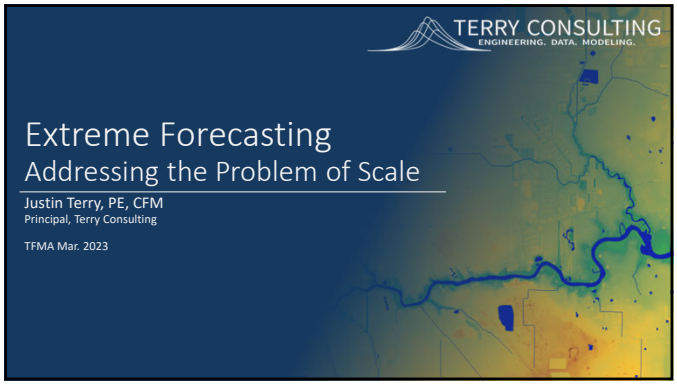

Overview

- Introduction
- Forecast Systems Basics
- Needs and Challenges
- Case Study
- Takeaways
- Questions

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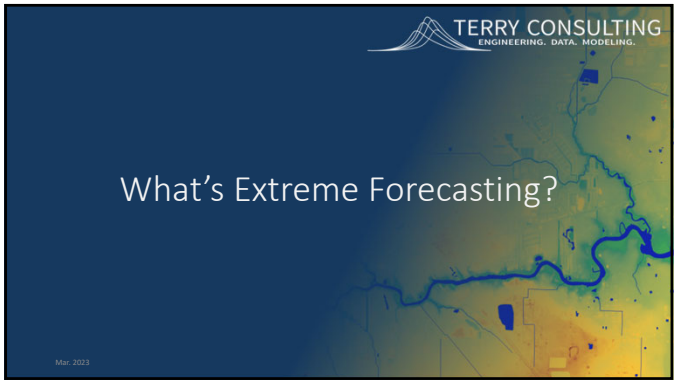
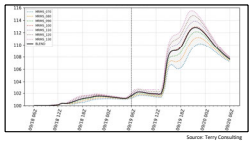
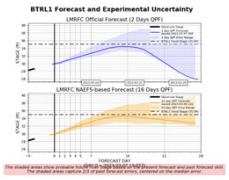


Flood Forecasting… What Is It?

- A prediction
- Derived from data and modeling
- Dependent on experts
- Decision support



Source: Terry Consulting



Source: https://www.weather.gov/lmrfc/experimental_16day_mississippi_stage

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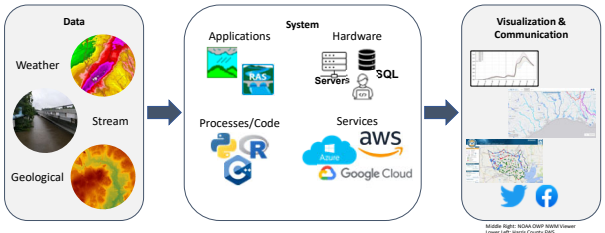
Components of a Forecast System



Middle Right: NOAA OWP NWM Viewer
Lower Left: Harris County FWS

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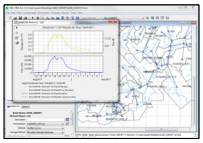
Building a Forecast System

- Gauges/Observation Points
  - Owned or USGS
- Models
  - Purpose built
  - Calibrated to historical events
- Ownership/Expertise
  - Subject Matter Expert (SME)
  - Internal (preferred) and external (beneficial)
- Funding
  - Capital/Start-Up
  - Staffing/Consulting
  - Systems/Platform Services
  - Maintenance
  - Future Development



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Common Challenges

- Reliability
  - Data variability
  - Model accuracy
  - Infrastructure
    - Software/system errors
    - Data/storage management
    - IT policies…
  - Maintenance
- Availability
  - Data feed outages
  - Data and model processing time
- Scalability
  - Model Complexity

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Case Study

Tropical Storm Imelda - Sep. 2019

Panther Branch, The Woodlands, TX

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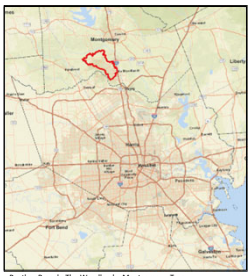
Case Study – Overview

- Problem
  - Standard methods limit use of advanced models in forecast applications
  - Modeling capabilities (e.g., 2D modeling) have outpaced forecasting methods
- Objectives
  - Identify approach that addresses *reliability, availability* and *scalability*.
  - Demonstrate the possibility of running advanced models (2D) in forecast scenarios



Panther Branch, The Woodlands, Montgomery, Texas

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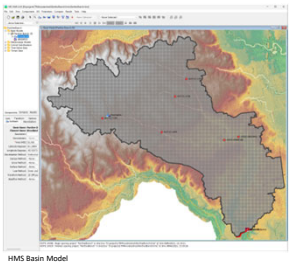
Case Study – Model Setup

- Domain
  - 30.2 Sq. Mi
  - ~21,000 cells (~200 ft cells)
- Methods
  - Diffusion Wave
  - Normal Depth TW
- Applications
  - HMS 4.10 & Python 3.9
- Hardware
  - Laptop, 2.5/4.9GHz (8/16), 64GB, 2TB
- Base model provided by

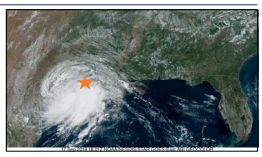
Andy Yung, PE, CFM, D.WRE,
ayung@walterpmoore.com
walter p moore

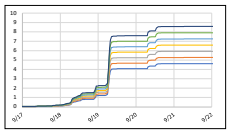


HMS Basin Model

Case Study – Event Rainfall

- Tropical Storm Imelda (9/2019)
  - 30-44" from Winnie to Orange, TX
  - 6-7" for Panther Branch
- Source
  - Multi-Radar Mulit-Sensor (MRMS) 2-Min PrecipRate (raw)
  - 9/14/2019 – 9/30/2019
  - 10,800 files downloaded and processed
- 7 scenarios
  - 70% to 130% in 10% increments

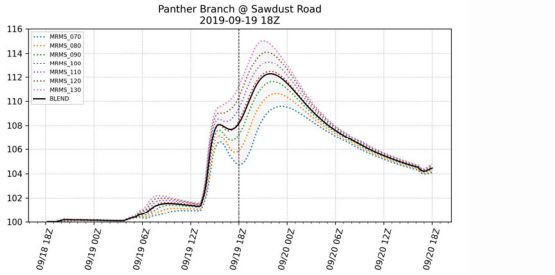




Case Study – Procedure

Data	Model	Analysis
Download	Configure Model	Extract and transform
Extract, resample, and transform	Compute Base Model	Compute stats
Write to model (DSS)	Batch Compute Forecast Simulation Runs	Generate plots

Case Study – Results Snapshot



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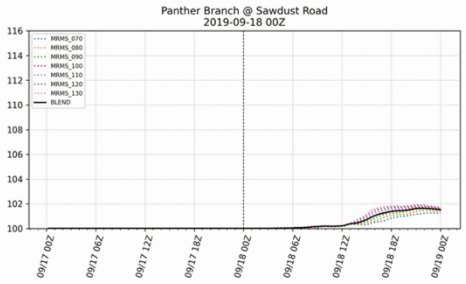
Case Study – Simulated Results



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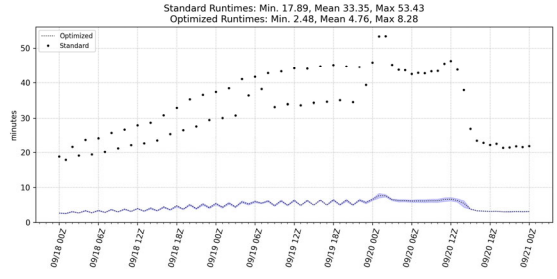
Case Study – Model Runtime Comparison



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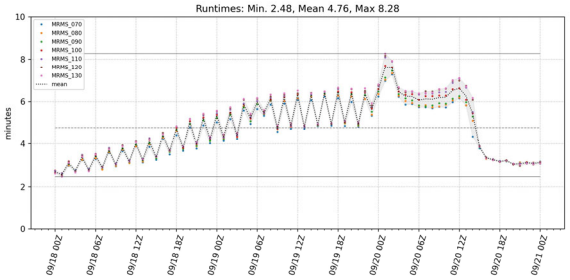
Case Study – Optimized Runtime Statistics



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Case Study – Takeaways

- Optimized approach provides 7x speed up over standard
- Performance improvements allows for more advanced models
- Owner
  - Increased reliability, shorter runtimes providing availability, and ability to scale model complexity.
- Engineers Benefit
  - Decreased runtime and flexibility to run more simulations (design and analysis) in less time.
- Limitations
  - Hardware

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Thank You!

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Justin Terry, PE, CFM
Founder, Principal
941-773-9741
justin.terry@terryconsulting.net
www.terryconsulting.net