Diagnostic Decision Support Systems (DDSS)

Dr. Hubert Montas
Fischell Department of Bioengineering, University of Maryland at College Park
Design with Changing Laws of Physics

Gravitational Force:

\[ F = G \frac{m_1 m_2}{r^2} \]

What if the Gravitational Constant (G) changed over time?
Changing Design Rainfall Statistics
(hypothetical change – 5-yr, 1-hr, 2.4 inch curve shown; DC is 2.2 inch)

DDSS Workflow: 1 – Hot-Spots

HYDRO-RESPONSE UNITS

HYDROLOGIC/WATER-QUALITY MODEL+WEATHER SIMULATOR

HOT-SPOT MAP

SPATIAL DATABASES (GIS)

Hydrography, Topography
Soils
Land Cover, Land Use
DDSS Workflow: 2 - Diagnosis

HOT-SPOT MAP

DIAGNOSIS EXPERT SYSTEM

HOT-SPOT DIAGNOSIS MAP

SPATIAL DATABASES (GIS)

Hydrography, Topography
Soils
Land Cover, Land Use
DDSS Workflow: 3 - Prescription

HOT-SPOT DIAGNOSIS MAP → PRESCRIPTION EXPERT SYSTEM → BMP PRESCRIPTION MAP

SPATIAL DATABASES (GIS)
- Hydrography, Topography
- Soils
- Land Cover, Land Use
DDSS Workflow: 4 – Verification

HYDROLOGIC/WATER-QUALITY MODEL + WEATHER SIMULATOR

HRUS w/Prescribed BMPs

HOT-SPOT MAP (empty)

SPATIAL DATABASES (GIS)

- Hydrography, Topography
- Soils
- Land Cover, Land Use
Trends in Observed Maximum 1-hr Rainfall in California (left) and the Southeastern States (right). Positive trends detected in 10 to 15% of stations (red plus signs for California, red dots for the SouthEast).

Research Questions

DDSS Development and Operation:

• Impact of Climate Change on Hot Spots (location, extent, severity, type: runoff, sediment, nutrient, pesticides)
• Robustness of Prescribed BMPs
• Strategies to Increase Robustness (if needed)
• Incorporating Uncertainty and Stochastic Techniques

Broader Questions:

• Cost of Climate Change (adaptation, mitigation, prevention)?
• Climate Evolving to a “New Normal” or Long-Term Non-Stationarity?