Cyberinfrastructure Perspectives: Academia An Oceanographer's Perspective

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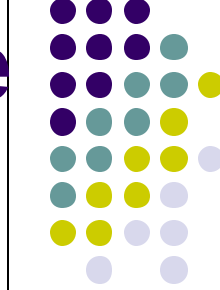
So Why am I at Cyberinfrastructure Panel, Anyway?



- **Education**
  - BS in Radio-techniques and **Cybernetics** 1973
  - MS in Oceanography 1976
  - PhD in Oceanography 1979
  - ScD in Oceanography 1992

- **Professional experience**
  - Air-sea interaction
  - Coastal oceanography
  - Sensor development

Cybernetics

Cybernetics is the science about cycles, self regulation, self organization…

- Cybernetics originally emerged from Science Fiction
- Popular among early computer scientists
- Later Cybernetics diffused to several sciences and partially lost its initial meaning

Cyberinfrastructure

Atkins (2002)

- The term *infrastructure* has been used since the 1920's to refer collectively to the roads, bridges, rail lines, and similar public works that are required for an industrial economy to function.
- The recent term *cyberinfrastructure* refers to an infrastructure based upon computer, information and communication technology (increasingly) required for discovery, dissemination, and preservation of knowledge.
- Traditional infrastructure is required for an industrial economy. Cyberinfrastructure is required for an information economy.

What distinguishes "Environmental Sciences"

(NSF Workshop, 2002)

- Spatial context
- Multiplicity of space/time scales (few scale separations)
- Different data types
- Real-time needs
- Observationally oriented (vs experiment)
- Many sub-disciplines (interdisciplinarity)
- Relationship to decision and policy
- Legacy, subjective, analog data
- Societal relevance (relation to outreach and education)

Oceanography and Cyberinfrastructure

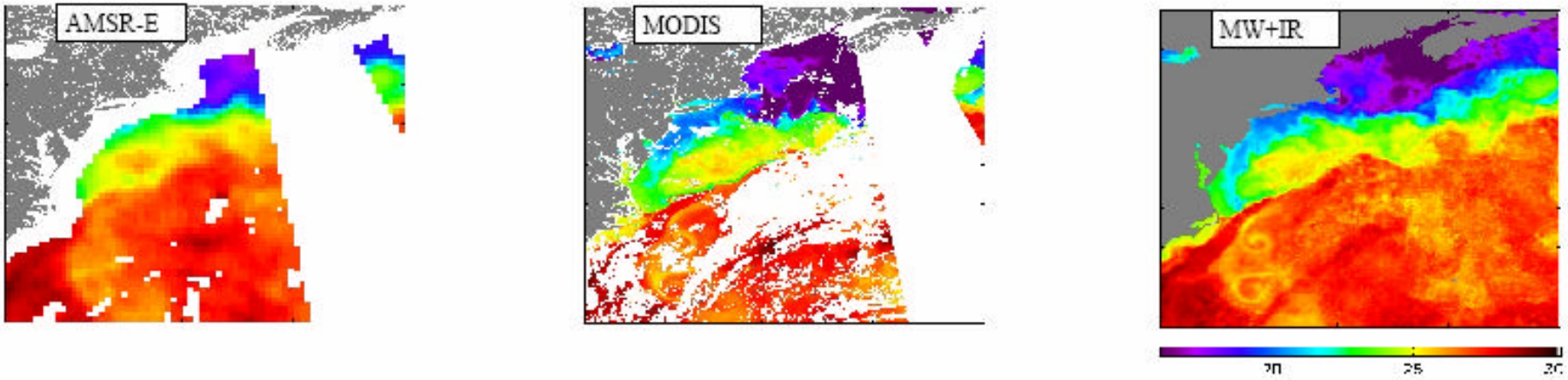
Specifics of oceanographic in situ observations: aggressive environment => The sensor system development and maintenance requires significant experience and investments.

Though cyberinfrastructure will bring the information about the ocean with unprecedented details in space and time domains, an effective use of large data sets will require implementation of proper statistical tools, such as:

- Optimal data interpolation
- Inverse methods
- Data assimilation
- Data mining (operational oceanography)

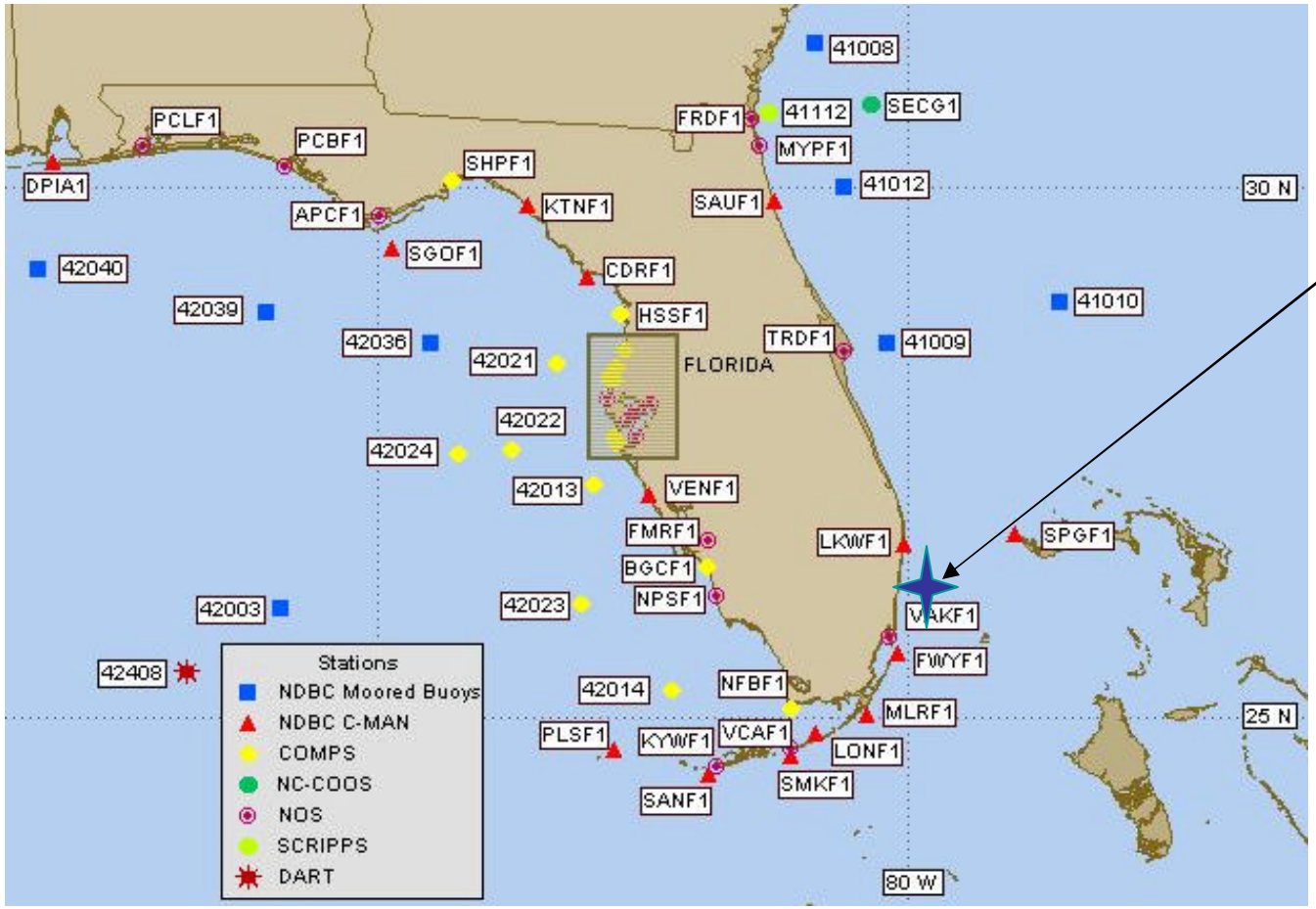
SST

Optimally interpolated IR and MW data shown in the bottom image is clearly better than either individual product.



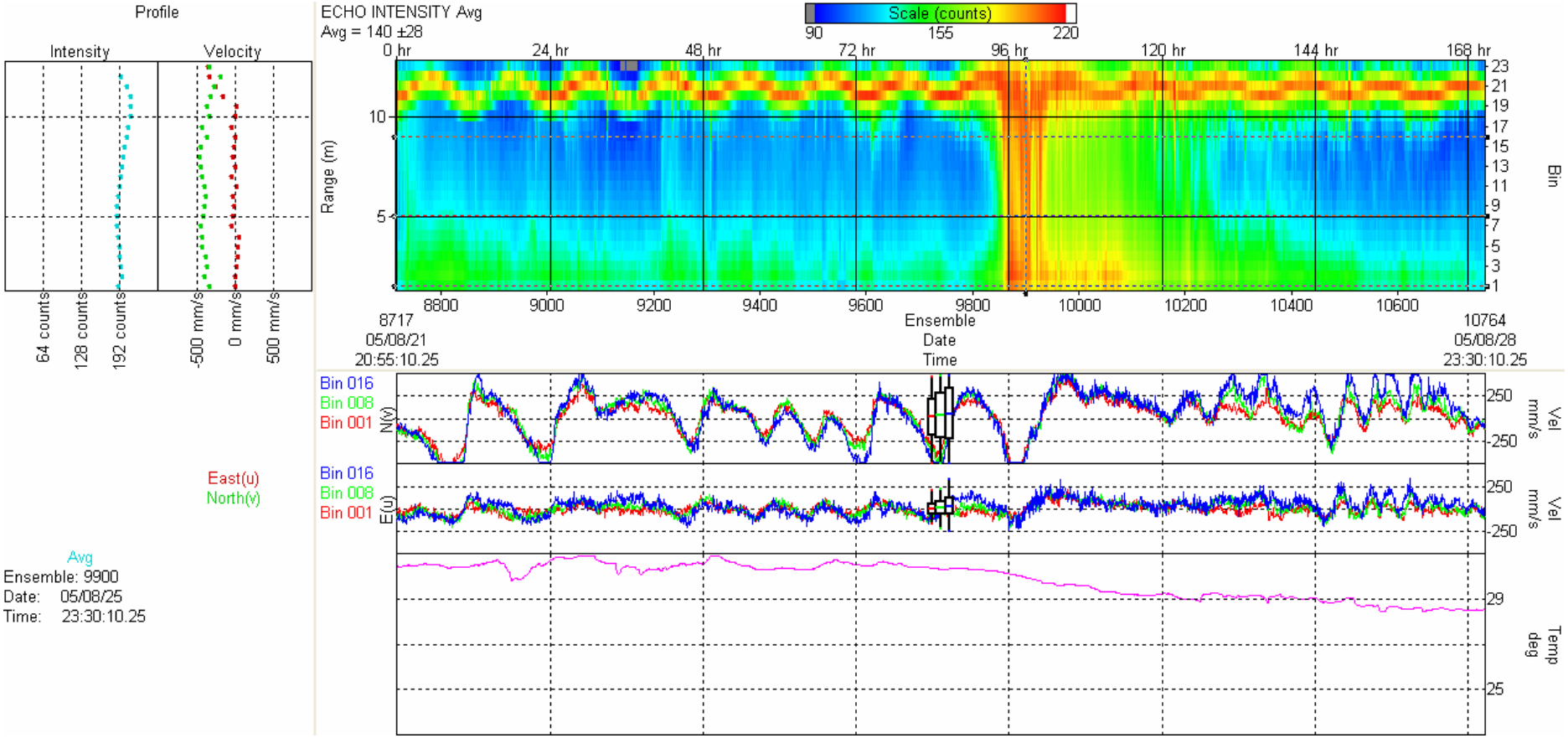
Gulf Stream SST on September 21, 2003. The left image shows 25 km AMSR-E SSTs, the center image shows 4 km MODIS SST, and the bottom image shows a 10 km optimal interpolation of the AMSR-E and MODIS data for a three-day window centered on September 21, 2003. (Gentemann et al., 2006.)

Coastal Oceanography

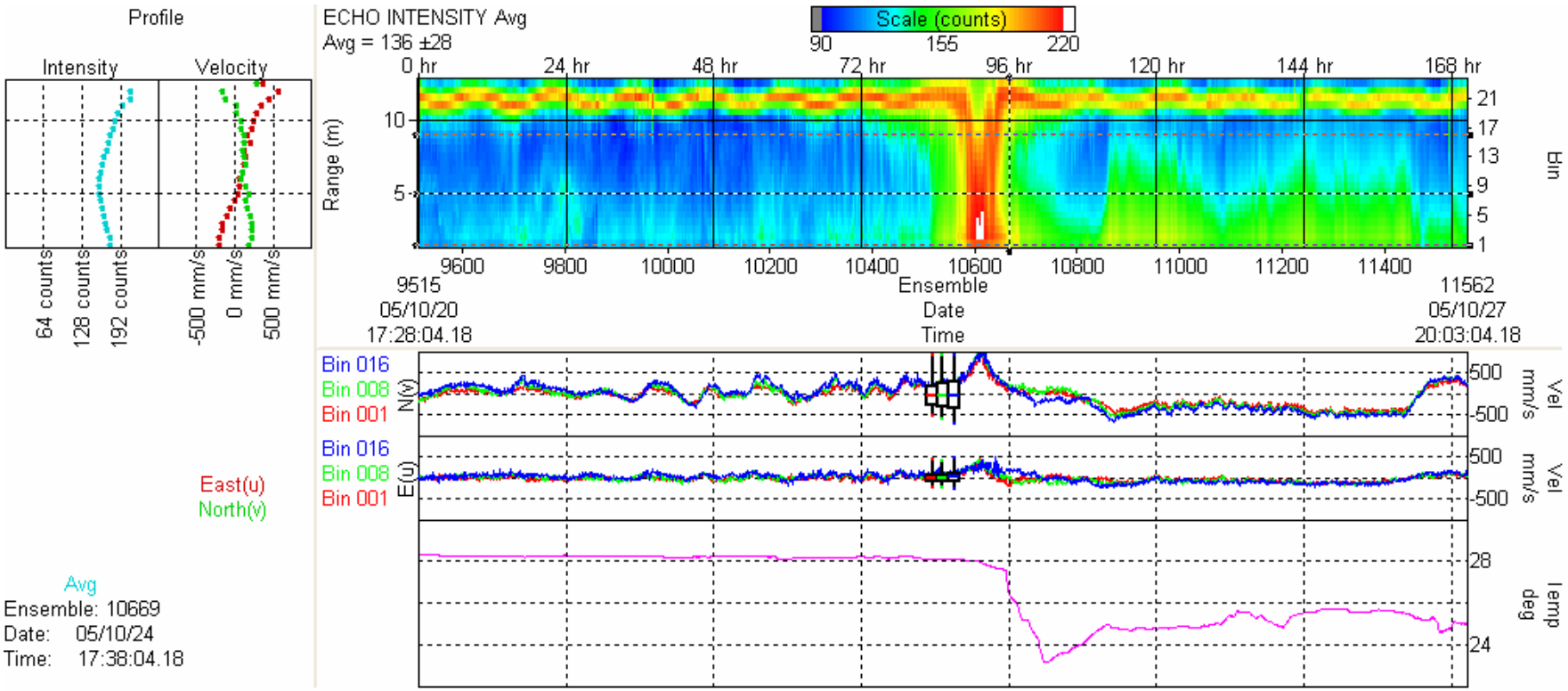


NSU/USF mooring array

Katrina 2005



Wilma 2005



Echo intensity (proxy for sediment), current velocities, and near-bottom temperature during Hurricane Wilma

Cyberinfrastructure: hardware, software, personnel, services, institutions

Oceanographic sensor systems:

• Process oriented (*e.g.*, hurricanes, HABs, climate chanage)

• Spacing between sensor systems should be optimized based on the local conditions (topography, prevailing currents, waves, winds etc.) and data assimilation requirements (de-correlation radius)

• Real-time data transmission is important for operational applications (perhaps less important for process studies)

Software:

• Data management (mining)

• Optimal interpolation, numerical models with data assimilation, inverse methods

• Merging interdisciplinary data

Personnel, services, institutions: FL-Caucus as a part of IOOS (SECOORA, GCOOS) ?