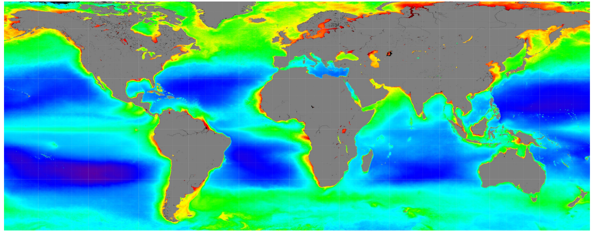
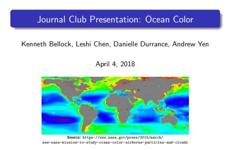
Journal Club Presentation: Ocean Color

Kenneth Bellock, Leshi Chen, Danielle Durrance, Andrew Yen

April 4, 2018



Source: `https://www.nasa.gov/press/2015/march/new-nasa-mission-to-study-ocean-color-airborne-particles-and-clouds`



Assumptions:

1. TODO: List assumptions.

Table of contents

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1. Introduction
2. Article Summaries
3. Summary and Conclusion

1. A road map is a great thing to have.
2. A joke or reference to current events in common culture would be great here if the audience appears receptive.

Introduction

Ocean Color refers to the multi-colored ocean map products created from the measurements of chlorophyll by global satellites. The satellites, equipped with temporal scanners, collect water-leaving radiances of the Earths oceans.
Ocean color products are useful to gain insight of the physical and chemical processes occurring in Earths oceans. Chlorophyll concentration maps can be used for climate studies, measuring the salinity of oceans, estimating carbon levels of ocean regions, and studying phytoplankton species.

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Biospheric Primary Production During an ENSO Transition

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Objectives To compare the simultaneous ocean and land net primary production (NPP) responses to El Nino to La Nina transitions utilizing SeaWiFS measurements of chlorophyll concentration (C_{sat}) in the oceans and Normalized Difference Vegetation Index (NDVI) on land.

Methods Characterization of global, 4-km resolution, monthly SeaWiFS C_{sat} and NDVI data sensed between Septermber 1997 and August 2000, an El Nino to La Nina transition period.

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2. There can be more than one note.

Biospheric Primary Production During an ENSO Transition

Findings The greatest increases in ocean NPP were found in regions most impacted by El Nino-Southern Oscillation (ENSO). The figure on the following slide shows. . .

A) Average NPP for the La Nina Austral summer of December 1998 to February 1999
B) Average NPP for the La Nina Boreal summer of June to August 1999
C) Transition from El Nino to La Nina conditions
D) Changes in NPP between two La Nina Boreal summers

2018-03-31
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└Article Summaries
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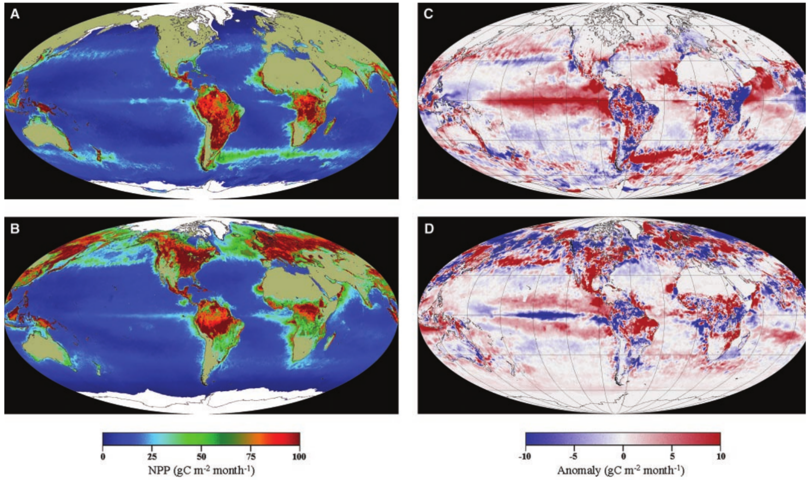

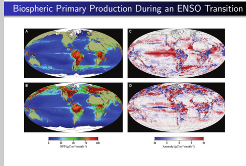

1. Pretty picture

Performance of the MODIS semi-analytical ocean color algorithm for chlorophyll-a

Authors K.L. Carder, F.R. Chen, J.P. Cannizzaro, J.W. Campbell, B.G. Mitchell

Objectives Test effectiveness of MODIS semi-analytical algorithm (Chlor_a_3) against previous chlorophyll–a measurements from CZCS and SeaWiFS - particularly for high latitudes and regions with strong overturn, where chlorophyll-a (Chla) concentrations have been severely underestimated.

Methods

- Separation of the chlorophyll-specific phytoplankton absorption coefficient, $a^*_{ph}(\lambda)$ from gelbstoff/detritus for more accurate measures of chlorophyll-a.
- Previous algorithms for measuring chlorophyll concentration relied on the strong positive dependencies between the phytoplankton absorption coefficient at 440 nm and 675 nm, $a_{ph}(440, 675)$, and Chla. The SA algorithm is exceptional because it accommodates high degrees of variability of $a^*_{ph}(\lambda)$ in high-latitude/strong upwelling zones.

Performance of the MODIS semi-analytical ocean color algorithm for chlorophyll-a

Findings

- Chla can be accurately measured by empirical algorithms for $a_{ph}(675) > 0.03$ m-1, or 1.5 -2.0 mg/m3, but the semi-analytical algorithm is necessary for $a_{ph}(675) < 0.03$ m-1.
- near 1:1 relationship between SA modeled Chla and in situ Chla measurements, with significantly worse performance from modeled Chla using the empirical Chlor_a_2 algorithm (0.5:1, and 0.7:1 underestimations for two different study areas).
- Chlor_a_2 and Chlor_a_3 both tend to agree with their estimations of Chla in equatorial waters, with the exception of zones of strong upwelling equatorial waters in the Eastern Pacific.
- The SA algorithm showed lower concentrations in chlorophyll-a than Chlor_a_2 in parts of the northern hemisphere because it was more effective at distinguishing between gelbstoff-rich runoff from northern rivers and ocean chlorophyll.
- One the most noticeable differences in Chla values is in high-latitude waters in the southern hemisphere during austral spring, where chlorophyll concentration in phytoplankton blooms was misrepresented by Chlor_a_2 because of chlorophyll packaging.

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1. TODO: Include a pretty picture.

Decadal changes in global ocean chlorophyll

Authors Watson W. Gregg, Margarita E. Conkright

Objectives The authors aim at finding decadal trends in global ocean chlorophyll between data obtained by CZCS (1979-1986) and those by SeaWiFS (1992 2000).

Methods
- Chlorophyll data from CZCS and SeaWiFS are combined for reanalysis at 1 spatial resolution.
- To increase compatibility and to reduce residual errors, both archives are blended with in situ data.

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Decadal changes in global ocean chlorophyll

Findings

- There is large similarity in the global spatial distributions and seasonal variability between the two chlorophyll archives.
- On average, the global ocean chlorophyll has decreased from the CZCS archive to the SeaWiFS by 6%, and changes are mainly observed in summer and autumn.
- Reductions in North Pacific and North Atlantics in summer are mainly caused by reduced wind stresses and warmer sea surface temperature (SST).
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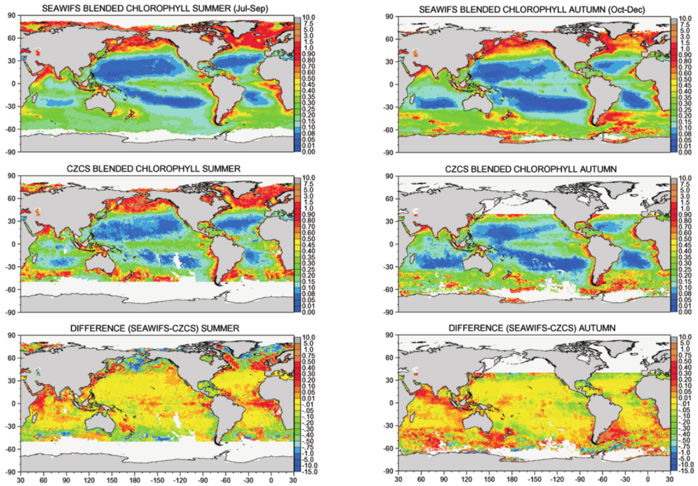

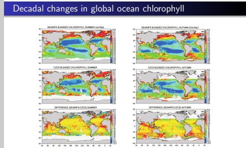

1. Pretty pictures

Corrections to the Calibration of MODIS Aqua Ocean Color Bands Derived From SeaWiFS Data

Authors Gerhard Meister, Bryan A. Franz, Ewa J. Kwiatkowska, Charles R. McClain

Summary A new calibration method was needed to correct a problem affecting the Moderate Resolution Imaging Spectroradiometer, MODIS Aquas, ability to provide accurate ocean color data. The system uses bands 8-14 to detect water leaving radiances from the Earths surface. The problem affected temporal information collected for wavelengths between 412-443 nm. Prior to the calibration issues, the MODIS Calibration and Support Team (MCST) used onboard calibrators and lunar irradiances to sufficiently calibrate the MODIS systems. Now, the calibration methods are based on the Ocean Biology Processing Groups (OBPG) calibration solution for MODIS Terra, which experienced a similar problem. In this method, the MODIS system is cross-calibrated with SeaWiFS to recharacterize the data to correct for the temporal trend error. Now, ocean color data is made with SeaWiFS and MODIS Aqua data merged together. Each data set is processed on its own and then reconfigured.

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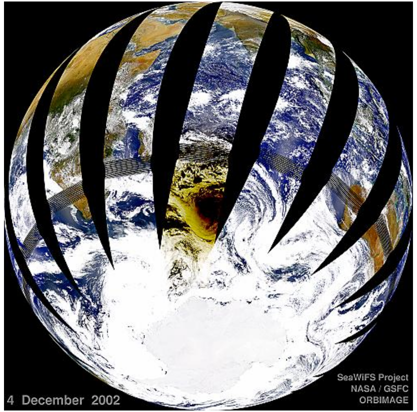
SEAWIFS SWATHS



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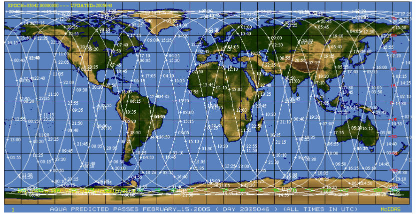
MODIS AQUA PREDICTED PATHS



Source: `https://nsidc.org/sites/nsidc.org/files/aqua_tracks.20050215.gif`

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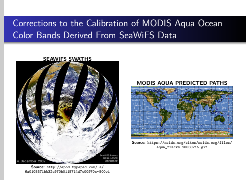

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These studies on ocean color discuss the evolution of chlorophyll-a measurements through advancements in remote sensing capabilities stemming from:

- Refining instrument calibration and assimilating datasets for long-term reanalysis.
- Better understanding of the effects of inter-annual and irregular climate phenomena on NPP and Phytoplankton absorption.
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Goodbye Everyone, I'll see you all in "...the next unit.