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First-application geostationary AHI and GOCI hourly AOD data fusion using the Bayesian Maximum Entropy Technique

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We, for the first time, applied Bayesian Maximum Entropy (BME) technique to AHI (Advanced Himawari Imager) and GOCI (Geostationary Ocean Color Imager) hourly AOD (Aerosol Optical Depth) data fusion. The data used in this study were the AHI AOD data and GOCI AOD data those were calculated from Yonsei aerosol retrieval algorithm. Whereas, AERONET (AErosol RObotic NETwork) AOD were used as reference (True value). Firstly, resampling and reprojection was performed to match the spatial resolutions and coordinates of two data sets. Then, we combined the two satellites AOD with simple arithmetic expression and removed the trend using moving window filter method to calculate spatio-temporal covariance matrix. Secondly, a statistical preprocessing was performed to consider spatio-temporal autocorrelation of each data and calculate uncertainties of the satellites data using the AERONET AOD data. Third, the posterior probability density function (PDF) are calculated through the BME process that combines the Bayesian paradigm and the Maximum Entropy method using the soft data and spatio-temporal covariance matrix. Finally, merged AOD (MAOD) is calculated by adding the averaged posterior PDF to the trend that was calculated in trend removal step. In comparison between MAODs and those of AERONET AODs, the mean bias is 0.05 and root- mean-square error (RMSE) is 0.13. These values are better than those against AHI (mean bias: 0.05, RMSE: 0.15) and GOCI (mean bias: 0.11, RMSE: 0.15). As a result, the accuracy of MAOD is higher than the accuracy of AHI and GOCI AOD in the region where both AHI and GOCI AOD data are available. In addition, we firstly performed AOD fusion at ocean site named Ieodo station which is near Korean peninsula. The mean bias and RMSE values were 0.08 at the ocean site. These values mean that AOD fusion using BME technique shows almost similar performance on the land and ocean.