Impact of rainfall on the rates and pathways of orgicanic carbon oxidaiton in the intertidal sediments of the Han River estuary, Yellow Sea

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Despite its potential significance as "hot moment" modulating elemental cycles and ecological processes in the coastal ecosystems, little has been known on the effect of continuous rainfall induced by the climatic changes on the biogeochemistry of the coastal sediments. To understand the effects of the three consecutive typhoons-induced heavy rainfall on the biogeochemcial dynamics, we investigated the geochemical constituents of the sediments and the rates and pathways of anaerobic C oxidation in the intertidal mud flat in the Han River estuary, Yellow Sea. Cumulative rainfall (844 mm for 15 days) accompanied by the summer typhoons (EWINIAR, BILIS, KAEMI) with strong wind (31-51 m s^{-1}) recorded approximately 20 times higher than that over winter season (28 - 50 mm). As the precipitation continues, the salinity decreased steeply from 25 psu to 6 – 9 psu. Concentrations of pore water constituents (Total CO_2, NH_4^+, SO_4^{2-}, H_2S, Fe^{2+}) during and immediately after the heavy rainfall (ca. 110 – 200 mm d^{-1}) appeared to be significantly lower ($P < 0.0001$) compared to that measured during fair weather condition, and exhibited relatively uniform distribution patterns with depth. Our results indicated that combination of the physical disturbance by heavy rainfall and re-oxidation of the reduced metabolic end products or dilution by percolation of rainwater was responsible for the lower concentrations of the reduced constituents in the pore water, thereby generating less anoxic conditions. Rates of anaerobic C oxidation, sulfate reduction (SR) and iron reduction (FeR) decreased during-immediately after heavy rainfall, and the relative significance of SR and FeR has dropped to 1.4 % and 20 % of anaerobic C oxidation, respectively. This result implied that the dominant pathway of organic matter degradation was shifted rapidly from sulfate and iron reduction to other alternative pathway (e.g. denitrification). Overall results strongly indicated that the intensified rainfall and riverine runoff of fresh water resulting from the climatic change may alter the biogeochmical cycles of carbon and nutrients, and thus the ecosystem structures by regulating redox conditions of the sediment and limiting nutrients in the water column.