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Impacts of earthquake and debris flow on the erosion of terrestrial organic carbon in the eastern margin of the Tibetan Plateau: Insight from biomarkers

JIN WANG[1], DR. ZHANGDONG JIN SR.[1], DR. FEI ZHANG, PHD[1] AND XIAOJUAN FENG[2]

[1]Institute of Earth Environment, Chinese Academy of Sciences

[2]Institute of Botany, Chinese Academy of Sciences

Presenting Author: wangjin09@ieecas.cn

Large earthquake and intense rainfall could trigger thousands of landslides and make an important contribution to erosion over decades to centuries. These processes also mobilize terrestrial organic carbon from soils, rocks, and vegetation to the fluvial system. Erosion and transfer organic carbon from different sources have different impacts on the atmospheric CO_2 budget across a range of timescales. To understand the importance of landsliding on the carbon cycle, it is vital to constrain the provenance of the organic carbon and the erosion process after the extreme events.

We used the suspended sediment collected at upper Min Jiang, the eastern margin of the Tibetan Plateau from 2005 to 2012. To constrain the source of particulate organic matter, we measure the abundance of lignin phenols and *n*-alkanoic acids of the suspended sediment, soils and landslide deposits. In combination with the analysis of bulk organic carbon concentration and isotopes ($\delta^{13}C$, $\delta^{14}C$), the biomarker measurements show that sources of the terrestrial of organic matter vary, mostly depending on suspended sediment concentration and its availability on the hillslopes. The sources of the river particulate organic carbon are likely stochastic during the periods of low erosion, while it is mostly from low-degraded organic matter (like the surface soil and plant debris) with input of clastic sediment at high erosion. We find that the contribution of terrestrial fresh organic matter of the river increased after the 2008 Wenchuan earthquake. However, the long-term impact of the earthquake is less clear, likely due to the relatively low coseismic landslide within the drainage area or/and sufficient sediment supply before the earthquake. The highest suspended sediment and particulate organic carbon concentration occurred during a debris flow event in 2005. This event mobilized a large amount of organic carbon and lignin from the plants and surface soil, highlighting the importance of climate on the export of terrestrial organic carbon in this tectonically active mountain range. Our work reveals the impacts of earthquake and debris-flow on the erosion and processing of terrestrial organic carbon, providing novel insight on the link between active tectonics, climate and the carbon cycle.