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A method for aerosol correction from the spectral variation in the visible and near infrared: application to the MERIS sensor

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Abstract

The signal recorded by the sensor at the satellite level contains information relative both to the atmosphere and the surface. Atmospheric correction is therefore necessary to extract the surface reflectance required within biophysical algorithms used to estimate canopy attributes. Aerosol characteristics are difficult to evaluate because they vary rapidly with time and space. The objective of this study is to develop an autonomous aerosol correction method exploiting the information content in MERIS images.

A dedicated neural network was trained to retrieve aerosol optical thickness (AOT) from the top of atmosphere signal recorded in 13 MERIS bands. The training database was made of radiative transfer model simulations, SMAC code coupled to SAIL and PROSPECT models. In this preliminary study, aerosol were characterized only by their optical thickness at 550nm, considering only the continental aerosol type.

Theoretical results derived from model simulations demonstrate the pertinence of the method, with a 0.058 Root Mean Square Error associated to the estimation of the AOT, inducing a RMSE on the estimated top of canopy reflectance better than 0.005. The method was then validated using 61 actual MERIS images acquired over AERONET sites. Results show RMSE values of 0.116 associated to the AOT estimation. Comparison with MODIS achieved over 31 among the 61 scenes show a RMSE value of 0.11 similar to the 0.10 value observed for MERIS with our algorithm. Comparison between atmospheric correction achieved with our algorithm and with those based on actual AERONET measurements show RMSE values on top of canopy reflectance close to 0.005.

Keywords

Atmospheric correction; MERIS/ENVISAT; aerosols; neural network; radiative transfer; SMAC; 6S; MODIS