Global analyses of cloud fraction and cloud phase by using spaceborne-lidar

*片桐 秀一郎[1]、佐藤 可織[1]、岡本 創[1]
*Shuichiro Katagiri[1], Kaori Sato[1], Hajime Okamoto[1]

1. 九州大学
1. Kyushu University

Information of vertical cloud distribution is crucial for the evaluation of the General Circulation Models (GCMs). There were large varieties in the vertical distribution of low-level clouds sorted by pressure and lower tropospheric stability among the models (Watanabe et al., 2011), while retrieved cloud properties from satellites were not converged. Cesana et al. (2016) evaluated three global cloud phase products using the CALIPSO, and showed large differences among the products. In this study, we revisit cloud detection by space-borne lidar.
We modified our cloud mask algorithm originally developed in Hagihara et al (2010) to increase detectability of optically thick low-level clouds. We use the attenuated total backscattering coefficient at 0.532 μm for the discrimination the cloudy pixels with the threshold total backscattering coefficient determined by Okamoto et al. (2007) and Okamoto et al. (2008). Remaining noise is estimated by using the data obtained at an altitude of 40 km to avoid contamination of PSCs.
In this algorithm, identification of the fully attenuated pixel is newly introduced. The discrimination confirms whether no cloud is in the atmosphere or no information is received. The fully attenuated mask is determined by referring to whether the surface return can be detectable or not.
After this cloud mask algorithm is applied, we use the cloud phase discrimination algorithm made by Yoshida (2010), which uses the relation between the depolarization ratio at 0.532 μm and the ratio of two successive attenuated backscattering coefficients at 0.532 μm in vertical, as proxy of extinction coefficient, to distinguish ice and water particles. Here we rely on the following different scattering properties of water and ice clouds. In case of spaceborne lidar observations, depolarization ratio of water clouds is often comparable to that of ice clouds so that the discrimination between ice and water is not possible by depolarization ratio alone. In turn, water clouds generally show larger extinction coefficients than ice clouds for the same depolarization ratio so that the discrimination become possible by using extinction and depolarization ratio. These characteristics are used in the cloud phase discrimination algorithm.
We will show the global analyses of cloud fraction and water/ice fraction by application of the new cloud mask scheme and differences for the old and new schemes are discussed.

キーワード：雲、ライダ
Keywords: cloud, lidar

