

# Integration of Visual Analytics and Discrete Sciences to COEs

**William Ribarsky**  
**Remco Chang**

University of North Carolina at Charlotte



# Supporting Other Centers of Excellence

- Center of Excellence for Natural Disasters, Coastal Infrastructure, and Emergency Management (DIEM)
  - 3D + time visualization
  - Infrastructure and terrain + population
- Center of Study of Terrorism and Response to Terrorism (START)
  - Analysis of the Global Terrorism Database (GTD)
  - Event, group, and social-political analysis through multimedia analysis



# Center of Excellence for Natural Disasters, Coastal Infrastructure, and Emergency Management (DIEM)

## Problems

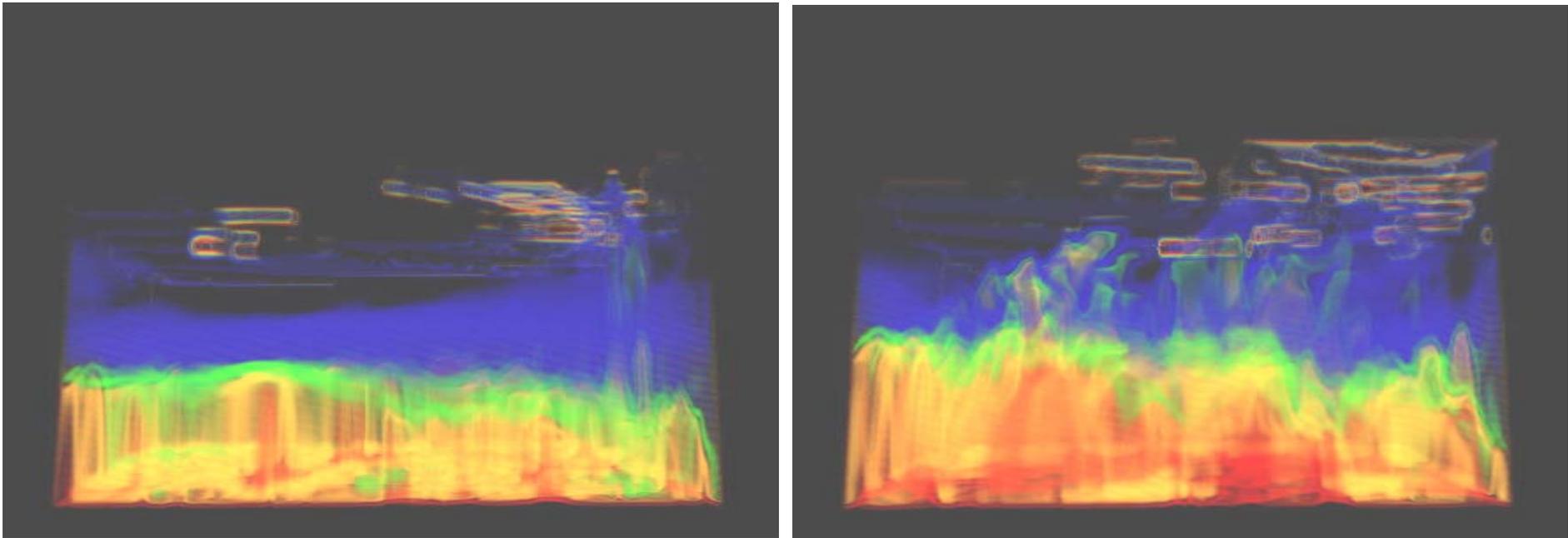
- Multiple, time-dependent 3D fields (rain, hurricane wind fields, storm surge, flooding)
- Analysis of coastal terrain changes due to natural and man-made effects
- Analysis of coastal infrastructure, coastal cities, and their inhabitants

These problems require visual analytics tools integrating interactive visualization with both application-focused and general analyses.



# 4D Feature-Based Data Analysis

- Explore interactive rendering methods to combine the visualization of 3D datasets and abstract information for advanced analysis capabilities
- Investigate an effective approach to visualize data correlations from multivariate time-varying datasets
- Explore enhancement methods to highlight context-based 4D data features



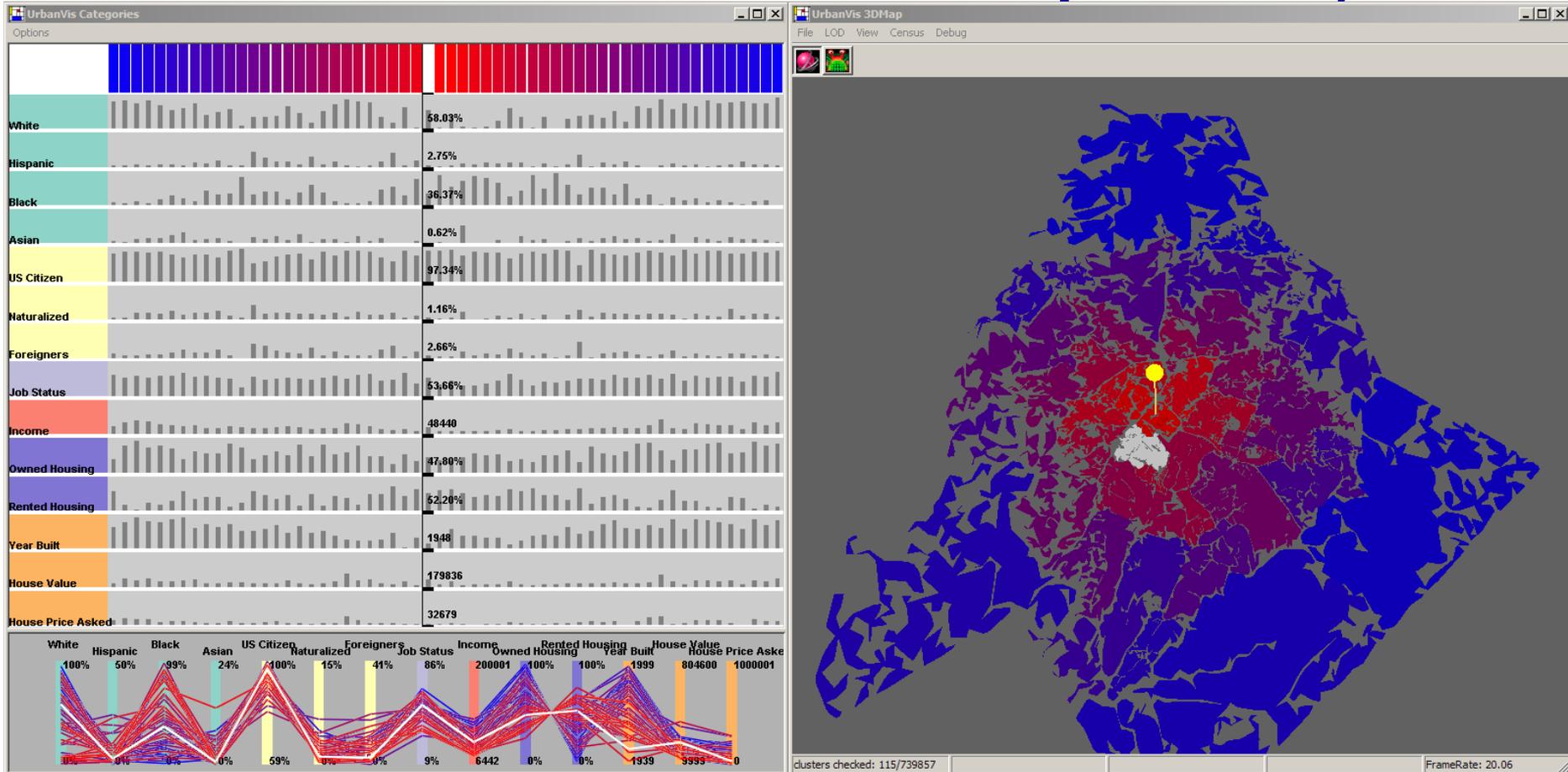
Morning (Left) and afternoon (right) of Nitrous Oxide over the Charlotte region from a run of the CMAQ model

# 4D Data Interaction

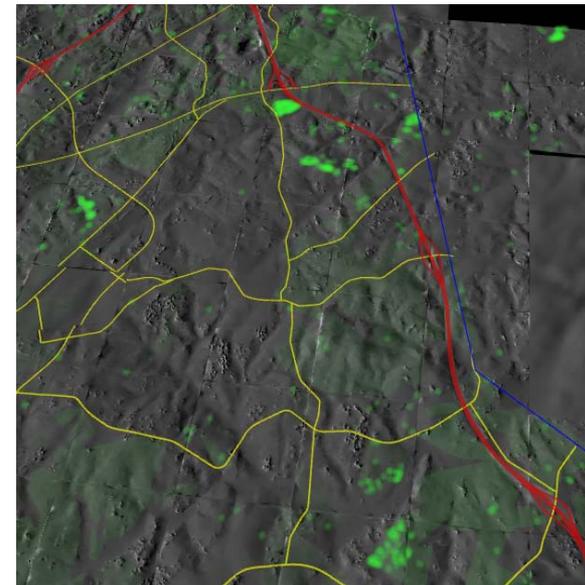
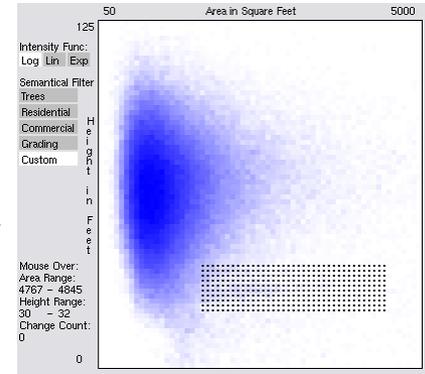
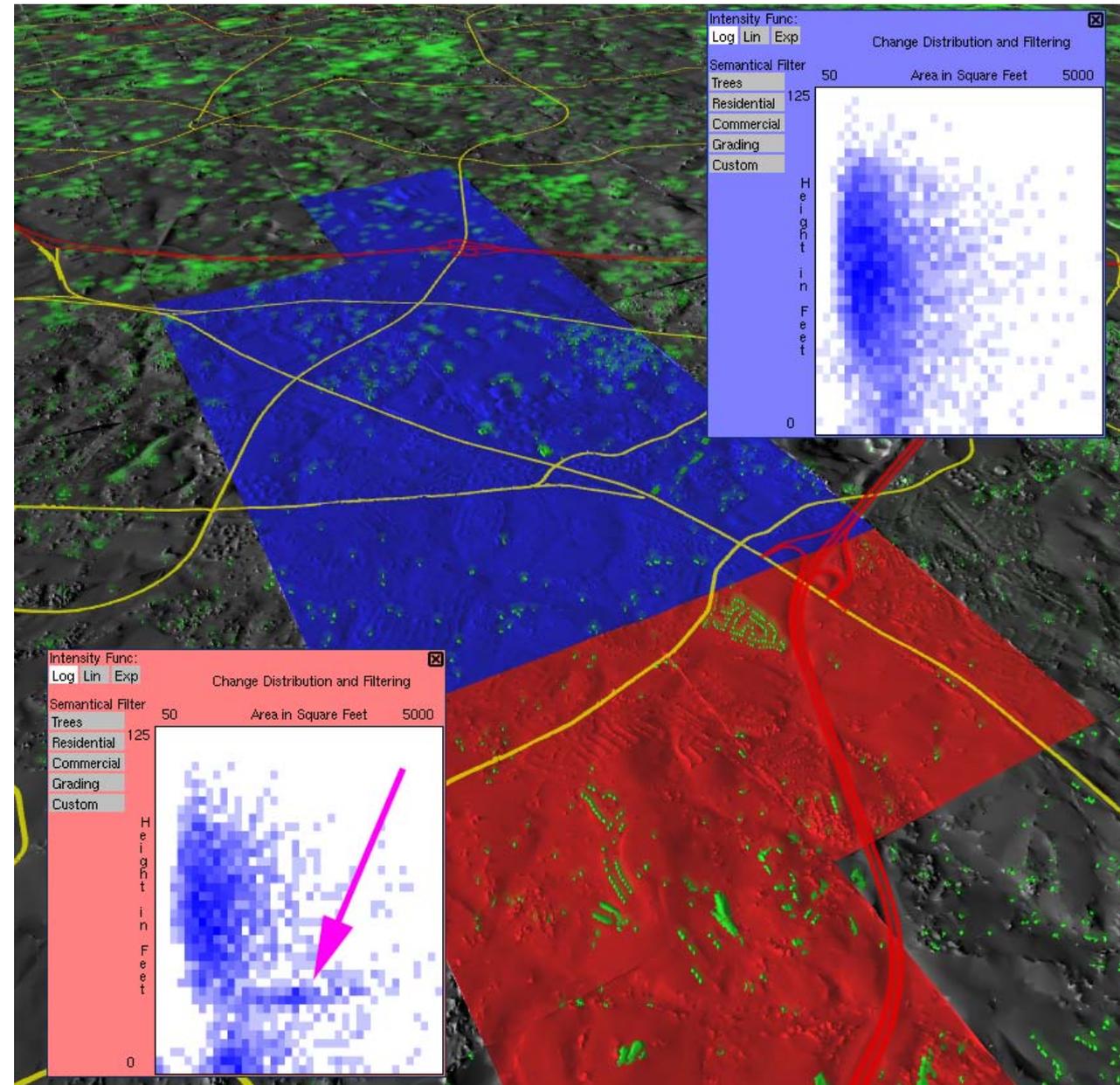
- Develop task-driven methods to assist and accelerate important visualization and analysis processes
- Integrate all the functions in a visualization environment and specialize it for models, such as storm surge and hurricane weather, that are interests to the center.



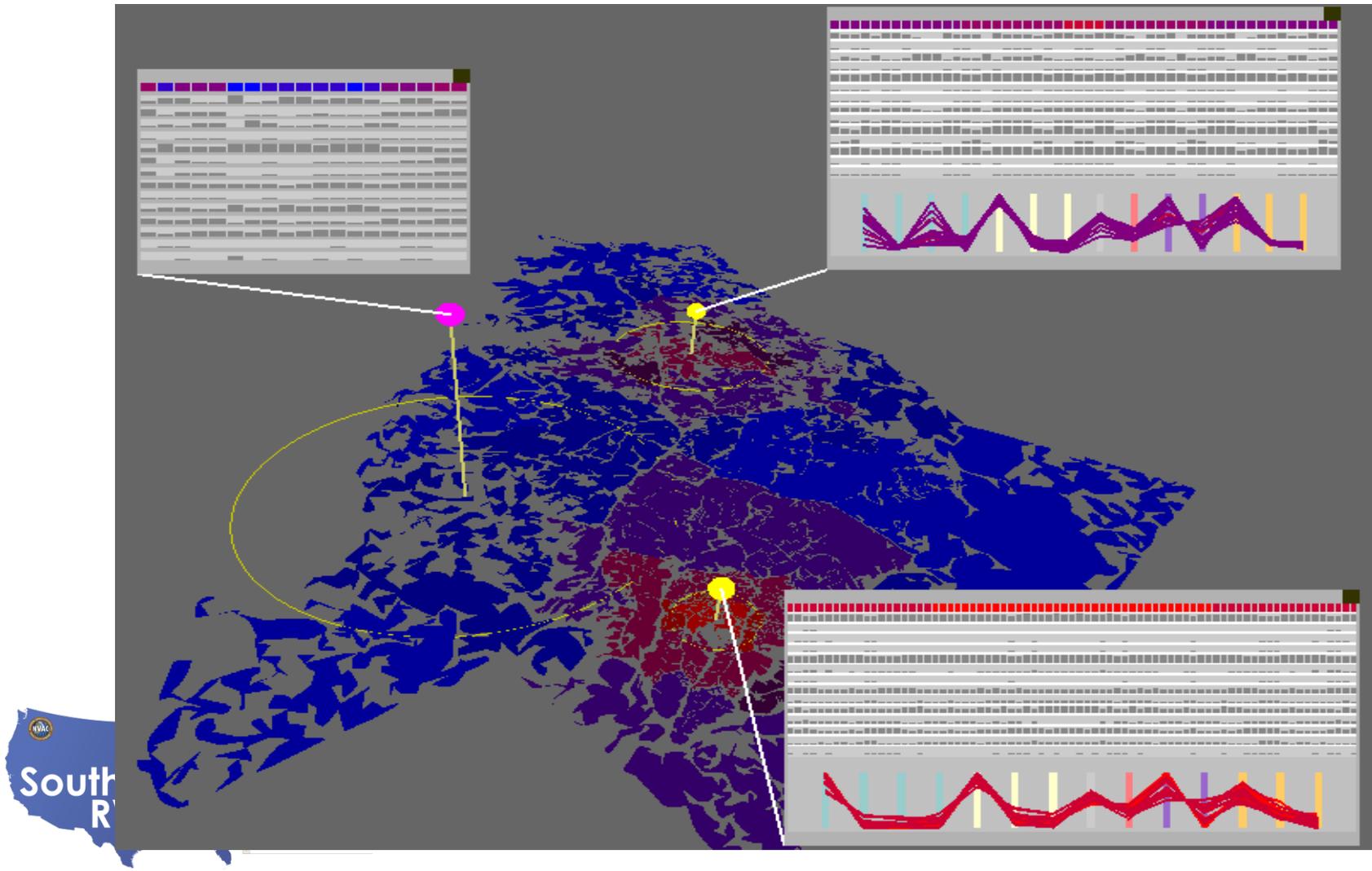
# UrbanVis (Tools for Cross-Analyzing Urban Infrastructure and Urban Populations)



# LIDAR Change Detection, with Probes

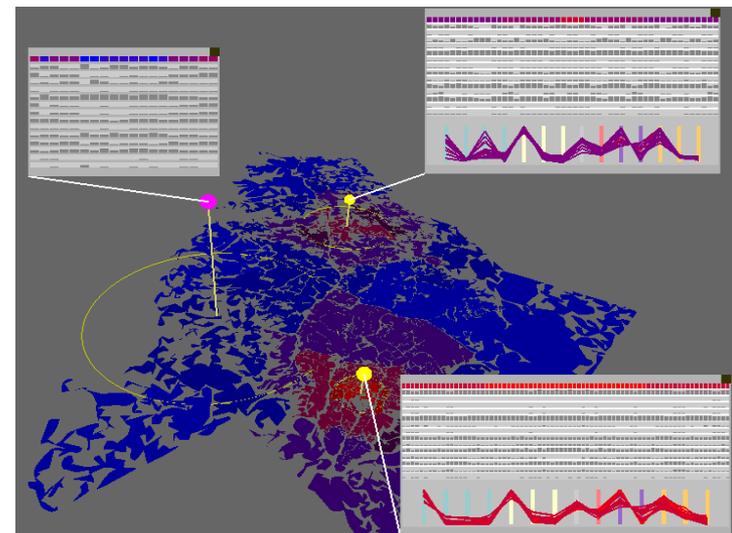
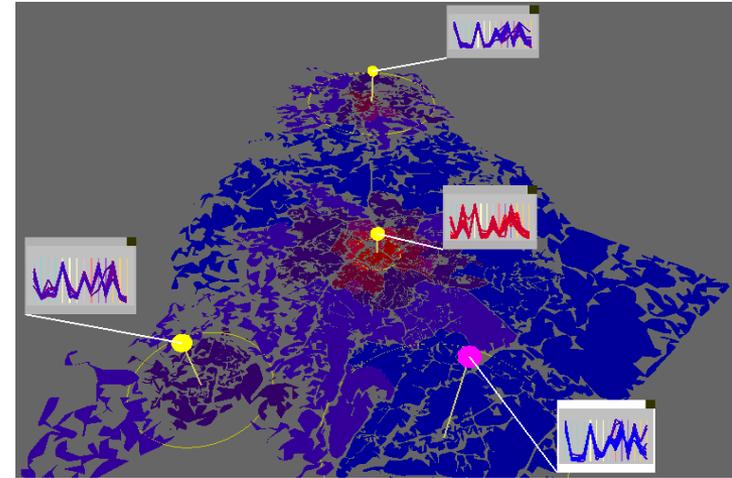


# UrbanVis, with Probes



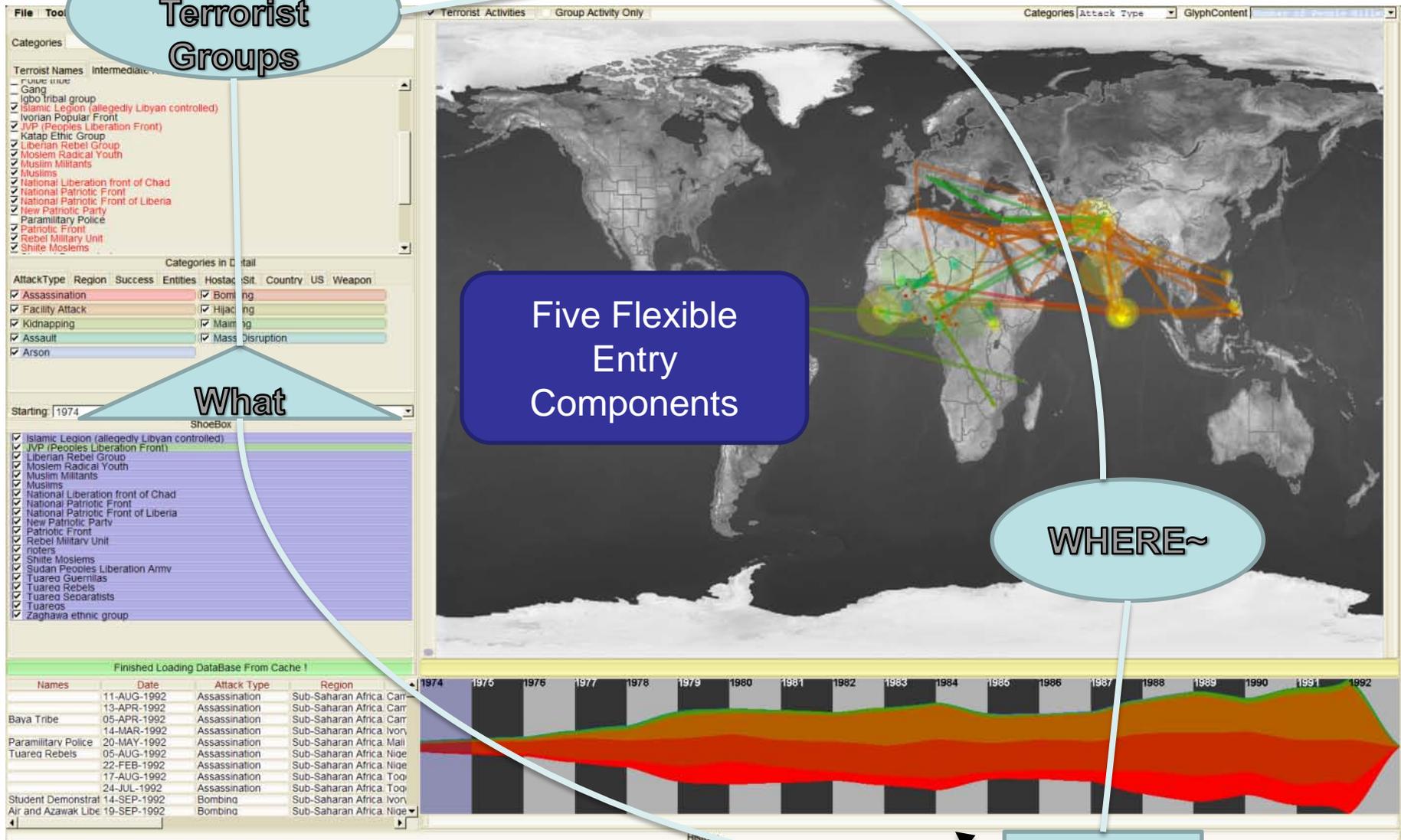
# Multi-Focus Comparison

- Interaction with multiple ROIs
- Clear relationships
- Annotation:
  - InfoVis panels → glyphs



# DHS START Center: Global Terrorism Database

WHO -  
Terrorist  
Groups

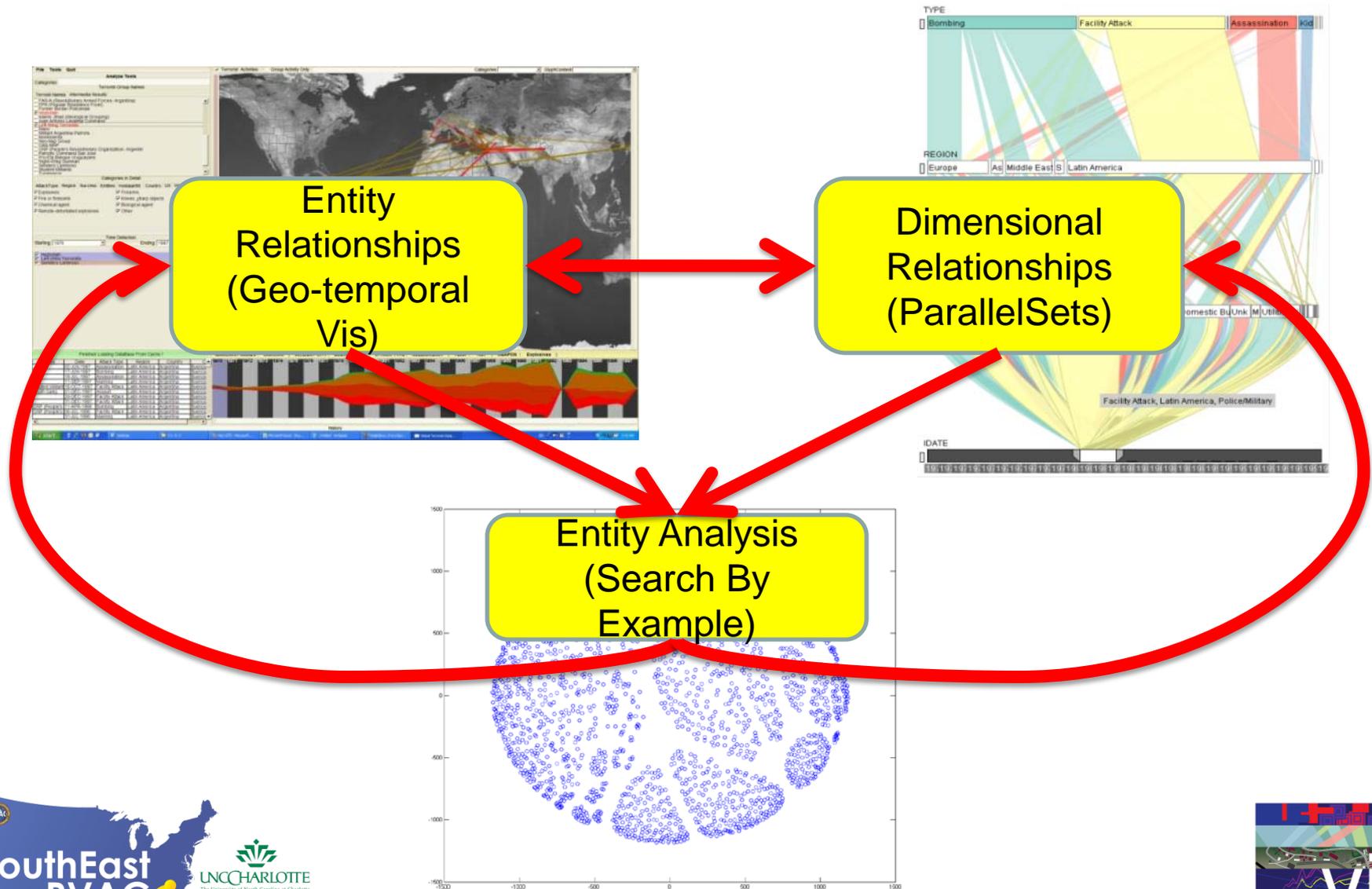


Five Flexible  
Entry  
Components

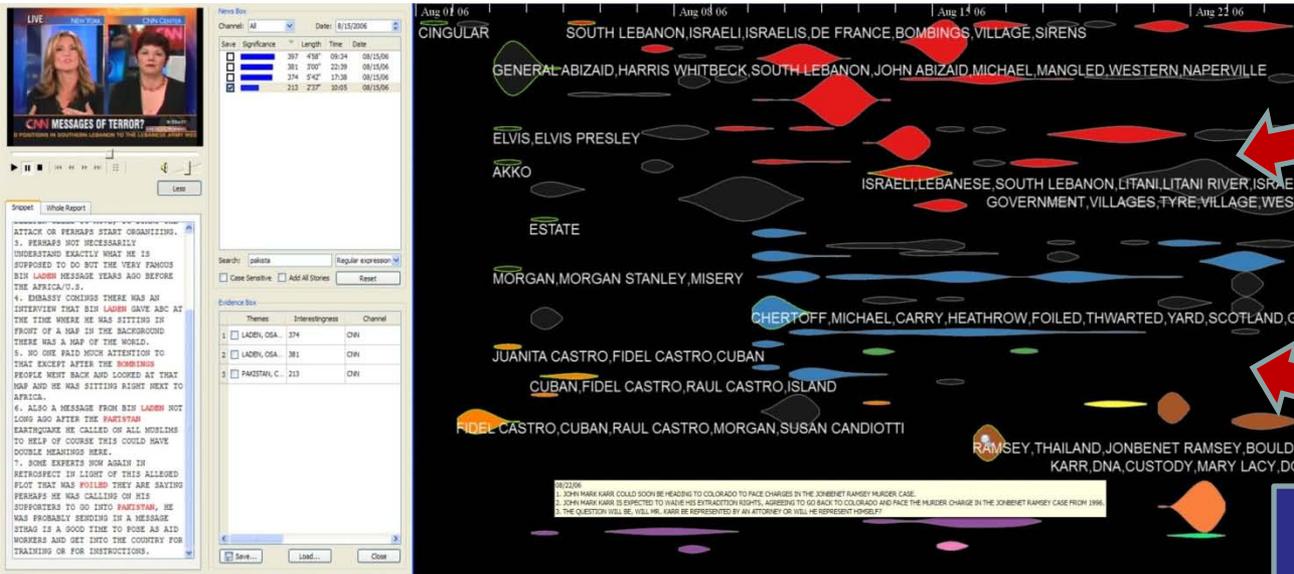
WHERE~

WHEN

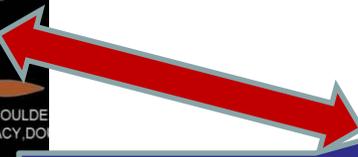
# Visual GTD Flow Chart



# START Center: Event, Group, and Social-Political Analysis



Opinion Analysis



Framing and Viewpoint Analysis

Geographic/Temporal Entity Extraction

Comparative Event Trend Analysis



# Planned CCI Center Integration

- Natural disaster and flood visual analytics coupled with urban emergency planning and response. (DIEM)
- Multimedia analytics for investigative analysis (including blogs, RSS feeds, online news, etc.) Useful for ICE, FinCEN, and other agencies. (START)
- Automated analytical reasoning and investigative tools (RESIN, STAB, predictive human cognitive model)
- Global terrorism and financial fraud analytics



# Questions?

[www.srvac.uncc.edu](http://www.srvac.uncc.edu)

[www.viscenter.uncc.edu](http://www.viscenter.uncc.edu)

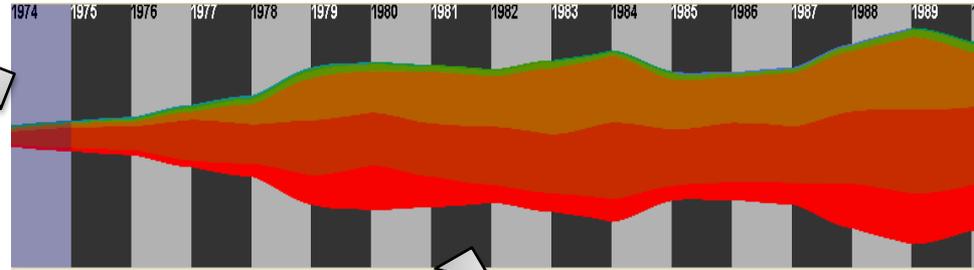
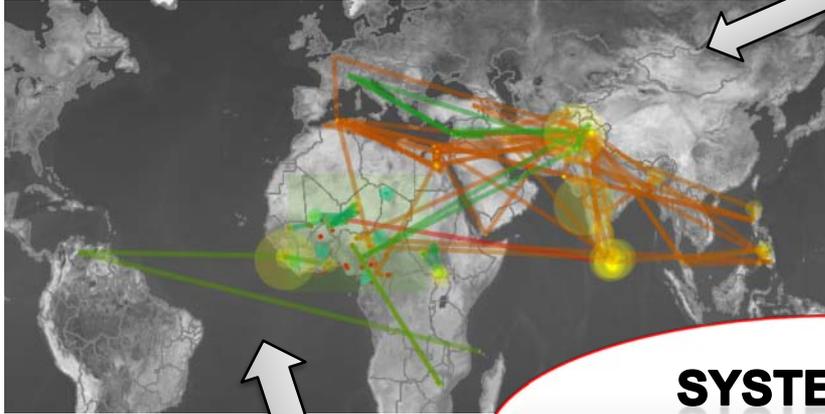


# DIEM: Multivariate Time-varying 3D Visualization

- Multiple, time-dependent 3D fields
- Challenges: large data amount and complex data relations
- Objectives: Visualize, analyze, and represent in an integrated environment
- Ultimately, comprehensive view of storm surge and hurricane weather models together over coastal terrain



**ENTER SYSTEM BY  
SINGLE OR MULTIPLE  
SELECTIONS**



**SYSTEM WILL  
SUPPLY SPECIFIC  
INFORMATION**

AttackType	Region	Success	Entities	HostageSit.	Country	US	Weapon
Assassination				<input checked="" type="checkbox"/>	Bombing		
Facility Attack				<input checked="" type="checkbox"/>	Hijacking		
Kidnapping				<input checked="" type="checkbox"/>	Maiming		
Assault				<input checked="" type="checkbox"/>	Mass Disruption		
<input checked="" type="checkbox"/> Arson							

- Islamic Legion (allegedly Libyan controlled)
- JVP (Peoples Liberation Front)
- Liberian Rebel Group
- Moslem Radical Youth
- Muslim Militants
- Muslims
- National Liberation front of Chad
- National Patriotic Front
- National Patriotic Front of Liberia
- New Patriotic Party
- Patriotic Front
- Rebel Military Unit
- rioters
- Shiite Moslems
- Sudan Peoples Liberation Army
- Tuareq Guerrillas
- Tuareq Rebels
- Tuareq Separatists
- Tuareqs
- Zaghawa ethnic group

**Drilldown to Original Info**

Names	Date	Attack Type	Region
	11-AUG-1992	Assassination	Sub-Saharan Africa. Can
	13-APR-1992	Assassination	Sub-Saharan Africa. Can
Baya Tribe	05-APR-1992	Assassination	Sub-Saharan Africa. Can
	14-MAR-1992	Assassination	Sub-Saharan Africa. Ivor
Paramilitary Police	20-MAY-1992	Assassination	Sub-Saharan Africa. Mali
Tuareq Rebels	05-AUG-1992	Assassination	Sub-Saharan Africa. Niqe
	22-FEB-1992	Assassination	Sub-Saharan Africa. Niqe
	17-AUG-1992	Assassination	Sub-Saharan Africa. Toq
	24-JUL-1992	Assassination	Sub-Saharan Africa. Toq
Student Demonstrat	14-SEP-1992	Bombing	Sub-Saharan Africa. Ivor
Air and Azawak Libe	19-SEP-1992	Bombing	Sub-Saharan Africa. Niqe



**CENTER**