Dynamics of autochthonous and allochthonous matter in Lake Baikal surface waters assessed by Ocean Colour satellite data

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Ocean Colour (OC) satellite data (Sea-viewing Wide Field-of-view Sensor (SeaWiFS)) were used within the EU project 'High Resolution CONTINENTal Paleoclimate Record in Lake Baikal, Siberia (CONTINENT)' (2001-2004) to assess information on the current dynamics of phytoplankton and terrigenous input in Lake Baikal (Siberia). While a valuable, large pool of limnological long-term data from Lake Baikal is available, the spatial extension of Lake Baikal is enormous (more than 600 km), and the spatial overview provided by satellite data supports interpretation and spatio-temporal interpolation of the data.

SeaWiFS is on board the Orbimage2 satellite on a 705 km circular orbit with a revisit time of two days (1 square km pixels). The optical sensor records the back reflected radiation in 8 spectral bands at 412, 443, 490, 510, 555, 670, 765, and 865 nm. After an adapted atmospheric correction of the SeaWiFS data for the specific case of Lake Baikal, ground truth data (field spectrometer data, phytoplankton pigments (S. Fietz, 2005), SPM, DOC, cDOM) and OC Chl-a algorithms were evaluated to process Ocean Colour Chl-a data. We found that in pelagic waters of Lake Baikal the OC2v4 and OC4v4 algorithms (O'Reilly et al., 2000) performed best with deviations of better than ± 30 % compared with the field Chl-a concentrations (averaged values within the first attenuation depth, ca 15 m). However, the calculated Chl-a-satellite values considerably overestimated Chl-a concentrations at locations of terrigenous input in Lake Baikal. In many cases, minerogenous terrigenous input is expected to produce enhanced water leaving reflectances. In case of tributaries from swamp-rich catchment areas, as it is common at Lake Baikal, in contrast, dissolved and particulate terrigenous organic material dominate the optical properties, leading to enhanced absorption processes. This enhanced absorption leads in consequence towards local overestimation in calculated Ocean Colour Chl-a. On the other hand, this optical behaviour serves as the tracer for the organic-rich terrigenous input into Lake Baikal. We assessed the pathways of short-term terrigenous input by using the optical parameter "downwelling irradiance attenuation coefficient" (Ocean Colour algorithm, O'Reilly et al., 2000) calculated from the SeaWiFS satellite data. Finally, the spatial Chl-a and terrigenous input data calculated from the remote sensing data were used to assist with analyzing the relationships between the different CONTINENT project sites.