (AIC). For the first time, this index is applied on this relatively large regional scale. The two objectives are to (1) evaluate the performance of the AIC at the regional scale and (2) analyse the role played by each input in the sediment patterns over the months of the year. The Jing sub-basin shows the highest sediment connectivity, while the Beiluo sub-basin has the lowest sediment connectivity on average, due to better ecological restoration in Beiluo sub-basin. Within the year, sediment connectivity is highest in April and lowest in January, due to the rainfall regime and land cover variations. Among the inputs of the AIC, the rainfall factor has the highest effect on sediment connectivity, implying that functional connectivity (graded by rainfall and soil cover) dominates over sediment dynamic more effectively than structural connectivity (mainly determined by topography and soil permeability). This study provides one of the first large-scale estimates of spatial and temporal sediment connectivity, which can be further employed to implement regional ecological construction and catchment management.