Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

BBG22-02 Room:103 Time:May 25 16:00-16:15

A coral internal model on photosynthesis and calcification processes incorporating trans-calcification mechanism

NAKAMURA, Takashi[1*], NADAOKA, Kazuo[1], WATANABE, Atsushi[1]

[1]Tokyo Tech.

Coral reef ecosystem has been exposed and affected to some environmental changes, such as global warming, ocean acidification, eutrophication, etc., and it has been responded to these environmental changes on community level, colony level and organism level. However, prediction of the responses of coral reef ecosystem is not easy because of complexity of coral internal processes. One of the effective approaches for understanding the responses of corals to multiple environmental changes is to develop a coral internal model and to obtain the solutions of the model by computer simulation.

In this study, a coral internal model for photosynthesis and calcification has been developed. This model is based on a conceptual model of trans-calcification by McConnaughey (1994). The model consists of three parts (ambient seawater, coelenteron and calcifying fluid), and fluxes of total alkalinity (TA) and total dissolved inorganic carbon (DIC) between each part by metabolic and physical effects are calculated, then TA and DIC are calculated to determine the photosynthesis rate, respiration rate and calcification rate, which are the functions of CO_2 system parameters. Simulation results of the model well reconstructed some coral internal conditions (i.e. internal pH, photosynthesis, respiration and calcification responses). The response of calcification rate against ambient aragonite saturation state was nonlinear in this model simulation, and the response agreed with the experimental responses observed in some previous studies (Gattuso et al. 1998; Marubini et al., 2008; Anthony et al., 2011; Inoue et al., 2011).

Keywords: hermatypic coral, coral internal model, photosynthesis, trans-calcification, ocean acidification