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Inferring organic content of sediments by means of scanning reflectance spectroscopy (380-730 nm); a case study from proglacial lakes in Norway

Mathias Trachsel (1), Atle Nesje (2,1), Jostein Bakke (3,1), Bjørn C. Kvisvik (1,3), and Pål R. Nielsen (3)

(1) University of Bergen, Bjerknes Centre for Climate Research, Bergen, Norway (mathias.trachsel@uni.no), (2) University of Bergen, Department of Earth Science, Bergen, Norway, (3) University of Bergen, Department of Geography, Bergen, Norway

We systematically explore the potential of scanning in-situ reflectance spectroscopy in the visible spectrum (380 – 730 nm) as a novel tool for high-resolution (2 mm) climate and environment reconstructions. Measurements were carried out on long (∼4-6 m) Holocene and Late Glacial sediment cores from proglacial lakes in Norway. In this study, we compared organic content derived from visible reflectance spectroscopy (VIS-RS) to loss-on-ignition (LOI) measurements. The LOI values measured within one core varied between 1% and >20%.
Conventionally, organic content is derived from VIS-RS applying simple algorithms (e.g. Rein and Sirocko, 2002). Following this approach, we found correlation coefficients between LOI and VIS-RS inferred organic content of > 0.8 for all cores analyzed.
When applying conventional algorithms to sediments from different lakes, however, two problems arise: (i) different algorithms are found to yield highest correlations with LOI in different lakes (e.g. in some lakes algorithms indicative of clastic material show highest correlations, whereas in other lakes algorithms indicative of pigments show highest correlations) (ii) univariate regression models between LOI and conventional VIS-RS data are only valid for one specific lake.
We attempt to solve these problems using two approaches:
(i) Applying multivariate statistical techniques (e.g. partial least squares regression) to calibrate VIS-RS to LOI measurements for one single lake (ii) establishing calibration models based on multivariate statistical techniques (e.g. partial least squares regression) including samples from different lakes.

Rein and Sirocko, Int J Earth Sci 91, 950 - 954 (2002)