Remote Sensing Of Water Quality Index in Florida Bay and Florida Keys: Current Status and Challenge

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Outline

1. Background: Why Remote Sensing?
2. Sea Surface Temperature
3. Ocean Color
4. What’s Next?
Water Quality

- Dissolved Oxygen
- pH
- Nutrients
- Bacteria
- Temperature
- Chlorophyll
- Water Clarity
- Turbidity (Sediment)
- Colored Dissolved Organic Matter (CDOM)
Water Quality

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Water Quality Monitoring

Libby Johns et al, NOAA/AOML and UM/CIMAS
1995 – present, South Florida, bi-monthly
1998 – present, Florida Bay, monthly
2002 – present, Biscayne Bay, monthly
Problem #1: Temporal Aliasing
Problem #2: Coverage/Resolution

NOAA/NESDIS Degree Heating Weeks for last 12 Weeks – 8/20/2005
Problem #2: Coverage/Resolution
Problem in high-resolution SST

November 25, 1999, 00:24 GMT
SST Cloud Screening

1. \( |\text{SST} - \text{SST}_{\text{clim}}| \geq \Delta X? \)
   - YES → Cloud
   - NO → NO

2. \( |\text{SST} - \text{SST}_{\text{median}}| \geq \Delta Y? \)
   - YES → Cloud
   - NO → Valid
SST Cloud Screening

(c) SST vs. NDBC SST
RMS = 0.60, SD = 0.53
r = 0.99, n = 377
bias = -0.29

(d) SST anomaly vs. NDBC SST anomaly
RMS = 0.44, SD = 0.44
r = 0.89, n = 377
bias = -0.00

DRYF1 Weekly SST
Satellite SST (°C)
Satellite SST anomaly (°C)
1-km SST

JPL AVHRR Pathfinder SST (4 km)  USF SST (1 km)
1-km SST DHWs
1-km SST “snapshots”
Integration with NOAA ICON

Where Are the Data?

http://imars.usf.edu/merged_sst

Institute for Marine Remote Sensing (IMaRS) - West Florida Shelf — University of South Florida (husf) Antenna - Monthly / Weekly — Anomaly & Mean

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SST Mean & Anomaly

Click month link below

2008
Dec  Nov  Oct
Sep  Aug  Jul
Jun  May  Apr
Mar  Feb  Jan

2007
Dec  Nov  Oct
Sep  Aug  Jul
Jun  May  Apr
Mar  Feb  Jan

2006
Dec  Nov  Oct
Sep  Aug  Jul
Jun  May  Apr
Mar  Feb  Jan

2005
Dec  Nov  Oct
Sep  Aug  Jul
Jun  May  Apr
Mar  Feb  Jan

This site is fully XHTML 1.0 Strict and CSS level 2.1 compliant. E 7 is not! If you are having difficulties, please use a W3C compliant browser to view this site correctly.

This site contains sea surface temperature (SST) imagery products derived from several satellite sensors including the Advanced Very High Resolution Radiometer (AVHRR) and MODerate resolution Imaging Spectroradiometer (MODIS). The background and methodology on how these products are generated as well as their applications can be found in the following publication:

Hu et al. (in press), Building an automated integrated observing system to detect sea surface temperature anomaly events in the Florida Keys. IEEE Transactions on Geoscience and Remote Sensing.

There are three different imagery products: mean, anomaly, climatology, and degree-heating-weeks (DHWs). The anomaly is defined as the difference between the mean and the corresponding 12-year climatology. DHW products are generated using the same algorithm and colorbar as applied to NOAA Coral Reef Watch images (http://www.osdpd.noaa.gov/PSD/EPs/SST/dhw_rer0.html). DHW values measure cumulative heat stress from SST anomalies above the maximum monthly mean summed over the previous 12 weeks. For a far more lengthy explanation of DHW details, please refer to NOAA's page by clicking here. While the mean and anomaly products are updated automatically every week, the DHW products are updated periodically and manually.

While the DHWs products are experimental, all other products have been validated.
What About Chlorophyll?
Chl Accuracy in Tampa Bay
Chl Accuracy in Florida Keys

RMS = 194%
Mean ratio = 2.27
Bias = 1.27
n=35
Chl Accuracy in Florida Keys

RMS = 64%
Mean ratio = 1.18
Bias = 0.18
r=0.88, n=35

Chl (corrected) = f (MODIS Chl, Bottom Depth, Rrs667)
Apply to Entire Region?
Chl as a Color Index

(a) 11/23/2005
(b) 2/12/2003
(c) 8/1/2004
(d) 8/8/2004

http://imars.usf.edu/~hu/scratch/villy/color/
Other Color Index

10/19/2003 MODIS/Aqua

1/30/2002 MODIS/Terra
Chl or CDOM?

RGB

FLH

Toxic Algae Bloom
(Red Tide)
Bloom => Bloom?

Bloom of phytoplankton
Rock Pile, Florida Keys

Bloom of chlorophyte
Cladophora liniformis

Photo courtesy of Brian Lapointe, HBOI
Where Are the Data?

http://modis.marine.usf.edu
New WQP: Floating Algae

Bloom of green macro algae
East China Sea
*Enteromorpha prolifera*
Too Much is No Good!
Sargassum in the Florida Keys?
Sargassum in the Florida Keys?
Conclusions

- Robust 1-km SST – ICON Integration
- Provisional Chl – Work in Progress
- Products Available to All
- New Products Coming Soon
- Teamwork Paid Off!