Field Research to Support Contaminant Transport Modeling of Tims Branch Watershed – Savannah River Site

DOE-FIU Science and Technology Workforce Development Program
Applied Research Center
Florida International University
Project Background

• **Study Location:** Tims Branch Watershed, Savannah River Site, Aiken, SC

• Heavy metal & radionuclide discharges into Tims Branch from SRS A/M Area
  • e.g., 43,500 kg of uranium released into A-014 outfall tributary into Tims Branch.

• Surface water hydrology modeling, particularly simulation of extreme rainfall events, crucial in understanding fate and transport of contaminants

• Good prediction and long-term monitoring tool

• Challenge finding observed/measured timeseries data

• Field data collected to fill data gaps and support model calibration and validation
Field Research: Water Sample Collection

- Collected water samples along A-014 OF tributary and main Tims Branch stream
  - (Sn, Na, Mg, Al, Ca, Mn, Fe, Ni, Cu, Zn, As, Se, Pb, U)

Sample collection at the A-014 outfall

Sample preparation at SREL
Installed two remote monitoring stations:
- A-014 OF tributary
- Tims Branch

Units currently log water levels only

Flexible support for broad range of sensors:
- e.g., Leaf Wetness, Light Intensity, Rainfall, Rel. Humidity, Soil Moisture, Temp., Volatile Organic Comp.
Water Level Data Collection

Collecting data since February 2018

- Luck: M-1 Air Stripper offline from March 6 – 23
  - Baseline data

Data collection for A-014 Unit – March 2018

- RWM018 tested on April 16 for aquifer properties
M-1 Air Stripper Online vs. Offline

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<th>A-014 water height (ft)</th>
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<th>A-014 water height (ft)</th>
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Model Development: A-014 Outfall Tributary

A-014 OF tributary

- Smaller and simpler

1. Developed shapefile for stream network
2. Developed MIKE 11 1-D stream network
3. Coupled with MIKE SHE OL flow model
4. Tested with data from 1993
Model Development:
A-014 Stream Network

Stream Network Simplification in ArcGIS

Generating Stream Network in MIKE 11
Model Development: A-014 Model Coupling and Testing

A-014 OF tributary without engineering control structures

A-014 OF tributary with engineering control structures

Weir and culvert
Model Simulation Comparison: Control Structures vs. No Control Structures

A-014 without culvert and weir

A-014 with culvert and weir
Simplified Tims Branch stream network using ArcGIS tools

- Decreased the features from approximately 500 to 100
Model Development: Tims Branch Stream Network

- Currently developing stream network and generating cross-sections in MIKE11

Stream network in MIKE11

Upstream section of TB with three “negative” chainages and one tributary with generated cross-sections
Future Work

1. Collect flow data and track storm events

2. Complete Tims Branch stream flow model
   - Build stream network in MIKE11
   - Couple with A-014 and MIKE SHE
   - Implement timeseries flow data being collected in model
   - Begin development of advection-dispersion model using MIKE ECO Lab for heavy metal and radionuclides transport

3. Model effects of:
   - Constant flow vs. no flow
   - Control structures vs. no control structures
   - Storm events
Acknowledgements

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  – Ms. Angelique Lawrence
  – Modelling and Simulation Team

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Thank You

Questions?