***Field:***

*Earth Science/Geosciences/Environment*

***Session Topic:***

*Interaction between Ocean and Atmosphere*

***Introductory Speaker:***

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Recently, much attention has been paid in an increase in the amount of greenhouse gases such as carbon dioxide ($CO_2$). Biogeochemical models have estimated that the oceans presently take up roughly a third of the anthropogenic carbon, representing that the oceans play a crucial role in the carbon sequestration. However, the greatest uncertainties in the estimations seem to lie more with the biology than with the physics and chemistry of ocean processes. One of the major reasons is that the quantification of spatiotemporal biological activities is still very difficult. We can rather precisely predict how physical and chemical parameters such as temperature and pH in seawater regulate carbon exchange between the ocean and the atmosphere. However, it is marine organisms, especially microscopic algae (i.e. phytoplankton) that can fix $CO_2$ as much as terrestrial plants through photosynthesis, and the fixed organic matters that can sink and be stored into the deep sea from hundreds to a few thousand years. The whole biological carbon sequestration mechanism in the sea is so-called the biological pump. Here I briefly introduce some recent topics of the biological pump with reference to climate change and atmospheric processes. If climate change results in an increase in temperature in the future, subsequent expansion of arid regions (e.g. dessert) will enhance the input of atmospheric dust containing nutrients such as iron into the sea, and lead to an increase in the biological pump. On the other hand, the warming of seawater could alter the condition of stratification in the water-column, resulting in decreases in nutrient supply from deeper waters to the surface and phytoplankton productivity in temperate regions. It is also known that coccolithophores, belonging to haptophytes and possess $CaCO_3$ plates as their cell walls, play a key role in the biological pump. Coccoithophores and other specific phytoplankton groups produce dimethylsulfoniopropionate (DMSP), the precursor of dimethylsulfide (DMS) which can produce aerosol particles acting as cloud condensation nuclei (CCN) and those influence cloud formation and albedo, that is, a potential negative feedback mechanism to counter global warming. However, coccolithophores may respond to increased ocean acidity, caused by increasing the anthropogenic $CO_2$ levels. As a result, they may become less calcified, and that will affect the biological pump ability. Continuous efforts in laboratory experiments, field observations and modeling must be required for predicting the responses of the biological pump to climate change.