Geophysical Research Abstracts
Vol. 14, EGU2012-1046, 2012
EGU General Assembly 2012
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Aerosol optical depth and type retrieval using MSG/SEVIRI data

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IPCC fourth assessment report demonstrated that aerosol is the least understood with highest uncertainty (The uncertainty of aerosol radiative forcing is even larger than radiative forcing itself) factor compared to other component in the climate system (IPCC, 2007). The mainly reason is due to the high variability in space and temporary of aerosol and it is really difficult for us to obtain enough information for understanding aerosol effect. Even we obtain sufficient information; there is still a problem to get the aerosol properties with high accuracy because almost all the aerosol properties are coupled. Many different aerosol monitoring schemes using different satellite data are available, the original stem is based on at least one assumption; that is except the retrieval aerosol properties, all the other properties (both aerosol and surface) can be obtained first. For instance, DeepBlue method is supported by a reflectance database (Hsu et al., 2004) while DDV algorithm need much prior knowledge about other aerosol properties (Levy et al., 2007) in order to retrieve aerosol optical depth (AOD). However, the retrieval methods are not always capable of reproducing the AOD spectral slope in a correct way because the correspondent aerosol model (Kokhanovsky et al, 2009) and other factors are not retrieved but rather prescribed. Is it possible for us to retrieve several aerosol or surface properties simultaneously?

A novel approach for the joint retrieval of AOD, aerosol type and surface reflectance, using Meteosat Second Generation – Spinning Enhanced Visible and Infrared Imagers (MSG/SEVIRI) observations in two solar channels, is presented in this paper. MSG/SEVIRI combines the advantages of a multi-spectral sensor as well as high-temporary satellite. The paper confined the consideration only to one approximate method of reducing the problem to solving a set of differential equations in the application to the case of shortwave radiation transfer. After approximating the exact integrodifferential equation of radioactive transfer equations for radiant intensity by common differential equations for the upward and incident radiation fluxes, a MSG/SEVIRI multi-spectral for three series time algorithm to retrieve AOD and surface reflectance will be proposed. And then the proposed model will be used as a forward model, a new joint retrieval of the total column AOD and surface reflectance over land surface from MSG/SEVIRI observations with an optimal estimation approach will be obtained. As to the aerosol type, six predefined aerosol type were used, all aerosol type of each pixel in area of a certain area is statistic, and the type with the highest mean probability is taken as the best one for the area. And then we get the aerosol type in the whole study area; we should reprocess the AOD using the update aerosol type. The main point is to choose the best aerosol properties for define aerosol type during retrieving.

Primary validation using AEORNET show that the good agreement between retrieval results and ground-based observation, the relative error compared with AERONET is around 0.3. Primary validation also demonstrates that the MSG retrieval provides larger coverage and a comparable result compared with MODIS product, meanwhile, it also provide aerosol type product. Although preliminary validation is encouraging, the difference in wavelength and time differences makes comparison difficult, and further validation is needed.