



## **Plankton production and respiration during a spring diatom bloom**

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The magnitude of plankton primary production is one of the most crucial determinations made by biological oceanographers. Unfortunately none of the currently available methods of determining primary production provide an unequivocal measurement of the property. Until an unambiguous technique is developed and a suitably large database accumulated, comparisons between estimates derived from different methods can constrain the range of uncertainty and probe our understanding of the physiological and ecological processes involved. However, surprisingly few direct comparisons of two or more methods have been made. Only two studies have compared gross production rates derived from three or more methods and only 4 have compared rates derived from in vitro bottle incubations with in situ changes in a photosynthetic product or substrate. The development of new methods for the determination of primary production inevitably requires comparison with more established (though not necessarily more accurate) techniques before they are widely adopted. Pump and probe, and fast repetition rate fluorometry (FRRF) allow phytoplankton production to be measured in situ at spatial ( $< 1\text{m}$ ) and temporal (ca. 1s) resolutions which simply cannot be achieved with incubation experiments. The global operation of ocean colour satellites and refinement to algorithms estimating primary production from ocean colour are beginning to enable comparison between estimates of primary production from space and estimates derived from in situ measurements and bottle incubations. The present study was undertaken during a bloom of the diatom *Thalassiosira* and utilised a sampling approach informed by near real time images of ocean colour. This enabled us to sample high and low chlorophyll containing waters and so facilitate a comparison of different methods of determining primary production. To our knowledge this

is the first time that four in vitro [ $^{14}\text{C}$  (24h natural light and Photosynthesis vs Irradiance incubations),  $\text{O}_2$  concentration and  $^{18}\text{O}$  bottle incubations] and three in situ [ $\text{O}_2$ , oxygen:argon ratio and FRRF] methods are compared alongside two algorithms normally used to derive primary production from remotely sensed parameters. We aimed to address the questions 'How do these methods compare and contrast in their representation of a spring diatom bloom ?' and 'Do these comparisons concur with comparisons made previously in other plankton communities ?'