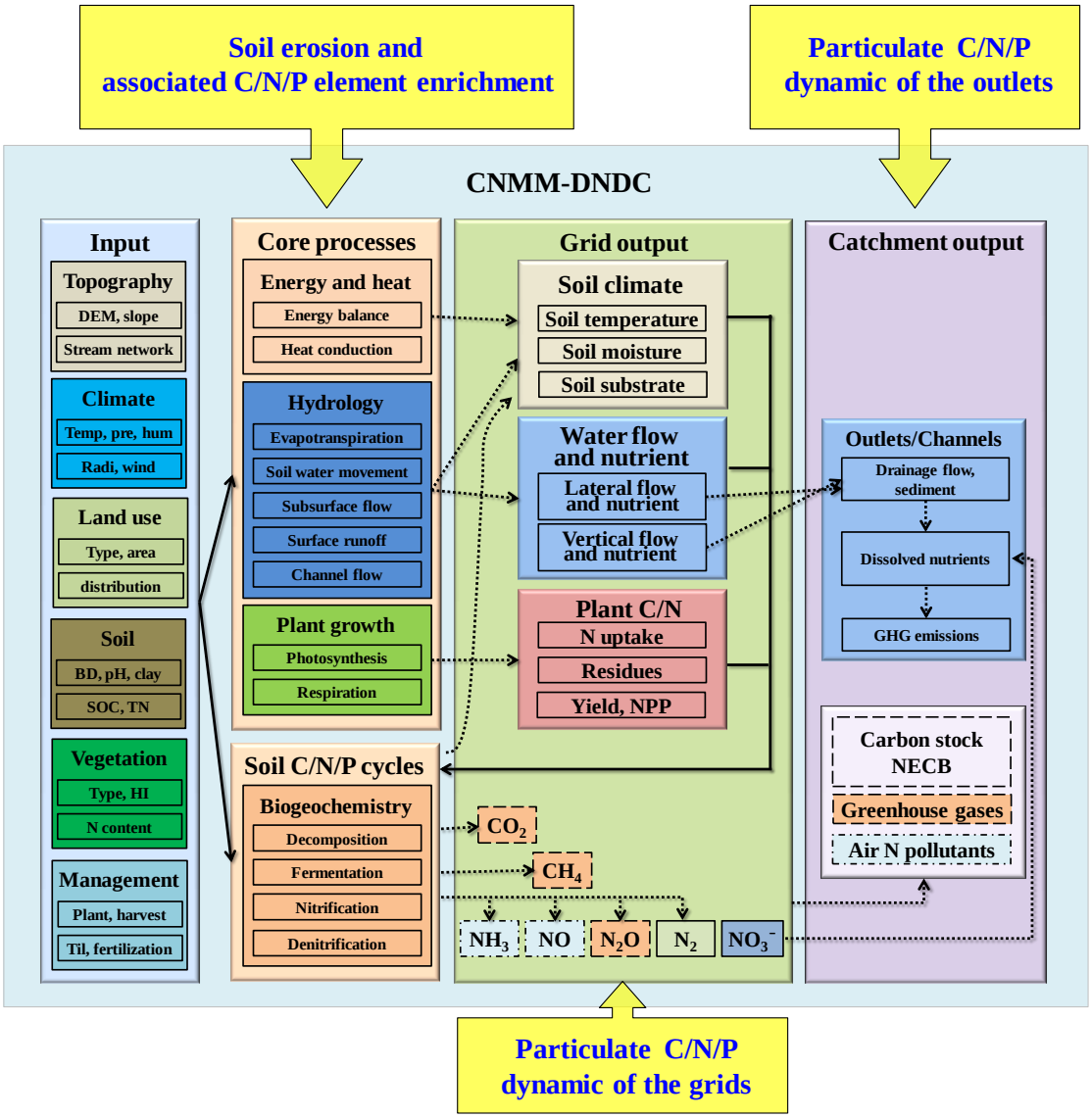

Fig. S1 The schematic of the existing and upgraded modules. The modules in the yellow boxes are added by this study.

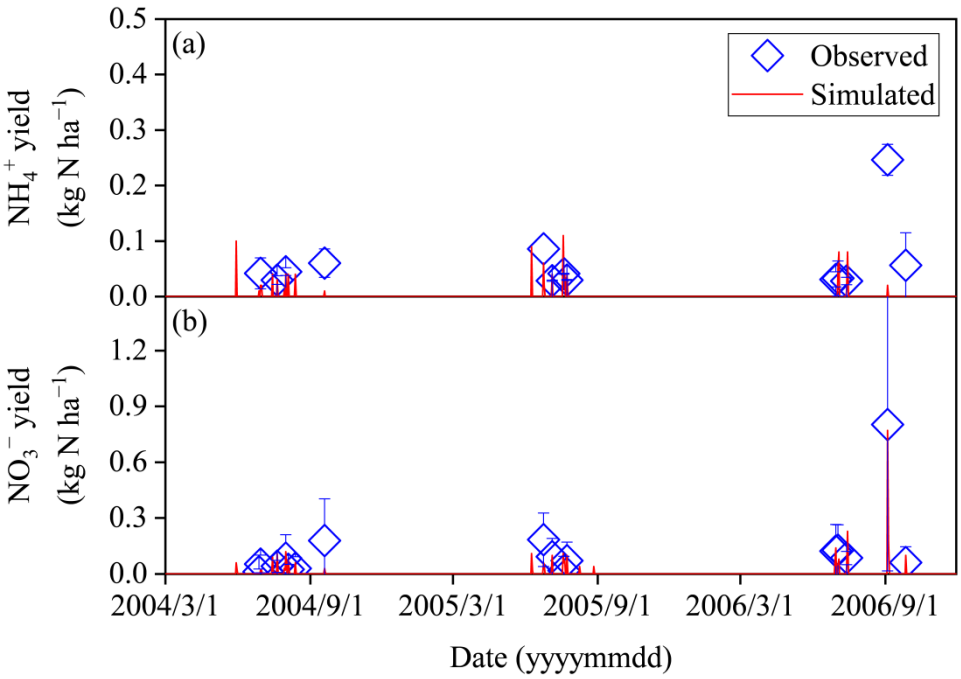

Fig. S2 Observed and simulated NH_4^+ (a) and NO_3^- (b) yields in the lysimetric plot from 2004 to 2006. The vertical bars indicate the standard error of three spatial replicates. The observed data, from Deng et al. (2011) and Zhang et al. (2018), were provided by Bo Zhu.

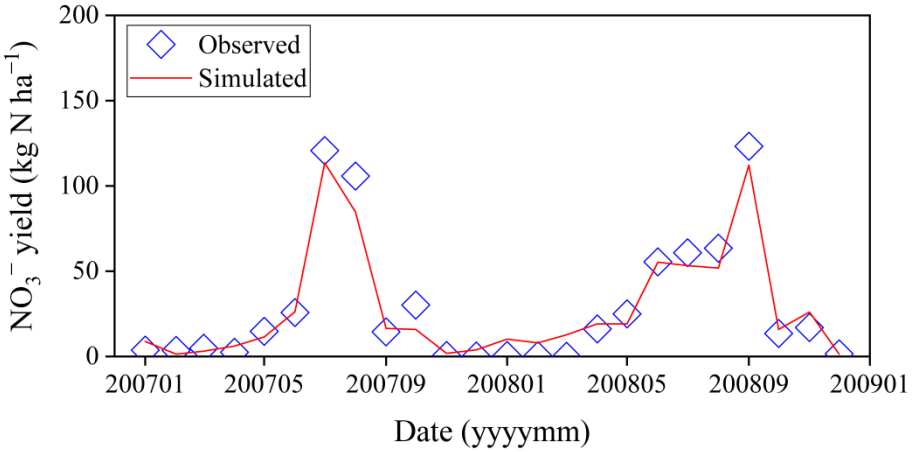

Fig. S3 Monthly observed and simulated NO_3^- yield at the outlet of Jieliu catchment from 2007 to 2008. The observed data, from Deng et al. (2011) and Zhang et al. (2018), were provided by Bo Zhu.

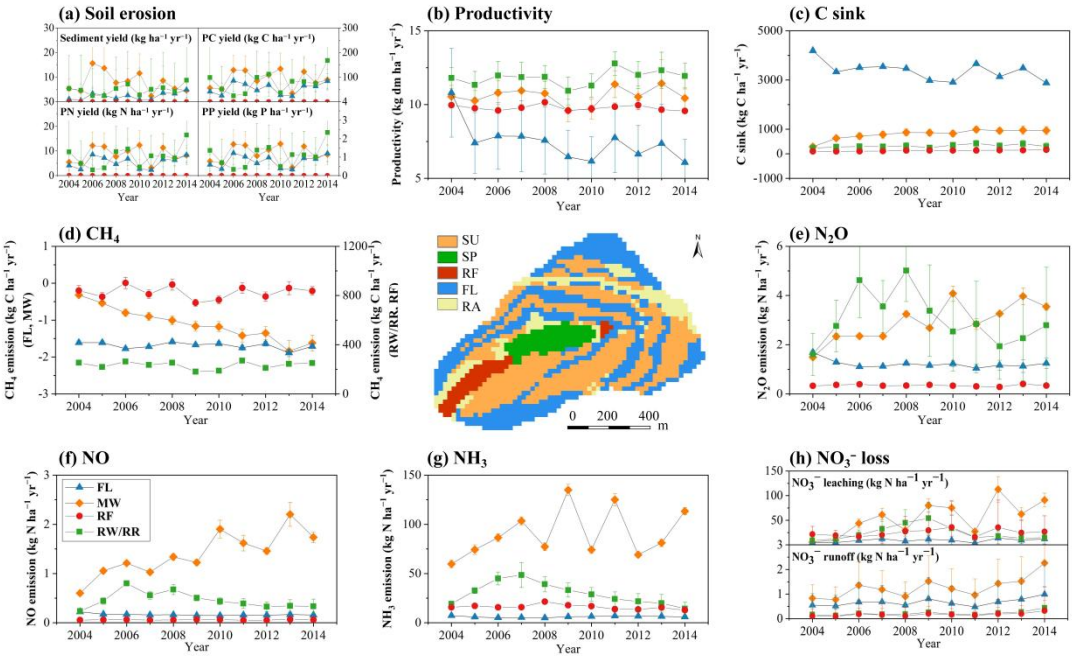

Fig. S4 Simulated soil erosion, productivity and carbon and nitrogen losses from different land uses from 2004 to 2014. The PC, PN and PP are the abbreviation of the particulate carbon (PC), nitrogen (PN) and phosphorus (PP) yields, respectively. The land use types are the sloping cultivated upland (SU) with the summer maize−winter wheat rotation (MW), seasonally waterlogged paddy (SP) with the paddy rice−winter wheat rotation or paddy rice−rape rotation (RW/RR), the winter-flooding paddy with the paddy rice flooding-fallow regime (RF), forest land (FL) and the village residential areas (RA).

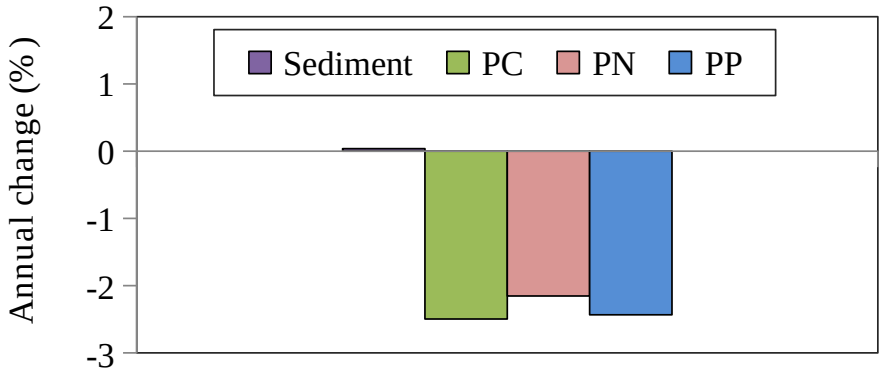

Fig. S5 Simulated effects of no-tillage on sediment yield and particulate carbon (PC), particulate nitrogen (PN) and particulate phosphorus (PP) yields compared to the baseline scenario with the conventional tillage in the validation year, 2008.

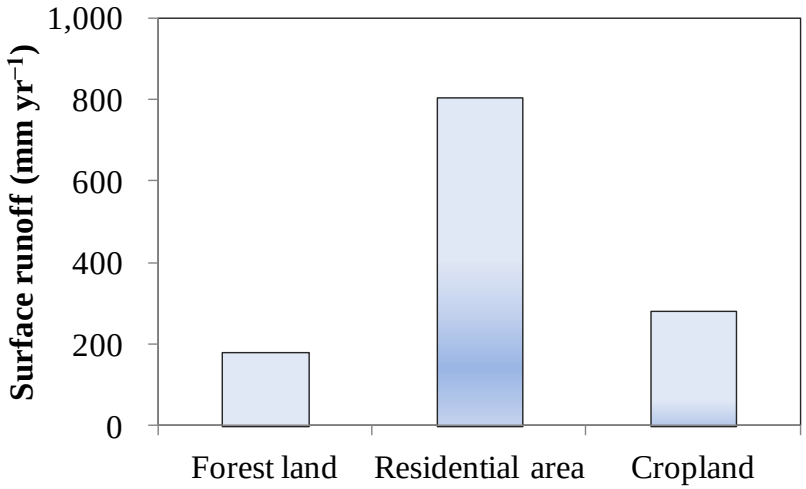

Fig. S6 Simulated annual surface runoff of different land use types in the validation year, 2008.

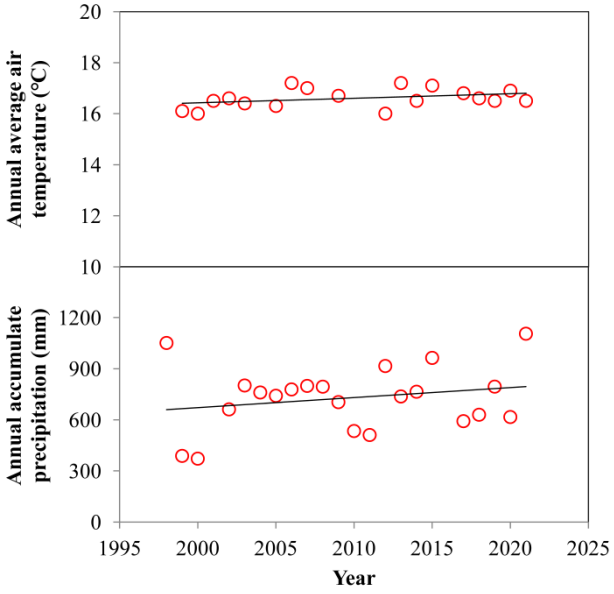

Fig. S7 Annual average air temperature and accumulate precipitation of Jieliu catchment from 1998 to 2021 (extracted from the openly accessible online database of http://yga.cern.ac.cn, last access: July 26, 2023).

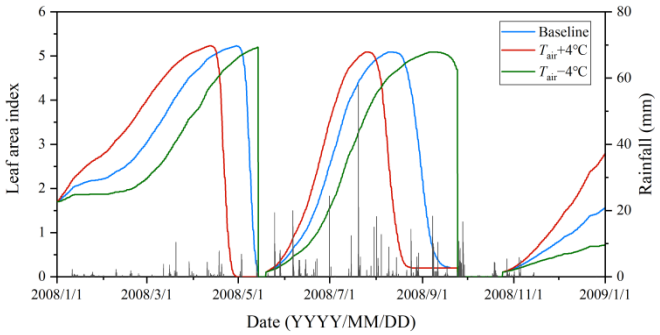

Fig. S8 Simulated leaf area index of the baseline scenario and the air temperature increasing and decreasing 4℃ scenarios (T_{air}+4℃ and T_{air}−4℃) in the validation year, 2008.