ENHANCED MONITORING OF BIO-OPTICAL PROCESSES IN COASTAL WATERS USING HIGH SPATIAL RESOLUTION CHANNELS ON SNPP-VIIRS

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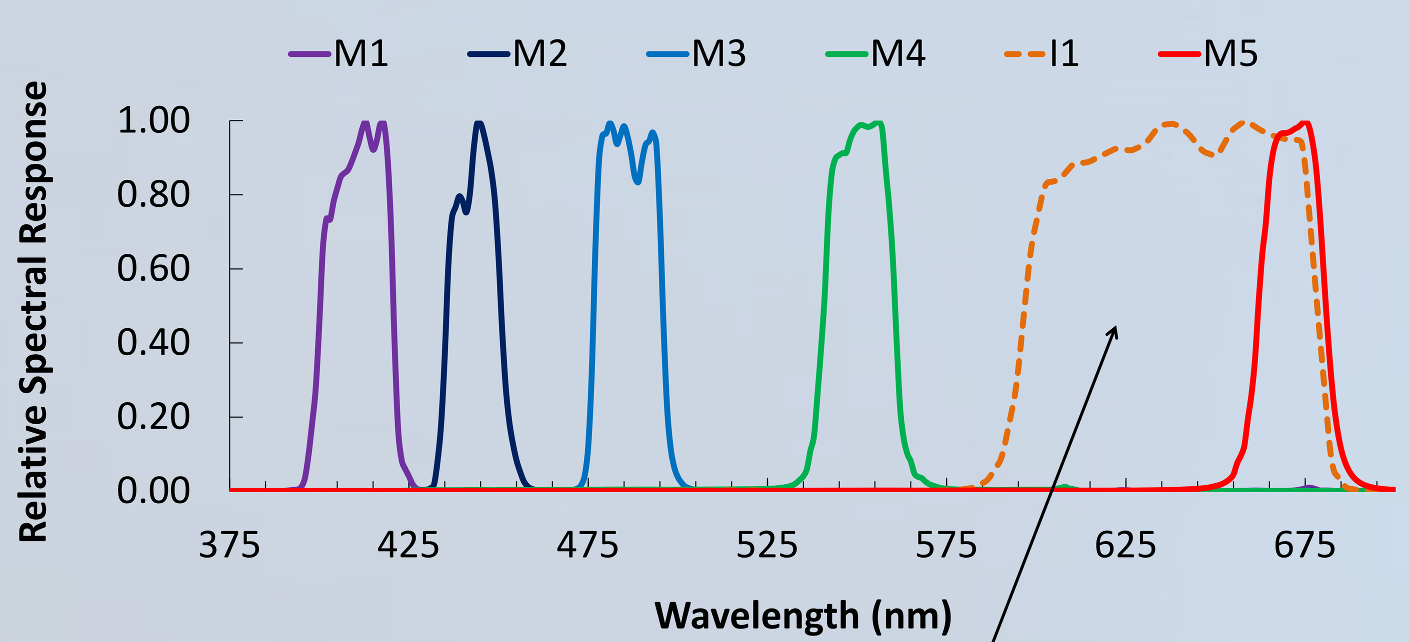
THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Ocean Weather
Real-time monitoring

OBJECTIVES

- Demonstrate a spatially improved ocean color product by combining the VIIRS 750-meter (M- channels) with the 375-m (I1-channel) to produce an image at a pseudo-resolution of 375-m.
- Apply a dynamic wavelength-specific spatial resolution ratio that is *weighted* as a function of the relationship between proximate I- and M-band variance at each pixel.



Challenge:
I-1 band is not panchromatic, must account for *dynamic variance* across the spectrum based on differing absorption and scattering coefficients at each λ.

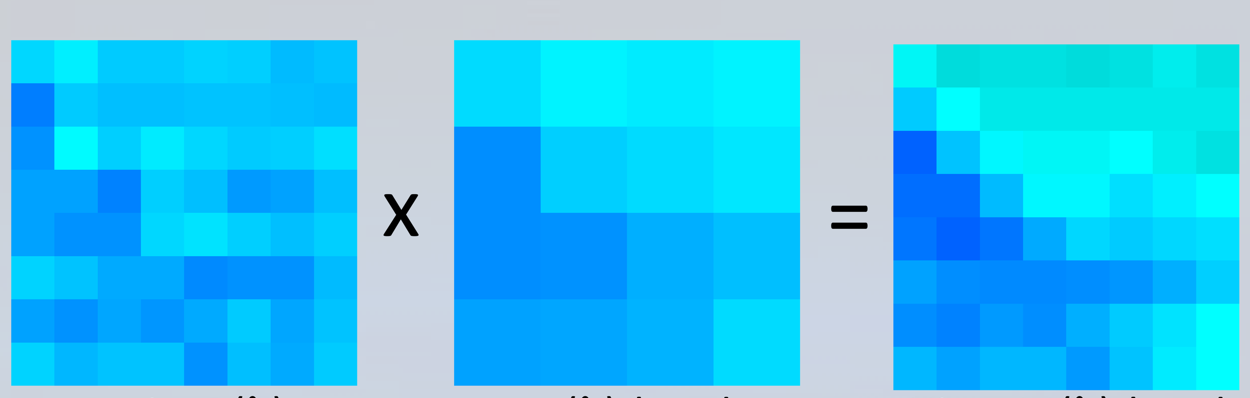
APPROACH

1) Determine wavelength specific spatial resolution ratio, $R(\lambda)$, for every pixel in image:

$$R(\lambda) = ([(I - I^*) \times (M(\lambda)_{CV} / I_{CV})_{thresh=1}] + I^*) / I^*$$

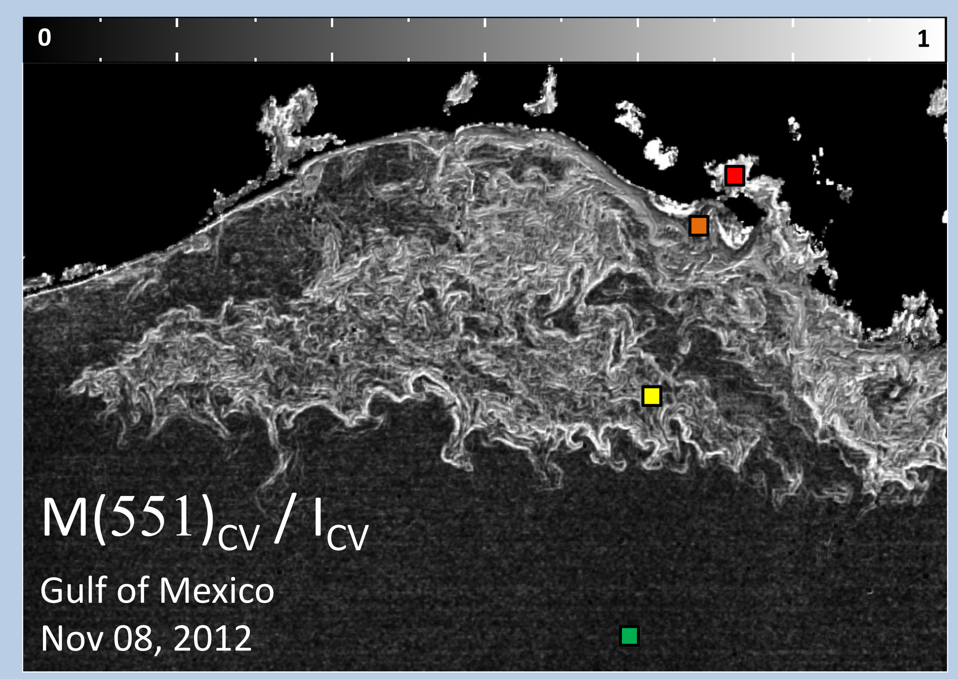
- I = VIIRS I1-Band (375-m resolution)
- I^* = VIIRS I1-Band (750-m resolution)
- $M(\lambda)_{CV}$ = VIIRS $M(\lambda)$-Band coefficient of variance (5 x 5)
- I_{CV} = VIIRS I1-Band coefficient of variance (5 x 5)

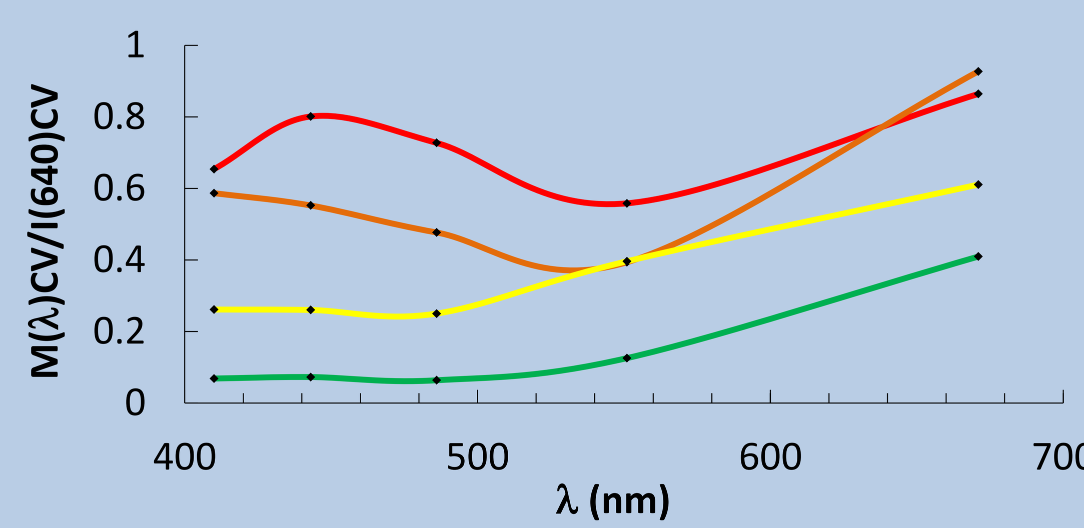
2) Apply *dynamic* ratio to each low-resolution M-band:



RESULTS & DISCUSSION

- By comparing variance across the interpolated spectrum with the variance of the high resolution band, a "sharpening probability map" is created.

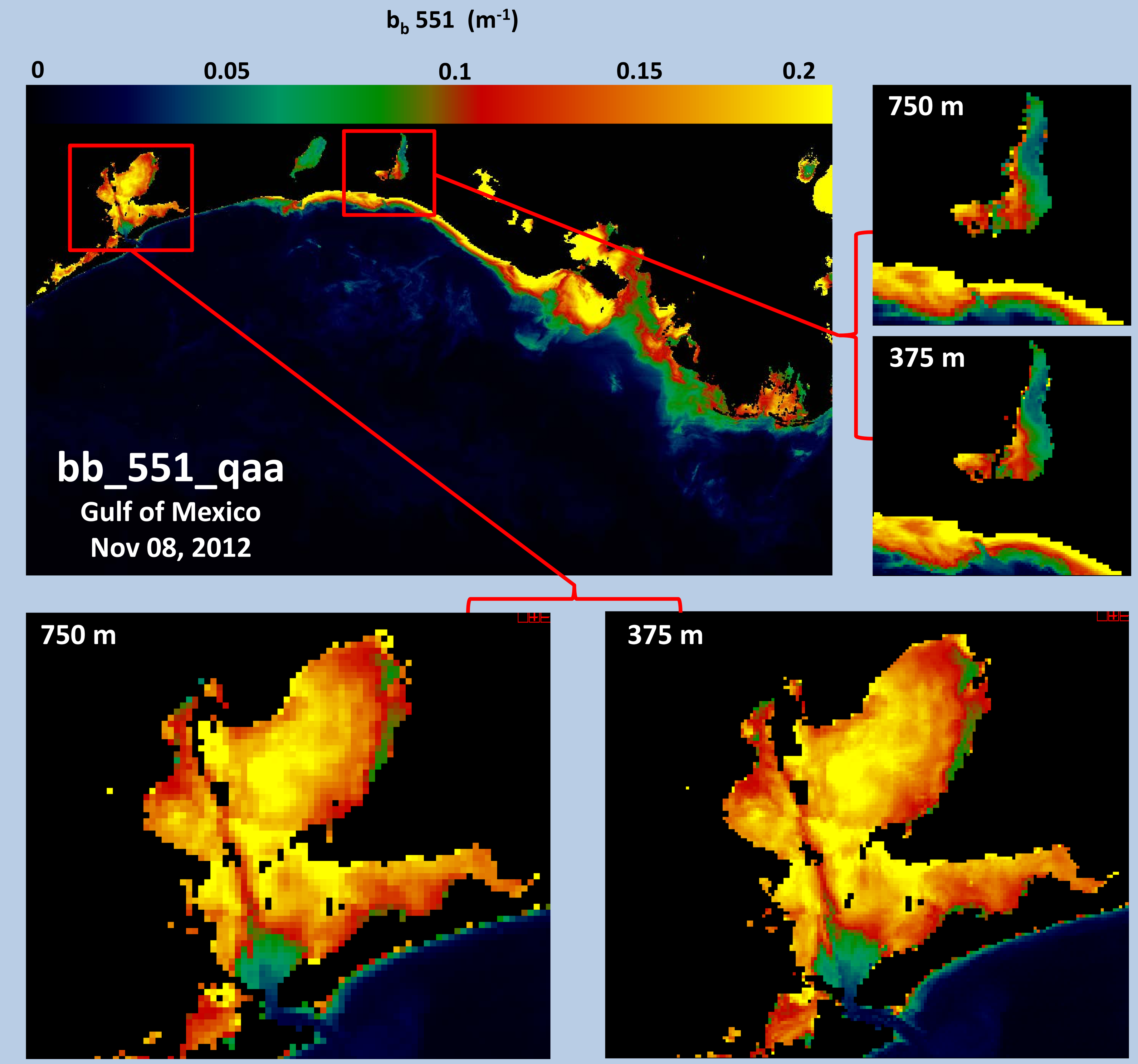




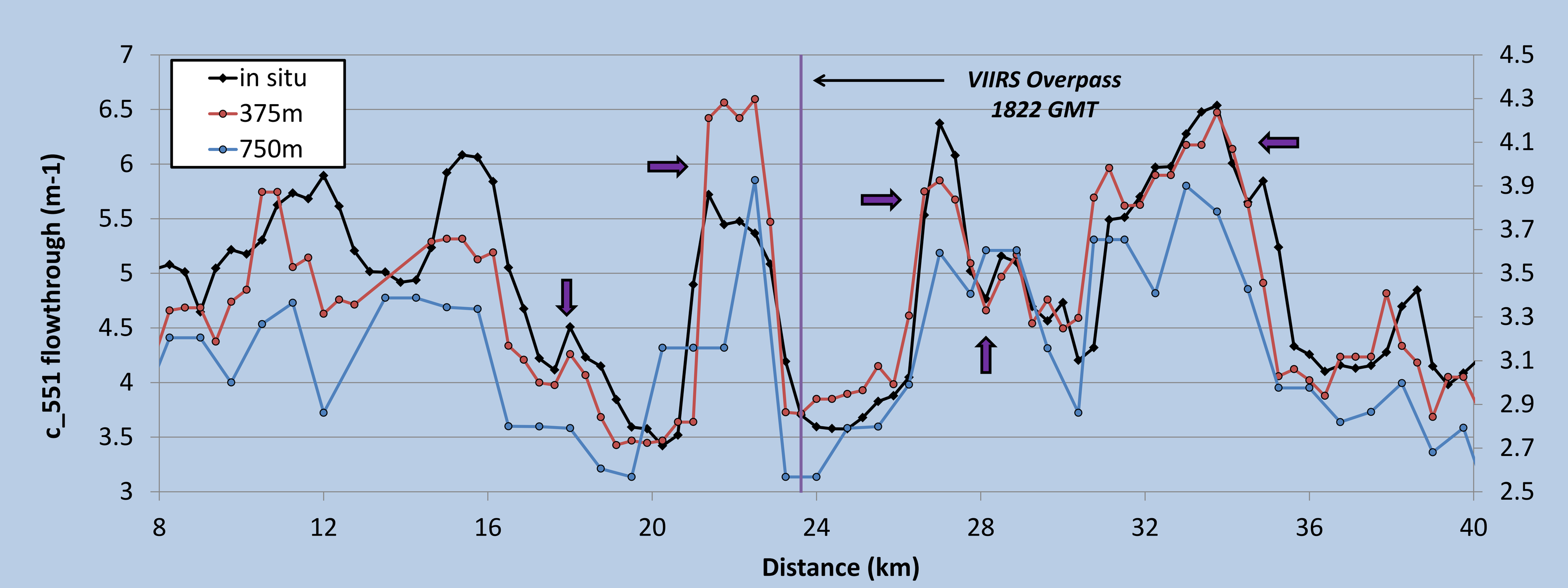
- At pixels where $M(\lambda)_{CV} / I_{CV}$ ratio is closer to 1 (i.e. covariance of M and I-channel), $M(\lambda)$ is sharpened according to I-band variance. Where divergence in variance occurs, the sharpening weight is adjusted in proportion to the difference in variance between the two bands.

	375-m		750-m	
Λ	slope	**r2**	slope	**r2**
nLw_410	0.9943	**0.8666**	0.9892	**0.8510**
nLw_443	0.9746	**0.9563**	0.9688	**0.9477**
nLw_486	0.9648	**0.9787**	0.9823	**0.9715**
nLw_551	1.0092	**0.9866**	0.9941	**0.9808**
nLw_671	1.2532	**0.9636**	1.233	**0.9528**

- A scatter plot comparison of 44 *in situ* spectral reflectance measurements (Hyperpro, Sky-blocked approach [Lee et al. 2013], ASD, AERONET) to VIIRS satellite data processed at two different resolutions shows enhanced accuracy and precision at 375-m resolution compared to the native 750-m resolution of the sensor.



The sharpened water leaving radiance (nLw)) radiance spectrum is placed into l2gen software, and processed to produce bio-optical products (bb_551 shown above) at a higher spatial resolution. Notice the increased feature resolution for coastal bays and inland waters in the northern Gulf of Mexico.



An *in situ* flow through data set showing bean attenuation (551 nm) is binned to 375-m (black line) and compared to satellite products at 375-m (red) and 750-m (blue). Results show an increased feature detection for the VIIRS sensor.