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Typhoon-driven variations of phytoplankton and bacterial production in the coastal waters of Sagami Bay, Japan

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Variations of physical and chemical environments, and responses of phytoplankton and bacterial communities after the passage of typhoon Malou (T1009) in the coastal water of Sagami Bay, Japan, were investigated in order to clarify the effect of a typhoon passage on the temperate coastal ecosystem. Water temperature, salinity, nutrients (dissolved inorganic nitrogen; DIN, phosphate and silicate), dissolved organic carbon (DOC), chlorophyll *a* (Chl *a*), primary production (PP), bacterial abundance (BA) and bacterial production (BP) were measured. Malou approached the study site in Sagami Bay on 8 September 2010 and induced large-scale terrestrial runoff, which led to decrease in salinity to 22.1. Simultaneously with decrease in salinity, concentrations of inorganic nutrients and DOC increased (DIN = 22.4 uM, phosphate = 1.05 uM, silicate = 61.6 uM and DOC = 3.1 mg C L^{-1}), which were more than 3 times higher than the average concentrations of the study site in summer. BP and BP/BA showed relatively fast responses to the passage of Malou reaching maximums of 132 mg C m^{-3} d^{-1} and $13.3*10^{-8}$ ug C $cell^{-1}$ d^{-1} two days after the passage of Malou, respectively. BA increased gradually reaching a maximum of $2.84*10^{9}$ cell L^{-1} six days after Malou passage. PP/Chl *a* was relatively low just after passage of Malou, and reached a maximum of 184 mg C [mg Chl *a*]$^{-1}$ d^{-1} three days after typhoon passage. PP showed the highest value of 554 mg C m^{-3} d^{-1} five days after Malou passage, and Chl *a* reached a maximum of 7.65 mg m^{-3} six days after typhoon passage. BP and PP showed no correlation and the maximum value of BP/BA was 6.8 times higher than the average value of the study site in summer, which implied that the allochthonous substrate loaded by typhoon passage enhanced bacterial activity just after the passage. BP/PP was highest at 1.5 one day after the passage of Malou, and decreased to 0.1 on the fifth day after typhoon passage suggesting dominant carbon flux changed dynamically from BP to PP in a short time after typhoon passage. Moreover, the integrated PP for 7 days after the passage of Malou accounted for 9% of the annual PP in the upper water of Sagami Bay. Meteorological disturbances such as typhoons, which will likely intensify as global climate change progresses, should be considered in annual production models.

Keywords: typhoon, primary production, bacterial production, temperate coastal region