Phytoplankton functional types, biomass and photosynthetic competency in the mid-Atlantic Bight following hurricane Matthew

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BROAD OBJECTIVES

Examine the distribution and photo-physiology of phytoplankton functional types (PFTs) in the Mid-Atlantic Bight shelf region using high resolution flow through measurements.

Examine the potential of flow through measurements for enhancing the utility of satellite ocean color for PFT biomass and productivity estimates.
FLOW-THROUGH SETUP

- Automated Laser Fluorometer (Chl a, CDOM, PE-1, PE-2, PE-3, Fv/Fm, NPQ, PQ)
- Satlantic FIRe (Chl a, Fv/Fm, sPSII)
- bbe-Moldaenke (Chl a - Diatoms, Cryptophytes, Green Algae, Cyanobacteria)
- FlowCAM (Phytoplankton imaging, taxonomy and size classification)

WATER COLUMN MEASUREMENTS

- Automated Laser Fluorometer (Chl a, CDOM, PE-1, PE-2, PE-3, Fv/Fm, sPSI)
- Satlantic FIRe (Chl a, Fv/Fm, sPSII, Electron Transport Reactions)
- FlowCAM (Phytoplankton imaging, taxonomy and size classification)
- Phycobilipigment estimates in seawater
Cruise Track

SST, CDOM and Chl a, along cruise track
Distribution of Chl a, blue water cyanobacteria, coastal water cyanobacteria, Cryptophytes along cruise track
SST, Diatoms and Green algae along cruise track
Distance plots of CDOM, Chl a and Diatoms
Distribution of major PFTs at stations 3 & 4
Phytoplankton Community Composition

- Diatoms
- DDAs
- Dinoflagellates
- Diazotrophs
- Other
- Beads

Distribution of major PFTs at station 5
Distribution of major PFTs at stations 6, 7, 8, 9

Phytoplankton Community Composition

- **Diatoms**
- **DDAs**
- **Dinoflagellates**
- **Diazotrophs**
- **Other**
- **Beads**

Map showing distribution with color-coded regions for each PFT.
Distribution of major PFTs at stations 10, 11 & 12

Phytoplankton Community Composition

- **Diatoms**
- **DDAs**
- **Dinoflagellates**
- **Diazotrophs**
- **Other**
- **Beads**
Composition of PFTs at discrete stations

- Diatoms
- Dinoflagellates
- Diazotrophs
Variability of phytoplankton specific absorption coefficient (Oct. 2016)
Diversity of PFTs during cruise 2016
Distribution of major PFTs during 2014 and 2016 cruises
T-S plots showing PFTs associated with different water types
Green Algae

Cryptophytes

Diatoms

T-S plots showing PFTs associated with different water types
NANCY FOSTER CRUISE - 2014

Comparison of MODIS-A and VIIRS derived Chl \(a\) with in-situ Chl \(a\) along the cruise track.
FUTURE PLANS

• Distribution patterns of PFTs in relation to microscale features and frontal zones

• Estimation of net primary productivity using measurements of phytoplankton absorption cross section and quantum yield

\[ \text{NPP}(z) = \int \phi(z) \times a_{ph} \times \text{E}(z, \lambda) \, d\lambda \]

• Validation with deck incubation based measurements of net primary productivity

• Utilize O-BGC provinces of Wei-Lee (2016) for scaling shipboard measurements to regional, basin and global scales

• Compare with sea surface nitrate and new production measurements from NPP-VIIRS
Comparison of phytoplankton specific absorption coefficient during cruises of 2014 and 2016
a) Chl distributions southwest of Sargasso Sea (November 2014); (b) O-BGC provinces derived for the cruise area, with each province denoted by different colors. Two eddies associated with the Gulf Stream are visible in the new O-BGC provinces. Overlaid pie charts denote the percentages of PFTs and the total cell abundance showing differences in PFTs and cell numbers with each province.
NASA-KORUS Cruise Track (May-June 2016) and variable fluorescence ($F_v/F_m$) values shown in inset super-imposed on Aqua-MODIS Chl for waters around Korean Peninsula, (b) O-BGC provinces (May-2016) derived using Wei et al (2016) approach with each province denoted by different colors. Superimposed on O-BGC provinces are fluorescence values showing high/low phytoplankton biomass areas indicated by higher/lower fluorescence. Also shown PFTs associated with O-BGC province
Interannual variability in sea surface nitrate for Sept. from MODIS-Aqua
Monthly maps of sea surface nitrate showing changes in nitrate inputs and drawdown
Interannual variation in nitrate based new production measurements in the North Pacific Ocean from MODIS-Aqua
THANK YOU