**Discussion Paper 3:**

**Summary:**

Researches have worked to understand what causes vernal blooms that occur across many oceans. The Sverdrup Critical Depth model reasons that there is a critical depth where the total production (P) exceeds the total respiration (R) and at this point blooming can occur if the mixed layer depth is less then this critical value. Essentially this is a point where phytoplankton growth exceeds loss. This assumption also builds upon the idea that these blooms are triggered by improved stratification conditions, light and temperature.

Behrenfeld challenges these assumptions by utilizing nine years of satellite data from the subartic Atlantic. There were some very interesting results of this research that specifically challenge Sverdrup’s original model. One of these is that bloom initiation occurs during when; which is when the mixed layer depths are at a maximum. Another important finding was that the maxima of net population growth rates are as likely to occur in midwinter as they are in spring. To explain these findings Behrenfeld develops the Dilution-Recoupling Hypothesis which states that blooms are caused due to a decoupling between phytoplankton growth and loss. These hypothesis also focuses on balancing phytoplankton growth and grazing and also seasonally varying physical processes that influence this.

**Discussion:**

This research works to further understand a very complex system; one that has been misunderstood for the last fifty years. Because of this I feel that combining experimental evidence, satellite data and improved computational methods might further help to understand this phenomenon. This unified perspective that discusses blooms in terms of physical drivers and biotic responses is presented in the research *Spring blooms and annual cycles of phytoplankton: a unified perspective.*

My personal hope is to combine aspects of computer science into biological oceanography and I feel large complex systems and problems like this would be ideal for this integration. One idea might be to utilize machine learning image recognition to expand upon a larger database of satellite data. Another potential use would be using improved computational power to synthesize data from past experiments.

**Reference:**

Behrenfeld MJ. 2010. Abandoning Sverdrup's Critical Depth Hypothesis on phytoplankton blooms. Ecology 91:977–89