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The composition and flux of vascular-plant derived organic matter export from small mountainous rivers during typhoon event

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Small mountainous rivers, which suffer from landslides triggered by tropical cyclones, may transfer particulate organic carbon (POC) from land to the ocean in an express way, hyperpycnal flow. A significant amount of organic carbon produced by biosphere was channeled to the deep sea during flash flood. The OC source characterization is essential to understand the biosphere denudation and the responses of river basin to the growing climate extremes. Lignin phenols had been widely used in the geochemical studies to trace the terrestrial POC transport as it is unique to the vascular plants. In present study, we first measured lignin phenols in samples collected from three stations in a Taiwan river, Chuoshui River, during the Typhoon Mindulle in 2004 with high time resolution (every 3 hours) to explore the source variation and accurately quantify vascular plant derived OM throughout the flood. In the mainstream, $\Lambda 8$ (Lignin concentration normalized to POC) varied from approximately 0.4 mg/100mg OC at the flood rising and up to 2.4 mg/100mg OC at the peak discharge. A significant positive correlation between water discharge and $\Lambda 8$ was observed ($r=0.93$, $p<0.001$) suggesting that precipitation, thus discharge is the primary control for the transport of the vascular plant OM. Moreover, a significant negative relation observed between $\Lambda 8$ and degradation indicator (P/(V+S)) ($r=0.62$, $p<0.001$)revealed that freshly produced vascular POC was diluted by highly degraded OC.

We calculated that approximately 1.3 Gg of particulate lignin was exported within 84h from Chuoshui River to the ocean, in which $\sim$50% was achieved during the 3 hours discharge peak. The event exporting particulate lignin from Chuoshui River was $\sim$10% of annual export from Changjiang, which is 600x larger in watershed size. Moreover, >90% particulate lignin in Chuoshui River was delivered via hyperpycnal flow, representing an efficient sequestration of terrestrial OC in deep ocean.