ATMOSPHERIC CORRECTION AND WATER CONSTITUENTS RETRIEVAL PROCEDURES FOR TURBID COASTAL AND LAKE WATER SCENES OF MERIS

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The quality of coastal and inland waters has become a major issue in many countries worldwide. Monitoring of water quality is the prerequisite for a successful management of this most important resource as well as for the management and conservation of aquatic ecosystems. Due to the vast extension of most coastal areas and of some of the large inland waters as well as due to the high dynamics of physical and bio-geochemical processes in water there is a requirement methods, which cover large areas in a synoptic view and allow time series with a high frequency. Furthermore, for coastal monitoring sites, it is not only necessary to observe the area of interest but also the far field, which determines the local expression of interacting processes on multiple spatial and temporal scales.

Optical remote sensing is one of the methods, which, in principle, fulfils some of these requirements. However, in contrast to blue water, the reflectance spectrum of which is mainly determined by only one variable, i.e. the concentration of phytoplankton, coastal and inland waters pose a number of problems for remote sensing, which require special algorithms and also procedures to detect cases, when an algorithms is out of its scope. This is not only true for the retrieval of water variables including the concentrations of substances as well as optical variables such as the light penetration depth, but also for the correction of the influence of the atmosphere, which is much more difficult of coastal and inland waters.

For the Medium Resolution Imaging Spectrometer MERIS on ESA's earth observing satellite ENVISAT we have developed special processor for coastal and inland waters, which is based on artificial neural networks (NN). This processor is implemented in the BEAM software as a plug-in for processing MERIS level 1 data of coastal and inland waters. With its spatial resolution of 300 m in full resolution mode, its revisit period of 3 days at equator and its 15 narrow spectral bands in the 400 - 900 nm wavelength range MERIS is well suited for remote sensing of coastal and larger inland waters.

The processor consists of two parts, an atmospheric correction procedure and a procedure for retrieving water properties. The NNs for both procedures, which function as multiple non-linear regressions, are trained with simulated reflectance spectra to cover the large range of possible cases with sufficient density. In case of the water NN the simulations are based on bio-optical models, which have to be based on measurements of the inherent optical properties of the water constituents of the respective area. Included in the simulations is also the variability of these properties so that the NN learns to handle a certain range of variations. The NN for the atmospheric correction is based on an aerosol optical model with 4 different types of aerosols and thin cirrus clouds. This NN can also handle sun glint, which normally masks nearly half of the image, in particular in low latitudes, as it is the case in Africa. The output of this atmospheric correction NN is the bi-directional water leaving radiance reflectance, which is the input to the water NN.

Areas in Africa, where this processor has been applied and which will be demonstrated in the presentation, are the Benguela upwelling zone off Namibia and Lake Victoria.