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Riverine dissolved carbon concentration and yield in subtropical catchments, Taiwan

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Dissolved carbon is not highly correlated to carbon cycle, but also a critical water quality indicator and affected by interaction of terrestrial and aquatic environment at catchment scale. However, the rates and extent of the dissolved carbon export are still poorly understood and scarcely quantified especially for typhoon events. In this study, regular and events' data of riverine dissolved organic carbon (DOC) and dissolved inorganic carbon (DIC) were monitored to estimate the export. Meanwhile, the hydrological model and mixing model were used for determination of DOC and DIC flow pathways at 3 sites of Tsengwen reservoir in southern Taiwan in 2014-2015. Results showed that the mean DOC concentration was 1.5 - 2.2 mg l^{-1} (flow weighted) without seasonal variation. The average DOC yield was 3.1 ton-C km^{-2} yr^{-1}. On the other hand, DIC concentration ranged from 15 to 25.8 mg l^{-1}, but DIC concentration in dry season was higher than wet season. Mean annual DIC yield was 51 ton-C km^{-2} yr^{-1}. The export-ratio of DOC:DIC was 1:16.5, which was extremely lower than that of worldwide large rivers (DOC:DIC=1:4.5 in average) and other mountainous rivers (DOC:DIC=1:4.6 in average). Both DOC and DIC concentration showed the dramatically discrepant change in typhoon events. The DOC concentration increased to 4-8 folds rapidly before the flood peak. However, DIC concentration was diluted to one third with discharge simultaneously and returned slowly to base concentration in more than a week. According to the hydrological model, events contributed 14.6% of the annual discharge and 21.9% and 11.1% of DOC and DIC annual flux, respectively. Furthermore, 68.9% of events' discharge derived from surface runoff which carried out 91.3% of DOC flux and 51.1% of DIC flux. It implied that increases of surface runoff transported DOC form near soil surface, but diluted DIC concentration likely implied the contribution of groundwater. Our study characterized the specialty of dissolved carbon export and elucidated the different flow pathways of DOC and DIC in mountainous catchments.