



UNF SCHOOL OF
ENGINEERING

College of Computing, Engineering & Construction

“Comparison of Hydrologic Model Performance Statistics Using Rain Gauge and NEXRAD Precipitation Input at Different Watershed Spatial Scales and Rainfall Return Frequencies for the Upper St. Johns River, Florida USA”

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Study to Compare Model Data Inputs

- Study of two different precipitation model input types including standard rain gauges and Nexrad radar-derived data.
- This is a companion presentation for paper by Bredesen and Brown.
- General conclusion of the study is that for large basins Rain Gauge precipitation input data was about the same or slightly better than Nexrad data. For small basins, Nexrad data proved superior.

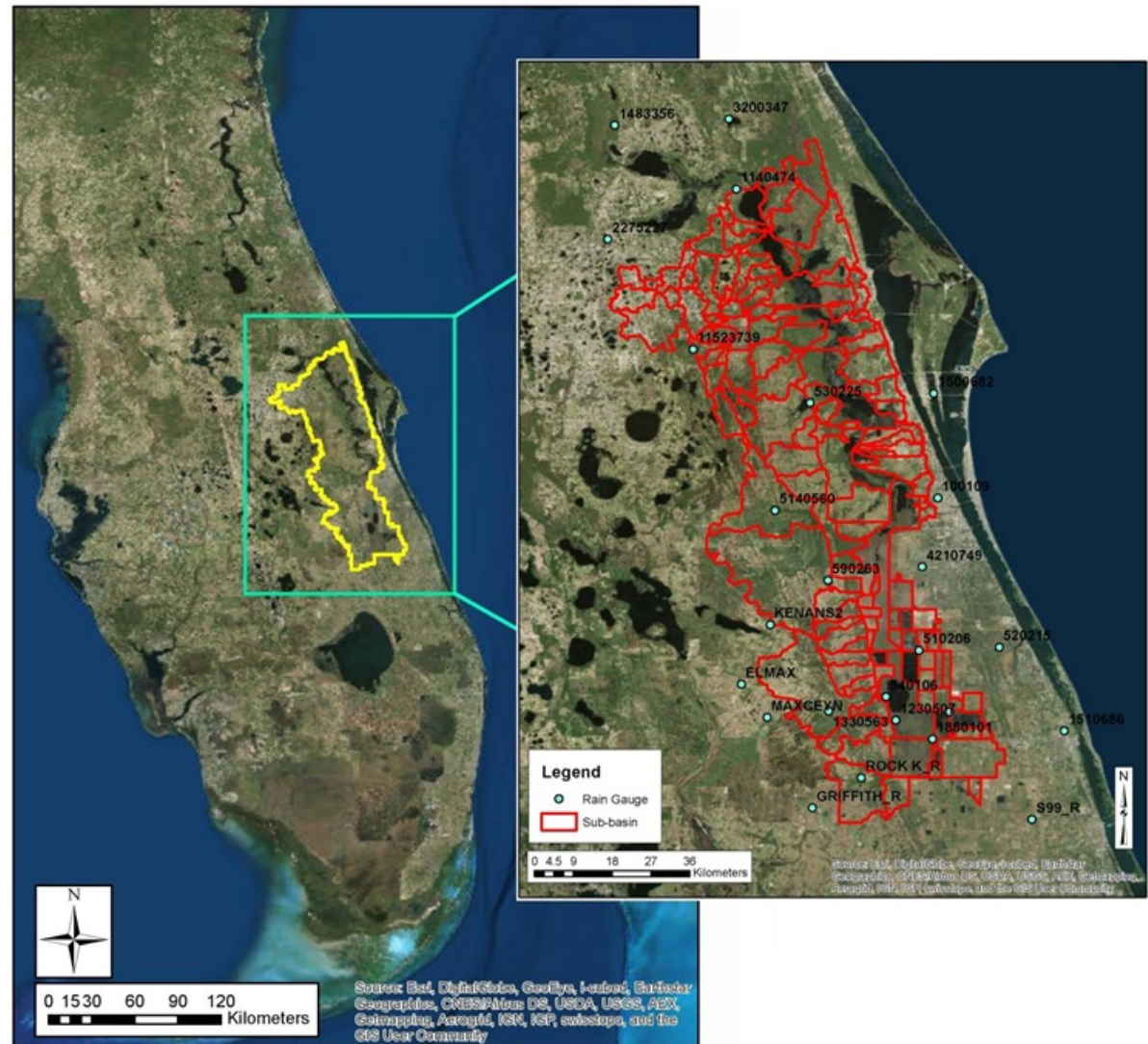


Study to Compare Model Data Inputs

- For higher return frequency rain events, Rain Gauge data was about the same as Nexrad data.
- For smaller return frequencies, Nexrad data was best.

Study to Compare Model Data Inputs

- General project Study Area is the Upper St. Johns River in Florida, USA:



■ General Methods Used:

- First, the research team developed a HEC-HMS hydrologic (rainfall-runoff) model of the Upper St. Johns watershed.
- Then, once the model was sufficiently calibrated and validated, the research team compared calibration statistics using two different data inputs, namely:
 - Standard rain gauge data;
 - Remotely-sensed data using radar estimates or Nexrad for short;

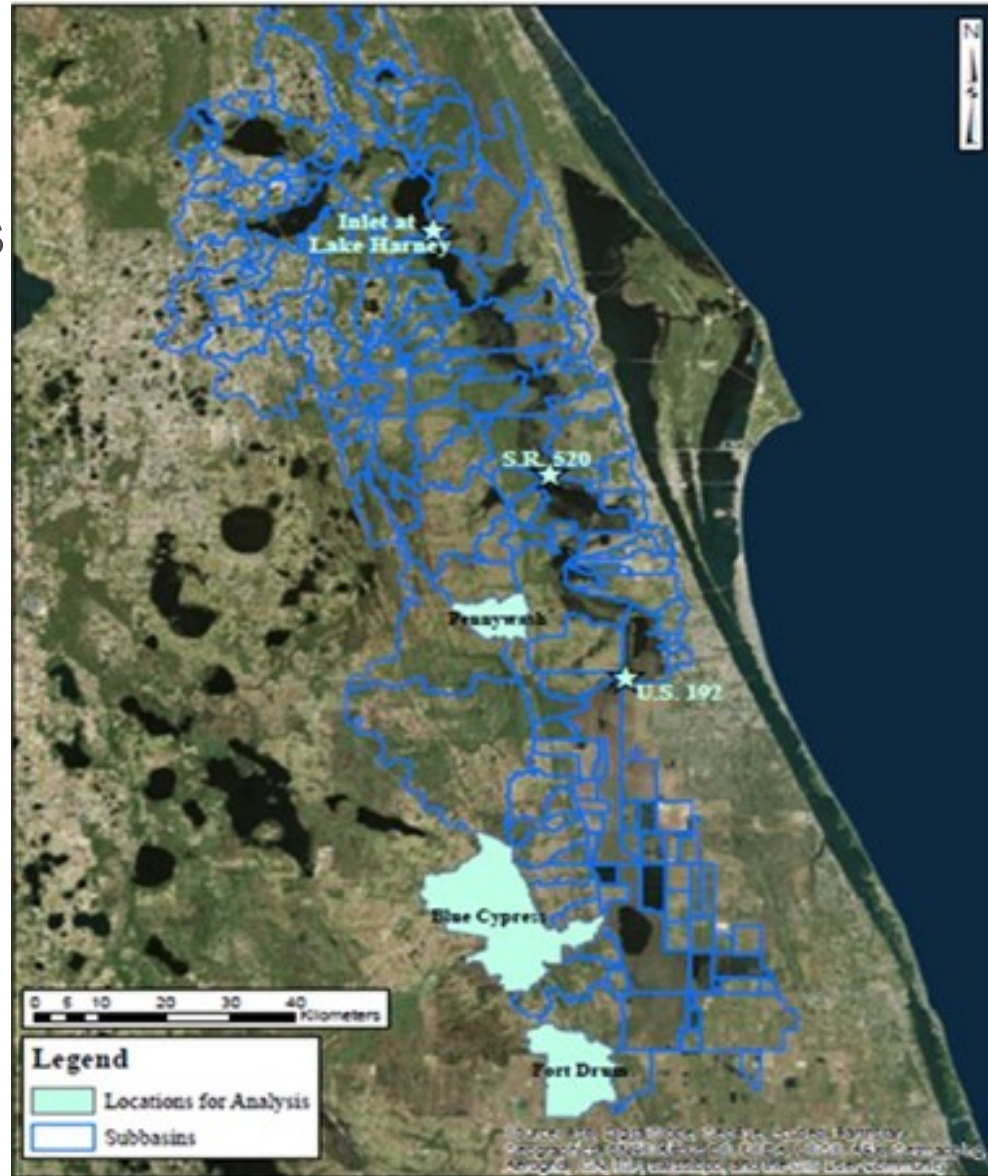
■ General Methods Used:

- Then, the results were also discretized into sub-catchment or sub-basin size versus degree of calibration and;
- Precipitation return frequency versus degree of calibration;
- The concept being that the additional pre and post-processing required to use the Nexrad data instead of the gauge data might not be worth it if the model calibration statistics could not be improved, e.g. what is the value of the Nexrad data versus the gauge data.



Study to Compare Model Data Inputs

- General model domain in Central Florida, USA;
- Representative sub-basins also shown to demonstrate initial model calibration and validation.



Study to Compare Model Data Inputs

- How about some results ?

Study to Compare Model Data Inputs

- Summary of Initial Model Calibration Using R^2 and Nash-Sutcliffe Efficiency Factor (NSE):

Table 2. Initial model calibration performance statistics for representative basins.

Gauge Location	r^2	NSE
Fort Drum	0.89	0.85
Blue Cypress	0.84	0.84
Penneywash	0.86	0.79
US 192	0.88	0.86
FL 520	0.98	0.98
Inlet Lake Harney	0.93	0.90

Study to Compare Model Data Inputs

- Summary of Degree of Model Calibration for the two different precipitation datasets using R^2 and Nash-Sutcliffe Efficiency Factor (NSE):

Table 3. Coefficient of determination simulation results.

USGS Gauge Identification Number	Coefficient of Determination (r^2)							
	2008		2007		2010		2011	
	Rain Gauge	Radar	Rain Gauge	Radar	Rain Gauge	Radar	Rain Gauge	Radar
02231342	0.89	0.93	0.49	0.70	0.89	0.91	0.83	0.77
02231396	0.89	0.90	0.52	0.63	0.91	0.90	0.80	0.80
02231600	0.91	0.90	0.64	0.87	0.94	0.95	0.76	0.78
02232000	0.88	0.89	0.90	0.88	0.96	0.93	0.98	0.97
02232155	0.86	0.87	0.11	0.55	0.85	0.85	0.74	0.76
02232200	0.87	0.87	0.29	0.86	0.86	0.86	0.82	0.84
02232400	0.98	0.98	0.48	0.30	0.97	0.96	0.99	0.98
02232500	0.95	0.93	0.95	0.89	0.95	0.92	0.94	0.93
02234000	0.93	0.91	0.72	0.60	0.95	0.93	0.95	0.95
02233460	0.85	0.91	0.16	0.23	N/A	N/A	N/A	N/A
02233473	0.89	0.92	0.53	0.56	N/A	N/A	N/A	N/A
02233484	0.90	0.80	0.85	0.81	0.90	0.89	0.94	0.95
02233500	0.87	0.78	0.82	0.82	0.65	0.67	0.96	0.95

*N/A denotes USGS gauge data that was not available

Study to Compare Model Data Inputs

- Summary of Degree of Model Calibration for the two different precipitation datasets using R^2 and Nash-Sutcliffe Efficiency Factor (NSE):

Table 4. Nash-Sutcliffe efficiency coefficient simulation results.

USGS Gauge Identification Number	Nash-Sutcliffe Coefficient (NSE)							
	2008		2007		2010		2011	
	Rain Gauge	Radar	Rain Gauge	Radar	Rain Gauge	Radar	Rain Gauge	Radar
02231342	0.85	0.93	0.33	0.65	0.85	0.86	0.67	0.72
02231396	0.84	0.84	-0.06	0.11	0.86	0.86	0.72	0.74
02231600	0.90	0.89	0.41	0.81	0.91	0.94	0.59	0.64
02232000	0.86	0.87	0.74	0.72	0.98	0.97	0.98	0.97
02232155	0.79	0.79	-1.27	0.14	0.85	0.84	0.64	0.69
02232200	0.87	0.87	-0.11	0.77	0.83	0.83	0.80	0.83
02232400	0.98	0.98	-1.00	-1.25	0.96	0.94	0.99	0.98
02232500	0.94	0.92	0.67	0.53	0.93	0.91	0.94	0.89
02234000	0.90	0.88	-0.47	0.21	0.87	0.88	0.93	0.94
02233460	0.83	0.89	-2.44	-0.72	N/A	N/A	N/A	N/A
02233473	0.86	0.88	-2.86	-0.30	N/A	N/A	N/A	N/A
02233484	0.89	0.77	0.57	0.58	0.79	0.84	0.94	0.94
02233500	0.85	0.77	0.19	0.74	0.24	0.44	0.95	0.94

*N/A denotes USGS gauge data that was not available

■ Future Research:

- Do similar studies of other watersheds in the USA using HEC-HMS or other hydrologic models; and,
- Review additional storm return frequencies for the same watersheds studied in order to add validity to some of the study conclusions.

- Thank you for the opportunity to provide this presentation.



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