Integrated Sensing and Prediction of Urban Water for Sustainable Cities (iSPUW)

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Urban Water Resources

- GIS and hydrologic/hydraulic modeling and watershed delineation
- NEXRAD radar-based flood warning system
- FloodPlain Map Library (FPML) – a real-time hydraulic prediction tool and unsteady-state floodplain modeling
- Water distribution network
- Low Impact Development (LID) modeling and sustainable design
- Groundwater flow and contaminant transport modeling
User and Stakeholder Engagement and Decision Support

Regional Users and Stakeholders:

- Academic Experts from DFW, Houston, San Antonio – several years of experience with LID sampling/evaluation
- Engineers, City managers, and Planners, and Landscape Architects from the DFW area and other concerned citizens
- Education and workforce development for future students and professionals (STEM, K-12, interns, etc.)

Ms. Suzanna Perea from EPA Region 6 was speaking at the workshop

The workshop covers topics:

- EPA Green Infrastructure (GI)
- GI Practice Performance Evaluation
- Sensing/Computing/Modeling
- LID Modeling Using Weather Radar
- Flood Prediction and Mitigation
- iSWM™
- Data Enabled Discovery
- Decision Support
- Economic assessment of GI/LID
The Integrated Sensing and Prediction of urban Water for Sustainable Cities (iSPUW)

(http://ispuw.uta.edu/nsf/)

Purpose:
• Population growth
• Urbanization
• Climate change
• Water supply shortages
• Flash floods
iSPUW Projects

(http://ispuw.uta.edu/nsf/)

- Advanced sensing and communications Precipitation sensing
- Water quantity and quality sensing
- Soil moisture sensing
- Crowd sourcing of water observations
- Distributed computing and intelligent systems
Researchers at iSPUW

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The Dynamic Inundation during Tropical Storm Allison (June, 2001)

\[ y = 1.04x - 1.67 \]

\[ R^2 = 0.90 \]
Dynamic Moving Storms (DMS)

Spatial Variability
Size, Shape, Orientation
Spatial pattern

Temporal Variability
Peak timing, Temporal pattern

Movement
Velocity, Direction, Pause, Turn
Sensitivity Analysis: Velocity & Dimension

- Peak Volume (cms) vs. Peak flow (cms)
- Diameter (km) vs. Velocity (km/h)
Tropical Cyclone Rainfall Reconstruction
Tropical Cyclone Rainfall Reconstruction
May 26 Flood in Houston

Motorists stranded along I-45

Brays Bayou overflowing its banks nearby North Braeswood.

Texas Medical Center during the flood

Memorial Drive during the flood
Brays Bayou and Harris Gully

Harris Gully:  4.5 sq. mi.
Brays Bayou:  129 sq. mi.
FAS3 Performance
May 25 - 26, 2015 Event

**HEC1 Flow**

- **Peak modeled flow**: 609 cfs
  - Occurred 12 hours ago
  - 12 hr. peak observed flow: 233 cfs
  - Occurred 6 hours, 55 minutes ago

- **No significant rainfall in last 12 hours**

  HEC1 computed at 8:32 PM. Data about 5 minutes old.

**HEC1 Flow**

- **Peak modeled flow**: 7646 cfs
  - Will occur in 3 hours, 45 minutes

  HEC1 computed at 9:31 PM. Data about 5 minutes old.

**HEC1 Flow**

- **Peak modeled flow**: 18617 cfs
  - Will occur in 3 hours

  HEC1 computed at 10:28 PM. Data about 10 minutes old.

**HEC1 Flow**

- **Peak modeled flow**: 24664 cfs
  - Will occur in 2 hours, 5 minutes

  HEC1 computed at 11:32 PM. Data about 5 minutes old.

**Observed Flow**

**Flow (cfs)**

- **2.0 in/hr**

**Flow (cfs)**

- **12-hour cumulative rainfall**: 1.2 inches
  - 1.1 inches in last hour.

**Flow (cfs)**

- **2.0 in/hr**

**Flow (cfs)**

- **12-hour cumulative rainfall**: 4.3 inches
  - 1.4 inches in last hour.
Flood Alert System Performance

May 26, 2015 Event

- Peak modeled flow: 28,264 cfs occurred 4 hours, 15 minutes ago.
- 12 hr. peak observed flow: 26,800 cfs occurred 6 hours, 10 minutes ago.
- 12-hour cumulative rainfall 8.4 inches.
- No appreciable rain in last hour.

HEC1 computed at 7:32 AM. Data about 5 minutes old.
Harris Gully at Brays Bayou

May 26, 2015 Event
Harris County OEM Rain Gage Data

Period: 24 hours
From May 25th 5:30 PM
to May 26th 5:30 PM
Harris County OEM Rain Gage Data
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