Real-Time Flood Forecasting
Opportunities and Challenges for Automating Flood Models

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Model Development

- GMU: 2D Coastal Flood Modeling
  - ADCIRC Sensitivity Analyses
    - Friction
    - Storm Characteristics
    - Mesh design

- Dewberry: 1D & 2D Riverine Flood Modeling
  - FEMA Floodplain Studies: Flood Maps
    - HMS: Precipitation 1% Annual Event
    - HEC-RAS: Steady Flow, 1% Annual Event

- Results:
  - Flood Maps & Statistics
  - Repeat
Model Re-Development

Coastal Flood Models:
• Adaptation for Forecasting
  • Mesh Refinement
  • HPS Allocation & the Queue

Riverine Flood Models:
• Adaptation for Forecasting
  • HEC-HMS: Gridded Data
  • HEC-RAS: Unsteady Flow

Input/Output:
• Scripting
• Flood Maps
Forecast Model: Input

Coastal Flood Models:

- National Hurricane Center: HURDAT2
- Adcirc Surge Guidance System: ASGS

Riverine Flood Models:

- National Weather Service
- Mid Atlantic River Center
Forecast Model: Automation

• USACE: CWMS (RTS)
  • Reservoir Management
  • Dewberry

• Deltares: FEWS
  • CHPS
  • Potomac River Basin

• Bash, Python & the Cloud
  • Event Based Scenarios
  • George Mason Campus
USACE

• Corps Water Management System (CWMS)
  • HEC Products
  • Oracle Database
  • Unix Operating System
  • Data Retrieval Client Based

• Real Time Simulation (RTS)
  • HEC Products
  • HEC-DSS
  • Windows PC
  • Scripting Capability
FEWS: ICPRB

LFFS
Forecasted Meteorological Data

- MARFC’s 3-day quantitative precipitation forecasts (QPFs)
- National Digital Forecast Database (NDFD) 3-day QPFs
- Weather Prediction Center (WPC) 7-day QPFs
- Global Ensemble Forecast System (GEFS) 15-day forecasts
FEWS: National Weather Service

- Community Hydrologic Prediction System/Flood Emergency Warning System

Hydrologic Service Delivery

CHPS for FEWS makes our lofty goals for the future of Water Resources Services much more attainable!
ESTOFS Storm Surge Model Guidance (0-96 Hour Forecasts)

Go to 0-96 hour forecasts – Go to 97-180 hour forecasts – Go to Total Water Level (including tides) forecasts

(Mouseover and click the area where you would like to view the current extratropical storm surge model guidance data)
Chesapeake Bay OFS Water Level Nowcast

All model nowcast and forecast information is based on a hydrodynamic model and should be considered as computer-generated nowcast and forecast guidance.
Gap Areas & Transition Zones

River-Estuary-Ocean (REO) Interactions

Estuary

Freshwater

Ocean

Surface Winds

Water Levels

Waves

Water Temperature

Currents

Salinity

Potomac River at Washington DC
Forecasting in Transition Zones

Meteorological Model → Hydrologic Model

Hydrodynamic Model → Hydraulic Model
Unstructured Alternatives

- George Mason Campus
  - Microsoft Azure & Amazon EC2 Cloud Computing
  - SQL Database
  - Linux/Windows Platforms
  - Bash Scripting

- Hurricane Joaquin
  - HEC-RAS on Azure
  - ADCIRC on ARGO
  - Python Scripting
Summary & Conclusions

• In many cases, existing models can be refitted for forecasting

• Tools are readily available for transforming to an operational forecast capacity

• Forecast can be done at regional and local levels to augment national operations

• Water Resources Engineers need to become more familiar with the data types and data tools in use by meteorologist

• Flood Alerts: Operational forecast maps
Questions?
Graphical References

Models and Modeling in FEWS, Part I: Micha Werner, Deltares & UNESCO

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