Using a dynamic global vegetation model to simulate the impact of typhoon disturbance on forest carbon cycle

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Disturbance is a factor to alter forest regeneration, composition, structure and function within a short period. Typhoon disturbance may cause massive litterfall (accounting for 30-60% of annual litterfall) and woody debris to alter the forest biomass and carbon cycle in frequently perturbed regions such as Taiwan. The objectivity of this study is integrating typhoon disturbance into a dynamic global vegetation model, Hybrid, to simulate the effect of typhoon disturbance on carbon cycle in a subtropical forest ecosystem. The result showed the maximum daily wind speed was a critical factor to dominate the litter production. The Hybrid modeled and observed leaf litter was significant correlated ($r2 = 0.33$, $p < 0.001$) with moderate underestimation (15.6%). The modeled forest ecosystem without typhoon disturbance would have higher leaf litter (3.47%), LAI (12.7%), total biomass (7.46%), GPP (13.1%) and NPP (15.3%) but lower soil respiration (-2.23%) than that of the observed ecosystem with typhoon events. The increases of typhoon intensity and frequency significantly raise leaf litter and soil respiration, but reduce LAI and total biomass ($p < 0.05$). Overall, the ecosystem with typhoon disturbance would contribute more carbon loss, and it may play an important role for calculating the regional carbon budget, especially in frequently perturbed regions.