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Evaluating uncertainties in projected effects of global warming on corals in seas close to Japan

Yumiko Yara¹, Kazuhiro Oshima¹, Masahiko Fujii^{1*}, Hiroya Yamano², Naosuke Okada¹, Yasuhiro Yamanaka¹

¹Hokkaido University, ²National Inst. for Environmental Studies

Using projected monthly-mean sea surface temperature in the 21st century obtained by climate models that were cited in IPCC Fourth Assessment Report, we quantitatively evaluate uncertainties in projected potential influences of global warming to corals in seas close to Japan. Effects of global warming and subsequent rise in water temperature on corals are assessed in this study, using simplified indices of northern limit of coral habitats represented by the isothermal line of 13 degree in the coldest month. The uncertainties in the projection are split into three temporal components, i.e. interannual variability, decadal variability, and longer warming trend. The climate models are applied to eight coastal areas in various subtropical and temperate zones in Japan, including Iki Island. Our study shows that the projected timing when the northern limit of coral habitat reaches Iki Island differs widely among 18 climate models, from 2010s to 2080s, without considering interannual and decadal variability. If the decadal variability is taken into account along with longer warming trend, the projected timing by the 18 climate models has larger uncertainty by 10 years. We would very much like to have long-term in-situ monitoring data necessary to compare with the model results and to reduce the model uncertainties. Such projected results by climate models, on the other hand, presumably provide helpful information in installing future monitoring sites to observe the effects of global warming on corals, and therefore, monitoring-modeling collaborations are highly required.

Keywords: corals, global warming, northward migration, climate model, projection, uncertainty