Investigation of the role of phytoplankton functional types in CO₂ flux variability

Stage 1 Intercomparison of PFT techniques: Microplankton

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SeaWIFS 8 day composite 2nd week May 1999

METHODOLOGY

SeaWIFS 8 day composite for the 2nd week of May 1999 was downloaded from the NASA Ocean Color website (http://ocean.color.gsfc.nasa.gov) (a*) and a_Chi_a for the week was calculated according to Bricaud et al. (1995), Sathyendranath et al. (2001) and Devred et al. (2006). A preliminary oceanic PFT index (PFI) approach of Alavain et al. (2000) (In press), Uzt et al. (2006), Rattos et al. (2008), and Hirata et al. (In Press) (using Chi-a) was applied to the dataset, and output from the NASA Ocean Biogeochemical Model (NOBM) for the week was also utilised. The Inherent Optical Property (IOP) approaches of Hirata et al. (In Press) (using a* Chi_a) Devred et al. (2006), and Cotti et al. (2002) (using a*443) were also applied to the dataset. Output was then split between the techniques that calculate dominance and those that calculate non-dominance (a probability percentage), and sub-sorted to the CASE I comparison area (shown by the green box in the figure below). The non-dominance techniques were then regressed against each other in order to assess similarities and differences between the techniques, and the dominance techniques were compared by assessing the amount of pixels that identified microplankton. These two approaches were then combined by assessing where the dominance technique’s assigned microplankton, to the respective values calculated according to the non-dominance technique’s.

CPR data for the same week was used to provide in situ validation (as shown by the red points in the left figure), and output from the various PFT techniques were mathed up with the in situ data on a pixel by pixel basis, in order to determine the most appropriate approach for detecting microplankton.

REFERENCES:

- An intercomparison between non-dominance techniques found that Uzt et al. (2006) and Devred et al. (2006) show the highest degree of similarity. Hirata et al. (In Press) and Alavain et al. (2005, In Press) were found to predict the highest amount of dominant microplankton pixels in the study area. From a comparison of dominance and non-dominance techniques, Devred et al. (In Press) provided the highest non-dominance factors (a% or ρ(443)) in pixels where the dominance techniques identified microplankton. It was found that the techniques of Cotti et al. (2002) and Hirata et al. (In Press) provided the highest indication of microplankton compared to non-dominance, and Devred et al. (2006) and Uzt et al. (2006) showed the highest non-dominance factors (see Table 3).

Table 1: Regression between non-dominance techniques.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Pearson Correlation</th>
<th>Confidence Interval</th>
</tr>
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<tbody>
<tr>
<td>Cotti et al (2002)</td>
<td>0.79</td>
<td>0.69 - 0.87</td>
</tr>
<tr>
<td>Hirata et al (In Press)</td>
<td>0.76</td>
<td>0.66 - 0.85</td>
</tr>
<tr>
<td>Devred et al (2006)</td>
<td>0.73</td>
<td>0.63 - 0.82</td>
</tr>
<tr>
<td>Uzt et al (2006)</td>
<td>0.71</td>
<td>0.61 - 0.81</td>
</tr>
</tbody>
</table>

The amount of pixels that each dominance technique identified as microplankton were compared. Hirata et al. (In Press) identified the greatest amount of pixels followed by Alavain et al. (2005, In Press) (see Table 2). These techniques were then compared to establish whether the same techniques identified the same pixel as microplankton. It was found that the two techniques of Hirata et al. (In Press) and that of Alavain et al. (2005, In Press) identified the most (see Figure 3).

RESULT 1: Intercomparison between the different PFT methods

The non-dominance techniques were regressed against each other, and it was found that Devred et al. (2006) and Uzt et al. (2006) were the most similar with a Pearson correlation coefficient of between 0.86 and 0.88 (see Table 1). These were plotted against each other (Figure 1) and an exponential relationship was found with R² value of 0.96. Multivariate statistics were applied to the non-dominance techniques and a dendrogram based on hierarchical cluster analysis was produced (Figure 2), where this also showed the similarity between Uzt et al. (2006) and Devred et al. (2006) with an 89% similarity, and Rattos et al. (2008) and the NOBM model with 84% similarity.

RESULT 2: In-situ validation

From a possible 66 in situ points, 22 diatom and 25 diatom and microplankton were identified, taking account of cloud coverage. It was found that the dominance technique of Hirata et al. (In Press) found the highest amount of match ups between 60-63.4% of the in situ data. The non-dominance technique of Devred et al. (2006) was also found to have a mean of 59%, 5.8% of microplankton that all the 22 and 25 in situ data points, and Rattos et al. (2008) was found to have a probability of 0.55 ± 0.05.

CONCLUSION:

- An intercomparison between non-dominance techniques found that Uzt et al. (2006) and Devred et al. (2006) show the highest degree of similarity. Hirata et al. (In Press) and Alavain et al. (2005, In Press) were found to predict the highest amount of dominant microplankton pixels in the study area. From a comparison of dominance and non-dominance techniques, Devred et al. (In Press) provided the highest non-dominance factors (a% or ρ(443)) in pixels where the dominance techniques identified microplankton. It was found that the techniques of Cotti et al. (2002) and Hirata et al. (In Press) provided the highest indication of microplankton compared to non-dominance, and Devred et al. (2006) and Uzt et al. (2006) showed the highest non-dominance factors (see Table 3).

- However, in order to accurately conclude upon the most validated method a greater amount of in situ data will be needed, with increased spatial and temporal coverage. Future work will also need to focus on other PFTs such as nanoplanckton and picoplankton, before being compared to the FOAM-HADCC system.