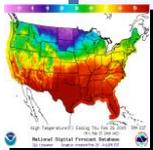


NCRFC Support of Wisconsin's Manure Management Advisory System

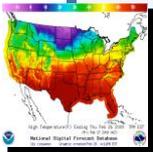
Development and Production of a Decision
Support System for Wisconsin Manure Producers

Dustin Goering & Brian Connelly
North Central River Forecast Center



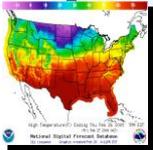
Project Motivation

- **Goal: Alert producers of future risky conditions for spreading manure to reduce contaminated runoff**
- **No standardized, real-time method exists alerting producers of predicted runoff risk**
 - *Some States use only QPF, don't account for snowmelt or soil moisture*
 - *No organization is producing forecasts regularly in real-time*
 - *Other methods are heavy on site-specifics, but don't include weather info*
- **Great example of using existing NWS capabilities for DSS**
 - *5 day QPF twice a day, SAC-SMA allows for constant soil moisture approximation, SNOW-17 handles snow melt conditions*
 - *Example of how NOAA & NWS can help with water quality support*



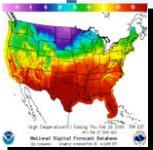
Project Development

- **Define what a simulated runoff event is**
 - *3 criteria used and all must be met for an event:*
 - SAC-SMA Interflow runoff component exists
 - RAIM present (Rain and/or melt)
 - UZTWD = 0 (Upper Zone Tension Water Deficit)
- **Generate list of simulated events for NWS basins using historical temp & precip data**
- **Evaluate the model by comparing historical simulated events with observed runoff events**
 - *4 field scale basins and 7 small USGS watersheds*
- **Simultaneously pushing real-time runoff event lists for basins in WI to DATCP for webpage development**



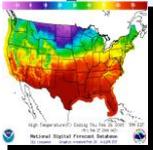
Project Perspective

- **Scale is a known factor with this approach**
 - *Fields are in acres, some NWS basins are 100s of mi²*
- **Important assumption must be communicated:**
 - *This approach will never produce perfect prediction*
 - One farm may have runoff, the next one may not
 - Rainfall patterns, differences in snowpack distribution, etc.
 - *User must combine knowledge of local conditions with forecast*
- **It is hoped that over time the model will be an accurate predictor of average field scale conditions (and associated runoff events) in a given basin**



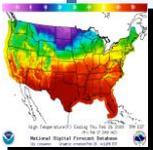
Initial Results

- **Field Plot:** % Hit = **79** % Miss = **21** % FA = **68**
- **USGS Basin:** % Hit = **64** % Miss = **36** % FA = **44**
- **Encouraging results overall**
- **Is there anything we can do about the high false alarms when comparing to the field scale?**

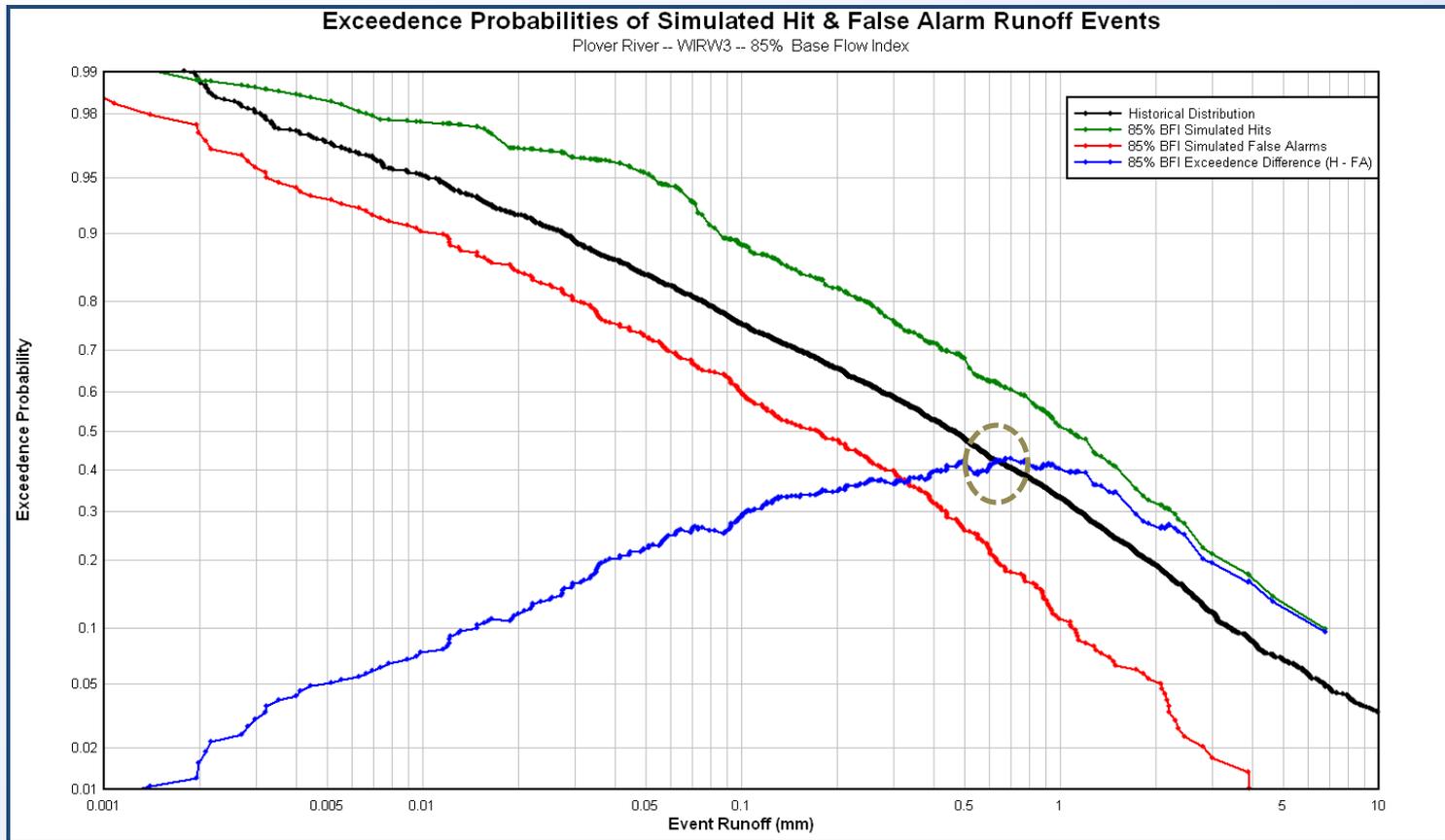


Mitigating False Alarms

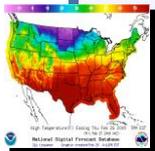
- **The exceedence probabilities of the simulated hits and false alarms for each basin were plotted**
 - *Chose the event runoff value where the maximum difference occurred*
- **That runoff value was cross referenced with that basin's historical distribution**
 - *The corresponding exceedence value was chosen as the basin threshold*
- **The median of the 11 basin thresholds was designated as the universal basin threshold to be applied to all Wisconsin basins**
 - *Corresponding historical event runoff used to stratify real time events into risk categories*



Mitigating False Alarms

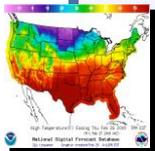


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Mitigating False Alarms

- **Exceedence thresholds were very similar for both scales**
 - *Field scale* = 0.39
 - *USGS basins* = 0.40
 - *Universal Threshold chosen* = 0.40
- **How does applying a threshold impact historical comparison?**
 - **Before...**
 - *Field Plot:* % Hit = 79 % Miss = 21 % FA = 68
 - *USGS Basin:* % Hit = 64 % Miss = 36 % FA = 44
 - **After...**
 - *Field Plot:* % Hit = 64 % Miss = 36 % FA = 49
 - *USGS Basin:* % Hit = 45 % Miss = 55 % FA = 33

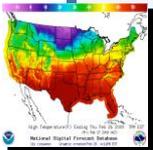


Putting Misses in Context

- **Field scale still within reason (36%)**
- **USGS basin scale is alarming at first, however:**
 - *Events are derived from Base flow Index*
 - Best approximation: not a ground truth event like at field scale
- **Distinct separation between median observed hit and miss event runoff**

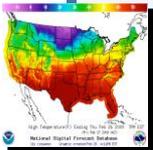
➤ <i>Field Scale</i>	<i>Hits: 2.44 mm</i>	<i>Miss: 0.50 mm</i>
➤ <i>USGS Scale</i>	<i>Hits: 5.53 mm</i>	<i>Miss: 0.30 mm</i>
➤ <i>Combined</i>	<i>Hits: 3.67 mm</i>	<i>Miss: 0.39 mm</i>

 - *Field scale hits are 5x larger than misses. USGS scale are 18x larger. Combined there is a 10x magnitude difference.*



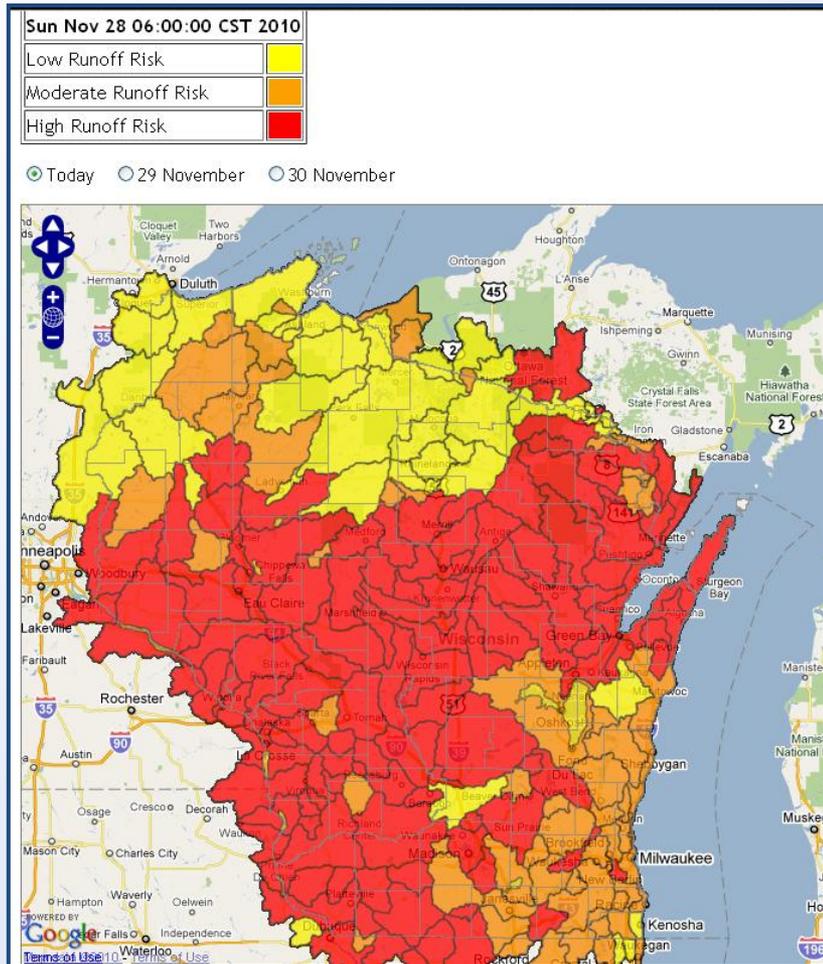
Overall Impact of Threshold

- **Threshold applied to historical records of 214 basins in or near Wisconsin**
 - *(50+ years/basin = > 12,000 years total summarized)*
- **Three categories defined:**
 - *CAT 1: No runoff events*
 - *CAT2: Runoff events below basin threshold*
 - *CAT3: Runoff events \geq basin threshold*
- **% of time in each category:**
 - *CAT1: 90%*
 - *CAT2: 4%*
 - *CAT3: 6%*

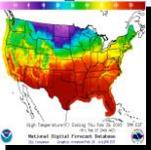


Real-time Product

➤ Real Time MMAS Webpage

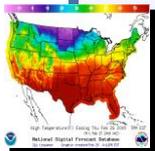


- The webpage is a University of Wisconsin & WI DATCP joint venture
- NCRFC sends them data files once daily (soon to be twice)
- They include extra 72 hour restriction on the basins
 - *Each basin looks ahead 3 days for a runoff event over threshold*



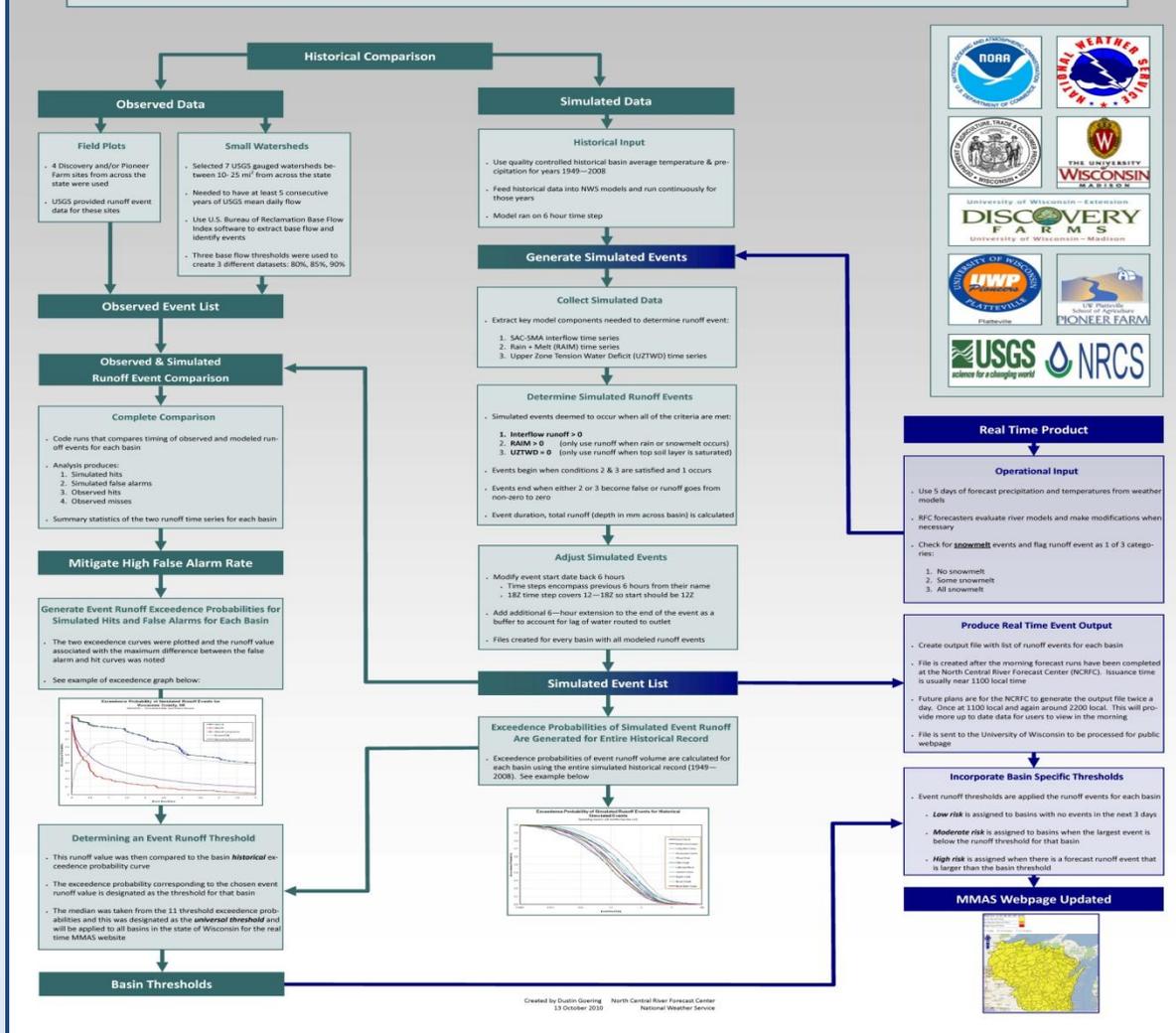
Next Steps

- **Significance of observed miss magnitude**
 - *Acceptable at those levels?*
- **Monitor product performance**
 - *Begin tracking how often each basin produces runoff with real-time input*
 - *Are there outlier basins that respond too much, not often enough*
 - *Adjust basin thresholds if necessary*
 - *Highlight basin recalibration needs*
- **Support DATCP as product is introduced to the public**
 - *Attend manure producer/spreader meetings?*
 - *Help update documentation for website*



Process Flow Chart

North Central River Forecast Center Runoff Risk Model for the Manure Management Advisory System (MMAS)



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