CALIBRATION, PARAMETERIZATION AND APPLICATION OF MERIS WATER CONSTITUENT ALGORITHMS FOR PREALPINE LAKES

Daniel Odermatt[(1)], Viacheslav Kiselev[(2)], Thomas Heege[(2)], Mathias Kneubühler[(1)], Claudia Giardino[(3)], Mariano Bresciani[(3)], Jens Nieke[(4)], Klaus Itten[(1)]

[(1)]Remote Sensing Laboratories (RSL), Dept. of Geography, University of Zurich, Winterthurerstr. 190, CH-8057 Zurich (Switzerland), Email: daniel.odermatt(mathias.kneubuehler;klaus.itten)@geo.uzh.ch
[(2)] EOMAP GmbH & Co. KG, Sonderflughafen Oberpfaffenhofen, Geb. 319 D-82205 Gilching (Germany), Email: heege(kiselev)@eomap.de
[(3)] Remote Sensing Dept., National Research Council, CNR-IREA, via Bassini 15, I-20133, Milan, (Italy), Email: giardino.c@irea.cnr.it
[(4)] ESA/ESTEC, Keplerlaan 1 NL-2200 AG Noordwijk (Netherlands), Email: jens.nieke@esa.int

1. INTRODUCTION

Ongoing progress in the development of case II water constituent retrieval algorithms has led to a variety of different applications, ranging from simple, user-friendly data processors to complex, demanding processing systems. We compare on one hand MERIS' inland water processors (MERIS C2R), which are available through ESA's BEAM toolbox [1]. On the other hand, we apply a coupled air/water constituent algorithm based on the inversion of a radiative transfer database to MERIS data (MIP, [2]). An adjacency effect correction procedure (ICOL, [3]), which is also available as BEAM plugin, was evaluated with both methods. A previous validation campaign with single MERIS images, simultaneously measured optical in situ data and laboratory sample analyses revealed that the retrieval of total suspended matter (TSM) is quite accurate with existing methods, while the retrieval of chlorophyll-a (CHL) remains problematic [4, 5]. However, CHL is considered to be the most important optically active parameter in prealpine lakes. It is therefore monitored in situ, either bi-weekly or monthly, with either fluorescence probes or HPLC analysis of laboratory samples. Such data cannot be taken as equivalent to remote sensing derived products, since they represent different sections of the water body. Nevertheless, they can be used for validation, where match-ups with satellite image acquisition occur [6]. We therefore applied both C2R and MIP to ICOL corrected and uncorrected data, and compared the CHL products with one another as well as with the CHL concentrations measured in the context of water quality monitoring programs.

2. METHODS

The MERIS C2R algorithms consist of neural networks, which enable fast command line processing of large quantities of data and a minimum of parameterization effort by the user. The same applies to ICOL, which performs adjacency effect correction for a two layer model based on a primary scattering approximation, either for Rayleigh scattering only or including aerosol scattering. On the contrary, the MIP water constituent algorithm requires complex parameterization regarding specific inherent optical properties (SIOP), aerosol model, and channel wise weighting and recalibration, whereas the latter addresses systematic biases between the simplified ratiative transfer model and the data as measured by the sensor. This parameterization was done on the basis of the optical in situ measurements taken in the MERIS lakes validation field campaigns and from independent campaigns on Lakes Garda and Geneva. All three algorithms were then joint in an automatic, IDL based processing environment, which applies C2R, ICOL and MIP command line routines and supports the extraction of arbitrary parameters in predefined areas or sites.

3. RESULTS

The correlation of the C2R CHL product and corresponding in situ measurements varies strongly between different sites. For example in Lake Constance, the results for two sites are strongly correlated (R=0.9, n=16), while those of the two other sites are not. Moreover, the separation in well and poorly retrieved sites does neither correspond to the two basins of the lake, nor to pelagic or littoral locations. Taking into account the warning flags set by the C2R algorithm does not significantly enhance the results, and neither does ICOL. The CHL results calculated with the MIP algorithm are highly correlated with in situ data for single images, but the derivation of a universally applicable parameterization remains a challenge. However, MIP allows for a detailed analysis of single images, and the influence of ICOL has a distinctive effect on the parameterization, since it apparently accounts for some of the bias between ratiative transfer model and satellite data [5].

4. REFERENCES

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