Classification and visualization of simulated clouds using machine learning

*松岡 大祐[1]
*Daisuke Matsuoka[1]

1. 国立研究開発法人海洋研究開発機構
1. Japan Agency for Marine-Earth Science and Technology

High-resolution atmospheric general circulation models reproduce realistic behavior of atmosphere in global scale. The data set generated by such simulation contains a large amount of information. One of the most important variable of the simulation results is a cloud. In order to understand such simulation results, it is necessary to visualize individual clouds and their physical properties. In the present study, we propose a new visualization method which enables scientists to classify and visualize them based on ten type cloud classification proposed by World Meteorological Organization (WMO). The proposed method is divided into two steps. In the first step, individual clouds are classified into six types (low clouds, middle clouds, high-clouds, low-middle clouds, cumulus, cumulonimbus) based on their vertical flow and altitude of top and bottom of them. In the final step, their clouds are further classified more finely into ten types (cirrus, cirrostratus, cirrocumulus, altocumulus, altostratus, nimbostratus, stratocumulus, stratus, cumulus, cumulonibmus) by their appearance using deep learning which is one of machine learning techniques. Here, we used photographs of these clouds, which we can easily download on the web, as training data. As a result, we succeeded in effectively visualizing three-dimensional cloud and their temporal behavior during complex atmospheric phenomena such as development of cumulonimbus and generation of tropical cyclone. The proposed method is beneficial to intuitive understand information-rich simulation data.

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