

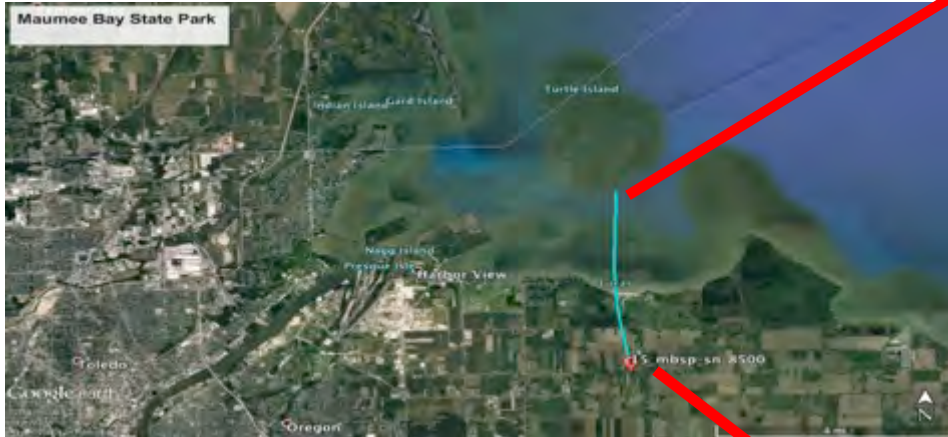
# Hyperspectral Application of Derivative Spectroscopy



## NASA HSI2 (Hyperspectral Imager 2)

North of Maumee Bay State Park

June 21, 2016, Swath 13



Initial SNR 1000:1

062116 13\_MBSP

VPCA Decomposition

RGB

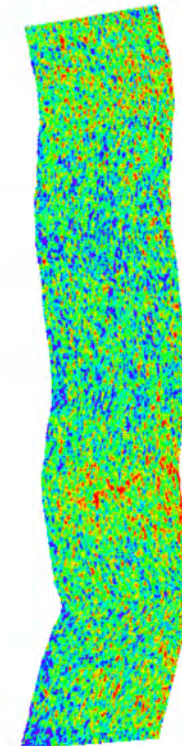
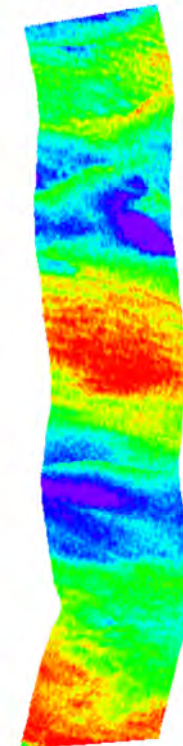
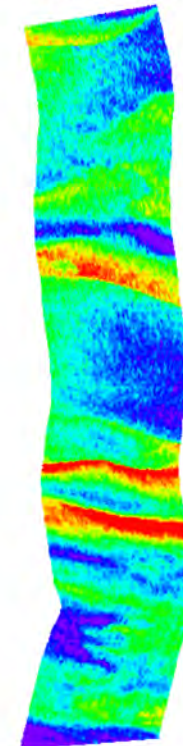
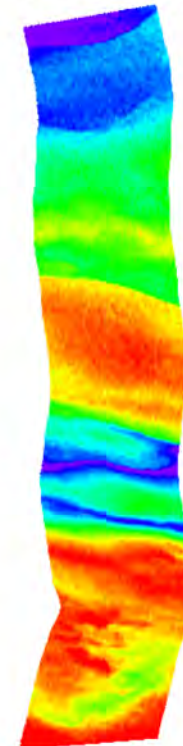
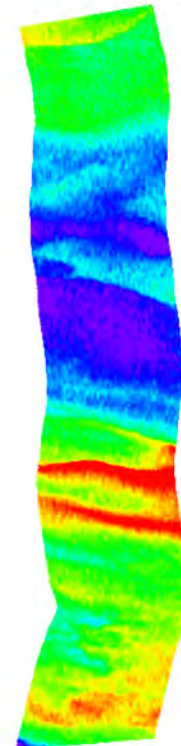
VPCA 1: 56.1%

VPCA 2: 21.4%

VPCA 3: 9.1%

VPCA 4: 4.7%

VPCA 5: 4.2%

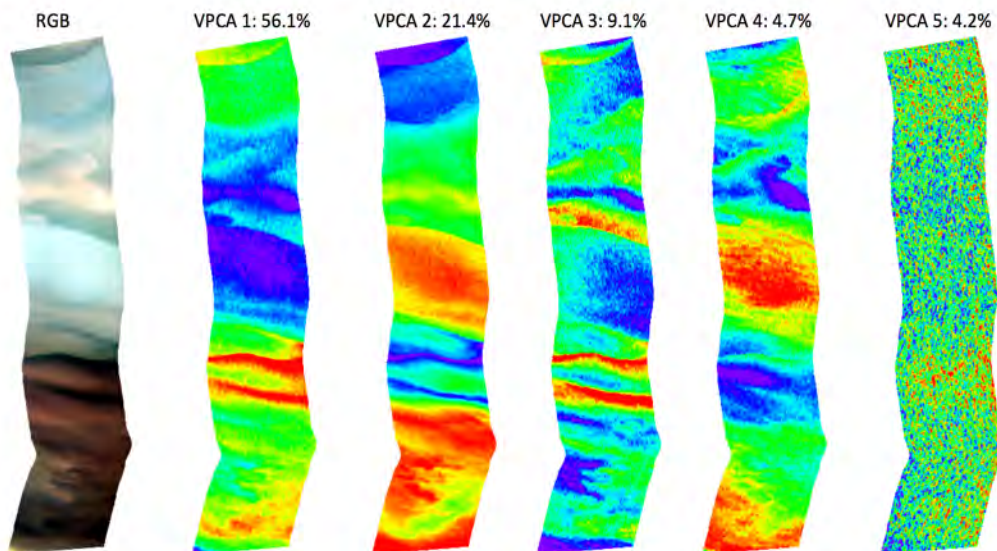


Original Image (RGB)

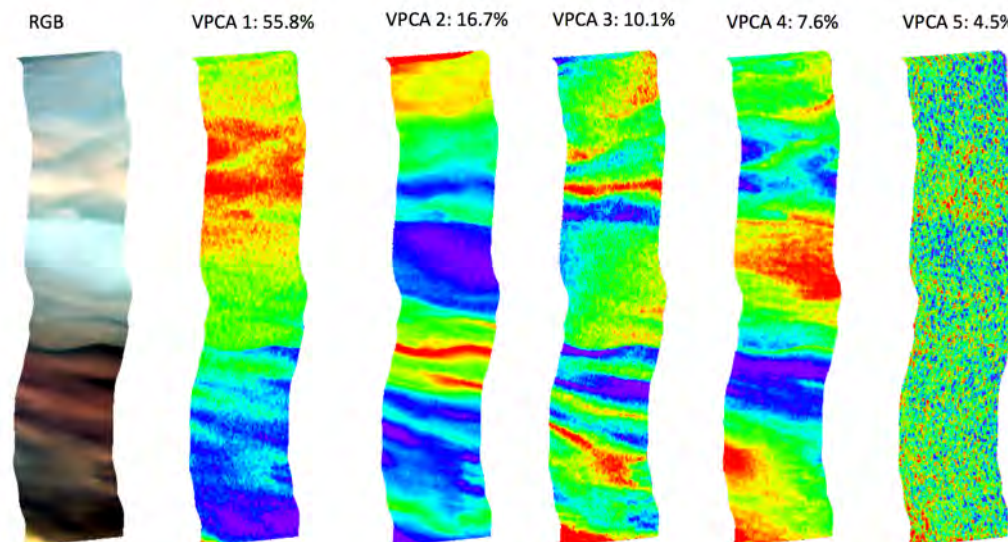
**After:** J.D. Ortiz, D. Avouris, S. Schiller, J.C. Luvall, J.D. Lekki, R.P. Tokars, R.C. Anderson, R. Shuchman, M. Sayers, and R. Becker, Evaluating visible derivative spectroscopy by varimax-rotated, principal component analysis of aerial hyperspectral images from the western basin of Lake Erie, Journal of Great Lakes Research, in press, 2019.

<https://doi.org/10.1016/j.jglr.2019.03.005>; Email: jortiz@kent.edu

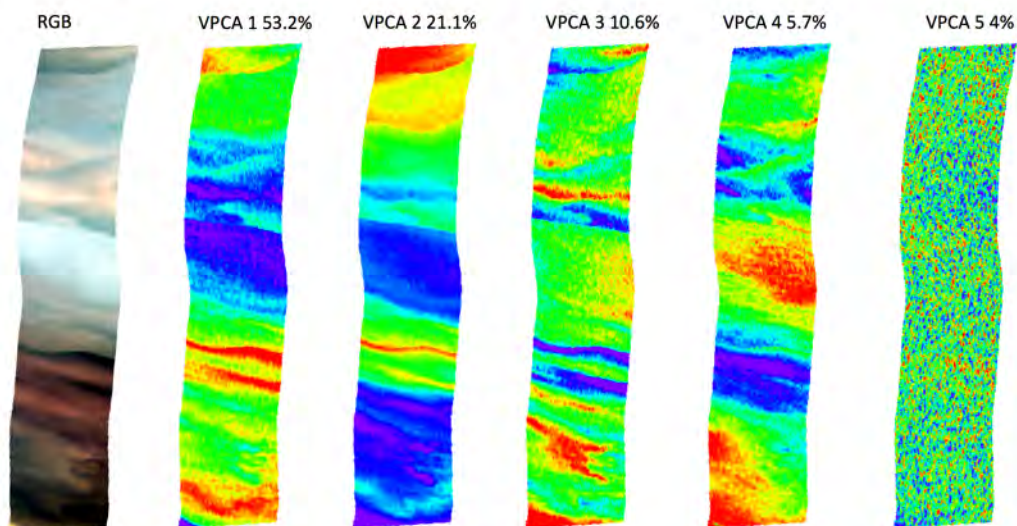
062116 13\_MBSP



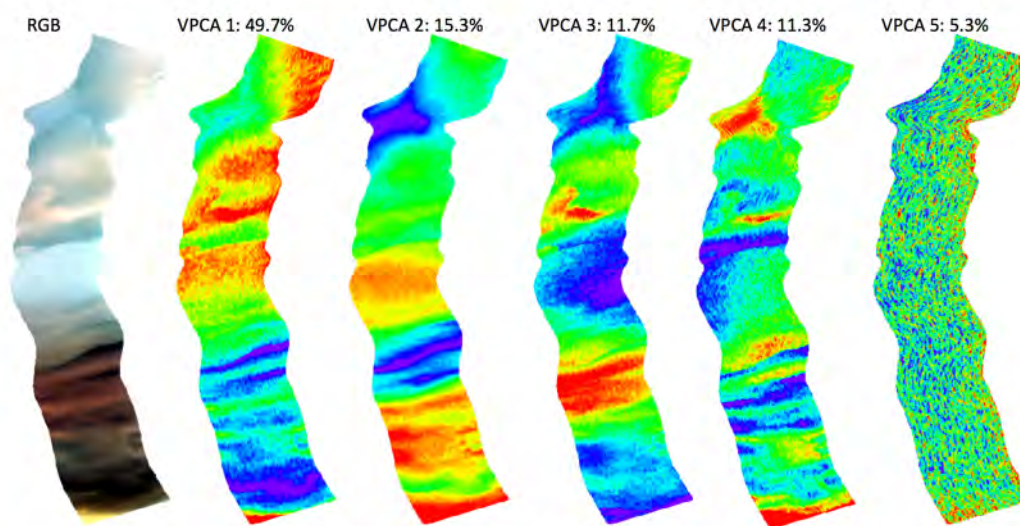
062116 15\_MBSP

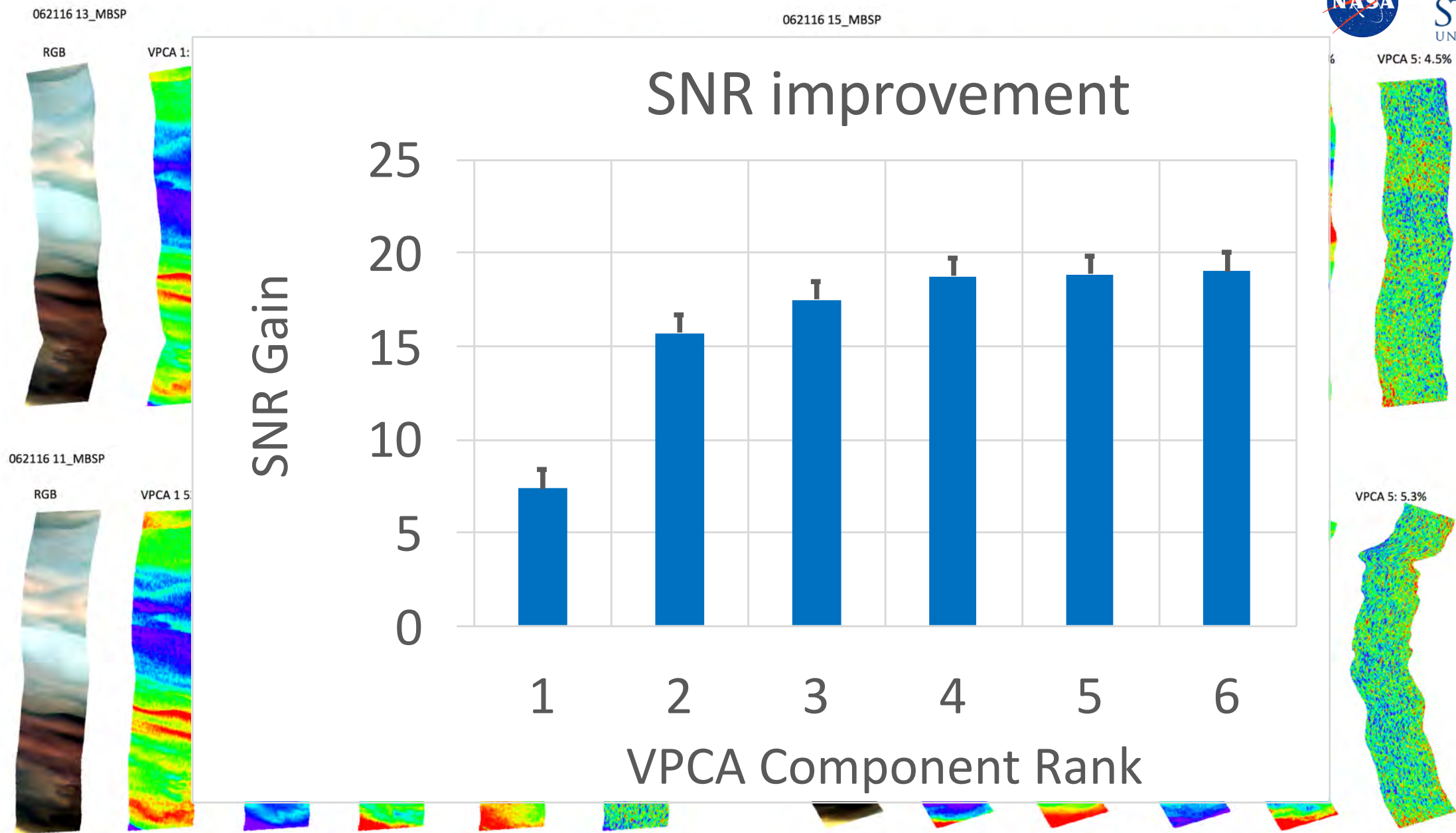


062116 11\_MBSP

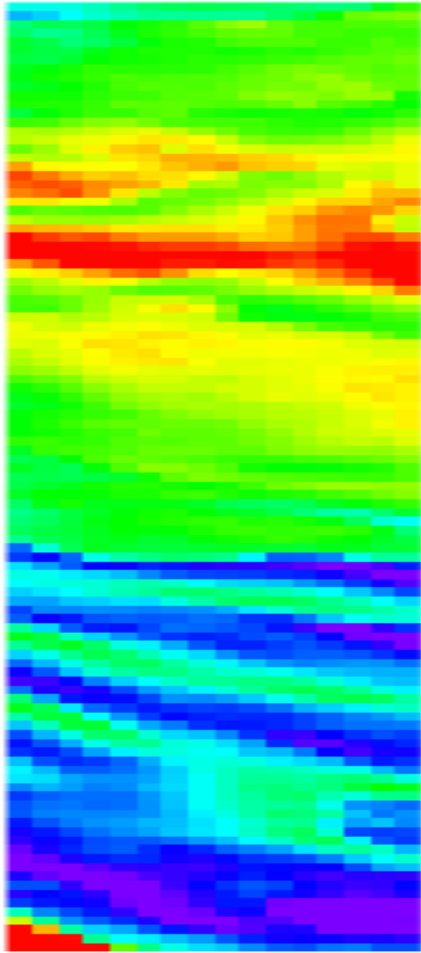


062116 09\_WE6\_MBSP

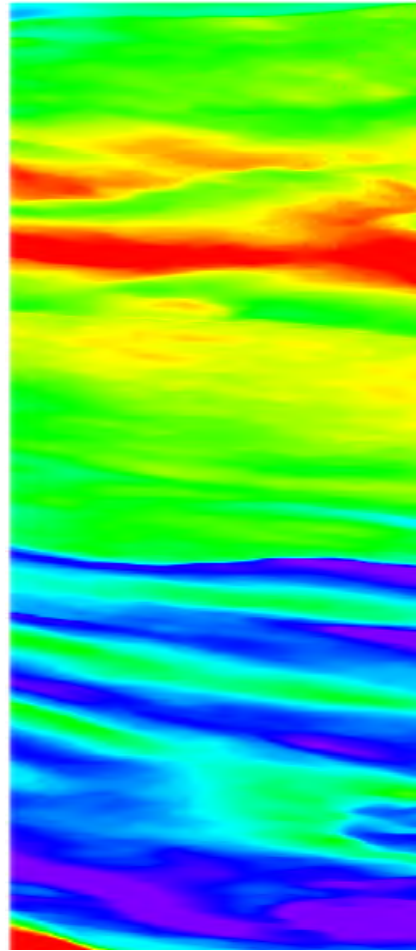




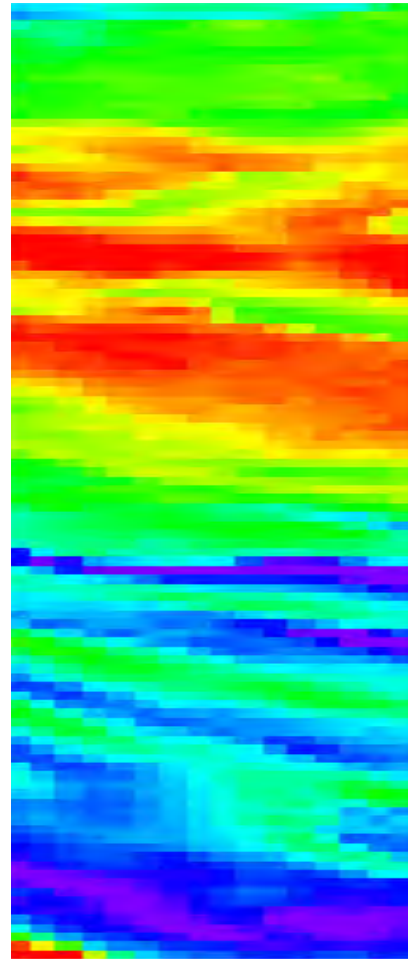
VPCA 1 Simulated  
L8 bands, 30m



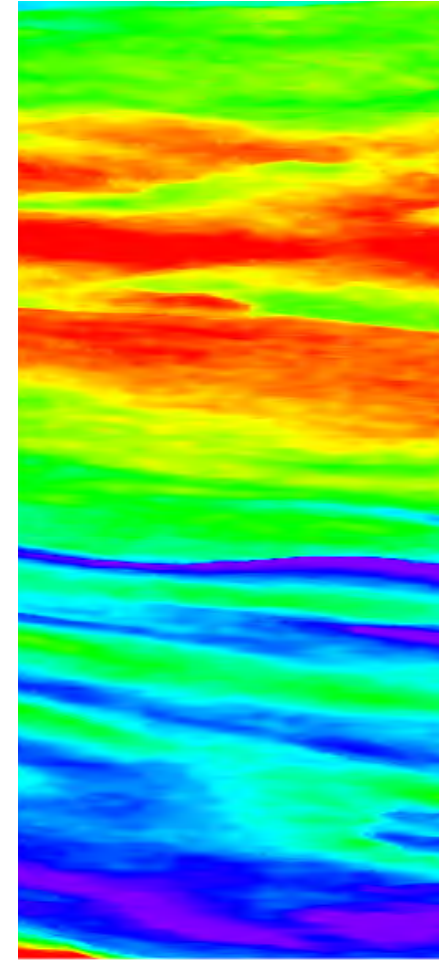
VPCA 1 Simulated L8  
bands, 3m, Smooth 9x9



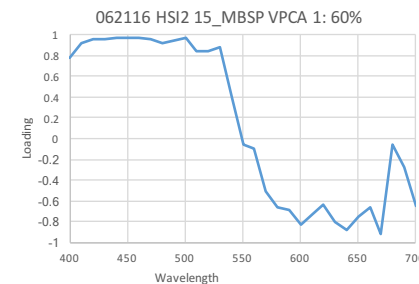
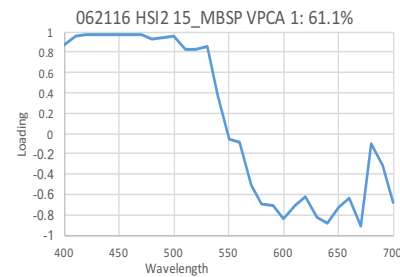
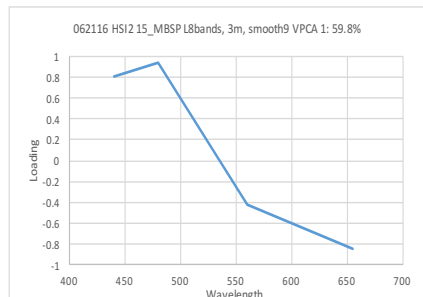
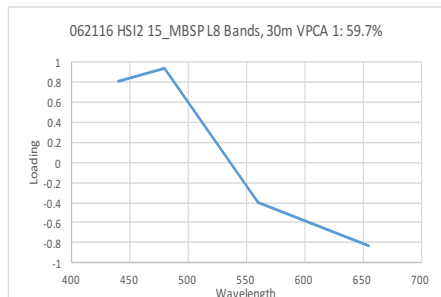
VPCA -1 HSI2  
10nm, 30 m



VPCA1 HSI2 10nm,  
3 m, Smooth 9x9



**Composition:**  
Illite,  
diatoms and  
phycoerythrin  
(R=0.94)

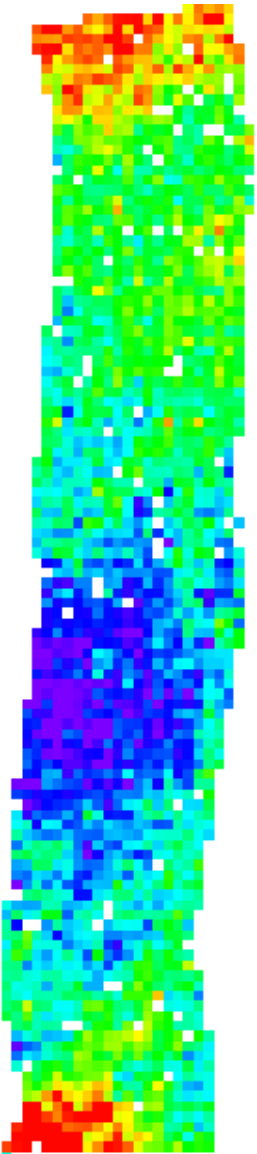


**Ortiz et al., (HyspIRI 2017;  
jortiz@kent.edu)**

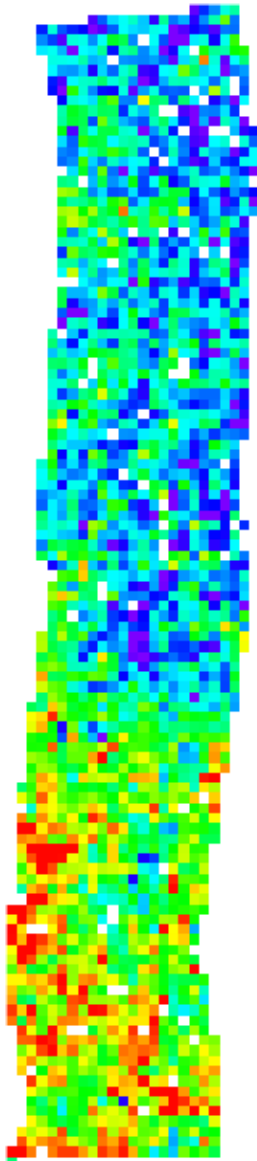
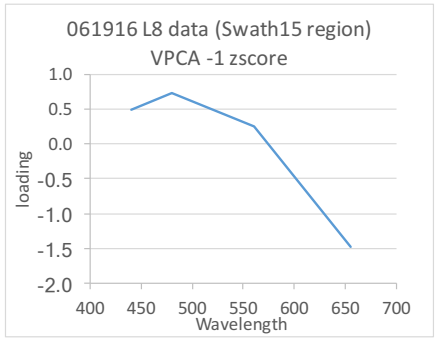
# Actual L8 Image Decomposition

061916 L8 (surface reflectance product), swath15 subset: VPCA decomposition

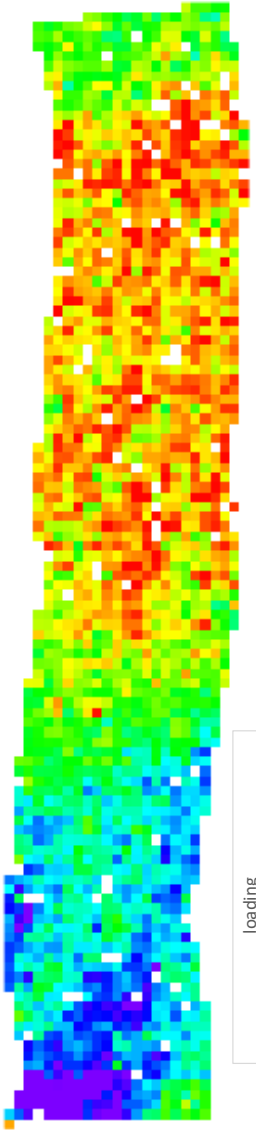
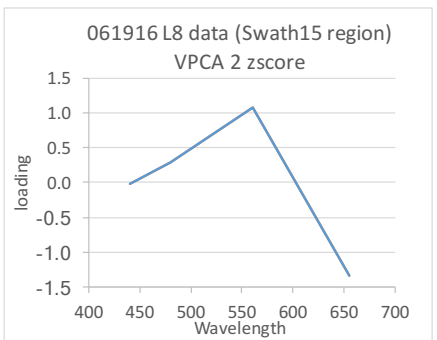
RGB      061916 L8 swath 15 subset VPCA -1      061916 L8 swath 15 subset VPCA 2      061916 L8 swath 15 subset VPCA 3



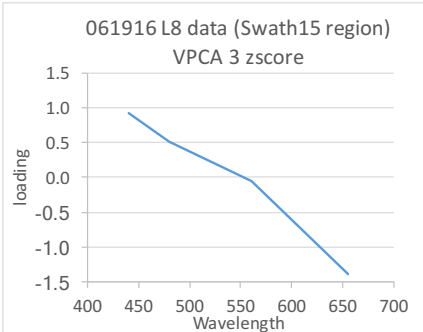
**Composition:**  
Diatoms  
(R=0.996)



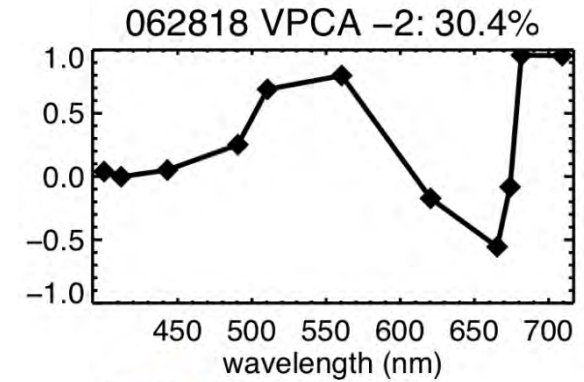
**Composition:**  
Phycocyanin  
(R=0.993)



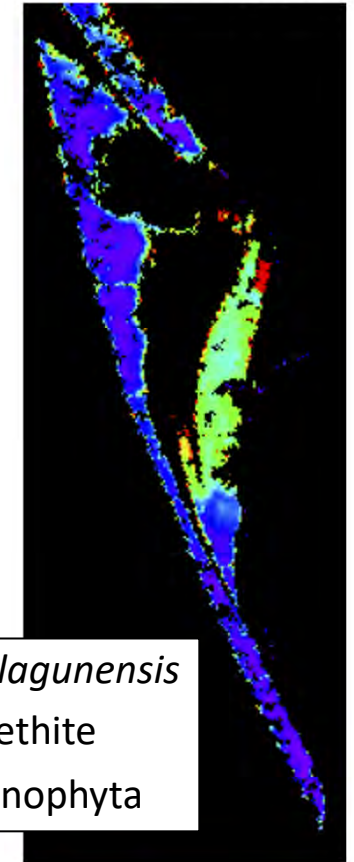
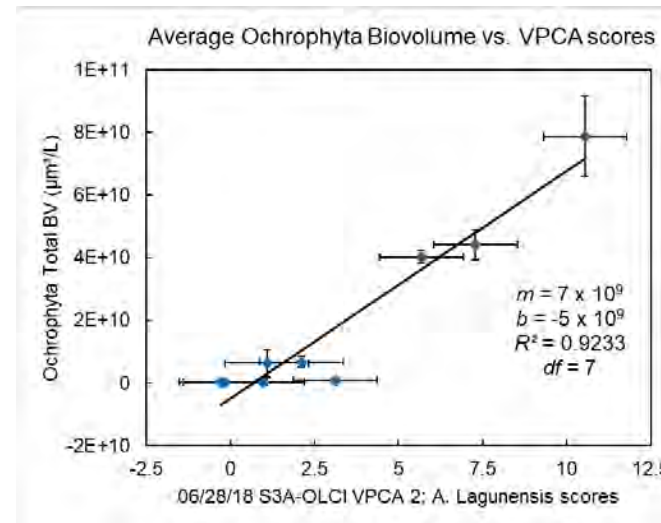
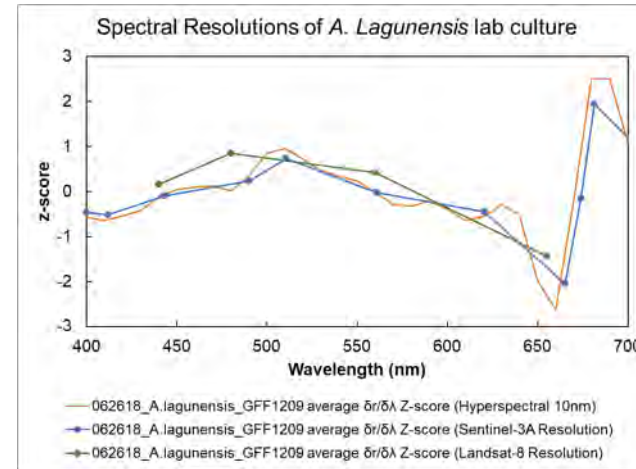
**Composition:**  
Chl a & carotenoids  
(R=0.996)



# Indian River Lagoon Brown Tide *A. lagunensis* from Sentinel-3A



- KSU VPCA spectral decomposition identifies Brown Tide in IRL, Florida
- Spectral signature for *A. lagunensis* in spectral library matches spectral signal extracted from Landsat 8 OLI, Sentinel-3A OLCI
- Landsat 8 OLI, Sentinel-3A OLCI spatial patterns match known Brown tide in Mosquito Creek, IRL
- Cell count concentration for Ochrophyta match pixels values extracted from Sentinel-3A OLCI ( $R^2 = 0.92$ )



+ *A. lagunensis*  
+ goethite  
- cyanophyta

