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Modelling the evolution of chemical weathering rate in landslide-dominated region

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Chemical weathering due to the capacity of CO_2 consumption is particularly of interest in landslide-dominated region where the physical denudation rate may accelerate the chemical weathering rate (CWR) which influences the stability of hillslope and nutrient of ecosystem. However, none of the proposed models have been applied in Taiwan where physical denudation rate is the highest in the world. In this study, a 7-year time series of monthly CWR (calculated from the streamwater chemistry) with landslide inventories in the Liwu watershed were used to evaluate and modify the model proposed by Gabet (2007). The model with four parameters and landslide area as an independent variable cannot well depict the CWR in the Liwu watershed. We further revised the model by adding the stream discharge which has been well known influencing CWR. This modified model integrates the effects of both landslide area and stream discharge on estimating CWR. The result shows that the revised model significantly improves the simulation indicating the importance of stream flow on CWR estimation. Meanwhile, the estimated erosion rate, approximately 9.79 mm/yr, by the revised model, agrees with the observation (8∼12 mm/yr). Besides, the calculated CWR is about 25.73 t/km2/month which is roughly 17 times greater than the global average. The CWR increases proportionally with physical denudation rate indicating that CWR will not be depressed by the increasing physical denudation rate even during catastrophic typhoon events. We suggest that further studies in estimating the CWR in landslide-dominated region should consider the effect of stream discharge which represents the river capacity of dissolve loads from landslide sites to outlet.