

Characteristics of water temperature and current including typhoon periods in Amitori Bay of Iriomote Island, Japan and the influence on coastal ocean ecosystem

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The Sakiyamawan–Amitoriwan nature conservation area of Iriomote Island is Japan's only oceanic nature conservation area. It retains a natural environment without significant human influence because it is uninhabited and inaccessible by land. Furthermore, it has various temporal environmental gradients such as typhoons and seasonal wind from the continent as well as various spatial environmental gradients, such as reef slope facing on open ocean, rapid change of water depth, sand and mud bottom in the inner bay, and low salinity region of river mouth in the most inner bay. These environmental gradients influence the coastal ocean ecosystem such as corals.

We have conducted observations of physical variables such as water temperature and current including typhoon periods and investigations of coastal marine ecosystem such as corals in Amitori Bay of Iriomote Island since 2011 (Ref. 1-5). In this study, characteristics of water temperature and current including typhoon periods in the bay are shown, and the influence on coral distributions is discussed.

The results are in the followings;

- Changes of water temperature in a surface layer are almost in phase with those of atmospheric temperature. In summer, stratification develops and the difference of water temperature between a surface layer and a lower layer becomes large. In winter, stratification collapses and it becomes small.
- In summer, the periodic decline of water temperature in a lower layer can be seen, which is different from the changes of water temperature in a surface layer. The period is close to that of the inertial oscillation ($1.25 \text{ days} = 0.5 \text{ days}/\sin 24^\circ$). This decline of water temperature (inflow of water mass with low temperature) can influence coral survives in summer.
- When typhoons attack in summer, vertical mixing due to strong wave and current with the typhoons causes rapid decline of water temperature. The analysis showed that in summer of 2016, a delay of typhoon attack to this region caused lengthening of high water temperature resulting in large scale coral breaching.
- The analysis also showed that the development of current speed and the momentum transport from a upper layer to a lower layer depend on the typhoon path, that is, the wind direction to the bay, even if the typhoon has a wind speed exceeding 25 m/s.
- In particular, typhoons with wind direction from bay mouth to inner bay can cause the inverse of current speed in vertical direction (i.e., current speed in upper layer < that in lower layer). This strong current in a lower layer can influence the forms and survives of corals inhabiting there.

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