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Improvement of GK-2A atmospheric vertical information with PCA technique

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The GK-2A AAP (Geo-Kompsat-2A AMI Atmospheric Profile) and other 1D-Var atmospheric profile retrieval algorithms have common limitations about ill-posed problem due to lack of observed information. Thus the retrieved profiles are often unstable or depends on first-guess profiles.

In this study, we estimated Empirical Orthogonal Functions (EOFs) and Principal Components (PCs) for temperature and humidity profiles to solve the ill-posed equation problem by reducing variables. The number of components of vertical profile was reduced using main EOFs and PCs, and GK-2A AAP was modified based on Principal Component Analysis (PCA-AAP) to get optimized atmospheric vertical information. To calculate the temperature and humidity profile using PCA-AAP, the UM model and GK-2A radiance were used as input in the same way as GK-2A AAP.

The PCA-AAP retrieved profiles was validated with radiosonde in August 2022. The accuracy of PCA-AAP was nearly similar to those of first guess and GK-2A AAP. However, the inaccurate GK-2A AAP profiles were not retrieved in PCA-AAP because main EOFs prevent unstable retrievals. This results show that PCA technic complement AAP algorithm and provide stable and continuous vertical profiles. Therefore, we have plan to make EOFs more accurate using global radiosonde data and model analysis data to

improve accuracies of temperature and humidity profiles. We expect this improvement to be helpful in supporting very short range forecast and nowcasting more effectively.

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