Updates on the Development, Operation, and Maintenance of the HCFCD Flood Forecast Program

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Program Goal

Produce accurate and timely forecasts of water levels and flood inundation in real-time for Harris County's 22 watersheds, and provide advance flood warning and guidance for emergency managers, first responders, public officials, and the public to reduce property damage and loss of life.

Achieving Our Goal

- Build on our existing capabilities by leverage staff knowledge and expertise
- Develop and maintain quality, representative models
- Maintain a high quality gauge network
- Establish operational procedures for reliability and consistency
- Know limitations
- Keep our goal in mind

History of Forecasting at HCFCD

- Pilot Study (2006-2010)
  - HMS with RAS Unsteady (1D)
  - White Oak and Little White Oak Bayou
- Software Evaluation (2016-2017)
  - Identify HEC-RTS as software for forecast system
  - Recommended phased approach
- Pilot Study with RTS (2017-2018)
  - HEC-HMS with rating curves for Brays Bayou
- Countywide Development (2018-Present)

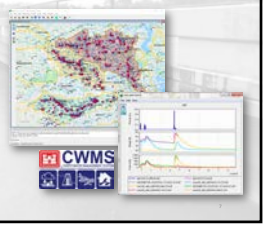
Advance Capabilities

- Flood Warning System
  - Comprehensive network of 236+ gauges including HCFCD owned and partners
  - Warning relies heavily on experience
  - By nature is more reactive
- Forecast System
  - Supplements experience, but does not replace it
  - Provides guidance on future outcome
  - Allows us to see beyond gauges
  - Allows for what-if scenarios to be evaluated

Forecast Approach

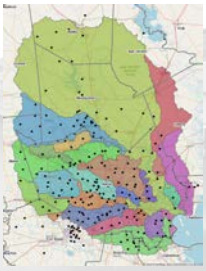
Forecast System

- HEC-RTS (CWMS) using HEC-HMS with rating curves
- Links HMS, RAS and others HEC software
- Handles import and export of model data
- Manages data
- Schedules the forecasts



Domain

- 2500 square mile model domain
- 22 watersheds consisting of 950+ sub-basins
- 250+ gauge locations
- 177 forecast points in and around

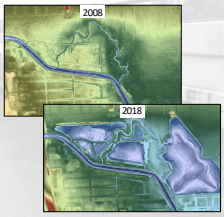


Forecast Datasets

- Precipitation Data
  - HCFCD/Partner Gauges
  - Gridded Rainfall
    - NWS MRMS (QPE) and HRRR (QPF)
    - Vieux GARR (QPE)
- Steam Data
  - HCFCD/Partner Gauges
    - USGS, SJRA, and others
  - WGRFC forecasts
- Processed using custom script library

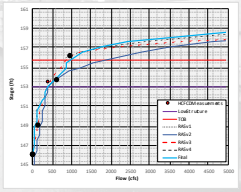
Model Development

- Utilize effective, RiskMAP, CLOMR, and preliminary models.
- Updated detention, channel and bridge improvements.
- Creating models for areas outside of county
  - Spring Creek tributaries and San Jacinto River.
- Calibrated to range of non-flooding and flooding events.
  - Jul 2012, Memorial Day 2015/2016, Tax Day 2016, Harvey 2017, etc.



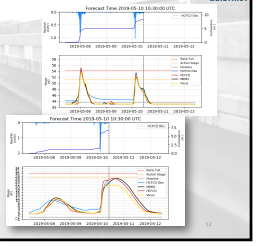
Rating Curve Development

- Rating curve defined at HCFCD stream gauges
- Developed from
  - HCFCD flow and HWM measurements
  - USGS flow measurements and rating
  - HEC-RAS rating
    - Typically used for out of bank flow
- Limitations
  - Does not account for backwater or storm surge



Evaluating Forecasts

- Library of custom scripts
- Reports/plots created with each run
- Provides quickest means of evaluating results
- Available for guidance, but largely reserved for testing and verification



Operational Challenges

- Data feed limitations, gaps, and availability
- Run time
- Each event is unique
- Messaging and Communication
  - Interagency communication
  - Twitter, Facebook, media, etc…

Required Maintenance

- Changes to data feeds
- Keep models current with changes in watershed:
  - Regional detention
  - Channel modifications
  - Bridges, etc.
- Addition of new gauges or products
- Calibration of new events

Ongoing Efforts

- Developing Watersheds
  - Completion Apr. 2020
- Continue testing and verification
- Developing operational procedures and guidelines
- Improve reporting functionality

Future Work

- Migrate forecast inputs/outputs to SQL DB (2019)
- Migrate forecast system and databased to Azure Cloud (2019)
- Incorporate rainfall products
  - WGRFC QPE/QPF, MRMS GARR, more…
- Forecast Dashboard (2020)
  - Support forecast operations and internal communication
- Forecast Inundation (2020)
- Implement coupled HMS and 1D Unsteady RAS (2020-2021)

Contributors

Questions?

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