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Interactive comment on "Satellite-detected fluorescence reveals global physiology of ocean phytoplankton" *by* M. J. Behrenfeld et al.

Anonymous Referee #2

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General comments: The world's oceans are the site of ˜50 % of global primary productivity. As a consequence, the photosynthetic activities of phytoplankton of the open ocean are an extremely important component of the global Carbon cycle. A major obstacle to gaining a thorough understanding of oceanic primary productivity however is one of scale. Biological oceanographers typically work with small discrete water samples and even if multiple samples are taken over a grid, they only represent a small portion of the ocean. Remote sensing of the oceans has dramatically changed our ability to obtain synoptic pictures of phytoplankton distributions in the oceans, but to date an estimate of their physiological condition has still been restricted to discrete, smaller scale sampling. The current paper by Behrenfeld et al. changes this.

Using satellite based chlorophyll fluorescence signals, Behrenfeld et al. have been

able to obtain synoptic data on three main features of phytoplankton fluorescence and physiology, namely chlorophyll concentration, non-photochemical quenching (NPQ - by which excess light energy is dissipated as heat) and the package effect (where there is self-shading which reduces the efficiency of light absorption). The authors illustrate the efficacy of this approach to examine the impacts of iron limitation.

The approach is careful and methodical and the arguments and analyses clearly presented and well substantiated. The appendices outlining the approaches used are especially informative.

Specific comments: The authors acknowledge that this is a first step in developing the approach and they have made a number of approximations and assumptions that are debatable – for instance they have used a single light function to correct for NPQ, whereas light acclimate and NPQ will vary greatly with, for example, latitude and other environmental factors. As with all remote sensing data, fluorescence signals are dominated by the top several meters and, as a result, the information and interpretation suffer from the fact that impacts of phytoplankton in deeper water are not detected. In many cases this might not matter, but in waters characterised by sub-surface maxima in chlorophyll distributions, this might be an issue.

Nonetheless, this paper represents a novel and exciting new tool for biological oceanographers. Further refinement will undoubtedly lead to new and improved understanding of physiological processes in phytoplankton at the global scale.

Interactive comment on Biogeosciences Discuss., 5, 4235, 2008.