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Phytoplankton composition and distribution in the Western Pacific – insights on temporal and spatial dynamics from in-situ and satellite data

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Biogenic sources such as phytoplankton, macroalgae and sea weed play a major role in contributing to oceanic emissions of trace gases which are influencing the climate. Still, the knowledge to link phytoplankton composition and abundance to oceanic emissions is poorely understood because so far only the relation to the overall phytoplankton biomass (total chl-a) has been investigated. During the expedition „TransBrom“ on board of the RV „Sonne“ the physics, chemistry and biology of the surface ocean, marine boundary layer and the atmosphere was studied within the Western Pacific. In order to get a precise idea on phytoplankton composition and biomass distribution, the biooptical characteristics and composition of phytoplankton were determined. An unsupervised similarity-based cluster algorithm (see Torrecilla et al., 2010) analysis on the basis of pigment and phytoplankton absorption was performed to obtain information on the similarity of samples between these two characteristics. By this analysis, biooptical and biogeochemical provinces were defined and compared to ecological provinces proposed by Longhurst (2007). In order to extrapolate these phytoplankton results on a larger temporal and regional scale, the PhytoDOAS method was applied to SCIAMACHY satellite data (according to Bracher et al. (2009) modified by Sadeghi et al. (2010)) and monthly maps from 2002-2010 were derived for four types of phytoplankton groups (cyanobacteria, diatoms, dinoflagellates, coccolithophores) and also for the total phytoplankton biomass (total chl-a) from the GlobColour product (hermes.acri.fr). These satellite data were validated with the in-situ phytoplankton data. The seasonal patterns and trends of the phytoplankton composition and distribution in the Western Pacific using the phytoplankton satellite data considering the different biogeochemical provinces were determined and discussed considering effects by land, winds and currents and compared to other results monitoring phytoplankton composition in this part of the World's ocean. The outcome of this study is used to parameterize oceanic emissions of bromine compounds in the Western Pacific (Quack et al. in prep.) and DMSP production (Zindler et al. in prep.), but also for parameterization of models focusing on biogeochemical fluxes and trend studies.

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