Distributed Hydrologic Modeling
-WGRFC experience and perspective

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History of WGRFC involvement

• Fall 2003/Spring 2004 – DHM 1.0 released to ABRFC and WGRFC. Began testing basin setup and calibration
• Feb 2004 – Setup hourly DHM runs for operational forecast comparisons (8 basins).
• 2004 – 2006 - early testing and calibration (25 basins)
• 2004 - 2007 – Providing feedback to OH and detailing requirements for an operational DHM (OSIP process); latest version…Operational DHM OB8.3;
• 2006 - 2007 – not much progress with calibrations; hl-rdhm continuing to develop (ie. new apriori SAC parameter grids, optimization, forecast mode, sac-HT, etc)
• Presently… Recently began testing with HL-RDHM and use of optimization and new SAC parameter grids; waiting to implement DHM OB8.3
Initial Interest in DHM

- Limitations of Lumped modeling potentially averted with ability to distribute parameters (ie. precip, land-use, soils)
- Rapid hydrologic response times of WGRFC forecast pts (approx 50% crest in 12hrs or less)
- Ability to compare with VAR study basins
Test Basins Locations

Basins currently implemented
DHM Test Basins

Varied basin size, terrain, land-use/cover, soils

DA:
75 – 400 mi²

Peak times:
6 – 60 hr
Operational Forecasting

• Continue to use DMS 1.0 forecast mode
• Runs on cron once per hour
• No operational mods possible (ie. precip, sac)
• TS displayed in IFP with Tulsa-plot
• Forecasts issued on DHM as desired using QINE mod
Early Research Conclusions

- Manual “expert” calibrations improvement over apriori parameters
- Limited success with manual calibration improvement over 1hr lumped model
- Event timing generally good; a few basins with unexplainable timing issues
- Biggest challenge in matching peaks
- More experience needed with calibration
Early Research Conclusions

Questions/Concerns of DHM at WGRFC

• Difficult to calibrate peak flows
• Model errors and uncertainties tend to increase at smaller scales
• Does SAC model error compound for each grid cell (diffused with lumped)?
• Gridded data for all parameters may be too much complexity (ie. zones?)
• QPE most sensitive parameter… spatial and magnitude errors explain false peaks and compound peak flow errors
Transitioning from early research to present

- Early OB8.x versions of Operational DHM a good start, but decided to wait for OB8.3 improvements before implementing (ie. runtimes, scalar precip and sac mods)
- Currently focused on HL-RDHM to explore optimization and use of different apriori sac parameter grids
Apriori SAC-SMA Parameters Grids

• 3 available apriori SAC parameter grid sets (statsgo, statsgolu, and surgofil)
• All at 4km resolution
• 11 of 17 sac parameters have grids
• All computed from Koren’s methodology, with hopeful improvements by using higher resolution data

1. statsgo- Based on STATSGO + constant LU
   – Assumed “pasture or range land use” under “fair” hydrologic conditions
   – National coverage
2. statsgolu- Based on STATSGO + variable LU
   – National coverage
3. surgofil- Based on SSURGO + variable LU
   – Parameters for 25 states so far
   – Soils and LU data sets much higher resolution

**all available now via CAP**
Current Research Objectives

comparisons and questions to answer…

• **dms vs. rdhm**… for the same data sets, are both models simulating the same results?

• **apriori SAC parameter grids**… are there any clear advantages/benefits between statsgo, statsgolu, and surgofil apriori parameter grids?

• **apriori vs manual calibrations**…

• **lumped vs distributed SAC model**… is there clearly benefit to using distributed SAC parameters?

• **optimization strategies**… does the opt utility benefit the calibration process?... Are there certain strategies to make the use of optimization more effective?
Current Research Objectives

Data Preparation

• Created quality controlled one hour qin timeseries from USGS unit value data for 8 year period: 1/1/2000 – 1/31/2007.
• Checked for consistency with USGS daily values.
• Ran MAPX for 8 year period.
Current Research Objectives
Model Preparation

- Made calibration runs for lumped 1hr and 6hr models.
- Updated dms calibration runs through 12/31/2007.
- Converted dms decks to hl-rdhm format.
Current Research Objectives
Model Preparation

- Created hl-rdhm decks for
  - Apriori Parameters (dms grids)
  - Apriori Parameters*
  - Manual Calibrations*
  - 1 Hour Lumped parameters *
  - 1 Hour Lumped equivalent parameters*

* Using statsgo, statsgo w/ variable land use, and surgo parameter grids
Current Research Objectives
Data Analysis

• Set up stat-q decks to compute statistics on each simulation.
• Set up ICP decks to view simulations.
• Set up optimization decks to become familiar with the process.
• Made preliminary rdhm runs & a few optimization runs.
A Cursory Look at Model Correlations

- HI-rdhm simulations using dms parameter grids, yield the same simulations.
- Similar “r” for statsgo, statsgo w/ LU, and surgo parameter grids for most sites.
- Similar “r” for lumped and lumped equivalent parameters for many sites.
- Well calibrated lumped 1 hour model shows similar “r”.
- Can increase “r” thru optimization.
Simulation Correlations

![Bar chart showing simulation correlations for various tests and methods.]
Current Research Objectives
From Here

• Much more needs to be examined beyond overall correlation.
• Continue to attempt to improve simulations thru optimization.
Thanks