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Observation of cyanobacteria and diatoms from space using Differential Optical Absorption Spectroscopy on SCIAMACHY data

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Information on phytoplankton light absorption is necessary to derive accurate estimates of marine chl a concentration and primary production. Global satellite data on photosynthetically active radiation and chl a concentration are available from a suite of satellite imagers like CZCS, SeaWiFS, MODIS, MERIS and others, but spectral information of absorption by phytoplankton and other water constituents is still lacking. Therefore, we used Differential Optical Absorption Spectroscopy (DOAS) to study the retrieval of phytoplankton distribution and absorption with the satellite sensor Scanning Imaging Absorption Spectrometer for Atmospheric Chartography (SCIAMACHY). SCIAMACHY measures back scattered solar radiation in the UV-Vis-NIR spectral region with a high spectral resolution (0.2 to 1.5 nm). We used in-situ measured phytoplankton absorption spectra from two different RV Polarstern expeditions where different phytoplankton groups were representing or dominating the phytoplankton composition in order to identify these characteristic absorption spectra in SCIAMACHY data in the range of 430 to 500 nm. Our results show clearly these absorptions in the SCIAMACHY data. The conversion of these differential absorptions by including the information of the light penetration depth (according to Vountas et al.,

Ocean Science, 2007) globally distributed pigment concentrations for these characteristic phytoplankton groups for two monthly periods (Feb-March 2004 and Oct-Nov 2005) were derived. The satellite retrieved information on cyanobacteria (Synechococcus sp. and Prochlorococcus sp.) and diatoms distribution matches well with the concentration measured from collocated water samples with HPLC technique and also to global model analysis with the NASA Ocean Biogeochemical Model (NOBM from http://reason.gsfc.nasa.gov/OPS/Giovanni/) according to Gregg and Casey 2006 and Gregg 2006. Results are of great importance for global modelling of marine ecosystem and climate change studies regarding changes in the ocean.